A Rare Case of Prosthetic Joint Infection with
Streptococcus gordonii

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Patient: Female, 75-year-old
Final Diagnosis: Right knee prosthetic joint infection
Symptoms: Knee pain
Medication: —
Clinical Procedure: Revision of right total knee arthroplasty including complete revision of the femoral and tibial components
Specialty: Infectious Diseases
Objective: Rare coexistence of disease or pathology
Background: Chronic prosthetic joint infection (PJI) is a devastating complication following total joint arthroplasty, resulting in significant morbidity and mortality. The criterion standard of treatment for chronic PJI is two-stage revision arthroplasty consisting of complete hardware removal, thorough irrigation and debridement, placement of an antibiotic spacer, prolonged intravenous antibiotics based on culture sensitivities, and revision total knee arthroplasty once the infection resolves. The most common organism implicated in chronic PJI is Staphylococcus aureus.

Case Report: In this report, we have summarized the case of a 75-year-old woman who developed chronic PJI caused by an unusual organism, Streptococcus gordonii, 1 year after a right total knee arthroplasty. S. gordonii is a gram-positive organism that is an oral flora and a colonizer of human teeth. This organism is known to create biofilm on the human teeth, more commonly known as dental plaque. S. gordonii has the ability to travel to extraoral sites and cause infection. It has been found to be a cause of subacute bacterial endocarditis, but it has been rarely described in the literature as a cause of prosthetic joint infection. Treatment of S. gordonii requires a tailored approach.

Conclusions: This case report highlights the clinical presentation, diagnosis, and treatment of chronic prosthetic joint infection caused by S. gordonii and identifies a rare cause of PJI that is not well documented in the literature. Streptococcal PJI portends a poorer prognosis, and identification of this organism is crucial for prompt treatment and improved outcomes for PJI.

Keywords: Biofilms • Knee Joint • Reoperation • Streptococcus gordonii

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Background

Prosthetic joint infection (PJI) is defined as an infection of the joint prosthesis and intra-articular soft tissue. It is a devastating complication that affects approximately 1-2% of all total joint replacements [1-4]. Diagnosis of PJI is based on clinical appearance of the joint, laboratory markers, and synovial fluid analysis. Treatment of PJI depends on whether the infection is acute (<6 weeks from index surgery) or chronic (>6 weeks from index surgery). The criterion standard for treatment of chronic PJI is implant removal with thorough irrigation and debridement, placement of an antibiotic spacer, prolonged course of culture-specific intravenous antibiotics, and revision total joint arthroplasty once the infection has resolved [5]. Chronic PJI necessitates this form of orthopedic management because the infection cannot be eradicated with antibiotics alone once biofilm has formed on the orthopedic implants [5]. Even with criterion standard treatment, the morbidity and mortality rates of PJI are extremely high, with complications including poor patient-reported outcomes, disability, persistent infection, need for amputation, sepsis, and death [6]. The 1-year mortality rate for PJI is approximately 5-10%, with a 5-year mortality rate approaching 25% [6].

Staphylococcus aureus is the most common organism implicated in prosthetic joint infection [1]. In this report, we have summarized the case of a 75-year-old woman who developed chronic PJI caused by an unusual organism, Streptococcus gordonii, 1 year after a right total knee arthroplasty. S. gordonii is a gram-positive organism that is a type of oral flora and a colonizer of human teeth [2]. In the literature, S. gordonii is frequently reported as a cause of subacute bacterial endocarditis [7], but it has been rarely described in the literature as a cause of prosthetic joint infection [2]. This case report highlights the clinical presentation, diagnosis, and treatment of prosthetic joint infection caused by S. gordonii and identifies a rare cause of PJI that is not well documented in the literature.

Case Report

A 75-year-old woman with a past medical history of hypertension and type 2 diabetes mellitus with insulin dependence presented 11 months after a primary right total knee arthroplasty with progressive pain and swelling of her right knee (Figure 1). She was evaluated by her orthopedic surgeon as an outpatient, where samples were taken for laboratory testing and a knee aspiration was performed. Laboratory test results revealed erythrocyte sedimentation rate (ESR) of 55 mm/h, C-reactive protein (CRP) of 12.8 mg/dL, and synovial white blood cell (WBC) count of 5000 K/µL, consistent with chronic PJI. Cultures were taken from this knee aspiration, which did reveal growth of S. gordonii, but results of this aspiration were not finalized until after the initial surgical procedure. Thus, empiric antibiotics were held until intraoperative tissue specimens could be obtained, as the patient was clinically and hemodynamically stable prior to surgery. She denied any history of recent dental or other invasive procedures. Of note, the patient did not undergo dental clearance prior to her initial procedure, as this is not routinely recommended unless patients have very poor

Figure 1. Anteroposterior (A) and lateral (B) radiographs of the right knee status after the index procedure, demonstrating the cemented total knee arthroplasty in appropriate alignment without evidence of acute osseous abnormalities. The dark arrows indicate the femur and femoral component, while the light arrows indicate the tibia and tibial component.
dentition or current oral pathology. Hemoglobin A1C was 6.9 mmol/mol, consistent with a diagnosis of diabetes.

The patient underwent the first stage of her procedure, which consisted of removal of the right knee total arthroplasty, thorough irrigation and debridement, and placement of a static antibiotic spacer consisting of 2 batches of antibiotic-laden cement with 6 g of vancomycin and 4.8 g of tobramycin (Figure 2). She was initially treated for prosthetic joint infection with intravenous ceftriaxone 2 g daily and intravenous vancomycin 1 gm/D5W 200 mL pb every 24 h. This isolate was noted on the liquid broth media, which was aliquoted onto an agar plate and incubated for a minimum of 18-24 h. On the second reading of the agar plates, there was growth of the isolate, which was tested with a BioMerieux Vitek GPI card. The Vitek MS (MALDI-ToF) system was used for identification of the isolate. The Vitek system uses mass spectrometry, which is highly sensitive for organism identification. In our patient, the Vitek MS system identified the bacterium S. gordonii from the intraoperative right knee tissue specimens. Five tissue specimens were obtained from the intra-articular synovium during this procedure. Three of the 5 specimens yielded growth of S. gordonii. Blood cultures prior to surgery and after surgery remained negative.

Antibiotics were de-escalated to intravenous ceftriaxone 2 g every day according to sensitivities. The organism was pansensitive. Transthoracic echocardiography did not reveal obvious vegetations seen on any valves. Her postoperative course was complicated by an acute kidney injury, which resolved within 2 days of fluid hydration, and acute blood loss anemia, with hemoglobin measuring 6.9 g/dL, which resolved after transfusion with 1 unit of packed red blood cells. The patient was discharged on postoperative day 4 with ceftriaxone 2 g daily for a total of 6 weeks duration via a peripheral-ly-inserted central catheter. Based on the growth of S. gordonii, the patient was recommended to have a detailed dental exam with a panoramic X-ray and a gastroenterological exam with a colonoscopy upon discharge.

At 8-week follow-up, the patient demonstrated resolution of infection, with repeat inflammatory markers within normal limits 2 weeks after an antibiotic holiday. One year following her initial total knee arthroplasty, and 8 weeks following PJI treatment, our patient underwent revision of the right knee total arthroplasty (Figure 3). Three intraoperative intra-articular synovial tissue samples were sent to Pathology, which did not demonstrate acute inflammation, confirming resolution of infection and the ability to proceed with the revision total knee arthroplasty. The patient was not continued on long-term suppressive antibiotics after this procedure. She recovered uneventfully from the right revision total knee arthroplasty and is now doing well over 6 months after surgery. She has not demonstrated any signs or symptoms of recurrent infection and is
happy with the functional level of her right knee. She continues to be routinely followed in the orthopedic clinic. There is a plan for continued follow-up with dental studies and colonoscopy.

**Discussion**

*S. gordonii* is an anaerobic, gram-positive, non-motile coccus member of the *Streptococcus viridans* family. It usually inhabits the oral flora and is commonly found in the periapical endodontic lesions of patients with apical periodontitis. In the oral cavity, *S. gordonii* is known to create biofilm on the teeth, forming dental plaque [3]. This organism also has the ability to spread to extraoral sites and cause systemic infections. In our patient’s scenario, it is believed that this organism likely spread hematogenously from the oral cavity to the right knee joint. Why this happened is unclear, as the patient denied recent dental procedures or routine dental cleanings.

One potential explanation is oral trauma from the initial surgery, though this is unlikely as her infection developed 1 year after her index total knee arthroplasty and she underwent spinal anesthesia with monitored anesthesia care (MAC) during this procedure. Once the organism invaded the knee joint, *S. gordonii* essentially created dental plaque on the total knee prosthesis, forming biofilm on the metallic implant, which protects the organism from host immunity. This resulted in the development of a chronic PJI, which required the criterion standard treatment for resolution of infection.

Prosthetic joint injection risk factors commonly include intravenous drug abuse, rheumatologic disorders, alcoholism, previous intra-articular corticosteroid injection, and diabetes mellitus. Our patient was diabetic, which may have predisposed her to the risk of prosthetic joint infection. Interestingly, she denied any recent history of routine dental cleaning or invasive dental procedures, which would have predisposed her to
Table 1. Different case report findings.

| Case Report         | Age | Gender | Site     | PJI | Risk factors                                      | Treatment methods                                             | Outcomes                                |
|---------------------|-----|--------|----------|-----|--------------------------------------------------|---------------------------------------------------------------|-----------------------------------------|
| Fenelon et al, [14] | 69  | Female | Hip      | Yes | Chronic sinus infection in a left upper incisor | IV ceftriaxone for six week duration, followed by suppressive amoxicillin and extraction of left upper incisor | Complication with clostridium difficile colitis following long term antibiotic therapy |
| Klein et al, [15]   | 65  | Female | Knee     | Yes | Excessive flossing and gingival manipulation preoperatively | Antibiotic therapy for two weeks. Authors do not specify the antibiotic regimen | Resolution of symptoms                  |
| Yombi et al, [16]   | 62  | Male   | Knee     | No  | Poor dental status                               | Ampicillin intravenously for two weeks, then moxifloxacin orally plus rifampicin for two weeks. Total treatment duration four weeks | Complete clinical and functional recovery |
| Yombi et al, [16]   | 78  | Female | Knee     | Yes | Pre-existing valvulopathy                        | Amoxicillin and rifampicin for total of twelve weeks of antibiotic therapy, along with removal of prosthesis and aortic valve replacement | Uncomplicated follow up                  |
| Flowers et al, [17] | 68  | Female | Shoulder | No  | Recent shoulder injection                        | Intravenous ceftriaxone and oral levofloxacin to complete six weeks of therapy following surgical washout procedure | Post-infectious adhesive capsulitis currently managed with conservative treatment |

PJI caused by this specific organism. Orthopedic surgeons rarely require dental clearance prior to elective joint arthroplasty, but generally advise patients to delay dental procedures until 3 to 6 months after joint arthroplasty and recommend antibiotic prophylaxis for dental procedures indefinitely [8,9].

*Streptococcus gordonii* is suspected to form biofilms by producing lipoteichoic acid (LTA), which orchestrates expression and presentation of cell surface-associated proteins and functions [10]. *S. gordonii* produces a complex type 1 LTA that shows abundant D-alanylation and glycosylation; this has been the understood mechanism for biofilm formation [10]. Strong biofilm production is associated with worse clinical outcome and represents up to a 5-fold increased risk for developing recurrent infection [11].

The *Streptococcus viridans* group has been linked to infections of the knee, intervertebral discs, and acromioclavicular joints [12-14].

Kansara et al described a case of *S. viridans* group organisms causing septic arthritis after periodontal scaling 1 week prior. Three cases of spondylodiscitis were documented by Weber et al, in which 1 patient also had endocarditis, and Blankstein et al described an extremely rare case of an acromioclavicular joint infection caused by *S. viridans* group. Interestingly, a case report described PJI of the left hip with cultures positive for *S. gordonii*, with a source identified as sinus infection in the left upper incisor [15]. Another case report described PJI of the right knee with *S. gordonii* after the patient followed a vigorous flossing routine [16]. It is reasonable to speculate that this patient developed PJI due to the flossing regimen, which predisposed her to a transient bacteremia with the culprit organism [16]. These cases demonstrate a *S. gordonii* PJI following dental infection. Our case is unique because no recent dental work or dental infection was identified in our patient.

The case report by Yombi et al discussed 2 patients with PJI due to *S. gordonii*. One patient had a markedly poor dental status and severe pre-existing degenerative arthritis. The second patient had a total left knee arthroplasty 9 months prior to presentation, with a subsequent prosthetic joint infection, similar to our patient [17], and had a subsequent diagnosis of aortic endocarditis.

A case report by Flowers et al described a 68-year-old woman who presented with septic arthritis of her glenohumeral joint following COVID-19 vaccination, with intraoperative joint cultures growing *S. gordonii*. She was initially treated with intravenous ceftriaxone, and then switched to oral levofloxacin for a total of 4 weeks. She initially showed improvement upon discharge, but after a little more than 1 week she reported
increased swelling and pain. Her oral levofloxacin was continued for an additional 2 weeks and she was ultimately diagnosed with post-infectious adhesive capsulitis [18]. Table 1 shows these case report findings.

A single-center case series by Dadon et al presented 15 patients with culture-proven *S. gordonii* bacteremia. The most common diagnosis was infective endocarditis (9 patients), spondylodiscitis (2 patients), necrotizing fasciitis (1 patient), sternitis (1 patient), pneumonia (1 patient), and septic arthritis (1 patient) [7]. In patients with *S. gordonii* bacterium, spondylodiscitis was the presenting symptom of 18% of patients with associated endocarditis [7].

Although the *S. viridans* group is commonly implicated in PJI, ranging from 16% to 43% [19,20], a review of the literature showed few cases of PJI linked specifically to *S. gordonii*. The identification of this specific viridans organism is important due to difficulty eradicating the organism [19], poorer prognosis of patients with streptococcal PJI [20,21], and centralized treatment tailored to acute streptococcal PJIs, sometimes involving specialized centers.

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### Conclusions

PJI is a devastating complication of orthopedic surgery, resulting in significant morbidity and mortality. Diagnosis and treatment of PJI requires a multidisciplinary approach with cooperation among orthopedics, medicine, and infectious disease departments. Our patient presented with chronic prosthetic joint infection caused by the unusual pathogen *S. gordonii*. This organism is a normal member of the oral flora and is known to create biofilm on the teeth, more commonly known as dental plaque. Although our patient denied any recent dental procedures or routine dental cleaning, *S. gordonii* likely spread from the oral cavity to the knee joint and formed biofilm on the prosthetic implant. Biofilm formation on the prosthesis protects the organism from host immunity, thus resulting in chronic PJI. She was treated according to the criterion standard protocol for chronic PJI. The patient had full clinical recovery after treatment. It is particularly interesting that the patient did not have recent dental work, as previous reports have described. This case report highlights a rare case of PJI caused by *S. gordonii*, which is not well documented in the literature.

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