



ANAESTHETIC MANAGEMENT OF A CASE OF ZENKER'S DIVERTICULUM POSTED FOR Z-POEM UNDER GENERAL ANAESTHESIA

Anaesthesiology

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ABSTRACT

Zenker's diverticulum is a rare disorder characterized by the herniation of the post-pharyngeal wall through the Killian's triangle, located between the inferior constrictor muscle and the cricopharyngeus muscle. Surgical intervention used to be the primary treatment for Zenker's diverticulum, despite its high morbidity and mortality rates. In recent years, Z-POEM, a technique utilizing third-space endoscopy, has emerged, specifically tailored for Zenker's diverticulum. It is a relatively new addition to the natural orifice transluminal endoscopic surgeries (NOTES). Usually carried out in endoscopy suites, a crucial step in the procedure involves creating a submucosal tunnel in the esophageal wall and the continuous insufflation of CO₂ can inadvertently lead to complications such as subcutaneous emphysema, capnomediastinum, capnothorax, or even capnoperitoneum, due to tracking of CO₂ in surrounding tissues. Anesthesiologists face the challenge of not only administering anesthesia in a remote location, but also promptly detecting and managing these complications. Here, we outline the effective anesthetic management in the case of an adult male diagnosed with Zenker's Diverticulum who underwent Z-POEM procedure under General Anesthesia.

KEYWORDS

Z-POEM, Zenker's diverticulum, General anesthesia, Anesthesia Challenges

INTRODUCTION

Zenker's diverticulum is a rare disorder characterized by the herniation of the post-pharyngeal wall through Killian's triangle, located between the inferior constrictor muscle and the cricopharyngeus muscle. It predominantly affects males and elderly individuals, with the exact cause remaining unknown (1).

Surgical intervention has been the primary treatment approach for the condition, despite its associated morbidity and mortality rates. (2). Endoscopic interventions, aimed at septum cutting, have been explored but are associated with risks such as perforation and incomplete septum cutting, leading to higher recurrence rates (3).

In recent years, there have been some reports of managing Zenker's diverticulum using Peroral Endoscopic Myotomy (POEM) (4). POEM, based on the concept of tunneling or "third-space" endoscopy, has gained popularity for various indications, including Zenker's diverticulum.

Building upon this, a novel approach, termed Z-POEM, has emerged in recent years, aiming to address the condition through a modified POEM technique tailored specifically for Zenker's diverticulum. Although a relatively short procedure, general anesthesia is usually a preferred modality in POEM surgeries.

Numerous studies indicate that maintaining a positive intrathoracic pressure under general anesthesia with endotracheal intubation reduces the risk of iatrogenic events such as perforation, bleeding, and CO₂ insufflation-related complications compared to intravenous sedation during a POEM procedure (5,6).

Based on a similar rationale, here we report a case of per-oral endoscopic myotomy for Zenker's diverticulum (Z-POEM) performed safely under general anesthesia without any major complications.

Case Report

A 51-year-old male patient with a known upper esophageal stenosis, and a Zenker's Diverticulum, presented with dysphagia to solids and semi-solids, insidious in onset, localized to neck, and gradually progressive in nature since 6 years. A prior OGDscopy was performed, which revealed a large diverticulum at the upper end of the esophagus.

Zenker's diverticulum extended from 15 to 20 cm from incisors. A CT scan of the chest revealed a large out-pouching showing air-fluid level arising through a defect measuring 1.5 cm in the posterior pharyngeal wall at the level of extending on the left posterolateral aspect which shows pooling of contrast in the outpouching; the features suggestive of an esophageal diverticulum likely Zenker's diverticulum.

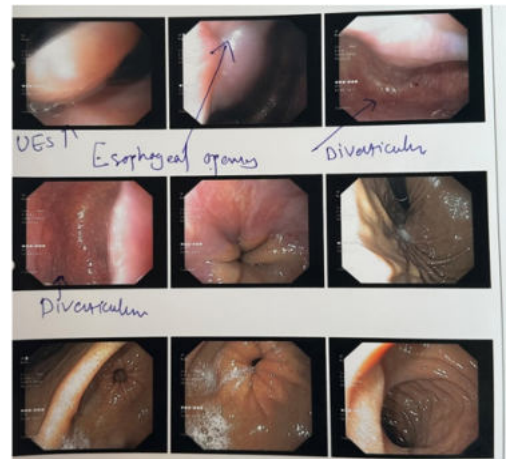


Fig 1. OGDscopy showing Zenker's Diverticulum

The patient was a known case of hypertension, well controlled on regular medications. His vital parameters were within normal limits. The mouth opening of the patient was 3 Finger Breadth and his Mallampatti Classification was Class 2. His systemic examination and blood workup were within normal limits. A decision to take up the patient for Z POEM under general anesthesia was made. After explaining the procedure, and the various risks and obtaining proper consent, the patient was classified under ASA (American Society of Anaesthesiologists) grade 2 and prepared for surgery.

The patient was taken to the endoscopic suite after confirming NBM (nil by mouth) and an IV line was secured and connected to Ringer's Lactate solution. All monitors were attached and vital parameters like heart rate, oxygen saturation, respiratory rate, blood pressure, and electrocardiogram (ECG) were monitored. The patient was premedicated with Inj. Glycopyrrolate 0.2 mg IV and Inj. Fentanyl 2ug/kg IV. Preoxygenation of the patient with 100% oxygen was started for 3 minutes. All equipment for difficult airway management was kept ready as well. Anesthesia was induced with Inj. Propofol 2mg/kg IV slowly in graded doses till loss of consciousness. After checking for ventilation, Inj. Atracurium 0.75 mg/kg IV was administered.

The patient was ventilated with oxygen and nitrous oxide for 2.5 minutes followed by 100% oxygen for 30 seconds to buy enough time for a smooth intubation. An endotracheal tube of size 7.5 was gently introduced and guided into the trachea in the first attempt. After

confirming proper placement of the endotracheal tube, the tube was fixed and the patient was handed over for the procedure. Anaesthesia was maintained with sevoflurane in oxygen and air throughout the procedure.



Figure 2: Z POEM procedure (Inaccessibility to the head end – cause of concern for Anesthesia)

A large diverticular opening was seen just below the Upper Esophageal Sphincter. Submucosal injection was given with Interject using diluted methylene blue solution. Mucosal incision was taken over the septum. Submucosal incision and dissection were done with a triangular tip knife on the diverticular and esophageal side. Submucosal tunnelling extended till the base of septum was exposed on both the sides. Myotomy was done with a Triangular tip knife and the mucosal incision was closed using Medorah clips. CO₂ insufflation was utilized throughout the procedure.

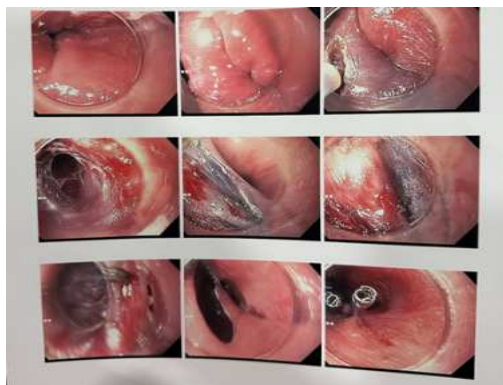


Figure 3: Steps Delineating Z POEM Procedure – From Identifying the Septum to Clip Closure

The patient tolerated the procedure well with no major derangements in vital parameters. There was one episode of rise in EtCO₂ from a baseline of 35 gradually to 55mm Hg. This was not associated with a drop in saturation or rise in peak pressures or any derangement in other vital parameters. The endoscopy team was asked to pause the procedure and prompt manual ventilation to wash out CO₂ was carried out. There were no signs of subcutaneous emphysema. Once the EtCO₂ normalized, the procedure was restarted, with a vigilant watch for any signs of subcutaneous emphysema, capnomediastinum, or capnothorax.



Figure 4 : Rise in EtCO₂ to 55 mm Hg

After the procedure, once the patient's adequate breathing efforts were confirmed, he was reversed using neostigmine and glycopyrrolate and extubated. Postoperatively, the patient was conscious, breathing adequately, maintaining good saturation on room air, and was hemodynamically stable. There was subtle subcutaneous emphysema present in the neck region, which resolved gradually over the next two days. The patient was shifted to the postoperative ward after observation.

DISCUSSION

Surgical intervention used to be the primary treatment for Zenker's diverticulum, despite its high morbidity and mortality rates. In recent years, as endoscopies have developed, Z-POEM, a technique utilizing third-space endoscopy, has emerged, specifically tailored for Zenker's diverticulum. Z-POEM offers two significant advantages. Firstly, it enables precise myotomy of the septal muscle, minimizing the risk of perforation and symptom recurrence associated with incomplete myotomy. Secondly, it facilitates a clear identification of the diverticulum's base through submucosal tunneling, thereby lowering the incidence of mucosal perforation. Despite its therapeutic potential, Z POEM poses an interdisciplinary challenge, lacking specific anesthesia care algorithms and evidence-based recommendations.

Typically conducted within an endoscopy suite; congested working spaces, shared airway with the endoscopy team, continuous insufflation of CO₂, and complications such as subcutaneous emphysema, capnomediastinum, capnothorax, or even capnoperitoneum are some of the major concerns for anaesthesiologists in case of POEM procedures. Preventing aspiration during anesthesia induction is paramount, especially considering the incidence of 3 in 10,000 cases in the general population. Rapid sequence induction (RSI) may be advocated in some cases due to its efficacy (7). The selection and dosage of anesthetic agents depend on individual patient factors such as underlying diseases and hemodynamic status. Proper positioning and fixation of the endotracheal tube are crucial, particularly given the challenging accessibility to the airway due to the endoscopists who typically stand near the patient's head. Adequate neuromuscular relaxation is vital to prevent any patient movement during the procedure. (8)

Ventilation in pressure control mode may be favored, as it compensates for potential ventilation reductions caused by pressure limitation and ensures even gas distribution in the lungs. Monitoring and adjusting minute ventilation to maintain an end-tidal carbon dioxide tension (ETCO₂) of 35–45 mmHg is essential (9). If ETCO₂ rises despite hyperventilation, temporary interruption of the procedure may be necessary. Any sudden rise in ETCO₂ or peak airway pressure should be promptly communicated to the endoscopist for appropriate action, as it may indicate capnothorax.

During the procedure, continuous gas insufflation is important for creating a submucosal tunnel and ensuring proper visualization of the septum. General anesthesia and CO₂ insufflation can induce significant physiological changes, just similar to laparoscopic procedures, potentially leading to a rise in the mean arterial pressure (MAP) and heart rate (HR). This response may be due to systemic absorption, sympathetic stimulation, and increased catecholamine release (10). Persistent CO₂ insufflation can disrupt systemic CO₂ balance, possibly resulting in respiratory acidosis and elevated peak airway pressures. Minute ventilation can be easily managed in intubated patients under general anesthesia. Mucosal injury, and subcutaneous emphysema are often managed conservatively, whereas, tense capnoperitoneum and capnothorax may require needle decompression and intercostal chest drain placement (11). Subcutaneous emphysema is a common adverse event related to CO₂ insufflation. Early detection is crucial, as elevated end-tidal carbon dioxide (ETCO₂) levels exceeding 50 mm Hg have been associated with subcutaneous emphysema in 60% of cases (12). In extensive instances, hyperventilation may not suffice, and a subcutaneous needle drain may be necessary. Minimizing these events hinges on controlling the total amount of gas insufflated.

Postprocedural management protocols vary between centres. Typically, patients are kept nil per oral (NPO) overnight after the procedure and receive intravenous antibiotics. Following confirmation of no leakage via water-soluble contrast esophagogram on postoperative day one, a soft diet is initiated. Postoperative incentive spirometry helps prevent atelectasis (9). Z-POEM presents a

minimally invasive treatment avenue for Zenker's Diverticulum, underscoring the importance of interdisciplinary collaboration between anesthesiologists and endoscopists to mitigate complications. Further research is, however, warranted to refine pre-procedure protocols, ventilation strategies, and CO₂ insufflation rates in the management of such cases.

CONCLUSION:

Zenker's diverticulum was traditionally treated surgically, despite the high risks involved. Z-POEM, a specialized endoscopic technique, has emerged recently for the management of Zenker's Diverticulum with advantages including precise myotomy and clear identification of the diverticulum's base. However, it poses various challenges for anesthesiologists due to shared airway, CO₂ insufflation, and other potential complications. Complications like subcutaneous emphysema are common and mostly managed conservatively. Other complications like capnothorax and capnomediastinum may require further intervention. Communication between anesthesiologists and endoscopists is vital to mitigate complications in such cases. Therefore, the accessibility of standardized equipment, vigilant monitoring, prompt action and cultivating mutual understanding, alongside establishing closed-loop communication between anesthesiologists and endoscopists, are pivotal measures for augmenting patient safety. However, further research is still needed to refine protocols and ventilation strategies in such cases.

Conflict of Interest: None

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