

Spinal Hardware Induced Cervical Esophageal Perforations

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Introduction

Perforation of the cervical esophagus is a rare and potentially life-threatening complication. Prompt diagnosis and treatment is critical to avoid short and long-term sequelae. Multiple etiologies including foreign body ingestion, penetrating trauma, and bulky hardware erosion have been documented in the literature. However, erosion of spinal hardware in the posterior esophageal wall can account for 45-76% of documented cases and can range from 5 hours to 11 years post anterior cervical spine surgery. Management of these unique sequelae can be complicated by multiple peri- and post-operative scenarios that may differ depending on the time lapse of presentation following anterior spine surgery. The purpose of this study was to examine the management of spinal hardware induced cervical esophageal perforations in both acute and delayed presentations. We discuss two cases of hardware induced perforations, one acute (2 weeks) and the other delayed (22 years). We address the differences and similarities between these unique scenarios coupled with the challenges facing a head and neck surgeon in the management of these complications.

Table 1. Reported* Complications of Cervical Esophageal Perforation

Airway Compromise

Mediastinitis

Spinal Instability

Dysphagia

Hematemesis

Osteomyelitis

Abscess/Fistula Formation

Sepsis

*References 1-6

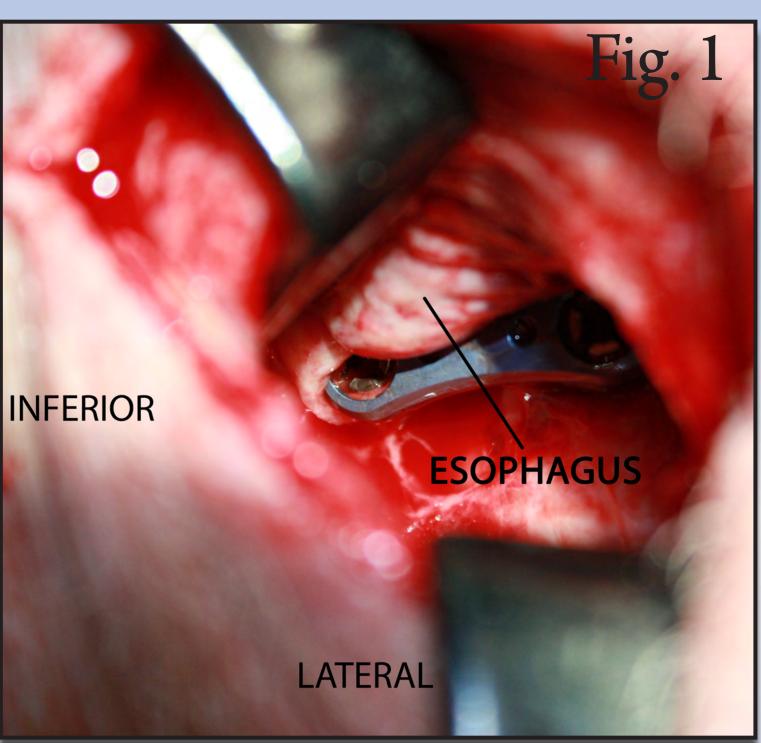




Figure 1. Spinal hardware erosion into the posterior cervical esophageal wall. Figure 2. Halo traction secondary to spinal instability from dislodged cervical spine hardware.

Acute Presentation

An 83 year-old man presents two weeks post anterior spinal plating and C3-C7 interbody fusion with progressive airway distress and a rapidly expanding neck abscess. Tracheostomy was performed and the abscess was drained. Rigid endoscopy reveals hardware protrusion at the esophageal inlet with a 3 cm mucosal defect. Left neck exploration reveals a dislodged cervical spine plate at the level of C-7 protruding through the posterior esophageal wall (Figure 1). Due to the hardware failure and resulting spinal instability, orthopedic surgery removed the loose hardware and placed the patient in halo traction (Figure 2). This allowed otolaryngology to repair the esophageal lesion.

Primary mucosal closure of the posterior esophageal wall was possible due to the acute nature of the perforation and relatively healthy mucosa. A superior omohyoid muscle (SOM) flap was then mobilized and secured behind the defect for reinforcement. A portion of the sternocleidomastoid muscle (SCM), approximately 30% of width, was mobilized from the medial aspect, based inferiorly and rotated into the paravertebral space to fill the extensive space created by the recent dissection for spine fixation. Post-operatively the patient remained in a halo-vest for spine stabilization and was managed with tube feeding, IV antibiotics for cervical spine osteomyelitis, and tracheostomy care. Three weeks post-operatively, the patient returned to the operating room for posterior cervical spine fixation with hardware to provide long-term stability and allow for halo-vest removal. Tube feedings continued for 38 days post-operatively and were discontinued when an esophagram showed no leakage or stenosis. The patient is currently able to maintain full oral feeding with good swallowing function.

ABSTRACT

OBJECTIVE: Cervical esophageal perforation from spinal fixation hardware is a rare and potentially life-threatening condition. The purpose of this study is to describe our surgical and post-operative management of sequelae.

METHODS: Two cases of spinal hardware induced cervical esophageal perforation are presented; one acute and the other delayed in onset. Management issues including appropriate imaging studies, peri-operative nutrition, surgical approaches to defect repair, spinal hardware management, and potential spine instability. Long-term comorbidities including osteomyelitis, poor bone healing and esophageal stricture are also addressed.

RESULT: The time lapse between anterior spine surgery and perforation presentation between these two cases yield a dichotomous set of challenges and issues to be considered in the course of treatment. The magnitude of soft tissue involvement, extent of infection, airway management, spinal instability, infection clearance from involved bone, and perforation location low and posterior in the neck or upper chest encompass a formidable challenge for the head and neck surgeon.

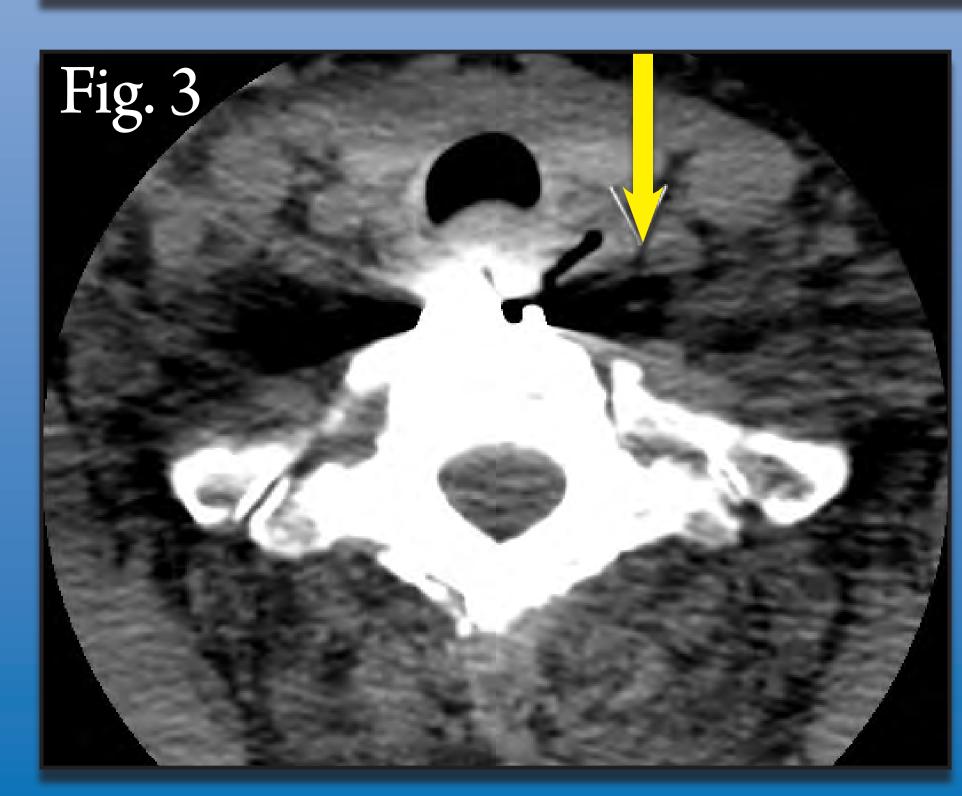
CONCLUSION: Surgical technique along with peri- and post-operative management differs between acute and delayed cases of spinal hardware induced cervical esophageal perforations. Successful management of this unusual complication requires a high index of suspicion coupled with aggressive and early intervention to avoid potentially devastating patient outcomes.

Delayed Presentation

A 49 year-old man presents with progressive dysphagia, neck abscess, and esophageal-cutaneous fistula to the left neck. The patient has a history of anterior cervical spine fusion 22 years prior. CT scans of the neck displayed erosion of spinal hardware into the posterior esophageal wall (Figure 3). Subsequent abscess formation and fistula communication between the esophagus/hypopharynx and the left neck skin was noted. Cervical spine imaging confirmed adequate fusion of the vertebrae with spine stability (Figure 4).

Surgical exploration of the neck commenced with entrance into the paravertebral space though the abscess cavity. Abundant scar tissue was noted along the pre-vertebral fascia and the anterior spinal hardware was identified within the pre-vertebral plane. No loosing of hardware was noted. However, the plate had eroded in the posterior esophageal wall yielding a 1 x 3 cm defect and associated abscess (Figure 5). Orthopedic surgery removed the plate and curettaged the bone until healthy vertebrae was identified. Spinal fusion was solid with no instability noted, therefore halo traction was not indicated.

Esophageal examination revealed fibrosis, inflammation, and retraction of the perforated mucosal edges resulting in a mucosal defect. The SOM belly was mobilized, rotated inferiorly, and positioned into the posterior esophageal wall defect. The SOM was sutured to the mucosa edges to fill the defect. Tacking sutures to the surrounding tissues supported the SOM flap. The fistula tract was dissected to the skin and excised. Post-operatively the patient experienced severe gastroesophageal reflux despite maximal medical therapy. On the second post-operative day tube feeds were observed and upon surgical re-exploration a small dehiscience was noted in the repair. The wound was irrigated, packed, and wound care was continued until closure was achieved. The patient was on total parenteral nutrition for 25 days until follow-up esophagram demonstrated the absence of leakage and stenosis.



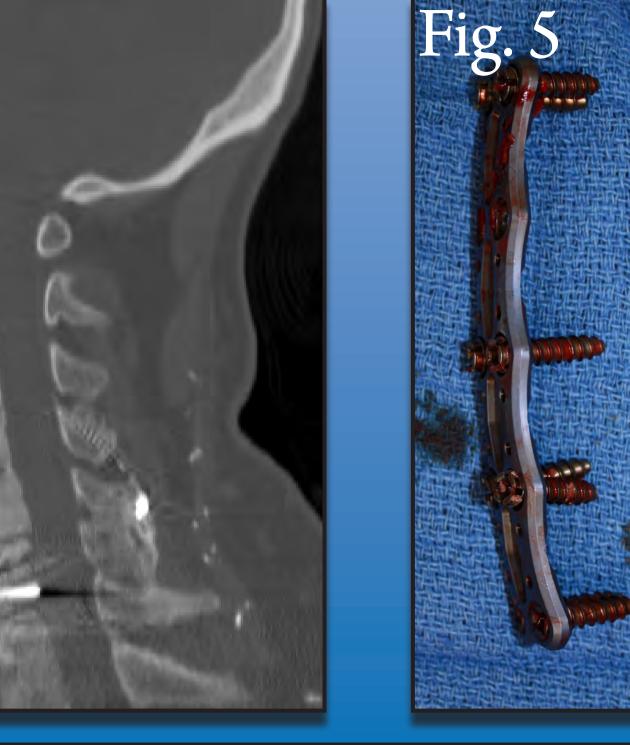


Figure 3. CT scan of pre-vertebral abscess formation and esophageal-cutaneous fistula to the left neck. Figure 4. CT scan of cervical spinal hardware demonstrating bony fusion and air around the plate. Figure 5. Removed spinal fusion hardware.

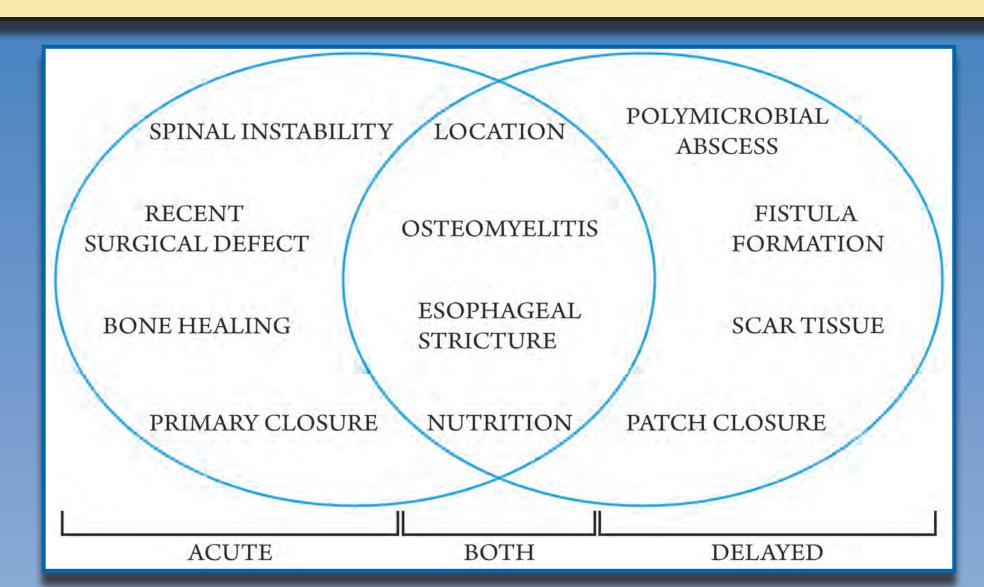


Figure 6: Representation of the differences and similarities in the treatment of esophageal perforations based on the time lapse between spinal surgery and perforation presentation.

Discussion

Management of cervical esophageal perforation involves components of operative and non-operative management. However, a step-wise approach to these sequelae may facilitate a rapid but effective approach to these complex lesions. The time lapse between anterior spine surgery and perforation presentation creates a dichotomous set of priorities in the treatment of lesions (Figure 6).

In the acute setting, spinal instability is of primary concern. Patients presenting within weeks of spinal surgery are unlikely to have adequate fusion of cervical vertebrae. In most instances, removal of the hardware will be necessary to manage the perforation and infection. It is paramount that the spine is stabilized prior to removal of the hardware. Application of halo traction is an option in this setting, providing spinal stability allowing perforation repair. The patient should then remain in the halo traction for three to six weeks post-operatively to facilitate osteomyelitis management and wound healing. Once the surgical team is comfortable with the patients condition, orthopedic surgery can re-fuse the compromised vertebrae utilizing a posterior approach. The second consideration in an acute presentation is the surgical approach to defect repair. The perforated esophageal mucosa in this setting should still be relatively healthy with minimal scar tissue and good vascularization. As a result, primary closure may be an option for repair. However, the patients recent spinal surgery may have left a large post-surgical dead space that needs to be filled. A partial SCM flap superimposed on a pedicled SOM flap can provide adequate tissue coverage. We found the synergism between this flap combination to be effective in this setting without causing significant functional and cosmetic defects.

In a delayed presentation, spinal stability is less concerning due to the probability that adequate fusion has occurred. Abscess and fistula formation may be present, but migration is limited due to tissue scarring. Osteomyelitis may be present in the cervical vertebrae and bone curettage is indicated after hardware removal. The surgical approach for defect repair will likely be complicated by the abscess cavity and extensive scar tissue within the paravertebral space. Primary defect closure is contraindicated if the mucosal edges are fibrotic and retracted. In addition, extensive scarring can intefere with the placement of a large pedicle flap. "Patch" closure utilizing a pedicle SOM flap will provide adequate coverage of small to mid-sized defects (1-6 cm x 1-4 cm). This can be reinforced by a partial SCM flap and secured to the surrounding soft tissue for additional support.

Acute and delayed presentations vary in their management, but several factors remain the same. Pre-operative issues including airway management, soft tissue involvement, and defect location low in the neck need to be appropriately addressed. Defect location low in the posterior neck and upper chest limits surgical exposure and can result in mediastinal structural involvement. Post-operative issues including nutrition, infection management, bone healing, and esophageal stricture need to be managed.

Conclusions

Overall, successful management of this unusual complication requires a a high index of suspicion coupled with aggressive and early intervention. Multidisciplinary cooperation and a step-wise approach to surgical and post-surgical treatment can avoid potentially devastating patient outcomes.

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