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CASE REPORT

Rothia prosthetic knee joint infection

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Rothia species — Gram-positive pleomorphic bacteria that are part of the normal oral and respiratory flora — are commonly associated with dental cavities and periodontal disease although systemic infections have been described. We describe a 53-year-old female with rheumatoid arthritis complicated by prosthetic knee joint infection due to *Rothia* species, which was successfully treated by surgical removal of prosthesis and prolonged antimicrobial therapy. The issue of antibiotic prophylaxis before dental procedures among patients with prosthetic joint replacements is discussed.

Introduction

Rothia species are Gram-positive, pleomorphic bacteria that are part of the normal flora of the oral cavity and the respiratory tract. They are commonly associated with dental cavities and periodontal disease, although systemic infections have been described. The most commonly reported systemic infection caused by *Rothia* species is endocarditis, which typically occurs in patients with underlying valvular abnormalities.[1] On rare occasions it has been implicated in cases of endopthalmitis,[2] lung disease,[3] peritoneal infections,[4] corneal ulcers,[5] or sepsis in immunocompromised patients.[6] We describe a prosthetic knee joint infection due to *Rothia* species in a 53-year-old female with rheumatoid arthritis (RA), who was not placed on any immunosuppressant drugs, and who was later successfully treated with surgical removal of prosthesis and prolonged antimicrobials. Dental infections may predispose patients to prosthetic joint infections. We also reviewed the literature regarding recommendations for prophylaxis in patients with prosthetic joint infections undergoing dental procedures.

Case report

A 53-year-old woman presented to the emergency room of our hospital with the chief complaints of left knee pain and swelling for several days. She had an oral temperature of 38.8°C at home, associated with weakness. She denied having any chills, headache, chest pain, shortness of

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breath, back pain, other joint pain, abdominal pain, nausea, vomiting, or diarrhea. She denied any trauma or injury to the affected knee.

She had a medical history significant for long-standing RA, which was first diagnosed when she was 16, as well as hypertension and depression. She was prescribed steroids intermittently, but had not received any steroids for about 10 years before presentation. She had required multiple joint replacements with revisions. Notably, she had knee replacements bilaterally and had undergone revision of the left knee 6 years before presentation. She denied having a history of any joint infections. A few weeks before presentation, she had chipped her tooth and developed facial swelling. Her symptoms resolved completely after tooth extraction and a short course of oral penicillin VK.

Upon physical examination, she was found to have a temperature of 38.6°C. Examination of her left knee found the presence of an effusion with erythema and tenderness on palpation. The range of motion was severely limited to both active and passive flexion and extension. No dental pathology was seen. The results of the remainder of her physical examination, including the joints, were otherwise unremarkable.

Initial laboratory data revealed a normal complete blood count and serum biochemistry (white blood cell count of 7.4 K/μL; hemoglobin and hematocrit of 11.8 g/dL and 35.4%, respectively; platelets of 325 K/μL; sodium of 138 mmol/L; potassium of 3.7 mmol/L; blood urea nitrogen and creatinine of 10 and 0.6 mg/dL, respectively). She had an elevated erythrocyte sedimentation rate of 106 mm/h and a C-reactive protein of 36.8 mg/dL (normal upper limit: 0.4 mg/dL).

The orthopedic surgeon was consulted, and a diagnostic arthrocentesis was performed before antibiotic therapy. The joint fluid appeared turbid with 52,000 total nucleated cells/mL (white blood cells) and 26,000 red blood cells/mL. Initial Gram's stain, and fungal and acid-fast stains of the joint fluid did not reveal any organisms. Cultures of the joint fluid and blood were sent for evaluation. The patient received intravenous vancomycin (1 g every 12 hours) and piperacillin-tazobactam (3.375 g every 8 hours) (extended infusion).

The following day, she underwent incision and drainage of the knee. All hardware was removed, and an antimicrobial spacer infused with gentamicin, tobramycin, and vancomycin was placed at the site. Intraoperatively, a large amount of pus was noted surrounding the site, and pleomorphic branching filamentous Gram-positive round to rod-shaped bacteria were noted in the tissue culture. The organism identified by the RapID™ ANA II System (Remel Inc.) was catalase positive, nitrite (0.01%) and nitrate reductase positive, and esculin and deoxyribonuclease positive. It produced acid from glucose, glycerol, and sucrose, but not from lactose, mannose, or mannitol.Using the RapID CB plus system (Remel Inc., Norcross, GA, USA),[7] the isolate was determined to be *Rothia* species at the reference laboratory of the Department of Health of New York State. Sensitivity testing with the E-test revealed that the isolate was sensitive to ampicillin (0.047 μg/mL), cefotetan (3.0 μg/mL), clindamycin (1 μg/mL), and ertapenem (0.125 μg/mL).

While awaiting culture results, she was treated with ertapenem (1 g daily) and later amoxicillin—clavulanate. She received reimplantation of the knee prosthesis after 8 weeks of antimicrobial therapy. She then received a further 4 months of oral amoxicillin—clavulanate and is currently well without clinical signs and symptoms of recurrent infection.

Discussion

Rothia species are aerobic or facultatively anaerobic, nonendospore forming, nonmotile, pleomorphic, Gram-positive coccobacilli that can form filamentous branches.[8] *Rothia* species, first discovered in 1967, are part of the normal mouth flora.[8] The organisms may resemble *Nocardia* and *Actinomyces* species morphologically but differ from these in terms of their cell wall constituents, physiology, and biochemical reactions.[8] They are commonly associated with dental cavities and periodontal disease although systemic infections have been described.[1–6,9,10]

Rothia species are often difficult to isolate as witnessed in our case. Colonial and microscopic morphologies, poor growth under anaerobic conditions, and being CAMP negative, as well as the end-products of glucose metabolism, should lead to the correct diagnosis.[8] Prolonged incubation, which could last up to 4 weeks, may be needed to isolate these organisms from tissue specimens and in joint infections occurring after dental procedures or disease. The laboratory personnel should be aware of this possibility. Species identification using sequencing of the 16S rRNA gene can be performed, although this technique was not available to our reference laboratory at the time of our case.

Although *Rothia* species have been implicated in a myriad of infections, this case — to our knowledge after an extensive literature review — represents one of the very few cases involving a prosthetic knee joint. There have been several case reports of *Rothia* species causing joint infections (see Table 1). Recently, a native joint infection caused by *R. mucilaginosa* has been described.[11] Michels et al[12] described a case of prosthetic hip infection also with *R. mucilaginosa* that required prosthesis removal in a two-stage procedure and prolonged vancomycin therapy. The authors suggested that high-risk patients with prosthetic joints should receive antimicrobial prophylaxis for dental procedures.

An underlying rheumatologic disease has been shown as a major risk factor in developing septic arthritis.[13] One recent study demonstrated that the incidence of septic arthritis was 0.29 per 1000 person-years for the general population as compared to 1.31 per 1000 person-years for patients with RA.[14] A patient with poor dentition along with RA being treated with immune-modulators (etanercept) was found to have septic arthritis caused by *R. dentocariosa*.[15] Our patient's RA resulted in multiple orthopedic surgeries and revisions as therapy. A unique aspect of our case is the fact that, unlike the other patients with *Rothia* septic arthritis, our patient had not received any immunosuppressants (Table 1).

Our case, similar to the case report by Michels et al,[12] brings into focus the issue of antibiotic prophylaxis for patients with prosthetic joints. Ricaurte et al[1] postulated that *Rothia* periodontal disease or dental procedures, in turn, may be the first step in the infection of other tissues. They hypothesized that a transient bacteremia can result from periodontal disease, later seeding the joints and surrounding tissue.

Table 1 Treatment and outcome of *Rothia* joint infections reported in the literature

First author/ reference	Species	Native/ prosthetic	Immune status	Antibiotics	Duration	Outcome
Kaasch et al [9]	*R. mucilaginosa*	Native knee	RA on prednisone	Moxifloxacin + amp/sulbactam	8 wk	Full recovery
Michels et al [10]	*R. mucilaginosa*	Prosthetic hip	Immunocompetent	Vancomycin	8 wk	Hardware removal/ full recovery
Verrall et al [18]	*R. aeria*	Native shoulder	RA on methotrexate, prednisone	Penicillin	2 wk	Full recovery
Favero et al [12]	*R. dentocariosa*	Native knee	RA on etanercept	Clarithromicin + levofloxacin	Unknown	Partial recovery

RA = rheumatoid arthritis.

The risk of prosthetic joint infections as a result of dental procedures is not clearly defined. One study involved 339 patients to find the association between antibiotic prophylaxis and prosthetic hip or knee infections after dental procedures, and found that antibiotic prophylaxis in high-risk or low-risk dental procedures did not reduce the risk of joint infections.[16] The American Dental Association released a set of guidelines concluding that antibiotic prophylaxis is not routinely indicated for most patients with total joint replacements.[17] However, the American Academy of Orthopedic Surgeons strongly recommended the consideration for antibiotic prophylaxis to all patients with prosthetic joint replacements.[17] The suggested antibiotics include cephalexin, cephradine, or amoxicillin given 1 hour before any dental procedure.[17]

In conclusion, *Rothia* species, although uncommon, should be regarded as a potential pathogen for prosthetic joint infections in the setting of dental disease or procedures. Given the difficulty in isolating this organism, the laboratory staff should be informed and prolonged incubation of culture specimens requested in such patients. Further discussion regarding the role for antibiotic prophylaxis during dental procedures among patients with prosthetic joint replacements is warranted.

Conflict of interest

All contributing authors declare no conflict of interest.

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