

## Endoscopic band ligation for nonvariceal bleeding: A review

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Endoscopic band ligation (EBL) is the most effective and accepted treatment for acute esophageal variceal bleeding (1). EBL is an easy and safe method to achieve hemostasis for gastrointestinal (GI) bleeding, in contrast to other endoscopic therapies (thermal, mechanical, injection). The use of EBL for other types of bleeding in the GI tract has been published mostly as case report series (Table 1). In the present review, we describe the results of published studies that have evaluated different options for EBL in the setting of nonvariceal bleeding.

### VASCULAR LESIONS IN THE GI TRACT

Vascular malformations may cause chronic blood loss or acute GI hemorrhage. These lesions, often called angiodysplasias or vascular ectasias, are single or multiple bright red round spots of variable diameter with uniform or slightly irregular margins. These can present independently or in association with other conditions such as radiation injury, collagen vascular disease, chronic renal failure, cirrhosis or hereditary hemorrhagic telangiectasia, and they account for 1% to 5% of all causes of GI bleeding reported (2) (Figure 1).

Treatment of vascular lesions with EBL has been reported to be effective. Wong et al (3) described two patients with GI bleeding secondary to gastric angiodysplasia successfully treated with EBL, one of them previously treated with pure ethanol injection. Furthermore, Abi-Hanna et al (4) described 10 patients with vascular lesions in the stomach and duodenum successfully treated with EBL. Four of the patients had previous endoscopic therapy and four had active bleeding at the time of ligation therapy. No rebleeding was observed at a mean follow-up time of six months. In another prospective study that evaluated treatment of vascular lesions in the small bowel (5), a cohort of patients with upper GI bleeding were investigated and 14 patients with angiodysplasias were identified. These lesions were located in the duodenal bulb (n=5), the second portion of the duodenum (n=8) and the third portion of the duodenum (n=1). All patients were treated with EBL and hemostasis was achieved in a single endoscopic session. No patients had further bleeding at 40 days of follow-up.

### DIEULAFOY LESION

A Dieulafoy lesion (DL) is a large-calibre, tortuous artery that is located in the submucosa in close contact with the mucosa. The erosion of the mucosa and arterial wall can initiate massive bleeding. The majority of these lesions are located in the gastric fundus. DLs represent approximately 0.3% to 6% of all causes of GI bleeding (6).

Several reports and series on endoscopic treatment for DLs have been published. Most DLs have been treated by thermal or injection methods, or hemocliping (7-12). The initial success rate reported for hemostasis with these methods was 84% and 90% in two different studies that included 26 and 40 patients, respectively (7,8).

The first use of EBL for the treatment of a gastric DL was reported in 1994 (13). Since then, there has been a trend to treat these lesions with EBL (Figures 2 and 3). The majority of the reported cases responded immediately after one session of EBL and usually only one band per lesion was sufficient. Effective EBL of a bleeding rectal DL that was previously treated with hemoclips has also been reported (14).

Although most DLs are located in the stomach, esophageal and duodenal DLs have been successfully treated with EBL (15,16).

From all the cases reviewed, we found only one case of rebleeding after 24 h of therapy with EBL – a shallow ulcer at the site of banding was seen and adrenaline 1:10,000 was injected with no further rebleeding at 12 months follow-up (4). There was only one reported case (17) of fatal rebleeding after EBL for a DL located at the gastric cardia in a patient with previous failed endoscopic treatments (injection and thermal probe coagulation). Two rubber bands had to be applied because of a large-size lesion and a delayed massive rebleeding occurred (after 33 days of EBL treatment). A diagnostic upper endoscopy was not performed, nor was an autopsy to confirm the cause of death. In a retrospective study, Mumtaz et al (18) analyzed the outcomes of patients with DL who were treated with EBL compared with thermal-injection therapy. Twenty-three patients were included in the study (14 patients in the EBL group). Active hemostasis was achieved in 100% of cases in both groups but early rebleeding occurred in one

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**TABLE 1**  
**Different options for endoscopic band ligation in nonvariceal bleeding**

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Vascular lesions in the gastrointestinal tract
Dieulafoy lesion
Mallory-Weiss tear
Gastric antral vascular ectasia
Postpolypectomy bleeding
Rubber bleb nevus syndrome
Colonic diverticular bleeding

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patient in the thermal-injection therapy group. The authors concluded that EBL is as effective as injection with or without thermal therapy in the treatment of DL.

In a prospective, randomized trial (19) comparing EBL with hemoclip placement for bleeding DL, 26 patients were enrolled, 13 in each group. One rubber band was applied for each EBL case and the median number of hemoclips needed was one. Primary hemostasis was achieved in all patients with one case of rebleeding in each group. No complications were reported. The authors concluded that there were no differences in the efficacy or safety between EBL and hemoclips for the treatment of DL.

#### MALLORY-WEISS TEAR

Mallory-Weiss tears (MWTs) are lacerations at or near the esophagogastric junction that may cause acute GI bleeding. These lacerations are secondary to sudden elevations in abdominal pressure, usually after retching or vomiting.

The first cases of successful treatment of MWTs with EBL were reported in 1998, one after previous failed endoscopic treatment with adrenaline injection (3,4).

Another patient (20) with bleeding secondary to an MWT was successfully treated with EBL. In this case, a 75-year-old man presented with hematemesis after severe retching during a gastroscopy. The bleeding stopped immediately after the release of one rubber band at the site of the mucosal tear. Gunay et al (21) reported four patients with bleeding MWTs that were successfully treated with EBL. All patients achieved complete hemostasis and no rebleeding was observed.

In a prospective, randomized trial comparing EBL with adrenaline injection for bleeding MWTs (22), 34 patients were enrolled; 17 patients underwent EBL and 17 underwent adrenaline injection. One to two rubber bands were applied in the EBL group and the mean volume of adrenaline required in the second group was 18 mL. Primary hemostasis was achieved in all cases in the EBL group and in 16 cases in the adrenaline group, with no rebleeding or major complications in either group. The authors concluded that there was no difference in the efficacy or safety of EBL versus adrenaline injection for the treatment of bleeding MWTs. A case series also described the usefulness of EBL for bleeding MWTs (23). Thirty-seven patients were prospectively treated with EBL. Thirty-six patients achieved complete hemostasis after the first session, while the remaining patient had severe liver failure with coagulopathy. No complications were reported. The authors concluded that EBL is an effective and safe procedure for treating bleeding MWTs.

Finally, a recently published prospective, randomized study compared EBL with endoscopic hemoclip placement (EHP) in actively bleeding MWTs (24). Forty-one patients were included

and 20 were treated with EBL. Primary hemostasis was achieved in all patients. Two patients in the EBL group and one in the EHP group had recurrent bleeding and were treated with a second session of the same endoscopic modality. Secondary hemostasis was achieved in all patients. There were no complications, and no differences in hospital stay or transfusion requirements between the two groups. The authors concluded that EBL and EHP are equally effective and safe for the treatment of actively bleeding MWTs.

#### POSTPOLYPECTOMY BLEEDING

The occurrence of bleeding after endoscopic polypectomy is seen in approximately 2% of cases, and there are several therapies to achieve hemostasis. These include hemoclips, argon plasma coagulation (APC), heater probe and adrenaline injection. The use of EBL for the treatment of postpolypectomy bleeding (PPB) in the colon was first described in 1994. Slivka et al (25) reported the case of a 70-year-old patient with multiple comorbidities and bleeding from three polypectomy stalks – two at the hepatic flexure and one at the sigmoid colon. He was treated first with electrocautery and adrenaline injection, but rebleeding occurred. EBL was performed and immediate hemostasis was observed with no further rebleeding. In another case report (26), a patient's bleeding immediately after polypectomy was controlled with EBL after unsuccessful treatment with adrenaline injection. Since then, there have been several reports of successful EBL for the treatment of PPB. One rubber band is usually required and hemostasis is achieved immediately (Figures 4 and 5). No complications of this procedure have been reported (27). No trials comparing this therapy with other modalities for PPB have been reported.

#### GASTRIC ANTRAL VASCULAR ECTASIA

Gastric antral vascular ectasia (GAVE) or watermelon stomach is characterized by red, angiomatous, ectatic lesions in the gastric antrum that can be associated with GI hemorrhage at endoscopic examination (28). There are two kinds of patterns identified. The first pattern is multiple red stripes, which are often raised and radiate to the pylorus. The etiology is unknown in the majority of patients but sometimes it is associated with autoimmune or connective tissue diseases. The second pattern is more diffuse lesions with a pattern of small, flat spots, primarily in the antrum. This is usually associated with portal hypertension (29).

GAVE can account for approximately 3.9% of cases of obscure GI bleeding (30). Endoscopic treatment is now the preferred therapy in the majority of cases. Surgical therapy consisting of antrectomy is effective but its application is limited by the high surgical risk of most patients and the morbidity related to the procedure.

Various endoscopic treatment modalities have been used for GAVE. These include monopolar electrocoagulation, heater probe, cryotherapy and APC (31-36). Currently, APC is the most frequent endoscopic modality used for the treatment of GAVE. The treatment time and number of sessions needed to complete eradication of lesions depends on the pattern (the diffuse type takes longer to eradicate), the extent and number of lesions, and the circumstances of treatment (active bleeding takes more sessions than elective therapy). On average, two to four treatment sessions are needed to achieve complete eradication with APC. Two recent reports have described



Figure 1) Multiple angiodyplasias in a patient with hereditary hemorrhagic telangiectasia. Multiple lesions were ligated

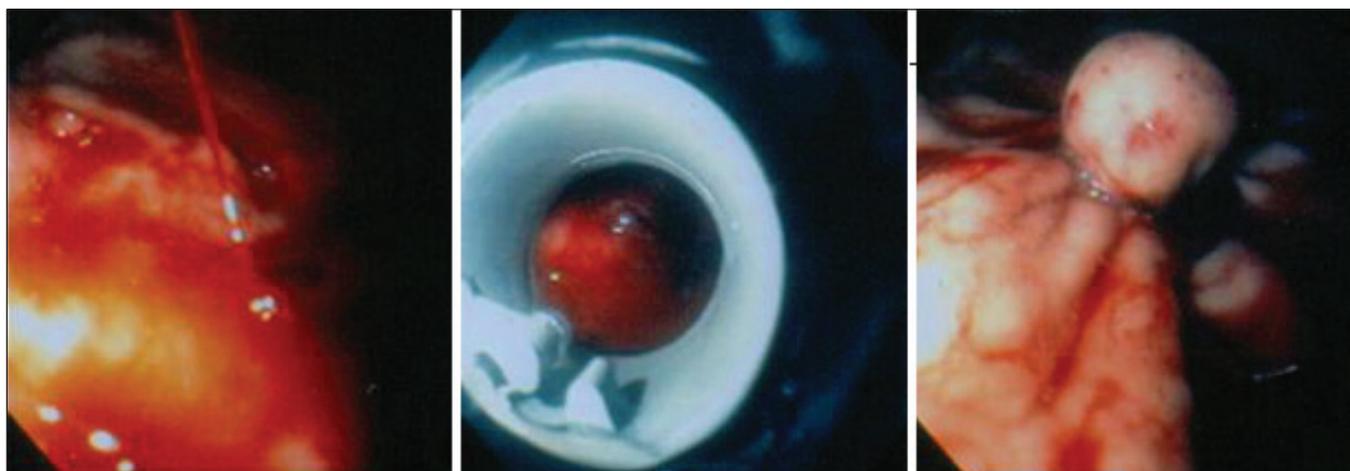


Figure 2) Spurting Dieulafoy ulcer controlled with rubber band ligation

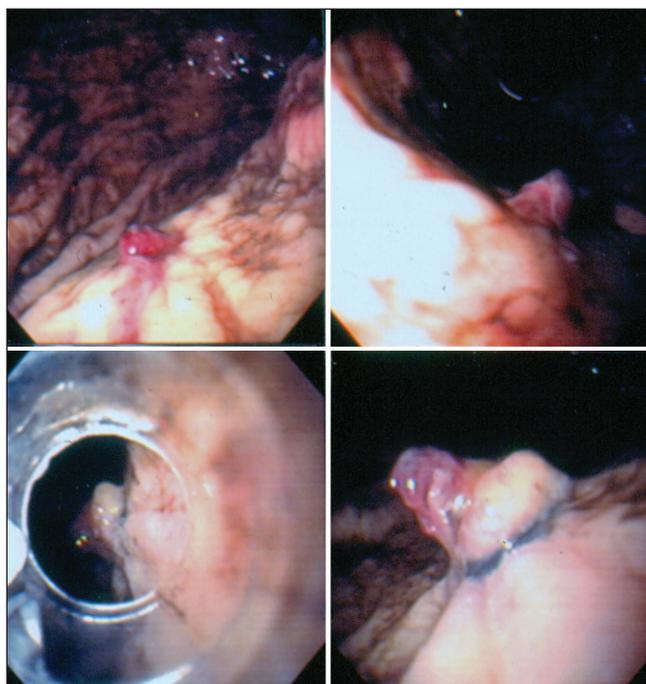


Figure 3) Nonbleeding Dieulafoy ulcer

the use of EBL for the treatment of GAVE. In the first report (37), a 53-year-old man was evaluated for iron deficiency

anemia and an episode of hematemesis. An upper endoscopy revealed a type 1 GAVE, and EBL of the ectasias was performed because APC was not available. Six bands were deployed from the stripes of the pylorus to a more proximal location. Further endoscopies revealed partial resolution of the lesions and a second session of EBL was performed six months later, applying another six bands that targeted the residual areas of GAVE. No complications were observed during or after the procedure. The hemoglobin level stabilized and subsequent endoscopic examinations after two and six months showed complete resolution of GAVE. The patient remained asymptomatic after 16 months of follow-up. In another case report (38), a 55-year-old woman with a history of melena and severe anemia had been treated with APC on two occasions for GAVE. She was treated with EBL as a salvage therapy. In the first session, five bands were applied and in the second (two weeks later), 11 bands were deployed. There was clinical and endoscopic improvement, and the reported adverse effects after EBL were epigastric pain controlled by oral analgesics (not specified) and ulcers at the site of treatment, which healed completely. After 15 months of follow-up, she remained stable.

#### OTHER CAUSES OF GI BLEEDING

There was one report (39) of the use of EBL for rubber bleb nevus syndrome in a 15-year-old boy with hematemesis and four elevated bluish lesions in the antrum. Two treatment sessions were performed and no further bleeding was documented.

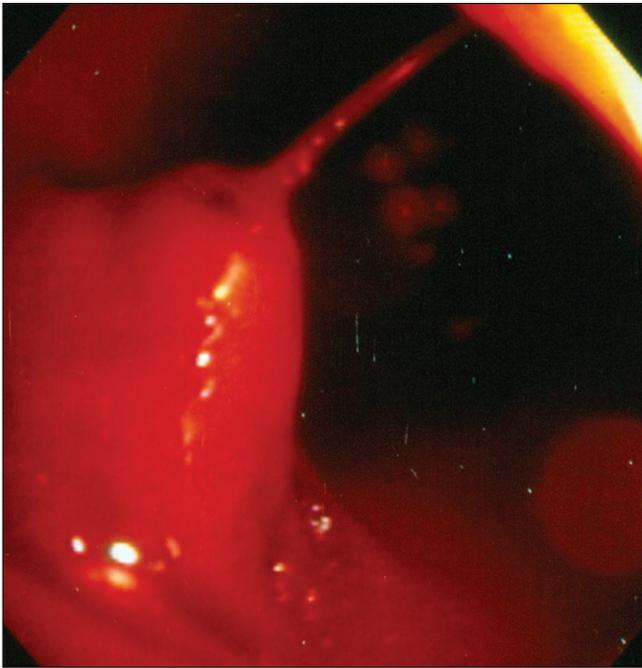


Figure 4) Spurting stalk after a polypectomy in the sigmoid colon

Colonic diverticular bleeding has been reported to be effectively treated by EBL in four patients (40). There were no complications or rebleeding during a 12-month follow-up period.

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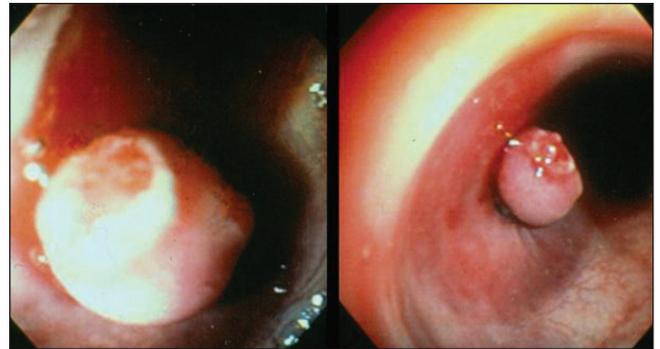


Figure 5) Stalk of polyp ligated with control of bleeding

## CONCLUSIONS

EBL is increasingly being used as a primary therapy for non-variceal bleeding lesions in the GI tract. It has been shown to be an easy and safe method with a high rate of success. It is at least equally effective as the previous standard methods such as hemocclipping, injection of adrenaline or sclerosants, and thermal therapy. There is more information in patients with vascular malformations, Dieulafoy lesions and MWTs, but recent studies have also shown promising results for the treatment of GAVE and PPB. EBL could be a primary or alternative method for the treatment of nonvariceal bleeding lesions of the GI tract.

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