

Pneumococcal Meningitis Complicated with Vasculitis and Severe Carotid Stenosis

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Received: September 07, 2022; **Published:** September 19, 2022

Abstract

Introduction and Case Report: A previously healthy and fully vaccinated 7-year-old girl presented with high fever, vomiting, severe headache with phonophobia, photophobia and drowsiness. Physical examination was un-remarkable except for the presence of neck stiffness. Cerebrospinal fluid real-time polymerase chain reaction revealed *Streptococcus pneumoniae* DNA. With the diagnosis of pneumococcal meningitis, antibiotic therapy was started. The patient did not show the expected clinical improvement and had a self-limited episode of dysarthria. Magnetic resonance imaging showed a bilateral 90% reduction in the caliber of the cavernous segment of the internal carotids with associated vasculitis. The patient received a high dose of methylprednisolone for 5 days, with a remarkable improvement, followed by a 1-month treatment with oral prednisolone. Before discharge, the patient repeated the imaging exam which revealed resolution of the stenosis and the vasculitis findings. The patient has no neurological sequelae.

Conclusion: If there is a patient with pneumococcal meningitis who does not improve his clinical status, there should be a high index of suspicion for vasculitis. This report shows a very extensive vasculitis and important stenosis phenomena. Magnetic resonance imaging plays an essential role in the investigation of cerebrovascular complications. Steroids are the first-line drug to control parainfectious vasculitis.

Keywords: Carotid Stenosis; Cerebral Vasculitis; Corticosteroids; Meningitis; *Streptococcus pneumoniae*

Abbreviation

CSF: Cerebrospinal Fluid

Introduction

Pneumococcal meningitis is a life-threatening infection [1]. Although its prevalence has declined since the introduction of vaccines against *Streptococcus pneumoniae*, this infection is still a concern [1]. Pneumococcal meningitis is associated with 10% mortality and

20 - 30% morbidity [1]. Although less reported, parainfectious vasculitis is one of the many complications related to bacterial meningitis. Corticosteroids should be used as therapy in case of vasculitis, as a weapon against the intense host inflammatory response [2].

The authors report a case of pneumococcal meningitis complicated with extensive vasculitis with important stenosis phenomenon in a healthy and fully vaccinated 7-year-old female. Our aim is to discuss the importance of ruling out these complications and their management with steroids.

Case Presentation

The patient was a 7-year-old girl, previously healthy and fully vaccinated, including the 13-valent pneumococcal conjugate vaccine. She presented to the emergency department with high fever (39°C), vomiting and intense frontal headache with biparietal extension. On the second day of symptoms, she was medicated with amoxicillin and clavulanic acid for acute sinusitis. However, there was a worsening of the headache associated with phonophobia, photophobia and drowsiness. There was no disease epidemiological link. On examination, the patient was conscious and oriented. She was afebrile and without signs of shock. There were no skin rashes. Neurological exam was normal except for the presence of neck stiffness. Other systems were unremarkable. On admission, hematological tests showed leukocytosis (15620/uL leukocytes with 13620/uL neutrophils) and elevated C reactive protein (12,8 mg/dL). Computed tomography of the head showed polysinusitis. A lumbar puncture was performed. Her cerebrospinal fluid (CSF) was turbid and had an increase in white cell count (3040 cells/uL with 99% polymorphonuclear leukocytes) and protein count (2,66 g/L), with a normal glucose level (50 mg/dL). Meningitis was suspected and the patient started empirical intravenous treatment with ceftriaxone, ciprofloxacin and acyclovir. Later, the team received the remaining results: CSF real-time polymerase chain reaction revealed *Streptococcus pneumoniae* DNA, negative virus screening and negative cultural exam. The diagnosis of decapitated pneumococcal meningitis was made since there were no signs of bacterial growth in cultures in a patient already under antibiotic treatment. For this reason, the therapeutic attitude changed as we suspended of ciprofloxacin and acyclovir and added vancomycin.

However, the patient did not show the expected clinical improvement. On the 6th day of hospitalization, she remained febrile, with persistent headaches and had a self-limited episode of dysarthria. Therefore, the team repeated the lumbar puncture (significant reduction of white cell count) and performed a magnetic resonance imaging that showed a bilateral 90% reduction in the caliber of the cavernous segment of the internal carotids with vasculitis associated (Figure 1). There were no signs of cerebral ischemia. The neurosurgery and vascular surgical team decided that endovascular treatment was not an option because of the risk of approaching the cavernous segment of the internal carotids. Thus, she received a high dose of methylprednisolone (30 mg/kg/day) for 5 days and meropenem was added to treat potentially resistant pneumococci. This initial therapy was followed by a 1-month treatment with oral prednisolone (1 mg/kg/day). After the introduction of corticosteroids, the patient showed a remarkable improvement.

Before discharge, the imaging exam was repeated and revealed resolution of the stenosis and the vasculitis findings. On the 30th day of hospitalization, the patient was discharged with no neurological sequelae. Afterward, the screening for immunodeficiencies was performed and the administration of a 23-valent pneumococcal polysaccharide vaccine was recommended.

Discussion

Pneumococcal meningitis causes neurological complications in 75% of patients, leading to a higher risk of sequelae compared to *Neisseria meningitidis* or *Haemophilus influenzae* [3]. These complications include seizures, cerebral edema, subdural empyema, brain abscess, hearing loss, hydrocephalus and vasculitis [4]. Although rare, parainfectious vasculitis is a serious complication that can narrow the vascular lumen and lead to cerebral ischemia [4]. In our case, the presence of vasculitis led to a severe bilateral carotid stenosis, and to the best of our knowledge, has never been reported in the literature. Magnetic resonance imaging showed no signs of cerebral ischemia. However, the described dysarthria episode may have been a transient ischemic attack.



Figure 1: Magnetic resonance imaging showing a bilateral 90% reduction in the caliber of the cavernous segment of the internal carotids.

The pathophysiology of this vasculitis is well known. The administration of antibiotics releases bacterial cell wall components, which leads to the increase of inflammatory cytokines in the subarachnoid space [4]. Furthermore, bacteria penetrate the vessel wall, causing increased vascular permeability and damage to the blood-brain barrier [5]. Vasculitis usually occurs in the second week of the disease, following an initial clinical improvement [5]. This inflammatory incidence usually has a 2-phase pattern - initial improvement followed by a neurological deterioration [4].

If there is a patient who does not improve the clinical status and has a normalized repeated lumbar puncture, an imaging exam should be performed to rule out cerebrovascular complications. Magnetic resonance imaging has high sensitivity (90%) for identifying early changes in cerebral vasculitis, as it can detect white matter lesions, ischemic necrosis and arterial changes [6].

Steroids should be considered as the first-line therapy for vasculitis, as they inhibit the synthesis of cytokines and stabilize the blood-brain barrier [4]. Literature suggests the use of a high dose pulse of methylprednisolone, for 3 to 5 days, followed by tapering doses of oral prednisolone for 4 to 6 weeks [5]. Nevertheless, there is no consensus about the corticosteroid doses [2,4]. The use of immunosuppressants, such as cyclophosphamide, can also be part of the treatment [2,5]. In addition to their therapeutic use, steroids may have a beneficial effect in preventing neurological complications. Although their use in *Haemophilus influenzae* meningitis appears to reduce hearing loss, the use of dexamethasone in pneumococcal meningitis remains controversial [3]. However, the decision can be individualized. Some authors defend that its use might be considered in suspected pneumococcal meningitis in patients older than 6 weeks [1,7]. The main concerns are that the use of corticosteroids may decrease anti-biotic penetration into the CSF and interfere with the clinician's ability to evaluate clinical response to treatment [4]. Furthermore, if this drug is administered one hour after the first dose of the antibiotic, it is less likely to prevent pneumococcal neurological sequelae [4].

Finally, we should point out that an effective vaccination program is the most important way to prevent morbidity and mortality due to bacterial meningitis.

Conclusion

Pneumococcal meningitis has high morbidity and mortality in the pediatric population. The present paper reports a case of complicated meningitis with vasculitis and severe bilateral carotid stenosis. There should be a high index of suspicion for vasculitis in this disease, and magnetic resonance imaging plays an essential role in the investigation. So far, steroids are the first-line drug to control this intense host inflammatory response [3].

Conflict of Interest

The authors declare no conflict of interest.

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Volume 11 Issue 10 October 2022

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