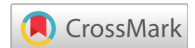
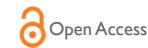


Case report



Sudden sensorineural hearing loss after auto inflation of the middle ear in a patient with a stapes prosthesis

Abstract

An adult male, asymptomatic for years after surgery for otosclerosis, was traveling abroad. He was experiencing upper respiratory infection symptoms along with sensations of bilateral ear pressure and congestion while traveling through elevation changes. An attempt at auto inflation of both ears resulted in a brief episode of pain and an immediate loss of hearing and new tinnitus in his operated ear. He also experienced varying degrees of dizziness for days after. His symptoms had stabilized upon presentation to the Otolaryngology clinic approximately 1 week later. His audiogram confirmed complete deafness in the operated ear. A temporal bone CT scan suggested lateral displacement of the prosthesis. Traumatic perilymphatic fistula caused by this maneuver has not been reported. This is the only published case report of this occurring in an ear with a stapes prosthesis. The mechanics of this type of injury are briefly reviewed. Patients with a stapes prosthesis should be warned to avoid forceful middle ear autoinflation, particularly in cases where there may be Eustachian tube inflammation. This combination may result in the transmittance of higher than tolerable levels of air pressure into the middle ear space.

Keywords: otolaryngology, auto-inflation, stapes prosthesis, sudden sensorineural hearing loss, perilymphatic fistula, temporal bone, eustachian tube inflammation, mechanics, dizziness, vertigo, trauma, audiogram, foot plate, *polymyalgia rheumatica*, prednisone, otosclerosis, ct scan, otic capsule

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Abbreviations: PLF, perilymphatic fistula; SNHL, sensorineural hearing loss

Introduction

Sudden hearing loss has various proposed etiologies and, in a significant percentage of cases, the cause is not definitively known.¹ Among the potential mechanisms is the phenomenon of a perilymphatic fistula (PLF). A PLF occurs when there is a membrane compromise at either the oval or round window. Leakage of perilymph results in immediate sensorineural hearing loss and vertigo. Prompt surgical intervention may mitigate the degree of hearing loss and resolve the vertigo.² In the surgical treatment for otosclerosis, the fixated stapes, with or without the footplate, is either completely removed or removed with a fenestration of the foot plate. The fenestration is immediately closed with a piston prosthesis and, typically, other material to form a seal around the piston. The case report presented here provides an example of a mechanism through which this otherwise stable prosthesis/oval window interface can be traumatized and result in permanent sensorineural hearing loss.

Case report

An otherwise healthy 79year old male was traveling on vacation overseas. He was noting some mild upper respiratory illness symptoms during this time. While traveling via train through some elevation changes, he noted that his ears felt plugged and his hearing decreased in both ears. A traveling companion suggested he 'pop' his ears and demonstrated for him a modified Valsalva maneuver (auto-inflating the ears). Immediately after attempting this, he noted a sudden pain in the right ear accompanied by an immediate worsening of his hearing in that ear along with loud tinnitus. It did not occur to him that anything serious or permanent happened and did not

seek immediate help. Over the next several days he did experience prolonged dizzy spells. Upon returning home, he finally presented to the Otolaryngology clinic with persistent loss of right-sided hearing, but now steadily improving dizziness symptoms. His medical history was significant for the stapes surgery, low ejection fraction and *Polymyalgia Rheumatica*. It was not known exactly what type of stapes operation he had, or the specific prosthesis used. Examination of his ears showed normal tympanic membranes. His gait and station were normal and there was no gaze nystagmus. An audiogram was obtained (Figure 1). This showed no response in the right ear and a moderate to severe sensorineural hearing loss (SNHL) in the left ear. There was no pre-morbid audiogram available for comparison.

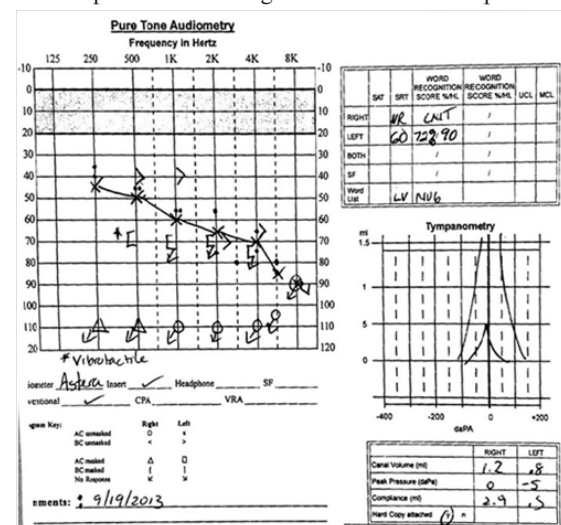


Figure 1 Audiogram and Tympanogram, 1 week post-onset.



He was advised of the potential etiologies for sudden SNHL. Although the favored mechanism of loss was the result of a forceful and sudden lateralization of the stapes prosthesis, resulting in a PLF, surgical intervention was not encouraged given the duration of the deafness and the spontaneous resolution of the dizziness. Other etiologies were also considered. Therefore he did begin a course of high dose oral prednisone. A high resolution Temporal bone CT scan was obtained. Representative images are shown Figures 2 & 3. While not definitive, these did appear to show lateral displacement of the stapes piston. He returned to the office 1week later with no improvement in his hearing. The steroids were discontinued. His dizziness continued to resolve.

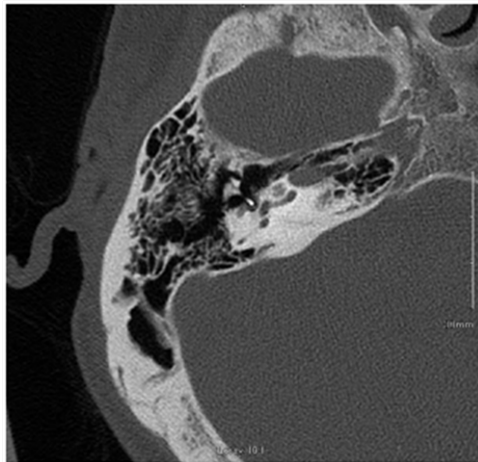


Figure 2 Axial Temporal bone CT. This image depicts the medial-most position of the prosthesis in the axial plane.

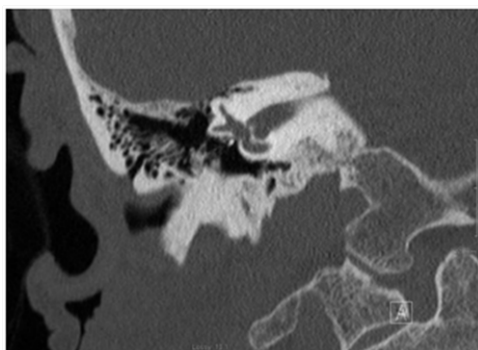


Figure 3 Coronal Temporal bone CT. This image depicts the medial-most position of the prosthesis in the coronal plane.

Discussion

A PLF can occur either spontaneously or as a result of trauma. Trauma to the otic capsule or compromise at either the oval or round windows can be potential avenues for this typically devastating event. Rapid surgical intervention may minimize the degree of hearing loss and vertigo suffered. Often the time to intervention is suboptimal given the typically delayed presentation to an Otolaryngologist.³ Politzer and Valsalva described techniques by which the middle ear can be inflated via the Eustachian tube.^{4,5} These maneuvers involve an individual forcing air into the middle ear by exhaling against a closed mouth and nose. It is a technique that many use to accommodate atmospheric barometric pressure changes. While pain with this has been reported, serious adverse events have not.⁶

The stapes footplate attaches to the otic capsule via the stapedial annular ligament, allowing motion within a limited range.^{7,8} These qualities are only partially maintained with placement of a stapes prosthesis (ie, the annular ligament function is not restored). Thus the lateralizing force that the natural ossicular chain can resist before failure is likely greater than that that could be resisted by a chain with a stapes prosthesis.⁹ Moreover, under circumstances where Eustachian tube inflammation is present, the amount of force required to inflate the middle ear space (via auto inflation) is greater than would otherwise be required.¹⁰ This entry of an especially increased amount of air pressure into the middle ear space may lateralize the TM enough to fully displace the stapes prosthesis from the footplate fenestration. The result may be a PLF with its often devastating consequences. Caution should be advised to patients with a stapes prosthesis against forceful autoinflation, particularly in cases where Eustachian tube dysfunction is suspected.

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Conflicts of interest

Author declares there are no conflicts of interest.

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