

Surgical Management of Epiphrenic Diverticula in the Minimally Invasive Era

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ABSTRACT

Background: Epiphrenic diverticula are rare outpouchings of the distal esophagus that infrequently require surgical intervention for the treatment of symptoms. In cases where surgical therapy is indicated, the traditional approach is through a thoracotomy. Advances in minimally invasive techniques have led to thoracoscopic and more recently laparoscopic management of epiphrenic diverticula. The purpose of this article is to review the literature on minimally invasive surgery for epiphrenic diverticula with particular attention to the operative approach and technique, surgical mortality and morbidity, and symptomatic outcomes.

Methods: A review of the literature limited to studies in the English language and performed on humans was conducted on PubMed using the following key words: “esophageal diverticula” and “epiphrenic”. Articles retrieved by the PubMed search were reviewed.

Conclusions: A minimally invasive approach to epiphrenic diverticula offers reduced operative mortality, decreased length of stay, and similar symptom relief compared with open surgery in the hands of experienced laparoscopic surgeons.

Key Words: Diverticulum, Esophagus, Minimally invasive surgery, Laparoscopy.

INTRODUCTION

Epiphrenic diverticula are defined as mucosal outpouchings located in the distal 10cm of the thoracic esophagus that are pulsion in origin. They are rare entities with an estimated prevalence of approximately 0.015% based on radiologic data.¹ In large series reporting on clinical findings, 50% to 80% of patients had minimal or no symptoms.^{2,3} In asymptomatic patients with small diverticula (<5 cm), routine clinical and esophagoscopy follow-up is advised. Medical and endoscopic therapies may be utilized in patients with minimal symptoms or those who are not good surgical candidates. Surgical therapy, typically reserved for large diverticula or those producing significant symptoms, has traditionally been performed through a thoracotomy. Recent advances in minimal access surgery have led to thoracoscopic and laparoscopic management of this disease. In this article, we review the literature on minimally invasive surgery for epiphrenic diverticula.

MATERIALS AND METHODS

A review of the literature limited to studies reported in the English language and performed on humans was conducted on PubMed using the following key words: “esophageal diverticula” and “epiphrenic.” Articles retrieved by the PubMed search were reviewed. Case reports were excluded. Operative details, perioperative outcomes, and follow-up data were examined.

RESULTS

A total of 10 studies cumulatively reporting the outcomes of 85 patients undergoing minimally invasive surgery for epiphrenic diverticula were identified utilizing the above search criteria. Two of the series included a subset of patients with midesophageal diverticula, and these manuscripts were carefully analyzed in an attempt to include only patients with epiphrenic diverticula in the summary of data. The majority of patients (73/85; 86%) were approached laparoscopically and underwent diverticulectomy, myotomy, and fundoplication (63/85; 74%) (**Table 1**). Only 1 patient out of all the series required conversion to an open procedure due to dense fibrous tissue surrounding the esophagus making dissection of the diverticulum difficult.⁹ One 30-day death was

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Table 1.
Minimally Invasive Surgical Approach and Operative Technique

Series	No. Patients	Approach*	Operation	Conversion to Open Rate
van der Peet et al (2001) ⁴	5	VATS: 4 Lap (converted from VATS): 1	5 D + M	0%
Rosati et al (2001) ⁵	11	Lap: 11	11 D + M + F	0%
Neoral et al (2002) ⁶	3	Lap: 3	3 D + M + F	0%
Matthews et al (2003) ⁷	5	Lap: 4 VATS: 1	4 D + M + F 1 D + M	0%
Fraiji et al (2003) ⁸	6	Lap: 6	6 D + M + F	0%
Klaus et al (2003) ⁹	11	Lap: 10 VATS: 1	5 D + M + F 3 F 2 M + F 1 D	9%
Del Genio et al (2004) ¹⁰	13	Lap: 13	13 D + M + F	0%
Fernando et al (2005) ¹¹	20 (4 mid esophageal)	Lap: 10 VATS: 7 Lap + 6 VATS: 2 Lap + thoracotomy: 1	12 D + M + F 4 D + M 2 D 2 D + F	0%
Tedesco et al (2005) ¹²	7	Lap: 7	7 D + M + F	0%
Palanivelu et al (2008) ¹³	12 (4 mid esophageal)	Lap: 8	4 D 2 D + M + F 2 D + F	0%

*Lap = Laparoscopic; D = Diverticulectomy; M = Myotomy; F = Fundoplication.

reported in a patient who had a myocardial infarction post-operatively (**Table 2**). Morbidity rates ranged from 0% to 50%, with the most common complications being leak, pneumonia, and empyema. In 6 of the series, at least 1 patient underwent early reoperation for a complication, the most common of which was primary repair of a leak. Surgical outcomes were excellent or good (ie, asymptomatic or minimally symptomatic) in 83% to 100% of patients in each series with short to intermediate follow-up (5 to 58 months) (**Table 3**). Diverticular recurrence was limited to 1 patient.

DISCUSSION

The majority of series have preferred a laparoscopic approach in this patient population. The reported benefits of this technique include better visualization of the distal esophagus, which is of particular importance in patients undergoing a myotomy, fundoplication, or both of these, and better alignment of the endoscopic stapler along the longitudinal axis of the esophagus.^{4,10,12,13} The disadvan-

tages of the laparoscopic approach are seen in cases of diverticula that are large or inflamed with significant adhesions, both of which make adequate transhiatal dissection difficult.^{5,6,10} The VATS approach has been preferred in these cases. When a long myotomy is performed, some authors have continued to use a laparoscopic approach, whereas others will selectively use VATS in these cases.

Whether or not to include a myotomy is controversial. In some series, a myotomy and fundoplication were performed in all patients regardless of preoperative manometric findings.^{5,9,10} The principal factor in this decision is that higher rates of diverticular recurrence and leak have been observed in those undergoing diverticulectomy alone in prior open studies. The length of the myotomy is another area of debate. Some authors advocate a long myotomy in all patients,⁹ others a myotomy extending from the upper limit of the diverticular neck to the proximal 1.5 cm to 2 cm of the stomach,^{5,10-12} and yet others will correlate the length of the myotomy with the extent of the motor abnormality.¹³ The

Table 2.
 Perioperative Mortality and Morbidity of Minimally Invasive Surgical Therapy

Series	No. Patients	Perioperative Mortality	Complication Rate	Complications	Leak Rate	Reoperation for Complication	LOS (days)
van der Peet et al (2001) ⁴	5	0%	20%	1 leak 1 abscess 1 sepsis	20%	20%	10 (9-11)
Rosati et al (2001) ⁵	11	0%	9%	1 leak	9%	9%	–
Neoral et al (2002) ⁶	3	0%	33%	1 leak	33%	0%	–
Matthews et al (2003) ⁷	5	0%	0%	None	0%	0%	3 (2-6)
Fraiji et al (2003) ⁸	6	0%	50%	1 intraoperative perforation 1 pneumonia 1 empyema 1 prolonged ileus	0%	17%	4 (1-8)
Klaus et al (2003) ⁹	11	0%	18%	1 leak 1 empyema	9%	9%	5 (1-29)
Del Genio et al (2004) ¹⁰	13	7.7%	38%	3 leaks 1 intraoperative mucosal tear 1 myocardial infarction	23%	0%	14 (7-25)
Fernando et al (2005) ¹¹	20 (4 mid esophageal)	0%	45%	4 leaks 1 intraoperative perforation 2 pneumonia 2 empyema 1 pulmonary embolism 1 pneumothorax 1 myocardial infarction 1 atrial fibrillation 1 congestive heart failure 1 cerebrovascular accident 1 seizure 1 port site hernia 1 wound seroma requiring drainage 1 renal failure	20%	10%	5 (1-61)
Tedesco et al (2005) ¹²	7	0%	14%	1 leak 1 acute paraesophageal hernia	14%	14%	6
Palanivelu et al (2008) ¹³	12 (4 mid esophageal)	0%	25%	1 pneumonitis 1 dysphagia	0%	0%	5 (3-7)

majority of series report an accompanying fundoplication in patients undergoing myotomy, although determining which type of fundoplication to use and in which cases varies widely amongst authors. Moreover, Rosati and colleagues⁵

use the presence of preoperative gastroesophageal reflux disease (GERD) as a guide in determining which type of wrap to use. A Dor fundoplication is used if the patient has prior GERD, and a Toupet if they do not. Klaus et al⁹ perform

Table 3.
Outcomes of Minimally Invasive Surgical Therapy

Series	No. Patients	Follow-up (months)	Recurrence of Diverticulum	Asymptomatic or Minimally Symptomatic at Follow-up
van der Peet et al (2001) ⁴	5	–	20%	–
Rosati et al (2001) ⁵	11	36	0%	100%
Neoral et al (2002) ⁶	3	–	–	–
Matthews et al (2003) ⁷	5	16 (3-36)	–	100%
Fraiji et al (2003) ⁸	6	9 (1-17)	–	100%
Klaus et al (2003) ⁹	11	26 (2-48)	–	100%
Del Genio et al (2004) ¹⁰	13	58 (3-96)	0%	100%
Fernando et al (2005) ¹¹	20 (4 mid esophageal)	15 (1-70)	0%	83%
Tedesco et al (2005) ¹²	7	6	–	100%
Palanivelu et al (2008) ¹³	12 (4 mid esophageal)	5(3-7)	–	83%

a Nissen fundoplication in patients with normal esophageal motility and a Toupet in those with a proven motor abnormality. Del Genio and coworkers¹⁰ support the use of a Nissen-Rosatti and use intraoperative manometry to ensure that the lower esophageal sphincter pressure is not too high secondary to a tight wrap. Tedesco et al¹² report the use of Dor in all patients, whereas Fernando and colleagues¹¹ use a fundoplication only in patients with preoperative GERD, a hiatal hernia, or in those undergoing significant hiatal dissection. Palanivelu et al¹³ use a floppy Nissen in those with prior GERD or a hiatal hernia, a Toupet in those with associated achalasia, and a Dor in all remaining patients. Regardless of preference, it is clear that a randomized trial of these various fundoplications limited to patients with a diagnosis of epiphrenic diverticulum would be difficult secondary to the rare incidence of the disease. Rather, data from studies of other

benign esophageal diseases will likely need to be extrapolated to determine the optimal type of fundoplication to use in this patient cohort.

The minimally invasive approach appears to be safe, with no operative mortality and only 1 death secondary to a postoperative myocardial infarction reported in the articles that were reviewed. Morbidity rates ranged significantly from 0% to 50%, with 12 (14%) cumulative leaks being reported. Many of these leaks were encountered early in the authors' experience and were associated with operations that have since been revised. Surgical outcomes were excellent, with 83% to 100% of patients in the reviewed studies being completely asymptomatic or minimally symptomatic at follow-up. Only 1 diverticular recurrence was reported.

These results are encouraging and comparable to outcomes

Table 4.
Outcomes of Open Surgical Therapy for Epiphrenic Diverticula

Series	No. Patients	30-Day Mortality	Complication Rate	Leak Rate	Recurrence	Length of Stay (days)	Follow up (months)	Asymptomatic or Minimally Symptomatic at Follow up
Fekete et al (1992) ¹⁴	27 (7 mid esophageal)	15%	19%	10%	–	–	6	78%
Streitz et al (1992) ¹⁵	16	0%	38%	6%	–	–	84 (2-156)	87%
Bennaci et al 1993) ³	33	9%	33%	18%	0%	13 (6-36)	83 (4-180)	76%
Altorki et al 1993) ¹⁶	17	6%	–	–	–	–	84 (12-156)	93%
Jordan, Jr. et al (1999) ¹⁷	19	0%	5%	–	–	–	–	90%
Nehra et al (2002) ¹⁸	18	6%	–	6%	–	–	24 (9-96)	94%
Varghese et al (2007) ¹⁹	35	3%	14%	6%	–	7	45 (1-192)	76%

reported in large open series (**Table 4**). Among the potential benefits of a minimally invasive approach in these patients is reduced perioperative mortality, as there was only 1 death (1.2%) in 85 patients in the laparoscopic or VATS series compared with 9 (6.1%) deaths in 147 patients in the open series. Length of stay was less than 1 week in 6 of the 8 minimally invasive series reporting this variable, whereas patients in both of the open series that reported length of stay remained in the hospital at least 1 week on average. Perioperative morbidity, including leak rate, was comparable as there was significant overlapping between the ranges observed within each group. Symptom relief appears to be favorable in the minimally invasive series; however, the follow-up period was significantly shorter than those reported in the open literature. Long-term data will help confirm whether the minimally invasive approach truly offers comparable symptomatic control. As more data are published, other potential benefits of laparoscopy or VATS in this patient cohort will certainly be elucidated.

CONCLUSION

Minimally invasive surgery has progressed over the last several years and is increasingly being used for the management of patients with technically demanding surgical diseases. Diverticulectomy, myotomy, and fundoplication are all challenging procedures, even with an open approach. The principal benefits of a minimally invasive approach appear to be reduced operative mortality, decreased length of stay, and comparable symptom relief. These observations support the use of a laparoscopic or VATS approach. However, it is important to note that many authors of the reviewed series are surgeons with significant experience in minimally invasive foregut surgery. Therefore, the extrapolation of these data to all centers regardless of volume or experience would undoubtedly be flawed. The technical difficulty of these procedures and associated morbidity demands caution and should limit the use of laparoscopic or VATS approaches for epiphrenic diverticula to centers with significant experience in minimally invasive esophageal surgery.

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