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Published In/Presented At

Shah, M., Patnaik, S., Wongrakpanich, S., Alhamshari, Y., & Alnabelsi, T. (2015). Infective endocarditis due to *Bacillus cereus* in a pregnant female: A case report and literature review. *IDCases*, 2(4), 120–123.
<https://doi.org/10.1016/j.idcr.2015.10.003>

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Case Report

Infective endocarditis due to *Bacillus cereus* in a pregnant female: A case report and literature review



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ARTICLE INFO

Article history:

Received 13 September 2015

Received in revised form 12 October 2015

Accepted 12 October 2015

Keywords:

Bacillus cereus

Infective endocarditis

Pregnancy

Intravenous drug use

ABSTRACT

Incidence of infective endocarditis during pregnancy is around 0.006% with high maternal and fetal mortality. *Bacillus cereus* is an extremely rare cause for endocarditis in intravenous drug abusers (IVDA) or those with valvular disease or devices such as pacemakers. We report a case of *B. cereus* endocarditis, which, to the best of our knowledge, has never been reported in pregnancy. A 30-year-old, 25-week pregnant female presented with right shoulder pain, swelling and erythema on the lateral aspect of deltoid muscle from large abscess over her deltoid muscle. She was found to have a vegetation on the native tricuspid valve. Cultures from abscess fluid and blood cultures grew *B. cereus*, she was appropriately treated with antimicrobials and had favorable outcomes. There are <20 cases of *B. cereus* endocarditis reported but none during pregnancy. When cultures grow unusual organisms the case must be thoroughly investigated. This case illustrates a rare situation (endocarditis in pregnancy) with an unusual outcome (*B. cereus*) on an uncommon valve (tricuspid valve).

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Introduction

The occurrence of infective endocarditis during pregnancy is a very rare event with a reported incidence around 0.006%. Maternal mortality rate is documented to be as high as 33% [1,2]. Most of the deaths are secondary to heart failure or the presence of embolic events that complicate clinical course. Fetal mortality rates of up to 30% have also been reported [1].

Bacillus cereus is an extremely rare cause for endocarditis, and less than 20 cases reported so far. It is particularly seen in intravenous drug users (IVDU), those with underlying valvular disease or intravascular devices such as pacemakers and prosthetic valves [3]. We are reporting a case of *B. cereus* endocarditis in a young pregnant woman. To the best of our knowledge, *B. cereus* endocarditis has never been reported in pregnancy before.

As the most common tricuspid valve infective endocarditis in intravenous drug users is from *Staphylococcus aureus* infection, this

case illustrates an unusual outcome (*B. cereus*) on an uncommon valve (tricuspid valve) in a rare situation (endocarditis in pregnancy).

Case report

A 30-year-old, 25-week pregnant female presented to the emergency room (ER) with right shoulder pain, which was progressively worse over a week with associated swelling and erythema on the lateral aspect of deltoid muscle. She has a long standing history of intravenous (IV) heroin and chronic methamphetamine use with tap water as diluents, as well as history of multiple hand abscesses.

At presentation, she was afebrile, hypotensive to 85/62 mmHg, tachycardic to 120/min, mildly tachypneic to 26/min, with normal oxygen saturation. Physical examination revealed poor oral dentition, and a large abscess over her deltoid muscle, from repeated intramuscular heroin injections. The abscess was incised and drained in the ER, and 100 mL of purulent fluid was obtained. Rest of her exam including the cardiovascular examination was unremarkable. White cell count (14.6 g/dL), ESR (55 mm/h) and CRP level (29 mg/L) were elevated. Her electrocardiogram was unremarkable, except for sinus tachycardia. There were no changes

Abbreviations: ESR, erythromycin sedimentation rate; CRP, C-reactive protein; MIC, minimum inhibitory concentration.

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<http://dx.doi.org/10.1016/j.idcr.2015.10.003>

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Table 1
Characteristics of previously reported cases of *Bacillus cereus* endocarditis.

Author (year)	Reference	Valve involved	Predisposing factors	Remarks
Craig et al. (1974)	Craig, C. P., W.-S. Lee, and M. Ho. 1974. <i>Bacillus cereus</i> endocarditis in an addict. Ann. Intern. Med. 80 :418–419.	Native (tricuspid valve)	IVDU	18 year old with atrial septal defect
Lee et al. (1974)	Lee, W., and M. Ho. 1974. <i>Bacillus cereus</i> endocarditis in an addict. Ann. Intern. Med. 80 :418	Native (tricuspid valve)	IVDU	
Block et al. (1978)	Block, C. S., M. L. Levy, and V. U. Fritz. 1978. <i>Bacillus cereus</i> endocarditis. S. Afr. Med. J. 53 :556–557.	Prosthetic valve (mitral valve)	Prosthetic mitral valve	
Tuazon et al. (1979)	Tuazon CU et al., 1979. Serious infections from <i>Bacillus</i> sp. JAMA 241:1137–1140.	Native (tricuspid valve)	IVDU	3 Cases
Wanvarie et al. (1979)	Wanvarie S, Rochanawatanon M. 1979. <i>Bacillus cereus</i> endocarditis. J. Med. Assoc. Thai. 62:34–38.	Aortic valve	Rheumatic heart disease	
Weller et al. (1979)	Weller PF, Nicholson A, Braslow N. 1979. The spectrum of <i>Bacillus</i> bacteremias in heroin addicts. Arch. Intern. Med. 139:293–294.	No vegetation by echocardiogram	IVDU	
Oster et al (1982)	Oster, H. A., and T. Q. Kong. 1982. <i>Bacillus cereus</i> endocarditis involving a prosthetic valve. South. Med. J. 75 :508–50	Prosthetic valve	Prosthetic aortic valve	
Sliman et al. (1987)	Sliman, R., S. Rehm, and D. Shlaes. 1987. Serious infections caused by <i>Bacillus</i> species. Medicine (Baltimore) 66 :218–223.	Right ventricular pacing wire	History of rheumatic fever Pacemaker	
Steen et al. (1992)*	Steen, M. K., L. A. Bruno-Murtha, G. Chaux, H. Lazar, S. Bernard, and C. Sulis. 1992. <i>Bacillus cereus</i> endocarditis: report of a case and review. Clin. Infect. Dis. 14 :945–946	Prosthetic valve (aortic valve)	Prosthetic aortic valve	Mentions that there were 10 cases reported so far- 6 were IVDA, 1 had pacemaker, rest had valvular heart disease
Tomomasa et al. (1993)	Tomomasa, T., K. Itoh, A. Matsui, T. Kobayashi, N. Suzuki, S. Matsuyama, and T. Kurome. 1993. An infant with ulcerative colitis complicated by endocarditis and cerebral infarction. J. Pediatr. Gastroenterol. Nutr. 17 : 323–325.	Native	Immunosuppression Gastrointestinal instrumentation	12 month old infant in setting of diarrhea, ulcerative colitis and sepsis
Yamamura et al. (1994)	Yamamura M, et al. 1994. A case of <i>Bacillus cereus</i> prosthetic valve endocarditis. Kyobu Geka 47:232–234. (In Japanese.)	Mechanical mitral valve	Prosthetic valve	
Martin Cadenas et al. (1998)	Martin Cadenas P, et al. 1998. Endocarditis by <i>Bacillus cereus</i> 1 in prosthetic mitral valve. Enferm. Infecc. Microbiol. Clin. 16:102–104. (In Spanish.)	Mechanical mitral valve	Prosthetic valve	
Castedo et al. (1999)	Castedo E, Castro A, Martin P, Roda J, Montero CG. 1999. <i>Bacillus cereus</i> prosthetic valve endocarditis. Ann. Thorac Surg. 68:2351–2352.	Prosthetic valve (mitral valve)	Prosthetic mitral valve	
Cone et al. (2005)	Cone LA, Dreisbach L, Potts BE, Comess BE, Burleigh WA. 2005. Fatal <i>Bacillus cereus</i> endocarditis masquerading as an anthrax-like infection in a patient with acute lymphoblastic leukemia: case report. J. Heart Valve Dis. 14:37–39.	Native valve (mitral valve)	Immunosuppression	Relapsing acute lymphoblastic leukemia with thigh abscess
Abusin et al. (2008)	Abusin S, Bhimaraj A, Khadra S. 2008. <i>Bacillus cereus</i> endocarditis in a permanent pacemaker: a case report. Cases J. 1:95.	Pacing wire	Pacemaker	
Thomas et al. (2012)	Thomas BS, Bankowski MJ, Lau WK. Native valve <i>Bacillus cereus</i> endocarditis in a non intravenous- drug-abusing patient. J Clin Microbiol 2012;50:519–21.	Native		No IVDU
Barrund et al. (2012)	Barrund O, Hidri N, Kim L et al. Pace-maker-associated <i>Bacillus cereus</i> endocarditis. Diagnostic Microbiology infectious diseases 2012; 74L 313–315	Native	Pacemaker	
Oh et al. (2012)	Oh DH, Kim MH, Kim YC et al. A case of native valve infective endocarditis caused by <i>Bacillus cereus</i> . Infection Chemotherapy 2012; 44: 310–314	Native (mitral valve)		No IVDU
Ngow et al. (2013)	Ngow HA, Khairina WMN. <i>Bacillus cereus</i> endocarditis in native aortic valve J Infect Chemother 2013; 19:154–157	Native (aortic valve)	Former IVDU	

concerning for ischemic disease or conduction anomalies. She was started on methadone for control of opioid withdrawal and the fetus was closely monitored.

An extensive history about the technique of heroin use revealed that she often used her neck veins for access, disinfected the site of injection with alcohol swabs every time, used tap water as a diluent and denied using saliva or licking the needles at the time of use.

The patient was initially started on IV hydration with normal saline and was empirically started on IV daptomycin due to the growth of drug resistant organisms on cultures in the case of previous abscesses. A transthoracic echocardiogram showed a 0.3 cm × 0.4 cm vegetation on the native tricuspid valve along with mild tricuspid regurgitation. The rest of the heart chambers and valves were intact.

Cultures from abscess fluid grew *B. cereus* and *Staphylococcus epidermidis*. Multiple sets of blood cultures grew *B. cereus*. Antibiotic susceptibility tests revealed an elevated MIC for daptomycin and the patient was switched to IV vancomycin. The patient remained afebrile with stable vitals during the rest of her hospital stay. A decision was made to keep the patient on 6 weeks of IV vancomycin but the patient left against medical advice after completing five full weeks of treatment.

On a return visit to the hospital 4 weeks, the patient complained of vaginal discharge flu like symptoms for a week. Her blood cultures remained negative and the symptoms were attributed to opioid withdrawal. She was found to have elevated transaminases with an ALT of 1048 IU/L and AST of 480 IU/L but a work up for hepatitis was negative and the right upper quadrant ultrasound was within normal limits. Her LFTs trended down without intervention. The transaminitis was attributed to the presence of hepatotoxic agents in the street drugs that she had resumed after discharge. The patient did not have any signs or symptoms concerning for infection and was cleared for discharge.

She had an uncomplicated preterm vaginal delivery in her 37th week of gestation. Her infant was healthy at birth and on subsequent follow up.

Discussion

Bacillus infections have been recognized since the beginning of the 20th century and the nonanthrax species have increasingly been identified as pathogens [4–8]. *B. cereus* is a Gram-positive to Gram-variable aerobic or facultative anaerobic spore-forming rod that is ubiquitous in nature. *Bacillus* species have been demonstrated to be present in the hospital surroundings including equipment and mucous membranes of healthy individuals [4,5]. The *B. cereus* group consists of six closely linked species: *B. cereus*, *B. mycoides*, *B. pseudomycoides*, *B. thuringiensis*, *B. weihenstephanensis*, and *B. anthracis*. Distinguishing between the individual species usually needs specialized in-laboratory molecular testing [9].

A majority of the human Bacillus infections are caused by *B. cereus* [3,5,10]. Clinical infections by *B. cereus* may be broadly classified as local infections, septicemia, central nervous system (CNS) infections including meningitis, respiratory infections, endocarditis or pericarditis and food poisoning caused by the production of a heat stable emetic and diarrheagenic toxin [7,8, 11–14]. A majority of the bacteremias with *B. cereus* are transient and clinically insignificant. Majority of the significant illnesses are seen in populations at risk such as IVDUs, patients on hemodialysis, neonates, immunocompromised patients and those with underlying malignancy [7,14–16].

B. cereus is an unusual cause of endocarditis, usually associated with IVDUs, an underlying valvular disease or in association with

implanted pacemakers and prosthetic valves (Table 1). All together, to the best of our knowledge, there are less than 20 cases of *B. cereus* endocarditis in literature but none have been documented in pregnancy [3]. The advancement in microbiological testing and increased awareness of its infectious potential allowed more cases of *B. cereus* endocarditis to be identified and reported. The first case of *B. cereus* endocarditis was reported in the 1970s in a patient with IVDU [17,18]. In most previous cases of *B. cereus* endocarditis of the native valves in IV drug abusers, the patients responded well to antimicrobials alone and there was no need for surgery. Worse outcomes, poor antibiotic response and surgical intervention are more common in patients with prosthetic valves according to literature [19–21].

The commonest sources leading to bacteremia in those with IV heroin abuse are colonization of the skin, contamination of injection equipment or paraphernalia, and organisms present in the heroin itself. In a study published in 1974, it was seen that 32% of street heroin samples and almost 50% of the injection drug paraphernalia grew *Bacillus* spp. on culture [7]. Other studies have shown the presence of *Bacillus* spp. in alcohol prep pads which may be used by these patients prior to injection [22]. We were unable to acquire the actual heroin samples or her equipment for testing but at least one of the above mentioned sources may have been the source of origin for the infection.

It is important to realize in clinical practice that *B. cereus* is a known blood culture contaminant and may be linked to contamination of ethanol solutions, hospital linen, culture media, hand gloves, and hospital construction material [23–27]. Another contributing factor is that *Bacillus* spp. grow easily on blood and chocolate agars at temperatures between 25 and 37 °C. Hence, a high suspicion should be maintained in the correct clinical setting especially in patients who continue to have multiple positive blood cultures. IVDUs with *B. cereus* bacteremia are at a high risk for developing aggressive endophthalmitis, panophthalmitis or acute keratitis that can lead to blindness within hours requiring enucleation of the eye [8,26].

The choice of appropriate management of endocarditis in pregnancy can be challenging but prompt treatment is needed due to the high rates of maternal and fetal mortality associated with it [28,29]. *B. cereus* unlike most *B. anthracis* isolates, produces beta lactamases and is usually resistant to Beta-lactam antimicrobials, including the third generation cephalosporins. Alternative antimicrobials that can be used are aminoglycosides, vancomycin, clindamycin or erythromycin [15,16], however, their safety in pregnancy is debatable. Hence, their use should be considered with caution and on an individual basis. IV daptomycin is category B drug in pregnancy but since the organism had a high MIC (>4) for daptomycin, vancomycin (category C drug in pregnancy) was used instead which is known to be efficacious against *B. cereus*. Vancomycin may rarely be associated with sensorineural hearing loss or nephrotoxicity in the fetus after maternal use in the 2nd or 3rd trimester. Our patient tolerated the antibiotic well without any maternal or infant related adverse events even on follow up at 2 weeks postpartum.

Conclusion

A high suspicion for endocarditis must be maintained in patients with a history of IVDU and cultures growing unusual organisms, cases as such must be further investigated and early initiation of empiric antimicrobial therapy may improve outcomes. Early diagnosis of endocarditis in pregnancy may decrease the need for surgery in most cases. Pregnancy poses special challenges like optimal management of delivery and timing of surgery if indicated.

Conflict of interest statement

The authors declare that there are no conflicts of interest.

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