Endoscopic Detachable Snare Ligation Therapy for Colonic Diverticular Hemorrhage Improves Procedure Time Compared to Endoscopic Band Ligation

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ABSTRACT

Background: The clipping method is widely used in endoscopic hemostasis for colonic diverticular hemorrhage. Recently, rebleeding was shown to be less common in ligation therapy than in clipping. Ligation methods include endoscopic band ligation (EBL) and endoscopic detachable snare ligation (EDSL). No studies have compared procedure times for EBL and EDSL. The present study aimed to compare EDSL and EBL in terms of procedure time.

Methods: In this single-center retrospective observational cohort study, we evaluated the data of 39 patients who underwent EBL or EDSL for colonic diverticular hemorrhage. The primary and secondary outcomes measured were the total procedure time and early rebleeding rate, respectively.

Results: Among the 39 patients included in the study, 18 underwent EBL, and 21 underwent EDSL for hemostasis. The median total procedure times for the EBL and EDSL groups were 50 (range, 30-80) minutes and 35 (range, 18-55) minutes, respectively, demonstrating that the total colonoscopy time was significantly shorter in the EDSL group (P < .001). The early rebleeding rate was 11.1% (2/18) in the EBL group and 4.8% (1/21) in the EDSL group (P = .246).

Conclusion: Important improvements in procedure time were achieved in the EDSL group. Based on our results, we believe that EDSL may reduce patient and endoscopist burden.

Keywords: Colonic diverticular hemorrhage, colonoscopy, endoscopic band ligation, endoscopic detachable snare ligation, endoscopic treatment, lower gastrointestinal bleeding

INTRODUCTION

Colonic diverticular hemorrhage, the most common cause of lower gastrointestinal bleeding, requires endoscopic intervention when stigmata of recent hemorrhage (SRH) are observed.[1-4] For the treatment of diverticular hemorrhage, coagulation and local epinephrine injection have been proposed.[4,5] Although the clipping method[6] has become popular to improve hemostasis, in many cases, it cannot directly reach the vessel at the base of the diverticulum, and rebleeding has been observed in approximately 30% of the cases.[7] Recently, endoscopic band ligation (EBL), which ligates the diverticulum by banding, was reported,[8,9] and a significantly lower rate of rebleeding than with clipping was identified. In EBL therapy, the bleeding vessels of the diverticula can be completely

occluded using an O-ring.[2] However, in EBL, when bleeding is confirmed, the endoscope needs to be removed to place a device, and then, it must be re-inserted. This procedure requires significant time.

Another important problem is that the placement of a device narrows the field, thereby increasing the degree of difficulty of the procedure. For this reason, endoscopic detachable snare ligation (EDSL) was devised, characterized by a snare inserted through the forceps hole to perform hemostasis without removing the endoscope.[10] In EDSL therapy, the ruptured vessels of the diverticula can be completely occluded with a detachable snare. This mechanism of hemostasis is like EBL. The method is relatively simple and may necessitate a shorter procedure time
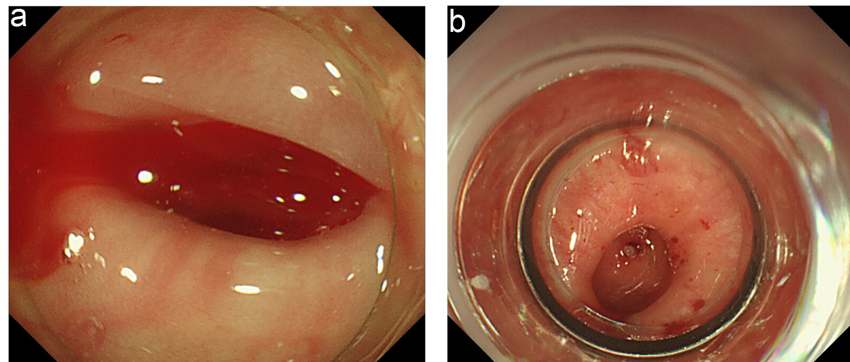
Figure 1. Endoscopic images showing the stigmata of recent hemorrhage. (A) Active bleeding from a diverticulum; (B) A non-bleeding visible vessel in the diverticulum.

to ensure hemostasis than EBL; nevertheless, no studies to date have compared procedure times with those of EBL. Colonic diverticular hemorrhage occurs more commonly in elderly patients with comorbidities.[11,12] A desirable objective is to reduce the burden associated with the procedure.

The present study aimed to compare EDSL and EBL procedure times because improvements in procedure times will reduce the burden on the patient and endoscopist.

MATERIALS AND METHODS
Study Population
This was a single-center, retrospective, observational cohort study. Our study population comprised patients who underwent endoscopic hemostasis for colonic diverticular hemorrhage at our hospital between April 2015 and October 2019. The inclusion criteria consisted of patients aged >18 years, with SRH (Figure 1), who underwent either EBL or EDSL. Patients who underwent other hemostatic procedures were excluded. The method of

Main Points

- The present study aimed to compare EDSL and EBL in terms of procedure time because improvements in procedure times will reduce the burden on both the patient and endoscopist.
- The median total procedure times for the EBL and the EDSL groups were 50 (range, 30-80) minutes and 35 (range, 18-55) minutes, respectively, demonstrating that the total colonoscopy time was significantly shorter in the EDSL group (P < .001).
- Based on our results, we believe that EDSL may reduce patient and endoscopist burden.

hemostasis was selected according to the judgment of the attending physicians.

The study's protocol was approved by the ethics committee of our hospital and conformed to the ethical guidelines of the 1975 Declaration of Helsinki. The requirement for informed consent was waived due to the retrospective study design.

Colonic Endoscopy
In patients showing signs of shock, endoscopy was performed after the vital signs were stabilized using fluid resuscitation. We performed transfusions when severe anemia was observed. In all patients, bowel preparation with polyethylene glycol or glycerin enema was performed before endoscopy. All patients underwent full colonoscopy within 24 hours after the initial consultation. Water-jet scopes (PCF-Q260 JI, PCF-Q260 AZI, or PCF-H290T; Olympus Medical Systems Corp., Tokyo, Japan) were used in all procedures performed by expert endoscopists who had performed over 1000 colonoscopies.

Endoscopic Hemostasis with Endoscopic Band Ligation
The EBL procedure has been reported in detail in previous reports.[13,14] Colonoscopy was performed using a transparent hood (D-201; Olympus Medical Systems Corp., Tokyo, Japan) to detect the affected diverticulum. After the bleeding site was found, we performed clipping for marking. The endoscope was temporarily removed and a band-ligator device (MD-48910B EBL device or MD-48709U EVL device; Sumitomo Bakelite, Tokyo, Japan) was positioned, and the endoscope was re-inserted. The bleeding diverticulum was suctioned
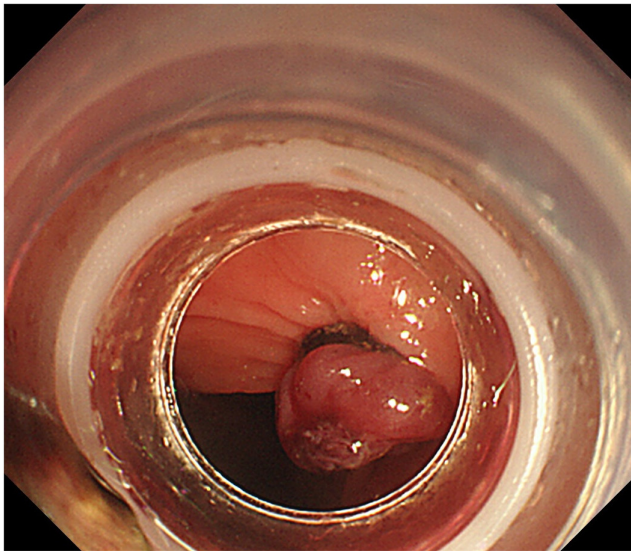
Figure 2. After endoscopic band ligation therapy, hemostasis is obtained.

into the cup of the endoscopic ligator, and the elastic O-ring was released (Figure 2).

Endoscopic Hemostasis with Endoscopic Detachable Snare Ligation

The EDSL procedure has been reported in detail in previous reports.[10,15] Colonoscopy was performed using a transparent hood (MAJ-665 or MH-594; Olympus Medical Systems Corp.). After the bleeding site was determined, the detachable snare was inserted (MAJ-339: Olympus Medical Systems Corp.) through the scope, and the detachable snare was set inside the hood. The bleeding diverticulum was suctioned into the hood and was tightly tied at the base with the detachable snare (Figure 3). Clipping for marking was not performed because we

performed hemostasis with the retained snare immediately after the bleeding site was located. All procedures were assisted by medical assistants with over 3 years of experience.

Outcome

The primary outcome measure was the procedure time. The secondary outcome measures included procedure time to hemostasis after the identification of the bleeding site, hemostasis success rate, presence of symptoms related to the endoscopic procedure (perforation, abdominal pain, fever), number of days from hemostasis to discharge, rate of early rebleeding (within 30 days), and the need for transcatheter arterial embolization or surgery. The age, sex, bleeding site, administration/ non-administration of an oral antithrombotic agent, and type of bowel preparation were examined as potential confounders.

Statistical Analysis

Fisher's exact test was used to compare categorical variables. Continuous variables are expressed as the median and range. Median values of continuous data were compared using the Mann–Whitney U-test. If there are differences in background factors that may be confounders, a multilinear regression analysis was performed. All statistical analyses were performed using IBM Statistical Package for Social Sciences (SPSS) software version 19 (IBM Corp., Armonk, NY, USA); all tests were 2-tailed, and a P-value of <.05 was considered statistically significant.

RESULTS
Patient Characteristics

We identified 52 patients diagnosed with colonic diverticular bleeding and performed endoscopic hemostasis in
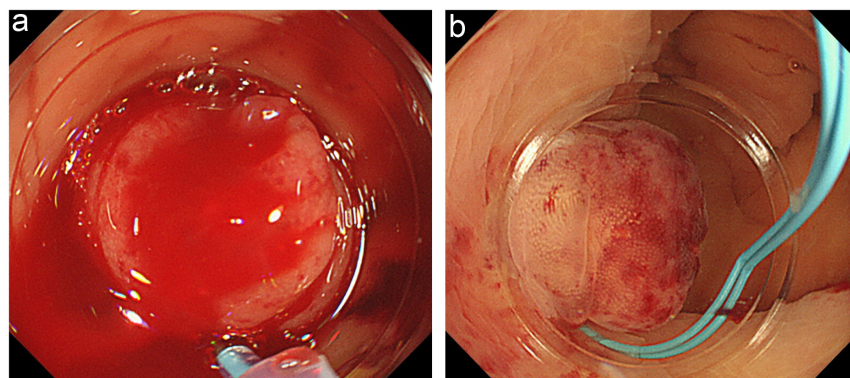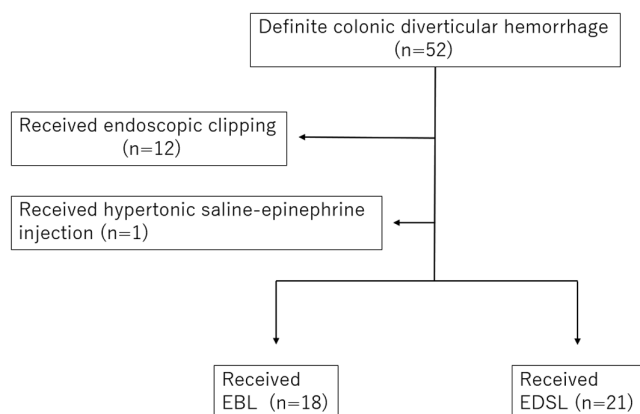

Figure 3. Endoscopic images of the endoscopic band ligation procedure. (A) Active bleeding from a diverticulum; (B) After endoscopic detachable snare ligation therapy, hemostasis is obtained.

Definite colonic diverticular hemorrhage
(n=52)

Received endoscopic clipping
(n=12)

Received hypertonic saline-epinephrine
injection (n=1)

Received
EBL (n=18)

Received
EDSL (n=21)

Figure 4. Flowchart of the patients in this study. EBL, endoscopic band ligation; EDSL, endoscopic detachable snare ligation.

our study group. Among these, 39 patients were enrolled in this study (EBL = 18 and EDSL = 21) after satisfying the inclusion criteria (Figure 4). Patient characteristics are summarized in Table 1. There were no significant differences between the 2 groups with respect to age, sex, history of diverticular hemorrhage, comorbidities, prescription medication (antiplatelet agents, anticoagulants, nonsteroidal anti-inflammatory drugs, or steroids), serum hemoglobin levels on admission, or bowel preparation. Linear regression analysis was not performed because there was no difference in background factors.

Outcomes

Table 2 shows the treatment outcomes. There were no significant differences in the bleeding site between the 2 groups. The median total procedure times for the EBL and the EDSL groups were 50 (range, 30-80) minutes and 35 (range, 18-55) minutes, respectively, demonstrating that the total colonoscopy time was significantly shorter in the EDSL group ($P < .001$). Initial hemostasis was achieved in all patients in both groups. Time to hemostasis after identifying the bleeding site was significantly lower in the EDSL group than in the EBL group ($P < .001$). The early rebleeding rate was 11.1% (2/18) and 4.8% (1/21) in the EBL and EDSL groups, respectively, which was not statistically significant ($P = .246$). Additional endoscopic hemostasis was performed for all early rebleeding cases, and TAE or surgery was not required.

DISCUSSION

In the present study, the procedure times for colonic diverticular hemorrhage were compared between the EBL and EDSL groups. The results showed that the procedure times in the EDSL group were significantly lower

Table 1. Characteristics of Patients Who Underwent EBL or EDSL as Treatment for Definite Diverticular Hemorrhage

	EBL (n = 18)	EDSL (n = 21)	P
Age (years)	77 (50-87)	72 (38-86)	.171
Male sex	13 (72.2)	17 (81.0)	.395
History of diverticular hemorrhage	2 (11.1)	8 (38.1)	.058
Comorbidities			
Hypertension	14 (77.8)	15 (71.4)	.468
Diabetes mellitus	5 (27.8)	2 (9.5)	.144
Heart disease	6 (33.3)	6 (28.6)	.380
Chronic kidney disease	5 (27.8)	8 (38.1)	.368
Cerebrovascular disease	4 (22.2)	7 (33.3)	.442
Prescription medication			
Antiplatelet agents	8 (44.4)	8 (38.1)	.688
Anticoagulants	2 (11.1)	4 (19)	.410
NSAIDS	0 (0)	3 (14.3)	.146
Steroids	0 (0)	2 (9.5)	.283
Hemoglobin on admission (g/dL)	10.6 (7.2-15.8)	10.9 (7.3-14.5)	.988
Bowel preparation			
Polyethylene glycol	14 (77.8)	18 (85.7)	.683
Stigmata of hemorrhage (AB : NBVV + AC)	16 : 2	19 : 2	.636
Bleeding site (right colon : left colon)	8 : 10	15 : 6	.088

Values are expressed as median (range) or n (%). EBL, endoscopic band ligation; EDSL, endoscopic detachable snare ligation; NSAIDS, nonsteroidal anti-inflammatory drugs.

than those in the EBL group. To our knowledge, no previous studies have compared EBL and EDSL in this respect; therefore, this is possibly the first report on this matter and contributes important new evidence to the literature.

According to a previous study, no significant difference was reported in total procedure time or time to hemostasis after identifying the bleeding site between the EBL and clip groups.[9] In the present study, total procedure time and time to hemostasis after identifying the bleeding site were significantly lower in EDSL than in EBL procedures. With an O-ring attached to the endoscope tip, the field of view is narrowed, and finding the bleeding site is considered difficult. Consequently, in EBL, after the bleeding site is located, the endoscope needs to be temporarily removed, the band-ligator device is positioned, and the endoscope re-inserted at the bleeding

Table 2. Treatment Outcomes of EBL or EDSL as Treatment for Definite Diverticular Hemorrhage

	EBL (n = 18)	EDSL (n = 21)	P
Successful initial hemostasis	18 (100)	21 (100)	
Total procedure time (minutes)	50 (30-80)	35 (18-55)	< .001
Time to hemostasis after identification of bleeding site (minutes)	22 (7-37)	5 (1-27)	< .001
Early rebleeding	2 (11.1)	1 (4.8)	.441
Complication			
Perforation	0	0	
Abdominal pain	1 (5.6)	2 (9.5)	.559
Diverticulitis	0	0	
Time to discharge after initial hemostasis (days)	6 (0-8)	5 (0-12)	.224

Values are expressed as median (range) or n (%). EBL, endoscopic band ligation; EDSL, endoscopic detachable snare ligation; AB, active bleeding; NBVV, non-bleeding visible vessels; AC, adherent clot.

site to perform hemostasis. By contrast, with the transparent hood used in EDSL attached to the endoscope tip, the field of view remains relatively wide. It allows initiating the examination while the transparent hood is placed on the endoscopic tip and setting the detachable snare in the transparent hood when the bleeding site is located to perform hemostasis. Because of this difference, our results showed differences in the total procedure time and time to hemostasis after identifying the bleeding site. Since there is no need to remove the endoscope and the procedure time is short, the burden on the operator and patient should be lessened.

Previous reports have reported antiplatelet drugs, non-steroidal anti-inflammatory drugs, and hypertension as risk factors for recurrent diverticular hemorrhage.[16,17] In this study, there were no significant differences in these factors between the 2 groups.

Early rebleeding rate was 11.1% in the EBL-treated group. This result agreed with the previously reported early rebleeding rate (4-16%) in EBL.[8,9,13,14,18] In addition, the early rebleeding rate was 4.8% in the EDSL group, which is considered similar to the early rebleeding rate (6.3% [19], 7.9% [15]) in EDSL.

In terms of differences between EBL and clipping, the early rebleeding and the long-term recurrent bleeding rates were reported to be lower in EBL.[9,18] Further, comparing EDSL and clipping, the early rebleeding rate was lower in EDSL, suggesting that EDSL was superior to clipping as a treatment for colonic diverticular hemorrhage.[19] Based on these reports, rebleeding is considered less common in ligation therapy than in hemostasis by clipping.

Although there was no occurrence of delayed perforation or diverticulitis in either group in the present study, delayed perforation[20] and diverticulitis[19,21] have been reported previously, thus warranting attention. Cases with small orifices and large domes caused insufficient suction into the transparent hood, and ligation became difficult in some patients.[8,19] Nevertheless, in the present study, hemostasis was successful using either EBL or EDSL in all patients. This is presumably because the sample size was small, and there may have been cases in which hemostasis had to be performed by another method such as clipping. Completing snare ligation might be difficult for inexperienced medical assistants. In this study, all procedures were assisted by experienced assistants. The procedures may take longer, or there may be unsuccessful snare ligation cases if assistants are inexperienced.

Over-the-scope clipping[22] needs to be comparatively studied in the future as a choice for hemostasis.

The limitations of the present study were the small sample size, the insufficient statistical power in the analysis of the occurrence of early rebleeding events, and the undeniable probability of a type II error. In addition, all patients underwent a full colonoscopy to detect the bleeding site because urgent contrast-enhanced computed tomography (CT) was not performed in this study. If the extravasation is confirmed by contrast-enhanced CT, further time reduction may be possible. Because the treatment was performed by experts, the results may differ from those obtained by amateurs. The present study assessed feasibility during the period of introduction of the technique in a small number of patients; thus, there may be no problem with the results during

the learning period. To guarantee external validity, we should gather and report results from multiple facilities in the future.

CONCLUSION

In conclusion, remarkable improvements in procedure time and time to hemostasis after identifying the bleeding site were achieved in the EDSL group. Based on our results, we believe that EDSL may reduce patient and endoscopist burden.

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