

Tympanic membrane penetrating trauma with CSF leak leading to pneumococcal meningitis in an infant

Case Report

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Abstract: We report the case of an eighteen-month-old child who suffered a tympanic membrane perforation caused by a digital thermometer. This injury led to a CSF leak. The patient was followed conservatively with no surgical intervention or prophylactic antibiotic therapy and developed pneumococcal meningitis 7 days later. He was then treated with Ceftriaxone for 12 days with full recovery, from a short and long term perspective. Issues concerning the management of CSF leak will be discussed along with review of the literature. This is the first report of post-traumatic meningitis as a result of mild trauma not involving maxillofacial or basilar fractures. The aim of our report is to raise awareness to this cause of meningitis and to stress the importance of immunizing against *Streptococcal pneumoniae*, a measure which may have prevented the sequelae in our case.

Keywords: CSF leak • Tympanic membrane • Meningitis • *Streptococcus pneumonia*

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1. Introduction

Several reports in the literature discuss the management of head trauma or maxillofacial trauma involving a fracture and causing a CSF leak, the rates of secondary meningitis and the need for early surgical intervention and antibiotic prophylaxis [1-4]. The conclusions of these studies are conflicting with regards to the need for surgery or prophylactic antibiotics to prevent meningitis from occurring. This is the first report of CSF leak and secondary meningitis due to ear penetrating minor trauma with no craniofacial fracture.

2. Case report

An eighteen-month-old infant, previously healthy, presented to the emergency room immediately after his 3 year old sister inserted a digital thermometer in to

his ear, deep enough to cause perforation of his tympanic membrane. On physical examination, fluid discharge was noted from a perforated tympanic membrane, which was positive for β 2-transferin and was therefore identified as CSF. A CT scan of the head and temporal bone did not reveal temporal bone fracture or a perilymphatic fistula. Spontaneous resolution of the leak occurred and the child was discharged home after a few days of observation.

One day following his discharge, and 7 days following the trauma, the child was readmitted with fever of 39°C, vomiting, lethargy, unresponsiveness, neck stiffness and positive Kernig and Brudzinsky signs. A blood culture and CBC were obtained and dexamethasone (0.15 mg/kg QID), ceftriaxone (100 mg/kg once daily) and vancomycin (15 mg/kg QID) were initiated. No papilledema was identified and lumbar puncture was performed. The CSF was cloudy with a high opening pressure. The complete blood count showed a WBC to be

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32,000/mmc, and CSF analysis showed the following: PMN, 1150/mmc; RBC, 120/mmc; LYM, 50/mmc; undefined cells, 2650/mmc; Gram-positive diplococci; CSF glucose, 3.6 mmol/L and serum glucose, 9.4 mmol/L; the CSF protein was 1249 mg/L. One hour later, limbs twitches were observed and phenobarbital (loading dose of 20 mg/kg, followed by 5 mg/kg/d) was initiated. Non-typeable *Streptococcus pneumoniae* susceptible to ceftriaxone (MIC of 0.19 mg/L in serum, 0.25 mg/L in CSF) and intermediate to penicillin (MIC 0.25 mg/L in serum, 0.75 mg/L in CSF) was isolated from the blood and CSF cultures. Accordingly, vancomycin was discontinued. Dexamethasone was administered for 2 days, and phenobarbital for 10 days with no additional episodes of convulsions. The patient was discharged after 12 days of IV antibiotics, with full recovery. The patient received pneumococcal polyvalent vaccine and a weekly dose of azithromycin (10 mg/kg) for 3 weeks as prophylaxis until he was able to mount an adequate humoral response to the vaccination. A follow-up brain MRI two weeks after discharge showed no abnormalities. A long term follow-up of 3.5 years showed no recurrent meningitis, no seizures, no developmental delay or learning disabilities; no additional surgery was required.

3. Discussion

Posttraumatic CSF leakage frequently complicates skull base fractures. While most CSF leaks will cease without treatment, patients with persistent CSF leaks may be at increased risk for pneumococcal meningitis, some of which will require surgical intervention. Several studies have attempted to assess the need for surgery versus conservative management and the need for prophylactic antibiotics. The reported data are confusing and inconsistent. A retrospective study of 1036 patients treated for severe cranial trauma revealed that 2.6% of the patients had a CSF leak. Surgical treatment did not lower the incidence of meningitis compared with conservative treatment, and the incidence was 40% and 29% respectively [1]. A review of 51 patients treated with CSF leaks that persisted for 24 hours or longer following head trauma concluded that prophylactic antibiotic administration halved the risk of meningitis, from 21% to 10%, and that patients with skull fractures involving the skull base or frontal sinus should be followed for delayed leakage [2]. Another review of 735 patients who suffered basilar fractures or severe facial trauma showed an incidence of 4.6% CSF leak with no cases of meningitis. That study concluded that post-traumatic CSF leaks are uncommon and will usually resolve without surgical intervention [3]. A retrospective analysis of 160 cases with

traumatic CSF leaks showed a 30.6% overall incidence of meningitis before surgical dural repair and a cumulative risk of 85% at 10 year follow-up. Meningitis was recurrent in 30%. Prophylactic antibiotics reduced the risk of meningitis from 61% to 34% [4]. As mentioned above, all previous studies referred to traumatic maxillo-facial trauma or base of skull fractures, and not a minor penetrating tympanic membrane trauma, as reported in our case. The mechanism of CSF leak in our case is a perilymphatic fistula, which is an abnormal connection between the inner and middle ear that allows escape of perilymphatic fluid into the middle ear compartment. In most cases, traumatic tears in the oval or round windows are the port of entry of nasopharyngeal flora leading to bacterial meningitis. Surgical treatment with patching of oval or round windows is the mainstay of therapy for persistent leaks or when there is radiologic evidence of perilymphatic fistula. When no such evidence exists “who should we treat” remains the big unanswered question. Previous reports suggested that CSF analysis may help in predicting the risk for meningitis by detecting increased biochemical markers as beta-lysin and lysozyme [5]. The meningitis in our case was caused by a *Streptococcal pneumoniae*, which is the leading pathogen responsible for meningitis, especially in post-trauma cases. The child was not immunized against *Streptococcus pneumoniae* and the conjugate pneumococcal vaccine was not yet available at the time; it might have prevented the meningitis in this minor trauma. This and similar cases of pneumococcal meningitis stress the importance of advocating the vaccination in children up to 5 years of age. Prophylactic treatment with antibiotics is debatable, partly because of lack of strong evidence supporting this approach. When treating with prophylactic antibiotics, any clinical signs of developing meningitis are masked, and the question then arises regarding the duration of prophylactic treatment. This is the concern of those who do not support routine prophylactic treatment, especially in minor trauma such as the case presented in this report. Despite the lack of evidence or any guidelines in cases such as this, the authors recommend prophylactic antibiotic treatment in high-risk patients such as unimmunized or immunodeficient children, or those with significant maxillo-facial trauma involving CSF leak. This case demonstrates that minor trauma as well, involving no maxillofacial fracture, can lead to meningitis. Therefore, we feel that the risk of developing meningitis is greater than that of unnecessary antibiotic treatment.

In summary, we report a rare case of CSF leak and subsequent pneumococcal meningitis following traumatic perforation of the tympanic membrane that was not treated surgically. Surgery was not considered in this

case as the leak ceased spontaneously, and prophylactic treatment was not given so not to mask signs of developing meningitis and promote partially treated meningitis thereafter. A large-scale study may be needed to evaluate the role of prophylactic antibiotics in cases of CSF leaks which do not require surgery, in addition to the routine immunization against *Streptococcal pneumoniae*.

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