Case Report

*Bacillus cereus* Native Valve Endocarditis with Multiple Brain Infarctions: A Case Report and a Review of the Literature

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Abstract

*Bacillus cereus* (*B. cereus*) endocarditis is a rare condition that can occur in patients with prosthetic heart valves. Involvement of the native valve is very rare, but several cases of right-sided native valve endocarditis have been reported in intravenous drug users. The present report describes an adult case of native aortic valve endocarditis with *B. cereus* accompanied by multiple cerebral hemorrhages. After 3 days, *B. cereus* was isolated from blood culture. *B. cereus* endocarditis could have left-sided vegetations with multiple metastatic lesions in non-intravenous drug users.

ABBREVIATIONS

*B. cereus*: *Bacillus cereus*; LDH: lactate dehydrogenase; CRP: C-reactive protein; CT: computed tomography; MIC: minimum inhibitory concentration

INTRODUCTION

*Bacillus cereus* (*B. cereus*) is ubiquitous environmental, gram-positive, facultative anaerobic, spore-forming rod, which is commonly considered a contaminant when cultured from clinical specimens. However, *B. cereus* produces a variety of toxins and is a potential pathogen that can cause serious infections, such as food poisoning, pneumonia, sepsis, central nervous system infection and endocarditis [1-4]. Endocarditis due to *B. cereus* is rare but can occur in patients with prosthetic heart valves. Involvement of a native valve is very rare, but several cases had been reported in intravenous drug users. The present report describes an adult case of native aortic valve endocarditis due to *B. cereus* accompanied by multiple cerebral hemorrhages in a non-drug user.

CASE PRESENTATION

A 66-year-old male was admitted to our hospital with fever and loss of consciousness. He had diabetes mellitus and was undergoing chronic treatment with oral hypoglycemic agents.

On admission, vital signs were as follows: temperature, 39.4°C; blood pressure, 134/76 mmHg; heart rate, 80 bpm; respiratory rate, 12/min. On physical examination, diastolic murmur was heard at the left upper sternal border. There were no skin markings to indicate intravenous drug use. Neck stiffness was not observed.

On laboratory testing, the white blood cell count was 12,300/μL; the platelet count was 10.1*10^4/μL; lactate dehydrogenase (LDH) level was 272 IU/L; total bilirubin level was 2.42 mg/dL; C-reactive protein (CRP) level was 10.87 mg/dL; glucose level was 346 mg/dL; and hemoglobin A1c was 9.4%. Examination of the cerebrospinal fluids showed normal cell count and protein level. Transthoracic echocardiography revealed multiple vegetations. Transesophageal echocardiography performed on the day 11 revealed abscess in the aortic annulus with valvular vegetation and perforation. The blood cultures grew Gram positive rods, which were identified as *B. cereus* because the isolate showed motility, and were positive in lecithinase test, Voges-Proskauer test, and citrate utilization test. *B. cereus* was susceptible to vancomycin, dindamycin, imipenem-cilastatin erythromycin, gentamicin but was resistant to ampicillin and cefotaxime. A diagnosis of *B. cereus* bacterial endocarditis was made on the basis of valvular lesion seen on
Central infection, most isolates of Bacillus species can cause true bloodstream infection, and are regarded as contaminants. A retrospective review of Bacillus species blood isolates in one hospital over a 5-year period concluded that 5 to 10 percent of isolates represented clinically significant pathogens [5]. Contamination should be suspected when bacterial growth occurs in blood cultures only after 72 hours of incubation. A previous report of endocarditis showed that 5 days was required to isolate Bacillus species from blood cultures [4]. In our case, it took 3 days for B. cereus to be isolated from blood cultures. Therefore, clinicians should carefully interpret blood cultures that turn positive only after a long incubation period in a case of suspected endocarditis.

B. cereus is a rare cause of infective endocarditis. To date, 18 cases of B. cereus endocarditis have been reported in the English literature (Table 1). Among these cases, 11 cases were native valve endocarditis, and seven cases were prosthetic valve endocarditis. Moreover, in the cases of B. cereus native valve endocarditis, seven cases were reported in the 1970s, and four cases were reported after 2005. Although six of the seven cases of native valve endocarditis due to Bacillus reported in the 1970s were in intravenous drug users, none of the four B. cereus endocarditis patients reported after 2005 were drug users. It is not clear why cases of endocarditis due to B. cereus were not reported between the two time periods and why there were differences in patient backgrounds between the two time periods. According to Levine et al., the pathogens and the valves infected among patients with endocarditis of intravenous drug users may depend on the type of illicit drug used, as they noted that the use of certain drugs was associated with particular pathologies [6]. For example, Jain et al. demonstrated that tricuspid valve endocarditis occurs more frequently in heroin users than in other intravenous drug users [7]. Therefore, trends in drug types among drug users might be related to decrease in B. cereus endocarditis.

The entry site of B. cereus in our case was not clear. Most cases of Bacillus endocarditis in intravenous drug users were associated with right-sided vegetations, which could be the result of the site of bacterial entry. On the other hand, all cases of Bacillus endocarditis in non-intravenous drug users had left-sided vegetations, but the entry site was not determined. Our patient was not an intravenous drug user. We speculate that the entry site in our case was the oral mucosa because the patient had poor oral hygiene. The organism most commonly associated with neurologic manifestations is Staphylococcus aureus [8]. There have been no previous reports of multiple brain infarctions in patients with native valve Bacillus endocarditis. This and previous cases demonstrated that Bacillus could be a pathogen causing left-sided native valve endocarditis and that such patients might also have neurological involvement.

In previous studies, most B. cereus isolates showed high minimum inhibitory concentrations (MICs) for β-lactams, such as penicillins and third-generation cephalosporins, and some also did for meropenem, erythromycin, clindamycin, and sulfamethoxazole/trimethoprim [9-12]. Bacteremia caused by B. cereus is usually treated with antimicrobials, such as vancomycin, clindamycin, quinolones, and carbapenems. We suggest that, even when blood cultures do not yield any bacteria in cases of suspected endocarditis after several days of empiric antibiotic administration, antibiotic administration should not be promptly discontinued.

DISCUSSION

Bacillus species are ubiquitous, aerobic, spore-forming gram-positive rods, and are common contaminants in blood cultures. Clinical infection with B. cereus can be categorized broadly as food-poisoning-related disease or non-gastrointestinal disease. The latter can be separated into local infections, such as postsurgical or traumatic wound infections, burn super-infection, ocular lesions, or systemic infection, such as sepsis, meningitis, pneumonia, and endocarditis. Systemic Bacillus species infections are usually accompanied by bacteremia, in which a positive blood culture is important for the diagnosis. However, differentiating true bacteremia from contamination due to Bacillus species is difficult. Although Bacillus species can cause true bloodstream infection, most isolates of Bacillus species from blood cultures are regarded as contaminants.

Figure 1 Brain computed tomography shows a low density area of the right frontal lobe in the right middle cerebral artery territory (A, arrow) and a low density area of the left cerebellum in the left posterior artery territory (B, arrow).

Figure 2 Transesophageal echocardiogram shows a perforation in the aortic valve (arrow). LV: left ventricle.
In conclusion, this report described an adult case of native valve *B. cereus* endocarditis. A long incubation time was required to isolate *B. cereus* from blood culture. *B. cereus* endocarditis can manifest with left-sided vegetations and multiple embolic-type lesions in non-intravenous drug users.

**REFERENCES**


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Table 1: Clinical characteristics of native valve endocarditis due to *Bacillus cereus*.

<table>
<thead>
<tr>
<th>Year reported</th>
<th>Age (years)/ Gender</th>
<th>Risk factors</th>
<th>Valve affected</th>
<th>Distant site of infection</th>
<th>Incubation time of blood culture (days)</th>
<th>Antibiotic therapy (weeks)</th>
<th>Surgery</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979[5]</td>
<td>50M</td>
<td>IVDU</td>
<td>NR</td>
<td>None</td>
<td>NR</td>
<td>CLDM (4)</td>
<td>No</td>
<td>Cured</td>
</tr>
<tr>
<td>2011[7]</td>
<td>42M</td>
<td>None</td>
<td>A</td>
<td>Kidney</td>
<td>NR</td>
<td>CTRX (6)</td>
<td>AVR</td>
<td>Cured</td>
</tr>
<tr>
<td>2013[1]</td>
<td>31M</td>
<td>previous IE</td>
<td>A</td>
<td>None</td>
<td>5</td>
<td>CMX (6)</td>
<td>No</td>
<td>Cured</td>
</tr>
<tr>
<td>2015</td>
<td>66M</td>
<td>DM</td>
<td>A</td>
<td>Brain</td>
<td>3</td>
<td>VCM (9)</td>
<td>AVR</td>
<td>Cured</td>
</tr>
</tbody>
</table>

**Abbreviations:** F: Female; M: Male; PH: Pulmonary Hypertension; IVDU: Intravenous Drug User; RF: Rheumatic Fever; ALL: Acute Lymphoblastic Leukemia; IE: Infective Endocarditis; DM: Diabetes Mellitus; T: Tricuspid valve; A: Aortic valve; M: Mitral valve; NR: Non-Recorded; EM: Erythromycin; LCM: Lincomycin; CLDM: Clindamycin; PCG: Penicillin G; VCM: Vancomycin; SM: Streptomycin; NFPC: Nafcillin; CF: Chloramphenicol; GM: Gentamicin; CPFX: Ciprofloxacin; CTRX: Ceftriaxone; CMX: Cefotaxime; AVR: Aortic Valve Replacement

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Cite this article