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Imaging of temporal bone trauma

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Multidetector computed tomography aids in the detection and subsequent classification of skull base and temporal bone fractures. Classifying temporal bone fractures aids in predicting complications and can help guide treatment. In this article, we discuss the detection and classification of temporal bone fractures for injury stratification and review normal anatomy of temporal bone structures, which may mimic fractures.

High-resolution multidetector computed tomography (MDCT) plays an important role in the evaluation of patients with fractures of the skull base and temporal bone. Most fractures of the temporal bone are a result of high-energy blunt trauma and can cause complications, such as sensorineural hearing loss, conductive hearing loss, facial nerve paralysis, and direct communication into the intracranial compartment with potential cerebrospinal fluid (CSF) leaks and infection. Advanced MDCT, particularly with increasing number of detector rows and coverage volume, allows for rapid image acquisition with minimal patient motion artifact, thereby improving fracture detection and helping identify possible complications associated with temporal bone injury. In this communication, we focus on the role of MDCT for the detection, classification, and subsequent stratification of temporal bone injury severity.

Temporal bone anatomy—Fracture mimics

A significant challenge in detecting and classifying temporal bone fractures is the inherent complexity of temporal bone anatomy. Though evaluation of symmetry is helpful for distinguishing normal anatomy from acute injury when combined with secondary signs of more superficial injury, temporal bone sutures or fissures and canals can still be mistakenly interpreted as fractures. Here, we provide a brief overview of normal structures that can mimic fractures. For a more detailed evaluation of temporal bone anatomy, please see more complete texts, such as Ref. 1 or companion article by J. Chen in this issue.

Sutures or fissures

Normal bony sutures or fissures may mimic fracture lines to the unfamiliar. Because the temporal bone is composed of 5 major osseous components, including the squamous, mastoid, petrous, tympanic, and styloid portions, each is separated by several sutures or fissures, which are named for their adjoining bones. Here we focus on the smaller, less well-known sutures and fissures.

Internal sutures or fissures

The tympanomastoid and tympanosquamous (squamotympanic) fissures parallel the anterior and posterior walls of the external auditory canal, respectively (Figure 1A and B). The tympanomastoid fissure separates the external auditory canal from the mastoid space and gives passage to the auricular branch of the vagus nerve (Arnold nerve). The tympanosquamous fissure continues medially to form

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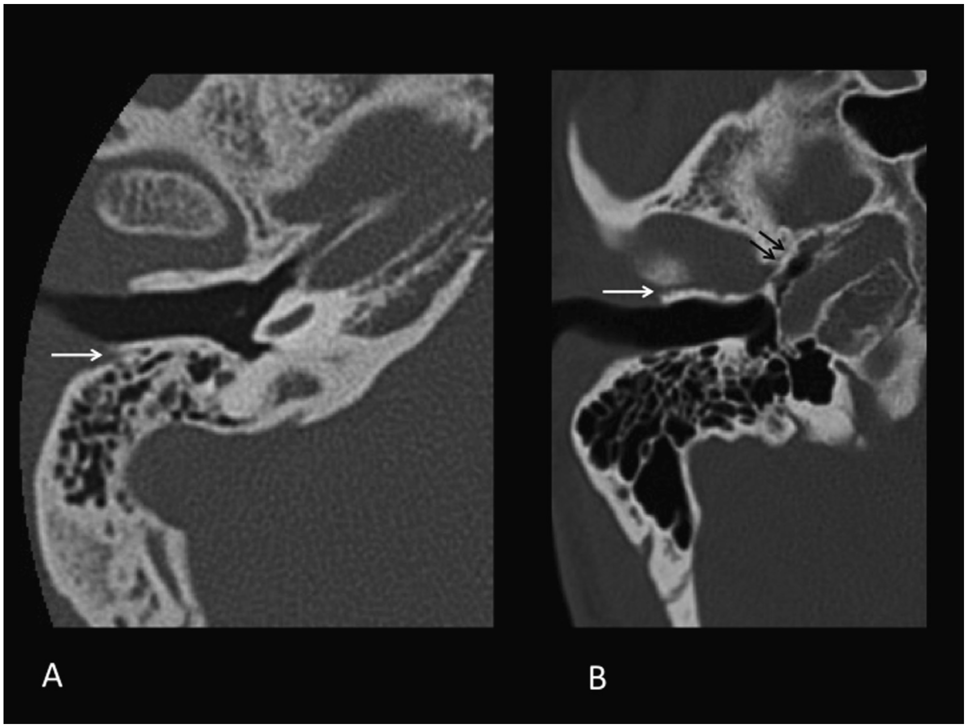

Figure 1 (A) Axial CT image showing the tympanomastoid suture (white arrow), posterior to the external auditory canal (EAC), and (B) axial CT image demonstrating the tympanosquamous (white arrow), anterior to the EAC and continuing medially as the petrotympanic suture (2 black arrowheads).

the petrosquamosal and petrotympanic fissures. The lower portion of the cerebral (internal) surface of the squamous is concave and demonstrates grooves corresponding to the branches of the middle meningeal artery. This lower portion is fused to the anterior surface of the petrous bone (petromastoid) but traces of a petrosquamosal suture can be seen in the adult temporal bone. The line delineating the fusion of the petromastoid and squamous portion of the temporal bone is known as Körner septum (Figure 5A). Cells lateral to the Körner septum belong to the pneumatizated squamous portion, and the cells medial to it belong to the pneumatizated petromastoid portion of the temporal bone. The posterior end of the Körner septum is frequently involved in longitudinal temporal bone fractures, which may reflect selective involvement of the weaker portion of the bone to acute injury (Mahmood Mafee, personal communication). The petrosquamosal fissure, continuous with the Körner septum, extends anteromedially from the mandibular fossa, coursing in between the petrous and the squamous portions of the temporal bone, whereas the petrotympanic fissure (also known as the glaserian fissure) runs from the temporomandibular joint to the tympanic cavity and gives passage to the anterior tympanic branch of the internal maxillary artery, and a canal slightly separated from Huguier canal, which transmits the chorda tympani nerve.

External sutures or fissures

Four external sutures separate the temporal bone from its neighboring skull bones. These include the (1) sphenosquamosal suture, formed between the greater wing of the sphenoid and the squamous temporal bone, located lateral to the foramen spinosum (Figure 2A); (2) occipitomastoid suture, which separates the mastoid process from the occipital bone; (3) sphenopetrosal suture (Figure 2B), which courses anteromedially, along the anterior margin of the petrous bone and between the foramen ovale and carotid canal; and (4) petrooccipital suture (Figure 2C), which also runs anteromedially, coursing superior to the sphenopetrosal suture and along the posterior aspect of the petrous bone.

Canals

The temporal bone also contains a number of small canals or passages that can also be mistaken for fractures. Of these, the most prominent is the facial nerve canal, a Z-shaped canal that runs a long and complex course from the fundus of the internal acoustic meatus to the stylomastoid foramen and contains the fallopian segment of the facial nerve (cranial nerve [CN] VII) (for a detailed discussion of the course of the facial nerve, see Ref. 2 in this issue). The facial nerve passes through the anterosuperior quadrant of the internal acoustic meatus and enters the facial nerve canal, passing anterolaterally between and superior to the cochlea and vestibule (labyrinthine segment), and then coursing anteriorly to the geniculate ganglion (geniculate segment). From there, the nerve follows a posterolateral course along the superior medial wall of the tympanic cavity, superior to the canal for tensor tympani (semicanal) and cochleariform process, continues lateral to the vestibule