

CASE REPORT

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# Cricopharyngeal myotomy for cricopharyngeus muscle dysfunction after esophagectomy

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## Abstract

**Background:** Pharyngoesophageal dysphagia sometimes develops after esophagectomy. However, severe dysphagia after esophagectomy due to cricopharyngeus muscle dysfunction is a rare complication. There are no recommended clinical treatments for cricopharyngeus muscle dysfunction after esophagectomy. We report a case of myotomy for cricopharyngeus muscle dysfunction after esophagectomy.

**Case presentation:** A 75-year-old man with mild dysphagia diagnosed with advanced esophageal cancer by esophagogastroduodenoscopy at a clinic was admitted to our hospital. He had occasional mild dysphagia when he swallowed solid foods. After chemotherapy, the patient underwent minimally invasive esophagectomy with regional lymph node dissection and was reconstructed with a gastric conduit and cervical anastomosis by the retrosternal route. Aspiration pneumonia developed after esophagectomy without paralysis of the vocal cords. In esophagoscopy, there was no stricture around the anastomosis. However, severe pharyngoesophageal dysphagia with cricopharyngeus muscle dysfunction was revealed by videofluoroscopic examination. Bilateral cricopharyngeal myotomy was performed because balloon dilations had failed. The histological findings revealed atrophy and fibrosis of the cricopharyngeus muscle fibers. Pharyngoesophageal dysphagia improved immediately after myotomy. The patient swallowed solid food easily without dysphagia 12 months after myotomy.

**Conclusion:** Dysphagia after esophagectomy was worsened by cricopharyngeus muscle dysfunction. Cricopharyngeus myotomy may lead to long improvement of pharyngo-oesophageal dysphagia after esophagectomy.

**Keywords:** Esophagectomy, Cricopharyngeus muscle dysfunction, Cricopharyngeus myotomy

## Background

Dysphagia is a common predominant symptom after esophagectomy [1–4]. Cervical anastomosis and paralysis of recurrent laryngeal nerve sometimes cause pharyngeal swallowing dysfunction and aspiration pneumonia [5, 6]. Cricopharyngeus muscle dysfunction is a disorder caused by failure of the upper esophageal sphincter (UES) to relax during swallowing, thereby causing oropharyngeal dysphagia [7].

However, severe dysphagia due to cricopharyngeus muscle atrophy after esophagectomy is a rare complication. Thus, there are no recommended clinical treatments for severe dysphagia because of cricopharyngeus muscle hypertrophy after esophagectomy.

We report a successful case of cricopharyngeal myotomy for cricopharyngeus muscle dysfunction after esophagectomy.

## Case presentation

A 75-year-old man was admitted to a clinic with mild dysphagia. His past and family histories were

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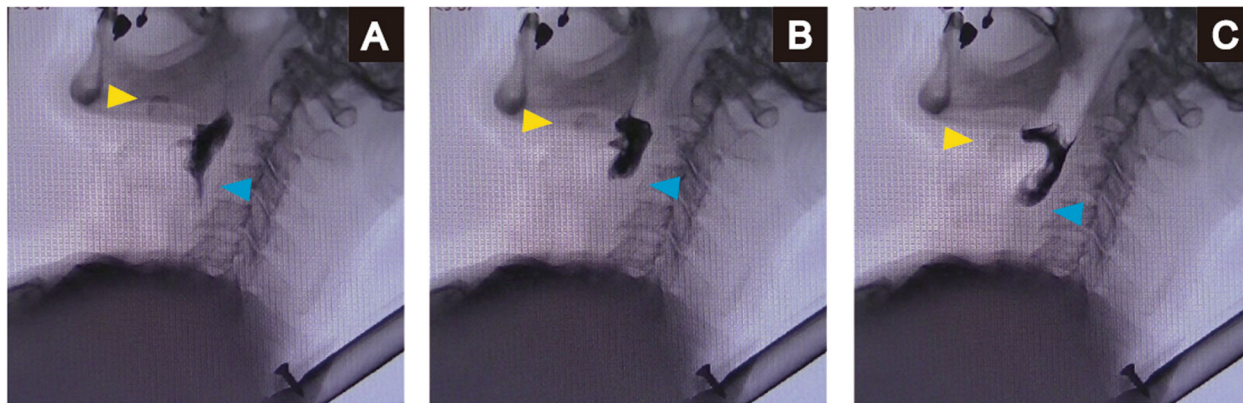
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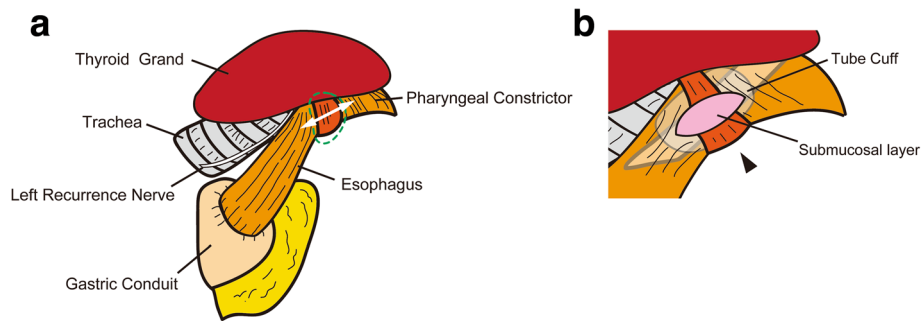
**Fig. 1** Computed tomography examination. No abnormalities around the cervical anastomosis after esophagectomy were observed

unremarkable. Esophagogastroduodenoscopy (EGD) at the clinic revealed a tumor of the thoracic esophagus. He was referred to our hospital for further examination. His physical findings were normal. All laboratory data were within normal limits. Tumor marker levels were all within normal limits. An EGD revealed a type II tumor, 20 mm in diameter, of the thoracic esophagus. The histological findings of biopsy specimens from the tumor showed squamous cell carcinoma. Computed tomography (CT) showed swollen lymph nodes and mediastinum metastasis without invasion to the adjacent organs. The esophageal carcinoma was clinically diagnosed as T2N1M0 (StageII) according to the eighth edition of the

Union for International Cancer Control [8]. The patient underwent preoperative chemotherapy, followed by minimally invasive esophagectomy with regional lymph node dissection and gastric conduit reconstruction by the retrosternal route following the Esophageal cancer practice guidelines 2017 edited by the Japan Esophageal Society [9]. The esophageal carcinoma was finally diagnosed as ypT1bN0M0 (ypStageI) [10]. The patient did not develop hoarseness. However, pharyngoesophageal dysphagia developed, and he was unable to swallow anything immediately after the esophagectomy. In laryngoscopy, there was no paralysis of the vocal cords, although left vocal cord weakened on postoperative day (POD) 7. In EGD, there was no stricture around the anastomosis. In CT scan, there was also no compartmental tissue around the anastomosis (Fig. 1). Severe supraglottic penetration with cricopharyngeus muscle dysfunction was revealed in videofluoroscopic examination (Fig. 2). Although balloon dilations around the pharyngoesophageal junction had been performed several times, cricopharyngeus muscle dysfunction remained, and the patient developed aspiration pneumonia. Bilateral cricopharyngeal myotomy was performed for cricopharyngeus muscle dysfunction on POD 43. Access to pharyngoesophageal region was obtained through an oblique cervical incision bordering the anterior edge of the sternocleidomastoid muscle. The region was exposed by retracting the carotid sheaths laterally and the trachea and larynx medially. The incision lines were placed in bilateral cricopharyngeus muscles without the injury of the recurrent nerves. The incisions to the cricopharyngeus muscle were carried down to the mucosa and were extended caudally by 30 mm on to the esophagus (Fig. 3a). A disposable plastic endotracheal tube (Inner diameter: 5.5 mm) was inserted in pharyngoesophageal region, and the cuff was gradually dilated in the



**Fig. 2** Swallow functional test before cricopharyngeal myotomy. **a** Laryngeal penetration occurred during laryngeal elevation in the pharyngeal phase. **b** The bolus did not pass entirely through the upper esophageal sphincter in the esophageal phase. **c** Breathing was reinitiated with a massive amount of pharyngeal residue. Yellow arrow; Hyoid bone, Blue arrow; Esophageal orifice

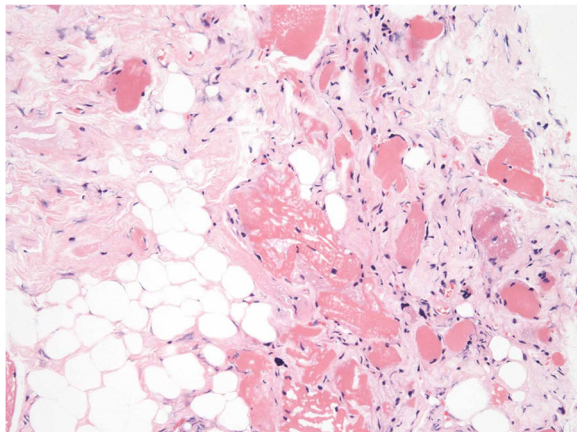


**Fig. 3** Schematic of cricopharyngeal myotomy. **a** Fibrosis occurred in the cricopharyngeus muscle (green dots). The resection line (white line) was demonstrated lateral cricopharyngeus muscle. **b** When the bilateral cricopharyngeus muscles (arrow) were resected, a disposable endotracheal tube (Inner diameter: 5.5 mm) was inserted in pharyngoesophageal region, and the cuff was gradually dilated. The myotomy allowed the dilated mucosa

myotomy. The myotomy allowed the dilated mucosa to protrude freely through the incision (Fig. 3b). The histological findings revealed atrophy and fibrosis of the cricopharyngeus muscle fibers (Fig. 4). Pharyngoesophageal dysphagia improved immediately after myotomy. Supraglottic penetration with cricopharyngeus muscle dysfunction was improved in videofluoroscopic examination (Fig. 5). The patient swallowed solid food easily without dysphagia 12 months after myotomy.

## Discussion

Cricopharyngeus muscle atrophy and spasm cause cricopharyngeus muscle dysfunction. Atrophy of the cricopharyngeal muscle especially prolongs deglutition and causes severe aspiration [11]. Cricopharyngeus muscle atrophy is associated with paralysis or various systemic diseases, including motor neuron disease, general granulomatous disease, and muscle atrophy [11, 12]. Structural and functional pharyngeal changes occur with age. Cricopharyngeal abnormalities sometimes develop in

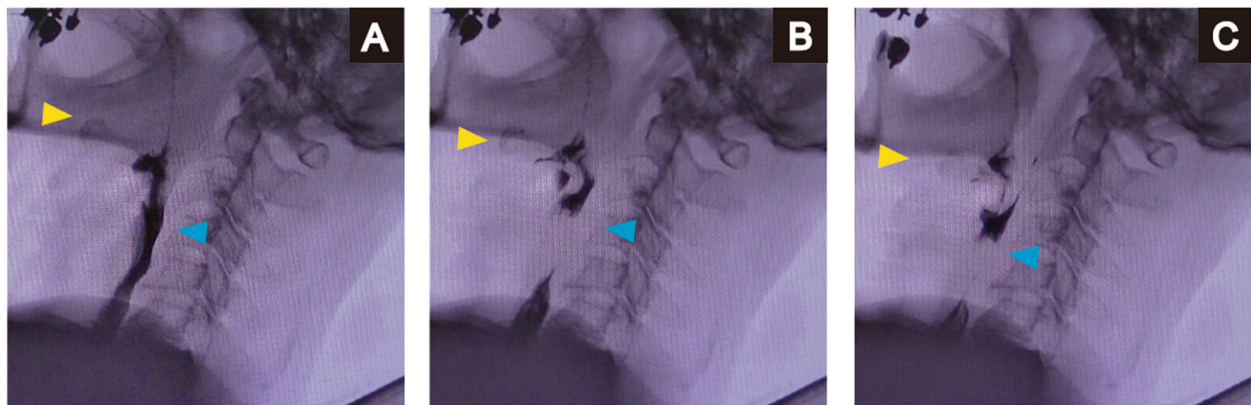


**Fig. 4** Histopathological findings. Diffuse atrophy and fibrosis of the cricopharyngeus muscle fibers developed

adults without dysphagia over 70 years old [13]. In the present case, mild dysphagia before esophagectomy, the chief complaint, was likely induced by latent cricopharyngeus muscle dysfunction with cricopharyngeus muscle atrophy but not stenosis of esophageal cancer.

In esophagectomy, the most general gastric reconstruction is gastric conduit [9]. Cervical anastomosis and paralysis of the recurrent laryngeal nerve sometimes cause pharyngeal swallowing dysfunction and aspiration pneumonia [3, 4]. Vocal fold immobility due to injury to the recurrent nerve during esophagectomy causes penetrated materials to be easily aspirated to the trachea [6]. Moreover, several biomechanical abnormalities in swallowing can develop after esophagectomy [6, 14]. These abnormalities, which include delayed onset of swallowing, reduced hyoid or hyolaryngeal elevation, and reduced UES opening, are demonstrated by videofluoroscopic examination and high-resolution manometry [7, 15]. The reconstruction route may also cause swallowing abnormalities [1]. The hyoid or hyolaryngeal elevation is reduced in retrosternal reconstruction due to adhesion to the front of the trachea [1]. The UES opening is also reduced in retrosternal reconstruction [1]. In the present case, the cricopharyngeus muscle was not directly accessed in esophagectomy. In the dissection of cervical paraesophageal lymph nodes, energy devices were not used. Retrosternal reconstruction after esophagectomy may have caused severe pharyngoesophageal dysphagia in addition to cricopharyngeus muscle atrophy before esophagectomy.

In the field of laryngology, cricopharyngeal myotomy has been successfully employed to treat cricopharyngeus muscle dysfunction caused by neurological disease or surgery for head and neck cancer [16, 17]. Fujita et al. reported that cricopharyngeal myotomy is effective as an operative rehabilitation procedure for severe dysphagia after esophagectomy [18]. Endoscopic cricopharyngeal myotomy has recently been reported as a new approach that appears to be as effective but less morbid than



**Fig. 5** Swallow functional test after cricopharyngeal myotomy. **a** The bolus easily entered the esophagus during laryngeal elevation in the pharyngeal phase. **b** Slight laryngeal penetration occurred in the esophageal phase. **c** Breathing was reinitiated with a small amount of pharyngeal residue. Yellow arrow; Hyoid bone, Blue arrow; Esophageal orifice

classical open surgery [16]. Botulinum toxin A injection is a less invasive therapy for cricopharyngeus dysfunction, although dysphagia reoccurs more often with this therapy than with cricopharyngeus dilation and myotomy [19]. Although dilation is likely to provide temporary benefit, surgical myotomy provides long remission [20]. In the present case, cricopharyngeal myotomy provided longer relief of cricopharyngeus muscle dysfunction, although cricopharyngeus dilation also failed to improve cricopharyngeus muscle dysfunction.

## Conclusions

In conclusion, we have described a case of cricopharyngeus muscle dysfunction after esophagectomy. Swallowing functional tests should be used to examine patients with dysphagia before esophagectomy. Cricopharyngeal myotomy may improve pharyngo-esophageal dysphagia after esophagectomy.

## Abbreviations

UES: upper esophageal sphincter; EGD: Esophagogastroduodenoscopy; CT: Computed tomography; POD: postoperative day

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## Authors' contributions

All of the authors read and approved the manuscript. S.K. collected patient disease data, edited the manuscript and approved the final submission of this manuscript. K.T. supervised patient treatments. F.T., who is an otorhinologist, supervised patient treatments and edited the manuscript. S.M., who is a pathologist, edited the manuscript in the histopathological section. T.H., S.M., T.T., H.T., and T.K. participated in the discussion.

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## Availability of data and materials

Not applicable.

## Ethics approval and consent to participate

Publication of the present study was undertaken in accordance with the ethical standards of our institution (2019151).

## Consent for publication

Informed consent was obtained from the patient and his family for the publication of this report.

## Competing interests

The authors declare that they have no competing interests.

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