

Minimally Invasive Approach to Epiphrenic Oesophageal Diverticulum: A Case Report

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ABSTRACT

An oesophageal diverticulum is a relatively rare disorder of the oesophagus which results in the outpouching of the oesophageal mucosa through a weak portion within the oesophageal lining. Oesophageal diverticula occur in <1% of the population and are found in approximately 1-3% of those presenting with dysphagia. A 75-year-old male patient came to the surgical Outpatient Department (OPD) with chief complaints of difficulty in swallowing for 2-3 months, initially with solids which later progressed to difficulty in swallowing liquids. He was diagnosed on a Contrast-Enhanced Computed Tomography (CECT) scan with a large oesophageal diverticulum arising from the right lower lateral thoracic oesophagus just proximal to the oesophagogastric junction in the retrocardiac region with no filling defect or mucosal thickening. The patient was treated with transhiatal laparoscopic oesophageal diverticulectomy with cardiomyotomy and Dor fundoplication. For symptomatic patients, most often, minimally invasive myotomy and removal of the pouch endoscopically are advised, which may pose a surgical challenge due to the rarity of the disease.

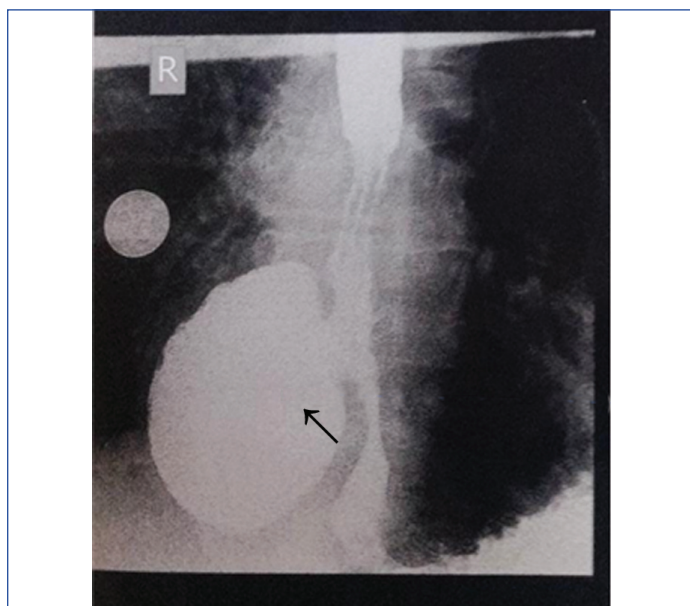
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CASE REPORT

A 75-year-old male patient presented with a three-month history of progressive dysphagia, initially to solids and later to liquids, accompanied by halitosis, reduced appetite, and significant weight loss. A barium swallow revealed a large oesophageal diverticulum originating from the right lower lateral thoracic oesophagus, just proximal to the oesophagogastric junction in the retrocardiac region, with no filling defects or mucosal thickening [Table/Fig-1]. Oesophageal manometry indicated incomplete oesophagogastric emptying and elevated Lower Oesophageal Sphincter (LES) pressure, likely due to compression causing oesophagogastric outflow obstruction and a grade II hiatus hernia. Abdominal and pelvic CT demonstrated a large diverticulum filled with oral contrast and an air-fluid level, measuring approximately 65x52x61 mm, arising from the lower oesophagus in the right para oesophageal region near the oesophagogastric junction, consistent with an epiphrenic diverticulum, with no filling defect, mucosal thickening, or irregularity noted [Table/Fig-2]. Upper gastrointestinal endoscopy confirmed a large oesophageal diverticulum with antral gastritis.



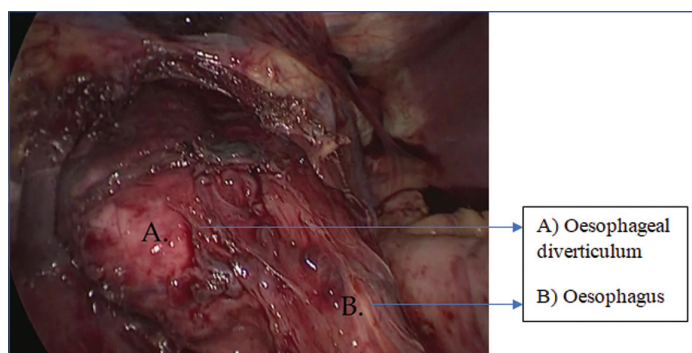
[Table/Fig-2]: CECT of the abdomen and pelvis showing a large diverticulum filled with oral contrast and an air-fluid level, measuring approximately 65x52x61 mm, arising from the lower oesophagus in the right paraoesophageal region near the oesophagogastric junction consistent with epiphrenic diverticulum, with no filling defect, mucosal thickening, or irregularity noted.



[Table/Fig-1]: Barium swallow showing large oesophageal diverticulum originating from the right lower lateral thoracic oesophagus (arrow).

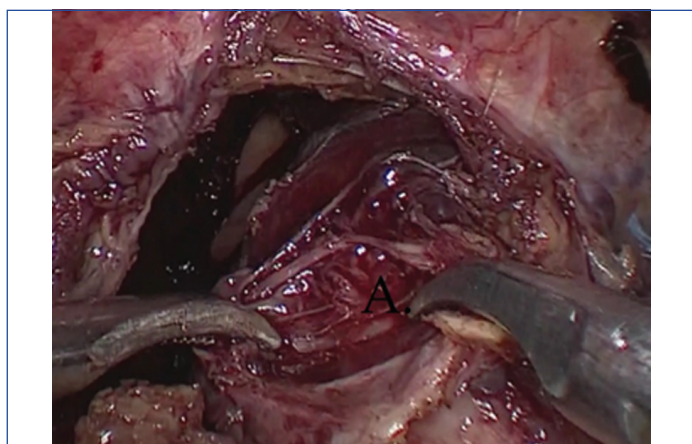
Following comprehensive evaluation and optimisation, the patient underwent laparoscopic diverticulectomy with cardiomyotomy and Dor fundoplication. The patient was positioned in a 30° reverse Trendelenburg position under general anaesthesia with bilateral lower limb abduction. The pneumoperitoneum was established using a Veress needle, and the camera port was placed to the left of the midline, between the middle and lower thirds of the xiphoid-umbilical line. Operative trocars were positioned cranially to the camera port, near the left and right hypochondria. Additional trocars for assistance were strategically placed.

The procedure began with the release of the gastrocolic and gastrohepatic ligaments, followed by the dissection of the right crus of the diaphragm after detaching the phreno-oesophageal membrane. The dissection extended to the left crus up to the oesophageal ring, and the oesophagus was encircled with umbilical tape via a retro-oesophageal window [Table/Fig-3]. Mediastinal dissection was conducted using a harmonic scalpel around the diverticulum. A linear endoscopic stapler with a 45 mm cartridge was utilised for diverticulectomy after complete dissection of the diverticulum neck. Cardiomyotomy was performed from 2 cm above the gastroesophageal junction to 4 cm below to alleviate

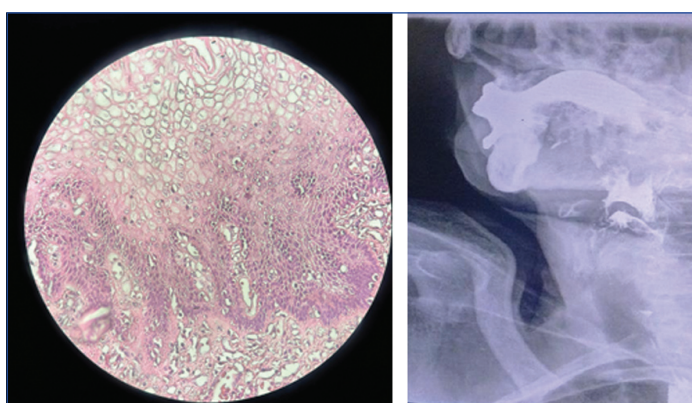


[Table/Fig-3]: Intraoperative findings.

sphincter pressure [Table/Fig-4]. An anterior 90° fundoplication was subsequently executed. The excised specimen was sent for histopathological examination [Table/Fig-5]. The sections showed a diverticulum lined by hyperplastic stratified squamous epithelium with wall thickening and focal infiltration by lymphocytes and plasma cells with multiple foci of submucosal gastric glands. These findings are consistent with a chronically inflamed oesophageal diverticulum.



[Table/Fig-4]: Cardiomyotomy being performed.
A- Site of cardiomyotomy being done using Maryland.



[Table/Fig-5]: Histopathological examination of the excised specimen suggestive of true diverticulum (4x, H&E).

[Table/Fig-6]: Postoperative gastrograffin swallow study. (Images from left to right)

Postoperatively, the patient was maintained on a liquid diet for 14 days. A dye study on postoperative day 10 showed no leaks [Table/Fig-6]. The patient was gradually advanced to a full diet, prescribed a double dose of Proton Pump Inhibitors (PPI), and discharged. At a two-month follow-up, the patient tolerated a full diet with complete resolution of symptoms.

DISCUSSION

Oesophageal diverticula are mucosal and submucosal protrusions through the muscular layer of the oesophagus, typically arising due to increased intraluminal pressure and associated with oesophageal motility disorders [1]. Epiphrenic diverticula, a subtype of pulsion

diverticula, predominantly occur within the distal 10-15 cm of the oesophagus and are frequently linked to primary oesophageal motility disorders such as achalasia, nutcracker oesophagus, or diffuse oesophageal spasm. These diverticula are relatively rare, with an occurrence rate of <2%, and are symptomatic in <1% of the population, predominantly presenting with dysphagia [2]. Epiphrenic diverticula are typically pulsion diverticula that are formed as a result of increased intraluminal pressure that is a result of oesophageal motility disorders such as achalasia, diffuse oesophageal spasm, or hypertensive LES. The diverticulum is typically formed on the right posterior side of the oesophagus when the oesophageal membrane weakens and protrudes. The development of these diverticula is strongly associated with oesophageal motility disorders, as emphasised by studies conducted by Gockel I et al., and Herbella FAM et al., [3,4]. Patients with epiphrenic diverticula frequently exhibit symptoms that are non specific and may resemble those of other oesophageal conditions. The most prevalent symptom is dysphagia, followed by regurgitation of undigested food, chest discomfort, and weight loss [4]. In certain instances, patients may experience respiratory symptoms as a result of aspiration. Symptomatic patients frequently have more severe underlying motility disorders and larger diverticula.

Surgical intervention is frequently necessary for patients who are symptomatic or have complications such as oesophagitis or aspiration. The conventional method of surgery has been traditional open surgery, which involves a thoracotomy or laparotomy. Katada N et al., have described diverticulectomy, myotomy of the lower oesophagus, and occasionally a partial fundoplication as techniques for preventing reflux [5]. The prevalence of minimally invasive surgical methods, such as laparoscopic or thoracoscopic surgery, has been attributed to their quicker recovery times and reduced morbidity. The efficacy and safety of these techniques have been demonstrated in numerous studies, such as those conducted by Kent MS et al., and Rossetti G et al., [6,7]. Endoscopic remedies, such as flexible endoscopic septotomy, have also been investigated for patients who are not suitable for surgery. The long-term results of surgical treatment for epiphrenic diverticula are generally favourable, with a substantial improvement in quality of life and significant symptom relief [7]. Nevertheless, symptoms may recur, particularly if the underlying motility disorder is not adequately addressed. Chan SM et al., conducted research that indicates a comprehensive treatment plan, which includes myotomy, can substantially reduce recurrence rates [8].

Epiphrenic diverticula are commonly located on the right posterolateral wall of the oesophagus and can be diagnosed through barium studies, upper gastrointestinal endoscopy, oesophageal manometry, and CT imaging. They are often symptomatic when larger than 5 cm, presenting with dysphagia, halitosis, weight loss, decreased appetite, nausea, vomiting, retrosternal pain, regurgitation, and potentially severe complications such as recurrent respiratory infections and aspiration pneumonia [9]. Initial management strategies were conservative, emphasising dietary modifications and symptomatic relief. These early interventions aimed to alleviate discomfort without surgical intervention due to the high-risks associated with the surgical procedures available. Open thoracotomy or cervical approaches were employed in the coming decade, depending on the diverticulum's location [9]. Surgeons performed diverticulectomy, the resection of the diverticulum, or diverticulopexy, suspending the diverticulum to prevent food stasis [10]. These early surgeries carried significant risks, including high morbidity and mortality due to infection, leakage, and the rudimentary nature of surgical techniques and instruments.

Advancements in the mid-20th century brought significant improvements in anaesthesia, aseptic techniques, and surgical instrumentation, reducing the complications associated with

open surgeries. During this period, combining diverticulectomy with myotomy, particularly for epiphrenic diverticula, became a standard practice to address underlying motility disorders and reduce recurrence rates. The thoracotomy traditional method enables the precise manipulation of the oesophageal diverticulum by providing excellent visualisation and control. It is especially beneficial for diverticula that are large or intricate, as it necessitates detailed anatomical access [11]. Thoracotomy offers the capacity to effectively manage complications and the comprehensive management of adjacent structures. Nevertheless, thoracotomy is a highly invasive procedure that results in a prolonged recovery period, significant postoperative discomfort, and lengthier hospital stays. There is an elevated likelihood of complications, including infection, respiratory issues, and fibrosis, for patients [11]. In the present case scenario, the patient already had interstitial fibrosis secondary to advanced age, this would prove as a deterring factor in opting for this approach.

Another alternative open approach is laparotomy. The oesophagus is typically accessed through an abdominal incision during laparotomy, a procedure that is typically employed to treat diverticula that are situated near the gastroesophageal junction. This method mitigates the risk of pulmonary complications by avoiding the necessity of opening the thoracic cavity, which is especially advantageous for patients with underlying lung disease. Laparotomy is a versatile procedure which may be suitable in cases where surgeons are not so proficient with the laparoscopic approach, that can be combined with other procedures, such as antireflux surgery, to provide effective access to the lower oesophagus. Although less invasive than a thoracotomy, laparotomy still necessitates a prolonged recuperation period and substantial postoperative distress when contrasted with minimally invasive techniques. It may complicate the procedure, particularly in complex cases, as it offers less direct visualisation of the oesophagus [11].

Following a revolutionary shift with the advent of minimally invasive techniques, laparoscopic and thoracoscopic surgeries transformed the surgical landscape by reducing postoperative pain, shortening hospital stays, and accelerating recovery times compared to traditional open surgery [11]. Laparoscopic approaches to oesophageal diverticulectomy allowed for precise resection of the diverticulum with minimal invasiveness [11]. Video-Assisted Thoracoscopic Surgery (VATS) emerged as an alternative approach, particularly beneficial for diverticula in the middle and upper thoracic oesophagus. These laparoscopic techniques have been further refined. Laparoscopic transhiatal diverticulectomy with cardiomyotomy and anterior 90° Dor fundoplication has become the standard for symptomatic epiphrenic diverticula [12]. This method offers excellent outcomes with low complication rates. The introduction of robotic-assisted surgery has further refined treatment by providing enhanced precision, improved dexterity, and better visualisation, especially in complex cases. Endoscopic techniques, such as Peroral Endoscopic Myotomy (POEM) and endoscopic diverticulotomy, have emerged as less invasive options, particularly for Zenker's diverticulum, offering shorter recovery times for high-risk patients [13-18]. Due to the patient's advanced age, the extent of the diverticulum, chronicity of symptoms, and the elevated oesophageal pressure, the decision was made to proceed with laparoscopic surgery in this case.

VATS employs a thoracoscope to visualise the oesophagus through small incisions, offering a minimally invasive alternative to open thoracotomy. This approach ensures quicker recovery, less scarring, and reduced postoperative discomfort. Enhanced visualisation with the thoracoscopic camera improves surgical precision, resulting in shorter hospital stays and fewer complications. However, VATS requires specialised skills and equipment, limiting its availability. It may be less effective for large or complex diverticula. Conversely, the transhiatal approach accesses the oesophagus via the abdomen

and neck, avoiding thoracotomy and related complications. Though beneficial for lower oesophageal diverticula and patients with lung disease, it offers less direct visualisation and can lead to a longer recovery [15-20].

Current trends focus on hybrid procedures, combining endoscopic and minimally invasive surgical techniques to maximise benefits and further reduce complications. Addressing underlying oesophageal motility disorders through comprehensive preoperative evaluation with manometry and targeted surgical interventions like myotomy is emphasised to prevent recurrence and improve long-term outcomes. The surgical management of oesophageal diverticula has undergone significant evolution over the past century. Transitioning from high-risk open surgeries to advanced minimally invasive and endoscopic techniques, the focus has shifted towards reducing complications, improving recovery times, and addressing underlying oesophageal motility disorders [16].

Due to the rarity of the condition and potential postoperative complications, surgical intervention is often recommended for patients experiencing worsening symptoms. Surgical options include a transhiatal approach or a transthoracic approach for diverticulectomy, often followed by a cardiomyotomy and an antireflux procedure [16]. Patients with severe pulmonary symptoms, particularly those with life-threatening aspiration, should not be treated conservatively [16]. Laparoscopic transhiatal diverticulectomy with cardiomyotomy and an anterior 90° Dor fundoplication is currently favoured [17-21]. This approach offers advantages such as improved alignment of the stapler cartridge with the oesophageal axis, better visualisation of the oesophagogastric junction for myotomy, easier access for crural repair and antireflux procedures, and facilitation of the proximal myotomy extending high into the mediastinum above the diverticular neck [21]. Postoperative follow-up is crucial due to the risk of complications such as stapler line leaks, inflammation, ulceration, abscesses, fistulas, and empyema. Minimally invasive techniques, including laparoscopic and video-assisted thoracoscopic approaches, have become popular options for surgical treatment of epiphrenic diverticula, allowing for treatment even in cases of large diverticula of the lower thoracic oesophagus [14].

CONCLUSION(S)

Given the rarity of oesophageal diverticula, thorough evaluation is imperative for patients presenting with dysphagia. Minimally invasive surgical interventions, including myotomy and endoscopic pouch removal, are recommended for symptomatic patients. Despite the challenges posed by the infrequency of this condition, such surgical procedures are crucial for effective management and symptom resolution.

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