Catheter-related bloodstream infection caused by *Gordonia terrae* in a bone-marrow transplant patient: case report and review of the literature

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Introduction: *Gordonia* spp. are a rare but recognized cause of bloodstream infections (BSIs), particularly catheter-related BSIs (CR-BSI). These infections are mostly associated with long-term central catheters and occur in immunocompromised patients. Their optimal management is still uncertain due to the paucity of cases.

Case presentation: We describe a case of CR-BSI by *Gordonia terrae* in a bone-marrow transplant patient. Definitive diagnosis of the CR-BSI was confirmed by using the differential time to positivity of blood cultures. The patient was treated with antibiotic therapy without catheter removal and the infection cleared despite the presence of persistent bacteraemia.

Conclusion: Although in the present case report persistent CR-BSI bacteraemia by *G. terrae* cleared without catheter removal, further experience is required to confirm that these infections can, in some cases, be successfully treated while retaining the catheter.

Keywords: bloodstream infection; catheter; diagnosis; *Gordonia* spp.; immunocompromised.
incubation. At that time, the patient was afebrile and had no clinical signs or symptoms of infection. In addition, there were no signs of infection at the insertion site of the catheter. To determine the clinical significance of the isolate, two sets of blood cultures collected from a percutaneous venipuncture (one set) and from the central catheter (one set) were taken and treatment with teicoplanin was started. Both peripheral and catheter blood cultures were positive for Gram-positive coryneform rods. The differential time to positivity between catheter and peripheral blood cultures was >120 min.

The catheter was not removed because the patient remained afebrile and had no clinical signs of sepsis. Repeated blood cultures after 1 week of treatment were still positive. Finally, blood cultures obtained after 14 days of intravenous therapy with teicoplanin were negative. Despite this, the patient died due to steroid-refractory GVHD 1 month after the first isolation of the *Gordonia* sp.

The organism was first identified by API Coryne system (BioMérieux) as *Rhodococcus* sp. The isolate was sent to the National Microbiology Center, Instituto de Salud Carlos III, Madrid, Spain, which confirmed identification of the organism as *G. terrae* by 16S rRNA gene sequencing analysis. Susceptibility testing was done by E-test (AB Biodisk) and a commercial broth microdilution method (MicroScan; Siemens Healthcare Diagnostics), which showed the following MICs: amikacin, <8 μg ml\(^{-1}\) (susceptible); amoxicillin-clavulanic acid, 0.25/0.12 μg ml\(^{-1}\) (susceptible); imipenem, 0.06 μg ml\(^{-1}\) (susceptible); linezolid, <4 μg ml\(^{-1}\) (susceptible); ciprofloxacin, 0.12 μg ml\(^{-1}\) (susceptible); gentamicin, 4 μg ml\(^{-1}\) (susceptible); tobramycin, 0.75 μg ml\(^{-1}\) (susceptible); cefotaxime, >8 μg ml\(^{-1}\) (resistant); cefepime, >256 μg ml\(^{-1}\) (resistant); erythromycin, >4 μg ml\(^{-1}\) (resistant); trimethoprim-sulfamethoxazole, >4/76 μg ml\(^{-1}\) (resistant); and vancomycin, 1 μg ml\(^{-1}\) (no interpretative breakpoint available). The interpretive criteria used for all antimicrobial agents, except vancomycin, were those recommended by the Clinical and Laboratory Standards Institute for mycobacteria, nocardiae and other actinomycetes (CLSI, 2011).

**Discussion**

*Gordonia* spp. have been identified as an unusual cause of different infections, mainly catheter-associated bacteraemia in immunocompromised patients. It is believed that their role as a cause of human infections could be underestimated, as their identification by conventional microbiological methods is difficult. Moreover, the microorganism is often misidentified as other actinomycetes, as initially occurred in this case, and requires the use of molecular techniques to secure an accurate identification to species level (Sng et al., 2004; Shen et al., 2006).

To date, a total of 33 other reported cases of *Gordonia* spp. BSIs in both adults (28 cases) and children (five cases) have been published. Of these, 23 cases (70 %), 18 in adults and five in children, were catheter-related bacteraemia. Other sources than a catheter were respiratory infections (Sng et al., 2004; Gupta et al., 2010; Johnson et al., 2011); acute cholecystitis (Gil-Sande et al., 2006) and unknown origin (Riegel et al., 1996; Lai et al., 2010).

Table 1 shows the relevant clinical information for the 18 CR-BSI adult cases and our case. Most cases were due to *G. terrae* (n=9) and *G. sputi* (n=7). Almost all isolates (15 isolates) were initially identified as *Rhodococcus* spp. by conventional biochemical tests. In one case, the isolate was identified as *Corynebacterium pseudodiphtheriticum*, and two case reports did not include biochemical identification.

Most of these BSIs occurred in cancer patients and were associated with long-term central venous catheter use. *Gordonia* spp., like many other actinomycetes, are able to colonize the human skin. In addition, they have the ability to produce extracellular polysaccharides and thereby to form biofilms (Arenskött et al., 2004). These are important features that strongly contribute to the development of catheter-related infections.

All the reported cases of CR-BSI caused by *Gordonia* spp. were considered true episodes of bacteraemia. However, catheter-related bacteraemia was confirmed in only two cases (cases 2 and 18). In case 13, there was no information concerning the laboratory diagnosis. In seven cases (patients 1, 4, 5, 6, 10, 11 and 12), the organism was isolated from a single blood culture obtained through the catheter. Therefore, it is questionable whether the *Gordonia* isolates were true pathogens or whether they represented contaminants or colonizers. For the eight remaining cases (patients 3, 7, 8, 9, 14, 15, 16 and 17), two sets of blood cultures (one obtained from the catheter and the other from a peripheral vein) were positive and six of these episodes were persistent bacteraemia or complicated infections. Therefore, it must be assumed that all these episodes represented true infections. Although the source of bacteraemia was not confirmed in any of these cases, the catheter was the most probable source of infection. The definitive diagnosis of CR-BSI was obtained by culture of the catheter tip (case 2), and paired quantitative blood cultures (case 18). In the present case, CR-BSI was confirmed by using the differential time to positivity of blood cultures drawn simultaneously from both the catheter and a peripheral vein.

Definitive diagnosis of CR-BSIs caused by unusual pathogens is crucial for guiding decisions regarding the management of these infections, particularly those regarding removal of the catheter. Overall, 10 of the 18 previous reported cases were treated with catheter removal, whilst in nine patients (including the present case), the catheter was left in situ.

The catheter was retained in most cases (6/9) in which the *Gordonia* sp. might represent a colonizer or a contaminant. By contrast, removal of catheter was the strategy of
<table>
<thead>
<tr>
<th>Case</th>
<th>Age/sex</th>
<th>Underlying condition</th>
<th>Identification</th>
<th>Type CVC</th>
<th>Diagnosis</th>
<th>Catheter removal</th>
<th>Antibiotic</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>43/F</td>
<td>Ovarian adenocarcinoma, TPN</td>
<td>G. terrae</td>
<td>Hickman</td>
<td>C/C</td>
<td>No</td>
<td>Vancomycin</td>
<td>Cured</td>
</tr>
<tr>
<td>2</td>
<td>65/F</td>
<td>Chronic intestinal syndrome, TPN</td>
<td>Gordonia sp.</td>
<td>Hickman</td>
<td>Confirmed</td>
<td>Yes</td>
<td>Vancomycin, gentamicin</td>
<td>Cured</td>
</tr>
<tr>
<td>3</td>
<td>31/F</td>
<td>Splenectomy, haemochromatosis</td>
<td>G. sputi</td>
<td>Subcutaneous venous port</td>
<td>True BSI</td>
<td>No</td>
<td>Amoxicillin, ceftriaxone</td>
<td>EI mitral/cured</td>
</tr>
<tr>
<td>4</td>
<td>28/M</td>
<td>Chronic leukaemia, splenectomy</td>
<td>G. terrae</td>
<td>NE</td>
<td>C/C</td>
<td>No</td>
<td>Vancomycin, ceftazidime</td>
<td>Cured</td>
</tr>
<tr>
<td>5</td>
<td>44/F</td>
<td>Brain tumour</td>
<td>G. terrae</td>
<td>NE</td>
<td>C/C</td>
<td>No</td>
<td>Vancomycin ceftazidime</td>
<td>Cured</td>
</tr>
<tr>
<td>6</td>
<td>54/F</td>
<td>Acute leukaemia</td>
<td>G. terrae</td>
<td>NE</td>
<td>C/C</td>
<td>No</td>
<td>Imipenem, levofloxacin</td>
<td>Cured</td>
</tr>
<tr>
<td>7</td>
<td>46/F</td>
<td>Unknown primary cancer</td>
<td>G. terrae</td>
<td>NE</td>
<td>True BSI</td>
<td>Yes</td>
<td>Vancomycin, imipenem</td>
<td>Relapsed/cured</td>
</tr>
<tr>
<td>8</td>
<td>60/M</td>
<td>Thyroid cancer</td>
<td>G. terrae</td>
<td>NE</td>
<td>True BSI</td>
<td>Yes</td>
<td>Clindamycin, azithromycin</td>
<td>Relapsed/cured</td>
</tr>
<tr>
<td>9</td>
<td>78/M</td>
<td>Myelodysplastic syndrome</td>
<td>G. polyprenivorans</td>
<td>Hickman</td>
<td>True BSI</td>
<td>Yes</td>
<td>Imipenem, amikacin</td>
<td>EI aortic/died</td>
</tr>
<tr>
<td>10</td>
<td>26/F</td>
<td>Chronic leukaemia, BMT</td>
<td>G. polyprenivorans</td>
<td>Hickman</td>
<td>C/C</td>
<td>Yes</td>
<td>Piperacillin/tazobactam, amoxicillin, ciprofloxacin</td>
<td>Cured</td>
</tr>
<tr>
<td>11</td>
<td>24/M</td>
<td>Cardiomyopathy, chronic abuse of anabolic steroids</td>
<td>G. terrae</td>
<td>NS</td>
<td>C/C</td>
<td>No</td>
<td>Piperacillin/tazobactam, levofloxacin</td>
<td>Died (4th)</td>
</tr>
<tr>
<td>12</td>
<td>69/M</td>
<td>Laryngeal cancer</td>
<td>G. sputi</td>
<td>NS</td>
<td>C/C</td>
<td>No</td>
<td>Ticarcillin-clavulinate, ciprofloxacin</td>
<td>Cured</td>
</tr>
<tr>
<td>13</td>
<td>43/F</td>
<td>SLE, pulmonary hypertension</td>
<td>G. spita</td>
<td>Subclavian</td>
<td>NE True</td>
<td>Yes</td>
<td>Vancomycin, imipenem</td>
<td>Cured</td>
</tr>
<tr>
<td>14</td>
<td>46/F</td>
<td>HIV, pulmonary hypertension</td>
<td>G. spita</td>
<td>Subclavian</td>
<td>BSI True</td>
<td>Yes</td>
<td>Vancomycin, imipenem</td>
<td>Relapsed/died</td>
</tr>
<tr>
<td>15</td>
<td>78/F</td>
<td>TPN, mesenteric ischaemia</td>
<td>G. spita</td>
<td>Hickman</td>
<td>BSI</td>
<td>Yes</td>
<td>Linezolid</td>
<td>Cured</td>
</tr>
<tr>
<td>16</td>
<td>58/F</td>
<td>Acute myeloid leukaemia</td>
<td>G. terrae</td>
<td>Port-A Cath</td>
<td>True BSI</td>
<td>Yes</td>
<td>Vancomycin, imipenem</td>
<td>Relapsed/cured</td>
</tr>
<tr>
<td>17</td>
<td>14/F</td>
<td>Short bowel syndrome, TPN</td>
<td>G. spita</td>
<td>Hickman</td>
<td>True BSI</td>
<td>No</td>
<td>Imipenem, amikacin</td>
<td>Relapsed/cured</td>
</tr>
<tr>
<td>18</td>
<td>70/F</td>
<td>Breast cancer</td>
<td>G. spita</td>
<td>Hickman</td>
<td>Confirmed</td>
<td>Yes</td>
<td>Ceftriaxone, teicoplanin; amikacin; meropenem</td>
<td>Cured</td>
</tr>
<tr>
<td>19</td>
<td>19/M</td>
<td>BMT</td>
<td>G. terrae</td>
<td>Hickman</td>
<td>Confirmed</td>
<td>No</td>
<td>Teicoplanin</td>
<td>Relapsed/died</td>
</tr>
</tbody>
</table>

*Patients 1 and 2, Buchman et al. (1992); patient 3, Lesens et al. (2000); patients 4–8, Pham et al. (2003); patient 9, Verma et al. (2006); patient 10, Kempf et al. (2004); patient 11, Grisokl et al. (2007); patient 12, Renvoise et al. (2009); patients 13–15, Brust et al. (2009); patients 16 and 17, Lai et al. (2010); patient 18: Diamantis et al. (2012).
treatment in the majority of cases (8/10) corresponding to those considered true BSI episodes. In addition, in five of these cases, catheter removal was necessary because of persistent bacteraemia (four cases) or complicated infection (infective endocarditis). Despite this strategy of treatment, two patients died.

Clinical management of G. terrae CR-BSIs is far from clear. Analysis of the published experiences suggests that prompt catheter removal is not always necessary for haemodynamically patients. In addition, blood-culture contamination or colonization must be ruled out before the decision to remove the catheter is made.

The data reviewed here emphasize that, for catheter management, it is essential to ensure that a positive blood culture reflects a true BSI and that the catheter is the source. In view of the above, it could be suggested that removal of the catheter should be recommended for the treatment of these infections. Indeed, Blaschke et al. (2007) recommend catheter removal for Gordonia infections in children. However, in two previously reported cases of true BSIs (patients 3 and 17) and in the present case, the catheter was retained and the infection cleared despite the presence of persistent bacteraemia and complicated infection. One of these patients died, but the death was not related to the infection. This observation suggests that, although Gordonia spp. may be difficult to eradicate, in some cases, proven BSIs by these organisms may be cured while leaving the catheter in place.

Antibiotic therapy varied widely among the reports. The antimicrobial susceptibility data of Gordonia isolates that have been published previously (Blaschke et al., 2007; Aoyama et al., 2009; Moser et al., 2012) show that the most active in vitro antimicrobials were carbapenems (99 %, n=66 isolates tested), fluoroquinolones (92 %, n=65 isolates tested) and aminoglycosides (100 %, n=53 isolates tested against amikacin; 98 %, n=47 isolates tested against gentamicin). Although vancomycin is used as an initial therapy for infections caused by Gram-positive rods, it is not recommended for Gram-negative rods. Therefore, therapy with this agent should be based on the isolate’s in vitro antimicrobial susceptibility test results.

The overall mortality was 21 % (4 of 19 patients died). In the present case, the death was not related to the CR-BSI. In general, Gordonia spp. are thought to be of low virulence; in our patient, as in other cases, the infection was unapparent. It has to be noted, however, that persistent bacteraemia was common (six cases) and two patients developed infective endocarditis (mitral and aortic native valve). Thus, we believe that CR-BSIs caused by Gordonia spp. must be taken seriously and should prompt initiation of antibiotic therapy. In addition, the patients should be monitored to detect complicated infections, mainly persistent bacteraemia despite 3 days of appropriate therapy and infective endocarditis.

In conclusion, Gordonia spp. are a very rare cause of CR-BSIs, mostly in cancer patients with long-term indwelling catheters. Although the present case report describes a case of confirmed infection in which persistent bacteraemia cleared without catheter removal, further experience is required to confirm that these infections can, in some cases, be successfully treated whilst retaining the catheter.

References


