0021-7557/06/82-02/127
Jornal de Pediatria

doi:10.2223/JPED.1459

ORIGINAL ARTICLE

Endoscopic dilatation of esophageal strictures in children and adolescents

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Abstract

Objective: To assess the causes of esophageal stricture in pediatric patients and their response to endoscopic dilatation.

Methods: Retrospective analysis of clinical and endoscopic data obtained from children and adolescents with esophageal stricture submitted to endoscopic dilatation between July 1993 and January 2003.

Results: A total of 125 patients aged between 1 month and 16 years were included in the study. Among the types of stenosis, postoperative (43.2%), corrosive (27.2%) and peptic (21.6%) strictures were the most prevalent. Those patients with corrosive esophageal stricture needed more dilatation sessions. Five cases of esophageal perforation and one case of hemorrhage occurred due to complications during the procedure. Good response to endoscopic treatment was described in 74.4% of cases, but better results were obtained from patients with peptic esophageal stricture.

Conclusions: Endoscopic treatment of esophageal strictures in children and adolescents yields good results and has a low rate of complications. Corrosive esophageal strictures have a higher morbidity and require more dilatation sessions.

J Pediatr (Rio J). 2006;82(2):127-31: Gastrointestinal endoscopy, gastroesophageal reflux, esophageal atresia, corrosives.

Introduction

Esophageal strictures, either congenital or acquired,[1,2] result from injuries to the esophageal wall with subsequent thickening of its layers and eventual development of fibrosis. Patients have high morbidity with severe consequences, such as weight loss, malnutrition, food impaction, and pulmonary aspiration.[1]

The treatment of esophageal strictures aims to alleviate dysphagia and to prevent recurrent esophageal narrowing. Current treatments include surgery, endoscopic dilatation, and use of removable self-expanding intraluminal stents; the latter two are conservative and have significantly reduced indications

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Manuscript received Sep 21 2005, accepted for publication Nov 30 2005.

Suggested citation: Bittencourt PF, Carvalho SD, Ferreira AR, Melo SF, Andrade DO, Figueiredo Filho PP, et al. Endoscopic dilatation of esophageal strictures in children and adolescents. J Pediatr (Rio J). 2006;82:127-31.

for surgery.[1-4] Esophagectomy with gastric or intestinal interposition for transit reconstruction has high morbidity and uncertain results in the long run, and is therefore reserved for cases that are unresponsive to endoscopic treatment.[5]

Conservative treatment with wire-guided dilatation is preferred for esophageal strictures, is easy to use, and offers great relief of dysphagia with low rates of complications.[4,6] The most frequently used dilators are those guided over a metal wire (Savary-Gilliard, Eder-Puestow, Celestin, Plummer-Jackson), those made of rubber (Tucker), and hydrostatic or pneumatic polyurethane balloons.[6]

The aim of this study is to assess the causes of esophageal strictures in pediatric patients and their response to endoscopic dilatation.

Methods

This is a retrospective study of 125 children and adolescents with esophageal stricture submitted to endoscopic dilatation between July 1993 and January 2003. The study was conducted at three centers for pediatric digestive endoscopy in the city of Belo Horizonte: Hospital Felício Rocho, General Pediatric Center of Fundação Hospitalar do Estado de Minas Gerais and Instituto Alfa de Gastroenterologia of Hospital das Clínicas of Universidade Federal de Minas Gerais. All patients treated at these centers during this period were included in the study.

Initial assessment consisted of the review of patients' clinical history and of the contrast-enhanced radiological examination of the esophagus. Parents or surrogates were informed about possible complications that might result from the treatment, and a written consent form was signed before the procedure. The study protocol was approved by the Research Ethics Committee of Universidade Federal de Minas Gerais.

Examinations were performed under general anesthesia, with airway protection, and a minimum fasting period of six hours. On esophagoscopy, the location, diameter, and macroscopic aspect of the stricture were assessed in order to facilitate the selection of the most appropriate dilator. The guidewire was inserted under endoscopic control without fluoroscopy. Dilatation sessions were run at an average interval of 15 days, with the use of at most three dilatators with progressively increasing diameters per session. After the procedure, patients remained under observation at the endoscopy unit for two to three hours. The ideal final diameter of the esophageal lumen was based on patient's symptoms and nutritional history. Relief of dysphagia and weight gain during outpatient follow-up were used as clinical parameters to determine the response to endoscopic treatment, as well as the interval between sessions. Those patients who did not need endoscopic dilatation for six months were discharged.

The following dilators were used: Savary-Gilliard semiflexible thermoplastic bougies (5.0 to 12.8 mm), Eder-Puestow metal olives (21 to 39 Fr), and Tucker spindle-shaped rubber bougies (21 to 39 Fr), which were chosen according to the endoscopic and radiological characteristics of the esophageal stricture.

Epi-Info 6.0 was used for statistical analysis. The comparison of means was done by the analysis of variance (ANOVA), and the significance level was set at 5%.

Results

A total of 125 children and adolescents aged between one month and 16 years (mean = 13.5 months; median = 24 months) were assessed, 74 (59.2%) of whom were male. This group of patients was submitted to 869 dilatations, with a range of 1 to 36 sessions/patient (mean = 6.9 sessions; median = 4 sessions).

There was a predominance of strictures secondary to surgical correction of esophageal atresia (43.2%), followed by corrosive (27.2%), peptic (21.6%), congenital (4.0%), and traumatic (1.6%) strictures, and also by strictures secondary to sclerotherapy of esophageal varices (0.8%) and following esophagogastroplasty (0.8%), in addition to strictures of unknown etiology (0.8%).

The following types of dilators were used: Savary-Gilliard (69.6%), Eder-Puestow (26.4%), Tucker (3.2%) and Chevalier-Jackson (0.8%).

Patients with corrosive strictures needed a larger number of dilatation sessions comparatively to those patients with peptic strictures ($p = 0.002$) and postoperative strictures ($p = 0.0004$) (Table 1).

Complications secondary to the procedure were observed in 4.8% of the patients, including five cases of esophageal perforation and one case of hemorrhage. Complications were present in 0.7% of 869 dilatations in this study, and no statistically significant differences were found between groups. Esophageal perforation occurred in two cases of congenital strictures, in one case of corrosive stricture and in two cases of postoperative strictures.

Ninety-three patients (74.4%) were discharged from the procedure before the conclusion of this study. Two patients were referred to surgery due to endoscopic treatment failure (1.6%), and 30 patients are in the process of dilatation (24.0%). Patients with peptic and postoperative strictures were discharged earlier than those with corrosive strictures ($p = 0.04$) (Table 1).

Table 1 - Distribution of analyzed variables in relation to the etiologies of esophageal strictures

Variables	Postoperative strictures (n = 54)	Corrosive strictures (n = 34)	Peptic strictures (n = 27)
Age (months)			
Range	1.0-58.8	12.0-192.0	5.0-144.0
Mean	9.2±14.2	49.0±44.0	75.8±51.0
Gender (male/female)	33/21	15/19	19/08
No. of dilatations			
Range	1-21	1-36	1-26
Mean	4.0±4.0	13.7±10.9	5.0±5.1
Complications	1	2	–
Discharged * (n)	45 (83.3%)	20 (58.8%)	22 (81.5%)

* Number of patients discharged from endoscopic treatment.

Discussion

The incidence of esophageal strictures in the pediatric population, as far as their etiology is concerned, varies with the geographical region and with peculiar characteristics of the endoscopy unit.[2,7] The implementation of properly equipped neonatal intensive care units, with well-trained medical and nursing teams, allowed for better treatment of newborn infants with congenital malformations, including esophageal atresia. The increase in the survival rate of these patients caused the number of children referred to endoscopic treatment of esophageal anastomotic strictures to rise, as described in the literature and observed in our patient population.[8-10] In developed countries, preventive safety measures against caustic ingestion are usually applied, reducing the incidence of corrosive esophageal stricture. On the other hand, in developing countries, this type of accident is still frequent among children.[1-3]

Strictures secondary to the surgical correction of esophageal atresia often show a better response to endoscopic treatment, requiring fewer dilatation sessions for an appropriate intraluminal diameter.[2,7] In refractory cases, there may be associated gastroesophageal reflux or concomitant congenital esophageal stricture, favoring the persistence of dysphagia, poor response to endoscopic dilatation, and higher risk of esophageal perforation during the procedure.[11]

Corrosive esophageal strictures tend to be multisegmented, rigid, tortuous, more extensive, being technically difficult to dilate, and with a higher rate of recurrence compared to esophageal strictures of other etiologies.[1,2,4,5,12] These findings are confirmed by the larger number of dilatation sessions and by the lower discharge rates of patients with corrosive strictures compared to patients with other types of strictures.

Gastroesophageal reflux is one the most common disorders in pediatric practice. However, the prevalence of esophageal stricture secondary to severe gastroesophageal reflux is poorly documented in childhood and is estimated to be around 1.5%.[13,14] Most of these strictures are found in the distal third of the esophagus. Predisposing factors for esophageal strictures include neurological disorders, chronic lung disease, hiatus hernia, congenital gastrointestinal malformations, and fundoplication failure.[15,16] In this study, 21.6% of strictures were secondary to gastroesophageal reflux disease, which is not observed in most cases of pediatric esophageal strictures. Such evidence is due to the fact that the analyzed centers are referral services for pediatric gastroenterology, thus receiving a large number of patients. In general, peptic esophageal stricture shows a good response to dilatation sessions, when combined with appropriate treatment with proton pump inhibitors (complete resolution in 70 to 90% of cases).[17-20] The inability of total healing of the coexistent esophagitis is a predictive factor for the poor response to endoscopic dilatation.[19] There is a high rate of recurrence of erosive or ulcerating peptic esophagitis after discontinuation of acid-suppressive treatment even with documented esophageal healing.[17-21] Nevertheless, it is common knowledge that fundoplication in the pediatric population has significant rates of failure, and that the child may have to remain under clinical and endoscopic treatment after the procedure.[18,22] The efficacy and safety of omeprazole, combined with endoscopic treatment, defined a new pattern for the treatment of children with complicated reflux esophagitis, which should be the treatment of choice, reserving surgical treatment for refractory cases.[23]

Congenital esophageal stricture is relatively uncommon (1:25,000-50,000 live births), consisting of

the membranous, fibromuscular and cartilaginous histopathologic types (tracheobronchial remnants).[24] Surgical treatment is elective for the cartilaginous type, since there is a high incidence of esophageal perforation during the dilatation procedure whereas fibromuscular and membranous stenoses are responsive to endoscopic dilatation.[25,26] In this study, there were five cases of congenital esophageal stricture, with esophageal perforation during endoscopic dilatation in two of them. Recent studies have shown that echoendoscopy has been used to help with the etiological and therapeutic definition of congenital esophageal strictures, as the findings of focal thickening of the esophageal *lamina propria* and of hyperechoic areas in a variable number suggest fibromuscular and tracheobronchial etiology, respectively.[25,26]

Esophageal strictures are dilated by tubes, bougies or pneumatic balloons. Although balloon dilatation is effective and exerts a radial and uniform force at the site of the stricture, it is not the treatment of choice in our setting. Balloon dilatation is costly, and it is recommended that the balloon be used only once; furthermore, the literature shows no significant difference between wire-guided dilators and polyurethane balloons in terms of efficacy and rate of complications.[2,8,10]

Esophageal dilatation must be performed in the safest possible fashion. In our patient population, we decided to manage patients on an individual basis, and we used the anatomy of the esophagus to determine the type of dilator and technique to be employed. The use of three dilators per session, with progressively increasing diameters, starting the subsequent session with the second tube used in the previous examination, is mainly valid for Eder-Puestow or Tucker dilators, whose diameters vary slightly from one dilator to another. When using Savary-Gilliard bougies in pediatric patients, especially younger ones, one should not forget that there is a remarkably difference in diameter between them (in French), which may increase the risk of esophageal perforation if thicker dilators are used. In general, the procedure does not require the use of radioscopy, provided that the endoscopist strictly follows the rules for the correct and safe procedure, such as previous clinical and radiological assessment of each patient. Fluoroscopy is an important aid in the presence of technical problems with the guidewire, remarkably tortuous strictures, several stenotic segments or distorted anatomy of the esophagus.[6] The ideal final diameter of the esophageal lumen is determined by the patient's clinical conditions, considering the improvement of dysphagia and/or nutritional status, and weight gain, in addition to endoscopic examination of the esophageal mucous membrane.[1,2,7]

Esophageal perforation is the most dreaded complication of endoscopic dilatation, with an incidence of 0.7 to 3.5%, and is always regarded as a severe clinical condition.[1,2,4,7,27] In our assessment of 869 dilatations, we had five cases of esophageal perforation (0.7%), which is in agreement with the literature. Early diagnosis of esophageal perforation with quick implementation of treatment is the most important prognostic factor for reducing morbidity and mortality among these patients.[27] The conservative treatment of esophageal perforation with antibiotics, fasting, total parenteral nutrition, and intensive clinical monitoring is the method of choice for treating pediatric patients, resulting in a high survival rate and in organ preservation.[27]

Other endoscopic treatments for esophageal stricture have been recently described in the literature. The intralesional use of corticosteroids (triamcinolone) in more complex esophageal strictures has been highlighted in the literature, and its use is justified based on the reduction of inflammatory response, of fibrosis, and of the development of restenosis after dilatations, observed by the relief of symptoms, maintenance of esophageal diameter during dilatation, and increase of the interval between endoscopy sessions. However, the results are still heterogeneous and the procedure is not always sufficient to keep the patency of the esophageal lumen.[2,28] The development of self-expanding and removable plastic stents (Polyflex®) allowed for a new treatment of strictures, with the advantage of reducing the number of dilatation sessions and keeping the patency of the esophageal lumen for longer periods, without the complications that are usually associated with metal stents.[3,29] Broto et al. conducted the largest experiment in pediatrics, in which 10 children and adolescents with esophageal strictures unresponsive to endoscopic dilatation were submitted to esophageal stenting, with good results.[3] This seems to be an actually thriving method, and four children with corrosive esophageal stricture refractory to conventional dilatation were submitted to the placement of a Polyflex® stent, with the aim of assessing the efficacy of this treatment, gaining experience with the method and establishing a protocol for the use of these stents in pediatric patients with esophageal strictures.

This study shows that the endoscopic dilatation of esophageal strictures often yields good results and has low rates of complications. Patients with esophageal stricture secondary to caustic ingestion have higher morbidity and need more dilatation sessions. Patients should be treated on an individual basis, even if they have strictures of identical etiology. It is extremely important that the health professionals attending to these patients receive qualified training at referral centers and be able to improve their skills in pediatric endoscopy, always bearing in mind the peculiarities of childhood disorders and their treatment.[30] However, despite the current improvements in digestive endoscopy, prevention is still the best treatment

against esophageal strictures. Precautions and recommendations regarding primary health care of children allow for an appropriate diagnosis and surgical management of congenital malformations, reduces the incidence of caustic ingestion, and optimizes the clinical treatment of gastroesophageal reflux disease, avoiding the development of complications.

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