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ORIGINAL PAPER

Colonoscopic Treatment of Acute Diverticular Hemorrhage Using Endoclips

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Abstract Although colonoscopy is used in the diagnostic evaluation of patients with diverticular hemorrhage, data on colonoscopic treatment outcomes are limited. We reviewed records of inpatients undergoing colonoscopy to identify patients that were colonoscopically diagnosed and treated for acute diverticular hemorrhage. Eleven patients with acute diverticular hemorrhage had active bleeding ($n = 7$) or non-bleeding visible vessel ($n = 4$) at colonoscopy. Endoclip treatment (preceded by epinephrine injection in 64%) achieved hemostasis in all patients without procedural complications. Patients were discharged within three days without evidence of early rebleeding. During a median follow-up of 15 months, late recurrent bleeding occurred in two patients (18.2%). Colonoscopic treatment of patients with acute diverticular hemorrhage using endoclips appears to be effective and safe, with high rates of immediate and long-term success. Colonoscopy should be considered in patients with suspected acute diverticular hemorrhage, as it may enable definitive therapy without the need for more invasive treatment.

Keywords Diverticulosis · Diverticular hemorrhage · Colonoscopy · Hematochezia

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Diverticular hemorrhage is the most common identifiable cause of lower gastrointestinal (GI) bleeding, comprising 15–55% of cases [1], and remains a common cause of hospitalization [2]. There is recent interest in performing urgent colonoscopy with endoscopic treatment of diverticular bleeding at many centers. The success of colonoscopic treatment for diverticular hemorrhage, especially regarding long-term outcome after initial treatment, is largely unknown. Here, we report a relatively large experience to date of colonoscopic therapy, utilizing endoclips, in controlling acute diverticular hemorrhage.

Patients and methods

We reviewed endoscopic records of all patients admitted from March 2004 to December 2005 who underwent inpatient colonoscopy for evaluation of overt lower GI bleeding within the University of California San Francisco academic program, which includes Moffitt-Long Hospital, San Francisco General Hospital, and the San Francisco Veterans Affairs Medical Center. In our system there are no pre-defined algorithms for managing acute lower GI bleeding. Initial triage was performed by housestaff and emergency department attendings. Specific evaluation and management of lower GI bleeding was then directed by the on-call gastroenterology fellow and attending.

Patients were included in this report only if attempts at endoscopic treatment were performed and evidence of definite diverticular hemorrhage were found, defined as the colonoscopic visualization of active bleeding or non-bleeding visible vessels from or within a diverticulum. All other patients with overt hematochezia, including those with presumed diverticular bleeding, but without stigmata as stated above, were excluded.

Patients received standard supportive medical care for lower GI bleeding, including monitoring for hemodynamic stability and intravenous crystalloid and/or colloid when needed. Nasogastric tube lavages were performed to exclude upper GI sources of hemorrhage. Colonoscopy preparation consisted of poly(ethylene glycol) (Golytely, Braintree Laboratories, Braintree, MA, USA), either orally or via nasogastric tube. Nursing staff were instructed to give 1 l poly(ethylene glycol) every 30–45 min when using a nasogastric tube, with the goal of continuing until the rectal effluent was liquid without clots or stool. Patients received between 3 and 8 l poly(ethylene glycol).

After informed consent had been obtained, patients underwent colonoscopy under conscious sedation using adult colonoscopes (Olympus CF-Q160, CF-Q180; Olympus America, Melville, NY, USA or Pentax EC3831-L; Pentax Medical Company, Montvale, NJ, USA). Attempts at close visual inspection of each diverticulum for bleeding or visible vessels were performed. If the dome of a diverticulum was obstructed from view because of fecal material or clot, the area was vigorously irrigated. Mechanical methods (e.g. biopsy forceps) were also used to carefully remove residual clot, if necessary. Colonoscopes with dedicated water-pump irrigation systems were used in most (55%), while other cases required syringe irrigation through the instrument channel.

Patient demographics and clinical history were recorded. The hospital course was reviewed to determine units of blood transfusions, length of hospitalization after endoscopy, and need for other non-endoscopic diagnostic or therapeutic procedures for lower GI bleeding. Procedural data, including time from admission to colonoscopy, colonic location of bleeding, location of bleeding site within the diverticulum (dome or lip), and procedural and treatment techniques were recorded. Occurrence of late recurrent bleeding, defined as hematochezia reported by the patient, and information regarding specific evaluation for these recurrent episodes were assessed through direct patient telephone contact and review of hospital records.

This study was approved by the University of California San Francisco Committee on Human Research and the San Francisco VA Research and Development Committee.

Results

Eleven patients were treated by colonoscopy for diverticular bleeding (Table 1). All patients presented with hematochezia and clinical suspicion for acute lower GI bleeding. Patient mean age was 71.7 years (range 51–92 years) and 91% were men. Most had comorbid illnesses. Eight patients (73%) were using daily aspirin or nonsteroidal anti-inflammatory medications. On initial presentation, all had red blood on digital rectal exam, and 36% had tachycardia (pulse >100) and/or low systolic blood pressure (<100 mmHg). Prior to colonoscopy, patients received a median of five units of blood transfusions.

Median time from admission to colonoscopy was 21 h. In cases #1 and #10 colonoscopic treatment occurred more than one day after admission. In case #1, the initial colonoscopy performed within 24-h was unable to locate a bleeding source. After rebleeding occurred on day 6 of the same hospitalization, a repeat colonoscopy performed 13 h after the repeat episode of hematochezia confirmed active diverticular hemorrhage. In case #10, urgent colonoscopy within 24 h of admission was deferred because of an absence of clinical evidence for ongoing overt GI bleeding. Active hematochezia recurred 4 h before a scheduled non-urgent colonoscopy, and a diverticular bleeding site was found and treated. No patients underwent tagged technetium-99m-red blood cell scintigraphy prior to colonoscopy. One patient (#2) had angiography prior to colonoscopic therapy. Despite suspicion of active bleeding, the angiogram did not reveal a bleeding source. However, at subsequent colonoscopy, an actively bleeding diverticulum in the transverse colon was identified and treated.

At the time of colonoscopic treatment, active bleeding was seen in seven patients (64%), and a non-bleeding visible vessel in four (36%). Bleeding sites were scattered throughout the colon, including the ascending colon (4), transverse colon (3), descending colon (2), and sigmoid colon (2). Diverticular hemorrhage originated from the dome of the diverticulum in most cases (82%), and from the lip in the remainder (18%).

Endoclips were used in treating diverticular hemorrhage in all cases. Thermal therapies were not used in any case during the study period. Specific clip models included the Resolution Clip (Boston Scientific, Natick, MA, USA) in five cases, the TriClip (Cook Endoscopy, Winston-Salem, NC, USA) in three cases, and the Quickclip (Olympus America, Melville, NY, USA) in four cases. More than one model was used in one case. The use of different endoclip models was unintentional and dependent on endoclip availability at each hospital site where colonoscopy was

Table 1 Demographic information, procedural findings, and follow-up data for 11 patients treated for acute diverticular hemorrhage using endoclips

Patient	Age	Sex	Comorbid conditions	Time from admission to colonoscopy	Site of bleeding	Bleeding point	Type of bleeding	# units blood transfusion (pre/post endoscopy)	Rebleeding in hospital	Length of follow-up (months)	Late rebleeding
1	92	M	CAD, HTN	7 days (see text)	Sigmoid colon	Dome	Visible vessel	3/0	No	11	No
2	75	M	HTN	24 h	Transverse colon	Dome	Visible vessel	7/0	No	22	No
3	67	M	CAD, CRI	18 h	Ascending colon	Dome	Active bleeding	7/0	No	16	No
4	77	M	None	16 h	Ascending colon	Dome	Visible vessel	2/0	No	12	No
5	69	M	COPD, HTN	10.5 h	Hepatic flexure	Lip	Active bleeding	8/0	No	15	No
6	66	M	Cirrhosis, DM, HTN	20 h	Ascending colon	Dome	Active bleeding	6/0	No	17	No
7	83	F	HTN	10 h	Sigmoid colon	Lip	Visible vessel	5/0	No	14	No
8	85	M	CAD, Afib, CHF, CRI, CVA, HTN	21 h	Descending colon	Dome	Active bleeding	4/0	No	1 (died)*	No
9	52	M	COPD, CHF, CVA, HTN	26 h	Transverse colon	Dome	Active bleeding	8/0	No	16	Yes (5 mo)
10	51	M	HTN	3 days (see text)	Transverse colon	Dome	Active bleeding	0/0	No	20	Yes (6 mo)
11	72	M	DM, HTN	22 h	Descending colon	Dome	Active bleeding	3/0	No	4	No

*This patient expired one month after treatment from unrelated complications of CHF

Abbreviations: Afib = atrial fibrillation; CAD = coronary artery disease, CHF = congestive heart failure, COPD = chronic obstructive pulmonary disease, CRI = chronic renal insufficiency, CVA = cerebral vascular accident, DM = diabetes mellitus, HTN = hypertension

performed. About 5–10 ml dilute epinephrine (1:10,000) injection treatment was also applied in 7 of 11 cases (all had active diverticular hemorrhage) for the purpose of decreasing voluminous active bleeding and thereby allowing improved visualization for endoclip targeting. When the bleeding point was located on the lip of the diverticulum, endoclips were applied directly on the site (Fig. 1). In most cases of dome-located bleeding sites (8 of 9), endoclips were applied such that one prong was over the bleeding point within the diverticulum, and the other prong (or prongs depending on clip model) extended over the diverticular lip on to adjacent colonic mucosa (Fig. 2). When active hemorrhage from the dome made it difficult to identify the actual bleeding point, additional clips were placed in a similar manner around the lip, until bleeding ceased. In one case of a dome-located bleeding site, hemorrhage was rapid from a small-mouthed diverticulum, and the diverticular orifice was nearly closed using two clips. Number of clips used per case ranged from one to six. Procedural duration was recorded in four cases, and ranged from 45–115 min.

In all instances, endotherapy achieved successful immediate hemostasis without procedural complications. No patients exhibited clinical evidence of further bleeding during their hospitalization, none required subsequent blood transfusions, and none needed further interventions for treatment of bleeding (i.e. angiography, surgery) after endoclip therapy. All patients were discharged from the hospital within 3 days of treatment.

Patients were contacted by telephone for follow-up. During a median follow-up of 15 months, late recurrent bleeding occurred in 2 of 11 patients (18.2%). After initial colonoscopic therapy, patients #9 and #10 developed recurrent hematochezia at 5 and 6 months, respectively. In both cases, urgent repeat colonoscopy revealed diverticulosis without suspicious bleeding sites. Patients #9 and #10 received two and zero units of blood transfusions, respectively. Neither had further clinical evidence of bleeding during their hospitalizations, and both were discharged home without further interventions. Although definitive causes of recurrent hemorrhage were not established, it was assumed that both had self-limited diverticular hemorrhage. Following these repeat episodes of hemorrhage neither had additional recurrence during 11 and 14-month follow-up, respectively.

Discussion

The optimal therapy for acute diverticular hemorrhage is controversial. Traditional options have included expectant medical management, angiographic therapy, and surgery. Endoscopic options have emerged more recently. The

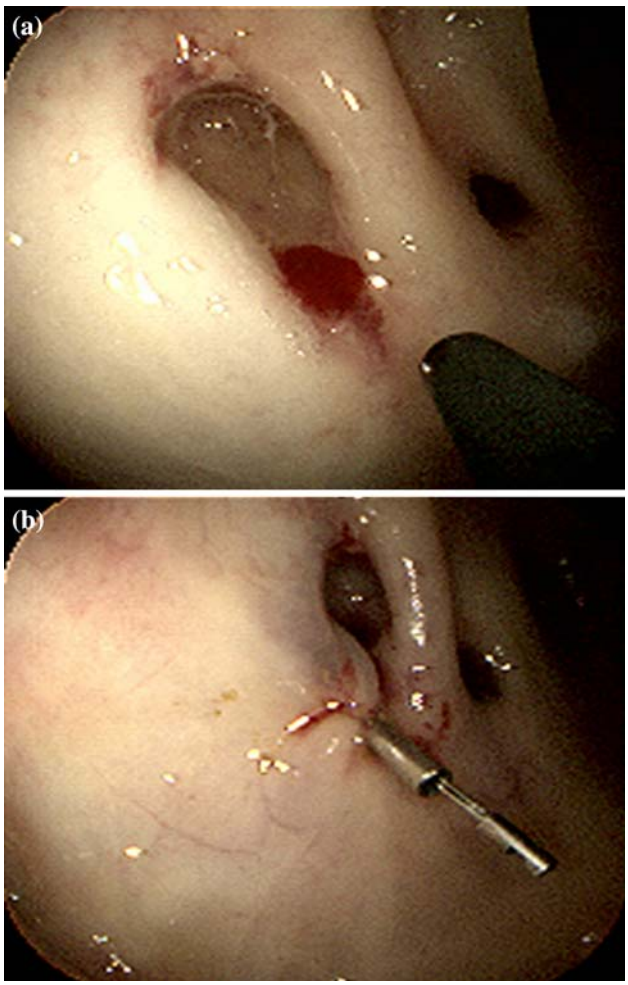

Fig. 1 (**a**) Endoscopic view of active bleeding originating from the lip of a sigmoid colon diverticulum. (**b**) Hemostasis achieved following epinephrine injection and endoclip placement directly on the bleeding site

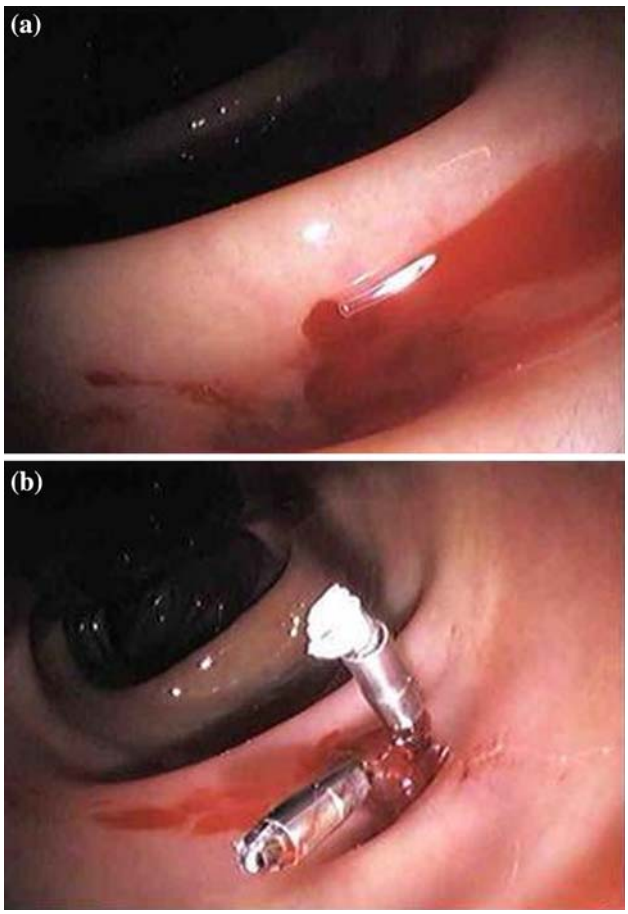

Fig. 2 (**a**) Endoscopic view of active bleeding originating from the dome of a transverse colon diverticulum. (**b**) Hemostasis achieved after epinephrine injection and placement of two endoclips along the diverticular rim (one prong inside the dome on the bleeding site and one prong outside the diverticulum on adjacent colonic mucosa)

specific management strategy is often guided by local expertise, and by the severity of hemorrhage.

Theoretically, the best treatment for overt diverticular hemorrhage would be one that is immediately successful in treating an acutely bleeding lesion safely, and one that prevents recurrent future episodes. Given that diverticular hemorrhage ceases spontaneously in many, medical management alone has been used for interval stabilization. However, delayed recurrent bleeding may occur in 16–38% with this strategy [2, 3]. Segmental colonic resection after preoperative angiography has resulted in recurrent bleeding rates of 0–15%, but has been associated with mortality rates up to 22% [4]. The mortality rate is higher overall for blind segmental resection in patients with negative angiography, ranging from 20–57% [4, 5]. Subtotal colectomy remains an option for unlocalized colonic bleeding, but surgical mortality rates vary widely from 3% to 40% [4, 6–8]. In a recent meta-analysis angiography with selective embolization for acute diverticular hemorrhage was 85% successful and was associated 30-day recurrent bleeding rates of 14% (0–75%) [9]. However, rates of recurrent bleeding over longer follow-up periods (>30 days) after angiographic embolization are not well described, and procedural complications, including intestinal ischemia, contrast allergy, renal failure, and local vascular complications range from 0–33% [9].

Recently, there has been interest at some centers in performing urgent colonoscopy to evaluate suspected acute diverticular hemorrhage. Several studies involving small series of patients have reported successful endoscopic therapies for diverticular hemorrhage, including epinephrine injection, contact thermal therapy, band ligation, and endoclips [10–27]. Critics of urgent colonoscopic evaluation may comment on the difficulty of adequate visualization in the setting of retained feces and clots. However, we believe that sufficient oral purge enables reasonable endoscopic evaluation. Moreover, we have found that technological improvements in newer models of

colonoscope with dedicated water-irrigation channels (separate from the instrument/suction channel) particularly useful in rapidly and vigorously cleansing any suspicious or obscured areas of mucosa.

Although urgent colonoscopy has been previously defined as within 12–48 h of admission, recent studies have shortened this interval to within 8–12 h of hospitalization [22, 27]. In our case series, only 2 of the 11 patients met these stringent criteria. In fact, two of our patients had colonoscopies 3 days and 7 days after admission. However, in both these cases colonoscopy was performed within 14 h of the last episode of hematochezia, and enabled us to treat a suspicious or actively bleeding diverticulum. Thus, from our experience with "urgent" colonoscopy, successful detection and treatment of diverticular bleeding seemed dependent on ongoing hematochezia as opposed to actual time from hospital admission to colonoscopy. Our results should encourage the performance of an expedited colonoscopy after rapid bowel prep for patients with ongoing or recurrent hematochezia, regardless of time interval from initial hospitalization.

Although many series describe excellent immediate success with endoscopic treatment, rates for late recurrent bleeding have varied from 0–38% [22, 23, 27]. Our experience with endoscopic treatment is an immediate treatment success rate of 100%, and a late recurrent bleeding rate of 18%. Of note, all patients in our series had diverticular hemorrhage with high-risk stigmata (active bleeding or visible vessel), and the majority (64%) required >4 units of blood transfusions. Both of these features have been identified as predictors of ongoing or early recurrent bleeding that would more likely require intervention [3, 28, 29], suggesting that expectant medical management alone may not have been sufficient for most patients in our series.

In this report, endoclips with or without epinephrine injection were used to treat all cases of diverticular hemorrhage. We preferred using this mechanical hemostatic device rather than thermal methods, as most bleeding sites were located in the diverticular dome, which lacks a relatively thicker, muscular wall. Although there are no recognized differences with respect to efficacy and safety of various endoscopic treatments, available data are based only on series with limited numbers of patients. Therefore, we are in agreement with other investigators who have suggested a theoretically decreased risk of perforation with endoclips compared with contact thermal methods [19, 26], and would advocate clips as the preferred technique for endoscopic treatment. Metal clips have the additional advantage of serving as radiographically visible targets for angiographic treatment, should endoscopic attempts fail.

In most cases of bleeding sites originating from the diverticular dome, we applied endoclips such that one prong was within the dome and the other prong(s) was (were) outside the diverticular lip on adjacent colonic mucosa (Fig. 3). We believe this technique to be an effective means of applying mechanical pressure and hemostasis either directly to the bleeding point (when visible) or on the vessel supplying the bleeding point. Moreover, this method decreased our concern with the difficulty and potential risks of attempting complete intradiverticular clip placement. When using this technique, additional endoclips can be applied circumferentially along the diverticular rim until hemostasis is achieved.

In summary, colonoscopic therapy of acute diverticular hemorrhage using endoclips appears to be safe and effective, and should be considered as one of the initial treatment strategies. It is a promising means of achieving immediate and potentially long-term hemostasis, and is associated with low rates of recurrent bleeding. Further comparative studies involving patients with similar stigmata and clinical severity of diverticular bleeding are needed to clarify the exact place of endoscopic therapy amongst the available treatment options.

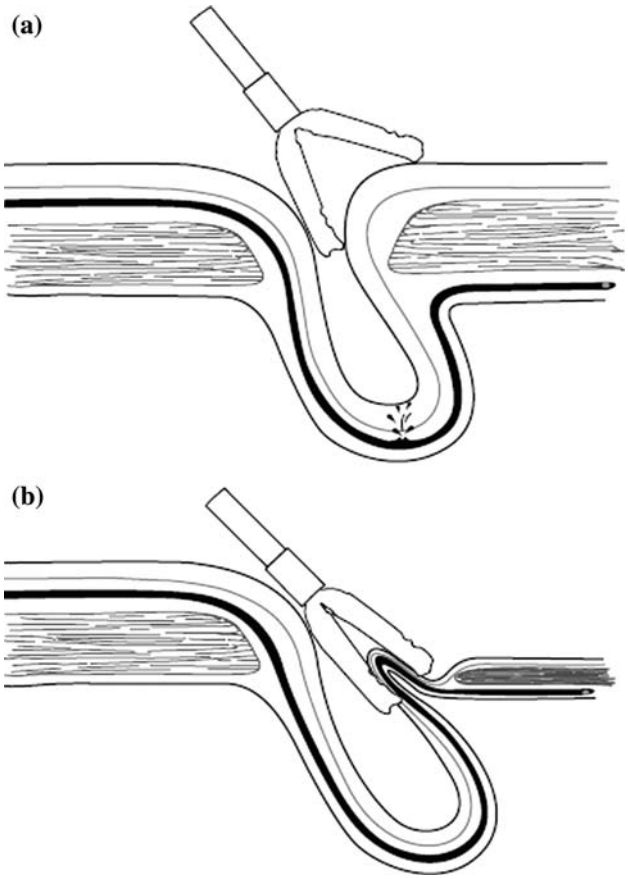

Fig. 3 Artist rendition of endoclip technique for treating hemorrhage originating from a diverticular dome. (**a**) Open clip is placed such that one prong is within a diverticulum and the other prong is outside of a diverticulum along adjacent colonic mucosa. (**b**) Deployment of clip results in tamponade of vessel leading to bleeding site

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References

1. Elta G (2004) Urgent colonoscopy for acute lower-GI bleeding. Gastrointest Endosc 59:402–408
2. Longstreth GF (1997) Epidemiology and outcome of patients hospitalized with acute lower gastrointestinal hemorrhage: a population-based study. Am J Gastroenterol 92: 419–424
3. McGuire HH (1994) Bleeding colonic diverticular: a reappraisal of natural history and management. Ann surg 220 653–656
4. Vernava AM, Moore BA, Longo WE, Johnson FE (1997) Lower gastrointestinal bleeding. Dis Colon Rectum 40:846–858
5. Parkes BM, Obeid FN, Sorensen VJ, Horst HM, Fath JJ (1993) The management of massive lower gastrointestinal bleeding. Am Surg 59:676–678
6. Renzulli P, Maurer CA, Netzer P, Dinkel HP, Buchler MW (2002) Subtotal colectomy with primary ileorectostomy is effective for unlocalized, diverticular hemorrhage. Langenbecks Arch Surg 387:67–71
7. Bender JS, Wiencek RG, Bouwman DL (1991) Morbidity and mortality following total abdominal colectomy for massive lower gastrointestinal bleeding. Am Surg 57:536–540
8. Setya V, Singer JA, Minken SL (1992) Subtotal colectomy as a last resort for unrelenting, unlocalized, lower gastrointestinal hemorrhage: experience with 12 cases. Am Surg 58:295–299
9. Khanna A, Ognibene SJ, Koniaris LG (2005) Embolization as first-line therapy for diverticulosis-related massive lower gastrointestinal bleeding: evidence from a meta-analysis. J Gastrointest Surg 9:343–352
10. Mauldin JL (1985) Therapeutic use of colonoscopy in active diverticular bleeding. Gastrointest Endosc 31:290–291
11. Johnston J, Sones J (1986) Endoscopic heater probe coagulation of the bleeding colonic diverticulum. Gastrointest Endosc 32:AB168
12. Pardoll PM, Neubrand S (1989) Injection control of colonic hemorrhage with hypertonic saline-epinephrine solution. Am J Gastroenterol 84:215
13. Bertoni G, Conigliaro R, Ricci E, Mortilla MG, Bedogni G, Fornaciari G (1990) Endoscopic injection hemostasis of colonic diverticular bleeding: a case report. Endoscopy 22:154–155
14. Kim YI, Marcon NE (1993) Injection therapy for colonic diverticular bleeding: a case study. J Clin Gastroenterol 17:46–48
15. Andress HJ, Mewes A, Lange V (1993) Endoscopic hemostasis of a bleeding diverticulum of the sigmoid with fibrin sealant. Endoscopy 25:193
16. Savides T, Jensen D (1994) Colonoscopic hemostasis for recurrent diverticular hemorrhage associated with a visible vessel: a report of three cases. Gastrointest Endosc 40:70–73
17. Foutch PG, Zimmerman K (1996) Diverticular bleeding and the pigmented protuberance (sentinel clot): clinical implications, histopathologic correlation, and results of endoscopic intervention. Am J Gastroenterol 91:2589–2593
18. Ramirez FC, Johnson DA, Zierer ST, Walker GJ, Sanowski SA (1996) Successful endoscopic hemostasis of bleeding colonic diverticula with epinephrine injection. Gastrointest Endosc 43:167–170
19. Hokama A, Uehara T, Nakayoshi T, Uezu Y, Tokuyama K, Kinjo F, Saito A (1997) Utility of endoscopic hemoclipping for colonic diverticular bleeding. Am J Gastroenterol 92:543–544
20. Rino Y, Imada T, Iwasaki H, Tanabe H, Toyoda H, Kato N, Amano T, Kondo J (1999) Hemostasis of colonic diverticular bleeding with hemoclips under endoscopic control: report of a case. Hepatogastroenterology 46:1733–1735
21. Prakash C, Chokshi H, Walden DT, Aliperti G (1999) Endoscopic hemostasis in acute diverticular bleeding. Endoscopy 31:460–463
22. Jensen DM, Machicado GA, Jutabha R, Kovacs TO (2000) Urgent colonoscopy for the diagnosis and treatment of severe diverticular hemorrhage. N Engl J Med 342:78–82
23. Bloomfeld RS, Rockey DC, Shetzline MA (2001) Endoscopic therapy of acute diverticular hemorrhage. Am J Gastroenterol 96:2367–2372
24. Lara LF, Bloomfeld RS (2001) Endoscopic therapy for acute diverticular hemorrhage. Gastrointest Endosc 53:492
25. Farrell JJ, Graeme-Cook F, Kelsey PB (2003) Treatment of bleeding colonic diverticula by endoscopic band ligation: an in-vivo and ex-vivo pilot study. Endoscopy 35:823–829
26. Simpson PW, Nguyen MH, Lim JK, Soetikno R (2004) Use of endoclips in the treatment of massive colonic diverticular bleeding. Gastrointest Endosc 59:433–437
27. Green BT, Rockey DC, Portwood G, Tarnasky PR, Guarisco S, Branch MS, Leung J, Jowell P (2005) Urgent colonoscopy for evaluation and management of acute lower gastrointestinal hemorrhage: a randomized controlled trial. Am J Gastroenterol 100:2395–2402
28. Foutch PG, Zimmerman K (1996) Diverticular bleeding and the pigmented protuberance (sentinel clot): clinical implications, histopathologic correlation, and results of endoscopic intervention. Am J Gastroenterol 91:2589–2593
29. Foutch PG (1995) Diverticular bleeding: are nonsteroidal anti-inflammatory drugs risk factors for hemorrhage and can colonoscopy predict outcome for patients? Am J Gastroenterol 90:1779–1784