Vestibular Pneumolabyrinth Following Temporal Bone Trauma

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Abstract

Objective: Perilymphatic fistula is a pathological communication between the inner and middle ear cavities. In some cases, temporal bone CT scans shows vestibular pneumolabyrinth. This paper’s objective is to review clinical findings and outcomes of patients with vestibular pneumolabyrinth secondary to blunt trauma of the temporal bone.

Study Design: Retrospective case review performed at a tertiary referral center

Methods: Eleven trauma patients with vestibular pneumolabyrinth were identified on dedicated temporal bone CT scans from July 2005 to April 2010. Data regarding the mechanism of injury, type of temporal bone fracture, vertigo, tinnitus, hearing loss, cranial nerve palsies, intracranial complications, presence of CSF leak, need for intervention, and final disposition were analyzed.

Results: All patients had otic capsule violating fracture and most had an intracranial bleed (n=9). Nine patients complained of hearing loss, 3 complained of vertigo and 1 had tinnitus. Six patients had concomitant facial nerve palsies and 1 had abducens nerve palsy. Most were managed with conservative observation. One patient had surgical repair of the perilymph fistula. Four patients passed away as a result of their injuries and 1 patient was discharged to rehab.

Conclusions: Vestibular pneumolabyrinth is an uncommon finding on CT, but should be considered in patients with severe head trauma particularly those with otic capsule violating temporal bone fractures. Most patients present with vestibular pneumolabyrinth and the majority have cranial nerve palsies. Most patients require no surgical intervention because their symptoms resolve spontaneously, but in those with intractable vertigo, middle ear exploration may be beneficial.

Materials and Methods

A retrospective chart review was conducted using all patients with temporal bone fractures evaluated at the Pennsylvania State University Hershey Medical Center from July 1, 2005 to April 30, 2010. 172 temporal bone fractures occurred during this time period. These scans were reviewed and 11 cases of vestibular pneumolabyrinth were identified. The charts of these patients were reviewed for the mechanism of injury, symptoms/signs of temporal bone fracture, intracranial injury, associated injuries, audiologic data, intervention, and disposition. Patients were excluded from this study if they did not undergo a dedicated temporal bone CT scan. The Pennsylvania State University Institutional Review Board approved this study and its guidelines were followed. Participants gave consent during their initial hospitalization for the use of their records in medical research.

Results

Table 1. Summary data for the 11 patients with vestibular pneumolabyrinth. LOC = loss of consciousness; FN = facial nerve; CSF = cerebrospinal fluid; EDH = epidural hematoma; SAH = subarachnoid hemorrhage; SDH = subdural hematoma

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<th>Hearing loss</th>
<th>Vertigo</th>
<th>Tinnitus</th>
<th>CSF leak</th>
<th>EDBH</th>
<th>SAH</th>
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Fig 1. Summary audiogram for the ears with vestibular pneumolabyrinth.

Fig 2. Summary pure tone averages of affected and unaffected ears.

Fig 3. (A) Axial and (B) coronal views of a right otic capsule violating temporal bone fracture. The fracture extends to the vestibule (yellow arrow) where vestibular pneumolabyrinth is seen (green arrows).

Fig 4. Pre and post-operative audiometry of a patient who underwent surgical exploration and fat grafting of a PLF.

Fig 5. Microscopic view of the right middle ear. Green arrow indicates the area of the oval window where perilymph was noted during the middle ear exploration. Orange arrow denotes the round window niche.

Discussion

Traumatic vestibular pneumolabyrinth is a rare imaging finding associated with perilymphatic fistula (PLF). A large amount of force is necessary to produce such injuries. Therefore, most patients have a LOC and an intracranial complication.

Sensorineural hearing loss (SNHL) and nystagmus should raise the suspicion of a PLF. A dedicated temporal bone CT scan using dynamic focal spot mode is important to identify vestibular pneumolabyrinth.

Historical treatment for PLF was exploratory tympanotomy for diagnostic and therapeutic purposes. Improvements in imaging of the temporal bone obviates the need for diagnostic surgical intervention. Recent reports are mixed between conservative observation and surgical exploration.

At our institution, surgical intervention is offered on a case by case basis, but in general exploration is offered to patients with vestibular pneumolabyrinth on dedicated temporal bone scan with persistent vestibular symptoms for more than 3 days or fluctuating/worsening sensorineural hearing loss. The 1 patient in our series who had a surgical exploration suffered from persistent vertigo, nausea, and vomiting for 3 days following a fall. During the exploration, a PLF was identified at the oval window and patched with fat. His symptoms/signs of PLF resolved post-op and his audiogram showed a mild improvement in his bone conduction line at mid-high frequencies. Word recognition scores improved from 20% at 90dB to 50% at 70dB.

Based on these limited reports and our experience, surgical intervention is recommended for patients with persistent vestibular symptoms, but improvement in sensorineural hearing loss is less reliable. This is important for patient counseling so they have appropriate expectations prior to surgery. However, more data is necessary to determine the timeframe and patient selection for surgical intervention.

Conclusions

- Diagnosis of PLF requires a high degree of clinical suspicion
- Vestibular pneumolabyrinth on a dedicated temporal bone CT scan confirms PLF
- Most patients can be treated with observation alone
- Persistent vertigo tends to improve following PLF fat grafting, whereas SNHL is less likely to improve following surgical intervention

References