

Spinal Neurosurgery Report **Fracture of anterior cervical plate implant – report of two cases**

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Summary

Anterior cervical plate is a convenient and popular implant employed after corpectomy and bone grafting for traumatic or degenerative cervical spine disease. Although short-segment anterior cervical surgery may adequately be managed with anterior plate fixation alone, multilevel anterior cervical constructs exhibit a relatively high complication rate warranting a simultaneous posterior fusion. We report two patients undergoing two-level anterior corpectomy/fusion with a fixed anterior plate alone and exhibiting plate fracture in conjunction with pseudoarthrosis. The instrument failure was mainly attributed to pseudoarthrosis. However, improper contouring of the plate causing microstructural damage might create a weak point and contributed to this unusual hardware failure.

Keywords: Cervical spine; complication; plate fixation; spinal fusion; spinal implant.

Introduction

Anterior plating after anterior cervical corpectomy and fusion (ACF) has been commonly utilized in patients with unstable spinal injury or spondylotic myelopathy caused by multilevel herniated disc diseases or ossification of posterior longitudinal ligament (OPLL). The newly designed titanium plates not only provide stronger stability to augment fusion but also become more and more user-friendly. These devices, however, are not without complications or failures. In long-segment operations, the hardware associated complications are common with reported failure rate of 9% for two-level and up to 50% for three-level surgery [8]. The authors report two patients who underwent two-level ACF with fixed plates and developed plate fractures secondary to well-documented pseudoarthrosis.

Case report

Case 1

A 46-year-old female with a known history of cervical spondylosis was involved in a motor vehicle accident, which aggravated a pre-existing myeloradiculopathy. When the magnetic resonance imaging (MRI) revealed C3–C6 disc disease with multiple spur formation, a C3–C6 discectomy, C4–C5 corpectomy and fusion with iliac crest autograft was performed followed by instrumentation with Cervical Spine Locking Plate (radius 25 mm) (Synthes Spine, Paoli, PA). The operative procedure went uneventfully and the neurological deficits disappeared completely after surgery except for mild neck pain. Three months later, a pseudoarthrosis was demonstrated at the C3 vertebral body-graft interface. Because of trivial symptoms, instead of offering the patient posterior wiring and fusion, she was left in a cervical collar and followed with imaging studies. Eighteen months postoperatively, she twisted her neck on a roller coaster and experienced neck pain without neurological deficits. X-ray revealed a fracture of the plate through the midline hole at the lower aspect of the plate (Fig. 1). The superior pseudoarthrosis remained unchanged. A second procedure was performed and during surgery residual disc tissue was identified between C3 vertebral body and graft. An anterior fusion was repeated with a Caspar plate (Aesculap, San Francisco, CA). Follow-up x-rays ultimately showed complete fusion and she later requested elective plate removal.

Case 2

A 45-year-old female who suffered from cervical myelopathy due to OPLL combined with herniated discs underwent a C4–C5 corpectomy, removal of OPLL, C3–C6 autogenous iliac graft fusion and anterior instrumentation with a Cervical Spine Locking Plate. The patient was placed in a neck collar for 8 weeks after surgery. The neurological symptoms and signs resolved completely and follow-up x-rays revealed progressive union. Four months after surgery, during an argument with her husband, she was slapped in the face and twisted her neck when she experienced neck pain and dysphagia. Neurological examinations did not reveal any new deficits but x-rays showed a plate fracture with graft protrusion (Fig. 2). Surgery for a revision was carried out using the original graft and a new cervical plate. No reason could be identified for the delayed fusion. The patient made an uneventful recovery and follow-up radiographs one year later also showed good fusion.



a



b

Fig. 1. (a, b) Radiographs 18 months after surgery showed fracture of the cervical plate. A radiolucent gap between the graft and the inferior surface of C3 vertebral body was also noted



a



b

Fig. 2. (a, b) Radiographs four months after surgery showed fracture of the cervical plate and protrusion of the bone graft

Discussion

The addition of an anterior cervical plate to ACF not only prevents graft displacement but also offers immediate stability with the potential advantages of increasing union rate, decreasing graft collapse and minimizing the need for long-term postoperative immobilization. Compared to the conventional Caspar plate, various locking screw systems have been devised in recently designed cervical plates eliminating the necessity to purchase posterior cortex during screw insertion. Cervical Spine Locking Plate utilizing an expanding bolt in each screw provides tight security anchoring the plate to the vertebral body and results in a rigid reconstruct after ACF.

However, a new set of problems has developed appertaining to these anterior screw-plate instruments including biomechanical changes of the reconstruct and various hardware associated complications. The benefits of anterior cervical plating for multilevel ACF remain to

be justified [6, 8]. Accumulating biomechanical studies have suggested that the anterior-only instrumentation is neither adequate for the stability of the construct nor for improving union rate in long-segment cervical surgery [2, 3]. Furthermore, the biomechanical changes in the restored construct make cervical plate and the points of attachment sustain significant forces from the neck movement before solid fusion occurs and therefore contribute to more hardware failures including loosening, dislodgement or fracture of the screw and plate. Two types of screws are available in the Synthes system. The plasma-coated fenestrated screw permitting bony ingrowth has been reported to have higher incidence of breakage. The solid screw is stronger but the stiff connection of the plate and vertebral body transfers a greater portion of stress to the plate itself.

In both of our cases, no metallurgical flaw was identified. Pseudoarthrosis is considered as the main etiology

responsible for the plate fracture. In the anterior plated reconstruct, the axis of rotation is shifted anteriorly [6]. As the capability of the plate to stabilize the spinal reconstruct following long segment corpectomy is significantly reduced after fatigue loading [4], lack of solid union forces the plates to keep on sustaining most of the stress. A long-term fatigue loading and a sudden stress caused by a twist of the neck finally led to plate fracture. Fortunately, both of them did not suffer a neurological catastrophe although minimal neurological complications have been reported to be associated with the implant failure [5]. Another possible reason causing the fracture might be the contouring of the plate. Uneven anterior vertebral surface is quite common in patients with advanced degenerated spinal disease and cervical lordosis should also be taken into consideration while applying the implant [1]. Therefore, the straighter design of the Cervical Spine Locking Plate necessitates more or less contouring for optimum fit. Using the bending device, the area containing the midline screw hole is most susceptible to bending force and a crack may be caused at this vulnerable area becoming a weak point. The crack progresses as a combination of fatigue and stress [1]. Once a sudden stress occurs, the additional force transfers through the locking screws to the plate and contributes to eventual fracture through the weak point. We do not routinely use additional screws to the graft through the midline holes, because this could risk the graft to fracture and transfer more stress to the neighboring plate.

As with lumbar spine instrumentation, mechanical failure of plated ACF should always raise the suspicion of nonunion [5, 7]. To achieve a good fusion, adequate preparation of the recipient trough after corpectomy is a prerequisite. Inappropriate bending of the plate especially bending back and forth is forbidden. Newer commercialized anterior cervical plates have already been molded to simulate the lordosis of cervical spine. If the curve of the plate still does not fit and adjustment is inevitable, careful contouring avoiding the site con-

taining the screw hole would reduce the possibility damaging the implant.

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Comments

The authors present an exciting case report of the occurrence of an anterior cervical plate fracture after multilevel corpectomy and fusion. The figures are very impressive.

Michael Synowitz
Berlin

The case report is well written and illustrates the well known risk of plate failures in cervical multilevel fusion. The incidence for its appearance increases with the number of treated segments. To prevent those complications, biomechanical as well as surgical basics have to be followed.

Michael Winking
Osnabrück

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