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Retrospective analysis of endoscopic dilatation for pediatric patients with esophageal stricture: Bangladesh perspective

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ABSTRACT

Background and objectives: Esophageal stricture in children is an intrinsic narrowing of the esophagus due to different etiologies, including congenital anomalies, corrosive substance or foreign body ingestion, and post-esophageal surgeries. The purpose of this study is to retrospectively evaluate the results and procedures of endoscopic dilatation (ED) performed on children with esophageal strictures in a specialized center in Bangladesh. **Methods**: Between September 2018 and October 2022, 21 children aged 0.2 to 15 years at the time of the first procedure who underwent 48 ED sessions were included at Bangladesh Specialized Hospital (Dhaka, Bangladesh). We documented the basic characteristics of patients, indications for ED, therapeutic procedures, and outcomes. Outcome parameters were the frequency of dilatations, complications (if any), and clinical success rates. Clinical success was defined as no necessity of ED for a minimum of one year or increasing intervals among repeated dilatations. **Results**: Among the studied patients, the most common causes of stricture were congenital esophageal atresia and ingestion of corrosive substances. More than half of the studied patients required multiple ED sessions, with one patient requiring eight sessions who had congenital esophageal atresia with a post-surgical stricture. Dilatation was achieved mostly using Savary-Gilliard or controlled radial expansion balloons varying in sizes between 8.0 mm to 30 mm. More than 76% of the studied patients had clinical success, while the rest had clinical failures or unfinished treatment. **Conclusion**: ED attained good clinical success if performed by skilled gastroenterologists. However, repeated dilatation is frequent, especially in patients with a corrosive-caused stricture.

Key words: esophageal stricture, endoscopic dilatation, corrosive ingestion, savary-gilliard, balloon dilatation

INTRODUCTION

Pediatric esophageal stricture is an intrinsic narrowing of the esophagus due to various etiologies. These strictures have different etiology than adults.[1,2] Its most common cause is surgical complications of esophageal atresia or esophageal burns due to corrosive ingestion, which mainly occurs in children under the age of 5 years.[3] The incidence of the different etiologies varies among countries.[4] In developing countries, corrosive-caused injuries are more frequent.[5,6] All these conditions have similar clinical manifestations, mainly dysphagia and vomiting. These children often have long-term morbidity and require multiple procedures to improve their symptoms.[7] The inability to thrive is the main consequence of this clinical condition, as it decreases oral intake.[8] The endoscopic treatment of esophageal strictures has been reported to be the most frequent

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strategy in pediatric patients.[9] There is no universally accepted standard for the choice of endoscopic technique in patients with esophageal strictures.[3] Improvements in endoscopes and accessories have supported an increase in the number of patients conservatively treated with endoscopic dilatations and a significant reduction in surgical treatments.[9]

Currently, different dilators are available. Fixed diameter push-type dilators such as semi-rigid Savary-Gilliard bougies and radial expanding balloon dilators are the most used devices.[10] However, there is still no consensus about which one has to be favored.[10] Previously, constriction was treated with a rigid dilator; however, the management has evolved toward balloon dilatation because the radial force applied can reduce the risk of esophageal damage and stenosis recurrence.[11] No prospective studies have directly compared the safety and efficacy of these types of dilators.[2]

Esophageal dilatation is associated with clearly defined morbidity and mortality, and experienced endoscopists should only perform it under general anesthesia.[10] Its efficiency can be checked directly by endoscopy or indirectly by fluoroscopic examination.[7] Surgery is usually reserved for resistant types of esophageal strictures, such as long strictures and cases of congenital stenosis.[12] Perforation is a considerable risk of this approach. The risk of this complication may be reduced by performing an accurate study of the stricture morphology and etiology, choosing the correct type and size of the dilators, and performing dilatations under fluoroscopic control.[1]

Endoscopic dilatation (ED) is relatively uncommon in treating esophageal stricture in the pediatric age group. Thus, the present study retrospectively evaluates the results and procedures of endoscopic dilatation performed on children in a specialized center in Bangladesh.

METHODS

This study is a retrospective analysis based on reviewing medical records of children with esophageal stricture. Between September 2018 and October 2022, 21 patients who underwent 48 ED sessions were included at Bangladesh Specialized Hospital (Dhaka, Bangladesh). Among them, 11 were male, and the rest 10 were female. The patient's age at the time of the first procedure ranged from 0.2 to 15 years, with a median of 2.7 years.

All the procedures were performed under deep sedation using a combination of injectable midazolam and propofol. An anesthesiologist supervised the sedation and performed constant cardiovascular and respiratory monitoring. All the patients were kept nil by mouth for 6 to 8 hours before the procedure.

A single trained and vastly experienced adult gastroenterologist performed all the procedures. In the recent procedures, a pediatric gastroenterologist also assisted. The dilatations were performed using a flexible video endoscope (Olympus CV-190 EVIS EXERA III Video Endoscopy System, Olympus America Inc., USA). An appropriate dilator was chosen depending on the patient's age, the diameter of the esophageal stricture portion, and the attending gastroenterologists' judgment.

The balloon catheter was inserted after placing a guidewire under endoscopic guidance and inflating it with normal saline. The dilator size was increased gradually until bleeding or laceration was noted, and it was held in place for about 40 to 60 seconds before rising to the next size.

The complete dilatation process was performed under fluoroscopic guidance. The cessation of the stricture under a direct endoscopic view indicated successful dilatation. Clinical success was defined as no necessity of ED for a minimum of one year or increasing intervals among repeated dilatations. Since there are no established guidelines to define the interval between successive dilatation sessions, we estimated the required interval on a case-by-case basis.

The essential characteristics of patients, the types of sedation used, the etiology of esophageal strictures, the success of the procedure, clinical presentation, endoscopic results, treatment modality, postoperative outcomes, and complications were extracted from the hospital records. Additionally, the type and size of dilators, the number of dilatation sessions, and the interval between them were documented.

All the extracted data were recorded in data files (as comma-separated values or CSV) using the spreadsheet program Microsoft Excel (by Microsoft Inc., USA). Further exploration of data and necessary analysis were performed using Wolfram|Alpha Notebook (by Wolfram Research, Champaign, IL, USA).

RESULTS

Among the 21 studied patients, the most common cause was congenital esophageal atresia (33%), and the second most common cause was stricture due to ingesting corrosive substances (29%) (Table 1). The sites of stricture were divided into four categories based on distance and specified in Table 2. Four patients had multiple strictures in different areas.

Our team performed 48 endoscopic dilatations during the studied period for 21 patients. A summary of all these procedures is presented in Table 3. Among these

Table 1: Frequency of etiologies of esophageal stricture (*n* = 21)

Etiologies of esophageal stricture	Number of patients (%)
Idiopathic esophageal stricture	2 (10)
Esophageal atresia	7 (33)
Achalasia cardia	2 (10)
Corrosive injury	6 (29)
Gastroesophageal reflux disease	2 (10)
Stricture due to foreign body	1 (5)
Chronic duodenal ulcer	1 (5)

Table 2: Frequency of sites of esophageal stricture (*n* = 21)

Site (distance from the lower lip)	Number of patients (%)
< 15 cm	5 (23.8)
15–25 cm	6 (28.6)
> 25 cm	6 (28.6)
Multiple strictures	4 (19.0)

Table 3: Summary of all patients including etiology and treatment

Patient	Age[a] (years)	Etiology	No. of procedures	Treatment duration (years)	Dilator sizes[b] (mm)	Clinical success
1	6	Idiopathic esophageal stricture	1	-	11	Yes
2	1.2	Esophageal atresia	1	-	11	Yes
3	2.2	Esophageal atresia	8	3	15, 11, 11, 12.8, 12.8, 12.8, 14, 12.8	Unknown
4	13	Achalasia cardia	1	-	30	Yes
5	15	Corrosive injury	1	-	20	Yes
6	2.8	Corrosive injury	2[c]	-	18, 18	Yes
7	2.7	Gastroesophageal reflux disease	5	1.1	11, 12.8, 12.8, 18, 18	Yes
8	2	Gastroesophageal reflux disease	1	-	11	Yes
9	0.2	Esophageal atresia	3	0.3	8, 9, 11	Yes
10	1.6	Stricture due to foreign body	2	0.6	20, 20	Yes
11	13	Chronic duodenal ulcer	2[c]	-	20, 20	Yes
12	0.7	Esophageal atresia	2	1.3	11, 12.8	Unknown
13	3.6	Corrosive injury	2	0.1	20, 20	Yes
14	0.7	Esophageal atresia	1	-	9	Yes
15	0.9	Achalasia cardia	1	-	18	Yes
16	14	Corrosive injury	2	0.1	20, 20	Yes
17	10	Corrosive injury	5	0.8	15, 15, 15, 15, 15	Unknown
18	2.2	Corrosive injury	5	1	11, 11, 11, 12.8, 12.8	Unknown
19	8	Esophageal atresia	1	-	18	Yes
20	3.3	Esophageal atresia	1	-	18	Yes
21	1	Idiopathic esophageal stricture	1	-	12.8	Unknown

[a]Age at the start of the treatment. [b]In the chronological order of the procedures. [c]Multiple procedures completed within 1 month.

patients, ten required single procedures, while the rest 11 patients required multiple procedures. Among these procedures, 38 (79.2%) were esophageal dilatations. One patient had eight procedures. This patient started his treatment at the age of 2.2 years, and eight procedures occurred over three years. The etiology of this patient is

Table 4: Frequency of dilators used (*n* = 48)

Dilator (size and type)	Count (%)
8 mm biliary balloon	1 (2.08)
9 mm Savary-Gilliard	2 (4.17)
11 mm Savary-Gilliard	10 (20.83)
11 mm biliary balloon	1 (2.08)
12.8 mm Savary-Gilliard	10 (20.83)
14 mm Savary-Gilliard	1 (2.08)
15 mm Savary-Gilliard	6 (12.5)
18 mm controlled radial expansion	7 (14.58)
20 mm controlled radial expansion	9 (18.75)
30 mm controlled radial expansion	1 (2.08)

congenital esophageal atresia with post-surgical stricture. Five out of eleven (45.5%) patients who required multiple procedures had an injury due to corrosive ingestion. The treatment duration for the multiple procedures cases ranged from 0 to 3 years. One patient had two successive sessions in a week. However, the median duration of the treatment period was 0.6 years.

Dilatation was achieved mostly using Savary-Gilliard (SG) or Controlled Radial Expansion (CRE) balloons with varying sizes per the patient's need (Table 4). Size ranged between 8.0 mm to 30 mm, with a median of 13.4 mm. The two most common dilators were 11 mm and 12.8 mm Savary-Gilliard.

Most of our patients (16 out of 21) had clinical success, while the other five were either clinical failures or unfinished treatment.

In cases of only two (among the 48) procedures, the patients were admitted, and the rest 46 procedures were performed on patients visiting the outpatient department. Also, 11 of the 21 patients were referred to our center by pediatricians and other childcare centers with limited resources to perform these procedures.

DISCUSSION

Considering the age of the first treatment, the median age of the 21 studied patients was 2.7 years, which is very close to the median age in the study by Bawazir *et al.*[7] Earlier studies also suggested that esophageal strictures are common in children under the age of 5 years.[3]

Our two most common etiologies were esophageal atresia and corrosive injuries totaling over 62% of our patients. According to Pieczarkowski *et al.*,[3] the most common cause is surgical complications of esophageal atresia or esophageal burns due to corrosive ingestion. A foreign body can also cause esophageal stricture in young children. Like Chang *et al.*, [13] in the current study, only one patient had esophageal stricture due to a foreign body. This patient only had two dilatation sessions and improved afterward.

According to the earlier works, the incidence of the different etiologies varies between countries, and corrosive injuries are more common in developing countries.[4–6] In this present study, 29% of the patients had corrosive injuries. Half the corrosive injury patients were toddlers and more prone to accidentally ingesting harmful substances. The other half were adolescents; their medical history showed they attempted self-harm due to emotional breakdowns.

In our study, about 47% of patients had symptom relief after their first ED session, comparable to the rates achieved by others.[7,14] The rest, 52.4%, had multiple sessions. We observed that a median of 2 sessions was required for patients with multiple ED. Ahmadi *et al.*, [15] experienced that the mean session of ED was 6.24 per patient, and researchers in Turkey observed a mean of five sessions per patient.[7] Some earlier studies have given an average of 2 to 5 dilatation sessions per patient with a mean interval of 2 to 4 weeks between dilatation sessions.[16,17] The low median in our study could be attributed to the shortage of specialized centers and high procedure costs. In this study, only one patient had eight sessions at our center over three years; before coming to our center, this patient had 19 sessions in overseas centers. Since there are no specific guidelines about the interval between sessions, like others, we measured the time interval based on the impacts of the earlier dilatation session and the degree of symptomatic improvement.[1,15]

We used SG push-type semi-rigid dilators for 60% of procedures and CRE balloons for over 36% of procedures. According to Bawazir *et al.*, balloon dilatation can be more effective and less traumatic than traditional bougies but could be more expensive than

bougie.[7] We preferred using SG due to its capacity to fix long strictures and cost-effectiveness.

Currently, pediatric esophageal dilatations are almost exclusively performed under general anesthesia[3]. However, 96% of our procedures were for patients visiting our outpatient department. Therefore, we used deep sedation supervised by an anesthesiologist instead of general anesthesia.

ED is associated with a significantly low risk of complications. The most frequent potential complication is bleeding, whereas esophageal perforation remains the most dreaded complication.[2] The risk of esophageal perforation reported in earlier literature ranged between 0–10%[18]. However, we experienced only a few bleeding cases and no perforation. Zero perforation was primarily attributed to performing dilatations under fluoroscopic guidance and the experience of our gastroenterologist.

Over 76% of our patients had clinical success, *i.e.*, they did not require ED within one year of their last session. We need more data for the remaining cases to confirm clinical success. However, one of these remaining patients who had eight sessions at our center (mentioned earlier) was a resistant case. We advised this patient to undergo necessary surgical procedures.

Across the board, we found that endoscopic dilatation is a safe and practical intervention for pediatric esophageal strictures.

The current study had a few limitations. First, it was a single-center retrospective study with small sample size. Second, most studied patients only visited the outpatient department and had no follow-up data.

In conclusion, endoscopic dilatation attained good clinical success if performed by skilled gastroenterologists. However, we experienced repeated dilatation is frequent, especially in patients with a corrosive-caused stricture.

DECLARATIONS

Author contributions

Rashid R and Rukunuzzaman M designed the study; Arfin MS performed all the procedures; Rashid R and Alam MB assisted the procedures; Mazumder MW, Rashid R and Alam MB participated in the data acquisition, analysis, and interpretation of the data; Rukunuzzaman M and Rashid R drafted the initial manuscript; Arfin MS, Rukunuzzaman M and Mazumder MW revised the manuscript for important intellectual content; finally all the authors reviewed the manuscript.

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Informed consent statement

All study participants, or their legal guardians, provided necessary informed consent before enrollment.

Conflicts of interest

There is no conflict of interest among the authors.

Data sharing statement

No additional data is available.

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