Prosthetic joint infection due to *Mycobacterium moriokaense* in an immunocompetent patient after a total knee replacement

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ABSTRACT

Nontuberculous mycobacteria (NTM) are a rare cause of prosthetic joint infection (PJI) that is documented to affect immunocompromised patients primarily. In this case report, we describe an immunocompetent patient with a rare case of PJI caused by *Mycobacterium moriokaense* after a total knee replacement. This patient is the eighth reported case of PJI caused by NTM and the first reported case in an immunocompetent individual. Because PJI caused by NTM is rare and difficult to treat, it is essential to include it in the differentials during initial workup of suspected PJI, especially in the context of negative preliminary bacterial cultures.

KEYWORDS *Mycobacterium moriokaense*; nontuberculous mycobacteria; prosthetic joint infection

The incidence of prosthetic joint infections (PJI) increased from 2.05% to 2.18% between 2001 and 2009.¹ *Staphylococcus aureus* is the most common cause of both polymicrobial and monomicrobial infections responsible for PJI, with most infections occurring within 3 months of arthroplasty.² With the growing incidence of PJI, it is essential to expand the list of different pathogens when evaluating patients for infections after joint arthroplasty. Nontuberculous mycobacteria (NTM)—ubiquitous bacteria found in soil and water sources, typically causing respiratory illness and disseminated infection in patients with impaired systemic immunity³—only cause 0.6% of PJIs, with *Mycobacterium tuberculosis* being the most common culprit of mycobacterial PJI. Because NTM are a rare cause of PJI, patients often experience a delay in diagnosis.⁴ Infections in both native joints and prosthetic joints caused by NTM have been documented in only 25 cases. Eighteen cases in PJI were caused by rapidly growing mycobacteria, as reported by Eid et al in a retrospective study. They identified 10 prior cases of rapidly growing mycobacteria causing PJI and reported an additional 8 cases in their retrospective study spanning 38 years.⁵ The remaining seven cases were separate studies reporting PJI caused by *Mycobacterium avium* complex (MAC); all seven documented cases occurred among immunocompromised patients.^{1,6} We

describe a rare case of PJI caused by *Mycobacterium moriokaense* in an immunocompetent man after a total knee arthroplasty.

CASE PRESENTATION

A 68-year-old Hispanic man presented with right knee pain and swelling 4 years after a total knee arthroplasty performed for degenerative joint disease. His past medical history included hypertension and prostate cancer (in remission after prostatectomy and radiation). Two years after total knee arthroplasty, he experienced fluid collection to the right posterior knee and had several joint aspirations with recurrence of the fluid accumulation. Fluoroscopic-guided aspiration of the right knee was performed with injection of contrast for a computed tomography arthrogram and showed evidence of communication between the joint and the posterior lateral fluid collection. Aspiration fluid analysis showed >20–30 white blood cells per high-power field, and the microbial cultures were positive for methicillin-resistant *S. aureus*. He was treated with sulfamethoxazole-trimethoprim 800–160 mg orally twice daily for 2 weeks for treatment of the popliteal cyst. His erythrocyte sedimentation rate and C-reactive protein level were both within normal ranges at that time. After completion of treatment, he underwent a surgical

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Table 1. Prosthetic joint infections caused by nontuberculous mycobacteria between 1987 and 2019

Age/ gender	Immunodeficiency status	Site*	Pathogen	Antibiotics	Surgical resection	Year published/citation
N/A	Renal and heart transplant	Hip	MA	N/A	–	1987 ⁹
20/M	AIDS	Hip	MAC	Ciprofloxacin, clarithromycin, rifampin, clofazimine	+	1994 ⁶
67/M	Renal transplant	Hip	MAC	Azithromycin, ethambutol, rifabutin	+	2009 ¹⁰
39/M	Renal transplant, anal cancer, lupus	Hip	MAI	Azithromycin, ethambutol	+	2012 ¹¹
41/M	Prednisolone for polymyositis	Knee	MI		–	2013 ¹²
73/M	Thalidomide and dexamethasone for multiple myeloma	Knee	MI	Clarithromycin, ethambutol	+	2015 ⁴
79/M	Leflunomide, prednisone, and infliximab for rheumatoid arthritis	Hip	MAI	Rifampin, ethambutol, clarithromycin	–	2017 ⁶

*In the context of total hip or total knee arthroplasty.

MA indicates *Mycobacterium avium*; MAC, *Mycobacterium avium* complex; MAI, *Mycobacterium avium-intracellulare*; MI, *Mycobacterium intracellulare*.

procedure to excise the recurrent popliteal cyst without any complications. The pathology report of the cyst was consistent with a popliteal cyst with no evidence of malignancy.

Six years after total knee arthroplasty, the patient again presented with recurrent fluid collection on his right knee. Synovial fluid biopsy at that time was positive for caseating granulomatous lesions. The cultures were positive for acid-fast bacilli, but identification and sensitivities were still pending; therefore, the patient was empirically started on levofloxacin 500 mg, ethambutol 800 mg, and pyrazinamide 1500 mg by mouth once a day for 30 days due to suspicion for *M. tuberculosis*. Dose adjustments were not required due to normal hepatic and renal function.

On the 4-week reevaluation, acid-fast bacilli identification and sensitivities were still pending, but the patient appeared to be improving clinically. He was afebrile and did not complain of pain or swelling to the surgical site. QuantiFERON-TB Gold was negative at this time. The patient was continued on the same regimen of levofloxacin, ethambutol, and pyrazinamide.

The fifth-week microbiology report showed slowly growing *Mycobacterium* species with susceptibility to ciprofloxacin and ethambutol and resistance to rifampin and sulfamethoxazole/trimethoprim. The laboratory was unable to definitively identify the organism by partial ribosomal DNA sequencing using current quality-controlled databases. However, the sequencing was most closely related to slowly growing *Mycobacterium* species.

Nine weeks later, the final microbiology report identified *M. moriokaense* via genetic sequencing at a state-level lab. The microorganism was susceptible to the patient's current antibiotic regimen. The patient continued to improve with no clinical signs of disseminated NTM infection. His latest erythrocyte sedimentation rate and C-reactive protein level

were within normal limits. Treatment was continued with Monday-Wednesday-Friday quad therapy for 8 months. Follow up at the end of therapy showed no evidence of infection.

DISCUSSION

NTM is a rare cause of PJI. Although they typically cause pulmonary infections in individuals with underlying lung pathology and disseminated disease in those who are severely immunocompromised, there have been seven documented cases thus far of PJI caused by NTM. There are three proposed mechanisms for infections caused by NTM. First, the contiguous spread of disease from adjacent skin and soft tissue may lead to contamination of the prosthesis. Although NTM is thought to be commonly cultured from healthy skin flora, cases have been reported of NTM skin infections in immunocompetent individuals without any systemic complications.^{7,8} Mycobacteria have evolved mechanisms to evade host immune response by the formation of biofilms. Because prostheses can serve as a nidus for biofilm formation, only a small amount of pathogen is needed to cause infection in a prosthetic joint.¹ Second, hematogenous seeding can also occur. Immunocompromised individuals or patients with underlying lung pathology are the most susceptible to NTM infections. However, our patient did not fall into either of these categories. Although hematogenous seeding can occur at any time after arthroplasty, late onset of infection (>1–2 years after surgery) is mostly due to hematogenous seeding, with *S. aureus* being the most common microorganism.¹ PJI due to hematogenous seeding of a distant NTM infection has not been reported in the literature to the best of our knowledge. Finally, aerosolized contamination of prosthesis or direct inoculation during surgery can also lead to PJI caused by NTM.¹ This is less likely due to

strict sterile technique practices in orthopedic surgeries. Although our patient was not immunocompromised, his extensive history of recurrent joint aspirations to the surgical site secondary to fluid accumulation may have served as an opportunity for inoculation.

All the reported PJI cases caused by NTM are listed in [Table 1](#).^{4,5,9–12} Our patient is the only immunocompetent individual. One limitation of the list is the fact that NTM is not a reportable disease. Therefore, PJI among immunocompetent individuals could be more prevalent, but the data are currently lacking.

Because PJI caused by *Mycobacterium* species is rare, it provides a new therapeutic challenge to clinicians. A high index of suspicion is needed in patients with recurrent PJI, especially in the context of negative bacterial cultures. Further characterization of patients with similar cases may provide an opportunity for future research.

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