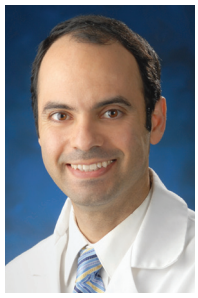
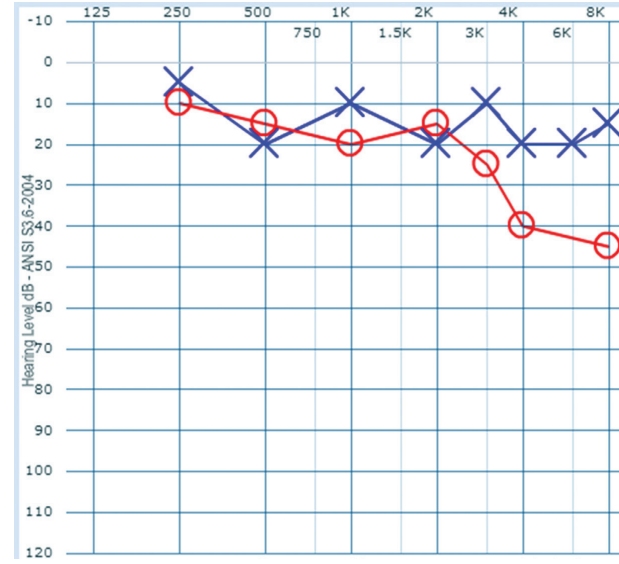


Symptom: Right-Sided Tinnitus

By Hamid R. Djalilian, MD

The patient is a 49-year-old woman presenting with facial pain and a history of right-sided tinnitus for more than a year. She describes the tinnitus as a high-pitched ringing. Her previous migraine headaches were primarily in the forehead and the current headaches are mainly the midface on the cheek. She also has some tingling sensation in that area. Her hearing feels normal to her. Her past medical history is significant for being a gymnast in the past with a few episodes of fall from the parallel bars where she lost consciousness. She had a CT of the brain at age 19, which was normal. Her audiogram is on the right.



What is your diagnosis? See p. 9.

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

Diagnosis: Asymmetric Hearing Loss: Petroclival Meningioma

By Hamid R. Djalilian, MD

Continued from p. 8

A patient presenting with an asymmetric hearing loss requires further attention. The definition of asymmetric hearing loss for the purpose of further workup has been the subject of some controversy. The American Academy of Otolaryngology has recommended referral of patients to otolaryngologists in cases of unilateral or asymmetric hearing loss defined as an air-conduction pure-tone PTA (500, 1000, 2000, and 3000 Hz) difference of 15 dB or greater, sudden, or recent onset within the previous six months, or bilateral hearing loss greater than 90 dB (*Am Acad Otolaryngol Head Neck Sur: Bulletin* 1994:26–28). However, acoustic neuromas or other retrocochlear lesions most commonly cause asymmetric hearing loss in the high frequencies. Therefore, a commonly used definition in scientific studies is an asymmetry of 15 dB in three adjacent frequencies. This definition would encompass the more common high frequency asymmetric hearing loss.

ADDITIONAL TESTS REQUIRED

Depending on the patient and circumstances, the further workup of asymmetric hearing loss may require serial audiograms or obtaining imaging for evaluation of a tumor. If a retrocochlear lesion is suspected, an MRI of the internal auditory canal is the best imaging modality to evaluate the cochleovestibular nerves for the presence of a tumor. If a patient has a pacemaker or defibrillator, a CT scan of the brain with contrast can be obtained. An MRI with contrast was always obtained to evaluate for a tumor in the past. However, with improvement in MRI technology, a non-contrast MRI can image tumors down to 2 mm in size. A CISS sequence MRI, which obtains 1 mm thick slices of the internal auditory canal region, shortens the duration of the MRI, reduces the cost of the imaging by half, and prevents exposure to gadolinium contrast material used in MRIs. Recent evidence suggests that gadolinium may accumulate in the body and in patients with poor renal function may have a heightened risk of systemic fibrosis. Therefore, we try to avoid the use of gadolinium in imaging unless it is absolutely necessary.

Acoustic neuromas are the most common retrocochlear tumors affecting the hearing. These are benign tumors of the covering of the nerves (nerve sheaths, i.e., Schwann cells) and are nearly always of the vestibular nerve origin. Therefore, the more appropriate terminology for this tumor is a vestibular schwannoma. The second most common retrocochlear tumor that affects the hearing is a meningioma, a tumor of the coverings of the brain (meninges).

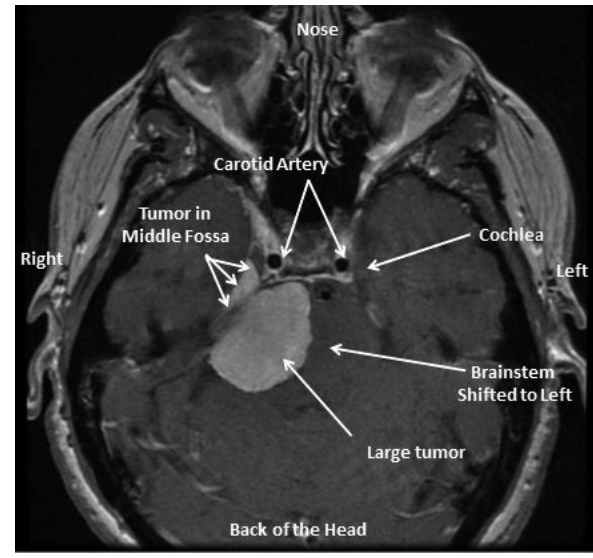


Figure 1. Axial (horizontal) T1 post-gadolinium MRI of the brain demonstrating a large mass in the right cerebellopontine angle. There is an extension into the middle fossa.

CLASSIFYING THE DIAGNOSIS

This patient had an MRI that showed a large mass in the cerebellopontine angle and extending into the internal auditory canal anteriorly. While at first glance this may appear to be a vestibular schwannoma, careful review of the imaging shows the tumor to be extending anteriorly into the petroclival region. This mass has the classic appearance of a petroclival meningioma. Sometimes meningiomas will have calcification within them (gather calcium) or induce new bone growth in the adjacent area that will be visible on CT imaging. The CT imaging, however, did not show calcification in this case.

While vestibular schwannomas are benign more than 99 percent of the time, meningiomas can be aggressive approximately 10 percent of the time, and two percent of time are very aggressive and sometimes termed malignant. Meningiomas are classified based on the WHO classification system as benign (Grade I) (90% of tumors), atypical (Grade II) (approximately 7% of tumors), and anaplastic/malignant (Grade III) – (2% of tumors). Meningiomas most commonly arise from the petrous face (the posterior aspect of the temporal bone) in the cerebellopontine angle.

IDENTIFYING RISK FACTORS

Risk factors for meningiomas include previous radiation to the head (e.g., for head and neck cancers, or as done for acne

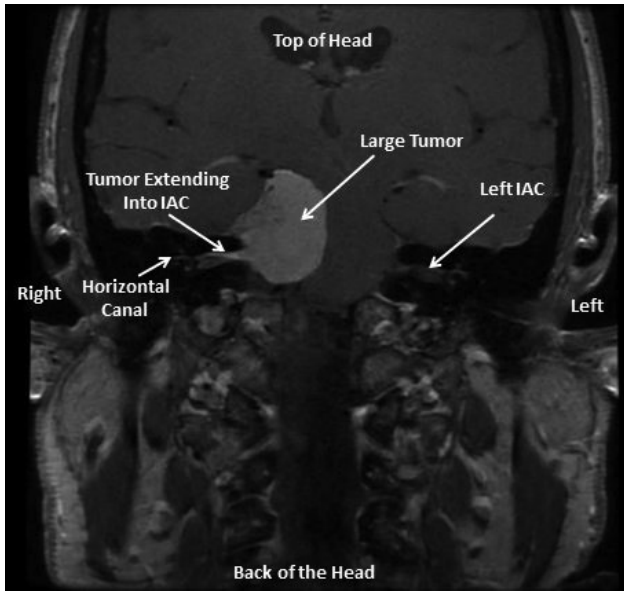


Figure 2. Coronal T1 post-gadolinium MRI image at the level of the internal auditory canal (IAC) showing extension of the mass into the IAC.

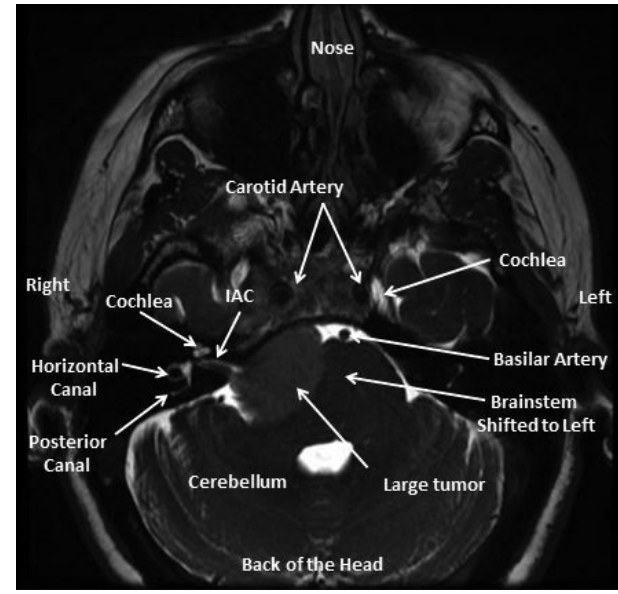


Figure 3. Axial CISS MRI of the patient at the level of the IAC showing no significant mass in the IAC.

many years ago), as well as previous brain injury, which is associated with the development of meningiomas. Nuclear bomb survivors from Japan had a higher risk than non-exposed individuals of developing meningiomas. People living closer to the explosion site were at a higher risk of developing a tumor than those who lived further away. Other risk factors include neurofibromatosis type 2, and a multitude of dental x-rays as done many years ago prior to the low-dose protocols.

The treatment of meningiomas generally involves observation, surgery, or stereotactic radiation (e.g., GammaKnife or CyberKnife). Large tumors (> 3 cm in diameter) are generally not amenable to radiation depending on the location. Because tumors will initially have some swelling after radiation, a large tumor may become excessively large and lead to significant compression of the normal surrounding brain.

Petroclival meningiomas are tumors that originate at the petroclival junction and are medial to the trigeminal nerve that supplies sensation to the face. The petroclival junction is where the most medial aspect of the temporal bone (petrous region) joins the portion of the skull anterior to the brainstem (the clivus). These tumors generally displace the brain stem and the basilar artery (the primary artery that feeds the brainstem, occipital lobes, and cerebellum) to the opposite side. Petroclival meningiomas may be in the posterior fossa alone, or may span the middle and posterior cranial fossae.

Petroclival meningiomas are some of the most difficult tumors to remove due to their location and surrounding vital structures (cochleovestibular nerves, facial nerve, trigeminal nerve, and the basilar artery and its tributaries). A number of surgical approaches have been developed to reach these tumors. The goal of these surgical approaches is to develop a corridor to the tumor to allow for full resection of the tumor without compromising the structures of the temporal bone. These approaches generally require a combined middle and posterior fossa approaches with removal of all of the mastoid cells and thinning of the posterior and superior canals. Rarely, removal of the superior and posterior canals may be necessary for full tumor exposure. This procedure can be done without compromising the hearing in a vast majority of patients.

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