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Fatal pneumonia in an immunocompetent individual: Role of Bacillus cereus

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***Abstract*---**This case clearly demonstrate the need for increased awareness of the potential for B. cereus to cause serious systemic infections, even in patients who appear to be otherwise healthy. Unless there is good liaison between the pathologist and clinicians, their role in genuine infection can be easily overlooked. Knowing that Bacillus species can cause life-threatening infections in such apparently normal hosts should prevent clinicians from regarding these organisms as mere contaminants when they are recovered from seriously ill patients. Initial empirical treatment with β- lactam antibiotics in patients showing aerobic gram positive rods may be avoided which may preclude the treatment of B.cereus.

***Keywords*---**fatal pneumonia, immunocompetent individual, Bacillus cereus.

Introduction

Bacillus species are aerobic to facultative anaerobic, Gram-positive spore forming rods found widely distributed in air, soil, water, milk, faeces and on mucous membranes of healthy people. (1). Often this bacterium is an indicator of contaminant, specially considered as a sign of improper specimen collection or

processing or contamination in specimen collection devices. Therefore they are missed, the identification thus often ends descriptive, and many times the report is not proceeded and mostly left neglected in clinical microbiology. (2, 3, 4)

Bacillus cereus in recent days has become emerging respiratory pathogen; particularly it can cause pneumonia that may be serious and can exhibit the anthrax-like symptoms and shares many genotypical, phenotypical, and pathogenic features. Treatment of *B. cereus* lower airway infections is becoming increasingly hard, due to rapid progression of the disease, fatality and the spread of multidrug resistance traits among members of the species. (1c) We report here a case of pneumonia caused by *B. cereus* in a patient who had no obvious immunologic compromise.

Case Report

A 65 year old obese female, a home maker who had been healthy until 7 days prior to hospital admission had experienced cough with expectoration. During the last 24 hours before her presentation in the emergency room, she developed fever and sudden onset of breathlessness. She was a hypertensive for past 15 years on treatment with T. Atenolol with no other significant past history. She is a nonsmoker and a nonalcoholic.

On initial examination patient was dyspneic with bilateral pitting pedal edema, oral temperature of 99.2˚F, pulse of 120/min, respiratory rate of 34/min and BP of 150/90 mm Hg. Physical examination revealed inspiratory crepitations in all areas of lung fields. Heart sounds were rapid and normal. Chest X ray revealed diffuse parenchymal infiltrates and cardiomegaly with unfolding of aorta.

Initial evaluaition showed Hb: 12.3 gm/dl, total count 1230 cells/cu.mm, urea : 47mg/dl, creatinine : 1.6 mg/dl, electrolytes in normal range, ECG – sinus tachycardia, peripheral smear showing neutrophilia, AEC : 400 Cells per cu.mm. Her serum IgG levels were normal and HIV serology negative. Echo was normal with EF-67 %. Sputum AFB and eosinophils were negative. Sputum culture and sensitivity revealed no growth initially. Bronchoalveolar lavage (BAL) was done on 3rd day of admission which revealed *Bacillus cereus*.

As first BAL specimen collected shows *B. cereus* growth Repeat BAL was done after two days to rule out contamination, which also showed growth of *B. cereus*. Simultaneously blood culture also has showed *B. cereus* growth. The specimens were processed for isolation of pathogenic bacteria by standard conventional bacteriological methods and the bacteria isolated were identified to species level using standard biochemical tests. A positive culture was defined as growth of the microorganism in two or more media or confluent growth at the site of inoculation.

Bacillus cereus was identified by both the conventional procedure and by VITEK 2 Systems Version: 07.01. The organism produced grey coloured non- haemolytic colonies in blood agar, lactose fermenting colonies in MacConkey agar. They produced lecithinase and lipase the most important virulence phenomena of the organism. Other biochemical reactions are shown in table 1 and antibiogram

pattern in the table 2 below. The organism were also confirmed by PCR based DNA sequencing using ABI3100 Genetic Analyzer (Applied Biosystems, USA.) with polymer POP6 and sequenced. The sequences were analyzed using BIOEDIT, (downloaded from http://www.mbio.ncsu.edu/BioEdit/bioedit.html), and finally blasted with NCBI Blast website (http://blast.ncbi.nlm.nih.gov/Blast.cgi) to identify species and their corresponding homology (5).

Repeat chest Xray showed bilateral minimal pleural effusion. Pleural fluid analysis exhibited exudative effusion with normal ADA, cytology suggestive of inflammatory or reactive effusion and negative for malignancy. Patient was initially started with injection imipenem and vancomycin and other conservative management. Antibiotics were revised and started with ciprofloxacin, according to culture and sensitive reports. Over the next few days patients condition deteriorated, developed septic shock and respiratory failure. The patient died after six days of admission.

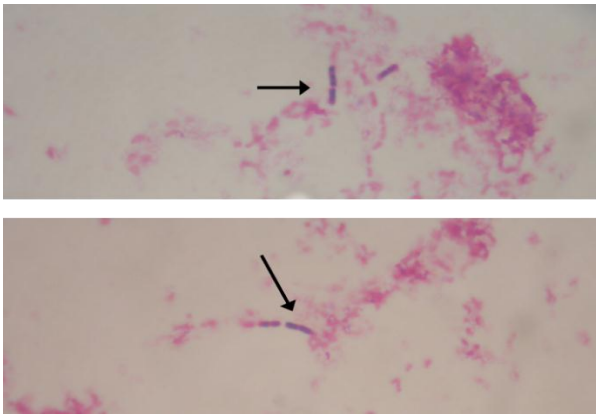

Figure 1 - Grams staining from direct specimen – Under 100X Objective

Figure 2 - *Bacillus cereus* growth in Blood agar plate

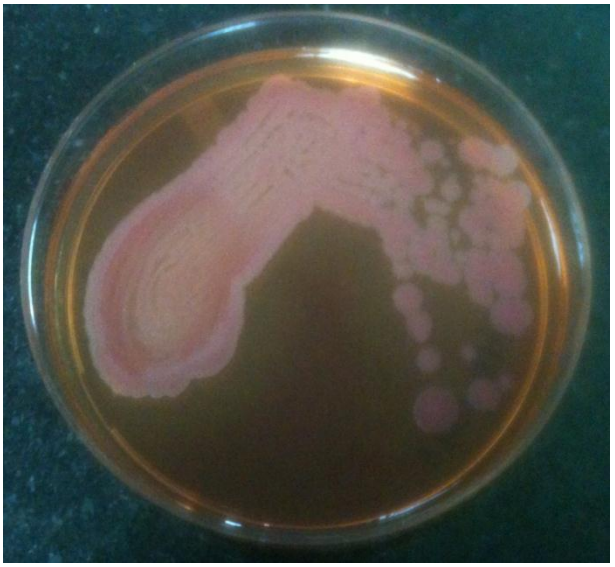

Figure 3 - *Bacillus cereus* growth in MacConkey agar plate

Figure 4 - *Bacillus cereus* growth in Egg yolk agar - Lecithinase and lipase positive

Discussion

This case is unusual in that healthy middle aged individual, with no known immunocompromised status, succumbed to overwhelming sepsis and lung infiltrates associated with *B. cereus* and symptoms resembling those of *B. anthracis* respiratory disease. *Bacillus cereus* is a Gram positive motile bacillus with sub-terminal spores. It is catalase positive and produces lecithinase in egg yolk agar. Bacillus species include *B. cereus*, *B. mycoides*, *B.pseudomycoides*, *B. thuringiensis*, *B. weihenstephensii* and *B. anthracis*. Bacteria of the genus Bacillus except B. *anthracis* rarely cause pulmonary infection. *Bacillus cereus* is known to

cause food poisoning in the form of diarrhea and vomiting. *Bacillus spp.* are often encountered in the laboratory as contaminants (1).

In this case as it was isolated twice from BAL which is a protected specimen as well as from blood and hence it can be regarded as the actual infection. The isolation of the organism from more than one specimen in a case may be helpful in establishing its significance, particularly if it is cultured from sites which are normally sterile. Apart from cases of food poisoning, *B. cereus* infections most often occur in patients with underlying debilitating illnesses or post traumatic wounds. The organism seems to have particular affinity for the eye, causing rapid destructive endophthalmitis, associated with intravenous drug abuse, (6) and after penetrating eye injury (7) In other reported cases, underlying illnesses associated with *B. cereus* infection (e.g., pneumonia) include leukemia, (8, 9) patients with asthma who receive long-term corticosteroids, (10) Meningitis in a patient with ventriculoatrial shunt has been reported. Leffert, et al., and Farrar described several cases of Bacillus meningitis, (11) and patients undergoing renal dialysis with improperly decontaminated hemodialyzers (12), severe pneumonia (13), necrotizing fasciitis and osteomyelitis (14, 15) endocarditis (15).

The potential of *B. cereus* to cause necrotizing disease indicates that it has the ability to produce toxins. Studies by Bonventre and Johnson have shown that *B. cereus* produces significant amounts of different enzymes like phospholipase C, hemolysins, lecithinase, protease and necrolising enterotoxin that at least three of these will participate in the pathogenesis in humans and animals (16). Turnbull and colleagues have shown that exotoxins of *B. cereus* injected into the skin of rabbits caused increased vascular permeability and necrosis (17). At a later date Turnbull and Kramer reported an analysis of exotoxin production by strains isolated from nongastrointestinal diseases such as bacteremia/septicemia, postoperative wound infections, panophthalmitis, and respiratory tract infections (18).

Hoffmaster *et al.*, reported a unique strain of encapsulated *B. cereus* (G9241) associated with severe pneumonia (13). David sue et all findings demonstrate that capsule expression in *B.cereus* is rare; they observed capsules in only 3 of the 47 total *B. cereus* isolates we examined. Therefore, the total number of reported encapsulated *B. cereus* strains is four, including G9241. The clinical sources of these four strains are notably similar (2, 13). Each of the encapsulated *B.cereus* strains was implicated in either fatal (three strains) or near-fatal (one strain) pneumonia in individuals characterized as immunocompetent (2, 13). Progressive azotemia may have increased susceptibility to the infection, defects of cellular and humoral immunity having been documented in patients with renal insufficiency (19)

Conclusion

This case clearly demonstrate the need for increased awareness of the potential for *B. cereus* to cause serious systemic infections, even in patients who appear to be otherwise healthy. Unless there is good liaison between the pathologist and clinicians, their role in genuine infection can be easily overlooked. Knowing that Bacillus species can cause life-threatening infections in such apparently normal

hosts should prevent clinicians from regarding these organisms as mere contaminants when they are recovered from seriously ill patients. Initial empirical treatment with β- lactam antibiotics in patients showing aerobic gram positive rods may be avoided which may preclude the treatment of *B.cereus*.

Table 1 : Biochemical reactions of *Bacillus cereus* isolate

No.	Biochemical test	Result
1	Catalase	Positive
2	Oxidase	Positive
3	Glucose	Fermented, No Gas
4	Sucrose	Fermented
5	Lactose	Fermented
6	Maltose	Not Fermented
7	Citrate	Produced
8	Urease	Not Produced
9	Nitrate	Reduced
10	Indole	Not Produced
11	Bile esculin	Not Hydrolysed
12	6.5% Nacl	Growth seen
13	Lecithinase	Hallow opalascence Produced
14	Lipase	Pearly layer Produced

Table 2 : Antibiotic suceptibility pattern of *Bacillus cereus* isolate

No.	Antibiotics	Result
1	Gentamicin	Sensitive
2	Ciploxfloxacin	Sensitive
3	Norfloxacin	Sensitive
4	Levofloxacin	Sensitive
5	Erythromycin	Sensitive
6	Clindamycin	Sensitive
7	Linezolid	Sensitive
8	Teicoplanin	Sensitive
9	Vancomycin	Sensitive
10	Tetracycline	Sensitive
11	Tigecycline	Sensitive
12	Nitrofurantoin	Sensitive
13	Cefotaxime	Sensitive
14	Chloramphenicol	Sensitive
15	Co-trimoxazole	Sensitive
16	Trimethoprim/Sulfamethoxazole	Resistant

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