Two Cases of Medical Device-Related Corynebacterium striatum Infection: A Meningitis and A Sepsis

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Corynebacterium striatum is a commonly isolated contaminant in the clinical microbiology. However, it can be an opportunistic pathogen in immunocompromised and even immunocompetent hosts. The increasing prevalence of C. striatum infection has been associated with immunosuppression and prosthetic devices. We report a case of meningitis with cerebrospinal fluid drainage and a case of catheter-related bloodstream infection caused by C. striatum. The isolates were identified as nondiphtherial Corynebacterium species by VITEK 2 (bioMérieux, France) anaerobe and Corynebacterium card. The final identification by 16S rRNA gene sequencing analysis was C. striatum with 99.7% identity and 99.6% identity with C. striatum ATCC 6940, respectively. Both strains were sensitive to vancomycin and gentamicin, but multidrug-resistant to ciprofloxacin, penicillin, erythromycin and imipenem. (Ann Clin Microbiol 2016;19:28-31)

Key Words: Bloodstream infection, Corynebacterium striatum, Meningitis, 16S rRNA gene sequencing

INTRODUCTION

The genus Corynebacterium is a group of diverse organisms, which is a normal commensal of human skin and mucous membrane. Of which, Corynebacterium striatum is a frequently isolated species in clinical microbiology and considered as contaminant. However, it can be opportunistic pathogen in immunocompromised and immunocompetent hosts [1]. Ever since the first infection of C. striatum, pleuropulmonary infection, was found [2], this organism has been reported as the cause of a variety of invasive infections, including endocarditis [3], respiratory infection [4], catheter-related bloodstream infection, meningitis with cerebrospinal fluid (CSF) drain. C. striatum has been increasingly reported as true pathogen when patients are immunocompromised and have prosthetic devices [5]. Here, to our knowledge, we present the first case of meningitis with CSF drain in Korea and a case of catheter-related bloodstream infection caused by C. striatum.

CASE REPORTS

1. Case 1

A 74-year-old woman with a history of hypertension was admitted with a diagnosis of spontaneous subarachnoid hemorrhage. She had been hospitalized in neurological intensive care unit after coil embolization of aneurysm. On hospitalization day (HD) 7, she developed a fever of 38.1°C. On HD 8, she was made lumbar puncture with drain due to persistent fever with mental change. She suffered from persistent fever, but it failed to grow any microorganisms from blood, urine, CSF samples except for transtracheal aspirate; methicillin resistant Staphylococcus aureus. Intermittent leak was present from the spinal drain. On HD 14, CSF profile showed elevated white blood cell count 620/μL with 58% neutrophils, and increased protein level; 102 mg/dL. Peripheral white blood cell count was 12,860/μL with 87.4% neutrophils and C-reactive protein increased into 12.84 mg/dL. And then, intravenous vancomycin (750 mg per 12 hours) therapy was empirically initiated when cultures of CSF and the
lumbar drain tip were performed. At that time, the inflammation sign of redness and swelling was noted in the lumbar drain insertion site. At the same time, gram positive rods were detected by Gram staining CSF fluid. On HD 15, parental ceftazidime (2 g per 8 hours) was added, and diphtheroid species (strain 1) grew on blood agar plate (BAP) from the CSF culture. The overnight culture of the thioglycollate broth (NIH Thioglycollate Broth, Becton Dickinson, Sparks, MD, USA) for the lumbar drain tip was inoculated into BAP and MacConkey agar. On HD 16, the same diphtheroid species was yielded on BAP. Fever subsided after 3 days of intravenous vancomycin treatment. She was treated with vancomycin for 14 days and discharged with full recovery.

2. Case 2

A 48-year-old male patient with acute myeloid leukemia failed to achieve complete response. After fludara-busulfex conditioning via a left subclavian venous catheter, he underwent allogeneic peripheral blood stem cell transplantation (allo-PBSCT). Since then, he suffered from diarrhea and developed skin eruption on the 9th day after allo-PBSCT. On the 15th day, he developed a fever of 37.9°C. The blood profile showed pancytopenia; white blood cell count 540/μL, hemoglobin 6.2 g/dL, platelet count 4,000/μL. C-reactive protein level was elevated to 2.0 mg/dL. Peripheral and central catheter blood were drawn in doublet with urine, and cultured. And then, he was empirically administered with ceftazidime (2 g per 8 hours). After 24 hours incubation, gram positive rods (strain 2) were detected in all four aerobic blood culture bottles at the same time. Subcultures on BAP agar yielded diphtheroid species. Subsequent blood cultures on the 17th day showed the same results while the culture through the catheter blood yielded the isolates 3.5 hours earlier than the peripheral blood culture. And then, additional teicoplanin (400 mg per 24 hours) was administered. Following blood cultures on the 20th day showed negative results. Even though parental antibiotics were changed to meropenem (1 g per 8 hours) and vancomycin (500 mg per 24 hours) on the 21st day, he expired on the 22nd day after allo-PBSCT due to acute graft-versus-host disease (GVHD).

3. Identification

Colonies after 24 hours of incubation on blood agar was convex, circular, shiny, moist with entire edges, white to gray and non-hemolytic, about 1 to 1.5 mm in diameter. In the previous study, we performed 16S rRNA gene sequencing as described from the previous study [6]. Using the EzTaxon server (http://www.ezbiocloud.net/eztaxon; [7]), both strains were identified as *C. striatum* with 99.7% identity and 99.6% identity with *C. striatum* (ATCC 6940) (Table 1).

4. Antimicrobial susceptibility test

To study the antimicrobial susceptibility of the isolates, we evaluated the minimum inhibitory concentrations (MICs) by using Etest (bioMérieux) and Oxoid M.I.C. Evaluator Strip (Thermo Fisher Scientific, Basingstoke, UK). The suspensions of the isolates adjusted to 0.5 McFarland standard were inoculated onto Mueller-Hinton agar plates with 5% sheep blood (Asan Pharm, Seoul, Korea) and incubated at 37°C for 20 hours. Results of antimicrobial susceptibility regarding strain 1 and strain 2 are shown in Table 2. Both strains were sensitive to vancomycin and gentamicin, but resistant to penicillin, imipenem, erythromycin, and ciprofloxacin.

**DISCUSSION**

*C. striatum* had long been considered as a contaminant from normal skin or nasopharyngeal flora. This opportunistic patho-

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**Table 1. Identification of the isolates**

<table>
<thead>
<tr>
<th>Isolate No.</th>
<th>Culture site</th>
<th>Phenotypic method (VITEK 2)</th>
<th>16S rRNA gene analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strain 1.</td>
<td>CSF and drainage tip</td>
<td><em>Corynebacterium striatum</em></td>
<td><em>Corynebacterium striatum</em></td>
</tr>
<tr>
<td>Strain 2.</td>
<td>Catheter blood and peripheral blood</td>
<td>1st <em>Corynebacterium amycolatum</em></td>
<td>2nd <em>Corynebacterium striatum</em></td>
</tr>
</tbody>
</table>

*Abbreviation: CSF, cerebrospinal fluid.*
by analyzing the full length of 16S rRNA gene sequence. We successfully identified two strains to the species level.

Peripheral blood leukocytosis with neutrophilia, increased C-reactive protein level, CSF color change with increased white blood cell count. Case 1 showed peripheral blood and venous catheter blood, and following culture showed the same results with different time to positivity. In both cases, patients were in immunocompromised conditions having indwelling medical devices.

For more reliable identification to the species level, we performed 16S rRNA gene sequence analysis. Analysis of partial 16S rRNA gene sequence might fail to identify Corynebacterium to the species level, since corynebacteria show little polymorphism of this gene [12]. When analyzed the whole gene sequence, most species in Corynebacterium can be distinguished [13]. We successfully identified two strains to the species level by analyzing the full length of 16S rRNA gene sequence.

Multidrug-resistant C. striatum has been implicated especially in long-term hospitalized patients [14], and the most frequent mechanism of antibiotic resistance in Corynebacterium species is the transmission of extrachromosomal genetic elements on large plasmids or on transposons [15]. Since the antimicrobial susceptibility of C. striatum is not predictable due to the emergence of multidrug resistance, antimicrobial susceptibility test should be performed for correct treatment. In these cases, both two strains were highly resistant to penicillin, imipenem, ciprofloxacin. All were resistant to erythromycin, but susceptible to gentamicin and vancomycin. As previously reported [14], we confirmed that the empirical treatment of choice for Corynebacterium species infection is vancomycin. Case 1 was treated with parental vancomycin and fully recovered from the C. striatum infection. Case 2 expired due mainly to acute GVHD, therefore we could not assess the outcome of catheter-related bloodstream infection by C. striatum.

In our report, we present that C. striatum should be considered as pathogens in CSF and bloodstream in immunocompromised patients with medical devices. And in addition to phenotypic data, 16S rRNA gene sequencing could be a good tool for more reliable identification of genus Corynebacterium into species level. The C. striatum isolates were multidrug-resistant, but still vancomycin could be a choice of an empirical therapy.

<table>
<thead>
<tr>
<th>Antibiotics</th>
<th>MIC (µg/mL)</th>
<th>Strain 1</th>
<th>Strain 2</th>
<th>CLSI interpretive criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penicillin</td>
<td>&gt;32</td>
<td>&gt;32</td>
<td>≤1</td>
<td>S 2 ≥4</td>
</tr>
<tr>
<td>Imipenem</td>
<td>&gt;32</td>
<td>&gt;32</td>
<td>≤4</td>
<td>I 8 ≥16</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>&gt;32</td>
<td>&gt;32</td>
<td>≤1</td>
<td>R 2 ≥4</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>4</td>
<td>4</td>
<td>≤0.5</td>
<td>S 1 ≥2</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>0.06</td>
<td>4</td>
<td>≤4</td>
<td>S 8 ≥16</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>0.75</td>
<td>0.75</td>
<td>≤2</td>
<td>S</td>
</tr>
</tbody>
</table>

Abbreviations: MIC, minimal inhibitory concentration; CLSI, Clinical and Laboratory Standards Institute; S, susceptible; I, intermediate; R, resistant.

In our report, we present that C. striatum should be considered as pathogens in CSF and bloodstream in immunocompromised patients with medical devices. And in addition to phenotypic data, 16S rRNA gene sequencing could be a good tool for more reliable identification of genus Corynebacterium into species level. The C. striatum isolates were multidrug-resistant, but still vancomycin could be a choice of an empirical therapy.

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