High-Dose Barium Impaction Therapy for the Recurrence of Colonic Diverticular Bleeding

**A Randomized Controlled Trial**

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**Objective:** We compared the clinical efficacy of barium therapy and conservative therapy in preventing recurrence in patients with diverticular bleeding.

**Background:** Previous case reports have indicated that barium impaction therapy provides initial hemostasis for diverticular bleeding and prevention against rebleeding.

**Methods:** After spontaneous cessation of bleeding, patients were randomly assigned to conservative treatment (n = 27) or high-dose barium impaction therapy (n = 27). Patients were followed up for 1 year after enrollment of the last patient. The main outcome measure was rebleeding.

**Results:** Median follow-up period was 584.5 days. The probability of rebleeding at 30-day, 180-day, 1-year, and 2-year follow-up in all patients was 3.7%, 14.8%, 28.4%, and 32.7%, respectively. By group, probability at 1 year was 42.5% in the conservative group and 14.8% in the barium group (log-rank test, P = 0.04). After adjustment for a history of hypertension, the hazard ratio of rebleeding in the barium group was 0.34 (95% confidence interval, 0.12–0.98). No complications or laboratory abnormalities due to barium therapy were observed. Compared with the conservative group, the barium group had significantly (P < 0.05) fewer hospitalizations per patient (1.7 vs 1.2), units of blood transfused (1.9 vs 0.7), colonoscopies (1.4 times vs 1.1 times), and hospital stay days (15 days vs 11 days) during the follow-up period. No patients died and none required angiographic or surgical procedures in either group.

**Conclusions:** High-dose barium impaction therapy was effective in the long-term prevention of recurrent bleeding, and reduced the frequency of rehospitalization and need for blood transfusion and colonoscopic examination.

**Keywords:** barium solution, colonic diverticular hemorrhage, long-term follow up, natural history, preventive therapy

**Study Design**

The study was conducted under a single-center, 2-arm, parallel group, open-label, randomized controlled design with a 1:1 treatment allocation, and included a minimum 1-year follow-up period (ClinicalTrials.gov number, UMIN number: 00002832). The study protocol was approved by the clinical research ethics committee of the National Center for Global Health and Medicine (no. 765). All patients provided written informed consent for participation in the trial.

**Setting and Patients**

From December 2009 to December 2011, all patients admitted to our hospital with painless overt signs of LGIB were treated jointly by a team of gastroenterologists. Among these, patients meeting the following inclusion criteria were eligible for entry in the trial: (1) age between 20 and 90 years; (2) Japanese nationality; (3) spontaneous cessation of bleeding after hospitalization; and (4) CDB. CDB was defined as definite or presumptive on the basis of colonoscopy with other imaging modalities. Definite diagnosis was based on coloscopic visualization of colonic diverticulum, with active bleeding, adherent clot, or visible vessel. Presumptive diagnosis was based on fresh blood localized to colonic diverticula in the presence of a potential bleeding source on complete colonoscopy; or bright red blood
per rectum confirmed by objective color testing and colonoscopy that demonstrated a single potential bleeding source in the colon, complemented by negative upper endoscopy or negative capsule endoscopy, or negative nasogastric tube; or multidetector computed tomography (MDCT) visualization of the extravasation of contrast medium localized into colonic diverticulum and colonoscopy showing a potential bleeding site in an area of positive MDCT findings.\textsuperscript{19,20} Colonoscopy was performed within 4 days of hospitalization. MDCT was performed within 12 hours of LGIB onset.

Patients were excluded if they presented any of the following: (1) spontaneous cessation of bleeding within 4 days of hospitalization; (2) shock requiring intensive medical care; (3) history of allergic reaction to contrast dye; (4) intestinal obstruction; (5) history of barium examination within 6 months; (6) difficulty in changing body position; (7) pregnancy; (8) history of colonic resection; (9) diagnosis of inflammatory bowel disease or colorectal cancer; or (10) coexisting advanced cancer. Inclusion and exclusion criteria were established in consideration of study safety and ethics, and data reliability.

**Randomization and Masking**

After hospitalization, all patients underwent fasting and rest with drip infusion. Eligible patients were then assigned to one of 2 treatments: barium impaction therapy or conservative treatment after spontaneous cessation of bleeding. Randomization was stratified according to whether or not patients had a history of hypertension, which is reportedly a common risk factor of CDB.\textsuperscript{22,23} A random allocation sequence was then generated using a computer-generated list of random numbers in blocks. To ensure concealed allocation, investigators were informed of the assignment only after identification of an eligible patient. These procedures ensured that investigators were blinded to the allocation sequence.

Patients in the barium group underwent bowel preparation using 1 mL of sodium picosulfate hydrate and 250 mL of magnesium citrate at least 4 hours before impaction therapy. Most also underwent treatment with 2 L of polyethylene glycol solution the day before treatment, during colonoscopy preparation. Barium sulfate was administered with an enema bag positioned 3 to 4 ft above the patient, using a double-balloon enema tip. The final concentration of barium was 200 w/v percentage (200 g/100 mL) with tap water to a total volume of 400 mL. The rectal and anal cuffs were then inflated. All patients were able to tolerate the treatment without incontinence. Barium impaction therapy was conducted by 2 gastroenterologists and 1 experienced radiological technician. After confirming the filling of multiple colonic diverticula with the barium solution (Fig. 1), the enema tube was clamped to retain the solution in the entire colon, and the patient was asked to frequently change position by rotating stepwise through the prone, left lateral, supine to right lateral positions to ensure the filling of each diverticulum. Barium dosage, concentration, and administration method were conducted in the same manner regardless of the bleeding location or the anatomical distribution of diverticula. The enema tube was then withdrawn. Vital signs were monitored throughout the procedure.

After randomization, all patients in the conservative group, and in the barium group after impaction therapy, were started on a liquid food diet, and gradually progressed to a solid diet over 3 days. During hospitalization, blood transfusion was indicated in patients in either group when the hemoglobin level fell below 7.0 g/dL, or below 8.0 g/dL in those showing unstable vital signs.

**Outcomes**

The primary outcome was recurrence of CDB. Patients who experienced rebleeding after discharge continued to visit the hospital regularly during the follow-up period to identify further bleeding episodes. Rebleeding was defined as significant amounts of fresh bloody or wine-colored stools (≥200 mL) without lower abdominal pain, and was evaluated by either or both anoscopy and MDCT, within 12 hours of onset, wherever possible. Rebleeding prompted further endoscopy whenever possible. Second-look endoscopy was not routinely performed when rebleeding occurred during hospitalization or within 1 month of discharge, but was used to confirm rebleeding and determine the need for intervention when frequent or massive bleeding occurred.

Secondary outcomes were the number of hospitalizations, blood transfusions, and colonoscopies within the observation period; length of hospital stay; barium impaction therapy-related complications, including colon perforation and laceration of the rectal mucosa by the enema tube\textsuperscript{13,24}, and unfavorable changes in health, including worsening of hemodynamic and respiratory status, development of clinical symptoms, and abnormal laboratory findings.

**Statistical Analysis**

Sample size was calculated under the assumption that 43.4% of the conservative group and 15.9% of the barium impaction therapy group would experience recurrent bleeding.\textsuperscript{24} To detect a difference between groups of at least 26% using a log-rank test with a 2-sided alpha error of 0.05 and power of 0.80, entry period of 12 months, and observation period of 12 months, we required a total of 29 events and 24 patients in each treatment group. Baseline characteristics of patients were compared using the Mann-Whitney U test, Pearson’s $\chi^2$ test, or Fisher exact test as appropriate, with recurrent bleeding as the primary end point. The recurrence curve of CDB was estimated using the Kaplan–Meier method, and a history of hypertension between groups was compared using the stratified log-rank test. Data were censored at the time of the last visit or at the end of the follow-up period. Efficacy data were analyzed on an intention-to-treat basis. Adjustment for hypertension, nonsteroidal anti-inflammatory drugs (NSAIDs), and chronic renal failure, which are known to be associated with recurrence,\textsuperscript{7,25,26} was done using the Cox proportional hazards model, and the proportional hazard assumption was assessed by inspection of log-log plots.

The total number of rebleeding episodes per patient, hospitalizations, and need for colonoscopy within the follow-up period were also compared between groups using the Mann-Whitney U test. All statistical analyses were performed with Stata version 10 (StataCorp, College Station, TX). All reported P values were 2-tailed, with a P value of $<0.05$ considered statistically significant.

**RESULTS**

**Study Sample**

Of the 71 patients admitted during the study period with painless LGIB, 61 were found to have CDB. After excluding 7 patients, 54 were recruited to the study (Fig. 2), of whom 27 underwent barium impaction therapy or endoscopic clipping, as determined on a case-by-case basis.

Patients were followed up for 1 year after enrollment of the last patient. After discharge, all patients were requested to visit the hospital on a scheduled day within 1 month of discharge during the observation period; every 3 months during the subsequent follow-up period; and additionally at any time in the case of bloody stools. Patients who did not visit the hospital on a scheduled day were interviewed by telephone and encouraged to visit.

**Measurements and Follow-up Procedures**

After randomization, patients were asked to record the characteristics of their stools daily. Patients who experienced rebleeding during protocol treatment received an alternative treatment, such as barium impaction therapy or endoscopic clipping, as determined on a case-by-case basis.

Statistical analyses were performed with Stata version 10 (StataCorp, College Station, TX). All reported P values were 2-tailed, with a P value of $<0.05$ considered statistically significant.

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impaction therapy and 27 conservative therapy. No patients were excluded from the intention-to-treat analysis.

Twenty-five patients (46%) had been previously diagnosed with CDB (Table 1). Three patients were identified with SRH (stigmata of recent hemorrhage) on colonoscopy, giving a definitive diagnosis in 3 patients and a presumptive diagnosis in 51.

With regard to the severity of the initial bleeding, the 2 groups were similar in the number of units of blood transfused before randomization and length of spontaneous cessation of bleeding (Table 1). Other factors were also similar between the 2 groups, including obesity, alcohol and smoking consumption, urgent colonoscopy, anatomical characteristics of colonic diverticula, and CDB diagnosis data (Table 1). Furthermore, the 2 groups were also similar with regard to laboratory data, medication, and coexisting illness (Supplementary Table 1, Supplemental Digital Content 1, available at http://links.lww.com/SLA/A546).

Primary Outcome

During hospitalization, further bleeding was documented in 4 patients (14.8%) who received conservative therapy alone, but in none of those who received barium impaction therapy (Fisher exact test, \( P = 0.11 \); Table 2).

After discharge, 12 patients in the conservative therapy group and 5 in the barium group experienced rebleeding. Median follow-up period was 584.5 days (range: 204–814). The probability of rebleeding at 1-year follow-up was 42.5% (95% CI, 26.1%–63.7%) in the conservative group and 14.8% (95% CI, 5.83%–34.8%) in the barium group (stratified log-rank test, \( P = 0.04 \); Fig. 3B). After adjustment for a history of hypertension, NSAIDs, and chronic renal failure, the hazard ratio of rebleeding in the barium group was 0.34 (95% CI, 0.12–0.97).

Episodes of recurrent bleeding from colonic diverticula are illustrated in Figure 2. The total number of rebleeding episodes within the follow-up period was 25 (Table 2), with fewer episodes in the barium group than in the conservative group (\( P = 0.06 \); Table 2).

Complications and Secondary Outcomes

No complications were observed during or after barium therapy, including colorectal perforation, diverticulitis, or laceration of the rectal mucosa by the enema tube. In addition, no worsening of hemodynamic or respiratory status was observed. A number of clinical symptoms were observed, namely nausea (\( n = 3 \)), vomiting (\( n = 1 \)), abdominal distension (\( n = 4 \)), and constipation (\( n = 5 \)), but these were mild to moderate and either resolved by dietary manipulation or disappeared within 3 days. Constipation was resolved after treatment with 1 mL of sodium picosulfate hydrate. No abnormal laboratory findings were observed during hospitalization after barium impaction therapy, such as a deterioration in WBC (white blood cells), CRP (C-reactive protein), electrolytes, or creatinine levels.

During initial hospitalization, the total units of blood transfused after randomization was smaller in the barium group than in the conservative group, albeit without statistical significance (\( P = 0.23 \); Table 2). Duration of the initial hospital stay did not differ significantly between the 2 groups (\( P = 0.38 \); Table 2).
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FIGURE 2. Flow chart of the study design. In the conservative group, 12 patients experienced rebleeding at 16, 51, 63, 96, 163, 183, 225, 284, 326, 334, 355, and 400 days, of whom 8 received conservative therapy, 2 underwent barium therapy, and 2 underwent endoscopic clipping. Four of these 12 patients, namely 3 who received subsequent conservative therapy and 1 who received subsequent barium therapy, experienced the second rebleeding at 107, 195, 364, and 717 days. Of these 4 patients, 3 achieved hemostasis within the follow-up period while 1 experienced the third rebleeding at 411 days and received conservative therapy. In the barium group, 5 patients experienced rebleeding at 30, 115, 131, 278, and 388 days, of whom 4 received conservative therapy and 1 underwent barium therapy. Three of these 5 patients experienced the second rebleeding at 133, 370, and 392 days, respectively, with 2 going on to receive conservative therapy while 1 received barium therapy. ADL indicates activities of daily living.

TABLE 1. Clinical Characteristics on Admission and at Follow-up

<table>
<thead>
<tr>
<th>Baseline Characteristic</th>
<th>Conservative Therapy Group (n = 27)</th>
<th>Barium Therapy Group (n = 27)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male, n</td>
<td>19</td>
<td>21</td>
</tr>
<tr>
<td>Age, yr</td>
<td>70 ± 11</td>
<td>71 ± 13</td>
</tr>
<tr>
<td>BMI, kg</td>
<td>24 ± 3</td>
<td>23 ± 4</td>
</tr>
<tr>
<td>Waist circumference, cm</td>
<td>87 ± 8</td>
<td>84 ± 11</td>
</tr>
<tr>
<td>Smokers (never/occasional/daily), n</td>
<td>14/8/5</td>
<td>11/9/7</td>
</tr>
<tr>
<td>Smoking index†</td>
<td>806 ± 614</td>
<td>890 ± 424</td>
</tr>
<tr>
<td>Alcohol (non/light/ moderate/ heavy), n‡</td>
<td>14/3/2/8</td>
<td>16/1/3/7</td>
</tr>
<tr>
<td>Previous colonic diverticular bleeding, n</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Distribution of colonic diverticula (right/left/bilateral colon), n§</td>
<td>9/5/13</td>
<td>7/5/15</td>
</tr>
<tr>
<td>Colonic diverticula (2–9/≥ 10 diverticula), n</td>
<td>7/20</td>
<td>10/17</td>
</tr>
<tr>
<td>Urgent colonoscopy, n¶</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Identification of bleeding on colonoscopy, n¶</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Units of blood transfused before randomization per patient, n</td>
<td>1.0 ± 1.9</td>
<td>0.8 ± 1.9</td>
</tr>
<tr>
<td>Length of spontaneous cessation of bleeding, d</td>
<td>3.1 ± 1.1</td>
<td>3.0 ± 0.9</td>
</tr>
</tbody>
</table>

*Values presented with a plus/minus sign are means ± standard deviation. Some patients had more than one coexisting illness. The distribution and the number of colonic diverticula were assessed by colonoscopy.
†Smoking index was evaluated for occasional and daily smokers, and defined as the number of cigarettes per day multiplied by the number of smoking years.
‡Alcohol consumption was divided into 4 groups: nondrinker, light drinker (1–180 g/wk), moderate drinker (181–360 g/wk), and heavy drinker (≥361 g/wk).
§Right-sided: transverse or proximal colon; left-sided: descending or distal colon; bilateral: around the entire colon.
¶Urgent colonoscopy was defined as that performed within 24 hours of admission. Colonoscopy was performed in 52 of the 54 patients in whom observation up to the terminal ileum was possible. The remaining 2 were excluded because of a previous diagnosis of CDB by colonoscopy and exclusion of other sources of bleeding within 3 months of LGIB onset in one each.

BMI indicates body mass index.
TABLE 2. Outcomes After Randomization

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Conservative Therapy Group (n = 27)</th>
<th>Barium Therapy Group (n = 27)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>During initial hospitalization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Further bleeding</td>
<td>4</td>
<td>0</td>
<td>0.11</td>
</tr>
<tr>
<td>Units of blood transfused per patient, n†‡</td>
<td>1.1 ± 1.9</td>
<td>0.4 ± 1.0</td>
<td>0.23</td>
</tr>
<tr>
<td>Length of hospital stay per patient, d</td>
<td>9.9 ± 4.2</td>
<td>8.7 ± 2.8</td>
<td>0.38</td>
</tr>
<tr>
<td>Angiographic embolization or surgery, n</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Follow-up period after discharge‡</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rebleeding episodes, n§</td>
<td>17</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Episodes per patient, n§</td>
<td>0.6 ± 0.8</td>
<td>0.3 ± 0.7</td>
<td>0.06</td>
</tr>
<tr>
<td>Hospitalizations per patient, n</td>
<td>1.7 ± 0.7</td>
<td>1.2 ± 0.6</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Units of blood transfused per patient, n</td>
<td>1.9 ± 2.4</td>
<td>0.7 ± 1.2</td>
<td>0.03</td>
</tr>
<tr>
<td>Length of hospital stay per patient, d</td>
<td>15 ± 8</td>
<td>11 ± 6</td>
<td>0.03</td>
</tr>
<tr>
<td>Colonoscopies per patient, n</td>
<td>1.4 ± 0.6</td>
<td>1.1 ± 0.3</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Angiographic embolization or surgery, n</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

∗Plus/minus values represent means ± standard deviation.
†P value for comparison between groups was obtained using the Mann-Whitney U test.
‡Outcomes due to bleeding events including those that occurred during initial hospitalization. P value for the comparison between groups was obtained using the Mann-Whitney U test.
§Total number of patients in the group who experienced recurrent bleeding during the observation period.

FIGURE 3. Probability of recurrent bleeding. (A) Incidence of rebleeding with a median follow-up period of 584.5 days. (B) Probability of rebleeding was significantly higher in the barium group than in the conservative group (P = 0.04).

During the overall study period, in contrast, the total number of hospitalizations, units of blood transfused, and colonoscopies per patient was significantly lower in the barium group than in the conservative group (Table 2). Furthermore, the total length of hospital stay per patient was also significantly lower in the barium group (P = 0.03; Table 2). No patients died or required angiographic embolization or surgical resection in either group within the follow-up period (Table 2).

DISCUSSION

In this study, we evaluated the efficacy of high-dose barium therapy against rebleeding in a series of patients with CDB. Most cases were presumptive and had a history of CDB, and all cases had spontaneous cessation of initial bleeding. The barium therapy group showed a substantially lower incidence of rebleeding than the conservative therapy group, with a hazard ratio of 0.34. Furthermore, these patients had lower frequencies of rehospitalization, repeated blood transfusion, and colonoscopic reexamination, and a shorter length of hospitalization during long-term follow-up. These findings suggest that high-dose barium therapy may be effective in this hitherto difficult clinical condition.

The probability of rebleeding in this prospective cohort study was higher than in Western populations. Previous studies have shown low rebleeding ratios in Western populations,1,6 at 4% to 9% of patients at 1 year and 10% at 2 years, versus high ratios in Asians, at 20% to 35% at 1 year and 33% to 42% at 2 years.7,26,27 A rebleeding rate of 27% at 1 month was recently reported in Japan.28 Our present result is consistent with these Asian studies. The most likely explanation is related with differences in anatomical distribution patterns of diverticula, which are predominantly left-sided in the West and right-sided or bilateral in Asia.29

Several case reports or case series of barium impaction therapy for severe CDB have been reported.9,13–18 Adams13 demonstrated for the first time that 26 of the 28 massive bleeding episodes were resolved by barium impaction therapy, and that this treatment avoided emergency colectomy in 3 patients. In addition, Koperna et al9

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reported failure rates of conservative therapy and barium therapy with subsequent rebleeding of 43.4% and 15.9%, respectively, and suggested that complications and mortality after surgery were higher than those after barium therapy. The goal of intervention in CDB is to identify SRH. However, the rate of SRH identification varies widely, from 7.7% to 43% of LGIB cases because the colon has an anatomically large and complex surface area, often with multiple potential sources, and because bleeding tends to be intermittent in nature. Most diagnoses of CDB are therefore presumptive, accounting for as many as 87% of LGIB cases. Moreover, even when SRH is identified and treated, some patients with multiple diverticula will bleed again from another diverticulum. We consider that this clinical picture supports the indication of barium impaction therapy for presumptive CDB, particularly with multiple diverticula (Fig. 4). Previous reports have also suggested that barium impaction therapy has advantages in patients at risk for surgery or angiography; in patients with uncontrolled bleeding because of therapeutic procedures or uncontrolled presumptive CDB; as well as in patients unable to receive 4 to 6 L of bowel preparation or with multiple or inaccessible lesions. Concerns have been raised that retained barium would preclude accurate colonoscopic visualization of rebleeding cases. However, colonoscopy with full preparation in our present cases did not interfere with visualization of the bowel lumen.

The fundamental mechanism of the effect of barium enema is unknown, but 3 factors can be considered: (1) tamponade of the bleeding vessel through physical pressure caused by the barium solution, (2) a direct hemostatic effect of barium sulfate, and (3) protection from intestinal fluids through the long-term presence of barium in the diverticula. Barium enema administered from 3 ft (91 cm) above the examination table produces an estimated intraluminal colonic pressure of 90 mm Hg, which is considered safe, whereas administration from 6 ft (1.8 m) produces 140 to 168 mm Hg, which can result in perforation. The source of CDB is thought to be arterial, which would produce a mean arterial pressure of about 90 mm Hg. We therefore administered barium from 3 to 4 ft above the table, equivalent to an intraluminal colonic pressure of 90 mm Hg, and this might therefore have been effective in stopping the arterial bleeding. During barium coagulation, a tap water enema is reportedly better than most barium suspensions as it contains no anticoagulants and is more effective in clot formation. Moreover, use of a high concentration of barium and retention in the colon may be related to increased viscosity and the facilitation of coagulation. Accordingly, we used 200 w/v percentage barium sulfate with tap water in the present study. Finally, previous studies have shown that barium in the colorectal diverticula or appendix can be retained without inflammation for several months, and sometimes years, suggesting that barium impaction is effective in preventing rebleeding as well as safe. Moreover, long-term impaction with barium may protect diverticula from the adverse impact of colonic microflora in the development and progression of diverticular disease.

This study experienced no severe complications from barium impaction therapy, suggesting the safety of barium enema of the colon. Nevertheless, complications have been reported. These include perforation, trauma from the enema tip or retention balloon, mucosal irritation, and thrombosis of the involved vessels. Of these, colonic perforation is the most frequent, occurring in approximately 0.04% of patients. Contrasting with this, patients undergoing endoscopy are also at risk of perforation, particularly those with colonic diverticula. Thus, both forms of CDB examination should be carried out carefully.

This study has several limitations. First, it was conducted in a non–double-blinded manner because of the difficulty in producing a suitable barium replacement. Although this might have biased the secondary outcomes, it is unlikely to have influenced rebleeding. Second, although we adjusted the multivariate analysis for hypertension, NSAIDs, and chronic renal failure, the number of patients with rebleeding was too small to allow adjustment for other risk factors. Third, although we formulated precise

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**FIGURE 4.** Flow chart for the management of colonic diverticular bleeding. When patients are hospitalized for severe or continuous bleeding suspected from colonic diverticula, most cases resolve without procedures. Urgent or elective colonoscopy with or without other modalities is indicated in accordance with the general condition of the patient as well as in consideration of institutional and national background. However, stigmata of hemorrhage is infrequently identified, and thus many bleeding cases given a final diagnosis of diverticulosis will have a presumptive rather than definite diagnosis. Definite diagnosis should be managed by endoscopic therapy initially in the conventional manner, possibly with the option of adding high-dose barium impaction therapy in particularly patients with multiple diverticula, whereas presumptive cases have the additional option of barium impaction therapy to prevent further rebleeding.
diagnostic criteria for CDB, the number of patients who underwent urgent colonoscopy was small (n = 6), which likely resulted in a low detection rate of SRH. Nevertheless, the groups did not significantly differ in urgent colonoscopy rate.

CONCLUSIONS

We found that high-dose barium therapy reduced recurrent bleeding in a series of patients with CDB, particularly those with a presumptive diagnosis and with spontaneous cessation. This treatment also decreased the frequency of rehospitalization, repeated blood transfusion, and colonicoscopic reexamination, and shortened the length of hospitalization during long-term follow-up. Generalization of these results requires additional investigation at multiple institutions with a larger group of patients.

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REFERENCES