

Received: 2020.01.21
Accepted: 2020.03.18
Available online: 2020.04.20
Published: 2020.06.24

A Case of Atraumatic, Streptococcal Pneumocephalus: A Rare Complication of Influenza B Infection

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

ABDEF 1 **Muhammed Atere**
E 1 **Vaithilingam Arulthasan**
E 2 **Jay M. Nfonoyim**

1 Department of Internal Medicine, Richmond University Medical Center, Staten Island, NY, U.S.A.
2 Department of Critical Care/Internal Medicine, Richmond University Medical Center, Staten Island, NY, U.S.A.

Corresponding Author: Muhammed Atere, e-mail: MAtere@Rumcsi.Org
Conflict of interest: None declared

Patient: Female, 51-year-old
Final Diagnosis: Pneumocephalus • Pneumococcal meningitis
Symptoms: Worsening of mental status
Medication: —
Clinical Procedure: —
Specialty: Critical Care Medicine • Infectious Diseases • General and Internal Medicine

Objective: Rare co-existence of disease or pathology





Background: Pneumocephalus is a rare occurrence without trauma, neurosurgery, or intracranial pathology. It is an uncommon complication of bacterial meningitis, and it is usually diagnosed with a CT head. Bacterial pneumocephalus in the setting of influenza B virus infection is an extremely rare complication; however, vaccination against influenza and early diagnosis and treatment help prevent mortality.

Case Report: A 51-year-old woman presented to the Emergency Department in early winter because of worsening mental status over seven days prior to presentation. She was not vaccinated against influenza. Before and upon presentation to our facility, she was diagnosed with influenza B virus infection and was positive for streptococcal meningitis. A CT head revealed pneumocephalus, likely due to Streptococcus infection. She was treated with antibiotics, and a repeat CT head showed resolution of the lesion.

Conclusions: Bacterial pneumocephalus in the background of influenza is an uncommon occurrence. Influenza vaccination and early diagnosis with a CT of the head and prompt initiation of antibiotics are essential in preventing mortality.

MeSH Keywords: Influenza B virus • Meningitis • Pneumocephalus • *Streptococcus pneumoniae*

Full-text PDF: <https://www.amjcaserep.com/abstract/index/idArt/923029>

 1232  —  2  19



Background

Influenza is a disease of the respiratory tract diagnosed at any time of the year, but it is most common during the fall and winter [1]. Complications directly caused by influenza manifest in some patients, including acute respiratory distress syndrome, myocarditis, rhabdomyolysis and encephalitis [2]. Secondary bacterial infections such as bacterial pneumonia also develop and typical bacterial species involved are *Staphylococcus* and *Streptococcus* [3]. An advanced complication like pneumocephalus after a diagnosis with influenza B virus infection is unusual. Pneumocephalus, which is air within the brain parenchyma, is frequently associated with head trauma, intracranial pathologies or neurological surgery [4,5]. Direct etiologies related to infections are less prevalent and require aggressive management to reduce mortality. Here, we describe a rare complication of influenza B virus infection by delineating a case of bacterial meningitis and pneumocephalus in a patient with influenza B virus infection.

Case Report

A 51-year-old woman with a past medical history of iron deficiency anemia and morbid obesity presented to the Emergency Department in early winter because of worsening mental status over seven days. She was unvaccinated against influenza and was diagnosed with influenza a few days earlier at an urgent care clinic. A few hours before presentation she was retching and unable to talk. A family member denied any recent history of head trauma or surgery. Her vital signs revealed a temperature of 104.4°F (40.2°C), pulse rate of 123 beats per minute, blood pressure of 160/81 mmHg, respiratory rate of 20 cycles per minute, and oxygen saturation of 95% on room air. Her Glasgow Coma Scale was nine. On physical examination her head inspection was normal, pupils were equal and reactive to light, she had no nuchal rigidity, and Brudzinski sign was negative. The rest of the examination was unremarkable. She was alert and moved all extremities but was not following commands.

Laboratory results revealed she was positive for influenza B antigen but because of the possibility of an acute intracranial pathology she had an urgent computed tomography (CT) of the head (Figure 1). It revealed pneumocephalus in the left parietal occipital vertex, acute-on-chronic sinusitis, and left middle ear fluid with left mastoid air cell effusion. A chest x-ray was unremarkable. Other laboratory investigations were significant for a white cell count of 18 400/ul with neutrophil percent of 91.6, international normalized ratio of 1.26, lactic acid of 2.3 mmol/L, hemoglobin A1c of 7.9%, and serum glucose of 266 mg/dL. A urinalysis revealed glucose of greater than 1000 mg/dL and ketones of 80. An electrocardiogram

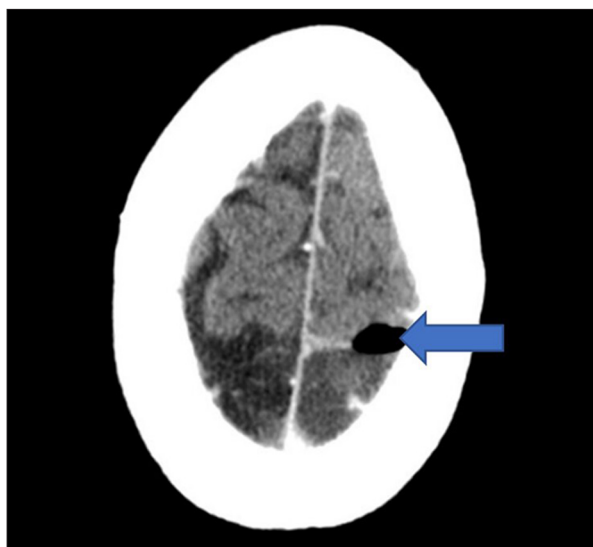


Figure 1. CT head: blue arrow demonstrating pneumocephalus.

demonstrated sinus tachycardia with occasional premature ventricular complexes.

Meningitis was highly suspected and she was started on empiric antibiotics of intravenous ceftriaxone (2 gm every 12 hours), intravenous meropenem (2 gm every 8 hours), and intravenous vancomycin (1 gm every 12 hours). She was also treated with intravenous dexamethasone (10 mg every 6 hours), a full course of oral oseltamivir, and parenteral insulin. Subsequent cerebrospinal fluid (CSF) analysis revealed a hazy appearance, a white count of 387/mm³, a red count of 409/mm³, glucose of 90 mg/dL, and a total protein of 174.6 mg/dL. The CSF microbiology was positive for *Streptococcus pneumoniae* antigen, but the Gram stain was negative and the CSF did not grow any organisms. A blood culture grew *Streptococcus pneumoniae*. She decompensated mentally and had multiple seizures after a few days, which required intubation four days later for airway protection. She was also started on levetiracetam for seizures. Fortunately, she improved clinically and she regained her mental state to her previous baseline without residual neurological deficits. A CT head (Figure 2) was repeated 15 days after presentation showing complete resolution of the pneumocephalus.

Discussion

Influenza virus infections are most prevalent during the fall and winter [1]. The most common types are influenza A and B, belonging to the Orthomyxoviridae viruses [6]. Between 2000 and 2018, influenza B was the main cause of influenza in about 25% of cases globally [7]. It often infects the respiratory tract and it has been linked to several complications like myocarditis, encephalitis, ophthalmitis, and acute kidney failure [2].

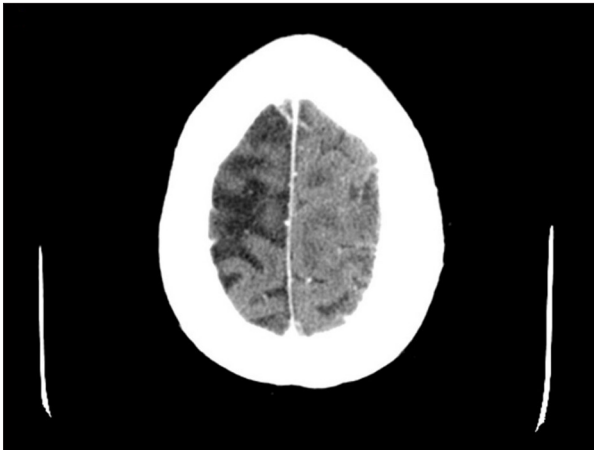


Figure 2. CT head demonstrating complete resolution of pneumocephalus.

Secondary bacterial infections can also manifest in patients with influenza. *Streptococcus pneumoniae*, *Staphylococcus aureus*, and *Hemophilus influenzae* have been identified in causing bacterial pneumonia in patients with influenza [3]. Nonetheless, further complications due to secondary bacterial infections have not been well documented.

Our patient had a distinctive situation because she developed secondary streptococcal bacteremia and meningitis with subsequent pneumocephalus after a recent diagnosis of influenza B virus infection. A literature search resulted in articles that discussed pneumocephalus but only a few implicated *Streptococcus pneumoniae*. Some of the cases of pneumocephalus were due to head traumas or neurosurgical interventions [4,5,8,9]. Other causes were secondary to intracranial anatomic pathologies and infections [10–13]. Based on the clinical manifestations and diagnosis of our patient, we searched for articles about pneumococcal meningitis with pneumocephalus, with emphasis on influenza diagnosis. In a 2019 case report by Barry et al., the patient developed pneumococcal meningitis with pneumocephalus in the setting of mastoiditis and sinusitis, but the pneumocephalus resolved after treatment with antibiotics [13]. In another case report, the patient was also treated with antibiotics against pneumococcal pneumocephalus in the background of sinusitis, although there was no laboratory evidence of *Streptococcus pneumoniae* [14]. Other case reports we reviewed were similar to the ones that have been discussed [15,16]. Our patient also had CT evidence of acute-on-chronic sinusitis with mastoid effusion, but a diagnosis with influenza B infection makes our case unique.

We searched PubMed and Google Scholar for articles on pneumocephalus development in the context of influenza, using the keywords “pneumocephalus”, “flu”, and “influenza”. However, just one case was reported where pneumocephalus in a 9-year-old boy was determined to be the result of influenza, but no laboratory evidence of influenza was documented in the article [17]. Pneumocephalus arises because of an entrapped air that moves from outside into the cranial cavity or when CSF loss causes negative intracranial pressure [18,19]. Our patient was diagnosed with influenza at an urgent care center. Her mental state deteriorated, prompting a visit to our medical center, where clinical evaluation revealed influenza B infection with pneumococcal meningitis and pneumocephalus.

We believe a recent diagnosis with influenza was the potentiating factor that eventually led to pneumocephalus. Vaccination against the influenza viruses and recognition of influenza complications and early treatment are important in preventing mortality. We believe our case report is the first to present streptococcal meningitis with resulting pneumocephalus in a patient with evidence of influenza B virus infection. Our patient was managed with antibiotics, and a repeat CT scan of the head showed complete resolution. Our report emphasizes the need to continue to educate patients about the benefits of influenza vaccination. Clinicians should always keep in mind that a superimposed complication from secondary bacterial infections in patients with influenza virus infection is not limited to the respiratory system.

Conclusions

Atraumatic pneumocephalus is a rare complication of bacterial infections in a patient with influenza. Our search of the literature revealed just a few cases in which *Streptococcus pneumoniae* meningitis resulted in pneumocephalus, and none of the patients had a diagnosis of influenza. Furthermore, only one case report revealed pneumocephalus as a complication of influenza; however, laboratory evidence of influenza was not reported in the case report. Early recognition and treatment help prevent mortality. Emphasis on vaccinations against influenza is an important preventive measure that must be promoted by clinicians.

Conflict of interest

None.

References:

1. Centers for Disease Control and Prevention, National Center for Immunization and Respiratory Diseases (NCIRD). 2018, July 12. <https://www.cdc.gov/flu/about/season/flu-season.htm>
2. Sellers SA, Hagan RS, Hayden FG, Fischer WA 2nd: The hidden burden of influenza: A review of the extra-pulmonary complications of influenza infection. *Influenza Other Respir Viruses*, 2017; 11(5): 372–93
3. Morris DE, Cleary DW, Clarke SC: Secondary bacterial infections associated with influenza pandemics. *Front Microbiol*, 2017; 8: 1041
4. Pillai P, Sharma R, MacKenzie L et al: Traumatic tension pneumocephalus – Two cases and comprehensive review of literature. *Int J Crit Illn Inj Sci*, 2017; 7(1): 58–64
5. Yun JH, Kim YJ, Yoo DS, Ko JH: Diffuse pneumocephalus: A rare complication of spinal surgery. *J Korean Neurosurg Soc*, 2010; 48(3): 288–90
6. Blut A: Influenza virus. *Transfus Med Hemother*, 2009; 36(1): 32–39
7. Caini S, Kuszniierz G, Garate VV et al: The epidemiological signature of influenza B virus and its B/Victoria and B/Yamagata lineages in the 21st century. *PLoS One*, 2019; 14(9): e0222381
8. Dabdoub CB, Salas G, Silveira Edo N, Dabdoub CF: Review of the management of pneumocephalus. *Surg Neurol Int*, 2015; 6: 155
9. Allard E, Selim J, Veber B: Pneumocephalus and pneumorachis after blunt chest trauma without spinal fractures: A case report. *J Med Case Rep*, 2019; 13: 317
10. Iplikcioglu AC, Karabag H: Frontoethmoid osteoma causing tension pneumocephalus. *J Neurosci Rural Pract*, 2019; 10(3): 548–50
11. Mirzai S, Rifai AO, Webb S et al: Probable *Clostridium septicum* pneumocephalus in a user of natural remedies with newly diagnosed diabetes mellitus type 1. *IDCases*, 2019; 17: e00581
12. Ansari AS, Dennis BB, Shah D, Baah W: An unusual case of infective pneumocephalus: Case report of pneumocephalus exacerbated by continuous positive airway pressure. *BMC Emerg Med*, 2018; 18(1): 2
13. Barry C, Rahmani G, Bergin D: Pneumocephalus and meningitis as complications of mastoiditis. *Case Rep Radiol*, 2019: 2019: 7876494
14. Nomura M, Baba E, Shirokane K, Tsuchiya A: Pneumocephalus due to meningitis extending from sphenoid sinusitis: Case report and review of literatures. *Neurology and Clinical Neuroscience*, 2019; 7: 107–11
15. Jayaram S, Jadhav S, Rathod D et al: Meningitis: An unusual cause of pneumocephalus. *J Assoc Physicians India*, 2004; 52: 67–68
16. Kim SH, Kim SW, Kim SH: Spontaneous pneumocephalus caused by pneumococcal meningitis. *J Korean Neurosurg Soc*, 2013; 53(4): 249–51
17. Kotan D: Widespread subarachnoidal pneumocephalus development as a complication of influenza: A case report. *Arch Med Sci*, 2008; 4: 471–73
18. Dandy WE: Pneumocephalus (intracranial penumatocele or aereocele). *Arch Surg*, 1926; 12(5): 949–82
19. Horowitz M: Intracranial pneumocele: An unusual complication following mastoid surgery. *J Laryngol Otol*, 1964; 78: 128–34