Acquired oesophageal strictures in children: emphasis on the use of string-guided dilatations

Saleem M M

ABSTRACT

Introduction: Acquired oesophageal strictures are common in children. Treatment is either surgical or conservative by dilatations. String-guided dilators (SGD) are not well popularised. This is a report of the paediatric surgery experience at Jordan University Hospital on a group of 38 children, with emphasis on the use of SGD.

Methods: Between January 1998 and January 2006, a total of 38 children (median age 3.2 years; range one month to ten years) with acquired oesophageal strictures were managed in the paediatric surgery unit. Main causes of strictures were corrosive strictures (18, 47.3 percent), post-oesophageal atresia repair (9, 23.6 percent) and post-hiatus hernia repair (4, 10.5 percent). SGD was used in 18 children, six following perforation and 12 classified as severe according to the established criteria. 14 were secondary to corrosive strictures.

Results: There were 801 dilatation sessions with an average of 20.1 +/− 17.3 dilatation sessions per patient. Corrosive strictures were more severe, and required more dilatations per patient. The mean dilatation was 34.2 +/− 16.6 for corrosive strictures vs. 10.4 +/− 8.2 for non-corrosive strictures (p-value is less than 0.0001). 32 (84.2 percent) were successfully dilatated. Two are currently still under treatment and four failed conservative treatment after dilatation for one year. Two underwent oesophageal replacement and two refused surgery but continued to receive dilatation at 4–6 week intervals. SGD was used on 18 patients, six following perforation episodes. Two (5.3 percent) complications resulted in oesophageal perforations.

Conclusion: Tucker's dilators, with or without string, are safe, cost-effective and the use of string is a safeguard against perforations.

Department of Paediatric Surgery, Jordan University Hospital, PO Box 13546, Amman 11942, Jordan

Saleem MM, MD
Medical Doctor

Correspondence to:
Dr Mohammad M Saleem
Tel: (962) 6535 3444 ext 2483
Fax: (962) 6535 3388
Email: mohomari@hotmail.com

Keywords: acquired stricture, corrosive stricture, oesophageal stricture, string-guided dilator

Singapore Med J 2009;50(1):82-86

INTRODUCTION

The major cause of oesophageal strictures in children is benign, in contrast to that in adults. A variety of causes are encountered in children. Acquired causes include ingestion of corrosives, peptic oesophagitis, post-surgical repair of oesophageal atresia, fundoplication, gastric pull-up procedure and gastric tube replacement. All these can produce strictures that may require management by surgery or dilatation. In adults, the recommended oesophageal dilatation is endoscopical dilatation, whereas in children, the recommended treatment is balloon dilatation, bougie dilatation or surgery. Experience with the Tucker's string-guided dilators (SGDs) is limited.[1] We report an experience with the use of Tucker's dilators as the sole method of dilatation, with or without string guidance,[2] over an eight-year period.

METHODS

Between January 1998 and January 2006, a total of 38 children with oesophageal strictures were diagnosed and treated at the Department of Paediatric Surgery, Jordan University Hospital. Median age of the patients was 3.2 years (range one month to ten years), with a male-to-female ratio of 1.2:1. The causes of strictures were: corrosive strictures in 18 patients, post-oesophageal atresia repair in nine patients, gastro-oesophageal reflux disease (GERD) in three patients, post-gastric tube for oesophageal replacement in two patients, post-fundoplication for hiatus hernia repair in four patients, and post-gastric pull-up for oesophageal replacement in two patients (Table I).

All perforations and strictures with a history of perforation were treated as severe strictures. In 18 (47.3%) patients, the strictures were severe or associated with perforation. All dilatations were performed under general anaesthesia. New patients with corrosive ingestion were subjected to oesophagoscopy within 24 hours post-ingestion, and if they had a oesophageal burn, they were

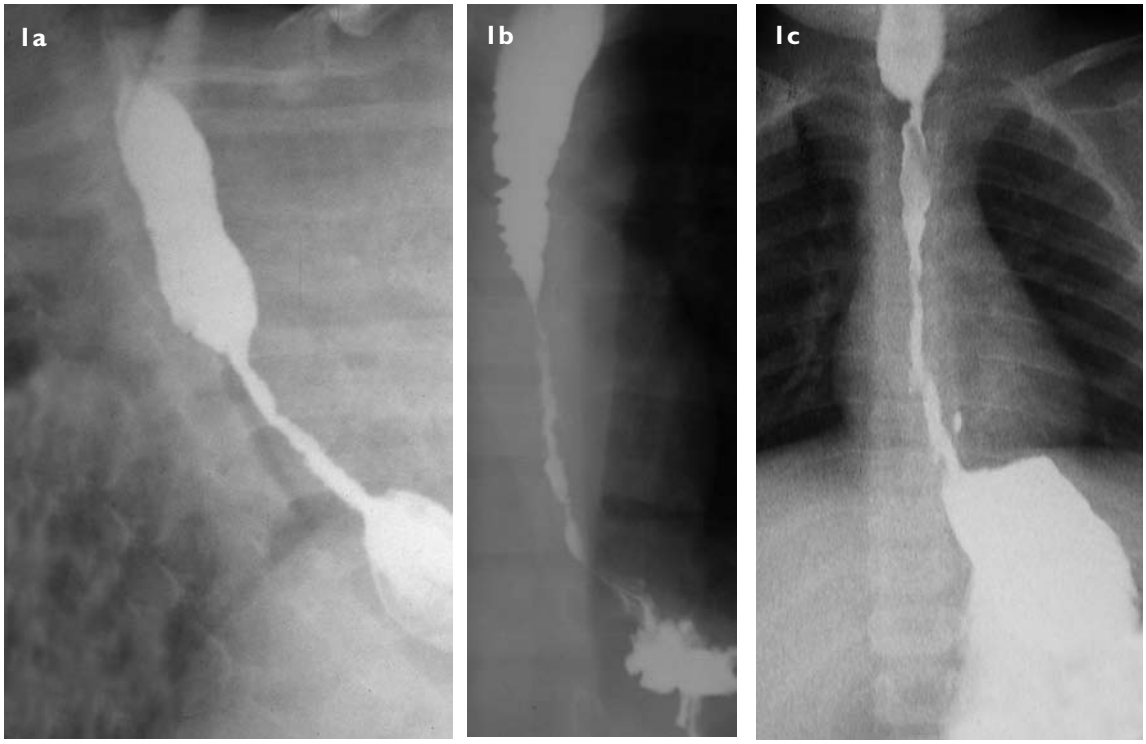

Fig. 1 Radiographs taken during barium swallow in three different patients show (a) a severe stricture involving the middle third of the oesophagus; (b) a severe stricture involving the lower two-thirds of the oesophagus; and (c) a severe stricture involving most of the oesophagus.

treated accordingly and followed-up. If they became symptomatic, an oesophagogram was obtained, and when a stricture was present, dilatation sessions were started. All patients were diagnosed with a oesophagogram and oesophagoscopy. The stricture was considered to be severe if the patient was symptomatic with dysphagia and regurgitation, had experienced previous perforation, appeared on imaging to be longer than 3 cm or multiple (Fig. 1), or if the lumen of the oesophagus was very narrow and not admitting the smallest dilator on endoscopy. No patient was excluded from dilatation, even when the lumen was completely obliterated. If a guidewire could pass into the stomach, a trial of dilatation was made. One such patient in the series who had complete obliteration of the oesophagus, and who was continuously drooling and surviving on gastrostomy feeding for one and a half years, turned out to be easy to dilate after the institution of SGD dilatation.

Severe strictures were subjected to gastrostomy and string placement, after which dilatation sessions were started. The string was brought out through the nose, taped alongside the nostril and covered with a piece of plaster. The other end was brought out alongside the gastrostomy tube and taped along with it. At the time of dilatation, the string was brought out through the mouth and tied to successfully larger dilators, which were drawn through the stricture by traction on the string from the gastrostomy site. The first session of dilatation was at the time of gastrostomy. The dilatation programme was as follows; once weekly for four weeks, then once every two weeks for four sessions, then once every three weeks for four sessions and once monthly thereafter. Initially, the string may be kept indwelling until dilatation was possible without it. The string may stay along the gastrostomy tube, or alone after the gastrostomy was no longer required, or it may be removed once the dilatation was performed without difficulty. Outcome parameters included the number of dilatations, time interval between each dilatation and complications. Successful treatment was defined as an increasing time interval between dilatations and increasing tolerance of food intake appropriate for age. Failure was defined as the need for operative intervention despite repeated dilatations for more than one year.

RESULTS

There were a total of 801 dilatation sessions, with an average of 20.1 ± 17.3 dilatation sessions per patient. Corrosive strictures were more severe and required more dilatation per patient. Mean dilatations were 34.2 (± 16.6) for corrosive strictures vs. 10.4 (± 8.2) for non-corrosive strictures ($p < 0.0001$). 18 (47.3%) patients required the placement of gastrostomy and string, 14 were corrosive strictures (Fig. 1), three had post-oesophageal atresia repair with severe irregular stricture and one stricture was in a patient following post-gastric tube for oesophageal

Table I. Distribution of cases.

Aetiology	No. of cases (%)	No. of cases with string-guided dilatations
Corrosive stricture	18 (47.3)	14
Post-EA & TEF repair	9 (23.6)	2
GERD	3 (7.8)	0
Post-gastric tube replacement	2 (5.2)	1
Post-hiatus hernia repair	4 (10.5)	0
Post-gastric pull-up replacement	2 (5.2)	1
Total	38 (100)	

EA & TEF: oesophageal atresia and tracheo-oesophageal fistula; GERD: gastro-oesophageal reflux disease

Table II. Literature review and outcome of series in which string-guided dilatations were used.

Author/s	Year	Indication	No. of cases	Outcome
Boix-Ohoa and Rehbein[18]	1965	Corrosive	NA	Successful
Tanyel et al[11]	1987	Corrosive	NA	Successful
Gandhi et al[15]	1989		12/12	Successful
Gundogdu et al[14]	1992	Corrosive	NA	Successful
Rode et al[16]	1992		NA	Successful
Cywes et al[20]	1993	GERD and corrosive	22/55	Replacement
Mahomed et al[17]	1997	Total occlusion	1/1	Successful
deJong et al[21]	2001		11/16	Successful
Baskin et al[19]	2004	Perforation, intractable stricture		Successful
Numanoglu et al[9]	2005		7/16	Successful
Present series	2007	6 perforations, 7 corrosive	18/38	Successful

GERD: gastroesophageal reflux disease; NA: not available

replacement (Table I). 32 patients successfully completed stricture dilatations (84.2%). Two patients are currently still under the dilatation programme and four failed the dilatation programme after one year of dilatations. Two patients underwent surgery for oesophageal replacement, but the parents of two children refused surgery and preferred to continue dilatation at 4–6 week intervals in spite of having completed 36 and 48 months of dilatation, respectively.

Three patients required additional surgical procedures for two upper and one lower oesophagogastric anastomotic strictures. These were inpatients with oesophageal tube replacements. Two perforations occurred in two (5.2%) strictures, one at the end of a successful dilatation thought to be due to over-enthusiasm, the other at the start of a dilatation before judging the severity of the stricture. Both were potentially avoidable, were inpatients with corrosive strictures and they successfully completed their dilatation sessions. None of the perforations occurred in association with the use of a string.

DISCUSSION

The spectrum of causes of oesophageal strictures in children is broad. There is variation from one country to another, especially between developed and developing countries. Corrosive oesophageal strictures are the most common in children in the developing countries.[3-8] Corrosive strictures of the oesophagus remain the principal indication for oesophageal replacement in paediatric patients. Corrosive strictures constituted 47.3% of cases in the present series. Corrosive ingestion in children is usually accidental, in contrast to some intentional cases in adults. The amount of ingested material, which is the most important decisive factor in stricture formation, is very difficult to estimate. Fortunately, the majority of strictures are mild to moderate, but some are severe. GERD strictures can be severe enough to require string-guided dilatation.[9] Postoperative strictures may occur following repair of oesophageal atresia, gastric pull-up or oesophageal replacement. An irregular stricture may develop in some cases following a major leak. Attempts at oesophageal preservation remain the mainstay of initial therapy before surgical substitution is recommended. The need for oesophageal substitution has declined in recent years, partly because of the expert treatment of oesophageal strictures.[10]

Oesophageal strictures are usually managed either by surgery or by dilatation. When dilatation is not possible or associated with a high risk of failure, then surgery is indicated. Determinant factors of success or failure vary in reported series and include: age of the child, site of stricture,[11] tightness of stricture, length of stricture, number of strictures and failure to respond to dilatation. Failure to respond to dilatation is believed to be the most important factor, as other factors are subjected to radiological and individual variations. Dilatations are achieved either with a pneumatic balloon or with various types of bougies. The risk of perforation is increased in corrosive strictures

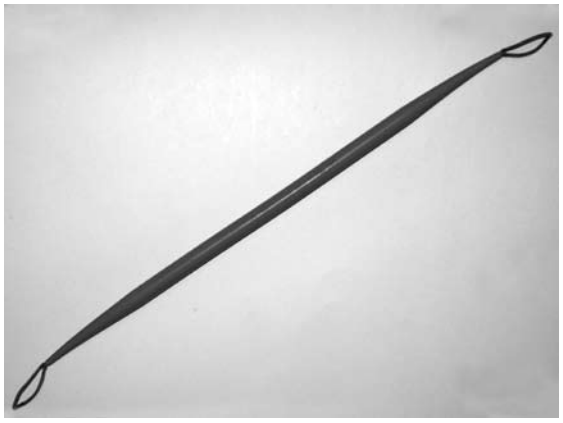

Fig. 2 Photograph shows Tucker's dilator.

whether they are treated with bougies or by balloon dilatation, because of the length and transmural nature of the stricture.[12] Each method has its advantages and disadvantages. Advantages of pneumatic dilatation are: it applies expansile force uniformly and radially at the site of the stricture, it is an effective method of dilatation for a single time and it is usually performed under fluoroscopic guidance. Advocates of balloon dilators admit that it fails in severe strictures. Lan et al recently reviewed the literature on balloon dilatation in children, including their own series.[13] There were only 35 corrosive strictures among 287 strictures in the 15 series reviewed. In their series, there were three corrosive strictures among 77 strictures over 17 years, and two of the three strictures suffered perforation. Jayakrishnan and Wilkinson compared fluoroscopically-guided balloon dilatations with surgical bouginage.[12] There were only two caustic strictures, one of which developed a perforation. Dilators are numerous, and they are chosen depending on personal or institutional availability. Tucker's dilators are the only dilators that can be used with a string-guided technique, and they were used in most patients in this study because of its safety and the ability to do both retrograde and antegrade SGD dilatation. The string was necessary and used in 18 patients in this series; in six after perforation and in 12 for severe strictures.

The literature on string-guided dilatations showed that this type of dilatation is used as salvage following perforation or failed dilatation (Table II). In a large series of patients with caustic strictures, 34 perforations resulted in seven deaths, all of which occurred during antegrade dilatation before gastrostomy and SGD was established for the next 40 patients without any perforation.[14] The authors have since adopted the routine use of SGD for caustic strictures. Others have adopted the same method.[11,15] No perforation has been reported with the use of this method. Strictures other than caustic ones can be severe and require SGD; this was used in GERD and oesophageal atresia strictures.[9,15,16] Complete obliteration of the oesophageal lumen has been dilated using this method.[17] Such a stricture was dilated in this study in a three-year-old child, who lived on gastrostomy feeding for one and a half years. Others advocate antegrade dilatation, if possible without gastrostomy, because gastrostomy itself may promote GERD if incorrectly sited. However, these authors admit that, with tight strictures and severe oesophagitis, the placement of the transoesophageal string may make dilatation safer.[18]

Contrary to the common belief that if an oesophageal perforation does occur, the stricture is no longer treatable by dilatation and oesophageal bypass surgery becomes mandatory, strictures following a perforation episode have been successfully dilated in this study, as well as in other studies.[19,20] Although SGD is a safe method of dilatation and is protective against perforation, failure to achieve successful dilatation depending on the criteria used has been reported.[20,21] Advantages of the string-guided oesophageal dilatation are: ability to perform antegrade as well retrograde dilatations, dilatations made by pulling rather than pushing and hence minimising the risk of perforation, the assessment of stricture severity is better made by pulling the dilatators through rather than pushing, the associated string can be left indwelling to facilitate future dilatation, and the gastrostomy can be used to augment nutritional support.

In conclusion, this study shows that dilatation of oesophageal strictures often yields good results and has a low rate of complications. Patients with corrosive oesophageal strictures have higher morbidity and need more dilatation sessions. Patients should be treated on an individual basis even if they have identical aetiology. However, despite the current improvement in stricture management, prevention is still the best treatment against oesophageal strictures. This study confirms that string-guided oesophageal dilatation is safe and effective for severe caustic strictures.

REFERENCES

1. Tucker GF Sr. Cicatricial stenosis of the esophagus with particular reference to treatment by continuous string retrograde bouginage with the author's bougie. Ann Otol Rhinol Laryngol 1924; 33:1180-1223.
2. Tucker GF. Caustic esophageal burns. In: Raffensperger JG, ed. Swenson's Pediatric Surgery. New York: Appelton-Centry-Croft, 1980:784-92.
3. Stringer MD. Oesphageal substitution. Pediatr Surg Int 1996; 11:213.
4. Broor SL, Lahoti D, Bose PP, et al. Benign esophageal strictures in children and adolescents: etiology, clinical profile, and results of endoscopic dilation. Gastrointest Endosc 1996; 43:474-7.
5. Broto J, Asensio M, Jorro CS, et al. Conservative treatment of caustic esophageal injuries in children: 20 years of experience.

Pediatr Surg Int 1999; 15:323-5.
6. Glick ME. Clinical course of esophageal stricture managed by bouginage. Dig Dis Sci 1982; 27:884-8.
7. Earlam R, Cunha-Melo JR. Benign esophageal strictures: Historical and technical aspects of dilatation. Br J Surg 1981; 68:829-36.
8. Zargar SA, Kochlar R, Nagi B, Mehta SK. Ingestion of corrosive acids. Spectrum of injury to upper gastrointestinal tract and natural history. Gastroenterology 1989; 4:55-61.
9. Numanoglu A, Miller AJW, Brown RA, Rode H. Gastroesophageal reflux strictures in children, management and outcome. Pediatr Surg Int 2005; 21:631-4.
10. Otherson HB Jr, Parker EF, Smith CD. The surgical management of esophageal strictures in children. Ann Surg 1988; 207:590-7.
11. Tanyel FC, Buyukpamukcu NB, Hicsonmez A. An improved stringing method for retrograde dilatation of caustic esophageal strctures. Pediatr Surg Int 1987; 58:57-8.
12. Jayakrishnan VK, Wilkinson AG. Treatment of esophageal strictures in children:a comparison of fluoroscopically guided balloon dilatation with surgical bouginage. Pediatr Radiol 2001; 31:98-101.
13. Lan LCL, Wong KKY, Lin SCL, et al. Endoscopic balloon dilatation of esophageal strictures in infants and children: 17 years' experience and a literature review. J Pediatr Surg 2003; 38:1712-5.
14. Gundogdu HZ, Tanyel FC, Buyukpamukcu N, Hicsonmez A. Conservative treatment of caustic esophageal strictures in children. J Pediatr Surg 1992; 27:767-70.
15. Gandhi RP, Cooper A, Barlow BA. Successful management of esophageal strictures without resection or replacement. J Pediatr Surg 1989; 8:745-50.
16. Rode H, Miller AJW, Brown RA, Cywes S. Reflux strictures of the esophagus in children. J Pediatr Surg 1992; 27:462-5.
17. Mahomed A, Mahomed A, Youngson G. Endoscopic restoration of esophageal continuity in caustic burn. J Pediatr Surg 1997; 32:1747-8.
18. Boix-Ohoa J, Rehbein F. Esophageal stenosis due to reflux esophagitis. Arch Dis Child 1965; 40:197-9.
19. Baskin D, Urganci N, Abbasoglu L, et al. A standarised protocol for the acute management of corrosive ingestion in children. Pediatr Surg Int 2004; 20:824-8.
20. Cywes S, Miller AJW, Rode H, Brown RA. Corrosive strictures of the esophagus in children. Pediatr Surg Int 1993; 8:8-13.
21. deJong AL, Macdonald R, Ein S, Forte V, Turner A. Corrosive esophagitis in children: a 30-year review. Int J Pediatr Otorhinolaryngol 2001; 57:203-11.