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Case report

# Bacteremia caused by cellulosimicrobium in a bone marrow transplant patient: A case report and literature review

Jose Armando Gonzales Zamora*, Nicholas Camps

*Division of Infectious Diseases, Department of Medicine, University of Miami, Miller School of Medicine, Miami 33136, FL, USA*

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ABSTRACT

*Background:* *Cellulosimicrobium* sp. is a ubiquitous gram-positive bacillus that was formerly known as *Oerskovia.* This bacterium is found in soil and decaying plant material and is rarely associated with infections in humans.
*Case report:* We report the case of a 44 year-old woman with history of bone marrow transplant that developed *Cellulosimicrobium* sp. bacteremia secondary to a central line infection. She was admitted with presumed sepsis. Blood cultures from central line and periphery revealed the growth of gram-positive rods that were further identified as *Cellulosimicrobium sp.* by MALDI-TOF. She was treated with vancomycin and line removal. Microbiologic cure was achieved; however, she developed hospital-acquired pneumonia, which led to a fatal outcome.
*Conclusion:* To our knowledge, there are only 15 documented cases of *Cellulosimicrobium* sp. bacteremia. Our case illustrates the potential pathogenicity of this bacterium and the importance of appropriate antimicrobial therapy and removal of infected central catheters. It is essential to know that gram-positive bacilli should not be disregarded as contaminants when recovered from multiple blood cultures. In this situation, a full microbiologic identification must be attempted.

## Introduction

*Cellulosimicrobium* sp. is a gram-positive bacillus that belongs to the order Actinomycetales. It was formerly known as *Oerskovia*, but was recently reclassified as *Cellulosimicrobium* based on phylogenetic evidence and chemotaxonomic status. The organism is widely distributed in the environment and has been isolated from soil, decaying plant material, brewery sewage, and aluminum hydroxide gel [1]. It is relatively avirulent and rarely associated with human infections. Clinically significant isolates have been described mainly in immunocompromised hosts or in patients with indwelling access devices [2]. We present a case of *Cellulosimicrobium* sp. bacteremia secondary to central line infection in a bone marrow transplant patient. To our knowledge, there are only 15 cases of bacteremia due to this organism documented in the English literature. We also review the literature for similar cases and summarize clinical presentation, diagnosis and management.

## Case description

A 44 year-old African-American woman presented to the Hematology/Oncology clinic with complaints of weakness and fatigue. Her past medical history was significant for HTLV associated T-cell lymphoma/leukemia for which she underwent allogenic bone marrow transplant. Despite transplant, she developed disease relapse and graft failure resulting in blood transfusion dependence. She was recently admitted due to disseminated aspergillosis involving the skin and lungs. At the time of admission, she was on treatment with oral posaconazole and high dose micafungin administered via left tunneled internal jugular catheter. Her prophylaxis regimen included oral acyclovir, oral levofloxacin and monthly inhaled pentamidine. On physical exam, she was hypotensive (83/57 mmHg), tachycardic (117 bpm) and afebrile. Her skin revealed a non-tender ulceration of 2 cm in diameter in right distal leg without erythema, discharge or induration. She had a left internal jugular tunneled catheter, which has been in place for approximately 5 weeks. The catheter exit site did not revealed any erythema or drainage. The patient was admitted to the intensive care unit with a presumptive diagnosis of sepsis. Blood cultures were obtained from the central line and periphery. She was empirically treated with cefepime and vancomycin. Laboratory studies were significant for leukopenia (2.0 K/uL) with an absolute neutrophil count of 0.04 K/uL, low hemoglobin (10.2 g/dL), thrombocytopenia (platelet count of 25 K/uL),

* Corresponding author at: Division of Infectious Diseases, Department of Medicine, University of Miami, Miller School of Medicine, 1120 NW 14th Street, Suite 863B, Miami, FL 33136, USA.
*E-mail addresses:* jxg1416@med.miami.edu (J.A. Gonzales Zamora), nicholas.camps@jhsmiami.org (N. Camps).

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**Table 1**
Summary of Cases Reported in the Literature for Cellulosimicrobium bacteremia.

| Ref | Age(y)/sex | Underlying disease | Infection | Foreign body/Source removal | Antibiotic therapy | Outcome |
|---|---|---|---|---|---|---|
| [3] | 68/M | Crohn's, ankylosing spondylitis | Endocarditis | Prosthetic valve/yes | SXT + AMP − > AMX | Cure |
| [4] | 3/M | Acute myelogenous leukemia | CVC-related bacteremia | CVC/yes | AMK | Cure |
| [5] | 40/F | Crohn's, short bowel syndrome | Bacteremia from TPN contamination | CVC/no | VAN + GEN + MET − > VAN | Cure |
| [6] | 40/M | Cirrhosis, variceal hemorrhage | Bacteremia | None | CRO + CLI − > CRO + VAN − > + GEN | Cure |
| [7] | 54/F | Metastatic breast cancer | Bacteremia, pneumonia | Unclear | CXM − > VAN | Cure |
| [8] | 49/F | Metastatic colonic cancer | CVC-related bacteremia | CVC/no | VAN | Cure |
| [9] | 27/M | HIV | CVC-related bacteremia | CVC/yes | IPM + AMK | Cure |
| [10] | 53/F | Non-Hodgkin's lymphoma, BMT | CVC-related bacteremia, endocarditis | CVC/yes | DOX − > CLI − > MPM − > SXT + AMX − > PEN | Death |
| [11] | 64/F | Immunocompromised | Bacteremia | None | TZP − > + NET − > NET + VAN − > TZP | Cure |
| [12] | 27/M | Renal transplant | CVC-related bacteremia, endocarditis | CVC/yes | SAM + VAN − > Caz + VAN − > VAN | Cure |
| [13] | 13/M | Short bowel syndrome | CVC-related bacteremia | CVC/no | VAN− > + RIF | Cure |
| [14] | Neonate/M | None | Bacteremia | None | CTX + AMP − > VAN | Cure |
| [15] | 81/M | None | CVC-related bacteremia, endocarditis | CVC/yes, prosthetic valve/no | VAN + GEN | Death |
| [16] | 80/M | ESRD on hemodialysis | CVC-related bacteremia | CVC/yes | VAN | Cure |
| [17] | 59/F | Metastatic rectal cancer | CVC-related bacteremia | CVC/yes | VAN + IPM + VAN locks − > VAN | Cure |
| Present report | 44/F | T-cell lymphoma/leukemia, BMT | CVC-related bacteremia | CVC/yes | VAN + CPM − > VAN + MPM − > VAN | Death |

Ref, reference; M, male; F, female; CVC, central venous catheter; TPN, total parenteral nutrition; HIV, human immunodeficiency virus; BMT, bone marrow transplant; ESRD, end stage renal disease; SXT, trimethoprim-sulfamethoxazole; AMP, ampicillin; AMX, amoxicillin; AMK, amikacin; VAN, vancomycin; GEN, gentamycin; MET, metronidazole; CRO, ceftriaxone; CLI, clindamycin; CXM, cefuroxime; IPM, imipenem; DOX, doxycycline; MPM, meropenem; PEN, penicillin; TZP, piperacillin-tazobactam; NET, netilmicin; TZP, piperacillin-tazobactam; SAM, ampicillin-sulbactam; Caz, ceftazidime; RIF, rifampin; CTX cefotaxime; CPM, cefepime.

high creatinine (1.24 mg/dL) and marked elevation of transaminases (AST 505 U/L and ALT 477 U/L). Chest computed tomography showed bilateral perihilar and pulmonary nodules. These findings were unchanged from previous images taken one month ago. On day one of hospitalization, the patient's hypotension worsened requiring norepinephrine infusion. Antibiotic therapy was escalated from cefepime to meropenem; vancomycin was continued. Given the transaminitis, intravenous isavuconazole was substituted for the posaconazole and intravenous micafungin continued. On hospital day two, four sets of blood cultures grew gram-positive rods, which were further identified as *Cellulosimicrobium* sp. by matrix-assisted laser desorption ionization time of flight (MALDI-TOF). This technique was only able to identify the organism to the genus level. In vitro susceptibility testing performed by E-test showed the following results: Benzyl penicillin minimum inhibitory concentration (MIC) = 0.012 ug/mL, levofloxacin MIC > 32 ug/mL and vancomycin MIC = 0.38 ug/mL. Given the high suspicion for catheter related bloodstream infection, the tunneled catheter was removed. The catheter tip grew *Cellulosimicrobium* sp. The patient clinically improved with resolution of hypotension, acute renal failure and transaminitis. Meropenem was discontinued and oral levofloxacin was resumed for neutropenic prophylaxis. Repeat blood cultures became negative 2 days after intravenous vancomycin therapy. The patient was discharged in stable condition to complete a two-week course of intravenous vancomycin as an outpatient. She was readmitted eight days after hospital discharge with pneumonia, which led to her death.

## Discussion

*Cellulosimicrobium sp*. is an environmental bacterium, known to cause opportunistic infections in immunocompromised individuals. Documented infections include catheter-related bacteremia, peritonitis, endocarditis, cellulitis, keratitis, pyonephrosis and ventriculitis [2]. In the majority of cases, the organism gained entry into the body through the presence of foreign bodies, including central catheters, prosthetic valves, contact lens, peritoneal catheters or ventriculoperitoneal shunts. Our patient developed *Cellulosimicrobium* sp. bacteremia secondary to a central line infection. When gram-positive bacilli were reported from blood cultures, we initially suspected *Corynebacterium spp*., a common skin contaminant. However, with multiple blood cultures positive, contamination was unlikely. Our diagnosis of central line infection was later confirmed by the growth of *Cellulosimicrobium* sp. from the catheter tip culture.

To review our current state of knowledge on this subject, we searched MEDLINE (1946 to May 2017) via OVID and EMBASE (1967 to May 2017) via Scopus for the relevant Medical Subject Headings terms in English-language literature. The terms included in our search were "*Oerskovia*" and "*Cellulosimicrobium*". We considered only the cases in which any of these two organisms were identified as the cause of bacteremia. We also searched within references of these case reports for relevant articles. We found 15 case reports fitting our search criteria [3–17] (Table 1). The mean age of affliction was 43.9 years, ranging from 0 to 81 years. There was a male predominance, with a male to female ratio of 3:2. The majority of the patients (86%) presented certain degree of immunosuppression that included neoplastic conditions, rheumatologic diseases or history of transplant. Our patient's clinical characteristics were similar to the ones described in the literature. She was severely immunocompromised due to her history of bone marrow transplant and leukemia/lymphoma relapse.

There were 9 (60%) cases of *Cellulosimicrobium* sp. bacteremia secondary to central catheter infections; 3 of them led to endocarditis. Three patients developed bacteremia without an identified source. Reller et al. reported a case of endocarditis, in which the infection focus was probably a contaminated homograft heart valve [3]. Despite negative preoperative cultures of the involved homograft tissue, the authors could not completely exclude the possibility of contamination, especially after isolation of *Cellulosimicrobium* sp. in other valves harvested at the same medical center. Another case to highlight was reported by Guss et al., in which the source of infection was contaminated total parenteral nutrition [5]. McDonald et al. described a patient with confirmed *Cellulosimicrobium sp*. bacteremia and pneumonia. [7]. The lower respiratory tract was suspected as the source of this patient's bacteremia, but it was not proved by cultures.

There are no standards for treatment of *Cellulosimicrobium* bacteremia and selection of therapy is largely based on case reports. The organism appears to be most susceptible to vancomycin, trimethoprim/

sulfamethoxazole and rifampin. In vitro studies have shown consistent resistance for macrolides, lincosamides, aminoglycosides and penicillins. Susceptibility to cephalosphorins and quinolones is variable [14]. Our patient's strain was resistant to quinolones and susceptible to vancomycin and penicillin.

In the majority of reports removal of the foreign body has been a crucial part of the treatment. However, good outcomes have been achieved with central line retention and treatment with vancomycin and rifampin [13]. Maguire et al. reported a patient in whom successful treatment was obtained with vancomycin monotherapy and retention of the vascular access device [8]. In our patient, rapid deterioration prompted removal of her tunneled catheter, which with vancomycin therapy led to a microbiologic cure and a favorable clinical outcome. Our patient developed a fatal pneumonia before completing her antibiotic therapy, which did not allow a full evaluation at the end of therapy.

Favorable outcomes described in patients with *Cellulosimicrobium* sp. bacteremia are likely due to the low virulence of the organism. Of the 15 cases of bacteremia documented in the literature, 13 patients achieved cure. The only 2 fatal cases occurred in patients who developed endocarditis as a result of bacteremia [10,15].

## Conclusions

The report illustrates the pathogenic potential of *Cellulosimicrobium* in immunocompromised patients with central catheters. The isolation of gram-positive rods from multiple blood cultures should always raise the suspicion for a clinically significant infection. In this situation, coryneform gram-positive bacilli should not be disregarded as contaminants and a full microbiologic identification must be attempted at least to the genus level. The early recognition of this infection is crucial to initiate appropriate antimicrobial therapy and to remove any potentially infected foreign bodies. Our case supports the use of vancomycin for the treatment of this organism.

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## Declaration of interest

On the behalf of all authors, the corresponding author states that there is no conflict of interest.

## Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

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