Does Meningitis Stop CSF Rhinorrhea following Lateral Skull Base Surgery?

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ABSTRACT

In cases of cerebrospinal fluid (CSF) rhinorrhea following lateral skull base surgery, fibrosis and fibrin formation resulting from meningitis has been postulated as a mechanism of spontaneously resolving the CSF leak. This study was undertaken to explore any possible relationship between the cessation of CSF leak and meningitis. A retrospective study at a tertiary referral center of 232 consecutive patients was performed. Out of a total of 232 procedures, 29 patients developed CSF rhinorrhea, of whom 7 subsequently developed meningitis. Bacteria were isolated in CSF obtained at lumbar puncture in 5 cases, with the CSF analysis in the remaining 2 cases suggesting aseptic meningitis. Conservative treatment failed to stop the CSF rhinorrhea in 6 of 7 cases. In this study, the development of meningitis did not appear to aid in the resolution of the CSF rhinorrhea. We conclude that surgical intervention should not be delayed in the expectation that meningitis and conservative interventions may promote CSF leak resolution.

KEYWORDS: Meningitis, cerebrospinal fluid, skull base surgery, translabyrinthine, vestibular schwannoma complications

Anecdotally it has been suggested that meningitis may help in the resolution of cerebrospinal fluid (CSF) leak following lateral skull base surgery. Leptomeningeal fibrosis and fibrin formation,

resulting from the ensuing inflammatory response, is postulated as helping to seal the origin of the leak. The aim of this study was to explore the relationship between CSF leak and meningitis

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Received: February 20, 2007. Accepted: March 7, 2007. Published online: June 1, 2007.

DOI 10.1055/s-2007-981694. ISSN 1531-5010.

following excision of vestibular schwannomas, to establish if the anecdotal observation is supported in clinical practice.

METHODS

A retrospective study was performed of the case notes of 232 consecutive patients who underwent acoustic neuroma excision over a 4-year period. Patients who had a CSF leak complicated by meningitis were identified. CSF rhinorrhea was diagnosed when clear fluid emanated from the ipsilateral nostril provocation, by placing the patient in the "head down" position or performing Valsalva's maneuver.¹ If any clinical uncertainty persisted then a fluid sample was sent for β -2 transferrin electrophoresis. Meningitis was defined by clinical (fever, headache, meningism), microbiological (Gram stain and culture), and CSF analysis (protein, glucose, and white blood cells) criteria. All patients in this study had had at least 12 months' follow up.

The literature articles used in the preparation of this review were identified following a systematic electronic search (PubMed) using MeSH headings such as acoustic neuroma surgery, complications, CSF leak, and meningitis. No articles were identified investigating the possible effect that meningitis may have on outcome of postoperative CSF leak.

RESULTS

In this series, 232 consecutive patients who had undergone lateral skull base surgery were identified. The pathology was vestibular schwannoma (92.7%), meningioma (5.2%), and other (2.1%). The surgical approaches were translabyrinthine (91.8%), retrosigmoid (3.9%), and middle cranial fossa (3.4%). A total of 29 (12.5%) patients had CSF rhinorrhea, of whom 7 subsequently developed meningitis. It is the departmental policy not to give CSF leaks prophylactic antibiotics. All 7 patients had had a trans-

labyrinthine approach to remove a vestibular schwannoma, with a mean intracranial size of 1.71 cm (range, 0.5 to 3.5 cm). There were 4 males and 3 females with a mean age of 50.3 years. Five tumors were solid. There was no case of neurofibromatosis type 2.

Bacteria were isolated in CSF obtained at lumbar puncture in five cases (streptococci, *Haemophilus influenzae*, *Staphylococcus aureus*, and two cases of Gram-positive cocci), and in the remaining two cases CSF analysis was suggestive of aseptic meningitis (no bacterial growth, elevated mononuclear cells). There were six cases in which active CSF rhinorrhea was noted at the presentation of meningitis, and one case where the rhinorrhea had clinically ceased 8 days before the onset of the meningitis. In this case, because no other cause of the meningitis was found, it was felt likely to be through the same route as the CSF rhinorrhea. One patient had previously undergone lumbar drain insertion, 37 days before onset of meningitis; this was not thought to be a cause of the meningitis. The time interval between the primary surgery and meningitis ranged from 33 to 283 days with a mean of 80 days.

The initial treatment of meningitis consisted of intravenous antibiotics in all cases and conservative measures to reduce pressure CSF (nursing the patient "head up," avoiding coughing/sneezing, and providing laxatives). These patients were not given steroids at any point. Six patients also underwent controlled lumbar drainage of CSF.

By day 7 after the diagnosis of meningitis, only one case of CSF rhinorrhea had stopped permanently, in response to conservative treatment. In four of the seven cases the CSF rhinorrhea continued unabated following the onset of meningitis and these required surgical exploration, namely, blind sac closure of the external auditory meatus and insertion of a lumbar drain, between days 8 and 14 following meningitis. In two cases the CSF rhinorrhea ceased temporarily but restarted at days 8 and 28 after the diagnosis of meningitis, requiring surgical exploration, blind sac closure of the external auditory meatus, and insertion of a lumbar drain for 4 days. Overall, conservative

treatment in the presence of meningitis failed to stop permanently the CSF rhinorrhea in six of seven cases (86%). There was no long-term morbidity or mortality as a result of the meningitis in any case. This compares unfavorably to the 22 patients with CSF rhinorrhea without meningitis, only half of whom required surgical re-exploration to terminate the leak.

DISCUSSION

The creation, and subsequent persistence, of an abnormal communication between the CSF in the subarachnoid space and the middle ear and mastoid is responsible for the development of CSF leakage after lateral skull base surgery.² The CSF may leak as rhinorrhea (via the eustachian tube), otorrhea, or through the surgical wound.

Bacterial postoperative meningitis is due to contamination of the CSF, either at the time of surgery or secondary to persistent leakage of CSF.^{2,3} Aseptic meningitis results from contamination of the CSF with the "by-products of surgical intervention," such as blood,² or it may be of viral origin. The different types of meningitis may be difficult to differentiate, either clinically or following laboratory analysis.^{1,2} All patients in this study were treated with intravenous antibiotics, to limit the potential mortality associated with bacterial meningitis.^{1,3} The meningitis rate in this series was 3%, in agreement with the incidence reported by other workers (1.5% to 5.3%).^{1,3,4}

A degree of controversy exists as to the exact relationship between CSF leakage and meningitis. However, the majority of authors report an apparent role for CSF leakage in the pathogenesis of meningitis.^{1,2,4,5} The results of this series supported this view. Other authors have not found a statistically significant relationship. In their study, Rodgers and

Luxford (1993) postulated that their departmental policy of early surgical intervention (after 2 days of conservative management) for CSF leaks prevented meningitis from occurring.³

Six out of seven patients with meningitis and CSF rhinorrhea in this series required surgical intervention to seal the site of CSF leakage. Presumably, this is because any ensuing leptomeningeal fibrosis is insufficient to seal completely the dural defect. In this study the development of meningitis did not appear to aid in the resolution of the CSF rhinorrhea. We believe that surgical intervention should not be delayed in the expectation that meningitis and conservative treatment may promote CSF leak resolution.

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Commentary

In this brief report, Malik et al challenge the long-standing myth that the inflammatory response seen in meningitis helps to seal postoperative

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Skull Base 2007;17:237-238. Copyright © 2007 by Thieme

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Published online: June 1, 2007.

DOI 10.1055/s-2007-981695. ISSN 1531-5010.

cerebrospinal (CSF) fistulae. The authors have retrospectively examined a highly select cohort of patients who developed postoperative CSF leaks and subsequently meningitis (seven patients) after surgery for acoustic neuromas. They conclude that the inflammation seen in meningitis is insufficient to seal such leaks and that other interventions (i.e., CSF diversion, operative repair) should not be withheld expectantly. We agree with their findings. The dural defect created during transpetrosal approaches is too large to be sealed by this inflammatory response. One cannot overstate the point that a postsurgical CSF leak requires urgent surgical intervention for closure. This may not hold true for

all CSF fistulae, such as those encountered in skull base trauma. In patients with post-traumatic CSF leak, the defect is often small and may seal with this inflammatory response.¹

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