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Diagnosis and treatment of definitive diverticular hemorrhage (DDH)

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Diverticular hemorrhage is the most common cause of severe colonic bleeding in adults [1–5]. Urgent colonoscopy (after purging the colon to clear stool, clots, and blood) is the gold standard for diagnosis of DDH based on CURE Hemostasis Group studies [3, 4, 6, 7]. The diagnosis of DDH depends upon finding some stigma of recent hemorrhage (stigmata) in a single diverticulum [6, 8]. We classify diverticular stigmata as active arterial bleeding, oozing, non-bleeding visible vessel, adherent clot, or flat spot, similar to peptic ulcer bleeding [4, 6–8] (Fig. 1). For our patients with DDH on colonoscopy, more than 60% have diverticula with the stigmata at or proximal to the splenic flexure [4, 6]. Also, on urgent colonoscopy, about 50% of stigmata are in the base of the diverticulum and 50% are at the neck. Our diagnosis is ‘presumptive diverticular hemorrhage’ for patients with severe hematochezia and diverticula without stigmata and a negative anoscopy, push enteroscopy, and capsule endoscopy [3, 4]. Those with another (non-diverticular) source of hemorrhage in the colon, UGI track, or small bowel are diagnosed as ‘incidental diverticular hemorrhage’.

[3, 4]

DIVERTICULAR VASCULAR ANATOMY

Arterial vascular anatomy is shown in Fig. 2. Relating arterial blood flow and artery location to the stigmata is critical for successful endoscopic hemostasis of DDH, as in ulcers [4, 9]. An arcade is formed by submucosal and subserosal arteries in the diverticular neck joining with a larger mesenteric artery in the base. Blood flow is bidirectional in these arteries. When endoscopists only treat on top of the stigmata or remotely from it, arterial blood flow often continues and rebleeding through the side hole of the artery (underneath the stigmata) is likely [10, 11].

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CONFLICT OF INTEREST

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In CURE Doppler endoscopic probe studies, about 90% of all stigmata in diverticula had underlying blood flow and the artery location was traced [6, 8]. Doppler probe allows us to focus hemostasis on and adjacent to stigmata, to seal the underlying artery, eliminate focal blood flow, and prevent rebleeding [6]. This treatment is safe and effective, similar to use in ulcers [6, 9].

TECHNIQUES FOR ENDOSCOPIC DIAGNOSIS AND TREATMENT

Resuscitation, correction of coagulopathies, and clearing the colon of stool and blood are required to visualize and localize DDH. Performing urgent colonoscopy within 15–24 h will increase the yield of finding stigmata (Fig. 1). Goals of diverticular hemostasis are control of active bleeding and prevention of rebleeding [3, 4, 6–8]. For active arterial bleeding or adherent clots, 1:20,000 epinephrine is injected in 1–1.5 cc on or around the stigmata. This usually controls active bleeding temporarily and for adherent clots reduces rates of induced bleeding with cold guillotining off clots, as in ulcer hemostasis [9, 12]. Then hemoclips or multipolar electrocoagulation (MPEC) is applied for definitive hemostasis.

For standard colonoscopic treatment of DDH, we recommend MPEC coagulation for stigmata at the neck of the diverticulum (for coaptive coagulation) and hemoclippping for stigmata in the base (for mechanical closure of the artery) [6] (Figs. 3 and 4). For stigmata in the diverticular base, hemoclippping is usually with epinephrine pre-injection. Hemoclippping on and within 5 mm on each side of the stigmata along the artery is recommended [6] (Fig. 3). For stigmata at the neck, MPEC (low power—12–15 watts, short pulses 1–2 s, and moderate laterally applied tamponade pressure) is effective in coaptively coagulating the underlying small arteries, similar to PUB's [6, 9, 13] (Fig. 4.) Doppler probe is useful to confirm obliteration of underlying arterial blood flow and improve definitive hemostasis [6].

LIMITATIONS, PROBLEMS, AND RISK FACTORS FOR REBLEEDING

Focal treatment of stigmata and obliteration of underlying arterial blood flow are required for definite diverticular hemostasis [6]. This is critical for success of endoscopic hemostasis particularly if bleeding is from the base, where the artery is larger. If the endoscopist attempts to close the diverticular neck with hemoclips when the stigmata is in the base, rebleeding is very common [10, 11]. Based on arterial vascular anatomy (Fig. 2), bidirectional blood flow, and a patent artery in the base, rebleeding is predictable. Therefore, this technique is not recommended [10, 11]. Transendoscopic hemoclips do not always obliterate the underlying artery because they may be difficult to place or they fall off with colon motility. Furthermore, epinephrine or saline injection alone are only temporary and not definitive, because arterial blood flow underneath stigmata returns soon, when monitored by Doppler probe [6].

Risk factors for rebleeding within 30 days include endoscopic treatment remote from the stigmata (such as at the neck rather than base), residual arterial blood flow after visually guided hemostasis with any technique, medical treatment alone without endoscopic hemostasis, and early re-institutional of anti-coagulants and/or anti-platelet drugs [4, 6, 10, 11].

Limitations of our approach are the need for thorough cleansing of the colon by purge prior to urgent colonoscopy and having a GI hemostasis team readily available which is skilled in diagnosis and treatment of diverticular bleeding [1–3, 6]. Thermal coagulation in the diverticular base can cause post-coagulation syndrome, pneumoperitoneum, or perforation [4, 6]. Use of hemoclips for stigmata in the base and MEPC at the neck has obviated this potential complication in our experience [3, 4, 6, 7].

RESULTS

See Table 1 for a comparison of 118 CURE patients with definitive diverticular hemorrhage treated medically or endoscopically by our group. 30-day outcomes for patients with major stigmata (active bleeding, non-bleeding visible vessel, and adherent clot) are shown, but spots are not included [8]. Patients with endoscopic hemostasis had significantly better outcomes than those managed medically without endoscopic hemostasis [2–4, 6].

CONCLUSIONS

Successful diagnosis and endoscopic treatment of definitive diverticular hemorrhage depend upon on a good colon preparation, a dedicated and skilled hemostasis team, and knowledge of stigmata and diverticular arterial blood flow. Although more challenging than endoscopic management of ulcers, significant improvements in clinical outcomes are reported with a focused, urgent endoscopic approach to patients with diverticular hemorrhage [1–6, 8].

REFERENCES

1. Longstreth GF. Epidemiology and outcome of patients hospitalized with acute lower gastrointestinal hemorrhage: a population-based study *Am J Gastroenterol*. 1997;92:419–24. [PubMed: 9068461]
2. Jensen DM, Machicado GA. Diagnosis and treatment of severe hematochezia—the role of urgent colonoscopy after purge. *Gastroenterology*. 1988;95:1569–74. [PubMed: 3263294]
3. Jensen DM, Machicado GA, Jutabha R, Kovacs TOG. Urgent colonoscopy for the diagnosis and treatment of severe diverticular hemorrhage. *N Engl J Med* 2000;342:78–82. [PubMed: 10631275]
4. Jensen DM. Diverticular Bleeding: An Appraisal Based Upon Stigmata of Recent Hemorrhage. *Tech Gastrointest Endosc*. 2001;3:192–8.
5. Strate LL, Gralnek IM. ACG clinical guideline: management of patients with acute lower gastrointestinal bleeding. *Am J Gastroenterol*. 2016;111:459–74. [PubMed: 26925883]
6. Jensen DM, Ohning GV, Kovacs TOG, Jutabha R, Ghassemi K, Machicado GA, Dulai GS. Natural history of definitive diverticular hemorrhage based upon stigmata of recent hemorrhage and doppler blood flow monitoring for risk stratification and definitive hemostasis. *Gastrointest Endosc*. 2016;83:416–23. [PubMed: 26227931]
7. Savides TJ, Jensen DM, Machicado GA, Hirabayashi K. Colonoscopic hemostasis for recurrent diverticular hemorrhage associated with a visible vessel: a report of three cases. *Gastrointest Endosc*. 1994;40:70–73. [PubMed: 8163141]
8. Jensen DM, Jensen ME, Kovacs TOG, Ghassemi KA, Ohning GV, Kaneshiro M, Sedarat A, Dulai GS, Machicado GA. Flat spots are unrecognized as stigmata for diagnosis of definitive diverticular hemorrhage in the colon. *Gastrointest Endosc*. 2017;85:AB247.
9. Jensen DM, Kovacs TOG, Ohning GV, Ghassemi K, Machicado GA, Dulai GS, Sedarat A, Jutabha R, Gornbein J. Doppler endoscopic probe monitoring for blood flow improves risk stratification and outcomes of patients with severe non-variceal UGI hemorrhage. *Gastroenterology*. 2017;152:1310–8. [PubMed: 28167214]

10. Ishii N, Hirata N, Omata F, Itoh T, Uemura M, Matsuda M, et al. Location in the ascending colon is a predictor of refractory colonic diverticular hemorrhage after endoscopic clipping. *Gastrointest Endosc*. 2012;76:1175–81. [PubMed: 23021162]
11. Kawanishi K, Kato J, Kakimoto T, et al. Risk of colonic diverticular rebleeding according to endoscopic appearance. *Endosc Int Open*. 2018;06:E36–E42.
12. Jensen DM, Kovacs TOG, Jutabha R, Machicado GA, Gralnek IM, Savides TJ, Smith J, Jensen ME, Alofaituli G, Gornbein J. Randomized, controlled trial of medical therapy compared to endoscopic therapy for prevention of recurrent ulcer hemorrhage in patients with non-bleeding adherent clots. *Gastroenterology*. 2002;123:407–13. [PubMed: 12145792]
13. Johnston JH, Jensen DM, Auth D. Experimental comparison of endoscopic Yttrium aluminum-Garnet laser, electrosurgery, and heater probe for canine gut arterial coagulation: the importance of vessel compression and avoidance of tissue erosion. *Gastroenterology*. 1987;92:1101–8. [PubMed: 3493938]

Fig. 1.

Stigmata of definitive diverticular hemorrhage (and their prevalence as a percentage of total). a. Active arterial bleeding (25%) from the diverticular base. b. Non-bleeding visible vessel (25%—prevalence) at the diverticular neck. c. Adherent clot (35%) in the diverticular base. d. Flat spot (15%) in the diverticular base. These stigmata are difficult to identify in an unprepped colon. Although some endoscopists may consider this approach to diagnose active bleeding, active arterial bleeding is found in only about 25% of cases and they will not be able to identify the other 75% of stigmata because of blood, stool, and clots. Volume resuscitation, cleansing the colon with a purge (usually 6–8 liters), target irrigation and suctioning, and utilization of a cap on colonoscope facilitate identification and treatment of all the stigmata, not just active bleeding

Fig. 2.

Arterial vasculature In a colon diverticulum. An arcade is formed in the neck by submucosal and subserosal arteries joining with a larger mesenteric artery in the diverticular base. Stigmata are focal and represent the side hole in an underlying artery

Fig. 3.

a Non-bleed visible vessel in the diverticular base. **b** Hemocliping on either side of the non-bleeding visible vessel is to occlude the artery underneath it and to prevent diverticular rebleeding by achieving definitive hemostasis. Hemocliping can be done with or without epinephrine pre-injection, but this is particularly useful with active bleeding or an adherent clot to improve visualization

Fig. 4.

a For active bleeding at the diverticular neck, pre-injection with dilute epinephrine is recommended to control or slow active bleeding so that focal treatment is possible. Remote treatment (such as clipping) away from the stigmata is ineffective for definitive diverticular hemostasis. **b.** Then multipolar electrocoagulation (MPEC) with lateral coagulation is applied. It is fast and safe. MPEC coaptively coagulates the underlying small artery at the neck, which usually results in definitive hemostasis

Table 1

Outcomes: 118 definitive diverticular bleeds (CURE prospective, cohort studies)

	Medical treatment	Medical—endoscopic treatment
Patients	37	81
More bleeding ^a	24 (64.9%) [*]	5 (6.2%)
Severe rebleeding ^b	16 (43.2%) [*]	2 (2.5%) ^c
Surgery or embolization	16 (43.2%) [*]	2 (2.5%) ^c
Median time to discharge	8.5 days [*]	2 days
Complications	2 (5.5%)	2 (2.5%) ^d

^a More bleeding is clinical rebleeding with transfusion of ≥ 3 more units of red blood cells (RBC's) after resuscitation and initial urgent colonoscopy

^b Severe rebleeding is clinical rebleeding, transfusion of >3 units RBC's after baseline resuscitation, and either surgery or angiography for control of bleeding

^c After anticoagulation

^d 1 post coagulation syndrome and 1 pneumoperitoneum without perforation both after MPEC treatment of active bleeding in TIC bases.

^{*} $p < 0.05$