Endoscopic management for congenital esophageal stenosis: A systematic review

Keita Terui, Takeshi Saito, Tetsuya Mitsunaga, Mitsuyuki Nakata, Hideo Yoshida

Keita Terui, Takeshi Saito, Tetsuya Mitsunaga, Mitsuyuki Nakata, Hideo Yoshida, Department of Pediatric Surgery, Graduate School of Medicine, Chiba University, Chiba 260-8677, Japan

Author contributions: Terui K, Saito T, Mitsunaga T and Nakata M performed literature review; Terui K drafted the manuscript; Yoshida H performed critical revision of the manuscript for all intellectual contents.

Conflict-of-interest: The authors declare that they have no conflicts of interest.

Open-Access: This article is an open-access article which was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/

Correspondence to: Keita Terui, MD, PhD, Department of Pediatric Surgery, Graduate School of Medicine, Chiba University, 1-8-1 Inohana, Chuo-ku, Chiba 260-8677, Japan. kta@cc.rim.or.jp

Telephone: +81-43-2227171
Fax: +81-43-2262366
Received: August 31, 2014
Peer-review started: September 3, 2014
First decision: November 19, 2014
Revised: December 12, 2014
Accepted: December 29, 2014
Article in press: December 31, 2014
Published online: March 16, 2015

Abstract

Congenital esophageal stenosis (CES) is an extremely rare malformation, and standard treatment have not been completely established. By years of clinical research, evidence has been accumulated. We conducted systematic review to assess outcomes of the treatment for CES, especially the role of endoscopic modalities. A total of 144 literatures were screened and reviewed. CES was categorized in fibromuscular thickening, tracheobronchial remnants (TBR) and membranous web, and the frequency was 54%, 30% and 16%, respectively. Therapeutic option includes surgery and dilatation, and surgery tends to be reserved for ineffective dilatation. An essential point is that dilatation for TBR type of CES has low success rate and high rate of perforation. TBR can be distinguished by using endoscopic ultrasonography (EUS). Overall success rate of dilatation for CES with or without case selection by using EUS was 90% and 29%, respectively. Overall rate of perforation with or without case selection was 7% and 24%, respectively. By case selection using EUS, high success rate with low rate of perforation could be achieved. In conclusion, endoscopic dilatation has been established as a primary therapy for CES except TBR type. Repetitive dilatation with gradual step-up might be one of safe ways to minimize the risk of perforation.

Key words: Esophageal stenosis; Esophageal atresia; Tracheoesophageal fistula; Esophageal perforation; Dilatation; Endosonography; Deglutition disorders; Esophagoscopes; Esophageal ring; Plummer-Vinson syndrome

© The Author(s) 2015. Published by Baishideng Publishing Group Inc. All rights reserved.

Core tip: Congenital esophageal stenosis (CES) is a rare malformation consisting of 3 types; fibromuscular thickening, tracheobronchial remnants (TBR) and membranous web. Endoscopic dilatation has been established as a primary therapy for CES except TBR type. Endoscopic ultrasonography is useful to distinguish TBR from other types of CES. Repetitive dilatation with gradual step-up is recommended to minimize the risk of perforation.
INTRODUCTION

Congenital esophageal stenosis (CES) is an extremely rare malformation, and diagnostic criteria and standard treatment have not been completely established. By years of clinical research, evidence for the management of CES has been accumulated. In the management of CES, surgery and endoscopic modalities play a key role. Endoscopic management could be an effective and less-invasive, however, the risk of therapies and therapeutic margin should be considered. The aims of this systematic review were to identify all published studies of endoscopic management of CES and to assess outcomes in terms of relief of the stricture and complication rates. Frequency and characters of 3 categories of CES, and relationship with associated anomalies were also reviewed.

RESEARCH

A Definition of CES was based on the description by Nihoul-Fékété[1]; “an intrinsic stenosis of the esophagus, present although not necessarily symptomatic at birth, which is caused by congenital malformation of esophageal wall architecture".

Systematic review of English-language articles reporting CES was conducted by searching the PubMed database, in July 2014. Search terms "congenital" AND "esophageal stenosis" AND "endoscopy", and MeSH term "Esophageal Stenosis" AND the term "congenital" were used. The references of each of the included studies were then screened for any additionally relevant articles. Studies were selected according to the following inclusion/exclusion criteria: the only inclusion criteria was diagnosis of CES, defined as intrinsic stenosis of the esophagus. Esophageal stricture due to compression by cardiac/vascular malformations or intrathoracic tumor was excluded, if it is "congenital". Secondary esophageal stenosis due to gastro-esophageal reflux, postoperative anastomotic stricture of esophageal atresia (EA) without tracheal fistula, leiomyoma and dermatological diseases including epidermolysis bullosa, dyskeratosis congenita, Rothmund Thomson syndrome and Goltz syndrome were also excluded. Review articles and mere letters were excluded. There were no exclusions based on patient numbers or length of follow-up. Accordingly, a total of 570 studies were identified by the initial searches, of which 144 studies satisfied the selection criteria (Figure 1). All the studies included were case reports or retrospective observational studies.

INCIDENCE

Investigators have commented on the rarity of CES, but the true incidence is still unknown. Bluestone et al[2] treated 24 cases of CES and approximately 200 cases of tracheo-esophageal fistula in the single institution during the same 15 years, and estimated that the incidence of CES was one per 25000 births using that the incidence of tracheoesophageal fistula (TEF) was one per 2500 births[2]. Nihoul-Fékété et al[3] found 20 cases of CES and 484 cases of EA in the single institution during the same 25 years (1960-1984). According to this data, incidence of CES was lower than 1/20 of that of EA. Therefore, 1/2500-5000 live births is thought to be the incident rate of CES. These data are reliable and basically correct, but the frequency data should be revised based on the data at least in the 2000s.

CLASSIFICATION

The classification of CES has been confusing mainly because of its infrequency. Histological classification has been difficult because surgical specimens cannot be obtained if the only bougie can improves the symptom. Furthermore, it has also been difficult to differentiate CES from other non-congenital esophageal stricture such as achalasia, peptic esophageal stenosis due to gastroesophageal reflux and herpetic esophageal stenosis[3-4].

Various classification of CES had been proposed to date. Ohkawa et al[5] (1975) reported 5 entities of CES including tracheobronchial remnants, fibromuscular thickening, esophageal epithelioma, short esophagus and achalasia. Sneed et al[6] (1979) considered that there are congenital fibromuscular thickening (FMT), tracheobronchial remnants (TBR) and membranous web (MW) in the category of CES. Nihoul-Fékété (1989) clearly define CES and categorized the cases based on these 3 entities[7]. This categorization based on this sophisticated study has been broadly accepted to date. Ramesh et al[8] (2001) categorized CES into 3 groups; isolated segmental type, isolated diaphragm type and combined type. Isolated segmental type corresponds FMT and TBR, isolated diaphragm type corresponds MW and combined type corresponds segmental stenosis distal EA/TEF or MW. Although this classification involves the etiological consideration of CES, it is too complicated to use in clinical practice.

Frequency of 3 categories of CES were assessed by using the 3 observational studies including pediatric CES cases with detailed categorization (Table 1)[1,8,9]. Accordingly, overall frequency of FMT, TBR and MW were 53.8%, 29.9% and 16.2%, respectively. Locations of stenosis in each categories were assessed by using 52 case reports including 64 patients (Figure 2). Trends were as follows; MW mainly in the upper or middle third of the esophagus[10-27], FMT mainly in the
ASSOCIATION WITH ESOPHAGEAL MALFORMATION

CES associated with esophageal atresia (EA) and/or tracheoesophageal fistula (TEF) is not so rare, and 44 cases have been reported as case(s) report to date[12,22,26,28,31,33,37,44,47,50,55,63-75]. To assess relationship and EA and/or TEF, 14 observational studies of pediatric cases were reviewed[1,2,8,9,76-85]. According to the 4 observational studies[76,80,81,84], overall incidence rate of CES among patients with EA and/or TEF was 9.6% (Table 2). All the CES located in the middle to lower third of the esophagus; 13.5% in middle third of the esophagus, and 86.5% in lower third of the esophagus. Pathological findings of CES associated with TEF were not clear, because not all the cases had surgical specimens. In 15 cases (27% of CES cases), pathological assessment was performed; 10 cases (67%) had tracheobronchial remnant and 5 cases (33%) had fibromuscular stenosis. CES in TEF/EA is not a rare association, therefore, careful attention is required during the management of TEF/EA, especially in postoperative esophagogram.

According to the 10 observational studies[1,2,8,9,77-79,82,83,85],

Table 1  Frequency of 3 categories of congenital esophageal stenosis

| Ref.         | FMT | TBR | MW  | Total |
|--------------|-----|-----|-----|-------|
| Nihoul-Fékété et al[1] (1987) | 10 (50.0%) | 4 (20.0%) | 6 (30.0%) | 20    |
| Takamizawa et al[8] (2002)     | 13 (36.1%) | 15 (41.7%) | 8 (22.2%) | 36    |
| Michaud et al[9] (2013)        | 40 (65.6%) | 16 (26.2%) | 5 (8.2%)  | 61    |
| Total                     | 63 (53.8%) | 35 (29.9%) | 19 (16.2%) | 117   |

1Including cases of multiple web. FMT: Fibromuscular thickening; TBR: Tracheobronchial remnants; MW: Membranous web.

middle or lower third[28-39], and TBR mostly in the lower third[40-60]. Additionally, multiple web type of CES has been reported mainly in adults[61]. Only 1 pediatric case with multiple web has been reported[62].
The overall incidence rate of EA and/or TEF among patients with CES was 24.8% (Table 3). Variation of the incidence rate in each study may depend on study period, the role of institution and study design. Type of EA were not so different from original proportion; EA in 2.4%, EA+TEF in 92.7% and TEF in 4.9% of the cases. CES cases with complicated form of EA/TEF which cannot be classified were also reported\(^6,64\).

Additionally, another esophageal malformation with CES, including esophageal duplication\(^{22,50,86}\), diverticulum\(^{38}\) and achalasia\(^{11}\) were also reported.

### ASSOCIATED ANOMALIES OTHER THAN ESOPHAGEAL MALFORMATION

Seven observational studies with detailed description about associated anomalies were reviewed\(^1,8,77-79,82,83\). These studies included a total of 199 cases of CES. The cases without any anomalies accounted for 55.3% of CES cases. Associated anomalies other than esophageal malformation were miscellaneous. Relatively frequent anomalies were as follows; congenital heart disease (4.5%), 21trisomy (4.0%), anorectal anomaly (2.0%), duodenal atresia (1.5%), tracheal malacia (1.5%), esophageal hiatal hernia (1.0%).

### ADULT CASES

It is difficult to prove whether the adult cases with esophageal stenosis are truly "congenital". Actually, webs of the cervical esophagus have been commonly associated with Plummer-Vinson syndrome. In the largest series of adult CES cases, 62% of cases with upper esophageal webs had anemia, and all of them were female\(^87\). Khosla et al\(^88\) also reported that among 117 patients with iron deficiency anemia, 6 cases (5.1%) had upper esophageal webs. Meanwhile, esophageal stenosis may also be found without the Plummer-Vinson syndrome. We found 24 case reports including 30 adult cases of CES with the categorization\(^{10,11,13,15-18,20,21,40,41,59,89-99}\). In these, 26 cases (86.7%) had MW type of CES\(^{10,11,13,15-18,20,21,89-97,98,99}\). In these, 16 cases had multiple webs\(^{89-99}\), which was similar to ring of the trachea. Younes et al\(^{81}\) treated 10 adult cases of multiple esophageal webs during 7 years, and stated that CES in adults is under-recognized cause for intermittent, long-standing dysphagia. Although extremely rare, TBR\(^{40,41,59}\) and FMT\(^{30}\) type of CES were also reported in adults.

### FAMILY INCIDENCE

Occurrence of CES within a family was reported only in the 2 literatures; in father and son\(^\footnote{94}\), and sisters\(^\footnote{96}\). They all were over middle age, suffered from dysphagia and/or food impaction for long duration, and had multiple esophageal webs (one of the sisters had no detail). In the former family, the son had male sibling who died 1 wk after birth because of an inability to swallow. In earlier reports, the nature of multiple esophageal webs has been speculated to be either congenital or acquired\(^99\), and still remains unclear.

### DIAGNOSIS

In diagnosis of CES, it is essential to exclude postnatally acquired stenoses (peptic, caustic, infectious, neoplastic), extrinsic compression, and achalasia\(^1\). Careful medical interview is of key importance. Both esophagogram and esophagoscopy is required to know location, range, form and degree of stenosis. To exclude peptic stenosis, pH monitoring may be useful. To exclude achalasia, measure of esophageal pressure is also informative.

Endoscopic ultrasonography (EUS) is brilliant way to classify the CES, especially distinguishing TBR from FMT\(^{54,100,101}\). By using this modality, the cartilage in the esophageal wall is visualized as low echoic area\(^{54,106}\) or high echoic area\(^{8,101}\). Whether CES is classified as TBR or not is important information to determine the therapeutic strategy, because CES of TBR should be managed by surgery, not bougie due to high rate of perforation\(^50\).

### TREATMENT

Therapeutic option consists of dilatation and surgery. Although surgery tends to be reserved for ineffective dilatation, efficacy and risk of dilatation has been controversial. We, therefore, reviewed the literatures in which more than 5 cases of CES were treated by dilatation\(^1,8,9,79,81-83,85\). Studies were divided into two groups by whether EUS was used for case selection or not. EUS was to distinguish TBR type of CES. Accordingly, overall success rate of dilatation for CES with or without case selection was 89.7% and 28.9%, respectively (Table 4). Overall rate of perforation with or without case selection was 7.4% and 23.9%, respectively (Table 5). By using EUS, high success rate with low rate of perforation could be achieved. On the basis of this knowledge, flow chart of treatment is shown in Figure 3.

As a technique of dilatation, there are tapered...
dilator and balloon dilator, but there has been no comparison study of these. Some prefer balloon dilator because it enable expanding force to focus on the stenotic segment without shear stress, resulting in more effective and safer\cite{8,102}. Appropriate diameter of dilatation for CES is still unknown. Kozarek et al\cite{85} suggested that inflation of a single large-diameter dilator of less than 15 mm or an incremental dilation of more than 3 mm may be safe in simple esophageal strictures in adults. Fan et al\cite{82} reported 9 procedures with incision have not been reported.

### Table 3 Incidence rate of esophageal atresia and/or tracheoesophageal fistula among patients with congenital esophageal stenosis

| Ref. | Cases | Incidence rate | EA | EA + TEF | TEF |
|------|-------|---------------|----|----------|-----|
| Bluestone et al\cite{83} (1969) | 0/24 | 0.0% | 0 | 0 | 0 |
| Nishina et al\cite{80} (1981) | 4/81 | 4.9% | 0 | 3 | 1 |
| Dominguez et al\cite{85} (1985) | 5/34 | 14.7% | 0 | 5 | 0 |
| Nihoul-Fékété et al\cite{79} (1987) | 2/20 | 10.0% | 0 | 1 | 1 |
| Yeung et al\cite{80} (1997) | 6/8 | 75.0% | 1 | 4 | 1 |
| Vasudevan et al\cite{80} (2002) | 4/6 | 66.7% | 1 | 2 | 1 |
| Takamizawa et al\cite{80} (2002) | 13/36 | 36.1% | 0 | 13 | 1 |
| Amae et al\cite{80} (2003) | 4/14 | 28.6% | 0 | 4 | 0 |
| Romero et al\cite{80} (2011) | 15/47 | 31.9% | 0 | 15 | 0 |
| Michaud et al\cite{80} (2013) | 29/61 | 47.5% | 0 | 29 | 0 |
| Total | 82/331 | 24.8% | 2 (2.4%) | 76 (22.7%) | 4 (4.9%) |

EA: Esophageal atresia; TEF: Tracheoesophageal fistula.

### Table 4 Success rate of dilatation for congenital esophageal stenosis with/without case selection by endoscopic ultrasonography

| Ref. | Case selection by EUS | Modality | Success rate |
|------|-----------------------|----------|--------------|
| + - | + - | | |
| Takamizawa et al\cite{80} (2002) | 16/21 (76.2%) | BD | 0/21 (0.0%) |
| Romero et al\cite{80} (2011) | 45/47 (95.7%) | BD | 15/47 (10.6%) |
| Nihoul-Fékété et al\cite{79} (1987) | 7/14 (50.0%) | BD or TD | 6/14 (42.9%) |
| Yeung et al\cite{80} (1992) | 0/7 (0.0%) | BD or TD | 1/7 (14.3%) |
| Kawahara et al\cite{80} (2001) | 2/9 (22.2%) | BD | 3/18 (16.7%) |
| Vasudevan et al\cite{80} (2002) | 3/7 (42.9%) | TD | 4/9 (44.4%) |
| Amae et al\cite{80} (2003) | 3/11 (27.3%) | BD or TD | 4/9 (44.4%) |
| Michaud et al\cite{80} (2013) | 13/49 (26.5%) | BD or TD | 1/11 (9.1%) |
| Total | 611/68 (89.7%) | 28/97 (28.9%) | 16/67 (23.9%) |

BD: Balloon dilator; TD: Tapered dilator; EUS: Endoscopic ultrasonography.

### Table 5 Rate of perforation during dilatation of congenital esophageal stenosis

| Ref. | Case selection by EUS | Modality | Rate of perforation |
|------|-----------------------|----------|---------------------|
| + - | + - | | |
| Takamizawa et al\cite{80} (2002) | 0/21 (0.0%) | BD | 5/36 (13.9%) |
| Romero et al\cite{80} (2011) | 15/47 (10.6%) | BD | 16/67 (23.9%) |
| Nihoul-Fékété et al\cite{79} (1987) | 6/14 (42.9%) | BD or TD | 1/7 (14.3%) |
| Yeung et al\cite{80} (1992) | 1/7 (14.3%) | BD or TD | 3/18 (16.7%) |
| Newman et al\cite{80} (1997) | 3/18 (16.7%) | BD or TD | 4/9 (44.4%) |
| Kawahara et al\cite{80} (2001) | 4/9 (44.4%) | BD | 1/11 (9.1%) |
| Amae et al\cite{80} (2003) | 1/11 (9.1%) | BD or TD | 1/8 (12.5%) |
| Fan et al\cite{80} (2011) | 1/8 (12.5%) | BD | 5/68 (7.4%) |
| Total | 5/68 (7.4%) | 16/67 (23.9%) | |

BD: Balloon dilator; TD: Tapered dilator; EUS: Endoscopic ultrasonography.

### Long-term Prognosis

It is well known that the association of Plummer-Vinson syndrome with carcinoma of the mouth, hypopharynx and upper esophagus. In the 58 adult cases of MW type of CES, 9 cases (15.5%) had carcinoma; buccal carcinoma in 6, esophageal carcinoma in 3\cite{80}. Other than MW type, only one case has been reported, who had esophageal carcinoma associated with FMT type of CES; 65-year-old man who had suffered from dysphagia and vomiting since birth, but had not received any treatment because of mild symptom, underwent esophagectomy for worsening symptom. The resected specimen revealed squamous cell carcinoma in the region of fibromuscular stenosis\cite{17,19,105}. The authors speculated that chronic mechanical stimulation by food trapped above the stenosis may have induced dysplasia of the mucosa. Special attention should be paid to status of the esophageal passage. Long-term functional prognosis after dilatation of pediatric CES has not been reported. Further studies are still needed.
CONCLUSION
Endoscopic dilatation has been established as a primary therapy for CES except TBR type. EUS is useful to distinguish TBR from other types of CES. Repetitive dilatation with gradual step-up is recommended to minimize the risk of perforation.

REFERENCES

1 Nihoul-Fékété C, De Backer A, Lortat-Jacob S, Pellerin D. Congenital esophageal stenosis. A review of 20 cases. Pediatr Surg Int 1987; 2: 86-92 [DOI: 10.1007/BF00174179]
2 Bluestone CD, Kerry R, Sieber WK. Congenital esophageal stenosis. Laryngoscope 1969; 79: 1095-1103 [PMID: 5786187 DOI: 10.1288/00005537-196906000-00004]
3 Valerio D, Jones PF, Stewart AM. Congenital oesophageal stenosis. Arch Dis Child 1977; 52: 414-416 [PMID: 869573 DOI: 10.1136/adc.52.12.982]
4 Rossier A, de Montis G, Chabrolle JP. Congenital oesophageal stenosis and herpes simplex infection. Arch Dis Child 1977; 52: 982 [PMID: 606180 DOI: 10.1136/adc.52.12.982]
5 Ohkawa H, Takahashi H, Hoshino Y, Sato H. Lower esophageal stenosis in association with tracheobronchial remnants. J Pediatr Surg 1975; 10: 453-457 [PMID: 1151581 DOI: 10.1016/0022-3468(75)90184-0]
6 Sneed WF, LaGarde DC, Kogutt MS, Arensman RM. Esophageal stenosis due to cartilaginous tracheobronchial remnants. J Pediatr Surg 1979; 14: 786-788 [PMID: 551188 DOI: 10.1016/S0022-3468(79)80265-1]
7 Ramesh JC, Ramanujam TM, Jayaram G. Congenital esophageal stenosis: report of three cases, literature review, and a proposed classification. Pediatr Surg Int 2001; 17: 188-192 [PMID: 11315285 DOI: 10.1007/s003830000458]
8 Takamizawa S, Tsugawa C, Mouri N, Satoh S, Kanegawa K, Nishijima E, Muraji T. Congenital esophageal stenosis: Therapeutic strategy based on etiology. J Pediatr Surg 2002; 37: 197-201 [PMID: 11819198 DOI: 10.1053/jpsu.2002.30254]
9 Michaud L, Coutenier F, Podevin G, Bonnard A, Becmeur F, Khen-Dunlop N, Auber F, Maurel A, Bastiani F, Lamirault T, Gottrand F. Characteristics and management of congenital esophageal stenosis: findings from a multicenter study. Orphanet J Rare Dis 2013; 8: 186 [PMID: 24289834]
10 Adler RH. Congenital esophageal webs. J Thorac Cardiovasc Surg 1963; 45: 175-185 [PMID: 14011099]
11 Salzman AJ. Lower esophageal WEB associated with achalasia of the esophagus. N Y State J Med 1965; 65: 1922-1925 [PMID: 14338465]
12 Azimi F, O’Hara AE. Congenital intraluminal mucosal web of the esophagus with tracheo-esophageal fistula. Am J Dis Child 1973; 125: 92-95 [PMID: 4683963]
13 Liebman WM, Samloff IM. Congenital membranous stenosis of the midesophagus. A case report and literature survey. Clin Pediatr (Phila) 1973; 12: 660-662 [PMID: 4202409]
14 Gilat T, Rozen P. Fiberoptic endoscopic diagnosis and treatment of a congenital esophageal diaphragm. Am J Dig Dis 1975; 20: 781-785 [PMID: 1155417 DOI: 10.1007/BF01070837]
15 Ikard RW, Rosen HE. Midesophageal web in adults. Ann Thorac Surg 1977; 24: 355-358 [PMID: 907403]
16 Shauffer IA, Phillips HE, Sequeira J. The jet phenomenon: a manifestation of esophageal web. AJR Am J Roentgenol 1977; 129: 747-748 [PMID: 409295]
17 Acosta JC. Congenital stenosis of the esophagus. Gastrointest Endosc 1981; 27: 197-198 [PMID: 7297835]
18 Mercer CD, Hill LD. Esophageal web associated with Zenker’s diverticulum: a possible cause of continuing dysphagia after diverticulectomy. Can J Surg 1985; 28: 375-376 [PMID: 3926291]
19 Mares AJ, Bar-Ziv J, Lieberman A, Tovi F. Congenital esophageal stenosis. Transendoscopic web incision. J Clin Gastroenterol 1986;
surgical management. J Pediatr Gastroenterol Nutr 2013; 56: 1-14 [PMID: 22925920 DOI: 10.1097/MPG.0b013e31826aa086]

61 Younes Z, Johnson DA. Congenital esophageal stenosis: clinical and endoscopic features in adults. Dig Dis 1999; 17: 172-177 [PMID: 10697666]

62 Carlisle WR. A case of multiple esophageal webs and rings. Gastrointest Endosc 1984; 30: 184-185 [PMID: 6735096]

63 Goldenberg IS. An unusual variation of congenital tracheo-esophageal fistula. J Thorac cardiovasc Surg 1960; 40: 114-116

64 Lister J. An unusual variation of oesophageal atresia. Arch Dis Child 1963; 38: 176-179 [PMID: 5098620]

65 Mortensen W. Congenital oesophageal stenosis distal to oesophageal atresia. Pediatr Radiol 1975; 3: 149-151 [PMID: 1233429]

66 Sheridan J, Hyde I. Oesophageal stenosis distal to oesophageal atresia. Clin Radiol 1990; 42: 274-276 [PMID: 2225734]

67 Neilson IR, Croitoru DP, Guttman FM, Youssef S, Laberge JM. Oesophageal stenosis due to tracheobronchial remnants and its associated anomalies. Pediatr Surg 1992; 26: 457-458 [PMID: 13729392 DOI: 10.1159/000051394]

68 Shamma’a MH, Benedict EB. Esophageal webs; a report of 58 cases & an attempt at classification. N Engl J Med 1958; 259: 378-384 [PMID: 13566486 DOI: 10.1056/NEJM195808212590805]

69 Khosla SN. Cricoid webs—incidence and follow up study in Indian patients. Postgrad Med J 1984; 60: 346-348 [PMID: 6733932 DOI: 10.1136/pgmj.60.703.346]

70 Shiftlett DW, Gilliam JH, Wu WC, Austin WE, Ott DJ. Multiple esophageal webs. Gastroenterology 1979; 77: 556-559 [PMID: 456849]

71 Longstreth GF, Wolochow DA, Tu RT. Double congenital midesophageal webs in adults. Dig Dis Sci 1979; 24: 162-165 [PMID: 428304]

72 Janisch HD, Eckardt VF. Histological abnormalities in patients with multiple esophageal webs. Dig Dis Sci 1982; 27: 503-506 [PMID: 7083985]

73 Munitz HA, Ott DJ, Rocamora LR, Wu WC. Multiple webs of the esophagus. South Med J 1983; 76: 405-406 [PMID: 6829812]

74 Agarwal VP, Marcel BR. Multiple esophageal rings. Gastrointest Endosc 1990; 36: 149-150 [PMID: 2335284]

75 Harrison CA, Katon RM. Familial multiple congenital esophageal rings: report of an affected father and son. Am J Gastroenterol 1992; 87: 1831-1813 [PMID: 1440148]

76 Pokieser P, Schima W, Schober E, Bühm P, Stacher G, Levine MS. Congenital esophageal stenosis in a 2.1-year-old man: clinical and radiographic findings. J Pediatr Gastroenterol Nutr 1998; 170: 147-148 [PMID: 9423621]

77 Rangel R, Lizarralab M. Familial multiple congenital esophageal rings. Dig Dis 1998; 16: 325 [PMID: 10223838]

78 Bhaskar SK, Bin-Sagheer S, Brady PG. Congenital esophageal stenosis. Dig Dis 2000; 18: 186 [PMID: 11279339 DOI: 10.1111/00051394]

79 Gonzalez JA, Craft CM, Knight TT, Messerschmidt WH. Upper airway anomalies: clinical and radiographic findings. Arch Pediatr Adolesc Med 1994; 148: 761-765 [PMID: 8046926]

80 Sato Y, Frey EE, Smith WL, Pringle KC, Soper RT, Franken EA.
Balloon dilatation of esophageal stenosis in children. *AJR Am J Roentgenol* 1988; **150**: 639-642 [PMID: 3257622]

103 **Kozarek RA**, Patterson DJ, Ball TJ, Gelfand MG, Jiranek GE, Bredfeldt JE, Brandabur JJ, Wolfsen HW, Raitz SL. Esophageal dilation can be done safely using selective fluoroscopy and single dilating sessions. *J Clin Gastroenterol* 1995; **20**: 184-188 [PMID: 7797822]

104 **Fan Y**, Song HY, Kim JH, Park JH, Ponruswamy I, Jung HY, Kim YH. Fluoroscopically guided balloon dilation of benign esophageal strictures: incidence of esophageal rupture and its management in 589 patients. *AJR Am J Roentgenol* 2011; **197**: 1481-1486 [PMID: 22109306 DOI: 10.2214/AJR.11.6591]

105 **Chao HC**, Chen SY, Kong MS. Successful treatment of congenital esophageal web by endoscopic electrocauterization and balloon dilatation. *J Pediatr Surg* 2008; **43**: e13-e15 [PMID: 18206438 DOI: 10.1016/j.jpedsurg.2007.08.059]
