Bacillus cereus: Beyond Gastroenteritis

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ABSTRACT

Introduction: *Bacillus cereus (B cereus)* has been found within the gastrointestinal flora. Due to its ubiquity, *B cereus* is usually considered a contaminant. However, it can cause serious infections in certain populations.

Case Presentation: A 39-year-old woman with refractory gastroparesis requiring gastric pacemaker with a jejunostomy tube and cervical cancer status post chemotherapy presented with fever and fatigue. Initial and repeat blood cultures (from peripheral and port-a-cath access) grew *B cereus* and the port-a-cath was removed. She was treated with appropriate antibiotics and bacteremia resolved.

Discussion: *B cereus* is often associated with toxin-mediated emetic or diarrheal gastroenteritis. However, in patients with prosthetic devices or intravenous (IV) drug users, *B cereus* can cause serious infection. Biofilms produced by *B cereus* attach to indwelling catheters, allowing persistent infection until catheter removal.

Conclusion: In patients with prosthetic devices or IV drug use, *B cereus* should be treated with appropriated antibiotics and any indwelling catheters should be removed.

INTRODUCTION

Bacillus cereus (B cereus) is a saprophytic, gram-positive, aerobic-to-facultative, spore-forming rod. Although most often associated with toxin-mediated emetic or diarrheal gastroenteritis, the spores of *B cereus* can persist in hospitals and contribute to nosocomial infections.[1] *B cereus* has been found within the gastrointestinal flora of prolonged hospitalized patients. Due to its ubiquity in nature, *B cereus* is considered a contaminant when isolated from sterile specimens.[1,2] However, in patients with prosthetic devices, neonates, those undergoing chemotherapy for leukemia, or intravenous (IV) drug users, *B cereus* can be an important cause of infection.[2-5] Antibiotic-resistant biofilms produced by *B cereus* attach to indwelling catheters, allowing persistent infection until catheter removal.[1,6]

CASE PRESENTATION

A 39-year-old woman with history of severe refractory idiopathic gastroparesis requiring gastric pacemaker with gastrostomy and jejunostomy tube and cervical cancer status post chemotherapy presented to an outside hospital with fever, nausea, vomiting, and generalized weakness. Initial labs done at the outside hospital indicated that she had gram-positive bacteremia. She was transferred to our facility for further evaluation and treatment. Her other medical conditions included bipolar disorder, depression, systemic lupus erythematosus, and chronic pain syndrome. Her last chemotherapy was more than 5 years prior to presentation. She had undergone port-a-cath placement 7 years prior for chemotherapy and, given her history of no accessible peripheral veins, it was left in place for recurrent hydration needs. She lives alone, never smoked, and has a history of IV drug use with a urine drug screen positive for cannabinoids 3 months prior to her presentation. Upon arrival, her temperature was 98.5° F, heart rate 67 beats per minute, and blood pressure 122/75 mm of

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Hg. On exam, a port a-cath was noted on her left upper chest, no signs of infection. Gastrostomy and jejunostomy tube sites were clean. The rest of the physical exam was unremarkable. Upon further review, blood cultures from the outside hospital grew *B cereus*. Given the patient's history of angioedema due to vancomycin and penicillin allergy, she was given imipenem and levofloxacin while awaiting susceptibilities.

Susceptibility testing showed that the isolate was sensitive to sulfamethoxazole/trimethoprim, vancomycin, and imipenem and resistant to penicillin, clindamycin, and levofloxacin. The patient was switched to trimethoprim-sulfamethoxazole. Unfortunately, she developed a rash with use of sulfamethoxazole/trimethoprim, so she was switched back to imipenem. Repeat blood cultures, both peripheral and from the port-a-cath isolated the same *Bacillus*. The port-a-cath was removed as a part of source control, and the tip sent for culture grew the same isolate of *B cereus.* Repeat blood cultures obtained showed clearance of bacteremia. Transthoracic echocardiogram and transesophageal echocardiogram were performed and showed no evidence of vegetations. She was discharged to home on imipenem 500 mg IV every 6 hours for 14 days with a newly placed, peripherally inserted central venous line.

DISCUSSION

It was a commonly held belief that a positive *B cereus* culture likely represented contamination. However, an increasing number of case reports regarding non-anthrax *Bacillus* species causing systemic infection, including bacteremia and endocarditis, helps to raise awareness about *B cereus* as an important systemic pathogen. In 1963, Farrar published a review article of 12 cases of non-anthrax *Bacillus* causing serious infections.[7] Since then, multiple other cases of systemic *B cereus* infection have been reported.

Differentiation between true *B cereus* bacteremia and contamination can be challenging. A retrospective study of *Bacillus* species blood isolates of 1 hospital over 5 years found that 5% to 10% of isolates were pathogenic.[8] The incidence of bloodstream *B cereus* infection is higher in IV drug users, immunocompromised patients, and patients with central venous catheters compared to general population.[8,9] One meta-analysis done on 29 cases of *B cereus* between 2003 and 2012 at a teaching hospital in Japan showed that 69% of *B cereus* bloodstream infections were central venous catheter-related.[9] IV drug use and indwelling central venous catheters are independent risk factors for serious *B cereus* bacteremia and endocarditis.[10] *B cereus* can originate from cutaneous colonization, injection equipment, or even inhaled heroin.

The clinical presentation of *B cereus* bacteremia ranges from a mild fever to signs of sepsis like tachypnea, hypotension, persistent fever, nausea, and vomiting. The clinical course of fulminant *B cereus* septicemia is described by 2 phases: (1) a mild febrile illness lasting 6 to 14 hours with subtle symptoms of an overactive sympathetic nervous system and (2) a second short fulminant phase, marked by high fever (104° F-105.8° F) accompanied by major central nervous system disturbances, resulting in deep coma and brain stem dysfunction. Presence of an intravascular catheter is the most common feature of bacteremia caused by *Bacillus* species, and a significant proportion of patients have underlying malignancy or immunosuppression.

Endocarditis due to *B cereus* is rare and usually is associated with IV drug use, most commonly affecting the aortic or mitral valve. There has, however, been a case report of native valve *B cereus* endocarditis in a patient without any risk factors like IV drug use, immunodeficiency, or rheumatic heart disease.[11]

Treatment

B cereus bacteremia and endocarditis need to be treated with antimicrobials. Vancomycin is the preferred empiric antibiotic in suspected *B cereus* bacteremia with 100% susceptibility of isolates.[12] Penicillin and cephalosporins should not be the first choice, as many *B cereus* strains have beta-lactamase genes that are resistant to all beta-lactams other than carbapenems, although resistance to meropenem and imipenem has been encountered in the past. Interestingly, a literature review on 57 patients with *B cereus* infection showed that empirical treatment with beta-lactam antibiotics was associated with higher mortality.[12] Aminoglycosides, carbapenems, and fluoroquinolones can be used as a second line. Because there is evidence of clindamycin resistance, it can be used after sensitivity is confirmed.[13]

Although vancomycin and other antibiotics (eg, aminoglycosides, carbapenems, and fluoroquinolones) might be effective against free-floating *Bacillus*, they have poor activity against biofilm. Compared to free-floating *Bacillus*, *Bacillus* embedded in biofilm is resistant to antibiotics due to multiple mechanisms, including increased cell density, physical exclusion of the antibiotic, and physiological changes of individual bacteria.[14,15] Hence, source elimination is crucial, as infected lines and devices need to be removed.[16] In general, 7 to 14 days of antibiotic after removing the device is sufficient for *Bacillus* bacteremia.[17] Longer antibiotic course and further investigation are required for persistent bacteremia or symptoms. More complicated *Bacillus* infections, such as endocarditis, require 6 weeks of antibiotics.

CONLCUSION

This case demonstrates the capacity of *B cereus* in serious infection and the importance of not dismissing it as a contaminant when isolated in blood cultures of bacteremia patients with prosthetic devices. Although more commonly a cause of self-limited gastroenteritis, recognizing *B cereus* as a pathogen in bacteremia and beginning appropriate antibiotic therapy with source removal is crucial to prevent morbidity and mortality due to resulting systemic infections.

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