Case Report

Streptococcus pneumoniae Meningitis and Intracranial Vasculopathy: Clinical Correlation with Improving Transcranial Doppler Hemodynamics

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Keywords

Meningitis · *Streptococcus pneumoniae* · Transcranial Doppler

Abstract

Streptococcus pneumoniae are Gram-positive bacteria that are responsible for many types of illnesses including pneumonia, sinus infections, and community-acquired meningitis. One important complication of bacterial meningitis is intracranial vasculopathy. Possible etiologies include vasculitis, vasospasm, endocarditis, or intra-arterial thrombosis. We present a case report of *S. pneumoniae* meningitis treated with antibiotics in which clinical improvement correlated with serial transcranial Doppler ultrasonography (TCD) improvement, suggesting vasospasm or vasculitis as a possible mechanism for intracranial vasculopathy.

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Introduction

Streptococcus pneumoniae, or pneumococcus, are Gram-positive bacteria that are responsible for many types of illnesses including pneumonia, meningitis, as well as ear or sinus

infections. They are spread via several routes such as coughing, sneezing, or close contact with an infected person. *S. pneumoniae* are the most common pathogen in cases of community-acquired meningitis [1]. These cases may present with fever, stiff neck, headache, confusion, and sensitivity to light.

Intracranial vasculopathy is an important complication of bacterial meningitis. It increases the risk of stroke and negatively affects prognosis. It is also a common phenomenon, occurring in 37.1% of patients with bacterial meningitis according to one study [2]. Many possible etiologies have been identified including vasculitis, vasospasm, endocarditis or intra-arterial thrombosis [3]. Transcranial Doppler (TCD) ultrasonography is a non-invasive approach to detect intracranial vasculopathy and can identify patients at risk of stroke from the underlying infection [4, 5]. We present a case report of *Streptococcus pneumoniae* meningitis treated with antibiotics in which clinical improvement correlated with serial TCD improvement.

Case Report

A 50-year-old man presented with 2 days of fever, confusion and left-sided body weakness. On examination, he was febrile, confused and had left-sided hemiparesis. MRI brain (Fig. 1a, b) demonstrated right frontal cerebritis with acute infarcts in both basal ganglia. MRA (Fig. 1c) revealed generalized irregularities in the M1 segments of both middle cerebral arteries (MCAs). Lumbar puncture showed elevated polymorphonuclear leukocytes with low glucose (0 mmol/L) and high protein (4.9 g/L). Blood and CSF cultures grew *S. pneumoniae*. The patient received 42 days of antibiotics (intravenous Ceftriaxone 2 g BD). Antibiotic treatment was extended to 42 days in this case to cover for the possibility of the right frontal cerebritis (seen on MRI brain) developing into an abscess. The patient also received intravenous dexamethasone 24 mg BD for 4 days beginning on day 8 of his illness. A repeat MRI/MRA brain showed some resolution in the cerebritis and intracranial vasculopathy seen previously (Fig. 1d–f).

TCD on day 10 (Fig. 2, left column) of antibiotic treatment demonstrated high mean flow velocities in the right MCA (range 181–202 cm/s), right anterior cerebral artery (ACA) (range 129–154 cm/s) and the intracranial portion of the right internal carotid artery (ICA) (range 123–136 cm/s). Repeat TCD on day 42 (Fig. 2, right column) of antibiotic treatment demonstrated significant reductions in mean flow velocities: right MCA 56–65 cm/s, right ACA 87–91 cm/s, and right ICA 25–30 cm/s.

After discharge from the ward, he continued to improve and was subsequently deemed to be able to carry out daily activities independently.

Discussion

Intracranial vasculopathy that is seen in cases of bacterial meningitis can be due to several mechanisms, including vasospasm, vasculitis, or intra-arterial thrombosis. In many patients, it is often difficult to match any intracranial vasculopathy seen on imaging with its underlying mechanism. This case report illustrates one way in which TCD can be used to determine the cause of intracranial vasculopathy in individuals with bacterial meningitis.

Reduction in TCD velocities coupled with improvements on MRA with antibiotic treatment suggest that vasospasm/vasculitis may have been responsible for the changes that were originally seen. This case report also illustrates the utility of TCD in guiding further neuroimaging, with disturbances in TCD hemodynamics reflecting abnormalities seen in the patient's MRA. Going forward, improvements in TCD hemodynamics may be a useful surrogate marker for treatment trials involving patients with bacterial meningitis.

Conclusion

Antibiotic treatment for *S. pneumoniae* meningitis correlated with improvement in clinical status and TCD hemodynamics. Serial TCDs may be a potentially useful strategy in the management of bacterial meningitis.

Acknowledgement

No other persons or organizations have made significant contributions to the manuscript.

Statement of Ethics

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Fig. 1. Top row: **a** T2-weighted and **b** FLAIR sequences before treatment with antibiotics showing right frontal cerebritis. **c** MRA demonstrating generalized irregularities in the M1 segments of both MCAs (arrows). Bottom row: **d** T2-weighted and **e** FLAIR sequences showing resolution of the previously seen right frontal cerebritis. **f** MRA demonstrating attenuation of the irregularities previously seen in the MCAs (arrows).

Fig. 2. Mean flow velocities on day 10 (left column) and day 42 (right column) of antibiotic treatment.