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Tibial Osteomyelitis Caused by *Gordonia bronchialis* in an Immunocompetent Patient

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***Gordonia* species are aerobic Gram-positive bacilli that rarely cause human infections, often in the setting of indwelling intravascular catheters. We report the first case of osteomyelitis caused by *Gordonia bronchialis* in a healthy immunocompetent host in the absence of an intravascular catheter.**

CASE REPORT

A 22-year-old healthy, immunocompetent woman with no past medical history underwent an arthroscopic knee surgery for a left anterior cruciate ligament and left lateral meniscal tears following a sports-related injury. She had reconstruction with a hamstring autograft from the same leg and a partial meniscectomy. Three months after the surgery, she developed two areas of erythema, swelling, and pain around the harvest incision site, with small abscess formation which was draining small amounts of purulent fluid. She was afebrile and had no constitutional symptoms. At that time, the surgeon did a superficial debridement in the office, sent a swab culture, and empirically prescribed oral trimethoprim-sulfamethoxazole (TMP/SMX), pending cultures. She subsequently developed an allergic reaction related to the antibiotic, requiring discontinuation of the antimicrobial. Meanwhile, the culture showed rare growth of aerobic, weakly acid-fast-positive, Gram-positive bacilli on chocolate and blood agar, as well as the Lowenstein-Jensen medium. Eventually the colonies turned to an orange hue; however, they were initially grayish in color, and there was questionable branching on the Gram stain. Due to a suspicion of *Nocardia* species being the culprit, and the newly developed allergy, the antibiotic was switched to amoxicillin-clavulanate. She continued to have pain and drainage from the surgical site. The isolate was identified as *Gordonia bronchialis* by a reference lab (ARUP Laboratories, Salt Lake City, UT) using 16S rRNA gene sequencing on an Applied Biosystems 3730 sequencer and applying the CLSI standards (5). A 504-bp fragment of 16S rRNA was 100% identical to the corresponding fragment for *G. bronchialis* strain DSM 43237 (GenBank accession no. AY262331.1).

Given the persistence of symptoms and the unusual culture result, a decision was made to perform an excisional debridement in the operating room, for repeat culture and removal of the minimal hardware present in the tibia, consisting of a bioresorbable polymer screw (Intrafix DePuy Mitek, Inc., Raynham, MA). No knee effusion was present on the physical exam, and thus the joint was not aspirated or entered during this surgical procedure. Repeat cultures from bone fragments reamed out of the screw tunnel grew *G. bronchialis*. Susceptibility testing on the new isolate done by CLSI broth microdilution (6) at the same reference laboratory revealed the following MICs: amikacin, ≤1 μg/ml (susceptible); amoxicillin-clavulanate, ≤2/1 μg/ml (susceptible); ceftriaxone, ≤4 μg/ml (susceptible); doxycycline, 2 μg/ml (intermediate); minocycline, ≤1 μg/ml (susceptible); TMP/SMX, ≤0.25/4.8 μg/ml (susceptible); tobramycin, ≤1 μg/ml (susceptible); imipenem, ≤2 μg/ml (susceptible); ciprofloxacin, ≤0.12 μg/ml (susceptible); clarithromycin, 1 μg/ml (susceptible); linezolid, 2 μg/ml (susceptible); and moxifloxacin, ≤0.25 μg/ml (susceptible). Vancomycin was not tested. The MIC interpretations are tentative, using *Nocardia* breakpoints, as recommended by CLSI (6). After a 14-day course of intravenous vancomycin (administered prior to the above susceptibilities being available), the patient was prescribed oral ciprofloxacin for four additional weeks. The choice was based both on susceptibility and oral bioavailability of quinolones. The wound healed completely, and the patient remained asymptomatic afterwards, with no signs of recurrent infection. A 5-month office visit and phone call follow-up at 9 months after the last procedure revealed no recurrence.

Gordonia species are aerobic actinomycetes that rarely infect humans, most notably in the setting of intravascular catheter infections. *Gordonia*-related infections usually affect immunocompromised and rarely occur in immunocompetent patients (11). In 1971, the genus *Gordonia* was differentiated from other aerobic actinomycetes (20). Few reports of different infections due to several *Gordonia* species have been reported in recent years. A study in Thailand reported 171 aerobic actinomycete isolates sent to the U.S. National Institutes of Health for identification between 1996 and 2003, of which 6% were *Gordonia* species (17). Different types of infections caused by *Gordonia* species have been reported in the literature, including, but not limited to, sternal wound infections, otitis externa, and skin and soft tissue infections (1, 10, 13, 17). Interestingly, a case of *Gordonia araii* infection related to a similar bioabsorbable tapered screw was reported in 2008 (11).

G. bronchialis was first identified from samples of soil and sputum obtained from patients with pulmonary disease (20), and it is the causative organism in only a minority of human infections. It is a rare cause of bacteremia, usually in the setting of indwelling intravascular catheters (12). Only 13 cases of *G. bronchialis* infections in humans had been reported in our review of the literature

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TABLE 1 Summary of case reports of infections with *G. bronchialis*

Type(s) of infection	No. of cases	Patient's age	Underlying condition(s)	Treatment	Outcome	Yr of publication (reference)
Osteomyelitis	1	22 yr	Meniscal and anterior cruciate ligament tear s/p[b] arthroscopic repair	i.v.[a] vancomycin for 2 wk and oral ciprofloxacin for 4 wk	Clinical cure	2012 (this case)
Bacteremia and pleural infection	1	52 yr	Lymphoma, splenectomy, breast cancer, and pleural effusions	Oral ciprofloxacin and minocycline	Clinical recovery	2011 (12)
Bacteremia	1	67 yr	Diabetes and nonketotic hyperosmolar coma	Not stated	Not stated	2009 (3)
Intraventricular shunt	1	45 days	Premature neonate	i.v. meropenem and amikacin	Infection cleared	2007 (2)
Recurrent breast abscess	1	43 yr	Pituitary adenoma	Oral doxycycline	Recurrence	2005 (21)
Bacteremia	1	58 yr	Sequestrated lung and diabetes	i.v. vancomycin, i.v. ceftriaxone, and oral amoxicillin-clavulanate	Full recovery	2004 (19)
Sternal wound	7	51–68 yr	Surgery	Oral ciprofloxacin, i.v. ceftriaxone, and oral TMP/SMX	Not stated	1991 (18)

[a] i.v., intravenous.
[b] s/p, status post.

(Table 1), and to our knowledge, this is the first reported case of osteomyelitis caused by this organism.

The identification of *Gordonia* species based on morphology alone is not possible, and there are no commercial kits that can differentiate them from rhodococci and other aerobic actinomycetes (19). Both *Rhodococcus* and *Gordonia* colonies have a fairly characteristic red to orange color; however, they can be initially gray and chalky. They can be distinguished from *Nocardia* by the lack of branching, having a coryneform as opposed to filamentous beaded appearance on Gram stain, as well as the absence of aerial hyphae (7). Occasionally the organisms can be modified acid-fast positive, which can lead to confusion with *Nocardia* if no clear communication of morphology exists between the laboratory and clinicians. In our case, the repeat modified acid-fast stains from pure cultures were negative, even though the direct stains from the original specimen were very weakly positive. Utilization of 16S rRNA gene sequencing has significantly improved organism identification (4, 15). We believe that the identification to the species level was accurate, since the method using fragments of approximately 500 bp was previously proven to provide enough information to differentiate among various *Gordonia* species (16).

There are no standardized guidelines for treatment of infections due to *Gordonia* species. In the previously reported cases of *Gordonia* bacteremia, many different antimicrobials were used, either alone or in a variety of combinations, including vancomycin, cephalosporins, carbapenems, TMP/SMX, and others (12). In our case, the patient did not respond to oral antimicrobials (TMP/SMX and subsequently amoxicillin-clavulanate) until excisional surgical debridement was performed. It is likely the success of treatment in this case is related to the removal of infected hardware and good bioavailability and bone levels of ciprofloxacin, even when administered orally (8). The duration of treatment is not standardized as well, with many patients completing between 6 and 12 weeks of antibiotic treatment. Due to normalization of inflammation markers, as well as clinical resolution of infection, we decided to stop antimicrobials after a total of 6 weeks of treatment.

In conclusion, our case emphasizes the fact that although infections caused by *Gordonia* species in humans are rare, they still can occur in healthy, young, and immunocompetent patients. Also, this is the first case of osteomyelitis caused by *G. bronchialis* reported in the literature, and similar cases should be reported because *Gordonia* species now comprise a significant minority of aerobic actinomycetes in human diseases. Careful review of Gram stains and modified-acid-fast stains should be done, so that confusion with other actinomycetes is minimized, pending the genotypic identification.

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