Case Report

Correspondence

James C. M. Brust
jcb26@columbia.edu

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Five cases of bacteraemia due to *Gordonia* species

James C. M. Brust,¹ Susan Whittier,² Brian E. Scully,³
Carlton C. McGregor⁴ and Michael T. Yin³

¹Divisions of General Internal Medicine and Infectious Diseases, Montefiore Medical Center, Albert Einstein College of Medicine, Bronx, NY, USA

²Department of Microbiology, College of Physicians and Surgeons, Columbia University, New York, NY, USA

³Division of Infectious Diseases, College of Physicians and Surgeons, Columbia University, New York, NY, USA

⁴Division of Pulmonary, Allergy, and Critical Care Medicine, College of Physicians and Surgeons, Columbia University, New York, NY, USA

Gordonia species are aerobic Gram-positive bacilli and a rare cause of human disease. To our knowledge, there are only two cases of human infection with *Gordonia sputi* reported in the literature. We report five cases of bacteraemia due to *Gordonia* species at our institution since 2005, including four caused by *G. sputi*. Three of these cases were likely related to chronic indwelling central venous catheters.

Introduction

Formerly classified as rhodococci, the genus *Gordonia* (previously *Gordona*) comprises a group of aerobic, weakly acid-fast, thin Gram-positive bacilli which are very rare causes of human disease (McNeil & Brown, 1994). There are a limited number of case reports describing infections caused by *Gordonia*, mostly with *Gordonia terrae*, and rarely with *Gordonia sputi* and *Gordonia bronchialis*.

Here, we report five cases of *G. sputi* and *G. bronchialis* bacteraemia since 2005 from our institution and attempt to define the host risk factors and disease course in order to develop treatment strategies for this emerging pathogen.

Case reports

Case 1

A 43-year-old woman with a history of systemic lupus erythematosus treated with plaquenil and pulmonary hypertension requiring chronic treprostinil infusion presented to the hospital. She had several prior admissions for central venous catheter infections, and a new subclavian Groshong catheter had been placed 6 months earlier. Three weeks prior to admission, she had been hospitalized for fever and diarrhoea, and responded to empiric metronidazole for *Clostridium difficile* colitis. Blood cultures were negative at that time.

Two days prior to admission, the patient was evaluated for fevers and rigors. Blood cultures drawn at that time, as well as subsequent admission cultures, grew beaded, branching Gram-positive rods. On admission, she was febrile to 103.5 °F and hypotensive, requiring pressor support. She

had no tenderness, erythema or drainage around her catheter site and she had no productive cough. She was initially started on vancomycin and piperacillin/tazobactam but this was changed to imipenem, amikacin and minocycline. Her Groshong catheter was removed, but the tip was not cultured. After the organism in her blood was identified as *G. sputi*, her antibiotics were readjusted empirically to vancomycin and imipenem, resulting in clinical improvement and sterilization of blood cultures.

The patient's husband, a construction worker, often managed her chronic infusions and admitted to occasional breaches in aseptic technique. His hands were cultured using the standard 'juiced glove' technique (Larson *et al.*, 2003), but *Gordonia* was not recovered.

Case 2

The patient was a 46-year-old woman with HIV on antiretroviral therapy (CD4 176 cells mm⁻³, HIV-1 plasma RNA <50 copies ml⁻¹), with hepatitis C cirrhosis and pulmonary hypertension requiring chronic treprostinil infusion via a subclavian Groshong catheter with a 2-month history of progressive dyspnoea on exertion, weakness, dry cough, night sweats and weight loss. A chest CT with contrast 1 month prior to admission demonstrated multiple small nodular and patchy opacities bilaterally. A repeat scan 2 weeks later demonstrated similar nodular opacities in new locations and some resolution of the initial nodules. Work-up included negative tests for serum cryptococcal antigen, *Aspergillus* galactomannan, and *Histoplasma* and *Legionella* urinary antigens. Bronchiolar lavage fluid from a bronchoscopy

1 week prior to admission was negative for *Pneumocystis jiroveci*, *Aspergillus* spp., *Nocardia* spp., *Actinomyces* spp., respiratory viruses, fungi and acid-fast bacilli.

Two days after her bronchoscopy, she was admitted for subjective fevers and worsening dyspnoea. She was afebrile and normotensive with a room air oxygen saturation of 93 %. A CT angiogram of the chest revealed no pulmonary embolus but more patchy small nodules in the upper lobes bilaterally. After 6 days, her admission blood cultures grew Gram-positive bacilli. She was started on vancomycin (hospital day 9), but developed acute respiratory failure on hospital day 10. Repeat CT showed a new left lower lobe infiltrate and still more small nodular lesions. She was admitted to the intensive care unit with a presumed diagnosis of aspiration pneumonia and treated with levofloxacin, tobramycin and vancomycin. On hospital day 15, the admission blood culture isolates were identified as *G. sputi* (susceptible to penicillin, imipenem, vancomycin, gentamicin and tobramycin; resistant to erythromycin). Although blood cultures from hospital day 2 were negative, blood cultures from the Groshong catheter drawn on hospital day 5 and peripherally on hospital day 11 were both positive for *G. sputi*. Her Groshong was removed and a transthoracic echocardiogram revealed no vegetations. She remained on vancomycin and imipenem; blood cultures from hospital day 12 and 19 were negative, but her respiratory status worsened, requiring vasopressors, inotropic support, inhaled nitric oxide and intubation. On hospital day 23, she expired. An autopsy was not performed.

Case 3

A 78-year-old female smoker with emphysematous chronic obstructive pulmonary disease (COPD) on home oxygen therapy presented to the hospital for nausea and diarrhoea. Several months before, she had been hospitalized for mesenteric ischaemia and was receiving parenteral nutrition via a Hickman catheter. Three weeks prior to admission, she received a short course of oral steroids for a COPD exacerbation. Several days prior to admission, she experienced nausea, vomiting, diarrhoea and lethargy; she was found to have a temperature of 100.5 °F and a white blood cell count of 19 000 cells ml⁻¹. On admission, her oxygen saturation was 96 % while receiving oxygen by nasal cannula at 2 l min⁻¹. She was given levofloxacin initially, but this was discontinued when stool studies and abdominal ultrasound were negative. Her Hickman catheter was removed on hospital day 8 with resolution of her fever. One bottle from a blood culture drawn on hospital day 7 was initially reported as *Corynebacterium* sp., but was later revised to be *G. sputi* (susceptibility testing not performed). The tip of her Hickman catheter, however, grew more than 15 colonies of *Staphylococcus epidermidis*. She was treated with 7 days of oral linezolid.

Case 4

A 67-year-old diabetic man presented to the hospital with a non-ketotic hyperosmolar coma. He remained in a persist-

ent vegetative state with severe ischaemic encephalopathy. Blood cultures drawn on the day of admission grew *G. bronchialis* (identified by the New York City Department of Health Laboratory). Despite a prolonged hospital stay and multiple subsequent admissions over the following 3 years, no additional cultures grew *Gordonia* species from any site.

Case 5

A 60-year-old man was admitted with a community-acquired pneumonia, complicated by a large pleural effusion. A chest tube was placed and he was treated with levofloxacin. Blood cultures drawn on the day of the second admission grew *G. sputi* (one of three sets). These were felt to be a contaminant and repeat blood cultures drawn on hospital day 9 remained negative. Two years later, he remained well in outpatient follow-up.

Methods

Blood cultures. All adult blood cultures consist of one aerobic (BACTEC Plus Aerobic/F) and one anaerobic (BACTEC Lytic/10 Anaerobic/F) bottle. Each bottle is inoculated with 8–10 ml blood and the recommendation is to collect a minimum of two sets per febrile episode. Bottles are loaded onto BACTEC 9240 instruments (Becton Dickinson) and held for 5 days. The *Gordonia* isolates recovered from these case patients were all detected within 16–28 h of incubation.

Organism identification. Gram stains prepared from the positive blood culture bottles demonstrated Gram-positive rods, consistent with *Corynebacterium* species. The following day, sparse bacterial growth was observed on 5 % sheep blood agar and chocolate plates. Gram staining of the colonies revealed medium to long beaded Gram-positive rods which were also modified acid-fast positive and non-branching. After 48 h of incubation, macroscopic observation demonstrated small dry colonies that were non-haemolytic, slightly pink, with undulating margins. Isolate identification was attempted using the API Coryne strip (bioMérieux), which employs dehydrated substrates for the determination of enzymic activity and/or fermentation of carbohydrates. Biochemical reactions were read at 24 and 48 h, in accordance with manufacturer's directions. With the exception of urease and nitrate, all reactions remained negative at 48 h. When entered into the API database, this biochemical pattern identified the organism as *Rhodococcus* sp. (98 % identification percentage). This identification was inconsistent with morphological observations; therefore, preliminary identifications were either a Gram-positive rod or *Corynebacterium* sp.

Definitive identification was obtained by partial 16S rRNA gene sequencing, which employs two eubacterial universal primers, P8-27 and P1392-1372, followed by a direct sequencing method (Blaschke *et al.*, 2007). Sequences obtained for our clinical isolates matched that of *G. sputi* present in the GenBank/EMBL database.

Discussion

Since their taxonomic differentiation 20 years ago, 29 different species of *Gordonia* have now been identified. There are very few reports in the literature of *Gordonia* species causing disease, but among them, *G. bronchialis* has been identified as a cause of catheter-related sepsis and skin abscesses (Sng *et al.*, 2004; Werno *et al.*, 2005). In 1991,

Richet and others reported a cluster of seven cases of sternal wound infection with *G. bronchialis* following coronary artery bypass graft surgery (Richet *et al.*, 1991). The outbreak was later traced to a colonized operating room nurse. To our knowledge, there have only been two reports in the literature of human infection with *G. sputi*. One of these described a case of mediastinitis in a patient following coronary artery bypass graft surgery, who was treated with soft tissue debridement and several weeks of cefmetazole and piperacillin (Kuwabara *et al.*, 1999). In the other report, Riegel and others described the first and only case of *G. sputi* bacteraemia in a patient with metastatic melanoma who was receiving treatment with interleukin-2 (Riegel *et al.*, 1996). The infection was eventually cured by a course of amikacin and piperacillin although the authors do not report the duration of therapy.

Our five cases of *Gordonia* bacteraemia are heterogeneous. In cases 4 and 5, the *Gordonia* appears to have been either a contaminant or a colonizer. Cases 1, 2 and 3, however, all appear to represent true disease attributable to infection with *G. sputi* although their presentations differed. Whereas the patient in case 1 presented with fairly rapid onset of fever and sepsis, the patient in case 3 had a prolonged course over several months, notable for migratory pulmonary nodules which were hypothesized to be small septic emboli from her Groshong catheter. Because a transoesophageal echocardiogram could not be performed, however, this remains speculative.

Some similarities between the cases are noteworthy. First, all three patients had chronic indwelling venous catheters, which is consistent with the few prior reports of *Gordonia* bacteraemia (Buchman *et al.*, 1992; Lesens *et al.*, 2000; Pham *et al.*, 2003; Riegel *et al.*, 1996). Although DNA fingerprinting of the isolates was not performed, we do not believe that these three infections represent a single outbreak as they were temporally separated by several months and the patients had no common exposure.

Finally, all three cases were notable for delays in identification of the pathogen. Without molecular sequencing, many laboratories may erroneously identify these organisms as *Corynebacterium* species. Several features contribute to the difficulty in identifying *Gordonia* species: the organism is slow-growing and biochemical identification of the aerobic actinomycetes is time-consuming, labour-intensive and often not conclusive. Gene sequencing using 16S rRNA and HPLC can help make definitive identifications, but not all laboratories have the equipment and personnel to carry out these methods. As a result, identification usually requires referral of the isolate to a reference laboratory (Blanc *et al.*, 2007; Gil-Sande *et al.*, 2006).

We conclude that *G. sputi* is a rare but important cause of catheter-related infection in patients with underlying

illness. Because identification of *Gordonia* species can be prolonged or inaccurate when using traditional biochemical methods, it may be important to consider infection with these organisms when blood culture pathogen identifications are inconclusive and the patient is not responding to current antimicrobial therapy.

References

- Blanc, V., Dalle, M., Markarian, A., Debunne, M. V., Duplay, E., Rodriguez-Nava, V. & Boiron, P. (2007). *Gordonia terrae*: a difficult-to-diagnose emerging pathogen? *J Clin Microbiol* **45**, 1076–1077.
- Blaschke, A. J., Bender, J., Byington, C. L., Korgenski, K., Daly, J., Petti, C. A., Pavia, A. T. & Ampofo, K. (2007). *Gordonia* species: emerging pathogens in pediatric patients that are identified by 16S ribosomal RNA gene sequencing. *Clin Infect Dis* **45**, 483–486.
- Buchman, A. L., McNeil, M. M., Brown, J. M., Lasker, B. A. & Ament, M. E. (1992). Central venous catheter sepsis caused by unusual *Gordonia* (*Rhodococcus*) species: identification with a digoxigenin-labeled rDNA probe. *Clin Infect Dis* **15**, 694–697.
- Gil-Sande, E., Brun-Otero, M., Campo-Cerecedo, F., Esteban, E., Aguilar, L. & Garcia-de-Lomas, J. (2006). Etiological misidentification by routine biochemical tests of bacteremia caused by *Gordonia terrae* infection in the course of an episode of acute cholecystitis. *J Clin Microbiol* **44**, 2645–2647.
- Kuwabara, M., Onitsuka, T., Nakamura, K., Shimada, M., Ohtaki, S. & Mikami, Y. (1999). Mediastinitis due to *Gordonia sputi* after CABG. *J Cardiovasc Surg (Torino)* **40**, 675–677.
- Larson, E., Aiello, A., Lee, L. V., Della-Latta, P., Gomez-Duarte, C. & Lin, S. (2003). Short- and long-term effects of handwashing with antimicrobial or plain soap in the community. *J Community Health* **28**, 139–150.
- Lesens, O., Hansmann, Y., Riegel, P., Heller, R., Benaissa-Djelloul, M., Martinot, M., Petit, H. & Christmann, D. (2000). Bacteremia and endocarditis caused by a *Gordonia* species in a patient with a central venous catheter. *Emerg Infect Dis* **6**, 382–385.
- McNeil, M. M. & Brown, J. M. (1994). The medically important aerobic actinomycetes: epidemiology and microbiology. *Clin Microbiol Rev* **7**, 357–417.
- Pham, A. S., De, I., Rolston, K. V., Tarrand, J. J. & Han, X. Y. (2003). Catheter-related bacteremia caused by the nocardioform actinomycete *Gordonia terrae*. *Clin Infect Dis* **36**, 524–527.
- Richet, H. M., Craven, P. C., Brown, J. M., Lasker, B. A., Cox, C. D., McNeil, M. M., Tice, A. D., Jarvis, W. R. & Tablan, O. C. (1991). A cluster of *Rhodococcus* (*Gordonia*) *bronchialis* sternal-wound infections after coronary-artery bypass surgery. *N Engl J Med* **324**, 104–109.
- Riegel, P., Ruimy, R., de Briel, D., Eichler, F., Bergerat, J. P., Christen, R. & Monteil, H. (1996). Bacteremia due to *Gordonia sputi* in an immunocompromised patient. *J Clin Microbiol* **34**, 2045–2047.
- Sng, L. H., Koh, T. H., Toney, S. R., Floyd, M., Butler, W. R. & Tan, B. H. (2004). Bacteremia caused by *Gordonia bronchialis* in a patient with sequestrated lung. *J Clin Microbiol* **42**, 2870–2871.
- Werno, A. M., Anderson, T. P., Chambers, S. T., Laird, H. M. & Murdoch, D. R. (2005). Recurrent breast abscess caused by *Gordonia bronchialis* in an immunocompetent patient. *J Clin Microbiol* **43**, 3009–3010.