



# Hypopharyngeal Diverticulum: Toward a Unified Understanding of Its Etiopathogenesis

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## Abstract

The etiopathogenesis of Zenker’s diverticulum (ZD) remains uncertain. Increased hypopharyngeal pressure due to a hypertonic upper esophageal sphincter results in herniation proximal to the sphincter producing a pulsion diverticulum. Gastroesophageal reflux, which is known to induce shortening of the injured esophagus, likely plays a prominent role in ZD formation by pulling the cricopharyngeus muscle (CPM) away from the anchored inferior constrictor muscle. This creates a “weak zone” encouraging herniation. A bilobed diverticulum may originate from continuation of the fibrous midline raphe inferiorly to developmentally include part of the CPM. We report using laser endoscopy to divide the inter-diverticular septum followed by transmucosal cricopharyngeus myotomy. Presentation of a rare, bilobed diverticulum emphasizes the importance of the midline prevertebral raphe in anchoring the pharyngeal constrictor muscles with respect to the CPM. This lends support to the hypothesis that the etiopathogenesis of ZD is multifactorial while guiding us to a unified understanding of ZD.

**Keywords** Zenker’s diverticulum · Etiology · Pathogenesis · Bilobed Zenker’s diverticulum · Laser repair

A 78-year-old man presented to our outpatient clinic with several months of difficulty swallowing. His symptoms were worse with solid foods compared to liquids, and he also noted an increased production of “phlegm.” He had no significant past medical history.

On physical examination, he had a strong voice and his oral cavity was clear. Fiberoptic laryngoscopy revealed pooling of secretions in the vallecula and pyriform sinuses, but normal appearing laryngeal anatomy.

A complete metabolic panel, complete blood cell count, and coagulation studies were all within normal limits. A modified barium swallow study was performed by a speech and language pathologist (Fig. 1).

## What is the Diagnosis and Treatment?

The barium esophagram demonstrated a moderately enlarged, laterally displaced diverticulum of an unusual shape, as well as a small hiatal hernia. The patient was taken to the operating room and provided general anesthesia with orotracheal intubation. An esophagoscope was advanced to expose the upper esophageal sphincter where a ZD with a midline septum was visualized (Fig. 2a). A wire guide was passed through the upper esophageal sphincter and serial dilations were performed to dilate the sphincter.

The vertical septum within the Zenker’s pouch was horizontally divided using a CO<sub>2</sub> laser at 7 watts (Fig. 2b). This was followed by a vertical, transmucosal division of the CPM, opening the fundus of the diverticulum followed by insertion of a nasogastric tube (Fig. 2c).

A month later the patient was noted to be tolerating solid foods without “phlegm” or regurgitation.

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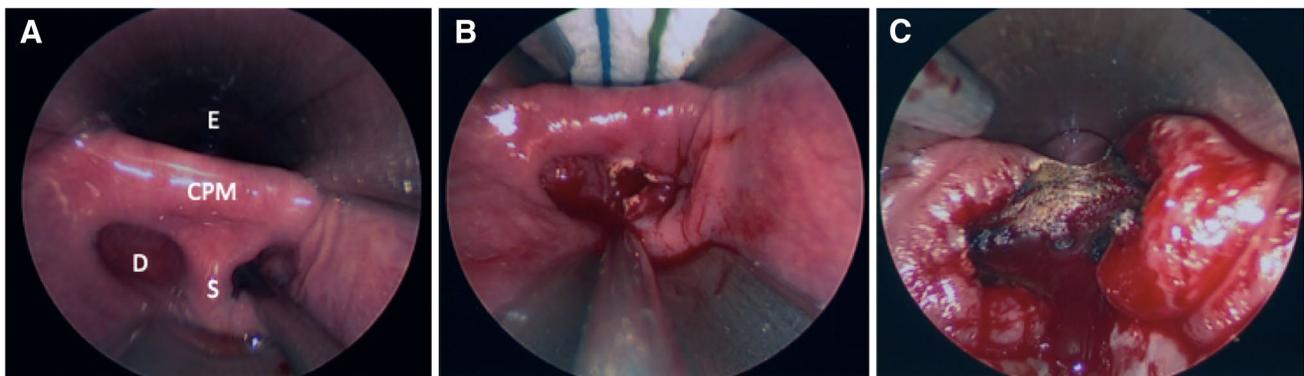
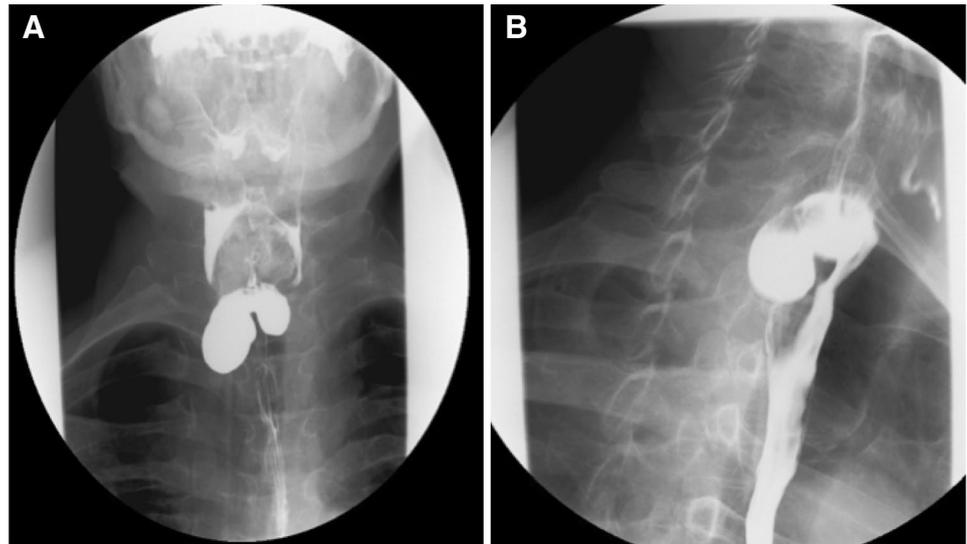
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## Discussion

A lack of vertical CPM stabilization allows it to be displaced caudally in relation to the anchored inferior constrictor muscle resulting in “Killian’s triangle.” [1]. The most prevalent

**Fig. 1** Barium swallow: **a** Anterior–posterior view of a bilobed diverticulum. **b** Lateral view of diverticulum



**Fig. 2** Bilobed Zenker's diverticulum: **a** Endoscopic view of bilobed Zenker's diverticulum. The mid-diverticular septum likely represents a submucosal midline pre-vertebral raphe with a developmental attachment to the horizontal fibers of the CPM. **b** Post-midline

septum ablation with CO<sub>2</sub> laser. **c** Transmucosal division of the cricopharyngeus muscle with opening of the diverticular fundus to esophageal lumen. (*E* esophagus, *CPM* cricopharyngeus muscle, *D* diverticulum, *S* septum)

theory for the reflux-related formation of ZD is an increased resting tone of the cricopharyngeus, resulting in a pulsion pseudodiverticulum through Killian's triangle [1]. However, the variation among different manometric studies does not allow for a conclusive pathogenic model [2]. Another explanation for its etiopathogenesis involves esophageal shortening induced by reflux injury [3]. A downward force acting on the un-anchored CPM may produce an inferior displacement of the muscle in relation to the inferior constrictor muscle predisposing an individual to ZD [4]. Regardless, a bilobed pseudodiverticulum would likely originate from a developmental submucosal attachment of the midline raphe to the upper horizontal fibers of the CPM.

Since 1942, ten cases of bilobed ZD have been reported. Dividing the mid-diverticular septum using a CO<sub>2</sub> laser is reported here for the first time, and is a safe maneuver to allow for one continuous sac to be opened into the

esophagus. Appreciating the radiographic presentation of a bilobed ZD, which may be interpreted as a lateral pulsion diverticulum—more consistent with a Killian–Jamieson—is an integral part of pre-operative planning. Most importantly, this report of an uncommon clinical presentation suggests a multifactorial etiopathogenesis, and a rare opportunity guiding us toward a unified causal understanding of ZD.

### Compliance with Ethical Standards

**Conflict of interest** The authors declare that there is no conflict of interest.

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