

CASE REPORT

Use of an External Ventricular Drain to Manage Cerebral Edema in Bacterial Meningitis

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Introduction

Bacterial Meningitis affects approximately 1.2 million people worldwide annually with 135,000 deaths.¹ In those who survive, neurologic sequelae are common. Cerebral edema is an occasional complication of this disease and heralds a more severe course. Although antibiotics are the mainstay of treatment, when cerebral edema is present more aggressive therapeutic measures directed specifically at this problem should be considered.

Case Report

A twenty-four-year old female was brought to the emergency department (ED) by EMS after being found unresponsive in her home by her boyfriend. Initial findings included altered mental status as well as leukocytosis with left shift. She was found with bottles of oxycodone/acetaminophen and hydrocodone/acetaminophen at her home. Of note, the patient had a splenectomy several years earlier as treatment for Idiopathic Thrombocytopenic Purpura, putting her at increased risk for encapsulated pathogens.

Serum acetaminophen level was elevated in the ED. She initially was treated for acetaminophen overdose with N-acetylcysteine. Several hours after admission during the first night, the patient developed a high fever, up to 105°F. However, there were no call parameters ordered, and a

physician was not contacted.

The next morning, the fever was discovered and bacterial meningitis was suspected. Due to her altered mental status and concern for elevated intracranial pressure (ICP), the patient was sent for computed tomography (CT) of the head prior to lumbar puncture. CT revealed cerebral edema (Figure 1) and the patient was started on empiric treatment for bacterial meningitis including ampicillin, ceftriaxone, vancomycin, and dexamethasone.



Figure 1. CT of the head on admission showing poor gray-white differentiation and effacement of the sulci.

At the time of treatment, the patient continued to have altered mental status and she was intubated due to concern that she could not protect her airway. Due to the severity of her illness, an infectious disease specialist recommended aggressive treatment of the cerebral edema. Her initial ICP was 34 mmHg. An external ventricular drain was placed in the right lateral ventricle to maintain ICP in target range. CSF revealed *Streptococcus pneumoniae*. In addition to the ventricular drain, hypertonic saline and mannitol were used to aid in decreasing ICP.

The patient improved clinically over the next several days. Antibiotics were tapered to penicillin alone based on sensitivities. She was extubated on day 6 and the ventricular drain was removed on day 8. A subsequent CT scan showed resolution of the cerebral edema (Figure 2). The patient suffered from sensorineural hearing loss, but otherwise had no other neurologic sequelae and was discharged on day 14, after receiving the proper immunizations.

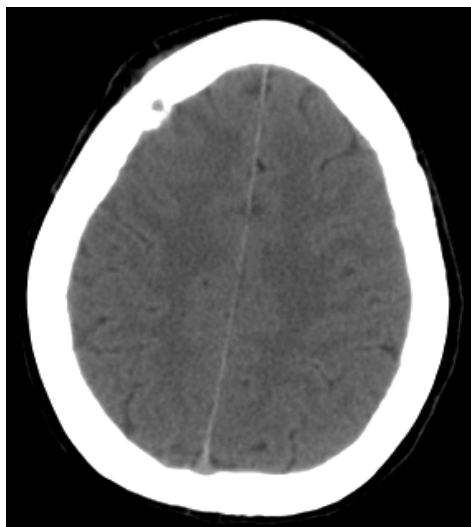


Figure 2. CT of the head on day 8 showing improvement of prior findings as well as right frontal burr hole.

Discussion

Cerebral edema is an occasional complication of bacterial meningitis.

Multiple mechanisms of development include: (1) vasogenic due to increased permeability of the blood brain barrier, (2) cytotoxic due to toxic factors from neutrophils, and (3) interstitial due to obstruction of flow of CSF.² Several factors placed this patient at increased risk for cerebral edema. There was a delay in treatment that was multifactorial in nature, including delays in diagnosis, discovering the patient's fever, and sending the patient for CT before starting empiric antibiotics. Additionally, the responsible bacteria, *Streptococcus pneumoniae*, are particularly pathogenic due to the severity of immune response it stimulates and the persistence of biologic activity of the debris of killed bacteria.³ Further, this patient was immunosuppressed due to prior splenectomy, decreasing her ability to fight infection.

There were no known clinical trials, but several case reports described using surgical means^{4,5} and medical therapy^{2,6} to treat elevated ICP and cerebral edema in bacterial meningitis. Given our patient's severe clinical state at the time of diagnosis, the decision was made to pursue aggressive measures to treat her cerebral edema and elevated ICP. The outcome of this case, while not perfect given the residual hearing loss, generally, was considered reasonable given the severity of her illness.

References

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