

## Large Oesophageal Epiphrenic Diverticulum Resected by Transhiatal Robotically-Assisted Approach - Case Report

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### Rezumat

#### *Diverticul esofagian epifrenic voluminos rezecat transhiatal prin chirurgie asistată-robotic - prezentare de caz*

**Introducere:** Diverticuli epifrenici reprezintă circa 20% din totalul diverticuli esofagieni. Ei sunt considerați a fi diverticuli de pulsione, caracterizați de prelungiri extralumenale ale mucoasei esofagiene de la nivelul ultimilor 10 cm ai esofagului, fiind frecvent asociați cu tulburări de motilitate ale esofagului. Cele mai frecvente manifestări clinice ale acestora sunt disfagia, regurgitațiile și durerea toracică. Au indicație chirurgicală numai diverticuli simptomatici. Operația se poate realiza prin abord miniinvasiv asistat-robotic și constă în diverticulectomie, recalibrarea hiatusului esofagian și un procedeu antireflux la care se adaugă de obicei și esomiectomie.

**Prezentarea cazului:** Prezentăm cazul unui pacient de 43 de ani care s-a internat cu un istoric de 4 luni de dureri epigastrice, pirozis și regurgitații. Investigațiile preoperatorii au diagnosticat un diverticul epifrenic voluminos cu dimensiunea de 6 cm. Operația efectuată a constat în diverticulectomie transhiatală cu endostapler liniar, recalibrarea hiatusului esofagian și fundoplicatură tip Nissen-Rossetti pe cale asistată-robotic folosind un sistem robotic da Vinci cu trei brațe. Durata operației a fost de 150 minute. Evoluția postoperatorie a fost favorabilă, pacientul fiind externat în ziua a 9-a fără compli-

cații. La zece zile după externare a fost reinternat de urgență pentru dureri toracice drepte, dispnee și halenă fetidă, fiind diagnosticat cu empiem pleural drept după fistulă tardivă a liniei de sutură esofagiană. S-a efectuat pleurotomie minimă dreaptă cu drenajul colecției pleurale sub anestezie locală și s-a instituit antibioterapie intravenoasă cu evoluție favorabilă, pacientul rămânând asimptomatic după 18 luni de monitorizare postoperatorie.

**Concluzii:** Abordul robotic este o opțiune chirurgicală minim invazivă fezabilă și sigură în tratamentul cazurilor selectate de diverticuli esofagieni. Considerăm că abordul robotic abdominal transhiatal este posibil în aproape toate cazurile de diverticuli epifrenici, indiferent de mărime, putându-se astfel evita abordul toracic și complicațiile majore posibile ale acestuia. Cea mai frecventă complicație postoperatorie după chirurgia diverticuli epifrenici o reprezintă fistula liniei de sutură esofagiană postdiverticulectomie, dar dacă este diagnosticată corect și rapid poate fi tratată conservator cu foarte bune rezultate.

**Cuvinte cheie:** diverticul epifrenic, chirurgie asistată-robotic, abord transhiatal

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### Abstract

**Introduction:** Epiphrenic diverticula (ED) represent about 20% of oesophageal diverticula. They are considered to be pulsion diverticula, characterized by outpouchings of the oesophageal mucosa originating in the distal 10 cm of the oesophagus and are frequently associated with spastic oesophageal dysmotility. The most frequent clinical manifestations of ED are dysphagia, regurgitations and chest

pain. Only symptomatic diverticula should be treated by surgery. The surgical procedure can be performed minimally invasively by robotic approach and consists of diverticulectomy, hiatus calibration and an antireflux procedure, usually adding an esophagomyotomy as well.

**Case-report:** We present the case of 43-year-old male patient who was admitted for a four-month history of epigastric pain, pyrosis and regurgitations. Preoperative investigations have shown an epiphrenic diverticulum 6 cm large in diameter. A robotic-assisted transhiatal diverticulectomy with a linear endostapler, hiatal calibration and a Nissen-Rossetti fundoplication were performed using a three-arm da Vinci Robotic System. Operative time was 150 min. Postoperative course was uneventful and the patient was discharged on postoperative day 9, without complications. Ten days later, he came back and was readmitted under emergency status for right chest pain, dyspnoea and fetid breath, being diagnosed with a right empyema secondary to a delayed fistula of the oesophageal suture line. A right minimal pleurotomy and pleural drainage under local anaesthesia were performed and an intravenous antibiotherapy was started with complete remission of symptomatology, the patient remaining asymptomatic after 18 months of follow-up.

**Conclusions:** Robotic approach is a feasible and safe minimally invasive surgical option in the treatment of selected cases of ED. We consider transhiatal abdominal robotic approach possible in almost all cases of ED, regardless of size, thus avoiding thoracic approach and its possible major complications. The most common serious complication after surgery of ED is postdiverticulectomy suture line fistula, but if properly and rapidly diagnosed it could be conservatively treated with very good results.

**Key words:** epiphrenic diverticulum, robotically-assisted surgery, transhiatal approach

## Introduction

Diverticula of the oesophagus represent a rare benign pathological entity with a reported prevalence range between 0.015% and 2%, but only for symptomatic and thus diagnosed ones (1). The true incidence remains unknown because the majority of them are asymptomatic and thus go undiagnosed (2). Usually they are single, but also up to 25% are reported to occur synchronously (1).

Oesophageal diverticula can be divided according to their localization in 3 groups: superior (pharygoesophageal or Zenker's diverticula), medi thoracic or midesophageal (diverticula of the oesophageal body) and inferior (epiphrenic diverticula). According to the pathogenesis, they are usually classified into pulsion and traction diverticula.

Epiphrenic diverticula (ED) represent about 20% of oesophageal diverticula (3). They are considered to be pulsion diverticula, characterized by outpouchings of the oesophageal

mucosa originating in the distal 10 cm of the oesophagus, usually on its right side, and are frequently associated with spastic oesophageal dysmotility and a high resting pressure of the lower oesophageal sphincter (2). The most frequent clinical manifestations of ED are dysphagia, regurgitations and chest pain. Only symptomatic ED, which represent up to 40% of total, should be treated by surgery (1,4).

Preoperative investigations must include an upper gastrointestinal contrast study and upper digestive tract endoscopy and usually an oesophageal manometry. However, manometry is not always successful due to inability to pass the probe past the diverticulum (2). In case of reflux symptoms, an oesophageal pH-monitoring could also be required.

## Case report

*Patient R.I., aged 43, with grade 2 obesity, presented himself to the General Surgery Clinic of "Prof. Dr. Agrippa Ionescu" Clinical Emergency Hospital in Bucharest in September 2011 for a four-month history of epigastric pain, pyrosis and regurgitations. Pathological aspects of significance in his past medical history were: arterial hypertension under ongoing treatment and an appendectomy.*

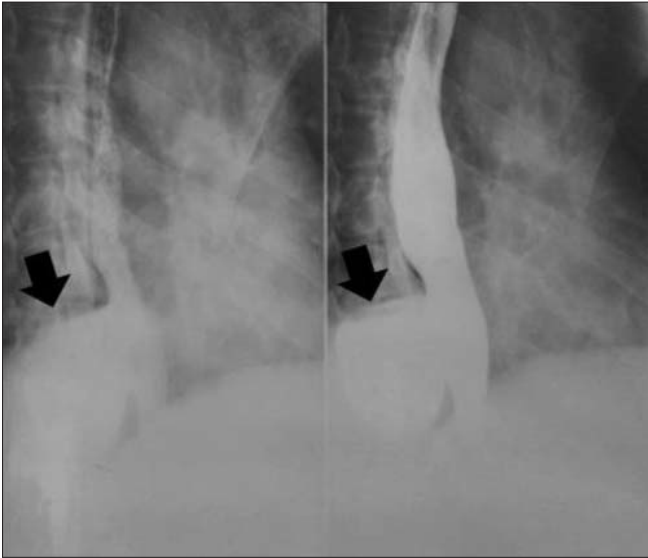
*Clinical examination showed a slightly painful abdomen, both spontaneously and on palpation, but without any signs of peritoneal irritation.*

*Routine preoperative blood tests did not show any significant abnormalities.*

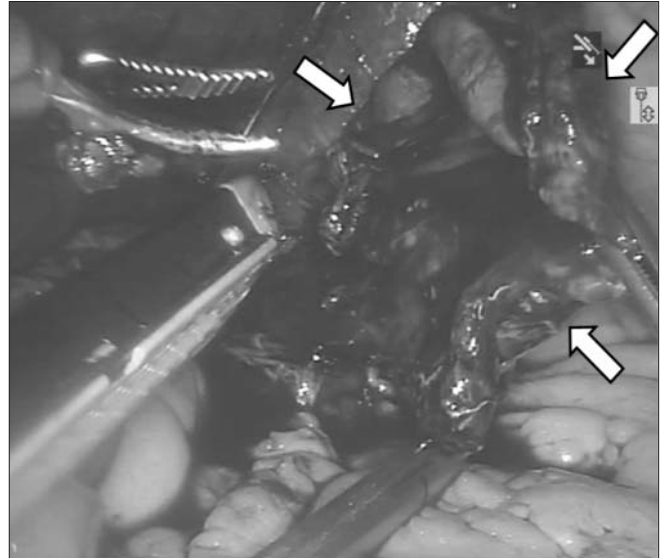
*Barium swallow exam revealed an oesophagus with normal transit of the barium substance through the inferior oesophageal sphincter; no signs of motility disorders at this level, presenting at the supracardial terminal end, on the right posterior-lateral wall, an additional oval image, approximately 6 cm in maximum transversal diameter; with an air-liquid level, and a large neck, suggestive for a diverticulum. Also, it showed a minimum gastroesophageal reflux in supine position, a stomach with normal faces and curvatures, with slightly thickened folds in the antral region; permeable central pylorus, duodenum C-loop with normal opacities. (Fig. 1)*

*Upper gastrointestinal endoscopy confirmed the presence of an ED, with a large implantation base on the right oesophageal lateral wall, above the oesogastric junction, and an erythematous antral gastritis. Oesophageal manometry could not be performed.*

*Surgery was performed under general anaesthesia with orotracheal intubation, by laparoscopic robotically-assisted approach (log no 716 / 8th September 2011). Patient was placed in 30° antiTrendelenburg supine position with the legs abducted (French position); after insufflation and achievement of 12 mmHg pneumoperitoneum, the primary and secondary trocars were introduced, later on being fixed to the 3 arms of the Intuitive Surgical da Vinci® Surgical System: one endoscopic and two operative trocars; 2 additional trocars were used, through which laparoscopic instruments were introduced: one 10 mm trocar for a left hepatic lobe spreader and a 12 mm one for the EndoGIA stapler. After cephalad traction of the left hepatic lobe and*



**Figure 1.** X-ray aspect of the epiphrenic diverticulum on barium oesophagogram (black arrow)



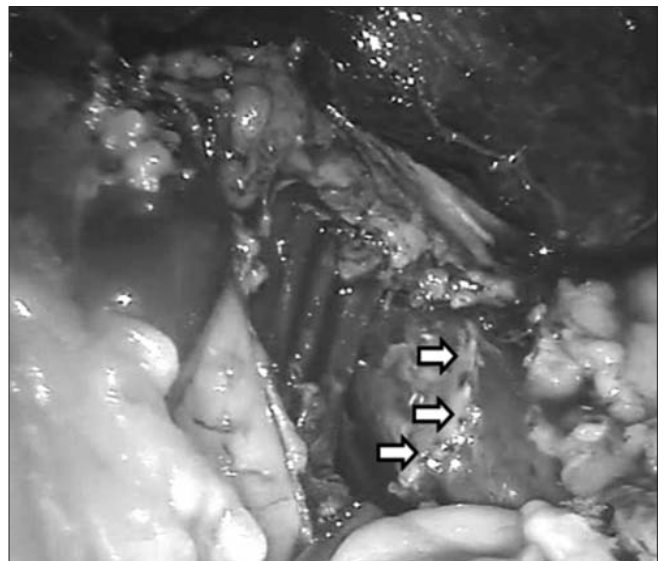
**Figure 2.** Intraoperative aspect of the epiphrenic diverticulum after complete mobilization (white arrows)

caudal traction of the stomach, the abdominal oesophagus and oesophageal hiatus were exposed; dissection of the abdominal oesophagus was performed, with an incision of the phreno-oesophageal membrane which allowed entrance to the posterior mediastinum and identification of a diverticular pouch in the inferior third of the oesophagus, which was circumferentially dissected down to its neck (Fig. 2). After complete dissection and exposure through lateral traction of the base of the diverticulum, dissection of the latter was performed using a green-cartridge Endo-GIA linear endostapler, with which the oesophagus was grazed (Fig. 3). The diverticulum was extracted and sent to histopathology examination; the oesophageal hiatus was sutured with separate threads and afterwards a Nissen-Rossetti fundoplication was performed, as an antireflux procedure; haemostasis control and subhepatic space drainage were performed. The surgical procedure ended with the retraction of the robotic arms, complete exsufflation of the peritoneal cavity, extraction of the trocars and suturing of the trocar insertion sites. Operative time was 150 min.

Results of the histopathology exam revealed an ulcerated oesophageal diverticulum, with areas of haemorrhagic infiltration.

Postoperatively, the patient retained the nasogastric tube, and received parenteral nutrition. 7 days after the operation, radiological exam with per os administered contrast agent (Gastrofin) revealed the existence of an oesogastric passageway, with integrity of the oesophageal suture and no fistulous tracts (Fig. 4). The nasogastric tube was removed and oral feeding was resumed, only with fluids initially. The patient was discharged without complications on postoperative day 9.

10 days after discharge the patient was readmitted to our clinic under emergency status, for right thoracic pain, dyspnoea and fetid halitosis. Clinical exam revealed lack of



**Figure 3.** Intraoperative aspect - postresection stapled line (white arrows)

vocal fremitus in the inferior third of the right hemithorax, dullness to percussion and no breath sounds perceivable in this area. Blood tests showed neutrophilic leukocytosis and a relatively high level of fibrinogen.

Chest X-ray (Fig. 5) revealed a massive opacity in the projection area of the right lung base, its superior level corresponding to the pulmonary hilum, presenting a number of air-liquid levels in its cranial segment, with an overall aspect suggestive of a right supradiaphragmatic effusion.

Oesogastroduodenal barium swallow detected the existence of a small oesophageal fistula with filiform trajectory of the contrast agent outside the oesophageal lumen.

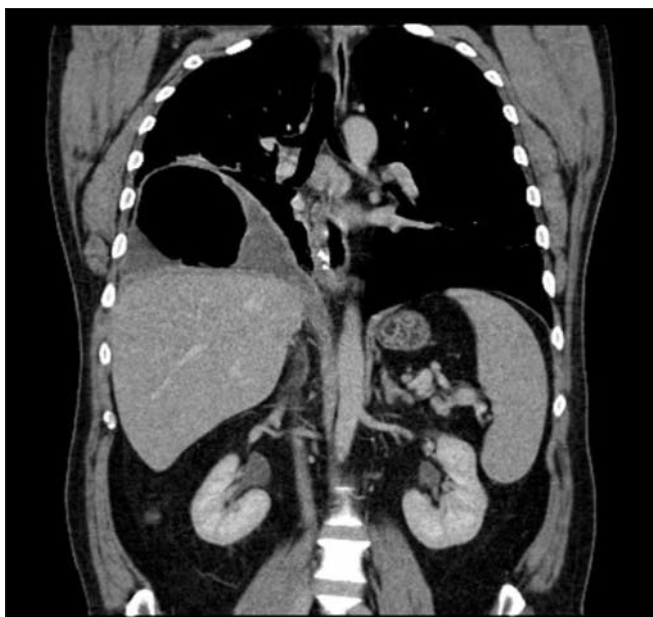




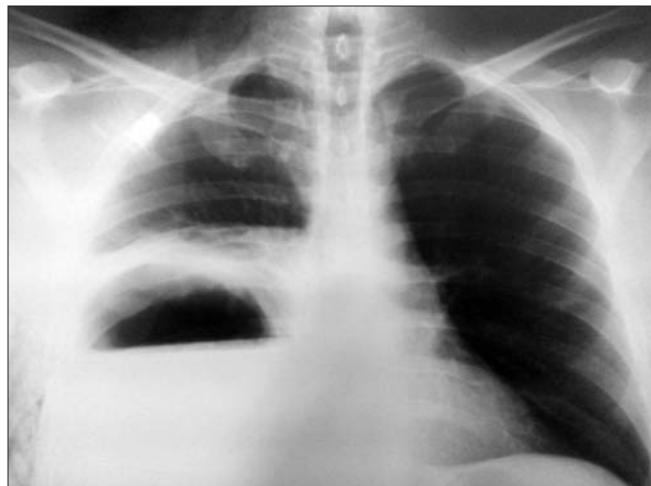
**Figure 4.** Postoperative contrast oesophagogram on p.o. day 7 showing good oesogastric passage and no leakage

The emergency CT scan performed described: oesophagus without any aspect of continuity solutions visible at distal thoracic segment level; large air-liquid collection visible in the right supradiaphragmatic area, with air-liquid levels present, measuring 204/70/108 mm. The collection determined the compression of the inferior right pulmonary parenchyma with visible collapse at this level and reached a superior margin corresponding to the 6th right lateral costal arch (Fig. 6).

Under the diagnosis of right pulmonary empyema secondary to delayed oesophageal suture fistula a minimal pleurotomy was performed on the midaxillary line in the seventh



**Figure 6.** Frontal CT cross section: air-fluid level of the postoperative right supradiaphragmatic pleural abscess cavity that is in contact with the post resection oesophageal stapled line (median - white)



**Figure 5.** Antero-posterior chest X-ray aspect of the empyema secondary to delayed oesophageal fistula

right intercostal space, with introduction in the right pleural cavity of a tube connected to a Beclere-type thoracic aspirative drainage system and evacuation of approximately 750 ml of malodorous purulent fluid (log no 771 / 21st September 2011).

24 hours after the pleural drainage, radiological exam of the thoracic cavity showed no more signs of collection presence, with the reexpansion of the lung (Fig. 7).

Per os feeding was suppressed, the patient postoperatively receiving parenteral nutrition for 2 weeks. During this period, antibiotherapy with Ceftriaxone and Metronidazole was instated. Oesogastric barium swallow was repeated 2 weeks after, showing closure of the fistula. Oral feeding was gradually resumed, starting with liquids. Pleural drainage was suppressed 17 days postoperatively, at which time the patient was also discharged. Further evolution was favourable, the



**Figure 7.** 24-hour postoperative X-ray after right pleural drainage

*patient remaining asymptomatic at 6 months and 1-year follow-up exams.*

## Discussions

The main surgical procedure for ED consists in diverticulectomy and was typically performed via thoracotomy (mainly left) or via laparotomy with transhiatal approach. In addition to diverticulectomy, the other surgical therapeutic objectives include an adequate myotomy on the opposite side of the oesophagus as against the diverticular neck and a gastric fundoplication, as an antireflux procedure (5). The undetermined aetiology of ED has led to controversy regarding the routine use of a myotomy associated with diverticulectomy (2). Although the majority of authors use myotomy as a routine procedure in the surgical treatment of ED (1,4-9), some authors consider this manoeuvre is not necessary in all cases, especially if there is no demonstrated dysmotility of the lower oesophageal sphincter at preoperative manometry (1,2,4,10).

Traditionally, ED were operated by thoracotomy approach (usually left), by laparotomy, or even through a combined thoracoabdominal approach, surgical procedures that involved high surgical risks. Since the introduction of minimally invasive surgery, the laparoscopic approach of ED has been favoured against open surgery due to its known benefits (4,6,8,10-12), thus leaving the way open in recent years for the introduction and development of robotic approach in the surgical management of this rare disease (13,14).

The technical advantages of robotic approach in comparison to laparoscopic surgery, and open surgery especially, are indisputable in terms of high definition visualisation of anatomical structures, and more so of facile dissection and mobilization of the oesogastric junction, of the inferior oesophagus and of the diverticular sac in particular from the mediastinal structures, even in the presence of extensive adhesions or large diverticula. However, on a global scale, robotic approach in ED surgery is still at the beginning, the medical literature encompassing only sporadic reports of cases treated surgically by transhiatal (13,14) or even transthoracic approach (15).

Several reference articles have been published in Romanian surgical journals regarding the surgical treatment of ED (3,7) and the use of robotic surgery by means of the da Vinci® Surgical System in abdominal and oesogastric junction pathology (16,17), several renowned university clinics already having accumulated a high degree of experience in this top surgical domain.

The most common disadvantages of using robotic approach consist in financial reasons, due to the high price and costs of maintenance of this advanced surgical technology, and also in a longer learning curve.

Although the reported success rate of ED surgical treatment can reach 80-100%, the mortality rate cannot be ignored, varying between 0-9%, while the overall morbidity rate exceeds 5.3%, with an average 13%, but reaching even 50% in some studies (1,4). However, morbidity and mortality rates after ED surgery are lower in the case of laparoscopic or robotically-

assisted approach compared to open surgery (1,2,10,11). The most frequently encountered postoperative complication is oesophageal fistula at postdiverticulectomy suture line level, with an incidence ranging between 5.3% and 37.5% (4). The risk factors for postdiverticulectomy suture line fistula include the use of 2 or more linear staplers in case of large neck diverticula, inadequate quality of the staples used for the mechanical suture compared to the oesophageal wall thickness, increase of tension in the suture line due to hypertonia of the inferior oesophageal sphincter in the absence of myotomy. Some authors also recommend approximating muscular oesophageal margins over the stapled line using interrupted or running sutures (4,5), although this can sometimes lead to oesophageal stenosis. In the case reported, we did not consider myotomy useful given that there were no dysmotility disorders of the inferior oesophageal sphincter detected by preoperative investigations, and the approximation of muscular oesophageal margins over the stapled line seemed to present a too high degree of risk of oesophageal stenosis.

Treatment of postdiverticulectomy oesophageal fistula sometimes involves surgical reintervention with secondary suture of the fistulous orifice or, in cases with small opening fistulas, can be conservative, by setting a nasogastric tube or even endoscopically placing of an oesophageal stent, stopping of oral feeding and administering parenteral nutrition. However, in cases with purulent collection of the adjacent pleural or abdominal area an external drainage should be added.

## Conclusions

Robotic approach is a feasible and safe minimally invasive surgical option in the treatment of selected cases of ED. Due to its intrinsic characteristics, the da Vinci® Robotic System could facilitate a better visualisation and especially an improved mobilization of the lower oesophagus and oesogastric junction and also a superior dissection of the ED compared with laparoscopic approach or open surgery. However, robotic approach in the management of ED should only be used by experienced surgical teams who are already familiarized with laparoscopic surgery of the oesogastric junction. We consider transhiatal abdominal robotic approach possible in almost all cases of ED, regardless of size, thus avoiding thoracic approach and its possible major complications. The most common serious complication after surgery of ED is postdiverticulectomy suture line fistula, but if properly and rapidly diagnosed it could be conservatively treated with very good results.

## Disclosures

The authors have no conflict of interest.

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