Late Complication of Surgically Treated Atlantoaxial Instability: Occipital Bone Erosion Induced by Protruded Fixed Titanium Rod: A Case Report

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Abstract

Objective: Polyaxial screw-rod fixation of C1-C2 is a relatively new technique to treat atlantoaxial instability, and there have been few reports in the literature outlining all possible complications. The purpose of this case report is to present the occurrence and management of occipital bone erosion induced by the protruded rostral part of a posterior atlantoaxial screw-rod construct causing headache.

Clinical Features: A 70-year-old Asian man with rheumatoid arthritis initially presented to our institution with atlantoaxial instability causing progressive quadraparesis and neck pain.

Intervention and Outcome: Posterior atlantoaxial instrumented fixation using C1 lateral mass screws in conjunction with C2 pedicle screws was performed to stabilize these segments. Postoperatively, the patient regained the ability to independently walk and had no radiographic evidence of instrumentation hardware failure and excellent sagittal alignment. However, despite a well-stabilized fusion, the patient began to complain of headache during neck extension. Follow-up imaging studies revealed left occipital bone erosion induced by a protruded titanium rod fixed with setscrews. During revision surgery, the rod protrusion was modified and the headaches diminished.

Conclusion: This case demonstrates that occipital bone erosion after posterior atlantoaxial fixation causing headache may occur. The principal cause of bone erosion in this case was rod protrusion. Although posterior atlantoaxial fixation using the screw-rod system was selected

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to manage atlantoaxial instability because it has less complications than other procedures, surgeons should pay attention that the length of the rod protrusion should not exceed 2 mm. © 2014 National University of Health Sciences.

Introduction

The atlantoaxial complex may become unstable due to a congenital disease, an inflammatory disorder, trauma, or a neoplasm.¹ Although its complication rate is low, neurological impairment is catastrophic when present in the immediate proximity of the cervicomedullary junction.¹ In such conditions, atlantoaxial fixation may be required to correct the deformity, to provide stability, and to prevent neurological deficits.² This instability can be surgically corrected with various options such as C1-C2 transarticular fixation, wiring techniques, laminar hooks, and screw-rod constructs.³ Posterior atlantoaxial fixation using C1 lateral mass and C2 pedicle screws is a relatively new technique for atlantoaxial stabilization.^{1,4}

Complications from atlantoaxial fixation using this method have been rarely reported. The purpose of this case report is to present the occurrence and management of occipital bone interference of the rostral part of a posterior atlantoaxial screw-rod construct causing headache. The predisposing factors, imaging findings, and management are discussed.

Case Report

A 70-year-old Asian man with a 32-year-history of rheumatoid arthritis initially presented to our institution with atlantoaxial instability (Fig 1) causing neck pain (Ranawat score I) and myelopathy-quadruparesis (Ranawat score IIIA). Preoperatively, there was no

occipital erosion. Decompression and posterior atlantoaxial fixation using C1 lateral mass and C2 pedicle screws were performed. Tricortical structural autografts and morselized cancellous autografts were harvested from the posterior iliac crest. The structural autograft was fixed using the McGraw method. The morselized cancellous autograft was packed around the remaining laminar surface. A titanium rod protruded 2 mm on the right side, and 6 mm on the left side from the set screw installed at C1. Cerebrospinal fluid leakage was not observed perioperatively. Postoperatively, the patient regained the ability to independently walk and had no radiographic evidence of construct failure and the demonstrated excellent sagittal alignment. However, despite a well-stabilized upper cervical spine, the patient began to complain of headache during neck extension. Postoperative imaging at 3 months demonstrated left occipital bone erosion induced by the protruded titanium rod. Six months after posterior C1-C2 fixation, the patient had a second surgery to adjust the position of titanium rod. The titanium rod on the left side was replaced with a shorter one. The rod protrusion was set to 2 mm. The patient did not complain of headache after the revision surgery (Fig 2).

Discussion

This case report is informative not only to surgeons but also to other health care providers who see patients with neck pain and headaches. Because surgeries for

Fig 1. A and B, Preoperative lateral dynamic radiograph demonstrates atlantoaxial instability. C, Preoperative sagittal T2 weighted MR image shows compression myelomalacia due to pseudotumor (arrow) as well as atlas subluxation.

Fig 2. A, Postoperative sagittal T2 weighted MR image obtained after first surgery shows well-decompressed cord. B, Postoperative right parasagittal CT reconstruction shows adequately placed screws and rod. C, Postoperative left parasagittal CT reconstruction demonstrates 6 mm of cranial rod protrusion from C1 set screw. D, It was adjusted to 2 mm during the second operation.

instability are fairly common, it is important that all providers managing postsurgical patients are aware of such complications.

A variety of atlantoaxial fixation techniques have been described, including posterior wiring techniques, and transarticular screw fixation through the C2 pars interarticularis into the C1 lateral mass and occipitocervical fixation.⁵ Although a 3-point fixation technique using a transarticular screw in combination with posterior wiring displayed a better fixation and immediate postoperative stability than a single wiring technique, this is technically demanding and requires considerable experience. In addition, for its successful implementation, the sagittal angle needs to be acute, C1-C2 need to be completely reduced before screw placement, and the size of C2 pars interarticularis needs to be of an acceptable size.⁶ Indeed, almost 20% of patients will not be candidates for

placement of transarticular screws due to the aberrant course of the vertebral artery.⁷ Occipitocervical fixation is also an accepted treatment option for upper cervical spine instability. However, occipitocervical fixation affects flexion-extension function and may cause dysphagia by developing oropharyngeal stenosis.^{8,9} A technique concerning the placement of individual screws in C1 and C2 with additional rods for their connection is an alternative way to avoid the inevitable loss of occipitocervical motion in occipitocervical fixation and to enable posterior C1-C2 fixation in patients who are not suitable for transarticular screw fixation due to anatomic variations.^{10,11} This technique has also been well evaluated and has been considered satisfactory in several studies.^{6,12} Hence, the C1 lateral mass and C2 pedicle screw fixation technique is being widely used for various atlantoaxial problems.¹³

Regardless of specific methods and instruments, a variety of complications have been reported after cervical spine surgery. However, complication with regard to C1 lateral mass and C2 pedicle screw fixation has seldom been reported so far except for the incidence of the vertebral artery injury ranging from 0% to 5.8%¹⁴ and a few cases with complications relating to anatomical proximity such as hypoglossal nerve palsy and occipital neuralgia.¹⁵ This seems to be due to the relatively little data and lack of a long-term follow-up period. To the best of our knowledge, problems associated with hardware failure, such as shown in the present case, have not been demonstrated yet.

Rigid titanium is one of few materials that naturally match the requirements for implantation in the human body but is too strong and can erode into bone in patients with poor bone quality. Particularly, the caudolateral part of occiput is prone to be eroded because the thickness of the skull decreases laterally away from the midline and closer to the foramen magnum.⁴ Surgeons should pay attention to the length of the rod protrusion to avoid such a complication. If the rods protrude more than necessary from the set screw, they should be removed and replaced with ones with an appropriate length. Furthermore, the atlas screw angle relative to occiput is important. Even if the rod protrusion is small, a construct may erode occiput in case the atlas screw head faces the cranial side. Nonsurgeons (eg, physical therapists, chiropractors) and surgeons should consider such a complication while performing ortho-neuro examination and evaluating radiographs.

Patients who experience degeneration and other sources of pain caused by the surgical procedures on their cervical vertebrae will undoubtedly attempt to

alleviate their pain. Certain restrictions may be present for a patient who present with past surgeries. Those who use manual therapy techniques (eg, doctors of chiropractic, physical therapists, osteopaths, physiatrists) should request that the radiographer examine the exact presentation of the surgical devices, because a rod running along the posterior aspect between C1 and C2 may be hazardous to the patient if the practitioner is performing a range of motion tests and if any degree of passive extension is forced. The exact position will help the practitioner exercise the proper amount of caution when assessing and treating the postsurgical patient.

From these concepts, we suggest that the rod protrusion from the C1 set screw should be short enough, and the optimal insertion angle of the atlas screw should be parallel to lamina or caudocranial direction in the sagittal plane to avoid occipital erosion.

Conclusion

This case described a patient with occipital bone erosion after posterior atlantoaxial fixation causing headache. The principal cause of bone erosion was a cranial rod protrusion. Although posterior atlantoaxial fixation using the screw-rod system may be a good procedure to manage atlantoaxial instability with a lower complication rate, it is important to pay attention to screw insertion angle and the length of the rod protrusion to avoid such a complication.

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No funding sources or conflicts of interest were reported for this study.

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