



CLINICAL CONSULTATION

Symptom: Pulsatile Tinnitus

By Hamid R. Djalilian, MD

A 50-year-old patient has experienced pulsatile tinnitus in his left ear for six months. He recently saw a few physicians for pressure sensation in the ear and mild hearing loss. Otherwise, the patient is healthy and takes no medications.

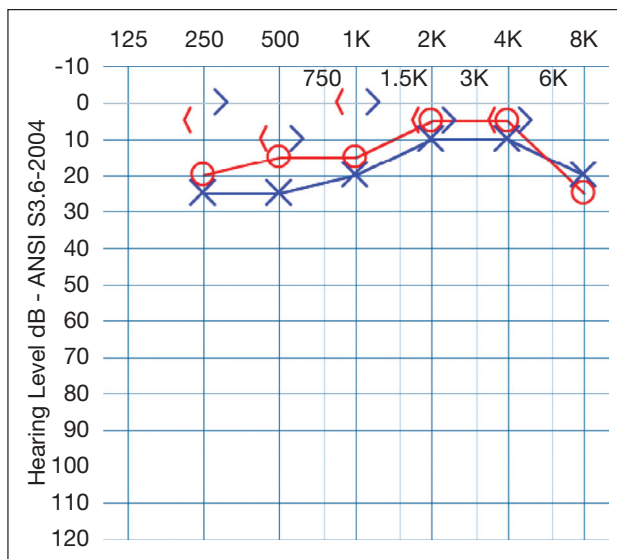
His medical history is significant for chronic ear infections and multiple ear-tube placements as a child.

The patient's examination is difficult because of his very narrow ear canal with multiple hairs. The tympanic membrane shows a small retraction in the attic area and overlying cerumen-like material. The patient denies having any active drainage or dizziness.

The patient's audiogram is on the right.

What is your diagnosis? See p. 26.

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



This is the audiogram for a patient with pulsatile tinnitus and mild hearing loss.

Diagnosis: Cholesteatoma Eroding the Tegmen and Horizontal Canal

By Hamid R. Djalilian, MD

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The complaint of pulsatile tinnitus generally requires some investigating on the part of the clinician. There is no universally accepted method of working up these patients.

Some authors have recommended the performance of a temporal bone CT, as well as CT angiography of the head. Some clinicians perform an MRI of the temporal bone and internal auditory canal. The workup also may include magnetic resonance (MR) angiography or MR venography.

Pulsatile tinnitus has a long differential diagnosis that includes tumors of the temporal bone or skull base. The sudden unilateral development of pulsatile tinnitus warrants a complete head and neck exam and audiogram.

Particular attention should be paid to the microscopic ear exam, with all debris first removed from the tympanic membrane. Debris on the tympanic membrane can hide underlying pathology, such as a cholesteatoma.

In the presence of a very hairy ear canal, it is difficult to visualize the tympanic membrane using a larger (e.g., 5-mm) speculum. The hairs will get caught in the speculum and interfere with visualization. For better visualization in these cases, a smaller 2.5-mm or 3-mm speculum should be used to pass through the hairs and reach the bony canal, even when the canal is large.

Auscultation of the neck and mastoid is a useful adjunct to a thorough ear exam. While they are very rare, significant carotid stenosis or arteriovenous malformations can be heard when the clinician uses a stethoscope to listen to the neck or mastoid.

An evaluation of thyroid function and hemoglobin level, as well as a pregnancy test, may be necessary in certain cases.

A frustrating part of working up patients with pulsatile tinnitus is that no particular cause is found in a vast majority of patients. For some of these patients, intracranial hypertension or migraine is the source of the problem.

CLUES FROM IMAGING

In patients who have constant pulsatile tinnitus of unknown origin, an evaluation with imaging is oftentimes performed to rule out major pathologies around or of the temporal bone.

Typically, a patient can describe for the clinician how the sound is extinguished by gentle pressing or turning of the neck, which generally indicates that the sound is venous in origin. In these types of cases, magnetic resonance arteriography or formal angiography are most likely unnecessary.

If blood vessel imaging is to be obtained in such a patient, magnetic resonance venography is the best choice. Formal

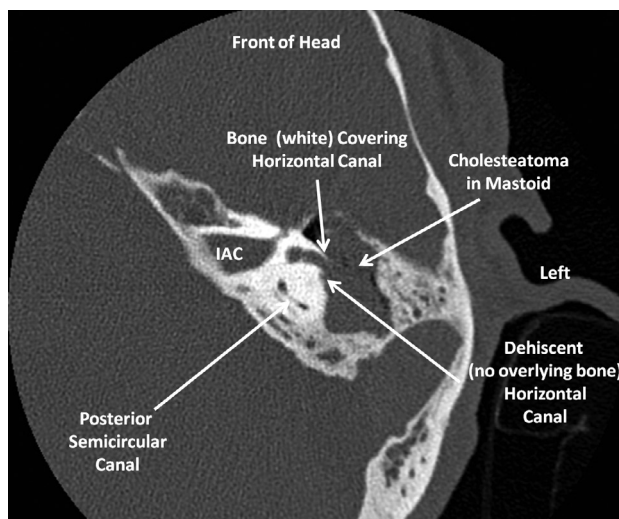


Figure 1. The axial CT scan of our patient shows a large defect in the mastoid, which is likely filled with soft tissue. “IAC” stands for internal auditory canal.

angiography is primarily indicated to rule out a dural arteriovenous fistula.

Our patient had a CT scan of the temporal bones, which is shown in figures 1 and 2. The scan shows a large soft tissue mass that has partially destroyed the mastoid bone and is abutting the dura.

There is a large defect of the tegmen—the bone separating the mastoid from the brain—and significant destruction of the bone overlying the horizontal semicircular canal, which has caused dehiscence of the membranous canal in the mastoid. The mass is likely transmitting pulsations from the brain to the horizontal canal, creating the sensation of pulsatile tinnitus.

MRI also was obtained on this patient, showing a mass that is most consistent with a cholesteatoma (see figure 3).

The primary clue to the presence of the cholesteatoma on examination was the keratin (dead skin) that looked like cerumen in the attic region emanating from the retraction pocket. The patient’s long history of Eustachian tube dysfunction since childhood put him at risk for developing a cholesteatoma.

The treatment of a cholesteatoma in the presence of a dehiscent dura and a horizontal canal fistula is complex. When only a horizontal canal fistula is present, the surgeon has the option of leaving some of the cholesteatoma matrix on the membranous labyrinth. This approach allows the cholesteatoma to be exteriorized, and the surgeon does not have to separate the cholesteatoma from the membranous labyrinth, which may cause permanent sensorineural hearing loss or complete deafness.

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FOUR BONUS VIDEOS: SEE THE SYMPTOMS

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

In the first video, see the axial CT images that demonstrate a soft tissue mass eroding the mastoid and horizontal canal.

The second video details the coronal CT, which shows the extent of the defect of the middle cranial fossa floor.

In the third video, the coronal T1-weighted MRI of the temporal bone reveals the presence of the mastoid soft tissue mass against the dura without intracranial protrusion or epidural abscess.

The fourth video depicts the axial T2 MRI of the mass and its relationship with the middle ear.

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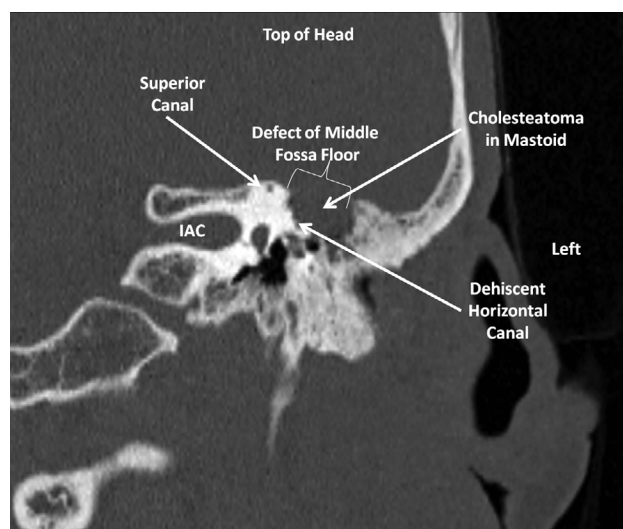


Figure 2. The coronal CT scan of our patient demonstrates a defect of the floor of the middle cranial fossa. The horizontal semicircular canal is also dehiscent. “IAC” stands for internal auditory canal.

When a large dural defect is present, though, the mastoid cavity cannot be left open; over time, brain herniation will likely occur without support of the dura by the mastoid bone. In this case, a middle cranial fossa procedure has to be performed first to reconstruct the defect of the mastoid roof, with a second procedure leaving the cholesteatoma matrix on the horizontal canal open to a canal wall down mastoid.

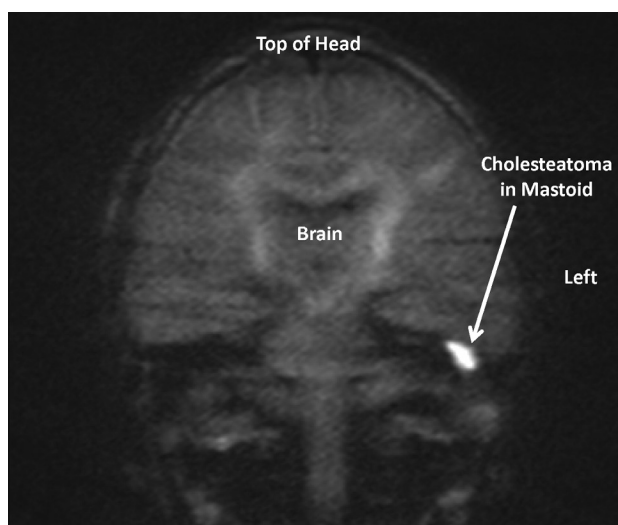


Figure 3. Coronal diffusion-weighted imaging of our patient at the level of the mastoid demonstrates a bright white mass indicative of cholesteatoma that fills the mastoid.

The alternative approach is to try to remove the entire cholesteatoma and obliterate the mastoid fully. If this choice is made, long-term follow-up with imaging is necessary to ensure that the cholesteatoma does not re-form from a small residual focus. Also, very gentle dissection needs to be performed around the horizontal canal so as not to disrupt the membranous labyrinth, with immediate reconstruction to prevent complete sensorineural hearing loss from the surgery. 