

Case Report
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Odontoid Resorption After Posterior Occipitocervical Fusion in Rheumatoid Basilar Invagination

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ABSTRACT

Background Context: Inflammatory arthritis of the cervical spine is common and begins early after the onset of rheumatoid arthritis. Atlantoaxial instability is the most common pattern followed by cranial settling or basilar invagination, with subaxial subluxation being least common. Vertical migration of the odontoid (basilar invagination) poses an increased risk of sudden death from compression of the brain stem. A combination of transoral decompression and posterior occipitocervical fusion has been described, although a single posterior approach stabilization may suffice and avoid the associated comorbidities with an anterior/posterior surgery in a high-risk rheumatoid patient.

Purpose: To report a case of odontoid resorption and cervicomedullary angle improvement after occipitocervical fusion.
Study Design: A retrospective case report.

Methods: Radiographic analysis.

Results: After posterior occipitocervical fusion alone for basilar invagination there was a reduction of cervicomedullary angle to 127 degrees at 3 years follow up. This was improved from an initial 115 degrees through odontoid remodeling.

Conclusions: Basilar invagination treated with posterior alone occipitocervical stabilization may suffice in providing stability and long term decompression of the cervicomedullary junction through resorption and remodeling of the odontoid. This case study supports the viability of avoiding a transoral resection for an irreducible severely migrated odontoid.

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Introduction

Inflammatory arthritis of the cervical spine is commonly involved in patients with rheumatoid arthritis. Atlantoaxial instability is the most frequent abnormality found and although basilar invagination is less frequent, it can be seen in isolation or combination with other instabilities. Both transverse and vertical instability patterns can result in progressive neurologic deficits at which point surgical stabilization is generally the accepted treatment [1,2]. Direct anterior decompression with dens and pannus removal along with posterior fixation is a popular technique, preventing potential paralysis and providing stabilization to the cervical spine [1]. The development of cervical disease and natural history is variable and with disease-modifying anti-rheumatic drugs (DMARDs), is even less frequent. The pathogenetic mechanism first involves

the presence of chronic synovial inflammation. Proliferating fibroblast and inflammatory cells form granulation tissue or pannus that then produces collagenase and other proteolytic enzymes. This then causes adjacent cartilage, tendon, ligament, and bony destruction of the lateral masses of the atlas and atlantoaxial stabilizing ligaments. With gradual destruction of the atlantoaxial facets/lateral masses, the atlas falls down around the axis and atlantoaxial impaction, subluxation, and/or instability develops. This instability combined with pannus may compress the spinal cord, nerve roots, and vertebral arteries, resulting in pain and neurologic abnormalities.

This case report demonstrates the importance of surgical stabilization in improving myelopathy vs direct transoral resection of the odontoid and pannus. As with pannus resorption in a stable non-mobile environment, we report odontoid remodeling after occipitocervical fusion in rheumatoid basilar invagination.

Narrative

A 49-year-old male with profoundly advanced rheumatoid arthritis presented for follow up of his neck and occipital pain complaints. The patient had formerly undergone bilateral total knee and hip arthroplasties as well as foot and ankle reconstructions bilaterally. He had developed findings consistent with progressive cervical myelopathy with a neurologic decline. His left upper extremity had 0/5 muscle strength with atrophy of the biceps, triceps, wrist flexors/extensors, and hand intrinsics. The right upper extremity demonstrated some weakness with muscle strength of 3/5 biceps, triceps, wrist flexors, and extensors. He was nonambulatory in a wheelchair with profound lower extremity weakness and bilateral ankle-foot orthoses. There was no significant ankle or foot motion on the right side and a flicker of muscle strength of EHL and anterior tibialis on the left. He did have 4/5 muscle strength of his quadriceps and hamstrings bilaterally. Imaging studies had demonstrated progressive vertical migration of C2. Initial MRI (Figure 1) demonstrated his cervicomedullary angle to be 150 degrees with subsequent follow-up (Figure 2) at 115 degrees. Given his exam findings and significant progression of the vertical migration of C2, the patient underwent occipitocervical fusion with posterior iliac crest bone graft harvest to inhibit further progression of his neurologic decline. He was admitted the day prior to surgery and placed in tong traction with 3.6 kg overnight. A posterior decompression of C1 and C2 was performed with occiput to C4 fusion using lateral mass screws at C3 and 4 and 6 occipital screws (Figure 3).



Figure 1: Initial baseline lateral radiograph and sagittal MRI. Basilar invagination noted with 140-degree cervicomedullary angle

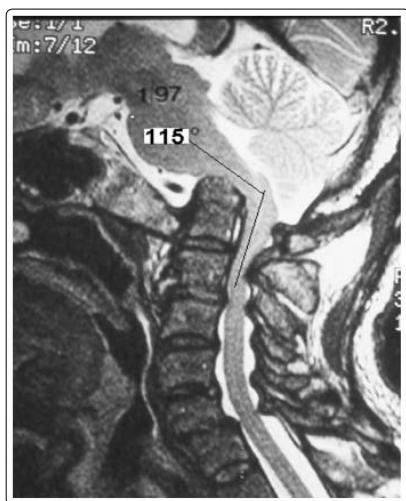


Figure 2: Sagittal MRI at 6 month follow up with progressive severe basilar invagination. C2-3 disc level at clivus with cervicomedullary angle at 115 degrees

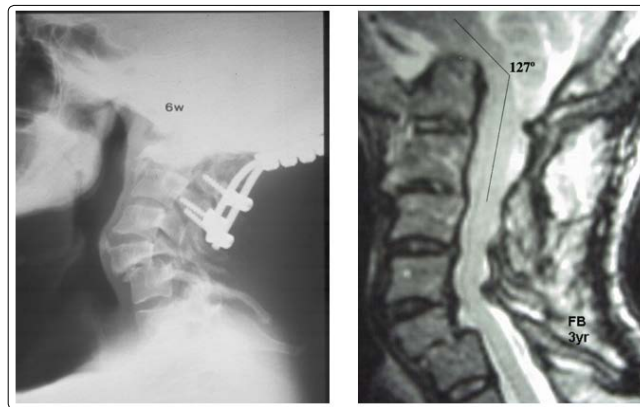


Figure 3: Three-year post-operative lateral radiograph and sagittal MRI. C2-3 disc level remains at clivus with cervicomedullary angle now at 127 degrees and resolution of pannus and tip of odontoid.

Discussion

Although basilar invagination is the least common type of subluxation in rheumatoid patients, it can be the most dangerous with compression of the brain stem [3,4]. These patients can have progressive myelopathy, pain, vertigo, loss of equilibrium, visual disturbances, nystagmus that can rapidly progress to paralysis, or death. Diagnostic serial clinical and lateral radiographic screening with follow up is critical. Although multiple radiographic parameters between anatomic landmarks have been described to diagnose basilar invagination, it can be difficult to diagnose because of potential multiple subluxations, erosions, and osteopenia [5]. With the advent of MRI, the true extent of invagination or subluxation with cord compression from cervical rheumatoid pannus or instability can be appreciated. Bundschuh et al [6]. used MRI measurements of the cervicomedullary angle to predict spinal cord compression. The authors found a strong correlation between angles less than 135 degrees and myelopathy/paralysis in patients with rheumatoid arthritis. It has been generally accepted that surgical intervention must be considered when the tip of the odontoid process reaches the foramen magnum or for those at risk of spinal cord and brain stem compression from radiographic severe instability [2]. The goals of surgery are to prevent irreversible neurologic deficit, avoid sudden death secondary to spinal cord compression, and avoid unnecessary surgery. Determining which patients are at risk for paralysis is challenging and prophylactic cervical arthrodesis can be considered for those with progressive neurologic deficits or intractable pain [7,8]. Evident basilar invagination with neurologic deficit carries higher surgical morbidity and often patients undergo an anterior resection of the odontoid with occipitocervical fusion. Surgery in patients with advanced stages of rheumatoid arthritis has also been associated with increased mortality and complication rates [9]. With atlantoaxial instability, neurogenic compression secondary to a retroodontoid pannus overgrowth can occur leading to neurologic compromise. It is well described that patients undergoing a posterior C1-2 fusion will experience pannus reduction, supporting the concept that the pannus is a reactive fibrous mass due to instability and not the inflammatory process itself [10]. However, with basilar vertical invagination, the “gold standard” has been described as a combination of transoral anterior decompression with odontoid resection and posterior stabilization. In our case study, a posterior alone occipitocervical fusion proved sufficient to allow odontoid resorption improving the cervicomedullary angle indirectly as of the 3 year follow-up. A stable non-mobile environment is created via the arthrodesis allowing the spinal cord

to recover in the absence of other dynamic stresses [11].

Conclusion

To our knowledge, this is the first description of odontoid remodeling with cervicomedullary angle improvement after rigid occipitocervical fusion. This case study shows the feasibility of a single posterior approach for basilar invagination and the avoidance of a transoral approach with its associated comorbidities and complications, thus posing a significant advantage in the higher risk rheumatoid patients.

Conflicts of Interest: The authors declare that there are no conflicts of interest.

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Author Contribution: Each author listed above provided substantial contribution, drafted, approved, and agreed upon the entirety this case report.

Ethical Approval: None; Case Report.

Informed Consent: Informed consent was obtained by all participants in this study.

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