7

Emergency Total Intraoperative Enteroscopy Using a Colonoscope

Francisco Pérez-Roldán, Pedro González-Carro
and María Concepción Villafáñez-García
Hospital General La Mancha-Centro
Alcázar de San Juan
Spain

1. Introduction

Hemodynamically unstable lower gastrointestinal bleeding is a challenge for on-call teams, especially when symptom severity leaves no time to apply diagnostic techniques. While colonoscopy and gastroduodenoscopy performed before arteriography or scintigraphy are considered the usual diagnostic tools, capsule endoscopy provides new options in patients with stable digestive bleeding that is difficult to locate. Computed tomography (CT) angiography is beginning to replace arteriography and labeled red cell scintigraphy. Nonetheless, the primary objective is to locate the bleeding source, and, in cases where this must be located by surgery, intraoperative enteroscopy using a colonoscopy can be applied. In fact, intraoperative enteroscopy is considered effective from a diagnostic and therapeutic perspective in selected patients, for example, those with severe gastrointestinal bleeding of no apparent etiology and for whom other diagnostic techniques are ineffective or unavailable. This technique ensures that surgical resection is minimally invasive.

2. Etiology of severe gastrointestinal bleeding

Massive gastrointestinal bleeding is often associated with the upper digestive tract. Therefore, in suspected upper gastrointestinal bleeding, the first technique to be applied is esophagogastroduodenoscopy, which makes it possible to diagnose lesions as far as the angle of Treitz. If the patient does not present hematemesis and upper endoscopy findings are normal, the diagnosis is lower gastrointestinal bleeding.

Colonoscopy is one of two tools used to assess lower gastrointestinal bleeding. Some studies have shown that it can identify the bleeding source in slightly more than 70% of patients. Colonoscopy can be performed as an emergency technique or as an elective technique, depending on hemodynamic status, and in many cases it enables us to diagnose and treat a lesion endoscopically. However, in the case of massive bleeding, the effectiveness of colonoscopy could be limited by its poor visibility.

In fact, massive lower gastrointestinal bleeding with an unidentified source is one of the most severe problems faced by a Digestive Service or General Surgery Service. Bleeding of the small intestine is rare, accounting for 2-10% of all cases of gastrointestinal bleeding. The

most common causes of gastrointestinal bleeding are vascular malformations (especially angiodysplasia), tumors (including lymphoma), ulcers (caused by nonsteroidal anti-inflammatory drugs, Crohn disease, and enteritis), Meckel diverticulum, diverticulum of the jejunum and ileum, aortoenteric fistula, hemobilia, and pancreatic bleeding (Table 1). Meckel diverticulum should always be taken into consideration in children and young adults. However, in adults and elderly people, the most frequent causes are vascular lesions followed by tumors, irrespective of the presentation of the bleeding.

Upper gastrointestinal tract	Small bowel	Large bowel
Peptic ulcer disease 40-79%	Angiodysplasia 70-80%	Diverticular disease 17-40%
Gastritis/duodenitis 5-30%	Jejunoileal diverticula	Arteriovenous malformations 2-30%
Esophageal varices 6-21%	Meckel diverticulum	Colitis (ischemia, IBD, radiation) 9-21%
Mallory-Weiss tear 3-15%	Benign/malignant neoplasm	Colonic neoplasm 5-8%
Esophagitis 2-8%	Lymphomas	Post-polypectomy bleeding 3-6%
Gastric cancer 2-3%	Enteritis	Anorectal conditions 4-10%
Dieulafoy lesion <1%	Crohn disease	Colonic tuberculosis
Gastric arteriovenous malformation <1%	Aortoduodenal fistula	
Portal gastropathy <1%	Hemobilia, hemosuccus pancreaticus	

Table 1. Causes of acute massive gastrointestinal bleeding.
(IBD, inflammatory bowel disease)

3. Radiologic evaluation of severe gastrointestinal bleeding

In cases of massive lower gastrointestinal bleeding where it is not possible to diagnose the cause, other diagnostic methods should be applied to identify the bleeding source. The primary objective of traditional radiologic tests, including labeled red blood cell scintigraphy and angiography, is localization of the bleeding source so that therapeutic embolization of the feeding vessel can be performed. Novel imaging studies such as CT enterography and CT angiography not only allow localization of the source and diagnosis of the underlying etiology of gastrointestinal bleeding, but also facilitate luminal and extraluminal evaluation of the small bowel.

Mesenteric arteriography is widely used to assess massive gastrointestinal bleeding, although it is also used to assess bleeding of obscure origin that cannot be identified by endoscopy. It is very effective for detecting arteriovenous malformations and tumors—these lesions

present a characteristic vascular pattern—and, in active bleeding, it identifies the bleeding source in 50% of patients. It has the added advantage that it can embolize the feeding artery and control bleeding, thus stabilizing the patient. This is particularly important in many high-risk surgical patients, since the technique is safe, morbidity and mortality are low, and ischemia and rebleeding are very uncommon.

Helical CT with intravenous contrast or CT angiography is similar to arteriography, although it could produce false negatives due to the intermittent nature of bleeding. In cases of massive bleeding, diagnostic efficacy (extravasated contrast medium in the intestine during the arterial phase) reaches 88.5%, with a sensitivity of 90.9% and a specificity of 99%. The location of the source of extravasation on the CT angiogram corresponds exactly to the results of arteriography. Once the bleeding source is found, therapeutic angiography can be applied or alternative treatment can be selected depending on the findings.

CT enterography and CT enteroclysis are dedicated examinations of the small bowel that allow the detection of vascular lesions and tumors. The technique optimizes luminal distension by administering larger volumes of neutral oral contrast via peroral (CT enterography) or nasojejunal intubation (CT enteroclysis), thereby allowing optimal visualization of mucosal and vascular detail. The evaluation of gastrointestinal bleeding usually involves multiphasic imaging (arterial, enteric, and delayed imaging, with or without precontrast images). Typical features of angiodysplasia on CT include the presence of a vascular tuft in the arterial phase and an early draining mesenteric vein. Active bleeding may also be identified on multiphasic imaging by the increasing accumulation of contrast in the small bowel lumen. CT enterography has the added advantage being able to identify small bowel strictures/obstruction prior to capsule endoscopy and provides important information on luminal and extraluminal findings that cannot be detected on capsule endoscopy.

Lastly, we must remember other radiologic tests such as *^{99m}Tc red blood cell scintigraphy*, a noninvasive examination that can detect bleeding with a loss lower than that observed with arteriography (0.1-0.4 ml/min). It can identify an indeterminate source in 20-40% of patients—this percentage rises to 68% when there is active bleeding—and is generally used to detect the source of intestinal bleeding and improve the management of patients with active bleeding, thus making it possible to choose the best therapeutic option, which is often arteriography. 99mTc red blood cell scintigraphy is the technique of choice in the diagnosis of Meckel diverticulum. An additional approach in this disease is *technetium 99m pertechnetate scintigraphy (MeckelScan)*, which makes it possible to detect ectopic gastric mucosa with 64-100% sensitivity; however, its main disadvantage is the rapid isotope washout when there is active gastrointestinal bleeding.

4. Endoscopic evaluation of severe gastrointestinal bleeding

In the last few years, several advances have been made in endoscopy techniques applied for the diagnosis and treatment of diseases of the gastrointestinal tract. However, few of these advances are of benefit in diseases of the small bowel, because access with an endoscope remains difficult. Since the introduction of push endoscopy in 1971, only the proximal jejunum could be examined to about 50 cm from the ligament of Treitz. Examination of the small intestine has improved with more recent discoveries, including include capsule endoscopy, double-balloon enteroscopy, and spiral enteroscopy. Capsule endoscopy as a

diagnostic method has revealed a new challenge, namely, determination of the confirmatory and therapeutic approach to the lesions found.

Gastroscopy and colonoscopy are both available in all hospitals. If these techniques do not confirm the diagnosis in patients with massive low gastrointestinal bleeding, we must determine the cause of the lesion and decide how to diagnose and treat it. Bleeding of the small intestine has been a complex diagnostic problem for many years, because this organ could not be explored using endoscopy and the cause of the bleeding was difficult to locate using more conventional techniques. Severe active intestinal bleeding can be diagnosed using radiological techniques (see above) and endoscopic techniques, including push enteroscopy, capsule endoscopy, balloon-assisted enteroscopy, spiral enteroscopy, and endoscopy-assisted laparoscopy-laparotomy (intraoperative enteroscopy). However, these techniques are only available in tertiary hospitals. Secondary hospitals do not usually have all of the techniques described and the distance to the nearest reference hospital must be taken into account. Consequently, it is necessary to act more effectively and invasively in extreme cases (eg, intraoperative enteroscopy). Below, we provide a brief summary of the different endoscopic techniques.

Push enteroscopy. For several years, push enteroscopy has been the most widely used and effective diagnostic procedure for direct evaluation of the intestinal mucosa. One of its limitations is that only the proximal jejunum can be visualized, leaving most of the small intestine unexamined. The technique provides a diagnosis in a large percentage of patients with undiagnosed gastrointestinal bleeding (Figure 1) and enables us to treat it, especially in the case of vascular lesions.

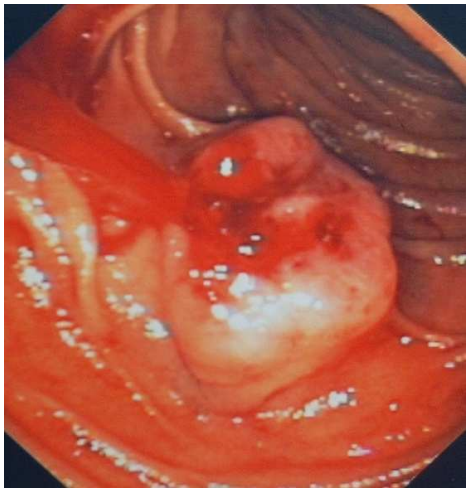


Fig. 1. Stromal tumor in the jejunum diagnosed using push enteroscopy.

Video capsule endoscopy. Visual capsule endoscopy is a noninvasive technique that has proven effective in the evaluation of patients with suspected bleeding of the small intestine. It enables us to visualize the whole small intestine. Several studies have proven the superiority of this technique over other conventional modalities, including barium x-ray. However, the real significance of specific findings and the false negatives caused by food and liquids, the lack of distension or propulsion, and the rapid passage through large segments are limitations that have yet to be resolved. The main disadvantage of the capsule is that it is an exclusively diagnostic technique, with limited capacity for identifying the lesion with accuracy and with no possibility of obtaining biopsies or carrying out therapeutic procedures (Figure 2).

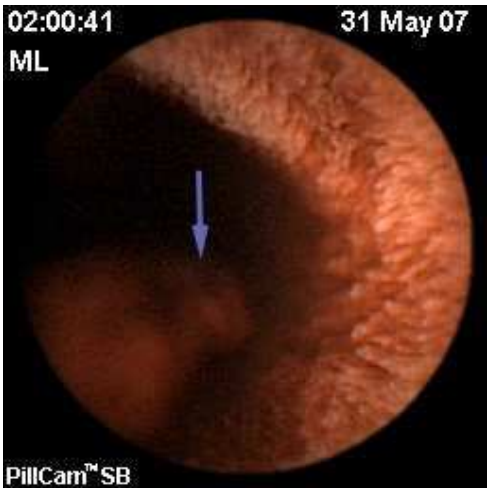


Fig. 2. Capsule endoscopy image of bleeding with a clot in the small intestine.

Balloon-assisted enteroscopy

a. *Double-balloon enteroscopy.* Double-balloon enteroscopy represents a huge advance. In theory, the whole small intestine can be examined, biopsies taken, and treatment administered, or, if this is not possible, the lesion can be marked. This technique makes it possible to reach more distal sections of the small intestine, although it rarely manages to reach the distal ileum; therefore, enteroscopy requires the combination of the antegrade and retrograde approaches for an examination of the whole intestine. Double-balloon enteroscopy is considered a safe and well-tolerated technique for the diagnosis and treatment of diseases of the small intestine.
b. *Single-balloon enteroscopy.* Single-balloon enteroscopy is the latest balloon-assisted endoscopic technique for the evaluation and management of small bowel disorders. It involves inserting a balloon catheter through the working channel of a colonoscope and moving the endoscope progressively along the small intestine by inflating and deflating the balloon. This technique has proven safe and effective, and in some cases (up to 25%) has made it possible to perform a complete enteroscopy.

Spiral enteroscopy. Spiral enteroscopy allows for advancement and withdrawal of the enteroscope through the small bowel by using clockwise and counterclockwise movements, respectively. The distal end of the overtube is positioned 25 cm from the tip of the enteroscope and locked into place. The system is then advanced to the ligament of Treitz with gentle rotation. The collar is subsequently unlocked, and the enteroscope is advanced past the ligament of Treitz. The overtube is then advanced using clockwise rotation until pleating of the small bowel no longer occurs over the enteroscope. The enteroscope is then unlocked and advanced to facilitate further advancement into the small bowel. In order to ease withdrawal of the enteroscope, the overtube is rotated in a counterclockwise direction. The insertion depth is 262±57 cm, and mean examination time is 33-35 minutes. This endoscopic modality also makes it possible to adopt a therapeutic approach, including biopsy, hemostasis, and polypectomy. Only minor complications (sore throat and minimal mucosal trauma) have been reported thus far and no perforations have been observed. Some studies have compared spiral enteroscopy with double-balloon enteroscopy and report that double-balloon enteroscopy has a better diagnostic yield.

Intraoperative enteroscopy. Intraoperative enteroscopy by insertion of an endoscope through 1 or more enterotomies has a high diagnostic yield, identifying lesions in 70-100% of patients. The technique is started once the surgeon has performed a laparotomy, in general to gain access to the small intestine. Once the small intestine is exposed, 2 or more enterotomies are made and the colonoscope is inserted with the surgeon's help. Intraoperative enteroscopy makes it possible to examine the whole small intestine, always with the assistance of a surgeon. It is limited by its high morbidity (intestinal wall hematoma, mesenteric hemorrhage, prolonged ileus, intestinal ischemia, and perforation); therefore, this procedure is reserved for patients with persistent bleeding and high transfusional requirements in whom diagnosis cannot be established by other means (Figure 3). A variation of the technique involves oral insertion of the enteroscope during surgery, which makes it possible to see 93% of the ileum and establish a diagnosis in almost 60% of cases. Its drawback is the considerable operative morbidity in a relatively high proportion of cases (serosal tear or ruptured mesenteric vein).

A. B.

Fig. 3. Jejunal aneurysm. A. Endoscopic image using intraoperative enteroscopy; B. Microscopic image showing caliber-persistent artery with mucosal rupture (x20)

5. Management of severe gastrointestinal bleeding

Severe bleeding in the small intestine is extremely problematic for a hospital. First, patient instability limits the diagnostic methods at our disposal. Second, not all hospitals have the diagnostic and therapeutic methods described here. Only tertiary hospitals can apply all the techniques described. Our objective should be to improve therapeutic options using the tools generally available in the hospital.

Consequently, when faced with a hemodynamically unstable patient who cannot be transferred, we must use all available diagnostic approaches, beginning with standard techniques (gastroscopy, colonoscopy, and helical CT) and moving on to other available methods such as intraoperative enteroscopy, which is indicated in acute intestinal bleeding of unknown origin, either when alternative techniques fail or when the patient's condition makes it impossible to apply them. Although this technique is very effective, in a small percentage of patients it may be impossible to find the bleeding source, especially when this is vascular and small. Nevertheless, it is still considered the reference technique, enabling accurate location of the lesion and minimally invasive surgery, with a lower number of recurrences.

It is very important to examine the whole small intestine, even once a lesion has been identified, as the presence of concomitant lesions could cause subsequent problems. Location of the lesion enables minimally invasive resection, with lower morbidity and mortality. In some cases with active bleeding, hemostasis can be restored using endoscopy. Once the patient is stable, the lesion can be resected.

Our approach to severe bleeding in the small intestine is to perform esophagogastroduodenoscopy and colonoscopy in order to rule out lesions in the corresponding areas. If the patient is sufficiently stable, capsule endoscopy can be performed and, depending on the location of the lesion, push enteroscopy or balloon-assisted enteroscopy can be used for therapy. If the lesion is not accessible for endoscopic treatment, a medical approach (embolization) or surgical approach should be adopted. If the patient presents massive bleeding or is hemodynamically unstable, CT angiography and/or arteriography are advised to locate and treat the cause of the bleeding. Intraoperative enteroscopy should be reserved for severe recurrent bleeding with high transfusion requirements, inaccessible lesions, or unavailability of balloon-assisted enteroscopy.

6. Summary

Total intraoperative enteroscopy is effective for the diagnosis of severe gastrointestinal bleeding of unknown origin. It enables more localized and efficacious surgery when other diagnostic techniques—arteriography, labeled red cell scintigraphy, and endoscopic capsule—cannot be performed. Furthermore, total intraoperative enteroscopy can be performed in selected cases at any hospital without the need for advanced technology.

7. References

Manning-Dimmitt LL, Dimmitt SG, Wilson GR. Diagnosis of gastrointestinal bleeding in adults. Am Fam Physician, 2005; 71: 1339-46.

Saperas E. Lower gastrointestinal bleeding: The great unknown. Gastroenterol Hepatol 2007; 30: 93-100.

Farrell JJ, Friedman LS. The management of lower gastrointestinal bleeding. Aliment Pharmacol Ther 2005; 21; 1281-98.

Brackman MR, Gushchin VV, Smith L, Demory M, Kirkpatrick JR, Stahl T. Acute lower gastroenteric bleeding retrospective analysis (the ALGEBRA study): An analysis of the triage, management and outcomes of patients with acute lower gastrointestinal bleeding. Am Surg 2003; 69: 145-9.

Mathus-Vliegen EM, Tytgat GN. Intraoperative endoscopy: Technique, indications, and results. Gastrointest Endosc, 1986; 32: 381-4.

Mihara Y, Kubota K, Nagata H, Takagi K, Hortie T, Oda N, et al. Total intraoperative endoscopy using acolonoscope for detecting the bleeding point. Hepatogastroenterology, 2004; 51: 1401-3.

Whelan RL, Buls JG, Goldberg SM, Rothenberger DA. Intraoperative endoscopy. University of Minnesota experience. Am Surg 1989; 55: 281-6.

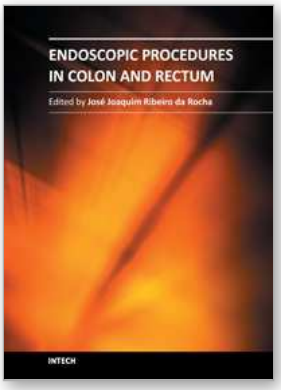
Zaman A, Sheppard B, Katon RM. Total peroral intraoperative enteroscopy for obscure GI bleeding using a dedicated push enteroscope: diagnostic yield and patient outcome. Gastrointest Endosc 1999; 50: 506-10.

Douard R, Wind P, Panis Y, Marteau P, Bouhnik Y, Cellier C, et al. Intraoperative enteroscopy for diagnosis and management of unexplained gastrointestinal bleeding. Am J Surg 2000; 180: 181- 4.

Pérez Roldán F, González Carro P, Villafáñez García MC, Picazo Yeste J, Lucendo Villarín A. Urgent Intraoperative total enteroscopy with colonoscopy by means of a double enterotomy in a severe lower digestive tract haemorrhage. Cir Esp, 2009; 86: 252-3.

Akerman PA, Agrawai D, Cantero D, Pangtay J. Spiral enteroscopy with the new DSB overtube: a novel technique for deep peroral small-bowel intubation. Endoscopy, 2008; 40: 974-8.

Frieling T, Heise J, Sassenrath W, Hülsdonk A, Kreysel C. Prospective comparison between double-balloon enteroscopy and spiral enteroscopy. Endoscopy, 2010; 42: 885-8.



Endoscopic Procedures in Colon and Rectum

Edited by Prof. Jose Ribeiro Da Rocha

ISBN 978-953-307-677-5
Hard cover, 156 pages
Publisher InTech
Published online 07, November, 2011
Published in print edition November, 2011

Endoscopic procedures in colon and rectum presents nine chapters which start with introductory ones like screening by colonoscopy as the preparation and monitoring for this exam. In addition to these approaches the book aims in the last four chapters to explain endoscopic diagnostic and therapeutic aspects in the colon and rectum. The description of each text is very comprehensive, instructive and easy to understand and presents the most current practices on the topics described. This book is recommended for general and colorectal surgeons as it presents guidelines for diagnosis and treatment which are very well established.

INTECH
open science | open minds

InTech Europe
University Campus STeP Ri
Slavka Krautzeka 83/A
51000 Rijeka, Croatia
Phone: +385 (51) 770 447
Fax: +385 (51) 686 166
www.intechopen.com

InTech China
Unit 405, Office Block, Hotel Equatorial Shanghai
No.65, Yan An Road (West), Shanghai, 200040, China
中国上海市延安西路65号上海国际贵都大饭店办公楼405单元
Phone: +86-21-62489820
Fax: +86-21-62489821