

The Abdominal Approach for Epiphrenic Esophageal Diverticulum as an Alternative to the Thoracic Approach

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Background: There is no established surgical procedure for the treatment of epiphrenic esophageal diverticulum. The aim of this study was to compare the clinical outcomes of esophageal diverticulectomy using abdominal and thoracic approaches. **Methods:** We retrospectively reviewed 30 patients who underwent esophageal diverticulectomy through the thoracic or abdominal approach for an epiphrenic diverticulum at a single center between 1996 and 2018. We compared clinical outcomes, including the postoperative length of stay, time from the operation to oral feeding, leakage rate, and reoperation rate between the 2 groups. **Results:** The median age was 56 years. Of the 30 patients, 18 (60%) underwent diverticulectomy via the thoracic approach and 12 (40%) underwent the abdominal approach. The median hospital stay was 10 days (range, 5–211 days) in the thoracic approach group and 9.5 days (range, 5–18 days) in the abdominal approach group. The median time from the operation until oral feeding was 6.5 days (range, 3–299 days) when the thoracic approach was used and 5 days (range, 1–11 days) when the abdominal approach was used. In the thoracic approach group, the leakage rate was 16.67% and the reoperation rate was 27.78%. However, there were no cases of leakage or reoperation in the abdominal approach group. **Conclusion:** The abdominal approach for esophageal diverticulectomy is a feasible and appropriate alternative to the thoracic approach.

Key words: 1. Epiphrenic esophageal diverticulum
2. Abdominal approach
3. Thoracic approach
4. Laparoscopy
5. Transhiatal approach

Introduction

Epiphrenic esophageal diverticulum, which occurs in the distal third of the esophagus, is a rare condition. The pulsion type, which is caused by motility disorders, is most common [1,2]. Its estimated prevalence is 0.015% in the United States, 0.77% in Japan, and 2% in Europe [3], but is unknown in

Korea. According to most reports in the literature, surgery is indicated when symptoms related to an epiphrenic esophageal diverticulum are present [3].

In surgery for epiphrenic esophageal diverticulum, no consensus exists regarding the approach (abdominal or thoracic), the extent of myotomy, or what type of anti-reflux procedure to apply [2,3]. The conventional approach is left thoracotomy, through

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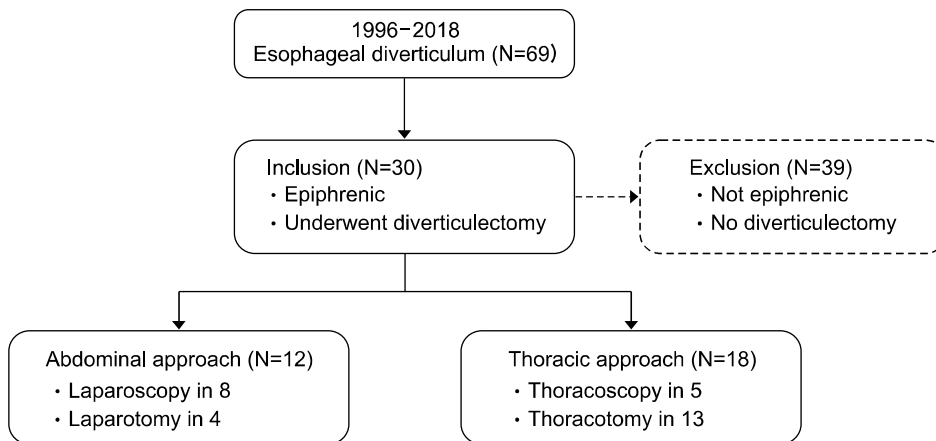


Fig. 1. Flow chart of patients.

which diverticulectomy and myotomy are performed. In some cases, an anti-reflux procedure may be added [3,4]. Although reports differ, the morbidity rate of this well-known surgical procedure ranges from 8.7% to 25%, the leakage rate ranges from 0% to 18.2%, and the mortality rate ranges from 0% to 11.1% [5-9].

These results have led to a search for other surgical methods, and recent advances in minimally invasive techniques have made the abdominal approach easier. Many experienced authors have suggested that the abdominal approach can be a good alternative to conventional surgical methods. The aim of this study was to compare the clinical outcomes of esophageal diverticulectomy using the abdominal and thoracic approaches.

Methods

We identified 69 patients with an esophageal diverticulum who were treated between 1996 and 2018 at Samsung Medical Center, of whom 39 were excluded because they did not meet the definition of epiphrenic diverticulum or did not undergo diverticulectomy. These included patients with Zenker diverticulum, mid-esophageal diverticulum, and traction-type diverticulum. We divided the remaining 30 patients into 2 groups according to the approach used. The thoracic approach referred to the use of thoracoscopy or thoracotomy to perform diverticulectomy, and the abdominal approach referred to the use of laparotomy or laparoscopy. We determined whether myotomy or anti-reflux procedures were performed. Twelve patients underwent surgery

using the abdominal approach (laparoscopy in 8, laparotomy in 4) and 18 underwent surgery using the thoracic approach (thoracoscopy in 5, thoracotomy in 13). One of the 4 laparotomy cases was converted from laparoscopy to laparotomy for reinforcement of the myotomy site, while laparotomy was deemed more appropriate for the remaining 3 cases. For example, 1 case had a fistula connecting with the left lower lobe that was difficult to access through laparoscopy. We retrospectively reviewed the medical records of patients in both groups and analyzed demographics, diverticular characteristics, operative characteristics, and clinical outcomes, including the postoperative length of stay, time from the operation to oral feeding, leakage rate, and reoperation rate (Fig. 1).

All variables examined in both groups were compared using the Student t-test or the Wilcoxon rank-sum test for continuous variables and the chi-square test or Fisher exact test for categorical variables. All p-values <0.05 were considered to indicate statistical significance. Statistical analyses were performed with SAS university edition ver. 9.4 (SAS Institute Inc., Cary, NC, USA).

This study was approved by the Institutional Review Board of Samsung Medical Center (IRB approval no., 2019-04-018-001), and the informed consent requirement was waived.

Results

The average age of patients in the study group was 56.2 years, and the proportion of males was 53.3% (n=16). The mean body mass index was 23.1

Table 1. Demographics of patients and characteristics of diverticulum (n=30)

Characteristic	Total (n=30)	Abdomen (n=12)	Thorax (n=18)
Patients' characteristics			
Age (yr)	56.23±13.69	53±16.67	58.39±11.28
Sex			
Male	16 (53.33)	7 (58.33)	9 (50)
Female	14 (46.67)	5 (41.67)	9 (50)
Body mass index (kg/m ²)	23.1±2.95	22.91±3.36	23.23±2.73
Presenting symptoms			
Dysphagia	20 (66.67)	10 (83.33)	10 (55.56)
Regurgitation	8 (26.67)	3 (25)	5 (27.78)
Dyspepsia	9 (30)	3 (25)	6 (33.33)
Respiratory symptoms	9 (30)	0	1 (5.56)
Hematemesis	1 (3.33)	1 (8.33)	0
No symptoms	2 (6.67)	0	2 (11.11)
Diverticular characteristics			
Distance from incisors (cm)	36 (30, 40)	37 (33, 40)	36 (30, 40)
Size (cm)	5.19±1.8	5.14±2.1	5.22±1.64

Values are presented as mean±standard deviation, number (%), or median (minimum, maximum).

Table 2. Perioperative characteristics (n=30)

Operative characteristics	Total (n=30)	Abdomen (n=12)	Thorax (n=18)
Minimally invasive surgery	13 (43.34)	8 (66.67)	5 (27.78)
Operation time (min)	214.1±60.08	233.8±76.84	200.9±43.35
Esophagomyotomy	16 (53.33)	11 (91.67)	5 (27.78)
Anti-reflux procedure	12 (40)	11 (91.67)	1 (5.56)

Values are presented as number (%) or mean±standard deviation. Minimally invasive surgery: laparoscopy or video-assisted thoracic surgery.

kg/m². Most of the study group (93.3%, n=28) reported symptoms related to an esophageal diverticulum. Dysphagia was the most common symptom, reported by 66.7% of patients (n=20). The diverticulum was found at an average of 36 cm (range, 30–40 cm) from the incisors. There were no significant differences in the demographics and diverticular characteristics between the 2 groups (Table 1).

Approximately 67% (n=8) of the abdominal approach cases and 28% (n=5) of the thoracic approach cases were performed with minimally invasive surgery. The average operation time was 233.8 minutes for the abdominal approach and 200.9 minutes for the thoracic approach, and no significant difference was observed. Esophagomyotomy was performed in 91.7% of the abdominal approach cases and in 28% of the thoracic approach cases, a significant difference between the groups ($p < 0.001$).

Anti-reflux procedures were performed in 91.7% (n=11) of the abdominal approach cases and in 5.6% (n=5) of the thoracic approach cases, which also reflected a significant difference between the groups ($p < 0.001$) (Table 2).

The median observation period was 14.6 months (range, 1.7–31.2 months) for patients who underwent surgery using the abdominal approach and 13.5 months (range, 0.4–179.3 months) for patients who underwent surgery using the thoracic approach. The median time to oral diet after surgery was 5 days (range, 1–299 days). The median duration of hospitalization was 9.5 days (range, 5–211 days). Reoperation was required in 16.7% (n=5) of cases, all of which were in the thoracic approach group. All reported complications followed the thoracic approach, and the leakage rate was 10% (n=3). There were no deaths in either group during the entire ob-

Table 3. Postoperative characteristics (n=30)

Postoperative characteristics	Total (n=30)	Abdomen (n=12)	Thorax (n=18)
Time to oral feeding (day)	5 (1, 299)	5 (1, 11)	6.5 (3, 299)
Hospital days (day)	9.5 (5, 211)	9.5 (5, 18)	10 (5, 211)
Reoperation rate	5 (16.67)	0	5 (27.78)
Morbidity	7 (23.33)	0	7 (38.89)
Leakage	3 (10)	0	3 (16.67)
Wound problem	2 (6.67)	0	2 (11.11)
Empyema	4 (13.33)	0	4 (22.22)
Pleural effusion	1 (3.33)	0	1 (5.56)
Acute lung injury	1 (3.33)	0	1 (5.56)
Mortality	0	0	0

Values are presented as median (minimum, maximum) or number (%).

ervation period. There were no statistically significant differences in these variables between the groups (Table 3).

Discussion

Esophageal epiphrenic diverticulum is a rare condition. Although no consensus exists regarding its treatment, it is known that surgical removal of a diverticulum is helpful for improving symptoms [3,8]. The most common symptom is dysphagia. In some cases, pulmonary complications occur, including recurrent pneumonia, aspiration pneumonia, and lung abscess [1,3,10], with a significant impact on mortality. Diverticulectomy is clearly helpful for improving symptoms, but the operative morbidity and mortality rates reported in previous studies are not negligible (morbidity: range, 8.7%–25%; mortality: range, 0%–11.1%) [3,5-9]. To overcome these risks, minimally invasive techniques such as endoscopy and laparoscopic diverticulectomy with an abdominal (transhiatal) approach have been introduced as promising alternatives [2,4,7].

The laparoscopic abdominal approach has the advantages of good accessibility and better visualization of the operative field, as well as permitting an adequate stapling line. This approach makes it easy to perform myotomy, extend the resection margin to the stomach, and perform anti-reflux procedures. As a chest tube is not required, postoperative discomfort is reduced [2,4]. Although these advantages are evident, there is currently no consensus on whether this procedure significantly reduces the risk compared to conventional methods [2-4,8]. No statistically sig-

nificant differences in postoperative variables were found in this study. However, no morbidities occurred in patients who underwent surgery using the abdominal approach. In addition, several studies have suggested that myotomy should be performed for the treatment of epiphrenic esophageal diverticulum. Because the pathophysiology of epiphrenic diverticulum is a motility disorder, it is necessary to excise the muscles. However, it has been confirmed that leakage can be prevented [1,4,7,9]. In this study, the rate of myotomy with the abdominal approach was 91.7%, which was significantly higher than that using the thoracic approach. Based on these results, we recommend the abdominal approach as a good alternative in light of advances in minimally invasive techniques.

However, our study has several limitations. The size of the study population was small, and our research was based on past records with a retrospective design. In fact, the thoracic approach was only performed once a year from 1996 to 2015. In contrast, the abdominal approach began to be used in earnest starting in 2014. The number of cases has increased, and it was performed 4 times in 2017. Prior to 2014, there was only 1 case in 2003. Because of this difference in the timing of the procedures, the data for the thoracic approach were drawn from older records that may be relatively inaccurate. For example, the rate of myotomy was very different between the abdominal approach and the thoracic approach. Obviously, the abdominal approach has some inherent advantages, such as good accessibility (as discussed above), but that does not mean that myotomy is impossible in the thoracic

approach. Therefore, this difference may have been caused by inaccurate data due to missing records.

In this study, diverticulectomy was performed by total of 6 surgeons. The abdominal approach was used by 3 different surgeons. Two surgeons used the abdominal approach in only 1 case each, but performed their 8–9 other diverticulectomy cases using the thoracic approach. In contrast, 1 surgeon used the abdominal approach in all 10 of his diverticulectomy cases. Thus, the abdominal approach was primarily performed by a single surgeon in this study, and it is possible that this difference in preference between the surgeons may have affected the outcomes.

Motility disorders are the leading cause of epiphrenic esophageal diverticulum [1,3]. A study by Vicentine et al. using high-resolution manometry confirmed motor abnormalities in patients with an epiphrenic esophageal diverticulum [10]. Thus, high-resolution manometry would be very useful for diagnosing epiphrenic diverticulum and for determining whether to perform myotomy. However, we could not confirm whether high-resolution manometry was performed in the cases included herein.

Considering that epiphrenic diverticulum is a rare disease, the presence of a sample size similar to that of other studies is considered to be a major strength of this study. However, the limitations of retrospective research are obvious, so further research is required to support our recommendation.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

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