Communication from the ASGE Standards of Practice Committee

GUIDELINE

The role of endoscopy in the evaluation and management of dysphagia

This is one of a series of statements discussing the use of GI endoscopy in common clinical situations. The Standards of Practice Committee of the American Society for Gastrointestinal Endoscopy (ASGE) prepared this update of a previous ASGE guideline.[1] In preparing this guideline, a search of the medical literature was performed by using PubMed for the period 1990-2013. Additional references were obtained from the bibliographies of the identified articles and from recommendations of expert consultants. When few or no data exist from well-designed prospective trials, emphasis is given to results from large series and reports from recognized experts. Guidelines for appropriate use of endoscopy are based on a critical review of the available data and expert consensus at the time that the guidelines are drafted. Further controlled clinical studies may be needed to clarify aspects of this guideline. This guideline may be revised as necessary to account for changes in technology, new data, or other aspects of clinical practice. The recommendations are based on reviewed studies and are graded on the strength of the supporting evidence (Table 1).[2] The strength of individual recommendations is based on both the aggregate evidence quality and an assessment of the anticipated benefits and harms. Weaker recommendations are indicated by phrases such as "We suggest…" whereas stronger recommendations are typically stated as "We recommend…"

This guideline is intended to be an educational device to provide information that may assist endoscopists in providing care to patients. This guideline is not a rule and should not be construed as establishing a legal standard of care or as encouraging, advocating, requiring, or discouraging any particular treatment. Clinical decisions in any particular case involve a complex analysis of the patient's condition and available courses of action. Therefore, clinical considerations may lead an endoscopist to take a course of action that varies from these guidelines.

ETIOLOGIES OF ESOPHAGEAL DYSPHAGIA

Dysphagia may result from structural or neuromuscular disorders of the esophagus. Patients with structural disorders of the esophagus typically have dysphagia with solids alone, in contrast to patients with motility disorders who present with both liquid and solid food dysphagia.[3] Structural disorders include inflammatory and malignant conditions. Benign inflammatory strictures result from collagen and fibrous tissue deposition in patients with severe or chronic inflammation in the esophagus,[4] whereas malignant strictures result from intrinsic luminal tumor growth or extrinsic esophageal compression.

The most common causes of esophageal dysphagia are listed in Table 2. Peptic strictures, a sequela of GERD, have been reported to account for up to 80% of all benign esophageal strictures.[5] However, their incidence appears to have decreased in the last decade because of the widespread use of proton pump inhibitors. With the reported increase in its prevalence, eosinophilic esophagitis (EoE) is now recognized as a common benign cause of dysphagia.[6] Motility disorders that cause dysphagia include achalasia, diffuse esophageal spasm, and hypomotility secondary to scleroderma and other connective tissue disorders.

THE ROLE OF ENDOSCOPY IN THE EVALUATION OF DYSPHAGIA

Endoscopy is indicated in patients with dysphagia to determine the underlying etiology, exclude malignant and premalignant conditions, assess the need for therapy, and perform therapy, such as dilation. Esophageal dilation is a therapeutic procedure performed for the management of dysphagia. The primary indication for dilation is to provide immediate and durable symptomatic relief of dysphagia. Most of the data on esophageal dilation is compiled from the adult population, but its safety and efficacy also have been confirmed in the pediatric population.[7,8] In contrast to mechanical stenoses, motility disorders may not respond to dilation, with achalasia being the notable exception.

EGD is an effective tool for the diagnostic evaluation and management of patients with dysphagia. One study reported a diagnostic yield of 54% with EGD in the initial evaluation of patients aged >40 years, who presented with dysphagia and concomitant heartburn, odynophagia, and weight loss.[9] A cost analysis also showed that EGD with therapeutic intent is more cost effective than an initial diagnostic approach with barium swallow in patients with histories suggestive of benign esophageal obstruction.[10]

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TABLE 1. GRADE system for rating the quality of evidence for guidelines[7]

Quality of evidence	Definition	Symbol
High quality	Further research is very unlikely to change our confidence in the estimate of effect.	⊕⊕⊕⊕
Moderate quality	Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.	⊕⊕⊕◯
Low quality	Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.	⊕⊕◯◯
Very low quality	Any estimate of effect is very uncertain.	⊕◯◯◯

During endoscopic evaluation of an esophageal stricture, biopsy specimens should be obtained when a malignancy is suspected on the basis of clinical presentation or endoscopic findings. Biopsies should be obtained from the proximal and distal esophagus to evaluate for EoE in patients with dysphagia and endoscopic findings suggestive of the disorder as well as in the absence of typical endoscopic findings of EoE in patients without esophageal mechanical obstruction.[11,12] Mucosal biopsies performed in conjunction with dilation do not appear to confer any additional risk for perforation.[13] Retroflexion of the endoscope before dilation, when possible, to evaluate for malignancy or varices in the gastric cardia, is another important part of the examination and is considered to be one of the quality indicators for EGD.[14]

Adults are usually able to tolerate a modified diet at an esophageal luminal diameter of 15 mm and a regular diet at an esophageal luminal diameter of 18 mm.[15,16] An esophageal luminal diameter of $\leq$13 mm results in dysphagia. Esophageal strictures can be classified as simple or complex, based on their diameter and associated anatomic abnormalities. A simple stricture is defined as a short stricture with a symmetric or concentric lumen and a diameter of $\geq$12 mm that can be traversed easily with an endoscope. A complex stricture is usually longer than 2 cm, may be angulated or irregular, and has a diameter of $<$12 mm. It may be associated with a large hiatal hernia, esophageal diverticula, or tracheoesophageal fistula.[3] Complex strictures have a higher rate of recurrence and an increased risk for dilation-related adverse events, compared with simple strictures.[17,18] The severity of a stricture can be estimated by the resistance encountered with passage of the diagnostic endoscope, which has a typical external diameter of 9 mm. A mild stricture allows passage of the endoscope without resistance, a moderate stricture offers increased resistance, whereas a severe stricture may not be traversable.[19] However, this estimation is limited by the subjective perception of the endoscopist. The diameter of a stricture can be objectively measured on barium radiography or by determining the maximal sized barium tablet that can pass through the lumen.[16]

Although some endoscopists have advocated the role of large-bore (50F) dilators in patients with dysphagia and normal endoscopic findings,[20] several studies have failed to demonstrate improvement in dysphagia scores with this approach.[21-23] The risk of perforation with large-bore dilators may outweigh the benefits, especially in patients with undiagnosed EoE.[11,24]

Patients with dysphagia caused by esophageal cancer or extrinsic compression present a challenge to the endoscopist. Most malignant strictures respond to dilation, but symptomatic relief may be only short term, and additional treatment with stent placement may be necessary in these patients.[25,26] Dysphagia caused by extrinsic compression of the esophagus responds poorly to esophageal dilation.[27] In patients with malignant strictures, dilation facilitates feeding gastrostomy tube placement, palliative management with esophageal stenting, and completion of the endoscopic examination, including staging with EUS.[28-30]

Types of dilators

Esophageal dilators include the weighted push type (Maloney; Medovations, Milwaukee, Wis; Teleflex Medical, Research Triangle Park, NC), polyvinyl wire–guided dilators (Savary-Gilliard; Cook Medical, Winston-Salem, NC, and American ConMed, Utica, NY), and balloon dilators (wire-guided and through-the-scope [TTS]).[31]

Bougie dilators rely on tactile perception to determine the amount of resistance encountered with passage through the esophagus. Maloney dilators range in size from 16F to 60F. They can be passed into the esophagus blindly or under fluoroscopic guidance. Maloney dilators can be used without sedation and may be used for self-dilation by select patients.[18] These dilators should not be used for narrow, complex strictures because of the possibility that they could buckle above the stricture and result in perforation. Polyvinyl dilators (Savary-Gilliard and American) have a more tapered and rigid tip than Maloney dilators and a central hollow core for passage of a guidewire. They also range in size from 16F to 60F. The Savary-Gilliard dilators are marked with a radiopaque band at the level of their maximal

TABLE 2. Common etiologies of esophageal dysphagia

Common etiologies	Amenable to dilation
Benign etiologies	
Peptic stricture	Yes
Schatzki ring	Yes
Esophageal web	Yes
Eosinophilic esophagitis	Yes
Caustic injury	Yes
Anastomotic stricture	Yes
Radiation injury	Yes
Pill-induced stricture	Yes
Post-endoscopic therapy stricture	Yes
Congenital esophageal anomalies (tracheoesophageal fistula)	Yes
Cricopharyngeal bar	Yes
Malignant etiologies	
Esophageal adenocarcinoma	Yes
Esophageal squamous cell carcinoma	Yes
Pseudoachalasia	Yes
Extrinsic compression	No
Motility disorders	
Achalasia	Yes
Diffuse esophageal spasm	No
Hypomotility (secondary to connective tissue disorders)	No

diameter for radiographic visualization during fluoroscopy. American dilators have a shorter tapered tip and are impregnated with barium throughout.

Polyethylene balloon dilators include single-diameter and multiple-size balloon dilators that may be used over a guidewire (over-the-wire [OTW]) or passed through the endoscope (TTS). The multiple-size balloons are designed to expand to 3 diameters and are useful for sequential dilations with a single passage of the dilator. Smaller balloons (up to 20 mm) are used for dilation of strictures, whereas larger balloons (30 mm to 40 mm) are used for pneumatic dilation in patients with achalasia. TTS dilators are used more commonly than OTW dilators because of their safety and advantage of dilation under direct visualization.[32]

Large-caliber (0.89 mm) monofilament or coiled wires are predominantly used for esophageal dilation. However, smaller caliber wires may be advantageous in cannulation of severe strictures.[33]

Preparation

Esophageal dilation usually is performed in the outpatient setting. Patients are instructed to refrain from intake of solids for 6 hours and clear liquids for 2 hours before the procedure.[34] Those who have esophageal stasis because of underlying achalasia, diverticula, or tight strictures may require a prolonged fast or nasogastric tube placement to minimize the risk of aspiration.[35] Moderate sedation is used for dilation in the majority of patients, whereas deep sedation or general anesthesia may be required for complex procedures and patients with significant comorbidities.[36]

The management of patients on antithrombotic agents undergoing endoscopic procedures is discussed in detail in a different ASGE guideline.[37] Esophageal dilation is considered a high-risk procedure for bleeding adverse events. In patients who are considered low-risk for thromboembolic events, oral anticoagulation with warfarin should be held for 5 to 7 days before the procedure. Bridging therapy is often recommended for patients who are at high risk for thromboembolic events. Thienopyridines (eg, clopidogrel) usually are held for 7 to 10 days before the procedure. Clinicians may elect to continue aspirin before esophageal dilation, depending on the indication for antiplatelet therapy and individual patient characteristics. In patients who are receiving dual antiplatelet therapy, dilation should be deferred, if possible, until the patient has received the minimum length of therapy recommended by the American College of Cardiology/American Heart Association (AHA) guidelines.[37,38]

Although esophageal dilation is associated with rates of bacteremia of 12% to 22%, the overall risk of infective endocarditis is extremely low.[39-41] Current AHA and ASGE guidelines do not recommend prophylactic antibiotics before dilation solely for the prevention of infective endocarditis.[42,43]

It is important to confirm that all necessary equipment is available in the endoscopy suite before initiation of the procedure. Standard, pediatric, and ultrathin endoscopes and fluoroscopy should be available when dilation of a complex stricture is anticipated. Additional accessories that may be necessary include biopsy forceps, needle-knife papillotome, and steroids (triamcinolone) for injection. The endoscopist should be supported by assistants who are experienced in monitoring patient comfort and safety throughout the examination and who are familiar with the endoscopic tools and dilators being used. Patients should be closely monitored during and after esophageal dilation to detect adverse events.

Techniques of dilation

Bougie dilators exert both radial and axial forces along the entire length of the stricture. The amount of radial force exerted depends on several factors, including caliber of the dilator relative to the stricture diameter, surface

friction of the dilator, angle of taper, and intrinsic characteristics of the stricture.[44] Radial force is inversely proportional to the shear force, and a bougie with a shorter taper results in a more effective and safer dilation.[16]

Bougie dilation with a Maloney dilator may be performed with the patient in the left lateral or upright position. The shaft of the dilator is held with the thumb and medial 3 fingers of the right hand, which enables better tactile perception compared with a closed-hand grip.[45] The dilator is slowly passed into the esophagus with clockwise and counterclockwise rotations until the widest diameter is distal to the stricture. The dilator is then withdrawn in a single slow movement.

In the technique of wire-guided bougie dilation, a guidewire is passed through the esophagus so that its tip is positioned in the antrum. This length is approximately 60 cm from the incisors in a patient without prior esophagogastric surgery. The guidewire can be passed under direct endoscopic visualization or fluoroscopic guidance into the stomach. Pediatric and small-caliber endoscopes are compatible with the guidewires. The dilator is then passed over the guidewire with a single smooth movement until the maximal diameter is beyond the stricture. A slight wire retraction may be necessary to ensure that the guidewire is maintained in place. The dilator is then gradually withdrawn while the position of the guidewire is maintained in a one-to-one exchange method. After passage of the last dilator, both the dilator and guidewire are withdrawn together.

Balloon dilators exert only radial force along the length of the stricture. This circumferential pressure, called hoop stress, is a product of the diameter and pressure within the balloon. The opposing static force of the stricture creates an hourglass waist in the balloon. The dilating force of a balloon dilator is inversely proportional to the diameter of the waist. A larger balloon that exerts a higher radial force requires less pressure for dilation but may be associated with a higher risk for perforation.[44] The dilating force is also dependent on the surface area of the stricture, with more effective dilation of longer strictures.[16]

For TTS balloon dilation, the endoscope is positioned at the proximal end of the stricture. The balloon dilator is advanced through the accessory channel of the endoscope through the stricture. Alternatively, if the stricture allows passage of the endoscope through it, the balloon may be advanced and then the endoscope withdrawn to position the balloon within the stricture. The balloon is inflated and maintained at the inflation pressure under direct visualization for approximately 30 to 60 seconds or until there is a sudden drop in manometric pressure. There are no data on the optimal time the balloon should remain inflated. TTS balloons require a 2.8-mm working channel and are not compatible with most small-caliber and pediatric endoscopes. With OTW balloon dilation, a guidewire is passed into the stomach, and the balloon is advanced under fluoroscopic guidance. The dilator is then centered within the stricture by visualization of radiopaque markers at the center and ends of the balloon. Care should be taken to maintain the wire in position by applying a slight retraction.

Peptic strictures

Patients with peptic strictures may be treated with Maloney, push-type dilators and balloon dilators with similar efficacy.[19,46] Patients undergoing dilation of peptic strictures should be treated with acid suppressive therapy to prevent stricture recurrence.[47-49]

Dilation under fluoroscopic guidance, guidewire assistance, or direct visualization is recommended for complex peptic strictures.[18] The degree of dilation in a session should be based on the severity of the stricture. The "rule of 3" for bougie dilation has been accepted but not formally studied for its safety.[50-52] The initial dilator is selected based on the stricture diameter. This is estimated as approximately the same size as, and not more than, 1 mm to 2 mm larger than the lumen of the stricture. Sequential dilation is then performed. After moderate resistance is encountered, typically no greater than 3 consecutive dilators in increments of 1 mm are passed in a single session. The "rule of 3" does not apply to balloon dilation, and inflation of a single, appropriately sized balloon dilator should be done. Incremental dilations of >3 mm may be safe for simple strictures.[53-55]

Schatzki ring

Dilation with a single, large (16 mm to 20 mm) dilator leads to rupture of the Schatzki ring, and symptomatic relief in almost all patients.[56,57] Adjunctive methods that have been used with dilation are electrocautery incision with a needle-knife papillotome[58,59] and 4-quadrant biopsies of the ring.[60] Several studies have reported an association between EoE and Schatzki ring; biopsies of the esophagus should be considered if there is a clinical suspicion of EoE.[61,62] One study that compared 4-quadrant biopsies alone versus bougie dilation reported comparable results with both techniques.[63]

If a Schatzki ring cannot be distinguished from a peptic stricture, graded stepwise dilation is recommended. A peptic stricture is a smooth, concentric, fixed narrowing most commonly seen in the lower esophagus, which may occur in the presence or absence of esophagitis.[64] In contrast, a Schatzki ring is a diaphragm-like web that is located at the squamocolumnar junction and usually marks the proximal margin of a hiatal hernia.[65] This is best detected on a barium swallow because it may disappear with air insufflation at endoscopy. Similar to patients with peptic strictures, patients with Schatzki rings may present with recurrent symptoms and require repeated dilation.[56,66]

Eosinophilic esophagitis

In adults with suspected EoE, initial evaluation should include esophageal biopsies to confirm the diagnosis, followed by medical management. Both bougie and balloon

dilation have been described in the management of patients with EoE.[24] Several case reports and case series have reported both spontaneous as well as endoscopic adverse events of esophageal perforation and Boerhaave syndrome.[67-70] However, based on the results of two recent systematic reviews, the overall risk of perforation with esophageal dilation is <1% in patients with EoE.[71,72] Postprocedural pain and mucosal lacerations are common in this population. Risk factors for dilation-associated adverse events in patients with EoE include younger age, multiple dilations, upper esophageal strictures, and inability to traverse the stricture with the endoscope.[73]

A novel balloon pull-through technique for assessment and dilation of EoE-related strictures was described recently in a series of 13 patients. A TTS multiple-size balloon is selected based on initial assessment of the esophageal luminal diameter at endoscopy. The balloon is positioned across the gastroesophageal junction and inflated to the smallest diameter. The catheter is grasped with the left hand to assess the tension during pull-through. The endoscope is then slowly withdrawn to the proximal esophagus. If no significant mucosal trauma is noted, the procedure is repeated by using a sequentially larger diameter balloon until adequate dilation is achieved. In this series, mucosal tears occurred in 67% of patients, but there were no perforations.[74]

Clinical efficacy of dilation for EoE has been demonstrated in several studies. A recent review of 12 studies reported improvement in dysphagia in 92% of patients with EoE after dilation.[71] A large, retrospective study of 207 adults with EoE found that dilation with or without medical management with steroids resolved or nearly-resolved dysphagia in up to half of patients, 45% remaining symptom free for ≥2 years.[75] A consensus committee on EoE recommended that dilation be reserved for patients who have a dominant esophageal stricture or ring as well as those who remain symptomatic despite medical therapy. In these patients, dilation should be performed cautiously with small-caliber dilators, followed by slow advancement, not exceeding a maximal diameter of 18 mm.[6,76] Most studies and the consensus committee have suggested bougie dilation as the preferred method because EoE may involve the entire esophagus, whereas others have recommended TTS balloons for dilation under direct visualization.[6,71,73]

Postesophagectomy anastomotic strictures

Anastomotic strictures have been reported in 9% to 48% of patients after esophagectomy for esophageal cancer.[77-80] The diagnosis is made in patients with dysphagia in whom the standard flexible esophagoscope cannot be passed across the anastomosis.[81] Risk factors for developing an anastomotic stricture include anastomotic leakage, ischemia, a stapled as opposed to a hand-sewn anastomosis, gastric pull-up instead of colonic interposition, and medical comorbidities of cardiovascular disease and diabetes mellitus.[77,82,83]

Endoscopy allows evaluation for local recurrence of malignancy as well as the performance of dilation for benign anastomotic strictures. Both bougie and balloon dilation have been used for treatment of anastomotic strictures, with a success rate of up to 93%.[77,83-85] However, there is a high recurrence rate and patients often require frequent and multiple sessions (median 2-9 per patient) to achieve effective dilation.[79,83,84,86] Electrocautery needle-knife treatment has been described in the management of anastomotic strictures that are resistant to dilation, but long-term outcomes in large series are unavailable.[87,88] Although short strictures (<1 cm) respond to a single electrocautery treatment, longer strictures may require multiple sessions.[87] Tissue remodeling with temporary placement of fully covered self-expandible metal stents has been increasingly applied for the management of these benign, refractory, esophageal strictures.[89]

Post-radiation strictures

Proximal esophageal strictures occur in 2% to 16% of patients after radiation therapy for head and neck or lung cancer.[90,91] The majority of the radiation-induced strictures are complex, and several sessions of bougie dilation may be necessary for adequate treatment. Adequate relief of dysphagia is reported in up to 84% of patients.[92-94] A combined antegrade-retrograde rendezvous approach has been described in case reports and case series for the management of severe radiation-induced strictures with complete occlusion of the proximal esophagus. In this technique, a standard endoscope (after dilation) or a small-caliber endoscope is passed via an existing gastrostromy tract through the stomach into the esophagus. The proximal side of the closed lumen is visualized by using a rigid or flexible endoscope by a second endoscopist. Both endoscopes are aligned by using fluoroscopy and transillumination. The stricture is dissected from above, and an ERCP guidewire is passed from below to traverse the stricture. Serial Savary-Gilliard dilators are passed over the guidewire until moderate resistance is encountered. A small-caliber nasogastric tube is left in place to maintain patency of the lumen and enable subsequent dilations.[95,96]

Recurrent or refractory esophageal strictures

A refractory or recurrent stricture has been defined as an anatomic restriction due to cicatricial luminal compromise or fibrosis that results in dysphagia in the absence of endoscopic evidence of inflammation. This may occur as the result of either an inability to successfully dilate the stricture to a diameter of 14 mm over 5 sessions at 2-week intervals (refractory) or as a result of an inability to maintain a satisfactory luminal diameter for 4 weeks once the target diameter of 14 mm has been achieved (recurrent). This does not include patients with inflammatory strictures (which will not resolve successfully until the

inflammation subsides) or those with satisfactory stricture diameters who have dysphagia on the basis of neuromuscular dysfunction.[97]

Despite the use of acid suppressive therapy, up to 40% of patients with peptic strictures have recurrent dysphagia requiring repeat dilations.[46,55,98,99] The most common causes for recurrence include the presence of complex strictures, untreated acid reflux, and undiagnosed EoE.[47,100,101] For patients who require repeat dilations, the maximal sized dilator used at the prior dilation may be used as the initial dilator for the subsequent session. There is no reported limit to the number of dilation sessions a patient can undergo.

Steroid injection into refractory, benign strictures immediately before or after dilation has been shown to increase the post-dilation diameter (50F vs 40F for peptic strictures; $P = .027$) (47F vs 42F for radiation strictures; $P = .004$),[102] decrease the need for repeat dilations (13% vs 60%; $P = .02$),[103] and increase the interval between dilations (167 days vs 23 days; $P < .05$).[102-104] The mechanism of action is considered to be inhibition of matrix protein genes by the steroids, which leads to a decrease in deposition of collagen and fibrous tissue in the esophagus. The most common steroid used for this purpose is triamcinolone acetonide, 40 mg/mL, 0.2 mL to 0.5 mL aliquots injected into 4 quadrants of the stricture.[105] A few investigators have suggested the use of an ultrasound (US) probe to enable injection into the thickest portion of the stricture,[102,106] but this is not routinely performed in clinical practice.

Temporary esophageal stent placement is an adjunct to dilation in the management of patients with refractory, benign, esophageal strictures. Because of the high rate of tissue ingrowth, uncovered metal stents have been largely replaced by plastic or fully-covered metal stents for this indication.[17,107,108] A systematic review of 10 studies with 130 patients reported successful plastic stent placement in 98% of patients with benign strictures. Successful dilation was achieved in 52% of patients. Clinical success was significantly lower for cervical strictures compared with strictures in the remainder of the esophagus (33% vs 54%; $P < .05$). There was a high rate of stent migration in 24% of patients. The rate of major adverse events was 9%, including bleeding, perforation, and 1 death.[109]

Fully-covered metal stents and biodegradable stents are not U.S. Food and Drug Administration approved for the management of benign esophageal strictures but have been evaluated for this indication. A study of 25 patients being treated with fully-covered metal stents reported rates of stent migration of 80%, new stricture formation of 48%, and development of esophagobronchial fistulae of 4%.[110] In a recent study of 15 patients with benign, esophageal strictures, stents were removed prematurely in 60% of patients because of migration, tissue ingrowth, or pain. Recurrent dysphagia occurred in all patients after stent removal.[111] A biodegradable stent made of poly-L-lactic acid monofilaments has been studied in a trial of 13 patients. Symptomatic improvement was reported in only 2 patients, and the rate of stent migration was 77%.[112] A study by Hirdes et al[113] evaluated the role of single and sequential biodegradable stent placement in the management of 28 patients with benign strictures. In total, 59 stents were placed in these patients. Thirteen patients underwent sequential biodegradable stent placement (median 3, range 2-8) during the study period. After initial stent placement, the median dysphagia-free period was 90 days (range 14-618 days). Clinical success, described as absence of dysphagia for 6 months or longer after stent placement, was achieved in 7 patients (25%), and major adverse events occurred in 8 patients (29%). After placement of a second biodegradable stent, the median dysphagia-free period was 55 days (range 25-700 days), and clinical success was achieved in 15% of patients. After placement of a third stent, the median dysphagia-free period was 106 days (range 90-150 days), but clinical success was not achieved in any of the patients.

Self-bougienage is another option for patients who require multiple and frequent dilations. The initial dilation sessions should be performed under the supervision of a clinician in order to ensure that the patient learns the correct technique. A single Maloney dilator with a diameter of 42F, 45F, or 48F is used. The dilator should be marked at the required depth of insertion, and dilation performed with the patient in the sitting position. The dilator is lubricated with water, and the tapered end is introduced into the oropharynx with the left hand. The end of the dilator is raised above the head by using the right hand, which allows the tungsten to migrate to the tip. The dilator is slowly advanced into the esophagus until the marking is seen at the level of the incisors. The dilator is then slowly withdrawn.[114-116]

Achalasia

Esophageal dilation for achalasia involves forceful disruption of the lower esophageal sphincter. This usually is accomplished with 30 mm to 40 mm diameter pneumatic balloon dilators. Dilation is generally performed over a wire under fluoroscopic guidance,[117,118] although nonfluoroscopically-guided dilation by using endoscopic visualization alone has been reported.[119,120] Although short-term relief of dysphagia is favorable, recurrence has been reported in approximately one-third of patients,[121] and long-term resolution of symptoms after the initial response has been reported to be as low as 40% to 50%.[122,123] One study reported a 3-year success rate of 88%, which was attributed predominantly to the use of larger balloons (35 mm to 40 mm). Pneumatic dilation with 30 mm balloons failed in 42% of patients within 3 months.[124] The overall risk of perforation with pneumatic dilation is in the range of 3% to 5%.[118,125,126] The strategy of 30 mm balloon dilation followed by 35 mm dilation may be a safer approach because initial dilation with the 35 mm balloon has a higher perforation rate (31% vs 4%; $P < .001$).[127]

An alternative to dilation in patients with achalasia is the endoscopic injection of botulinum toxin. The symptomatic response to this treatment is often short lived, with greater than 50% recurrence by 6 months.[128] In randomized studies, pneumatic balloon dilation is more effective than botulinum toxin injection, with significantly higher cumulative remission rates (70%-89% compared with 32%-38%, respectively; $P < .01$).[128,129] A large, randomized trial of 201 patients compared pneumatic dilation with laparoscopic Heller myotomy (LHM). There was no significant difference in therapeutic success between the 2 groups, 86% with pneumatic dilation and 90% with LHM after 2 years ($P = .46$). Perforation occurred in 4% of patients with pneumatic dilation, whereas mucosal tears occurred in 12% of patients with LHM.[127]

A meta-analysis of 17 studies evaluated various treatment options for achalasia.[130] Pneumatic dilation demonstrated a better remission and lower relapse rate compared with botulinum toxin for the initial management of patients with achalasia. There was an increase in remission and no differences in adverse event rates with LHM compared with pneumatic dilation. Another recent meta-analysis of 36 studies with 3211 patients reported a mean 5-year remission rate of 61.9% and 10-year remission rate of 47.9% with pneumatic dilation, compared with 76.1% and 79.6%, respectively, with LHM. The perforation rate was 4.8% with LHM and 2.4% with pneumatic dilation ($P < .05$).[131] Cost analysis models indicate that initial pneumatic dilation is a more cost-effective approach compared with botulinum toxin injection or LHM for healthy patients with achalasia.[132,133] A study of 99 patients with achalasia diagnosed with high-resolution manometry showed that type II patients (achalasia with esophageal compression) are more likely to respond to any therapy (Botox 71%, pneumatic dilation 91%, or Heller myotomy 100%) than type I (achalasia with minimal esophageal pressurization) (56% overall) or type III (achalasia with spasm) (29% overall) patients. Type II achalasia was a predictor of positive treatment response, whereas type III and pretreatment esophageal dilatation were predictors of a negative treatment response.[134]

Before endoscopic treatment, patients with achalasia should be informed of all therapeutic options available. Symptomatic patients with achalasia who are good surgical candidates should be given the option of either graded pneumatic dilation or cardiomyotomy. Open surgical repair with myotomy of early recognized endoscopic perforation offers outcomes similar to those of elective open myotomy. However, LHM may not be technically feasible after an endoscopic perforation.[135] In comparison, pneumatic dilation can be performed safely in patients after a failed myotomy.[136,137] The subset of patients in whom the latter approach has failed may require esophagectomy. Botulinum toxin may be the preferred approach in patients who are poor candidates for surgery, as pneumatic dilation is not recommended in these high-risk surgical candidates.

Peroral endoscopic myotomy (POEM) is a new endoscopic procedure that has been used in the treatment of achalasia. The technique involves the creation of a 2-cm long mucosal incision in the esophagus, approximately 14 cm proximal to the lower esophageal sphincter (LES). A submucosal tunnel is then created from the incision to the LES followed by dissection of the circular muscle fibers over the distal 7 cm of the esophagus and proximal 2 cm of the gastric cardia. The mucosal incision is then closed using endoscopic clips.[138] A study that evaluated the role of POEM in 17 consecutive patients with achalasia reported a significant improvement in dysphagia scores (1.3 vs 10; $P < .0003$) and lower esophageal sphincter pressure (19.8 vs 52.4; $P < .0001$).[139] The success rate was significantly higher in patients who had a nontortuous esophagus compared to those with a tortuous esophagus. Another study by the same investigators reported treatment success in 94% of patients after peroral endoscopic myotomy (mean dysphagia score 1.4 vs 8.8; $P < .001$ and lower esophageal sphincter pressure 11.8 vs 27.2; $P < .001$).[140] Reflux esophagitis after POEM was reported in one patient in each of these studies. Long-term data and randomized trials comparing this technique to conventional modalities of management are necessary before it can be adopted into clinical practice, but the procedure is becoming more widely used in expert centers.

Dysphagia due to hypopharyngeal causes

Disorders of the upper esophageal sphincter or hypopharynx can cause oropharyngeal dysphagia, typically distinguishable from esophageal dysphagia based on a careful history and diagnostic evaluation of the swallowing mechanism. EGD should be performed in patients suspected of having oropharyngeal dysphagia in order to exclude alternative or additional pathologic conditions and should include a complete examination of the upper esophageal sphincter and hypopharynx. A variety of endoscopy based therapies including dilation and injection therapy have been described for the treatment of upper esophageal sphincter dysfunction and entities such as cricopharyngeal bars.[141-143]

Contraindications and adverse events of esophageal dilation

The presence of an esophageal perforation is an absolute contraindication to esophageal dilation. Dilation should be performed with caution in patients who have had a recent, healed perforation or upper GI surgery. The main adverse events associated with dilation are perforation, bleeding, and aspiration. The perforation rate for esophageal strictures after dilation ranges from 0.1% to 0.4%[18] and is higher with complex strictures[18] and radiation-induced strictures.[144] The perforation rate may be influenced by endoscopist experience. One study indicated that the perforation rate was 4 times greater when

the endoscopist had performed fewer than 500 previous diagnostic upper endoscopic examinations.[145]

Perforation after esophageal dilation can be intra-abdominal or intrathoracic at the site of the stricture. This adverse event should be suspected if a patient develops severe or persistent chest or abdominal pain, dyspnea, tachycardia, or fevers after dilation. The physical examination may reveal subcutaneous crepitus of the chest or cervical region. Although a chest radiograph may indicate a perforation, a normal study result does not exclude it, and a water-soluble contrast esophagram or contrast-enhanced computed tomogram of the chest may be necessary to confirm this adverse event.[146] The use of large-diameter covered metal stents and expandable, retrievable plastic stents has been effective in the management of perforation after dilation of benign and malignant strictures.[147,148]

RECOMMENDATIONS

1. We recommend endoscopic dilation for patients with dysphagia secondary to benign intrinsic strictures of the esophagus. (⊕⊕⊕⊕)
2. We recommend wire-guided dilation, preferably under fluoroscopic guidance, or TTS balloon dilation for complex esophageal strictures. (⊕⊕⊕○)
3. We recommend antisecretory treatment in conjunction with dilation to reduce the recurrence rate of peptic strictures. (⊕⊕⊕⊕)
4. We recommend that dilation for adult patients with EoE be reserved for those who have a dominant esophageal stricture or ring and those who remain symptomatic despite medical therapy. (⊕⊕⊕○)
5. We suggest adjunctive treatment with corticosteroid injection into recurrent or refractory benign esophageal peptic strictures. (⊕⊕○○)
6. We suggest that esophageal stent placement be reserved for refractory esophageal strictures that do not respond to sequential dilation and/or steroid injection. (⊕⊕○○)
7. We recommend that both endoscopic and surgical treatment options for achalasia be discussed with the patient. In patients who opt for endoscopic management and are good surgical candidates, we recommend pneumatic dilation with large-caliber balloon dilators for the endoscopic treatment of achalasia. (⊕⊕⊕⊕)
8. We recommend botulinum toxin injection for endoscopic treatment of achalasia in patients who are poor candidates for surgery or pneumatic dilation. (⊕⊕⊕○)

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Abbreviations: AHA, American Heart Association; EoE, eosinophilic esophagitis; LHM, laparoscopic Heller myotomy; OTW, over-the-wire; TTS, through-the-scope.

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