

Case Reports

## *Corynebacterium bovis* shoulder prosthetic joint infection: the first reported case

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### Abstract

We report the first case of *Corynebacterium bovis* shoulder prosthetic joint infection. The organism was isolated from intraoperative tissue culture and from the removed prosthesis using sonication. A 2-stage exchange and 3 months of antibiotic therapy were performed. *C. bovis* may cause implant-associated infections, which can manifest as low-grade infection.

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### 1. Introduction

*Corynebacterium bovis* is a rare human pathogen (Coyle and Lipsky, 1990). It is a common commensal of the bovine udder and may cause bovine mastitis. Although the mode of transmission to humans is unknown, drinking contaminated bovine milk and nosocomial acquisition is discussed (Smith and Locksley, 1982). Until now, 8 patients with *C. bovis* infections were described, including line-related sepsis, ventriculojugular shunt nephritis, meningitis, leg ulcer, chronic otitis media, epidural abscess, and infectious endocarditis (Bolton et al., 1975; Dalal et al., 2008; Vale and Scott, 1977). To our knowledge, *C. bovis* has not been reported as the causative organism of prosthesis joint infection, despite that other corynebacteria (or corynebacteria not classified to the species level) have been with implant-associated infections (Trampuz et al., 2003). Here, we report a patient with a shoulder prosthetic joint infection,

in whom *C. bovis* with identical phenotypic characteristics was repeatedly isolated from different specimens collected 2 weeks apart.

### 2. Case report

A 62-year-old female developed secondary arthrosis of the acromioclavicular joint after surgical stabilization of the left shoulder 9 years before presentation. She underwent a shoulder arthroplasty in August 2007. After an initial pain-free interval of 3 months, she presented with sudden occurrence of shoulder pain and stiffness, which gradually increased over months, leading to limited joint motion. No fever or other local manifestations of infection, such as redness, swelling, warmth, drainage, or sinus tract, were present. Six months after shoulder arthroplasty in January 2008, corticosteroids were injected in the joint without clinical improvement. At admission in April 2008, the peripheral blood leukocyte count was normal at  $5.2 \times 10^9/L$ , whereas the erythrocyte sedimentation rate (22 mm/h) and C-reactive protein value (7 mg/L) were both slightly elevated. No loosening of the shoulder prosthesis was noted in the conventional X-ray. Magnetic resonance imaging excluded relevant joint effusion. Scintigraphy with <sup>99m</sup>Tc-labeled

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antigranulocyte monoclonal antibodies showed no pathologic tracer accumulation in the joint. During diagnostic arthroscopy, smeary fibrinous coating of the prosthesis surface and substantial destruction of the cartilage were noted. Partial synovectomy was performed and multiple periprosthetic tissue specimens were cultured on blood and chocolate agar and thioglycollate broth for 10 days. *C. bovis* grew from 1 of 7 tissue specimens after incubation at 35 °C with 5% CO<sub>2</sub> for 5 days. Microscopic examination showed Gram-positive rods positive for catalase and urease and grew better on blood agar with added 5% Tween-80 consistent for *Corynebacterium* spp. Further classification of the organism was performed by the API CORYNE system (BioMérieux, La-Balme-les-Grottes, France), which yielded a good identification of *C. bovis* (with a low possibility of *Corynebacterium urealyticum*), which was confirmed by 16S rRNA gene sequencing showing a 100% (470 of 470 nucleotides) match of the deposited sequence of *C. bovis* in the NCBI (National Center for Biotechnology Information) GenBank (Adderson et al., 2008).

Because of persistent pain, the shoulder prosthesis was removed 2 weeks after arthroscopy, without insertion of a spacer. Underneath the removed prosthesis head, a central bone necrosis of the humerus was detected. Six tissue specimens were sampled for culture and histopathology, but all samples remained negative in culture. Histopathologic examination showed signs of chronic osteomyelitis and acute and chronic inflammation of the synovial tissue. The removed shoulder prosthesis was subjected to sonication, and *C. bovis* grew after 4 days of incubation in the resulting sonication fluid (Trampuz et al., 2007). Identification of the organism was performed as described above. Both isolates showed identical antimicrobial susceptibility pattern as determined by the E-test (AB Biodisk, Solna, Sweden) and interpreted as susceptible according to the Clinical and Laboratory Standards Institute (CLSI, 2006) guidelines. The MIC values were as follows: penicillin (0.25 mg/L), amoxicillin (0.125 mg/L), imipenem (0.064 mg/L), ciprofloxacin (0.25 mg/L), levofloxacin (0.25 mg/L), clindamycin (0.25 mg/L), gentamicin (0.25 mg/L), rifampicin (0.006 mg/L), and vancomycin (1.5 mg/L). The patient was treated for prosthetic joint infection and chronic osteomyelitis with intravenous imipenem (500 mg qid), followed by oral amoxicillin (500 mg qid), for a total duration of 3 months. After an antibiotic-free interval of 4 weeks, reimplantation of a reverse shoulder prosthesis was performed. All 7 intraoperative tissue cultures revealed no bacterial growth. At last follow-up 10 weeks after the reimplantation, the patient showed no clinical or laboratory findings suggestive for infection.

### 3. Discussion

In this report, we present the first case of a low-grade infection of the prosthetic shoulder joint caused by *C. bovis*,

a Gram-positive, aerobic, or facultatively anaerobic bacillus, belonging to lipophilic corynebacteria, such as *Corynebacterium jeikeium* and *C. urealyticum* (Meyer and Reboli, 2005). The pathogen was isolated from intraoperative tissue culture and from removed prosthesis using sonication 2 weeks apart. The source of infection in our patient remains unknown. No contact with cattle or other animals was reported. However, the timing suggests intraoperative route of infection, originating from own skin flora. Low-virulent organisms constituting the skin flora, such as corynebacteria, may cause infections mimicking aseptic (mechanical) implant failure. Persistent pain and slightly elevated inflammatory parameters can be the only manifestation of such low-grade infection.

Several factors can affect the yield of joint fluid or tissue cultures. One factor is the low burden and patchy distribution of microbial biofilms in periprosthetic infections (Trampuz et al., 2003). Sonication of the removed implant, as used in our patient, has the advantage of being able to detect the presence of biofilms on the entire prosthesis surface. In prosthetic hip and knee joint infection, sonication has been shown to have superior sensitivity compared with tissue culture (78.5% versus 60.8%) (Trampuz et al., 2007). Another factor that can affect the culture yield is special characteristics of the causative organism. Corynebacteria require specialized growth conditions, and prolonged incubation for up to 2 weeks may increase the culture sensitivity (Schäfer et al., 2008; Smith and Locksley, 1982).

In summary, a high index of suspicion for infection is needed in patients with painful prosthetic joints. New diagnostic methods, such as sonication, may improve the microbiologic diagnosis of low-grade infections. This case demonstrates the potential pathogenic role of corynebacteria in low-grade implant-associated infections.

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