

Transoral Endoscopic Zenker Diverticulotomy

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Introduction

Zenker's diverticulum is an outpouching that emerges from Killian's triangle dehiscence, formed by oblique fibers of the inferior pharyngeal constrictor muscle and cricopharyngeus muscle. The reported prevalence lies between 0.01 and 0.11% and affects predominantly middle-aged and elderly patients [1].

Pathophysiology

The development of Zenker's diverticulum is proposed to be due to cricopharyngeal dysfunction (CPD). In CPD, repeated discoordination between the upper esophageal relaxation and pharyngeal contraction during deglutition results in perpetual increased intra-esophageal pressure contributing to the development of the outpouching over the anatomic weakness of the Killian dehiscence [2]. Similarly, patients with Zenker's diverticulum may have coexisting gastroesopha-

geal reflux disease (GERD) and hiatus hernia, although the causal relationship between these conditions has not been established [3, 4].

Clinical Features

- Small diverticula are typically asymptomatic and may be detected incidentally on cross-sectional imaging such as computed tomography of the neck (CT neck).
- Larger diverticulum (typically more than 1 cm)—patients may present with halitosis, gurgling in the throat, regurgitation of food into the mouth, dysphagia, and even frank aspiration symptoms. In those with longstanding dysphagia, they may present with significant weight loss and malnourishment [5]. Examination of the head and neck region is usually unremarkable. On flexible nasopharyngoscopy, there may be pooling of saliva in the hypopharynx. Occasionally, a soft swelling in the neck with a positive Boyce's sign may be present. Boyce's sign refers to the presence of a splashing sound during palpation over the soft swelling in the neck. This is due to accumulated fluid within the diverticulum.

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Investigations

1. Barium swallow test.
2. CT neck.

3. Functional endoscopic evaluation of swallowing (FEES) and/or Video fluoroscopy (VFS).

These investigations are performed when the clinical suspicion of aspiration is high. VFS can also be used to assess the narrowing of pharyngo-esophageal sphincter and persistent prominence of cricopharyngeus muscle termed as the cricopharyngeal bar [6].

associated with an open approach were more severe including recurrent laryngeal nerve injury (3.3%) and esophageal perforation (3.3%) [8]. Transoral approach has a shorter operation time and shorter length of stay [9]. However, failures associated with a transoral approach lie in the difficulty of adequate visualization of the surgical field; and incomplete division of party wall resulting in an inferior ridge [10].

Treatment Options

Surgery is indicated for patients with symptomatic Zenker’s diverticulum. Most patients with a small diverticulum (usually less than 1 cm) are usually asymptomatic.

Surgery can be broadly divided into endoscopic transoral versus an open transcervical approach. In the transoral endoscopic assisted approach, the aim of surgery is to divide the “party septal wall” between neck of the diverticulum and true esophageal opening. This procedure creates a common cavity between the esophageal lumen and diverticulum. Table 1 summarizes the pros and cons of these two approaches.

Overall, transoral endoscopic approach has lower morbidity of 8.7% as compared to open approach of 10.5%. The most common complications associated with transoral approach are cervical emphysema (2.2%), perforation (1.4%), and dental injury (1.1%); whereas complications

Contraindications

Incidental small Zenker’s diverticulum of less than 1 cm does not require any surgical intervention as these patients are usually asymptomatic.

Contraindications for a transoral approach include factors that preclude adequate exposure of the hypopharynx. These factors can be summarized according to the 8 Ts of endoscopic access: teeth, trismus, transverse dimensions (mandibular), tori (mandibular), tongue, tilt (atlanto-occipital extension), treatment (prior radiotherapy), and tumor [11].

Preoperative Assessment

A barium swallow test should be done to confirm the diagnosis of a Zenker diverticulum, and to assess swallowing and the length of diverticulum (Fig. 1). Additionally, staging system can be

Table 1 Summary of the pros and cons of open versus endoscopic approach

	Open approach	Transoral endoscopic approach
Pros	Lower risk of symptom recurrence	Less invasive Shorter operating time Shorter length of hospitalization Earlier diet introduction Lower rate of complications Easy access in case of recurrence
Cons	More invasive Longer operating time (standardized mean difference 78.06 min, 95% CI 90.63,65.48) [7]. Longer length of hospitalization Longer time to diet introduction Higher rate of complications including recurrent laryngeal nerve injury	Higher rates of symptom recurrence



Fig. 1 Barium swallow (lateral view) demonstrating Zenker's diverticulum

assessed on barium swallow test using Morton's staging system [12].

1. Small sacs are less than 2 cm in length.
2. Intermediate sacs are 2–4 cm in length.
3. Large sacs are greater than 4 cm in length.

OT Setup and Equipment Required

- Supine position with head donut and no shoulder roll.
- TV tower system monitor at the patient's foot.
- Weerda diverticuloscope.
- Long suction device.

Surgical Technique

- Patient is put under general anesthesia with complete muscle paralysis.
- Rigid esophagoscopy is performed to examine the entire length of the cervical esophagus.
- The scope is then slowly removed until the diverticulum is encountered at the level of cricopharyngeus before removing completely. This allows confirmation of the diagnosis and facilitated the identification of the true esophageal lumen and the lumen of the diverticulum.

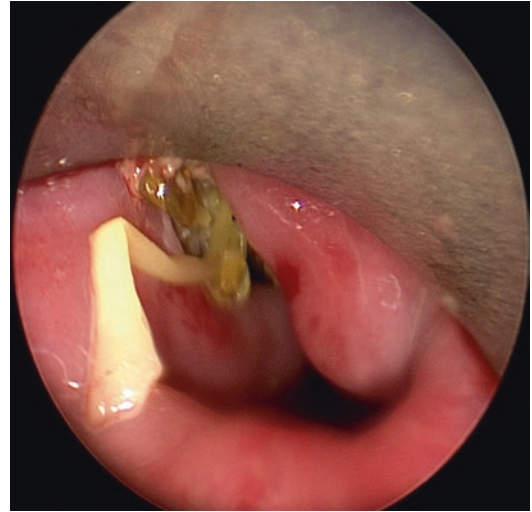


Fig. 2 Endoscopic exposure of Zenker's diverticulum sac and septum between the diverticular sac and cervical esophagus—with food debris seen in diverticulum sac

- The rigid Weerda diverticuloscope (Karl Storz, Tuttlingen, Germany) is placed with anterior blade into the lumen of esophagus and posterior blade in the diverticular sac. The diverticuloscope is opened proximally sufficiently in order to allow a zero-degree 4 mm telescope and stapler insertion.
- Once a good exposure of the party wall is accomplished, the 12 mm endo-GIA 30 stapler (US Surgical Corp, Norwalk, CT) is inserted to engage septum between diverticulum sac and esophagus under direct vision. Some surgeons recommend two stay sutures to be applied on both sides of the cricopharyngeus muscle in order to retract the party wall for ease of stapling. This step can also minimize any remnant inferior ridge left in situ after the stapling process.
- Once endo-stapling of the party wall is accomplished, the divided party wall is inspected using an endoscope to ensure that there is no residual inferior ridge. The stapler line is also inspected to ensure complete closure and hemostasis.
- The summary of the surgical steps is presented in (Figs. 2, 3, and 4)



Fig. 3 Endoscopic exposure of Zenker's diverticulum sac and septum between the diverticular sac and cervical esophagus

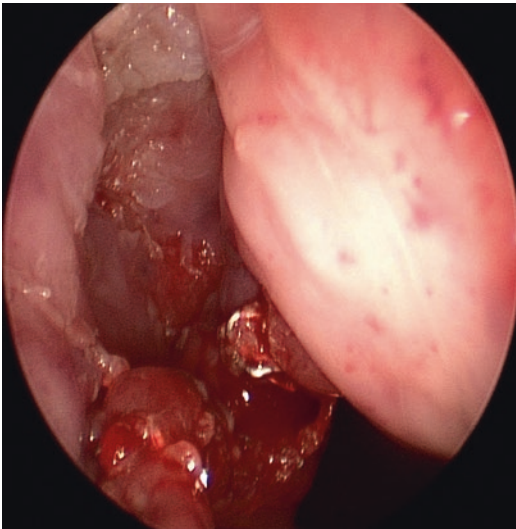


Fig. 4 Septum stapled to the inferior end of the diverticulum

Complications and Management

- Pain or discomfort of the throat—usually temporary and resolve by 1–2 days.
- Esophageal perforation leading to subcutane-

ous emphysema and possibly mediastinitis if undiagnosed intraoperatively.

- Bleeding—endolaryngeal bipolar diathermy can be used to achieve hemostasis.

Postoperative care

1. Keep nil by mouth for 24–48 h.
2. Gastrograffin swallow to be performed 24–48 h postoperatively. If there is no esophageal leak noted, oral liquid diet can be started for approximately 1 week before progressing to semi-solid diet in the next 2–4 weeks.
3. Antibiotics coverage for 1 week (covering broad spectrum bacteria including anaerobes. Clindamycin is a good alternative for those patients who are allergic to penicillin-based antibiotic.
4. Adequate analgesia.

Conclusion

Transoral endoscopic Zenker diverticulotomy is a minimally invasive approach that is effective and safe to improve symptom control among patients with this condition. Appropriate patient selection and complete division of the septal party wall between the diverticulum and true esophageal lumen are key pointers towards a successful clinical outcome.

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