
Endoscopic Therapy for Lower Gastrointestinal Bleeding

Ivan Jovanović · Tomica Milosavljević

Clinic for Gastroenterology and Hepatology, Clinical Center of Serbia, Belgrade, Serbia

Abstract

Lower gastrointestinal bleeding (LGIB) refers to blood loss of recent onset originating from a site distal to terminal ileum. It is less common than upper GI bleeding, but if it is massive, it can be a serious clinical condition. Management of GI bleeding includes initial assessment, resuscitation and triage, history and physical examination, laboratory evaluation and upper endoscopy, if necessary followed by colonoscopy. Total colonoscopy is a procedure of choice for evaluation of patients with LGIB but in some cases can be complemented with angiography and/or nuclear medicine scintigraphy and surgery. Data show that careful early colonoscopy is highly effective for both diagnosis and therapeutic intervention of patients with severe LGIB. The localization of the bleeding source has priority over any therapeutic actions and early colonoscopy facilitates identification of bleeding site or bleeding stigmata which enables successful endoscopic therapy and prevents rebleeding. Injection therapy, together with thermal and mechanical modalities, can be used for treatment of most acutely bleeding lesions.

Copyright © 2010 S. Karger AG, Basel

Lower gastrointestinal bleeding (LGIB) refers to blood loss of recent onset originating from a site distal to terminal ileum. It is less common than upper GI bleeding, but if it is massive, it can be a serious clinical condition. Approximately 20% of acute hemorrhage presents as massive LGIB. A recent US population-based study estimated an annual incidence rate of lower GI bleeding at 20.5/100,000 [1]. The most common diagnoses were diverticulosis, colorectal cancer and ischemic colitis [1]. The mean age of presentation ranged from 63 to 77 years and there was a 200-fold increase in the frequency of lower GI bleeding from the third to ninth decade of life [2–7]. The severity of LGIB is variable but overall mortality is low (2.4–4%) among patients admitted with lower GI bleeding compared with 23.1% in patients who developed lower GI bleeding while hospitalized for another reason. Mortality is more common in older adults, those with intestinal ischemia and comorbid illnesses [1, 2, 7].

The causes of LGIB may be arbitrarily grouped into several categories: anatomic (diverticulosis), vascular (angiodysplasia, ischemic, radiation-induced), inflammatory (infectious, IBD), and neoplastic. In addition, LGIB can occur after therapeutic interventions such as following polypectomy. LGIB can also be grouped by its intensity – occult, acute mild, acute massive. Acute LGIB is arbitrarily defined as bleeding of less than 3 days in duration that may result in

instability of vital signs, anemia, and/or the need for blood transfusion. Chronic LGIB is a passage of blood per rectum over a period of several days or longer and usually implies intermittent or slow loss of blood. The patient with chronic bleeding can have occult fecal blood, occasional episodes of melena or maroon stools, and small quantities of visible blood per rectum.

Management of Gastrointestinal Bleeding

Initial Assessment, Resuscitation and Triage

The patient who presents with acute lower GI bleeding may complain of passing bright red blood per rectum, dark blood with clots, or, less commonly, melena. In fact, clinical manifestation can range from hematochezia with hemodynamic instability, to melena or rectal bleeding without hemodynamic compromise. The color can suggest the source as the darker blood denotes more proximal source of bleeding, except for cases of massive bleeding from the upper GI. Blood originating from the left colon typically is bright red. In comparison, bleeding from the right side of the colon usually appears dark or maroon-colored and may be mixed with stool. However, rapid transit of blood from the right side of the colon or massive upper GI bleeding can present as bright red blood per rectum. Melena suggests upper gastrointestinal bleeding (UGIB), although bleeding from the cecum may present in this manner. Thus, although helpful, the distinctions based upon stool color are not absolute. Patients may have chronic GI bleeding with asymptomatic iron-deficiency anemia, or hemoccult-positive stool on screening for colorectal cancer. In most cases of lower GI bleeding there are no symptoms of abdominal pain, except if there is ischemia and IBD.

The triage and initial assessment of patients presenting with presumed acute lower GI bleeding is based on the dynamics and severity of hemorrhage. Large volume hemorrhage can have major cardiovascular effect and symptoms associated with blood loss may be present even before any blood appears per rectum. Hypotension (systolic blood pressure <100 mm Hg), tachycardia (>100 beats/min), sweating, thirst, postural hypotension (blood pressure fall of 15 mm Hg when the patient sits up from recumbent position or pulse increase of 15 beats/min) even collapse indicates a significant blood loss of at least 20–30% of blood volume.

Patients presenting to the emergency room with hemodynamic instability require rapid clinical assessment, intravenous access with at least two large-diameter IV lines and laboratory evaluation (see below). Initial volume replacement should be with crystalloids and then with blood. Admission to hospital is required for most patients presenting with acute, massive lower GI bleeding. Those who present with mild bleeding without evidence of continued bleeding, but have had a significant drop from baseline hemoglobin (>2.0 g/l) and have a need for transfusion should also be hospitalized. In general, young patients with self-limited GI bleeding who present without hemodynamic instability and who have no significant comorbid conditions may be managed as outpatients.

History and Physical Examination

After the patient is stabilized, one should take detailed history, particularly noting GI symptoms, previous episodes of bleeding, drug intake particularly regarding anticoagulants or inhibitors of

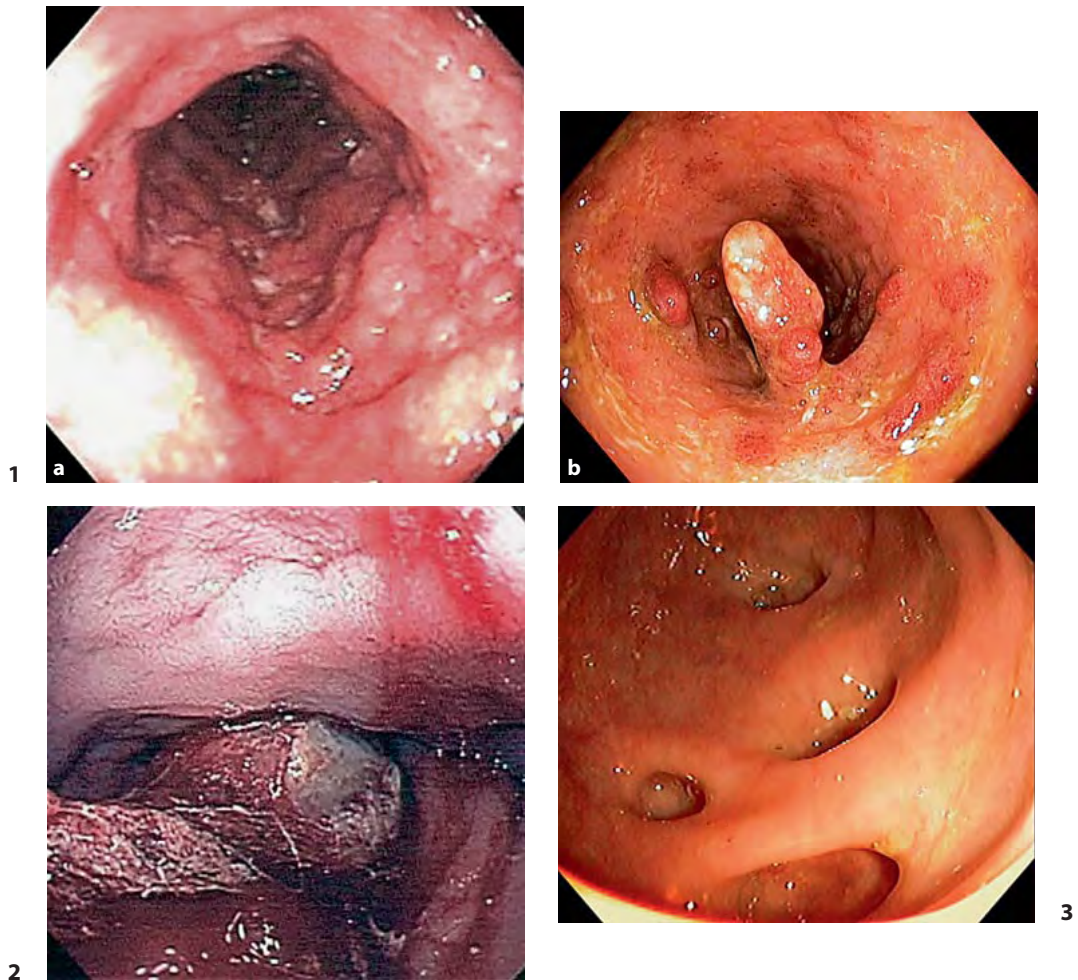


Fig. 1. a Diffuse mucosal edema and bleeding in a patient with ulcerative colitis. **b** Large pseudopolyp and multiple subepithelial hemorrhages in ulcerative colitis. **Fig. 2.** Elderly male with rectal bleeding. Colonoscopy revealed a large mass (prostate cancer) penetrating into the rectosigmoid lumen. **Fig. 3.** The most common causes of lower GI bleeding are diverticula. However, in the absence of a bleeding diverticulum, other sources should be considered and searched for.

platelet aggregation (clopidrogel, salicylates and NSAIDs). Patients with suspected lower GI bleeding should also be asked about hemorrhoids, associated diarrhea, change in bowel habits, recent polypectomy, family history of GI disorders, history of inflammatory bowel disease, prior abdominal aneurysm repair, pelvic radiation therapy (for prostatic or gynecologic malignancies), bleeding disorders, other diseases and treatments that could cause clotting defects (fig. 1a, b). Patient age is also relevant. Bleeding is more common among younger patients due to IBD, from Meckel's diverticulum, or juvenile polyps, while middle-aged patients tend to bleed from diverticular disease and neoplasms (fig. 3, 4). Colonic diverticula and arteriovenous malformations (angiodysplasias) are more common source of bleeding in elderly patients [1, 2, 6, 7]. Infectious causes of LGIB include common bacterial pathogens such as *Salmonella*, *Shigella* and *Campylobacter*. *Clostridium difficile* and *Cytomegalovirus* can also result in colonic bleeding (fig. 5, 6).

Thorough physical examination should be undertaken as it can provide helpful clues (i.e. abdominal masses, tenderness and bruits, mucosal teleangiectasias in case of collagen vascular disorders and Osler-Weber-Rendu disease, etc.). A digital rectal examination is *conditio sine qua non* to exclude anorectal pathology as well as confirming the patient's description of the appearance of the stool.

Laboratory Evaluation

This should include a complete blood count (CBC) with platelet count, prothrombin time/partial thromboplastin time (PT/PTT), international normalized ratio (INR) and creatinine/blood urea nitrogen (BUN) in order to assess renal function in case of resuscitation purposes and also in case of need for angiography. Blood type and cross-matches should also be obtained. Usually, otherwise healthy patients with a hemoglobin level >80 g/l do not require transfusion, but in elderly cases (>65 years) and comorbid patients, Hgb should be maintained at >100 g/l as it allows safe and diagnostic and therapeutic endoscopy. Clotting defects that precipitate bleeding should promptly be corrected with fresh-frozen plasma and in some cases with platelet transfusion when needed (platelet count <50,000).

Upper Endoscopy (Esophagogastroduodenoscopy, EGD)

Distinguishing between an upper and lower source of bleeding is usually relatively straightforward. However, 10–15% of patients presenting as 'lower GI bleeding' actually bleed from the upper GI tract [2, 7]. These patients are usually unstable hemodynamically. Nasogastric tube aspirate may fail to identify bleeding from the upper GI tract [8]. Thus, an EGD is mandatory in patients with LGIB and hemodynamic changes.

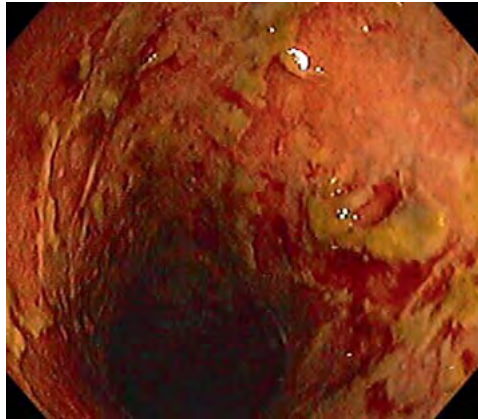
Techniques (fig. 6–10)

General. Patients with bright red hematochezia and minimal blood loss can initially be evaluated with anoscopy and flexible sigmoidoscopy. Otherwise, a total colonoscopy is a procedure of choice for evaluation [9]. The diagnostic accuracy of colonoscopy ranges from 48 to 86% in the setting of LGIB, and cecal intubation is achieved in greater than 95% of attempts [10–13]. However, as the localization of the site and source of bleeding requires ongoing bleeding, these figures are likely to be overestimated in terms of the utility of colonoscopy as most bleedings stop spontaneously. Still, even if the source of bleeding is not found, it can be of benefit to document the finding in colon. Furthermore, if total colonoscopy is feasible and no source of bleeding is found, then the ileal intubation is a prerequisite to exclude bleeding from the small bowel. Although retrograde passage from colon can occur, ileal blood in most cases indicates a small-bowel origin. Richter et al. [5] also demonstrated that the yield from colonoscopy is greater when done earlier in the hospital stay, and patients who undergo colonoscopy for LGIB have a shorter length of stay compared with those who did not [14, 15].

Angiography. Angiography should be reserved for those patients with active bleeding and continued hemodynamic instability in whom endoscopy is not feasible [16, 17]. Selective



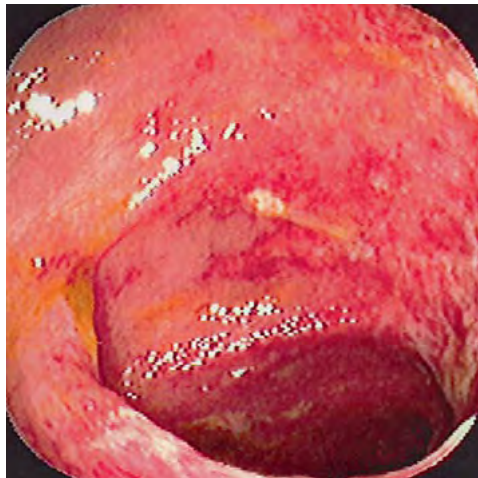
4



5



6



7



8

Fig. 4. Colon cancers generally result in anemia (right-sided colon cancer) or obstruction (left colon cancer). However, overt bleeding is not uncommon, specially in patients who take anticoagulant therapy.

Fig. 5. *Clostridium difficile* colitis can occasionally result in frank rectal bleeding.

Fig. 6. Cytomegalovirus colitis should always be considered in the differential diagnosis of lower GI bleeding in any immunosuppressed patient (e.g. HIV, status post-transplant). Endoscopically, CMV results in ulcers or stellate erosions such as this case.

Fig. 7. Most of the patients with ischemic colitis do not require any intervention to control bleeding, since it usually stops spontaneously and lesions are diffuse in character. **Fig. 8.** SRUS bleeding vessel.

angiography has diagnostic yield ranging from 27 to 67% with a complication rate of 2–4% (contrast-induced renal failure, arterial injury and mesenteric ischemia), but it requires bleeding rate of at least 1.0–1.5 ml/min. Angiographic location allows vasopressin infusion and/or embolization. Provocative angiography with short-acting agents such as heparin, tolazoline or

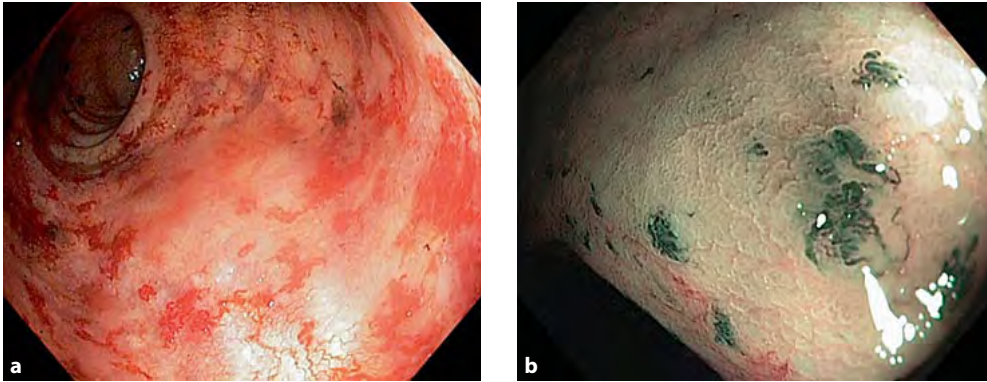


Fig. 9. **a** Radiation treatment of pelvic malignancies frequently causes acute and chronic changes which can take the form of telangiectasias and hemorrhagic changes of rectal mucosa as a spectrum of radiation proctitis (cf. fig. 4). **b** Narrowband imaging of radiation proctitis.

urokinase has unclear success and it is not generally recommended unless patient is not immediately referred to surgery.

Nuclear Medicine Scintigraphy. Nuclear scans have poor accuracy in localizing the bleeding site and are difficult to interpret. The threshold rate of GI bleeding for localization with radioisotope scanning is about 0.1 ml/min or more. Nuclear scans are either technetium sulfur colloid (short half-life) or technetium-labeled red blood cells. A colonic resection should not be only based on the results of a nuclear scan.

Surgery. Surgery is generally reserved for patients whose bleeding site is identified by angiography but who are inappropriate for, or fail, angiographic therapy. Besides, surgical intervention is required when hemodynamic instability persists despite resuscitation or severe bleeding recurs. Guidelines for the evaluation of patients with LGIB are provided in the algorithm shown in figure 10 [17].

Endoscopic Treatment. Hemodynamic and respiratory stability of the patient is a prerequisite for the safe and complete emergency endoscopy. Intravenous sedation should be avoided in hemodynamically unstable patients. The experience and skill of the endoscopist is of critical value for the successful completion of the procedure. Another factor determining the outcome of hemostatic procedure is knowledge of the limitations of hemostatic techniques and timing. A delayed decision to refer a patient to surgery and irrational repeated attempts to achieve hemostasis can be just as devastating as bleeding by itself.

Colon Preparation. In a case of active LGIB, the colon must be cleansed prior to the procedure. Examining unprepared colon gives a very little yield to the diagnosis of the source of bleeding. Therefore, most experts suggest quick purge of the colon with 4–6 liters of PEG (polyethylene glycol) either per os or through the nasogastric tube together with some prokinetics (metoclopramid i.v.) in order to speed up peristalsis. The only exception from this generally accepted policy is when there is a high suspicion of rectal bleeding, when rectosigmoidoscopy can be performed on an unprepared colon.

Timing of Examination. Several studies have shown that colonoscopy is safe and effective when performed within 12 h of admission although two recent studies challenged the utility of early colonoscopy [20, 21]. In their settings, urgent colonoscopy had no advantage over expectant

Table 1. Most common causes of massive LGIB

Children and adolescents
 Meckel's diverticulum
 Juvenile polyps
 Inflammatory bowel diseases

Adults
 Diverticulosis
 Inflammatory bowel diseases
 Colorectal neoplasia
 Infectious colitis

Adults >60 years of age
 Angiodysplasia
 Diverticulosis
 Colorectal neoplasia
 Ischemic colitis

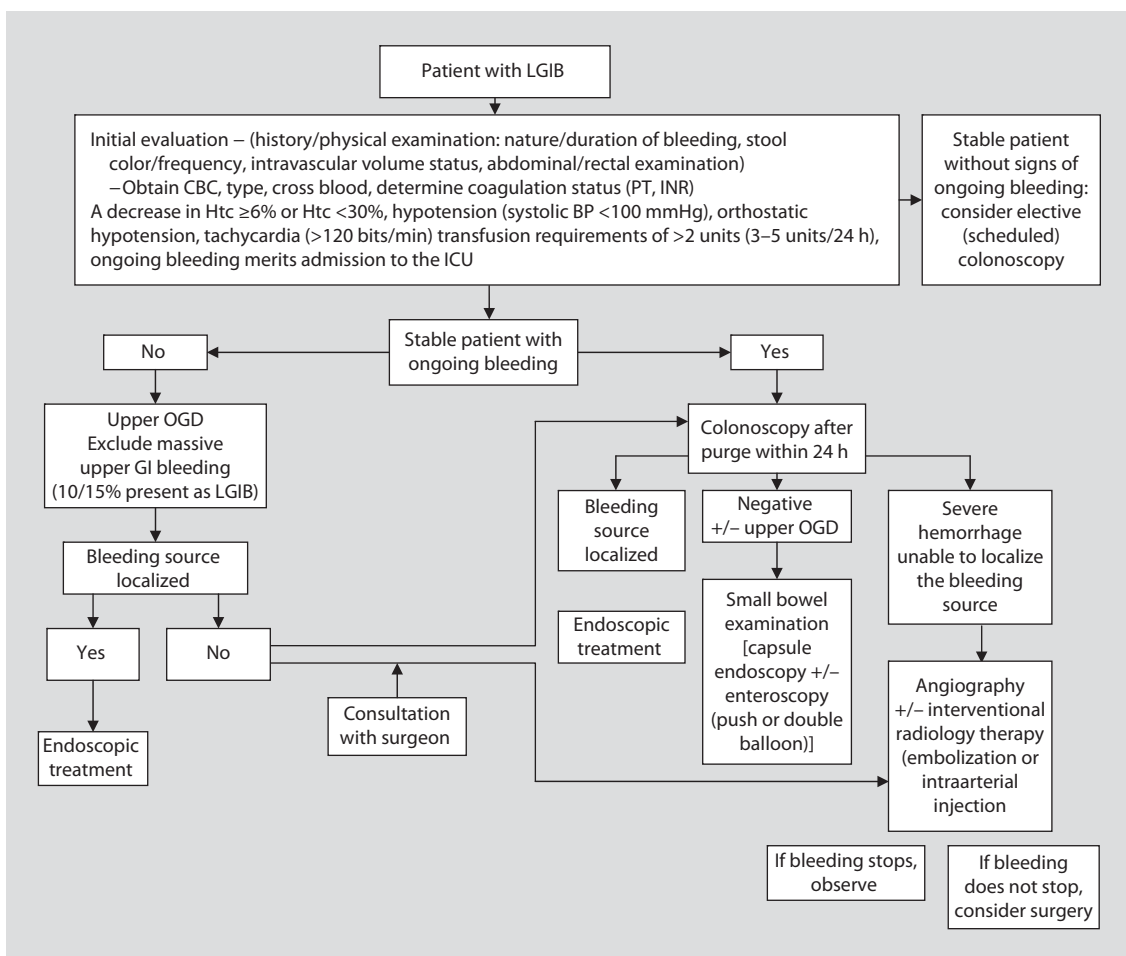


Fig. 10. Guidelines for the evaluation of patients with LGIB.

colonoscopy in terms of diagnostic yield, subsequent therapy, hospital stay and overall clinical outcome. Thus, decisions concerning care for patients with acute LGIB and timing of colonoscopy should be based on individual experience and local expertise. It is our practice to perform colonoscopy the following morning and after the patient is stabilized in the ICU (within 12–24 h of admission). If the patient stops bleeding, colonoscopy is usually deferred until 48–72 h.

Equipment. Endoscopic hemostasis should be attempted with a 3.7- to 4.2-mm large-channel colonoscope to allow blood and colon content to be suctioned through the working channel alongside an accessory. Alternatively, a double-channel colonoscope can be used when available, which enables accessories manipulation independently from aspiration.

Accessories (also see Accessories Used for Hemostasis in Gastrointestinal Bleeding, pp. 18–36)

Outcomes

Data show that careful early colonoscopy is highly effective for both diagnosis (sensitivity of proximally 86% ranging from 48 to 90%) and therapeutic intervention of patients with severe LGIB [22, 23]. Early colonoscopy is also associated with a shorter hospital stay and it is more cost-effective (cost saving of approximately USD 10,000 per patient) than other strategies for diagnosis and treatment of severe hematochezia [14, 15]. Early colonoscopy facilitates identification of bleeding site or bleeding stigmata which enables successful endoscopic therapy and prevents rebleeding. Some experts therefore strongly advocate early colonoscopy to prevent rebleeding through endoscopic therapy. The UCLA/Center for Ulcer Research and Education (CURE) group found a 53% rebleeding rate among non-treated patients with recent diverticular bleeding, but no rebleeds over a period of 3 years among endoscopically treated patients [24]. The implications of these studies are that a shorter hospital stay, along with elimination of further diagnostic tests and procedures, can lower hospitalization costs. Other uncontrolled studies have not demonstrated a convincing improvement in rebleeding rates [20, 21, 25, 26]. A case series from the Mayo Clinic [30], two non-randomized studies [20, 26] as well as a randomized controlled trial from Duke University [21] failed to document a benefit (mortality, hospital stay, ICU stay, transfusion requirements, early rebleeding, or late rebleeding) from an early colonoscopy.

Regardless of the approach (urgent vs. expectant colonoscopy), mortality rates for LGIB remain low and under 5% [2, 27], unless bleeding starts after hospital admission (23%) for another reason [2]. Urgent colonoscopy is not essential for initial evaluation of acute LGIB but it has a major advantage over the other hemostatic techniques as it can become therapeutic at the same time. Spontaneous resolution of bleeding is also common without further medical intervention besides initial resuscitation. Patients presenting with lower GI bleeding should nonetheless undergo colonoscopy within a reasonable period of time from admission to rule out other significant pathology, including neoplasm. Thus, the approach algorithm should be developed according to the available resources and expertise.

Therapeutic Intervention in Specific Lesions

Hemorrhoids. Hemorrhoidal bleeding is the most common cause of mild and intermittent lower GI bleeding. Bleeding is typically with bright red blood on the surface of the stool, on the toilet paper and/or in the toilet bowl. It may occur from any grade of hemorrhoids, but it is more severe from the advanced stadium. The majority of patients require treatment. Treatment of

Table 2. Diagnosis in elderly patients with lower GI bleeding

Diverticular bleeding	43%
Vascular ectasias	20%
Colonic cancer or polyp	9%
Radiation proctitis	6%
Ischemic colitis	4%
Miscellaneous causes	11%
Source not determined	11%

hemorrhoids in our settings is usually carried out by coloproctology surgeons and it is beyond the interest of this chapter (book). The diagnosis can be confirmed on anoscopy and/or flexible sigmoidoscopy and for those patients >50 years of age, colonoscopy is recommended.

Diverticular Bleeding. The prevalence of diverticulosis is estimated as 30–50% in asymptomatic individuals ≥ 50 years [2, 6, 7]. Bleeding will occur in 15–17% of patients with diverticulosis, being massive in approximately one-third. Affected patients have an appreciable risk of rebleeding (14–38%). The UCLA/CURE group found that among 17 patients with stigmata of recent diverticular hemorrhage there was a very high rebleed rate of 53% and an emergency surgery rate of 35% [3, 4, 24].

Many patients are elderly, with comorbid conditions that contribute to morbidity and mortality rates which together approximate 10–20% [1, 2, 6].

It is very rare for bleeding to coexist with diverticulitis which reflects non-inflammatory pathogenesis of the bleeding. Bleeding usually occurs in the neck or in the base of the diverticulum and in 75–80% stops spontaneously. Therefore, the diagnosis is often made by finding diverticula on colonoscopy in the absence of another identifiable cause of lower GI bleeding (50%) [28]. A clot is rarely seen in the diverticulum that has bled (20%) [28, 29]. Patients with a single self-limited episode of diverticular hemorrhage can be managed conservatively. The remaining 15% with stigmata of significant bleeding seen on colonoscopy such as adherent clots, a non-bleeding visible vessel, or active bleeding are more likely to require transfusion and specific hemostasis intervention which can now be successfully delivered by colonoscopy [24, 26, 28, 30]. Endoscopic treatment of bleeding secondary to diverticulosis includes epinephrine injection, contact thermal modalities, hemoclip application, band ligation and combination of the above.

In theory, early endoscopy would facilitate identification of bleeding site, but endoscopic treatment of diverticular bleeding is not always preferred for at least two reasons: first, most often, bleeding stops spontaneously, and second, it is often difficult to localize the bleeding diverticulum in case of the active bleeding as non-bleeding diverticuli can contain blood (especially in a case of extensive left colon diverticular disease). Last but not the least, thermal treatment of the bleeding diverticulum has been associated with a perforation of the colon.

Our experience with endoscopic treatment of patients found to be bleeding from colonic diverticuli is similar to the treatment of bleeding ulcer disease. Endoscopic treatment of diverticula with active bleeding, non-bleeding visible vessel or an adherent clot is treated with paradiverticular injection of a 1:10,000 dilution of epinephrine in 0.5 aliquots using a standard Teflon sheath injection catheter with a 4-mm needle extension. A submucosal injection of 1–2 ml in 2–4 sites around the diverticulum is often sufficient [28–31]. After a period of observation, the site is lavaged with water and observed for hemostasis. Subsequently, the bleeding vessel is cauterized with multipolar probe (10–15 W, 1-s pulses with light tamponade pressure). The perforation

Table 3. Aetiology of lower gastrointestinal bleeding

Reference (first author)	Diverticulosis %	Angiodysplasia %	Colitis %	Neoplasm %	Anorectal %	Miscellaneous %	Small intestine %	Unknown %
Longstreth 1997 [2]	3	41	16	9	5	14	NA	NA
Jensen 1997 [4]	40	23	12	15	5	4	NA	NA
Richter 1995 [5]	12	48	6	11	3	6	NA	NA
Chaudhry 1998 [12]	20	11.8	33	11	14	7	12.1	3.5
Ohyama 2000 [13]	5.2	1.2	27	2.9	3.2	14.5	4.9	11
Strate 2003 [15]	3	30	21	6	14	28	NA	NA
Boley 1979 [54]	11	40	12	14	NA	NA	NA	NA
Jansen 1988 [55]	17	30	9	11	4	7	9	6
Leitman 1989 [56]	24	27	10	15	NA	NA	NA	NA

risk is substantially higher when the vessel is located at the base of the diverticulum. In this circumstance, clipping of the visible vessel or entire diverticulum might be a safer alternative [32]. Adherent clot is usually washed and suctioned or, if resistant, removed with a basket or snare with prior injection of epinephrine at the base of the clot. The exposed vessel is then coagulated with a multipolar probe or clipped [30–32].

More recently, the treatment of bleeding diverticuli with band ligation has been demonstrated, with inversion of the diverticulum by suction and its banding. Farrell et al. [34] and Tucker [35], based on the previous work of Witte [33], have reported cases of diverticular bleeding treated by elastic band ligation and suggested that this might be a promising method not only for the hemostasis, but for diverticular reversion as well.

Bleeding is rarely massive on presentation, requiring emergent diagnostic angiography followed by intraarterial infusion of vasopressin or segmental resection.

Vascular Anomalies. Angiodysplasia accounts for another 20–30% of cases of hematochezia. Colonic angiodysplasia occurs in approximately 1% of the adult population and is one of the most common causes of massive LGIB in patients over the age of 65 years [2, 6, 7]. It is also one of the major causes of GI bleeding, particularly recurrent bleeding, in patients with end-stage renal disease. They are usually a few millimeters in size but may be as big as 1 cm or larger [36]. They are most commonly seen in the right colon and can be single or multiple [36]. While angiodysplasia can be found anywhere along the colon, significant bleeding occurs most frequently from

those lesions located in the cecum [36]. Patients who bleed typically present with occult blood loss. However, marked acute bleeding, causing orthostatic or hypotension, can occur.

Endoscopic hemostasis has been successfully reported using thermal modalities (bipolar probe, heater probe, and APC) as well as injection therapy [37–40]. The recommended power setting for multipolar probe is 10–12 W with 1- to 2-s pulses. Applications are repeated until the lesion is completely obliterated and hemostasis achieved. Often a prominent feeding or draining vascular structure is identified and more cautery may be required to completely coagulate this site. The cauterized areas should be flushed with water and observed for repeated applications if necessary. Transmural injury resulting in perforation has been reported but is uncommon. Alternatively, hemostasis can be achieved with a heater probe using a setting of 10–15 J. Both modalities are equally efficient in long-term follow-up in terms of number of bleeding episodes, blood transfusions and hematocrits when compared to prior to endoscopic treatment. Coagulation complications can be expected in 5% of the treated patients and they include recurrent delayed hemorrhage due to postcoagulation ulceration and postcoagulation syndrome.

Among all available techniques and accessories, APC appears to be the simplest and safest modality. Argon gas offers superficial coagulation that can be easily applied to multiple and widespread locations. However, care must be taken in the right colon, as perforations after APC have been reported.

For treatment of vascular ectasias in the colon, a meticulous preparation is necessary and endoscopic trauma and suction of the mucosa should be avoided. Treatment is easier in en-face view and when the lesion is not actively bleeding, although, in a case of side-firing APC probe, truly, it does not make a difference if you approach the lesion in a tangential manner. Before the start of the procedure, the position of all lesions needs to be carefully observed. The most dependent ones should be treated first. Also, smaller lesions should be treated first as the treatment of larger lesions often provokes bleeding and which can obscure the view. Large lesions should be treated from the periphery to the center while smaller ones can be targeted directly.

The ascending colon and cecum are the thinnest part of the colon, and too much insufflation further thins the wall. Therefore, it is wise to aspirate excess air in between attacks. Effective ablation can also be achieved with contact devices such as a multipolar cautery device or the heater probe. There is evidence that vascular malformations tend to recur, therefore endoscopic surveillance is necessary, particularly in patients with multiple lesions.

Colorectal Neoplasm. Although colorectal cancer is most commonly associated with occult blood loss rather than acute bleeding, patients with rectosigmoid lesions may present with hematochezia (fig. 4). Colonoscopy in this setting is primarily diagnostic.

Ischemic Colitis. Most of the patients with ischemic colitis do not require any intervention to control bleeding, since it usually stops spontaneously and lesions are diffuse in character (fig. 7). Endoscopy is usually diagnostic and it is indicated in the setting of possible inflammatory or ischemic colitis, unless there is clinical evidence for perforation. In some cases, focal bleeding ulcers or stigmata of hemorrhage can be treated endoscopically. Otherwise, endoscopic findings as well as mucosal biopsies are diagnostic.

Solitary Rectal Ulcer Syndrome. Endoscopic treatment consists of injection of diluted epinephrine (1:10,000) circumferentially around the bleeding point. In addition, visible vessel can be further cauterized with a bipolar probe using a power setting of 12–16 W or with a heater probe at 10–15 J. A cold polypectomy snare should be used to remove the clot after an injection of diluted epinephrine around the pedicle. After the vessel is exposed, it can be further

cauterized as described. Ever since the introduction of endoclips, we increasingly use a combination of injection therapy and hemoclips for hemostasis of bleeding rectal ulcers.

Treatment of Radiation Proctitis. Radiation treatment of pelvic malignancies frequently causes acute and chronic changes which can take the form of teleangiectasias and hemorrhagic changes of rectal mucosa as a spectrum of radiation proctitis (fig. 4). Endoscopy therapy includes coagulation with bipolar [37], heater probe [37, 38], APC [39–42] and Nd:YAG lasers [43, 44], which all have been used successfully to treat bleeding from radiation-induced angiectasias. Recently, APC has become the treatment of choice which provides controlled, superficial, non-contact coagulation. It is very important to apply coagulation carefully in order to avoid the creation of deeper ulceration in a fragile ischemic mucosa. Multiple sessions are usually required [41, 42]. The use of APC to treat radiation proctitis is effective as it can lead to an improvement of symptoms and bleeding episodes after an average of two sessions carried out at an interval of 4 weeks.

Postpolypectomy Bleeding. Bleeding is the most common complication of polypectomy. Reported risk factors for postpolypectomy bleeding during colonoscopy include older age (≥ 65 years), large polyps (>2 cm), thick stalks, sessile polyps, right colon polyps and use of pure cut electrosurgical current [45–47]. Delayed postpolypectomy bleeding may be associated with hypertension [47], aspirin [48, 49], NSAIDs [49], or resuming anticoagulants [49, 50]. Endoscopic management techniques include re-snaring the stalk (without cautery), epinephrine injection, thermal coagulation, hemoclips, and endoloops [51].

Other Causes. Dieulafoy lesions rarely lead to bleeding from the small bowel and colon. Hemostasis of Dieulafoy lesions can be achieved by epinephrine injection, thermal coagulation, band ligation, and clipping; nevertheless, no single modality has been proven superior to the others [52, 53].

Conclusion

To conclude, localization of the bleeding source has priority over any therapeutic actions. In this respect, colonoscopy is superior to other diagnostic methods and is recommended in the early evaluation of acute LGIB. The diagnostic yield of urgent colonoscopy in acute LGIB is high. Injection therapy, together with thermal and mechanical modalities, can be used for treatment of most acutely bleeding lesions. Still, if there is a profuse bleeding that cannot be controlled endoscopically, angiography is the means of choice. Subtotal colectomy has proven advantageous over segmental resection if the bleeding site is unclear, but preoperative localization of bleeding should be attempted by all available diagnostic means. In approaching patients with LGIB, also consider the patient's age, general condition, bleeding source, and availability of technology at the treating hospital (endoscopy, interventional angiography, nuclear medicine, surgeons) and skills of all treating personal. Nevertheless, it is important to take into account an ability to transfer patients to the tertiary center. Therefore, a diagnostic and therapeutic approach is more dependent on local expertise and availability than on an algorithmic approach.

References

- 1 Farrell JJ, Friedman LS: Gastrointestinal bleeding in the elderly. *Gastroenterol Clin North Am* 2001;30: 377–407.
- 2 Longstreth GF: Epidemiology and outcome of patients hospitalized with acute lower gastrointestinal hemorrhage: a population-based study. *Am J Gastroenterol* 1997;92:419–424.
- 3 Wong Kee Song LM, Baron T: Endoscopic management of acute lower gastrointestinal bleeding. *Am J Gastroenterol* 2008;103:1881–1887.
- 4 Jensen DM, Machicado GA: Colonoscopy for diagnosis and treatment of severe lower gastrointestinal bleeding. Routine outcomes and cost analysis. *Gastrointest Endosc Clin N Am* 1997;7:477–498.
- 5 Richter JM, Christensen MR, Kaplan LM, Nishioka NS: Effectiveness of current technology in the diagnosis and management of lower gastrointestinal hemorrhage. *Gastrointest Endosc* 1995;41:93–98.
- 6 Rios A, Montoya MJ, Rodriguez JM, et al: Acute lower gastrointestinal hemorrhages in geriatric patients. *Dig Dis Sci* 2005;50:898–904.
- 7 Wilcox CM, Clark WS: Causes and outcome of upper and lower gastrointestinal bleeding: The Grady Hospital experience. *South Med J* 1999;92:44–50.
- 8 Cuellar RE, Gavalier JS, Aleksander JA, et al: Gastrointestinal tract haemorrhage. The value of nasogastric aspirate. *Arch Intern Med* 1990;150:1381–384.
- 9 Davila RE, Rajan E, Adler DG, Egan J, Hirota WK, Leighton JA, Qureshi W, Zuckerman MJ, Fanelli R, Wheeler-Harbaugh J, Baron TH, Faigel DO: ASGE Guideline: The role of endoscopy in the patient with lower-GI bleeding. *Gastrointest Endosc* 2005;62:656–660.
- 10 Peura DA, Lanza FL, Gostout CJ, Foutch PG: The American College of Gastroenterology Bleeding Registry: Preliminary findings. *Am J Gastroenterol* 1997;92:924–928.
- 11 ASGE Guideline: The role of endoscopy in the patient with lower-GI bleeding. *Gastrointest Endosc* 2005;62: 656–660.
- 12 Chaudhry V, Hyser MJ, Gracias VH, Gau FC: Colonoscopy: the initial test for acute lower gastrointestinal bleeding. *Am Surg* 1998;64:723–728.
- 13 Ohyama T, Sakurai Y, Ito M, et al: Analysis of urgent colonoscopy for lower gastrointestinal tract bleeding. *Digestion* 2000;61:189–192.
- 14 Schmulewitz N, Fisher DA, Rockey DC: Early colonoscopy for acute lower GI bleeding predicts shorter hospital stay: a retrospective study of experience in a single center. *Gastrointest Endosc* 2003; 58:841–846.
- 15 Strate LL, Syngal S: Timing of colonoscopy: impact of length of hospital stay in patients with acute lower intestinal bleeding. *Am J Gastroenterol* 2003;98:317–722.
- 16 Zuccaro G: Management of adult patients with lower gastrointestinal bleed. *ACG Guidelines. Am J Gastroenterol* 1998;93:1202–1208.
- 17 Faigel DO, Dominitz JA, Eisen GM and members of ASGE Standards of Practice Committee: An annotated algorithmic approach to acute lower gastrointestinal bleeding. *Gastrointest Endosc* 2001;53: 859–863.
- 18 Hunter JM, Pezim ME: Limited value of technetium-99m-labeled red cell scintigraphy in localization of lower gastrointestinal bleeding. *Am J Surg* 1990;159:504–506.
- 19 Levy R, Barto W, Gani J: Retrospective study of the utility of nuclear scintigraphic-labelled red cell scanning for lower gastrointestinal bleeding. *ANZ J Surg* 2003;73:205–209.
- 20 Angtuaco TL, Reddy SK, Drapkin S, et al: The utility of urgent colonoscopy in the evaluation of acute lower gastrointestinal tract bleeding: a 2-year experience from a single center. *Am J Gastroenterol* 2001;96:1782–1785.
- 21 Green BT, Rockey DC, Portwood G, et al: Urgent colonoscopy for evaluation and management of acute lower gastrointestinal hemorrhage: a randomized controlled trial. *Am J Gastroenterol* 2005;100:2395–2402.
- 22 Zuckerman GR, Prakash C: Acute lower gastrointestinal bleeding. Part I. Clinical presentation and diagnosis. *Gastrointest Endosc* 1998;48:606–616.
- 23 Zuckerman GR, Prakash C: Acute lower gastrointestinal bleed. Part II. Etiology, therapy, and outcomes. *Gastrointest Endosc* 1999;49:228–238.
- 24 Jensen DM, Machicado GA, Jutabha R, Kovacs TO: Urgent colonoscopy for the diagnosis and treatment of severe diverticular haemorrhage. *N Engl J Med* 2000; 342:78–82.
- 25 Smooth RL, Gostout CJ, Rajan E, et al: Is early colonoscopy after admission for acute bleeding needed? *Am J Gastroenterol* 2003;98:1996–1999.
- 26 Bloomfeld R, Shetzline M, Rockey DC: Urgent colonoscopy for the diagnosis and treatment of severe diverticular haemorrhage. *N Engl J Med* 2000;342:1608–1609.
- 27 Rios A, Montoya MJ, Rodriguez JM, et al: Severe acute lower gastrointestinal bleeding: risk factors for morbidity and mortality. *Langenbecks Arch Surg* 2007;392:165–171.
- 28 Prakash C, Chokshi H, Walden DT, Aliperti G: Endoscopic hemostasis in acute diverticular bleeding. *Endoscopy* 1999;31:460–463.
- 29 Foutch PG, Zimmerman K: Diverticular bleeding and the pigmented protuberance (sentinel clot): clinical implications, histopathological correlation, and results of endoscopic intervention. *Am J Gastroenterol* 1996;91: 2589–2593.
- 30 Bloomfeld RS, Rockey DC, Shetzline MA: Endoscopic therapy of acute diverticular haemorrhage. *Am J Gastroenterol* 2001;96:2367–2372.
- 31 Ramirez FC, Johnson DA, Zierer ST, Walker GJ, Sanowski RA: Successful endoscopic hemostasis of bleeding colonic diverticula with epinephrine injection. *Gastrointest Endosc* 1996;43:167–170.

- 32 Simpson PW, Nguyen MH, Lim JK, Soetikno RM: Use of endoclips in the treatment of massive colonic diverticular bleeding. *Gastrointest Endosc* 2004;59:433–437.
- 33 Witte JT: Band ligation for colonic bleeding: modification of multiband ligating devices for use with a colonoscope. *Gastrointest Endosc* 2000;52:762–765.
- 34 Farrell JJ, Graeme-Cook F, Kelsey PB: Treatment of bleeding colonic diverticula by endoscopic band ligation: an in-vivo and ex-vivo pilot study. *Endoscopy* 2003;35:823–829.
- 35 Tucker LE: Diverticular bleeding: novel treatment with band ligation. *Mo Med* 2004;101:61–63.
- 36 Hochter W, Weingart J, Kuhner W, Frimberger E, Ottenjann R: Angiodysplasia in the colon and rectum. Endoscopic morphology, localisation and frequency. *Endoscopy* 1985;17:182–185.
- 37 Jensen DM, Machicado GA, Cheng S, Jensen ME, Jutabha R: A randomized prospective study of endoscopic bipolar electrocoagulation and heater probe treatment of chronic rectal bleeding from radiation teleangiectasia. *Gastrointest Endosc* 1997;45:20–25.
- 38 Fuentes D, Monserat R, Isern AM, et al: Colitis due to radiation: endoscopic management with heat probe. *GEN* 1993;47:165–167.
- 39 Silva RA, Correia AJ, Dias LM, Viana HL, Viana RL: Argon plasma coagulation therapy for hemorrhagic radiation proctosigmoiditis. *Gastrointest Endosc* 1999;50:221–224.
- 40 Fantin AC, Binek J, Suter WR, Meyenberger C: Argon beam coagulation for treatment of symptomatic radiation-induced proctitis. *Gastrointest Endosc* 1999;49:515–518.
- 41 Tam W, Moore J, Schoeman M: Treatment of radiation proctitis with argon plasma coagulation. *Endoscopy* 2000;32:667–672.
- 42 Olmos JA, Marcolongo M, Pogorelsky V, Varela E, Davolos JR: Argon plasma coagulation for prevention of recurrent bleeding from GI angiodysplasias. *Gastrointest Endosc* 2004;60:881–886.
- 43 Buchi KN, Dixon JA: Argon laser treatment of hemorrhagic radiation proctitis. *Gastrointest Endosc* 1987;33:27–30.
- 44 Gostout CJ, Bowyer BA, Ahlquist DA, et al: Mucosal vascular malformations of the gastrointestinal tract: clinical observations and results of endoscopic neodymium: yttrium-aluminum garnet laser therapy. *Mayo Clin Proc* 1988;63:993–1003.
- 45 Van Gossum A, Cozzoli A, Adler M, Taton G, Cremer M: Colonoscopic snare polypectomy: analysis of 1,485 resections comparing two types of current. *Gastrointest Endosc* 1992;38:472–475.
- 46 Kim HS, Kim TI, Kim WH, et al: Risk factors for immediate postpolypectomy bleeding of the colon: a multicenter study. *Am J Gastroenterol* 2006;101:1333–1341.
- 47 Watabe H, Yamaji Y, Okamoto M, et al: Risk assessment for delayed hemorrhagic complication of colonic polypectomy: polyp-related factors and patient-related factors. *Gastrointest Endosc* 2006;64:73–78.
- 48 Nakajima H, Takami H, Yamagata K, et al: Aspirin effects on colonic mucosal bleeding: implication for colonic biopsy and polypectomy. *Dig Colon Rectum* 1997;40:1484–1488.
- 49 Hui AJ, Wong RM, Ching JY, et al: Risk of colonoscopic polypectomy bleeding with anticoagulants and antiplatelet agents: analysis of 1,657 cases. *Gastrointest Endosc* 2004;59:44–48.
- 50 Sawhney MS, Salfiti N, Nelson DB, Lederle FA, Bond JH: Risk factors for severe delayed postpolypectomy bleeding. *Endoscopy* 2008;40:115–119.
- 51 Wayne JD: Management of complications of colonoscopic polypectomy. *Gastroenterologist* 1993;1:158–164.
- 52 Lee YT, Walmsley RS, Leong RW, et al: Dieulafoy's lesion. *Gastrointest Endosc* 2003;58:236–243.
- 53 Fukumori D, Sasaki T, Sato M, Sakai K, Ohmori H, Yamamoto F: Massive rectal bleeding from a Dieulafoy's ulcer of the rectum. *Int Surg* 2004;89:63–66.
- 54 Boley SJ, DiBase A, Brandt LJ, Sammartano RJ: Lower intestinal bleeding in the elderly. *Am J Surg* 1979;137:57–64.
- 55 Jensen DM, Machicado GA: Diagnosis and treatment of severe haematochezia. The role of urgent colonoscopy after purge. *Gastroenterology* 1988;95:1569–1574.
- 56 Leitman IM, Paull DE, Shires GT III: Evaluation and management of massive lower gastrointestinal haemorrhage. *Ann Surg* 1989;209:175–180.

Ivan Jovanović, MD, PhD
 Clinic for Gastroenterology and Hepatology
 Clinical Center of Serbia
 CS-11000 Belgrade (Serbia)
 Tel./Fax +381 11 361 5587, E-Mail ivangastro@beotel.rs