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Case Report
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Post Traumatic Pneumolabyrinth on HRCT Temporal Bone - Where is the Fracture?

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Abstract

Objectives: To report a case of pneumolabyrinth and its imaging features of high resolution computed tomography.

Methods: Case report and literature review.

Results: The report outlines the case of a 7 year old male patient who presented to emergency department in semiconscious state with blood stained discharge from the left ear. High resolution computed tomography revealed left sided pneumolabyrinth involving vestibule and cochlea with capsule violating transverse fracture of left temporal bone. Patient was managed conservatively.

Conclusion: Pneumolabyrinth following temporal bone fracture is an extremely rare condition. Visualization of air in vestibule, cochlea or semi-circular canals should prompt careful evaluation of petrous temporal bone and inner ear structures to look for fractures and associated complications.

Introduction

Pneumolabyrinth is an abnormal condition in which air is present in inner ear structures. The most common etiological factor is trauma. Air in the inner ear is usually associated with transverse fracture of temporal bone involving otic capsule [1]. The fracture line may pass through cochlea, vestibule and/or semicircular canals. The common sites for air entry into labyrinth are oval window and round window. The abnormal pathological communication between inner and middle ear may result in Perilymphatic Fistula (PLF). High Resolution Computed Tomography (HRCT) of temporal bone is diagnostic modality of choice. HRCT can detect the pneumolabyrinth including its type, temporal bone fracture (type and otic involvement) and associated complications like dislocation of ossicular chain, hemotympanum, PLF, intracranial hematoma and facial nerve injury [2]. The common presenting complaints include hearing loss and dizziness. Pneumolabyrinth is commonly managed with conservative treatment. The cochlear and combined vestibulocochlear are associated with poor hearing outcome. We report the case of a 7-old male with a radiologically confirmed combined pneumolabyrinth with otic capsule violating temporal bone fracture secondary to head trauma following an accident. We also present a further review of the literature.

Case Presentation

A 7 year old male was brought to emergency with history of road side accident. Patient was semi conscious and had blood stained discharge from left ear. Non-contrast CT head was done which showed foci of intracranial air (pneumocephalus) in left temporal fossa with no evidence of any intracranial bleed or parenchymal contusion. Left tympanic cavity and mastoid air cells were opacified. A transverse fracture line was seen passing through left petrous temporal bone. Right tympanic cavity was unremarkable. Patient was put on conservative mode. He gained consciousness next day but complained of vertigo, left sided hearing loss and persistent discharge from left ear. Otoscopic examination revealed hemotympanum. Tuning fork examination followed by Brainstem-evoked response audiometry was done, which revealed severe left ear sensorineural hearing loss (Figure 1).

Patient was referred for HRCT of temporal bones. The study revealed soft tissue density contents in left external auditory canal with perforation of tympanic membrane. There was fluid in the left tympanic cavity with foci of air. The ossicular chain and facial nerve canal were intact. Stapes foot plate was also intact. A linear transverse fracture line was seen passing through left temporal bone causing violation of otic capsule at vestibule. Multiple foci of air were seen in vestibule, semi-circular canals and cochlea (Figure 2). Right tympanic cavity was unremarkable. A radiological diagnosis

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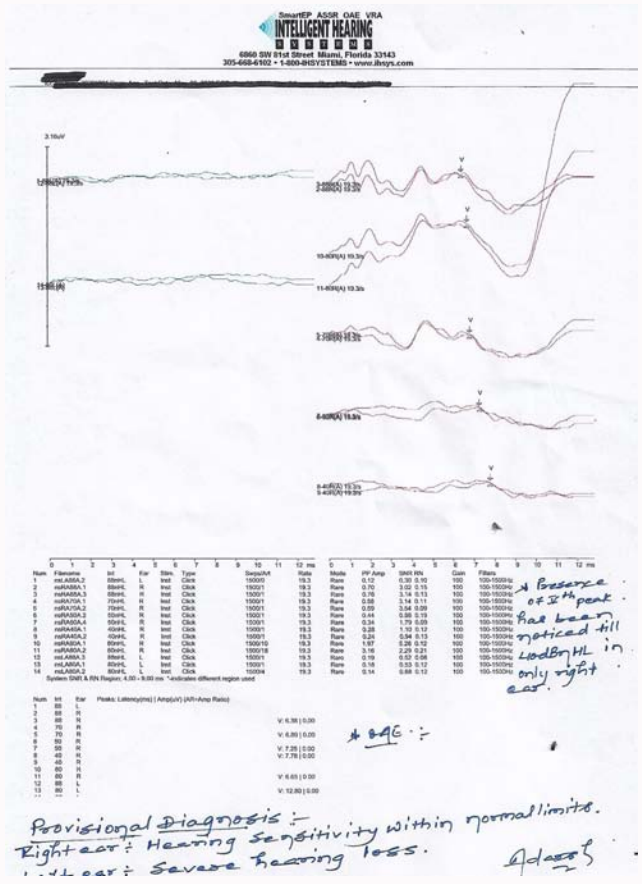

Figure 1: Brainstem-evoked response audiometry image showing severe left sided hearing loss. Right ear is normal.

of left side capsule violating transverse fracture of left temporal bone with pneumolabyrinth was made. The hematological examination was normal except leukocytosis. Patient's ear swab culture showed growth of *Staphylococcus aureus*. Patient was placed on intravenous antibiotics. During the next 2 days of bed rest, the patient continued to do well and was discharged. On 15 days follow up, the patient history revealed mild improvement in the vertigo and no subjective improvement in left sided hearing loss. The audiometry revealed no improvement in hearing function of left ear.

Discussion

The term pneumolabyrinth is used to describe the presence of air within the labyrinth. Pneumolabyrinth can be classified into three types, depending upon the location of air: vestibular pneumolabyrinth, when air is found in vestibule and/or semi-circular canals only; cochlear pneumolabyrinth, when air is located in cochlea only; and combined pneumolabyrinth, when the air is present in both vestibular organs and cochlea. The etiological factors for pneumolabyrinth include trauma (injury and/or barotrauma), surgery (post stapedectomy and post cochlear implantation), iatrogenic (stapes fractures during mastoid surgery), cholesteatoma, neoplasm of temporal bone, infection (labyrinthitis) and idiopathic [3]. Trauma is the most common cause and traumatic pneumolabyrinth are almost always associated with temporal bone fractures. The common sites for air entry into labyrinth are oval window, round window, fistula ante fenestram and Hyrtl's fissure [4].

Traditionally, the temporal bone fractures are divided into

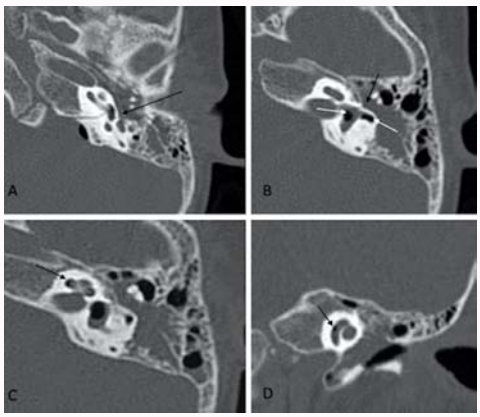

Figure 2: HRCT axial scans of left temporal bone. (A) Axial image showing pneumocephalus and transverse fracture of left temporal bone violating otic capsule (arrow). (B) Axial image showing air with fluid collection in left tympanic cavity and clearly evident otic capsular fracture (black arrow) involving vestibule. Foci of air are seen in vestibule and lateral semicircular canal also (white arrows). (C, D) Axial images showing foci of air in basal turn of cochlea (black arrows).

longitudinal, transverse or mixed types; based on the direction of fracture line being parallel or perpendicular to axis of petrous temporal bone. More recently, Brodie and Thompson [5] classified temporal bone fractures on the basis of involvement or sparing of otic capsule. Otic capsule violating fractures pass through the labyrinth and are more commonly associated with complications such as CSF otorrhea, sensorineural hearing loss, and facial nerve injury. Otic capsule sparing fractures spare the labyrinth and are more commonly associated with conductive hearing loss, hemotympanum and intracranial injuries. It has been seen that pneumolabyrinth is more commonly associated with transverse and capsule violating fractures. Among the three types of pneumolabyrinth, the isolated vestibular is most common, followed by combined type, and isolated cochlear is least common. In a study done by Choi et al. [6] on 175 patients of temporal bone fracture it was reported that pneumolabyrinth occurred in 8.0% of all temporal bone fractures, 4.0% of longitudinal temporal bone fractures, 16.1% of transverse or mixed temporal bone fractures, and 48.4% of otic capsule violating temporal bone fractures. In an another study done by Choi et al. [7] on 402 patients of temporal bone fractures, pneumolabyrinth was observed in 1.5% of temporal bone fractures and 7% of otic capsule violating fractures. The great difference in the incidence of pneumolabyrinth in these studies could be explained by the timing of CT acquisition. Air in the labyrinth disappears across time. For example in a study done by Bajin et al. [8] pneumolabyrinth was found in 100% of patients immediately after stapes surgery, whereas it disappeared in all of these patients 7 days after surgery.

The common presenting complaints include hearing loss and dizziness. Clinical history and physical examination are the most important tools to suspect the diagnosis [9]. Although the diagnostic workup is relatively non-specific, early audiometry and High Resolution CT (HRCT) are indeed mandatory to confirm the diagnosis. HRCT can delineate the temporal bone fractures including its type and presence or absence of otic involvement. Fracture line can be seen passing through inner ear, tympanic cavity, mastoid air cells and/or external auditory canal. Pneumolabyrinth appears as air shadow in the vestibule or cochlea and is regarded as radiologic marker for the presence of otic capsule disrupting fracture [2]. The

detection of cochlear pneumolabyrinth is quite difficult due to its anatomical complexity and if present, air should be differentiated from the normal hypodensity of the cochlea (technique related artifact).

A Perilymphatic Fistula (PLF) is an abnormal communication between the middle ear and inner ear may occur with injury to the otic capsule. The common signs of PLF on CT include presence of fluid in the round window niche (especially if >2/3 of the RW niche), disorientation of the footplate and presence of pneumolabyrinth [10].

These patients are usually managed with conservative treatment including bed rest, head elevation, avoidance of straining and use of a stool softener [11]. An exploratory tympanotomy is required for patients having severe or aggravation of vestibular symptoms, suspected perilymph leak in middle ear and aggravation of hearing loss. The hearing outcome of conservative therapy is variable and depends upon the type and severity of cochlear trauma. While vestibular pneumolabyrinth appear to cause partial or reversible hearing loss, cochlear and combined vestibulocochlear types are associated with progressive or irreversible hearing loss [12].

In conclusion, the pneumolabyrinth is a relatively specific sign of otic capsule violating fracture of temporal bone especially with history of trauma. So, visualization of air in vestibule, cochlea or semi-circular canals should prompt careful evaluation of petrous temporal bone and inner ear structures to look for fractures and associated complications.

References

1. Gross M, Ben-Yaakov A, Goldfarb A, Eliashar R. Pneumolabyrinth: An unusual finding in a temporal bone fracture. Int J Pediatr Otorhinolaryngol. 2003;67(5):553-5.
2. Zayas J, Feliciano Y, Hadley C, Gomez A, Vidal J. Temporal bone trauma and the role of multidetector ct in the emergency department. Radiographics. 2011;31(6):1741-55.
3. Lao W, Niparko J. Assessment of changes in cochlear function with pneumolabyrinth after middle ear trauma. Otol Neurotol. 2007;28(8):1013-7.
4. Woo H, Song S, Kim Y, Bai C. Pneumolabyrinth without temporal bone fracture: different outcomes for hearing recovery. Laryngoscope. 2008;118(8):1464-6.
5. Brodie HA, Thompson TC. Management of complications from 820 temporal bone fractures. Am J Otol 1997;18(2):188-97.
6. Choi H, Lee H, Lee J, Kim D, Hong S, Park B, et al. The rates and clinical characteristics of pneumolabyrinth in temporal bone fracture. Otol Neurotol. 2015;36(6):1048-53.
7. Choi J, Lyu A, Ryu K, Kim D, Park Y. Detection of pneumolabyrinth after temporal bone trauma using computed tomography. Acta Otolaryngol. 2016;136(7):682-6.
8. Bajin MD, Mocan BO, Sarac S, Sennaroğlu L. Early computed tomography findings of the inner ear after stapes surgery and its clinical correlations. Otol Neurotol. 2013;34(4):639-43.
9. Ko I, Lee HJ. Pneumolabyrinth associated with otic capsule-violating fracture: Diagnosis and clinical features. Korean J Otorhinolaryngol-Head Neck Surg. 2008;51(12):1081-7.
10. Venkatasamy A, Al Ohraini Z, Karol A, Karch-Georges A, Riehm S, Rohmer D, et al. CT and MRI for the diagnosis of perilymphatic fistula: A study of 17 surgically confirmed patients. Eur Arch Otorhinolaryngol. 2020;277(4):1045-51.
11. Sarac S, Cengel S, Sennaroglu L. Pneumolabyrinth following traumatic luxation of the stapes into the vestibule. Int J Pediatr Otorhinolaryngol. 2006;70(1):159-61.
12. Hidaka H, Miyazaki M, Kawase T, Kobayashi T. Traumatic pneumolabyrinth: Air location and hearing outcome. Otol Neurotol. 2012;33(2):123-31.