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Case Report

Flap Reconstruction for Esophageal Perforation Following Anterior Cervical Plate Fixation

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Anterior cervical plate fixation is a common surgical treatment for cervical spine trauma, disc herniation, or cervical spondylosis. Esophageal perforation following anterior cervical plate fixation is a rare but serious complication. Management of esophageal perforation is controversial; however, we suggest treating most cases surgically because this condition is slow to heal and often fatal. We managed 2 cases of esophageal perforation following anterior cervical plate fixation by flap reconstruction with the pectoralis major muscle in one case and a jejunal free flap in the other. Here, we report our experience and review the surgical indications.

Key words: anterior cervical plate fixation, esophageal perforation, reconstruction, pectoralis major flap, jejunal free flap

Anterior cervical plate fixation is a well-established, relatively safe, routine surgical treatment for cervical spine trauma, disc herniation, or cervical spondylosis. Esophageal perforation following anterior cervical plate fixation is rare [1] and is associated with various complications, including neck abscess, mediastinitis, and systemic sepsis [1-3]. Management of esophageal perforation is controversial [3]. Several studies have reported that conservative nonsurgical treatment (such as nasogastric tube insertion) or surgical treatment with primary suture can result in healing of the esophageal perforation without complications or recurrence, as long as the fistula is small, with vital tissues, and the fixation device is removed [4-6]. However, we think that most cases of esophageal perforation should be treated with safer and more definitive surgical treatment because this condition does not heal readily and is often fatal. Here, we report our experience with 2 patients who presented with esophageal perforation following anterior cervical plate fixation. These perforations were sizeable and scar tissue had formed around them. Therefore, we repaired the perforations surgically by using a muscle or jejunal free flap, which achieved good results.

Case Presentation

Case 1. A 55-year-old woman was diagnosed with ossification of the posterior longitudinal ligament and underwent anterior cervical plate fixation from C4 to C6 at another hospital. Six years after surgery, she was admitted to our hospital with complaints of dysphagia and odynophagia. Esophagoscopy revealed a narrow esophagus, while a contrast swallow examination demonstrated extravasation of fluid from the viscera. Computed tomography revealed cervical plate migration into the esophagus. These findings led to a diagnosis of esophageal narrowing caused by cervical plate displacement. To remove the plate, surgical treat-

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ment was planned after discussion with both orthopedic and head and neck surgeons.

The plate was revealed using a left cervical approach; however, esophageal perforation occurred while removing the plate. The perforation was repaired using a left precordial local flap. However, 6 days after the primary surgery, total necrosis of the flap was identified, and the patient's surgeons consulted our department for further treatment. After debridement, an esophageal perforation from the hypopharynx to the esophageal orifice was identified and a drainage tube was inserted. Because the perforation was large and scar formation was observed, there were concerns about the esophageal lumen narrowing if primary sutures were used. Therefore, we repaired the perforation by transferring a jejunal free flap at 8 days after debridement. The transverse cervical artery and internal jugular vein were used as recipient vessels (Fig. 1). Two weeks after surgery, a contrast swallow examination showed no extravasation of fluid. Six months after surgery, the patient was able to ingest foods orally and her nutritional status was good.

Case 2. A 29-year-old man fell, breaking cervical bones from C5 to C7, which resulted in tetraplegia. He was treated at another hospital with anterior cervical plate fixation from C5 to C7 and posterior cervical plate fixation from C3 to Th1. Six months after surgery, he developed a fever and dysphagia for liquids. Magnetic resonance imaging and computed tomography revealed osteomyelitis and fluid collection in the prevertebral space. Infection of the cervical plate was suspected, and orthopedic surgeons removed the plate. However, inflammation and fever continued, and a contrast swallow examination demonstrated extravasation of fluid from the esophageal lumen. Conservative treatment was performed, including total prohibition of oral intake and insertion of a nasogastric tube, but the perforation persisted. Subsequently, the patient consulted our department for surgical treatment.

During surgery, adhesion of the esophageal wall to the cervical vertebrae at the height of the thyroid cartilage was identified. We separated this adhesion gently, revealing esophageal perforation with severe scar formation on the posterior side of the esophageal wall. Because the perforation was not large, we sutured it primarily, then transferred a right pedicled pectoralis major flap to reinforce the repair (Fig. 2). Two weeks after surgery, a contrast swallow examination revealed no signs of perforation, and the patient began oral intake. Seven months after surgery, he has had no clinical complications.

Discussion

Esophageal perforation following anterior cervical plate fixation is a rare complication, with a reported rate of only 0.25% [1]. It occurs mostly at the level of C5-6 or C6-7 [3] because, anatomically, the esophagus lies and closes on the cervical vertebrae at the C6 level. Moreover, the posterior esophageal mucosa is unprotected by muscle and thus vulnerable, making perforation easy [7].

Clinical presentation of esophageal perforation includes fever, dysphagia, and odynophagia, but asymptomatic perforation has also been reported [8]. If esophageal perforation is suspected, imaging studies should be performed. Contrast swallow examination is useful for locating the perforation and extravasation, while computed tomography is useful for determining the presence of abscess and plate displacement. Additionally, plain radiography and esophagoscopy may reveal free air in the prevertebral soft tissue or perforation of the esophageal wall [4, 6]. However, some authors have reported that plain radiography has a high false-negative rate, and a previous imaging study indicated esophageal injury in only 73% of 44 affected patients [9]. Therefore, to confirm the diagnosis and condition of the wound, a combination of the above-mentioned imaging studies is required.

The important factors in the treatment of esophageal perforation are time of detection, size of perforation, degree of scar formation, and condition of the patient. If detection or treatment is delayed, various complications may occur, such as neck abscess, mediastinitis, and systemic sepsis [2]. The mortality rate for all causes of esophageal perforation of approximately 20%, which increases to 50% if treatment is delayed [8, 10]. In some cases, esophageal perforation near the larynx is associated with accidental swallowing, laryngectomy, and loss of the ability to speak.

Optimal management of esophageal perforation is controversial. Vrouenraets *et al.* reported that if the perforation is small and the patient has no symptoms, conservative treatment, such as nasogastric tube insertion, or surgical treatment with primary suturing can achieve good results [5]. In cases where the perforation

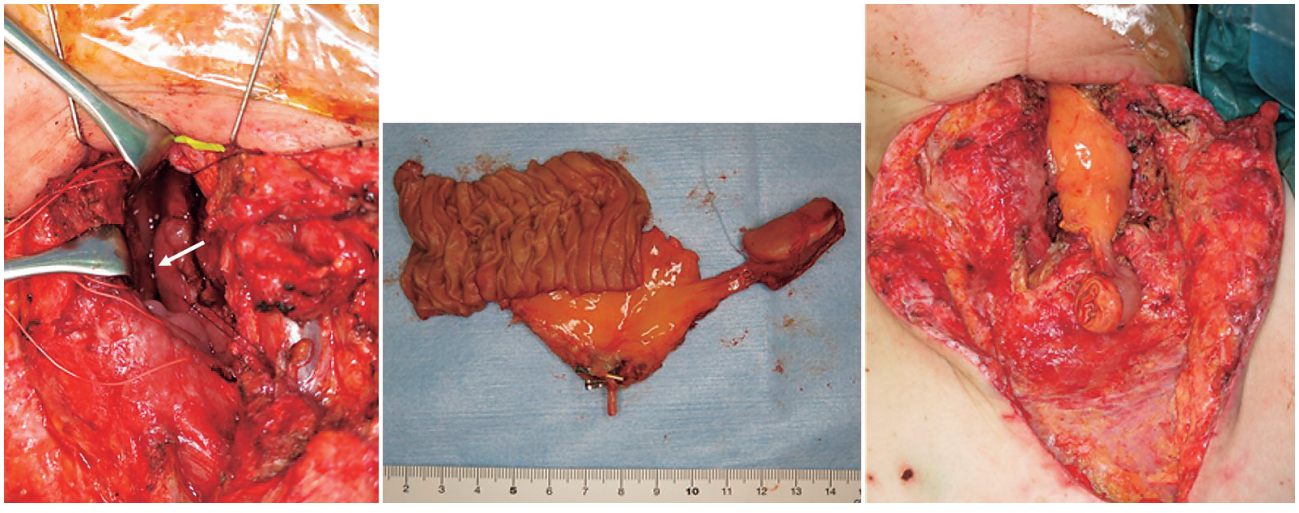

Fig. 1 (left) Intraoperative photograph showing esophageal perforation from the hypopharynx to the esophageal orifice. A jejunal free flap (center) was transferred to the perforation (right).

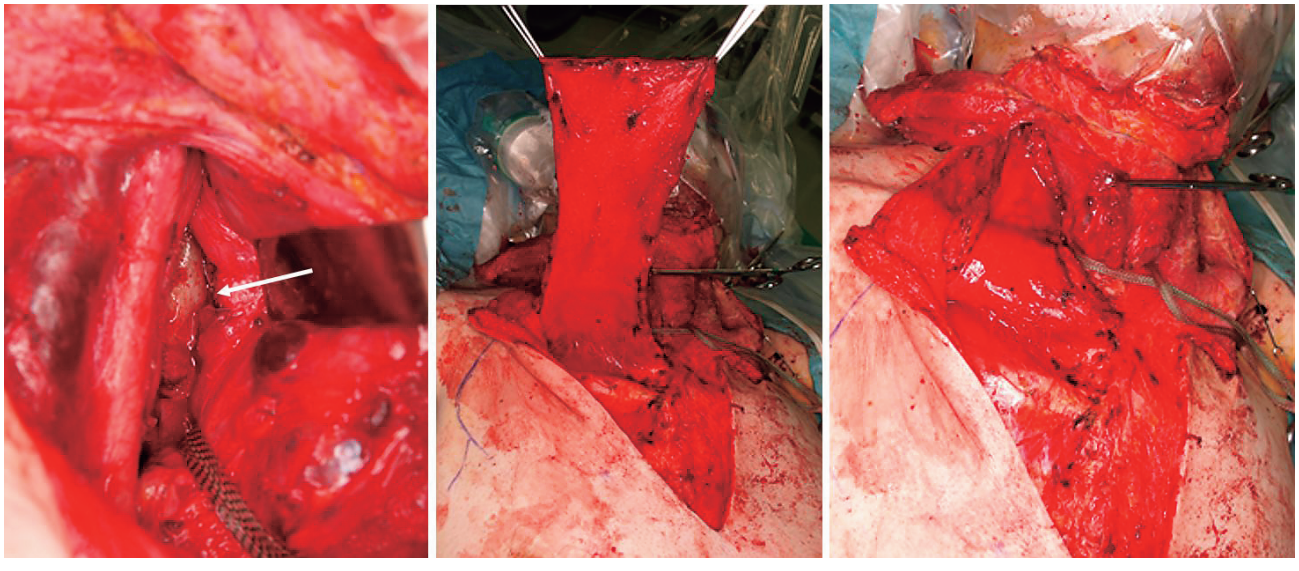

Fig. 2 (left) Intraoperative photograph showing an esophageal perforation with primary suturing. (center, right) A right pectoralis major flap was transferred to reinforce the suture.

is discovered at the time of or immediately after surgery, and no scar has developed, the perforation may heal with conservative treatment or surgical treatment with primary suturing. In patients with esophageal injuries that cannot be repaired at the time of surgery or hemodynamic instability and inability to tolerate definitive repair, management with an esophageal T-tube has been advocated. That method works by reducing local spillage and providing a conduit to drain the esophagus. Over time, a fibrous tract forms around the tube and is eventually obliterated once the tube is removed [11-13]. In addition, some reports describe endoscopic management such as esophageal stent placement in carefully selected patients who show no evidence of systemic sepsis, and in those who are inoperable [13,14]. However, we suggest that some cases of esophageal perforation should be treated with flap reinforcement or reconstruction because the condition is slow to heal and often fatal. For example, if scar formation or infection is observed and the plate cannot be

removed due to the absence of bone union, healing with conservative treatment or primary suture is difficult and recurrence is possible. In these cases, we recommend flap reinforcement of the primary suture or flap reconstruction because the flap supplies sufficient blood flow and advances healing. If the perforation is small and sutured primarily, we recommend using a pedicled sternocleidomastoid muscle or pectoralis major flap to reinforce the primary repair. If the perforation is large and primary suture is difficult due to narrowing of the esophageal lumen, we recommend using a jejunal free or forearm flap. In the selection of a flap, it is important that the flap is small and thin because the space around the perforation is limited and the sutured wound or perforation itself is not large. In flap reconstruction, it is useful to untie the suture and ligature at the end of the procedure, because the posterior wall of the hypopharynx and esophageal orifice are easy to injure and can be difficult to visualize.

Conclusion

Esophageal perforation following anterior cervical plate fixation is a rare complication, but delays in detection and treatment can have serious consequences. Cases with large perforations or with scar formation around the perforation do not readily heal with primary suture. We recommend reconstruction using a muscle or free flap.

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