Cellulitis and Bacteremia due to Corynebacterium striatum Identified by Matrix-assisted Laser Desorption Ionization-Time of Flight Mass Spectrometry

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Abstract

Corynebacterium striatum has been described as a pathogen in immunocompromised patients; however, correctly identifying Corynebacterium spp. is often difficult, and cases of cellulitis caused by C. striatum are only rarely reported. We herein describe a case of cellulitis and bacteremia due to C. striatum identified by matrix-assisted laser desorption ionization-time of flight mass spectrometry. Antimicrobial susceptibility testing was performed using the Strepto-Haemo Supplement method, and vancomycin was replaced by a narrow-spectrum oral amoxicillin.

Key words: Corynebacterium striatum, cellulitis, matrix-assisted laser desorption ionization-time of flight mass spectrometry

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Introduction

Corynebacterium spp. are widely disseminated in the environment and constitute part of the normal skin and mucous membrane flora (1, 2). Corynebacterium striatum has been increasingly reported as a human pathogen, with most cases of C. striatum infection occurring in immunocompromised patients or patients whose skin has been injured by a medical device (3-5). In 1980, the first case of C. striatum infection was reported in a patient with chronic lymphocytic leukemia who had a pleuropulmonary infection (2). C. striatum has been identified as a pathogen in severe infections, such as bloodstream infections (6), pneumonia (7), meningitis (8), endocarditis (9) and septic arthritis (10), and the mortality rate is approximately 11.8% (5).

Although correctly identifying Corynebacterium spp. has been challenging (11), in recent years, matrix-assisted laser desorption ionization-time of flight mass spectrometry (MALDI-TOF MS) has been increasingly used for clinical identification of Corynebacterium spp. (12). We herein describe a case of cellulitis and bacteremia caused by C. striatum, which was identified by MALDI-TOF MS.

Case Report

A 47-year-old Japanese woman was admitted due to increasing redness and pain in her right thigh. She had undergone a radical hysterectomy for cervical cancer four years earlier and had bilateral lower extremity lymphedema. She had a history of cellulitis occurring three times. The day before hospitalization, she had cut her right leg with a razor and later felt shaking chills followed by the onset of redness, pain and swelling of her right thigh. Her body temperature was 38.7°C, heart rate was 85 beats/min, respiratory rate was 20 breaths/min, and blood pressure was 113/70 mmHg. A scab had formed over the small wound on her right leg, thus samples from the wound were not cultured. A physical examination was otherwise unremarkable. The blood tests completed during admission revealed a white blood cell count of 13,500 cells/μL with 84% neutrophils. After two sets of blood cultures were obtained, the patient...
was described in 2003 in a 69-year-old man with rare cases of cellulitis due to Corynebacterium spp. However, only 65 to 85% of clinical isolates of Corynebacterium spp. can be identified at the species level using the API Coryne V2.0 system (bioMérieux Marcy-l’Etoile, France) were also identified by MALDI-TOF MS with scores >2.000 (12). Scores <2.000 indicate the inability to identify the bacteria at the species level (18).

Several biochemical and gene sequencing methods have been used to identify Corynebacterium spp. However, only 65 to 85% of clinical isolates of Corynebacterium spp. can be identified at the species level using the API Coryne system (19-21). Additionally, although 16S rRNA gene sequencing represents a highly accurate method for the identification of bacteria, it is used only in a limited number of facilities due to its complicated procedure. The MALDI-TOF system represents a rapid, inexpensive, alternative assay for identifying bacteria at the species level (22).

The susceptibility of C. striatum strains to antibiotics is variable. C. striatum has been reported to be susceptible to a wide range of antibiotics in vitro (23). Vancomycin has been the drug of choice for empirical antibiotic treatment of Corynebacterium spp. (24). The susceptibility of C. striatum to antibiotics can be accurately and easily determined by the SHS method. Otsuka et al. evaluated the utility of the SHS method for Corynebacterium spp. and observed nearly identical MIC results within one dilution difference of the standard method (13). If a strain is found to be susceptible to a wide range of antibiotics, treatment can be changed from intravenous vancomycin to narrow-spectrum antibiotics, such as oral amoxicillin.

In conclusion, although correctly identifying Corynebacterium spp. remains difficult, it may become easier due to the increasing use of MALDI-TOF MS. As a result, the number of cases of cellulitis determined to be due to C. striatum may increase. Because multidrug-resistant, including ampicillin-resistant, strains of C. striatum have been reported in many countries since 2003 (7, 25-27), antimicrobial susceptibility testing such as the SHS method should be performed.

The authors state that they have no Conflict of Interest (COI).

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**Table. Minimum Inhibitory Concentrations and Interpretation.**

| Antimicrobial Agent | MIC (µg/mL) | Interpretation according to CLSI criteria |
|---------------------|------------|----------------------------------------|
| Penicillin          | 1          | S                                      |
| Cefepime            | 1          | S                                      |
| Cefotaxime          | 1          | S                                      |
| Ceftriazone         | 2          | I                                      |
| Imipenem            | ≤ 0.12     | S                                      |
| Meropenem           | ≤ 0.25     | S                                      |
| Vancomycin          | ≤ 1        | S                                      |
| Gentamicin          | ≤ 2        | S                                      |
| Erythromycin        | ≤ 0.25     | S                                      |
| Clindamycin         | 2          | I                                      |

MIC: Minimum inhibitory concentration, CLSI: Clinical and Laboratory Standards Institute, S: susceptible, I: intermediate.

In the patient’s right thigh, a short, club-shaped, gram positive bacilli, which suggested a Corynebacterium sp., was isolated from both blood cultures. No bacteria were detected on the razor or in the cream the patient had used for shaving the day before hospitalization. Intravenous antibiotic therapy was changed from cefazolin to 1 g vancomycin twice a day to treat the bacteremia due to Corynebacterium spp. infection.

Corynebacterium spp. could not be characterized by the MicroScan WalkAway 40 plus System (Siemens, Sacramento, USA). Thus, MALDI-TOF MS using the Bruker Biotyper system (Bruker Daltonics, Billerica, USA) was performed to identify the bacteria at the species level. The best match was to C. striatum-type strain 143 RLT with a score of 2.321. Scores were obtained by comparing the similarity between spectra patterns, with a score over 2.000 indicating identification at the species level (12). Alatoom et al. reported that all 47 Corynebacterium spp. had been correctly identified at the species level (i.e., MS scores >2.000), with confirmation by an rpoB assay and 16S rRNA gene sequencing (18). Moreover, Vila et al. reported that all 16 strains identified as C. striatum by the API Coryne V2.0 system (bioMérieux Marcy-l’Etoile, France) were also identified by MALDI-TOF MS with scores >2.000 (12). Scores <2.000 indicate the inability to identify the bacteria at the species level (18).

After the pain and redness in the patient’s right thigh decreased, intravenous vancomycin was switched to oral amoxicillin eight days after admission to treat the cellulitis and bacteremia. This treatment continued for two weeks. No recurrence was observed at the one month follow-up.

**Discussion**

Cellulitis and bacteremia due to C. striatum was diagnosed using MALDI-TOF MS. Several cases of cellulitis caused by Corynebacterium spp. have been described (15); however, cases of cellulitis caused by C. striatum have been rarely reported. The first description of cellulitis due to C. striatum was described in 2003 in a 69-year-old man with chronic ischemia of the extremities who had cellulitis in a lower limb (4). Additionally, a 27-year-old man with a malignant cutaneous lesion was reported to have a C. striatum soft tissue infection (1). Although several cases of soft tissue infections due to C. striatum have been reported, including surgical site infections (16, 17), to the best of our knowledge, these two cases are the only reports of cellulitis caused by C. striatum.

In recent years, MALDI-TOF MS has been increasingly used for clinical microbial diagnosis and to analyze C. striatum (12). Alatoom et al. reported that all 47 Corynebacterium spp. had been correctly identified at the species level and 16S rRNA gene sequencing (18). Moreover, Vila et al. reported that all 16 strains identified as C. striatum by the API Coryne V2.0 system (bioMérieux Marcy-l’Etoile, France) were also identified by MALDI-TOF MS with scores >2.000 (12). Scores <2.000 indicate the inability to identify the bacterium at the species level (18).

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