CT Temporal Bones

CT of the temporal bones is requested for hearing loss, chronic infections, as well as middle and inner ear diseases. The anatomy is often perceived to be complex. Below is the approach I use, which follows an outside-in organization. First structures outside the temporal bones are evaluated on the full field images. Then the outer ear, middle ear, and inner ear are examined on the coned down views. Neurovascular structures and skull base anatomy are examined where adjacent to hearing apparatus. It is useful to stop at each place there is potential pathology.

1. **Look at the history, indication, and priors.**

2. **Assess the adequacy, technique, and limitations.**

3. **Always look at the localizer (scout) views first for incidentals outside your field of view and to prime you to major boney findings.**

4. **Examine the full field of view images.**
    a. Use MPRs to re-orient the patient anatomy to standard planes as needed.
    b. Examine all structures besides the temporal bones first.
    c. Look at the soft tissues.
        i. Examine the scalp and other subcutaneous tissues.
        ii. Look at the neck glands and nodal levels.
        iii. Examine the nasopharynx.
        iv. Look at the orbits.
    d. Look at the intracranial compartment.
        i. Along with the usual search pattern, look specifically for an expanded sella or low-lying cerebellar tonsils.
    e. Look at the paranasal sinuses, skull base, and visualized calvarium.
    f. Look at the cervical spine.
    g. Look at the bilateral pinnae.
        i. Note that portions may be excluded on the smaller FOV images.
        ii. Be aware of any head-packing within the scanner, especially if the pinna appears abnormal in shape.
        iii. Look for abnormal calcification. Consider systemic cartilaginous processes if you see calcification.
        iv. Look for inflammatory changes and mass lesions.
    h. Compare the bilateral IACs on the full field of view images.

5. **Examine dedicated temporal bone views one side at a time, as follows.**

6. **Assess the outer ear.**
    a. Examine the visualized pinna (a.k.a. auricle).
    b. Examine the external auditory canal for mass or obstruction.
        i. Look for soft tissue thickening and exostoses.
    c. Look to see that the tympanic membrane is normal.
        i. Note that the normal tympanic membrane is very thin. Any thickening is abnormal.
        ii. Note that with a middle ear effusion or other abnormality abutting the tympanic membrane, it cannot be evaluated fully. Consider reporting this caveat specifically.

7. **Assess the middle ear.**
    a. Examine the mesotympanum.
        i. Is there abnormal soft tissue density/fluid?
        ii. Look at the ossicular chain: malleus, incus, and staples.
        iii. Assess for erosion/thinning or displacement. Changing the window and level and scrolling through multiple planes may helpful here as abnormalities can be subtle.
        iv. Look for normal articulation between the malleus and incus.
        v. Look for normal articular of the stapes footplate and the oval window.
    b. Examine the epitympanum.
        i. The coronal images are especially useful for assessment of the epitympanum.
        ii. Is the scutum sharp? Is there blunting/destruction?
        iii. Is Prussak's space clear?
        iv. Is the tegmentum tympani intact? Is the adjacent tegmen mastoidium intact?
    c. Examine the hypotympanum.
        i. Look at the pyramidal eminence, sinus tympani, and facial nerve recess. Assess the round window niche.
        ii. Assess for abnormal soft tissue density.

8. **Assess drainage pathways/air passages associated with the middle ear.**
    a. Look at the mastoid air cells
        i. Is there demineralization, thickening, or sclerosis?
    b. Assess the Eustachian tube, fossa of Rosenmuller, and visualized portions of the posterior nasopharynx.
        i. Look for mass lesions especially.

9. **Assess neurovascular structures adjacent to the middle ear.**

a. Is the carotid artery normal in configuration (or lateralized/aberrant in course?) Is the bony covering intact?
    i. The internal carotid artery should be no more lateral that the cochlea.
b. Is there a high riding jugular bulb? Is the bony covering intact?
    i. If scrolling on axial images, the jugular bulb should be inferior to the IAC. I.e. you should not be able to see the IAC while scrolling up through the top of the jugular bulb.
    ii. Relative level of these structures can also be checked on coronal reformats.
    iii. Look for an enlarged or eroded jugular fossa.
c. Look at the hypoglossal canal on coronal sections.
d. Is the bony covering of CN7 intact along its tympanic portion?

10. Assess the inner ear.

a. Assess the otic capsule.
    i. Is the fissula ante fenestram normal in density?
    ii. Is the pericochlear bony labyrinth normal in density?
    iii. Change the window and level to detect subtle abnormality here, as the otic capsule is normally very dense.
b. Look at the cochlea.
    i. Does it have the appropriate number of turns?
    ii. Is there any abnormal attenuation (air, calcification) in the cochlea?
    iii. Are the oval and round windows normal in appearance?
c. Look at the vestibule and semicircular canals.
    i. Are these normal in size/configuration?
    ii. Look for dehiscence of the semicircular canals.
    iii. Consider looking at the superior semicircular canal in multiple planes, including the special Stenver and Poschl views to assess for dehiscence.
d. Assess the size of the vestibular aqueduct.
    i. It should be no wider than a semicircular canal.

11. Assess the internal auditory canal.

a. Look for abnormal/asymmetric contour.
b. Look for mass lesions.

12. Assess the course of CN7.

a. Look for caliber change of the canal along the:
    i. Labyrinthian portion.
    ii. Anterior gen (ganglion)

iii. Tympanic (horizontal) portion.
iv. Mastoid portion.

b. Increase in caliber suggests underlying mass lesion.

13. Assess the visualized extracranial soft tissues.

a. Scalp, orbits, visualized upper neck (including parotid glands).

14. Assess the remaining osseous structures.

a. Calvarium, skull base (including foramina), clivus. Remember that skull base lesions are easy to miss.
b. Look at the TMJs.
c. Bony orbits, paranasal sinuses, any visualized spine.

15. Assess the incidentally imaged CSF spaces and brain.

a. Look at the sulci, ventricles, basal cisterns.
b. Look at the brain parenchyma.

16. Perform last checks and proofread.