

Robotic Surgery: An Effective Treatment Option for Epiphrenic Diverticulum Associated with Nutcracker Esophagus

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How to cite this paper: Tinoco, A., Carvalho, G., Tinoco, L. and Quintão, A.P. (2024) Robotic Surgery: An Effective Treatment Option for Epiphrenic Diverticulum Associated with Nutcracker Esophagus. *Surgical Science*, 15, 1-6.
<https://doi.org/10.4236/ss.2024.151001>

Received: November 28, 2023
Accepted: January 13, 2024
Published: January 16, 2024

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Abstract

Background: Epiphrenic Diverticulum is frequently associated with esophageal motility disorders, such as nutcracker esophagus. The diagnosis is usually made using imaging studies such as a Barium esophagogram, and esophageal manometry. Surgical treatment options for epiphrenic diverticulum and EN include diverticulectomy and wide myotomy. **Aim:** The resection of three epiphrenic diverticula and extensive myotomy were performed by robotic thoracoscopy uneventfully. **Case presentation:** A 65-year-old female complaining of dysphagia for solid foods, Chest pain and regurgitation. Esophagogastroduodenoscopy (EDG) with difficulty in advancing the endoscope at 25 cm and demonstrating an ED, no hiatal hernia and normal stomach and duodenum. Barium Esophagogram showed multiple diverticula and tortuosity throughout the esophagus. **Conclusion:** With robotic surgery, surgeons can perform highly precise operations with enhanced 3D vision and control. Through this cutting-edge approach, the treatment of ED associated with EN can be drastically changed, promising better outcomes for patients.

Keywords

Robotic Surgery, Myotomy, Nutcracker Esophagus, Epiphrenic Diverticulum

1. Introduction

The prevalence of epiphrenic diverticulum (ED) associated with nutcracker esophagus (NE) remains unknown due to the rarity of these conditions [1].

NE, also known as hypertensive peristalsis or hypercontractile esophagus affects 2% to 3% of the population [2]. The true incidence is thought to be much higher since it is often misdiagnosed as acid reflux. ED is associated with eso-

ophageal motility disorder in 60% of patients, the most frequent being achalasia and diffuse esophageal spasm (DES). It is rarely reported with NE [3]. Unlike achalasia, NE have no well-defined pathology.

Recently, esophageal diverticula have been associated with motor abnormalities being characterized by high-pressure contractions in the esophagus, making swallowing difficult [4] [5]. There are non-surgical options such as lifestyle changes (avoiding certain foods and eating slowly) and medication which often end up being a temporary solution and not a long-term treatment. They may provide temporary relief, but they are not the definitive answer for all patients [6].

The treatment of esophageal motility disorders is a complex and evolving field, and the optimal management of patients with ED and DES remains controversial.

The key to successful treatment of DES and NE is to resecting the diverticulum and to perform a complete myotomy to prevent disease recurrence.

Robotic surgery has emerged as a promising approach for the treatment of ED associated with NE, offering greater precision and visualization, avoiding mucosal perforations during myotomy, when comparing to traditional surgical technique approaches. Despite the complexity of these conditions, advances in robotic surgery have paved the way for innovative solutions [7] [8]. By harnessing the power of technology, surgeons can perform highly accurate operations with precise movement of robotic arms, endowrist technology and enhanced 3D vision control.

The objective of this report is to demonstrate that performing resection of the epiphrenic diverticulum with extensive myotomy robotically to treat NE is feasible and safe, this method has not yet been reported in the literature.

2. Case Presentation

A 65-year-old female complains of dysphagia for solid foods, Chest pain and regurgitation. esophagogastroduodenoscopy (EDG) with difficulty in advancing the endoscope at 25 cm and demonstrating an ED, no hiatal hernia and normal stomach and duodenum. Barium esophagogram showed multiple diverticula and tortuosity throughout the esophagus (**Figure 1**). Manometry was not possible due to the difficulty in passing the probe through the esophagus.

Under general anesthesia, a single-lumen endotracheal intubation was used. The patient was in semi-prone position. A total of four trocars were used on the right chest. The initial endoscope was placed on port 2 at the 5th intercostal space (ICS), between the mid axillary line (MAL) and anterior axillary line (AAL). Intrathoracic carbon dioxide (CO₂) insufflates with an 8 mmHg pressure. Port 1 was positioned at 8 cm away from port 2 at the 8th ICS space and port 3 in the 3th ICS, between the MAL and AAL. The 12 mm assist port was placed at the 6th ICS at AAL. The Da Vinci[®] cart was docked at the patient left side.

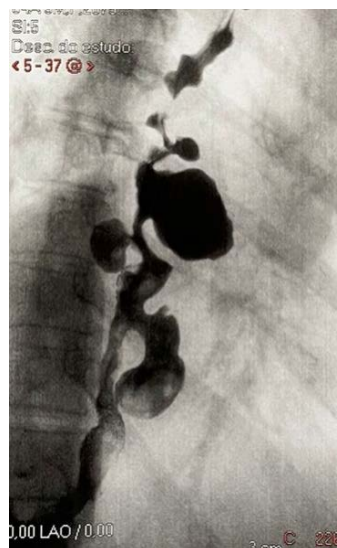


Figure 1. Barium esophagogram showed multiple diverticula and tortuosity throughout the esophagus.

Azygos vein dissection was performed with Cadieere forceps at arm 1, and sectioning with scissors with monopolar energy at arm 3. Ligation was done using 4 hemolocks. Proximal and distal dissection was done after the esophageal repairing with an umbilical tape. Three epiphrenic diverticula were identified after dissection of the esophagus up to the lower esophageal sphincter. After the neck was fully exposed, a 36-French boogie was inserted into the esophagus to avoid narrowing the lumen. Through the assistant port, an Endo-GIA stapler (45 mm length, vascular load; Medtronic, Minneapolis, Minnesota, USA) was inserted to divide the neck of the diverticulum. During this step, meticulous care was taken not to perforate the diverticulum. The diverticulum were removed and placed in an Endo Bag (Cook®). The staple line was examined for any leakage and reinforced was done with 3.0 prolene thread, using a running suture and an extensive esophageal myotomy was performed. A thoracic tube was placed into the right hemithorax (**Appendix, Video 1**).

An iodine esophagography was performed on the second postoperative day, demonstrating normal swallowing (**Figure 2**).

Informed consent was authorized by the patient to report this case.

In the Histopathological study, the following were identified in the macroscopic visualization: Three irregular fragments of tissue, brownish and elastic, measuring together $3.5 \times 2.2 \times 1.3$ cm. In conclusion: Epiphrenic Diverticulum.

Patient was discharged from hospital on the third day after the procedure, presented good clinical evolution, and remains in outpatient follow-up.

3. Discussion

ED is a rare type of esophageal diverticula with a prevalence ranging from 0.015% to 2%. Males show a slightly higher incidence, with a peak age between the sixth and seventh decades of life [9].



Figure 2. An iodine esophagography was performed on the second postoperative day, demonstrating normal swallowing.

NE is also a rare esophageal motility disorder characterized by simultaneous, uncoordinated or rapidly propagated contractions with normal amplitude and with dysphagia [10].

Esophageal spasms symptoms resemble those of a ED. Chest pain that may feel like heartburn, dysphagia, retrosternal pain mainly during swallowing, bolus sensation and regurgitation.

The presented case demonstrated an association of both diseases, with symptoms in line with those described in the literature and considering that, up to 60% of patients with ED also present with underlying motility disorders, with NE being one of them [3]. More recently, esophageal diverticula have been associated with motor abnormalities [4] [5].

Surgical treatment for ED and NE is diverticulectomy and wide myotomy of the esophageal musculature to prevent recurrence [11]. The presented case a robotic thoracoscopy resection of three diverticula and wide myotomy was done (**Appendix, Video 1**).

Surgical treatment for DE and NE has been shown to be effective in improving symptoms and improving patients' quality of life. On the other hand, the risks should be considered including bleeding, leakage, and damage to adjacent organs [12]. Surgical approach can be through conventional surgery or minimally invasive techniques such as laparoscopy or robotic-assisted surgery.

Controversy persists regarding the extent of the esophagomyotomy, both proximal and distally. Some authors advocate that should be done myotomy only in the motor disorder area, sparing the lower esophageal sphincter, unless it is hypertensive. The goal would be to avoid the need for an additional anti-reflux repair [13].

Limiting the myotomy may contributed to the recurrence, by not sufficiently reducing the abnormal contractions and maintaining the symptoms of the NE [14]. Without myotomy, the incidence of recurrence may reach 20% of the cases [15]. On the other hand, diverticulectomy with myotomy has been shown in the literature to have a postoperative leakage in approximately 7.7% - 27.2% la [11] [16].

Robotic surgery has a high level of precision and accuracy in performing surgical procedures [17] [18], making it possible to reduce morbidity and mortality.

4. Conclusions

In this patient, the robotic approach, with 3D vision, image magnification and endowrist technology made the operation easier and safer, especially considering the esophageal dissection, the suture invagination and the extensive myotomy, with less risk of mucosal injury.

Through this cutting-edge approach, the treatment of ED associated with NE can be dramatically altered, promising better outcomes for patients.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix

Video 1. Final minutes of surgery and an iodine esophagography was performed on the second postoperative day.

https://drive.google.com/file/d/1OSmQhPADkrP1z9e_BIJFzEWHzTFG-9JD/view?usp=sharing