ISSN: 3049-7272

Case Report

Journal of Biomedical Sciences and Biotechnology Research

A Rare Case of Pyogenic Ventriculitis Following Otitis Media Caused by A COVID-19 Infection

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Received: September 08, 2025; **Accepted:** September 15, 2025; **Published:** September 22, 2025

ABSTRACT

Pyogenic ventriculitis (PV) is a rare condition characterized by inflammation of the ependymal lining and purulent fluid in the ventricles in the brain. In this case report, we present an unusual case of pyogenic ventriculitis in a diabetic patient which likely was the result of an otitis media infection that occurred as a sequel to a prior COVID-19 infection. This case of PV was caused by a Streptococcus pneumoniae infection, and the patient was treated with IV antibiotic therapy.

Pyogenic ventriculitis in adults is a rare presentation to the emergency department, and the occurrence of PV following COVID-19 infection has not been well documented in the literature. In this case report we will review the clinical presentation, diagnosis, and management of pyogenic ventriculitis.

Introduction

Pyogenic ventriculitis (PV) is an uncommon complication of intracranial infection in adults characterized by inflammation of the ependymal lining and the presence of suppurative fluid in the ventricles of the brain [1]. It has also been referred to as ependymitis, intraventricular abscess, ventricular empyema, or pyocephalus [1-3]. PV is most typically a complication of hydrocephalus pressure relief treatment, such as infection via external ventricular drains or in patients with ventricular shunts [4]. It may also be caused by meningitis, brain abscess, trauma, or intrathecal chemotherapy [2-5]. Predisposing factors for ventriculitis include immunocompromised patients, alcoholism, cirrhosis, diabetes, or recent surgery6. Symptoms can be variable depending on the extent of the infection but often include fever, headache, nausea, vomiting, neck stiffness, photophobia, decreased mental status, and seizures [3,5,7].

In the limited studies on pyogenic ventriculitis, there is conflicting data in determining what is the most frequent cause of infection with some reporting gram negative bacilli and others describing gram positive cocci as the primary cause [4-6]. In hospital-acquired ventriculitis cases, a common cause is Actinetobacter baumannii, a gram-negative bacillus accounting for 3.6-11.2% of all cases [3]. However, primary pyogenic ventriculitis is rare, and only a few cases have been reported, mostly caused by neonatal group B streptococci infections [8]. In a 2017 review of primary ventriculitis, only six cases have been described in adults. Although these infections typically complicate meningitis, surprisingly there were no meningitis reported in five out of the six primary ventriculitis cases [8].

We report a rare case of pyogenic ventriculitis with left otitis media as a sequela of a prior COVID-19 infection in a 58-year-old male traveling to the Philippines. Pyogenic ventriculitis is a rare complaint to the emergency department, especially in adults, and the occurrence of PV following COVID-19 infection has not been well documented in the literature. Here we will review the clinical presentation, diagnosis, and management of PV.

Citation: Carter Chan, Cameron Ward, Jesse Wong, Elaine Cheung, Leonard Ranasinghe. A Rare Case of Pyogenic Ventriculitis Following Otitis Media Caused by A COVID-19 Infection. J Biomed Sci Biotech Res. 2025. 3(3): 1-4. DOI: doi.org/10.61440/JBSBR.2025.v3.29

Case Summary

On a visit to the Philippines from the United States, a 58-year-old patient presented to the ER in the Philippines on 11/2/2022 with a chief complaint of disorientation. He presented with left ear fullness, decreased hearing, fever, and chills that began 3 days prior, eventually progressing to vomiting and disorientation. His past medical history is significant for nasopharyngeal carcinoma, type II diabetes mellitus, and hypertension. He also had a recent positive PCR COVID test and reported having a COVID infection a few months prior. Upon physical examination, the patient was found to have pink palpebral conjunctiva, anicteric sclerae, hyperemic left tympanic membrane, and blood clots on the left external auditory canal. The patient also had irritable, uncooperative personality changes as per his family. On admission, he was diagnosed with encephalopathy.

The patient's behavioral changes, drowsiness, selective responsiveness, and nuchal rigidity led to a suspected CNS infection of either abscess formation, meningitis, or ventriculitis (fig1a). He was subsequently started on ceftriaxone, clindamycin, meropenem. The next day (11/3), initial brain CT depicted ventriculitis and the patient's following lumbar puncture showed elevated opening pressure of 44 mmHg and closing of 23 mmHg. Patient continued antibiotic treatment. On 11/5, vancomycin was added to his antibiotic regime due to positive Streptococcus pneumoniae results. During this time, the patient developed communicating hydrocephalus. On 11/9, the patient developed a headache and a second lumbar puncture was performed, which showed an improved opening pressure of 25 mmHg and closing at 18 mmHg. On 11/11, a diagnosis of ventriculitis was made based on clinical symptoms and CSF culture, and discussion for clearance to return to the US was done. On 11/19, he was discharged from the hospital and headed home to the US. On discharge, his final diagnoses were pyogenic ventriculitis as well as acute otitis media. He was advised to continue IV antibiotics for the following 6-8 weeks.

After he was discharged from the hospital in the Philippines, he came to an emergency department in a hospital in the US as advised on 11/19. He received IV vancomycin and meropenem during his plane ride from the Philippines. He presented to the ED with mild fatigue but otherwise felt good. He was asymptomatic with no abnormalities on exam. He was admitted the same day for observation and further evaluation. Head CT scan on 11/19 showed no acute intracranial hemorrhage but demonstrated opacification of the left mastoid air cells. Infectious disease consult recommended continuing antibiotics. On 11/20 he was still feeling well on evaluation. He received a brain MRI that same day to evaluate intracranial infection/inflammation with his history of mastoiditis, meningitis, and ventriculitis. This showed enhancing left mastoid effusion compatible with reported mastoiditis. It also showed possible purulent material within or along the bilateral ventricular posterior horns with associated ependymal enhancement concerning for ventriculitis (fig1b/c) He was recommended to continue vancomycin for 6-8 weeks and was discharged 11/21/22.

Discussion

Clinical Presentation

Pyogenic ventriculitis (PV) is more commonly seen in infants [9]. In adults, PV is typically a complication of external drains or shunts in the treatment of hydrocephalus [4]. However, it can also be caused by meningitis, brain abscess, trauma, intrathecal chemotherapy [2-5]. Primary pyogenic ventriculitis is rare with only a few reported cases, mainly caused by neonatal group B streptococci infections [8]. In our case, the patient most likely developed PV as a complication of acute otitis media caused by a prior COVID-19 infection earlier that year. He had a history of diabetes mellitus type II which is a reported predisposing factor for ventriculitis [6]. His CSF culture was positive for Streptococcus pneumoniae. Due to the limited studies on PV, the current literature is undecided on the most frequent cause of infection with some reporting gram negative bacilli and others describing gram positive cocci similar to our case [4-6]. Early on, our patient developed signs of meningitis including altered mental status, nuchal rigidity, fever, and chills which is consistent with common symptoms of PV [3,5,7]. Our patient also presented with left ear fullness and decreased hearing due to the otitis media. Meningitis is a known complication of otitis media and it is not unlikely that our patient instead developed pyogenic ventriculitis [10]. Due to limited studies, this association has not yet been reported in the literature, but it may be an important rare presentation to be aware of.

Diagnosis

Since PV is a rare disease, there is limited literature available and no standard diagnostic method. However, among the existing cases of PV, we can discuss some of the various methods in which PV gets diagnosed.

In general, clinicians diagnose PV through a combination of clinical symptoms and blood/CSF cultures identifying a source of infection. Clinical symptoms are found via physical examination including fever, headache, nausea, vomiting, neck stiffness, photophobia, decreased mental status, and seizures, which can vary depending on the extent of the infection [3,5,7]. Cultures are taken and analyzed for causative pathogens through lumbar punctures for CSF cultures and blood draws for blood cultures. The combination of both clinical symptoms and a causative pathogen lead to a diagnosis for PV. For more specific criteria, confirmative MRI scans that depict fluid-fluid levels inside the bilateral lateral ventricles, hyperintense lesions on diffusion- weighted images, as well as hypointense lesions on T2-weighted images have been determined to be pathognomonic for PV, since these specific findings have never been reported in other diseases [11].

Ventriculitis can be secondary to a multitude of causes, such as meningitis, cerebral abscess with intraventricular rupture, catheter-related infection, trauma, neurosurgery complication, intrathecal therapy complication, etc. Specifically, the diagnosis of PV and meningitis are often confused due to their similar clinical presentations. In such cases, the history of the patient should be considered. For example, PV risk factors such as being immunocompromised (cancer, HIV, diabetes, etc.) or infected with a high virulence pathogen should suggest a diagnosis of PV [9]. In cases of meningitis that recurs or does not respond well to antibiotics, we should consider a diagnosis of PV secondary to a meningitis infection [12].

Our patient was suspected to have PV on the basis of his altered mental status, nuchal rigidity, chills, and fever symptoms

consistent with the condition. He also had a concurrent lumbar puncture, which produced CSF cultures positive for Streptococcus pneumoniae. This lumbar puncture confirmed his diagnosis of PV. Otitis media was also diagnosed in our patient due to the patient's hyperemic left tympanic membrane and left external auditory canal blood
clots. The patient also reported left ear fullness and decreased hearing ability, which is consistent with otitis media. He also had a prior COVID-19 infection, which was determined to be the cause of the otitis media.

Treatment

Treatment for pyogenic ventriculitis consists of antimicrobial administration that can reach effective concentrations in the central nervous system, and varies based on the patient's age and other predisposing conditions [2,7]. Prior to administration, blood cultures and lumbar punctures are performed in order to identify the pathogen and create a targeted antimicrobial therapy [2,7]. Based on presentation to the ER, our patient was suspected of CNS infection of either abscess formation, meningitis, or ventriculitis and was empirically treated with meropenem, a carbapenem class antibiotic that shows higher activity against penicillin-resistant pneumococcal organisms when compared with other beta-lactam antibiotics [13]. As a result of positive CSF PCR for Streptococcus pneumoniae, vancomycin was added, which has proved to effectively treat cephalosporin resistant pneumococcal meningitis alone [14]. On discharge our patient was advised to continue IV antibiotics (vancomycin and meropenem) for the following 6-8 weeks.

In addition to the antibiotic therapy our patient was given levetiracetam for seizure prophylaxis. Seizures are a possible complication of pyogenic ventriculitis and commonly treated with anticonvulsants [15]. The patient was advised to continue levetiracetam for 3 months. Additionally, standard of care for pyogenic ventriculitis recommends follow up imaging as well as neurologic signs3. A follow up appointment on 2/27/23 showed normal EEG in our patient.

Conclusion

In this case report, we describe a patient with a rare case of pyogenic ventriculitis as a sequel to otitis media that was caused by a prior COVID-19 infection. We discussed the common clinical presentations, diagnostic strategies, and treatment approaches of pyogenic ventriculitis. This diagnosis is uncommon and there are few publications about this subject, especially in regard to COVID-19. Clinicians should be aware of this rare presentation as it is critical to identify and start treatment early to prevent adverse outcomes.

- There are foci of high diffusionsignal intensity within or along the bilateral ventricular posterior horns, possibly representing pus or other complicated material. There is associated ependymal enhancement along the right ventricular posterior horn, concerning for ventriculitis.
- There is additional extra-axial high diffusion signal intensity along the right interhemispheric falx, possibly representing additional pus or complicated material versus artifact.
- There is a left mastoid effusion demonstrating enhancement, likely representing reported mastoiditis.

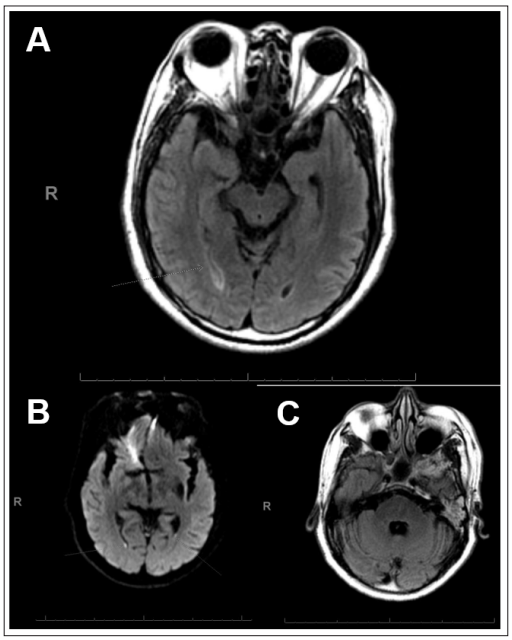

Figure 1: Head MRI with and without Contrast 11/20/2022.

Acknowledgments

We would like to express our sincere gratitude to Dr. Eric S. Chin and Dr. Dustin Paz for their invaluable contribution in providing the case that formed the basis of this report. Their expertise and collaboration have been instrumental in enriching the content and insights of this study.

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