Severe Sepsis due to Otogenic Pneumococcal Meningitis with Pneumocephalus without Meningeal Symptoms

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Abstract

The absence of meningeal signs and symptoms is rare in patients with bacterial meningitis and may lead to a delay in diagnosis and treatment. Furthermore, the onset of bacterial meningitis associated with pneumocephalus is a rare complication of ear infections. We herein report a rare case of otogenic meningitis complicated by pneumocephalus that was initially missed due to the absence of typical meningeal signs and symptoms and later diagnosed correctly based on a thorough review of the patient’s systems.

Key words: Streptococcus pneumoniae, otogenic meningitis, pneumocephalus


Introduction

Bacterial meningitis is typically fatal without prompt diagnosis and treatment (1, 2). In addition, the disease is difficult to diagnose when typical meningeal signs and symptoms are absent, which occurs in 1% of reported meningitis cases (3). Moreover, the development of pneumocephalus associated with otogenic meningitis is exceedingly rare and may be life-threatening (4, 5). We herein report a rare case of otogenic pneumococcal meningitis associated with pneumocephalus lacking typical meningeal signs and symptoms.

Case Report

The patient was a 37-year-old man with no significant past medical history who presented to our emergency room (ER) with a chief complaint of fever lasting for one day, before which he had been in his usual state of good health. The following day, his temperature increased to 41°C, accompanied by the onset of rigors, dyspnea at rest and dizziness, and he was again brought by family members to our ER. He denied having a headache.

On admission, the patient’s vital signs were as follows: blood pressure, 108/72 mmHg; pulse, 135 beats/minute; temperature, 39.0°C; respiratory rate, 30 breaths/minute; and oxygen saturation, 96% on room air. He was alert and oriented, although in mild respiratory distress. A cardiac examination revealed a regular heart rate with no murmurs. Additionally, the lungs were clear on auscultation bilaterally, and the findings of an abdominal examination were normal, with no hepatosplenomegaly. His skin was mottled and clammy and the extremities were cool; however, he displayed no nuchal rigidity, and both Kernig’s and Brudzinski’s signs were negative, with no obvious neurological deficits. The laboratory data showed a white blood cell count of 20,500/μL, with 94% segmented cells and 3.0% band forms. The hematocrit level was 46.9% and the platelet count was 192,000/μL. Furthermore, the electrolyte and liver enzyme levels were normal, with a creatinine level of 1.6 mg/dL, C-reactive protein level of 9.6 mg/dL and elevated lactate level of 44 mg/dL (range: 6.3-18.9 mg/dL). Based on the physical examination findings and laboratory data, the patient met the criteria for severe sepsis.

A chest X-ray was normal, and chest CT and abdominal pelvis CT scans obtained to identify the source of the sepsis showed no abnormalities. The department of General Internal Medicine was subsequently consulted from the ER to further investigate the cause of the fever and sepsis. After a thorough review of the patient’s systems, he was admitted due to left ear discomfort lasting for one day, thus prompting an otoscopic evaluation. Otoscopy subsequently revealed...
swelling of the external ear canal with copious purulent discharge obscuring the tympanic membrane. Manipulation of the left auricle resulted in pain; however, there were no signs of mastoid tenderness.

Based on the results of the otoscopic examination, the patient was diagnosed with an ear infection; in particular, otogenic meningitis was suspected as the cause of the severe sepsis. Subsequent head CT showed the presence of intracranial air (pneumocephalus) (Fig. 1) with fluid accumulation in the left mastoid process and middle ear (Fig. 2). A cerebrospinal fluid (CSF) analysis demonstrated a cell count of 11/μL with 91% polymorphonucleocytes, a protein level of 34 mg/dL, glucose level of 76 mg/dL and CSF: serum glucose ratio of 0.44. He was therefore diagnosed with meningitis complicated by otitis media, mastoiditis and pneumocephalus presenting as severe sepsis.

The administration of intravenous dexamethasone, meropenem and vancomycin to empirically treat both the bacterial meningitis and ear infection was subsequently initiated. Blood and CSF cultures grew *Streptococcus pneumoniae*,
and the antibiotics were switched to penicillin-G based on the findings of organism susceptibility. After several days, the left tympanic membrane became visible, and an otoscopic examination revealed fluid accumulation with inflammation of the membrane, confirming the diagnosis of otitis media. The patient improved rapidly and was discharged without sequelae.

Discussion

The classic triad of fever, neck stiffness and an altered mental status manifests in only 44% of meningitis cases (3). Taken individually, headaches occur in 87% of affected patients, with neck stiffness in 83%, fever in 77% and an altered mental status in 69% (3). However, as observed in this case, 1% of patients ultimately diagnosed with meningitis experience none of these symptoms (3). Given the rare absence of meningeal signs and symptoms, we hypothesize that the current patient developed a severe middle ear infection as the initial cause of sepsis, after which the bacteria invaded the intracranial space. His atypical presentation to the ER may reflect the ‘window period’ prior to the onset of classic meningeval symptoms; notably, the relatively low WBC count and CSF protein level support this hypothesis. In any event, as this case demonstrates that the absence of typical symptoms may not be sufficient to rule out the possibility of meningitis, physicians should consider the potential for occult meningitis in the absence of alternative causes of sepsis.

Intracranial complications of otitis media, although occurring at a rate as low as 0.24%, include a variety of severe conditions, such as meningitis, epidural, subdural and/or brain abscess formation and lateral sinus thrombosis (4). The mortality rate of otogenic intracranial complications is reported to be 18% (4). In a previous study, only 44% and 30% of patients reported experiencing otalgia and postauricular swelling, respectively (6). Nevertheless, potentially lethal intracranial complications should not be missed in any patient with sepsis presenting with accompanying ear symptoms, however mild.

Pneumocephalus most commonly occurs as a result of craniofacial trauma, although it may also be seen in patients undergoing neurosurgery and those with congenital defects, post-radiation necrosis or infections with gas-producing organisms, such as Clostridium perfringens, and mixed aerobic-anaerobic infections (7). As an alternative mechanism, it has been suggested that the extension of infection from the middle ear to the mastoid bone, with resultant bony destruction, allows air to enter the cranium (7).

Otogenic pneumococcal meningitis appears to be an exceedingly rare cause of pneumocephalus; a literature search revealed only three previous case reports (8-10). Two pathogenic mechanisms for the development of pneumococcal meningitis caused by ear infections have been proposed. More commonly, bacteria may enter the bloodstream, with subsequent invasion into the intrameningeal space. Alternatively, direct invasion of bacteria from the middle ear, with destruction of the external barrier formed by the leptomeninges and skull, may occur, thus resulting in meningitis (11). As Streptococcus pneumoniae does not typically produce gas, the latter mechanism is the likely pathogenic mechanism underlying the onset of pneumocephalus due to otogenic pneumococcal meningitis (11).

As severe disease may induce the formation of tension pneumocephalus with resultant neurological deterioration, close clinical monitoring is warranted in patients with pneumocephalus (5), and physicians should therefore be alert to this serious complication. While the mortality rates of pneumococcal meningitis vary from 16% to 37%, neurological sequelae occur in 30-52% of cases (11), highlighting the importance of providing an early diagnosis and prompt treatment. Delays in the initiation of treatment with empiric antibiotics have been reported to increase mortality (12). In the current case, meningitis was not initially suspected as a cause of the patient’s severe sepsis due to the absence of typical meningeal signs and symptoms. A careful review of the patient’s systems, however, revealed ear discomfort, prompting us to perform internal and external ear examinations. The discovery of a left ear infection led us to the final diagnosis of otogenic meningitis-related severe sepsis. Given the rarity of this life-threatening, yet eminently treatable, disease, we cannot stress enough the role of careful and thorough history-taking and physical examinations in achieving a timely and successful diagnosis.

We herein reported the fourth case of otogenic pneumococcal meningitis accompanied by pneumocephalus, a rare and life-threatening disease. Clinicians should consider the possibility of meningitis in all cases of sepsis associated with ear symptoms, even in the absence of typical meningeal signs. Obtaining an early diagnosis in such cases with appropriate history-taking and examinations, including otoscopy, is both critical and life-saving.

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References