Endoscopic interventions for nonmalignant esophageal strictures in adults

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INTRODUCTION

Most nonmalignant esophageal strictures result from long-standing gastroesophageal reflux disease (GERD), and management usually involves endoscopic dilation combined with medical therapy with acid-suppression. Some nonmalignant esophageal strictures are related to other underlying conditions such as radiation therapy, caustic ingestion, surgical anastomosis, or dermatologic disease (eg, epidermolysis bullosa, lichen planus, pemphigus). These conditions may result in long and narrow strictures that are more difficult to dilate, and in which dilation may be associated with a higher rate of complications.

This topic will address endoscopic interventions for nonmalignant esophageal strictures. Management of complications associated with endoscopic dilation of esophageal strictures is discussed in more detail separately. (See "Complications of endoscopic esophageal stricture dilation".)

Endoscopic management of other obstructive esophageal disorders is discussed separately:

- Esophageal rings and webs (see "Esophageal rings and webs")
- Achalasia (see "Pneumatic dilation and botulinum toxin injection for achalasia")
- Malignant esophageal obstruction (see "Endoscopic stenting for palliation of malignant esophageal obstruction" and "Endoscopic palliation of esophageal cancer")

RISK FACTORS FOR ESOPHAGEAL STRICTURES

Risk factors for nonmalignant esophageal strictures include chronic inflammation of the esophagus (eg, gastroesophageal reflux disease [GERD]) or therapeutic interventions (eg, surgical resection, radiofrequency ablation). Medical therapy for conditions that have been associated with esophageal stricture are discussed separately:

- (See "Medical management of gastroesophageal reflux disease in adults".)
- (See "Approach to refractory gastroesophageal reflux disease in adults".)
- (See "Treatment of eosinophilic esophagitis (EoE)".)
- (See "Overview of the management of epidermolysis bullosa".)
- (See "Caustic esophageal injury in adults".)

Therapeutic interventions that are associated with development of esophageal strictures are discussed separately:

- (See "Overview of endoscopic resection of gastrointestinal tumors".)
- (See "Barrett's esophagus: Treatment with radiofrequency ablation".)
- (See "Barrett's esophagus: Treatment of high-grade dysplasia or early cancer with endoscopic resection".)

CLASSIFYING ESOPHAGEAL STRICTURES

Nonmalignant esophageal strictures can be classified based on appearance, endoscopic findings, and response to dilation.

Stricture appearance — Strictures can be classified as either simple or complex based on appearance and endoscopic findings [1]:

- Simple strictures – Simple esophageal strictures are smooth-surfaced, short (<2 cm in length), straight, concentric, and allow the passage of an endoscope (ie, diameter of stricture lumen >10 mm). For example, peptic strictures are usually simple strictures that are related to chronic reflux esophagitis and are located in the distal esophagus.

- Complex strictures – Complex esophageal strictures have one or more of the following characteristics: length ≥2 cm, angulated, irregular surface, severely narrowed (diameter ≤10 mm), or are associated with large hiatal hernia (>5 cm), esophageal diverticula (image 1), or a tracheoesophageal fistula. Complex strictures require the use of a guidewire-based system or a balloon dilator [2]. (See 'Procedure' below.)

Response to dilation — Strictures that are not successfully dilated to a diameter of 14 mm over five endoscopic sessions at two-week intervals are defined as refractory. Most patients with esophageal strictures will respond to ≤5 endoscopic sessions with esophageal dilation [3]. (See 'Refractory strictures' below.)

PRE-DILATION EVALUATION

The cardinal symptom of an esophageal stricture is dysphagia. However, dysphagia may be caused by conditions other than a nonmalignant stricture, such as reflux esophagitis or infection (eg, esophageal candidiasis). The diagnostic evaluation for patients with dysphagia is discussed separately. (See "Approach to the evaluation of dysphagia in adults".)

Endoscopic evaluation is performed for all patients prior to dilating an esophageal stricture. In practice, endoscopic visualization and subsequent esophageal stricture dilation are often performed during a single endoscopic session.

In addition to diagnostic endoscopy, the following tests are obtained for selected patients:

- Barium esophagram (also referred to as barium swallow) – For patients who are at risk for complex strictures (eg, post-radiation therapy, history of caustic ingestion) and for patients in whom a proximal stricture is suspected (eg, history of aspiration, nonacute severe dysphagia with difficulty swallowing liquids), we perform a barium esophagram prior to endoscopic evaluation to establish the location, length, diameter, and number of strictures and to identify associated pathology such as esophageal diverticulum [4]. These factors may help estimate the number of sessions that will be required to relieve symptoms and the risks associated with dilation.

- Mucosal biopsies – We do not typically obtain mucosal biopsies from simple strictures prior to endoscopic dilation. However, for patients with complex strictures identified during the initial endoscopy, we obtain biopsies from the stricture to exclude malignancy. If the stricture characteristics are suggestive of malignancy (eg, irregular mucosa, visible tumor), we typically await histology results to establish a diagnosis prior to endoscopic dilation. Endoscopic palliation of esophageal cancer is presented separately. (See "Endoscopic palliation of esophageal cancer" and "Endoscopic stenting for palliation of malignant esophageal obstruction".)

For patients with esophageal strictures in whom eosinophilic esophagitis is suspected (eg, young patients with history of food impaction), we obtain biopsies of the esophagus and the stricture to establish a diagnosis prior to endoscopic intervention. The diagnostic evaluation for

patients with suspected eosinophilic esophagitis is discussed separately. (See "Clinical manifestations and diagnosis of eosinophilic esophagitis (EoE)", section on 'Diagnosis' and 'Patients with eosinophilic esophagitis' below.)

Mucosal biopsy of the esophagus prior to dilation carries the theoretical risk of causing a lead point for excessive mucosal tearing during dilation. However, limited data and clinical experience have suggested that obtaining mucosal biopsies prior to dilation is not associated with increased risk of complications. In a series of 48 patients who underwent esophageal dilation following mucosal biopsy, no complications related to the mucosal biopsy were observed [5].

CONTRAINDICATIONS

Contraindications to endoscopic interventions for nonmalignant esophageal strictures include:

- Patients who cannot tolerate moderate sedation, monitored anesthesia care, or general anesthesia. (See "Anesthesia for gastrointestinal endoscopy in adults".)
- Patients with acute or incompletely healed esophageal perforation.
- Patients with disorders of hemostasis including platelet count (<50,000/microL or international normalized ratio >1.5).
- Patients who are hemodynamically unstable.
- Patients with erosive esophagitis due to conditions such as uncontrolled gastroesophageal reflux disease (GERD) or recent food impaction. Esophageal dilation should be deferred for patients with erosive esophagitis until the underlying condition has been treated and the mucosa has healed. Grading the severity of erosive esophagitis is discussed separately. (See "Clinical manifestations and diagnosis of gastroesophageal reflux in adults", section on 'Endoscopic findings'.)
- Patients in whom a diagnosis of eosinophilic esophagitis is suspected but has not been confirmed and/or have not been treated with medical therapy.

The following factors may increase the risk of complications related to endoscopic dilation, while they are not absolute contraindications (see "Complications of endoscopic esophageal stricture dilation"):

- Recent gastroesophageal surgery – We avoid esophageal dilation for one month postoperatively for patients with recent gastroesophageal surgery to avoid risk of complications at the anastomotic site. However, most postsurgical strictures typically develop >2 months postoperatively.

- Large thoracic aortic aneurysm – For patients with a large thoracic aortic aneurysm (aortic diameter >5.5 cm) who require esophageal dilation, we use through-the-scope (TTS) balloon dilators rather than push dilators, while published data to support this preference are lacking. The risk of aneurysm rupture increases with larger aortic diameter, and this is discussed separately. (See "Epidemiology, risk factors, pathogenesis, and natural history of thoracic aortic aneurysm and dissection", section on 'Natural history'.)

ENDOSCOPIC DILATION

Goals — The goal of endoscopic intervention for patients with nonmalignant esophageal strictures is relief of dysphagia by increasing the diameter of the esophageal lumen [6]. For most patients, this can be accomplished with esophageal dilation, although in cases of refractory strictures, additional endoscopic therapy may be required. (See 'Refractory strictures' below.)

The endpoint of dilation is primarily informed by patient symptoms. There is no evidence-based target for maximum luminal diameter following dilation. However, data and clinical experience have suggested that esophageal lumen size generally corresponds to symptoms and oral intake (table 1) [7]:

- Lumen diameter ≥18 mm – Dilation to a lumen diameter ≥18 mm (ie, 54 French) typically allows intake of a regular-consistency diet (eg, solid foods).

- Lumen diameter 15 to 17 mm – Dilation to a lumen diameter of 15 to 17 mm (ie, 45 to 51 French) typically allows intake of a soft diet, while dysphagia for regular solid food persists for some patients.

- Lumen diameter 13 to 14 mm – Dilation to a lumen diameter of 13 to 14 mm (ie, 39 to 42 French) typically allows intake of thick liquids but dysphagia for solid foods persists.

Patient preparation — The preprocedure preparation for patients undergoing endoscopic dilation is similar to that described for patients undergoing upper gastrointestinal endoscopy (see "Overview of upper gastrointestinal endoscopy (esophagogastroduodenoscopy)", section on 'Patient preparation'):

- Adjusting medications – Most patients do not need to discontinue aspirin or nonsteroidal anti-inflammatories when undergoing upper endoscopy with dilation. However, for most patients on anticoagulants and/or nonaspirin antiplatelet agents who undergo dilation, the procedure-related bleeding risk is high. The management of antiplatelet and anticoagulant therapy is typically individualized, managed in conjunction with the prescribing subspecialist, and discussed separately. (See "Management of antiplatelet agents in patients undergoing endoscopic procedures" and "Management of anticoagulants in patients undergoing endoscopic procedures" and "Gastrointestinal endoscopy in patients with disorders of hemostasis".)

- Antibiotic prophylaxis – Most patients do not need prophylactic antibiotics prior to upper endoscopy with dilation. (See "Antibiotic prophylaxis for gastrointestinal endoscopic procedures".)

- Anesthesia – The procedure is typically performed on an outpatient basis using moderate sedation or monitored anesthesia care. Anesthetic management for endoscopic procedures including preprocedure fasting is discussed separately. (See "Anesthesia for gastrointestinal endoscopy in adults" and "Gastrointestinal endoscopy in adults: Procedural sedation administered by endoscopists".)

Procedure

General principles — General principles of endoscopy-guided dilation include:

- Number of dilations or size increments performed per session – For simple esophageal strictures, most endoscopists use no more than three push dilators of progressively larger diameter or, if using balloon dilators, no more than three incremental balloon inflation sizes during a single endoscopic session (referred to as the "rule of three"). This widely-accepted practice has been supported by expert consensus with the goal of reducing the risk of complications [6,8] (see "Complications of endoscopic esophageal stricture dilation"):

  - For push (bougie) dilators, no more than three dilators of progressively increasing diameter are passed in a single session such that luminal diameter should be increased by no more than 2 mm (6 French) during the session (eg, if the initial dilation is performed with a 30 French push dilator, the maximum dilator size that is used should be no more than 36 French).

  - For through-the-scope (TTS) balloon dilators, dilation is limited to no more than three incremental balloon inflation sizes (eg, sequential balloon inflations of 10, 11, and 12

mm or 12 to 13.5 to 15 mm).

For complex strictures that are very narrow (ie, diameter ≤10 mm) and/or long (ie, >2 cm), only one or two balloon dilations of 1 mm each should be performed per endoscopic session.

However, some advanced endoscopists may perform dilations that exceed the limit of three successive dilators or size increments in one session for selected patients (eg, patients with complete stricture recurrence following initial dilation) [9,10].

- Frequency and total number of endoscopic sessions – For patients who require more than one endoscopic session for relief of dysphagia, the duration of time between endoscopic sessions is individualized and depends on the initial stricture diameter, lumen diameter following index dilation, and the patient's symptomatic response [11]. For example, patients with a narrow, complex stricture (diameter ≤10 mm) may require multiple endoscopic sessions separated by one- to two-week intervals to achieve a lumen diameter >13 mm. After achieving lumen size >13 mm, the endoscopic sessions can be separated by longer time intervals (>2 weeks).

  In general, the largest dilator used in the previous endoscopic session can be passed first during the subsequent endoscopic session. However, some degree of esophageal restenosis following dilation is expected. Thus, we visualize and reassess the stricture diameter prior to dilation. If there has been restenosis resulting in lumen diameter that is smaller than the largest dilator used during the previous endoscopic session, a smaller dilator is generally required initially.

Types of dilators — Esophageal dilators fall into two main categories [12]:

- Push (bougie) dilators – Push (bougie) dilators are either wire-guided dilators or non-wire-guided dilators (tungsten-filled, weighted rubber bougies). Mechanical tapered push dilators exert both a longitudinal and radial force from the proximal to the distal end of the stricture [13]. Several versions of wire-guided push (bougie) dilators are available, but the Savary-Gilliard dilator has been commonly used because such dilators are flexible and easy to maneuver [14]. The Savary-Gilliard dilator is made from plastic, has a tapered tip, and comes in multiple sizes. A similar system of push dilators is the American Dilatation System.

  Non-wire-guided dilators include the Maloney dilator that does not require passage over a guidewire because it is passed blindly through the stricture. Maloney dilators have a tapered tip and come in multiple sizes.

- Balloon dilators – TTS balloon dilators are passed directly through the biopsy channel of the endoscope and are available in a variety of balloon lengths and diameters. TTS balloon dilators typically provide gradual dilation in 1 to 1.5 mm increments with three sizes per balloon (picture 1). Balloons are inflated by pressure injection of liquid (eg, water) using a hand-held accessory device. Balloon dilators simultaneously deliver the dilating force radially over the entire length of the stricture, thus reducing shear stress.

Selecting a dilator — The efficacy and safety of wire-guided push (bougie) dilators and TTS balloon dilators have been comparable; thus, the choice of dilator is individualized and based on stricture type (simple or complex), endoscopist's preference, local expertise, and equipment availability. (See 'Outcomes' below.)

However, we do not use non-wire-guided push dilators (Maloney dilators) for complex strictures because data have suggested that non-wire-guided push dilators have been associated with higher rates of esophageal perforation. In a study including 348 endoscopic sessions for esophageal dilation, Maloney dilators were associated with higher rates of esophageal perforation compared with balloon or wire-guided dilators (4 versus 0 and 0 percent, respectively) [2]. All perforations occurred when Maloney dilators were passed blindly into complex strictures.

In some cases, the patient may be managed using a combination of dilators. As an example, a patient with a narrow distal esophageal stricture that cannot be traversed with the endoscope may undergo initial dilation using a wire-guided or balloon dilator. Once the lumen is sufficiently patent (and if there are no other complex features such as angulation), Maloney dilators may be used for further dilating sessions.

Technique — For patients with nonmalignant esophageal strictures, endoscopic dilation sessions are initiated in a similar fashion to upper endoscopy (esophagogastroduodenoscopy) and are summarized as follows (see "Overview of upper gastrointestinal endoscopy (esophagogastroduodenoscopy)"):

- Position the patient in the left lateral decubitus position.
- Introduce the gastroscope into the patient's mouth and advance it under direct visualization through the upper esophageal sphincter and into the proximal esophagus. Continue advancing the gastroscope until the tip of instrument reaches the second portion of the duodenum.
- Use carbon dioxide insufflation instead of air during endoscopy to minimize luminal distension [15].

- Perform endoscopic evaluation as the gastroscope is withdrawn.
- When the gastroscope reaches the esophagus, assess the appearance of the esophageal mucosa and stricture.
- Select an initial dilator size based upon the stricture diameter, which can be estimated by comparing the stricture diameter to the outer diameter of the gastroscope (outer diameter 9 mm). For example, if the estimated diameter of the stricture is 12 mm, then the initial dilator size will be 12 mm (36 French) [16].

The subsequent steps depend on the type of dilator being used (see 'Types of dilators' above and 'General principles' above):

- **Wire-guided push dilators** – To dilate with wire-guided push dilators (eg, Savary-Gilliard):
  - With the tip of the endoscope positioned in the stomach, advance the tip of the guidewire through the accessory channel of the endoscope and into the antrum of the stomach.
  - Withdraw the endoscope, while maintaining the position of the guidewire. The wire should serve as an immobile monorail over which the dilator is passed.
  - Thread the tapered tip of the push dilator over the guidewire and dilate the stricture. Gauge the resistance to passage of the dilator and inspect the dilator for blood after it is withdrawn over the guidewire.
  - If there was no or minimal resistance during dilator passage and no blood on the dilator following removal, select the next larger-sized dilator and repeat the dilation. If there was moderate resistance and/or blood on the dilator, the dilation is complete. The skill of determining the maximal resistance that can be tolerated without increasing the risk of perforation is developed through endoscopist's training and experience.
  - Remove the guidewire.

  For simple strictures, wire-guided push dilators can be used with or without fluoroscopic guidance based on endoscopist's preference. Fluoroscopy may help characterize the length and diameter of the stricture, as well as evaluate for fistulous connections with surrounding structures. During placement of the wire into the stomach, fluoroscopic guidance can be useful by demonstrating that the wire has passed through the stricture and has remained straight. However, some endoscopists pass a guidewire through an

esophageal stricture using endoscopic visualization only, provided that the path into the stomach can be clearly seen and/or the stricture can be traversed with a smaller caliber gastroscope (outer diameter 5.4 mm) [17,18].

We use fluoroscopy during dilation of complex strictures (eg, ≥2 cm in length, angulated, multiple, and/or cannot be traversed with the diagnostic endoscope). We generally do not use fluoroscopy during dilation of simple strictures.

Clinical trials on the selective use of fluoroscopy (eg, dilation of complex strictures) have been lacking, while this approach has been supported by expert consensus and clinical experience [8,11,13,19].

- **Non-wire guided dilators** – The use of non-wire-guided dilators (Maloney dilators) is reserved for patients with simple strictures in the absence of anatomic variants such as large hiatal hernia or esophageal diverticulum. (See 'Classifying esophageal strictures' above.)

  To dilate with a non-wire push dilator:

  - Perform diagnostic upper endoscopy to determine the location, length, and extent of the esophageal stricture and to exclude anatomic variants.
  - Remove the endoscope.
  - Pass the dilator into the mouth and advance it blindly into the esophagus and stomach. Gauge resistance to passage of the dilator and inspect the dilator for blood after it is withdrawn. The presence of blood on the dilator suggests that the stricture has been successfully dilated.

- **Through-the-scope balloon dilators** – To dilate with TTS balloon dilators:

  - Perform diagnostic upper endoscopy to determine the location, length, and extent of the stricture.
  - Insert the TTS balloon dilator through the biopsy channel of the endoscope and advance it into the stricture under direct endoscopic visualization (picture 1 and picture 2).
  - Ensure that proximal migration of the balloon during inflation does not occur by positioning the endoscope just above the proximal end of the balloon, while holding the balloon sheath tightly in position.

- Instruct the endoscopy assistant to inflate the balloon and maintain insufflation for 30 seconds. Most endoscopists maintain balloon inflation for 30 to 60 seconds per dilation.

- If the inflated balloon can be moved freely through the stricture, increase the diameter of the balloon by inflating it to the next size.

- After dilating the stricture, deflate the balloon completely and remove it from the endoscope.

Postprocedure care — After the procedure, patients are recovered from sedation or anesthesia. (See "Anesthesia for gastrointestinal endoscopy in adults", section on 'Post-anesthesia care'.)

Patients may drink water after recovering from sedation. Patients are discharged with written diet instructions based on results of esophageal dilation and lumen size (table 1). As an example, patients with an esophageal lumen diameter ≥18 mm following dilation may resume intake of regular solid foods. (See 'Goals' above.)

The equipment is cleaned per procedural protocol. (See "Preventing infection transmitted by gastrointestinal endoscopy".)

Outcomes — Most esophageal strictures can be successfully dilated to a diameter of 14 mm over ≤5 endoscopic sessions at two-week intervals. Approximately 10 percent of patients with esophageal strictures have persistent dysphagia despite five endoscopic sessions, and such patients require further intervention [1,20]. (See 'Refractory strictures' below.)

Limited data comparing push dilators with balloon dilators have not demonstrated a significant difference in long-term relief of dysphagia or safety [21-23].

The diameter of the esophageal lumen following dilation has been associated with requiring fewer dilations and a longer dilation-free period [9,24]. In an observational study including 891 patients who underwent esophageal dilation for nonmalignant strictures, dilation to 13 to 15 mm was associated with requiring more dilation sessions compared with dilation to 16 to 18 mm (five versus four sessions) [24]. After one year of follow-up, rates of remaining dilation-free were reported by stricture etiology: anastomotic strictures, 313 of 416 patients (75 percent); radiation strictures, 94 of 132 patients (71 percent); peptic strictures, 60 of 86 patients (70 percent); post-endoscopic therapy strictures, 49 of 59 patients (83 percent); and caustic strictures, 13 of 21 patients (62 percent). In an observational study including 179 patients with postsurgical esophageal strictures, dilation to an esophageal diameter >16 mm was associated

with a longer dilation-free time period compared with dilation to diameter ≤16 mm (median 92 versus 42 days) [9].

Risk factors for and management of complications from endoscopic esophageal stricture dilation are discussed separately. (See "Complications of endoscopic esophageal stricture dilation".)

REFRACTORY STRICTURES

General measures — Some patients with nonmalignant esophageal strictures do not achieve dysphagia relief despite at least five endoscopic dilation sessions. Such esophageal strictures are regarded as refractory strictures. General measures for patients with refractory strictures include:

- Specialist referral – Patients with refractory strictures are referred to an advanced endoscopist and/or specialty center with expertise in managing refractory nonmalignant strictures. Selecting an intervention is typically individualized based on the advanced endoscopist's preference, stricture characteristics, and equipment availability.
- Confirm etiology of stricture – We obtain additional biopsies from a refractory stricture to confirm that it is nonmalignant. (See 'Pre-dilation evaluation' above.)

Initial intervention — For initial treatment of refractory nonmalignant esophageal strictures, we typically perform glucocorticoid injection into the stricture and endoscopic dilation during one endoscopic session [25].

To perform glucocorticoid injection:

- Place a sclerotherapy needle through the biopsy channel of the upper endoscope.
- Inject triamcinolone acetonide (10 mg/mL), 1 mL, into each of four quadrants of the stricture at its narrowest region. Some endoscopists use triamcinolone acetonide at concentrations of 20 mg/mL to 40 mg/mL and inject 0.5 mL aliquots. However, it can be difficult to inject a higher concentration of triamcinolone acetonide through a sclerotherapy needle due to its viscosity [25,26]. Thus, we dilute the triamcinolone solution to 10 mg/mL and inject larger volumes (eg, 1 mL aliquots) because it is technically easier.
- Remove the sclerotherapy needle.

Glucocorticoid injection of refractory strictures resulted in lower risk of stricture recurrence and fewer dilation sessions. In a meta-analysis of six trials (most of which were nonblinded) including 176 patients with refractory esophageal strictures, triamcinolone injection plus endoscopic dilation resulted in lower risk of stricture recurrence (risk ratio 0.64, 95% CI 0.51-0.81) and fewer endoscopic dilation sessions (mean difference -1.06, 95% CI -1.80 to -0.31) compared with dilation alone [27]. No significant differences in dysphagia-free intervals or in complication rates were found between the groups.

Data limited to patients with anastomotic strictures suggested that glucocorticoid injection reduced the total number of dilation sessions needed to achieve stricture resolution. In a meta-analysis of three trials including 72 patients with refractory anastomotic esophageal stricture, patients treated with intralesional glucocorticoid injection plus dilation had fewer endoscopic dilation sessions compared with patients treated with dilation alone (mean difference -1.62; 95% CI -2.72 to -0.50) [28]. For patients who received glucocorticoid injection, there was a nonsignificant trend toward remaining dysphagia-free after 6 months of follow up (40 versus 22 percent; odds ratio 2.36, 95% CI 0.94-5.91).

Glucocorticoid injection may provide benefit by inhibiting collagen deposition and enhancing its breakdown locally, thereby reducing scar formation [29].

Subsequent intervention — Temporary placement of an esophageal stent has been used for treating refractory nonmalignant esophageal strictures because it has been associated with symptom relief for some patients. Temporary stent placement allows for remodeling of scar tissue around the stent.

Types of stents that have been studied for nonmalignant strictures include (see "Endoscopic stenting for palliation of malignant esophageal obstruction"):

- Metal stents – Fully covered, self-expandable metal stents (FCSEMS) have a thin, flexible delivery catheter that can be easily operated and deployed within the esophagus. The fully covered nature of these metal stents facilitates stent removal, thus permitting their use in nonmalignant disease. FCSEMS are available with or without flared flanges (ie, "dog bone" design). Selection of a specific stent design is generally based on endoscopist's preference and stent availability. To secure the FCSEMS in place and prevent migration, an anchoring method such as endoscopic suturing or an over-the-scope clip may be used [30,31]. (See "Endoscopic clip therapy in the gastrointestinal tract: Bleeding lesions and beyond".)

  After placement, FCSEMS typically remain in place for at least six to eight weeks (but not to exceed 12 weeks) before endoscopic removal.

Partially covered or uncovered self-expandable metal stents are not used for nonmalignant esophageal strictures because the exposed wire mesh may become embedded in hyperplastic esophageal mucosa and result in recurrent dysphagia [32]. In addition, tissue hypertrophy around uncovered metal wire leads to difficult stent removal.

- Plastic stents – A silicone coated self-expandable plastic stent is available for patients with refractory nonmalignant strictures. After placement, self-expandable plastic stents typically remain in place for at least six to eight weeks (but not to exceed 12 weeks) before endoscopic removal.

- Biodegradable stents – Self-expandable biodegradable stents (not available in the United States) have been introduced as an alternative to fully covered metal or plastic stents for treating refractory nonmalignant esophageal strictures. Biodegradable stents are made from woven surgical suture material (polydioxanone) which is degraded by hydrolysis in 8 to 12 weeks. Thus, biodegradable stents do not require endoscopic removal [1].

  Adverse events that are specific to biodegradable stents have included developing symptoms such as pain and vomiting that can persist until the stent dissolves because it is not removable [33-35].

The practice of temporary placement of an esophageal stent for refractory strictures has been supported by studies demonstrating symptomatic improvement for some patients. Data have also suggested that no specific stent type has been more effective for refractory esophageal strictures. In a meta-analysis of 18 studies including 444 patients with refractory nonmalignant esophageal strictures, the pooled clinical success rate (defined as resolution of dysphagia without needing further intervention) was 41 percent [36]. Plastic or covered metal stents were not associated with higher rates of clinical success compared with biodegradable stents (46 and 40 percent, respectively, versus 33 percent). In the same meta-analysis, the pooled rate of adverse events was 21 percent [36]. There was no significant difference in overall adverse event rates among the three types of stents (plastic, covered metal, or biodegradable stents). The pooled rates of stent migration were 29 percent. The rates of stent migration were not significantly higher for plastic and covered metal stents compared with biodegradable stents (33 and 32 percent versus 15 percent, respectively).

Limited data suggest that biodegradable stent placement may reduce the need for esophageal dilation in the short term for patients with refractory nonmalignant strictures; however, the long-term benefits of this approach are uncertain [33,37-41]. In a trial of 66 patients with nonmalignant esophageal strictures, patients with biodegradable stent placement required fewer endoscopic dilations during the initial three-month follow-up period compared with

dilation alone (median number of dilations, zero versus one), but at six months, the need for dilation was similar in both groups [40]. The rate of adverse events was also similar in both groups.

Interventions of uncertain benefit — Other interventions have been used for treating refractory nonmalignant esophageal strictures, while their benefits have been uncertain:

- Endoscopic incisional therapy – Endoscopic incisional therapy has been studied for treating short (<1 cm) anastomotic strictures [42]. With this technique, the fibrotic rim of the stricture is directly incised in a radial fashion using a needle-knife or snare tip. Data regarding the efficacy and safety of this technique are limited. Small case series have reported some improvement in dysphagia following endoscopic incisional therapy for peptic strictures and short anastomotic strictures [42,43]. Further studies are needed before incisional therapy can be used routinely for refractory strictures.

- Mitomycin – Mitomycin is an antibiotic chemotherapeutic agent that has been studied in small case series for treating refractory nonmalignant strictures because it may inhibit fibrosis. Preliminary data have suggested that mitomycin injection (or sponge application) at the stricture site after dilation has been associated with improvement in dysphagia for some patients with refractory esophageal strictures who have not responded to other interventions [44-46]. Further studies are needed before mitomycin injection (or application) can be used routinely for refractory strictures.

- Self-dilation – Some patients with simple recurrent strictures despite a minimum of five endoscopic dilations may benefit from home-based self-dilation with a Maloney dilator [47,48]. While in a seated position, the patient can pass the Maloney dilator into the mouth and advance it through the stricture. However, home dilation has been associated with risk of complications (eg, perforation, bleeding, bacteremia, pneumonia) [49]. In addition, many patients are not interested or willing to pursue this approach to dilation.

SPECIAL POPULATIONS

Patients with proximal strictures — For patients in whom a proximal esophageal stricture is suspected, we obtain a barium esophagram prior to endoscopy with dilation to define the characteristics of the stricture (eg, location, length). (See 'Pre-dilation evaluation' above.)

To maximize patient comfort and airway protection, anesthesia for procedures requiring dilation of proximal esophageal stricture is usually administered by an anesthesia clinician. Strictures in the upper esophagus are typically treated by using a dilator that is passed over a

guidewire (eg, a Savary-Gilliard dilator) and fluoroscopic guidance. Through-the-scope balloon dilators generally cannot be used in patients with proximal strictures because to do so requires that the endoscope be maintained in the oropharynx during the dilation.

Patients with pharyngeal or cervical deformity — For patients with pharyngeal or cervical deformity, we use balloon dilators rather than push dilators to reduce the risk of perforation, while published data to support this approach are lacking.

Patients with eosinophilic esophagitis — For patients with eosinophilic esophagitis (EoE), dilation of esophageal strictures is typically a subsequent intervention when medical therapy does not result in relief of dysphagia. Management of EoE, including esophageal dilation, is discussed separately. (See "Treatment of eosinophilic esophagitis (EoE)".)

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Esophageal strictures, foreign bodies, and caustic injury".)

INFORMATION FOR PATIENTS

UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Basics topics (see "Patient education: Upper endoscopy (The Basics)" and "Patient education: Esophageal stricture (The Basics)")
- Beyond the Basics topics (see "Patient education: Upper endoscopy (Beyond the Basics)")

SUMMARY AND RECOMMENDATIONS

- Nonmalignant esophageal strictures can be classified based on appearance and endoscopic findings (see 'Stricture appearance' above):
  - Simple strictures – Simple esophageal strictures are smooth-surfaced, short (<2 cm in length), straight, concentric, and allow the passage of an endoscope (ie, stricture lumen diameter >10 mm).
  - Complex strictures – Complex esophageal strictures have one or more of the following characteristics: length ≥2 cm, angulated, irregular surface, severely narrowed (diameter ≤10 mm), or associated with large hiatal hernia, esophageal diverticula, or a tracheoesophageal fistula.
- Endoscopic evaluation is performed for all patients prior to dilating an esophageal stricture. In practice, endoscopic visualization and subsequent esophageal stricture dilation are often performed during a single endoscopic session. (See 'Pre-dilation evaluation' above.)
- For patients with nonmalignant esophageal strictures, the goal of endoscopic intervention is relief of dysphagia by increasing the diameter of the esophageal lumen. For most patients, this can be accomplished with esophageal dilation. (See 'Goals' above.)
- For simple esophageal strictures, most endoscopists use no more than three push dilators of progressively larger diameter or, if using balloon dilators, no more than three incremental balloon inflation sizes during a single endoscopic session (referred to as the "rule of three"). This widely-accepted practice has been supported by expert consensus with the goal of reducing the risk of complications. (See 'Procedure' above.)
- Most esophageal strictures can be successfully dilated to a diameter of 14 mm over ≤5 endoscopic sessions at two-week intervals. Approximately 10 percent of patients with esophageal strictures have persistent dysphagia despite five endoscopic sessions (ie, refractory strictures), and such patients require further intervention. (See 'Outcomes' above and 'Refractory strictures' above.)
- For patients with refractory strictures, we suggest glucocorticoid injection and esophageal dilation rather than serial dilation alone (**Grade 2C**). Refractory strictures are those that do not respond to at least five endoscopic dilation sessions. Glucocorticoid injection plus

dilation resulted in lower risk of stricture recurrence and fewer endoscopic dilation sessions to achieve stricture resolution. (See 'Initial intervention' above.)

- For refractory strictures that do not respond to glucocorticoid injection followed by dilation, subsequent options include temporary placement of an esophageal stent. (See 'Subsequent intervention' above.)

- Management of complications associated with endoscopic dilation of esophageal strictures is discussed separately. (See "Complications of endoscopic esophageal stricture dilation".)

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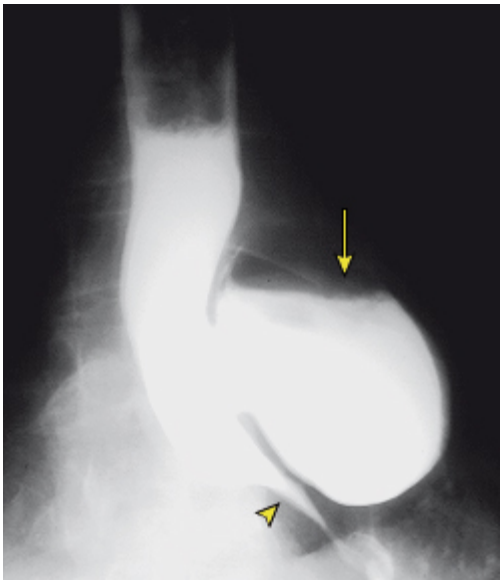
Topic 2270 Version 26.0

GRAPHICS

Epiphrenic diverticulum seen on barium swallow study



Barium swallow study, performed in a patient with dysphagia and recurrent reflux, shows a large epiphrenic diverticulum (arrow) which has arisen immediately above a stricture (arrowhead) of the distal esophagus. This stricture was caused by chronic reflux esophagitis and the patient required an antireflux procedure, and resection of the stricture and diverticulum.

Courtesy of Jonathan Kruskal, MD, PhD.

Graphic 57582 Version 4.0

International dysphagia diet standardization initiative[1]

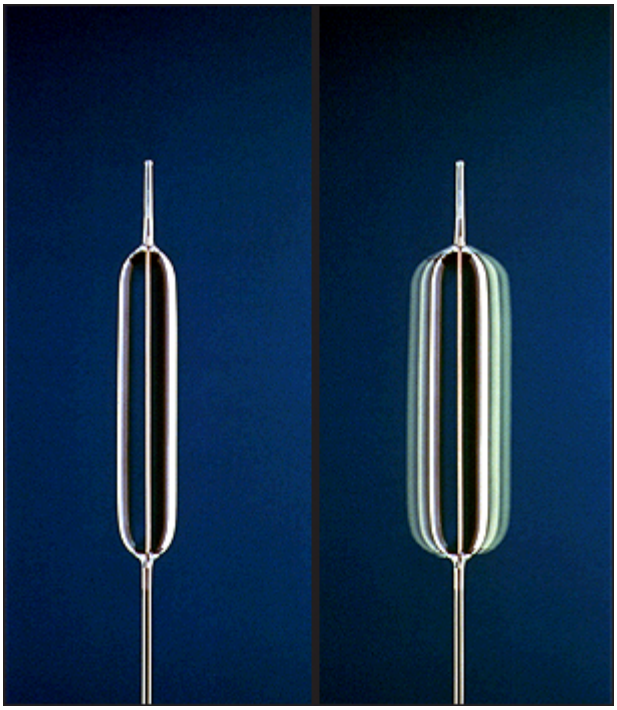
Level	Name	Descriptor
0	Thin	Flows like water
1	Slightly thick	Thicker than water; requires a little more effort
2	Mildly thick	Flows off a spoon; slower than thin drinks
3	Moderately thick	Can be drunk from a cup or eaten with a spoon
4	Pureed	Cannot be drunk from a cup; is eaten with a spoon; no chewing
5	Minced	Eaten with a fork or spoon; soft and moist
6	Soft and blenderized	Eaten with a fork or chopsticks; no knife required; needs chewing
7	Regular	Normal, everyday foods

Reference:

1. *International Dysphagia Diet Standardisation Initiative. Complete IDDSI Framework Detailed Definitions. Available at: https://iddsi.org/IDDSI/media/images/Complete_IDDSI_Framework_Final_31July2019.pdf (Accessed on January 21, 2020).*

Graphic 116403 Version 6.0

Through-the-scope (TTS) esophageal balloon dilator

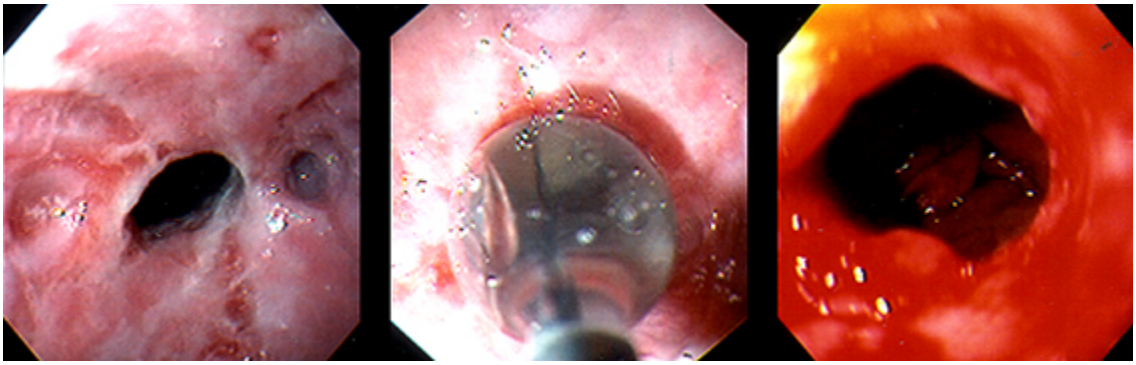


Left panel; Primary inflation width of the TTS balloon. Right panel: Three incremental increases in balloon size.

Courtesy of Boston Scientific/Microvasive.

Graphic 66533 Version 2.0

Balloon dilation of a peptic stricture in the esophagus



Endoscopic images demonstrate a stricture in the distal esophagus (first panel) that was dilated with a balloon (second panel) with a resulting larger esophageal lumen (third panel).

Courtesy of Moises Guelrud, MD.

Graphic 71653 Version 2.0

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Moises Guelrud, MD No relevant financial relationship(s) with ineligible companies to disclose. **John R Saltzman, MD, FACP, FACG, FASGE, AGAF** No relevant financial relationship(s) with ineligible companies to disclose. **Kristen M Robson, MD, MBA, FACG** No relevant financial relationship(s) with ineligible companies to disclose.

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