



Case report

Bacteremia and central line infection caused by *Bosea thiooxidans*Caleb Skipper^{a,*}, Patricia Ferrieri^b, Winston Cavert^{a,*}^a Department of Medicine, University of Minnesota Medical School, Minneapolis, Minnesota, USA^b Departments of Medicine and Laboratory Medicine and Pathology, University of Minnesota Medical School, Minneapolis, Minnesota, USA

ARTICLE INFO

Article history:

Received 18 November 2019

Received in revised form 26 November 2019

Accepted 26 November 2019

Keywords:

Bacteremia

Central line infection

Gram-negative bacteria

Bosea thiooxidans

ABSTRACT

We describe a case of central venous catheter infection and bacteremia caused by *Bosea thiooxidans*, which has not been previously described in the literature. *Bosea spp.* is a gram-negative bacterium that has been isolated from hospital water supplies and may become an important cause of nosocomial infections.

© 2019 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Long-term venous access devices can be complicated by bacterial infection, with rates as high as 0.35 events per 1000 catheter days in adult cancer patients [1]. Infections of indwelling catheters may have a range of symptomatic manifestation, from asymptomatic colonization to septic shock. Traditionally gram-positive bacteria have been considered the most common etiology of venous catheter infections, though gram-negative bacteria are increasingly being noted [1–3]. The advent of advanced microbiological diagnostics, such as mass spectrometry and ribosomal gene sequencing, has expanded the archive of organisms that may cause human disease. Herein, we present a case of a port-a-cath infection with symptomatic bacteremia caused by a novel gram-negative pathogen.

Case

A 70 year-old female was referred to an infectious diseases clinic with a chief complaint of recurrent fevers and chills. The patient had a past medical history of chronic gastroparesis requiring a gastric pacemaker, and had a port-a-cath implanted four years prior for frequent IV fluid administrations related to her severe gastroparesis. She described a year of transient fevers, chills,

tachycardia, and malaise each time the port was accessed and flushed—episodes which spontaneously resolved without treatment within 12–24 hours.

Additional past medical history included hypertension and Meniere's disease. Her family and social history were non-contributory, including no history of injection drug use. She reported allergies to penicillin and trimethoprim/sulfamethoxazole and was not on any antimicrobials at the time of referral.

On exam, the patient was afebrile with normal vital signs. She was generally well-appearing and cardiopulmonary and abdominal exams were unremarkable. She had no stigmata of endocarditis. Examination of her chest port site revealed mild tenderness around the port hub but no evidence of erythema or exudate.

A peripheral blood culture drawn 37 days prior grew an initially unidentified gram negative rod on the 3rd day of incubation in a single aerobic blood culture bottle (BD BACTEC™, Becton Dickinson, Sparks, MD). It grew as grey colonies on a sheep blood agar plate and as a non-lactose fermenter on MacConkey agar. There was inadequate identification by MALDI-TOF mass spectrometry and biochemical testing. The patient received a single dose of ceftriaxone at that time but had no further antimicrobial treatment. Blood cultures repeated at time of the referral visit grew a similar gram negative rod, this time from both the port draw (3rd day of incubation in both aerobic and anaerobic bottles) and the peripheral draw (5th day of incubation in aerobic bottle). The organism was sent to the Minnesota Department of Health and all isolates were identified as *Bosea thiooxidans* by 16S ribosomal RNA gene sequencing. The susceptibility profile is listed in Table 1.

The patient was treated with 14 days of intravenous ceftriaxone and had her port surgically removed. Repeat blood cultures documented

* Corresponding authors at: University of Minnesota, 689 23rd Ave SE, 4103 MRF, Minneapolis, Minnesota, 55455, USA.

E-mail addresses: skipp015@umn.edu (C. Skipper), caver003@umn.edu (W. Cavert).

Table 1
Antimicrobial susceptibility of isolated *Bosea thiooxidans*.

| Antibiotic | Minimum inhibitory concentration ($\mu\text{g/mL}$) |
|-------------------------|---|
| Amikacin | ≤ 16 |
| Cefepime | ≤ 2 |
| Ceftazidime | 4 |
| Ciprofloxacin | ≤ 1 |
| Gentamicin | ≤ 1 |
| Meropenem | ≤ 1 |
| Piperacillin/Tazobactam | ≤ 4 |
| Tobramycin | ≤ 1 |
| Ampicillin | ≤ 8 |
| Ampicillin/Sulbactam | 2 |
| Ceftriaxone | ≤ 1 |
| Cefotaxime | ≤ 2 |
| Imipenem | ≤ 0.5 |
| Tetracycline | ≤ 4 |
| Levofloxacin | ≤ 1 |
| Cefoxitin | ≤ 8 |

clearance of the bacteremia. She reported full recovery without any *Bosea* recurrence at 18-months follow-up.

Discussion

Bosea thiooxidans is a gram-negative, flagellated bacterium first described in 1996 by Das et al. as a novel thiosulfate-oxidizing organism found in soil samples [4]. Subsequently, eight more species have been added to the genus [5–8]. Clinically significant infection has been rarely reported, although the organism has been isolated from hospital-water supplies and bronchoalveolar lavage specimens [6,9]. *Bosea spp.* have been shown to survive in free-living amoeba—which may serve as environmental reservoirs and condition the bacteria to resist degradation by macrophages—raising concern that the organism could establish a niche as a pneumonic pathogen [10]. A case of endophthalmitis caused by *Bosea thiooxidans* after cataract surgery in an immunocompetent 86 year-old man has been reported [11].

To the best of our knowledge, this is the first case of *Bosea thiooxidans* bacteremia reported in the literature. Given the unique clinical presentation, including persistently positive blood cultures and syndromic resolution with treatment, we feel confident that the *Bosea* isolated represented the true pathogen of an infected indwelling venous catheter. It is possible the organism originated from a hospital water source and was acquired through frequent port access in emergency departments. Her one-year duration of symptoms suggests that *Bosea* established a relatively indolent but persistent infection.

Antimicrobial testing of initially-described non-clinical isolates demonstrated high minimum inhibitory concentration (MIC) values to natural and amino-penicillins, variable MIC values to third-generation cephalosporins and fluoroquinolones, and consistently low MIC values to tetracyclines [6]. In comparison, our isolate demonstrated overall greater antimicrobial susceptibility than the previously described environmental isolates. We elected to treat with a 14-day course of intravenous ceftriaxone, given a low MIC of $<1.0 \mu\text{g/mL}$ and ease of once-daily administration.

Human infections due to *Bosea spp.* are an emerging clinical entity. Here we present a novel case of bacteremia due to *Bosea thiooxidans*. As diagnostic technologies in clinical microbiology continue to advance, encounters with novel pathogens as causes of human disease are likely.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Funding

This work was supported in part by the National Institute of Allergy and Infectious Diseases [grant number T32AI055433] and a combined National Institute of Neurological Disorders and Stroke and Fogarty International Center award (grant number D43TW009345) via the Northern Pacific Global Health Fellows Program.

CRedit authorship contribution statement

Caleb Skipper: Investigation, Writing - original draft. **Patricia Ferriero:** Resources, Writing - review & editing. **Winston Cavert:** Supervision, Writing - review & editing.

Declaration of Competing Interest

The authors report no conflicts of interest.

Acknowledgement

We would like to thank our patient for her cooperation in her care and willingness to have her case described.

References

- [1] Pinelli F, Cecero E, Degl'Innocenti D, et al. Infection of totally implantable venous access devices: a review of the literature. *J Vasc Access* 2018;19:230–42.
- [2] Zakhour R, Hachem R, Alawami HM, et al. Comparing catheter-related bloodstream infections in pediatric and adult cancer patients. *Pediatr Blood Cancer* 2017;64.
- [3] Buetti N, Lo Priore E, Atkinson A, Widmer AF, Kronenberg A, Marschall J. Catheter-related infections: does the spectrum of microbial causes change over time? A nationwide surveillance study. *BMJ Open* 2018;8:e023824.
- [4] Das SK, Mishra AK, Tindall BJ, Rainey FA, Stackebrandt E. Oxidation of thiosulfate by a new bacterium, *Bosea thiooxidans* (strain BI-42) gen. nov., sp. nov.: analysis of phylogeny based on chemotaxonomy and 16S ribosomal DNA sequencing. *Int J Syst Bacteriol* 1996;46:981–7.
- [5] De Meyer SE, Willems A. Multilocus sequence analysis of *Bosea* species and description of *Bosea lupini* sp. nov., *Bosea lathyri* sp. nov. and *Bosea robiniae* sp. nov., isolated from legumes. *Int J Syst Evol Microbiol* 2012;62:2505–10.
- [6] La Scola B, Mallet MN, Grimont PA, Raoult D. *Bosea eneeae* sp. nov., *Bosea massiliensis* sp. nov. and *Bosea vestrisii* sp. nov., isolated from hospital water supplies, and emendation of the genus *Bosea* (Das et al. 1996). *Int J Syst Evol Microbiol* 2003;53:15–20.
- [7] Ouattara AS, Assih EA, Thierry S, et al. *Bosea minatitlanensis* sp. nov., a strictly aerobic bacterium isolated from an anaerobic digester. *Int J Syst Evol Microbiol* 2003;53:1247–51.
- [8] Safronova VI, Kuznetsova IG, Sazanova AL, et al. *Bosea vaviloviae* sp. nov., a new species of slow-growing rhizobia isolated from nodules of the relict species *Vavilovia formosa* (Stev.) Fed. Antonie Van Leeuwenhoek 2015;107:911–20.
- [9] Berger P, Papazian L, Drancourt M, La Scola B, Auffray JP, Raoult D. Ameba-associated microorganisms and diagnosis of nosocomial pneumonia. *Emerg Infect Dis* 2006;12:248–55.
- [10] Lamoth F, Greub G. Amoebal pathogens as emerging causal agents of pneumonia. *FEMS Microbiol Rev* 2010;34:260–80.
- [11] Dedania VS, Ghodasra DH, Zacks DN. Postoperative endophthalmitis caused by *Bosea thiooxidans*. *Retin Cases Brief Rep* 2017;11:329–31.