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A case of fulminant *Bacillus cereus* meningoencephalitis after neuroplasty with white matter change

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Abstract

Bacillus cereus meningitis can show unusual presentation and very rapid progression associated with high mortality and unusual MRI findings. We report a 77-year-old man with fever and altered mentality after epidural neuroplasty for chronic lumbar spinal pain. Symptoms rapidly progressed over the 12 hours following surgery. He was diagnosed with meningoencephalitis by *Bacillus cereus* confirmed by CSF culture and DNA sequencing. He improved with antibiotics slowly although his mental state did not completely revert to his prior level. This case demonstrates the rapid and fulminant clinical picture produced by *Bacillus cereus* associated with neuroplasty. It also shows peculiar frontal white matter changes with hydrocephalus on MRI.

INTRODUCTION

Bacillus cereus is an aerobic or facultatively anaerobic, gram positive, spore-forming rod[1] which rarely causes fulminant meningoencephalitis and primarily results in foodborne gastro-enteritis[2] due to a pre-formed enterotoxin. It is an environmental organism commonly found in soil, vegetation and rice frequently associated with contamination. However it plays a role as pathogen for various local and systemic infections. It is associated with pan-ophthalmitis[3], endocarditis[4], pneumonia[5], meningitis[4] and septic arthritis.[6] Further, it can be an opportunistic pathogen, causing infections in immunologically compromised patients.[7] We describe a fulminant case of meningoencephalitis caused by *B. cereus* in a patient who underwent neuroplasty. The infection was treated but improvement was incomplete.

CASE REPORT

A 77-year-old man was admitted to Seoul National University Bundang hospital with fever and altered mentality. Twelve hours prior, he underwent endoscopic epidural neuroplasty at a local clinic for treatment of a herniated nucleus pulposus at the L3-4 and L4-5 level. After neuroplasty, he developed back pain and rigors, fever, vomiting followed by decreased mentation and generalized tonic-clonic type seizure. On arrival at our hospital, temperature was 40.2°C. His medical history revealed diabetes mellitus (DM), chronic kidney disease associated with DM and arterial hypertension. Physical examination showed meningism, altered mental state with confusion. No other focal neurology was found. Routine tests showed increased leukocyte of 12.39 x 10^3/ml with 83.1% neutrophils and C-reactive protein level of 5.01 mg/dL (normal range: 0~0.5 mg/dL). Brain MRI showed profound meningeal enhancement in the basal cisterns and cerebral sulcus with hydrocephalus, compatible with meningitis (Figure1). Cerebrospinal fluid (CSF) was turbid, opening pressure was 180 mm H20, leukocyte count increased (11,200/mm^3: neutrophils, 81%; lymphocyte, 0%; and monocyte, 19%), increased protein level (4,475 mg/dL), and increased glucose level (CSF glucose, 312 mg/dL; blood glucose, 401mg/dL). Gram staining, acid-fast bacillus staining, fungus stain, and tuberculosis polymerase chain reaction (PCR) of CSF were negative.

On admission, vancomycin, ceftazidime and ampicllin were initiated intravenously as empirical antibiotics combined with dexamethasone 10mg intravenously every 6 hour. Two blood cultures and CSF grew *Bacillus species*. Bacterial DNA sequencing following PCR in CSF revealed *Bacillus cereus*. The strain was sensitive to vancomycin, chloramphenicol, clindamycin, gentamicin, ciprofloxacin but resistant to

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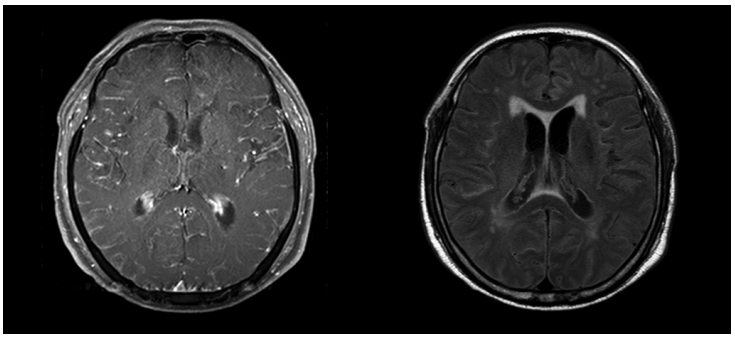

Figure 1. Initial brain MRI of the patient. (Left) Axial T1-weighted gadolinium-enhance image showed profound meningeal enhancement. (Right) FLAIR image showed minimal degree hydrocephalus suspected with white matter change by interstitial edema at the bilateral horns of lateral ventricles.

penicillin, erythromycin. Intravenous ceftazidime was given for 2 weeks, vancomycin for 3 weeks and he became afebrile after completion of antibiotics. The follow-up CSF examination showed decreased pleocytosis (leukocyte 4/mm^3) and protein (74 mg/dL) compared with the study done before. Follow-up brain MRI at 2 months showed much increased hydrocephalus with increased and marked periventricular white matter changes especially in anterior portion (Figure 2). His general state was improved but his mental state was poor and he was drowsy most of the day. Over a further month, he showed further slow improvement and he was able to recognize his family. No significant further changes in mental state were observed over the following 7 months.

DISCUSSION

This may be the first case report of *B. cereus* meningoencephalitis after a relatively minor and common procedure like neuroplasty. *B. cereus* as a pathogen of fulminant meningitis was first reported 1963.[8] Since then, more than 10 iatrogenic cases of *B. cereus* meningitis complicating neuro-invasive procedure were reported until the 1990s. Most were related to invasive procedures like ventriculo-peritoneal shunt, ventriculo-atrial shunt, or transnasal pituitary resection with lumbar drainage.[7]

Our patient had a history of endoscopic epidural neuroplasty at local clinic. The progression of disease was so fast that the time interval between procedure and symptom onset was less than 12 hours. According to a previous study, even in the case of timely administration of antibiotics, many of *B. cereus* meningoencephalitis progress rapidly[9] and the course of the meningitis is usually fulminant, evolving to death in an interval of 10 to 48 hours after the initial neurological symptoms.[10] A main factor predisposing to *B. cereus* infection is immunological compromise.[4] As a result, many infections have occurred in premature infants[11], alcoholics[8], drug addicts[2], following trauma[12] and with surgical stress.[2] Because our patient suffered from DM, it might be the predisposing factor in

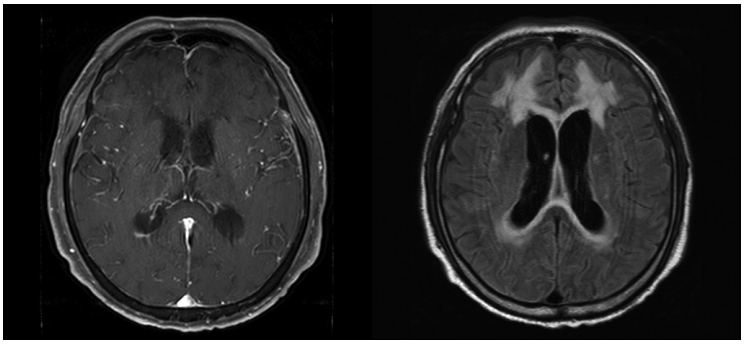

Figure 2. The follow-up brain MRI of the patient in 2 months. Axial T1- weighted gadolinium-enhance and FLAIR images showed slightly more progressed hydrocephalus with increased white matter change especially in anterior portion compared with posterior portion.

this case. And it is also possible that our patient was suffering from a long standing spinal infection resulting in radiculitis for which the patient was treated with neuroplasty. Then, surgery might have expedited the infection in view of the very rapid progression of symptoms after neuroplasty.

Because *B. cereus* is common in the environment, it is believed that contamination of hospital clothing, linen, intravenous catheters can contribute to the increased risk of nosocomial infections. Contaminated linen and operating room scrubs have been found responsible for meningitis after neurosurgery.[2] Because *Bacillus* species are ubiquitous organisms, the source of infection in our patient might be exogenous contamination from epidural neuroplasty.

According to recent nationwide prospective cohort study, hydrocephalus in adults with bacterial meningitis occurred about 5% (26 of 577 episodes) and is associated with poor outcome.[13] Follow up brain MRI in our patient revealed progressive hydrocephalus with increased periventricular white matter change more severe anteriorly. White matter change might be due to interstitial cerebral edema. This is caused by obstruction of normal CSF pathway, resulting in transependymal flux of CSF and usually appeared symmetrical, diffuse, smooth configuration particularly at the tips of the frontal, occipital and temporal horns.[14,15] To the best of our knowledge, an anterior location has not been reported in association with meningitis suggesting this may have diagnostic usefulness. Because our patient showed gradual improvement on antibiotics we did not perform shunt operation or repeated lumbar puncture.

One of the important aspects of treatment is that this organism produces beta-lactamase which makes it resistant to most penicillins and cephalosporins. Susceptible antibiotics include vancomycin, erythromycin, chloramphenicol, clindamycin and aminoglycosides[1] and it is reported that vancomycin plus aminoglycoside is a reasonable option for treatment.[9] Because sensitivity to vancomycin was good in our cultures we used vancomycin and ceftazidime to which patient showed good response. Aminoglycosides were not used due to the presence of chronic kidney disease from DM.

As *B. cereus* is a ubiquitous organism, positive finding of blood culture is usually regarded as contamination in clinical setting. However, its isolation from CSF should be carefully evaluated, especially in patients having undergone neurosurgical procedures and in those immunocompromised.

DISCLOSURE

Conflicts of Interest: None

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