

# **Laparoscopic surgery for ventrally located epiphrenic diverticulum with esophageal achalasia**

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**Running head:** Epiphrenic diverticulum with achalasia

## **Authors' contributions**

YU and ST wrote the manuscript. ST supervised the case. All other authors reviewed the manuscript and approved the final manuscript.

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## **Abstract**

Epiphrenic diverticulum is frequently associated with esophageal motility disorder, including esophageal achalasia. Heller's myotomy should accompany diverticulectomy to reduce the bulging pressure in surgery for epiphrenic diverticulum with esophageal achalasia. In such cases, designing myotomy is sometimes difficult, depending on the size and location of the diverticulum. Ventrally located diverticula require special caution to spare some muscular tissue between the longitudinal staple line of the diverticulectomy and myotomy, which is a crucial step to prevent staple-line dehiscence. In this article, we describe a case with ventrally located epiphrenic diverticulum who underwent successful laparoscopic resection and myotomy for esophageal achalasia with an informative surgical video.

**Key words:** epiphrenic diverticulum; achalasia; laparoscopy; Heller's myotomy

## **Introduction**

Epiphrenic diverticulum is frequently associated with esophageal motility disorder, and esophageal achalasia is found in >60% cases of esophageal diverticulum [1,2]. Most patients are asymptomatic; however, 15%–20% exhibit symptoms, such as dysphagia, bleeding, and inflammation [3,4]. Surgical intervention is indicated for symptomatic patients, and diverticulectomy is the standard procedure followed with Heller's myotomy and partial fundoplication [2].

Here we describe a case with ventrally located epiphrenic diverticulum who underwent successful laparoscopic resection and myotomy for esophageal achalasia.

## **Case report**

A 46-year-old male with a history of dysphagia lasting for 15 years presented with fever and lower chest pain to a regional hospital. Computed tomography scans revealed epiphrenic diverticulitis with extraluminal air. Conservative management with fasting and intravenous antibiotics was successful, and the patient was discharged and sent to our hospital for further definitive treatment.

Barium swallow examination confirmed a 4-cm esophageal epiphrenic diverticulum and proximal dilatation with a diameter of up to 1.9 cm (Fig. 1). Endoscopic examination revealed a large diverticulum on the ventral side, just above the esophagogastric junction (EGJ). The integrated relaxation pressure was 50.5 mm Hg, and the distal latency was 4.0 sec, as assessed via high-resolution manometry (Fig. 2). Accordingly, the patient was diagnosed as having type III achalasia according to the Chicago classification [5]. Laparoscopic resection of the epiphrenic diverticulum and

Heller's myotomy followed by Dor's fundoplication were performed as definitive treatment (Supplementary Video 1).

A 12-mm camera port was inserted through the umbilicus, and pneumoperitoneum was established. Next, four working ports were inserted (Fig. 3) because post-inflammatory dense adhesions around the diverticulum were expected. This is the method used for port placement for foregut malignancies at our institution. Two forceps can be used by the assistant in this placement, while three working ports are usually used for anti-reflux or Heller-Dor surgery. The hiatus was exposed, and dissection was proceeded to the mediastinum. The epiphrenic diverticulum was identified as a white saccular structure and pulled out through the hiatus into the abdominal cavity. Gentle dissection exposed the diverticulum protruding from the ventral side of the esophagus (12 o'clock position). Because of the dense adhesion around the diverticulum, it was impossible to preserve the anterior vagus nerve. The ventral aspect of the lower thoracic esophagus was also exposed as much as possible for myotomy. Subsequently, the incision line for Heller's myotomy was carefully simulated on the left ventral side of the esophagus (2 o'clock position), thus avoiding the diverticulum. The diverticulum was transected longitudinally using a linear stapler, and an 8-cm esophageal myotomy was performed, leaving some muscular layer toward the staple line and extending 3 cm into the proximal stomach. Intraoperative endoscopy confirmed opening of the EGJ. Finally, Dor's partial fundoplication was performed. The time required for surgery was 225 min, and intraoperative blood loss was minimal.

Postoperative histopathological investigation revealed an attenuated muscular layer, leading to the diagnosis of pseudodiverticulum. No malignancy was found in the epithelium. The postoperative course was uneventful. The patient did not have dysphagia or reflux at his one-year follow-up endoscopic evaluation.

## **Discussion**

The pathophysiology of epiphrenic diverticula is based on increased intramural pressure owing to the outlet obstruction of the distal esophagus, which can be identified easily by observational and manometric studies [6,7]. In epiphrenic diverticulum with esophageal achalasia, sufficient myotomy length should be included with the diverticulectomy to reduce bulging pressure, for preventing staple-line leaks [8] and for long-term recurrence. In such cases, the design of myotomy can be challenging depending on the size and location of the diverticulum. Because Heller's myotomy is usually performed on the ventral side of EGJ, patients whose diverticula are located ventrally require special caution to spare some muscular tissue between the longitudinal staple line of the diverticulectomy and myotomy, which we believe is important to prevent staple-line dehiscence. Recently, peroral endoscopic myotomy (POEM) without surgical diverticulectomy has been reported as a less invasive treatment option for epiphrenic diverticulum with or without esophageal motility disorders with acceptable outcomes [9,10]. However, it is theoretically impossible to prevent future diverticulitis or perforation of diverticulum by myotomy alone. We believe that the diverticulectomy with myotomy was required as a definitive treatment in this case, and we successfully managed the myotomy line by shifting to the left side of the esophagus although the diverticulum was located on the ventral side of the esophagus.

## **Disclosures**

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Compliance with ethical standards

Conflict of Interest: The authors declare that they have no conflict of interest.

Ethical approval: Not applicable.

Consent for publication: Informed consent was obtained from the patient for publication of this case report and the accompanying images.

## References

1. Herbella FA, Patti MG. Achalasia and epiphrenic diverticulum. *World J Surg.* 2015;39:1620–1624.
2. Herbella FA, Patti MG. Modern pathophysiology and treatment of esophageal diverticula. *Langenbecks Arch Surg.* 2012;397:29–35.
3. Santos MPD, Akerman D, Santos CPDD, et al. Giant esophageal epiphrenic diverticulum: presentation and treatment. *Einstein (Sao Paulo).* 2017;15:486–488.
4. Michael H, Fisher RS. Treatment of epiphrenic and mid-esophageal diverticula. *Curr Treat Options Gastroenterol.* 2004;7:41–52.
5. Kahrilas PJ, Bredenoord AJ, Fox M, et al. The Chicago Classification of esophageal motility disorders, v3.0. *Neurogastroenterol Motil.* 2015;27:160–174.
6. Nehra D, Lord RV, DeMeester TR, et al. Physiologic basis for the treatment of epiphrenic diverticulum. *Ann Surg.* 2002;235:346–354.
7. Melman L, Quinlan J, Robertson B, et al. Esophageal manometric characteristics and outcomes for laparoscopic esophageal diverticulectomy, myotomy, and partial fundoplication for epiphrenic diverticula. *Surg Endosc.* 2009;23:1337–1341.
8. Achim V, Aye RW, Farivar AS, et al. A combined thoracoscopic and laparoscopic approach for high epiphrenic diverticula and the importance of complete myotomy. *Surg Endosc.* 2017;31:788–794.
9. Beatrice O, Maximilien B, Marie-Anne G, et al. Per-oral endoscopic myotomy for esophageal diverticula with or without esophageal motility disorders. *Clin Res Hepatol and Gastroenterol.* 2020;44:82-89.

10. Kinoshita M, Tanaka S, Kawara F, et al. Peroral endoscopic myotomy alone is effective for esophageal motility disorders and esophageal epiphrenic diverticulum: a retrospective single-center study. *Surg Endosc.* 2020 <https://doi.org/10.1007/s00464-019-07340-6>.

## **Figure legends**

Fig 1. Barium swallow showing epiphrenic diverticulum and proximal dilated esophagus.

Fig 2. High-resolution manometry of the patient showing type III achalasia according to the Chicago classification.

Fig 3. Port placement and position of the surgeons.

Figure 1



Figure 2

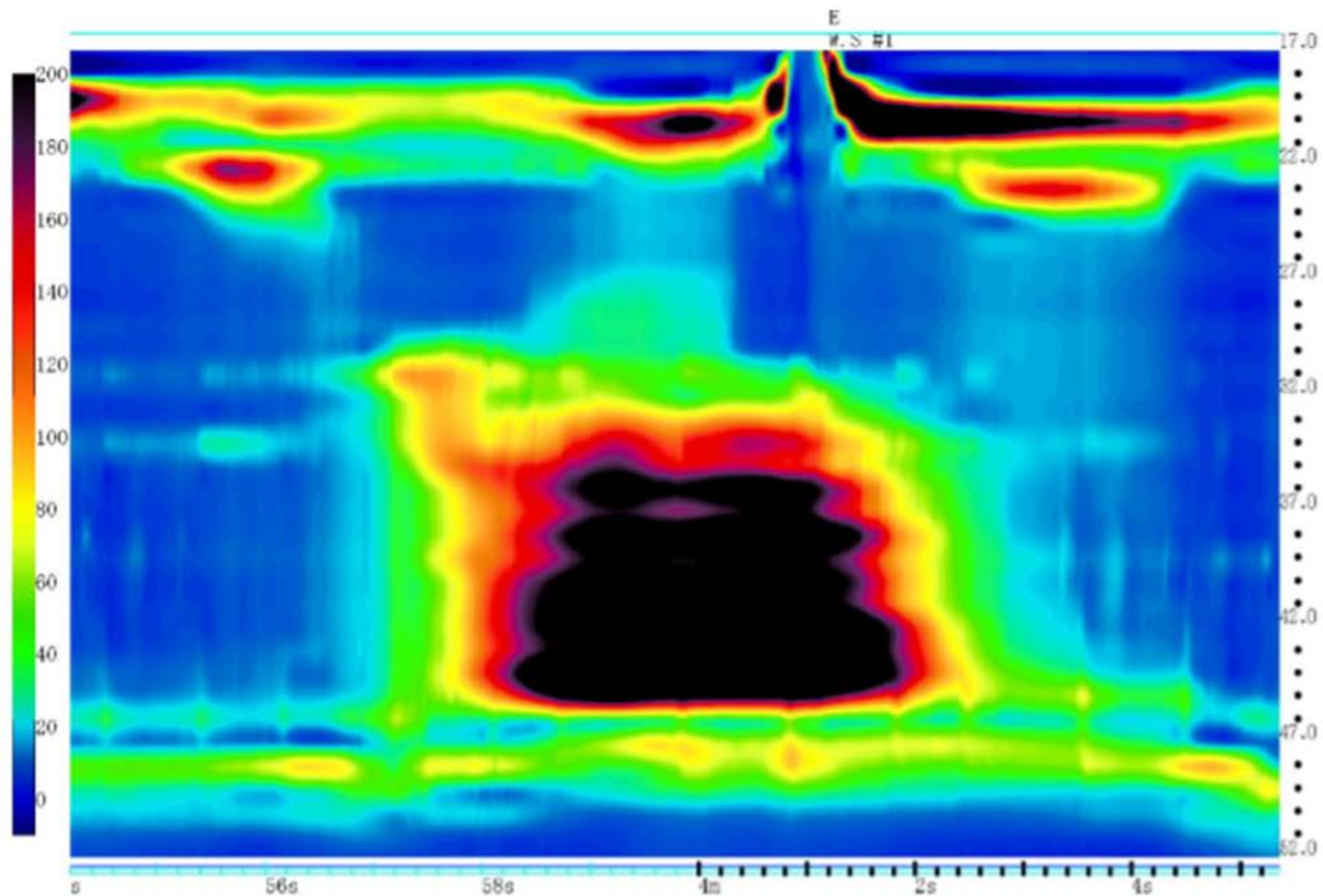
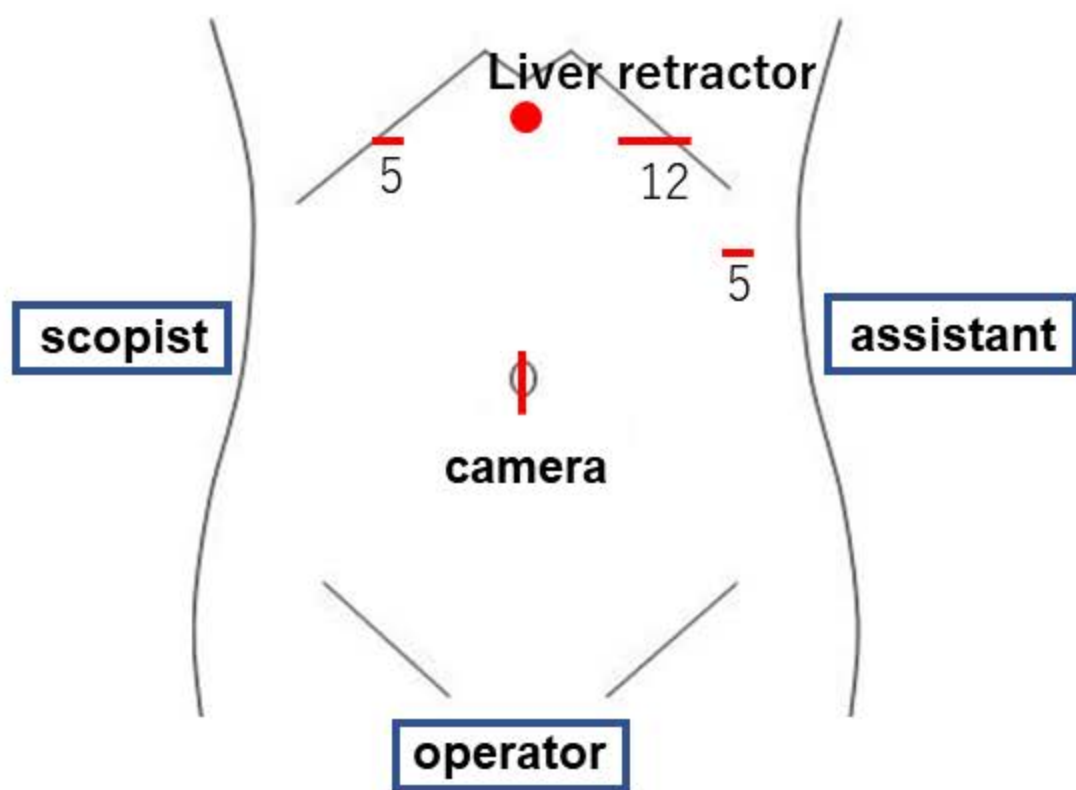


Figure 3

Usual case



This case

