Late-Onset Dysphagia From Hardware Migration After Anterior Cervical Discectomy and Fusion: An Unusual Cause and Review of Literature

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ABSTRACT: Post-operative dysphagia is the most common complication following anterior cervical discectomy and fusion (ACDF), with reports varying from 1% to 79%. We report a case of a 63-year-old female patient complaining of dysphagia presenting 9 years post surgery. The cause of dysphagia is often multifactorial with the true aetiology poorly understood. One potentially life-threatening cause of post-operative dysphagia is hardware migration associated with pharyngoesophageal perforation. This patient presents a unique case of a conservatively managed hardware migration with delayed onset dysphagia after 8 years of minimal symptoms. On further investigation, barium swallow identified a freely mobile screw in the oesophageal submucosa, rotating on swallowing. Retrieval of the screw was achieved transcervically with no visible perforation and resolution of dysphagia occurred 1 week post-operatively. Understanding the aetiology with early diagnosis and appropriate management of delayed hardware migration are paramount in reducing patient morbidity and potential life-threatening otolaryngologic complications.

KEYWORDS: Dysphagia, anterior cervical discectomy and fusion, hardware migration, pharyngoesophageal perforation

Introduction

Anterior cervical discectomy and fusion (ACDF) is currently considered the gold standard surgical treatment for radiculopathy caused by symptomatic cervical disc degenerative disease.1 The operation has high success rates of relieving symptoms and achieving good fusion in most cases, with low associated complications.2-4 Although rare, serious complications must be considered. Complications can be categorised into general, neurovascular, and adjacent organ injury; implant-related complications; and functional complications.5 Most commonly, these include acute airway obstruction (1.2%-1.9%), recurrent laryngeal nerve (RLN) palsy (2%-4%), and post-operative dysphagia (ranging from 1% to 79%).6-8 Perhaps the most dreaded life-threatening complication, however, is hardware migration and associated pharyngoesophageal perforation.9 The early detection and prompt management of such complications may reduce the associated mortality and morbidity. The following case report highlights a unique presentation of hardware migration and serves as a review of other post-surgical ACDF complications causing dysphagia.

Presentation of Case

A 63-year-old female patient with a 40-year pack history of smoking and alcohol intake complained of chronic dysphagia for 12 months. The dysphagia was described as pain and discomfort on swallowing high in the throat, of gradual onset with a tightness sensation associated with globus. It initially presented once weekly and progressively worsened to every meal per day. The patient reported needing to swallow multiple times in order to swallow one mouthful of liquid or food. There were no significant relieving factors; however, there was minimal improvement with a pureed diet for the past 6 months. This was associated with 4 kg of weight loss over 6 months, reduced neck mobility, and occasional expectoration not associated with blood or mucus. There was vomiting of food, up to two cups in volume, with no mucus or blood. Interestingly, on flexible nasal laryngoscopy, there were no obvious abnormalities documented, including obvious swelling in the hypopharynx or pooling of saliva in the pyriform fossa. Further, gastroesophageal endoscopy documented only a hiatus hernia and an irregular squamocolumnar junction (SCJ) without noting any laryngeal abnormalities.

The patient has a significant cervical orthopaedic surgery history. This included 8 cervical operations dating back to 1989 with the most recent at the time of presentation in 2009 with C3/C4, C4/C5 ACDF as well as C4/C5, C5/C6, and C6/C7 foraminotomy. Her medical history included a thoracic outlet syndrome secondary to a cervical rib and cervical myelopathy diagnosed in 2004.

Follow-up surgical scans in 2004 displayed C3/C4 ACDF plate with no loose screws (Figure 1). In 2009, a lateral cervical spine X-rays clearly displayed C3/C4 ACDF plate with one....

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loose screw (Figure 2). The cage plate was judged to be stable, with patient being asymptomatic, and considering the background of multiple previous surgeries and no obvious complications of the loose screw, this was managed conservatively with regular follow-up scans.

In the later months of 2017 and onwards, 12-month dysphagia in the patient was investigated. In December 2017, gastroscopy noted a hiatus hernia and an irregular oesophageal SCJ. In April 2018, a barium swallow confirmed gastroesophageal reflux and demonstrated extensive range of motion of the screw during swallowing from approximated 6 to 11 o’clock (Supplemental Figure 3). An external transcervical approach was used to retrieve the loose cervical screw (Figure 3). There was no visible oesophageal perforation post-operatively seen on contrast swallow (Supplemental Figure 5). In the early, 1-week post-operative period, the patient reported dysphagia being relieved and was scheduled for further monitoring.

Discussion

Dysphagia after ACDF is the most common post-operative complication, with reports varying from 1% to 79%. Variation on the true incidence of post-operative dysphagia may exist based on the surgeon’s and/or patient’s interpretations, lack of standardised criteria for diagnosis, patient’s age and sex, surgical technique, extent of surgery, spine level, operative time, or use of spinal instrumentation. Indeed, some authors consider transient, early post-operative dysphagia to be inevitable and not a complication. This is often due to local irritation post tracheal intubation and surgical retraction of neck tissue. Other less prevalent causes include anterior hardware migration, oesophageal injury, RLN palsy, and post-operative haematoma. A 100-patient cross-sectional cohort study found smokers post ACDF to be more likely to report dysphagia symptoms, which additionally persisted >1 year after surgery. The exact pathophysiologic mechanism for the occurrence of dysphagia is unknown. Anterior hardware migration may play a role in the multifactorial nature of many postulated causes of dysphagia. In our patient, the multifactorial nature of her dysphagia included extensive spinal surgery over multiple levels, chronic gastroesophageal reflux disease with a hiatus hernia, a significant smoking history as well as hardware migration.

There are rare yet still documented case reports of hardware migration following ACDF. In a study by Tasiou, the incidence of screw pullout was 0.9%; however, this often varies from 0% to 3.4%. There are a number of reasons for post-operative hardware migration. Specific to ACDF, the rate of post-operative complications for hardware migration was reported to increase with the initial malposition or suboptimal position of screw and/or plate, excessive movement, osteoporosis, surgical site infection, congenital abnormalities of the spine, multilevel disease, spondylosis, and ossification of the posterior longitudinal ligament. We are unsure of the precise reason for screw loosening in our patient. We believe that the following risk factors, including a past medical history of aberrant anatomy including a previously removed extra cervical rib, osteoarthritic changes, and multiple level spondylosis as well as multiple previous cervical operations and osteoporosis, contributed to this.

Figure 1. Lateral right X-ray of cervical spine (2004). (A) Flexion and (B) extension of the lateral right cervical spine displaying C3/C4 ACDF plate is noted with no loose screw. ACDF indicates anterior cervical discectomy and fusion.

Figure 2. Lateral right X-ray of cervical spine (2009). (A) Flexion and (B) extension of the lateral right cervical spine displaying C3/C4 ACDF plate is noted with one loose screw. ACDF indicates anterior cervical discectomy and fusion.

Figure 3. Intra-operative fluoroscopy (2018). Intra-operative image to assist safe removal of screw in cervical spine from previous C3/C4 ACDF surgery with one loose screw. ACDF indicates anterior cervical discectomy and fusion.
Due to the anatomical proximity between the cervical spine and oesophagus, a potentially life-threatening complication of fixation screw migration is pharyngoesophageal perforation, which can occur intra- or post-operatively. This is associated with pneumothorax, mediastinitis, sepsis, shock, and respiratory failure with an overall mortality of 16%.16 Other complications of ACDF include spinal cord injury (<1%), nerve root injury (0.9%), post-operative haematoma (1.7%), recurrent laryngeal nerve injury (2%-4%), vertebral artery injury (<1%), surgical wound infection (<1%), and adjacent intervertebral disc degeneration.5,6,17,18

Evidence suggests the incidence of delayed post-operative pharyngoesophageal perforation following ACDF varies from 0.2% to 1.49%.19,20 A literature review in 2015 reported that most delayed pharyngoesophageal perforations occurred in less than 1 year from the time of anterior cervical spine surgery, with only 14 cases 1 year post surgery.21 Vrouenraets reported a case of oesophageal perforation 9 years post ACDF due to fixation migration with a background of chronic oesophagitis.22 Although this time frame of complications is similar to our case report, our patient did not suffer a pharyngoesophageal perforation.

There are four main reasons for oesophageal perforation. These include migration or fracture of the fixation devices, chronic plate pressure and associated tissue ischaemia on the posterior pharyngoesophagus, pharyngoesophageal diverticulum formation, and chronic intrinsic oesophageal disease.21 This patient’s loose screw coincided with chronic oesophagitis from gastrooesophageal reflux disease for 9 years.

The clinical management of hardware migration is variable based on problem severity, patient’s general condition, and the presence/risks of complications.23 A surgical revision is not necessary for every patient. Conservative management of hardware migration is advised with no dislodged plate, if the patient is asymptomatic with no evidence of oesophageal perforation. Xing found loose screws in the range of 2 to 5 mm could be conservatively managed with close observation, cervical immobilisation via a Philadelphia collar for 3 months until bone union. This results in no further progression.24 This was based on a retrospective study of 2233 patients with ACDF with loose screws in 37 patients (1.7%). These findings echoed Lowery, who found screw loosening of 5 mm or less posed no increasing risk to neighbouring anatomical structures. However, screw loosening of 5 mm or more posed increased risk of oesophageal perforation and removable was advised.25 Other indications for hardware removal include persistent dysphagia. Our case represents a unique situation where the patient was initially asymptomatic; however, this progressed to the screw being loosened greater than 5 mm and having extensive range of motion on swallowing with associated dysphagia. At surgery, the plate was deemed to be stable. Hence, considering the multiple previous surgeries, a decision was made not to remove or replace it at this time. Careful assessment and follow-up of the stability of the cervical spine and plate will be undertaken in the future. Further, the patient was asymptomatic from a dysphagia perspective post-operatively.

Thus, the use of instruments including plates and screws in elderly patients or those with reduced bone quality such as osteoporosis should be carefully considered. Furthermore, meticulous technique, thorough knowledge of relevant anatomy, more research into optimal fixation devices, and periodic post-surgical follow-up are vitally important. This will enhance early prevention and identification of hardware migration with related complications.

Conclusions
In summary, fixation migration is a rare albeit serious post-surgery complication. It can manifest in a variety of ways and time frames, including globus sensation, significant dysphagia, and oesophageal perforation.

Author Contributions
CF helped in conception and design of the study, acquisition/analysis/interpretation of data, drafting and revising article, and final approval of the version to be submitted. HET contributed in editing and reviewing of article, case report design, image retrieval, and ethics submission. RB helped in reviewing of article, case report design, image retrieval, and ethics submission. PF contributed to the conception and design of the study, acquisition/analysis/interpretation of data, drafting and revising article, final approval of the version to be submitted, and supervision of paper. The statement that all authors have approved the final article should be true and included in the disclosure.

Ethical Approval
This case study has ethics committee approval and informed consent.

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Supplemental Material
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