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Case Report

Gas-Forming Brain Abscess Caused by *Klebsiella Pneumoniae*

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Gas forming brain abscess is a rare disease caused by *Klebsiella pneumoniae* occurring in patients with impaired host defense mechanism such as diabetes mellitus or liver cirrhosis. A 59-year-old man with 2-year history of diabetes mellitus and 20-year history of liver cirrhosis presented to the hospital with headache. On the day after admission, severe headache was developed and he deteriorated rapidly. Brain CT showed a non-enhanced mass including multiple air density as well as surrounding edema seen in the right occipital lobe, and isodensity air-fluid level seen in the right lateral ventricle. Despite emergent ventricular drainage and intraventricular and intravenous administration of antibiotics, his condition progressively worsened to sepsis and to death after 5 days. Bacterial culture of blood and ventricular fluids disclosed a Gram (-) rod, *Klebsiella pneumoniae*. In this report we review the pathogenic mechanism and its management .

KEY WORDS : Brain abscess · *Klebsiella pneumoniae* · Air.

INTRODUCTION

With the improved diagnostic imaging techniques, the development of new antibiotics and the evolution of neurosurgical techniques including stereotactic neurosurgical techniques, the mortality rates of patients with brain abscess have significantly decreased in recent years[7,10,14]. But, brain abscess is still a potentially fatal infection, especially when intraventricular empyema occurs[12,16]. Klebsiella species is one of the rare causative organisms but have become an increasingly important cause of brain abscess particularly in patient with impaired host defense mechanism due to diabetes mellitus, alcoholism and liver cirrhosis, or in head trauma or neurosurgical procedure[6,9]. Brain abscess causing bacteria that forms gas include Claustridium, enterobacter, Klebsiella, and Pseudomonas species. Often Klebsiella brain abscess has gas-forming appearance accompanied by rapid deterioration in consciousness[5,6,9]. We report a extremely rare case of gas-forming brain abscess with intraventricular empyema caused by *Klebsiella pneuminiae* in patient with impaired host defense mechanism due to diabetes mellitus and liver cirrhosis. We also discuss its pathologic mechanisms and managements.

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CASE REPORT

A 59-year-old man with 2-year history of diabetes mellitus and 20-year history of liver cirrhosis presented to the hospital with mild headache. He had several occasions of history of hepatic encephalopathy. He had no history of head trauma or contiguous infection. On admission, his vital signs were stable and no neurologic deficit observed except for the left homonymous hemianopsia. On the next day of admission, he developed severe headache and drowsiness. He was progressively deteriorated to semicoma in just 2 hours. On brain CT, a non-enhanced mass including multiple air density as well as surrounding edema seen in the right occipital lobe, and iso-dense air-fluid level seen in the right lateral ventricle (Fig. 1). Emergent ventricular drainage was performed. On puncture of ventricle, blood-tinged purulent material was drained. Intraventricular gentamicin was immediately administered and the intravenous vancomycin, 3rd -generation cephalosporin and metronidazole. After a few hours of aspiration, Gram's stain disclosed Gram (-) rods. We discontinued vancomycin and added

chloramphenicol to his antibiotics regimen. Despite ventricular drainage and intraventricular and intravenous administration of antibiotics, his condition was progressively worsened to sepsis and to death after 5 days. Gram stain and bacterial culture of ventricular fluids and blood showed numerous G (-) bacilli proven to be *Klebsiella pneumonia* through cultivation on Mackonkey Agar and biochemical tests (Fig. 2). There were no abscesses in other organs except for the blood, which was culture positive.

DISCUSSION

Gas-forming brain abscesses have been reported to result from escape of air into the cranium due to skull fracture or gas-forming organisms including Claustridium species, Enterobacter, Pseudomnas, Peptococcus and Bacteroides organisms[1,3,8,11,15]. Liliang et al.[6] reported 15 patients with Klebsiella brain abscess with relatively high mortality rate of 26.7% and debilitating abscess were common in *Klebsiella pneumoniae* infection. Two of 15 patients (13%) were found to have gas-forming abscess. Liliang et al.[5] reported gas forming brain abscess due to *Klebsiella pneumoniae* and the rapidly forming gas may be responsible for the patients with rapid deterioration in consciousness. To our knowledge, the pathogenesis of gas formation or the analysis of the gas composition in *Klebsiella pneumoniae* brain abscess has not been studied.

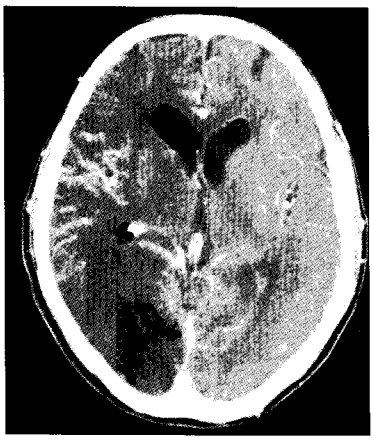

Fig. 1. Brain computed tomography shows non-enhanced low density mass with multiple air density and surrounding edema seen in the right occipital lobe, and isodense air-fluid level in the right lateral ventricle.

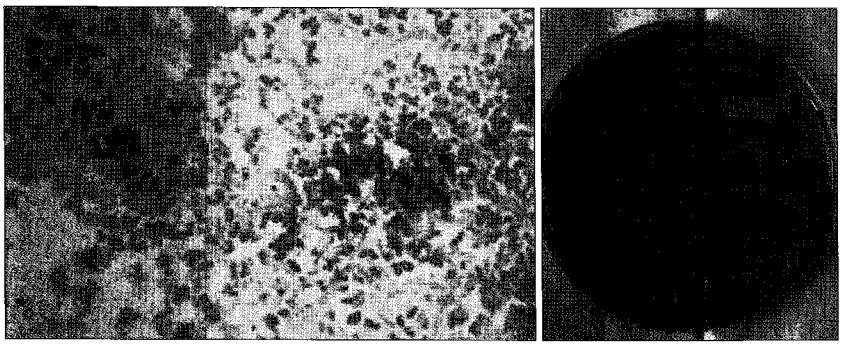

Fig. 2. Gram stain showing numerous G (-) bacilli proven to be *Klebsiella pneumonia* through cultivation on Mackonkey Agar.

Klebsiella species were thought to be a less common cause of brain abscess in adults[2,13]. But, they have become an increasingly important cause of brain abscess particularly in patients with impaired host defense mechanism, head trauma or neurosurgical operations[6,9].

Liliang et al.[6] and Rau et al.[9] noted that *Klebsiella pneumoniae* was associated with diabetes mellitus and liver cirrhosis and susceptible to 3rd-generation cephalosporins and chloramphenicol. They concluded with antibiotics with or without surgery, treatment of *Klebsiella pneumoniae* brain abscess in adult remains unsatisfactory, and mortality rate is high. They pointed out when brain abscess occurs in diabetic patients or has a gas-forming appearance, *Klebsiella pneumoniae* infection should be considered and further attention should be paid to discovering whether other metastatic septic abscess exist and early diagnosis and treatment are essential for survival. In our case, the patient with diabetes mellitus and liver cirrosis had gas forming Klebsiella brain abscess, lead to fulminant clinical course.

Intraventricular empyema is a catastrophic and fatal complication of purulent brain abscess. Zeidman et al.[16] noted that the mortality rate of patients with intraventricular empyema was approximately 85% and the incidence of intraventricular empyema about 5% in their review of literatures from 1950 to 1993. Takeshita et al.[12] reported that the mortality rate of patients with intraventricular empyema was 37.5% and the incidence of intraventricular empyema about 27% in their review of 121 patients with brain abscess.

With much regret in our case, we couldn't have good outcome despite emergent ventricular drainage and administration of antibiotics. It is very important that aggravation of headache or consciousness is warning sign of intraventricular empyema and suspicion, early detection and aggressive medical and/or surgical treatment is the only way to obtain a favorable outcome.

One should keep in mind that *Klebsiella pneumoniae* is an important pathogenic organism of brain abscess in patients with impaired host defense mechanism. When encountered with gas forming brain abscess, *Klebsiella pneumoniae* should be suspected as one of the causative organisms.

CONCLUSION

We describe the first case to show the gas-forming brain abscess with intraventricular empyema caused by *Klebsiella pneumoniae*. As the con-

dition is life threatening and results in poor outcome in patient with impaired host defense mechanism due to diabetes mellitus and liver cirrhosis, aggressive surgical treatment and proper antibiotic therapy should be considered.

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