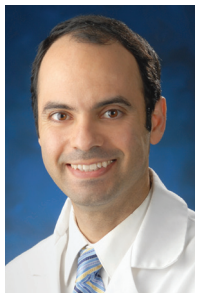


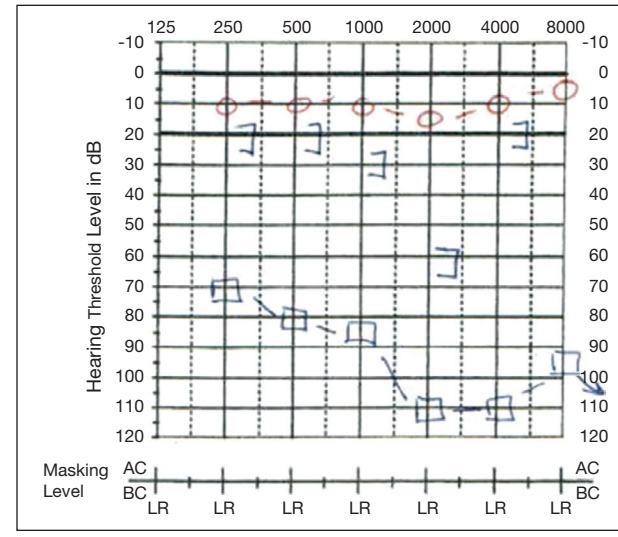
Symptom: Asymmetric Hearing Loss

By Hamid R. Djalilian, MD

A 23-year-old man comes in for a hearing evaluation. He states that he plans to enlist with the Coast Guard and wants to check his hearing before he goes in for his physical. He feels that the hearing in his left ear may be slightly worse than that in the right ear. He denies any recent history of ear infection. He had ear surgery for a tympanic membrane perforation when he was a child. He had always passed school hearing tests before. He states that he does not have the same level of agility that he had when he was participating in high school sports. He otherwise denies frank vertigo. An audiogram is obtained from the patient and is seen to the right.

What is your diagnosis? See p. 14.

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



The patient's audiogram

Diagnosis: Petrous Apex Cholesterol Granuloma

By Hamid R. Djalilian, MD

Continued from p. 12

An asymmetric hearing loss that occurs gradually can sometimes go unnoticed by patients for some time. Occasionally, patients come in denying any hearing loss when a significant asymmetric hearing loss exists. Patients sometimes think that a large hearing loss can be due to an error in testing and feel that they may have not responded correctly on one of the frequencies tested, which leads to the exaggerated loss. This usually just requires reassurance of the patients that the test is confirmed multiple times at each threshold.

The role of the ABR evaluation in the workup of these patients is the subject of much controversy. The ABR is sensitive for medium-sized or large tumors, but it is not very sensitive in the presence of small tumors involving the internal auditory canal. Therefore, young patients obtain MRIs more often for asymmetric hearing loss, whereas patients over the age of 75 are more likely to get serial audiograms or ABRs for slight asymmetry.

This patient had an MRI, which showed a large lesion in the petrous apex. The petrous apex is the medial most portion of the temporal bone and is uncommonly associated with pathologies. Anatomically, the petrous apex is divided into anterior and posterior aspects by the internal auditory canal. It is an area that is very difficult to access surgically because of the presence of the cochlea, carotid artery, jugular vein, labyrinth, brain, and the facial nerve, which all impede access to the petrous apex.

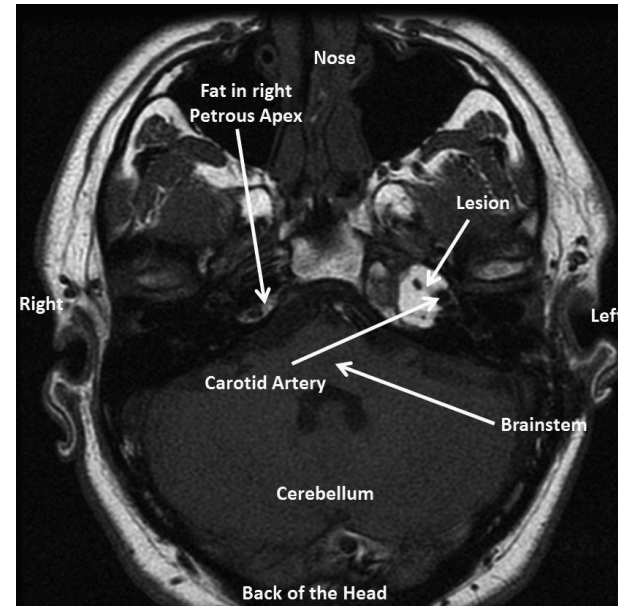


Figure 1. Axial (horizontal) T1 MRI of the brain, demonstrating a large mass in the left petrous apex that is brighter than the surrounding brain. The mass engulfs the anterior half of the carotid artery.

CHARACTERIZING PATHOLOGIES

The most common pathologies involving the petrous apex include a wide differential diagnosis, as depicted in the table. Although the list looks long and daunting, these lesions can generally be distinguished based on their imaging characteristics. The most common cystic lesion in the petrous apex is a cholesterol granuloma, distinguished by its hyperintensity (brightness) on T1- and T2-weighted MRI sequences. A cholesteatoma, on the other hand, is distinguished by its hyperintensity (brighter than the brain) on T2-weighted MRI and isointensity (same shade of grey as brain) on T1-weighted MRI. Cholesteatomas will characteristically appear bright on the diffusion-weighted imaging (DWI) sequence of the MRI. Sometimes, a CT of temporal bones must be obtained to distinguish these lesions, as occasionally one petrous apex may be aerated (have air cells within it) while the other side does not have air cells and contains bone marrow, as solid bone does everywhere. The fat in the bone marrow will look bright on T1-weighted sequence while the air in the opposite side looks dark, which creates the appearance of a lesion. Sometimes, a fat-suppressed sequence may have been obtained, which will make the fat look darker and answer the question of whether the possible lesion may just be bone marrow. At other times, a CT of temporal bones is obtained to fully assess aeration. Generally, air and dense bone (not bone marrow) will look dark on MRI, as the density of the hydrogen atoms is low.

Table. Common Pathologies Involving the Petrous Apex

Asymmetrical marrow	Benign tumors	Plasmacytoma
Petrous apex encephalocoele	Meningioma	Metastatic lesion
Petrous apicitis	Schwannoma	Langerhans cell histiocytosis
Congenital cholesteatoma	Malignancies	Aneurysm of the internal carotid artery
Cholesterol granuloma	Skull base chondrosarcoma	
Mucocoele of petrous apex	Skull base chordroma	

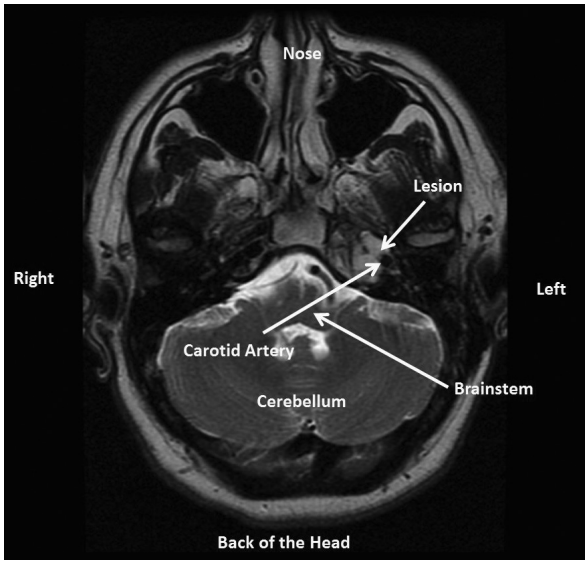


Figure 2. Axial T2-weighted MRI image showing that it is also bright on T2.

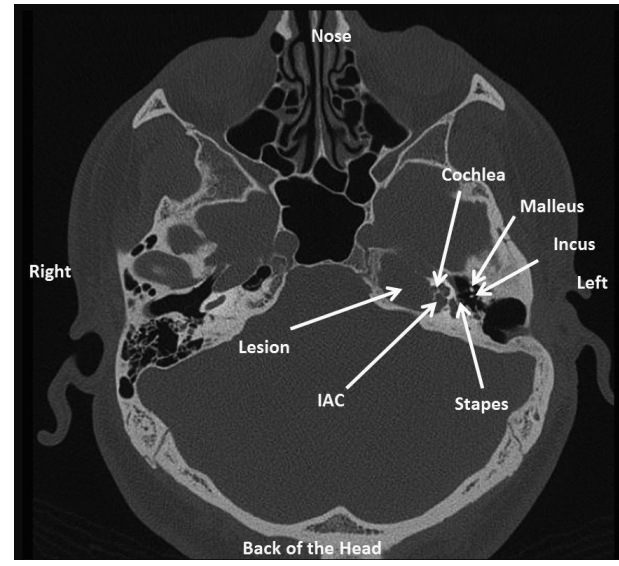


Figure 3. Axial CT image of the patient showing the petrous apex mass with large dehiscence (exposed) cochlea and IAC.

This patient's lesion was bright on T1- and T2-weighted sequences, indicating that it is a cholesterol granuloma of the petrous apex (Figures 1 and 2). Cholesterol granulomas are cysts that occur in the temporal bone and are thought to be the result of bleeding within a mucosa-lined cavity. It is believed to be due to either expansion of air-filled spaces invading adjacent marrow-filled bone, which leads to bleeding, or a negative pressure within the air space, thereby causing mucosal bleeding. Although these lesions may sometimes be contained within single air cells and may not grow, occasionally they can grow and be very destructive to the surrounding areas.

TREATMENT MEASURES

The treatment of cholesterol granulomas depends on their location and extent. Sometimes, small lesions are observed with serial imaging. Middle ear or mastoid lesions can be treated with tube placement or mastoidectomy, respectively. Petrous apex cholesterol granulomas that are expansile and destructive require drainage but not a full resection. Various approaches to these can be taken, depending on the location of the lesion and the patient's anatomy (*Otolaryngol Head Neck Surg* 2009; 140[6]:880-883). The most common approach to an anterior petrous apex lesion such as this patient's is an infracochlear approach. This approach requires drilling under the cochlea between the carotid artery and the jugular vein. Although this approach sounds scary, in experienced hands it can be handled without issues. The superior limit of dissection is the round window; the anterior limit is the carotid artery, which is not uncovered; and the posterior limit is the jugular vein, also not uncovered. This allows the surgeon to reach the inferior aspect of the lesion and allow drainage of the lesion into the middle ear. A stent is generally placed to keep the flow of the contents of the cyst from draining out into the middle ear. Occasionally, the thick contents of the cyst can accumulate in the middle ear and require placement of a tube in the tympanic membrane for drainage to the outside if the Eustachian tube does not clear the mucus.

The cause of the patient's conductive hearing loss is likely the presence of a large dehiscence of the cochlea, as seen in Figure 4. The middle ear structures are normal on imaging. The conductive component of the loss is likely due to an inner ear conductive loss caused by a third window effect, as seen in superior canal dehiscence. The patient's slight dizziness was likely due to pressure on the IAC, as the lesion was in contact with the dura of the IAC.

This patient underwent an infracochlear approach for drainage and has been doing well for the five years since surgery.

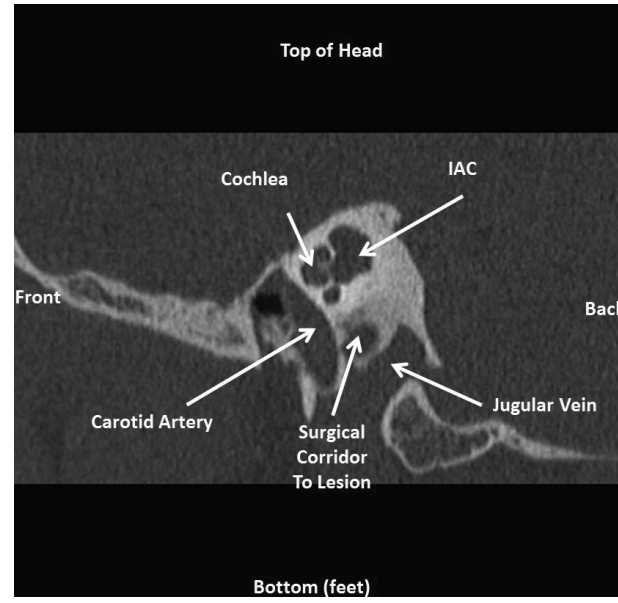


Figure 4. Sagittal CT image (looking from left to right in sequential slices) showing the anatomy of the surgical corridor in an infracochlear approach.