Case Report

# Suspected diphtheria turn out to be *Bacillus cereus*: A rare case study

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## ABSTRACT

*Bacillus cereus* rarely causes respiratory tract infections. We present a suspected case of diphtheria with sepsis, which turned out to be *B. cereus*. A 6-year-old female child presented with fever, cough, dyspnea, and dysphagia. On examination, bilateral submandibular swelling and pseudomembrane were present in the oral cavity. A throat swab and blood were taken for microbiological examination. Gram stain of throat swab showed Gram-positive bacilli, and there were no *Corynebacterium diptheriae*-like bacilli in Albert's stain. *B. cereus* grew both in the throat swab and the blood. Antibiotics were changed according to the culture report. Targeted therapy was successful, and the patient was discharged uneventfully. This is a rare case highlighting *B. cereus* as a potential pathogenic cause for a life-threatening infection in otherwise immunocompetent children whose vaccination status was complete. Microbiological testing, such as stains and culture, is essential for accurate diagnosis and timely management.

**Key words:** *Bacillus cereus*, Diphtheria mimic, Pseudomembrane

Pseudomembranous pharyngitis is a severe inflammatory condition characterized by a thick, greyish-white, adherent membrane covering the tonsils, pharynx, or nasopharynx. It is usually a hallmark of diphtheria, which is caused by *Corynebacterium diphtheria*, but can also result from other infections like fusobacterium and other causes. It usually occurs in immunocompromised patients; sometimes it may present in otherwise healthy individuals. Knowing the cause is important for accurate diagnosis and timely management. Timely microbiological investigation in such presentations and tailored therapy is the cornerstone to ensure effective management in such cases. Gram-positive aerobic or facultative anaerobic spore-forming rods are known as *Bacillus cereus*. It frequently results in food poisoning. It can produce severe symptoms in neutropenic and immunocompromised patients, yet it is frequently regarded as a contaminant and non-pathogenic in immunocompetent people. It has been shown to cause septicemia, central nervous system (CNS) infections, respiratory infections, endocarditis, as well as local wound, burn, and ocular infections [1-4]. Although rare, it can be highly fatal in patients with hematological malignancies [5-7]. In nature, the bacterium is both a vegetative cell and a spore producer; when it colonizes the human body, it is a vegetative cell. Some strains contain an outermost crystalline surface protein (S layer) [8,9]. When grown under aerobic conditions on 5% sheep blood agar at 37°C, *B. cereus* colonies are dull gray and opaque with a rough, matted surface. Colony perimeters are irregular and represent the configuration of swarming from the site of initial inoculation, perhaps due to *B. cereus* swarming motility [10]. The zone of beta-hemolysis surrounds and conforms to the colony morphology [11]. In some instances, smooth colonies develop either alone or in the midst of rough colonies.

Here, we report an unusual case of pediatric pseudomembranous pharyngitis with sepsis, which was initially diagnosed as diphtheria, but later turned out to be *B. cereus* septicemia. This case highlights the importance of considering bacterial causes other than *C. diphtheriae* in the case of pseudomembrane pharyngitis. The overlapping clinical features can delay diagnosis and clinical management.

## CASE PRESENTATION

A 6-year-old previously healthy girl was admitted with a 3-day history of fever, productive cough, difficulty in breathing, and dysphagia. There was no history of immunodeficiency, prior hospitalization, central venous catheter use, anthrax vaccination, or exposure to tuberculosis or ill contacts.

On examination, she was febrile (39°C) with a respiratory rate of 32/min, a pulse rate of 124/min,

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oxygen saturation of 89% on room air (improved to 96% with oxygen by nasal prongs), a blood pressure of 94/60 mmHg, and toxic-looking. Bilateral submandibular swelling was noted with a thick pseudomembrane covering the tonsillar area and soft palate.

An initial diagnosis of suspected diphtheria with sepsis was made, and the patient was started on crystalline penicillin (50,000 units/kg/dose intravenous [IV] every 6 h) and ceftriaxone (75 mg/kg/day IV). Oxygen therapy through nasal prongs improved her dyspnea. Laboratory investigations revealed White blood count 18,500/$mm^3$ (Neutrophils 86%), Erythrocyte sedimentation rate 42 mm/h, and C-reactive protein was elevated.

Throat swab and blood were sent for microbiological examination. On Gram stain, Gram-positive bacilli were seen in the throat swab, but no metachromatic granules containing club-shaped light green bacilli were seen in the Albert stain. No fungal element was observed. On the second day, both samples (Throat swab and blood) grew *B. cereus* (By automatic ID system), a large Gram-positive *Bacillus* with central spores (Fig. 1).

Antibiotics were revised to IV vancomycin (15 mg/kg every 6 h) and clindamycin (10 mg/kg every 8 h) on day 2 after initial diagnosis. The next day, antibiotic sensitivity showed a similar pattern. The isolate was resistant to penicillin and cephalosporins but susceptible to vancomycin, clindamycin, and linezolid. The child's condition improved over the next 72 h. The pseudomembrane resolved, the submandibular swelling subsided, and the inflammatory markers normalized. She was discharged on day 9 with oral clindamycin for 7 days.

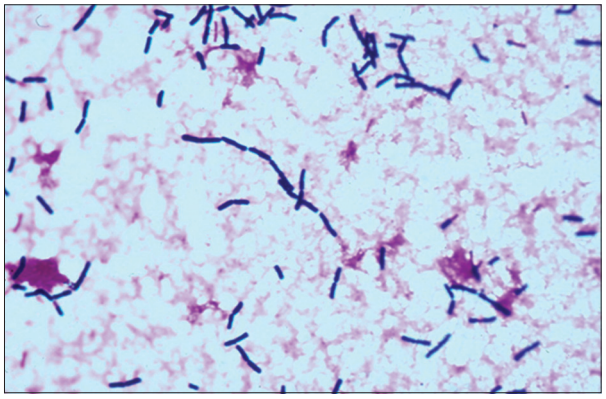

**Figure 1: Gram stain of blood culture showing Gram-positive slender bacilli with rounded ends singly, in pairs, and in short chains**

## DISCUSSION

Although *B. cereus* is often dismissed as a contaminant in clinical cultures, because it is found normally in the soil, it is known to cause self-limiting food poisoning which needs symptomatic treatment in immunocompetent patients. It has the potential to cause invasive disease, particularly in neonates, immunocompromised individuals, and those with indwelling devices. Respiratory tract infections are particularly uncommon and associated with high morbidity. The present case was initially managed as diphtheria based on classical pseudomembrane formation, submandibular swelling, and respiratory distress. Culture results from blood and throat swabs revealed *B. cereus*, which rarely causes such presentations. No risk factor associated with immunocompromised status was identified in this patient.

Pseudomembrane formation in the pharynx is a typical feature of *C. diphtheriae*. Others may also present similar clinical features such as streptococcal pharyngitis, infectious mononucleosis, Vincent angina, candida infection. Some case report has shown that other organisms also may cause pseudomembranous pharyngitis like *Aspergillus* spp. and non-diptheroid Corynebacteria. A rare case report has shown *B. cereus* as the cause of pseudomembrane formation, a case of a rapidly progressive pseudomembranous tracheobronchitis and pneumonia in a 52-year-old woman with severe aplastic anemia [12]. Unlike this, which occurred in immunocompromised hosts, our patient was an immunocompetent child with no identifiable predisposing risk factors. This makes the present case particularly unusual and emphasizes the need to consider *B. cereus* as a differential pathogen even in apparently healthy children presenting with pseudomembranous pharyngitis and sepsis. Uchino *et al.* present a case series of *B. cereus* septicemia in patients with hematological diseases. Pediatric oncology patients with *B. cereus* bloodstream infections have been reported to develop rapidly progressive sepsis, CNS involvement, and high mortality, emphasizing the importance of early microbiological diagnosis and prompt targeted therapy. He concluded that delayed administration of appropriate antibiotics tended to result in a fatal prognosis [13]. Another rare but clinically relevant report described pseudomembranous tracheobronchitis caused by *B. cereus* in an immunocompromised patient, in which the organism was isolated from respiratory specimens, blood culture, and pseudomembranous tissue. This report supports the possibility that *B. cereus* may produce toxin-mediated necrotizing inflammation and pseudomembrane formation in the respiratory tract, similar to the unusual presentation observed in our patient [7].

The case highlights several important clinical considerations. First, we should always consider an alternate pathogen for a usual clinical diagnosis. A proper microbiological investigation is utmost warranted in such cases. Second, getting *Bacillus* in the blood culture should be taken as a red flag, not only as a contaminant, which is a usual practice. Third, intrinsic resistance to beta-lactams drugs in such pathogens highlights the importance of targeted therapy over empirical treatment. The child's recovery following prompt antimicrobial adjustment highlights the clinical significance of correlating laboratory findings with patient status and maintaining a broad differential diagnosis in severe pediatric infections. The uniqueness

in this case lies in the isolation of a rare pathogen for a usual clinical condition. Awareness of such alternative pathogens is essential to avoid diagnostic delays, prevent complications, and guide appropriate antibiotic therapy. Early recognition and timely management can improve outcomes, particularly in children.

## CONCLUSION

This case underlines the importance of considering *B. cereus* as a possible cause of sepsis and respiratory tract infection in pediatric patients, even in the absence of classical risk factors. Timely diagnosis, culture confirmation, and appropriate antibiotic therapy are critical for a favorable outcome. Our patient perfectly responded to treatment with Vancomycin and Clindamycin based on the culture and sensitivity report. Early recognition and appropriate timely management, as in this case, was very crucial for a favorable outcome.

## AUTHORS' CONTRIBUTIONS

Dr. Ekta Singh contributed to the case management, data collection, literature review, and manuscript preparation.

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