Abiotrophia defectiva as a Rare Causative Agent of Periprosthetic Total Knee Arthroplasty Infections: A Case Report and Literature Review

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Abstract

We present a case of *Abiotrophia defectiva* in a prosthetic knee infection following total knee replacement for the first time. A 69-year-old female was prediagnosed with prosthetic knee infection, and a two-stage revision arthroplasty was applied. *A. defectiva* was cultured by matrix-assisted laser desorption ionization-time of flight mass spectrometry (MALDI-TOF MS) from the synovial fluid aspirates. Penicillin G and gentamicin had been administered. One year postoperatively, a scintigraphy showed no recurrence. *A. defectiva* may be missed in culture negative patients with knee or hip arthroplasty. They should be carefully evaluated if they have undergone recent dental procedures.

Keywords
- *Abiotrophia defectiva*
- osteoarticular infections
- MALDI-TOF MS

Introduction

Abiotrophia defectiva is a member of the human normal flora, which colonizes the oral cavity, intestinal, and genitourinary tracts. Its culture requires special conditions.[1]

A. defectiva specifically targets endovascular structures, and it is reported to be a key agent in cases of culture-negative endocarditis.[2,3] Furthermore, this fastidious pathogen has been associated with osteoarticular and prosthetic joint infections. Knee prosthesis infections caused by *A. defectiva* have been reported sporadically.[1,4]

The purpose of this report was to describe the clinical, radiological, and microbiological features of an exceptional case of total knee arthroplasty (TKA) infection due to *A. defectiva*.

Case History

A 69-year-old female who underwent a TKA a year ago was admitted with the complaints of pain, erythema, and swelling in the operated knee. She had no relevant medical history except a tooth extraction that occurred 3 months before the operation.

A plain radiograph was normal. Additionally, laboratory findings included high-levels of C-reactive protein (38 mg/L), erythrocyte sedimentation rate at 58 mm/h, and normal white blood count (7800 cells/mL). The initial diagnosis was periprosthetic TKA infection. No bacterial growth was yielded in any of the cultivations. A two-stage revision arthroplasty was applied.

In the first stage revision, a debridement of the infected area, removal of implants, and insertion of an antibiotic-impregnated cement spacer were performed. Meanwhile, synovial fluid aspirates were sent for microbiological analysis.

Laboratory Investigations

Intraoperative synovial fluid was inoculated into aerobic (BD BACTEC Plus Aerobic/F, USA) and anaerobic (BD BACTEC Lytic/10 Anaerobic/F, USA) blood-culture bottles and incubated in automatic chambers for 14 days. The aerobic bottle produced Gram-positive cocci after a 5-day incubation at 37°C, and highly pleomorphic coccobacilli in small chains were recognized after subculturing of the aerobic bottle in chocolate agar with supplemented pyridoxal 37°C under

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a 5% CO2 atmosphere for 24 hours. No growth was observed in 5% sheep-blood agar. The biochemical test results for the colonies were as follows: negative catalase and oxidase tests, and no growth on media with bile-esculin and 6.5% NaCl. Furthermore, although small colonies in small chains were observed in chocolate agar plate, these colonies were not identified by conventional identification methods or rapid identification systems including API Coryne and Rapid ID 32 Strep (bioMe´rieux, France).

Therefore, matrix-assisted laser desorption ionization-time of flight mass spectrometry (MALDI-TOF MS) analysis was performed with a MicroFlex LT mass spectrometer (Bruker Daltonics, Bremen, Germany). Each colony was overlaid with 1 µL of matrix solution, and mass spectra of the sample was then transferred to the Biotyper software (version 3.0; Bruker, Karlsruhe, Germany). The analyses were performed by comparing with other spectra in the Bruker database library. *A. defectiva* was identified with a homology of 99.9%. Susceptibility testing was performed on Mueller–Hinton agar with pyridoxal-supplemented sheep blood (CO_2 5%, 37°C, 24 hour), according to the guidelines of The Clinical and Laboratory Standards Institute (CLSI) for disk diffusion, and *A. defectiva* was detected to be susceptible to the all following antibiotics: penicillin G, erythromycin, imipenem, cefotaxime, ceftaroline, ceftriaxone, clindamycin, daptomycin, gentamicin, levofloxacin, linezolid, meropenem, penicillin, streptomycin, and vancomycin, with the exception of tetracycline. Minimal inhibitory concentrations obtained with the E-test (bioMérieux, Durham, NC, USA) were as follows: penicillin G, 0.032 mg/L; gentamicin, 4 mg/L). A combination of gentamicin and penicillin (first-line treatment) treatment was advised by the American Heart Association (AHA) guidelines for the treatment of infective endocarditis caused by *Abiotrophia species*[5]

After identifying the pathogen, based on drug susceptibility profile of *A. defectiva*, 4 × 1000.000 IU/mL penicillin G and 3 × 80 mg/L gentamicin IV had been administered parenterally for 30 days until acute phase reactants were normal and patient's physical examination was clinically stable. Because of the increased risk for endovascular infections in patients infected with *A. defectiva*, endocarditis was ruled out through an echocardiography. At 12 months of follow-up, considering normal levels of acute-phase reactants, the second stage of the revision arthroplasty was applied using a hinged knee prosthesis. One year postoperatively, a labeled leukocyte scintigraphy showed no evidence of recurrence. With a satisfactory functional condition, the patient returned to her daily life without any limitations. The knee society and The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score were preop 68 and 78, respectively.

Ethical approval was not necessary for case reports in our institution, and patient consent has been obtained.

Discussion

Exopolysaccharide and fibronectin are key virulence factors of *A. defectiva* and provide a strong binding capacity to endovascular structures and prosthetic surface.[3,4] Although there are a vast number of case reports dealing with *Abiotrophia* endocarditis in the medical literature, *Abiotrophia* infections associated with prosthetic joint replacement are uncommon and have been sporadically reported.[4] To the best of our knowledge, the literature has described only a few of orthopaedic prosthesis-associated *A. defectiva* infections to date

Abiotrophia infections associated with prosthetic joint replacement are uncommon.[4]

A 71-year-old man with a TKA infection had a negative bacterial culture, and *A. defectiva* was identified by 16S rDNA sequencing. The patient had underwent a dental intervention 3 weeks before the admission.[6] Similarly, a 65-year-old woman with TKA infection due to *A. defective* was identified by the PCR method.[7] Another example was a case of a total hip arthroplasty infection caused by *A. defectiva*.[8] MALDI-TOF MS offers a faster alternative for the detection of *A. defectiva*.[9] In an infective endocarditis case, MALDI-TOF MS presented sufficient ability to identify *A. defectiva*.[10] Therefore, we preferred to use MALDI-TOF-MS for the identification of A. *defectiva.*

It was previously reported that dental procedures were not risk factors for subsequent total hip or knee infection.[11] However, our patient had a tooth extraction 3 months before their TKA. Therefore, we may suggest that *Abiotrophia* infection may have originated from the oral flora, but the clinical signs started 9 months after the TKA. Cassir et al[6] reported that a 71-year-old patient with a total knee prosthesis underwent a dental treatment without antibiotic prophylaxis 3 weeks before the isolation of *A. defectiva.* The patient had infection signs before the dental procedure and concluded that the dental procedure may not be the origin. We are agree with the conclusions of Berbari et al and Cassir et al for ignoring the role of dental procedures in prosthetic hip or knee infections.[6,11] A mediate or high-penicillin resistance have been reported in *A. defective* strains, but our strain was highly susceptible to penicillin G.[12]

We used MALDI-TOF MS in place of 16S rRNA-based PCR. Protocol for the diagnosis of prosthetic joint infection using an "arthritis kit" procedure was advised by Cassir et al.[6] *A. defectiva* may be neglected in these infections because of its fastidious nature, and culture negative infections in patients with knee or hip arthroplasty should be carefully evaluated.

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Conflicts of Interest
None declared

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