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# Band Ligation Can Be Used to Treat Barrett's Esophagus and Concurrent Esophageal Varices: A Case Series

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## Abstract

**Background** Patients with Barrett's esophagus (BE) and esophageal varices present a unique management dilemma. Endoscopic ablation and endoscopic resection are not suitable treatment options due to bleeding risk. Data are limited on successful eradication of BE and esophageal varices utilizing band ligation.

**Aims** To assess the outcomes of patients with BE and esophageal varices treated with banding.

**Methods** Retrospective analysis of patients with BE and esophageal varices who were treated with band ligation.

**Results** A total of eight patients were included in the case series. In all eight cases, BE and esophageal varices were successfully treated with band ligation alone. There were no bleeding, perforation or infectious complications in any patients undergoing banding for treatment of BE. Four patients had biopsy-proven dysplasia prior to treatment with band ligation. After band ligation, the 2 of 4 dysplastic cases that had repeat biopsies showed histologic resolution of the dysplasia. All patients who received banding for BE were followed at least yearly except for one patient lost to follow up. No interval esophageal cancers were reported in any patients with BE that were banded.

**Conclusions** Band ligation was used to treat BE pathology in eight patients with esophageal varices. Treatment of dysplasia through this method yielded negative biopsies both for dysplasia and BE on repeat endoscopy. This case series highlights the value of utilizing band ligation to address the management dilemma of BE in the context of esophageal varices.

**Keywords** Barrett's esophagus · Esophageal varices · Band ligation

## Introduction

Barrett's esophagus (BE) involves metaplasia in which the normal nonkeratinized stratified squamous epithelium of the distal esophagus is replaced by nonciliated columnar

epithelium resembling intestinal epithelium [1]. BE is estimated to affect about 5% of American adults and is the only recognized risk factor for esophageal adenocarcinoma [2]. Esophageal varices (EV) classically arise in cirrhotic patients who develop portal hypertension. Hemorrhage from EV is the most lethal complication of cirrhosis [3]. Esophageal varices are typically managed with endoscopic variceal ligation, also known as band ligation, often with the addition of a beta blocker [4].

Patients with esophageal varices and BE present a unique management dilemma. Dysplastic BE is typically treated with radiofrequency ablation (RFA) or endoscopic mucosal resection (EMR) [5]. However, ablation and resection are both associated with bleeding and are not suitable treatment options for dysplastic BE with concurrent esophageal varices. Data are limited on successful eradication of BE and esophageal varices utilizing band ligation.

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## Methods

This is a retrospective case series at a single tertiary care center from 2014 to 2022 examining the outcomes of patients with BE and concomitant EV treated with band ligation. ICD 10 codes were used to extract data for patients who

had concurrent diagnoses of BE and EV. Patients who were treated with band ligation for BE were included. Information collected included age, sex, cause of portal hypertension, length of BE, and size of esophageal varices. Outcomes analyzed included number of procedures with banding for BE pathology, degree of dysplasia before banding, and degree of dysplasia after banding.

**Table 1** Baseline characteristics ( $N=8$ )

Male, $n$ (%)	6 (75%)
Age (years), mean $\pm$ SD	61.3 $\pm$ 9.6
Cause portal hypertension, $n$ (%)	
Alcoholic cirrhosis	4 (50%)
Cryptogenic cirrhosis	1 (12.5%)
Portal vein thrombosis	1 (12.5%)
Hepatitis C	1 (12.5%)
Nonalcoholic steatohepatitis	1 (12.5%)
Length BE, $n$ (%)	
Short (< 3 cm)	7 (87.5%)
Long (> 3 cm)	1 (12.5%)
Size of Varices, $n$ (%)	
Small (grade I and II)	4 (50%)
Large (grade III)	4 (50%)

## Results

A total of eight patients were included in the cohort as described in Table 1. The mean age was 61.3  $\pm$  9.6 years and 75% (6/8) were male. Short segment (< 3 cm) BE was encountered 87.5% (7/8) of patients. An equal number of patients had large (grade III) and small (grade I and II) varices. Due to the risk of bleeding, biopsy of the suspected BE was not performed in 2 cases. In these cases, band ligation was performed based on the gross appearance of BE with concurrent esophageal varices. Biopsies were obtained in 6 cases either before and/or after band ligation. All cases are discussed in further detail below and highlighted in Table 2. Patients with known high-grade dysplasia (HGD) were followed monthly for banding until resolution of EV and BE. All patients who received banding for BE were

**Table 2** Case descriptions of BE pathology treated with band ligation

Case	Length BE	Size esophageal varices	No. of treatments with banding	Pre banding (endoscopic appearance)	Post banding (endoscopic appearance)	Pre banding (biopsy)	Post banding (biopsy)
1	Long (4 cm), 8 mm nodule	Large (grade III)	7	Prague C2-M4, nodular	Slightly irregular z line, no definite BE seen no nodularity	Focal HGD, possible invasive adenocarcinoma	Negative for dysplasia, negative for BE
2	Short (1 cm)	Small (grade I)	1	Prague C1-M0	Slightly irregular z line, no definite BE seen	LGD	Negative for dysplasia, negative for BE
3	Short (< 1 cm)	Large (grade III)	2	0.5 cm flat salmon-colored mucosa (Paris 0-IIb)	No visible BE	N/A due to bleeding concerns	Negative for dysplasia, negative for BE
4	Short (1 cm), nodular	Small (grade II)	4	Prague C0-M1, nodular	No visible BE, no nodularity	HGD	N/A due to bleeding concerns
5	Short (2 cm)	Large (grade III)	1	Three 2–3 cm tongues of salmon-colored mucosa	No visible BE	Intestinal metaplasia	N/A due to bleeding concerns
6	Short (1 cm)	Small (grade I)	1	Prague C0-M1, mild mucosal irregularity	N/A patient lost to follow-up	HGD	N/A patient lost to follow-up
7	Short (1 cm)	Small (grade I)	1	Prague C0-M1	0.3 cm region of salmon-colored mucosa	N/A due to bleeding concerns	N/A due to bleeding concerns
8	Short (1 cm)	Large (grade III)	2	Prague C0-M1	No visible BE	N/A due to bleeding concerns	N/A due to bleeding concerns

followed at least yearly except for one patient lost to follow up. There were no bleeding, perforation or infectious complications in any patients undergoing banding for treatment of BE. No interval esophageal cancers were found in any patients with BE that were banded.

In case 1, a 73-year-old man with a history of cryptogenic cirrhosis presented with large (grade III) esophageal varices and long segment BE (4 cm) with an 8 mm nodule on esophagogastroduodenoscopy (EGD). Biopsies showed focal high-grade dysplasia (HGD) with possible invasive adenocarcinoma on the outside endoscopy. Band ligation was used to treat the EV and the high-grade dysplasia. The patient was followed monthly for banding for a total of seven distinct treatments with banding to eradicate the region of BE. The patient was followed for 2 years after initiation of treatment with banding and continued annual surveillance is scheduled. Repeat biopsies have showed complete resolution of the dysplasia and intestinal metaplasia.

In case 2, a 62-year-old man with a history of hepatitis C presented with short BE and small esophageal varices on EGD. Biopsy of the BE showed low grade dysplasia (LGD) and the region was treated with band ligation. Repeat biopsies after a single treatment with band ligation demonstrated complete resolution of the region of dysplasia and BE. The patient was followed yearly with EGD's for 7 years.

In case 3, a 41-year-old man with a history of alcoholic cirrhosis was found to have large EV and a short segment of suspected BE on EGD. Although biopsy of the region could not be obtained due to an underlying varix, the region containing the varix and suspected BE was treated with band ligation on two separate occasions. After treatment, EGD demonstrated gross resolution of the region and biopsy of the region indicated no BE. The patient was followed biannually for 1.5 years prior to publication.

In case 4, a 59-year-old woman with a history of portal vein thrombosis presented with small EV and a short segment of BE reported as high-grade dysplasia on biopsy. The patient was followed monthly for banding until gross resolution of the region of BE for a total of 4 separate treatments with banding. The patient had one EGD 3 months after completion of banding treatment which demonstrated gross resolution of the region of BE. Repeat biopsy of the region of HGD was not performed due to the patient's prior history of bleeding upon EGD biopsies. Further surveillance was scheduled but the patient was lost to follow-up after the initial 3-month follow-up.

In case 5, a 60-year-old woman with a history of non-alcoholic steatohepatitis was found to have large EV and a short segment of BE confirmed by biopsy. Treatment of BE with band ligation yielded gross resolution of the BE. Repeat biopsies of the region were not performed due to the continued presence of esophageal varices. The patient was followed at least yearly for 4 years after banding for BE.

In case 6, a 64-year-old man with a history of alcoholic cirrhosis complicated by bleeding esophageal varices presented with short segment BE and underlying small esophageal varices. The BE was found to be HGD on biopsy. The patient was treated with band ligation of the region of BE and underlying varices. Repeat EGD was planned for 3 months after the initial procedure, but unfortunately the patient was lost to follow-up.

In case 7, a 70-year-old man with alcoholic cirrhosis was found to have a short segment of esophageal mucosal changes suspicious for BE extending 1 cm with underlying small varices. Given the underlying varices, the region was not biopsied but instead a band was placed around the region and the underlying varices. At follow-up EGD 1 year later, the region of salmon-colored mucosa suspicious for BE had been reduced from 1 to 0.3 cm.

Finally, in case 8 a 61-year-old man with alcoholic cirrhosis presented with a short segment of suspected BE (1 cm) with underlying and surrounding large varices. The region containing the varices and suspected BE was banded. On repeat EGD 1 month later, the region had decreased from 1 to 0.5 cm and was banded again. Follow-up 1 year later demonstrated normal gastroesophageal junction without evidence of BE.

## Discussion

This case series describes the successful treatment of BE with and without dysplasia in the setting of esophageal varices utilizing band ligation. Literature is limited regarding the treatment of BE complicated by esophageal varices. Ueda et al. reports one case where Barrett's adenocarcinoma with esophageal varices was successfully managed with endoscopic submucosal dissection with direct varices coagulation [6]. Uchima et al. describes a case series of 3 patients with neoplastic BE and EV who were treated with endoscopic mucosal resection and radiofrequency ablation [7]. In another case, Raftopoulos et al. reports a single case of successful eradication of BE and esophageal varices utilizing band ligation [8]. Palmer et al. describes the management of high-grade dysplastic BE and esophageal varices with band ligation and concludes that band ligation alone rarely results in complete resolution of dysplastic HGD [9]. In contrast, this case series illustrates four cases of biopsy-proven dysplasia (1 LGD and 3 HGD) that were successfully treated with band ligation alone.

Band ligation has previously been shown to be effective for short segment BE without dysplasia in non-cirrhotic patients [10]. Banding for BE is especially useful in cirrhotic patients with bleeding risk who already undergo EGD surveillance and banding for EV. Band ligation likely works by strangulation deep enough to slough off the mucosal

**Table 3** Treatment options for BE with concurrent esophageal varices

Treatment method	Benefits	Drawbacks
Endoscopic mucosal resection (EMR) [11]	<ul style="list-style-type: none"> <li>• Provides tissue specimen for pathology</li> <li>• High rates of complete eradication of both BE and dysplasia</li> </ul>	<ul style="list-style-type: none"> <li>• Bleeding; EV are a contraindication</li> <li>• Other adverse events: perforation (rare) and stenosis</li> </ul>
Radiofrequency ablation (RFA) [12–14]	<ul style="list-style-type: none"> <li>• Highly effective at removing BE and dysplasia at both endoscopic and histologic level</li> </ul>	<ul style="list-style-type: none"> <li>• Bleeding; EV are a contraindication</li> <li>• Other adverse events: stricture formation and pain</li> <li>• Insufficient to treat nodular disease and cancer</li> <li>• No pathology specimen to examine</li> </ul>
Intensive endoscopic surveillance only [15]	<ul style="list-style-type: none"> <li>• Bleeding risk initially averted</li> </ul>	<ul style="list-style-type: none"> <li>• Bleeding risk still present if biopsy required</li> <li>• Risk of interval progression to cancer in setting of dysplasia</li> </ul>
TIPS + another method [16]	<ul style="list-style-type: none"> <li>• TIPS reduces portal pressure and decreases risk of variceal bleeding</li> <li>• After TIPS, RFA or EMR can be pursued</li> </ul>	<ul style="list-style-type: none"> <li>• TIPS increases risk of hepatic encephalopathy</li> </ul>
Band ligation	<ul style="list-style-type: none"> <li>• Treats both BE and EV at same time</li> <li>• Initial data shows safe and efficacious</li> </ul>	<ul style="list-style-type: none"> <li>• Requires two separate procedures to treat BE pathology</li> <li>• May require several EGD's for repeated banding</li> <li>• Literature is limited on this method</li> <li>• No pathology specimen is obtained to confirm eradication of dysplasia/cancer</li> <li>• Limited size of individual lesion to band of around 15 mm in a session; risk of not ablating margin of larger lesions</li> </ul>

layer in addition to strangulating the varices. Some patients may require several treatments with banding, such as case 1 which required 7 separate banding treatments for focal HGD. Considering the difficulty of obtaining biopsies to meet diagnostic criteria for BE in these patients, we recommend that band ligation be considered as an empiric treatment option for a region of suspected BE with nearby or underlying EV. This is illustrated in case 3, case 7, and case 8 where biopsies for formal diagnosis could not be made but regions of suspected BE were successfully treated with band ligation.

Another option to consider in patients with both BE and EV is a transjugular intrahepatic portosystemic shunt (TIPS) procedure to relieve portal pressure. After TIPS, treatment of the BE using more traditional EMR or RFA may be pursued. We have anecdotally previously also managed BE with HGD and early adenocarcinoma in a background of EV with TIPS to reduce portal pressure followed by band EMR. Alternatively, band ligation of EV until eradication could be performed first. Once varices are eradicated, patients could undergo EMR or ablation if international normalized ratio (INR) and platelet counts are in a safe range. A summary table of treatment options can be seen in Table 3. Ultimately, band ligation of both EV and BE during the same procedure provides an efficient and effective treatment in these patients. The number of procedures is reduced, and the BE can be managed sooner than if patients undergo variceal banding until eradication or TIPS followed by EMR or ablation.

This case series is limited by the retrospective design and the small sample sizes of patients with EV and BE. The difficulty of obtaining biopsies also complicates the analysis and is a limitation of the study. Even when biopsies can be obtained, conditions at the gastroesophageal junction such as background inflammation can be confused with dysplasia especially in the setting of short regions of suspected BE with limited surface area for biopsies. In addition, follow up biopsies to confirm eradication of intestinal metaplasia and dysplasia could only be obtained in 3 of 8 cases due to associated bleeding risk, which further limits the study. Future considerations for study may include the potential to utilize banding in the setting of BE with smaller varices that would otherwise not have been banded. In conclusion, this case series highlights band ligation as a valuable treatment option for patients with BE and EV. BE with underlying EV can be safely managed with band ligation.

**Author contributions** All authors contributed to the study conception and design. Data collection and analysis were performed by all authors. The first draft of the manuscript was written by CH and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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**Data availability** This research study was conducted retrospectively from data obtained for clinical purposes.

## Declarations

**Conflict of interest** There are no financial arrangements or conflicts of interest to disclose.

**Ethical approval** We consulted extensively with the IRB of Henry Ford Health System who determined that our study did not need ethical approval. An IRB official waiver of ethical approval was granted from the IRB of Henry Ford Health System.

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