

# Esophageal Dilation: Pearls and Pitfalls

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Foregut

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## Abstract

Esophageal dilation is an important part of endoscopic practice. Proper preparation and technique can optimize outcomes. Techniques include wire guided per oral dilation, blind bougienage and balloon dilation. Fluoroscopy and steroid injections may also be part of endoscopic practice. Diseases that are often and addressed with esophageal dilation include peptic strictures, lower esophageal rings, eosinophilic esophagitis, achalasia and other motility disorders, postoperative dysphagia, radiation induced strictures and malignant strictures. The techniques and approach to all of these disorders will be discussed in this review.

## Keywords

esophageal dilation, dysphagia, endoscopy

## Introduction

Dysphagia is a common indication for upper endoscopy, which may diagnose the disorder producing the symptom and offer the opportunity for intervention with esophageal dilation using various techniques for different disorders. We will discuss both general techniques and specific disease related approaches in this paper. There are many full-length manuscripts and reviews related to each of the topics discussed below and our goal is to provide general and helpful (we hope!) advice on an approach to esophageal dilation.

## Preparation Prior to Dilation

Traditionally, patients with dysphagia are often evaluated with a barium esophagogram prior to esophageal dilation. This may provide a “road map” to the subsequent endoscopy and dilation, particularly in an uninvestigated patient. It may provide information on degree of stenosis, oropharyngeal dysfunction and provide suggestive support for a major motility disorder such as achalasia. An ideal study should include a careful evaluation of proximal swallowing, a full column view of the esophagus and a solid bolus challenge. On the other hand, a patient with classic intermittent solid food dysphagia to solids suggestive of a lower esophageal ring may well move directly to endoscopy skipping a barium examination.

Most patients can follow preprocedural oral intake guidelines for routine upper endoscopy but patients with severe dysphagia, history of food impaction and major motility disorders may require a prolonged liquid diet and fasting. Anesthesia can also follow a center’s usual practice for upper endoscopy, although patients with advanced

achalasia, those with a history of retained material on prior procedures or radiographic evidence of a very dilated esophagus should be intubated prior to endoscopy. Also, if significant retained material is noted on introduction of the endoscope, withdrawing the endoscope and intubating the patient is reasonable. Guidelines for management of anti-coagulation should be followed remembering that esophageal dilation is considered a high-risk procedure for bleeding.<sup>1</sup> Prophylactic antibiotics are not recommended in most endoscopy including during esophageal dilation.<sup>2</sup>

## Dilation Techniques

### Wire Guided Per-Oral Dilation

Passing a guidewire and performing a dilation is a standard procedure that should be in the tool kit of all gastroenterologists. There are 2 types of guidewires available: a more stiff “piano wire” with a flexible tip and a totally flexible guidewire. The flexible wire has a more flexible end which should always be the end inserted through the endoscope. If the stenosis is mild and the endoscope (normal or small caliber) can reach the stomach, then either type of wire is acceptable. For very tight stenosis that will not allow the endoscope to pass, a flexible wire, ideally with fluoroscopy confirmation of gastric passage should be used. The “piano wire” has a tip that will not allow the dilator to pass beyond that tip, but care must be taken to

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not continue to push the dilator when that tip has been reached, since perforations from the tip have been reported.<sup>3</sup> Even with the flexible wire, it is important to not push the dilator past the end of the wire since at that point directional control is lost. The physician along with the nurse and technician must always monitor the location of the guidewire. This includes careful control of the end of the wire at the mouth and at the distal end. We have the technician anchor the wire to an area on the endoscopy cart to make sure it does not move. When leaving the wire in place while withdrawing the dilator, the endoscopist should advance the wire at the same rate as they withdraw the dilator. Notation should be made of the measurement on the wire and if it appears to have shifted, the team should immediately speak up and then the wire can be endoscopically (or fluoroscopically) repositioned.

Once the wire is confirmed to be in place, the dilation can begin. Endoscopic estimation of the diameter of a stenosis is notoriously inaccurate but the first dilator should be slightly larger than your endoscopic estimate. Experience guides the degree of resistance to push through but it is often surprising that a high resistance dilation does not always produce mucosal disruption and vice versa. We will review the approach to various disorders below, but the traditional thought of only dilating to 3 sizes above the first mucosal disruption<sup>4</sup> remains reasonable although the practicality of passing the endoscope between each dilation to look for that first disruption is challenging. Recent studies and practice suggest that a single dilation to 15mm (or more in the case of a Schatzki's ring) can be safe in simple strictures that allow passage of a standard endoscope.<sup>5</sup> The goal in most patients is to eventually achieve a diameter of 17 to 20 mm and it may take more than one procedure to reach that endpoint. On the other hand, many patients will do well with a 15 mm or even smaller esophagus, so clinical judgment and appropriate follow up are important.

### ***Blind Bougienage***

Blind bougienage using Maloney or similar dilators has the longest history of any technique. The dilators are more compliant and experienced operators believe that they allow better tactile control than the stiffer, guidewire driven dilators. Those less experienced with this technique often fear the blind passage (almost always safe, although passing into an esophageal diverticulum might result in perforation if this was not excluded with barium testing). Fluoroscopy will be specifically discussed below but its use can avoid the dilator bending back above a stenosis resulting in ineffective dilation or increased risk of perforation.<sup>6</sup> The progressive increase in dilator size is similar to guidewire-based dilation and varies depending on the disease being addressed.

### ***Balloon Dilation***

Through the scope balloon dilation (TTS-BD) has become the go to method for many gastroenterologists. Initially, the balloons were quite expensive but recently cost has decreased to the point where their use is reasonable even in ambulatory surgery units where cost cannot be passed on to patients. If the stenosis allows the endoscope to pass, the examination is completed, the endoscope withdrawn to just above the stenosis, the balloon passed into the stenosis and then inflated. Some balloons have a short guidewire that can be passed through a tight stenosis but all of the concerns above noted about blind wire passage with per-oral dilators applies here as well. It is important for the operator to maintain careful control of the location of the balloon since it is easy for the balloon to migrate above or below the stenosis during inflation. The operator can then deflate the balloon and evaluate the change in the stenosis or any mucosal disruption prior to re-inflating or changing to a larger balloon. Balloons are available that allow progressive dilation through several sizes, which is more economical and efficient compared to changing balloons between each size. One disadvantage of balloons is that they only dilate a specific part of the esophagus unlike per-oral dilators which dilate the entire esophagus. A technique of withdrawing the balloon through the entire esophagus either partially or completely inflated has been reported to be safe and effective.<sup>7</sup>

### ***Use of Fluoroscopy During Esophageal Dilation***

Early in my career, it was standard at my institution to use fluoroscopy with all per-oral dilation. While we eventually abandoned that approach on a routine basis, there are times when it is very helpful. If a barium exam shows a tight stricture that will not allow even a small caliber endoscope to pass, knowing the wire is in the stomach gives an added measure of confidence. In addition, when using blind bougienage there is always a chance that the dilator will "knuckle" back and not pass the stricture. In fact, after we began to book all dilations in standard, non-fluoroscopy rooms, my use of blind dilation gradually dwindled, and I became more reliant on guidewires and balloons. We routinely perform achalasia dilation and dilation with known complicated strictures in rooms with the availability of fluoroscopy. We have portable C-arm units available in all our units when unanticipated need arises.

### ***Which is Best Per-Oral or Balloon?***

In general, either choice is acceptable and should be based on local preference and expertise. Balloons were originally very expensive but now they have become

quite inexpensive and that is not a factor, perhaps outside of very low resource environments. There is also some ecological advantage of a set of dilators that can be used for many years compared to 1 time use disposables. We will discuss eosinophilic esophagitis below, but balloons may provide a distinct advantage in that disease when the degree of mucosal disruption is more important and can be directly examined visually after each inflation. There are also some very tight surgical and radiation induced strictures that may respond better to the linear force of a per-oral dilator compared to the radial force of a balloon. Per-oral dilators allow some degree of tactile impression on the “tightness” of a stenosis. That may be helpful in some but not all cases. That advantage may be offset by the direct visual inspection allowed with balloon dilation. In the 2 randomized controlled trials comparing per-oral dilation to TTS-BD there was no difference in efficacy at 1 year and safety.<sup>8,9</sup>

### **Steroid Injection**

Intralesional steroid injection has been proposed as an adjunct to improve both short and long-term efficacy of esophageal dilation. It has been studied in many situations with documented efficacy in corrosive, peptic, anastomotic and radiation induced strictures.<sup>10</sup> Many endoscopists reserve this for strictures that are refractory to dilation without steroids, although there are reasonable data to support initial use of steroids, particularly in anastomotic strictures where the median number of dilations to achieve resolution was 2 in the steroid group and 4 in placebo treated patients.<sup>11</sup> Most studies have used 40 mg of triamcinolone as the steroid preparation and dose of choice. I tend to dilute it to 4 to 5 mL and give 1 mL injections in a circumferential method around the stenosis. There is no clear guidance on injecting before or after the dilation but I tend to see very tight strictures and have better luck doing it afterward. Radiation and anastomotic strictures are often very fibrotic and finding an area that will accept the injection can be somewhat challenging. Another challenge is very proximal strictures where is difficult to get the endoscope into an appropriate injection orientation above the stenosis.

### **Specific Diseases**

#### **Peptic Strictures**

Reflux induced peptic strictures are a common problem leading to esophageal dilation. In the face of active esophagitis (particularly if severe-LA-C or D), it is often difficult to determine the degree of fixed stenosis. While dilating mild (LA-A or B) esophagitis is safe and effective, most experts would suggest a course of proton pump

inhibitors (PPI) to heal the mucosa prior to dilating severe esophagitis. I tend to use a balloon for most of these, since it is quite difficult to know the diameter when choosing a size for per-oral dilation. Dilating 3 to 5 mm above the predilation diameter seems prudent. If an appropriate diameter cannot be achieved during the first session, the patient is discharged on PPI therapy and then brought back for additional treatment. This can be in a few weeks if esophagitis is not present, but if there is significant esophagitis, it may take 6 to 8 weeks to achieve healing to subsequent dilation. Patients with reflux induced strictures should be encouraged to take PPI on a long-term basis, since this increases the duration of dysphagia remission after a dilation.<sup>12</sup> A high incidence of Barrett’s esophagus has been reported in and below peptic strictures so careful evaluation and biopsy are important. In the past, some experts have suggested to wait until after the dilation to perform biopsy out of fear of creating a nidus for perforation, but current data suggest it is very safe to biopsy prior to dilation.<sup>13</sup>

#### **Lower Esophageal (Schatski) Rings**

Dysphagia due to a bolus becoming obstructed above a lower esophageal or Schatski’s ring is very common. It was once called “steak house syndrome” since it often occurs with meat and may be more likely in a social situation with lots of conversation and perhaps alcohol consumption. These lesions are almost universally associated with a hiatal hernia. The technique for dilation is similar to that of a stricture but they are rarely very tight and most can be taken to 20 mm in a single setting. It was long held that these rings respond best to a single, aggressive dilation to 20 mm as opposed to sequential dilation as used for a peptic stricture.<sup>14</sup> The data are not as robust as for peptic strictures, but PPI therapy may slow recurrence of distal rings.<sup>15</sup> Interestingly, some rings have a diameter greater than 20 mm despite their symptomatic status. Electrical incision and aggressive 4 quadrant biopsy have been suggested as methods to disrupt the more patulous rings. It is possible that mild to moderate esophageal dysmotility may cause a bolus to stop above a patulous ring, so manometry should be considered if the symptoms are not supported by the endoscopic and barium appearance of a lower esophageal ring.

#### **Eosinophilic Esophagitis**

Dilation of esophageal stenosis related to eosinophilic esophagitis (EOE) creates a great deal of anxiety in many endoscopists, especially if these patients are uncommon in their practice. The narrowing in this disease can vary from very subtle rings up to and including near obstruction of the lumen. Thus, the approach varies greatly

depending on the individual case. In patients with EOE, a barium examination may be helpful to ensure adequate counseling and preparation prior to dilation. Fluoroscopy may be needed for safe dilation when a severe stenosis does not allow a standard or pediatric endoscope to pass. Once the diameter of the stenosis is confirmed, EOE is a disease where it seems to be better to be conservative and only to dilate a few sizes above the point of first mucosal disruption. Mucosal tears are very common and while less common, perforation is possible.<sup>16,17</sup> EOE is traditionally thought to be a diffuse process but there is often a dominant area of stenosis which is not infrequently at the esophagogastric junction that may be, or at least behave like a Schatzki's ring.<sup>18</sup> The diffuse nature of EOE leads to frequent use of per-oral dilators. Unfortunately, our ability to determine diameter during endoscopy is limited and significant resistance to dilation is less common in EOE compared to peptic and other strictures. Balloon based dilation is becoming more common with a recently described technique<sup>7</sup>. A TTS multiple-size balloon is chosen based on initial endoscopy. It is then inflated to the smallest diameter and pulled back through the esophagus, stopping if significant tension is noted. The mucosal is then evaluated and larger diameters employed until sufficient mucosal disruption is noted.

### ***Fundoplication, Linx and Other Foregut Surgeries With Dysphagia***

Dysphagia is relatively common after foregut surgery for reflux. Many patients recover without intervention but some require esophageal dilation. As with many disorders, a barium esophagogram is important in that it can exclude major disruption of the surgery and, at times, suggest an evolving motility disturbance, either of which predict a poor response to dilation. If the fundoplication appears "tight" then dilation to 20 mm may provide benefit. The new technique of EndoFlip may help identify an overly tight repair. Balloon or per-oral dilation can be performed. In fundoplication patients with refractory dysphagia, dilation with a 30 mm achalasia dilator has been reported to be safe and effective,<sup>19</sup> although a recent sham controlled study with a 35 mm balloon showed no difference.<sup>20</sup> The magnetic sphincter device (Linx) has a higher dysphagia rate than fundoplication with up to 60% having some degree of dysphagia after placement. Data on response to dilation are more limited but it seems to help in some cases. Fibrosis around the device may respond to 15 to 20 mm dilation.<sup>21</sup> Fluoroscopy may be enlightening if the beads of the device do not move or move asymmetrically with dilation.

Dysphagia after esophagectomy for esophageal cancer is very common and is often related to an anastomotic stricture.<sup>22</sup> Both per-oral and balloon dilators usually

provide initial success but recurrence of dysphagia is very common. In addition, some strictures are very tight and may require multiple, frequent session to reach an acceptable diameter. Adjuncts to dilation have included steroid injection, needle-knife incision and stent placement.

### ***Radiation Induced Strictures***

Proximal stenosis due to radiation for head and neck cancer are frequent and difficult to manage. More diffuse stenosis can occur after thoracic radiation for pulmonary or hematologic malignancies. When faced with a very tight stricture that does not allow passage of a small caliber endoscope, a flexible guidewire can be placed under fluoroscopic control to facilitate safe dilation. It appears that the risk of dilation is low but careful, graded dilation is still prudent. Radiation strictures seem to recur very quickly after dilation leading to the need to repeat the procedure every 2 to 4 weeks with the goal of progressively larger dilation. It is important to remember that many patients with head and neck cancer have multiple issues related to their therapy and a modified barium swallow with a speech therapist should be performed once a reasonable lumen has been re-established to make sure the patient is not aspirating and to help deal with pharyngeal dysfunction. The longer strictures associated with thoracic radiation are less likely to be extremely stenotic and can be treated similarly to EOE, although it is likely safe to be a bit more aggressive in dilation of these lesions.

If a guidewire cannot be placed across a stenosis, a combined antegrade-retrograde approach can be considered in experienced centers.<sup>23</sup> In this technique, a small caliber endoscope is passed into a pre-existing gastrostomy site and then retrograde up the esophagus. A guidewire can then be passed proximally and removed via a second endoscopy which was passed orally. If there is no lumen present, then re-establishment can be attempted using various incision techniques. This requires careful orientation with multiplane fluoroscopy and probably should be limited to centers with a high level of expertise. Once a wire is in place, appropriate dilation can then be performed, and a small-caliber nasogastric tube may be left in place to facilitate feeding and future dilation.

### ***Malignant Strictures***

Esophageal cancer can be encountered in patients with dysphagia and presents its own set of challenges. Ideally, a regular or small caliber endoscope can negotiate the stenosis allowing safe placement of a guidewire. As with above, a flexible guidewire can be advanced past the stenosis allowing safe dilation. Blind dilation of tight



strictures without fluoroscopic control should generally be discouraged due to the risk of perforation and the rare event of dilators going into fistulae. Adequate dilation for placement of an esophageal stent or to allow passage of endoscopic ultrasound is also frequently required, but must be weighed against the catastrophic complications that can result from the perforation of a malignant stricture.<sup>24</sup> Probe based ultrasound is an alternative to large caliber echoendoscopes and will not usually require aggressive dilation.

### *Empiric Dilation*

A normal endoscopy in the face of a suggestive dysphagia history is common. The use of a large-bore dilator to empirically dilate the esophagus has been performed and some patients report good relief of their symptoms. That having been said, randomized trials have not supported the concept.<sup>25</sup> One of the concerns raised is unappreciated EOE and how that might increase the risk of dilation. Empiric dilation may be reasonable when patients have previously responded without complication, prior endoscopy has not suggested any evidence of mucosal disease, a significant motility disturbance has been excluded and a barium tablet is delayed in passage through the esophagus.

Abnormal function of the cricopharyngeal area is common, especially with aging. Dilation may improve symptoms in a subset of patients,<sup>26</sup> although response is usually short lived and at times incomplete. Manometric signs of UES muscle dysfunction may predict response to esophageal dilation.<sup>27</sup> Careful endoscopic assessment is important, and most patients should have direct laryngoscopy performed by an otolaryngologist. It is important to remember that poor cricopharyngeal opening is often not the result of disease at the sphincter but may be due to weak pharyngeal muscle function not providing adequate pressure to open the already relaxed sphincter area. Although perforation should be very rare, special care should be taken when X-rays show a large osteophyte or post-surgical neck hardware pushing on the esophageal lumen.

### *Achalasia and EGJ Outflow Obstruction*

Pneumatic dilation is a unique procedure that should be performed by those who have expertise in the use of the technique and understand the disease process. The commonly used dilators come in 3 sizes (30, 35, and 40mm-Rigiflex dilator). Initial dilation should be performed with the 30mm dilator since it is effective and probably safer. Patients should understand that significant perforation requiring surgery is possible in up to 2% of cases. This is not a “through the scope” technique. An endoscope is passed through the esophagus into the stomach (with a careful retroflexed view to rule out an esophagogastric

tumor). The dilation can be performed with fluoroscopic or endoscopic control. When using fluoroscopy, the guide-wire is placed, then the endoscope is pulled back to the EGJ. Fluoroscopy is used to identify the location of the LES and the endoscope is withdrawn. The balloon is passed over the wire and position verified fluoroscopically. There are 4 radio-opaque rings on the balloon. The middle 2 are close together and represent the center of the balloon which should be at the predetermined location of the LES. The balloon is then progressively distended until the stenosis disappears on fluoroscopy. This usually requires a pressure of 10 to 15 PSI (I stop at 12 unless the stenosis appears to be persisting). The balloon tends to migrate if not held tightly at the mouth and I watch it with fluoroscopy to make sure it stays in the appropriate position. There are no clear data on how long to keep the balloon inflated, but shorter durations seem to be effective in that a brief 6 second duration was equal to 60 seconds if the balloon’s waist was obliterated.<sup>28</sup> The balloon and the wire are then withdrawn and blood on the balloon is common.

The method for endoscopic control is not as well described with 1 report suggesting using a retroflexed endoscopy to make sure the balloon is in the correct position<sup>29</sup> and others with the endoscope proximal to the balloon.<sup>30</sup> Either way, care must be taken to ensure the balloon remains in the correct position. Given the tendency of the balloon to migrate, I continue to use fluoroscopic control. Traditionally, a contrast study has been performed after the dilation, but recent guidelines have suggested that this can be eliminated unless there is clinical concern for perforation.<sup>31</sup> Personally, I continue to do a routine contrast study after most of my pneumatic dilations. Pneumatic dilation is also an appropriate approach in some patients with failed relief of dysphagia after myotomy.<sup>32</sup> A new 30mm balloon device is available (EsoFlip) that uses impedance planimetry to ensure correct position rather than endoscopy or fluoroscopy. Early data indicate that it may provide an effective alternative<sup>33</sup> and I have used it on occasion with success. The above noted processes should be followed including careful localization and post procedural care.

Recently, a more aggressive approach to poor LES relaxation (EGJ-outflow obstruction) in patients without manometric achalasia has been advocated. Isolated EGJ outflow obstruction should not lead to pneumatic dilation unless the patient has evidence of delayed esophageal emptying on a timed barium study or perhaps confirmation using EndoFlip.<sup>34</sup> The technical approach is identical to that with achalasia.

### *Post Dilation Management*

Most patients recover normally after a dilation. If they have persistent pain or other concerning symptoms they

should be evaluated in the recovery area. Occasionally, examination can suggest perforation when subcutaneous air is noted in the neck. Imaging with either a water-soluble esophagogram or, at times CT scan can be considered to rule out perforation. Pain is particularly common after dilation of EOE and usually does not indicate perforation. I believe pain is more commonly reported after pure propofol based sedation as opposed to conscious sedation using some narcotic. If their exam is acceptable, a small dose of narcotics in the recovery area (25-100 µg of fentanyl for example) may provide acceptable analgesia post dilation. Patients should be pain free or nearly so prior to discharge. Free perforation after dilation is rare and requires admission and surgical consultation. Use of a covered, expandable stent has been reported as a method to avoid major surgery in patients with a dilation induced perforation.<sup>35</sup>

## Summary

In summary, esophageal dilation is an important tool for all gastroenterologists. Regardless of the disease or indication, several things should be part of the care of these patients:

- An appropriate history and barium study of the esophagus may be used to guide and plan for dilation
- Careful endoscopy with biopsy when needed is important prior to dilation.
- Regardless of technique careful control using endoscopy, endoscopic landmarks, fluoroscopy, or a combination is important to optimize outcomes
- The approach varies depending on disease (eg, careful, gradual dilation in EOE compared to more aggressive dilation of lesions like Schatzki's ring)
- Most patients do well but post-procedural symptoms should be taken seriously and investigated when appropriate
- Acid suppression decreases recurrence of lesions that are associated with acid reflux (strictures and rings)
- Most lesions can be controlled and reasonable swallowing re-established, although some patients may require multiple and frequent treatment sessions to obtain and maintain an adequate lumen.

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