Management of Diverticular Hemorrhage

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ABSTRACT

Diverticular hemorrhage is the most common cause of lower gastrointestinal bleeding in Westernized cultures. Fortunately, the majority of diverticular bleeds will spontaneously resolve; however, 20% of patients will require therapeutic interventions to obtain hemostasis. The diagnostic and therapeutic options for the management of diverticular hemorrhage are discussed.

KEYWORDS: Lower gastrointestinal hemorrhage, diverticular hemorrhage

Objectives: On completion of this article, the reader should be able to discuss the diagnostic and therapeutic techniques employed in the management of diverticular hemorrhage.

Lower gastrointestinal bleeding (LGIB) has an annual hospitalization rate of 22 cases per 100,000 adults in the United States.¹ Bleeding from colonic diverticula is the most common cause of acute lower gastrointestinal bleeding in the United States accounting for 33.1% of cases.² Traumatic forces within the lumen of the diverticulum leads to segmental weakening of the associated vasa rectum.³ Rupture of these vessels into the intestinal lumen results in rectal bleeding ranging from intermittent spotting to life-threatening hematochezia. The risk of bleeding in patients with diverticulosis coli ranges from 4 to 48%.⁴ Risk factors for diverticular bleeding include advanced age, hyperuricemia, hypertension, three or more concomitant medical disorders, and steroid or nonsteroidal antiinflammatory drug (NSAID) use.⁵ In fact, NSAID use was found to increase the risk of diverticular bleed by a factor of 15.⁶ Fortunately, 70 to 80% of cases of diverticular hemorrhage will spontaneously resolve.⁷ Of these patients, 25 to 30% will have an additional episode of bleeding.⁸

Due to the usual advanced age and medical comorbidities of these patients, the evaluation and management of the bleeding patient must proceed in a logical

manner to ensure the best outcome. As with other causes of lower gastrointestinal bleed, the physician should obtain a directed history and physical examination. The exam must include a digital rectal examination and proctoscopy to rule out anorectal causes of bleeding. The placement of a nasogastric tube with the aspiration of bilious material can help exclude an upper gastrointestinal source of rectal bleeding. Initial laboratory tests including a complete blood count, coagulation profile, and basic metabolic panel should be obtained. Simultaneously, large-bore venous access is obtained, and resuscitation is begun. Once laboratory results are available, severe anemia and coagulopathy are corrected with the infusion of blood products.⁹

Although diverticulosis coli is most commonly found in the left colon of Westernized populations, bleeding from diverticulum can occur from anywhere in the colon¹⁰; therefore, localization of the bleeding source should ensue once the patient has been stabilized. The primary localization modalities include nuclear scintigraphy, angiography, and colonoscopy. Angiography and colonoscopy can provide therapeutic intervention at the time of diagnosis while nuclear

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scintigraphy is purely diagnostic. The modality of choice depends on the condition of the patient, the extent of ongoing hemorrhage, and local expertise.

NUCLEAR SCINTIGRAPHY

Nuclear scintigraphy was first introduced in the early 1980s.^{11,12} This examination is a sensitive diagnostic test as it can detect bleeding at a rate of 0.1 mL per minute.¹³ Technetium-99 (⁹⁹Tc) sulfur colloid injection and ⁹⁹Tc pertechnetate-tagged red blood cells are the two methods of obtaining this test. ⁹⁹Tc sulfur colloid has the advantage of requiring no preparation and can be injected directly into the patient. The half-life of ⁹⁹Tc sulfur colloid is 2 to 3 minutes as it is quickly cleared by the reticuloendothelial system; thus, it is only useful for patients who are actively hemorrhaging.⁷ On the other hand, ⁹⁹Tc pertechnetate-tagged red blood cells require several minutes to prepare, but the half-life of this method is measured in hours. The longer half-life of labeled red blood cells allows for detection of active as well as intermittent bleeding up to 24 hours from the time of injection. The ability to obtain delayed imaging and detect intermittent bleeding make ⁹⁹Tc pertechnetate-tagged red blood cell nuclear scintigraphy the preferred initial method to evaluate LGIB in most institutions.

The use of nuclear scintigraphy in the evaluation of LGIB is debatable. A review of 600 nuclear scans revealed the site of bleeding in 45% of evaluations.¹⁴ In another study, 62% of patients who were hypotensive within 24 hours of undergoing a scan had a diagnostic scan.¹⁵ These varying results suggest that the outcome of nuclear scintigraphy may be a result of timing and patient selection rather than the inferiority of the study itself. The ability of nuclear scintigraphy to localize a bleeding site is also variable in the literature. The reported localization of colonic bleeding by this study ranges from 41 to 94%;⁷ thus, most surgeons would not use nuclear scintigraphy as a guide for surgical intervention.

Although nuclear scintigraphy is not suited for guiding surgical therapy, its role as a screening exam for more invasive localization techniques is more accepted. Gunderman et al reported an increase in diagnostic yield from 22 to 53% for mesenteric angiograms preceded by a positive ⁹⁹Tc pertechnetate-tagged red blood cell scintigram.¹⁶ In a review from the Ochsner Clinic, a positive nuclear scan within 2 minutes of injecting ⁹⁹Tc pertechnetate-tagged red blood cells had a positive predictive value of 77% on the subsequent mesenteric angiography. A delayed positive result, greater than 2 minutes, corresponded to a negative predictive value of 93%.¹⁷ Another study from the same institution concluded that a negative nuclear scintigram indicates that the patient can safely be observed and undergo delayed colonoscopy. Twenty-seven percent of patients in this review of 84

negative scans had recurrent bleeding. However, 69% of these episodes occurred more than 30 days after the index bleed. None of the patients required surgical intervention, and no deaths occurred during the study.¹⁸ With its low complication rate and ability to distinguish which patients will benefit from invasive therapy, nuclear scintigraphy is an important screening test in the evaluation of LGIB.

ANGIOGRAPHY

Mesenteric angiography was first described as a localization technique for gastrointestinal bleeding in the 1960s.¹⁹ This technique requires a rate of bleeding of 0.5 mL/minute; thus, angiography is not as sensitive as nuclear scintigraphy.²⁰ The diagnostic yield of angiography is reported as 40 to 86,^{10,21-28} but this study is more precise in providing the anatomic location of colonic bleeding. Of all the common causes of LGIB, diverticular hemorrhage is the most likely to be visualized on mesenteric arteriography. The arterial bleeding from the vasa rectum allows for the extravasation of contrast in the early arterial phase. The contrast blush will intensify and persist through the venous phase and can assume a rounded shape as extravasated contrast fills the offending diverticulum.²³ The ability to localize a bleeding source with arteriography has resulted in decreased mortality for patients who eventually require surgery.²⁵

In addition to localizing bleeding, arteriography has the advantage of allowing therapeutic intervention at the time of diagnosis. Infusion of vasopressin into the mesenteric vasculature to control diverticular hemorrhage was first described by Baum et al in 1973.²⁹ Vasopressin infusion results in decreased blood flow to the offending site by causing colonic wall and arteriolar contraction. With this technique, an infusion catheter is placed into either the IMA or SMA and vasopressin infusion is begun at a rate of 0.2 units per minute. If a follow-up arteriogram reveals continued bleeding, the rate of vasopressin infusion can be increased to 0.4 units per minute and continued for 6 to 12 hours. This is followed by saline infusion for another 6 to 12 hours and a completion arteriogram. If bleeding has arrested, then the catheter is removed.⁹

The immediate success rate of vasopressin infusion in controlling LGIB is ~80% with a reported range of 36 to 100%.^{21,29,30} Success rates for diverticular bleeding are better than for other pathology with reported success rates of 92 to 100% immediate control of hemorrhage.^{31,32} Early recurrent hemorrhage following vasopressin infusion occurs in 36 to 43% of patients; thus, the overall success rate of mesenteric infusion of vasopressin is ~50%.^{31,32} In addition, this technique involves the infusion of a systemically active agent and long periods of time requiring vascular access, resulting in a major complication rate of 0 to 21%. These

complications include myocardial ischemia, arrhythmia, peripheral ischemia, aortic and femoral artery thrombosis, mesenteric thrombosis, and bowel ischemia. Of the major complications, up to 9% of them are fatal.³²⁻³⁵ The poor durability and increased complication rate of vasopressin infusion has led to its abandonment as the vascular intervention of choice in favor of embolization techniques.

Transcatheter embolization for the control of LGIB was first described by Bookstein et al in 1974.³⁶ Early results of mesenteric embolization were disappointing as bowel infarction occurred in 20 to 33% of patients.^{37,38} With the development of coaxial microcatheters and newer thrombotic agents, less than 10% of cases are complicated by ischemia requiring surgical intervention.³⁹ In a review of their results, Funaki et al report an immediate control rate of 96% and a prolonged hemorrhagic control rate of 81%. In their series, microcoil embolization at the level of the vasa recta or the marginal artery was utilized in all patients.⁴⁰ Results published by Khama et al support the results of Funaki and colleagues. In this meta-analysis, an overall failure rate of superselective embolization to control diverticular hemorrhage was 15%. This study also reports improved results when superselective embolization is applied to diverticular bleeding in comparison to other colonic pathology.³⁹

COLONOSCOPY

Like arteriography, colonoscopy allows for simultaneous diagnosis and treatment for colonic bleeding; however, controversies exist concerning the use of colon preparation, the timing of index colonoscopy, and the clinical impact of this modality in the management of LGIB. First, the need for colonic purging prior to colonoscopy is debated. Jensen et al performed urgent colonoscopy after patients underwent a 5 to 6 L sulfate purge. The authors stress the need for a prepared colon to adequately evaluate the colon. The diagnostic yield of colonoscopy in this study was 71%.⁴¹ On the other hand, Chaudry et al performed urgent colonoscopy for LGIB without the use of colonic preparation. They claim information gained from the amount and distribution of blood in the colon aids in diagnosis and is lost with the use of oral colonic preparation. Chaudry et al were able to complete the endoscopic evaluation of the colon in 98% of cases with a diagnostic yield of 97%.⁴² Likewise, Rossini et al report correct localization of colonic bleeding in 76% of 409 patients who underwent unprepared colonoscopy for LGIB.⁴³ The timing of index colonoscopy after an episode of LGIB was explored by a review of 94 colonoscopies from the Mayo Clinic. In this study, patients with diverticular hemorrhage underwent colonoscopy an average of 18 ± 11 (0 to 59) hours after presentation to hospital. No significant relationship

between diagnostic yield and timing of index colonoscopy was discovered⁴⁴; thus, it appears that stable patients with self-limited diverticular bleeding can undergo colonoscopy at a convenient time without impacting the endoscopist's ability to arrive at a diagnosis. Finally, some authors claim that urgent endoscopy can decrease hospital length of stay.⁴⁵ This was not supported by the only randomized clinical trial concerning the management of LGIB with colonoscopy. In this study, Green et al randomized 100 patients to either urgent colonoscopy following colon purge or a "standard algorithm" involving visceral angiography and elective colonoscopy. Their analysis did not demonstrate statistical difference in the length of intensive care unit care or hospitalization between the two groups.⁴⁶

Once the endoscopist diagnoses the cause of LGIB, various methods to control bleeding can be successfully employed. Chaudry et al applied epinephrine injection and electrocoagulation to 17 patients with diverticular bleeding. They obtained immediate hemorrhagic control in 25% of patients with active bleeding.⁴² Likewise, Bloomfield et al applied the same therapeutic technique in 13 patients with diverticular hemorrhage. Immediate hemostasis was obtained in 62% of the cases with an early rebleed rate of 38%.⁴⁷ Greene et al was able to obtain hemostasis in 86% of patients undergoing urgent colonoscopy utilizing epinephrine injections and electrocoagulation. Twenty five percent of these patients experienced early rebleeding.⁴⁶ Hemoclips were utilized by Yen et al to control 100% of diverticular bleeds seen at their institution. None of these patients experienced recurrent bleeding episodes during their hospitalization.⁴⁸ A review of the literature reveals a 14% incidence of early recurrent bleeding following endoscopic treatment of diverticular bleeding utilizing various techniques.⁴⁷ In conclusion, endoscopic therapy can achieve results approaching that of superselective embolization when performed by a skilled endoscopist.

SURGERY

Despite advances in diagnostic and therapeutic technology, 10 to 25% of cases of LGIB will require surgical intervention.²⁷ Hemodynamically unstable patients who do not respond to resuscitation represent the rare surgical emergency in the management of lower gastrointestinal bleeding and should be taken expediently for exploration. In these patients, intraoperative attempts to identify an obscure source of bleeding must be undertaken to exclude a small bowel lesion and prevent unnecessary colectomy. Options for this include bimanual palpation, transillumination, and enteroscopy. If these maneuvers fail to demonstrate a small bowel source of bleeding, then a total abdominal colectomy is the surgical procedure of choice. This procedure is associated with an approximate mortality of 27%; however, recurrent hemorrhage occurs

in less than 1% of cases.⁴⁹ LGIB patients who initially stabilize but continue to experience bleeding are more commonly encountered. Continued bleeding with transfusion requirements of 6 or more units of packed red blood cells or with episodes of hemodynamic instability is an indication for surgical therapy.⁵⁰ In patients with successful preoperative localization, a segmental colon resection can be safely performed. The reported mortality rate from this procedure is 10% with a 14% chance of rebleeding.⁴⁹ This is also true for patients with pancolonic diverticular disease and bleeding localized to a particular colonic segment.¹⁰ In patients without localization of a bleeding source, segmental resection is discouraged because of a 35 to 75% rate of recurrent hemorrhage and a mortality of 20 to 50%.⁹ Total abdominal colectomy with attempts to exclude a small bowel source is the surgical procedure of choice in these patients.⁴⁹

CONCLUSION

Diverticulosis coli remains the most common cause of lower gastrointestinal bleeding in Westernized civilizations. This disease can present the most skilled clinician with a challenging diagnostic and therapeutic dilemma. Treatment protocols based on local resources and expertise should be developed to ensure the best possible outcomes for these difficult patients.

REFERENCES

- Longstreth GF. Epidemiology and outcome of patients hospitalized with acute lower gastrointestinal hemorrhage: a population-based study. *Am J Gastroenterol* 1997;92(3):419-424
- Strate LL, Ayanian JZ, Kotler G, Syngal S. Risk factors for mortality in lower intestinal bleeding. *Clin Gastroenterol Hepatol* 2008;6:1004-1010
- Meyers MA, Alonso DR, Baer JW. Pathogenesis of massively bleeding colonic diverticulosis: new observations. *AJR Am J Roentgenol* 1976;127(6):901-908
- Gennaro AR, Rosemond GP. Colonic diverticula and hemorrhage. *Dis Colon Rectum* 1973;16(5):409-415
- Jansen A, Harenberg S, Grenda U, Elsing C. Risk factors for colonic diverticular bleeding: a westernized community based hospital study. *World J Gastroenterol* 2009;15:457-461
- Yamada A, Sugimoto T, Kondo S, et al. Assessment of the risk factors for colonic diverticular hemorrhage. *Dis Colon Rectum* 2008;51(1):116-120
- Hoedema RE, Luchtefeld MA. The management of lower gastrointestinal hemorrhage. *Dis Colon Rectum* 2005;48(11):2010-2024
- Breen E, Murray JJ. Pathophysiology and natural history of lower gastrointestinal bleeding. *Semin Colon Rectal Surg* 1997;8:128-138
- Vernava AM III, Moore BA, Longo WE, Johnson FE. Lower gastrointestinal bleeding. *Dis Colon Rectum* 1997;40(7):846-858
- Browder W, Cerise EJ, Litwin MS. Impact of emergency angiography in massive lower gastrointestinal bleeding. *Ann Surg* 1986;204(5):530-536
- Alavi A, Ring EJ. Localization of gastrointestinal bleeding: superiority of 99mTc sulfur colloid compared with angiography. *AJR Am J Roentgenol* 1981;137(4):741-748
- Miskowiak J, Nielsen SL, Munck O. Scintigraphic diagnosis of gastrointestinal bleeding with 99mTc-labeled blood-pool agents. *Radiology* 1981;141(2):499-504
- Kester RR, Welch JP, Sziklas JP. The 99mTc-labeled RBC scan. A diagnostic method for lower gastrointestinal bleeding. *Dis Colon Rectum* 1984;27(1):47-52
- Zuckerman GR, Prakash C. Acute lower intestinal bleeding: Part I: clinical presentation and diagnosis. *Gastrointest Endosc* 1998;48(6):606-617
- Feingold DL, Caliendo FJ, Chinn BT, et al. Does hemodynamic instability predict positive technetium-labeled red blood cell scintigraphy in patients with acute lower gastrointestinal bleeding? A review of 50 patients *Dis Colon Rectum* 2005;48(5):1001-1004
- Gunderman R, Leef J, Ong K, Reba R, Metz C. Scintigraphic screening prior to visceral arteriography in acute lower gastrointestinal bleeding. *J Nucl Med* 1998;39(6):1081-1083
- Ng DA, Opelka FG, Beck DE, et al. Predictive value of technetium Tc 99m-labeled red blood cell scintigraphy for positive angiogram in massive lower gastrointestinal hemorrhage. *Dis Colon Rectum* 1997;40(4):471-477
- Hammond KL, Beck DE, Hicks TC, Timmcke AE, Whitlow CW, Margolin DA. Implications of negative technetium 99m-labeled red blood cell scintigraphy in patients presenting with lower gastrointestinal bleeding. *Am J Surg* 2007;193(3):404-407; discussion 407-408
- Drapanas T, Pennington DG, Kappelman M, Lindsey ES. Emergency subtotal colectomy: preferred approach to management of massively bleeding diverticular disease. *Ann Surg* 1973;177(5):519-526
- Nusbaum M, Baum S. Radiographic demonstration of unknown sites of gastrointestinal bleeding. *Surg Forum* 1963;14:374-375
- Leitman IM, Paull DE, Shires GT III. Evaluation and management of massive lower gastrointestinal hemorrhage. *Ann Surg* 1989;209(2):175-180
- Boley SJ, Sammartano R, Adams A, et al. On the nature and etiology of vascular ectasias of the colon. Degenerative lesions of aging. *Gastroenterology* 1977;72:650-660
- Casarella WJ, Galloway SJ, Taxin RN, et al. Lower gastrointestinal tract hemorrhage: new concepts based on arteriography. *AJR Am J Roentgenol* 1974;121:357-368
- Nath RL, Sequeira JC, Weitzman AF, Birkett DH, Williams LF Jr. Lower gastrointestinal bleeding. Diagnostic approach and management conclusions. *Am J Surg* 1981;141(4):478-481
- Uden P, Jiborn H, Jonsson K. Influence of selective mesenteric arteriography on the outcome of emergency surgery for massive, lower gastrointestinal hemorrhage: a 15-year experience. *Dis Colon Rectum* 1986;29(9):561-566
- Welch CE, Athanasoulis CA, Galdabini JJ. Hemorrhage from the large bowel with special reference to angiodysplasia and diverticular disease. *World J Surg* 1978;2(1):73-83
- Colacchio TA, Forde KA, Patsos TJ, Nunez D. Impact of modern diagnostic methods on the management of active

- rectal bleeding: Ten year experience. *Am J Surg* 1982;143:607-610
28. Britt LG, Warren L, Moore OF III. Selective management of lower gastrointestinal bleeding. *Am Surg* 1983;49(3):121-125
 29. Baum S, Rösch J, Dotter CT, et al. Selective mesenteric arterial infusions in the management of massive diverticular hemorrhage. *N Engl J Med* 1973;288(24):1269-1272
 30. Molgaard CP. Mesenteric angiography for the diagnosis and treatment of lower gastrointestinal bleeding. *Semin Colon Rectal Surg* 1997;8:164-171
 31. Athanasoulis CA, Baum S, Rösch J, et al. Mesenteric arterial infusions of vasopressin for hemorrhage from colonic diverticulosis. *Am J Surg* 1975;129(2):212-216
 32. Johnson WC, Widrich WC. Efficacy of selective splanchnic arteriography and vasopressin perfusion in diagnosis and treatment of gastrointestinal hemorrhage. *Am J Surg* 1976;131(4):481-489
 33. Clark RA, Colley DP, Eggers FM. Acute arterial gastrointestinal hemorrhage: efficacy of transcatheter control. *AJR Am J Roentgenol* 1981;136(6):1185-1189
 34. Eckstein MR, Kelemouridis V, Athanasoulis CA, Waltman AC, Feldman L, van Breda A. Gastric bleeding: therapy with intraarterial vasopressin and transcatheter embolization. *Radiology* 1984;152(3):643-646
 35. Sherman LM, Shenoy SS, Cerra FB. Selective intra-arterial vasopressin: clinical efficacy and complications. *Ann Surg* 1979;189(3):298-302
 36. Rösch J, Dotter CT, Brown MJ. Selective arterial embolization. A new method for control of acute gastrointestinal bleeding. *Radiology* 1972;102(2):303-306
 37. Bookstein JJ, Chlosta EM, Foley D, Walter JF. Transcatheter hemostasis of gastrointestinal bleeding using modified autogenous clot. *Radiology* 1974;113(2):277-285
 38. Chuang VP, Wallace S, Zornoza J, Davis LJ. Transcatheter arterial occlusion in the management of rectosigmoidal bleeding. *Radiology* 1979;133(3 Pt 1):605-609
 39. Khanna A, Ognibene SJ, Koniaris LG. Embolization as first-line therapy for diverticulosis-related massive lower gastrointestinal bleeding: evidence from a meta-analysis. *J Gastrointest Surg* 2005;9(3):343-352
 40. Funaki B, Kostelic JK, Lorenz J, et al. Superselective microcoil embolization of colonic hemorrhage. *AJR Am J Roentgenol* 2001;177(4):829-836
 41. Jensen DM, Machicado GA, Jutabha R, Kovacs TOG. Urgent colonoscopy for the diagnosis and treatment of severe diverticular hemorrhage. *N Engl J Med* 2000;342(2):78-82
 42. Chaudhry V, Hyser MJ, Gracias VH, Gau FC. Colonoscopy: the initial test for acute lower gastrointestinal bleeding. *Am Surg* 1998;64(8):723-728
 43. Rossini FH, Perrari A, Spandore M, et al. Emergency colonoscopy. *World J Surg* 1989;13:190-192
 44. Smoot RL, Gostout CJ, Rajan E, et al. Is early colonoscopy after admission for acute diverticular bleeding needed? *Am J Gastroenterol* 2003;98(9):1996-1999
 45. Machicado GA, Jensen DM. Acute and chronic management of lower gastrointestinal bleeding: cost-effective approaches. *Gastroenterologist* 1997;5(3):189-201
 46. 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(11):2395-2402
 47. Bloomfeld RS, Rockey DC, Shetzline MA. Endoscopic therapy of acute diverticular hemorrhage. *Am J Gastroenterol* 2001;96(8):2367-2372
 48. Yen EF, Ladabaum U, Muthusamy VR, Cello JP, McQuaid KR, Shah JN. Colonoscopic treatment of acute diverticular hemorrhage using endoclips. *Dig Dis Sci* 2008;53(9):2480-2485
 49. Bender JS, Wiencek RG, Bouwman DL. Morbidity and mortality following total abdominal colectomy for massive lower gastrointestinal bleeding. *Am Surg* 1991;57(8):536-540; discussion 540-541
 50. Bass BL, Turner DJ. Acute gastrointestinal hemorrhage. In: Townsend CM Jr, Beauchamp RD, Evers BM, Mattox KL, eds. *Sabiston Textbook of Surgery. The Biological Basis of Modern Surgical Practice*. 17th Ed. Philadelphia: Saunders; 2004:1241-1264