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# Experience with esophageal dilatations in children

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## SUMMARY

***Aim:*** **Esophageal stenosis requiring treatment is a serious complication of a variety of otherwise benign conditions in children. Dilatation is the treatment of choice. However, the method and acceptable duration are largely a matter of personal preference. We present our experience with 81 children undergoing dilatations for benign strictures due to a variety of causes and discuss the resulting problems.**

***Material:*** **During the period 1987-2001, eighty-one children were treated for strictures of the esophagus. The causes were: correction of esophageal atresia (EATEF), gastroesophageal reflux (GER), stricture of the cerevical anastomosis following esophageal replacement (ER), burn due to ingestion of caustic agents (CB), tight fundoplication (TF), achalasia (EA), congenital esophageal stenosis (CES) and stenosis following sclerotherapy of esophageal varices (EV). All dilatations were performed under general anesthesia. Balloon dilatations were performed under fluoroscopic control following endoscopic insertion of the guide-wire.**

***Results:*** **The results were excellent or good in 58 children (78.3%). Twenty-four children (25.9%) had to be treated surgically either to stabilize the result of the dilatations or to correct an intractable stenosis. Complications occurred in 6 children (7.4%): Four suffered a rupture at the level of the stricture following bougienage. Transverse suture of the longitudinal tear resulted in cure of the stenosis in 3. In the fourth, a cervical esophagostomy and gastrostomy had to be placed. Finally one child had a subdiaphragmatic rupture at the esophago-gastric junction, also following bougienage, treated with drainage. Strictures following esophageal replacement required the most dilatations (mean 11.3 per patient). An increased number of procedures were also required in esophageal burns (mean 6.3).**

***Conclusion:*** **1) Esophageal dilatation is an effective treatment for strictures. 2) Rupture is a serious complication best treated surgically. 3) Transverse suture of a longitudinal tear results in resolution of the stenosis. 4) GER, whenever present, should be treated to preserve the result of the treatment.**


**Key words:** esophageal stenosis, dilatation, children

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## INTRODUCTION

Esophageal stenosis requiring treatment is a serious complication in a variety of otherwise benign conditions in children. Dilatation is the treatment of choice. Most authors agree that every effort should be made to preserve the patient's own esophagus, although there are instances when esophageal replacement should be considered.[1-4] Preservation of the native esophagus and problems arising during the management of the stenosis continue to challenge pediatric surgeons. In addition, the method and acceptable duration of dilatations, before reverting to other modes of treatment, are largely a matter of personal preference. Based on 81 patients treated during the last 15 years, we present our experience and discuss the resulting problems.

## MATERIAL AND METHODS:

The records of all patients who underwent dilatations from 1987-2001 were reviewed. At the beginning of the described period the only dilators available were the Maloney dilators, which were passed under guidance of the rigid esophagoscope or blindly. As soon as balloons and the Savary-Guillard (S-G) dilators became available,

blind bougienage was abandoned. All procedures were carried out under general anesthesia. The dilatation was repeated at intervals of 10-15 days as long as the stricture kept recurring, then less frequently until the diameter remained steady. The desired diameter of the esophagus was set arbitrarily at 10 cm for infants, increasing progressively with age. The dilatations with balloon or S-G bougies were performed over an endoscopically placed guide wire. Balloon dilatations were performed under fluoroscopic control. The radiation exposure as recorded during 79 dilatations in 28 patients ranged from 8" to 1'40" (mean 43.6").

Within the 15-year period, 81 children (49 boys and 37 girls) with a mean age of 3.5 years, were treated endoscopically with dilatations for benign esophageal strictures. The causes of stenosis are shown in Table 1. Nine out of 43 children with esopaheal atresia and tracheoesopageal fistula (EATEF) (20.5%), had to be operated upon to stabilize the dilatation results. Eight had a Nissen fundoplication and one with intractable stenosis underwent resection of the stricture and reanastomosis. Five out of 15 children with GER (33.3%) had to undergo a Nissen fundoplication, following which the stenosis stabilized. Two of them with severe mental retardation are being followed for Barrett's esophagus, but the stenosis has remained stable during the last 2 and 3 years respectively. Four out of 10 patients with esophageal replacement (ER) did not respond to prolonged dilatations and had to undergo revision of the anastomosis. All 4 children with caustic burn (CB) had a stricture length of 2-5cm and responded favourably after prolonged dilatations, and are being followed for ongoing gastroesophageal reflux, which may necessitate fundoplication. Two more children, referred more than 6 months following CB, had a filiform stricture of the entire esophagus, could not be dilated and are included in the ER group. Three children with a tight fundoplication wrap (TF) responded to a limited number of dilatations. Severe aggression, a frequent presenting symptom, disappeared with successful dilatation. The 3 children with achalasia were submitted to short-term dilatations until their pulmonary problems and their nutritional status improved and surgery could be performed. Finally, one patient with a congenital esophageal stenosis and one with stricture following variceal sclerotherapy responded well to 3 dilatations each.

The number of dilatations needed, according to the type of the stenosis, is analyzed in Table 1. Children with severe CB and those with stenosis following ER were most resistant to dilatations. The latter also had an increased need for surgical repair.

## RESULTS

The outcome of the dilatations is shown in Table 2. Excellent results were achieved (60.5%) when the children could swallow normally, requiring no further treatment. The results were satisfactory (11.1%) when the diameter of the esophagus was adequate, but the children had to be treated occasionally for food impaction.

**Table 1.** Dilatations for benign esophageal strictures in children

| | Causes of stenosis | | | | Frequency of dilatations | | |
|---|---|---|---|---|---|---|---|
| **Condition** | | | **Operated*** | | | | |
| | **#** | **%** | **#** | **%** | **Total** | **Mean** | **Range** |
| EATEF ** | 43 | 53,4 | 9 | 20,9 | 126 | 2,8 | 1 – 9 |
| Gastroesophageal Reflux (GER) | 15 | 18,5 | 5 | 33,3 | 52 | 2,8 | 1 – 9 |
| Esophageal Replacement (ER) (***) | 10 | 12,3 | 4 | 40,0 | 96 | 11,3 | 1 – 25 (*) |
| Burn (CB) | 4 | 4,9 | 0 | — | 68 | 6,3 | 2 – 19 |
| Fundoplication (TF) (****) | 3 | 3,8 | 0 | — | 6 | 2,0 | 1 - 3 |
| Achalasia (EA) | 4 | 4,9 | 4 | 100,0 | 6 | 1,5 | 1 - 2 |
| Congenital Esophageal Stenosis (CES) | 1 | 1,2 | 0 | — | 3 | 3,0 | —- |
| St.p. Variceal Sclerotherapy (EV) | 1 | 1,2 | 0 | — | 3 | 3,0 | —- |
| Total | 81 | 100,0 | | | 360 | | |

* Patients who underwent operation for correction of the stenosis and/or the underlying cause.

** Esophageal Atresia with or without Tracheo-Esophageal Fistula.

*** The stricture occurred at the level of the cervical anastomosis in all our patients.

**** A tight fundoplication wrap requiring dilatations

**Table 2.** Outcome and complications

| | patients | % | dilatations | % |
|---|---|---|---|---|
| Total dilatations | 81 | | 360 | |
| Excellent | 49 | 60.5 | – | |
| Satisfactory | 8 | 9.9 | – | |
| Operative correction | 24 | 29.6 | – | |
| Rupture (intrathoracic) | 4 | 4.9 | 4 | 1.1 |
| Rupture (intraabdominal) | 1 | 1.2 | 1 | 0.3 |
| Trachoesophageal fistula | 1 | 1.2 | 1 | 0.3 |
| Total complications | 6 | 7.4 | 6 | 1.7 |

Six of these children were mentally retarded. Another 22 children had to be treated surgically. Following this, only the children with ER needed occasional treatment. Six children suffered complications. This constitutes 7.4% of the patients treated (1.7% of the 360 dilatations performed). All 4 intrathoracic ruptures occurred at the level of the stenosis following bougienage. Two of these ruptures occurred following dilatation with Maloney dilators and 2 following S-G dilators. Prompt recognition and treatment by transverse suture of the longitudinal tear resulted in uneventful recovery and elimination of the stenosis in 3. The fourth suffered disruption of the anastomosis and had to be treated by placement of an esophagostomy and feeding gastrostomy. A fifth child with reversed gastric tube esophageal replacement suffered a rupture at the esophagogastric junction following dilatation with the S-G dilators. Finally, one patient with repaired EATEF suffered recanalization of the tracheoesophageal fistula, that had to be closed surgically.

## DISCUSSION

It has been recommended that esophageal dilatations in children should be considered unsuccessful if no permanent improvement is achieved in a relatively short period of time.[1-4] In addition, there is considerable diversity of opinion regarding the practice of dilatation based on individual experience. This retrospective study describes our experience with endoscopic dilatations in children during the last 15 years and attempts to give some answers to these problems.

The most frequent site of esophageal stenosis is the anastomosis following repair of EATEF, being the result of postoperative complications and inadequate operative techniques.[5,6] GER, which is frequently part of this congenital anomaly,[7] may be a contributing factor. Fundoplication is therefore often necessary to stabilize the dilatation results, as was the case in 8 of our patients. GER alone is the second most common cause of stenosis, although, due to more advanced methods of diagnosis and treatment, it is becoming less frequent. Both these types of stenosis proved quite amenable to dilatations and barring exceptional instances, balloons were sufficient for their management.

By contrast, ER posed an infinitely greater challenge. Stricture, which is usually the result of either ischemia, leakage and/or fistula formation at the site of the cervical anastomosis and is surrounded by rigid anatomical structures at the upper thoracic inlet, was encountered in all our patients in this group. Its management with balloon dilators was often ineffective and S-G dilators had to be used instead. Even then, the response was considerably slower and almost one half of our patients had ultimately to have their stenosis treated surgically. Strictures following CB are also resistant to dilatations. The guidelines for initial treatment according to the gravity of the esophageal burn have been well described[8]. Extensive cicatrization with total obstruction of the entire length of the esophagus requires ER. In shorter strictures of about 4-6cm length, perseverance leads to stabilization of the results. In one child with severe stricture, GER rendered the stenosis resistant and prolonged to 4 years the time required for positive results. Both the stenosis and the GER resolved in the end. The possibility of the development of malignancy following CB remains open[2] but this would ensue 2-3 decades later and the contribution of GER in such cases is uncertain. We therefore agree that the native esophagus is better than any substitute.[2,5,6,9,10] Long term surveillance is recommended. Esophageal replacement should be delayed until all other measures have failed.

Rupture is the most serious complication of dilatations and is a greater risk in small children who have a fragile esophagus. Small leaks may be treated with interruption of oral intake and thoracic drainage if needed.[2] If mediastinitis ensues, as was the case in all our patients, surgical correction is required. In adults, division of the esophagus, placement of a cervical esophagostomy and feeding gastrostomy is often recommended.[1-3] In most cases of children, however, transverse suture of the usually longitudinal tear is adequate and alleviates the stenosis. In our only case where this was unsuccessful, impairment of gastric emptying caused severe reflux and disruption of the suture. Another child, whose parents did not follow instructions for treatment of the underlying GER, suffered severe recurrence of the stricture and was treated with esophageal replacement elsewhere.

The hydrostatic balloon dilatation exerts only radial forces on the stricture, reducing mucosal trauma to a minimum.[6,11] Accordingly, the balloon was the dilator of choice in our series. This is supported by the lack of complications in our material. By contrast, bougies, apply both radial and shearing forces, which may render them more harmful. The increased frequency of ruptures with the Maloney dilators (3 in 26 dilatations) led us to abandon this mode and S-G bougies were used when balloons became inadequate. Passage over a guide-wire avoids the risk of blind introduction and perforation. An additional disadvantage, particularly in small children, is their long tip. This caused perforation at the gastroesophageal junction in a small child with gastric tube esophageal replacement. The rigidity of the bougies becomes an advantage in the treatment of dense strictures, as frequently seen after esophageal replacement. In such instances the balloon cannot inflate adequately, despite the use of increased hydrostatic pressure to breaking point.

We performed the balloon dilatations with endoscopic placement of the guide wire and control the grade of inflation fluoroscopically. This reduces radiation exposure to a minimum. The relatively longer exposure of children with esophageal replacement and GER is due to the grater number of dilatations required for resistant strictures. We did not place the guide-wire fluoroscopically and cannot therefore compare exposure times, but assume that it would significantly increase exposure.

We conclude that the use of balloons for the dilatation of various benign esophageal strictures is a safe and efficacious mode of treatment. Its advantage in comparison with the Savary-Guillard bougies, is that is caused less damage, to the stricture. However, the bougies are more successful in the treatment of very rigid strictures, as seen following esophageal replacement. We recommend prolonged treatment of resistant strictures following burns, followed by long term follow-up for the risk of malignancy. Rupture is a rare but serious complication of bougienage, less so with hydrostatic balloon dilatation, and can be treated, in most cases, with primary transverse suture of the tear, thus avoiding esophageal replacement. GER, whenever present, should always be treated to preserve the results of the dilatation treatment.

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