Research Article
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Management of childhood esophageal varices: learnings from an advanced medical centre

Abstract

Background: Variceal bleeding represents a significant clinical emergency with potential life-threatening implications in infants and children. Endoscopic band ligation is the standard treatment for esophageal varices.

Objective: The objective is to evaluate the effectiveness of band ligation for managing esophageal varices in both extra-hepatic and hepatic cases of portal hypertension.

Methods: A prospective study was conducted in the Department of Pediatric Gastroenterology, Hepatology & Nutrition, Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh on 56 pediatric cases of esophageal varices enrolled from January 2021 to December 2023. All of them were treated with EVL and tab. Propranolol thereafter. Later followed up for a minimum period of one year from 1st session of EVL.

Results: The study included 56 children aged 2 to 18 years, with a mean age of 8 ± 1.96 years and a male-to-female ratio of 1.8:1. Among them, 43 children (77%) had pre-hepatic causes of portal hypertension, while 13 (23%) had hepatic causes associated with chronic liver disease. Band ligation was completed in a single session for 10 (23.26%) pre-hepatic cases, whereas all hepatic cases required multiple sessions. On average, 2-3 bands were applied per session in both groups. Grade II esophageal varices with red signs were more frequently observed in pre-hepatic cases, while more severe varices (Grade III and IV) were predominantly found in hepatic cases. Gastric varices were more common in hepatic cases (4, 30.77%) compared to pre-hepatic cases (6, 13.95%). Recurrent bleeding occurred in 15 (35%) of the pre-hepatic cases and in all hepatic cases (100%). Early re-bleeding was more prevalent among hepatic cases (6, 46.15%), whereas late re-bleeding was noted in both groups-11 (25.58%) pre-hepatic and 7 (53.85%) hepatic cases. Minor complications such as discomfort were reported in 7 (16.28%) pre-hepatic and 3 (23.08%) hepatic cases. Nausea and vomiting were the most commonly observed post-procedural symptoms in both groups. Only one child (2.33%) from the pre-hepatic group experienced a major complication, which was the development of an esophageal stricture.

Conclusion: Pre-hepatic causes were the most common etiology of portal hypertension in children. Endoscopic band ligation was effective and safe, requiring fewer sessions in pre-hepatic cases, and showed higher re-bleeding rates and severity in hepatic cases.

Keywords: band ligation, esophageal varices, EVL

Volume 16 Issue 2 - 2025

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Received: December 25, 2024 | **Published:** April 28 2025

Background

Variceal hemorrhage is a major cause of severe gastrointestinal bleeding in pediatric patients and is associated with elevated fatality rates.[1] Endoscopic sclerotherapy (EST) is recognized as a routine procedure for the management of hemorrhaging esophageal varices. EST is associated with multiple consequences, including retrosternal discomfort, fever, infection, temporary dysphagia, and, in certain cases, pleural effusion. Seventy to eighty percent of patients experience mucosal ulcerations at injection sites, potentially resulting in severe complications such as esophageal strictures, rebleeding (up to twenty percent), and, in rare instances, perforation.[2–4] Endoscopic variceal ligation (EVL), developed by Stiegmann and Goff, has emerged as a feasible alternative to sclerotherapy. In adult patients, endoscopic variceal ligation (EVL) has superior safety and efficacy compared to endoscopic sclerotherapy (EST) and is presently considered the recommended endoscopic intervention for variceal bleeding.[5,6] According to Li et al.[7] EST, alone or in combination with EVL, is an effective and safe method of managing gastroesophageal variceal hemorrhage in children undergoing secondary prophylaxis.

Information concerning the utilization of EVL with a multiband ligator in pediatric populations is still scarce.[8] The multiband ligator offers a more efficient and convenient approach, enabling the ligation of up to six varices during a single endoscopic insertion.[9] This study assesses the clinical outcomes of endoscopic band ligation for esophageal varices in pediatric patients, concentrating on variceal eradication, recurrence, rebleeding rates, safety, and associated comorbidities.[10]

Materials and methods

From January 2021 to December 2023, a prospective study was done in the Department of Pediatric Gastroenterology, Hepatology, and Nutrition at Bangladesh Shishu Hospital & Institute in Dhaka, Bangladesh. After parental consent, 64 hospitalized children ages 2–18 with confirmed esophageal varices were enrolled in the study. Clinical evaluation, biochemical tests, and radiological imaging determined the etiology.[8] Using a forward-viewing flexible video endoscope (Olympus GIF-V) and conscious sedation with injectable midazolam (0.3 mg/kg per dose), endoscopy was carried out following proper resuscitation.

Varices were graded according to Conn's criteria:

- **Grade I**: Visible only during inspiration
- **Grade II**: Visible during both inspiration and expiration
- **Grade III**: Occupying less than 50% of the esophageal lumen
- **Grade IV**: Occupying 50% or more of the esophageal lumen[11]

Endoscopic variceal ligation (EVL) was conducted in patients with Grade II varices exhibiting red signs, as well as in all patients with Grade III or IV varices experiencing acute bleeding or recurrence following previous banding.[12] A Multi-Band Ligator (MBL-6-F, Wilson-Cook Medical, USA) was used to carry out the EVL procedure.[13] Severe varices were detected, sucked into the ligator's banding chamber, and suction was sustained until the endoscopic view became red, signifying adequate capture.

The handle was then turned clockwise to deploy the band. Bands were placed along the esophagus in ascending order (Figure 1 demonstrates the procedure).[12] EVL treatments were arranged at monthly intervals until the varices were either destroyed or diminished to Grade I or tiny thrombosed varices deemed unsuitable for ligation. A maximum of four bands were applied per session, starting in the distal esophagus, utilizing the multiband ligation device (Six Shooter). Endoscopies were performed monthly or sooner in the event of upper gastrointestinal bleeding, maintained for a minimum of one year. Band ligation, oral propranolol, and Omeprazole 1 mg/kg/day were given to all patients for at least two months or until endoscopic reassessment.[14] Variceal grading, the number of band ligation sessions, the number of bands per session, full variceal obliteration, the incidence of early and late re-bleeding, and any complications were used to assess the effectiveness of the treatment (Figure 2).[8]

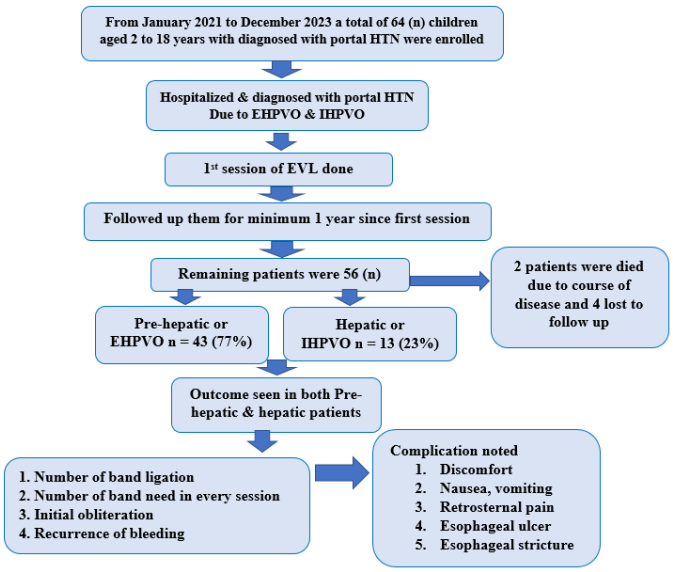

Figure 1 Study flow chart.

- **Initial variceal obliteration** was defined as complete disappearance of varices or reduction to a size too small for ligation.
- **Recurrence** was defined as reappearance or enlargement of previously thrombosed or small varices suitable for banding.[10,11]
- **Early re-bleeding** was defined as hematemesis, melena, bloody nasogastric drainage, or need for transfusion occurring within 1-month post-ligation.
- **Late re-bleeding** was defined by the same clinical features occurring ≥1 month after ligation.[12]

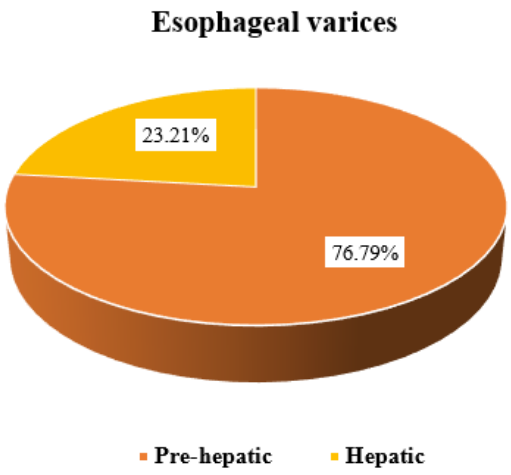

Figure 2 Etiology of esophageal varices.

The principal investigator employed a pre-designed semi-structured data collection form to gather data. SPSS version 11.5 was employed to conduct the statistical analysis. For continuous variables, descriptive statistics were displayed as mean ± standard deviation; for categorical variables, they were displayed as frequencies (percentages). Proportions were tested using the Z-test, and a p-value of less than 0.05 was deemed statistically significant (Table 1 & 2 Figure 3).

Table 1 Demographic criteria

Variables	**Value**	
Mean age(yrs.)	8±1.96	
Sex		
Male	36 (64.29)	
Female	20 (35.71)	
Mean age of first variceal bleed (Yrs.)		
All case	6.59	
Pre hepatic	5.51	
Hepatic	10.15	
Etiology	**Pre-hepatic**	**Hepatic**
Total, n (%)	43 (77%)	13 (23%)
Idiopathic	22 (51.16%)	
Portal vein thrombosis	12 (27.91%)	
Splenic vein thrombosis	4 (9.30%)	
others	5 (11.63%)	
Cryptogenic		4 (30.77%)
Wilsons's disease		5 (38.46%)
Autoimmune hepatitis		3 (23.08%)
Hep B virus		1 (7.69%)
Esophageal varies n (%)	**Pre- hepatic**	**Hepatic**
Grade I	6 (13.95%)	-
Grade II with red sign	18 (41.86%)	2 (15.38%)
Grade III	17 (39.53%)	7 (53.85%)
Grade IV	2 (4.65%)	4 (30.77%)
Gastric Varices, n (%)	**Pre- hepatic**	**Hepatic**
	6 (13.95%)	4 (30.77%)

Citation: Farhana T, Mahmud S, Tasneem F, et al. Management of childhood esophageal varices: learnings from an advanced medical centre. *Gastroenterol Hepatol Open Access*. 2025;16(2):61–65. DOI: 10.15406/ghoa.2025.16.00609

Table 2 Outcome of EVL

Outcome	Value	
Number of band ligation, n (%)	**Pre-hepatic**	**Hepatic**
1st session	10 (23.26)	-
2nd session	18 (41.86)	5 (38.46)
3rd session	10 (23.26)	5 (38.46)
>3 session	5 (11.63)	3 (23.08)
Number of band need in every session, n (average)	Pre- hepatic (1-3)	Hepatic (1-4)
Initial obliteration, n (%)	Pre- hepatic 43 (100)	Hepatic 13 (100)
Recurrence of bleeding, n (%)	**Pre-hepatic**	**Hepatic**
No bleeding	28 (65.12)	
Early re-bleeding	4 (9.30)	6 (46.15)
Late re-bleeding	11 (25.58)	7 (53.85)
Complication, n (%)	**Pre-hepatic**	**Hepatic**
Discomfort	7 (16.28)	3 (23.08)
Nausea±vomiting	9 (20.93)	5 (38.46)
Retrosternal pain	2 (4.65)	2 (15.38)
Esophageal stricture	1 (2.33)	-
Esophageal ulceration	-	-
Esophageal perforation	-	-
Aspiration pneumonia	-	-
Sepsis	-	-

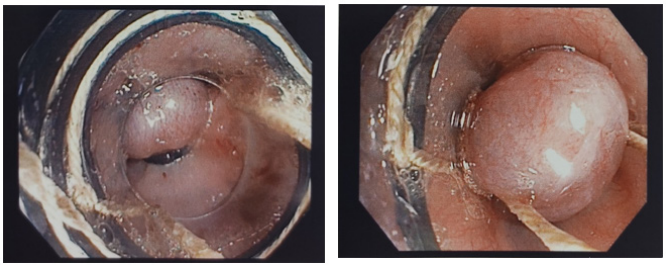

Figure 3 Endoscopic image showing large esophageal varix & ligating the varix using multiband ligator.

Results

Initially, 64 children with esophageal varices were enrolled; six (9.38%) were lost to follow-up, and two (3.13%) died as a result of variceal bleeding. The final sample size was 56. Selected children were between 2-18 years of age. Their mean age was 8±1.96 year. There were 36 (64.29%) male & 20 (35.71%) female cases. Male: Female ratio was 1.8:1. Out of 56 children, 43(77%) developed portal hypertension due to pre-hepatic causes and 13 (23%) due to hepatic causes. None was found with post-hepatic cause. The mean age at onset of the first variceal bleeding was at 6.59 years. In pre hepatic cases it was 5.51 years & in hepatic cases it was 10.15 years. So, in pre-hepatic cases first variceal bleed occurs much earlier than hepatic cases. Within the pre hepatic cases idiopathic was found 22(51.16%), portal vein thrombosis was 12(27.91%), Splenic vein thrombosis was 4(9.30%) & others were 5(11.63%). Among hepatic cases there were cryptogenic 4(30.77%), Wilsons's disease 5(38.46%), Autoimmune hepatitis 3(23.08%) & Hep B infection was found only 1(7.69%).

On endoscopic view varices were graded on the scale according to Conn's criteria, in pre-hepatic cases, grade-1 was 6(13.95%), grade-2 with red sign was 18(41.86%), grade-3 with red sign was 17(39.53%), grade-4 was 2(4.65%). Among the hepatic cases, grade-2 with red sign was 2(15.38%), grade-3 was 7(53.85%), grade-4 was 4(30.77%) found respectively. Only one session required in 10(23.26%) cases of pre hepatic children whereas multiple sessions required in hepatic children. Almost same number of bands required in every session of both pre-hepatic & hepatic cases. Recurrence of bleeding was observed in 15 (35%) cases of pre-hepatic & all cases (100%) of hepatic children. Early re-bleeding was more common in hepatic 6(46.15%) cases & late re-bleeding was more common in both pre-hepatic 11(25.58%) & hepatic 7(53.85%) cases. 7(16.28%) pre-hepatic cases experienced discomfort whereas 3(23.08%) hepatic cases have the same complain. Most common complications were nausea±vomiting was found both categories of cases. A single pre- hepatic case 1(2.33%) faced major complication like esophageal-stricture.

Discussion

Esophageal varices are the most frequent complication of both extrahepatic and intrahepatic portal vein obstruction (EHPVO and IHPVO). Once formed, varices tend to progressively enlarge and are at risk of rupture, leading to variceal bleeding- a medical emergency.[12–15] Endoscopic variceal ligation (EVL) is considered the gold standard for the management of acute esophageal variceal bleeding. In addition to its role in emergency treatment, EVL is also effective in both primary and secondary prophylaxis.[10] Previous studies have demonstrated that EVL is both safe and effective in the pediatric population.

In this study the most common etiology of portal hypertension was extra-hepatic 43 (77%). In the present study, portal vein thrombosis was identified in 12 cases (27.91%), while an idiopathic cause was found in 22 cases (51.16%). These findings are consistent with those of Mahmud et al. (2017), who reported that 32 cases (80%) were due to pre-hepatic causes and 8 cases (20%) to hepatic causes. Among the pre-hepatic cases in their study, portal vein thrombosis accounted for 20 cases (62.5%), splenic vein thrombosis for 4 cases (12.5%), and other causes for 8 cases (25%).[16–20]

One pediatric study comparing endoscopic sclerotherapy and EVL concluded that EVL was significantly more effective, resulting in faster variceal obliteration and requiring fewer treatment sessions.[10] A recent randomized controlled trial comparing endoscopic sclerotherapy (EST) and endoscopic variceal ligation (EVL) for the treatment of bleeding esophageal varices in children with extrahepatic portal vein obstruction (EHPVO) demonstrated that EVL achieved variceal eradication in significantly fewer sessions (3.9 ± 1 vs. 6.1 ± 1.7).[13]

In the present study, a single EVL session was sufficient for variceal eradication in 10 cases (23.26%) of children with extrahepatic portal vein obstruction (EHPVO), whereas all children with intrahepatic portal vein obstruction (IHPVO) required multiple sessions. Kerner et al. reported that using a multiband ligator resulted in variceal obliteration within two sessions in 26 out of 28 pediatric patients, with minimal complications. Their findings demonstrated that the multiband ligator is both technically feasible and safe for use in children. A similar observation was noted in the present study, where 2 to 3 bands were applied per session in both pre-hepatic and hepatic cases during endoscopic variceal ligation. Abbasi et al.[10] reported that initial variceal obliteration was achieved in 79.8% of cases. In contrast, the present study demonstrated a 100% initial obliteration rate following proper band application, indicating a highly effective outcome with endoscopic variceal ligation.[21–23]

In the present study, recurrence of bleeding was observed in all hepatic cases (100%) and more than one third of the pre-hepatic cases (35%). A meta-analysis of 15 studies comparing endoscopic variceal

ligation (EVL) with sclerotherapy for the prevention of variceal re-bleeding demonstrated that EVL was associated with a significantly lower re-bleeding rate.[22] Similar findings were reported by Pokhrana et al.[8] who observed that bleeding recurrence was considerably higher in intra-hepatic cases (91.7%) compared to extra-hepatic cases (8.3%).[15] Valantinas J et al.[15] reported that early re-bleeding was significantly more common in intra-hepatic cases (82.1%) compared to pre-hepatic cases (17.9%). Similar findings were observed in the present study, where early re-bleeding occurred in 6 (46.15%) of intra-hepatic cases and in 4 (9.30%) of pre-hepatic cases. Additionally, late re-bleeding was noted in both groups, with a higher incidence in pre-hepatic cases 11 children (25.58%) and in 7 children (53.85%) with hepatic involvement.

Complications such as esophageal perforation, bleeding, ulceration, and stricture formation have been reported to occur significantly more frequently in the endoscopic sclerotherapy (EST) group compared to the endoscopic variceal ligation (EVL) group.[8] In contrast, a study involving 17 children with extrahepatic portal vein obstruction (EHPVO) reported no short-term or long-term complications associated with EVL. Similarly, Chen SY et al.[12] also observed no fatal complications following EVL, further supporting its safety profile in the pediatric population. In the present study, 7(16.28%) pre-hepatic cases experienced discomfort w 3(23.08%) hepatic cases have the same complain. Most common complications were nausea±vomiting was found both categories of cases. Only single pre- hepatic case 1(2.33%) faced major complication like esophageal stricture.

Conclusion

Endoscopic band ligation efficiently eliminates esophageal varices in children with variceal bleeding, resulting in fewer complications and a reduced incidence of re-bleeding. This study indicated that pre-hepatic cases necessitated fewer sessions than hepatic cases. Early re-bleeding was more prevalent in children with hepatic etiologies of portal hypertension. Endoscopic variceal ligation with a multiband ligator is a safe and successful technique for managing acute variceal hemorrhage and preventing re-bleeding in pediatric patients.

Limitations of study

This study had two primary limitations. First, it was a single-centre study with a relatively small sample size and a short follow-up duration of approximately one year. To draw more robust conclusions, further research involving larger cohorts and extended follow-up periods is necessary. Second, this was a single-arm study focused solely on the outcomes of band ligation, without a comparative group. As a result, the findings could not be directly compared with other treatment modalities such as oral medications, endoscopic sclerotherapy, or combination therapies.

Availability of data and materials

The dataset used in the current study is available from the corresponding author on reasonable request.

Acknowledgements

The authors thank all the people responsible whose feedback helped to improve the paper.

Funding

The study is self-funded.

Conflict of interest

The authors declare that there were no conflict of interest.

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Citation: Farhana T, Mahmud S, Tasneem F, et al. Management of childhood esophageal varices: learnings from an advanced medical centre. *Gastroenterol Hepatol Open Access*. 2025;16(2):61–65. DOI: 10.15406/ghoa.2025.16.00609