

Removal of esophageal benign tumors with gastroscopy-assisted thoracoscopic surgery

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Abstract **Objective:** The purpose of the study was to report our experience in the treatment of benign esophageal tumors with fiberoptic gastroscopy-assisted thoracoscopic surgery. **Methods:** We retrospectively analyzed the clinical data of 24 consecutive patients (22 with esophageal leiomyoma and 2 with esophageal mesenchymoma) who underwent gastroscopy-assisted thoracoscopic surgery. There were 17 male and 7 female with a mean age of 36 years. The tumors were located in the upper and middle part of the esophagus in 17 cases and lower part in 7 cases. **Results:** All 24 procedures were successfully performed. The median operative time was 84 minutes and the median hospital stay was 7.5 days. One esophageal perforation due to dissection of a large lesion occurred intraoperatively, which was repaired by suturing. No deaths or other severe postoperative complications were encountered during the median follow-up period of 20.5 months. **Conclusion:** Gastroscopy-assisted thoracoscopic surgery provides a safe and effective alternative to open thoracotomy in the treatment of benign esophageal tumors.

Key words esophageal leiomyoma; mesenchymoma; video-assisted thoracoscopy operation; fiber gastroscopy

Benign tumors of the esophagus are uncommon, constituting less than 10% of all esophageal neoplasms [1]. Leiomyoma is the most common benign tumor of the esophagus, accounting for 70%–80% of all benign esophageal neoplasms [2–3]. Other benign esophageal tumors such as gastrointestinal stromal tumors [4] and mesenchymoma [5] are extremely rare. Esophageal tumors usually lead to dysphagia (difficulty swallowing) and chest tightness and pain. Barium swallow and endoscopy are the preferred methods for diagnosis of esophageal disease.

For small, asymptomatic esophageal tumors, the treatment strategy is to continue follow-up, while for large or problematic tumors, surgical intervention is required. Open thoracotomy is traditionally used for enucleation of benign esophageal masses. Recently, minimally invasive thoracoscopic approaches have been applied in these situations [6–7]. In the present study, we described our experiences with 24 patients with benign esophageal leiomyoma or mesenchymoma, who received successful treatment with gastroscopy-assisted thoracoscopic surgery.

Patients and methods

Patients

We retrospectively reviewed 24 consecutive patients who underwent gastroscopy-assisted thoracoscopic surgery for benign esophageal leiomyoma or mesenchymoma in our hospital between October 2004 and October 2011. Preoperative diagnosis was made by a combination of barium esophagram, upper gastrointestinal endoscopy (or endoscopic ultrasound), and computed tomography of the chest. All diagnoses were postoperatively confirmed by histology. Inclusion criteria included a definitive diagnosis of esophageal leiomyoma or mesenchymoma, receiving gastroscopy-assisted thoracoscopic surgery, and complete clinicopathologic and surgical data. Patients who had tumors beyond the scope (e.g. in the cervix or abdomen) of this technique described here or those with malignant disease were excluded from this study. The indications for the present technique were benign esophageal tumors in preoperative imaging assessment and tumor location in the middle esophagus or lower chest. This study was approved by the Ethics Committee of Nanjing Drum Tower Hospital, The Affiliated Gulou Hospital of Nanjing University Medical School (China).

Table 1 summarized the demographics and clinical characteristics of the study cohort. There were 17 men

Table 1 Demographic and clinical characteristics of patients

Characteristics	<i>n</i>	%
Age (years)		
Range	24–68	
Median age	36	
Sex		
Male	17	
Female	7	
Tumor location		
Upper and middle	17	71
Lower	7	29
Tumor size (cm)		
≥ 1.5	17	71
< 1.5	7	29
Symptoms		
Dysphagia	19	79
Epigastric pain	5	21
Combined dysphagia and chest pain	1	4

and 7 women with a mean age of 36 years (range, 24–68 years). Eighteen patients complained of dysphagia, 5 upper abdominal pain, and 1 combined dysphagia and chest pain. Two patients had two tumors in the esophagus and the other patients had solitary lesions. The tumors were located in the upper and middle part of the esophagus in 17 cases and lower part in 7 cases.

Technique

The video-assisted thoracoscopic surgery was done in all patients under general anesthesia with double lumen intubation. A fiberoptic gastroscope (Olympus, Japan) was introduced through the esophagus for localization of a tumor. The surgical route was decided depending on the location of the lesion: for upper and middle esophageal tumors, the procedure was performed through the right chest, while for lower esophageal tumors through the left chest. A 15-mm port was placed in the seventh intercostal space along the posterior axillary line, through which a rigid thoracoscope (30 degrees; Stryker, USA) was inserted. Two additional working ports were sited between the third and fifth intercostal spaces at the anterior axillary line and between the fifth and sixth intercostal spaces at the posterior axillary line, respectively. After the tumor was visualized by thoracoscopy and gastroscopy, the mediastinal pleura over the mass was incised using an endoscopic hook. The overlying muscle was carefully split and the esophagus was circumferentially dissected to allow exposure of the tumor. Oval forceps were used for excision of esophageal adhesions. After resection of the tumor, physical saline was infused through the working ports and air was insufflated through the endoscope into the esophageal lumen. The integrity of the esophageal mucosa was checked by observing if there is any bubble

Table 2 Peri-operative data and complications

Items	<i>n</i>	%
Operation time (min)		
Range	40–125	
Median	84	
Hospital stay (days)		
Range	5–14	
Median	7.5	
Estimated blood loss (mL)		
Range	30–100	
Median	55	
Time to liquid diet (days)		
3	23	96
6	1	4
Intraoperative complications		
Esophageal perforation	1	4
Postoperative complications		
Fever (≤ 38.0 °C)	11	46
Pain	2	8
Leakage	0	
Recurrence	0	

appearance in the water-submerged esophagus. The muscle layer was then sutured and a thoracic drainage tube was inserted through the camera port.

Immunohistochemistry

Paraffin sections (4 μ m thick) of tumor tissues were deparaffinized with xylene, and rehydrated. Endogenous peroxidase was quenched with 3% hydrogen peroxide for 10 min. Sections were individually incubated with mouse anti-human monoclonal antibodies against CD34 (DAKO, QBEND 10) and CD117 (DAKO, A4502, R) for 2 h, followed by the secondary reaction with DAKO Envision + Reagent (DakoCytomation, USA). Negative controls were included by omitting the primary antibody. Stained sections were photographed using an Olympus microscope.

Results

Of our series, 22 were benign esophageal leiomyoma and 2 esophageal mesenchymoma. Postoperative histological examination revealed that esophageal mesenchymoma was positive for CD34 and CD117 (Fig. 1). In contrast, only some non-tumor cells in esophageal leiomyoma showed immunoreactivity to CD34 and CD117.

Intraoperative and postoperative data were shown in Table 2. Technical success was achieved in all 24 procedures. The median operative time was 84 min (range 40–125 min). Intraoperative mucosal perforation was encountered in 1 case with a large lesion and severe esophageal adhesions and was surgically repaired. A liquid diet was resumed 3 days after operation in 23 patients and the

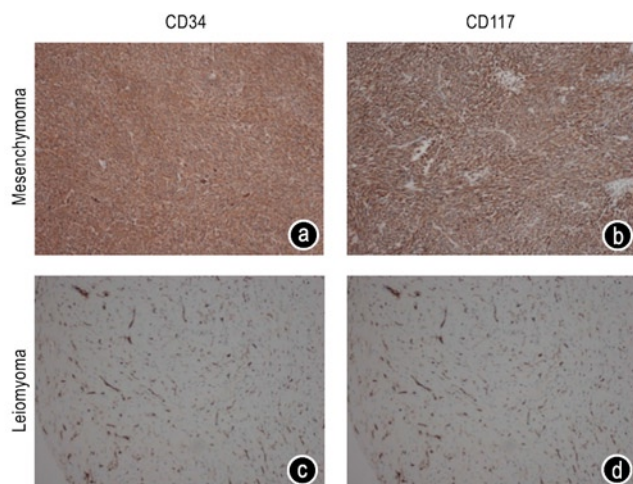


Fig. 1 Immunohistochemistry for CD34 and CD117 in benign esophageal leiomyoma and esophageal mesenchymoma. Esophageal mesenchymoma shows strong immunostaining for (a) CD34 and (b) CD117. In contrast, esophageal leiomyoma shows weak immunoreactivity to (c) CD34 and (d) CD117 in only some non-tumor cells. Magnification, 100 ×

patient with an intraoperative perforation was allowed to have a liquid diet until 6 days after surgery. The postoperative course was uneventful in all patients. The median hospital stay was 7.5 days (range 5–14 days). The median follow-up period was 20.5 months (range 6–60 months). Four patients were lost to follow-up. No dysphagia, gastro-esophageal reflux, tumor recurrence, or other related events was observed during the follow-up period.

Discussion

The most common benign tumor of the esophagus is leiomyoma, constituting of about two-thirds of all benign esophageal tumors [2–3]. Other benign esophageal tumors such as esophageal mesenchymoma [5] are relatively rare. Esophageal tumors are usually diagnosed by the combination of barium swallow, upper gastrointestinal endoscopy, and computed tomography. In this work, we reported 22 cases of leiomyoma and 2 cases of mesenchymoma of the esophagus that were removed using gastroscopically-assisted thoracoscopic surgery. Eighteen patients of our series presented with dysphagia, 5 with epigastric pain, and 1 with combined dysphagia and chest pain. The main symptoms of esophageal leiomyoma include dysphagia and epigastric pain, which, however, are not specific for this disease. Esophageal leiomyoma is easily misdiagnosed as esophageal stromal tumor [8] and malignant disease [9]. Gastrointestinal stromal tumors are an important subset of mesenchymal tumors of the gastrointestinal tract. Since gastrointestinal stromal tumors and leiomyomas have a similar appearance under endoscopy, immunohistochemistry is important in differentiating between them. It has

been reported that CD117 is a specific marker for gastrointestinal stromal tumors among tumors in the gastrointestinal tract, while true leiomyomas are consistently negative for CD117 [10]. CD34 is also valuable in differentiating gastrointestinal stromal tumors from leiomyomas [11]. Postoperative immunohistochemistry revealed that in our series, 2 cases of esophageal mesenchymoma were positive for both CD117 and CD34.

Open thoracotomy is traditionally regarded as a standard method for treating benign esophageal tumors. Thoracoscopic and laparoscopic approaches have recently emerged as valuable alternatives. Compared to open surgery, minimally invasive approaches reduce pulmonary complications, hospital stay, and postoperative wound-related pain. von Rahden *et al* [12] compared open surgery and minimally invasive approaches for enucleation of submucosal tumors of the esophagus (mostly leiomyomas) and suggested that thoracoscopic and laparoscopic techniques are suitable for treatment of submucosal esophageal tumors. A retrospective study on 40 cases undergoing thoracoscopic enucleation of esophageal leiomyoma showed that thoracoscopic enucleation of esophageal leiomyoma is technically safe and effective [13]. In agreement with these earlier studies, all procedures were successfully performed in our 24 patients. There was no conversion to open surgery. Major perioperative parameters (age, tumor location, operative time, time to liquid diet, and hospital stay) are comparable between the present and previous studies.

In cases of small tumors (i.e. < 1.5 cm in diameter), thoracoscopic localization of the tumor may be difficult. Choi SH *et al* [14] reported that 3 out of the 4 cases receiving thoracoscopic resection of small tumors were converted to thoracotomy. Jiang *et al* [13] also reported 2 cases of conversion to open surgery due to small lesions, among 40 cases with thoracoscopic enucleation of esophageal leiomyoma. In our procedures, a fiberoptic gastroscope was employed, which ensures accurate localization of small lesions, even those less than 0.5 cm in size. The application of gastroscopy also makes operation more efficient and safety.

The major complications for surgical removal benign tumors of the esophagus are mucosal damage and esophageal leakage. In our series, only 1 case had a perforation in the esophagus due to dissection of a large tumor, which was repaired by suturing with an absorbable suture. No major postoperative complications were found during the follow-up period.

However, some limitations of this study should be noted. First, this is not a randomized control. However, it has been suggested that thoracoscopic and laparoscopic techniques are better for surgical enucleation of submucosal esophageal tumors than open thoracotomy [12]. Therefore, we believe that the inclusion of a control group that un-

derwent open surgery for esophageal tumors may be not necessary. In addition, the sample size is relatively small and the follow-up period is short. Some complications such as tumor recurrence probably occur within longer follow-up periods.

In conclusion, we believe that gastroscope-assisted thoracoscopic technique is safe and reliable for enucleation of benign esophageal tumors.

Conflicts of interest

The author indicated no potential conflicts of interest.

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