Accepted Manuscript

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PII: S1529-9430(16)00373-9
DOI: http://dx.doi.org/doi: 10.1016/j.spinee.2016.02.020
Reference: SPINEE 56908

To appear in: *The Spine Journal*

Received date: 29-1-2016
Accepted date: 4-2-2016

Please cite this article as: Adam Schell, John M. Rhee, Abigail Allen, Lindsay Andras, Feifei Zhou, Surgical management of gorham disease involving the upper cervical spine with occipito-cervical-thoracic fusion: a case report, *The Spine Journal* (2016), http://dx.doi.org/doi: 10.1016/j.spinee.2016.02.020.

Surgical Management of Gorham Disease involving the Upper Cervical Spine with occipito-cervical-thoracic fusion: A Case Report

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Keywords: cervical spine, osteolysis, gorham disease, occipito-cervicalthoracic fusion

Abstract

Background context: Gorham disease is a rare osteolytic condition with only 17 reported cases primarily affecting the cervical spine.

Purpose: We report the case of a 31-year-old woman with severe kyphotic instability and myelopathy of the upper cervical spine secondary to massive osteolysis of the posterior elements. The surgical management, clinical outcome, and review of the relevant literature are discussed.

Study Design: Case report and literature review

Patient Sample: One patient with Gorham disease of the cervical spine.

Methods: We report the case of a 31-year-old woman with Gorham disease affecting the upper cervical spine. Combined posterior and anterior stabilization and fusion was performed from the occiput to the thoracic spine.

Results: Six-year follow-up with annual CT imaging showed solid fusion from occiput to T2. No spread or local recurrence has developed to date.

Conclusions: Correction of severe instability with myelopathy due to Gorham disease of the upper cervical spine was achieved though posterior and anterior occipito-cervical-thoracic fusion.

Introduction

Sub-acute osteolysis in an otherwise healthy individual is an unusual clinical finding. In the absence of malignancy, nephropathy, infection, or metabolic disease, a small group of disorders can cause this phenomenon(1). One such disorder is Gorham disease of bone, a rare condition of unregulated bone resorption related to focal areas of non-neoplastic vascular tissue proliferation(2). Gorham disease was first described in 1838(3), and since then more than 300 cases have been reported. It is known by at least ten names, including “vanishing bone disease,” “massive osteolysis,” and “phantom bone disease” among others. While substantial effort has been devoted to understanding this disorder, the etiology and underlying pathophysiology remain unclear(4).

The natural history varies widely among individuals and depends on the skeletal location of disease and time of diagnosis. The most common site of involvement is the shoulder, followed by the pelvis, ribs, and the skull. To date, approximately 50 cases affecting the spine have been reported, but only 17 of those primarily involved the cervical spine(5-7). A spectrum of clinical outcomes is reported when cervical vertebrate are affected, ranging from fatalities due to complications of osteolysis(8) to spontaneous osteolytic arrest after only conservative management(9).

Treatment of the underlying disorder includes both medical and surgical strategies, and spinal involvement typically necessitates surgical fusion to maintain stability and prevent neurologic injury. Historically, bone grafting in Gorham patients has been met with limited success due to graft osteolysis and poor graft ingrowth(10, 11). Herein we report the case of a 31-year-old woman with severe cervical instability secondary to Gorham disease affecting the upper cervical spine, and we provide clinical outcomes up to 6 years following circumferential fusion from the occiput to the thoracic spine.

Case Report

A 31 year old woman with a 7-year history of axial neck pain presented to the senior author with a one month history of rapidly progressive exacerbation of neck pain associated with bilateral hand numbness. The numbness was most severe while sitting upright and relieved by lying supine, and this sensory deficit made holding objects in her hands difficult. She also described gradual worsening of chronic neck pain in recent years, for which she had previously sought treatment by numerous physicians and chiropractors to no avail. Her past medical history was negative for arthritides, malignancy, endocrine disease, or familial disorders.

On physical exam, the posterior elements in the upper cervical spine were notably absent to palpation. Neurological exam was non-focal with no motor impairment or long tract signs. Her laboratory studies were within normal limits and showed no evidence of infection or systemic inflammatory disease. Flexion-extension lateral radiographs revealed the dorsal elements and facet complex were both missing at the levels of C2 and

C3 but had been present on historical radiographs from only 3 years prior (**Figure 1**). The arch of C1 was thinned, and the proximal portion of the C4 lamina and spinous process were missing as well. Computed tomographic imaging revealed similar findings (**Figure 2**). Magnetic resonance imaging showed no evidence of infection, malignancy, or cord compression. However, the posterior elements were notably missing. Given the clinical and radiographic findings of progressive osteolysis without identifiable cause, a diagnosis of Gorham's vanishing bone disease was made. Due to the significant instability, emergent stabilization and fusion was recommended.

The first stage operation involved a posterior fusion and instrumentation from the occiput to T2. The proximal and distal extents of the fusion construct were chosen to widely bridge the pathologically involved segments due to the potential for local recurrence and progressive osteolysis at adjacent levels. During dissection, the arch of C1 was approximately one-third its expected size, and only a thin membrane overlaid C2-C3. However, there was no intra-operative evidence of malignant, infectious, or inflammatory processes. Because there was no observable mass, there was no specific material to biopsy – specimens sent for pathology were non-specific and consistent with bone, muscle, and fibroconnective tissue. In order to bridge the large bony defect present posteriorly, an autologous rib graft was harvested and fashioned to strut from the occiput to the spinous process of C5. Supplemental morsellized iliac crest bone graft as well as InFuse (rhBMP-2; Medtronic) were used posteriorly. An aggressive approach to bone grafting was taken given the potential for graft osteolysis and progressive local disease. The patient then underwent staged multilevel anterior discectomy and fusion from C2 to T2 (**Figure 3**) two days later, using a combination of iliac crest bone graft, allograft, and

plates. Anterior fusion was thought necessary in order to enhance the probability of a successful arthrodesis throughout the entire length of the construct, as well as to provide anterior fusion in case progressive osteolysis occurred.

The patient underwent radiation oncology consultation postoperatively, but radiation therapy was not elected. At most recent follow up (6 years), CT demonstrated solid fusion. There has been no evidence of progressive disease or osteolysis either through, or adjacent to, the fusion mass (**Figures 4**).

Discussion

Gorham disease is an exceedingly rare osteolytic disease that has received substantial attention from the medical and surgical communities since it was first comprehensively described in 1955(12). Despite more than 300 published cases and many rigorous investigations into the molecular basis of disease(4), the precise etiology is still unknown. There is no evidence to suggest heritability, and both genders are affected in similar frequency. It can occur at any age, but the majority of cases occur before age 40(2).

The pathophysiology is unknown but appears to involve both spontaneous and post-traumatic angiomatosis. Osteolysis is thought to occur as a result of angiomatoid proliferation in the affected bone, generating a lymphovascular network that reduces osseous matrix pH and local oxygen tension. The resulting environment leads to activation of hydrolytic enzymes and phosphatase secretion from osteoblasts, and a destructive remodelling imbalance favoring excessive bone resorption is cultivated(13).

Both osteoclastosis and production of interleukin-6 reportedly contribute to this osteolytic cascade(14-16).

Gorham disease is a diagnosis of exclusion, and more common causes of osteolysis (such as infection, occult malignancy, and hyperparathyroidism) must be ruled out early in the evaluation. Heffez and colleagues developed a set of criteria that may aid in establishing a diagnosis if other osteolytic processes are suspected(17). Clinical signs are often subtle and may only become apparent late in the course of the disease. Like the patient in this report, some individuals experience chronic pain long before mechanical instability arises. Meanwhile, others will notice an acute pain or deformity, especially after sustaining trauma to the affected area. For this reason, the natural history varies greatly among affected individuals, and patient outcomes are optimized when diagnosis is established early in the course of disease.

The shoulder and pelvis are the most frequently affected sites, but involvement of humerus, sternum, clavicle, skull, ribs, femur, mandible, spine, hands, and feet are each described in multiple case reports(2). Morbidity and mortality are highest when the bony thorax and/or spine are involved. A well-known complication of thoracic involvement is lymphangiomatous extension into pleural space, which may lead to development of chylothorax(18). Morbidity is also higher when the spine is affected, due to instability, neurological decline, and the resultant comorbidities that may arise in the immobilized patient. Spinal fusion in this disease setting has been associated with a high incidence of graft resorption(11), fusion failure requiring reoperation(19), and unpredictable disease progression(10).

When mechanical instability arises, surgical correction is necessary, but mechanically stable lesions may be treated non-surgically using medical and radiation therapies alone. Reported medical treatment strategies include single or combination regimens of agents such as bisphosphonates(20), alpha-interferon 2b(21), and various cytotoxic agents(22). Radiation therapy has been employed as an adjunct to surgical treatment, and reports show conventionally fractionated doses as low as 40 Gy to slow progression of active Gorham lesions when administered following radical resection of affected tissues(23, 24). In this case, clinical evidence was most consistent with an arrested Gorham process, and after consultation with a radiation oncologist it was decided to forgo XRT in the absence of disease recurrence or progression.

Sixteen cases of cervical spine involvement are reported in the literature, and eight of those cases occurred at the C2 and/or C3 level as seen in this patient(10, 11, 25-30). This vertebral level appears to pose an increased risk of mortality, as three of the five patients who have died from complications of Gorham disease of the cervical spine had disease involving these levels. In these cases, mortality may be attributed to upper cervical cord injury, cerebrovascular accident, and complications following osteolytic progression and multiple unsuccessful fusion attempts. However, favorable outcomes are reported in the majority of cases where adequate spinal fusion is achieved(5, 31). In one case, diagnosis was obtained early in the disease process, and a combination of halo traction and radiation therapy was sufficient for reversal of osteolysis(9).

The goals of treatment in this patient were to achieve spinal stability through instrumentation and arthrodesis. An aggressive approach was taken in terms of both spinal fixation and bone grafting due to the potential for local recurrence and spread of

Gorham disease, as well as the possibility that the osteolytic process might impair the process of fusion. Therefore, the fusion and fixation were performed circumferentially. along with the addition of autograft rib and iliac crest. RhBMP-2 was used posteriorly as well to try to assure solid arthrodesis.

In conclusion, a case of advanced Gorham osteolysis affecting the upper cervical spine is described. While the exact etiology and pathophysiology of this disease remain mysterious, swift intervention may prevent neurologic decline in cases of osteolytic cervical instability. In the present case, correction of severe cervical instability and prevention of neurologic injury were achieved though emergent circumferential fusion from occiput to T2. Although extremely rare, Gorham disease should be considered in patients presenting with osteolytic cervical instability in the absence of a mass or infectious process. Maximal fixation and bone grafting strategies are recommended in order to ensure healing in the setting of a disease that may present with local recurrence.

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Figure 1. Lateral cervical spine radiographs. A) Neutral upright radiograph taken three years prior to presentation. At that time, the patient was complaining of gradually worsening axial neck pain but had no neurologic symptoms. Close inspection of the lateral radiograph demonstrates a somewhat mottled appearance to the C2 pars, facet, and lamina, as well as an indistinct cortical margin along the upper border of the C2 posterior elements. (B) Lateral upright radiograph taken at the time of presentation. The C1 laminar arch is notably thin. The facets, pars, lamina, and spinous process of C2 are completely absent. Large areas of the posterior elements of C3 and C4 are missing. Spondyloslistheses are noted at C2-3 an C3-4, along with a generalized kyphosis.

Figure 2. Axial Computed tomography images. There is severe destruction within the upper cervical spine and complete absence of the lamina, pedicles, and posterior elements at the level of C2 (Top left). Similar, but less extensive, bone loss is seen at C3 and C4.

Figure 3. Post-operative radiographs from AP and lateral views one year after circumferential fusion.

Figure 4. Post-operative computed tomography imaging in the sagittal plane 1 year post-op. A solid fusion is present throughout. Rib struts have reconstructed the large bony defect in the upper cervical spine and incorporated from the occiput to C5.