Hematogenous Infection of Total Hip Arthroplasty With *Actinomyces* Following a Noninvasive Dental Procedure

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**abstract**

This article describes a case of an infected total hip arthroplasty following a dental procedure. A 59-year-old man underwent total hip arthroplasty for osteoarthritis and had a routine recovery. Approximately 9 months postoperatively, he underwent a dental cleaning without antibiotic prophylaxis. One month later, he reported gradually worsening right hip pain and a purulent discharge. After several unsuccessful interventions, the patient was referred to the authors’ facility. The patient’s history, draining sinus tract, and radiographic changes were considered diagnostic of a late chronic infection, and the patient underwent 2-stage revision. Intraoperatively, the sinus tract extended directly to the acetabular component. *Actinomyces* spp were isolated from 3 of 7 intraoperative anaerobic cultures, and the patient received penicillin G for 8 weeks. Two weeks after discontinuing antibiotics, with no clinical manifestation of recurrent infection and a negative hip aspiration, a new hip prosthesis was implanted. The patient was prescribed penicillin for 12 months postoperatively. Harris Hip Score was 100 at 52-month follow-up.

The American Dental Association and the American Academy of Orthopaedic Surgeons issued consensus guidelines for chemoprophylaxis in orthopedic patients undergoing dental procedures in 1997 and 2003. Although the American Academy of Orthopaedic Surgeons issued a revised guideline in 2009 recommending more robust antibiotic prophylaxis, significant controversy exists because at least one professional organization representing dentists has repudiated the 2009 American Academy of Orthopaedic Surgeons guideline. The authors describe the implications from their experience and similar cases in the literature with regard to such guidelines.
Periprosthetic joint infection is a persistent risk for patients after arthroplasty because the host–prosthesis interface represents an immunocompromised fibroinflammatory area that is more susceptible to bacterial infection. The risk of periprosthetic joint infection from hematogenous bacterial seeding increases for patients undergoing dental procedures that facilitate bacteremia. Although antibiotic prophylaxis prior to dental procedures has been advocated to protect these patients against periprosthetic joint infection, this practice is controversial.

This article describes the rare occurrence of a periprosthetic joint infection with Actinomyces, a gram-positive, anaerobic bacterial genus that colonizes the mucous membranes of the mouth, colon, and vagina and can cause disease when bacteria breach damaged mucous membranes. Actinomyces can also spread hematogenously to infect distant sites and, in rare instances, can cause periprosthetic joint infections. A search of the English-language literature using PubMed and Ovid Medline resulted in 8 cases of actinomycotic periprosthetic joint infection. Recent dental history was available for 7 patients, and 2 patients underwent dental work shortly before symptom onset. Successful outcomes were reported for 5 cases, and 2-stage revision surgery was used in 4 cases. The timing of revision surgery varied. Whereas 1 knee was reimplanted after 9 weeks, 2 hip prostheses were reimplanted after 3 and 8 months, respectively.

**Case Report**

A 59-year-old man underwent sequential total hip arthroplasty (THA) for osteoarthritis in April 2005 (left hip) and June 2005 (right hip). He made routine recoveries and was asymptomatic when seen by his dentist in February 2006 for a prophylactic teeth cleaning, which he underwent with no antibiotic prophylaxis. Approximately 1 month later, he reported gradually worsening right hip pain. The patient consulted his original orthopedic surgeon in May 2006, and the right hip was injected with steroids for presumed trochanteric bursitis, which failed to alleviate his symptoms. Within 2 weeks, a grapefruit-sized swelling developed on the lateral aspect of the right hip that drained purulent material, and the patient was admitted to the hospital for a presumed adverse reaction to the steroid injection. The area over the right trochanteric bursa was aspirated, and the patient was started empirically on vancomycin and clindamycin. The aspirate was sent for culture and gram stain, and both were reported as negative.

Tenderness subsided initially, but the area eventually became erythematous, at which time the central portion of the wound was incised and a copious amount of yellow fluid and cellular material was drained. Drainage persisted, and a bone scan performed in July 2006 demonstrated increased uptake surrounding the lesser and greater trochanters and the acetabular component of the right hip. The patient underwent operative irrigation and debridement in October 2006 by his original surgeon. A wound swab was obtained, and gram stain and anaerobic cultures were reported as negative. Importantly, the anaerobic culture was held for only 48 hours. The operative note described a digital inspection of the wound that was negative for direct communication with the hip joint; however, neither a formal arthrotomy nor sinogram were performed to definitively exclude any communication between the superficial wound and the hip joint. The patient’s symptoms persisted, and he was referred to the current authors’ facility.

The senior author (C.J.D.) examined the patient in January 2007. A sinus existed at the distal portion of the scar over the right trochanteric region. Radiographs showed lucency with sclerotic margins behind the acetabular component (Figure 1). The femoral component appeared well fixed. The patient’s history, draining sinus tract, and radiographic changes were considered diagnostic of a late chronic infection, and a 2-stage revision surgery was recommended. Laboratory values obtained in March 2007 showed an elevation of acute-phase reactants, including an erythrocyte sedimentation rate of 70 mm/hour, a C-reactive protein level of 45.97 mg/L, and a white blood cell count of 6900 cells/mm³, with the differential showing 5900 neutrophils/mm³. Pus obtained from the wound was submitted for microbiology, which showed no organisms and 10 to 25 leukocytes/mL. Aspiration was not recommended preoperatively because the authors believed intraoperative specimens would provide the most accurate information. Treatment was delayed by 2 months due to the patient’s reluctance.

In April 2007, the femoral component was well fixed and was removed using an extended trochanteric osteotomy that was secured with cables. The sinus tract extended directly to the acetabular prosthesis, which was severely loosened. This was easily removed, and a layer of purulent material behind the acetabular com-

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**Figure 1:** Preoperative anteroposterior radiograph of the pelvis showing lucency of the right hip with sclerotic margins behind the acetabular component. The femoral component appears to be well fixed.
The patient’s late peri-prosthetic joint infection. The patient’s progress after primary THA of the right hip was uneventful until 9 months post-operatively, when he reported right hip pain approximately 1 month after undergoing a dental cleaning without antibiotic prophylaxis.

It is unlikely that the steroid injection caused this. Although steroid injections have been implicated in infections of immunocompetent patients, where cutaneous flora are introduced iatrogenically and then exploit the suppressed local immune system to infect the host, this is an unlikely source for the current patient’s infection because Actinomyces is not known to colonize human skin.\textsuperscript{5,14,15} Rather, the prophylactic dental cleaning likely resulted in an actinomycotic bacteremia that seeded the host–prosthesis interface. Dental cleanings are a well known cause of transient bacteremia, and Actinomyces spp are a prominent colonizer of the human oropharynx.\textsuperscript{5,16} The steroid injection likely resulted in local immunosuppression and facilitated transformation of a few nascent Actinomyces spp bacteria at the host–prosthesis interface, which produced the superficial abscess.

The anaerobic culture from October 2006 was likely a false negative. The anaerobic culture was held for only 48 hours, and Actinomyces spp are notoriously difficult to culture, generally requiring a minimum of 5 days of strictly anaerobic conditions.\textsuperscript{5} The timing of infection onset, identity of the pathogen, and absence of an alternative entry mode implicate an actinomycotic bacteremia after this patient’s dental visit as the etiology of the periprosthetic joint infection.

The patient was not a candidate for antibiotic prophylaxis prior to his dental cleaning according to the American Dental Association (ADA)/American Academy of Orthopaedic Surgeons (AAOS) joint guideline published in 2003.\textsuperscript{3} The guideline recommended prophylaxis for only patients at potential increased risk of experiencing hematogenous periprosthetic joint infection and those undergoing a procedure with a higher incidence of provoking bacteremia.\textsuperscript{2,3} The patient reported that the prophylactic cleaning was not anticipated to and did not provoke visible bleeding. Thus, the patient was not required to receive antibiotic prophylaxis; although he was in the increased risk category after having undergone THA within the previous 2 years, he was not undergoing a procedure with a higher incidence of bacteremia.

The AAOS published an updated guideline titled “Information Statement 1033: Antibiotic Prophylaxis for Bacteremia in Patients With Joint Replacements” in February 2009, which was most recently updated in June 2010.\textsuperscript{17} The updated guideline includes patients with a prosthetic joint replacement under the category of patients at potential increased risk of hematogenous periprosthetic joint infection and includes all dental procedures among those for which prophylaxis is recommended. Although the revised AAOS guidelines would recommend antibiotic prophylaxis for the current patient, the argument is not moot. Controversy exists in the literature regarding antibi-
otic prophylaxis. At least 1 professional organization representing dental practitioners—American Academy of Oral Medicine—has repudiated the 2009 AAOS guideline and instead recommends following the 2003 consensus ADA/AAOS guideline.

Lockhart et al studied bacteremia in the context of toothbrushing and dental extraction and reported that simple toothbrushing provoked bacteremia in 32% of patients, which suggests that a typical patient is exposed to more than 200 episodes of bacteremia per year. Despite evidence suggesting that chemoprophyaxis prior to dental procedures significantly (P<.0001) reduced the rate of incident bacteremia, Lockhart et al questioned the appropriateness of chemoprophyaxis prior to dental procedures given the known risk of bacteremia associated with daily toothbrushing and the impracticality of prophylaxis patients prior to brushing. This argument may have merit. However, it is currently not known whether the bacteremia following activities of daily living, such as mastication and toothbrushing, have the same potential for pathogenicity as the bacteremia from dental manipulation. Lockhart et al reported that “toothbrushing does not have the same incidence, duration, nature, or likely magnitude of bacteremia as dental extraction.”

**CONCLUSION**

The authors have presented evidence of a periprosthetic joint infection developing as a complication of a routine dental cleaning. The authors recognize that level I evidence is required to definitively characterize the proper role of chemoprophyaxis in patients after total joint arthroplasty. However, in light of the relative dearth of published cases, reports such as the current one should help shape the ongoing AAOS guideline and individual practitioner recommendations.

**REFERENCES**