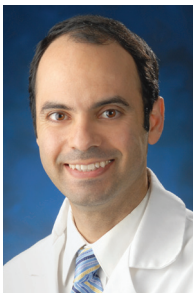


Symptoms: Hearing Loss and Vertigo after Trauma

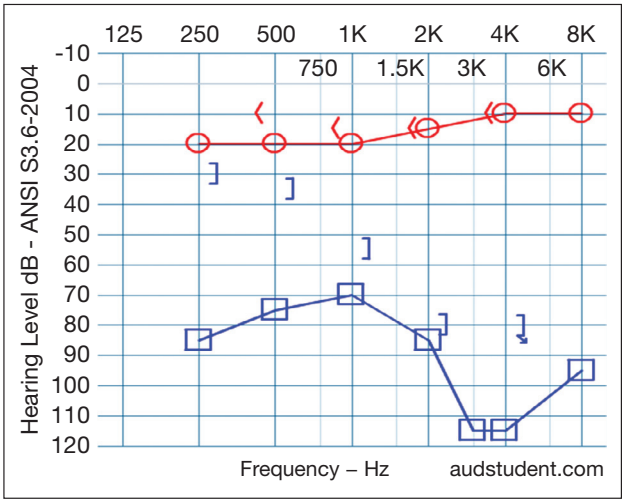
By Hamid R. Djalilian, MD

A 21-year-old man presents to the emergency department complaining of hearing loss. He said he was watching a baseball game when an argument erupted among some of the players. He went to separate the fighting players and he states that he was hit on the left side of the head. He said he believed he was struck with an object, possibly a baseball bat.

The patient has vertigo and feels his hearing has decreased. His examination shows blood in the external auditory canal. A bedside audiogram is performed, which is displayed in the image on the right.

What is your diagnosis? See p. 12.

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.



The patient's audiogram after he was struck in the head, possibly by a bat.

Diagnosis: Temporal Bone Fracture Involving the Otic Capsule

By Hamid R. Djalilian, MD

Continued from p. 10

Hearing loss after trauma has several causes, and the first task is to determine the type of trauma that occurred, which can help narrow down the possibilities on the differential diagnosis.

In cases of sharp trauma, such as a tree branch, pencil, or cotton swab, the clinician should think about trauma to the external auditory canal or the tympanic membrane. External auditory canal trauma can easily lacerate the ear canal wall skin. This occurs because the bony canal wall skin is very thin and tightly adherent to the external auditory canal bone. Any slight trauma to it will cause bleeding. External auditory canal trauma, however, should not cause vertigo.

Patients with vertigo after trauma should prompt the clinician to suspect trauma to the inner ear. This can occur as a result of a penetrating force going through the tympanic membrane and fracturing the stapes footplates or can occur from a fracture of the temporal bone.

This patient had a CT scan of the temporal bone, which found a temporal bone fracture. (Figure 1.)

TYPES OF FRACTURES

A temporal bone fracture generally requires very strong forces to the skull that occur either laterally or in an anterior or posterior ear direction. Temporal bone fractures were previously classified as longitudinal or transverse.

Longitudinal fractures run along the external auditory canal and are usually caused by a lateral blow to the head. These fractures uncommonly would involve the otic capsule or the facial nerve.

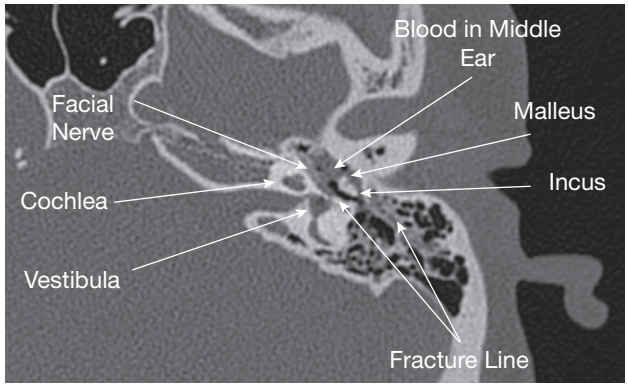


Figure 1. The axial CT scan of our patient's left temporal bone showed the fracture line as well as blood in the middle ear.

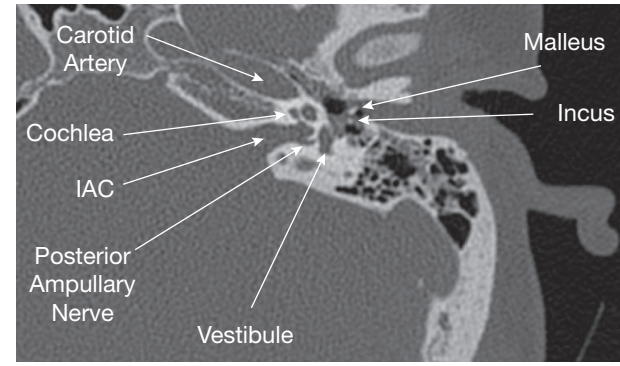


Figure 2. The axial CT of our patient's temporal bone demonstrates the posterior ampullary nerve. "IAC" stands for "internal auditory canal."

Transverse fractures occur from anterior or posterior trauma to the head and generally do not involve the external auditory canal. They are much more likely to cause facial paralysis and involve the otic capsule, causing hearing loss and dizziness.

The classification scheme has somewhat evolved, and these fractures are classified as otic capsule-sparing and otic capsule-involving fractures. This was partly because of the mixed nature of temporal bone fractures, where fracture lines can occur in longitudinal and transverse directions in the same patient.

Our patient had a mixed longitudinal and transverse fracture that involved the otic capsule. A transverse fracture generally does not involve the external auditory canal or cause external auditory canal laceration and bleeding. A longitudinal fracture, however, will cause an external auditory canal laceration and lead to bleeding from the ear canal.

Occasionally, the novice clinician may see the posterior ampullary nerve and consider it a fracture of the otic capsule. The posterior ampullary nerve is a branch of the inferior vestibular nerve and goes from the internal auditory canal to the posterior semicircular canal ampulla. (Figure 2).

These fractures can sometimes involve the superior aspect of that ear canal and lead to the extravasation of cerebrospinal fluid through the base of the skull into that ear canal and to the outside. Our patient had a fracture line that also went anteriorly and involved the temporomandibular joint as well. (Figure 3.) He also had a laceration of the ear canal involving the roof and the anterior ear canal, which can lead to stenosis of the ear canal from the healing process. Therefore, it is advisable to place wicks in the ear canal to prevent circumferential granulation tissue, which leads to stenosis of the ear canal. The wicks are removed in one to two weeks, when the lacerations have healed.

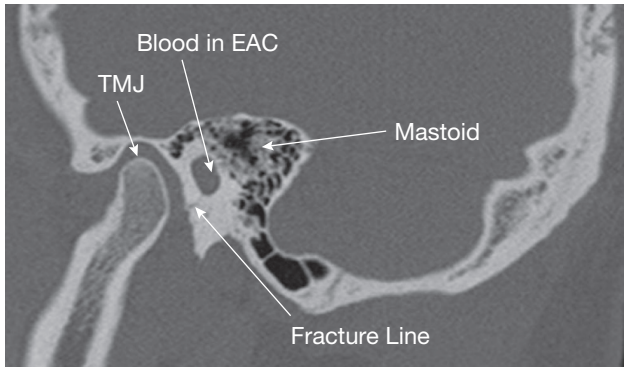


Figure 3. The sagittal CT of our patient's temporal bone shows the fracture line extending into the anterior ear canal and involving the temporomandibular joint (TMJ). "EAC" stands for "external auditory canal."

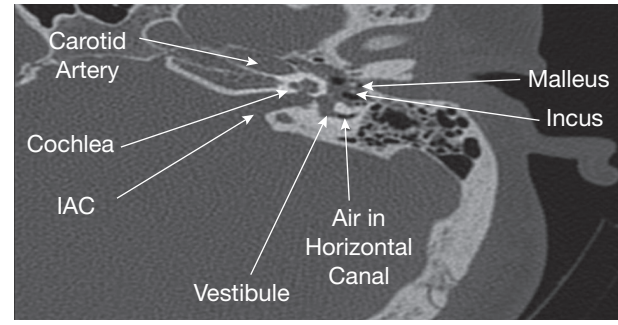


Figure 4. The axial CT of our patient's temporal bone demonstrates air (black) within the horizontal semicircular canal. Fluid within the inner ear appears gray gray. "IAC" stands for "internal auditory canal."

SPECIAL CONSIDERATIONS

This patient had a significant mixed hearing loss. The conductive component is partly related to the blood in that ear canal and the middle ear and a slight separation of the incudomalleal joint. The sensorineural hearing loss is from the fracture of the vestibule, which led to some air entering the vestibule that can be seen inside the horizontal semicircular canal. (Figure 4.)

Interestingly, the patient still had maintained some sensorineural hearing despite the fracture through the otic capsule. Many patients with fractures through the otic capsule will develop scar tissue within the involved portion, which can lead to bone formation within the inner ear.

If a cochlear implant is contemplated in a patient with a temporal bone fracture that leads to complete loss bilaterally or in a patient where the contralateral ear had no useful hearing and the hearing in the ipsilateral ear is lost, implantation should be performed more expeditiously to prevent bone formation within the inner ear, termed labyrinthine ossification. Labyrinthine ossification makes the procedure significantly more difficult.

It is important to evaluate the carotid artery when the fracture line involves the carotid canal. A fracture can cause a small laceration in the carotid artery wall and lead to an aneurysm formation or clotting/narrowing of the artery. Angiography was previously performed for this purpose. The catheter was placed through the groin, and contrast material was injected within the carotid artery. This procedure produces great images but carries a very small risk of stroke and exposes the patient to significant radiation.

The risk of stroke from traditional angiography has been eliminated, however, with newer imaging techniques using CT angiography. A CT angiogram subtracts the bony portion of the anatomy and will only demonstrate the arterial system that contains the contrast.

A three-dimensional image was obtained of our patient's entire intracranial vasculature. (Video 4; see box.) Our patient's angiogram was normal. A slight narrowing of the right carotid is seen and is artifactual.