

Esophageal Injury Following Anterior Cervical Plate Fixation

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We report five patients of esophageal injuries confirmed by clinical signs and radiological evidences. They include a partial tear and a perforation which were not noticed during the operation, a perforation which was primarily repaired during the operation, and two perforations which occurred during the reoperations for the removal of mal-positioned screws or plate. The partial tear was not repaired. The perforation which occurred during the operation was primarily irrigated and didn't receive further treatment. Two perforations which occurred during the reoperations were treated by irrigation, debridement with surgical drainage, and systemic antibiotics. One who was diagnosed later after the operation showed the poorest outcome and required longest hospital days among our series. Early detection and appropriate treatment of esophageal injury following anterior spinal surgery can only improve the prognosis by preventing secondary complications.

KEY WORDS : Esophageal injury · Anterior cervical surgery.

Introduction

Anterior cervical plate fixation is a widely used method of fusion for vertebral fracture, neoplasm, or degenerative diseases¹⁷⁾ with relatively low complication rates. It is used to improve the overall union rate, and to decrease the need for restrictive external immobilization¹⁸⁾. An esophageal injury is quite uncommon but well known complication following anterior cervical plate fixation^{3,9,23)}.

There are several causes of esophageal injury^{12,15,21)}. Although a blunt or penetrating injury involved with the cervical spine injury may be considered^{20,21)}, most of the esophageal injuries are caused by iatrogenic injury during the dissection, inappropriate placement or dislodgement of retractors, vigorous retraction, or chronic erosion secondary to hardware migration^{1,3,7,12,18)}. Besides, many other complications following anterior cervical spinal surgery have been reported^{10,13)}. Atelectasis, pneumonia, airway obstruction, tracheobronchitis, and pulmonary embolism are the common associated complications.

We present five patients of esophageal injury with different clinical courses and outcome.

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Case Report

Between 1999 and 2004, 270 patients underwent anterior cervical surgeries for degenerative spondylosis, disc herniation, ossification of the posterior longitudinal ligament, and vertebral fracture with dislocation. Among these, four patients were complicated with esophageal perforations and one with partial tear during the operations.

Case 1

A 38-year-old man who had been involved in a bicycle accident presented with quadriplegia at admission. The simple X-rays, computed tomography(CT), and magnetic resonance imaging(MRI) revealed a moderate to severe ossified posterior longitudinal ligament(OPLL) at the level of C4-5 and a small centrally herniated disc at the level of C5-6. There was no evidence of fracture or dislocation. He underwent anterior C5 corpectomy with total discectomy including endplates at the level of C4-5 and C5-6. Anterior cervical plate(AO plate) and screw fixation with autologous iliac bone graft were performed. He was discharged with improved quadriplegia. Two months after the surgery, he presented with complaints of paresthesia on both hands and foreign body sensation in the throat while swallowing. The simple X-ray films showed displaced cervical plate with loosened screws(Fig. 1A).

He underwent reoperation to remove the plate and screws after confirming of well fused cervical spines. Due to severe

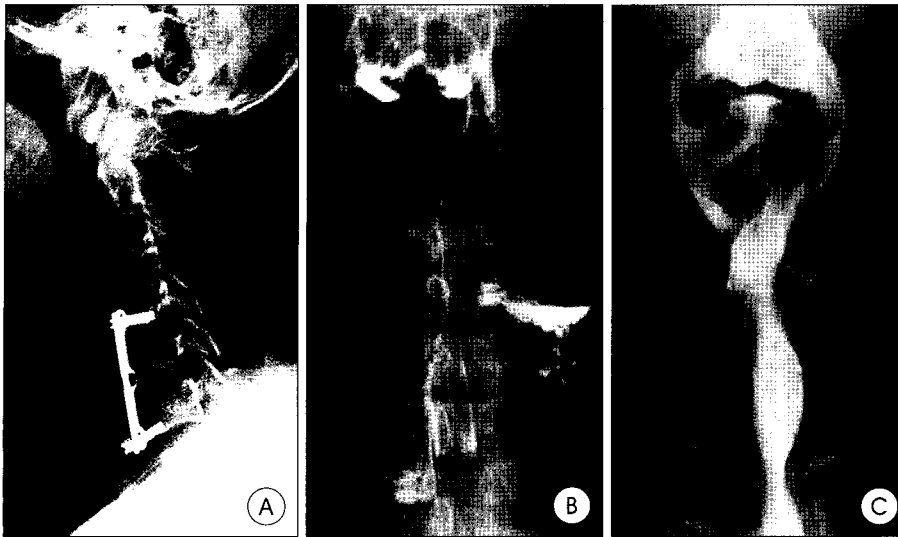


Fig. 1. A : Plane lateral X-ray shows a displaced plate and loosened screws. B : Esophagogram reveals leakage of dye into the mediastinum(arrow heads). C : Follow up esophagogram reveals no leakage of dye.

adhesion around the previous wound, the dissection was performed with great care. On the second postoperative day, however, he developed high fever(>38 °C), and complained of returning of foreign body sensation again. The esophagogram

revealed an esophageal perforation(Fig. 1B). The treatment included Levin tube insertion, wound revision, debridement with irrigation, and continuous drainage as well as systemic antibiotics.

Two weeks after the surgical drainage, the follow up esophagogram showed no leakage of dye(Fig. 1C). No further treatment or evaluation was necessary.

Case 2

A 57-year-old man who had been involved in motorcycle accident was admitted in paraplegic state. Simple X-ray films, spine CT, and MRI revealed a burst

fracture of C5 and dislocation between C5 and C6 with cord contusion. C5 corpectomy with autologous bone graft was followed by anterior cervical plate and screw fixation. Two months later, he complained of foreign body sensation in the

Table 1. Diagnosis, title of operation, mechanisms of injury, detection, treatment and clinical results of individual cases

	Case 1	Case 2	Case 3	Case 4	Case 5
Age/Sex	38/M	57/M	53/F	37/F	52/M
Diagnosis	OPLL C4-5	C5 burst Fx.*	Spinal stenosis, C5-6	Spinal stenosis, C4-5 & C5-6	C5 burst Fx.* & dislocation, C5-6
Operation	C5 corpectomy and ACPF**	C5 corpectomy and ACPF**	Discectomy and ACPF**	Discectomy and ACPF**	C5 corpectomy and ACPF**
Mechanisms of esophageal injury	During the reoperation for removal of loosened screws and plate	During the reoperation for removal of loosened screws and plate	During the initial operation, Partial tear	During the initial operation, Perforation	During the initial operation, Perforation
Detection	POD*** # 2	POD*** # 4	POD*** # 5	During the operation	POD*** #10
Treatment	Irrigation, Debridement, Antibiotics	Irrigation, Debridement, Antibiotics	No treatment	Primary suture, during the operation	Irrigation, Debridement, L-tube feeding, Gastrostomy, Intra-esophageal Stent
Outcome /Follow up period	No leakage of dye in two weeks	No leakage of dye in two weeks	Spontaneously resolved diverticulum	No postoperative leakage of dye	Esophagocutaneous fistula Sepsis Follow up for over a year

* Fx. : fracture, ** ACPF : Anterior cervical plate fixation, *** POD : Postoperative day

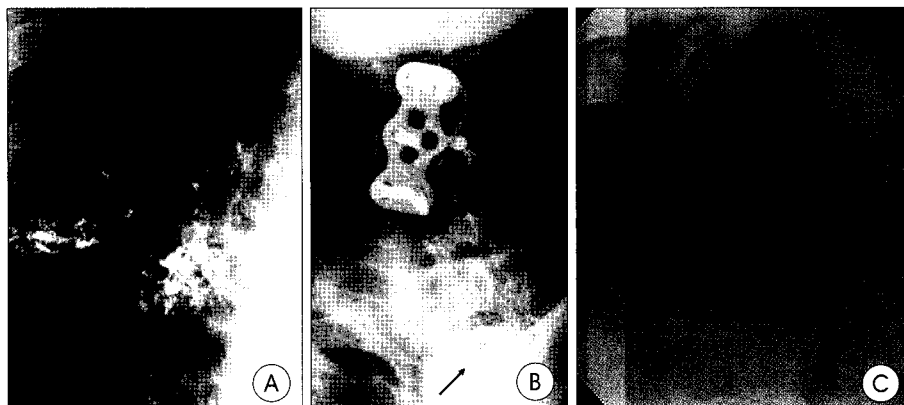


Fig. 2. A : Esophagogram reveals leakage of dye into the alveolar space. B : Intra-esophageal stent is inserted (arrow). C : Esophagoscopy shows screws and plate in the esophageal lumen.

throat, and the simple roentgenograms revealed displaced screws. He underwent a reoperation to remove the plate and screws. On the fourth postoperative day, he complained of swallowing difficulty and febrile sensation ($>38^{\circ}\text{C}$). The esophagogram showed some leakage of dye from the esophagus. He went through surgical drainage with debridement, irrigation and systemic antibiotics. Since no evidence of leakage was delineated on the follow up esophagogram taken 2 weeks later, he received no further treatment.

Case 3

A 53-year-old woman underwent an anterior cervical discectomy, bone graft from iliac crest and anterior cervical plate and screw fixation for spinal stenosis at the level of C5-6. At the fifth postoperative day, she complained of foreign body sensation while swallowing. A diverticulum-like lesion was delineated on the esophagogram. Assuming that the lesion was associated with partial tear, we performed no surgical intervention. The follow up esophagogram after three months, indeed, showed no abnormality.

Case 4

A 37-year-old woman with severe spinal stenosis and herniated cervical disc at the level of C4-5 and C5-6 underwent anterior cervical discectomy with plate and screw fixation. During the operation, a small serosal tear of the esophagus was noticed. The wound was sutured primarily and postoperative esophagogram revealed no leakage of dye. The patient did not receive further treatment.

Case 5

A 52-year-old construction laborer who had fallen to the ground from a 10meter high building was admitted to our

department in quadriplegic state. The diagnosis included C5 burst fracture and dislocation between C5 and C6 with complete cord injury. The posterior fusion by wiring and the anterior cervical plate and screw fixation were performed one by one. At the tenth postoperative day after the anterior cervical surgery, the wound began to discharge. Assuming that there was an unnoticed esophageal injury during the surgery, esophagogram was done, which revealed

considerable leakage of dye from the esophagus into the mediastinum and alveolar space (Fig. 2A).

The patient went through several times of cardiopulmonary resuscitation due to septic shock. After recovery from septic shock, Levin tube insertion and systemic antibiotics had been given. The follow up esophagogram after a month, however, did not show any improvement, and therefore an intra-esophageal stent was inserted (Fig. 2B). Despite no leakage of dye on the follow up esophagogram, an esophagoscopy revealed the screw protruding into the esophageal lumen and esophagocutaneous fistula (Fig. 2C). Three months after gastrostomy and reinsertion of intra-esophageal stent, the screw exposed to the esophageal lumen was covered by mucosal layer.

The diagnosis, operation title, the location, causes and mechanisms of injury, treatment, and the results of all the five cases are listed in Table 1. The injuries during the reoperations had better prognoses than those after the initial operations. When the tear was partial or primarily sutured, it did not need any further intervention. The injuries unnoticed and not repaired in situ had the poorest outcome.

Discussion

Anterior cervical spine fusion and plate fixation is a well-established procedure for the treatment of spondylitic disease, intervertebral disc disease, and cervical spinal injury¹⁰. The esophageal perforations have been reported to be complicated with these surgeries, but they also may be related either with hyperextension injury, blunt trauma^{2,4,14,19}, hyoid bone fracture or traumatic intubation^{11,24}, without surgeries. The complication rate after anterior cervical plating is generally low and decreases in accordance with the surgeon's experience^{5,6}. According to Zeidmann, overall

complication rate associated with anterior cervical spinal fusion is approximately 5%²⁶). The complications include bone graft failure, cerebrospinal fluid leak, recurrent laryngeal nerve injury, quadriplegia, and even death. At present, however, esophageal perforation is one of the rare but serious complications following anterior cervical spinal surgery. As previously mentioned, many authors concluded that the esophageal perforation could be a potentially devastating complication. But interestingly case 1 and 2, complicated by esophageal injuries occurred after the second operations to remove the loosened screw showed favorable outcomes by additional operations for debridement and irrigation with continuous drainage. We assume that pre-existing fibrosis or adhesion which had prevented diffusion of inflammatory esophageal contents into the mediastinum, had contributed to the outcome. Gradual screw migration causing esophageal perforation and finally eliminated through the gastrointestinal tract was reported^{8,25}). If a perforation was primarily repaired during the operation or if the injury was incomplete, no further treatment was required.

Contrary to case 1 through 4, case 5 had the devastating clinical course. Several times of cardiopulmonary resuscitation, long term use of Levin tube followed by gastrostomy, intra-esophageal stent insertion, and systemic antibiotics were included. Even though the patient survived, he had to undergo long-term treatment and required prolonged hospital days. If intra-operative esophageal injury is detected, only appropriate and vigorous management could prevent secondary complications such as septic shock and esophagocutaneous fistula and save the patient's life.

If intra-operative esophageal injury is suspected, methylene blue instillation in the pharynx or inspection of air leakage are used for the detection of the perforation. Postoperative diagnosis of esophageal perforation are by esophagogram, esophagography augmented by CT, and esophagoscopy. Because esophagoscopy and esophagography can yield a false-negative result, clinical suspicion is vital¹⁶) for the diagnosis. Contrast swallowing studies are useful in determining the location of the perforation and computed tomography are helpful in delineating the extent of an underlying abscess and possible extension along the pre-vertebral space²²).

A high index of suspicion is required in patients with osteopenia, neurologic deficits, poor screw fixation, and fixation to the first thoracic vertebrae¹⁸). In addition, clinical symptoms and signs such as fever, leukocytosis, wound discharge, dysphagia, and odynophagia must be considered to make timely diagnosis¹⁰).

Conclusion

Careful and meticulous surgical technique is required not to injure the esophagus during the anterior cervical spinal surgery. Although it is known that esophageal injury following anterior cervical fusion yield a poor outcome, early detection and appropriate treatment according to the individual cases can improve the prognosis. Because undetected esophageal injury during the operation has the poorest outcome, the surgeon should always mind the esophageal injury during anterior cervical spinal surgery.

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