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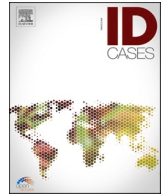Kobayashi, Takaaki
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Case report

# A case of prosthetic valve endocarditis and aortic abscess due to Bacillus cereus

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A B S T R A C T

*Bacillus cereus (B. cereus)* is commonly found in the environment and is often considered a blood culture contaminant. However, in patients with specific risk factors such as intravenous drug use, central venous access catheters, immunosuppression, or prosthetic valves, *B. cereus* can cause severe infections. Herein, we present a case of prosthetic valve endocarditis (PVE) caused by *B. cereus* in an 84-year-old woman with a history of aortic valve replacement for aortic stenosis five years earlier. She presented with anorexia, and her physical examination revealed tenderness in the left upper quadrant of the abdomen. Blood culture grew *B. cereus*, and a CT scan showed splenic infarction, raising suspicion of PVE. Transesophageal echocardiogram (TEE) revealed an abscess around the left coronary cusp of the aortic valve and a 15 mm vegetation. Due to the patient's high risk for postoperative complications and her unwillingness to undergo surgery, the surgery was deferred. Instead, she was successfully treated with six weeks of intravenous vancomycin and discharged home. Follow-up TEE demonstrated resolution of the vegetation and valvular abscess. At her six-month post-discharge evaluation, no signs of active infection were noted including fever or worsening heart failure. Although surgery is typically recommended for most cases of PVE, conservative treatment can be considered as an alternative option for selected patients.

## Introduction

*Bacillus cereus* is commonly distributed in the natural environment [1]. While isolation of the bacteria from blood cultures is often considered a contaminant, *Bacillus* spp. can also cause true bloodstream infection [1]. Additionally, although it is rare, native and prosthetic valve endocarditis due to *B. cereus* have been reported [2]. We herein present a case of prosthetic valve endocarditis caused by *B. cereus* in an older Japanese woman that was successfully treated without surgical intervention.

## Case

An 84-year-old woman with a history of aortic valve replacement for

aortic stenosis five years before presented to a local clinic with a five-day history of anorexia. Five days prior to admission, the patient experienced anorexia and fever. Three days prior to the admission, her fever temporarily subsided. On the day before admission, the patient was seen by a local doctor and tested negative for COVID-19. She was prescribed an antipyretic and instructed to come to our hospital for further evaluation. Later that day, abdominal pain developed, and early on the day of the admission, she was unable to move, experienced decreased urine output, and worsening appetite. She was brought to an outside hospital by ambulance, where she was suspected to have cholangitis because of elevated liver enzymes. The patient was then transferred to our hospital. She denied vomiting, diarrhea, and abdominal pain but had nausea and mid-abdomen and left upper quadrant discomfort. She had a history of diabetes, hyperlipidemia, hypertension, cholelithiasis, and colorectal

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**Fig. 1.** Computed tomography of the abdomen with contrast obtained on the day of admission. CT of the abdomen with contrast showed a wedge-shaped low-density area in the spleen, indicating splenic infarction (yellow arrow head).
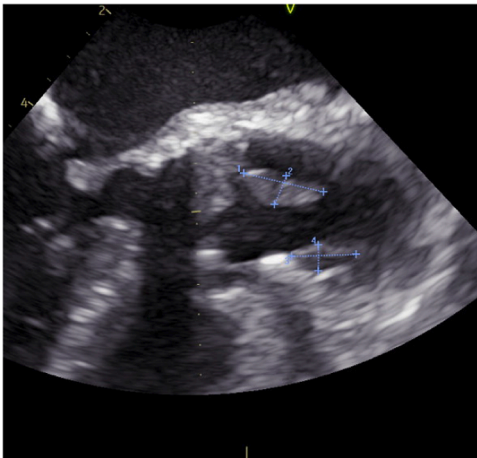


**Fig. 2.** Transesophageal echocardiogram on hospital day 3. TEE shows a 15 mm of mobile vegetation on the aortic valve and a valve ring abscess.

polypectomy. She also had a history of aortic valve replacement for severe aortic stenosis five years before. She had never traveled abroad and did not smoke cigarettes, drink alcohol, or use illicit drugs. She denied any recent dental procedures. She is self-sufficient, lives with her son, and does not hold a job. Physical examination revealed a temperature of 36.9 ℃, heart rate 88 beats per minute, and blood pressure 95/69 mmHg, and was otherwise unremarkable except for abdominal tenderness in the left upper quadrant. Laboratory workup revealed a white blood cell 20,700/μL (neutrophils 93 %), platelets 18,000/μL, aspartate aminotransferase (AST)  47 U/L, alanine aminotransferase ( ALT ) 85 U/L, lactate dehydrogenase (LD) 803 U/L, alkaline phosphatase (ALP) 221 U/L, and γ-Glutamyl transpeptidase (γ-GTP) 40 U/L. Urinalysis was negative. Contrast-enhanced computed tomography (CT) of the abdomen showed a wedge-shaped low-density area in the spleen, indicating splenic infarction (Fig. 1). Due to the fever, leukocytosis, and low platelet count, sepsis was suspected with concern for endocarditis considering the splenic infarction. Piperacillin-tazobactam was started. Two sets of blood cultures noted gram-positive rods on hospital day 1. On day 3, the gram-positive rods were speciated as *B. cereus* and the antibiotics were switched to vancomycin monotherapy. Transthoracic



**Fig. 3.** Transesophageal echocardiogram on hospital day 38. TEE shows no vegetation or abscess.

echocardiogram (TTE) showed increased luminosity with thickening of the prosthetic aortic valve and mitral valve. Transesophageal echocardiogram (TEE) showed abscess formation surrounding the left coronary cusp of the aortic valve and a 15 mm aortic valve vegetation with mobility (Fig. 2). Because of altered mental status, brain magnetic resonance imaging (MRI) was obtained. Diffusion-weighted MRI revealed hyperintensity areas in the bilateral frontal lobes, the occipital lobes and the cerebellum, consistent with acute ischemic stroke. The findings fulfilled one major criterion (i.e., vegetation) and three minor criteria (i.e., prosthetic heart valve, splenic infarction, and *B.cereus* bacteremia) of the modified Duke criteria for endocarditis, therefore, *B. cereus* prosthetic valve endocarditis (PVE) complicated by aortic valve abscess, splenic infarction, and ischemic stroke was diagnosed. Repeated blood cultures on hospital day 4 remained negative. Given the size of the vegetation (>10 mm) and the presence of an aortic valve abscess, surgery was considered. However, the cardiothoracic surgeons determined that the perioperative mortality rate would be significantly high, and the patient opted not to proceed with the surgery. Therefore, we decided to continue conservative management with a plan to administer antibiotics for at least six weeks. Repeated TEE near the end of the six-week therapy showed no vegetation or abscess (Fig. 3). She was treated successfully with six weeks of intravenous vancomycin and discharged to home in stable condition, able to walk on her own. On follow-up evaluation at our clinic six months after discharge, she continued to have no signs of active infection or worsening heart failure.

## Discussion

*B. cereus* is a spore-forming, aerobic-to-facultative, gram-positive rod that is commonly found in the natural environment [1]. This organism is well-known for causing food poisoning, and its pathogenicity can be either intestinal or non-intestinal in nature. *B. cereus* food poisoning is typically diagnosed clinically, and supportive therapy is the primary treatment approach [3]. *B. cereus* can also lead to infections in other organs such as the bloodstream, central nervous system, skin and soft tissues, and intraocular regions. This organism can produce biofilms, which play a major role in attachment to catheters [1].

Blood culture isolation of *B. cereus* is often regarded as a contaminant since it is primarily ubiquitous in the environment [4]. However, the rate of true bloodstream infections defined as "two sets or more positive blood cultures," "one set or more of positive blood culture with a positive catheter tip culture," or "one set of positive blood culture with persistently positive blood cultures" has been reported to occur in

**Table 1**

Summary of previously reported cases with prosthetic valve endocarditis caused by *Bacillus cereus*.

| No. | Author | Age/Gender | Valve | Other risk factors | Treatment (duration) | Surgery | Clinical Outcome |
|---|---|---|---|---|---|---|---|
| 1 | Block, et. al., 1978 [15] | 51F | MV | RHD<br>Post Operation | Tobr/Chlor (NR) | No | Died |
| 2 | Oster & Kong, 1982 [16] | 55M | AV | After intravenous treatment | Clinda/Gent (6 weeks) | Yes | Recovered |
| 3 | Steen, et. al., 1992 [17] | 34M | AV | NR | Vanco (6 weeks) | Yes | Recovered |
| 4 | Yamamura, et. al., 1994 [18] | 43M | MV | NR | Amk/Mino (NR) | Yes | Recovered |
| 5 | Cadenas et. al., 1998 [19] | NR | MV | NR | Gent/ Rifam/ Vanco (NR) | Yes | Recovered |
| 6 | Castedo, et. al., 1999 [20] | 45F | MV | RHD<br>After intravenous treatment | Gent/Rifam/ Vanco (6 weeks) | Yes | Recovered |
| 7 | This present case | 84F | AV | None | Vanco (6weeks) | No | Recovered |

NR, not reported. F, Female; M, Male.

AV, aortic valve; MV, mitral valve; RHD, rheumatic heart disease.

Amk, amikacin; Chlor, chloramphenicol; Clinda, clindamycin; Gent, gentamicin; Mino, minocycline; Rifam, rifampicin; Tobra, tobramycin; Vanco, vancomycin.

approximately 40 % of all cases with blood culture isolation of *B. cereus*. Most individuals had underlying conditions [5]. Therefore, true bacteremia should be suspected in patients with a history of immuno-suppression, intravenous drug use, central venous catheters, peripheral venous catheters for administering parenteral nutrition solutions, or prosthetic valves [6].

In this patient, the diagnosis of infective endocarditis was established using the modified Duke criteria, with splenic infarction and ischemic stroke being recognized as embolic symptoms contributing to the diagnosis. Endocarditis was highly suspected upon admission following the identification of splenic infarction on contrast-enhanced CT scan. Splenic infarctions are a rare occurrence, representing only 0.016 % of hospital admissions over a 10-year period [7]. Major causes of splenic infarction include atrial fibrillation, malignant tumors, lymphoma, infective endocarditis, and sepsis [8]. Among them, infective endocarditis is known to account for 5 % of the cases. Classic symptoms of splenic infarction are left upper quadrant pain and elevated LD. Among patients admitted to the hospital with splenic infarction, left upper quadrant abdominal pain is reported in 51 % of cases, while elevated LD levels are observed in 69 % of cases. Approximately 20 % of cases do not present with abdominal pain, and 22 % of cases have symptoms of nausea and vomiting [7]. In this case, the patient presented with abdominal pain, nausea, and elevated LD consistent with splenic infarction.

The recommended treatment for *B. cereus* bacteremia includes administering antimicrobial agents and removing infected devices if present [9]. Vancomycin is the first choice of antimicrobial agent [1], as the susceptibility of *B. cereus* to vancomycin has been reported almost 100 % in several reports [10–12]. Imipenem, levofloxacin, gentamicin, tetracyclines, and linezolid are also reported effective against *B. cereus* [9,12]. Concerning susceptibility, reports vary from 35–85 % for clindamycin and 62–100 % for sulfamethoxazole and trimethoprim [10–12]. *B. cereus* isolates are resistant to penicillin and cephalosporins, such that empiric administration of beta-lactam antibiotics has been associated with increased mortality [9]. Because *B. cereus* might have the ability to stay attached to biomedical devices, those devices need to be removed in patients with *B. cereus* bacteremia. In a previous study, over 20 % of patients with *B. cereus* infective endocarditis had prosthetic heart valves and most of them required surgery [2].

Surgical indications in patients with PVE include heart failure due to valve dysfunction, newly developed heart block, annular or aortic abscess, PVE due to fungi, persistent bacteremia, relapsing PVE, recurrent septic emboli, or mobile vegetations larger than 10 mm in length [13]. The Society of Thoracic Surgery Risk Score (STS score) for surgically treated infective endocarditis is used for clinical decision-making. In the present case, surgery was not performed because the mortality risk based on the STS score was as high as 48 %. In addition, both the patient and her family expressed unwillingness to undergo the procedure. In terms of the optimal duration of antimicrobial therapy for PVE, The American Heart Association guidelines and European Society of

Cardiology guidelines recommend a minimum of six weeks after blood cultures initially become negative. It is important to note that complete resorption of valvular vegetations by the end of antimicrobial therapy is rare, even with successful treatment [14]. In this case, repeated TEE did not reveal any abscesses or vegetations. As a result, we discontinued antibiotic treatment after the completion of a six-week course.

We conducted a PubMed literature search of English articles published between 1978 and 2023 on patients diagnosed with PVE caused by *B. cereus* and found six case reports. Including the present case, this totals seven cases (Table 1). Most reported cases of prosthetic valve endocarditis caused by *B. cereus* were observed in patients under 60 years of age (no cases were reported in patients over 80 years old). Among the six cases, apart from the present one, five patients underwent surgical intervention and achieved successful recovery. However, one patient who did not undergo surgery, unfortunately, died. This present case might be the first case report documenting a full recovery without surgery in an older patient with PVE caused by *B. cereus*.

In conclusion, when a patient presents with splenic infarction, it is crucial to consider the potential presence of infective endocarditis. Patients with prosthetic valves are at a higher risk of *B. cereus* bacteremia, including PVE. While surgical intervention is commonly necessary for treating PVE, intravenous antibiotics alone may serve as an alternative approach for selected patients, particularly those with exceptionally high surgical risks.

**Ethical approval**

The local ethical committee approval does not apply in this case.

**Consent**

The patient's written consent was obtained.

**Funding**

None.

**CRediT authorship contribution statement**

**Akina Fukushima:** Writing – original draft. **Akihito Yoshida:** Writing – review & editing. **Miyu Takagi:** Writing – review & editing. **Sandra Moody:** Writing – review & editing. **Naoto Hosokawa:** Writing – review & editing. **Yoshihito Otsuka:** Writing – review & editing. **Takaaki Kobayashi:** Writing – review & editing.

**Declaration of Competing Interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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*Patient consent*

The patient's written consent was obtained. Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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