



## Case report

## Sternal osteomyelitis caused by *Gordonia bronchialis* in an immunocompetent patient following coronary artery bypass surgery

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## ABSTRACT

Skin commensals, especially gram-positive cocci, are the usual microbial organisms that cause post-operative sternal wound infections. Rarely, environmental bacteria such as *Gordonia* spp. have been implicated as etiological agents in post-cardiac procedure surgical site infections. We report a case of a patient who presented with post-coronary artery bypass sternal osteomyelitis caused by this uncommon pathogen, and review relevant medical literature to identify commonalities in presentation, diagnosis and management. Repeat isolation of *Gordonia bronchialis* in the setting of post-procedure wound infection should raise suspicion for a real pathogenicity. Definitive identification requires a broad range of bacterial PCR DNA amplification and sequencing followed by susceptibility testing as treatment may require a prolonged course of antibiotics.

## Introduction

Postoperative surgical site infection (SSI) is an uncommon but severe complication following open cardiac surgery with an incidence varying between 1% and 4% depending on compliance with preventive measures, patient baseline risk factors, pre-, peri-, and post-operative risk factors, and degree of postoperative surveillance [1,2]. Factors associated with infection include high-risk preoperative state, obesity, older age, chronic obstructive pulmonary disease, transfusion, prolonged ventilation, postoperative vasopressin support, and bilateral internal thoracic arterial bypass grafting [1,2]. Microorganisms associated with sternal wound infections are primarily skin commensals with about 72% identified as gram-positive cocci [3]. Rarely, environmental bacteria such as *Gordonia* spp. have been implicated as etiological agents of surgical site and catheter-associated infections [1,2,4–10]. Here, we report a patient who presented with sternal osteomyelitis following infection with this uncommon pathogen and review relevant literature.

## Case presentation

An 81-year-old man with a past medical history of hypertension, mixed hyperlipidemia, and triple-vessel coronary artery disease

underwent coronary artery bypass graft (CABG) with bilateral internal thoracic artery and saphenous vein grafts. Two months later, he presented to the emergency department with complaints of sternal wound redness and incisional site pain of two weeks duration with drainage of a whitish fluid from the mid-portion of the incision. He denied fever, chills, night sweats, or other systemic symptoms, and he was afebrile and hemodynamically stable upon admission. Examination of his wound revealed a 1 cm × 1 cm erythematous, warm, tender, and swollen abscess about an inch-deep that was draining whitish purulent fluid.

The abscess was drained, thoroughly irrigated with normal saline until healthy granulation tissue was observed at the base, and packed with iodoform packing strips that were exchanged on a daily basis (Fig. 1). Abscess fluid was sent for microscopy and culture. The patient was started empirically on an intravenous (IV) regimen of vancomycin and cefazolin which was then transitioned to oral amoxicillin/clavulanate after 48 h. His symptoms, however, persisted at the one and three week follow-up visits.

The patient's white blood cell count (WBC) was normal at this visit but he had a mild increase in high sensitivity C-reactive protein (CRP) at 3.3 mg/dL [normal range: 0.0–1.0 mg/dL]. Blood cultures were negative. An initial computed tomography (CT) of the chest with contrast showed inflammatory changes surrounding the sternum with non-union

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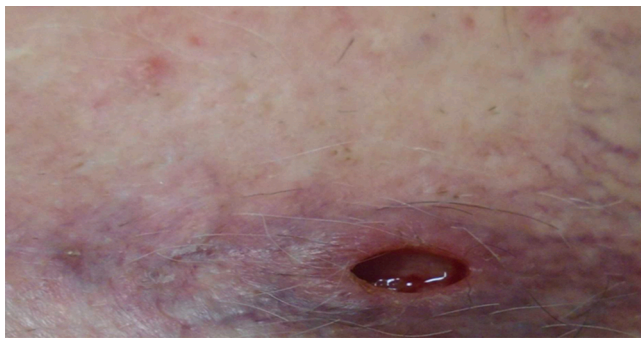


Fig. 1. Demonstration of the sternal wound at initial presentation.

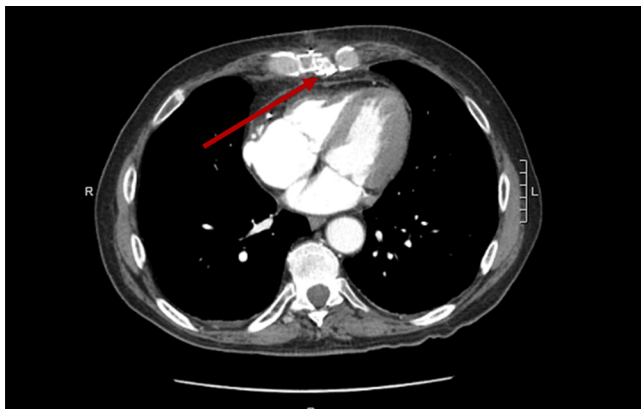


Fig. 2. Computed tomography of the chest with contrast showing inflammatory changes surrounding the sternum with non-union of sternal components (arrow).



Fig. 3. Erythema around the sternal wound edges with surrounding blisters (arrow) one week after completion of intravenous ceftriaxone.

of sternal components yet with no obvious abscess (Fig. 2).

Due to persisting wound erythema and poor healing on follow-up evaluation, the patient underwent sternal wound debridement and excision one month post-index visit. Wound management included

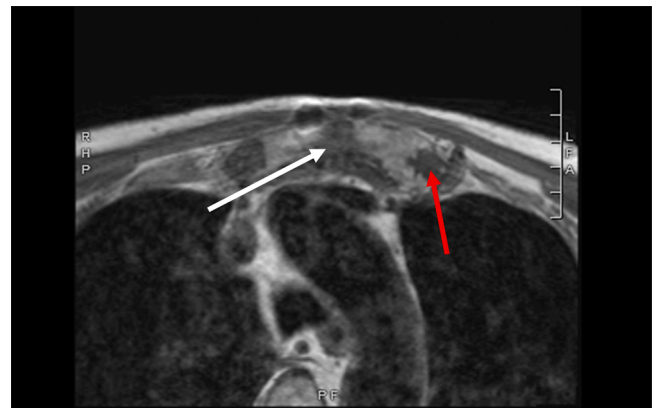


Fig. 4. Magnetic resonance imaging of the sternum with contrast showing chronic sternal non-union with reactive bone edema (white arrow) with a small non-enhancing fluid channel (red arrow) adjacent to the area of osteomyelitis suggesting a small fistulous tract extending to the skin surface.

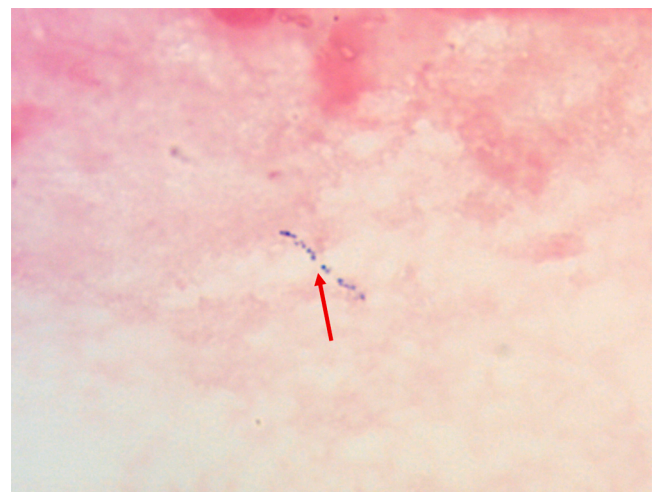


Fig. 5. Gram stain showing rare beaded Gram-positive rods consistent with the appearance of an aerobic actinomycete (arrow).

excision of necrotic tissue and debridement of sternum, removal of sternal wires, and vacuum-assisted closure (VAC) placement followed by hyperbaric oxygen therapy.

Aerobic culture of the patient's initial incisional discharge fluid grew numerous gram-positive bacilli initially reported as coryneform species. As a result, he was started on a six-week regimen of intravenous ceftriaxone based on preliminary results of microbial susceptibility testing. During the course of this treatment, the patient's chest pain symptoms improved as did wound healing. However, one week following completion of the ceftriaxone regimen, he developed recurrent anterior chest wall pain and erythema around the wound edges with surrounding blisters (Fig. 3). Repeat laboratory analysis of blood samples were notable for leukocytosis (WBC of 13,600/ $\mu$ L [normal range: 4100–10,900 / $\mu$ L]) and mildly elevated CRP (4.1 mg/dL [normal range: 0.0–1.0 mg/dL]).

Magnetic resonance imaging of the sternum with gadolinium contrast was performed that revealed evidence of chronic sternal non-union with reactive bone edema involving the entire sternum and localized abnormal signal changes as well as bone erosion compatible with osteomyelitis involving the sterno-manubrial junction and upper portion of the sternum. Also visualized was a small non-enhancing fluid channel adjacent to the area of osteomyelitis that suggested the presence of a small fistulous tract extending to the skin surface (Fig. 4).

**Table 1**  
Literature summary of sternal osteomyelitis post-cardiac bypass procedure.

Author/Reference	Site of Infection	Species	Treatment/Duration	Outcome
Richet et al., 1991 [7]	Sternal wound Infection	<i>Gordonia bronchialis</i>	PO and IV antimicrobial agents + surgical debridement. ciprofloxacin PO/74 days TMP-SMX PO/122 days IV ceftriaxone/108 days	No relapses after treatments
Rodriguez-Lozano et al. 2016 [15]	Sternal wound infection	<i>Gordonia bronchialis</i>	PO and IV antimicrobial agents + surgical debridement. 1. clindamycin and ceftazidime 2. imipenem and ciprofloxacin (3 weeks) 3. teicoplanin+ciprofloxacin + rifampin (6 weeks)	No relapse after treatments
Ambesh et al., 2019 [5]	Sternal wound infection	<i>Gordonia bronchialis</i>	PO and IV antimicrobial agents + surgical debridement. 1. vancomycin and meropenem/duration unknown ceftaroline (8 weeks)	Outcome unknown
Akrami et al., 2017 [2]	Sternal wound infection	<i>Gordonia bronchialis</i>	Antimicrobial agents + surgical debridement 1. vancomycin and cefotetan (unknown duration)	No relapse after treatment
Chang et al., 2014 [9]	Sternal wound infection	<i>Gordonia bronchialis</i>	Antimicrobial agents + surgical debridement 1. vancomycin and cefotetan (unknown duration) 2. penicillin G (unknown duration) 3. imipenem/8 weeks	No relapse after treatments

Abbreviations: IV: intravenous, PO: per os (by mouth), TMP-SMX: trimethoprim/sulfamethoxazole.

Based on these findings, the patient underwent a repeat exploration of the sternal wound with excisional debridement of soft tissue and the sternum, placement of inflow and outflow catheters, and subsequent closure using bilateral pectoralis myo-cutaneous advancement flaps.

Both tissue and bone samples grew aerobic gram positive bacilli that were now sent for definitive identification using broad range bacterial PCR DNA amplification and sequencing as well as Gram stain analysis. *Gordonia bronchialis* was subsequently identified in both tissue and bone samples. Gram stain revealed the presence of rare, beaded Gram-positive rods consistent with the appearance of an aerobic actinomycete (Fig. 5). Susceptibility testing for aerobic actinomycetes using Clinical and Laboratory Standards Institute guidelines demonstrated susceptibility to amikacin, augmentin, ciprofloxacin, clarithromycin, imipenem, linezolid, moxifloxacin, tobramycin and intermediate susceptibility to doxycycline, minocycline, and ceftriaxone [11].

The patient was started on a six week regimen of IV ampicillin/sulbactam. He had no chest symptoms during the course of treatment, and his wound healed optimally. Due to concerns for further relapse, upon completion of the IV antibiotic regimen the patient was transitioned to oral amoxicillin/clavulanate for another six weeks. Treatment was well-tolerated and during outpatient follow-up there was complete resolution of symptoms and with the wound now appearing well apposed and completely healed.

## Discussion

Organisms in the genus *Gordonia* are aerobic, non-spore forming, non-motile, and noncardioform actinomycetes that are catalase-positive, gram-positive to gram-variable, and weakly acid-fast using standard microbial analyses [4,8,11]. These bacterial species are commonly found in the soil but have also been isolated from the saliva of wild and domesticated dogs [7,12].

Species within the genus have been increasingly recognized as human pathogens in hospitalized patients, particularly in the setting of intravascular catheter related infections and uncommonly from sternal wounds [2,4–10]. In our patient, *G. bronchialis* was isolated from the sternal wound upon abscess drainage and from debrided tissue and bone on multiple occasions. Although the first set of cultures collected at two months post-CABG were reported as containing coryneform bacilli, we were not certain of the exact bacterial genus. Therefore, our patient was initially treated with IV ceftriaxone for a total of six weeks based on initial microscopic and susceptibility test results.

After the first regimen of antimicrobials, the patient subsequently presented with a second wound dehiscence and sinus tract formation with positive culture results for *G. bronchialis*, and he was treated again with excisional debridement of soft tissue and sternum. Molecular analysis of soft tissue and bone samples demonstrated *G. bronchialis* and

susceptibility tests showed intermediate sensitivity to doxycycline, minocycline and ceftriaxone. As a result, the initial empirical IV ceftriaxone was transitioned to IV ampicillin/subactam for total of six weeks.

The insidious and recurrent nature of the patient's sternal infection and osteomyelitis with repeated positive cultures from different samples documents this case as a true infection with *G. bronchialis*. Further analysis of the patient's history did not reveal any epidemiological source for this infection though it is suspected to have been community-acquired in part because of the timing and because there have not been any documented post-surgical site infections from similar organisms in our health system.

Although infection with *G. bronchialis* is rare in immunocompromised and immunocompetent humans, serious infections such as sternal wound infection/osteomyelitis post CABG, bacteremia, pleural infection, and recurrent breast abscess have been reported in the literature [2,5–10]. The number of these reports have been increasingly documented in the literature which could be a result of the increasing use of 16 S rDNA or hsp65 gene sequencing methods. Nucleic acid sequencing methods are preferable to other methods because it provides the opportunity for definitive identification [14]. However, because of limited availability and cost of comprehensive sequencing, many clinical laboratories use a combination of pathology staining and culture- and/or mass spectrometry-based methods to identify microbial species involved in SSIs [9]. Even with our comprehensive panel of staining, culture, and antibiotic susceptibility analyses, we were not able to definitively identify and satisfactorily address the infection until we analyzed the patient's bone and soft tissue samples with 16 S rDNA and hsp65 gene sequencing. Though treating the infection with debridement and a six week regimen of ceftriaxone initially improved our patient's surgical site wound, he was re-admitted a week after antibiotic completion which highlights the insidious and difficult-to-treat nature of this organism. Our patient was treated with oral and IV antibiotics for greater than twelve weeks before making a full recovery.

Identification of *Gordonia* to the species level is important in clinical practice as multiple identified species in the genus, such as *G. sputi* and *G. terrae*, have been isolated from blood, soft tissues, brain abscesses, and mediastinitis after various surgical procedures [8]. A standardized guideline for the treatment of *G. bronchialis* infection remains to be specified. However, there have been reports of treating this lesser known bacteria with antibiotics including imipenem, combination therapy with vancomycin plus ceftriaxone followed by augmentin, ceftriaxone plus ciprofloxacin, and ceftaroline [2,5,7,9]. A regimen of trimethoprim-sulfamethoxazole has been tried but has poor efficacy against *Gordonia* spp. in some publications [13,14] and 11% of the species are resistant to vancomycin [14]. Seventy percent of *Gordonia* spp. isolates have been reported as being susceptible to penicillin [9]. Our review of the literature suggests that outcomes of patients with

*G. bronchialis* infection were optimal when treated with 6–12 weeks of antibiotic therapy plus debridement in cases of sternal wound infection/osteomyelitis post CABG as shown in Table 1.

## Conclusion

*Gordonia* spp. are environmental pathogens that uncommonly cause post-CABG sternal osteomyelitis that may require a prolonged course of antibiotic treatment. A high clinical index of suspicion with associated prompt molecular identification of this uncommon pathogen is vital for proper treatment and avoidance of relapse. Repeat isolation of an uncommon organism initially suspected to be a skin colonizer should raise suspicion for a real pathogen and prompt further work-up by molecular methods to aid in identification of the pathogen for prognostic and therapeutic purposes. This case report adds to the growing body of evidence needed to make recommendations regarding the optimal identification and treatment of this uncommon pathogen.

## Consent

Informed consent was obtained from the patient.

## Conflicts of interest

We have no conflicts of interest to disclose.

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