TECHNICAL REVIEW

Dilation of refractory benign esophageal strictures

Peter D. Siersema, MD, PhD, Laetitia R.H. de Wijkerslooth, MD

Utrecht, The Netherlands

Benign esophageal strictures are frequently encountered as a problem in endoscopic practice.[1,2] Peptic injury, as a result of chronic exposure of the esophagus to gastric contents, is the most common cause of esophageal strictures, accounting for approximately 60% to 70% of cases.[3] Other etiologies include Schatzki's rings, esophageal webs, radiation injuries, caustic ingestions, photodynamic therapy-induced strictures, and anastomotic strictures.[2,4] For centuries, the cornerstone of treatment for esophageal strictures has been dilation therapy. The first documented treatment dates back to 1674 when the passing of a whale bone through a stricture in the esophagus was reported.[5] Since then, esophageal dilation devices have evolved and have continued to improve in efficacy and safety.[6]

Although dilation usually relieves symptoms of dysphagia, recurrent strictures do occur. Benign esophageal strictures can be classified according to complexity. Strictures that are short, focal, straight, and, in most cases, allow passage of a normal-diameter endoscope are considered simple strictures. Examples of these include Schatzki's rings, esophageal webs, and peptic strictures.[1] In general, one to 3 dilations are needed to relieve dysphagia because of simple strictures, with only 25% to 35% requiring additional sessions, with up to 5 dilations.[7] There is a subgroup of strictures that are more difficult to treat and tend to be refractory or tend to recur despite dilation therapy. These strictures are usually longer (>2 cm), angulated, irregular, or have a severely narrowed diameter.[1] The more complex strictures are defined as anatomic restrictions because of a cicatricial luminal compromise or fibrosis that results in symptoms of dysphagia in the absence of endoscopic evidence of inflammation. This may occur as the result of either an inability to successfully remediate the anatomic problem to a diameter of 14 mm during 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). It is important to note that this definition is not meant to include patients with an inflammatory stricture that will not resolve successfully until the inflammation subsides, or those with a satisfactory diameter who have dysphagia on the basis of neuromuscular dysfunction (eg, those with postoperative and postradiation therapy dysphagia).[8] The most common etiologies include anastomotic strictures, radiation-induced strictures, caustic strictures, and photodynamic therapy-related strictures.[1,6]

This review summarizes techniques for optimal dilation, and discusses alternative approaches for treating refractory benign esophageal strictures, such as dilation therapy combined with steroid injection, stent placement, and incisional therapy.

Abbreviations: SEMS, self-expanding metal stent; SEPS, self-expanding plastic stent.

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REVIEW METHODOLOGY OF PUBLISHED STUDIES

Key words, including "esophageal stricture," "benign," "refractory," "anastomotic," "caustic," "radiation," "peptic," "photodynamic therapy," "bougie dilation," "balloon dilation," "retrograde and antegrade dilation," "steroid injection," "stent," and "incisional therapy" with limits to studies in English, were used to search the PubMed database from 1975 to December 2008. In addition, a manual search of citations from relevant articles was performed.

DILATION

Treatment of benign esophageal strictures aims to relieve symptoms of dysphagia, with avoidance of complications and prevention of recurrences. Dilation used to be and still is the first-line option to treat benign esophageal strictures.[2] Various types of dilators are available and can be categorized into mechanical (bougie) or balloon-type dilators. Mechanical dilators can further be subdivided into those that are passed down the esophagus with or without a guidewire and/or fluoroscopy.[2,3,6] Bougies that do not need a guidewire for introduction into the esophagus are filled with mercury or tungsten (eg, Maloney dilators; Medovations, Germantown, WI). These types of bougies have a tapered tip and are available in multiple sizes. The most commonly used guidewire-assisted mechanical bougie is the polyvinyl Savary-Gilliard dilator (Wilson-Cook Medical, Winston-Salem, NC). Balloon dilators

can be passed through the scope and are available with or without a guidewire. Both Savary-Gilliard and balloon dilators are currently by far the most frequently used dilators.[6,7,9]

The exact mechanism by which the luminal diameter is increased during dilation has not been fully elucidated, but the most likely mechanism is that the esophagus is widened by circumferential stretching and/or splitting of the stricture.[1,10] Bougie dilators enable dilation of a stenotic segment by using gradually increasing dilator diameters. This results not only in a longitudinal force, but also in a radial, more shearing, force on the stricture. Balloon dilators can be passed through the working channel of an endoscope, which enables the procedure to be performed under direct vision. The balloon is inflated with water (or contrast if fluoroscopy is used) to a pressure that corresponds to a specific diameter. The middle part of the balloon is positioned at the narrowest part of the stricture. A guidewire and/or fluoroscopy can be used to position the balloon. In contrast to bougie-type dilators, balloon dilators only deliver a radial force, resulting in a simultaneously applied dilating force across the entire length of the stricture.[3,6,10]

Despite these mechanistic differences, no clear advantage of either balloon or bougie (Savary-Gilliard) dilation has been demonstrated. Scolapio et al[9] compared safety and efficacy of Savary-Gilliard dilation with balloon dilation in the treatment of peptic strictures and Schatzki rings. No differences in relief of dysphagia or in need for repeat dilation were observed. Moreover, both methods were found to be safe with no major complications observed in 251 patients. Also, other authors did not find functional differences between bougie and balloon dilation.[11-13] An advantage of Savary-Gilliard dilators is that they are more cost-effective because they are reusable, compared with balloon dilators that are intended for single use only.

The most frequently reported complications of esophageal dilation include perforation, hemorrhage, and bacteremia. Perforation rates varying between 0.1% and 0.4% have been reported.[2,7,14,15] In general, it is accepted that the risk of perforation is only minimal when ''the rule of 3'' is applied, meaning that no more than 3 dilators of progressively increasing diameter should be passed in a single session (corresponding with a total of $3 \times 1 = 3$ mm increase in diameter).[1,6] Although this ''rule'' is easily applicable as a clinical guideline, no studies have demonstrated that it indeed improves safety and efficacy.[3] Therefore, one could argue that in very tight or long strictures, only one or two dilators should be passed in each dilation session. It is commonly advised to limit initial dilation to 39F to 45F (corresponding to a diameter of 13 to 15 mm). Nonetheless, in a small series of 35 patients with predominantly peptic strictures, it was found that dilation with Rigiflex balloons (Rigiflex esophageal balloon dilator; KeyMed, Southend-on-Sea, UK), which were inflated up to 60F (20 mm) during the first session, did not result in complications.[11]

With such low complication rates it is hard to demonstrate a safety benefit of any dilation device. One study retrospectively compared the balloon-type Maloney device (both the hydrostatic and pneumatic type) and Savary-Gilliard dilators in 102, 156, and 90 sessions, respectively. An increased perforation rate was found with Maloney dilators that were passed blindly into complex strictures.[15] Therefore, using Maloney bougies only in patients with simple strictures is advisable.[2,15,16] The efficacy and safety of endoscopic dilation without fluoroscopy has been shown in several studies.[7,17-19] Nonetheless, it is generally advocated to use fluoroscopic guidance to enhance safety during dilation of complex strictures.[6]

The majority of complex strictures can be endoscopically passed with a guidewire, followed by dilation. Occasionally, it can be difficult to identify the true lumen of a stenotic esophagus, for instance in postradiation strictures in the cervical esophagus. In these circumstances, the passing of a guidewire for dilation through antegrade endoscopy is unsuccessful. To reduce the potential risk of perforation, the combined antegrade and retrograde dilation technique can be applied.[20,21] The principle of the combined antegrade and retrograde dilation technique is dual endoscopic access to the proximal and distal end of the stricture, resulting in better control during dilation. As a first step, a small-diameter endoscope is passed retrogradely into the patient's esophagus through the gastric lumen by using a mature gastrostomy or jejunostomy tract for access. Then a guidewire is passed from the distal side under fluoroscopic guidance across the stricture. If the lumen is not detected from the distal side, a guidewire puncture or the use of a pre-cut knife to provide a small access hole in the stricture under fluoroscopic guidance followed by passing a guidewire has been reported.[22-24] The guidewire is antegradely detected and picked up with a proximally positioned endoscope. Dilation can be performed by using either Savary-Gilliard or balloon dilation. Two studies in small groups of patients have demonstrated that the combined antegrade and retrograde dilation technique is indeed an effective and safe method.[20,21]

In summary, (repeat) dilations are effective in the majority of benign esophageal strictures, irrespective of the underlying disorder. In a minority of patients, however, strictures recur and are defined as refractory; in these patients, an alternative treatment strategy should be considered.

INTRALESIONAL STEROID INJECTION THERAPY

In 1966, the first reports of the successful treatment of cutaneous hypertrophic scars, burn contractures, and keloids by the local infiltration of triamcinolone diacetate were published. The intralesional injection of corticosteroids was shown to soften scars and keloids.[25,26] A few