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Case Report

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Bilateral temporal bone fractures: a case report

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ABSTRACT

Bilateral temporal bone fractures are rare; accounting for 9% to 20% of cases of temporal bone fractures. Clinical manifestations include hearing loss, facial paralysis, CSF otorhinorrhea and dizziness. This is a case report of a patient who presented with bilateral temporal bone fractures. This is a report of a 23-yr-old male who sustained bilateral temporal bone fractures and presented 18 days later with complaints of watery discharge from left ear and nose, bilateral profound hearing loss and facial weakness on the right side. Pure tone audiometry revealed bilateral profound sensori-neural hearing loss. CT temporal bones & MRI scans of brain were done to assess the extent of injuries. The patient underwent left CSF otorrhea repair, as the CSF leak was active and not responding to conservative management. One week later, the patient underwent right facial nerve decompression. The patient could not afford a cochlear implant (CI) in the right ear at the same sitting, however, implantation was advised as soon as possible because of the risk of cochlear ossification. The transcochlear approach was used to seal the CSF leak from the oval and round windows on the left side. The facial nerve was decompressed on the right side. The House-Brackmann grade improved from Grade V to grade III at last follow-up. Patients with bilateral temporal bone fractures require prompt assessment and management to decrease the risk of complications such as meningitis, permanent facial paralysis or hearing loss.

Keywords: Bilateral temporal bone fractures, Management

INTRODUCTION

Temporal bone fractures pose several management challenges to the otolaryngologist. Most of these fractures are unilateral, bilateral fractures are reported in 9% to 20%.[1] Most temporal bone fractures result from high-energy blunt head trauma, and are frequently related to other skull fractures or to polytrauma. A multidisciplinary evaluation is generally required, including otolaryngology, radiology and neurosurgery. The traditional classification indicates the relationship between the fracture line and the longer axis of the petrous portion of the temporal bone. Oblique fractures, also called mixed or complex fractures, are the most common types, followed by longitudinal and transverse fractures. Subsequently, fractures have been classified into otic capsule sparing (OCS) and otic capsule disrupting (OCD) fractures. Complications of temporal bone fractures include tympanic membrane perforation, hemotympanum, canal laceration, sensori-neural hearing loss (SNHL), conductive hearing loss, dizziness, facial nerve paralysis, cerebrospinal fluid (CSF) otorrhea, and vascular injury. High-resolution scanning is essential for evaluation of temporal bone fractures.[2] HRCT provides excellent delineation of bony anatomy and allows evaluation of the facial canal, ossicular chain, otic capsule, carotid canal, and middle cranial fossa. A thorough understanding of the etiology, classification, complications, and treatment of temporal bone fractures is mandatory for appropriate management.

CASE REPORT

A 23-yr-old male presented to the E.N.T department with complaints of watery discharge from left ear and nose, profound hearing loss in both ears and facial weakness on right side. He had been involved in a road traffic accident (RTA) and had bleeding from the left ear. There was no history of fever, vomiting, seizures and loss of consciousness after the RTA. He had been hospitalized for 8 days elsewhere and started on anti-convulsants, before presenting to our hospital 18 days later.

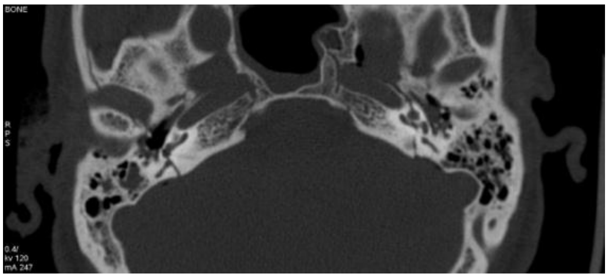

Figure 1: CT scan of temporal bones (axial view) showing bilateral transverse fractures.

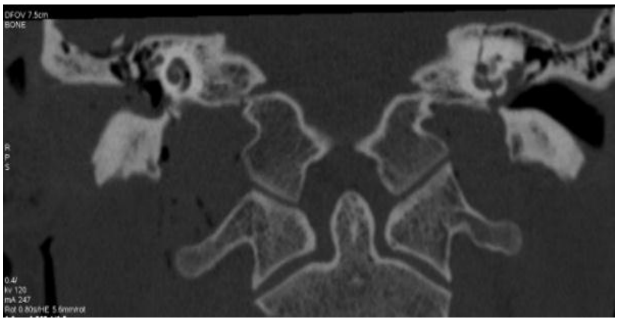

Figure 2: Coronal CT showing fracture line through the left cochlea.

Otomicroscopic examination showed bilateral haemotympanum. On tuning fork tests, no sound was perceived by the patient. There was a House Brackmann grade V facial palsy on the right side. Other cranial nerve examination was normal. Diagnostic nasal endoscopic examination showed clear fluid in the left nasopharynx. CT temporal bones (Figure 1 and 2) revealed fractures of the occipital bone extending across the foramen magnum into both temporal bones, involving the right vestibule, lateral semi-circular canal, middle ear cavity and the left cochlea. The fracture was found to traverse the right horizontal facial nerve canal and the left internal auditory canal. No bony fragment was made out in the scans. The fracture line of the left temporal bone was found to be passing through the cochlea and modiolus and was found to extend along the floor of the middle cranial fossa up to the left lateral wall of nasopharynx.

MRI brain did not reveal any intra-cranial injury. Pure tone audiometry revealed bilateral profound sensori-neural hearing loss (Figure 3).

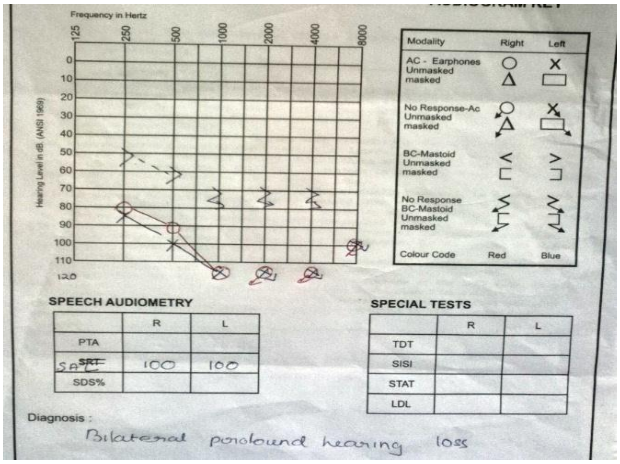

Figure 3: Pure tone audiometry showing bilateral profound hearing loss.

The patient was counseled for left CSF otorrhea repair as soon as possible. He was also counseled for right facial nerve decompression and right cochlear implantation as a staged procedure. Neuro-surgical clearance was obtained.

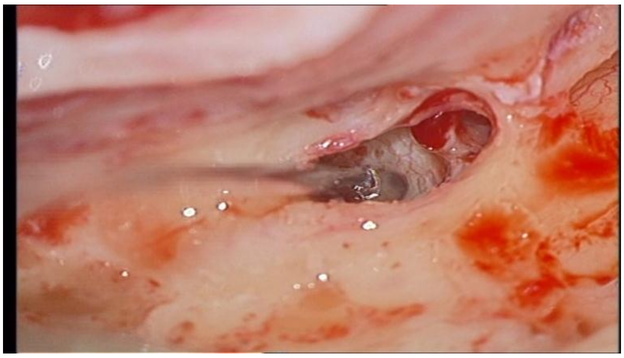

Figure 4: Left ear-CSF leak seen from the oval and round windows.

The patient underwent left CSF otorrhea repair, 20 days after the RTA, as the CSF leak was active and not responding to conservative management, in order to prevent meningitis. Intra-operatively, active CSF leak was noticed from the round window and oval window (Figure 4).

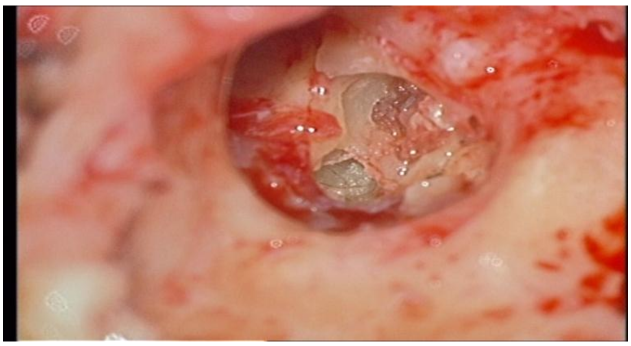

Figure 5: Transcochlear approach - Sealing of leak from the left cochlea.

Transcochlear approach was used to completely expose and repair the site of leak (Figure 5).

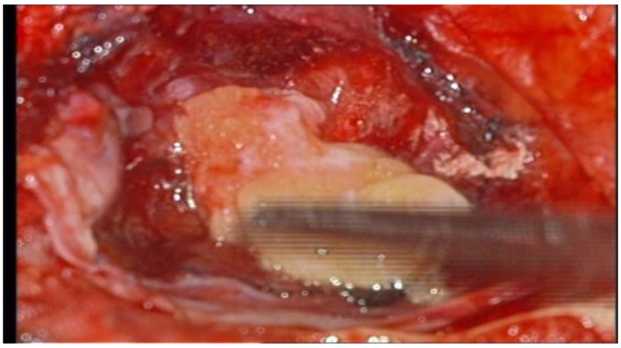

Figure 6: Left CSF leak repair with fat, temporalis fascia and fibrin glue.

The CSF leak was repaired with temporalis muscle and fascia, fascia lata and fibrin glue (Figure 6).

The Eustachian tube was plugged with muscle and blind sac closure was done. The patient received intravenous antibiotics, mannitol and anti-convulsants in the post-operative period.

One week later, the patient underwent right facial nerve decompression with facial nerve monitoring. Cortical mastoidectomy and posterior tympanotomy was performed. The facial nerve was decompressed in the vertical and horizontal portions. The vertical segment was found to be intact. The geniculate ganglion and labyrinthine segment were also exposed. The sheath of the tympanic segment and geniculate ganglion were found to be injured, however the nerve was in continuity (Figure 7).

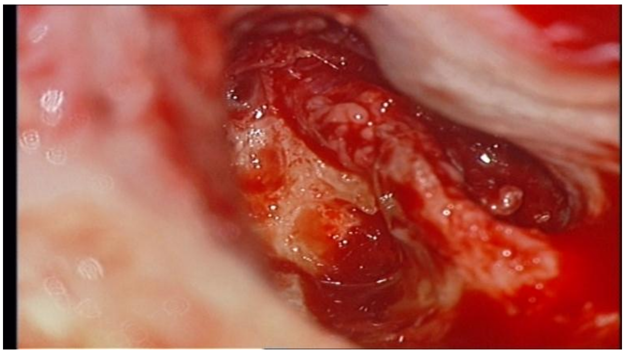

Figure 7: Right facial nerve decompression- intra-op picture showing intact vertical segment and injury to the sheath of the tympanic segment and geniculate ganglion.

Vein graft was harvested from the right forearm and used for the nerve repair (Figure 8).

Temporalis fascia and fibrin glue were used for repair. The patient received steroids which were tapered over 2 weeks. The patient could not afford a cochlear implant (CI) in the right ear at the same sitting, however, implantation was advised as soon as possible because of the risk of cochlear ossification. The facial function recovered from House-Brackmann grade V to grade III at last follow-up.

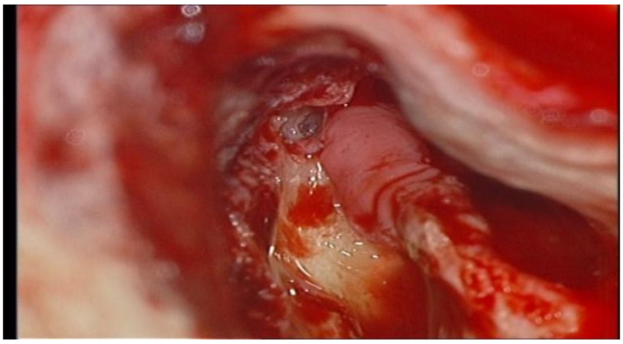

Figure 8: Vein graft used to cover the injured segment of the VII N.

DISCUSSION

Temporal bone fractures occur in approximately 14-22% of all skull injuries. These patients are at high risk of sustaining multiple other injuries to the head and neck.[3] In the adult population, approximately 90% of temporal bone fractures are associated with concurrent intracranial injuries and 9% with cervical spine injuries.[1] Most of these fractures are unilateral, with bilateral fractures reported in 9% to 20%. Children account for 8-22% of patients with temporal bone fractures. The otic capsule is spared in 90% and is involved in 10%. Common sequelae of temporal bone fractures include tympanic membrane perforation, facial nerve palsy, damage to cochleo vestibular apparatus causing sensori-neural hearing loss, conductive hearing loss due to ossicular disruption, tinnitus, vertigo, C.S.F. leak, perilymph fistula, post traumatic endolymphatic hydrops, cholesteatoma, meningocele/encephalocele, meningitis, injuries to lower cranial nerves, vascular injuries i.e. injuries to internal carotid artery and sigmoid sinus. OCS fractures are much more common (>90%) than OCD, and the latter is associated with higher incidence of facial nerve injury (30-50%), SNHL, and CSF leak (2-4 times higher than OCS). In a study performed by Dahiya et al comparing otic capsule–sparing and otic capsule–violating fractures, patients with an otic capsule–violating fracture were approximately twice as likely to develop facial paralysis, four times as likely to develop cerebrospinal leak, seven times as likely to experience profound hearing loss, and more likely to sustain intracranial complications, such as epidural hematoma and subarachnoid hemorrhage, than those with an otic capsule–sparing fracture.[4] While HRCT is the standard for evaluating temporal bone fractures, MRI is useful for revealing temporal lobe injuries.[5]

The facial nerve is affected in up to 7% of patients with temporal bone fracture. Most injuries of the facial nerve occur in the labyrinthine portion, in the region of the geniculate ganglion, and manifest as nerve contusion, edema and hematoma of the neural sheath and partial or complete nerve transection. Immediate-onset post-traumatic paralysis frequently indicates presence of nerve transection or compression by a bone fragment. Onset of facial involvement may be immediate or delayed and partial or complete. If the palsy has a delayed onset, complete recovery occurs in approximately 94%, and if onset is immediate, complete recovery occurs in approximately 50-75% of cases. The injury site is usually the horizontal segment of the nerve distal to the geniculate ganglion in 80-90% followed by labyrinthine and meatal segment. Delay in onset is the most important predictive factor for nerve recovery. Those patients with immediate paralysis of an incomplete nature almost always recover. Incomplete paralysis implies a functional nonsevered facial nerve with good prognosis. Surgical management is dictated if facial nerve function is determined to have a poor prognosis via testing results or if there is CT evidence of severe disruption or displacement of the facial nerve. Careful review of CT scans should be performed to determine if the nerve injury is located proximal or distal to the geniculate ganglion.[6] After deciding on facial nerve exploration, the suspect location of neural injury and hearing status are the two key factors in determining an appropriate approach. Injuries of the facial nerve at or distal to the geniculate ganglion can be approached via the transmastoid procedure. If there is no obvious fracture, a facial recess approach will help provide examination of the nerve from the geniculate ganglion to the second genu. Partial transections of less than 50% may be repaired with onlay nerve grafts. If transection exceeds 50%, an interposition nerve graft, such as the greater auricular nerve, should be used in approximation after the epineurium is trimmed and the nerve fascicles optimized. If the nerve is found to be intact, decompression of the epineural sheath is performed in proximal and distal fashion until normal nerve is encountered. Injuries medial to the geniculate ganglion may be approached in several ways, depending on the status of hearing. For patients in whom hearing is not useful, a transmastoid-translabyrinthine approach is reserved. The entire intratemporal course of the facial nerve can be seen after translabyrinthine skeletonization of the internal auditory canal. For patients with intact hearing, a transmastoid-supralabrinythine approach or a middle cranial fossa approach is considered.

CSF leak occurs in 15-20% of all temporal bone fractures. Fractures involving the otic capsule are associated with higher incidence of CSF leak. Management of cerebrospinal fluid leak begins with conservative measures including bed rest with head elevation, stool softeners, avoidance of nose blowing/sneezing and other forms of straining, and, in selected patients, placement of a lumbar drain. Spontaneous resolution with this conservative management occurs in 95% to 100% of patients. Surgical repair is recommended for those cases that persist 7-10 days after an injury.[7] The method of surgical closure of CSF fistulas after temporal bone fractures depends on the location of the fistula, hearing status of both ears, presence of brain herniation through the tegmen, and patency of the external canal.

More than half of patients with temporal bone trauma report some degree of hearing loss. The hearing loss, is most likely conductive followed by sensori-neural hearing loss and mixed hearing loss. Sensori-neural hearing loss may occur as a result of concussive damage. Ossiculoplasty may be indicated in conductive hearing loss. Hearing aids may be required for conductive or SNHL. Patients with bilateral temporal bone fractures that run through the otic capsule may develop profound hearing loss.[8] For unilateral profound SNHL, bone anchored hearing aid has been demonstrated to have good outcomes. Cochlear implantation has been shown to have benefits in treating patients with bilateral profound SNHL after temporal bone fractures. Hair cell loss, ganglion cell loss, and supporting cell loss may occur. In rare cases, labyrinthitis ossificans occurs secondary to the trauma or subsequent infection. The most frequent site of ossification is the basal turn of the scala tympani.[8] There are several issues to be considered with cochlear implantation after transverse temporal bone fractures. The number of surviving ganglion cells is a very important factor in determining the success of electrical stimulation. The patency of the cochlea after a fracture is another important factor for successful insertion of electrodes. Displaced fracture lines and labyrinthitis ossificans associated with temporal bone fractures may complicate the insertion of the electrode array. Patients with structural abnormalities may have a higher predisposition toward developing meningitis. There is a significant risk of facial nerve stimulation due to current leaks from the electrode through the low resistance of the fracture line. The sooner a cochlear implant is performed after the time of the temporal bone fracture, the less time is available for labyrinthitis ossificans to occur, and therefore the greater probability for successful insertion of electrodes.[9]

Progressive sensori-neural hearing loss has also been reported with and without vertigo. When vertigo is present with fluctuating or progressive loss, traumatic endolymphatic hydrops or perilymphatic fistula is the diagnosis. Vertigo after temporal bone trauma may be secondary to either vestibular concussion in OCS or vestibular destruction in OCD setting. It is usually self-limiting and resolves within 6 to 12 months from central adaptation. Brief vertigo episodes may be attributed to benign positional paroxysmal vertigo.

All temporal bone fractures involving the jugular fossa result in breach of internal jugular vein wall. Traumatic dissecting aneurysm of internal carotid artery can also be seen in patients with otic capsule violating injuries. Associated complications include arterial dissection, pseudoaneurysm, complete transection, occlusion and arteriovenous fistulas**.** Some of the late rare complications after temporal bone injury include meningocele, encephalocele, meningitis, carotid cavernous fistula, sigmoid sinus thrombosis and cholesteatoma. Paralysis of cranial nerve V, VI IX, X and XI may occur.

CONCLUSION

Bilateral temporal bone fractures are very rare in otolaryngology practice. A thorough evaluation, early intervention along with a multi-disciplinary approach can ensure good outcomes.

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