

CLINICAL CONSULTATION

Symptom: Conductive Hearing Loss

By Hamid R. Djalilian, MD

The patient is a 20-year-old with a history of otitis media, resulting in left conductive hearing loss. The patient underwent multiple tympanomastoidectomies when he was between 5 and 12 years old. He also experiences ear popping and worsened hearing when there is an increase in elevation. Likewise, Valsalva maneuver worsens his hearing. The patient is interested in improving his hearing through surgery. Upon examination, the tympanic membrane is thickened with poor landmarks. No prosthesis or distinguishable ossicle can be visualized. Weber examination goes to the left and bone conduction is louder than air conduction on the left side. The right side has a normal examination. The patient's audiogram can be seen on the right.

What is your diagnosis? See page 38.

Dr. Djalilian is director of neurotology and skull base surgery and professor of otolaryngology and biomedical engineering at the University of California, Irvine.

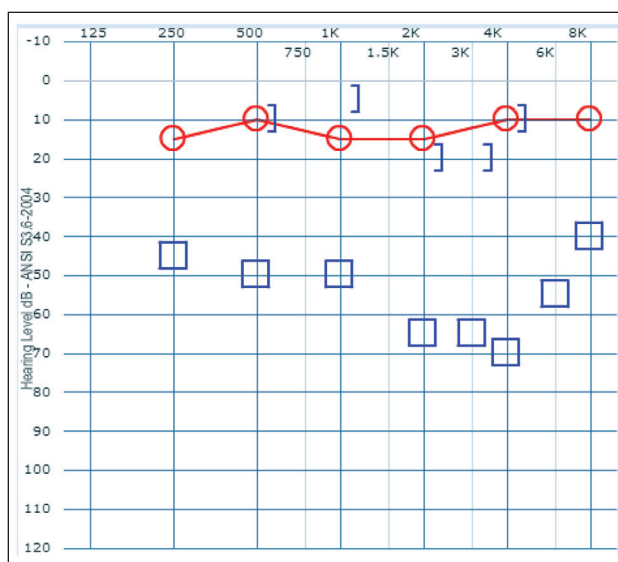


Figure 1. Image of the patient's audiogram.

iPad Exclusive!

BONUS VIDEOS: VISUAL DIAGNOSIS

Read this month's Clinical Consultation case, then watch the accompanying videos from Hamid R. Djalilian, MD, to review the patient's imaging for yourself.

- ▶ Video 1 shows Axial CT images of the left temporal bone showing the prosthesis and the middle ear and mastoid.
- ▶ Video 2 shows Coronal CT images of the left temporal bone showing the separation of the prosthesis
- ▶ Video 3 shows Sagittal CT images of the left temporal bone demonstrating the free head of the prosthesis and a small tegmen tympani destruction.
- ▶ Video 4 shows Axial CT images of the right temporal bone showing the mastoid which is contracted indicating poor eustachian tube function bilaterally since childhood.
- ▶ Video 5 shows Coronal CT images of the right temporal bone showing the good middle ear aeration indicating good function of the eustachian tube currently.
- ▶ Video 6 shows Sagittal CT images of the right temporal bone demonstrating the normal ossicular chain on sagittal imaging.

These exclusive features are only available in the July iPad issue.



Download the free *The Hearing Journal* app today at bit.ly/AppHearingJ.

Diagnosis: Total Ossicular Reconstruction Prosthesis

By Hamid R. Djalilian, MD

Continued from p. 37

The patient is presenting with a conductive hearing loss and a non-diagnostic examination. If the patient desires improvement of the hearing through surgery, consideration should be given to obtaining a CT scan to evaluate the middle ear. Conductive hearing loss in the setting of multiple surgeries in the past has a relatively short differential diagnosis. A congenital conductive hearing loss from ossicular malformation is possible but unlikely (Maducdoc. *Int J Pediatr Otorhinolaryngol* 2015;79[12]: 2277). The first thing that has to be determined is whether the normal ossicular chain is intact or not.

If the ossicular chain is intact, then the most likely cause of the conductive hearing loss is fixation of the ossicles. Most commonly, the fixation will occur around the malleus which would include anterior ligament calcification, malleus head fixation to the attic wall, and uncommonly posterior ligament calcification. Sometimes, stapes fixation due to tympanosclerosis, or incus fixation on the mastoid antrum can occur. Depending on the cause, treatment would be rendered. Traditionally, malleus or incus fixation has been treated using a prosthesis and the removal of the fixed ossicle. In our patients, we have found that fixation of the malleus or incus can be released with laser and microdrills (0.5 or 1 mm diamond burs). However, release of the fix areas is not enough as fixation will recur in a majority of cases. In order to prevent re-fixation very thin silicone sheeting (0.005 inch thick) can be placed around the fixed ossicle to prevent re-fixation of that ossicle. This will allow the natural ossicular chain to remain intact and more likely to completely close the air-bone gap. Patients with stapes fixation in the absence of middle ear inflammation or eustachian tube dysfunction can be treated with a stapedotomy operation.

A decrease in atmospheric pressure displaces the tympanic membrane laterally. In patients with eustachian tube dysfunction, this causes a larger airspace in the middle ear and a more neutral position of the tympanic membrane.

In this patient, however, fixation of the ossicles is unlikely to be the cause of the hearing loss. The reason is that the hearing changes, especially with reduced atmospheric air pressure or Valsalva. If ossicles were to be fixed, there would

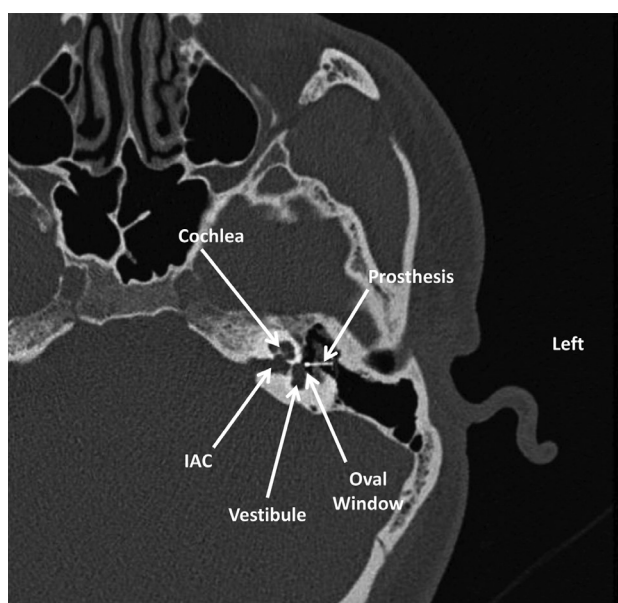


Figure 2. Axial CT image of the left temporal bones demonstrating the prosthesis that appears to span the tympanic membrane to the oval window.

be no significant noticeable change in the hearing level with atmospheric pressure changes.

Eustachian tube dysfunction can potentially account for a change in hearing with atmospheric pressure change. However, patients with eustachian tube dysfunction generally have an improvement of their hearing with reduced atmospheric pressure. A decrease in atmospheric pressure displaces the tympanic membrane laterally. In patients with eustachian tube dysfunction, this causes a larger airspace in the middle ear and a more neutral position of the tympanic membrane. This leads to a more efficient movement of the tympanic membrane. The same phenomenon occurs with a Valsalva maneuver when the middle ear is pressurized. This patient, however, had a decrease in hearing with Valsalva or decreased atmospheric pressure in elevations.

If an ossicular reconstruction has been performed in the past using a prosthesis then fixation or displacement of the prosthesis can occur. Fixation or displacement can occur at either the end of the prosthesis abutting the tympanic membrane or malleus, or the other end where it would be attached to the stapes (partial ossicular replacement prosthesis [PORP]) or the oval window (total ossicular replacement prosthesis [TORP]). Most of the time, a CT scan can help differentiate fixation from

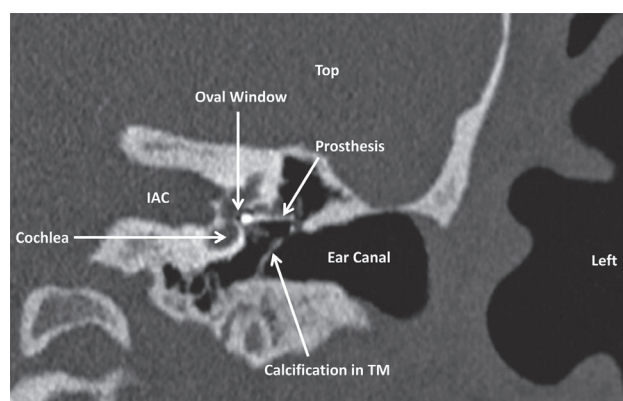


Figure 3. Coronal CT image of the temporal bone showing the separation between the prosthesis and the oval window. Some calcification (white) in the tympanic membrane (TM) seen due to tympanosclerosis.

displacement. Since the old CT scan involves some radiation, its use is reserved for patients who intend to have surgery. A CT scan without a plan for surgery on the patient's part would only expose the patient to an unnecessary amount of radiation. Some surgeons would perform the surgery without a pre-operative CT scan. However, better counseling and odds of success can be communicated to the patient once imaging is obtained. For example, if the patient requires only a partial ossicular prosthesis, the likelihood of profound hearing loss from the surgery is infinitesimally small and near zero. However, if the stapes prosthesis has to be replaced, a small (approximately 1 in 3000) chance of total deafness exists.

This patient is suffering from a total ossicular reconstruction prosthesis that has become displaced from the oval window. The CT scan shows that the prosthesis is slightly elevated off of the oval window (Figures 2 and 3). When atmospheric pressure is reduced or the patient performs a Valsalva maneuver, the prosthesis separates further from the oval window and worsens conductive hearing loss. The

cause of the new onset conductive hearing loss at the age of 20 is most likely related to the improved eustachian tube function as the patient matured. When the patient was younger, perhaps the eustachian tube did not function as well and the tympanic membrane was positioned medially because of decreased middle ear pressure. However, as the eustachian tube function improved, the tympanic membrane developed a more neutral position and displaced the prosthesis more laterally, causing a greater degree of conductive hearing loss. Sagittal image of prosthesis shows that the head of the prosthesis, which in this case appears like a steering wheel, is not attached to the tympanic ring and likely not fixed (Figure 4). The only abnormality appears to be its displacement from the oval window. The head of the prosthesis is displaced somewhat superiorly as can be seen in Figure 3. The treatment of this condition includes either replacement of the prosthesis with a slightly longer prosthesis, repositioning, the use of a footplate stabilizing prosthesis, which would effectively increase the length of the prosthesis, or the use of cartilage between the prosthesis head and the tympanic membrane. [HJ](#)

Read past Clinical Consultation columns in a special collection on the *HJ* website: bit.ly/HJClinicalConsultation.

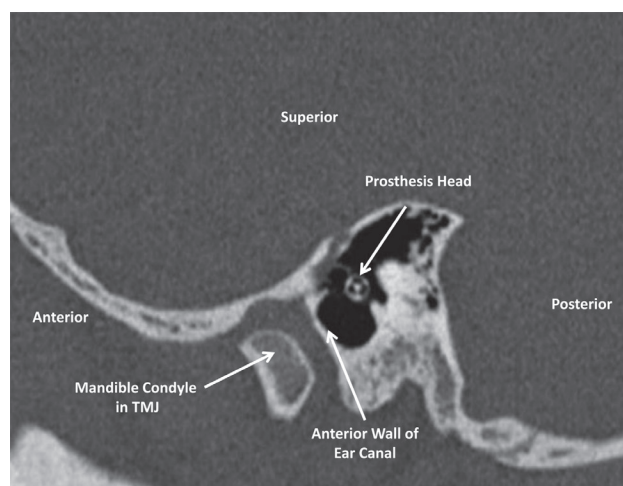


Figure 4. Sagittal CT image (similar to looking into the ear canal) showing the head of the prosthesis is not fixed to the tympanic ring.