Learning objectives

The objectives of this review are to illustrate small sutures and channels in the temporal bone, which may be confused with fractures. The anatomical significance of these 'pseudo-fractures', in relation to the vessels and nerves, that pass through is discussed.

Background

Pseudo-fractures can be divided into three categories:

1) intrinsic fissures are the connections between the five parts of the temporal bone

2) extrinsic fissures are formed by the borders of the temporal bone with the rest of the cranial skeleton

3) intrinsic channels are small connections that allow passage of various structures, and are distinct from fissures.

Imaging findings OR Procedure details

Intrinsic Fissures

The temporal bone is composed of five distinct segments, namely the squamous, petrous, tympanic, mastoid and styloid portions. Intrinsic fissures between these segments can give the appearance of 'pseudo-fractures'. In particular, four intrinsic fissures can be seen around the bony part of the external auditory canal (EAC).

*Tympanosquamous, petrotympanic, petrosquamous*

The tympanosquamous fissure is best seen anterior to the EAC (Figure 1), and continues medially into the petrotympanic and petrosquamous fissures.

The petrotympanic (Glaserian) fissure can be visualized on axial and sagittal images (Figure 2) and provides an exit route for the chorda tympani from the middle ear to the infratemporal fossa. It also allows passage of the anterior tympanic artery from the first part of the maxillary artery into the middle ear.
The petrosquamous fissure is continuous with Koerner's septum, and on axial images, may be seen as a cleft oriented anteromedially from the glenoid fossa, but is better demonstrated on coronal images as a small defect in the tegmen tympani (Figure 3).

*Typanomastoid suture*

Posteriorly, the tympanomastoid fissure is an inconstant cleft that separates the bony EAC from the mastoid process (Figure 4). The auricular branch of the vagus nerve (Arnold's nerve) passes through the mastoid canaliculus and emerges through the tympanomastoid suture to supply sensation to a small part of the tympanic membrane and external auditory meatus.

**Extrinsic fissures**

*Occipitomastoid suture*

The occipitomastoid suture is consistently visualised posterior to the mastoid process (Figure 5). It can have an asymmetrical appearance and be bifid causing difficulties in interpretation. On more cranial slices, its anterior continuation can give the appearance of a fractured piece of temporal bone, but careful scrutiny will show this to be in continuity with the main occipital bone.

*Petro-occipital suture*

The petro-occipital suture starts at the petrous apex, where it receives the inferior petrosal sinus from the cavernous sinus. The suture extends caudally, where it can be followed to the pars nervosa of the jugular foramen (Figure 6), allowing the inferior petrosal sinus to join with the internal jugular vein.

*Sphenosquamosal suture*

This is the suture between the greater wing of the sphenoid and the squamous temporal bone. It is characteristically located lateral to the foramen spinosum (Figure 7)

*Sphenopetrosal suture*

The sphenopetrosal suture is situated between the posterior part of the greater wing of the sphenoid and the petrous apex (Figure 8). It courses just posterior to the foramen ovale.

**Intrinsic Channels**
**Petromastoid canal**

The petromastoid canal (also known as the subarcuate canaliculus) is recognised by its characteristic anteriorly convex course between the two limbs of the superior semicircular canal (Fig. 9). The petromastoid canal allows passage of the subarcuate artery to the otic capsule, and dura also extends into the petromastoid canal. This can serve as a conduit for the intracranial spread of mastoid infection.

**Hiatus of the facial canal**

This hiatus is on the anterior surface of the petrous pyramid, and is continuous with the geniculate ganglion (Fig. 10). It allows exit of the greater superficial petrosal nerve to the middle cranial fossa.

**Singular canal**

The singular canal extends from the internal acoustic canal to the posterior semicircular canal (Fig. 11). The singular nerve (posterior ampullary nerve) passes through, from the inferior vestibular nerve to the posterior semicircular canal. It is an important landmark during retrosigmoid approach to vestibular schwannomas, as its identification prevents accidental labyrinthine damage.

**Vestibular aqueduct**

The vestibular aqueduct is a small canal extending from the vestibule to the posterior surface of the petrous bone (Fig. 12), and runs almost parallel to the petrous pyramid. The aqueduct contains the endolymphatic duct, which enlarges at its distal end to form the blind-ending endolymphatic sac.

**Cochlear aqueduct**

The cochlear aqueduct extends from the subarachnoid space to the basal turn of the cochlea, close to the round window (Fig. 13). This relationship to the round window allows the cochlear aqueduct to be differentiated from the singular canal, as both run in the same plane. The medial aperture of the cochlear aqueduct is funnel-shaped. The cochlear duct houses the perilymphatic duct, but there is controversy as to the patency of this duct in adults.

**Inferior tympanic canaliculus**

In the pars nervosa, the inferior tympanic branch (Jacobson’s Nerve) arises from the glossopharyngeal nerve, and ascends to the middle ear through the inferior tympanic
canaliculus. This is demonstrated on axial and coronal images (Fig. 14). The inferior tympanic artery also passes through, and in an aberrant ICA with absent petrous ICA, the inferior tympanic artery enlarges to form the proximal cranial ICA.

*Mastoid canaliculus*

The mastoid canaliculus transmits the auricular branch of the vagus nerve (Arnold's nerve) from the pars vascularis to the facial canal just above the stylomastoid foramen (Figs 15). The course of Jacobson's and Arnold's nerves are important to recognize not only to avoid confusion with fractures, but also because paragangliomas have a predilection for occurring along their course.

**Images for this section:**
Fig. 1: Tympanosquamous suture is seen anterior to the bony external auditory meatus.
**Fig. 2:** Petrotympanic suture (black arrows), with the Eustachian tube (white arrowhead) closely related. Sagittal reformats (white arrow) of the petrotympanic fissure show that it is a connection between the middle ear and infratemporal fossa.

**Fig. 3:** The petrosquamous fissure is the continuation of Koerner’s septum (arrows), and is better seen on coronal reconstructions (arrow).
Fig. 4: The tympanomastoid fissure (arrows)
**Fig. 5:** Occipitomastoid suture (black arrowheads). The anterior part of the suture (white arrowhead) can simulate a fractured piece of temporal bone (asterisk).
Fig. 6: The petro-occipital suture
Fig. 7: Sphenosquamosal suture (arrows) is lateral to the foramen spinosum (arrowhead)
**Fig. 8:** The sphenopetrosal suture (white arrowheads) is medial to the foramen ovale (asterisk). Note the proximity of the Eustachian tube (black arrowhead).
Fig. 9: The petromastoid or arcuate canal (arrow) courses between the limbs of the superior semicircular canal (arrowhead)
**Fig. 10:** The hiatus of the facial canal (white arrow) is in continuity with the geniculate ganglion (black arrowhead).
Fig. 11: The singular canal
**Fig. 12:** The vestibular aqueduct (arrow). Near its origin from the vestibule, the vestibular aqueduct has a reverse-J shape.

**Fig. 13:** The cochlear aqueduct
Fig. 14: Jacobson’s nerve arises from the glossopharyngeal nerve in the pars nervosa (asterisk), and runs in the inferior tympanic canaliculus (arrows), between the jugular foramen and the carotid canal (cc). On the coronal plane, the full course of Jacobson’s nerve (arrow) is seen, as it ascends to the hypotympanum to supply the middle ear.
Fig. 15: The mastoid canaliculus (arrows) runs to the facial nerve canal (arrowhead)
Conclusion

The anatomy of the temporal bone is complex, and correct identification of normal structures is necessary to prevent misinterpretation as fractures. This article reviews small sutures and channels that can cause confusion for the uninitiated, and this will allow more confident interpretation of studies involving the temporal bone.

Personal Information

References


