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Case Report

Successful Management of a Tracheo-gastric Conduit Fistula after a Three-field Esophagectomy with Combined Sternocleidomastoid Muscle Rotation Flap and Histoacryl Injection Treatment

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ABSTRACT

Tracheo-gastric conduit fistula is an extremely rare but severe complication that is difficult to manage. Conservative care, esophageal or tracheal stent placement, or cutaneomuscular flaps have been suggested; however, no definite treatment has been proven. We report a case of tracheo-gastric conduit fistula that occurred after a minimally invasive radical three-field esophagectomy. Following the primary surgery, the diagnosis was made while evaluating the patient's frequent aspiration and coughing. Conservative management failed, and a surgical correction was undertaken to identify the multifocal mucosal defect and exposed tracheal ring. A sternocleidomastoid muscle rotation flap and subsequent Histoacryl injection into the remaining fistula were performed, and the fistula was successfully managed.

Keywords: Esophageal cancer; Complication; Fistula

INTRODUCTION

Esophageal cancer is not only a biologically aggressive malignancy but is also located at a difficult position for performing curative surgery. For this reason, anastomosis after esophagectomy is always a surgical burden, whether it is performed in the intrathoracic or cervical area. Despite the rarities, anastomosis leakage or gastric conduit necrosis can result in trachea-anastomosis or -gastric conduit fistula [1,2]. Tracheo-gastric conduit fistula is an extremely rare but severe complication that is difficult to manage. Conservative care, esophageal or tracheal stent placement, or cutaneomuscular flaps have been suggested. However, no definite treatment has been proven. We report a case of a tracheo-gastric conduit fistula that occurred after a minimally invasive radical three-field esophagectomy.

CASE REPORT

A 76-year-old man visited our center for the management of an incidentally detected esophageal squamous cell carcinoma, which was located circumferentially between 25 and 35 cm distal to the incisors. Although preoperative endoscopic ultrasonography revealed that the

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

clinical tumor depth was confined to the mucosal layer without clinical lymph node or distant metastasis, surgical treatment was performed because of the circumferential involvement of a long segment of the esophageal lumen. Trans-thoracic esophagectomy, three-field lymph node dissection, and feeding jejunostomy were performed. The surgery began from the thoracic part. The patient was placed in a semi-prone position, and thoracoscopic trocars were inserted at the third, fifth, seventh, and ninth intercostal spaces of the mid axillary line. After ligation and division of the azygous vein, the mediastinal pleura was opened, and the thoracic esophagus was dissected. During the thoracic part of the surgery, the para-esophageal, para-tracheal, subcarinal, and both lymph nodes around the recurrent laryngeal nerve were dissected. After dividing the esophagus at the level of the upper thoracic esophagus, both esophageal stumps were sutured with non-absorbable long suture materials and tied. After esophageal dissection, gastric tubing was performed using the laparoscopic approach. The tubing had a diameter of 3 cm, and the final stapling was guided by intraoperative indocyanine green injection and confirmation of vascularity with a near infrared camera. Cervical lymph adenectomy included central, level 3, level 4, and level 5. The gastric conduit was pulled through the natural tract aided by a previously sutured material, and anastomosis was performed with three linear staples (**Fig. 1**). The final pathologic report revealed submucosal invasion by squamous cell carcinoma, without lymph node metastasis.

On postoperative day 10, the nature of the cervical drain content changed to a large amount of bilious fluid. Emergency computed tomography (CT) revealed jejunal obstruction at the level of the feeding jejunostomy, and emergency jejunojejunostomy was performed to relieve the outlet obstruction to promote the healing of the esophagogastrostomy leakage. The enterocutaneous fistula healed soon after the bypass surgery, and a liquid diet could be resumed on postoperative day 25. After initiating the diet, the patient developed fever and frequent postprandial coughing, suggesting tracheal aspiration. Chest CT was reviewed, and

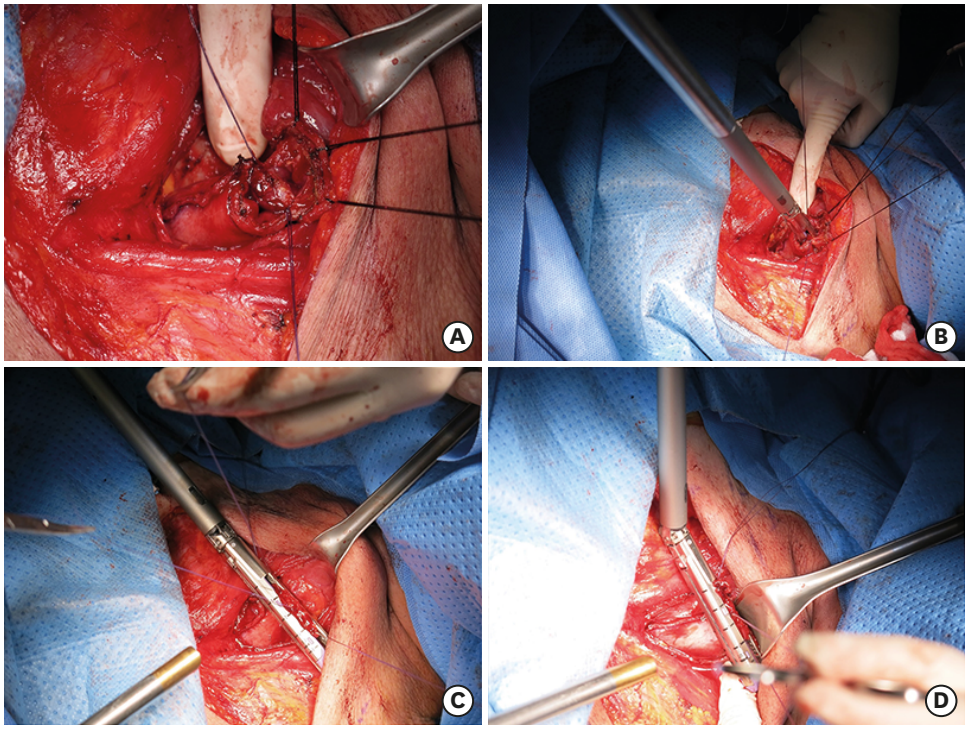

Fig. 1. Anastomosis between the gastric conduit and proximal cervical esophagus.

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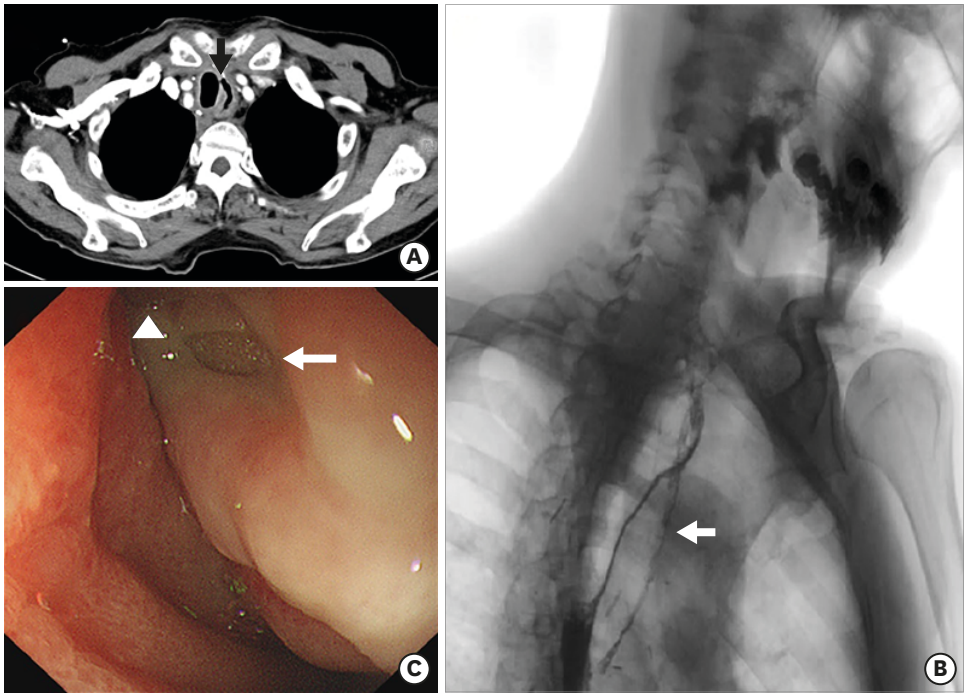

Fig. 2. (A) The fistula between the gastric conduit and trachea observed on computed tomography (black arrow). (B) Esophagoscopy showing the fistula opening (arrow head) and adjacent mucosal defect, with tracheal cartilage exposure (arrow). (C) Contrast leakage into the trachea is observed on the upper gastrointestinal series (arrow).

a minor tract was observed between the trachea and gastric conduit, suggesting an internal fistula (**Fig. 2A**). Upper gastrointestinal series showed contrast leakage into the trachea, and endoscopy revealed the fistula opening, adjacent gastric mucosal defect, and exposed tracheal cartilage (**Fig. 2B and C**).

Due to concerns about further damage to the tracheal cartilage, surgical exploration was performed. During the neck exploration, the gastric conduit and trachea were firmly fixed. After detachment of the two structures, we found a membranous defect between the third and fourth tracheal rings and gastric conduit. The right sternocleidomastoid (SCM) muscle was first mobilized to cover the tracheal defect, although there was tight tension (**Fig. 3**). Therefore, we changed the muscular flap to the left SCM muscle in the same manner. The flap was fixed on the tracheal wall using an absorbable suture material. A Foley gastrostomy tube was inserted through the defect in the gastric conduit. Nineteen days after the fistula repair, the Foley gastrostomy tube was removed after we were convinced that a well-controlled fistula had formed. However, there was still a slight fistula between the trachea and gastro-cutaneous fistula tract, and a small amount of grastrografin was observed to have leaked into the trachea (**Fig. 4**). Twenty-four days after reoperation and 5 days after Foley catheter removal, Histoacryl was injected into the submucosal space near the remaining tracheo-gastric conduit fistula (**Fig. 5B**). After seventeen days of Histoacryl injection, the trachea-gastric conduit fistula completely closed. Follow-up CT showed a well-settled Histoacryl between the trachea and gastric conduit (**Fig. 5A**). Finally, the patient resumed an oral diet and was discharged without any remaining problems.

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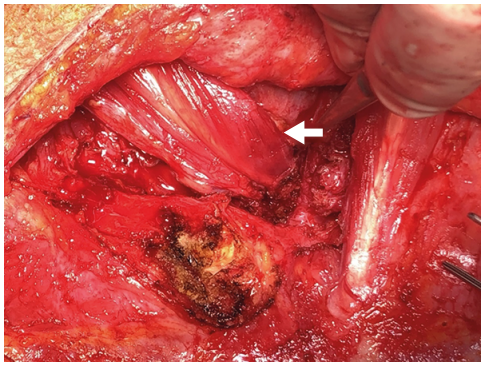

Fig. 3. Rotated sternocleidomastoid muscle (white arrow) covering the tracheal defect.

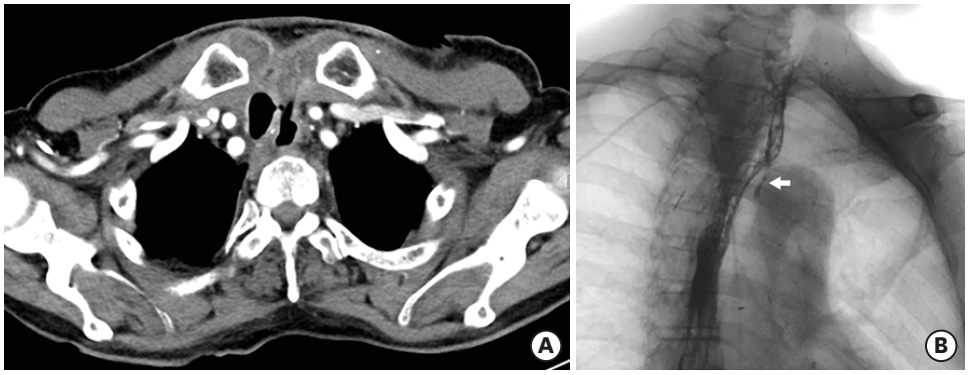

Fig. 4. (A) Computed tomography showing the smaller fistula between the trachea and gastro-cutanueos fistula tract formed by Foley gastrostomy. (B) Leakage of gastrografin is observed on the upper gastrointestinal series (arrow).

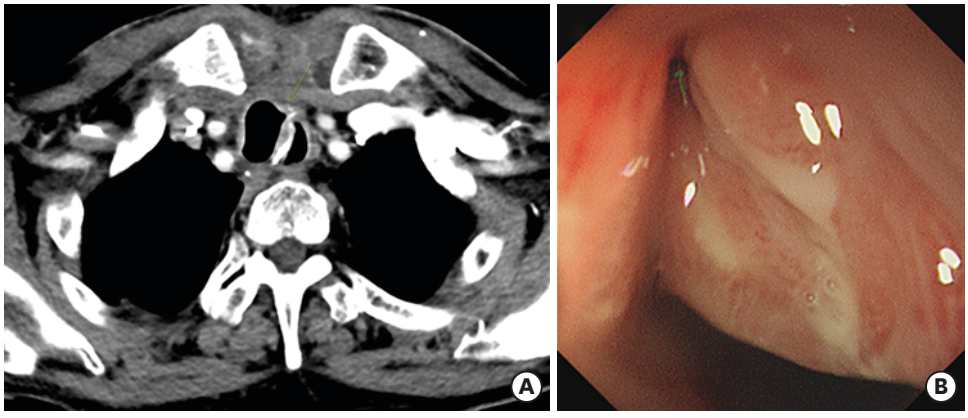

Fig. 5. (A) Computed tomography showing the closed fistula tract and radio-opaque Histoacryl filling the space between the gastric conduit and trachea. (B) An almost-closed fistula is shown on esophagoscopy after Histoacryl injection.

DISCUSSION

Esophageal cancer is biologically aggressive, regardless of the cell type. This is because the esophageal wall comprises solely of two layers, the mucosal and muscular layers, allowing the tumor to penetrate the muscular layer in a short period of time and to infiltrate the surrounding organs. The majority of esophageal cancer patients are already in the advanced

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stage at the time of diagnosis, with surgical treatment being possible only in < 50% of cases. Patients with localized tumors alone without distant metastasis or invasion of other organs may receive radical treatment. Surgical methods can be broadly divided into transthoracic and transhiatal esophagectomy, and the stomach is the most common conduit for the replacement of the resected esophagus. In addition, bowel interposition using the colon or jejunum is possible [3,4]. The postoperative mortality rate ranges between 8% and 23%, which is the highest reported rate among all elective gastrointestinal surgeries [5]. Such a high rate of mortality may also be attributed to the postoperative complication rates of esophagectomy, of which the overall complication rate has been reported to be ≥ 50% and varies within the range of 17%–74% [6].

Postoperative complications can be broadly divided into pulmonary complications, anastomotic complications, technical complications due to surgery, and functional complications. Pulmonary complications, such as pneumonia, aspiration, and acute respiratory distress syndrome, have been shown to be the major causes of mortality. Anastomotic leak complications occur in 10%–44% of cases, mostly within 10 days of surgery [4]. Anastomotic leaks, as in the present case, may result in acquired tracheo-gastric fistulas. According to the Lerut classification, the leak can be graded based on its extent, and the requirement for intervention or surgery can be evaluated [7]. Technical complications include recurrent laryngeal nerve injury, chylothorax, hemorrhage, and diaphragmatic hernia, while functional complications include delayed gastric emptying, dumping syndrome, anastomotic stricture, and dysphagia due to disease recurrence [4].

The main cause of tracheobronchial fistulas after esophagectomy is anastomotic leak, while other causes may be ischemic lesions due to intraoperative injury, devascularization of the trachea, or the gastric conduit [2,8]. Fistulas caused by anastomotic leaks are mostly found as an upper tracheal lesion, while fistulas caused by gastric necrosis are found as lower tracheal lesions [8]. The close contact between the esophagus and tracheobronchial tree creates an environment that facilitates infection while inducing fatal outcomes, such as respiratory failure, pulmonary sepsis, and septic shock [2].

The standardized treatment for fistulas has not yet been established, which is further challenged by the fact that both the airway and digestive tract should be repaired, and that the rate of recurrence is high owing to the close distance between the conduit and tracheobronchial tract.

Treatment for such fistulas can be broadly divided into conservative care, endoscopic management, and surgical management. Kauer et al. [9] and Schweigert et al. [2] reported that endoscopic stent insertion was feasible in postoperative intrathoracic leaks and esophago-tracheal fistula repairs, and yielded favorable outcomes. However, there is a limitation in that stent implantation cannot be applied to leak or fistula caused by ischemic necrosis of the gastric tube or gangrene of the airway.

Surgical treatment includes primary closure, muscle flap, gastric tube resection, and colon interposition. Boyd and Rubio reported that the recurrence rate of post-esophagectomy fistulas following tracheal stenting was as high as 39% [10]. Despite the high risk of morbidity and mortality after surgical correction [11], many successful treatment experiences have been reported using various muscular flaps, such as SCM, pectoralis major muscle, and intercostal muscle flaps [1,11-13].

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Histoacryl comprises monomeric n-butyl-2-cyanoacrylate and was first developed as a skin glue in the 1970s. It has been used for treating soft tissue and smooth skin wounds [14]. In addition to its use as a skin glue, Histoacryl has been applied in various medical conditions. It is frequently used in endoscopic injection therapy for hemostasis of esophageal and gastric varices [15]; it is also used in closing the opening or tract of fistulas connected to the tracheobronchial tract, for instance, in the endoscopic treatment of congenital recurrent tracheoesophageal fistulas [16,17] and in the endoscopic management of bronchobiliary fistulas [18]. A phase II study reported successful results from Histoacryl use in anastomosis fistula after esophagectomy. However, the abovementioned study included ordinary anastomosis leakages alone and not fistulas involving the trachea [19].

Regarding the patient in this case, the fistula was located near the cervical anastomosis, which made performing an endoscopic stent insertion difficult. To close the fistula tract, the SCM rotation flap method was used, while the Foley catheter used for gastrostomy was positioned toward the left neck wound to separate the trachea from the gastric conduit. As the patient subsequently showed improvement, the Foley gastrostomy catheter was removed; however, a space was left such that a connection could be formed between the tract and membranous portion of the trachea. Although the remaining fistula was much smaller than the first one, contrast leakage was observed. Histoacryl was injected into the submucosal space, which helped in narrowing the fistula size and lengthening the distance of the fistula tract. Thus, an environment that facilitates the closing of the tract was created. We believe this procedure was successful because the fistula size decreased without direct connections between the trachea and gastric conduit after the SCM rotation flap. Direct attempts to manage the initial status of the tracheo-gastric conduit fistula have failed. Finally, the patient showed improvement in symptoms, such as cough and fever; further, in the upper gastrointestinal contrast swallowing series and chest CT during the final follow-up, the fistula was observed to have been successfully closed. To the best of our knowledge, this is the first case of the successful treatment of a tracheo-gastric conduit fistula with an SCM muscle flap and subsequent Histoacryl submucosal injection.

In conclusion, a tracheo-gastric tube fistula is a rare postoperative complication of surgery for esophageal cancer, where management remains a challenge without an established, standardized method of approach. In this case study, the tracheo-gastric tube fistula was successfully managed using an SCM rotation flap and subsequent Histoacryl injection. To verify the utility of this treatment approach, further studies and accumulation of clinical experience are warranted.

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