Management of Epiphrenic Diverticula

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Epiphrenic diverticula are very rarely seen and are often associated with achalasia, esophageal body dysmotility, and a high resting lower esophageal sphincter pressure. The aim of this study was to evaluate the different treatment options for patients with epiphrenic diverticula. Patients with an epiphrenic diverticulum were divided into two treatment groups: surgical and nonsurgical. Retrospective chart review was performed, and a symptom questionnaire was created. There were six patients in the nonsurgical group and 11 patients in the surgical group. The mean follow-up was 26.4 months. Ten patients had a laparoscopic operation performed. One patient was operated on thoracoscopically and had to be converted to a thoracotomy. Two diverticula were inverted with good results. There was one postoperative esophageal leak where no myotomy was added. An empyema developed in another patient at 4 weeks after surgery. One patient, in whom no antireflux procedure was performed, reported postoperative heartburn. Patients in the nonsurgical group had smaller diverticula, were not good candidates for surgery, or were asymptomatic. Esophageal diverticula are very rarely seen. Asymptomatic patients may not require therapy. If surgery is performed and the diverticulum is large, it should be removed. The laparoscopic approach is the surgical treatment of choice. A long myotomy and an antireflux procedure should be added to avoid esophageal leakage at the line of repair and gastroesophageal reflux. (J GASTROINTEST SURG 2003;7:906–911)

KEY WORDS: Esophageal diverticulum, epiphrenic diverticulum, laparoscopic surgery, achalasia

Opinions differ as to whether epiphrenic diverticula are true[1,2] or false[3–5] diverticula, and their origin remains speculative. Furthermore, the reason for diverticula to increase in size is thought to be due to an outflow obstruction. Epiphrenic diverticula occur in the distal 10 cm of the esophagus and are frequently associated with spastic esophageal dysmotility and a high resting pressure in the lower esophageal sphincter (LES),[6] suggesting that they are pulsion diverticula. Streitz et al.[7] reported the occurrence of epiphrenic diverticula with achalasia and drew a line between these two diseases in terms of the pathophysiology that causes epiphrenic diverticula and esophageal body motility abnormalities. The true incidence of epiphrenic diverticula is unknown because they are often asymptomatic and usually go undiagnosed. Therefore most patients with an epiphrenic diverticulum do not undergo surgery. The decision to operate and which operation to perform depends on the presence of symptoms, which may include dysphagia, regurgitation, weight loss, and chest pain. The preoperative workup should include an upper gastrointestinal contrast study, upper endoscopy, and esophageal manometry. However, manometry may not always be successful in these patients because of the inability to pass the probe past the diverticulum.[8] If the patient has symptoms of reflux disease, pH monitoring should be done to diagnose true gastroesophageal reflux as opposed to reflux from the diverticulum into the midesophagus.[9]

The surgical approach may be via a left or right thoracotomy, a thoracoscopy, a laparotomy, or laparoscopy. The undetermined etiology of epiphrenic diverticula has led to controversy regarding the routine use of a myotomy in addition to the diverticulectomy.[10,11] Also, the required length of the myotomy remains controversial. The surgical therapeutic possibilities include diverticulectomy with a long myotomy with or without an antireflux procedure, diverticulectomy with selective myotomy for those with a motor abnormality found on manometry, or diverticulectomy alone if no motor abnormality is detected. The

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1091-255X/03/$—see front matter
doi:10.1016/S1091-255X(03)00147-1

latter is controversial because case reports suggest a lower recurrence rate, a reduced risk of suture line leakage, and better symptom resolution when a myotomy is performed. To evaluate the outcome of patients with epiphrenic diverticula, we investigated all patients in our institutional records between 1996 and 2000 who are known to have had an esophageal diverticulum and compared the different surgical and nonsurgical treatment options.

MATERIAL AND METHODS

Study Group

All patients undergoing surgery for epiphrenic diverticula at the Mayo Clinic Jacksonville, Florida, from May 1996 to December 2000 were included in the study group.

Control Group

All patients seen at the Mayo Clinic Jacksonville, Florida, from March 1996 to December 2000 who were known to have an epiphrenic diverticulum were included in the control group. These patients were identified by examining all esophageal manometric and radiologic records for this period of time.

Study Design

A retrospective chart review was done to determine preoperative symptoms, manometric findings, radiologic findings, type of surgical procedure, postoperative outcome, and type of conservative therapy. A questionnaire was answered by all patients via a telephone call from a blinded investigator. Patients were asked to rate their symptoms on a scale of 1 to 10 with 1 indicating no symptoms and 10 indicating severe symptoms. Questions were asked concerning dysphagia, regurgitation, chest pain, heartburn, other symptoms, and current treatment. All patients had a barium esophagram. Esophageal manometry and 24-hour pH monitoring were performed according to the method described by DeMeester et al.[10]

Surgical Procedures

In six patients the diverticulum was excised, in two it was inverted into the esophagus, and in three it was included in a fundoplication. The surgical approach was either laparoscopic or through the chest, depending on the size of the diverticulum or its accessibility from the abdomen. In 10 patients the laparoscopic approach was used. After the establishment of a pneumoperitoneum superior to the umbilicus and insertion of four subcostal ports, as is customary for laparoscopic Nissen fundoplication, the diaphragmatic hiatus was dissected and the esophagogastric junction encircled. The lower esophagus was dissected into the mediastinum until the diverticulum was evident on the right or left side of the esophagus. This was then dissected off the mediastinum using blunt and sharp dissection. Most were quite densely adherent to the mediastinum by fibrous tissue around the diverticulum. The neck was then identified and encircled until the esophageal muscle was evident all around the neck of the diverticulum. The diverticulum was then excised by firing an Endo GIA stapler (U.S. Surgical, Norwalk, CT) several times across its neck, or it was inverted into the esophagus and the muscle layer was closed with a few interrupted sutures. In all but one patient a Heller myotomy (anterior esophagomyotomy 6 to 8 cm in length) was performed after the diverticulectomy. The hiatus was approximated with several interrupted sutures, if required, and the short gastric vessels were divided. The fundus was brought behind the esophagus and a fundoplication was created. In one patient the thoracoscopic approach was attempted. This patient required conversion to a thoracotomy because of difficulty in dissecting the adherent diverticulum. The thoracoscopy was begun by placing four thoracoports after which the diaphragm and lung were retracted, and the pulmonary ligament was divided. An attempt was made to dissect the esophagus, which was surrounded by a large amount of fibrous tissue. It was then decided to convert to a thoracotomy. The diverticulum was fully mobilized in the mediastinum down to a narrow neck, which was stapled, and the diverticulum was removed. All but one patient who underwent surgery had an antireflux procedure performed. The choice of antireflux procedure, a 360-degree Nissen fundoplication or a 270-degree Toupet fundoplication, was based on the results of esophageal manometry. Patients with poor esophageal manometric findings (peristaltic pressure <30 mm Hg in the distal esophagus or 20% simultaneous or nontransmitted contractions) underwent a 270-degree fundoplication, whereas patients with normal esophageal body motility had a 360-degree Nissen fundoplication performed.

RESULTS

Demographics

Table 1 presents the demographic data from all patients in both groups. The total number of patients who underwent surgery during the study period was 11. Seven patients who had nonsurgical therapy constituted the control group. Surgical data are summarized in Table 2. The mean follow-up time was

Table 1. Demographic data in surgical and nonsurgical patients prior to therapy

	Treatment	
	Surgical	**Nonsurgical**
No. of patients	11	6
Sex ratio (females:males)	5:6	4:3
Mean age (yr)		
Females	65	60
Males	70	75
Mean weight (kg)		
Females	56.2	66.2
Males	82.2	74.4
Mean duration of symptoms prior to surgical or medical therapy (mo)		
Females	62	27
Males	18	75
Symptoms		
Heartburn	8	1
Regurgitation	7	1
Acid reflux	3	4
Dysphagia	6	3
Pulmonary symptoms	6	0
Vomiting	1	0
Chest pain	0	1

26.4 months with a range of 2 to 48 months. There was one conversion to an open procedure. Two patients had two complications. One patient had an esophageal leak at the staple line on day 4 after a laparoscopic diverticulectomy and required a right-sided thoracotomy to oversew the leak and to add a myotomy. A jejunal feeding tube was inserted via a minilaparotomy. This was the one patient in whom a Heller myotomy was not performed after diverticulectomy. Another patient had an empyema in the right chest 4 weeks after surgery. A Gastrografin swallow test showed no evidence of esophageal leakage of contrast medium. The empyema was successfully drained and the patient did well. All other operative procedures were successfully completed laparoscopically. Table 3 presents the details of patients after nonsurgical treatment. All of them had a small diverticulum (up to 2 cm) or a broad-based diverticulum. One patient died during follow-up due to progression of esophageal cancer. The other patients are either asymptomatic under conservative treatment or they were not operated on because of concomitant diseases that made surgery too risky.

Esophageal Manometry

The results of esophageal manometry in all patients is presented in Table 4. If no data are given,

Table 2. Patients treated with surgery

Patient	Diverticulum	Additional diagnosis	Diverticulectomy	Antireflux surgery	Myotomy	Approach	Complication	Conversion	Duration (min)	Blood loss (ml)	Length of hospital stay (days)
C.P.	2 diverticula <2 cm, midthoracic esophagus		No	Nissen	–	Lap	–	No	60	50	6
E.B.	Distal diverticulum <2 cm		No	Nissen	–	Lap	–	No	60	40	1
I.C.	Distal diverticulum <2 cm	Achalasia	No	Toupet	+	Lap	–	No	60	50	1
C.W.	Distal diverticulum <2 cm	Achalasia	No	Toupet	+	Lap	–	No	60	75	1
M.F.	7 cm Ø, distal diverticulum		Yes	None	–	Lap	Leak	No	175	100	29
J.D.	8 cm Ø, distal diverticulum		Yes	Toupet	+	Thorac	–	Yes	240	500	5
R.A.	8 cm Ø, distal diverticulum		Yes	Toupet	+	Lap	–	No	340	250	5
R.M.	10 cm Ø, distal diverticulum		Yes	Toupet	+	Lap	–	No	240	100	3
M.M.	10 cm Ø, distal diverticulum		Yes	Toupet	+	Lap	–	No	255	100	6
D.H.	Distal diverticulum <2 cm		No	Nissen	–	Lap	–	No	60	100	1
C.C.	10 cm Ø, distal diverticulum		Yes	Nissen	+	Lap	Empyema	No	300	200	2

Lap = laparoscopic; Ø = diameter; Thorac = thoracoscopic.

Table 3. Patients with esophageal diverticula and nonsurgical therapy

Patient	Diverticulum	Additional diagnosis	Therapy	Reason for conservative therapy
S.H.	2 cm distal diverticulum	Irritable bowel syndrome	Bethanecol	Normal 24-hour pH, normal EGD, asymptomatic
R.M.†	Small distal diverticulum	Esophageal cancer	Chemo and radiation therapy	Metastatic esophageal cancer
C.E.	Small distal diverticulum	Nutcracker esophagus	H_2 blocker	Asymptomatic
D.O.	Small diverticulum, midthoracic esophagus	Fibromyalgia, spastic esophagus	Botulinum injection	Spastic esophagus
M.M.	Small diverticulum	Severe Parkinson's disease, esophageal spasm	Dilatation	Surgery not indicated, esophageal spasm
G.M.	Small diverticulum, midthoracic esophagus	Distal esophageal ring	Proton pump inhibitor, esophageal dilation	Asymptomatic after dilation

EGD = esophagogastroduodenoscopy.
†Diseased.

this means that manometry could not be performed because of inability to pass the probe into the esophagus or into the LES.

Questionnaire

Eight of the 11 patients in the surgical group answered the questionnaire. One patient lives outside of the United States, and two patients were lost to follow-up. The data are graphically depicted in Fig. 1. None of the patients had significant dysphagia, regurgitation, chest pain, or heartburn. There was no statistically significant difference between the two groups. Only one patient required modification of his diet after surgery. Two patients were on proton pump inhibitors for mild reflux symptoms. One of these patients did not undergo an antireflux procedure. In the nonsurgical treatment group, four of the six patients were able to answer the questionnaire. One patient died of progression of esophageal cancer, and the second patient was unable to answer the questionnaire because of severe Parkinson's disease. Fig. 1 shows the results of the questionnaire. Two patients were asymptomatic while on medication, and two had mild symptoms according to the scoring system.

DISCUSSION

Epiphrenic diverticula are very rarely seen, and the pathogenesis is poorly understood. Esophageal

Table 4. Manometric characteristics of all patients

Patient	Therapy	LESP	OL	AL	rel	rP	Simult	Nontra
C.P.	Surgery	11.7	3.5	2	—	—	0	0
E.B.	Surgery	4.6	6.8	2	100	0	0	0
L.C.	Surgery	28.8	7	2.3	50	14.3	100	0
C.W.	Surgery	17.6	4.25	3.25	<85	2.94	100	100
M.F.	Surgery	13	—	—	100	0	100	0
J.D.	Surgery	—	5	5	100	0	0	30
R.A.	Surgery	25	5.7	3	100	0	0	30
R.M.	Surgery	—	—	—	—	—	10	10
M.M.	Surgery	—	—	—	—	—	—	—
D.H.	Surgery	10.2	10.3	4.5	100	0	0	10
C.C.	Surgery	—	—	—	—	—	0	10
S.H.	Conservative	33.1	3	2	100	0	10	20
R.M.†	Conservative	13.7	5	4	65.6	4.37	0	0
C.E.	Conservative	22.9	—	—	88	3.8	0	0
D.O.	Conservative	—	5	5	—	—	50	0
M.M.	Conservative	39.2	5	—	—	0	0	0

LESP = lower esophageal sphincter pressure (mm Hg), (normal 5–28 mm Hg); OL = overall sphincter length (cm), (normal >2 cm); AL = abdominal sphincter length (cm), (Normal >1 cm); Nontra = nontransmitted contractions (%), (normal <20%); rel = relaxation (%), (normal >85%); rP = residual sphincter pressure (mm Hg), (normal <2 mm Hg); Simult = simultaneous contractions (%), (normal <20%).
†Diseased.

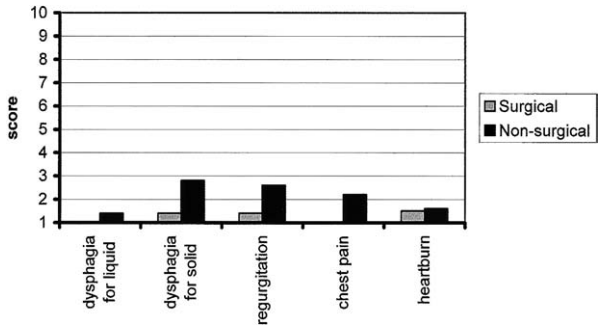

Fig. 1. Mean scores for postoperative symptoms in the surgical group and symptoms after conservative treatment in the non-surgical group.

motility abnormalities are commonly associated with esophageal diverticula; however, they may also arise in the absence of esophageal motility disturbances. Because esophageal epiphrenic diverticula are of varying sizes and symptomatology, the treatment must be individually adapted for each patient. Generally speaking, small diverticula are less symptomatic and can be treated nonsurgically. Patients who are asymptomatic and have their diverticula incidentally diagnosed do not require specific therapy. Symptomatic patients who are not suitable surgical candidates may benefit from medical therapy such as proton pump inhibitors or H_2 blockers. In our series we had two patients who were asymptomatic while on these medications. Alternatives other than surgical treatment are endoscopic dilation or botulinum toxin injection because epiphrenic diverticula are often associated with achalasia or achalasia-like conditions.

For symptomatic patients with large diverticula, the surgical treatment options are still controversial. Large epiphrenic diverticula should be removed. Since the introduction of minimally invasive surgery, the laparoscopic approach has been favored. In our series, laparoscopy was found to be safe and effective with a low mortality, acceptable blood loss, and rapid postoperative recovery, provided that there were no complications. On the other hand, thoracoscopy or thoracotomy was found to be more invasive and more difficult. The gastroesophageal junction may be more accessible by laparoscopy than by thoracosopy, as has been shown in anitreflux surgery. It is easier to dissect the diverticulum through the diaphragmatic hiatus and add a fundoplication from the abdomen than through the chest. In all of our 10 patients, the diverticulectomy was successfully performed laparoscopically without intraoperative complications and without the need for conversion to open surgery. Altorki et al.[11] reported their experience with the open transthoracic approach for epiphrenic diverticula in 17 patients. They did not encounter any morbidity; however, one patient died as a result of rupture of the mucosa through the myotomy site. Long-term outcome in their patient population was good, and all but one was symptom free during a follow-up of 2 years. Another large series has been reported by Benacci et al.[12] There were 112 patients in that series, 35 of whom had severe symptoms and underwent open surgical repair. These investigators also chose the open thoracic approach. Compared to our results, their perioperative and postoperative complications seem to be high. Six patients had esophageal leakage, four of whom had spontaneous resolution of the leaks and remained asymptomatic. There were three operative deaths. Two of these patients had esophageal leakage and one died of cardiac arrhythmia. This strengthens our opinion that the laparoscopic approach for patients with epiphrenic diverticula is associated with lower morbidity and mortality when compared to the open approach.

There is still controversy regarding the addition of a myotomy and the length of the myotomy. Because the pathogenesis of epiphrenic diverticula is thought to be due to esophageal dysmotility or an elevated LES pressure,[13] we added a long myotomy in all but one case after diverticulectomy. This patient, who had normal manometric findings and did not have an esophageal myotomy, had a postoperative leak and required a thoracotomy to oversew a leak at the staple line. This experience has strengthened our decision to perform a long myotomy in every patient to reduce the intraluminal pressure at the staple line. Nehra et al.[14] demonstrated similar findings and reported that resection of the diverticulum and a surgical myotomy of the manometrically defined abnormal segment results in relief of symptoms and protection from aspiration.

If a myotomy is added, a fundoplication should be done to prevent gastroesophageal reflux. Only one of our patients reported heartburn after surgery. We had not performed an antireflux procedure in this patient after the myotomy. The choice of antireflux procedure should be based on the results of esophageal motility testing. A Nissen fundoplication should be performed in patients who have normal esophageal motility and a partial Toupet fundoplication should be used in patients with altered esophageal motility.

CONCLUSION

We have shown that esophageal diverticula are very uncommon, and symptoms are related to the size of these diverticula. Asymptomatic patients, who usually have small diverticula, may not require specific therapy, and those patients who are not good candidates for surgery can be successfully treated nonsurgically.

Surgery should be considered in those with diverticula larger than 2 to 5 cm. The laparoscopic approach is the best surgical approach. A long myotomy and an antireflux procedure should be added to avoid esophageal leakage or gastroesophageal reflux.

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