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Effectiveness of therapeutic standard concentration barium enema for colonic diverticular bleeding: Preliminary results

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ABSTRACT

Purpose: To evaluate the effectiveness of a therapeutic barium enema as a treatment for colonic diverticulum bleeding, by using a standard concentration as a diagnostic examination.
Methods: We retrospectively analyzed 68 cases of the patients admitted to our hospital with colonic diverticular bleeding between October 2012 and September 2017. We evaluated the following items: (1) the presence/absence of a previous history of diverticular bleeding, (2) the use of medications (anticoagulants, nonsteroidal anti-inflammatory drugs, and antiplatelet drugs), (3) the location of bleeding, (4) the presence/absence of previous treatment and the result, (5) the time between bleeding and the beginning of the barium enema, (6) procedural success, (7) the clinical success of the initial hemostasis, (8) the clinical success of preventing recurrence, and (9) complications such as perforation and diverticulitis associated with this procedure.
Results: Four patients (three men and one woman; age range 60–85 years; median age 76 years) who underwent therapeutic barium enema with a concentration equivalent for diagnostic purpose (78 w/v%) were included. The follow-up period ranged from 11 to 12 months (median 12 months). All three patients who received a barium enema for initial hemostasis were successfully treated. All four patients remained free from recurrence during the follow-up period. There was no complication due to barium in this series.
Conclusion: Although we had no statistical evidence, a therapeutic barium enema with a standard concentration as a diagnostic examination may be effective for both the initial hemostasis and preventing the recurrence of colonic diverticular bleeding without complications.

1. Introduction

Colonic diverticular bleeding is the most common cause of lower gastrointestinal (GI) bleeding. The number of patients with diverticula has been increasing in recent years in Japan [1], and the aging of the country's population and the prevalence of diets with lower levels of dietary fiber have been posited as reasons for the increase in diverticula. It has been reported that bleeding occurred in approximately 14%–43% of patients with colonic diverticula [2–6]. As the prevalence of colon diverticula increases, the number of patients with diverticular bleeding is also increasing [7]. It is also suspected that an increase in the number of patients taking anticoagulant drugs and/or antiplatelet drugs is another cause of diverticular bleeding [8].

Endoscopic therapy and transarterial embolization (TAE) are known to be effective for definite diverticular bleeding. Spontaneous hemostasis has been observed in 70%–90% of diverticular bleeding cases, however [3]. It is also sometimes difficult to identify the specific site of bleeding. Even when bleeding sites have been identified and treated, the rate of recurrence within a month has been reported to be approximately 11%–38% after endoscopic therapy [9,10], and 30% after TAE [11]. Surgery is another option for GI bleeding, but this option is not always indicated in elderly patients.

Unlike the above-mentioned treatments, a therapeutic barium enema, which was initially introduced by Adams et al. [12] in 1970 before the advent of therapeutic colonoscopy, can be helpful when the specific site of bleeding is not identified clearly by endoscopy or

Abbreviations: GI, gastrointestinal tract; MDCT, multi-detector row computed tomography; TAE, transarterial embolization; w/v%, weight/volume percent

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angiography. Although the mechanisms underlying the hemostasis by barium are not known, several potential mechanisms have been considered: (1) the tamponade of the bleeding vessel through the pressure by the barium solution, (2) a direct hemostatic action by the barium solution, (3) the protection of the diverticulum from intestinal fluids, and (4) the thrombosis and the sclerosis of the exposed blood vessels [12,13]. It has also been speculated that a long-term persistence of barium in the diverticulum will sustain the recurrence-prevention effect.

Recently the effectiveness of this procedure has been proposed again, and some studies have verified the beneficial effect of a therapeutic barium enema as treatment for the initial hemostasis and for preventing recurrence in colonic diverticulum bleeding cases [4,13–19]. In the most of those studies, the barium concentration used was higher than the concentration used for diagnostic purposes [13,15,14–19], and complications (including diverticulitis and perforation of the digestive tract) have been reported among the patients treated with a high concentration of barium [12,18]. Fujimoto et al. [20] performed this therapy with a standard barium concentration, which was defined in the guideline of American College of Radiology for double-contrast examination for diagnostic purposes [21], might be ineffective to treat diverticular bleeding. However, in our clinical practice we have observed diverticular bleeding cases that were successfully treated with a standard diagnostic-purpose barium concentration. Therefore, we speculated that because of its low viscosity compared to dense 'therapeutic purpose' concentration of barium, we could reduce complications and could treat patients with a standard concentration as a diagnostic examination.

Therefore, we conducted the present retrospective case series study to evaluate the effectiveness of a therapeutic barium enema as a treatment for colonic diverticular bleeding in five-year period. We used a standard diagnostic-purpose barium concentration for this investigation.

2. Materials and methods

2.1. Patients

This retrospective study was approved by our institutional review board and written informed consent was waived. We reviewed the medical records and imaging findings including colonoscopy, angiography, and barium enema use of the patients who had been admitted to our hospital for suspected diverticular bleeding from October 2012 to September 2017. We included patients who were clinically diagnosed as having colonic diverticular bleeding. The inclusion criteria were as follows: (1) active bleeding from a diverticulum detected on colonoscopy, (2) an acute clot in a diverticulum detected on colonoscopy, (3) the presence of a colonic diverticulum and extravasation of contrast media on multi-detector row computed tomography (MDCT), or (4) a clinical diagnosis based on the combined findings of colonoscopy and MDCT with a previous history of diverticular bleeding. Patients were excluded when (1) other causes for GI bleeding were identified on colonoscopy or MDCT, or (2) the concentration of barium was not recorded.

The cases of a total of 68 patients hospitalized with diverticular bleeding (41 males and 27 women; age range 44–94 years; median age 73 years) were analyzed. Seventeen of the 68 patients had two or more episodes of diverticular bleeding during the study period. The number of episodes of bleeding were two (n = 9), three (n = 2), four (n = 4), and five (n = 2). The 68 patients had a total of 101 episodes of colonic diverticular bleeding. Fig. 1 provides a flow chart for the management of colonic diverticular bleeding for each episode. A total of seven patients received a therapeutic barium enema during the study period. One of these patients was excluded because a high concentration of barium was used. Two patients were excluded because the concentration of barium was not recorded. Therefore, a total of four patients (three men and one woman; age range 60–85 years; median age 76 years) was analyzed.

One of the four patients was treated with a barium enema for initial hemostasis, and two patients were treated for recurrence after other treatments (endoscopic treatment and conservative therapy, respectively) during hospitalization. The other patient received a barium enema to prevent recurrence after hemostasis by other treatments. Because this is a retrospective study, the criteria selected for a barium enema as a treatment were not consistent.

2.2. Therapeutic barium enema

In this patient series, a 78 wt/volume percent (w/v%) concentration of barium was used; this is the concentration that our hospital has routinely used as a double-contrast bowel enema for diagnosis. We used this concentration because we speculated that we could reduce mechanical irritation complications due to its low viscosity compared to dense 'therapeutic purpose' concentration, Barium was dissolved in water, and a total volume of 600–800 ml of barium was administered via the rectum with the use of a double-balloon enema tip. Single-contrast barium technique was used. After the cecum was filled with barium, the patient was set on the right lateral decubitus position, with a mildly upright position. The patient maintained the same position for 15 min before the removal of the barium tip to fill the diverticulum with barium.

2.3. Outcomes

We evaluated the following items: (1) the presence/absence of a previous history of diverticular bleeding, (2) the use of medications (anticoagulants, nonsteroidal anti-inflammatory drugs, and antiplatelet drugs), (3) the location of bleeding, (4) the presence/absence of previous treatment and the result, (5) the time between bleeding and the beginning of the barium enema, (6) procedural success, (7) the clinical success of the initial hemostasis, (8) the clinical success of preventing recurrence, and (9) complications such as perforation and diverticulitis associated with this procedure.

In reference to the descriptions in previous reports, we defined initial hemostasis as no evidence of continuous or recurrent bleeding (such as hematochezia, the progression of anemia, and a decrease in blood pressure after the procedure) and discharge from hospital without further treatment [15,16]. We defined the prevention of recurrence as being free from re-hospitalization with diverticular bleeding within this study period.

3. Results

The details of the patients who received a therapeutic barium enema for diverticular bleeding are summarized in Table 1. A total of four patients were analyzed. All patients had previous history of diverticular bleeding. One used nonsteroidal anti-inflammatory drugs while other three did not take medications such as anticoagulants, nonsteroidal anti-inflammatory drugs and antiplatelet drugs. The location of bleeding could not be identified using any imaging modalities except for one who was suspected to have bleeding from the ascending colon. The days from bleeding to the barium enema ranged from two to 11 days (median 3.5 days).

Three of the four patients received the barium enema for the purpose of initial hemostasis (cases 1–3). In case 1, hemorrhages from the diverticula of the ascending colon was suspected (there was no active bleeding), and endoscopic treatment (local injection therapy with hypertonic saline-epinephrine solution) was performed (Fig. 2A). However, the patient's bleeding continued with the progression of anemia, and barium enema treatment was thus performed on day 11(Fig.2 B, C). In case 2, because the patient had experienced technical difficulty during the endoscopy in a previous episode of diverticular bleeding,

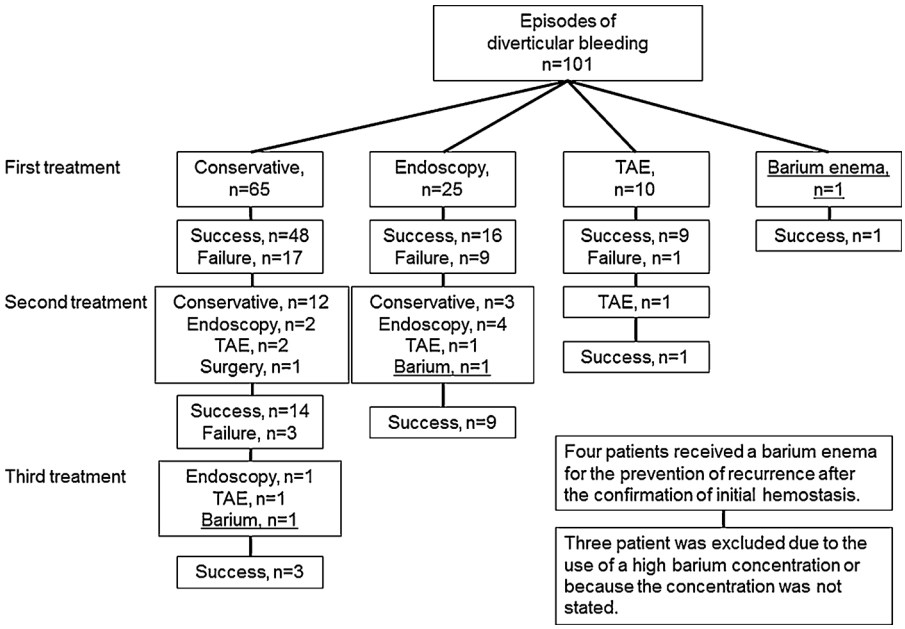

Fig. 1. Flow chart of the management of colonic diverticular bleeding.
Flow chart of the management of colonic diverticular bleeding. A total of 101 episodes were analyzed. Among the 65 patients initially treated with conservative treatment, 17 cases failed during hospitalization. Three of these cases failed again, and one was treated with barium as the third treatment. Among the 25 patients initially treated with endoscopy, nine cases failed during hospitalization, and one received barium therapy as the second treatment. Among the 10 patients initially treated with TAE, one case failed during hospitalization. Hemostasis succeeded in one patient initially treated with barium. Four patients received a barium enema for the purpose of preventing recurrence after initial hemostasis by other treatments, and three of them were excluded because of the use of a high concentration barium or the concentration was not recorded. A final total of four patients received a therapeutic barium enema was included in this study.
Note: TAE, transarterial embolization

and we could not detect a specific site of bleeding on MDCT, a therapeutic barium enema was considered more appropriate than TAE. In case 3, no specific site of bleeding was identified by contrast-enhanced MDCT and endoscopy, and the patient was initially treated conservatively. The conservative treatment failed, and the patient had continuous hematochezia and was treated with a barium enema. In all three of the above cases, the hemorrhaging was successfully controlled.

The other patient received a barium enema to prevent recurrence after hemostasis achieved with another method (case 4).

All four patients were successfully treated and remained free from recurrent bleeding during the follow-up period. The duration of the follow-up period ranged from 11 to 12 months (median 12 months). There were no complications (including perforation and diverticulitis) associated with the barium enema procedure.

4. Discussion

Patients with diverticular bleeding were successfully with a barium enema at a concentration that was standard for diagnostic purposes. To the best of our knowledge, there is only a single report stating that similar patients were unsuccessfully treated with a low concentration of barium (60 w/v %) [20].

There are several previous reports regarding primary hemostasis which are in line with our results (Table 2) [4,12–19]. Iwamoto et al. reported four cases that were successfully treated by the barium enema after endoscopic therapy and TAE had failed and all of them remained free from recurrent bleeding during the follow-up period (range; 17–35 months) [13]. Matsuura et al. proposed that therapeutic barium enema was effective for the control of diverticular bleeding when the location of active bleeding was not identified by colonoscopy [18]. Nagata et al. reported its effectiveness at preventing recurrence in a randomized controlled trial in Japan [19]. In Nagata's study, a total of 54 patients were examined in whom 27 patients were treated with the barium therapy and 27 patients received conservative treatment after spontaneous cessation of bleeding [19]. They reported that the rate of recurrence at one year after the treatment was 14.8% in barium group and that was 42.5% in conservative group [19]. Furthermore, they reported that the frequency of rehospitalization and need for transfusion and colonoscopic examination were reduced in barium group [19].

It should be noted that a therapeutic barium enema can be administered even in cases in which the source of bleeding is unknow. Because a patient with diverticular bleeding can present with intermittent bleeding as well as bleeding at multiple locations, endoscopic therapy and TAE often fail to identify the specific bleeding point, resulting in the failure of hemostasis. In one of the present study's patients, there was no active bleeding point detected by endoscopy, and the patient was treated for suspected sites of bleeding by local injection therapy with hypertonic saline-epinephrine. Bleeding later recurred, and it was successfully treated with a barium enema. Another benefit of the use of a barium enema is that since it is unnecessary to identify the specific sites of bleeding for a barium enema, the time required for the procedure is short, and the patient's pain can be relieved sooner.

In the present study's patients, a barium solution of 78 w/v% was used, and this is a much lower concentration than that used in previous studies (150–200 w/v%) [13,15–19]. Matsuura et al. reported that one of 20 patients developed colonic perforation after their treatment [18].

Table 1
Patient demographics.

Case	Gender	Age	Follow-up period (months)	Previous episode	Medications	Location of bleeding	Previous therapy	Days from bleeding	Barium solution	Procedural success	Initial hemostasis	Recurrence	Complication
1	F	80	12	+	–	AC suspected	1st: E (F)	11	78%	S	S	–	–
2	M	85	12	+	NSAIDs	NI	–	2	78%	S	S	–	–
3	M	72	12	+	–	NI	1st: C (F) 2nd: C (F)	2	78%	S	S	–	–
4	M	60	11	+	–	NI	1st: C (S)	5	78%	S	–	–	–

Note: AC, ascending colon, C, conservative, E, endoscopy, F, fail/female, M, male, NI, not identified, NSAID, nonsteroidal anti-inflammatory drug, S, success.

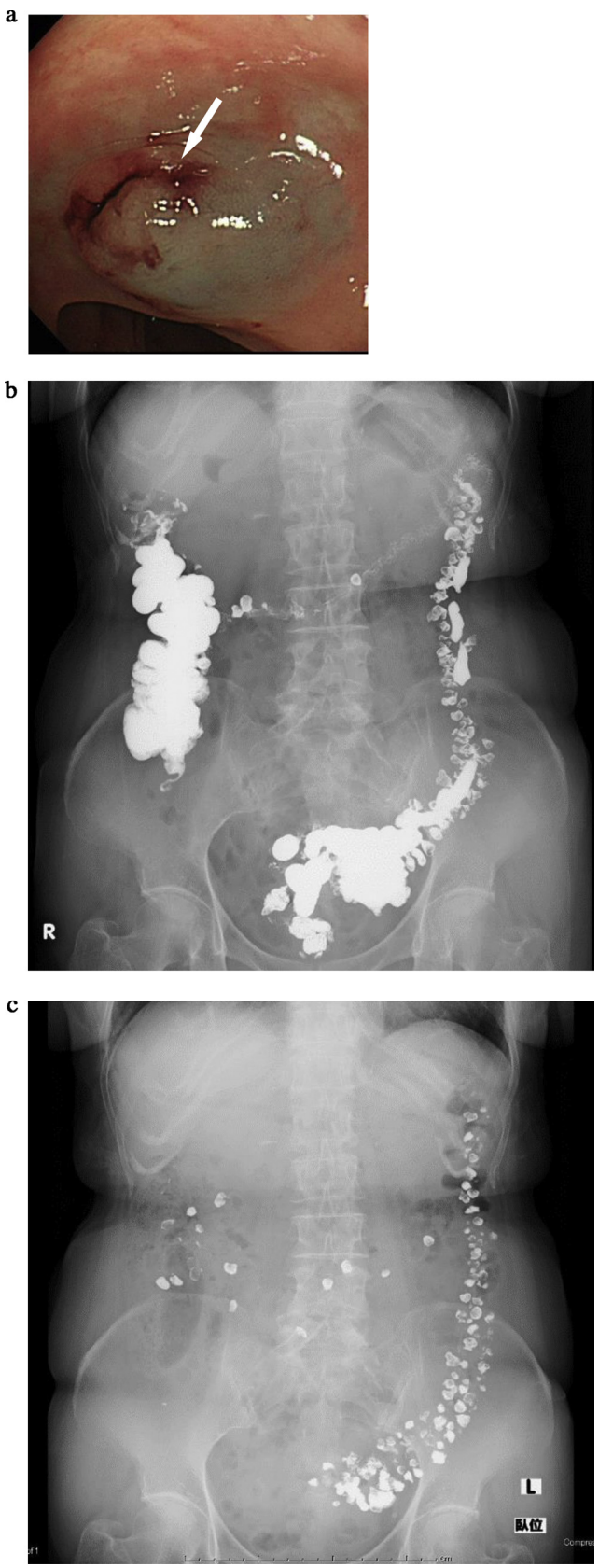

Fig. 2. An 80-year-old woman with diverticular bleeding (case 1).
a. Hemorrhages from the diverticula of the ascending colon was suspected, and endoscopic treatment (local injection therapy with hypertonic saline epinephrine solution) was performed. However, bleeding continued (arrow) and a barium enema was administered.
b. X-ray image at 3 days after the barium administration revealed diverticula filled with barium.
c. X-ray image at 6 days after the barium administration revealed diverticula filled with barium with less amount of the barium in the colon compared with those at 3 days prior.

Table 2
Previous reports on therapeutic barium enema.

Author, year	n	Concentration of barium	success	recurrence
Adams et al., 1970 [12]	28	20%	26	9
Chorost et al., 2000 [14]	1	20%	1	0
Koperna et al., 2001 [4]	63	NR	53	10
Matsuhashi et al., 2003 [15]	1	200%	1	0
Iwamoto et al., 2008 [15]	4	200%	4	0
Pausawasdi et al., 2011 [16]	1	171.5%	1	0
Niikura et al., 2013 [17]	1	200%	1	0
Matsuura et al., 2015 [18]	20	150%	20	4 (in a week) 4 (after a week)
Nagata, et al. 2015 [19]	27	200%	27	0 (in the hospital stay) 8 (follow-up period)
Current study 2017	4	78%	(3/3)	0

Note: NR, not reported.

Fujimoto et al. noted that when they used low-concentration barium (60 w/v%), the recurrent bleeding rate during the 7 months post-treatment was high at 54.5% [20]. Our present findings are comparable to those of the studies using a high concentration of barium, and our patients did not experience any complications. We therefore propose that a standard-concentration barium enema can be used for therapeutic purposes.

Our study has several limitations. Because this was a retrospective, single-center study with a small sample size with a selection bias and an inhomogeneity of patients' demographics, we could not perform statististical analysis. The observation period was short. In addition, because our study design was not a randomized prospective design, we could not exclude the effects of other treatments nor compare with control population. However, patients with colonic diverticular bleeding often require several types of treatments. Further randomized controlled trials including large sample sizes with a longer follow-up period are needed to establish the efficacy of the therapeutic barium enema.

5. Conclusion

Although we had no statistical evidence, a therapeutic barium enema at a concentration that is standard for diagnostic examinations may be effective for initial hemostasis and the prevention of the recurrence of colonic diverticular bleeding, without a significant risk of complications in our limited study population.

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Conflict of interest

None.

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