

Case Report

Repair of Esophageal Perforation Due to Anterior Cervical Spine Instrumentation

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The complication of esophageal perforation after anterior cervical spine fusion for cervical spine disease is rare but potentially fatal. We describe two cases of esophageal perforation found by esophagoscopy visualization. In one patient, primary closure could not be achieved, and a submental island flap was used to repair the defect. In the second patient, primary closure was achieved and a pectoralis major flap was interposed between the closure and the residual instrumentation. Postoperatively, both patients had no evidence of persistent perforation and had resolution of preoperative symptoms.

Key Words: Esophageal perforation, spinal fusion.

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CLINICAL PEARL

Esophageal perforations secondary to instrumentation failure after anterior cervical spine fusion must be repaired. Vascularized tissue flaps can be an important option both for closing the perforation and for providing additional bulk to cover residual tissue.

INTRODUCTION

Esophageal perforation is a rare complication of the anterior cervical approach with internal fixation for cervical spine stabilization. It can lead to deep neck space infection, mediastinitis, and airway obstruction. Esophageal perforations can happen intraoperatively, perioperatively, or many years postoperatively. Erosion of the hypopharynx or esophagus has been described as occurring up to 9 years postoperatively.^{1,2} It can happen

with or without instrumentation failure.² Reports on the management of esophageal perforations secondary to anterior instrumentation erosion have delineated treatments ranging from primary closure³ to the use of local tissue flaps.⁴ We report on two patients for whom tissue flaps were used to repair defects.

PATIENT 1

A 75-year-old woman with a history of metastatic breast carcinoma to C5 and a lateral neck node, who had required radiotherapy and resection 13 years earlier, presented with severe dysphagia, weight loss, fevers, night sweats, and voice changes. The resulting loss of bone mass in the spine after her prior cancer treatment had necessitated spinal fusion from C5 to C7. An upper gastrointestinal endoscopy revealed cervical instrumentation erosion from the posterior hypopharynx down into the esophagus. Radiographs, magnetic resonance imaging (MRI), and computed tomography (CT) demonstrated solid fusion of the cervical spine (Fig. 1A).

The spinal fusion instrumentation was removed from the patient through a left anterior cervical approach (Fig. 1B). A posterior full-thickness esophageal defect of 3 cm remained that could not be closed primarily. A left submental island flap was used to close this defect (Fig. 1C).

The patient's postoperative course was uneventful. She underwent a barium swallow study that showed no evidence of fistulas. Within 7 weeks, her feeding tube was removed and her fevers, night sweats, and voice improved.

PATIENT 2

A 22-year-old man presented to our clinic with dysphagia and a previously identified Zenker diverticulum. Five years earlier, he had been in a motor vehicle accident that resulted in a C6 burst fracture requiring spinal fusion of C4 to C7 through a right anterior cervical approach. Four years after the accident, dysphagia developed with regurgitation of undigested food. The section of the instrumentation that appeared to be contributing to his symptoms was replaced with lower-

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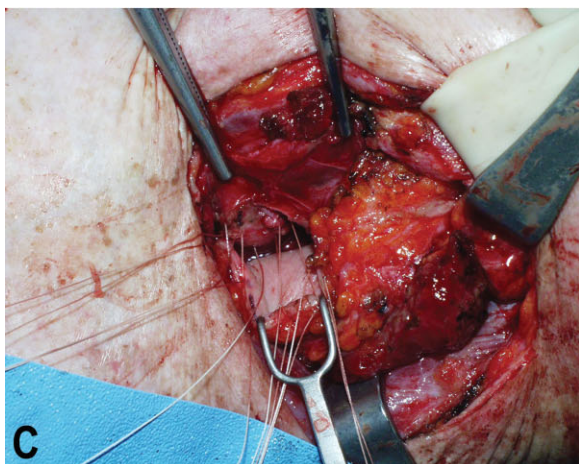
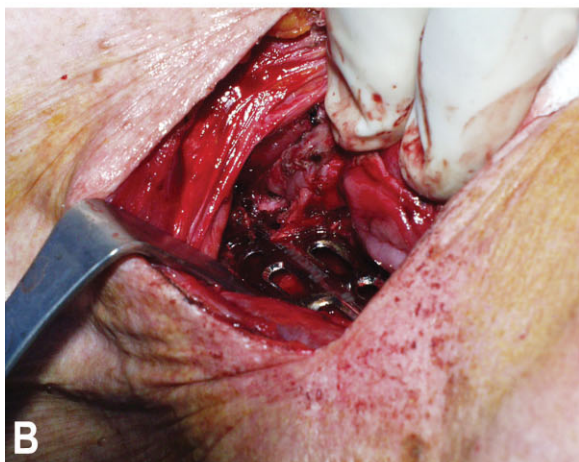


Fig. 1. (A) Coronal computed tomography of a 75-year-old woman shows fusion of the cervical spine. (B) Erosion of the cervical instrumentation shows through the posterior esophageal wall (base of neck at lower right). (C) Inset of a left submental island flap (base of neck at left).

profile instrumentation. During the same surgery, an unsuccessful attempt was made to identify the pharyngeal pouch through both right and left anterior cervical approaches. No esophageal perforation was identified at that time.

The patient continued to experience dysphagia, and another modified swallow study was conducted one year later that identified a Zenker diverticulum. A rigid esophagoscopy was performed, and the entire cage was appreciated through the posterior wall of the diverticulum (Fig. 2A). A CT scan demonstrated fusion of C4 to C5 but revealed no evidence of osteomyelitis (Fig. 2B).

A left anterior cervical approach was used to gain exposure. The esophageal defect was closed primarily, and the plate from C4 to C5 was removed. A left pectoralis major myogenous flap was then attached to the contralateral prevertebral fascia, interposing the pectoralis major muscle between the residual instrumentation and the esophagus.

The patient's postoperative course was uneventful. He was able to eat a regular diet without difficulty, and his gastrostomy tube was removed within a month.

DISCUSSION

Esophageal injury after anterior cervical spine fusion is a rare complication. Lowery and McDonough⁵ found a 35% (38 of 109 patients) incidence of instrumentation failure (i.e., "any broken or loosened screw or plate, regardless of clinical significance") at a mean follow-up of 43 months. However, instrumentation removal was required in only 5% (five patients) of the 109 patients, and there were no reports of esophageal complications.

A low (<1%) incidence of esophageal perforation after anterior cervical spine surgery has been reported.⁶ However, that incidence includes esophageal perforation sustained intraoperatively, such as from traumatic surgical exposure, ischemic necrosis caused by pressure from surgical instruments, or accidental direct injury from surgical instruments. Instrumentation failure can lead to the exposure of sharp edges, which may cause an esophageal tear.² There have also been reports of missing screws found in the gastrointestinal tract but without any evidence of esophageal scarring.⁷ In such cases, the perforations probably healed without any clinically significant symptoms. Thus the incidence of esophageal perforation secondary to instrumentation extrusion may be underreported.

Although esophageal perforations may follow a benign course, their early diagnosis and treatment is essential because of the potential for fatal complications. Perforation may present intraoperatively, perioperatively, or many years postoperatively, as was the case for one of our two patients. Esophageal perforation should be considered when a patient experiences unexplained fever, dysphagia, odynophagia, hoarseness, pain, aspiration, recurrence of preoperative neurologic symptoms, or drainage of food, saliva, or air from the neck incision site.³ Oropharyngeal secretions traveling through the

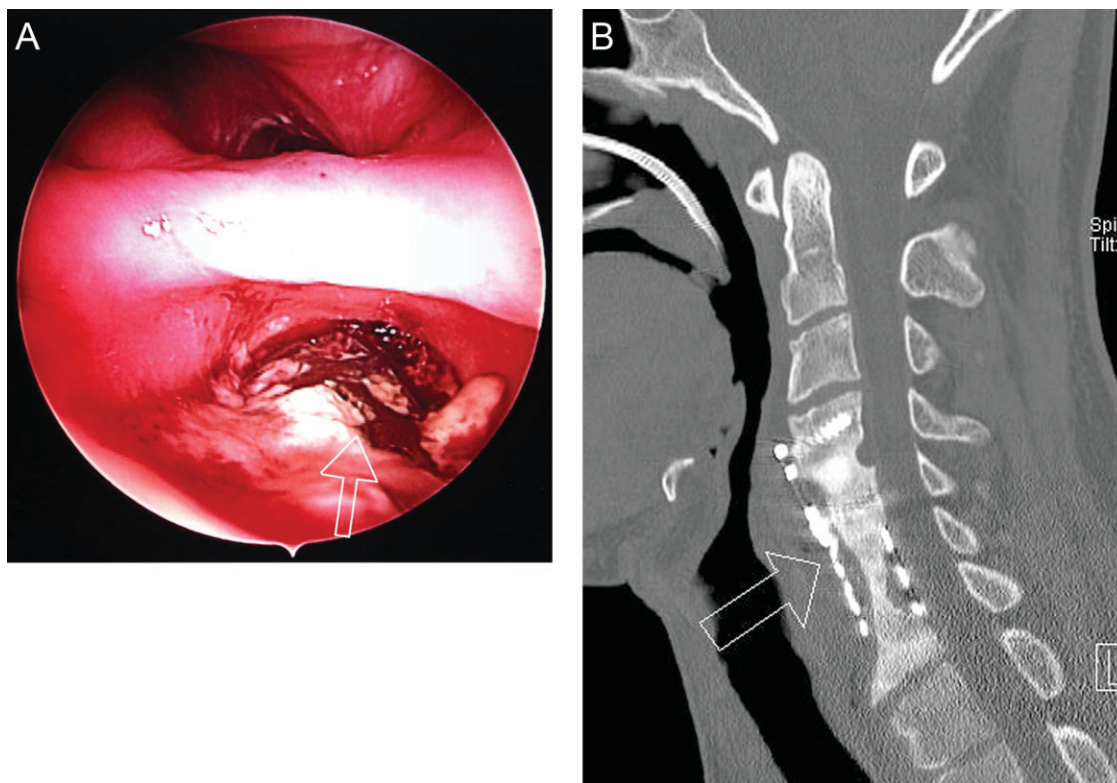


Fig. 2. (A) Rigid esophagoscopy in a 22-year-old man demonstrates a defect in the posterior wall of the diverticulum (arrow). (B) Coronal computed tomography shows fusion of the cervical spine (arrow).

perforation can lead to mediastinitis, pneumonia, pleuritis, pericarditis, or systemic sepsis.⁸

Radiographs of the cervical spine can reveal prevertebral air or loose or missing instrumentation. Swallow studies, preferably with barium, can also assist in diagnosis.³ Gaudinez et al.⁸ found that radiologic examinations did not indicate an esophageal injury in 23% (10 patients) of 44 patients who had esophageal perforations; thus, a high index of suspicion plays a large role in early diagnosis.

However, as was the case with our two patients, visual inspection of the esophagus versus radiographs and swallow studies may be necessary to identify an esophageal perforation. Rigid endoscopy allows for superior visualization, but it requires general anesthesia and may be more difficult to accomplish in patients with cervical spine immobilization.¹ CT or MRI can aid the identification of infection or perforation and can help document spinal fusion. Although methylene blue injection into the esophageal lumen has been suggested as a method to help identify a perforation,³ we have not found this approach to be helpful.

Treatment of esophageal perforations from anterior cervical spine manipulation includes conservative medical management, primary closure, and complex reconstruction.^{3,4,8} Conservative management of small perforations identified in the immediate postoperative period includes the use of intravenous antibiotics, a nasogastric tube, and extraoral nutrition.¹ However, an

esophageal perforation secondary to instrumentation erosion is unlikely to resolve with conservative management and instead requires surgical closure.⁴

With a small delayed esophageal perforation, T-tube placement after instrumentation removal may allow spontaneous closure.¹ The T-tube allows for diversion of saliva to the cervical skin. Larger defects may require vascularized flaps, which have had successful outcomes.⁴ The displaced instrumentation should be removed as completely as possible,^{4,8} because the perforation may recur after flap repair if the instrumentation is left intact.

In both of our patients, vascularized tissue was used to reinforce the repair and to prevent recurrence of the esophageal perforation. A submental island flap was used to repair the esophageal defect in one patient. In the other patient, a pectoralis major myogenous flap was used as an interposition flap between the esophagus and the residual instrumentation.

In our first patient, the submental island flap was used to close the defect because primary closure was not possible. The submental island flap is a versatile myocutaneous flap based off the submental branch of the facial artery. After the flap was dissected, it was tunneled below the bridge of skin that connected the hypopharyngeal-laryngeal dissection with the donor site in the upper neck. The skin from the submental island flap was then sutured circumferentially with the skin edges everted.

In our second patient, we used a pectoralis major myogenous flap to interpose considerable bulk between the esophagus and the remaining instrumentation. This technique was used to prevent erosion of the residual plate through the primary closure of the esophageal defect. The flap was rotated between the esophagus and the instrumentation, and it was attached to the contralateral prevertebral fascia.

A delayed esophageal perforation secondary to instrumentation erosion is a rare complication of anterior cervical spine surgery. A high index of suspicion is required to diagnose a delayed perforation because symptoms and diagnosis may occur years after the initial surgery. Although small defects may be closed primarily, larger defects may require more complex reconstruction with vascularized tissue. If possible, removal of the damaged instrumentation should be done to prevent future recurrences. When the instrumentation must be retained, a vascularized tissue flap of sufficient bulk can be interposed between the defect and the closure to prevent future esophageal perforations.

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