

Successful resection of large submucosal tumor in the esophagus: Novel thoracoscopic-endoscopic combined surgery with submucosal tunneling method

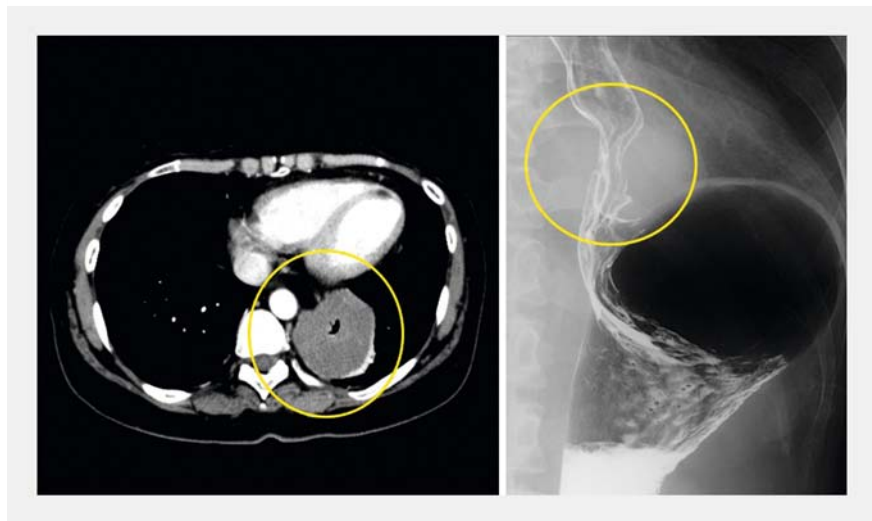
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Patients with esophageal leiomyoma, a benign submucosal tumor originating from the muscularis propria of the esophagus, present with dysphagia or chest pain depending on the tumor size and site. Conventional thoracoscopic surgery may cause a large muscle defect, possibly leading to esophageal stricture. As regards endoscopic procedures, there is a limit to the size of tumor that can be resected [1]. We report five cases of successful resection of large symptomatic leiomyomas with the thoracoscopic-endoscopic submucosal tunneling method (TEST), a novel treatment first reported in 2016 [2]. Results with the first of five cases demonstrate that the method has advantages for both thoracoscopic and endoscopic resection.

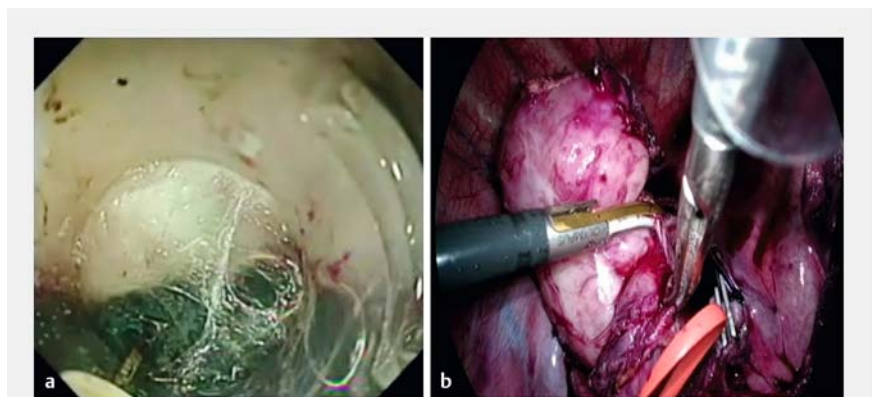
Five female patients aged 37 to 58 years with dysphagic symptoms underwent TEST from July 2012 to June 2021. Four patients had an abnormal shadow, identified using a chest X-ray, upper X-ray gastrointestinal angiography, and computed tomography (**► Fig. 1**). The diagnosis of leiomyoma was made in all patients using endoscopic ultrasound-guided fine needle aspiration before treatment.

Initially, endoscopic submucosal tunneling was performed applying the technique of per-oral endoscopic myotomy (POEM) until the tumor was exposed and separated from both the mucosa and muscle layer (Endoscope: GIF-Q260 J, OLYMPUS, Knife: Triangle Tip Knife, OLYMPUS). The tumor was dissected and extracted laparoscopically under both endoscopic and thoracoscopic guidance with minimal damage to the muscle layer (**► Fig. 2**). The mucosal incision on the esophageal wall was completely closed using endoscopic clips, and the muscle layer was sutured thoracoscopically.

Tumor size ranged from 5 to 80 mm (average 47 mm, median 50 mm). No ad-



► Fig. 1 Upper X-ray and computed tomography showed circumferential submucosal tumor in lower thoracic esophagus.



► Fig. 2 **a** Submucosal tunneling was performed, applying the technique of per-oral endoscopic myotomy (POEM). The tumor was exposed and separated from both mucosa and inner circular muscle layer. **b** The tumor was dissected and extracted laparoscopically under both endoscopic and thoracoscopic view.

verse events occurred peri-procedure or post-surgery. Esophagogastroduodenoscopy and the barium swallow procedure were performed on postoperative day (POD) 3 and liquid meals were introduced on POD 5. Average hospitalization duration was 13 days. Symptoms fully disappeared after TEST without recur-

rence in 60.8 months (median, 50 months) (**► Video 1**). TEST is a safe, effective, and minimally invasive treatment with minimal risk of postoperative stricture.

VIDEO



► **Video 1 Slide 1** Successful resection of large submucosal tumor in the esophagus. Novel thoracoscopic-endoscopic combined surgery with submucosal tunneling method. **Slide 2** Esophageal leiomyoma is a benign submucosal tumor originating from the muscularis propria of the esophagus. Dysphagia or chest pain may occur depending on the size and site. Conventional thoracoscopic surgery may cause a large muscle defect that can lead to esophageal stricture. **Slide 3 and 4** Comparison of advantages and disadvantages of esophageal submucosal tumor resection by thoracoscope or endoscope **Slide 5** The diagnosis of leiomyoma was made in all patients with endoscopic ultrasound-guided fine needle aspiration (EUS-FNA) prior to surgery. **Slide 6** Case 1. A 37-year-old woman with a chief complaint of dysphagia. Submucosal tumor in middle thoracic esophagus. **Slide 7** Endoscopic surgery. Entry was made from the esophagus side after injection into the submucosal layer of the esophagus anterior wall. Entry was made 2 cm from the oral side of the tumor. **Slide 8** Endoscopic surgery. Submucosal tunneling was performed by applying the technique of per-oral endoscopic myotomy (POEM). The tumor was exposed and separated from both mucosa and inner circular muscle layer. A hole was made on the muscular layer to the mediastinal side. **Slide 9** Thoracoscopic surgery. The hole made by the endoscope was used to guide the dissection and extraction with the thoracoscope. The procedure was performed under both thoracoscopic and endoscopic guidance. **Slide 10** Closure. The mucosal incision on the esophagus wall was closed with endoscopic clips. The muscle defect was sutured thoracoscopically. The tumor was removed through the intercostal space. **Slide 11** The pathological diagnosis was leiomyoma, esophagus, surgical, major diameter 80 mm. **Slide 12** Comparison of endoscope images before and after TEST. **Slide 13** Case 2 in a 54-year-old woman with a chief complaint of dysphagia, an abnormal chest X-ray, and a circumferential submucosal tumor in lower thoracic esophagus. **Slide 14** TEST was performed following the same procedure as previously described and the tumor was resected without remnant. **Slide 15** Endoscope images 8 months after TEST. **Slide 16** The outcome of TEST. **Slide 17** TEST is a safe, effective, and minimally invasive treatment with minimal risk of postoperative stricture.

Corresponding author

Hiroko Inomata

Department of Gastroenterology and Hepatology, Graduate School of Biomedical Sciences, Nagasaki University, 1-7-1 Sakamoto, Nagasaki City, 852-8501 Nagasaki, Japan
Fax: +81-95-819-7482
h.kawasaki.165@gmail.com

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Competing interests

The authors declare that they have no conflict of interest.

The authors

Hiroko Inomata¹, Hitomi Minami^{1,2}, Kengo Kanetaka³, Junya Shiota¹, Maiko Tabuchi¹, Susumu Eguchi³, Kazuhiko Nakao¹

- 1 Department of Gastroenterology and Hepatology, Graduate School of Biomedical Sciences, Nagasaki University, Nagasaki City, Nagasaki, Japan
- 2 Tachibana Bay Clinic, Nagasaki City, Nagasaki, Japan
- 3 Department of Surgery, Graduate School of Biomedical Sciences, Nagasaki University, Nagasaki City, Nagasaki, Japan