

## CLINICAL CONSULTATION

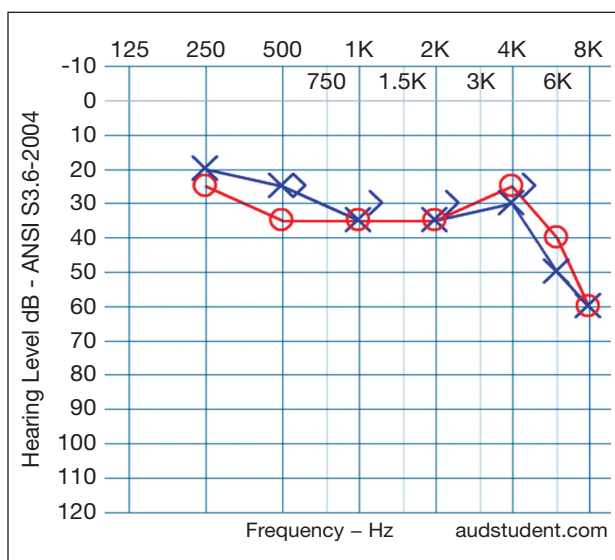
# Symptom: Pulsatile Tinnitus

By Hamid R. Djalilian, MD

A 52-year-old woman comes in complaining of pulsatile tinnitus in the right ear. The patient has had the symptoms since an airplane ride, during which there was a sudden change in air pressure. Since then, she states, she has developed pulsatile tinnitus in both ears, which increases with atmospheric pressure changes. Initially she had some off-balance sensation and head pressure, primarily on the left side. She denies any ear pressure, sound-induced vertigo, or other hearing disturbance. An audiogram can be seen to the right.

**What is your diagnosis? See p. 12.**

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



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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.

The first video shows a coronal CT of the left temporal bone, demonstrating dehiscence on only one slice.

The second video presents a coronal CT of the right temporal bone, demonstrating no dehiscence of the superior canal.

The third video is a coronal CT of the left temporal bone after surgery, demonstrating postoperative changes from superior canal occlusion.

The fourth video shows a T2-weighted MRI of the brain of the patient, demonstrating white matter changes. Most of the changes seen close to the top of the head are due to the presence of more white matter in those areas.

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# Diagnosis: Migraine and False Superior Canal Dehiscence

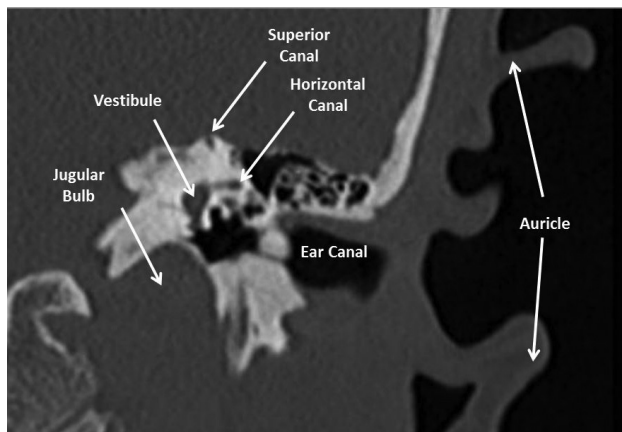
By Hamid R. Djalilian, MD

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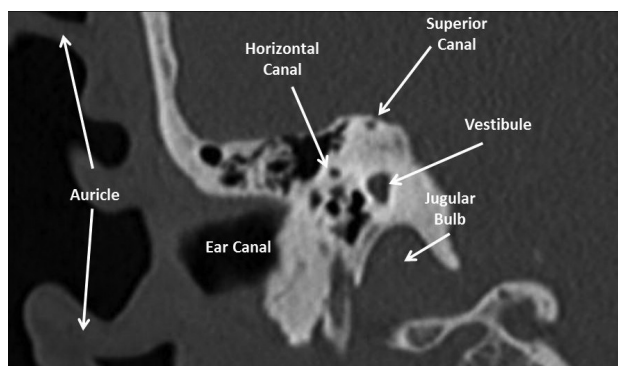
**P**ulsatile tinnitus is one of those vexing complaints for which there is no universally recognized workup. In the differential diagnosis, the most concerning problems should be ruled out first. Next, we look at problems that are potentially treatable and can be diagnosed using testing or specialty examinations. Finally, we consider problems that are diagnoses of exclusion—conditions for which there is no testing but there may be available treatments.

For patients with pulsatile tinnitus, the most concerning issues include tumors of the brain or temporal bone, such as tumors of the jugular foramen, arteriovenous malformations, or other posterior fossa lesions.

Next, we consider intracranial hypertension (initially called benign intracranial hypertension but now called idiopathic intracranial hypertension), which can remain undiagnosed for a long time. This condition most commonly affects middle-aged, overweight women. The problem occurs as a likely result of increased central venous pressure due to higher intra-abdominal weight and pressure. Pulsatile tinnitus can be its only manifestation. As a result, all patients with pulsatile tinnitus undergo a neuro-ophthalmologic evaluation to check for increased pressure around the optic nerve head. The gold standard test for evaluation of the intracranial hypertension is a lumbar puncture with opening pressure check. Once this condition has been identified, it requires long-term management with medications and weight loss.



**Figure 1.** The coronal CT of the left temporal bone demonstrates a possible dehiscence of the superior canal (no white bone over the gray circle).



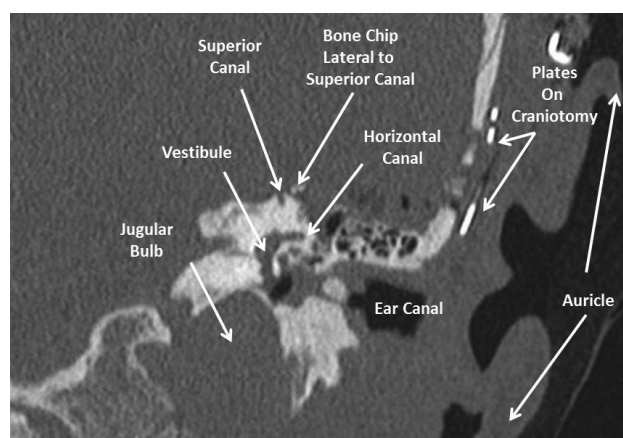
**Figure 2.** The coronal CT of the right temporal bone demonstrates no dehiscence of the superior canal (white bone seen over the gray circle).

When the worrisome conditions have been ruled out, our preference is to obtain a CT scan of the temporal bones if the

**Pulsatile tinnitus is one of those vexing complaints for which there is no universally recognized workup.**

patient wishes to consider surgical therapy. The two conditions that can be seen on a high-resolution CT of the temporal bones are semicircular canal dehiscence and sigmoid sinus diverticulum. This patient's CT scan showed a thin area of the left superior semicircular canal on one cut. She was told she had superior canal dehiscence (SCD) and went to another institution for repair. To diagnose superior canal dehiscence, an ultra-high-resolution CT scan of the temporal bones needs to be completed, which means slice thickness less than or equal to 0.7 mm, with reconstruction in various planes to visualize the semicircular canals well. Caution must be exercised when imaging shows only one slice of dehiscence on the semicircular canal. Images that are 0.5-mm thick represent a less than 0.5-mm dehiscence, which may be due to averaging of the images and not truly represent a dehiscence.

Based on the appearance of the thin superior semicircular canal on the left side, this patient underwent a middle fossa craniotomy to repair the possible dehiscence at the outside institution. The patient had relief from the pulsatile tinnitus for less than one minute during the first week after surgery. Other than that, there was no change in the character of the sound. Based on the thought that the patient had relief, she underwent

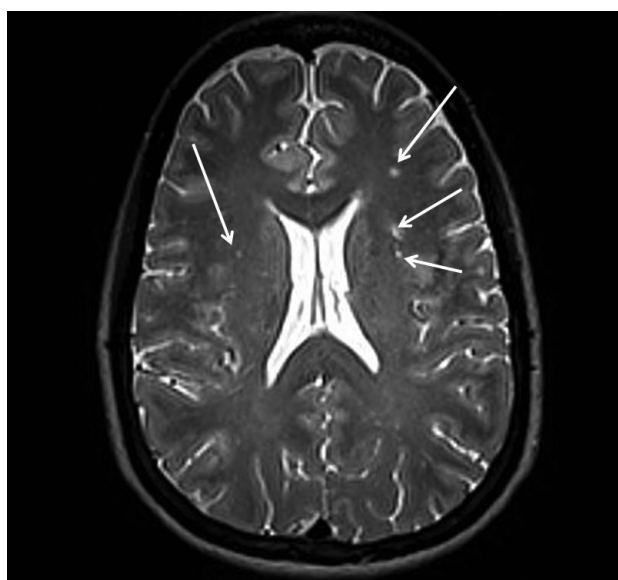


**Figure 3.** The coronal CT of the left temporal bone after surgery demonstrates a small bone chip (white dot) intended to occlude the dehiscent superior canal placed lateral to the superior canal.

a right-side craniotomy with superior canal plugging. The patient, however, did not have relief from her symptoms and sought care with our group.

Often, patients come in with a preconceived notion of their diagnosis. Sometimes, other clinicians have provided a diagnosis to the patient based on imaging or other tests. It is incumbent upon the clinician to evaluate the patient objectively based on history, examination, and imaging, as blindly following the diagnosis of other clinicians can lead to disastrous consequences and unnecessary treatment. Sometimes the disorder with which the patient presents to outside clinicians may have posed a different set of symptoms at the time of presentation. It is important to look at the patient in totality and not get sidetracked by tunnel vision when the patient presents with a diagnosis in hand. This is especially true for patients with SCD. We see patients with SCD who either have inadequate imaging or a clinically non-significant appearance of dehiscence. This patient had a coronal CT scan of the temporal bones, which showed not a true dehiscence but rather an artifact of imaging that occurs at the top of the canal on a coronal image. This artifact led to an appearance of dehiscence when, in reality, no true dehiscence was present. Unfortunately, this patient underwent two craniotomies, which could potentially have been avoided if the patient had been evaluated in totality, including all imaging studies and her history.

In this patient, the T2-weighted MRI shows areas of hyperintensity in white matter portions of the cortex, indicating that there have been small vascular changes in these areas. These findings are seen generally in one of only a few conditions, including a history of strokes or high blood pressure, migraines, or multiple sclerosis. This patient did not have a history of multiple sclerosis, high blood pressure, or strokes. She also denied a history of headaches. However, when one evaluates these imaging findings in the presence of significant sensitivity to atmospheric pressure changes, one must first think of migraine as the etiology of pulsatile tinnitus. In



**Figure 4.** The T2-weighted MRI of the brain of the patient demonstrates white matter changes (arrows), indicating a likely history of migraine.

our experience, many patients with SCD have clinical findings of migraine; it is critical that migraine be treated first before the patient undergoes any invasive procedures.

**A patient who presents with hours of dizziness should be evaluated for a possible migraine etiology before the symptoms are attributed to superior canal dehiscence.**

More recently, minimally invasive procedures to occlude the round window membrane have shown promise in improving the symptoms of SCD without the need for craniotomy. This success may be because many of the symptoms of SCD are due to the third window effect into the inner ear, meaning that, in addition to the oval window and round window, the canal dehiscence becomes a third window and leads to many of the symptoms of this condition. Occluding the round window can provide relief to the patient without the known risks of deafness, intracranial bleeding, or infection that are associated with the middle cranial fossa approach. This patient had other symptoms suggestive of migraine, including a left-sided head pressure as well as onset of episodic dizziness. SCD will generally not cause prolonged episodes of dizziness. Patients with this condition will experience very short bouts of dizziness due to a significant pressure change in the ear canal, such as some tympanograms or loud sounds. These symptoms, however, last only about one to two seconds. A patient who presents with hours of dizziness should be evaluated for a possible migraine etiology before the symptoms are attributed to superior canal dehiscence. [17](#)