Symptoms: Heartbeat and Whooshing Sound in Ear

By Hamid R. Djalilian, MD

A 45-year-old woman hears her heartbeat in her left ear. She noticed the sound three months ago, but did not think much of it. It has gradually become louder and more noticeable, with the sound increasing during exercise and decreasing when she compresses the left side of her neck.

She explained that the sound is synchronized with her pulse and makes a "whooshing" sound. It has now reached the point where she has difficulty sleeping at night. She denies experiencing tonal tinnitus, vertigo, or hearing loss, but she has occasional headaches that occur on both sides of her head. The headaches are associated with light and sound sensitivity.

An examination showed a normal otoscopic evaluation with no vascular mass behind the tympanic membrane. No bruits were evident after using a stethoscope to listen to her neck. Auscultation of the mastoid in the left showed a pulsatile bruit. Compression of the jugular vein on the left side diminishes the perception of the sound for the patient. The sensation of the pulsatile sound increases when the right jugular bulb is compressed.

What is your diagnosis? See p. 22.

Blast from the Past!

Check out one of the first Letters to the Editor from *The National Hearing Aid Journal* in January 1948:

The National Hearing Aid Journal
Sioux City, IA

Enclosed please find a check for one year subscription to the *National Hearing Aid Journal*. I am very well pleased with the first issue. It will pass valuable knowledge to men and women to better serve their clients both at home and in the office. May I wish you success.

Very truly yours,
I.M. Schwartz
Phoenix, AZ

Diagnosis: Pulsatile Tinnitus

By Hamid R. Djalilian, MD

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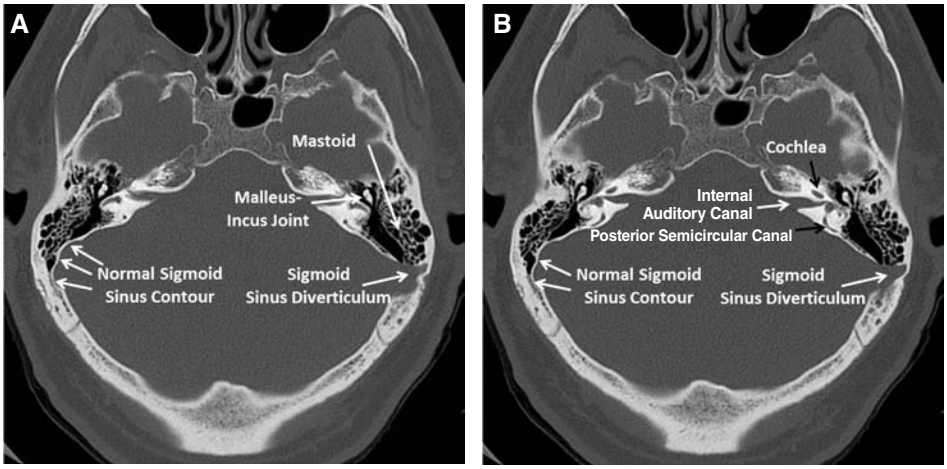
The internal carotid artery and the jugular vein travel within millimeters of the cochlea or the middle ear space. Several dural venous sinuses that drain the blood from the brain back to the heart are also near the ears' structures. The superior and inferior petrosal sinuses travel at the medial and posterior edge of the temporal bone. The transverse sinus drains into the sigmoid sinus, which travels behind the mastoid bone. The sigmoid sinus drains into the jugular bulb located immediately under the middle ear space. Any change in the flow of blood in these vessels, anomalous vasculature, or vascular tumor around the temporal bone can cause the sensation of a pulsatile tinnitus.



An axial CT scan of the temporal bones showing a sigmoid sinus diverticulum on the left side (A). A normal sigmoid sinus contour can be seen on the patient's right side (left side of the image). The close proximity of the sigmoid sinus to the structures of the ear can be seen. Axial CT of temporal bones at 0.6 mm below shows other pertinent anatomy including the internal auditory canal, posterior semicircular canal, and the cochlea (B).

DIFFERENTIAL DIAGNOSES OF PULSATILE TINNITUS

- Conductive hearing loss
- Middle ear effusion
- Carotid artery stenosis
- Dural arteriovenous fistula
- Carotid-cavernous sinus fistula
- Atherosclerotic carotid stenosis
- Aneurysm or dissection of the internal carotid artery (ICA)
- Fibromuscular dysplasia with ICA stenosis
- Cerebral venous sinus thrombosis
- ICA aneurysm
- Cerebral venous sinus stenosis
- Abnormal loop of the anterior inferior cerebellar artery
- Glomus tumors
- Intracranial hypertension
- Meningioma
- Sigmoid sinus diverticulum
- Superior canal dehiscence
- Anomalous carotid artery or jugular vein
- Anemia
- Thyrotoxicosis
- Venous hum
- Pregnancy

Patients will generally complain of a pulsatile sensation or of hearing one's heartbeat in one or both ears. The patient should be asked about signs of intracranial hypertension, including headaches, diplopia, or transient visual loss to rule out intracranial hypertension. Also ask about new life stressors, and specifically ask women about the possibility of pregnancy. Pregnancy, hyperthyroidism, and anemia cause an increase in the cardiac output, and lead to a change in blood flow in the vessels around the ear.

Pulsatile tinnitus is often a transient phenomenon caused by a stress-induced increase in the blood flow around the ear, but some life-threatening conditions can cause pulsatile tinnitus; this finding demands a full workup. An examination should include an evaluation of the ears for a middle ear mass (usually red or purple), auscultation over the carotid arteries in the neck and the mastoids, and gentle compression of the jugular vein for signs of symptom improvement. Fundoscopic examination of the eye should be performed for signs of intracranial hypertension. This is best performed by an ophthalmologist or, ideally, a neuro-ophthalmologist.

The diagnostic workup of pulsatile tinnitus is aimed at ruling out life-threatening abnormalities. A carotid ultrasound is warranted in any patient with an abnormal neck auscultation, a history of blunt neck trauma or chiropractic manipulation (to rule out a carotid dissection), or atherosclerosis in older patients. A CTof the brain and internal auditory canals with gadolinium will help rule out a majority of the possible abnormalities. (See scans.)

A thyroid panel and hemoglobin test will rule out hyperthyroidism or anemia. A pregnancy test is warranted if that possibility exists. A lumbar puncture should be performed after brain imaging to rule out a mass if benign intracranial hypertension is suspected based on the fundoscopic examination. A CT scan of the temporal bones to rule out a superior canal dehiscence or a sigmoid sinus diverticulum may be warranted. A hearing test will evaluate any conductive hearing loss or middle ear effusion, which can also cause a pulsatile tinnitus sensation.

This patient was found to have a normal MRI of the internal auditory canals with gadolinium. A CT of temporal bones was obtained, given the abnormal examination, and showed a sigmoid sinus diverticulum. (See scans.) Sigmoid sinus diverticulum is an outpouching of the sigmoid sinus that has an unknown cause because it is not known whether there is a congenital or gradual loss of the bony covering of the sigmoid sinus. This leads to a dilation of the vascular space into mastoid air cells. It is thought that turbulent blood flow within this outpouching is what leads to the pulsatile tinnitus sensation.

Sigmoid sinus diverticulum does not require treatment, but a surgical procedure for obliteration of the diverticulum is performed for patients who want treatment. The procedure entails a postauricular incision with a limited mastoidectomy to expose the area of the diverticulum and the use of bipolar cautery and other materials to close the diverticulum.

Treating pulsatile tinnitus in general depends on the specific etiology. The patient should be referred to an otologist or neuro-otologist for evaluation and management if abnormalities are discovered on the imaging studies. A patient suspected of benign intracranial hypertension should be referred to a neurologist. Dural arteriovenous fistulas should be referred to neurointerventional specialists for interventional treatment.

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

FastLinks

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