

Traumatic fracture of the stapes and perilymph fistula: Report of a case

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We herein report a case of traumatic fracture of the stapes accompanying vestibular window rupture with perilymph fistula, and its diagnosis and surgical procedure were discussed. In the present case, a direct force through the external auditory canal damaged not only the ossicular chain but also the vestibular window. On the exploratory tympanotomy, the complete dislocation and fracture of the stapes with a relatively huge rupture was confirmed. Perilymph fistula was repaired with a connective tissue graft, which was inserted between disrupted vestibular window and the long process of the incus. Vestibular dysfunctions disappeared within 3 days, and a satisfactory audiologic result was obtained one month after surgery.

Key words: Traumatic fracture, stapes, perilymph fistula

INTRODUCTION

Traumatic injuries of the middle ear structures can be caused by direct force through the external auditory canal. Traumatic perforations of the tympanic membrane are usually treated in a conservative, nonsurgical approach because of the high spontaneous healing rate. However, if a patient had a significant conductive deafness, continuous vertigo and sensorineural hearing loss, or if it was suspected to the ossicular chain disruption or possibility of perilymph fistula, the surgical procedure should be chosen immediately to protect the inner ear against irreversible degeneration of the membranous labyrinth. Inner ear damage is less frequent, but exposes the patient to permanent deafness, even if treated adequately.

CASE REPORT

A 35-year-old male had an accidental penetration of the tympanic membrane of his right ear with a tip of comb (Fig. 1), which is made of a plastic, by his daughter. He had an immediate onset of severe earache, vertigo and vomiting. He was treated in conservative manner at a local emergency hospital for 5 days, and he was referred to our hospital for further treatment.

On admission no perforation of the tympanic membrane was seen through an otoscope after removal of blood clots at the posterior superior quadrant of his right tympanic membrane (Fig. 2). A pure tone audiogram revealed severe, mixed hearing loss with pure tone average 87.5 dB with 47.5 dB air - bone gaps in his right ear (Fig. 3A). Spontaneous nystagmus directed toward the involved ear was recognized.

High resolution computed tomography (HRCT) revealed ossicular dislocation and an air bubble in the vestibule suggestive of perilymph fistula (Fig. 4). Exploratory tympanotomy was performed under local anesthesia 8 days postinjury.

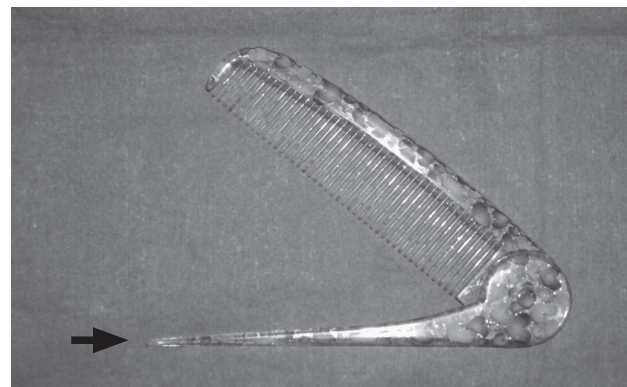


Fig. 1 The comb and its sharpen end.

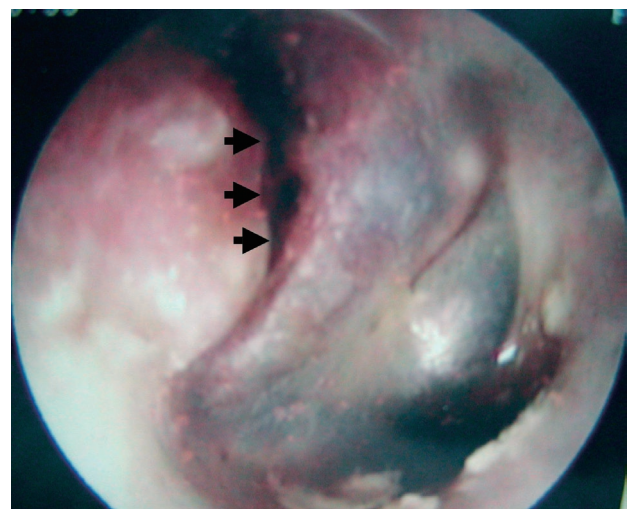


Fig. 2 Otoscopic finding of the tympanic membrane 5 days postinjury.

The black arrows point the perforated area of the tympanic membrane of the right ear.

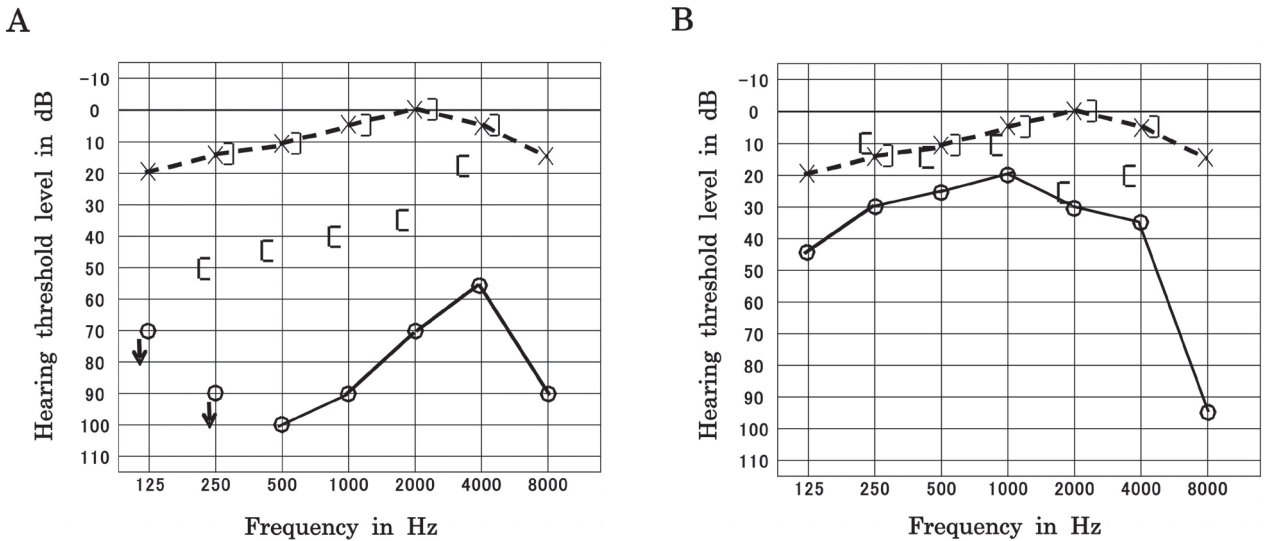


Fig. 3 Pre (A)-and postoperative (B) audiometric evaluation.
 Air Conduction ; ○—○ : Right, ×-----× : Left, Bone Conduction ; [: Right,] : Left.
 Postoperative audiometric evaluation shows a significant improvement of not only air but also bone conduction.

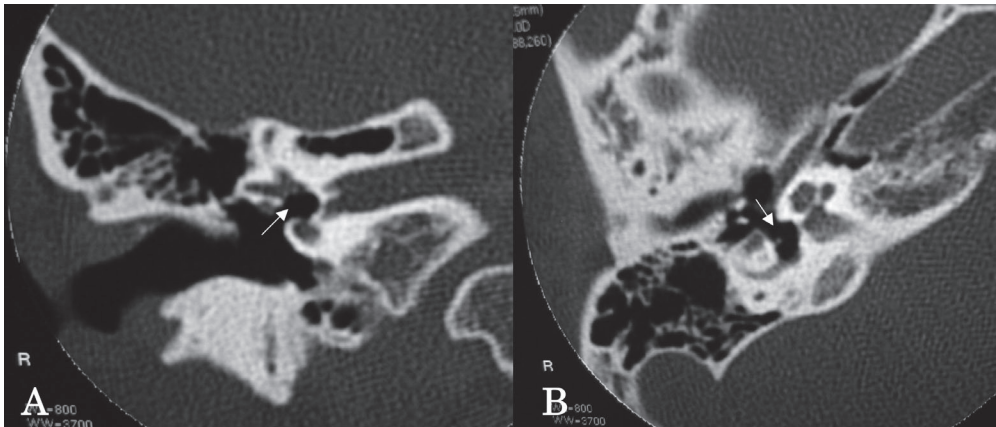


Fig. 4 CT shows air bubble in the vestibule (arrow) and disappearance of the stapes structures.

A postauricular skin incision was made and the middle ear cavity was explored and it was revealed that the incudostapedial joint was disrupted, the long process of the incus was dislocated anteromedially and the stapes crura were fractured and the footplate was depressed into the vestibule. Perilymph leakage due to the fracture of the stapes footplate was found (Fig. 5). The dislodged stapes footplate with the anterior crus was meticulously removed from the vestibule. It was also found that the stapes superstructure with footplate was fractured at 2 places, showing the anterior crus fractured near the stapes head and the posterior crus at the joint of footplate (Fig. 6). After all stapes structures were removed from the vestibular window niche, a piece of connective tissue graft was placed on the vestibular window and fixed with fibrin glue. Further connective tissue was inserted between the vestibular window area and the long process of incus. The postoperative progress was uneventful and the patient's vertigo on head movement was improved postoperatively, and spontaneous nystagmus was disappeared 3 days after the operation.

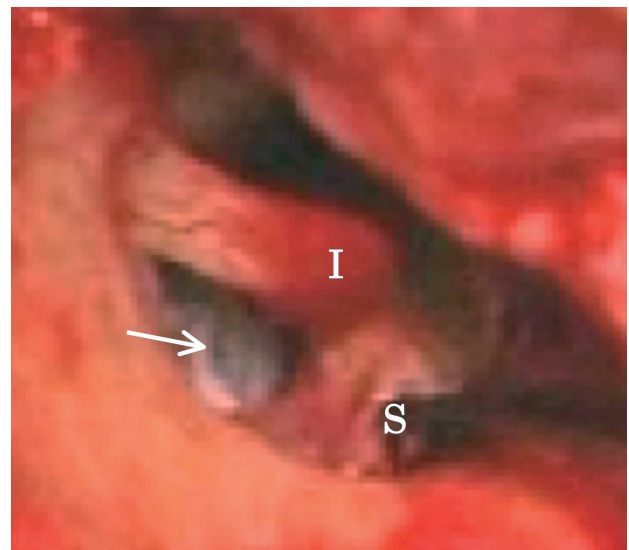


Fig. 5 Photograph of middle ear showing perilymph fistula with rent (arrow) in the vestibular window. S: the head of stapes. I: the dislocated long process of incus.

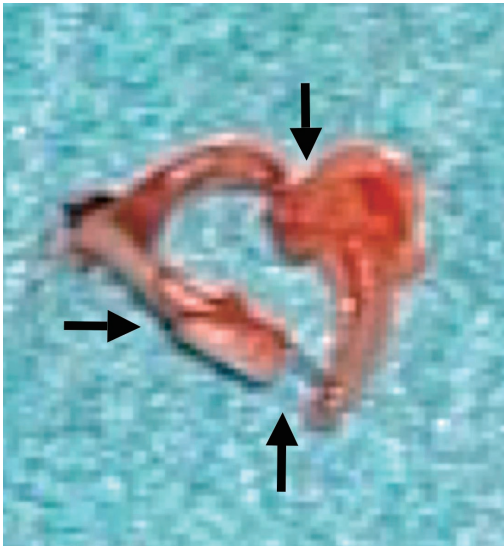


Fig. 6 The removed stapes in two pieces and arrows show the fracture lines.

His right hearing improved to 23.8 dB postoperatively which we never had expected pre- and peroperatively (Fig. 3B).

DISCUSSION

Simple traumatic perforations of the tympanic membrane from direct force through the external auditory canal can be expected to heal spontaneously [1, 2].

In cases of a perforation of the tympanic membrane with suspected ossicular disruption or fracture of the stapes with a leaking of perilymph, immediate surgery should be considered.

Silverstein *et al.* [1] warned that failure to recognize inner ear damage may result in severe permanent sensorineural hearing loss, and they recommended exploration of the middle ear within 24 hours after injury.

Yagi *et al.* [3] reported that the prognosis of the hearing after closure of perilymph fistula was clearly better in the patients who received surgery shortly after the onset of the disease.

Suzuki *et al.* [4] recommended that if there was any possibility of inner ear injury, prompt exploration of the tympanic cavity should be considered to check for the presence of a leaking labyrinthine lesion.

In the present case, in spite of receiving conservative treatments, the patient showed no improvement of significant mixed hearing loss and continuous vestibular symptoms. Therefore exploratory tympanotomy was performed 8 days postinjury. It was confirmed that the fractured stapes depressed into vestibule and the presence of perilymph fistula.

Fracture of the stapes is reported to occur in about one-third of traumatic ossicular lesions [5]. Surgical treatment of the damaged stapes is controversial.

Vanderstock *et al.* [6] emphasized that stapedial removal itself implies the possibility of further injury to the inner ear. They noted that touching the stapes should be avoided as much as possible.

Emmett and Shea [7] recommended repair of the

leaking labyrinthine lesion without removing the damaged stapes. They covered the damaged footplate of the stapes and fissure of membrane with a tissue graft, and reported complete recovery of hearing level.

On the other hand, Arrage and Paparella [8] argued that the injured stapes should be removed promptly from the vestibular window.

Suzuki *et al.* [4] described that careful treatment of the stapes was possible for bone conduction maintaining at the normal healing, although they removed the damaged stapes from the vestibular window.

In the present case, the fractured piece of the stapes footplate with anterior crus was meticulously and carefully removed from the vestibule and perilymph fistula was repaired which resulting in immediate improvement of vestibular symptoms and the preservation of the inner ear function.

Even if irreversible sensorineural hearing loss was strongly suspected, an otologic surgeon should consider the possibility of significant hearing improvement by prompt exploration of the damaged middle ear cavity and a repair of perilymph fistula.

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