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Is resection of an esophageal epiphrenic diverticulum always necessary in the setting of achalasia?

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Abstract

Background: Esophageal epiphrenic diverticulum (ED) is usually secondary to a primary esophageal motility disorder such as achalasia. While the recommended surgical treatment includes esophageal myotomy and diverticulectomy, the outcome of patients in whom a myotomy without ED resection is performed is not known. The aim of this study was to compare the outcome of ED patients who underwent ED resection and myotomy and those of ED patients who had a myotomy only.

Methods: Retrospective review of a prospective database. Thirteen ED patients had symptom evaluation, barium swallow, endoscopy and esophageal high resolution manometry (HRM). All patients underwent laparoscopic myotomy and Dor fundoplication. In 6 patients the ED was resected (excised ED group), while in 7 it was left in place (non-excised ED group); in 3 because it was small and in 4 for technical reasons).

Results: Preoperatively all patients had dysphagia and 85% had regurgitation. The mean preoperative Eckardt score was 6.5 ± 2.1 in excised ED group and 6.6 ± 3.3 in non-excised ED group ($p=0.95$). HRM showed type II esophageal achalasia in 85% of patients. One excised ED group patient had a staple line leak (17%). At a median follow-up of 2 years, the Eckardt score was 0 in excised ED group and 0.1 in non-excised ED group ($p=0.56$).

Conclusions: The results of this study showed that patients in whom a myotomy without ED resection was performed had resolution of their symptoms. These findings suggest that in patients with achalasia and ED the underlying motility disorder rather than the ED may be the cause of symptoms. **Studies with a larger number of patients and a longer follow-up will determine the validity of this approach.**

Key words

- Epiphrenic diverticulum
- Achalasia
- Diffuse esophageal spasm
- Chicago classification
- Eckardt score
- Diverticulectomy
- Myotomy

Introduction

Epiphrenic diverticulum (ED) of the esophagus is a rare entity. The most common presenting symptoms are dysphagia and regurgitation. Recent studies have shown that a primary esophageal motility disorder (PEMD), such as achalasia or diffuse esophageal spasm, is associated with ED and is thought to play a role in the ED pathogenesis and in the patient's symptoms [1-7].

Some retrospective studies comparing the outcome of surgical and non-operative treatment of ED have reported worse symptom control and the need for more esophageal dilatations or botulinum toxin injections in patients treated non-operatively. These data suggest that this approach should be reserved for patients with small asymptomatic or mildly symptomatic ED, or to those unfit for surgery [8,9]. The last two decades have witnessed a shift in the surgical approach to symptomatic ED patients. Nowadays, laparoscopic epiphrenic diverticulectomy with myotomy and fundoplication is considered the surgical treatment of choice as it provides excellent results [2,4,5,8-11]. However, epiphrenic diverticulectomy is a challenging procedure, with high postoperative complications rates. Staple line leaks occur in up to 23% of cases, pulmonary complications are observed in 8% to 10% of patients, and mortality rates range between 0% and 7% [12]. In addition, in some patients the upper pole of the diverticulum may be too high to be safely dissected laparoscopically or severe adhesions are present, and while the myotomy and the fundoplication can be completed, the diverticulectomy may require a thoracoscopic approach. Very little is known about the outcome of patients with symptomatic ED in whom a myotomy without ED resection is performed [13].

The aim of this study was to compare the outcome of patients with ED who underwent ED resection and myotomy and those of ED patients who had a myotomy only.

Material and Methods

This is a retrospective review of a prospectively set institutional review board-approved database of patients referred for evaluation and treatment of symptomatic ED to the Center for Esophageal Diseases of the University of Chicago Medical Center and Loyola University, between January 2009 and April 2013.

Preoperative assessment

The diagnostic workup included a) symptom evaluation; b) barium swallow; c) upper endoscopy; and d) esophageal manometry.

Symptom evaluation. Presence and duration of dysphagia, regurgitation, heartburn, hoarseness, cough, and chest pain were assessed.

Barium swallow. It was performed to assess the location, diverticular size, neck size, and distance of the ED from the gastroesophageal junction.

Upper endoscopy. It was performed to rule out the presence of a peptic stricture or cancer as cause of the dysphagia.

Esophageal manometry. High-resolution manometry was performed after an overnight fast using a solid-state catheter with 36 circumferential sensors spaced at 1-cm intervals as previously described [14].

Surgical technique: laparoscopic diverticulectomy, myotomy and partial fundoplication

Five 10-mm ports were used for the procedure and placed as described during a Heller myotomy for achalasia [15]. The operation started with the opening of the gastrohepatic ligament all the way to the right pillar of the crus, which was separated from the esophagus. The peritoneum overlying the esophagus was then transected, and the esophagus was separated from the left pillar of the crus. All short gastric vessels were taken down all the way to the left pillar of the crus. Dissection was completed from the left, adjoining the dissection that had been performed from the right. Both the anterior and the posterior vagus nerves were identified and preserved. A Penrose drain was passed around the esophagus, incorporating the nerves. The surgeon then proceeded with dissection of the esophagus in the posterior mediastinum in order to bring the diverticulum as close as possible to the hiatus. The neck of the diverticulum, the lower and the upper pole, and the lateral aspect of the pouch were freed from surrounding structures. After passing a bougie down the esophagus into the stomach, the neck of the ED was transected by using a linear Endo-GIA stapler with 3.5-mm staples. The staple line was covered by approximating the muscle layers with interrupted 2-0 silk stitches. A myotomy was performed in the 1 o'clock position, extending all the way to the upper portion of the diverticular neck, and about 2 cm onto the gastric. Finally, a Dor fundoplication was constructed [4].

Postoperative course

A routine esophagram was obtained postoperatively. If this test did not show a leak, patients were fed clear liquids and then a soft diet, and were usually discharged 23 to 48 hours after the operation.

Follow-up

Patients were seen in clinics 2 and 8 weeks after the operation. Subsequently they were contacted by phone or by e-mail every 3 months. The same questionnaire used pre-operatively to determine the Eckardt score was used.

Statistical analysis

Statistical analysis was performed using SPSS version 19 (Copyright © SPSS Inc., 2000). The data were collected in an Excel spread sheet. Quantitative data are given as mean and Standard Deviation (SD). Proportions were compared using the χ^2 test or the Fisher exact test where appropriate. Student's t test was used to compare normally distributed variables. A level of 5% was set as the criterion for statistical significance.

Results

Thirteen patients with symptomatic ED were referred to our Institutions between January 2009 and April 2013. All patients underwent laparoscopic myotomy and Dor fundoplication. In 6 patients the diverticulum was resected (excised ED group), while in 7 it was left in place (non-excised ED group). Table 1 summarizes the preoperative data in the two groups of patients. No differences were observed between the two groups in terms of age and gender. In 3 patients the ED was left in place because it was very small (between 2 and 3 cm) and in 4 patients for technical reasons. Specifically, the upper border of the ED neck and the upper pole could not be safely dissected laparoscopically because too far from the esophagogastric junction (EGJ), or because of severe adhesions (Table 2) (figure 1).

Symptom evaluation. Dysphagia was present in all patients; regurgitation was reported by 85% of patients, with no differences between the two groups. Three (50%) patients in the excised ED group and 3 (42.9%) patients in the non-excised ED group complained of cough. The preoperative Eckardt score was similar in both groups.

Duration of symptoms was 36 ± 33 months in excised ED group and 30 ± 35 months in the non-excised ED group ($p=0.66$). One (16.7%) patient in the excised ED group and 2 (28.8%) patients in the non-excised ED group had pneumatic dilatations before the operation.

Esophageal manometry. High-resolution manometry showed achalasia in all 13 patients, with no differences between the 2 groups in the type of achalasia according to the Chicago classification (Table 1).

Barium swallow. The barium swallow showed similar size, location, neck diameter, between the 2 groups, while the mean distance from the GEJ to the inferior border of the ED neck and to the upper pole of the ED was significantly higher in the patients in whom the ED was not excised for technical reasons (Table 2).

Intraoperative results. No patients in the excised ED group had intraoperative complications, while opening of the left pleura occurred in 1 (14%) patient of the non-excised ED group. There were no conversions to open surgery.

Postoperative course. There was 1 (17%) staple line leak in the excised ED group, while no complications occurred in the non-excised ED group. The leak was identified by the post-operative esophagram and it was successfully treated with a combination of a drain placed by interventional radiology next to the staple line, total parenteral nutrition, and use of endoscopic

clips. This patient remained in the hospital for 24 days. Excluding this patient, the hospital stay was similar in the 2 groups: excised ED 2.4±0.5 days, versus 1.7±0.8 days in the non-excised ED group (p=0.12).

Follow-up. At a mean follow-up of 20.7±16.6 months in the excised ED group and 11 ± 18 months in the non-excised ED group (p=0.38), the Eckardt score was 0 and 0.1 ± 0.4, respectively (p=0.56). One (16.7%) excised ED group patient had postoperative heartburn that was well controlled with acid reducing medications. No symptoms were reported in the group of patients who had myotomy and Dor fundoplication without ED excision.

Discussion

The results of this study showed that patients in whom a myotomy without resection of the ED was performed had resolution of their symptoms. These findings suggest that in patients with achalasia and ED the underlying motility disorder rather than the ED may be the cause of symptoms.

ED is a rare esophageal disease secondary to an underlying PEMD that is present in 75% to 100% of cases [1-7]. In the present series, achalasia was found in 100% of patients, confirming the results published by Nehra et al. in 21 ED patients undergoing 24-hour esophageal manometry [1].

There is general consensus that the surgical treatment should be offered only to symptomatic patients, since symptoms will develop in less than 10% of asymptomatic ED patients [8], and that postoperative morbidity and mortality rates are high even in referral centers

[5,6]. Because there is evidence that ED occurs in association with a PEMD, the surgical treatment of ED patients should always include a myotomy to address the PEMD and to reduce the risk of postoperative staple line leak. We routinely perform a long myotomy which extends to the upper portion of the diverticular neck proximally, and about 2 cm onto the gastric wall distally [16]. A partial anterior fundoplication is added as we do in patients with achalasia alone in order to prevent reflux [17].

The laparoscopic trans-hiatal approach to ED patients has been shown to be safe and effective, and to have several advantages when compared to the transthoracic approach: 1) avoidance of single-lung ventilation, with no need for a chest tube at the end of the procedure; 2) optimal visualization of both the GEJ and lower mediastinum to perform the dissection and a long myotomy; 3) perfect alignment of the stapler to the longitudinal axis of the esophagus and 4) the possibility of constructing a fundoplication.

Several factors including distance of the ED from the GEJ, severe inflammation and adhesions between the wall of the ED and the pleura might limit the feasibility of resecting the ED. To date, very little is known about the outcome of patients in whom a myotomy without ED resection is performed. The only study that specifically evaluated the outcome in these patients was published by Müller et al. [13]. They analyzed the outcome in 4 frail patients who underwent laparoscopic myotomy alone and in 2 fit patients who had ED by thoracoscopy or with thoracotomy. Three of the four risk patients showed normal postoperative courses after laparoscopic myotomy, while one patient died of pulmonary complications. Both patients who had undergone transthoracic ED resection developed postoperative staple line leak. After a mean follow-up of 15.8 months (range, 6–25), all patients were free of symptoms. The authors

concluded that myotomy alone without ED resection should be considered as a valid alternative option in frail patients. In addition, there is evidence that the size per se of the ED should not be considered an indication for surgery, since it does not correlate with presence and severity of symptoms [8,11].

Our results confirm that a myotomy alone can provide very good results. At the end of the follow-up, the mean Eckardt score significantly decreased from 6.5 to 0 in excised ED group and from 6.6 to 0.1 in non-excised ED group. One (16.7%) excised ED group patient had postoperative heartburn that was well controlled with acid reducing medications. No symptoms were reported in the group of patients who had myotomy and Dor fundoplication without ED excision. It is important to stress that a second procedure had been originally planned in the 4 patients in whom the diverticulum could not be resected for technical reasons. Because of the high location we had planned a diverticular resection through a left thoracoscopic approach, 4 to 6 weeks after the first operation. We were therefore very surprised when patients were symptom free during the first postoperative visit, and remained asymptomatic thereafter. This findings suggest that not only the dysphagia, but also the regurgitation is due to the underlying motility disorder such as in patients with achalasia without an ED.

Conclusions

We do acknowledge that this study has some limitations. First, the number of ED patients included in the analysis was small. However, ED is a rare disease and even tertiary care centers have a limited number of patients. Second, the follow-up is relatively short. **Studies with a larger number of patients and longer follow-up will be needed to confirm the validity of**

this approach. Third, the two groups were not comparable, as the anatomy was different in patients in whom the diverticulum was left in place.

We feel, however, that even with these limitations, this study contributes to the management of ED patients. When a laparoscopic approach is attempted and resection of the diverticulum is not possible, a myotomy and a fundoplication should be performed as in patients with achalasia alone. If the patient experiences resolution of symptoms, an expectant strategy should be followed, avoiding a second operation through the chest.

As the value of these data is limited by the small sample size, we plan to set up a prospective, multicenter study to try to give a more definitive answer about the role of diverticulectomy in symptomatic ED patients.

Legend to figures

Figure 1. Non resected epiphrenic diverticulum.

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Table 1. Preoperative data.

	<u>Excised ED (N=6)</u>	<u>Non-excised ED (N=7)</u>	<u>p value</u>
Age (years)	63 ± 10	67 ± 13	0.59
Gender (male %)	3 (50)	4 (57.1)	0.79
Dysphagia (%)	6 (100)	7 (100)	1
Regurgitation (%)	6 (100)	5 (71.4)	0.46
Esophageal Candida (%)	0	1 (14.3)	0.94
Achalasia type 1, N (%)	1 (16.7)	0	0.50
Achalasia type 2, N (%)	4 (66.6)	5 (71.4)	
Achalasia type 3, N (%)	1 (16.7)	2 (28.6)	
ED size (mm)	46.3 ± 5.5	40.6 ± 22.5	0.56
ED side (right), N (%)	5 (83.3)	3 (42.8)	0.27
Eckardt score	6.5 ± 2.1	6.6 ± 3.3	0.95

ED = epiphrenic diverticulum.

Table 2. Excised and non-excised epiphrenic diverticula.

	Excised ED (6 patients)	Non-excised ED for technical reason (too high, 4 patients)	p value
Inferior border of the neck (mm from GEJ)	16.6 ± 8.2	56.8 ± 5.2	0.0001
Upper ED pole from GEJ (mm)	51.5 ± 11.2	83.5 ± 5.1	0.0007
ED size (mm)	46.3 ± 5.5	57.7 ± 9.3	0.039
ED side (right), N (%)	5 (83.3)	2 (50)	0.67
Neck diameter (mm)	18.7 ± 4.7	14.6 ± 2.1	0.14

ED = Epiphrenic diverticulum; GEJ = Gastroesophageal junction