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INTRODUCTION

Hypopharyngeal diverticula, most commonly Zenker’s diverticulum (ZD), are relatively rare. The annual incidence of ZD’s is two per 100,000 patients, whereas the incidence of other hypopharyngeal diverticula is less known.1,2 The most commonly accepted theory for development of ZD’s postulates that a poorly compliant upper esophageal sphincter allows for increased pressurization of the hypopharyngeal region compared to a relative weakness proximal to the cricopharyngeus muscle during swallowing. This increased pressure time creates a pouch of mucosa that herniates through a weak area in the posterior hypopharyngeal wall between the inferior constrictor muscle and the cricopharyngeus muscle, known as Killian’s triangle, and thus a ZD is born. The restricted opening of the cricopharyngeus muscle is thought to be from muscle degeneration with replacement by fibroadipose tissue over several years’ time.3 Other diverticula, such as the Killian Jameson (KJ) diverticulum, arise from a weakness and increased pressure along the anterolateral position inferior to the cricopharyngeus muscle. The proximity of the KJ diverticulum to the recurrent laryngeal nerve (RLN) makes this more susceptible to neural injury during surgery. Another less common diverticulum, the Laimer diverticulum, arises from the Laimer-Haeckerman’s triangle, inferior to the cricopharyngeus muscle, and are more commonly a broad based posteriorly oriented diverticulum.4

Historically, ZD’s have been treated by transcervical diverticulectomy and cricopharyngeal myotomy, with a high success rate. However, since the 1980s, approaching ZD’s endoscopically has become popularized.5–7 In a meta-analysis of ZDs, 865 patients were treated across 11 selected publications, of which 106 patients were treated by an open transcervical approach, 310 endoscopic laser diverticulotomy, and 449 with an endoscopic staple assisted diverticulotomy. The authors found that no one method was superior to another, and that both dysphagia and regurgitation significantly improved no matter which method was chosen.8 With this in mind, the endoscopic approach has nearly become the standard of care when approaching ZDs, leaving the open approach for recurrent ZD, the less common diverticula, and in patients who fail endoscopic exposure. Since even less is known regarding incidence or surgical outcomes of the more uncommon esophageal diverticula, such as Killian Jameson, Laimer, and iatrogenic subtypes,9 it is important to remember that anatomical factors such as kyphosis, trismus, or cervical arthritis may preclude access for an endoscopic approach. Keeping these factors in mind, we have found the need to describe the hybrid utilization of flexible endoscopy during the open approach in treating diverticula.

Herein we describe three unique situations where use of a flexible esophagoscope (referred to as transnasal esophagoscopy, TNE) can be used during open transcervical diverticulectomy. Indications for this technique include: difficult exposure or an atypical location (KJ, Laimer’s, iatrogenic); using the TNE to confirm/ensure adequate myotomy and sac removal to decrease outflow obstruction after staple or pexy is completed; and finally, using the TNE for an intraoperative leak test to prevent fistula and/or delayed infection.

METHODS

Difficult Exposure, Identification

The patient is placed in the standard position for rigid esophagoscopy. Either the Weerda Distending Diverticuloscope (Karl Storz, Tuttingen, Germany) or the Benjamin Slimline Operating Laryngoscope (Karl Storz, Tuttingen, Germany) can be used to gain access to the esophagus, exposing the pouch and the party wall (esophagodiverticular septum.) During the exposure it is vital to ensure visualization of both the inferior most aspect of the pouch and the esophageal inlet together. This is
Intraoperative Leak Testing

Improving Outflow Obstruction

If the pouch was not accessible for packing during rigid endoscopy, identification of the pouch is facilitated by using both direct observation of the light from the endoscope and air insufflation (Fig 2). This is quite helpful especially in a recurrence and with diverticula in an unusual location, such as a traction or KJ diverticulum. The dissection is then continued to isolate the esophageal diverticulum from all fascial attachments as well to identify and isolate the cricopharyngeus muscle and the RLN in patients during KJ surgery. Next, the cricopharyngeal myotomy is performed (when indicated), and the diverticulectomy of the pouch performed. Flexible esophagoscopy can be performed again to ensure adequate myotomy. Often with use of a stapler, there will remain a small shelf-like protrusion at either the superior or more commonly, the inferior edge of the transected pouch. Use of vascular hemoclips can be used to narrow the remaining luminal protrusion (Fig 3).

Intraoperative Leak Testing

Finally, to ensure closure and no leakage at the end of the procedure we add saline into the surgical bed and the surgeon looks for air bubbles as air is insufflated with the esophagoscope. If no leak is observed then the surgical wound can be closed in the usual fashion. This is particularly valuable if an unintended enterotomy has occurred and can be immediately repaired.

RESULTS

When reviewing cases performed by our two institutions, we found that out of the 26 cases using these techniques that 10 (38%) were ZD, 9 (35%) Killian Jameson, six (23%) iatrogenic, and one (4%) Laimer diverticulum.

DISCUSSION

In the authors’ experience, the small caliber flexible esophagoscope (TNE) is routinely used in difficult endoscopic and open cases over the last 10 years. It is used to aid in diagnosis and allow confirmation of the diverticulum and esophagus especially in the difficult-to-expose patient. This technique has been particularly helpful in the exposure and identification of non-Zenker hypopharyngeal diverticula. Furthermore, it is a useful tool for intraoperative evaluation of outflow obstruction and esophageal leak.

The utility of a flexible esophagoscope (TNE) is three-fold. First, it helps verify surgical landmarks and confirm
identification of hypopharyngeal esophageal diverticula in challenging exposures and facilitates identification and dissection of the sac in the neck. Second, it can be used to confirm and improve outflow tract obstruction after diverticulectomy (± myotomy). Finally, the flexible esophagoscope may help ensure proper seal and closure of the diverticulectomy by use of insufflation. This is a valuable tool that should be considered in open hypopharyngeal diverticulum surgery.

**BIBLIOGRAPHY**


