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Review Article

Bacillus cereus as a nongastrointestinal pathogen

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ABSTRACT

The potential of Bacillus cereus to cause systemic infections is of serious concern. Apart from Gastrointestinal infections, it causes respiratory tract infections, nosocomial infections, eye infections, CNS infections, cutaneous infections, endocarditis, osteomyelitis and urinary tract infections. The potential of this bacterium to cause life threatening infections has increased. Trauma is an important predisposing factor for Bacillus cereus infections. The maintenance of skin and mucous membrane integrity limits infection by this micro-organism.

Keywords: Bacillus cereus, Mucous membrane integrity, Trauma

INTRODUCTION

Bacillus cereus potential to cause systemic infections is of current public health and biomedical concern. The spectrum of infections apart from gastrointestinal infections caused by B. cereus include Respiratory tract infections, Nosocomial infections, Eye infections, CNS Infections, Cutaneous infections, Endocarditis, Osteomyelitis and UTIs.[1]

RESPIRATORY INFECTIONS CAUSED BY BACILLUS CEREUS

Bacillus cereus can cause pneumonia and trachaeobronchitis. Usually B. cereus pneumonia is unusual in nonimmunocompromised hosts. But, Avashia et al. described two fatal cases of pneumonia in metalworkers due to inhalation exposure and none of them had any significant predisposing comorbidities.[2] Strauss et al. reported the development of pseudomembranous tracheobronchitis caused by Bacillus cereus in a 52 year old female with aplastic anaemia where treatment mediated damage to buccal mucosa caused spore / vegetative cell adherence & colonization of B. cereus which in turn led to severely inflammed tracheal & bronchial mucosa with white diphtheria like membranes obstructing the lower lobe bronchi.[3] Bacillus cereus colonization of the buccal cavity as seen here is the underappreciated first stage in pathogenesis of pulmonary infections.[1]

NOSOCOMIAL INFECTIONS CAUSED BY B. CEREUS

Bacteremias, catheter related blood stream infections and Pseudo infections occur due to B. cereus.[1] It is a classical and well-known environmental organism, usually considered as a contaminant in clinical samples. In general, its pathogenic role is confined to sporadic outbreaks of food poisoning, owing to its enterotoxigenic capacity. However, sporadic infections by B. cereus in surgical wounds, panophthalmitis, pneumonia, meningitis and bacteremia have been reported for many years. Almost all these infections occur in parenteral drug abusers, immunocompromised patients with malignant hematological diseases, patients with intraventricular shunts or other devices, and new-born babies.[4] But there is evidence of an immunocompetent postcholecystectomy patient with peritonitis whose blood cultures and intravenous catheter tip cultures were

positive for B. cereus suggesting that serious rupture of mucosal barriers in patients is also an independent risk factor for B. cereus infection.[5] The maintenance of mucous membrane integrity is a clinical factor which limits infection by this micro-organism.[6]

B. cereus pseudo infections among hospitalized patients have been well documented, especially with regard to pseudobacteremias.[7-9] A pseudo-outbreak has been defined as a situation in which an organism is recovered in culture at a rate that is greater than expected and that cannot be correlated clinically with the supposed infection implied by the culture results.[10] Pseudo-outbreaks of bacteremia and respiratory tract infections have been traced to contaminated ethyl alcohol[11] and fiber-optic bronchoscopy equipment[12,13] respectively.

EYE INFECTIONS CAUSED BY B. CEREUS

These include endophthalmitis and keratitis. Bacillus species are being recognized increasingly as major causes of posttraumatic ocular disease, with rates of infection often making them the second most commonly isolated organisms. Bacillus cereus, an especially virulent pathogen, causes a fulminant endophthalmitis characterized by rapid destruction of intravitreal contents and a uniformly poor visual outcome.[14] It causes keratitis due to contamination of contact lenses in immmunocompetent patients and is also associated with microabrasions of cornea suggesting trauma to be an important factor in eye infections also.[15,16]

CNS INFECTIONS CAUSED BY B. CEREUS

Bacillus cereus is associated with causation of meningitis, meningoencephalitis, intracerebral haemorrhage and brain abscess. Bacillus cereus is infrequently associated with invasive central nervous system (CNS) disease. But, despite aggressive treatment with broad-spectrum anti-infectives, the mortality of CNS invasive B cereus infections is high. Clinicians should not dismiss Gram-positive rods resembling Bacillus species from normally sterile sites as contaminants in critically ill patients. Reports of invasive CNS disease exist in both pediatric and adult populations.[17] Cases of meningitis and meningoenchephalitis were reported by various authors suggesting severe late onset haemorrhagic meningoencephalitis in preterm infants.[18,19] Strittmatter et al. reported multiple brain abscess and intracerebral haemorrhage caused by B. cereus in a case of all. Bacillus species has a special affinity for the CNS mediated by phospholipase C, which tends to associate with the lipid membranes of the brain.[20]

CUTANEOUS INFECTIONS CAUSED BY B. CEREUS

Cutaneous infections due to trauma and gas gangrene are associated with B. cereus. Primary cutaneous lesions attributed to B. cereus in immunocompetant persons is rare. But outbreaks of skin infections had been reported to be caused by B. cereus. Non pruritic impetigo like lesions on scalps were observed after a hair cut in military cadets. B. cereus is also known to cause chronic skin infections that are difficult to eradicate though less aggressive than necrotizing fasciitis.[21] Fulminant necrotizing infection resembling gas gangrene following penetrating trauma were reported by various authors.[22,23] In the above cases, penetrating trauma was implicated as an important factor for these infections .

ENDOCARDITIS CAUSED BY B. CEREUS

Bacillus cereus endocarditis has been implicated in intravenous drug users, and in patients with prosthetic heart valves. A case of Bacillus cereus infecting a permanent pacing wire was also reported were a mobile lesion attached to the pacing wire was seen on an echocardiogram. This case reminds the clinician to have a high index of suspicion for B. cereus endocarditis in any patient with cardiac prosthesis and to pursue the blood culture results even for rare and unexpected organisms.[24] In the recent past, cases of native valve Bacillus cereus endocarditis also have been reported even without any apparent risk factors like IV drug abuse.[25,26] This suggests that the potential of this bacterium to cause dreadful diseases has increased beyond doubt.

OSTEOMYELITIS CAUSED BY B. CEREUS

Osteomyelitis with non-anthracis Bacillus organisms has been described in adults. Chronic osteomyelitis due to Staphylococcus aureus and super infection with Bacillus cereus in a 13-year-old adolescent was reported. A Bacillus isolate should be considered a true pathogen in children with chronic osteomyelitis who have a poor clinical response to antistaphylococcal therapy.[27]

URINARY TRACT INFECTIONS CAUSED BY B. CEREUS

Urinary tract infections caused by B. cereus were also reported. Sato et al. reported acase of pyelonephritis in a patient on indwelling urethral catheter.[28] Tuazon et al. cited instrumental trauma as a predisposing factor for UTI caused by Bacillus cereus.[29]

CONCLUSION

The potential of Bacillus cereus to cause dreadful diseases has increased beyond doubt. Trauma is an important predisposing factor for Bacillus cereus infections. In the presence of trauma, Bacillus cereus infections occur in immunocompetant individuals also. Bacillus cereus colonization of the buccal cavity is the underappreciated first stage in pathogenesis of pulmonary infections. Bacillus species has a special affinity for the CNS mediated by phospholipase C, which tends to associate with the lipid membranes of the brain. It should be considered a true pathogen in children with chronic

osteomyelitis who have a poor clinical response to antistaphylococcal therapy. The maintenance of mucous membrane integrity is a clinical factor which limits infection by this micro-organism.

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