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## Eversion stripping of the esophagus with intraesophageal insufflation—A case report



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## ABSTRACT

**INTRODUCTION:** Patients with esophageal cancer frequently cannot tolerate thoracotomy due to their overall debilitated condition. Moreover, some patients have severe adhesions in the thoracic cavity. Eversion stripping of the esophagus is an option for resection in these patients.

**PRESENTATION OF CASE:** A 64-year-old man was admitted to our institution with the chief complaint of epigastric pain. Endoscopic examination showed a protruding lesion 22 cm from the incisors, with a superficial and circumferential mucosal irregularity on the distal side of the lesion. Biopsy revealed squamous cell carcinoma. Clinical stage was T1b(sm)N0M0, cStage I. In addition to the poor pulmonary status of the patient, adhesions in the intrathoracic cavity were predicted. The decision was made to perform esophageal resection without a thoracotomy. In order to ensure complete invagination of the esophagus, the esophagus was insufflated prior to stripping. The stripping process was observed with a gastroscope. During the stripping, the esophagus did not bunch up, and stripping was smooth and with minimal resistance.

**DISCUSSION:** The stripping resection of the esophagus is an important option for the esophageal surgeon. In this case report, we describe a new eversion stripping method of the esophagus. This easy and reliable stripping method incorporates intraesophageal insufflation.

**CONCLUSION:** The indications for blunt esophageal dissection without thoracotomy have been decreasing. On the other hand, our method seems to be useful in optimal case of stripping of esophagus.

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## 1. Introduction

The indications for stripping resection of the esophagus have decreased due to the widespread use of endoscopic mucosal resection and the advancement of thoracoscopic surgery. However, this procedure is an important option for the esophageal surgeon. Since the stripping occurs in the mediastinum, visual confirmation of adequate stripping is difficult to assess. In order to carry out this procedure more safely and reliably, we stripped the esophagus after intraesophageal insufflation [1,2]. Simultaneously, the esophagus was examined from within the esophageal lumen using an endoscope.

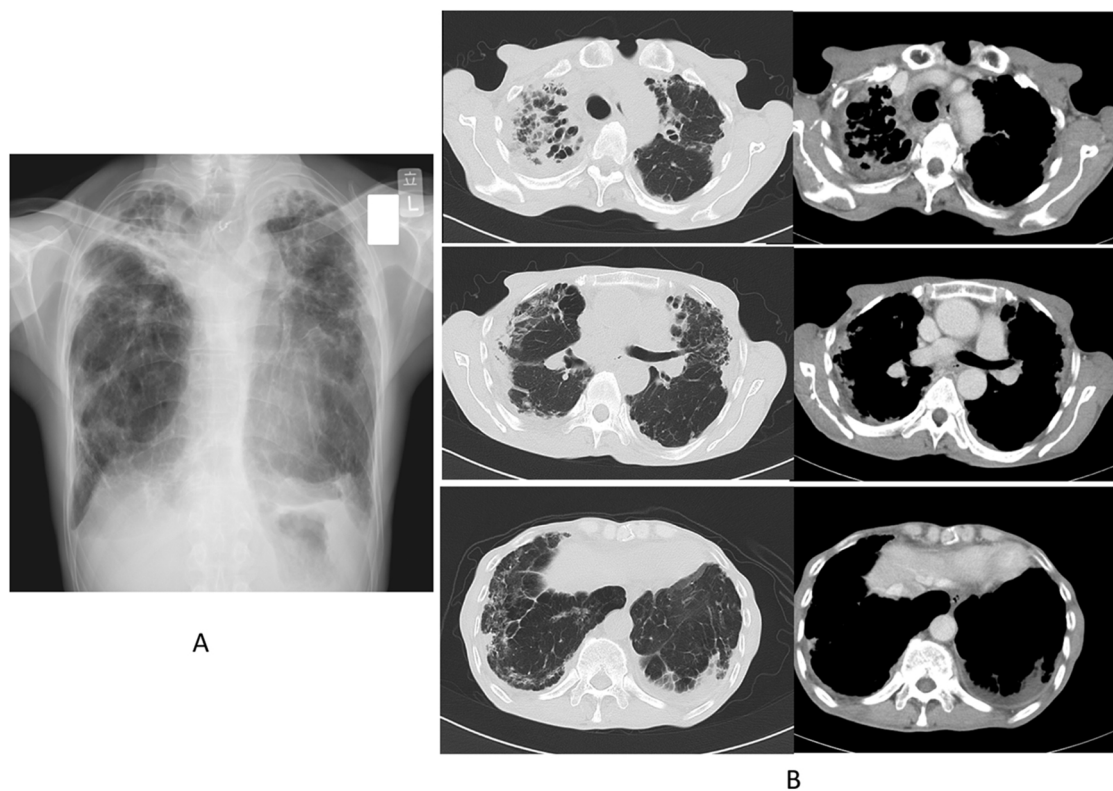
This work is reported in line with the SCARE criteria [3].

## 1.1. Patients

A 64-year-old man was admitted to our institution with the chief complaint of epigastric pain. Endoscopic examination showed a protruding lesion 22 cm from the incisors, with a superficial and circumferential mucosal irregularity on the distal side of the lesion. Biopsy revealed squamous cell carcinoma. Computed tomographic (CT) and positron emission tomographic (PET) scans were unable to detect the primary tumor, and showed no evidence of lymphadenopathy or distant metastasis. The clinical stage was T1b(sm)N0M0, cStage I according to the Japanese Classification of Esophageal Cancer. Chest X-ray showed contractile changes in the upper lung fields (Fig. 1A). CT showed chronic pulmonary inflammation, bronchiectasis, pleural thickness, and a left pleural effusion (Fig. 1B).

Endoscopic resection was not indicated for this extensive lesion. Judging from the depth of the lesion, thoracoscopic esophageal resection with lymph node dissection or primary chemoradiation therapy was indicated. However, in addition to poor pulmonary status of the patient, adhesions in the intrathoracic cavity were sus-

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**Fig. 1.** Chest X-ray and CT.

A: Chest X-ray showed contractile changes in the upper lung fields.

B: CT showed chronic pulmonary inflammation, bronchiectasis, pleural thickness, and left pleural effusion.

pected. We thus decided to perform esophageal resection without thoracotomy.

### 1.2. Operation

Neck dissection is performed with a collar incision along the skin crease. The esophagus is dissected circumferentially and encircled with a Penrose drain. The cervical and upper thoracic esophagus are dissected free.

Abdominal dissection is performed using an upper midline incision. The right gastroepiploic artery is preserved and other vessels are dissected. The omentum is left adherent to the stomach side as much as possible. The abdominal esophagus is dissected circumferentially and encircled with a Penrose drain. The lower esophagus is dissected to the extent possible via the esophageal hiatus.

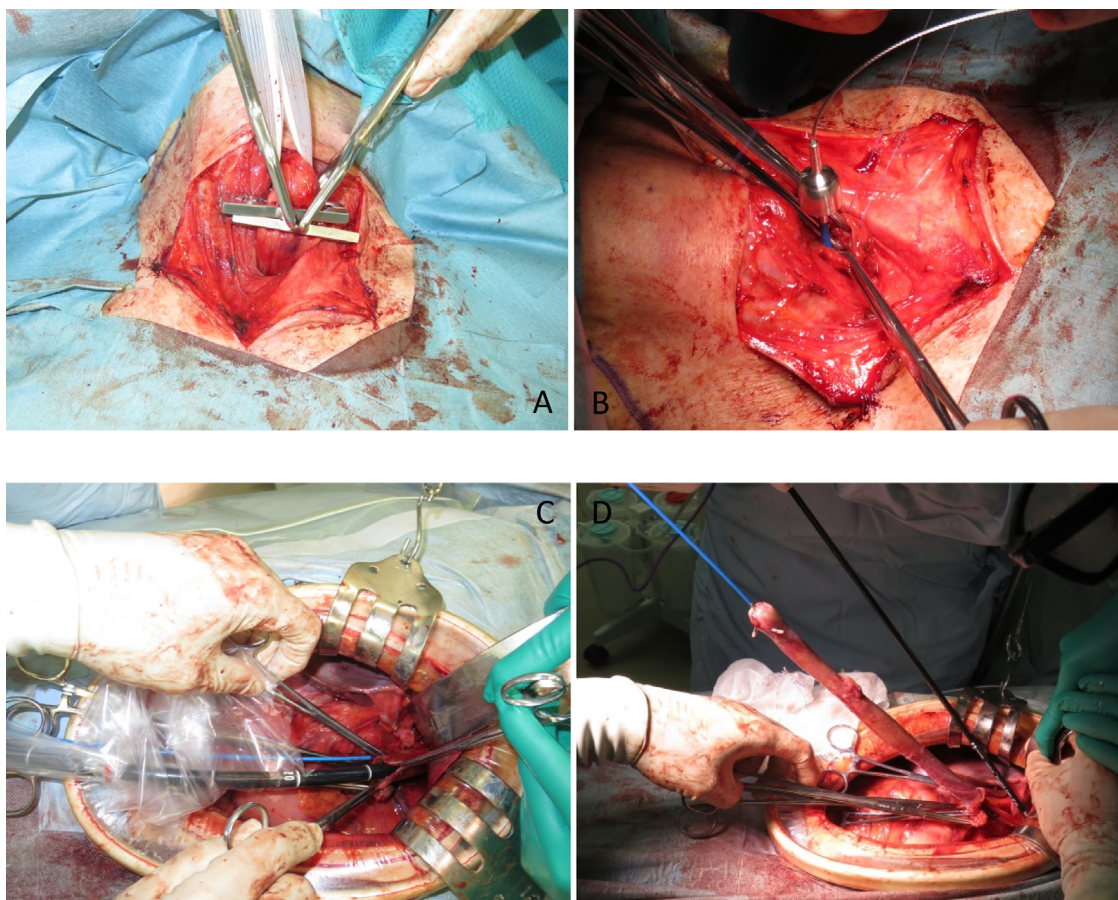
After dissection from the neck and abdomen, the stripping distance required is measured with a nasogastric tube. The distance in this case was 5 cm. Two purse string sutures are applied to the proximal edge of the tumor marked by a clip, and the esophagus is detached (Fig. 2A). The head of the circular stapler is sewn to the proximal stump of the esophagus. The stomach is separated proximally using an automatic stapler. A vein stripper is inserted toward the abdomen from the distal side of the esophagus. The stripper is left out of the stomach wall. The vein stripper and the distal stump of the esophagus are affixed firmly (Fig. 2B). After opening a small hole in the anterior wall of the stomach, a gastroscope is inserted into the esophagus (Fig. 2C). After the gastroscope enters the esophagus, the esophagus is easily expanded via insufflation by gently holding traction on the cardia (Fig. 3A,B). The lumen of the esophagus is observed via insufflation. The clip is confirmed on the proximal side of the tumor (Fig. 3C,D). After the gastroscope is pulled downwards, stripping of the esophagus is initiated. The esophageal stump is sequentially inverted under direct visualiza-

tion (Fig. 3E,F). The resistance of the stripper can be felt on the non-detached part of the esophagus (Fig. 3G). When this resistance disappears, stripping is completed (Fig. 3H). After confirmation of hemostasis, reconstruction with a gastric tube is performed and surgery is complete.

Pathological examination of the resected specimen revealed squamous cell carcinoma with submucosal invasion without lymphovascular infiltration. Pathological diagnosis was T1bN0M0, pStage I. There were no complications other than a mild recurrent nerve palsy.

### 2. Discussion

Blunt esophageal dissection without thoracotomy was first reported by Turner in 1936 for carcinoma of the thoracic esophagus, but indications for this operation are decreasing due to the widespread of endoscopic mucosal resection and the advancement of thoracoscopic surgery [4–6]. This operation is indicated as a radical surgery option for patients with superficial, mucosal cancer, or multiple early cancers of the esophagus that are difficult endoscopic or thoracoscopic resection cases. On the other hand, it is not indicated for cases who need thoracotomy for removing advanced cancers with right and left lymphadenectomy [7]. For these reasons, blunt esophageal dissection is only applicable to very limited cases. However, this method must be in the armamentarium of the esophageal surgeon. The eversion stripping method is one of the most widely used among blunt dissection options. The more the esophagus is dissected from incisions in the neck and abdomen, the lower the risk of bleeding and esophageal injury. On the other hand, the longer the distance of the dissected esophagus, the more difficult it is to perform eversion stripping. It is critical to ensure esophageal invagination in the beginning in order to complete successful eversion stripping. Even if the esophagus



**Fig. 2.** Operative findings.

- A: Two purse string sutures are applied.  
 B: Vein stripper is inserted toward the abdomen.  
 C: Gastroscope is inserted into the esophagus.  
 D: Stripping is completed.

becomes invaginated at the beginning of the stripping, however, there is the possibility that it will collapse without being inverted in the mid-point. Since the stripping occurs in the mediastinum, visual confirmation is difficult, and only the resistance transmitted to the stripper gives the surgeon cues about the adequacy of resection. Whether invagination will be completed depends on the magnitude of friction inside and outside of the esophagus. Invagination will occur if the magnitude of friction outside the esophagus is greater than that on the inside. If friction on the inside is greater, the esophagus will bunch like an accordion. Therefore, invagination is difficult to achieve in the area of dissection. However, invagination will occur after the esophagus becomes bunched without inverting if a large amount of resistance is applied to the stripper. In these cases there is the possibility of failure of stripping or damage to the esophagus itself. In order to solve this problem, our method of insufflation with direct endoscopic visualization was devised. This method is a simple and reliable procedure for inversion stripping resection of the esophagus with insufflation. In this case, gastroscopy was used for direct visualization, but it is not necessary in all cases if insufflation is adequate.

### 3. Conclusion

Although the indication is limited only for early esophageal cancers without risk of metastasis, our method was a secure technique for eversion stripping of the esophagus.

### Conflict of interest

None.

### Funding sources

None.

### Ethical approval

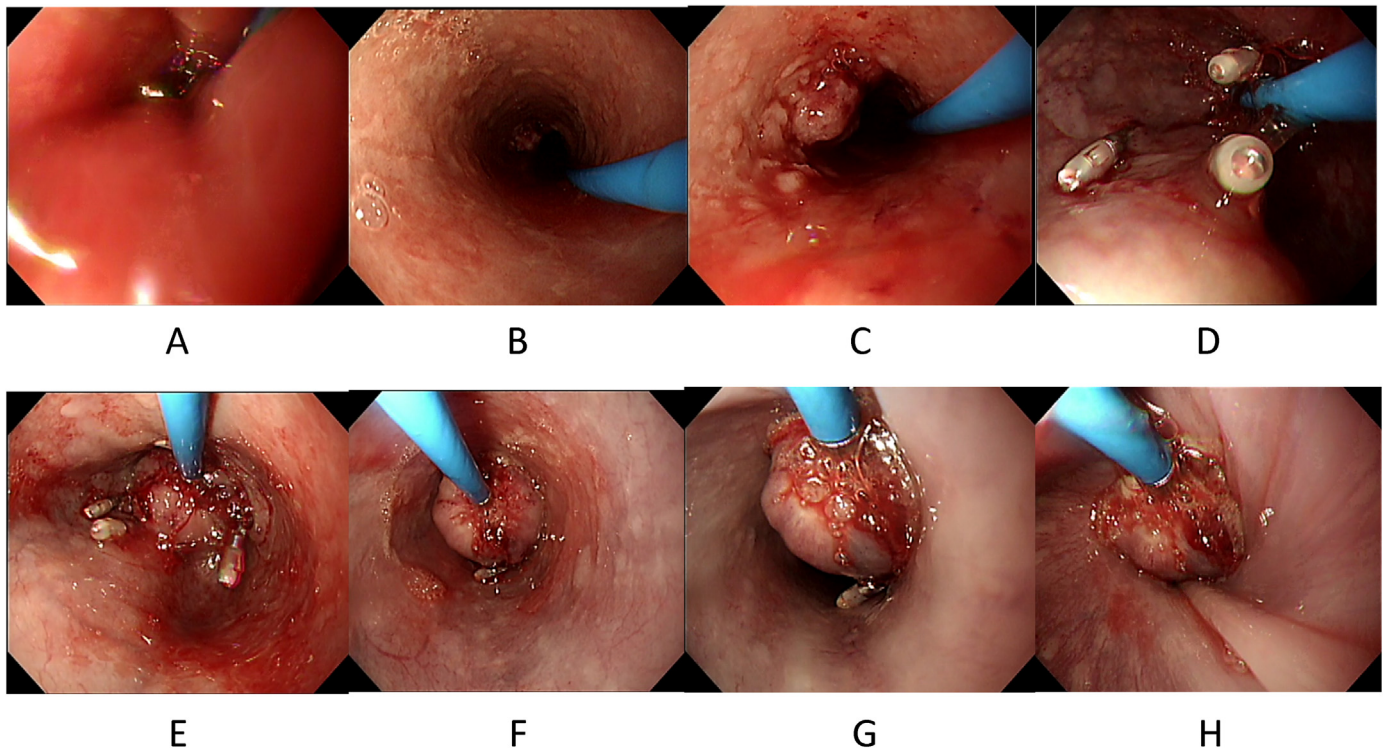
This paper is a case report. We have informed consent from the patient. Our work conforms to the guidelines set forth in the Helsinki Declaration of 1975.

### Consent

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

### Authors' contributions

Masahiro Kimura, Takaya Nagasaki, Yoshiyuki Kuwabara, Hironori Tanaka, Motoki Hato, Satoshi Taniwaki, Akira Mitsui, Yasuyuki Shibata, Kotaro Mizuno, Yoichiro Mori, Nobuo Ochi, Shuhei Ueno, Yuki Eguchi contributed with the study design, data collection, data analysis. Masahiro Kimura and Takaya Nagasaki wrote the paper.



**Fig. 3.** View from the esophageal lumen.

- A: Just after the insertion of gastroscope.  
 B: Esophagus expands after insufflation.  
 C: Elevated lesion of the esophageal cancer.  
 D: Stripping of the stump.  
 E: Start of stripping.  
 F: Resistance of the stripper can be felt at the non-detached part.  
 G: Resistance of stripper disappears.  
 H: The stump of esophagus reaches to the cardia.

#### Registration of research studies

Researchregistry2251.

#### Guarantor

Masahiro kimura.

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