The Two-Pound Rule: A Personal Experience with 1,226 Cases of Esophageal Dilation

Charles J Filipi, MD, FACS, Amr El Sherif, MD

Esophageal dilations are commonplace; in fact 800,000 dilations are performed annually in this country. Many patients experience difficulty swallowing from a variety of causes including cancer, ulcerations (peptic strictures), eosinophilic esophagitis, congenital webs, strictures from caustic materials, and radiation therapy.

There are many dilators commercially available. They fall into three categories: balloons, guided tapered tubes, and an optical dilator. The latter is a hollow transparent tube within which an endoscope is placed. The endoscope enables visualization of the obstructing lesion through the transparent wall as the dilation progresses. Balloons are placed through the biopsy channel of an endoscope and inflated within the obstruction, but one balloon can dilate only to three sizes. Finally, the tapered tubes are placed either over a guidewire introduced at endoscopy or they are passed freely. Several (up to 14) dilators are placed through the obstructing lesion. The risk of bacteremia is increased as more dilators are used.[1]

Complications from esophageal dilations occur infrequently, but a missed perforation can have devastating consequences, including death. The chance of bacteremia can be reduced with an efficient dilation system, but the overall incidence of esophageal perforation has not been reduced.[2-4] Avoiding aggressive dilation in high risk lesions may be helpful.[5,6]

During the senior author's residency, he was instructed by a respected faculty member not to introduce a rigid esophagoscope with more than 2 pounds of pressure. A 2-pound "push" was measured with weights, and the 2-pound rule was adhered to as much as possible during esophageal dilations throughout the senior author's career. The results were satisfactory in terms of complications.

Details of this dilation technique have not been previously reported. In this article, we discuss the senior author's experience with 1,226 esophageal dilations, patient complications, and the dilation technique used, with an emphasis on safety measures.

Competing Interests Declared: None.

Received March 6, 2007; Accepted March 14, 2007.
From the Department of Surgery, Creighton University, Omaha, NE.
Correspondence address: Charles J Filipi, MD, Creighton University, Department of Surgery, 601 N 30th St, Suite 3740, Omaha, NE 68131.

Methodology

Records of dilations performed by the senior author were reviewed. Patients with empiric dilation of the upper esophageal sphincter and patients undergoing dilation during operations were included. Patients who had a dilator placed for intraoperative calibration of a Nissen fundoplication or diaphragm closure were excluded. Pneumatic dilation for achalasia was not included in this series. The number of patients was tabulated, and patients experiencing potentially serious complications were reviewed.

Technique

With the patient in the left lateral decubitus position after endoscopy, one of three techniques was used, depending on the following circumstances. The Savary guidewire system (Bard Interventional Products) was used for patients with a tortuous esophagus, esophageal diverticuli, cancer, a small-caliber peptic stricture, an obstructing lesion longer than 3 cm, an esophageal anastomosis, or a previous fundoplication. The Hurst Maloney system (Medovation) was used for patients with a straight esophagus. A water-filled balloon system (Boston Scientific Corp) was used for patients with anastomotic strictures in which Decadron (Merck) was to be injected.

Savary guidewire system

At endoscopy, the guidewire was introduced through the endoscope biopsy channel after being lubricated with a silicon spray or gel. The spring tip was placed next to, but not necessarily through, the pylorus. The endoscope was removed over the guidewire incrementally, with the operator calling out "five" each time the guidewire was pushed 5 cm into the endoscope. At the time of the "five," the nurse assistant pulled 5 cm of endoscope out, using the face plate of the bite block as the point of reference. After the endoscope was off the guidewire, the size of the first dilator was chosen on the basis of endoscopic findings.

If the endoscope was too large for the obstructing lesion, a pediatric endoscope or a transnasal endoscope was used. If the latter could not pass the obstruction, the guidewire was advanced slowly until light resistance was encountered. This was done only if the lumen could be seen beyond the obstruction; otherwise, the procedure was performed under fluoroscopic control.

All Savary dilators in our laboratory have been marked

ISSN 1072-7515/07/$32.00
doi:10.1016/j.jamcollsurg.2007.03.029

circumferentially with indelible black ink 40 cm proximal to the beginning of the dilator's maximum diameter. Dilators were lubricated with either KY jelly (Johnson and Johnson Inc) or PAM (ConAgra Foods Inc), the operator held the dilator just outside the bite block with the left hand, and the right hand was placed proximal to the 40-cm mark with the thumb on the mark. The dilator was advanced slowly through the upper esophageal sphincter resistance (usually about 5 pounds for a 60-F dilator). The dilator progression through the esophagus is easy above the obstruction. Care was then taken not to push the dilator above 2 pounds. When the thumb of the right hand reached the bite block, it was assumed that the largest circumference of the dilator had traversed the obstruction. If the patient was tall, the dilator was pushed an additional 5 cm. If the dilator could not be passed through the obstruction, the dilator was pulled back, rotated, and pushed again, being careful to not exceed the 2-pound limit. If the dilator would not pass, using this protocol, a smaller dilator was chosen until one would pass the obstruction.

Additional resistance could be caused by the edge of the inner hole of the bite block, necessitating a slight bend in the dilator, and episodes of patient retching. The latter was avoided by waiting until the retching stopped. Additional sedation was often necessary in this situation.

Hurst Maloney system

The previously mentioned exclusion criteria for this system were observed. After the endoscope was removed, the chosen dilator was thoroughly lubricated and the distal tip was placed in the hypopharynx. Multiple passes were made until the tip entered the upper esophageal sphincter. Minimal resistance should be experienced at this phase of introduction. The patient may retch, and patience is important. With pressure no greater than 2 pounds, the dilator was advanced to the 20-cm mark from the beginning of the maximal diameter of the dilator. If the dilator had passed easily in to this point ($<$ 2 pounds of pressure), it was then advanced through the upper esophageal sphincter. After this, passage was easy until the point of obstruction, and the same axial pressure precautions used with the Savary system were observed.

Water-filled balloon system

Under direct endoscopic visualization, the balloon was introduced through the biopsy channel of the endoscope. Balloon sizes were chosen on the basis of the appearance of the anastomosis. The balloon was positioned midway within the obstructing lesion and inflated to the prescribed pressure. During balloon inflation, the endoscope was secured to the bite block by the nurse assistant, and the operator held the balloon catheter shaft at the endoscope insertion point to prevent proximal or distal balloon movement out of the area of obstruction. This process continued to the maximum sized balloon.

RESULTS

A female patient who underwent uncomplicated esophageal dilation for benign disease was noted on a postprocedure esophagram to have an extraluminal, linear 4-cm tract of contrast exiting from the esophagus and running parallel to the lumen. The patient was admitted to the hospital for observation. During the 2-day stay, she remained afebrile, her daily white blood cell count was never more than 9,000/μL, and she experienced no chest pain at any time. Physical findings were also normal. She was discharged and had an uneventful course.

No other patients experienced evidence of esophageal perforation or bacteremia on followup phone calls or office visits. It is possible that a complication occurred in this group because many patients were referred from outside facilities, but no notification was received.

DISCUSSION

Maximum preventative measures are imperative during esophageal dilation because the associated mortality rate for esophageal perforation is high.[6-8] Dilation techniques with the Savary system have been described previously, but none, to our knowledge, have described in specific terms the optimal axial force limit. In this article, we used 2 pounds of force as the parameter for safe dilation and had a 0.082% perforation rate, which is less than the normal incidence of 1.1%.[4]

Within this series, there was no attempt to avoid high risk patients, although the number of patients with radiation strictures, caustic strictures, and eosinophilic esophagitis was low. Direct esophageal wall observation after graduated dilation in these patients would probably be appropriate and is recommended.

The technique used emphasizes deliberate gentle dilation while monitoring the force applied to the dilator as it engages the obstructing lesion. This is not easy in combative patients or in those who are retching. In these circumstances, it is appropriate to either terminate the procedure and attempt the dilation under Diprivan (AstraZeneca; Propofol) or increase the sedative. In our circumstance, an anesthesiologist must be in attendance if Diprivan is to be used, so the procedure often was cancelled.

To adhere to the 2-pound rule, one must be aware of the friction applied by the outer edges of the bite block hole on the dilator. This can exceed 2 pounds, but can be avoided by bending the dilator slightly as it traverses through the bite block. In addition, the upper esophageal sphincter will

often exert more than 2 pounds of resistance if the dilation is not progressive, as in a 60-F empiric dilation of the upper esophageal sphincter. The 2-pound rule applies after the largest diameter of the dilator passes through the upper esophageal sphincter, which, in most patients, is 20 to 25 cm from the incisors. It is very tempting to push harder through the obstruction because the operator has tremendous mechanical advantage. A disciplined and focused approach is necessary during this phase of the procedure.

Dilation for high-risk lesions, such as cancer, requires the same care. But there is often more bleeding after dilation of a malignancy, and it is important to introduce the endoscope through the lesion so the guidewire can be placed accurately. If the endoscope cannot be passed through the malignancy, a pediatric or even a transnasal endoscope is used. If neither of these endoscopes can traverse the lesion, the case is terminated. The guidewire may pass without the endoscope through the lesion, but it is considered unsafe in our clinic to perform dilation in this circumstance. We do not use Hurst Maloney dilators in patients with cancer or any complex lesion, including postoperative Nissen fundoplication patients, because this dilator can fold at its tip, increasing its diameter and the risk of perforation.

Under fluoroscopy, we advance the dilators, still observing the 2-pound rule. If stent placement is to be performed, minimum size dilation must be achieved, but it is important not to exceed the 2-pound rule; even though the patient needs a stent, the stent may have been opened and perhaps the patient is under general anesthesia, all factors creating a relative urgency.

There were no known symptoms of bacteremia within this series. This complication is insidious and may have gone unrecognized. A specific effort to decrease the number of dilators used and the time of dilation was not implemented.

In conclusion, esophageal dilation is not difficult, but it is dangerous. All methods must be used to avoid esophageal injury. An esophageal dilation method that controls the amount of axial pressure applied to the obstructing lesion may be of benefit.

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