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CASE REPORT

Corynebacterium striatum bacteremia associated with central venous catheter infection

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Corynebacterium striatum (*C striatum*) has been considered a contaminant of blood culture in past decades. Here we report the case of a patient with acute deterioration of chronic renal failure. She received hemodialysis and died from *C striatum* bacteremia. By using a randomly amplified polymorphic DNA (RAPD) method, we found that an association existed between *C striatum* from the bloodstream and that from the central venous catheter. We suggest that *C striatum* could be a pathogen of bloodstream infection in patients with such a catheter in place.

Introduction

Corynebacteria are Gram-positive, catalase-positive, aerobic or facultative anaerobic, generally non-motile rods. The genus contains *Corynebacterium diphtheriae* and non-diphtherial corynebacteria, collectively referred to as diphtheroids. Non-diphtherial corynebacteria (*C striatum*, *C amycolatum*, *C minutissimum*, *C xerosis* and *C freneyi*) were originally thought to be contaminants. They have increasingly been reported as emergent opportunistic pathogens in immunocompromised hosts, such a patients with end-stage renal disease, hematologic malignancies or with critical illness.[1] Recognition of infections caused by coryneform bacteria is highly dependent on the level of alert and attentiveness of clinicians.

C striatum has previously been considered a saprophyte on skin and nasal mucosa, but it has been reported to be responsible for various type of infections, such as pneumonia, cerebro-spinal fluid infection, endocarditis, osteomyelitis of the diabetic foot, peritonitis in patients

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with peritoneal dialysis, septic arthritis and septicemia. Outbreaks of *C striatum* infections were also reported in long-stay hospitalized patients with underlying disease.[3–7]

Here we present the case of a patient with acute deterioration of chronic renal failure who developed *C striatum* in bacteremia. Using randomly amplified polymorphic DNA (RAPD) methods, we found that the same pathogens existed in the bloodstream and on the central venous catheter. The patient died from septic shock and multiple-organ failure due to delayed treatment.

Patient and methods

An 83-year-old woman was brought to our emergency department on December 19, 2008 due to loss of consciousness and cardiac arrest in the early morning. Her vital signs were recovered after cardiopulmonary resuscitation and then she was immediately admitted to the intensive care unit (ICU). Her underlying diseases were chronic renal insufficiency and hypertensive cardiovascular disease. Her white blood cell count was 16,080 cells/μL, her platelet count was 195,000 cells/μL and her hemoglobin level was 8.1 gm/dL. The patient's C-reactive protein level was 16.96 mg/dL. Her blood urea nitrogen level was 105 mg/dL and her creatinine level was 5.79 mg/dL. Her aspartate aminotransferase was 114 U/L, her alanine aminotransferase was 76 U/L, and her total bilirubin was 0.75 mg/dL. She received a central venous catheter in the right internal jugular vein to ensure venous access and was monitored for central venous pressure.

Due to her chronic renal failure with acute deterioration, the patient was given hemodialysis after hospitalization. A temporary double-lumen catheter was placed in the right femoral vein for hemodialysis on day 2 after admission. On account of the her uremic status and the fact that she was being considered for long-standing hemodialysis, the site of vascular access was changed to the left subclavian vein and substituted by Permcath dual-lumen on day 11 after admission.

On admission, the patient received piperacillin/tazobactam (2.25 g by intravenous injection every 6 hours), levofloxacin (500 mg intravenous injection every other day) and dopamine (10 meq/Kg/hour) for aspiration pneumonia and shock status. The findings from initial cultures yielded methicillin-sensitive *Staphylococcus aureus* from one of three sets of blood cultures and one set of sputum culture. The results of sensitivity testing this strain showed that it was sensitive to levofloxacin.

She received piperacillin/tazobactam and levofloxacin for the 14 days in which she stayed in the ICU. Due to ventilator dependence, the patient was transferred to the respiratory care center for further management on day 14 after admission.

The patient was put on fluconazole on day 17 after admission for a urinary tract infection with *Candida albicans*.

She was successfully weaned from the mechanical ventilator on day 18 after admission. Unfortunately, she developed fever and respiratory distress after the removal of the endotracheal tube and she was given bi-level positive airway pressure ventilation because the families did not want her to receive endotracheal ventilation. Cefpirome (1 g intravenous injection every 12 hours) was administered for sputum culture revealing *Enterobacter cloacae*.

The patient's complete blood count on day 25 after admission showed significant leukocytosis. The central venous catheter in the right internal jugular vein was removed due to fever and the catheter tip was sent for a semiquantitative culture on day 26. Two sets of blood culture (each set including aerobic and anaerobic samples), including one set drawn from the right internal jugular venous catheter at the same time, contained *C striatum*. At first, *C striatum* was considered to be contaminant and we did not prescribe any antibiotics. Her fever persisted, however, and the hemodynamic condition became unstable, especially during hemodialysis.

The results of repeated blood culture on days 30 and 34 still yielded *C striatum*. The *C striatum* susceptibility test showed that the strain was sensitive to vancomycin, linezolid, tigecycline and amoxicillin/clavulanate but resistant to ciprofloxacin, erythromycin, rifampin, tetracyclines, gentamicin and penicillin. The patient received amoxicillin/clavulanic acid (1.8 g intravenous injection every 8 hours) and vancomycin (1 g loading and 500 mg intravenous injection every 3 days) on day 30. Unfortunately, she started to go into septic shock and multiple-organ failure on day 35, and the patient expired at midnight.

From the patient's specimens, we identified six strains of *C striatum* from blood culture (aerobic and anaerobic) and three strains from the central venous catheter. The RAPD patterns of these nine isolates and two epidemiologically-unrelated isolates from another hospital were determined by arbitrarily-primed PCR using four random primers:

- A (5′-AGCAGCGCCTCA-3′);
- S (5′-TCACGATGCA-3′);
- M13 (5′-GTTTTCCCAGTCACGAC-3′); and
- OPB17 (5′-AGGGAACGAG-3′).

We found that the RAPD patterns from the nine isolates from the patient (strains 1—6 from blood, strains 7—9 from central venous catheter) were identical to each other (strains 1—9) and were different to those from the other hospital (strains 10 and11), see Fig. 1. Based on those observations, we suspect that the strains of *C striatum* found in the bloodstream match those from the central venous catheter. We therefore considered that the central venous catheter was the route of bloodstream infection in this patient.

Discussion

To our knowledge, this is the first report of a serial blood culture positive for *C striatum*, having the same genotype with central venous catheter tip strains. Although *C striatum* is infrequently isolated from blood culture, its degree of pathogenicity and the differentiation of colonization from pathogen-causing infections is still difficult to delineate. Septicemia with *C striatum* is a rare event and the route of transmission was first proven by molecular confirmation of entry through the skin in 2003 by Martin et al.[5]

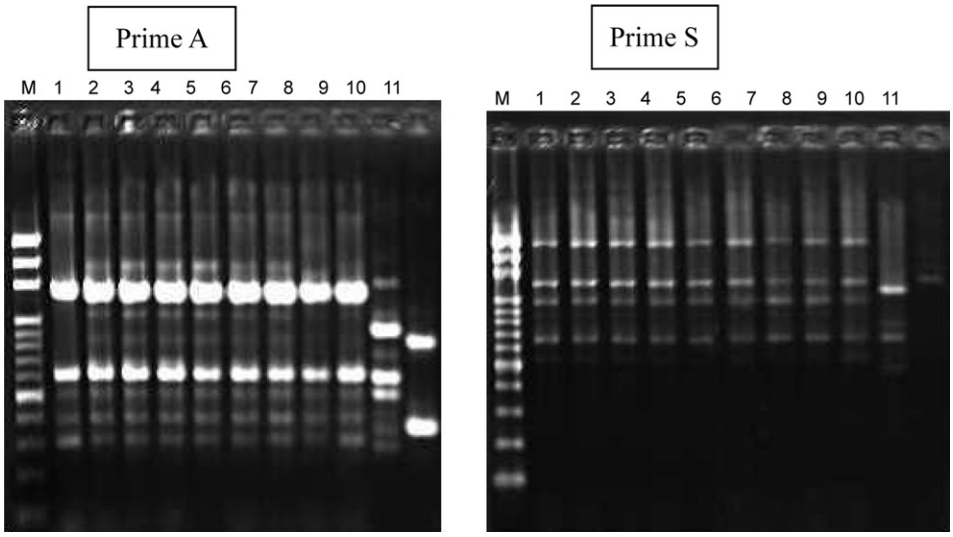

Figure 1. Molecular analysis of *C. striatum* strains isolated from blood and central venous catheter using the randomly amplified polymorphic DNA method. Key: lanes 1–6 = isolates from peripheral blood culture, lanes 7–9 = isolates from catheter tip and intra-catheter blood culture and lanes 10–11 = isolates from another hospital (for comparison). Prime A and Prime S were the specific gene of *C. striatum*.

The victim was a 69-year-old male with ischemic heart disease, refractory anemia and thyroid cancer who was found to be suffering from a blood-stream infection initiated by a known skin focus.[5]

Opportunistic corynebacteria infections were thought to originate endogenously, but in recent years the possibility of patient-to-patient transmission in ICU has been described in two studies using restriction fragment-length polymorphism analysis.[9–12] Outbreaks caused by multidrug-resistant *C striatum* have been reported in patients hospitalized for a long time who have had indwelling devices, prolonged exposure to broad-spectrum antibiotics and immunosuppression.[9,10,13]

Although most reported *C striatum* isolates are susceptible to a wide range of antibiotics,[2,8,14] it has been suggested that the selective pressure exerted by previous antimicrobial treatment has contributed to the overgrowth of *C striatum*, leading to it becoming a secondary colonizer in immunocompromised hosts.[9] In general, *C striatum* is resistant to penicillin but is susceptible to other β-lactams and vancomycin. In a previous report, vancomycin was recommended as an empirical therapy for serious infections caused by corynebacteria.[15] The optimal antimicrobial therapy for *C striatum* infections is, however, controversial. *In vitro* susceptibility tests of tigecycline and linezolid show that they are active against coryneform bacteria.[16,17] At present, there is no 'gold standard' or guideline for the management of corynebacteria found in *in vitro* sensitivity tests. In light of the emergence of multidrug resistance and its involvement in nosocomial infections, appropriate interpretive criteria are needed for corynebacteria.

In conclusion, we cannot assume that *C striatum* cultivated from blood culture is only a contaminant. We need to suspect the possibility of endocarditis in high-risk patients, especially in those with history of exposure to broad-spectrum antibiotics, immunosuppression or with a central venous catheter in place. The findings of this case report highlight that we need to be aware that *C striatum* is an emerging nosocomial pathogen, especially in critically ill patients with indwelling devices.

Conflict of interest

The authors have no conflicts of interest to declare.

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