



Hearing Preservation After Penetrating Cochlear Injury



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Abstract

Objectives: To share results and recommendations for the management of a unique case of penetrating traumatic cochlear injury.

Study Design: Case report.

Methods: A single patient underwent early repair of a penetrating cochlear injury and tympanoplasty after a projectile from a nail gun led to a traumatic cochleostomy with a narrow miss of both the facial nerve and intracranial carotid artery.

Results: Postoperatively the patient's audiogram identified a down-sloping hearing loss worse in the high frequencies, a PTA of 47.5dB for air conduction and 35dB for bone conduction with a Word Recognition Score of 76%.

Conclusions: Hearing loss from an acute penetrating cochlear injury can be mitigated with early repair, by minimizing inner ear trauma, and with the judicious use of steroids to treat post-traumatic labyrinthitis.

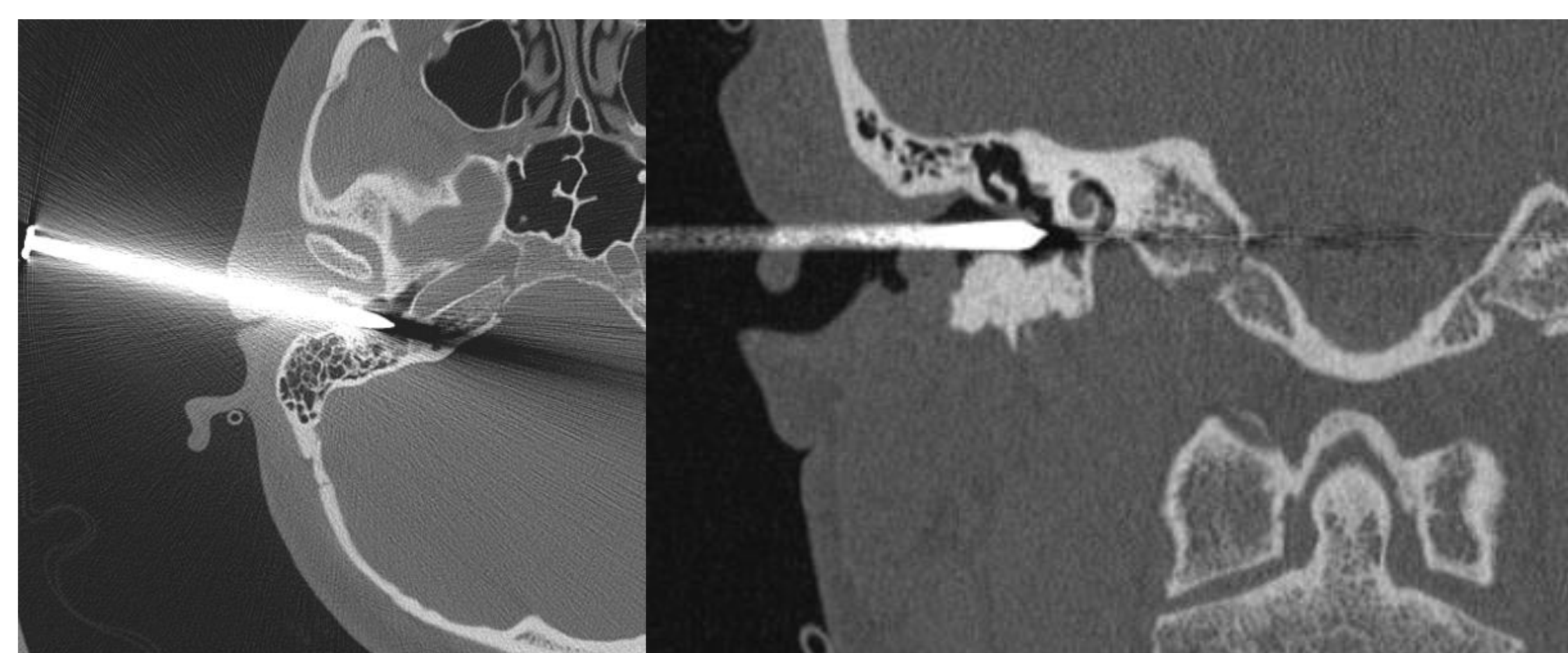
Case Presentation

A 36 year old female was transferred to our medical center for treatment following a penetrating injury to her right ear from a nail gun accident. She was experiencing hearing loss on the affected side but was without vertigo or signs of vascular or cranial nerve injury. The nail entered through the tragus and passed through the cartilaginous external auditory canal (EAC) obstructing the view of the middle ear. Using a 512Hz tuning fork her Weber test lateralized to the unaffected side, and air conduction was louder than bone conduction bilaterally. A high-resolution non-contrasted computed tomography (CT) of the temporal bone demonstrated an 8cm nail extending through the EAC, tympanic membrane, and middle ear with the nail projecting into the basal turn of the cochlea with associated pneumocochlea. The ossicles were not disrupted and the facial nerve and carotid artery avoided (Figure 1).

Picture 1: Appearance at presentation



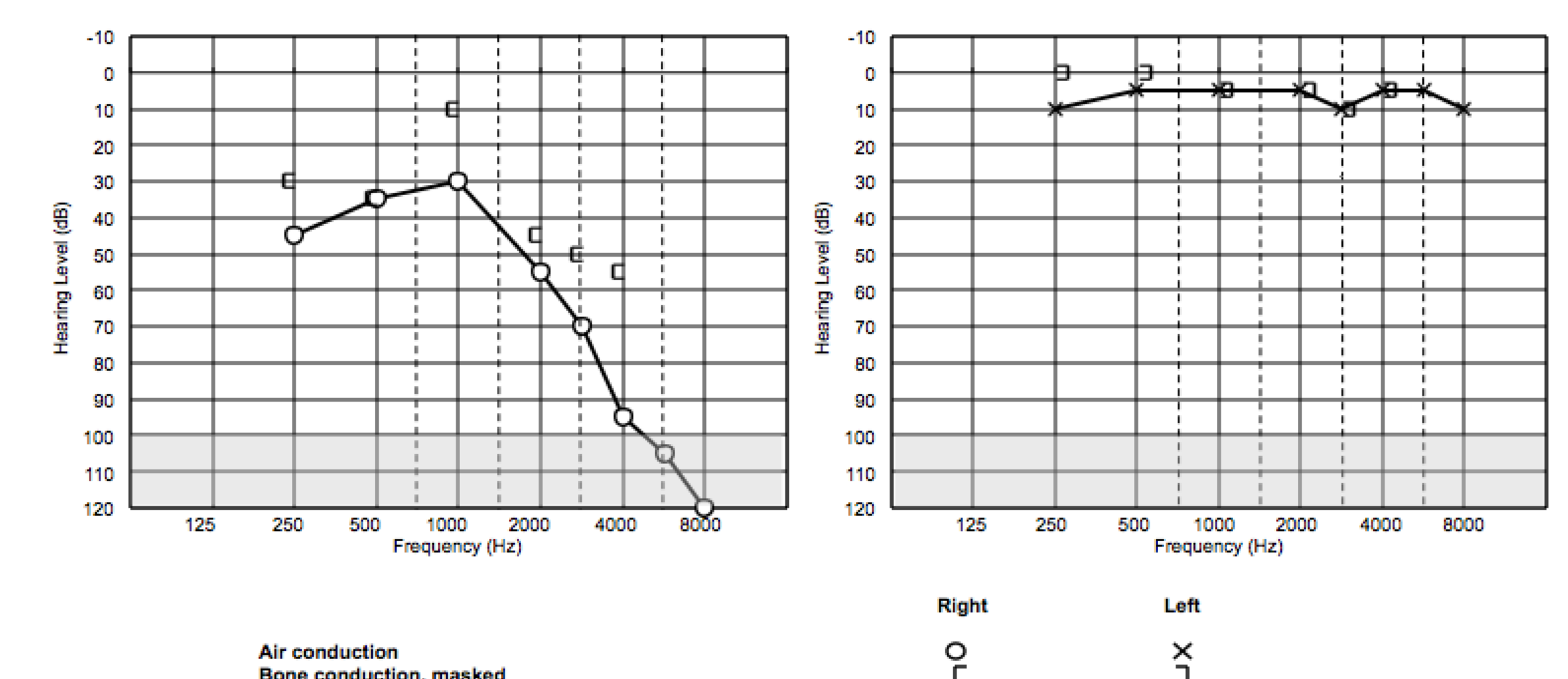
Figure 1: Axial and coronal CT imaging



Management

The patient was urgently taken to the operating room. The nail was removed and an inferior perforation of the tympanic membrane noted. A tympanomeatal flap was elevated and the middle ear explored. The ossicles were intact. The nail had penetrated the cochlear promontory creating a defect of the cochlear endosteum. Using gentle technique and minimizing suction near the cochlear fistula the fascia graft was laid over the defect. A muscle plug was then used to hold this fascia. One of the bone chips from the cochlear promontory was then placed over the repair. The total time from injury to repair of the cochlear fistula was nine hours. She was discharged with high-dose oral steroids (60mg prednisone) for one week followed by a one week taper. At her follow-up visit five weeks following her repair she did not note dull otalgia, decreased hearing, and tinnitus. She demonstrated a well-healed tympanoplasty without middle ear fluid. The audiogram identified a down-sloping hearing loss worse in the high frequencies, a PTA of 47.5dB for air conduction and 35dB for bone conduction with a Word Recognition Score of 76% (Figure 2). This likely correlates to direct injury at the promontory and basal turn of the cochlea, where high frequencies are tonotopically mapped.

Figure 2: Post-operative Audiogram



Introduction

Traumatic, penetrating cochlear injury typically causes devastating hearing outcomes. Pneumocochlea and pneumolabyrinth are radiographic signs of otic capsule violation. A recent literature review reported 51 cases of pneumolabyrinth where the primary etiology was blunt trauma, followed by penetrating trauma, iatrogenic injury, and barotrauma.¹ While 11 of 23 (48%) cases with pneumolabyrinth limited to the vestibular apparatus showed improvement in hearing (at least 10dB gain in an average of 0.5, 1, and 2 kHz), none of 6 cases (0%) with pneumocochlea showed hearing recovery. One case of isolated pneumocochlea from blunt trauma associated with a round window perilymph fistula (PLF) is reported.² This patient had a hearing loss with a pure tone average (PTA) of 27dB. The PLF was repaired three days following the injury and the patient had return of normal hearing with a PTA of 8dB.

We present a case of penetrating cochlear injury with early repair and preservation of serviceable hearing.

Conclusions

In cases of penetrating middle and inner ear injury we recommend early middle ear exploration and repair. Minimizing inner ear trauma is essential when a cochlear fistula is suspected. Gentle debris removal and minimal use of suction avoids further damage to intra-cochlear membranes and inadvertent perilymph evacuation. Finally, post-operative steroids may minimize post-traumatic labyrinthitis that could injure the inner ear.

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