A complex modality of achalasia, diverticulum and paraesophageal hernia treated through three-dimensional left thoracoscopy

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Abstract
Herein, we report a case of a patient with recurrent dysphagia after an open transabdominal hernia repair for a Type IV paraesophageal hernia performed elsewhere. Subsequent work-up and medical records’ review revealed the coexistence of a large left epiphrenic diverticulum in combination with achalasia synchronous to the recently repaired paraesophageal hernia. A three-dimensional left thoracoscopic diverticulectomy with a long esophagomyotomy was conducted under endoscopic guidance intraoperatively, with no perioperative complications. At 12 months’ follow-up evaluation, the patient presents well with no documented recurrence. Cumulative experience from various medical specialties regarding esophageal motility disorders and endoscopic state-of-the-art techniques, when combined with minimally invasive surgical techniques, provide an effective management of esophageal motility syndromes, overall.

Keywords: Diverticulectomy, esophagomyotomy, laparoscopic, minimally invasive, thoracoscopic

INTRODUCTION
Acquired pulsion esophageal diverticula arise from elevated intraluminal pressure due to esophageal motility disorders such as achalasia[1] or rarely due to a hiatal hernia.[2,3] The latter can exacerbate an underlying achalasia-related dysphagia and patients’ overall status by affecting their nutritional state. Herein, we report a case of a 63-year-old Caucasian male referred with recurrent dysphagia following a Type IV paraesophageal hernia repair.

CASE REPORT
Background
The patient’s medical history started 20 years ago, with a road traffic accident leading to a severe mid-thoracic spinal cord injury. He has since been paraplegic with complete impairment in motor and sensory function of the lower torso accompanied by a neurogenic bladder requiring daily self-catheterizations. The patient first reported odynophagia, early satiety and intermittent chest pain 10 years ago, initiating a workup with barium esophagram and computerized tomography to reveal a Type IV paraesophageal hernia repair. Subsequent work-up and medical records’ review revealed the coexistence of a large left epiphrenic diverticulum in combination with achalasia synchronous to the recently repaired paraesophageal hernia. A three-dimensional left thoracoscopic diverticulectomy with a long esophagomyotomy was conducted under endoscopic guidance intraoperatively, with no perioperative complications. At 12 months’ follow-up evaluation, the patient presents well with no documented recurrence. Cumulative experience from various medical specialties regarding esophageal motility disorders and endoscopic state-of-the-art techniques, when combined with minimally invasive surgical techniques, provide an effective management of esophageal motility syndromes, overall.

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paraesophageal hernia containing the whole stomach and pancreatic body into the left hemithorax [Figure 1a and b]. A conservative management was then deemed appropriate due to the patient’s mild symptomatology. He however gradually deteriorated with progressive dysphagia, regurgitation and heartburn accompanied by a remarkable total body weight loss and recurrent lower respiratory tract infections due to microaspirations. He was then referred to his community hospital, and an open transabdominal hernia reduction with posterior cruropexy was conducted. Nevertheless, postoperatively his dysphagia was not relieved, and he was referred to our upper GI Department for further management 1 month later. Subsequent work-up with esophageal manometry test combined with an upper endoscopy and barium esophagram confirmed the co-existence of a large 6–7 cm left epiphrenic diverticulum along with achalasia and the known paraesophageal hernia [Figure 1c and d]. Keeping in mind the wheel-chair bound patient’s history with a recent strenuous laparotomy and a worrisome pulmonary status, a three-dimensional (3D) left thoracoscopic esophageal diverticulectomy with a long esophagomyotomy was scheduled.

Surgical technique and technologies
The surgical procedure was conducted with the Olympus VISERA ELITE II OTV-S300, 30°, 3D-video system centre, with a two-dimensional-3D processor and a light-emitting diode light source (Olympus Medical Systems Corporation, Tokyo, Japan). The Sony LMD surgical series of liquid-crystal display monitors provided full HD-3D displays (Sony Corporation, Konan-Minato-ku, Tokyo, Japan). Intraoperative upper endoscopy was performed with the Karl-Storz flexible routine interventional Gastroscope with two working/suction Channels (Karl-Storz SE and Co. KG Tuttinglen, Germany), with an outer diameter of 9.3 mm and a working length of 1100 mm.

The patient was positioned right semi-prone and four ports were introduced (12 mm at 4th and 6th, 5 mm at 7th and 8th intercostal spaces respectively all medial to scapular line). After the exploration of the left chest cavity and division of the left inferior pulmonary ligament, the lung was retracted anteriorly and the mediastinal pleura was divided, exposing the esophagus. The esophagus was dissected proximally toward the thoracic inlet and distally to the diaphragmatic hiatus, exposing the broad neck of the diverticulum, safeguarding the adjacent anatomical structures, such as aorta, haemiazygos vein and vagus nerves. A gastroscope was intraoperatively set to calibrate the esophagus to prevent stenosis during diverticulectomy. It also guided the length of the myotomy by direct visualization of the Gastroesophageal Junction (GEJ). The esophagomyotomy was subsequently initiated caudally to the diverticulum’s neck by dividing both the longitudinal and circular musculature revealing the protruding mucosa. The myotomy extended distally, past the gastric fat pad and approximately 2 cm below the GEJ as revealed endoscopically. Diverticulectomy was finally accomplished by dividing the diverticulum’s neck with an iDrive ultra powered stapling System-Medtronic with the use of 60- and 45-mm tan cartridges [Figure 2a-f and Video 1].

Postoperative outcomes
Operative time was 100 min, estimated blood loss was <50 ml, with no intraoperative complications. Postoperative recovery was uneventful. A water-soluble leak test demonstrated no contrast extravasation with adequate flow into the stomach without any hold-up [Figure 3a and b]. The patient was allowed a semi-solid diet and discharged on the 8th postoperative day. At 12 months’ follow-up evaluation, he remains well with no documented recurrence.

DISCUSSION
To the best of our knowledge, this triple modality with the coexistence of Type IV paraesophageal hernia, achalasia and left epiphrenic diverticulum as well as the surgical
management with the 3D left thoracoscopic approach encompassing diverticulectomy plus myotomy has never been previously reported in the English literature.

Several important technical principles are highlighted. A high level of suspicion deriving from a profound knowledge in the field of benign esophageal disorders is mandatory for early detection of potential overlapping or co-incidence of these entities. The accurate diagnosis delineates the forthcoming surgical management, which saves unnecessary, insufficient or incorrect operative strategies that are potentially harmful to an already frail health status. The introduction of minimally invasive surgical techniques associated with the increasing improvement of surgical skills has revolutionized esophageal surgery by reducing surgical trauma, hospitalization, and by enhancing postoperative recovery with equivalent surgical outcomes. In our case with the large left diverticulum, far distant from the hiatus and with the adhesions from the previous abdominal surgery, our approach selection ensured optimal visualization and access to the distal esophagus providing the best exposure both for the diverticulectomy and myotomy, as well as an easier route for application of the endostapler to transect the diverticulum. Noteworthy, the present report substantiates that the management of complex benign esophageal disorders in a specialized center is directly related to patient outcomes and is a sine qua non.

Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that name and initials will not be published, and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Conflicts of interest
There are no conflicts of interest.

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