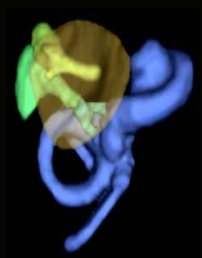
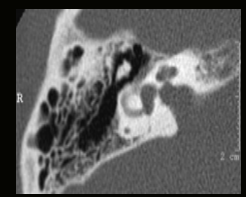
Temporal Bone Anatomy

C. Kirsch M.D.

ckirsch@mednet.ucla.edu

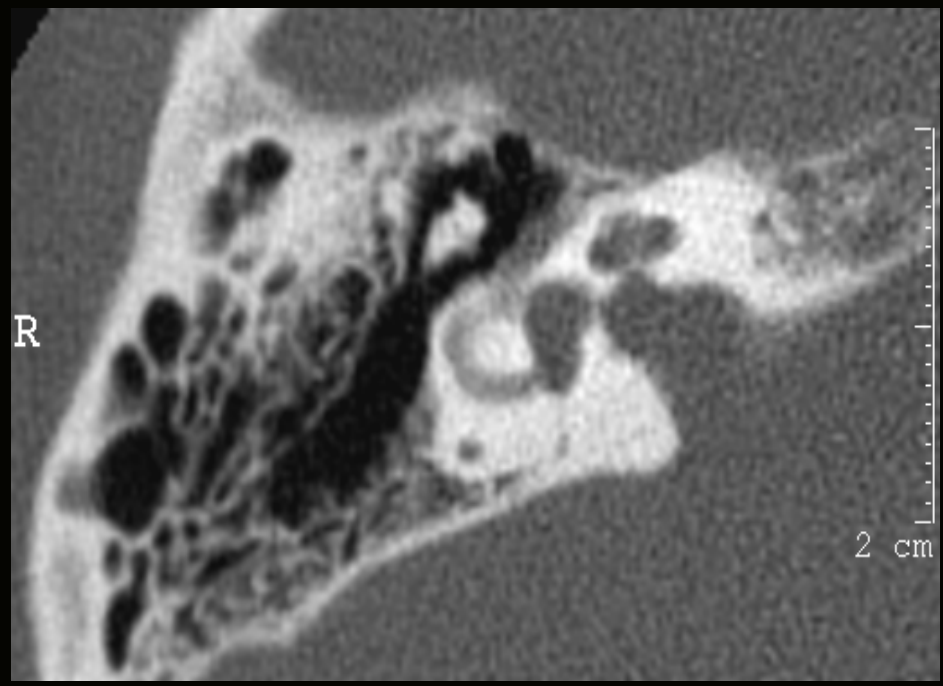
Assistant Professor of Neuroradiology
and Head and Neck Radiology
David Geffen School of Medicine at UCLA



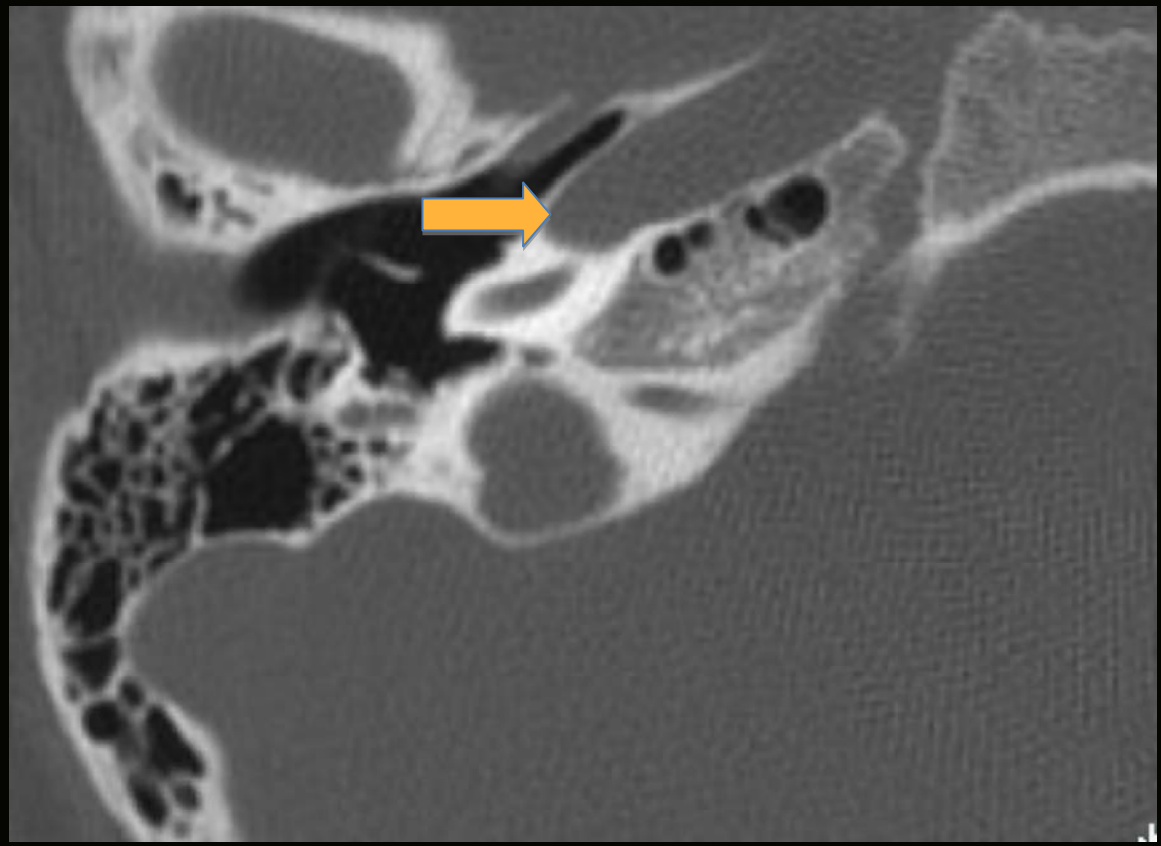


Goals of this lecture

- To review the key anatomy in both the axial and coronal plane
- Test your knowledge of that anatomy
- The importance and revelance of the structure identified!



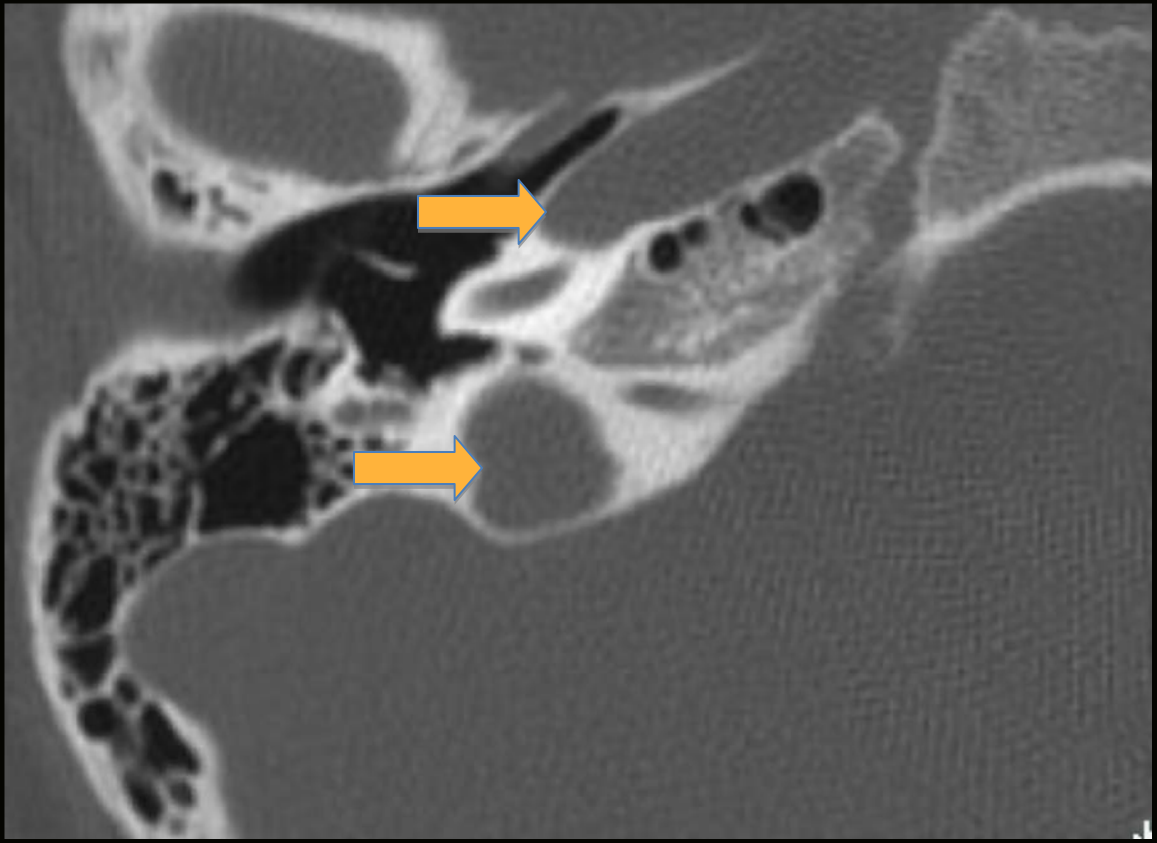
Axial CT Scan – Right side Key structures



□□□□□

- Internal carotid artery

Axial CT Scan – Right side

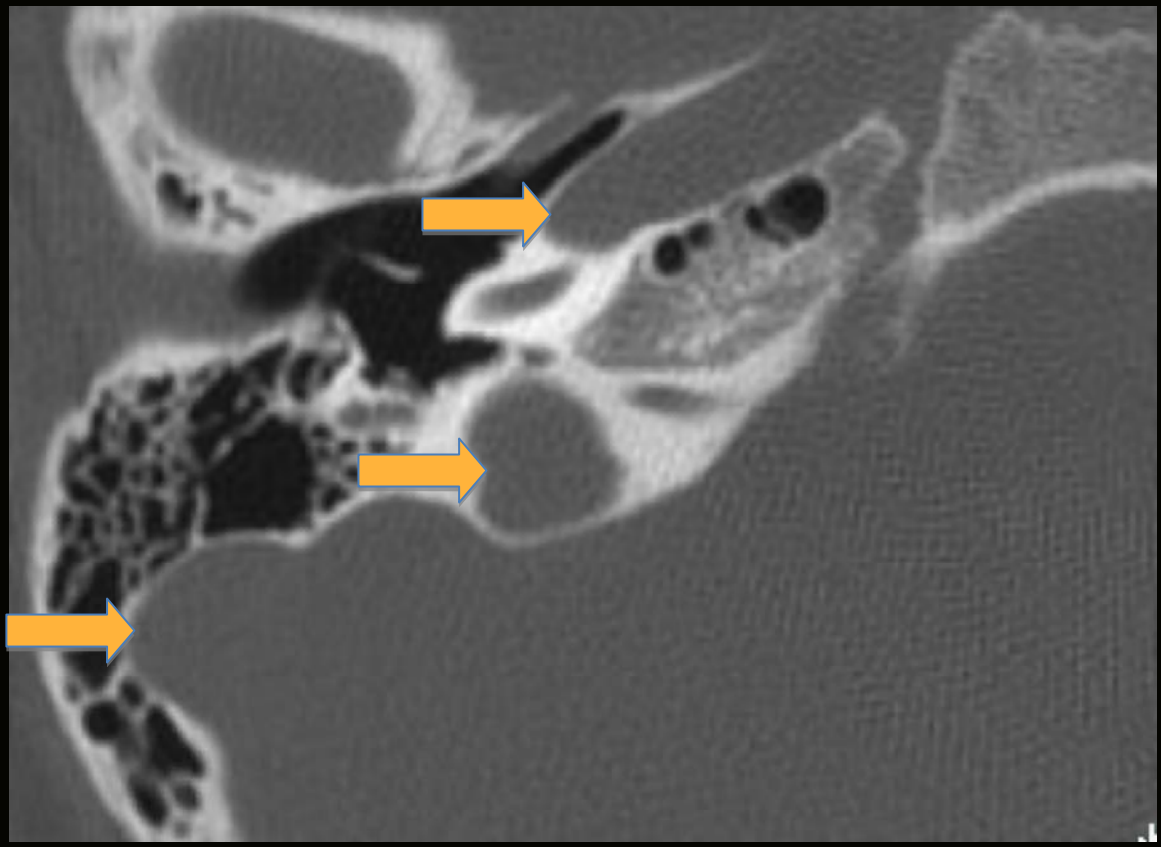


□□□□□

□□□□□

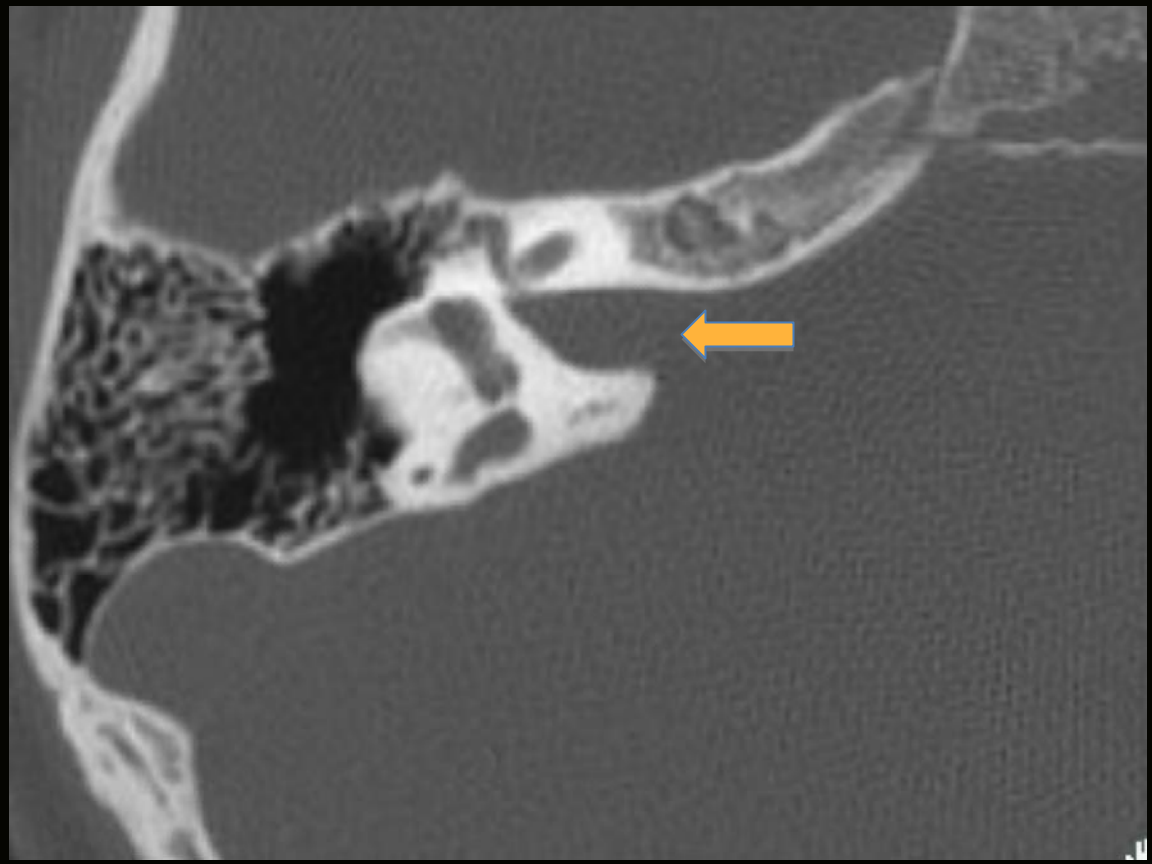
- Internal carotid artery
- Internal jugular vein

Axial CT Scan – Right side



- Internal carotid artery
- Internal jugular vein
- Sigmoid sinus

Axial CT Scan – Right side



BB = Bill's bar

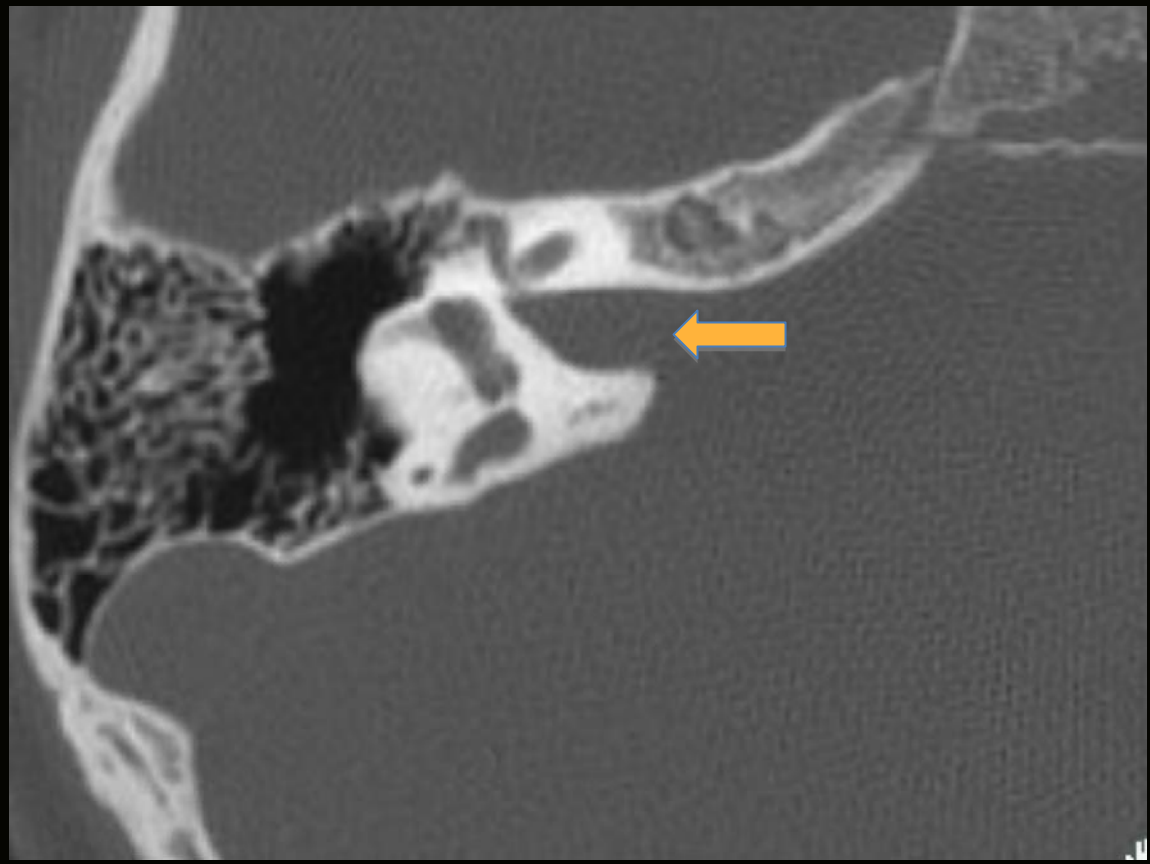
TC- Falciform or transverse crest

Think - Seven up

Coke down

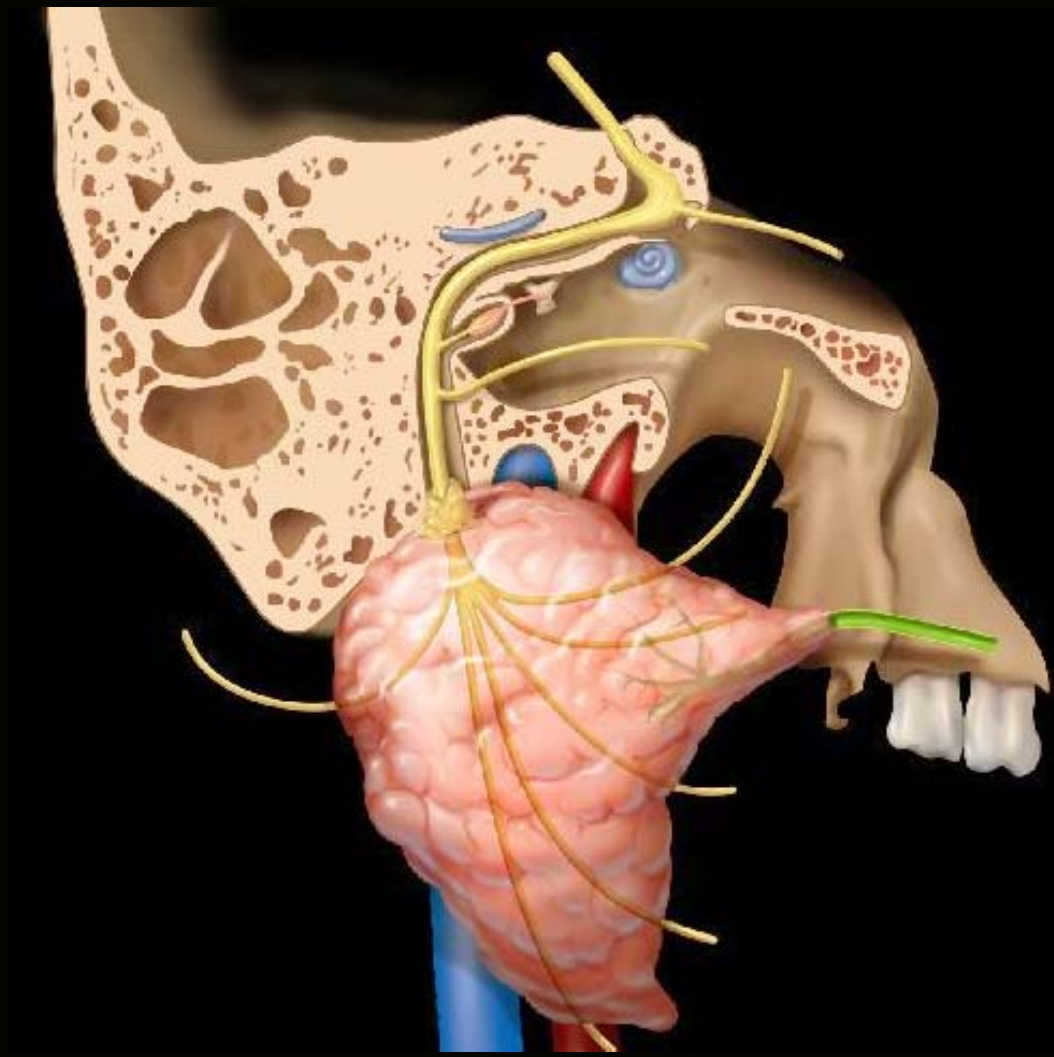
Internal auditory canal contains the intracanicular segment of the facial nerve (VII) and the vestibulocochlear nerve (VIII)

Axial CT Scan – Right side



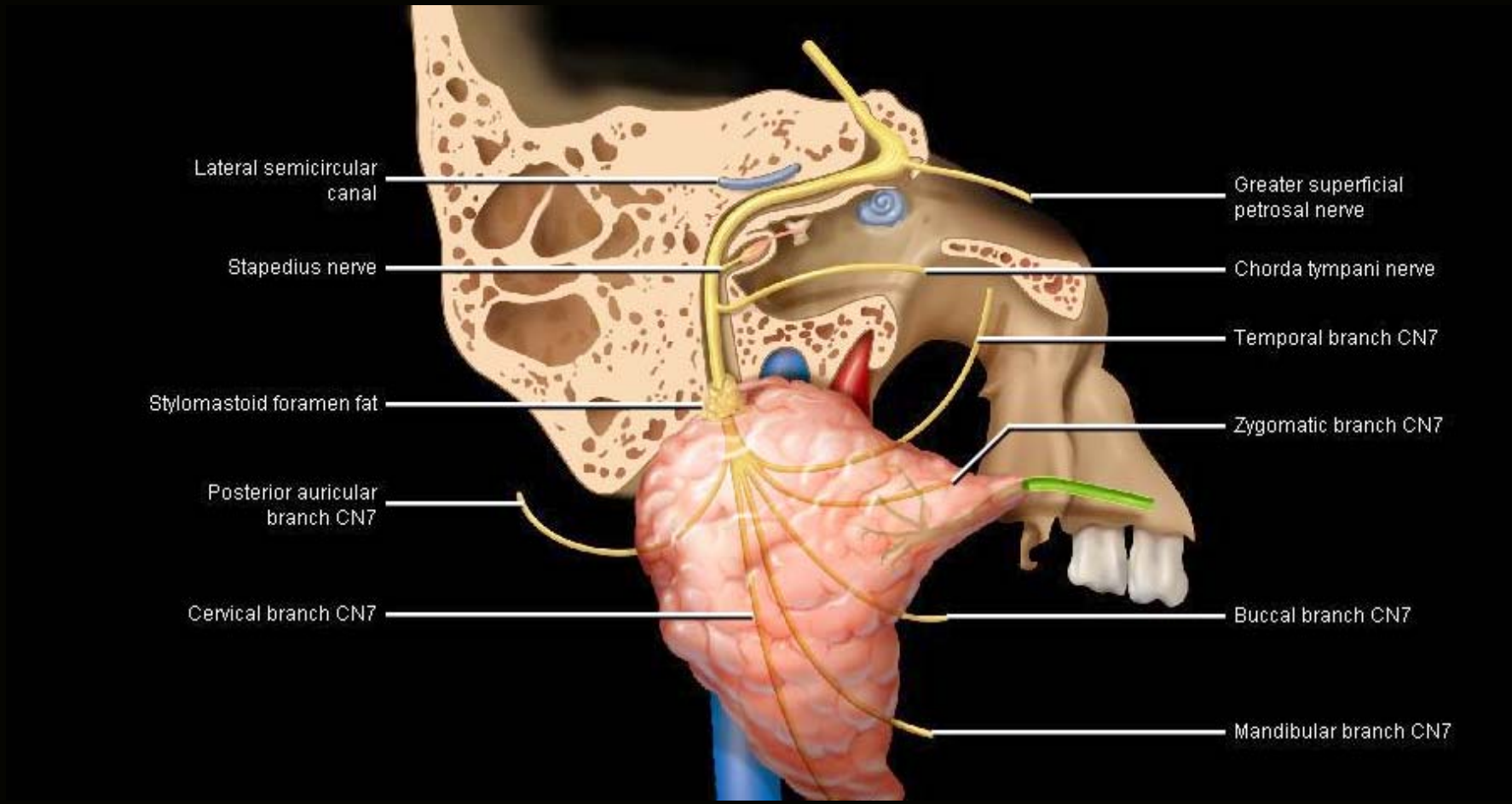
Going to follow the course of the facial nerve!
First portion - fundus of the IAC

Facial Nerve- Key to T-bone!



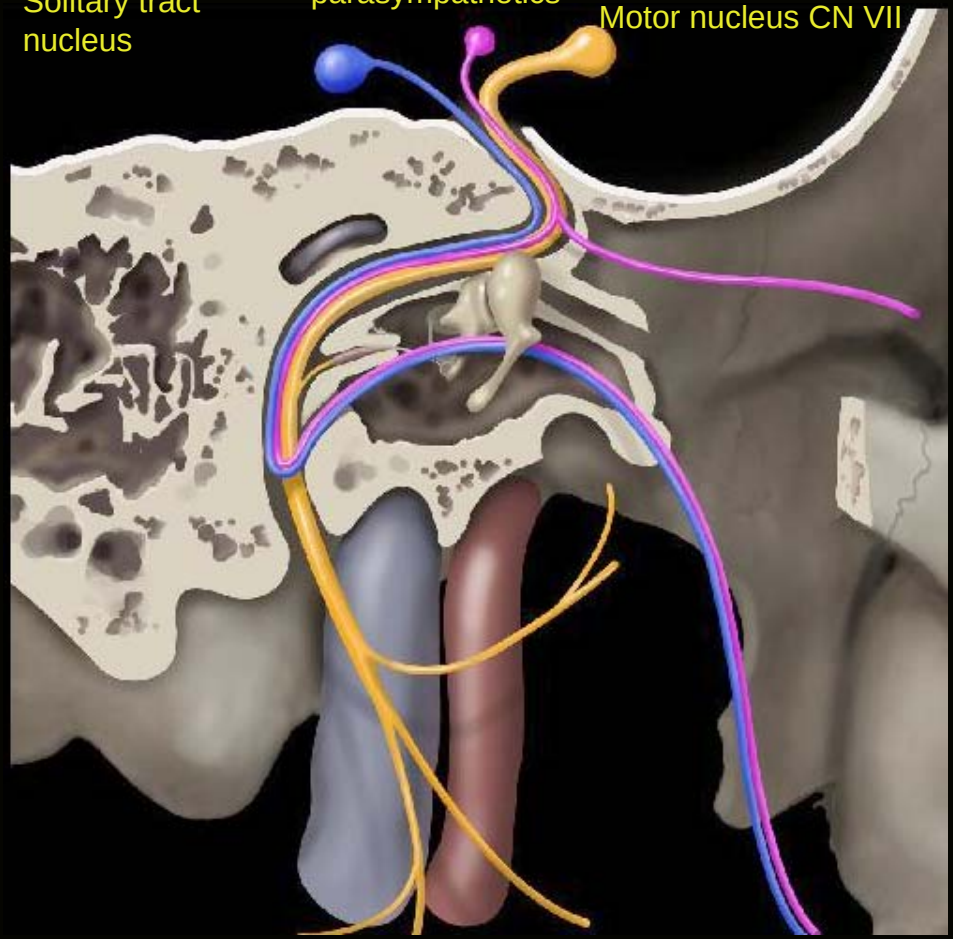
Slides courtesy of Amerisys

Facial Nerve- Key to T-bone!



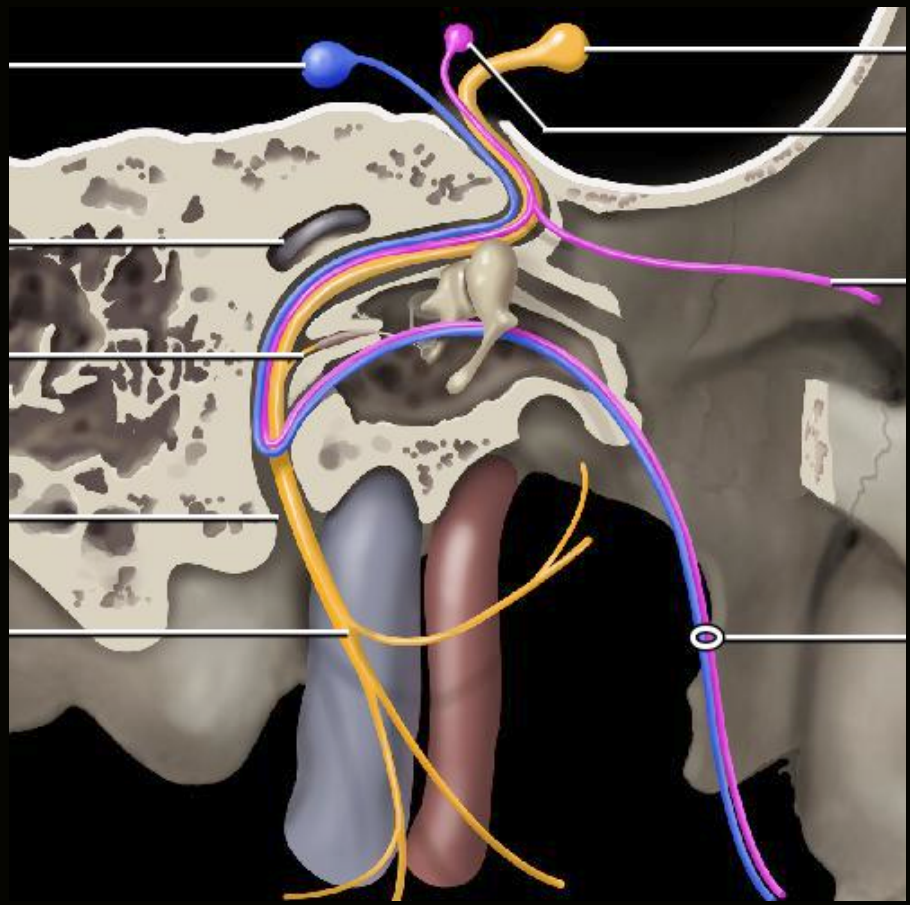
Slides courtesy of Amerisys

Facial Nerve- Key to T-bone!



Slides courtesy of Amerisys

Facial Nerve- Key to T-bone!



Slides courtesy of Amerisys

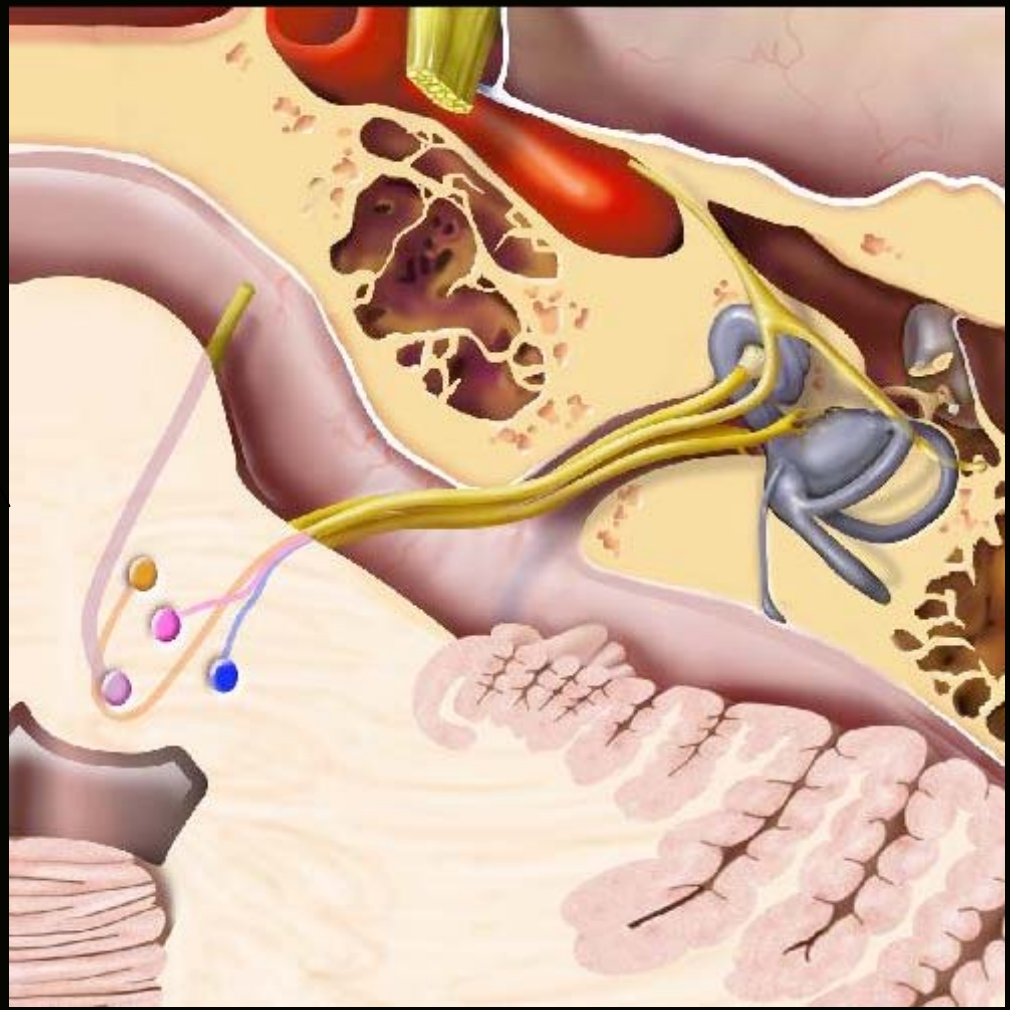
Facial Nerve- Key components

CN 6 nucleus & cisternal segment

Superior salvitory nucleus - parasympathetic to lacrimal, SMG, SLG

Solitary tract nucleus - ant 2/3 tongue

Motor nucleus & facial colliculus CN 7



GSPN

Geniculate ganglion

Labyrinthine segment CN 7

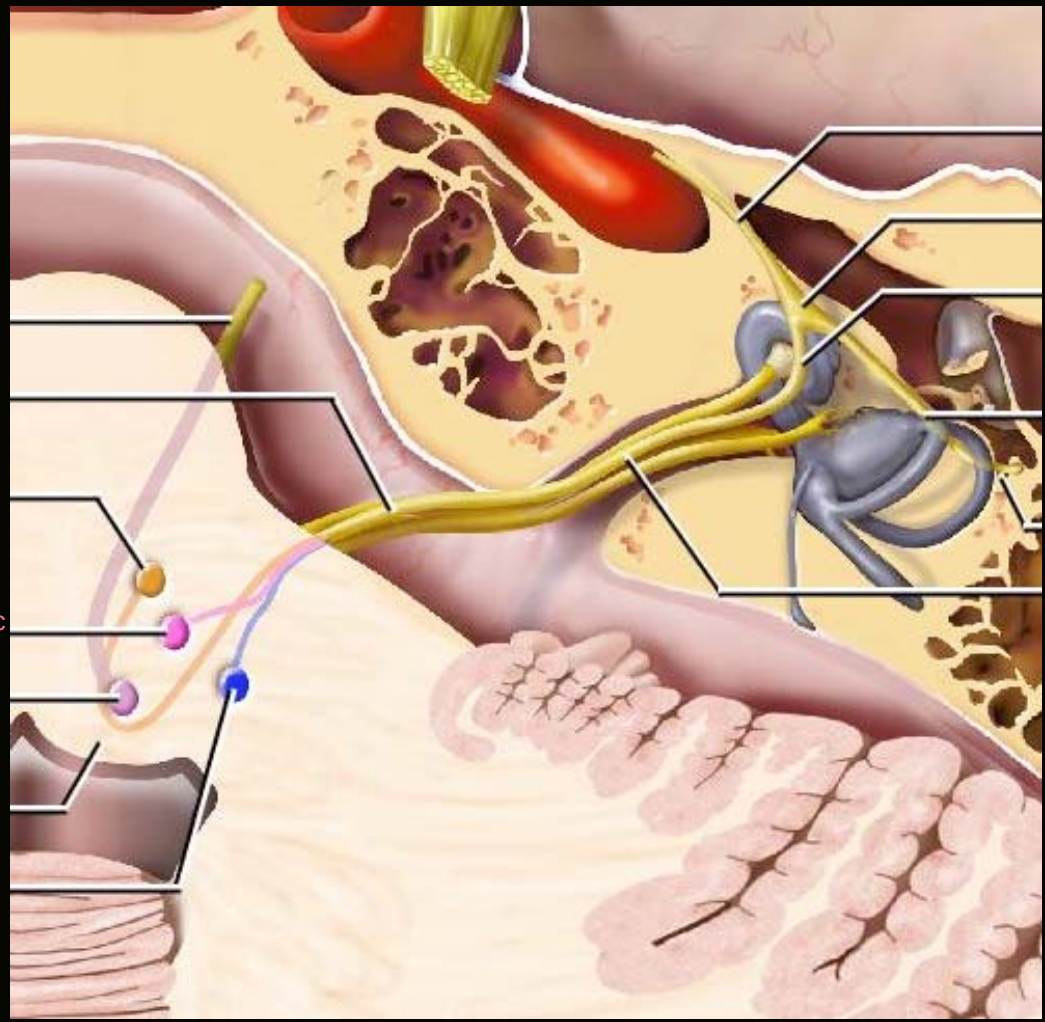
Tympanic segment CN 7

Posterior genu CN 7

IAC

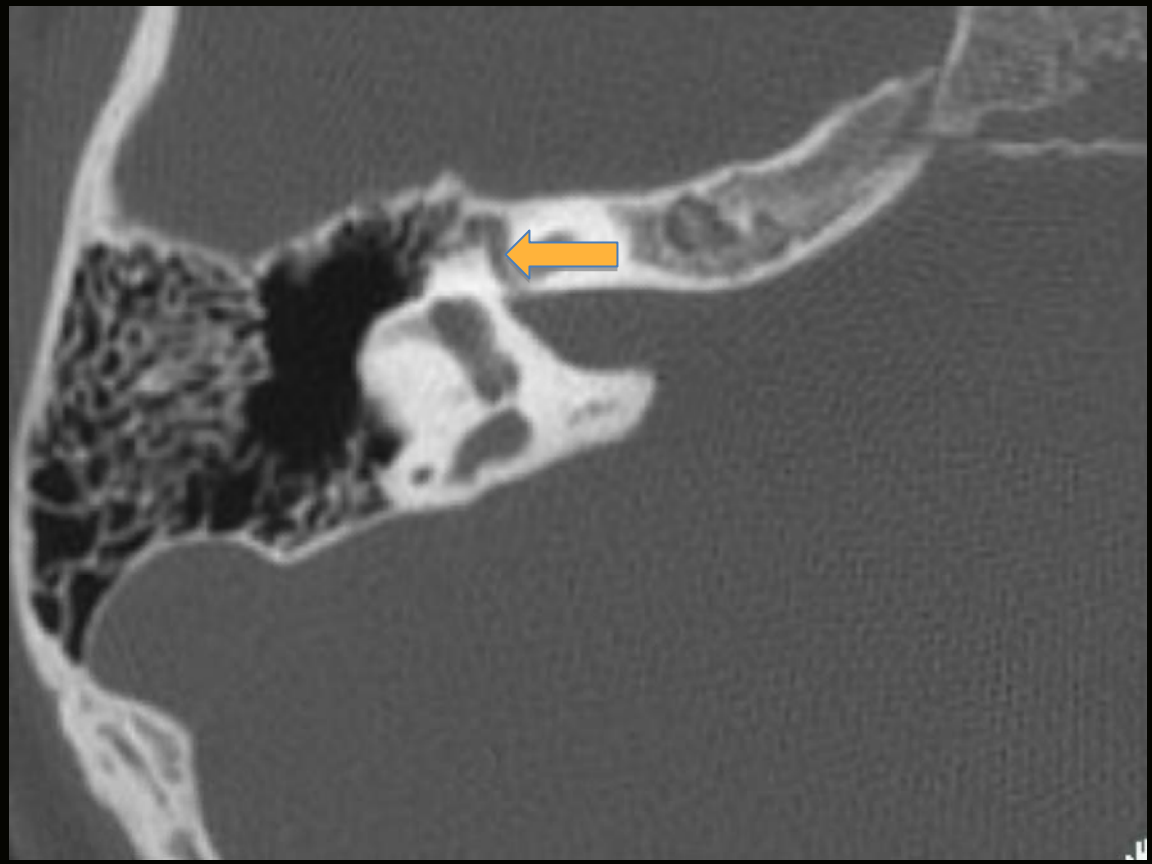
Slides courtesy of Amerisys

Facial Nerve- Key to T-bone!



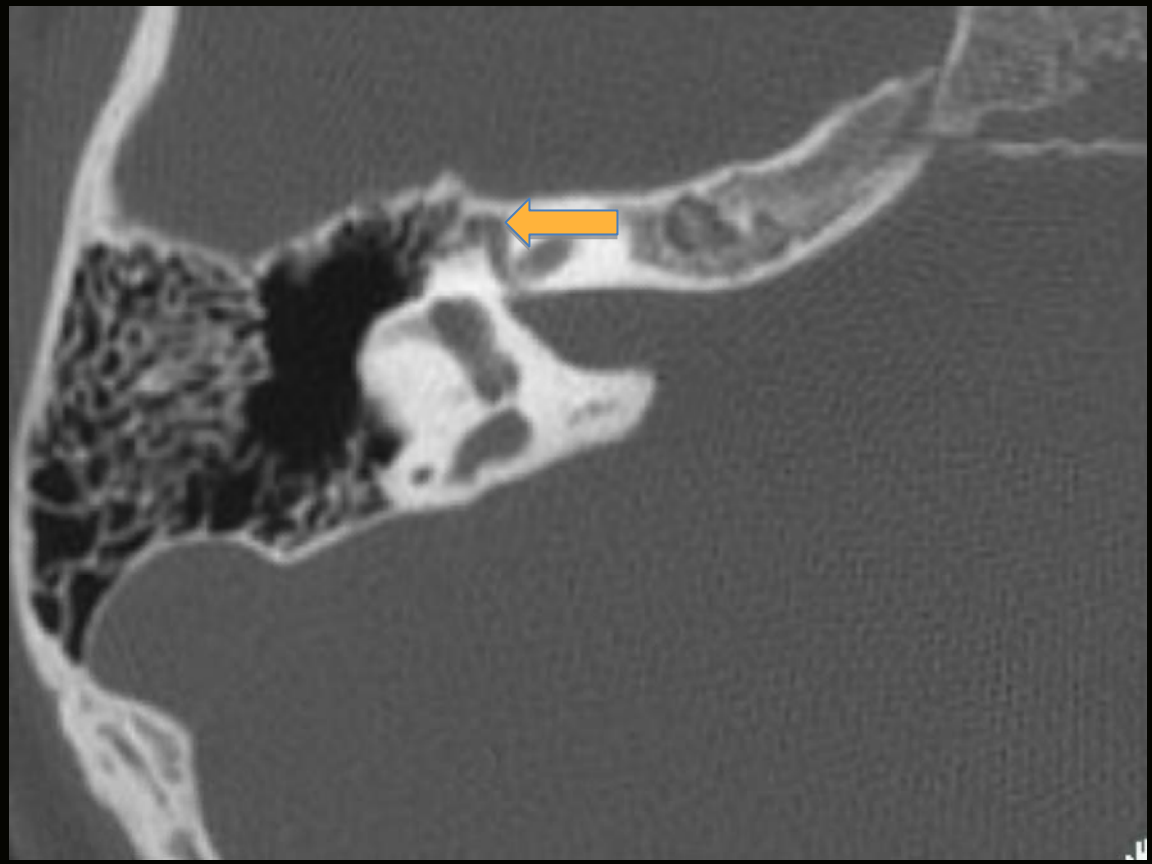
Slides courtesy of Amerisys

Axial CT Scan – Right side



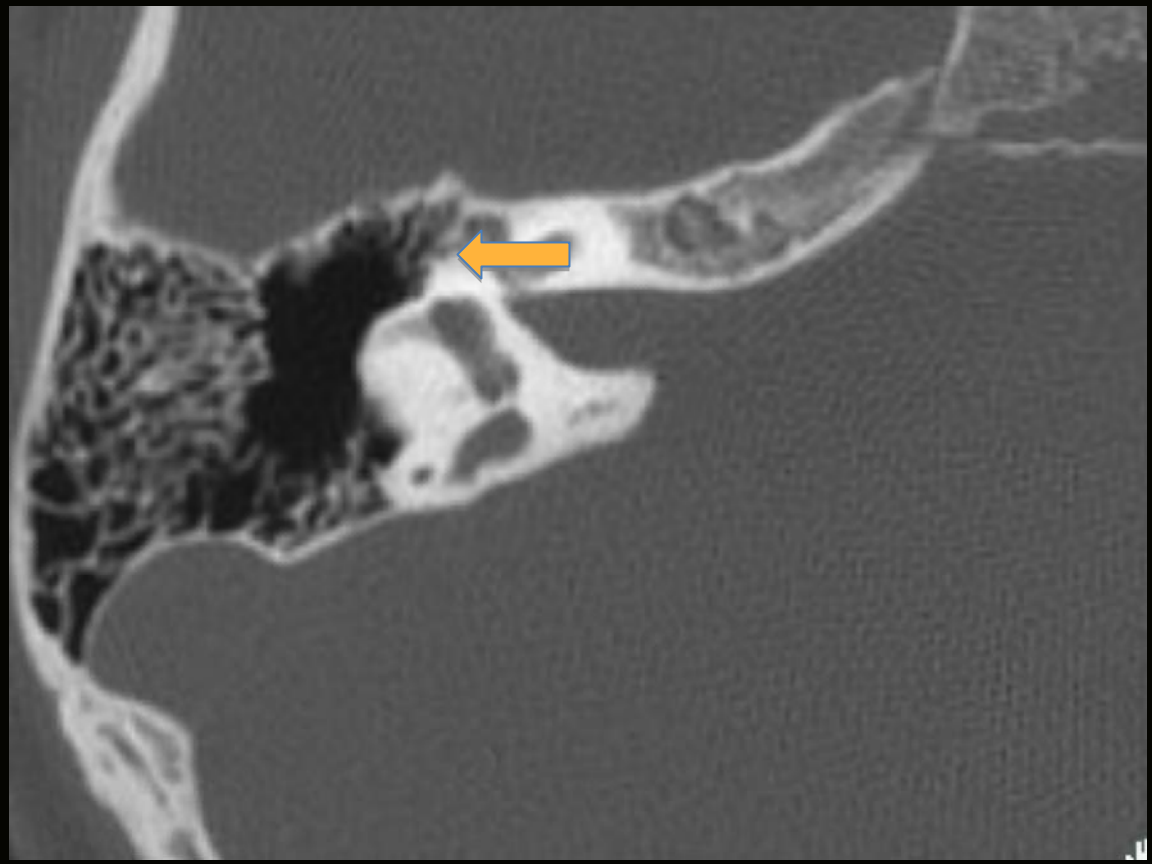
Labyrinthine (fallopian segment) of the facial nerve

Axial CT Scan – Right side



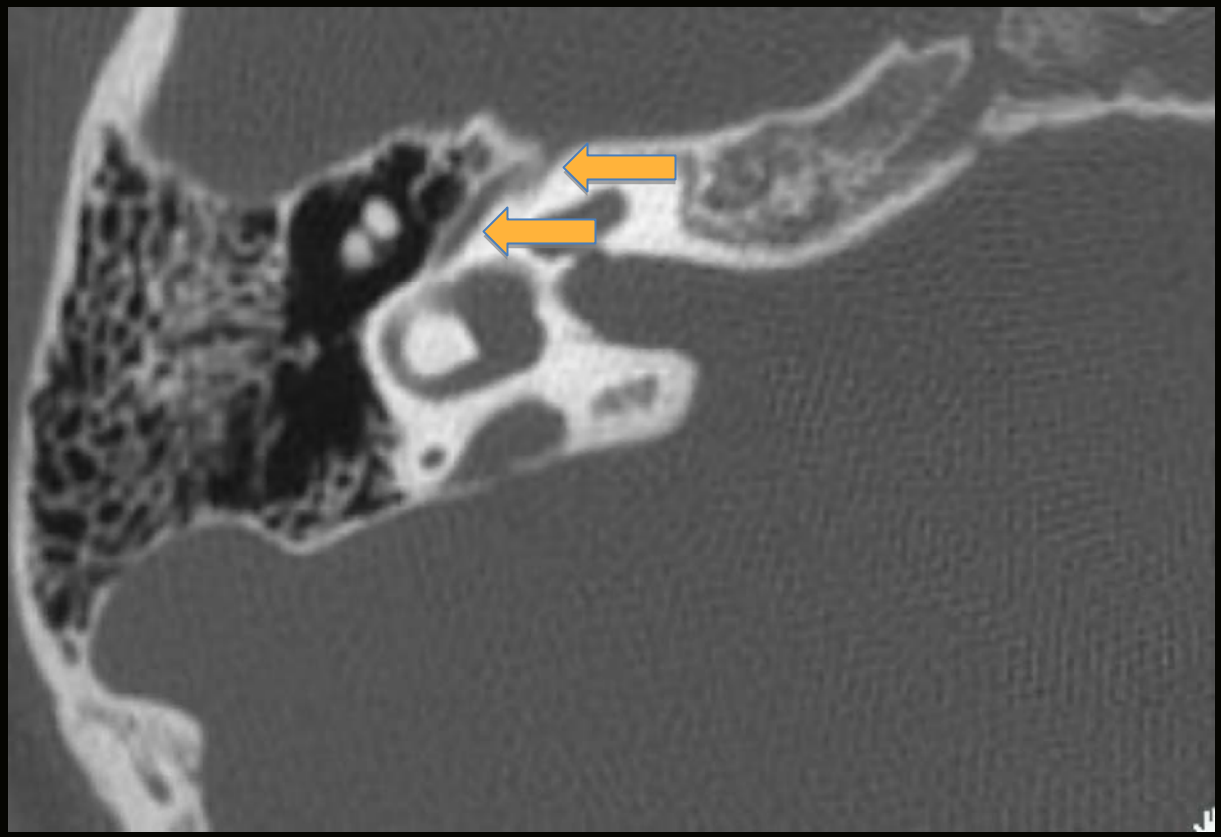
Anterior genu containing the geniculate ganglion of the facial nerve

Axial CT Scan – Right side



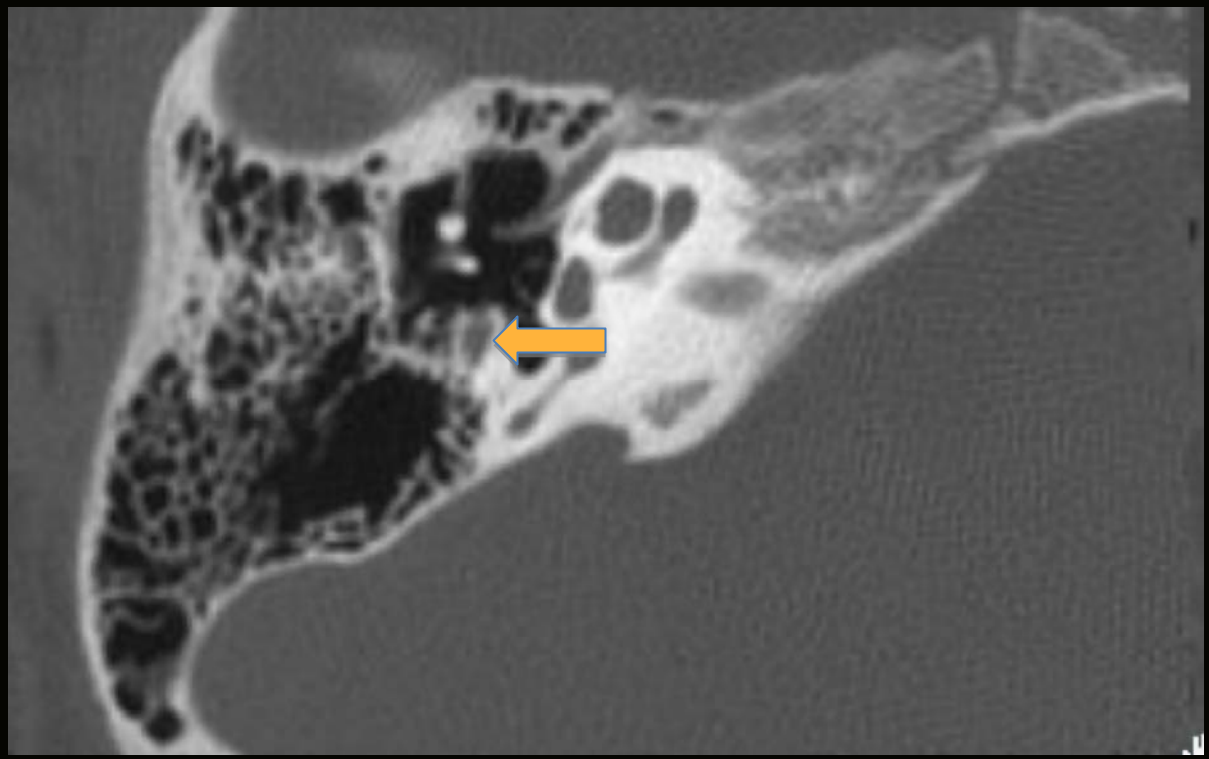
Tympanic (horizontal) segment of the facial nerve

Axial CT Scan – Right side



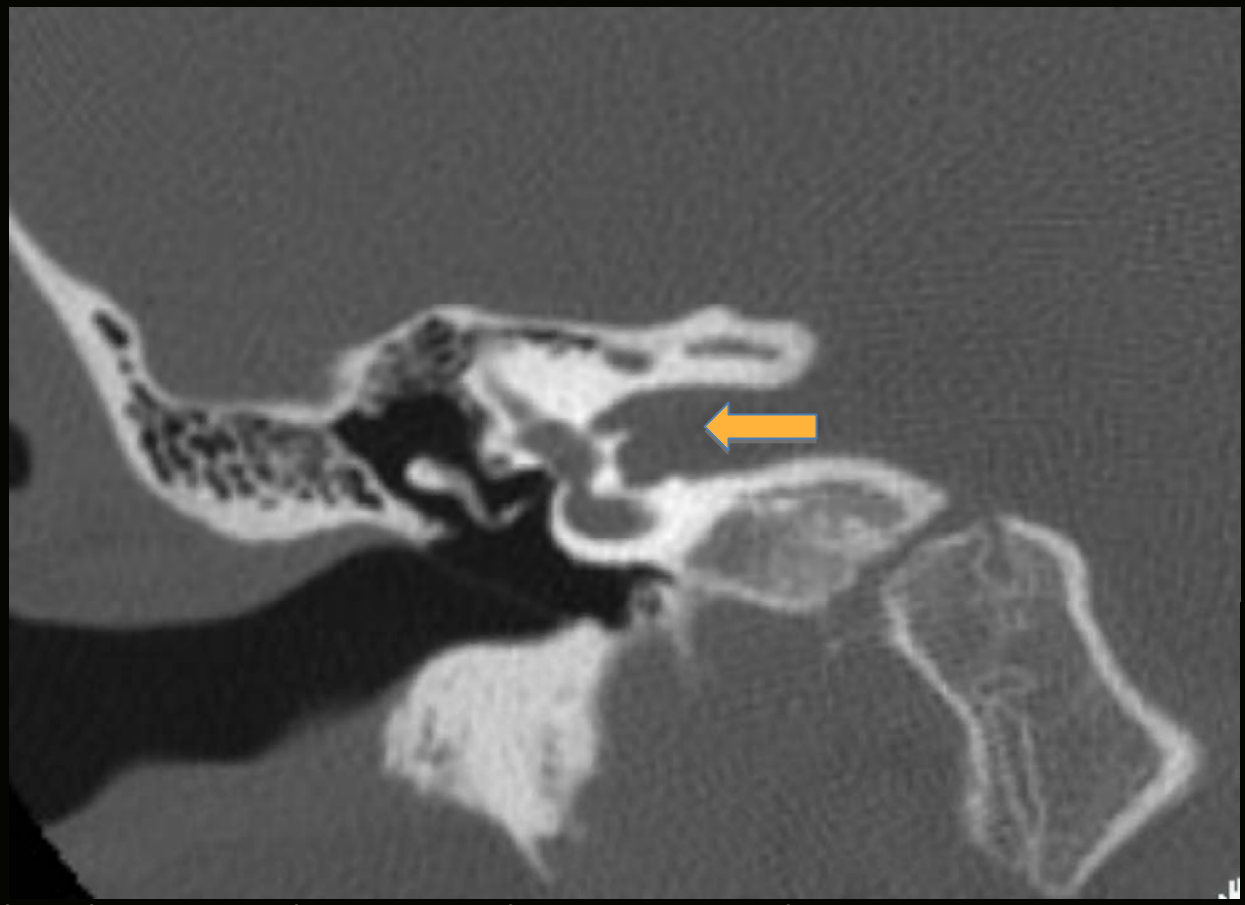
- Tympanic (horizontal) segment of the facial nerve
- GSPN - arising from the anterior genu

Axial CT Scan – Right side



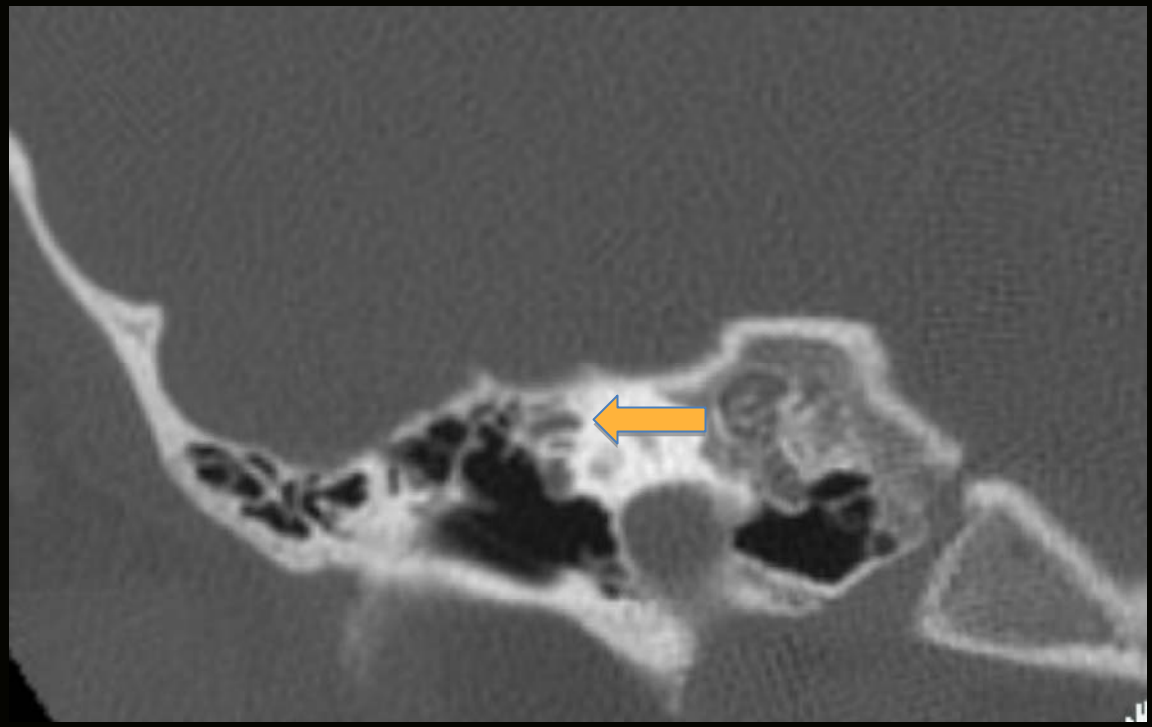
Descending portion of facial nerve
In the stylomastoid foramen

Coronal CT Scan – Right side



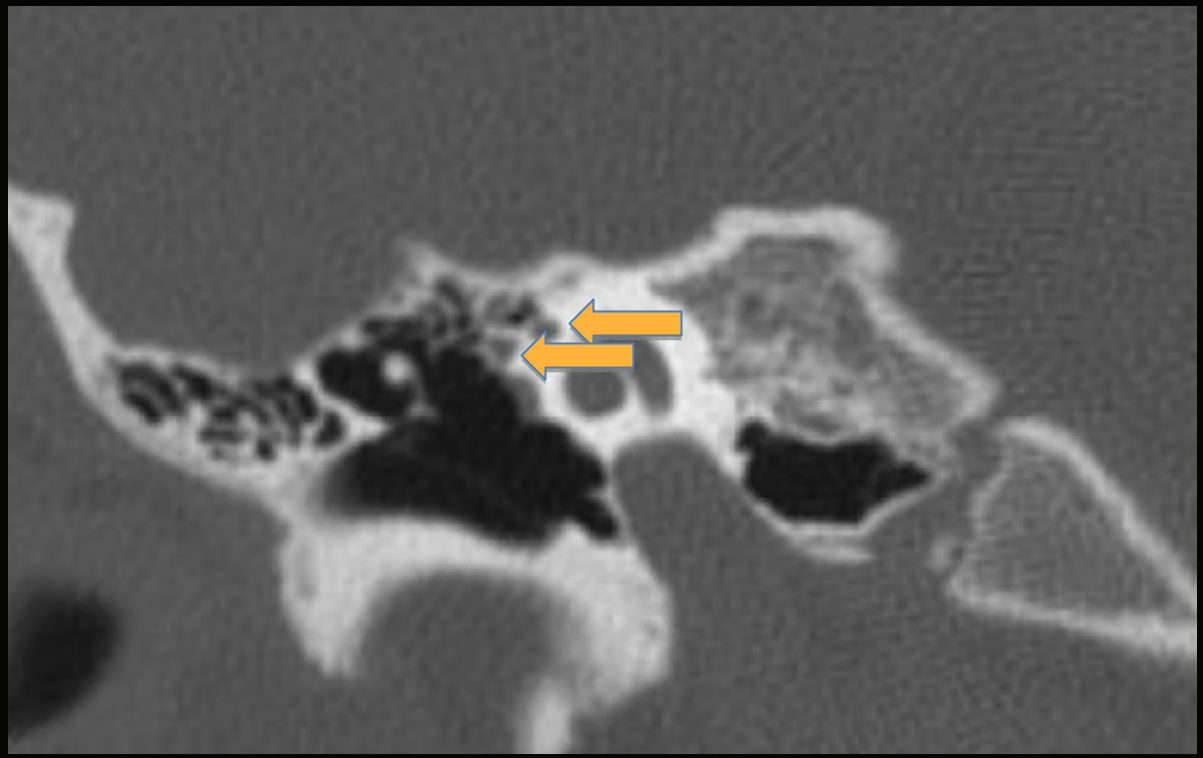
Internal auditory canal contains the intracanicular segment of the facial nerve (VII) and the vestibulocochlear nerve (VIII) separated by the bony crista falciformis

Coronal CT Scan – Right side



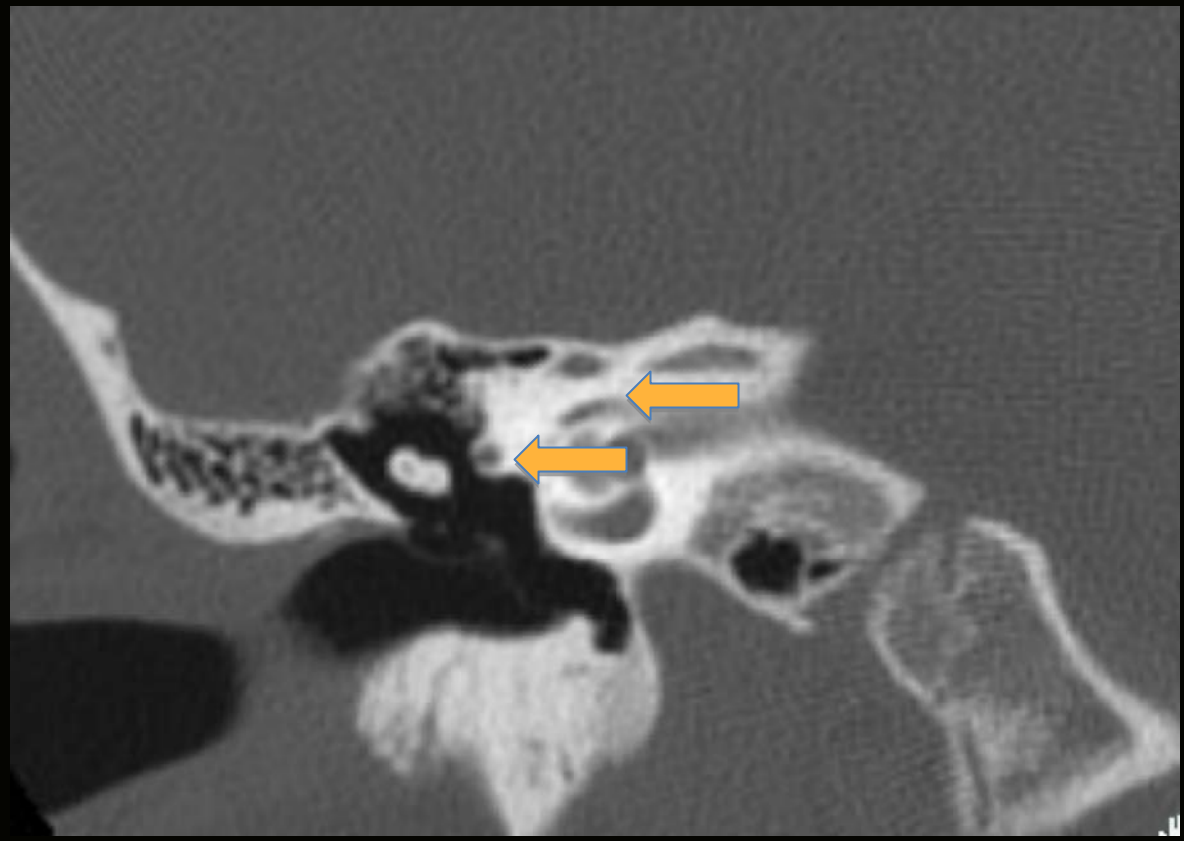
- Anterior genu, contains the geniculate ganglion of the facial nerve (VII)

Coronal CT Scan – Right side



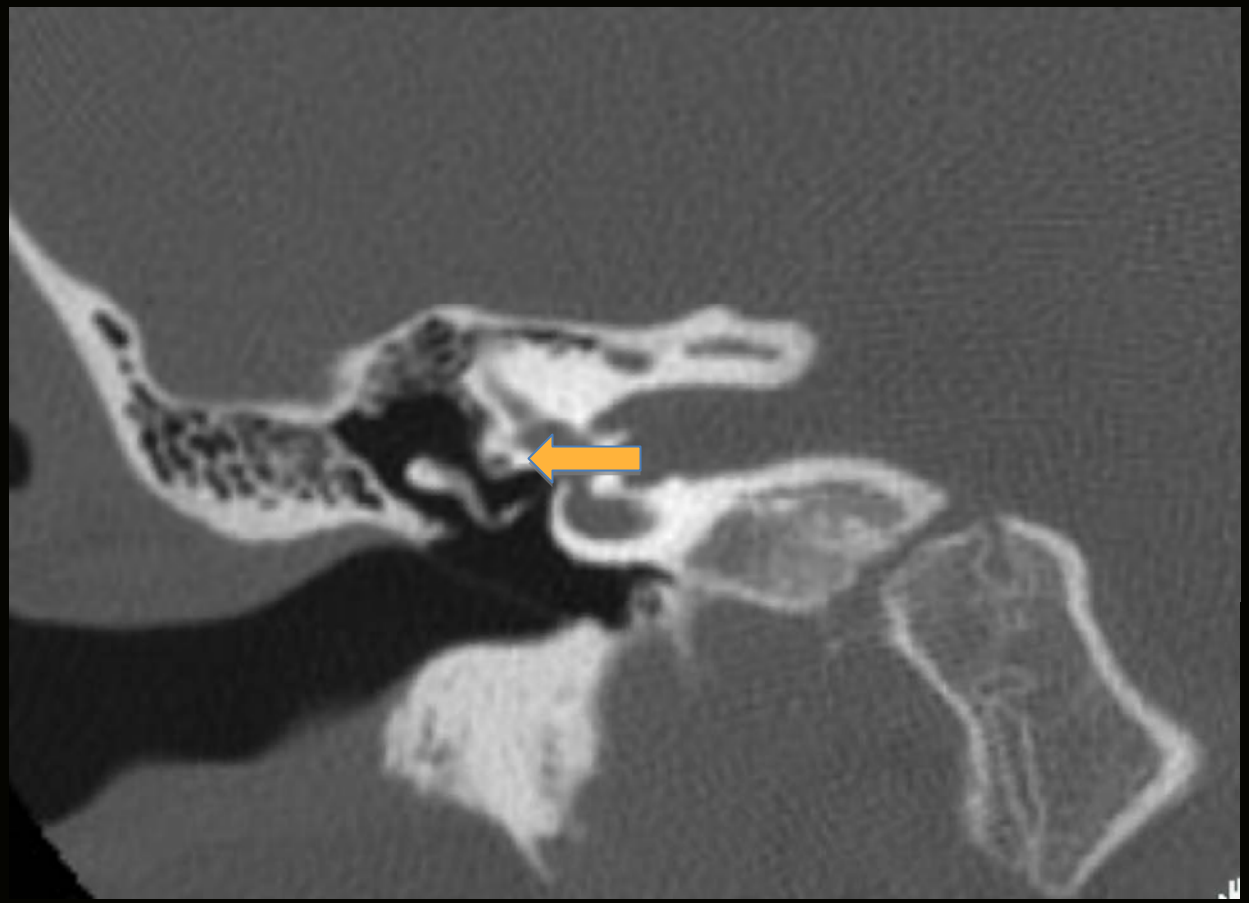
- Labryinthine (fallopian) segment of the facial nerve (VII)
- Tympanic (horizontal segment of the facial nerve

Coronal CT Scan – Right side



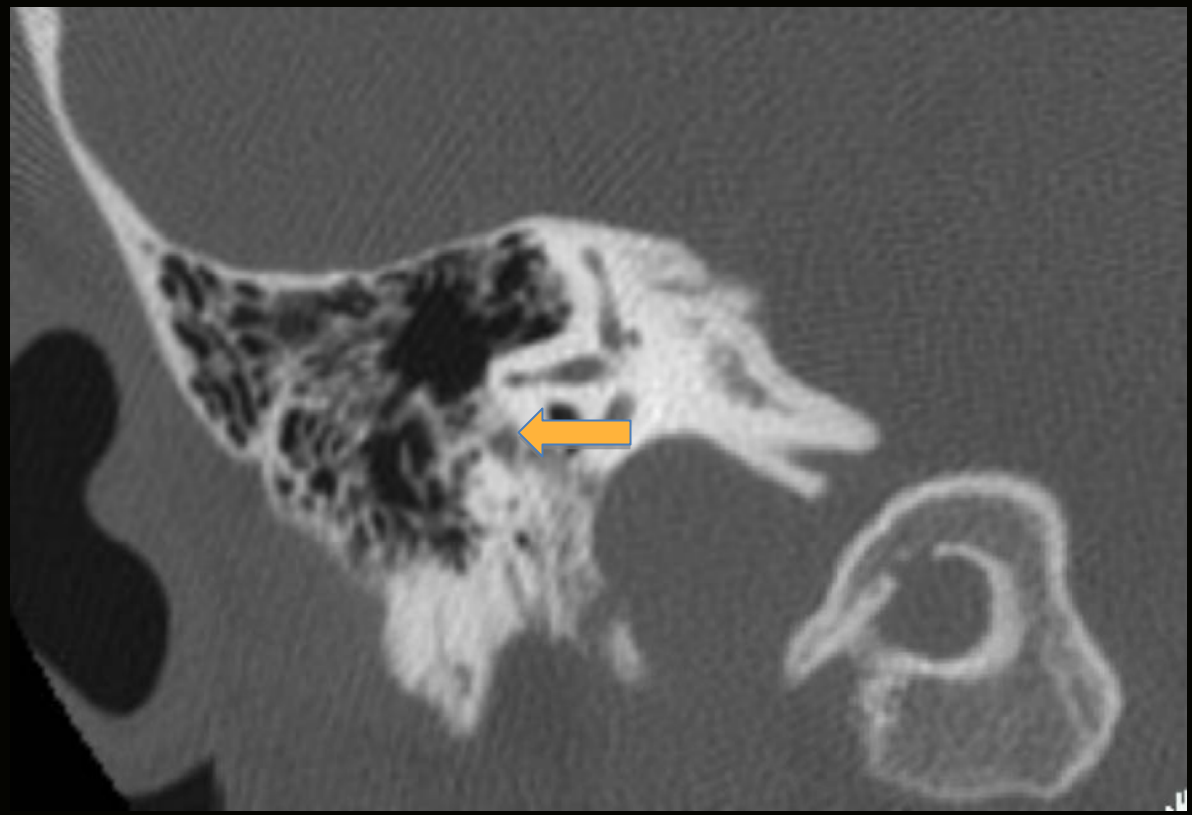
- Labryinthine (fallopian) segment of the facial nerve (VII)
- Tympanic (horizontal segment of the facial nerve

Coronal CT Scan – Right side



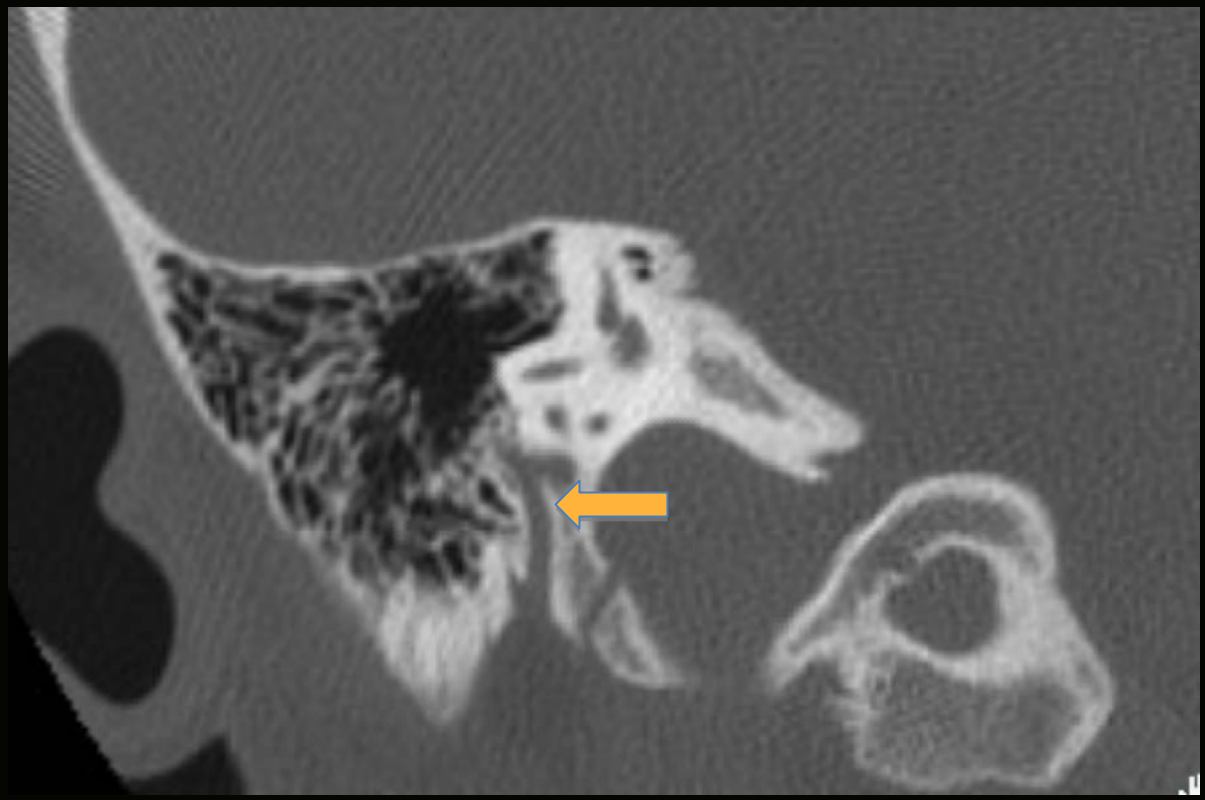
Tympanic (horizontal) segment of the facial nerve (VII) (steering wheel!)

Coronal CT Scan – Right side



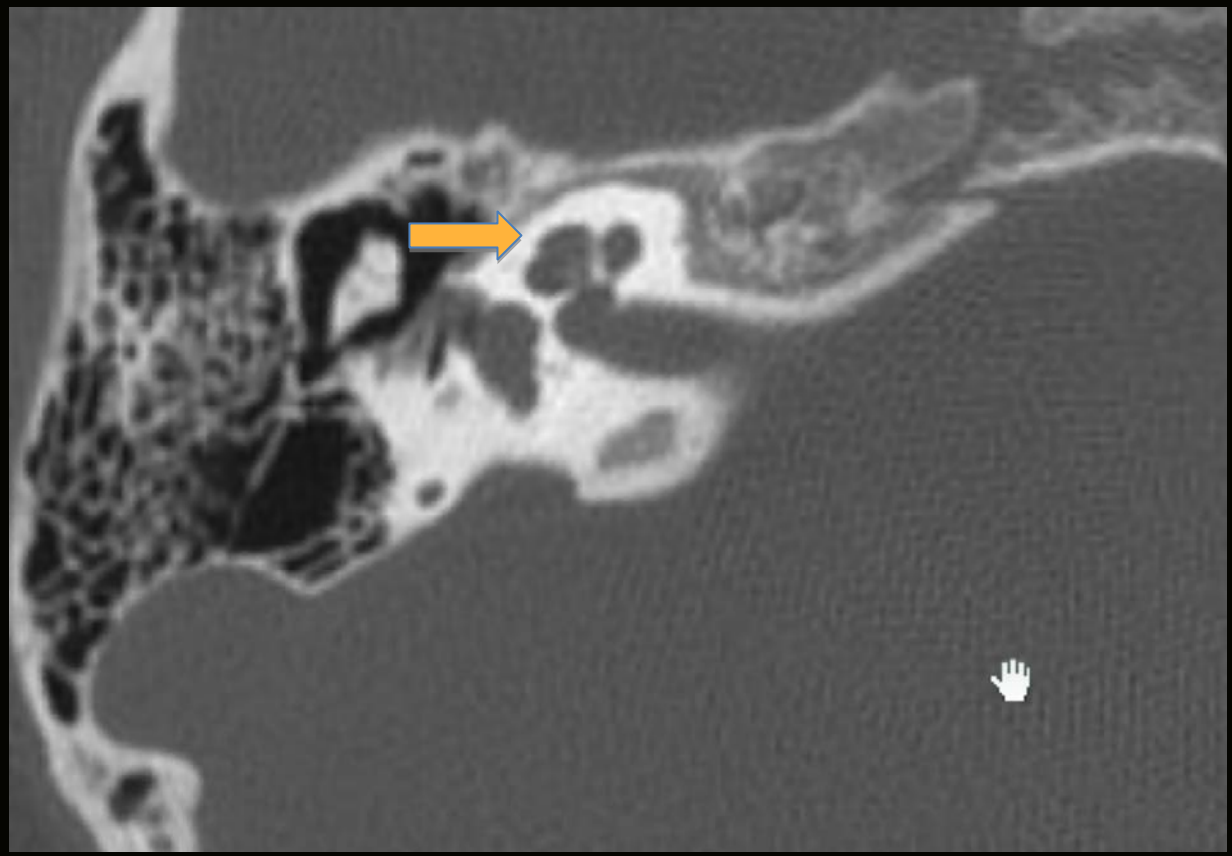
Posterior genu of facial nerve
Separates the descending portion from the horizontal tympanic segment

Coronal CT Scan – Right side



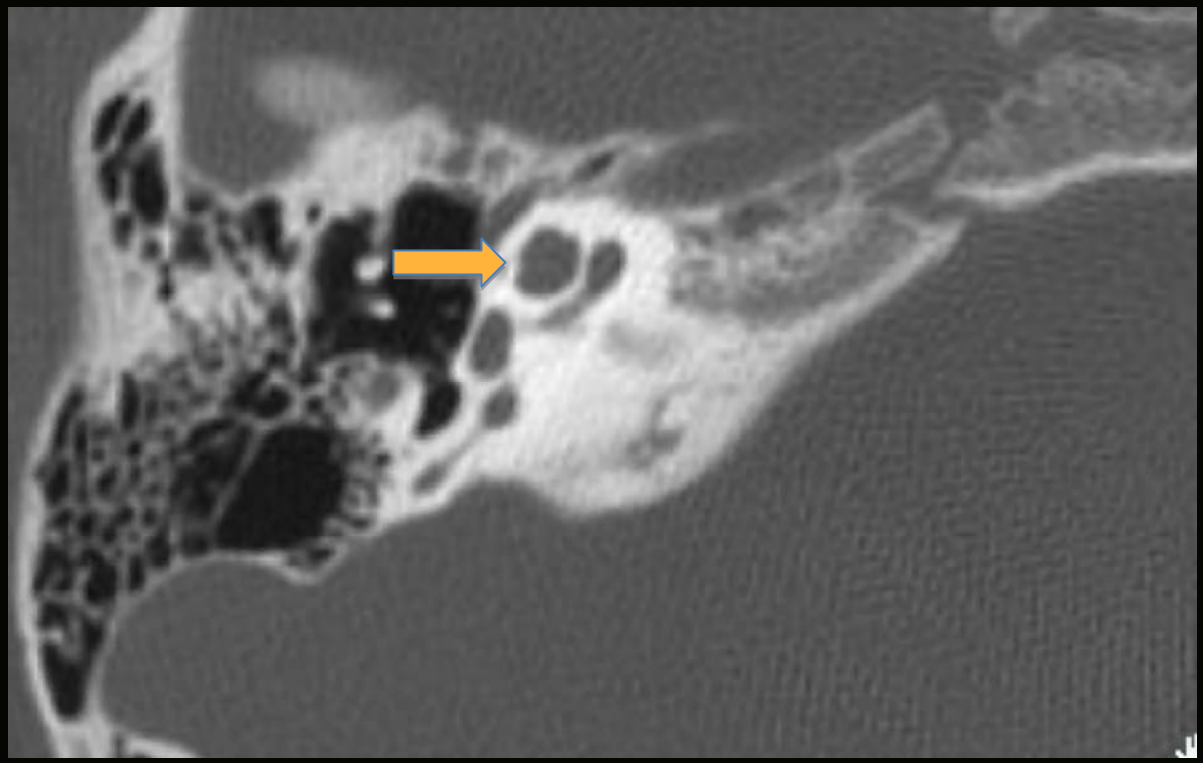
Descending portion of facial nerve
In the stylomastoid foramen

Axial CT Scan – Right side



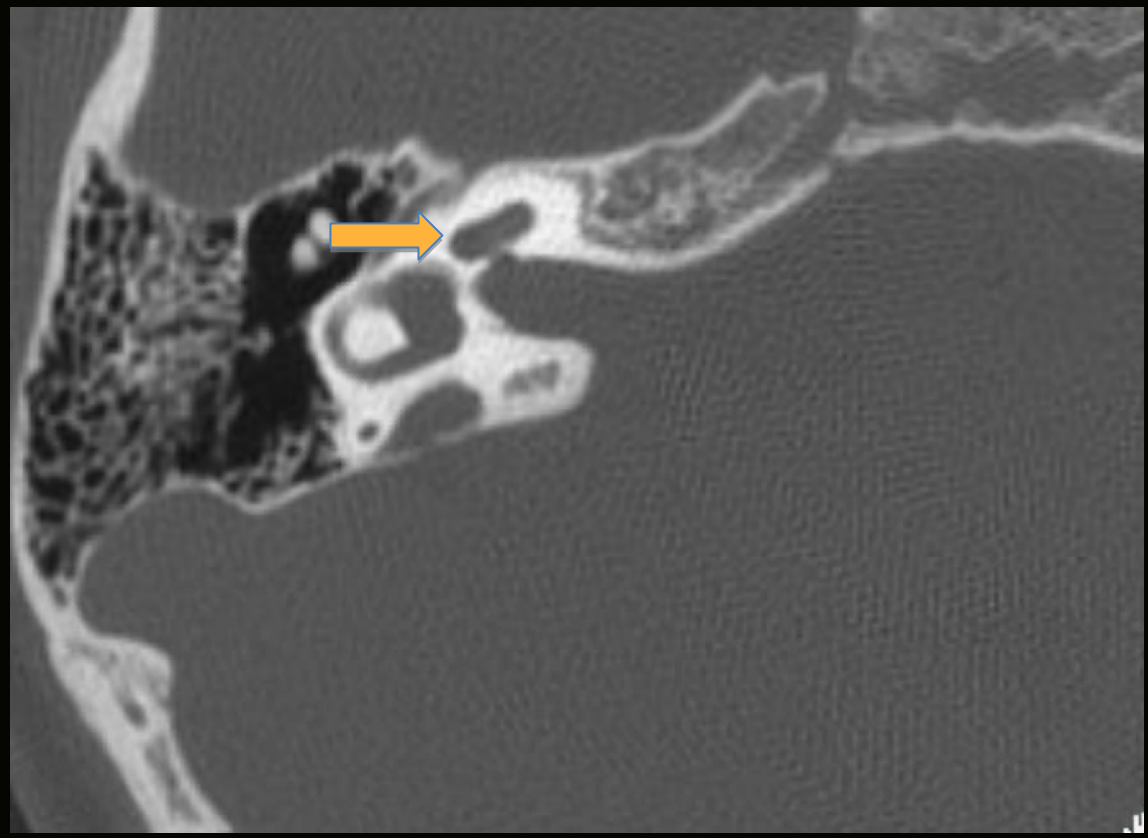
Cochlea - 2.5 turns - apical turn - frequency heard here is ?
The bony structure in the center is called the?

Axial CT Scan – Right side



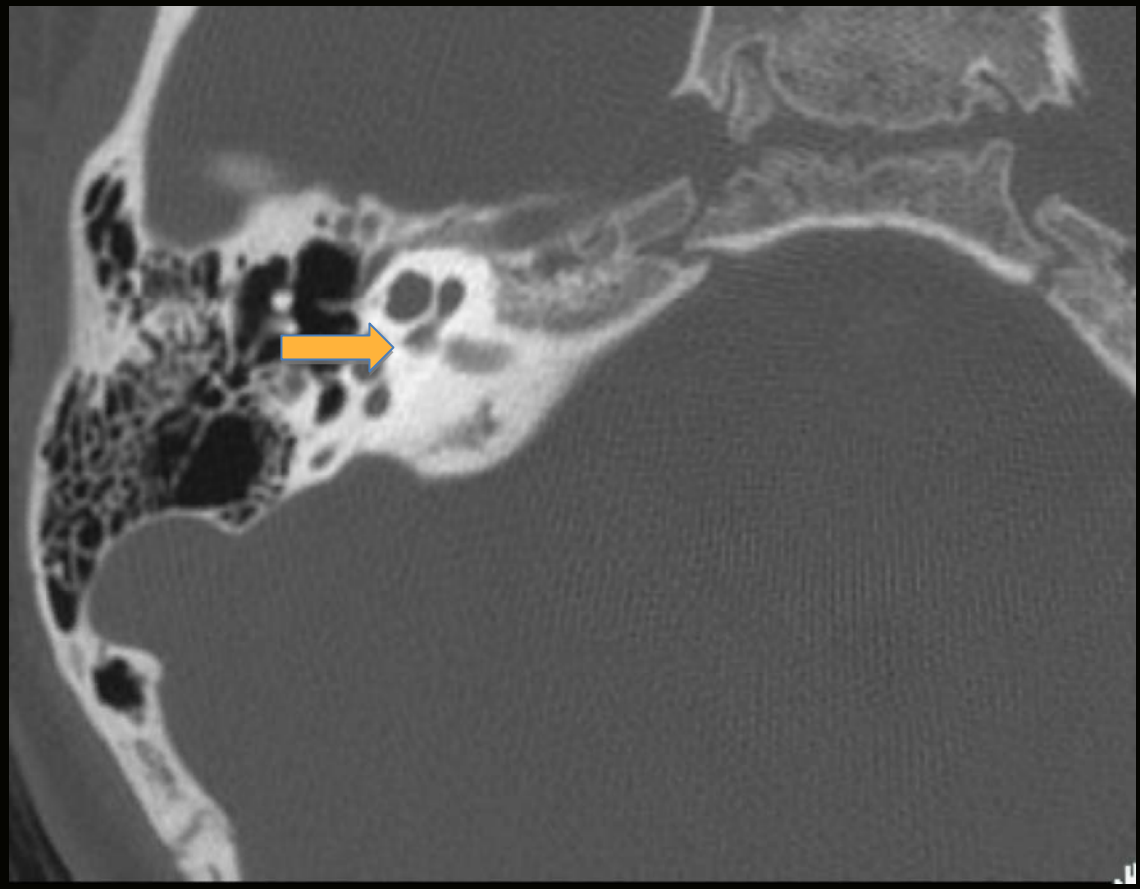
Cochlea - 2.5 turns - apical turn - frequency heard here is low
The bony structure in the center is called the modiolus

Axial CT Scan – Right side



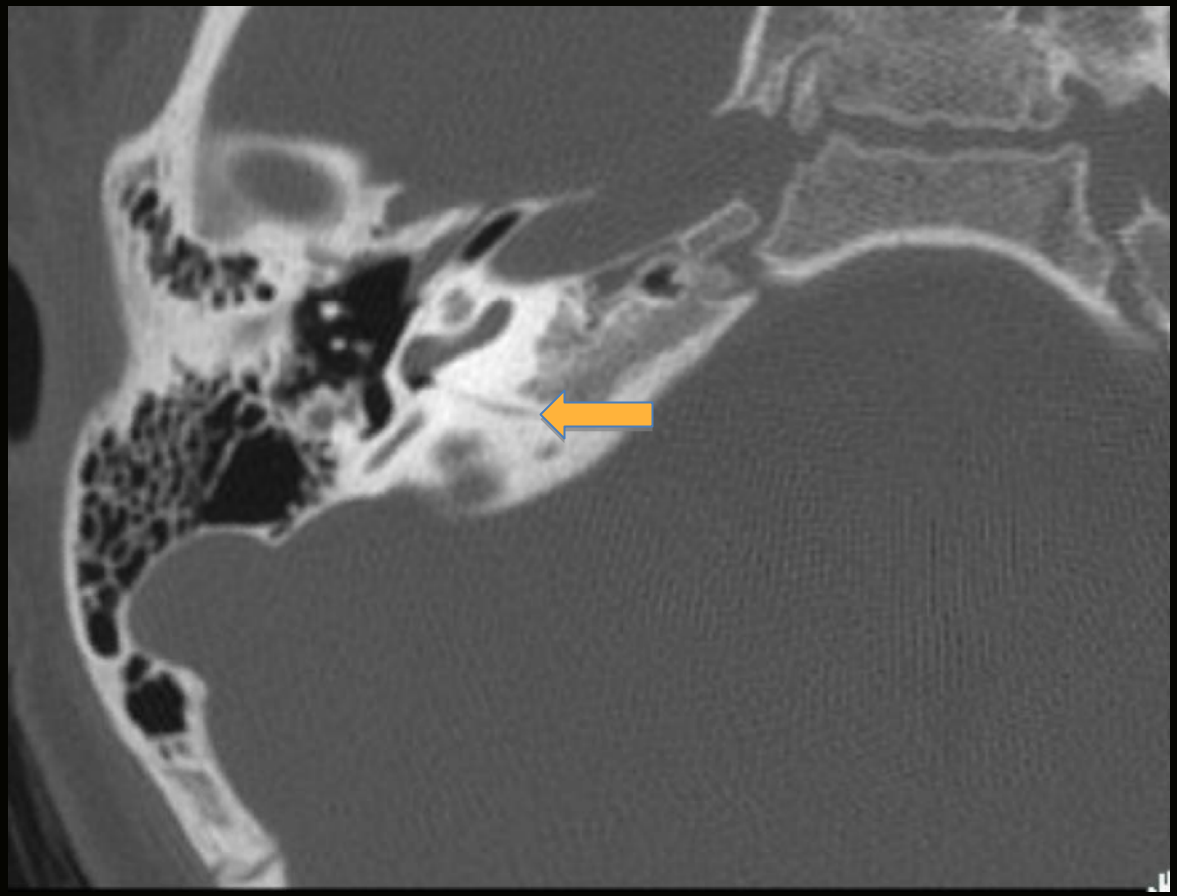
Cochlea - 2.5 turns - basal portion - frequency heard here is ?

Axial CT Scan – Right side



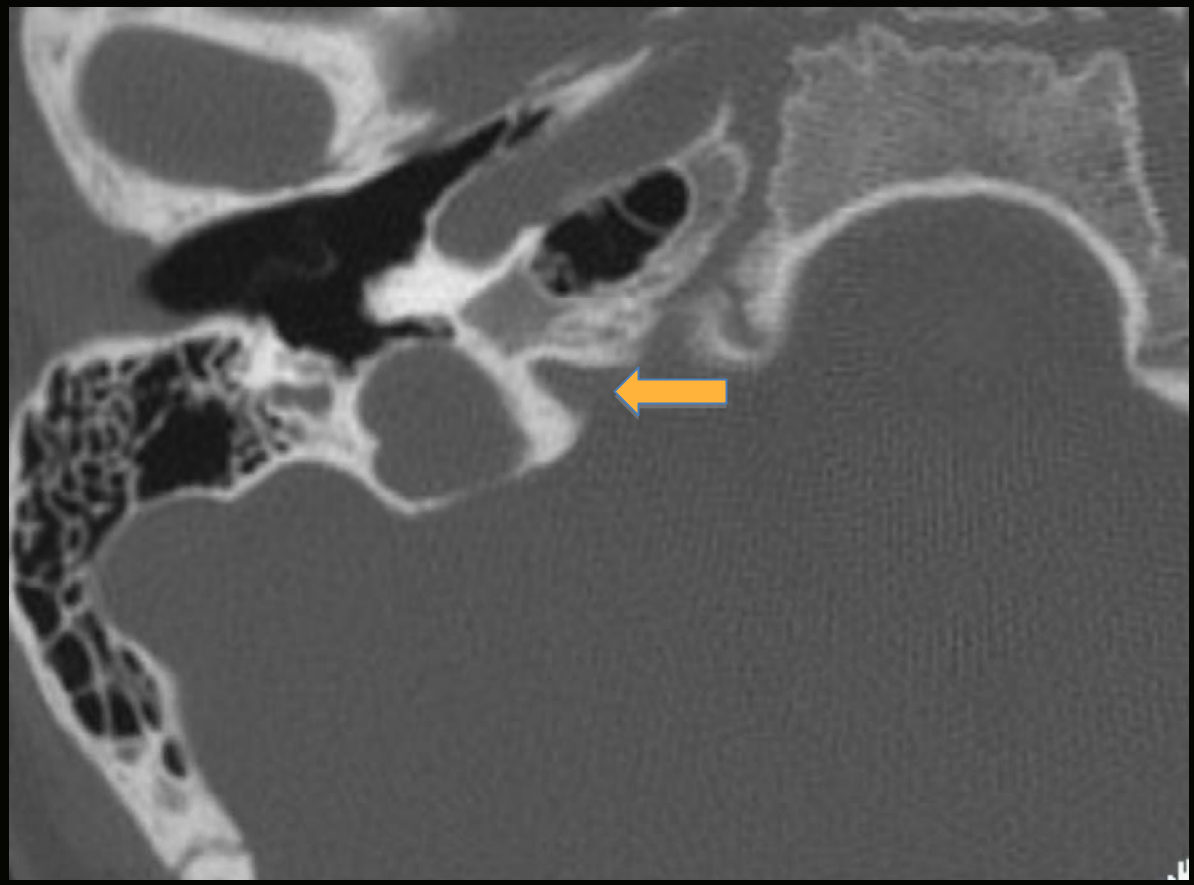
Cochlea - 2.5 turns - basal portion - frequency heard here is high

Axial CT Scan – Right side



Cochlear aqueduct - containing perilymph that is in communication with the basal turn of the cochlea

Axial CT Scan – Right side

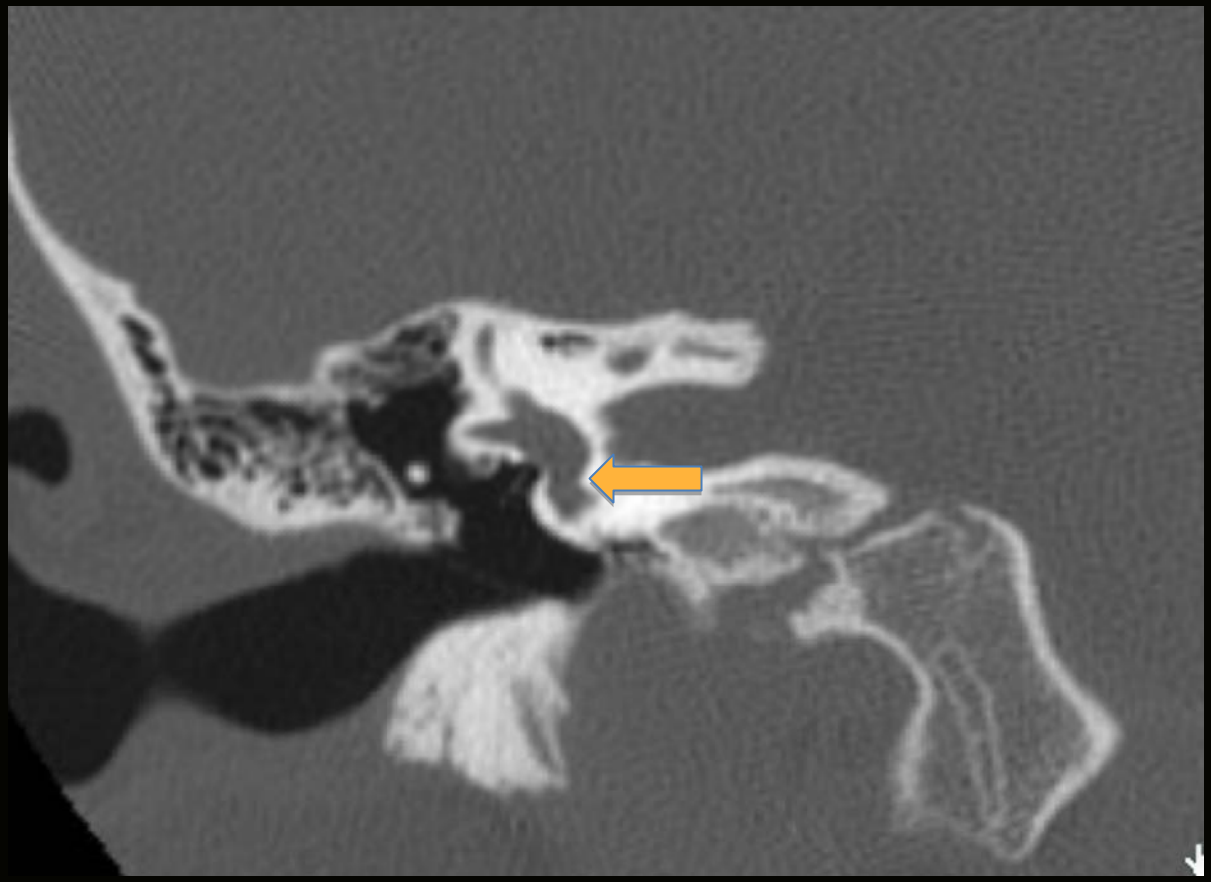


Cochlear aqueduct - containing perilymph that is in communication with the basal turn of the cochlea

Coronal CT Scan – Right side

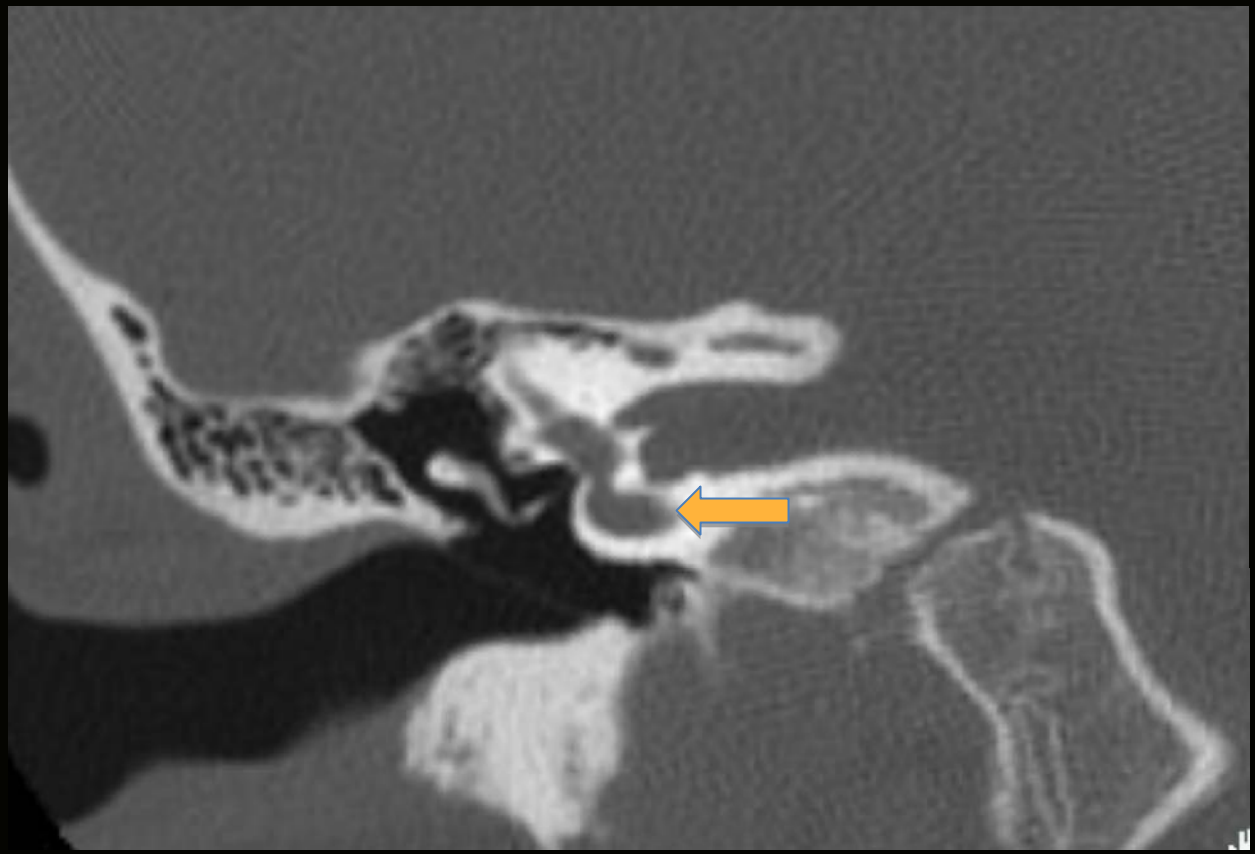
Round window - adjust and dissapate the perilymphatic wave transmitted through the cochlea

Coronal CT Scan – Right side



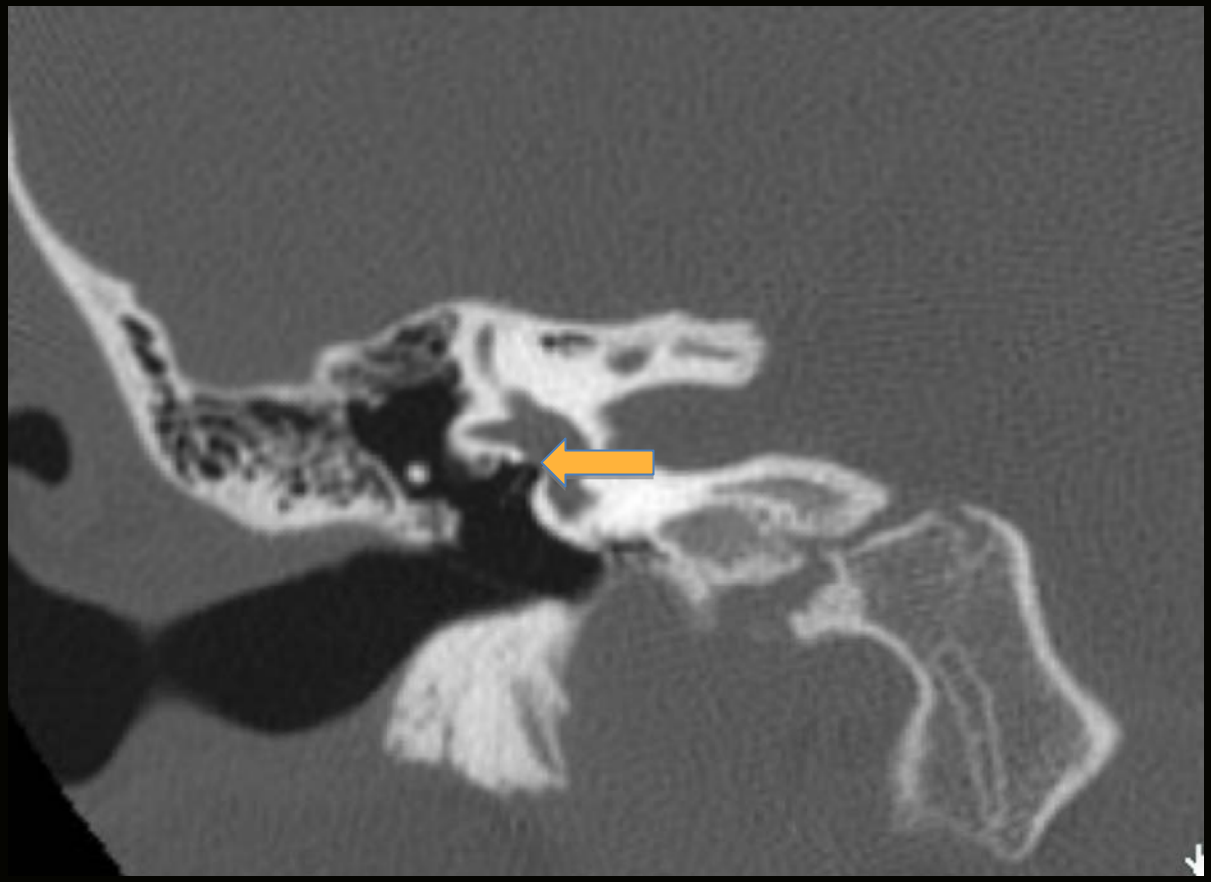
Cochlea - 2.5 turns - basal portion - frequency heard here is high!

Coronal CT Scan – Right side



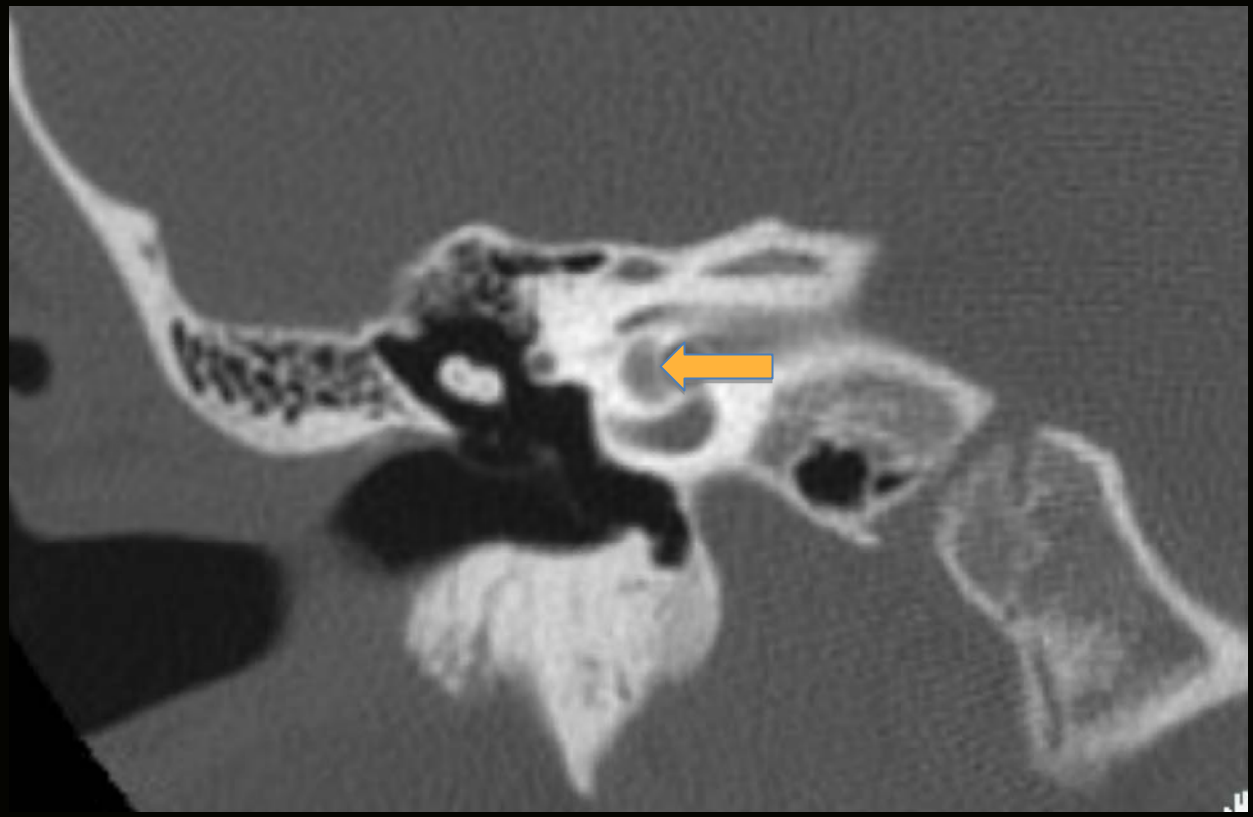
Cochlea - 2.5 turns - basal portion - frequency heard here is high!

Coronal CT Scan – Right side



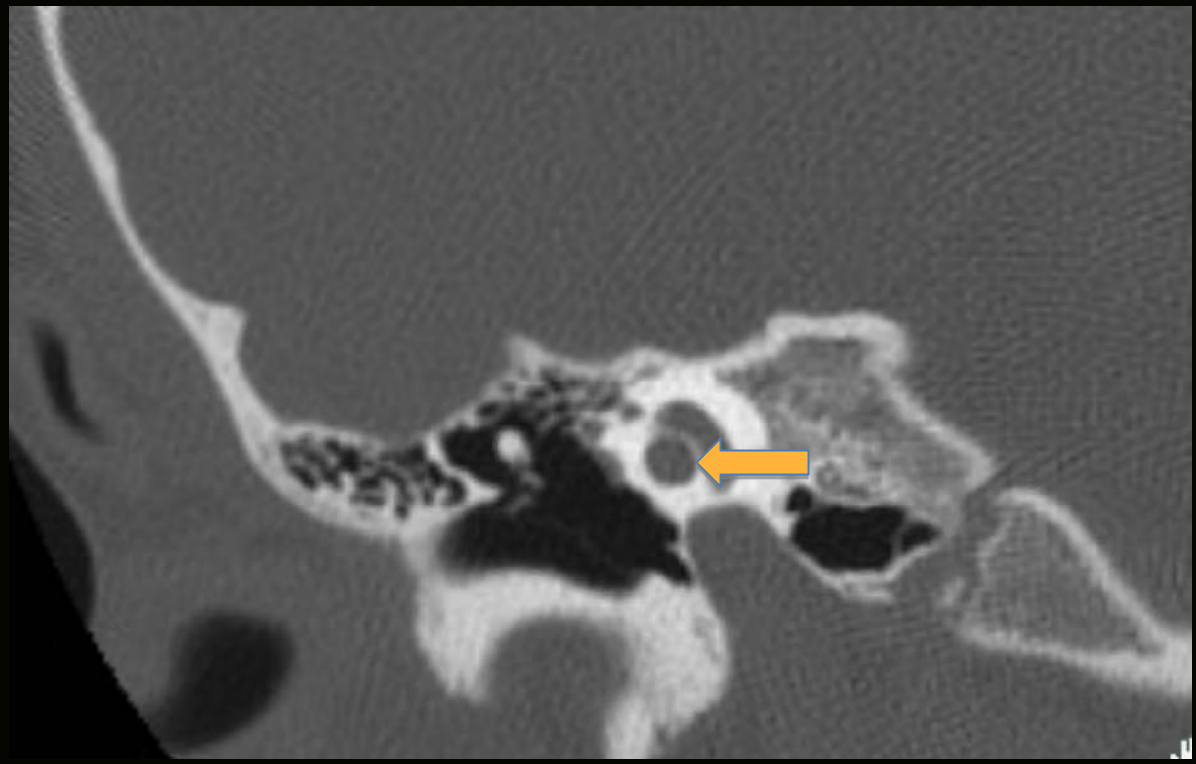
Oval window - connected to vestibule and cochlear recess

Coronal CT Scan – Right side



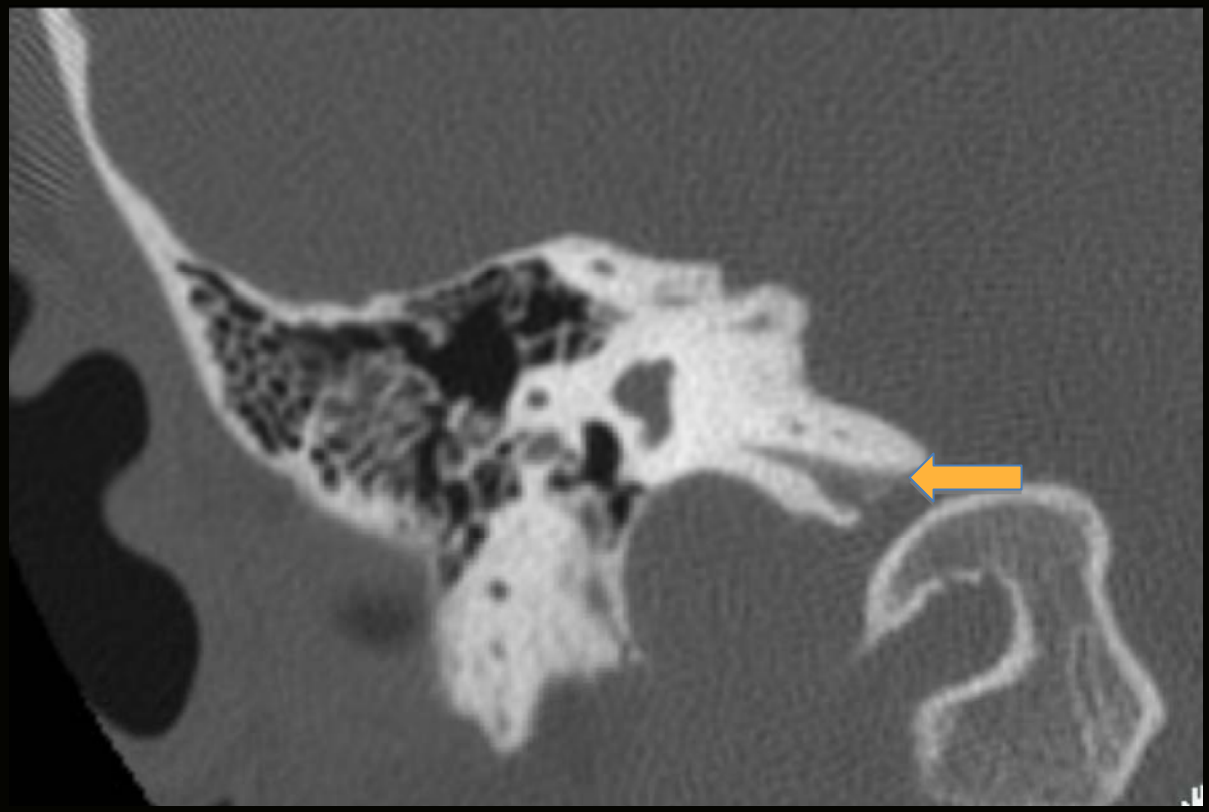
Cochlea - mid portion - converts fluid motion to electrical impulses

Coronal CT Scan – Right side



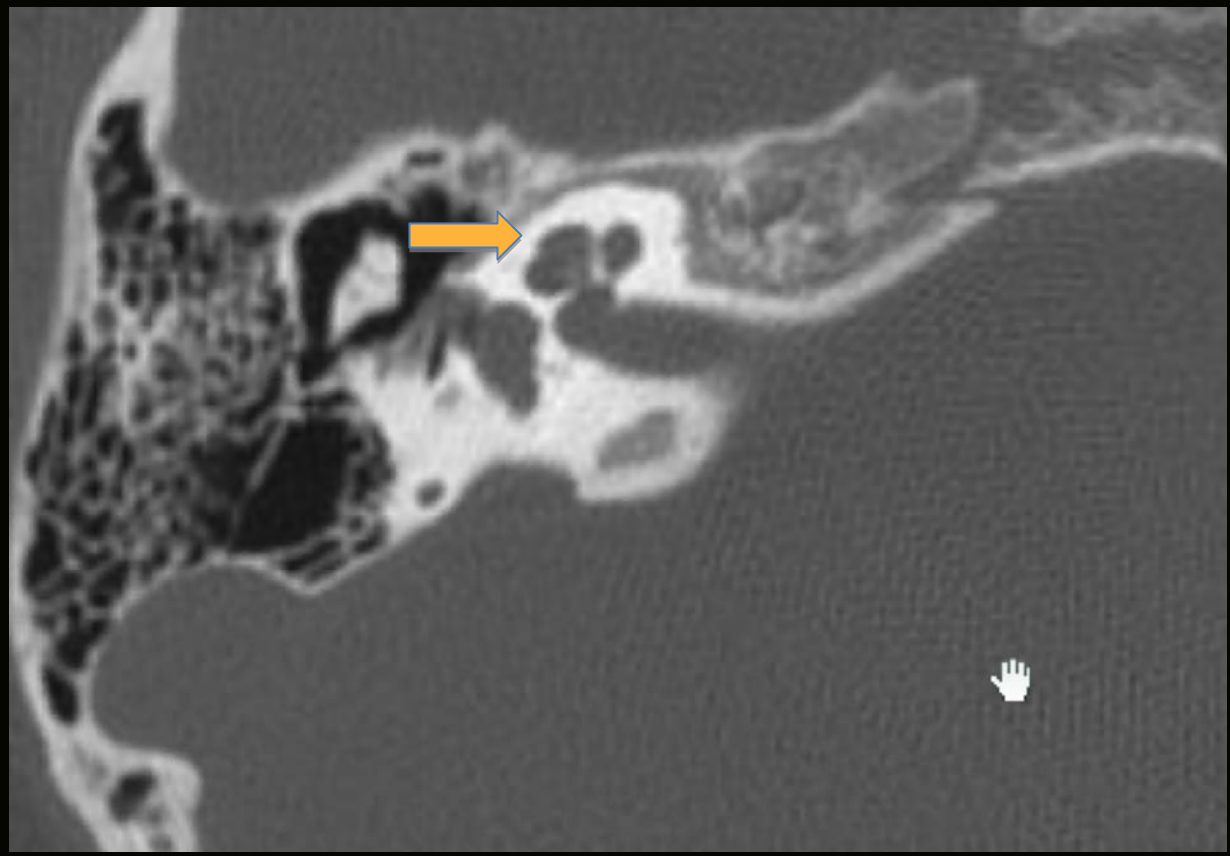
Cochlea - apical turn

Coronal CT Scan – Right side



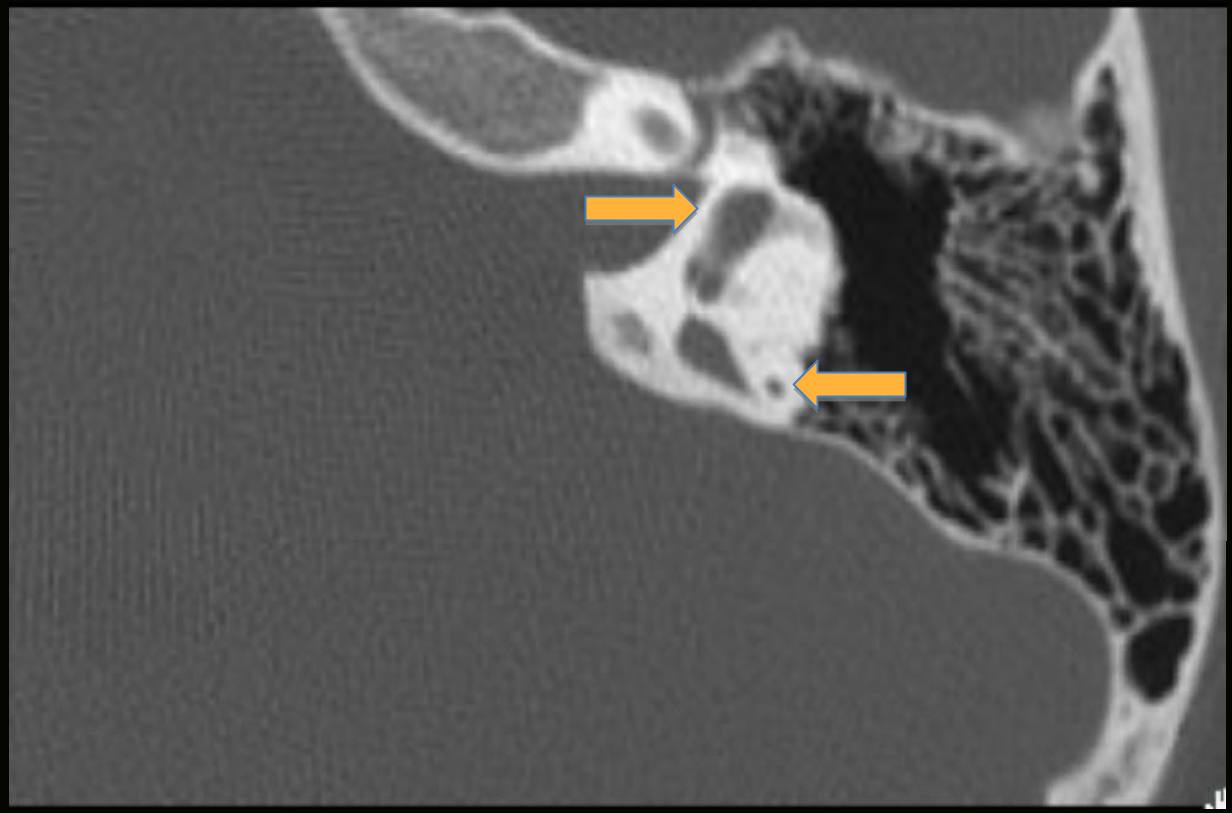
Cochlear aqueduct - containing perilymph that is in communication with the basal turn of the cochlea

Axial CT Scan – Right side



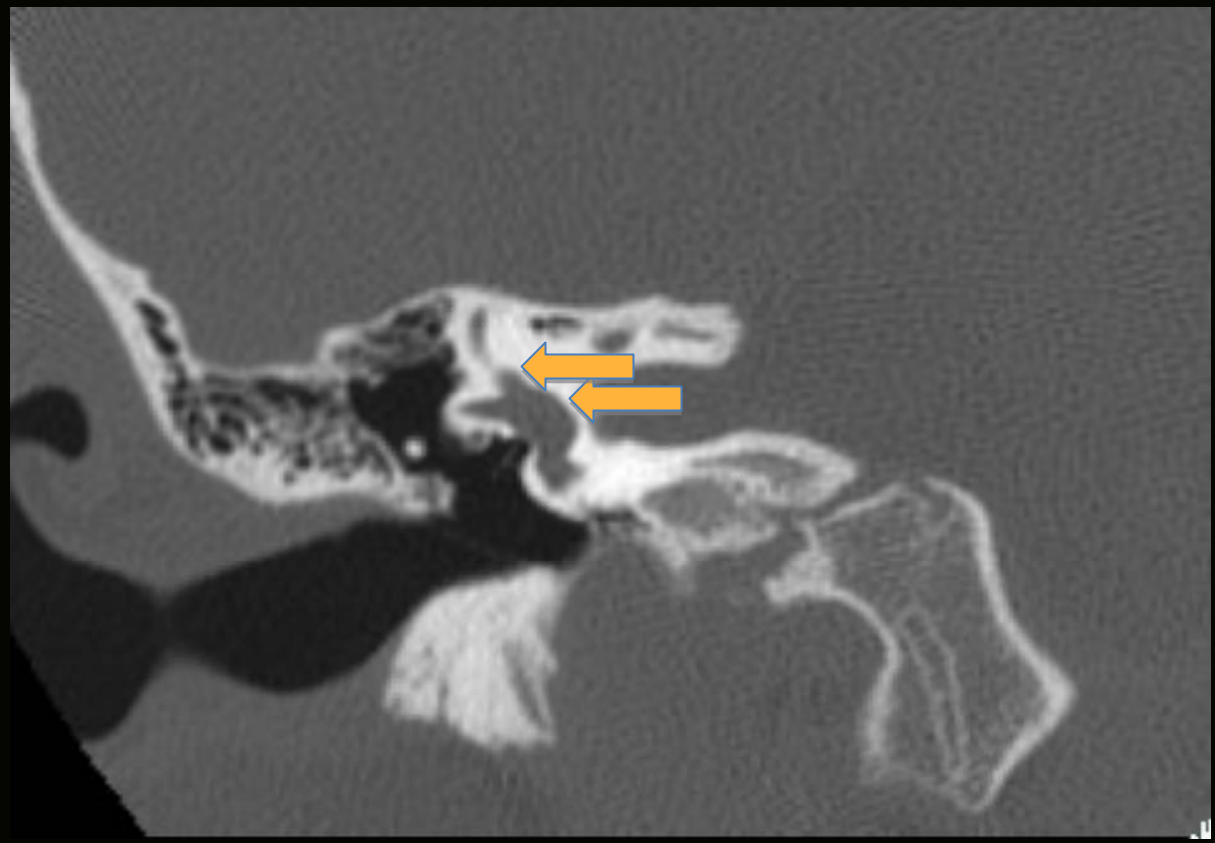
Cochlea - 2.5 turns - apical turn - frequency heard here is low!
The bony structure in the center is called the modiolus or osseous spiral lamina where the cochlear nerve travels

Axial CT Scan – Left side



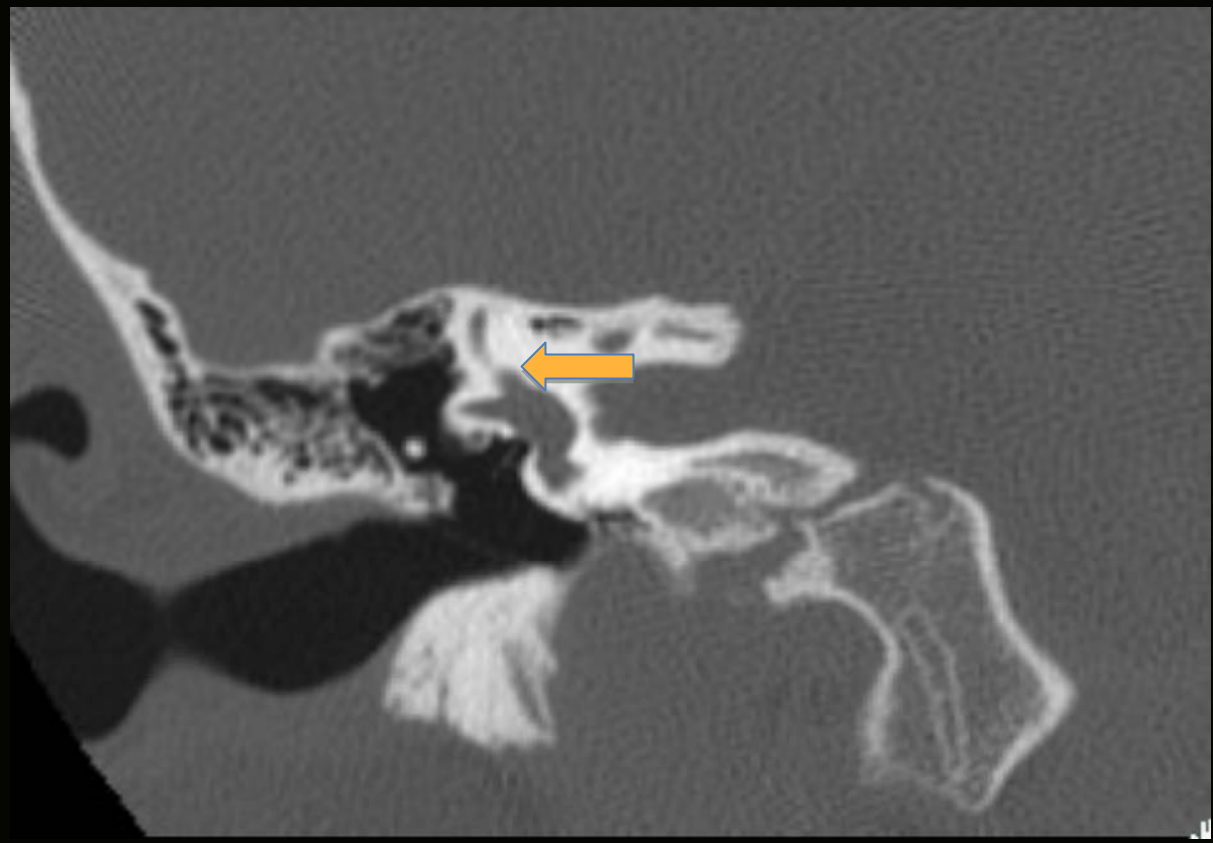
- Posterior SCC respond to rotational and angular acceleration
- Vestibule - largest labyrinthine cavity containing both the utricle and saccule - detects position of head relative to gravity

Coronal CT Scan – Right side



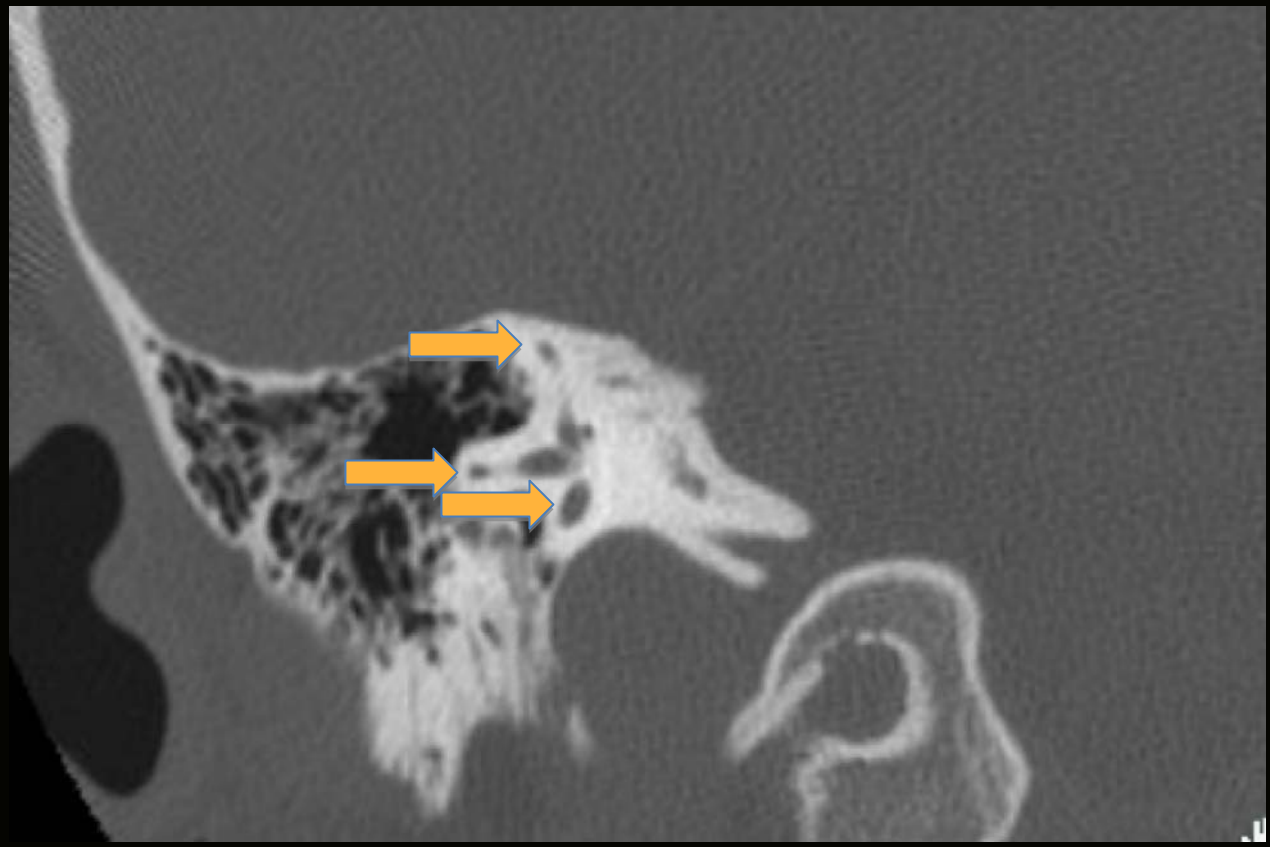
Vestibule - largest labyrinthine cavity containing both the utricle and saccule - detects position of head relative to gravity

Coronal CT Scan – Right side



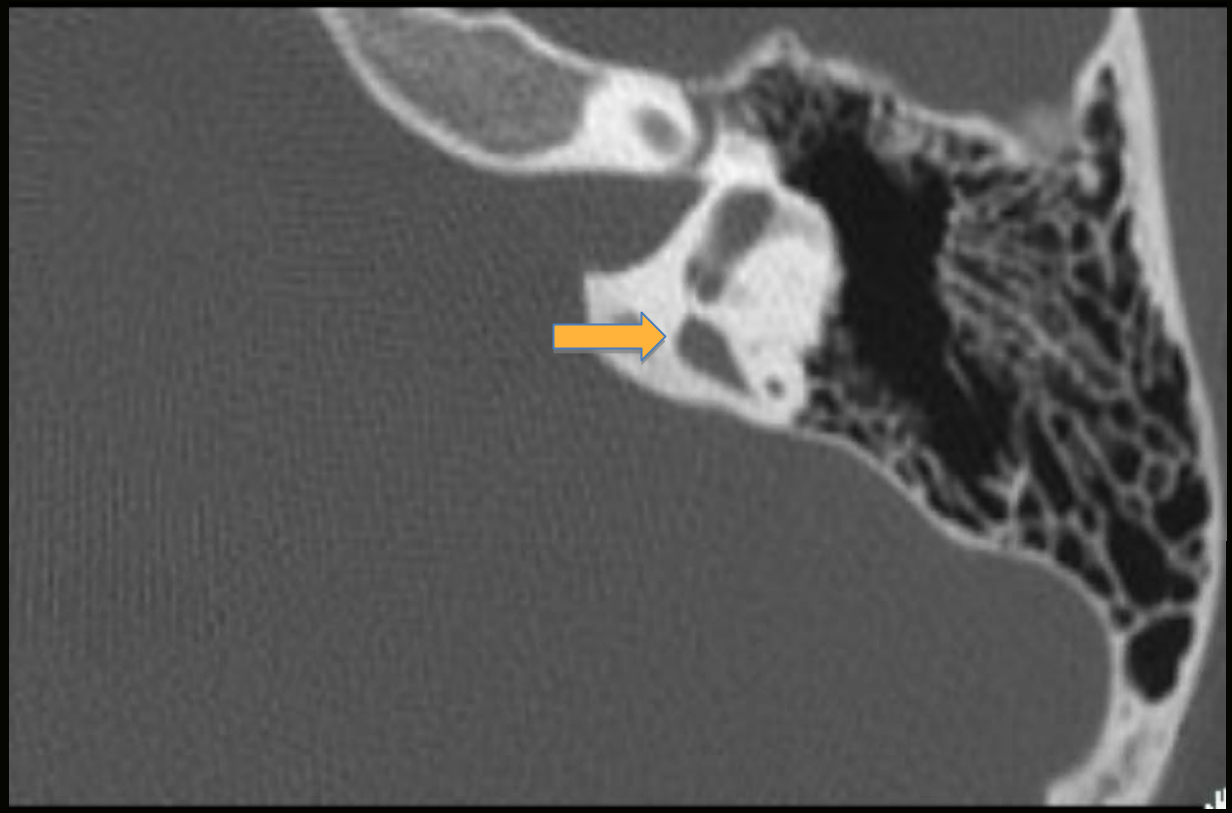
Ampulla - contains hair cells that are stimulated with angular movement

Coronal CT Scan – Right side

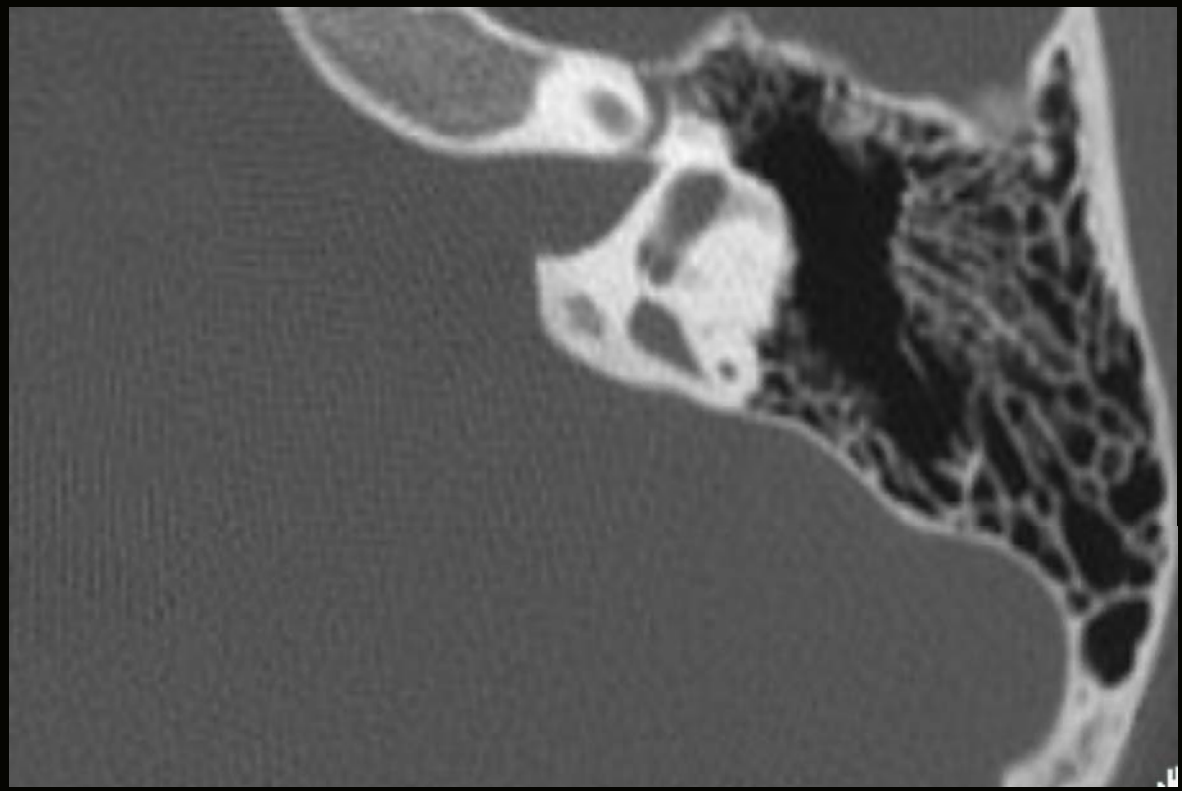


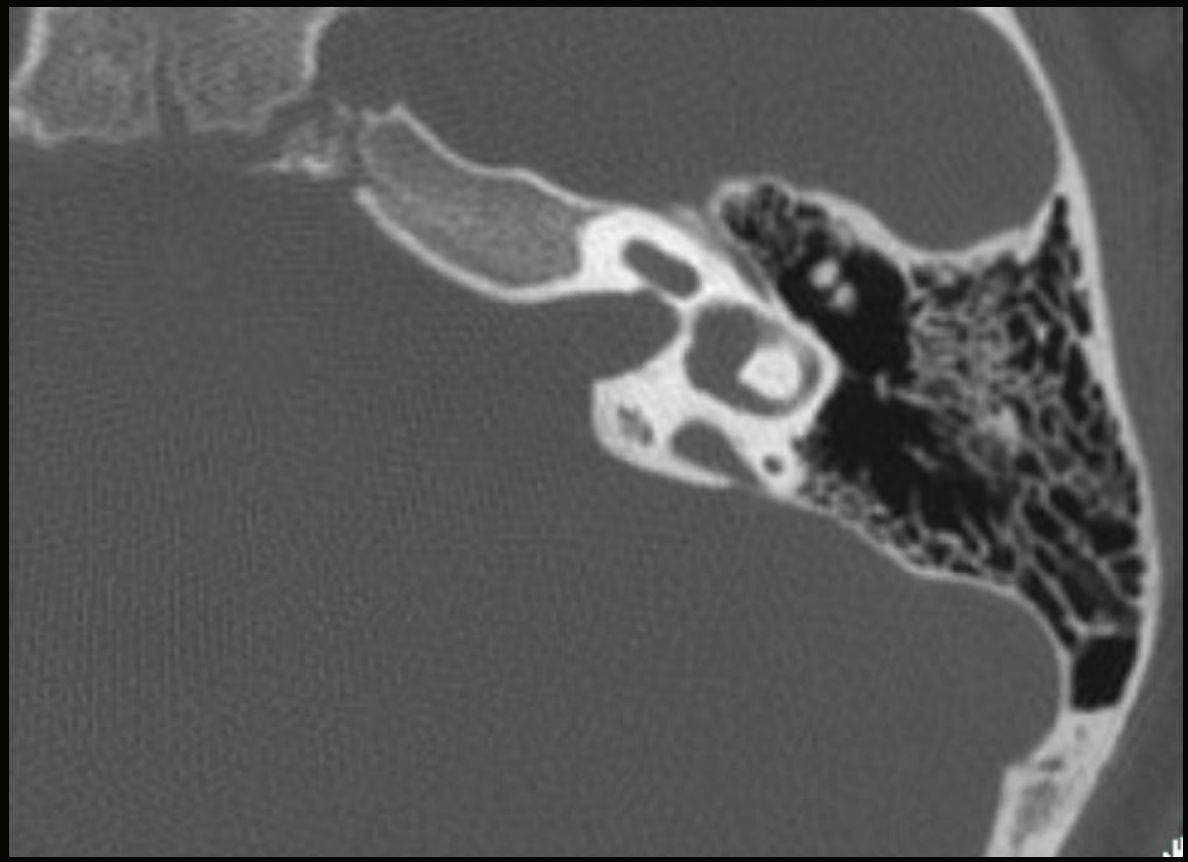
Superior, horizontal and posterior SCCs respond to rotational and angular acceleration

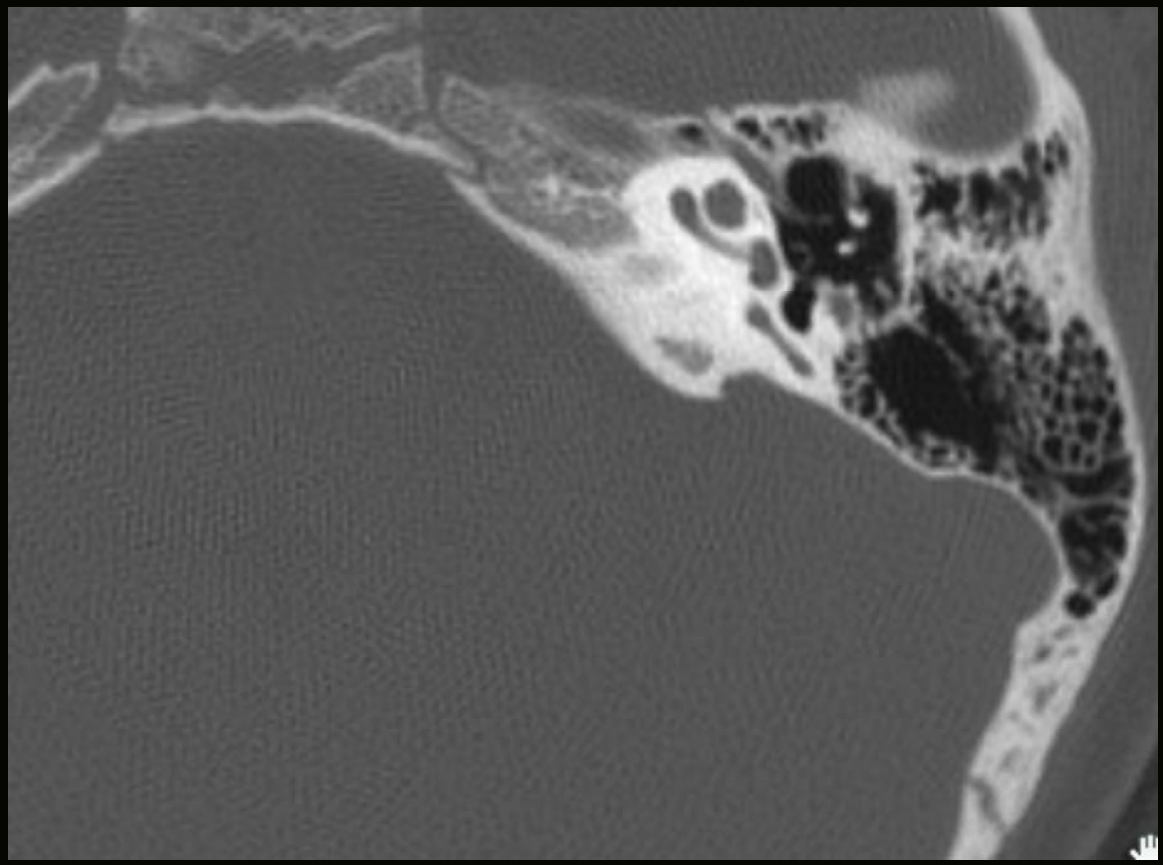
Axial CT Scan – Left side



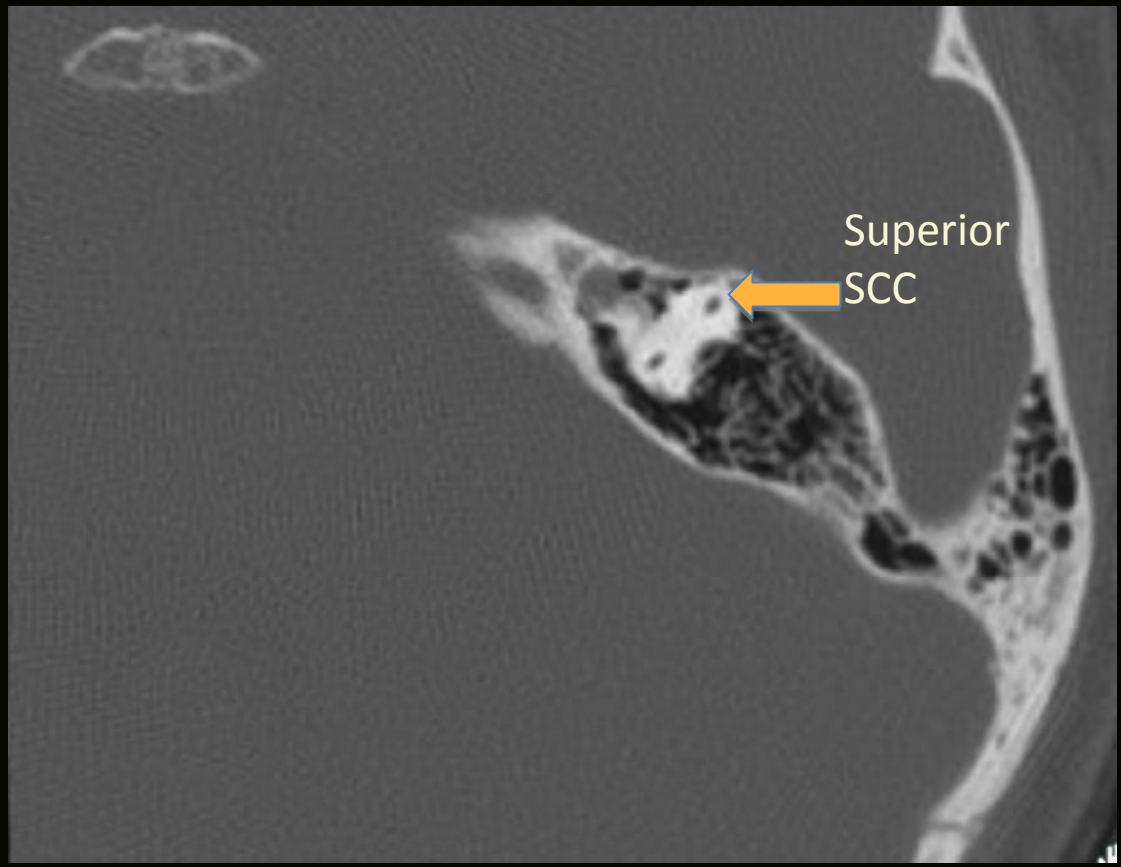
- Vestibular aqueduct containing the endolymphatic duct and sac





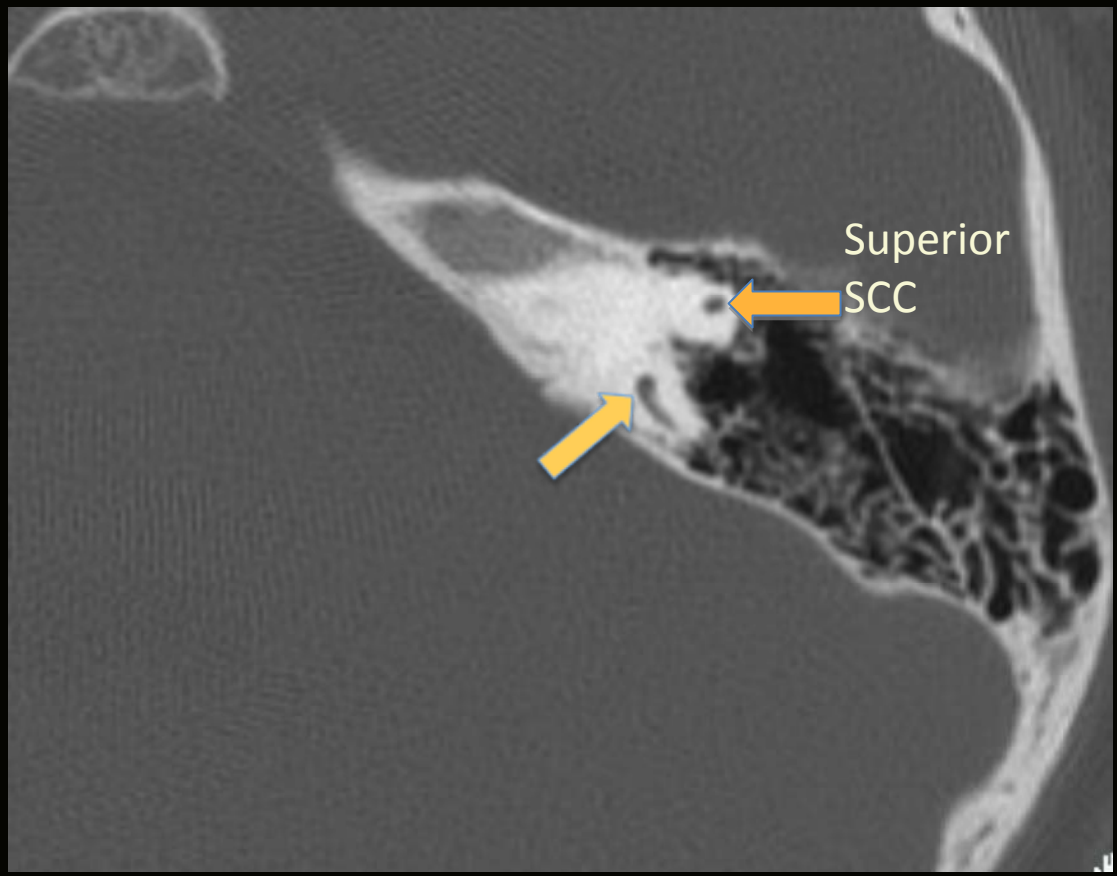


Axial CT Scan – Left side



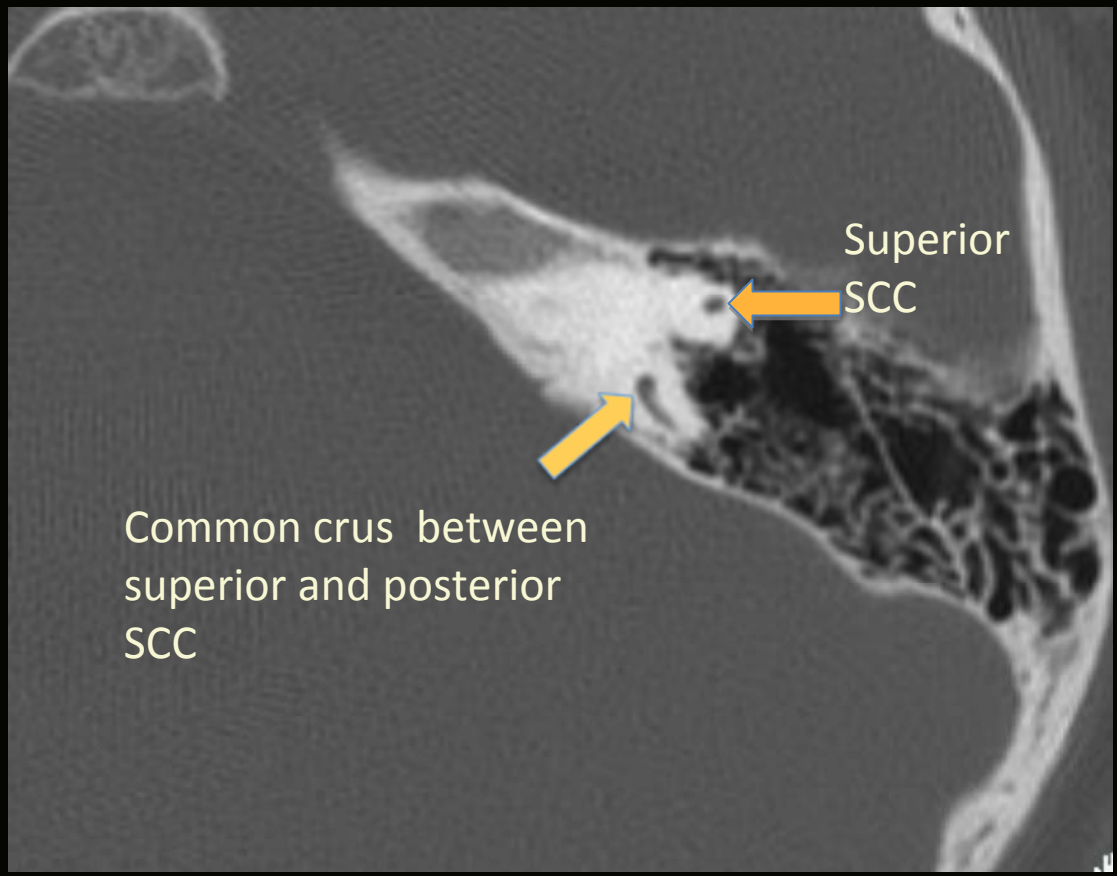
Superior SCC – responds to rotational or angular acceleration

Axial CT Scan – Left side



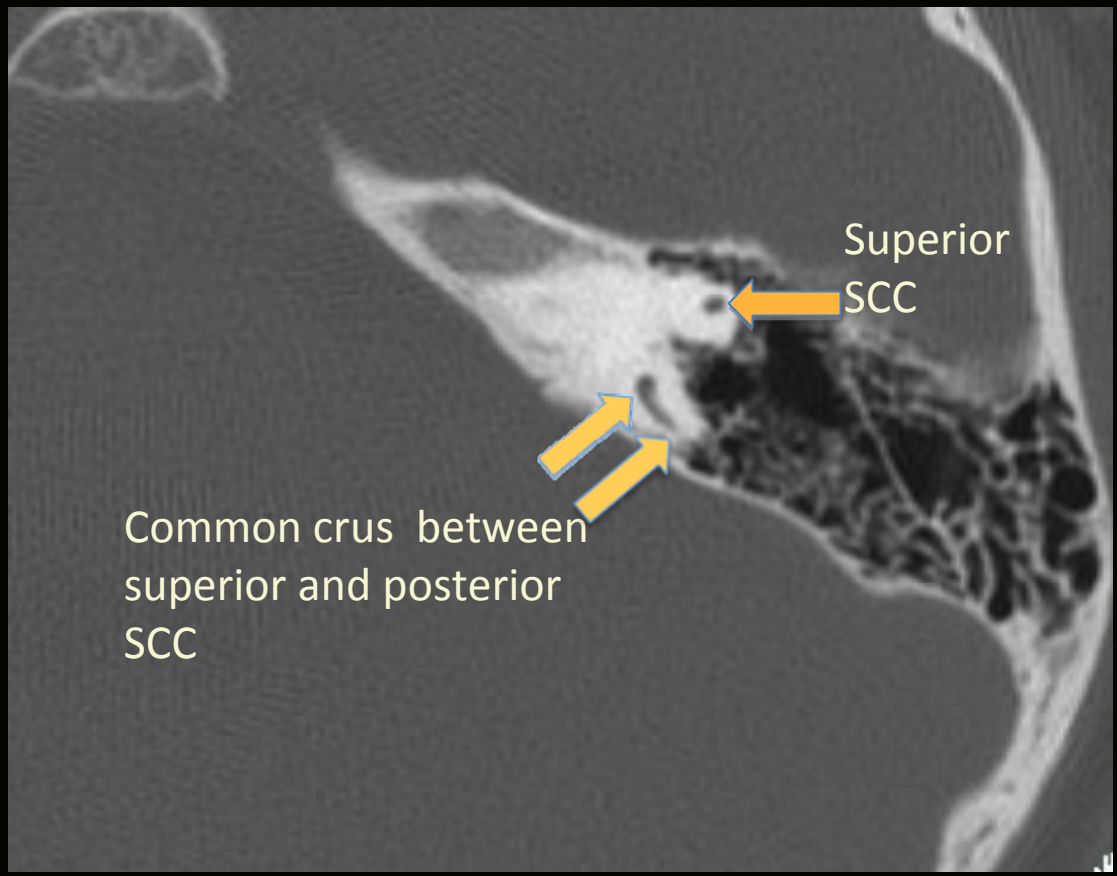
Superior SCC – responds to rotational or angular acceleration

Axial CT Scan – Left side



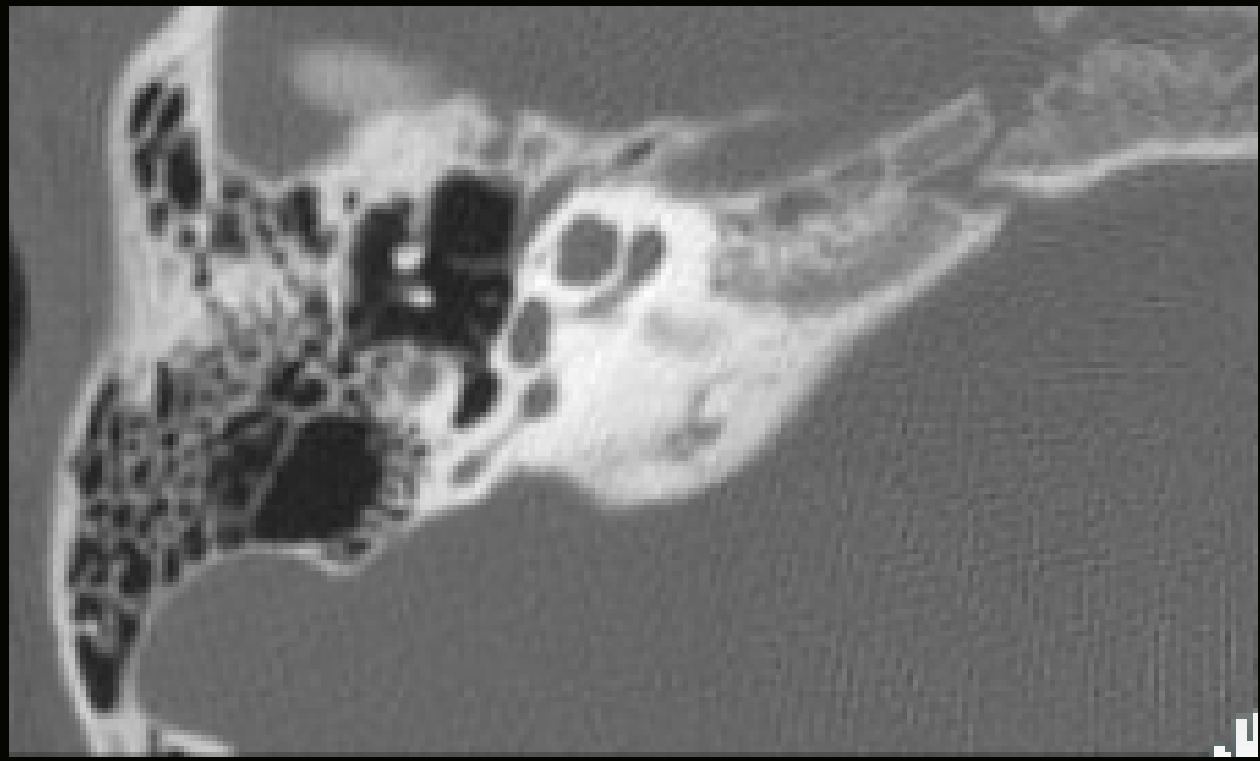
Superior SCC – responds to rotational or angular acceleration

Axial CT Scan – Left side

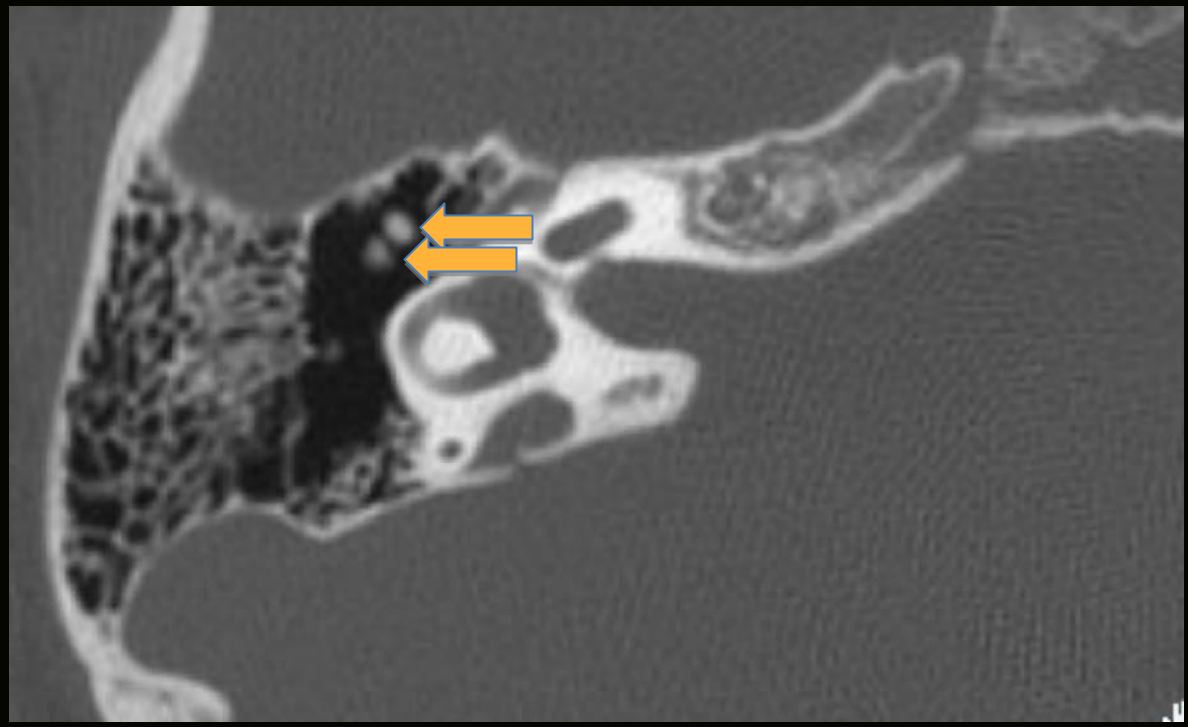


Both the superior and posterior SCC respond to rotational and angular acceleration

Axial CT Scan – Right side

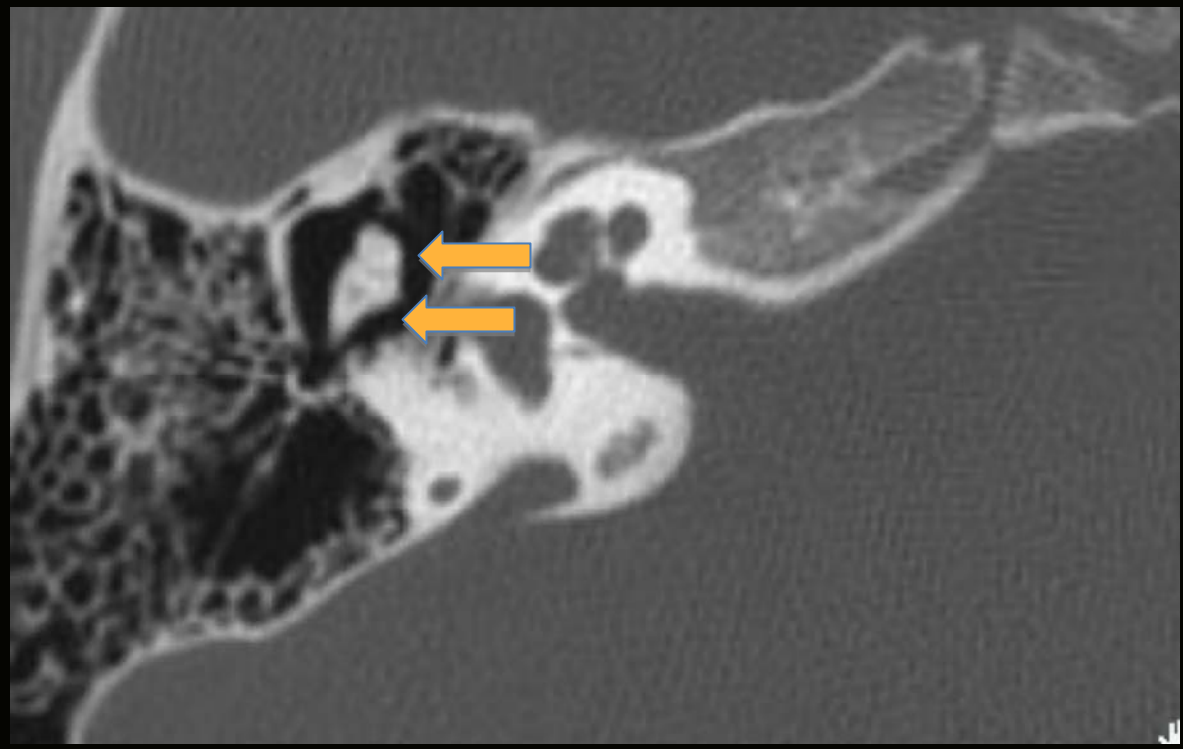


Axial CT Scan – Right side



- Ossicular chain - head of the malleus
- Incus body space between is the malleoincudal joint

Axial CT Scan – Right side

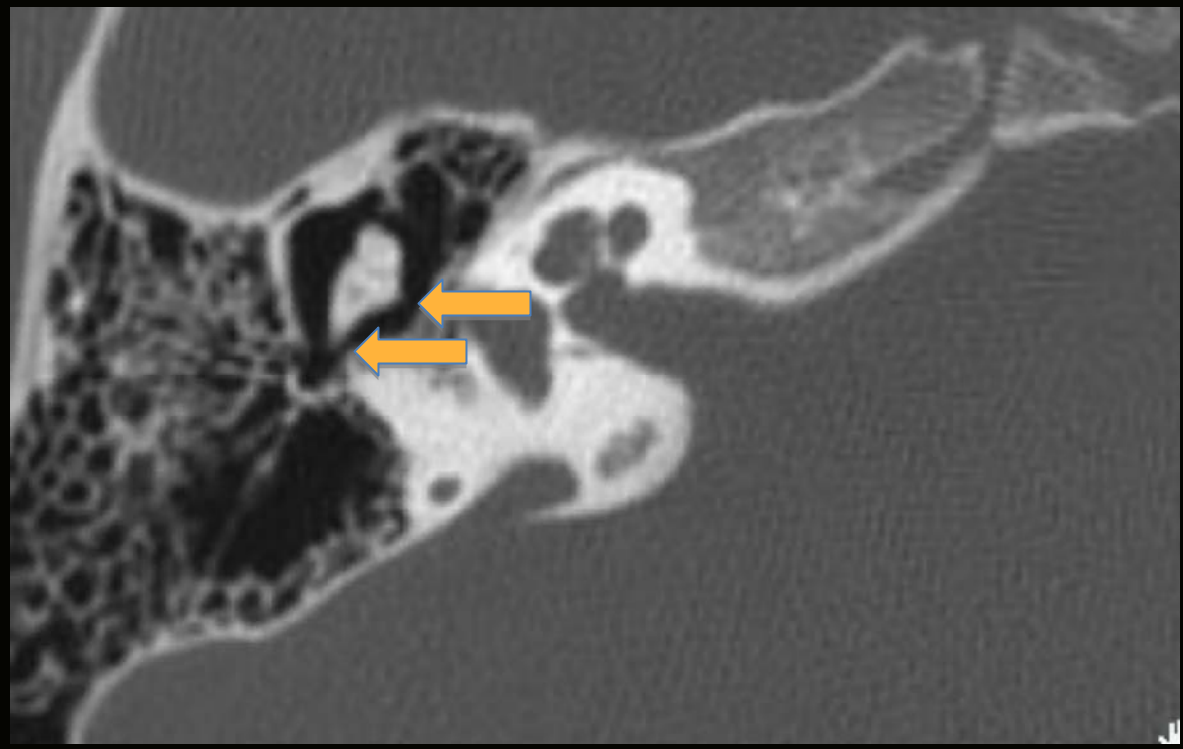


- Ossicular chain - head of the malleus
- Incus body space between is the malleoincudal joint

Axial CT Scan – Right side

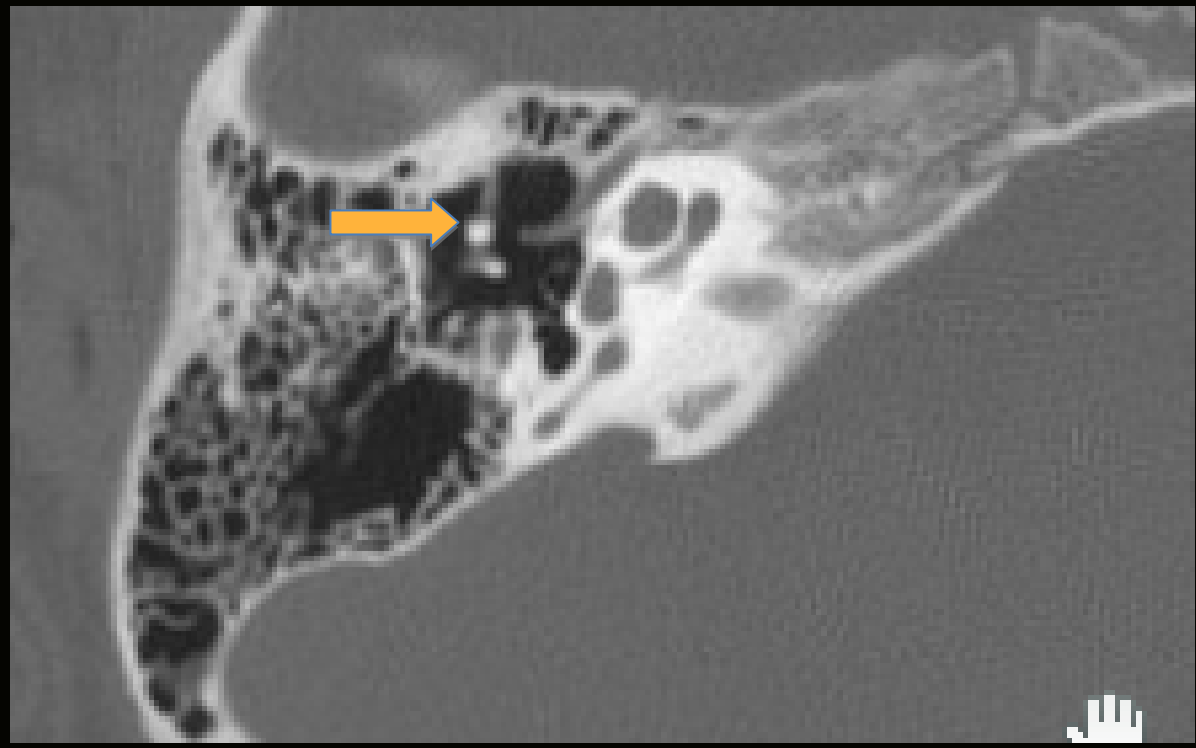
- Ossicular chain - head of the malleus
- Incus body space between is the malleoincudal joint
- Anteror malleolar ligament

Axial CT Scan – Right side



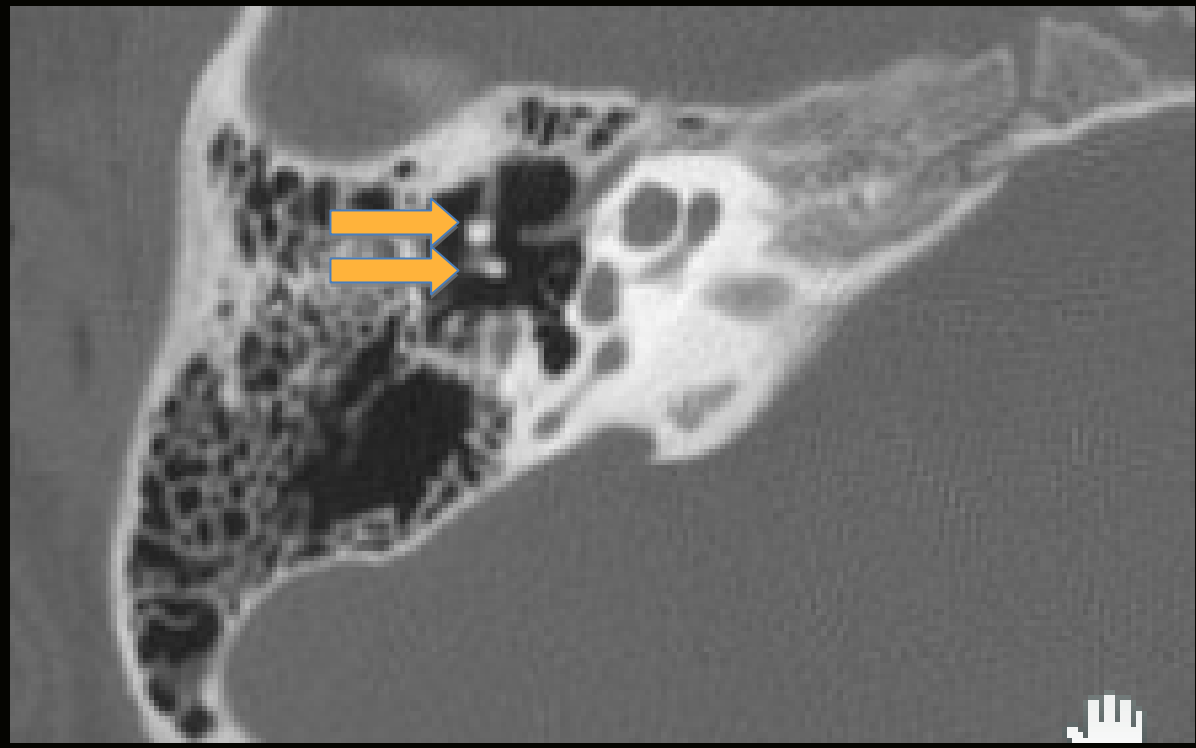
- Incus short process
- Incus long process

Axial CT Scan – Right side



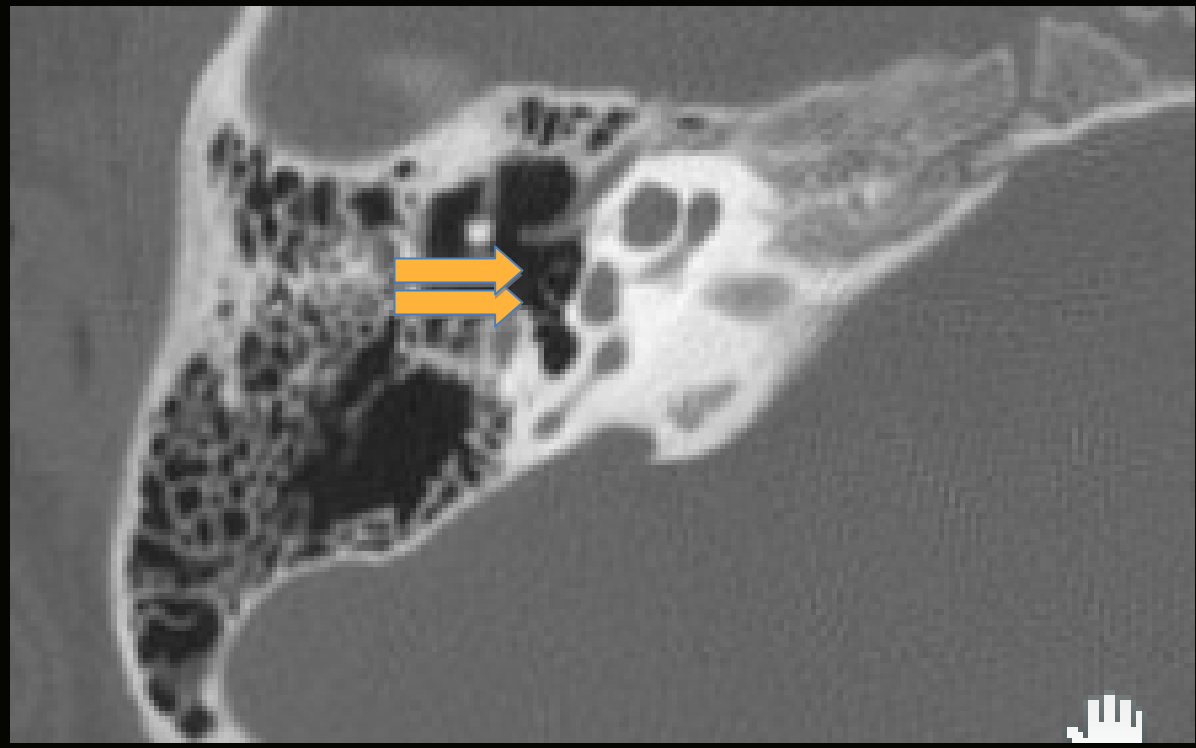
- Malleus neck

Axial CT Scan – Right side



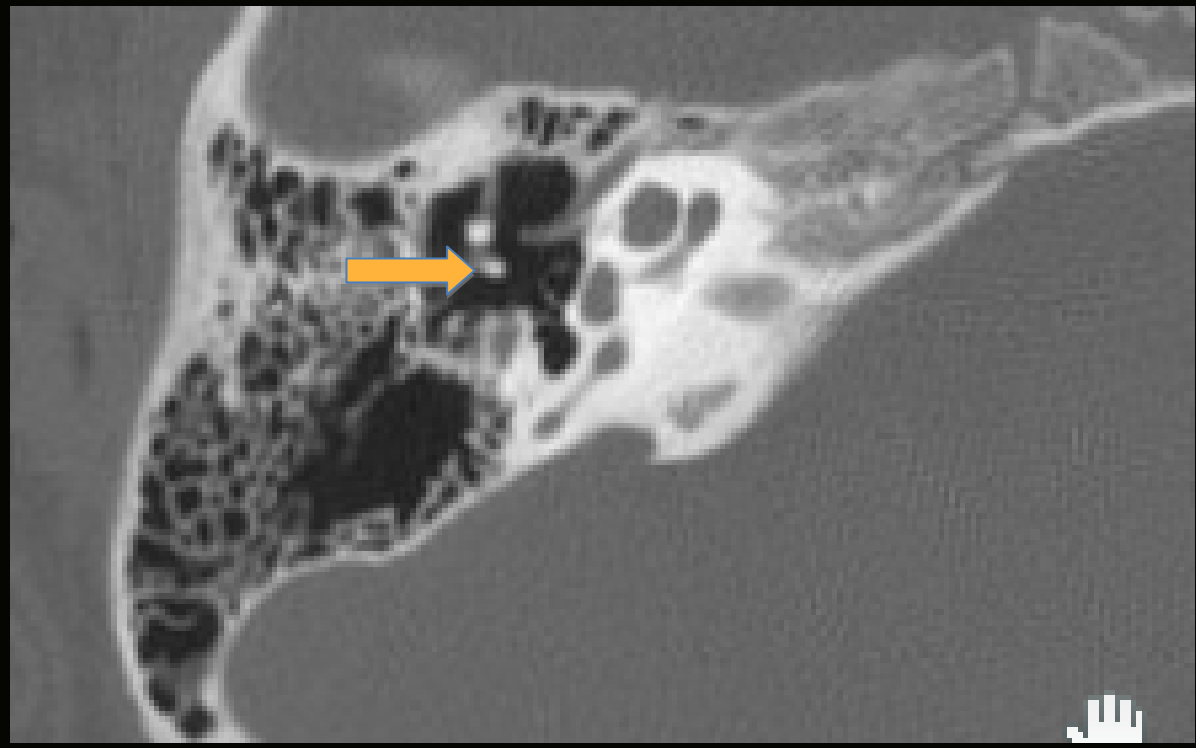
- Malleus neck
- Incus lenticular process connected to the head of the stapes

Axial CT Scan – Right side



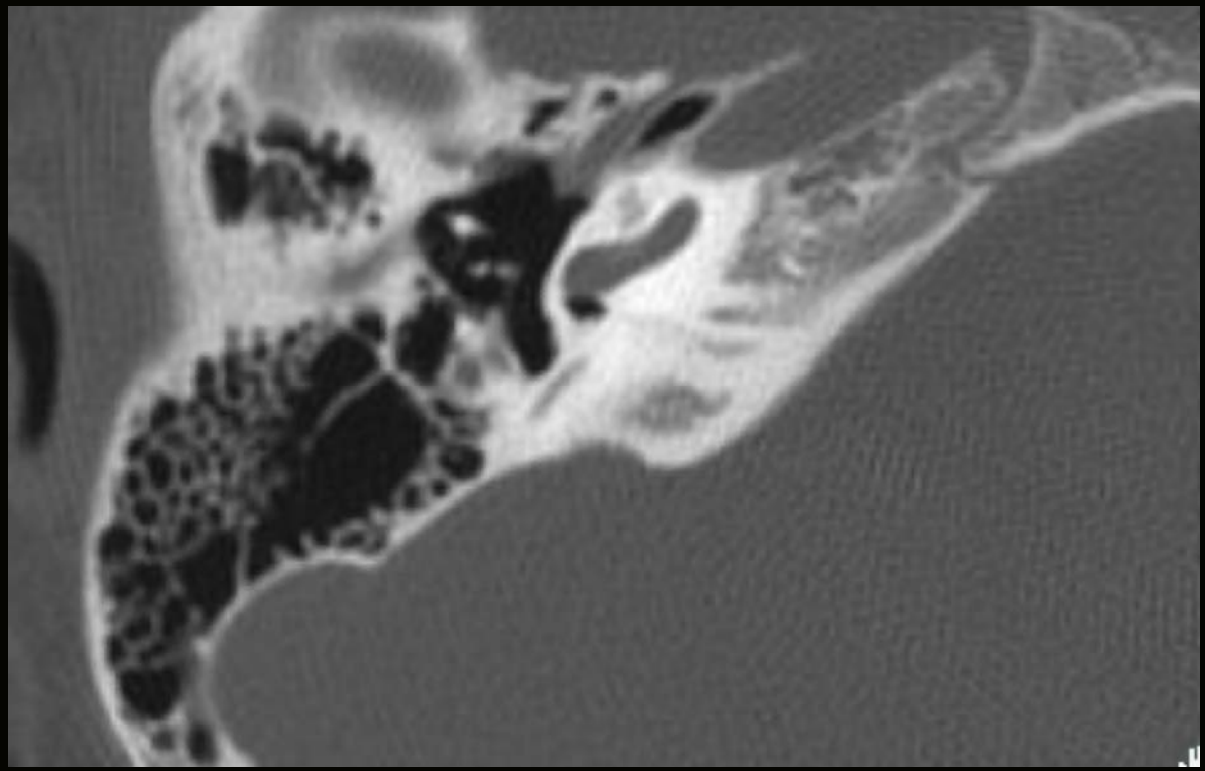
- Stapes anterior crus
- Stapes posterior crus

Axial CT Scan – Right side



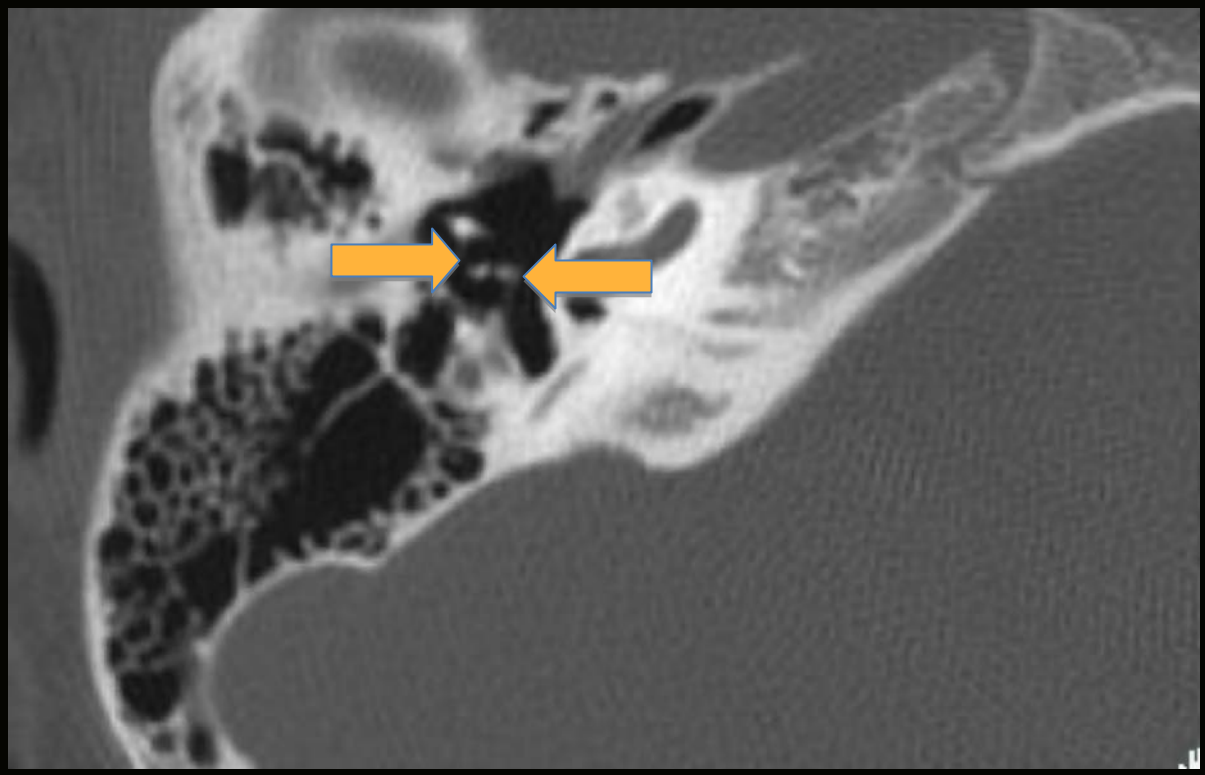
- Tensor tympani muscle - tendon inserts on the malleus neck
- Incus lenticular process connects to head of the stapes

Axial CT Scan – Right side



- Malleus neck

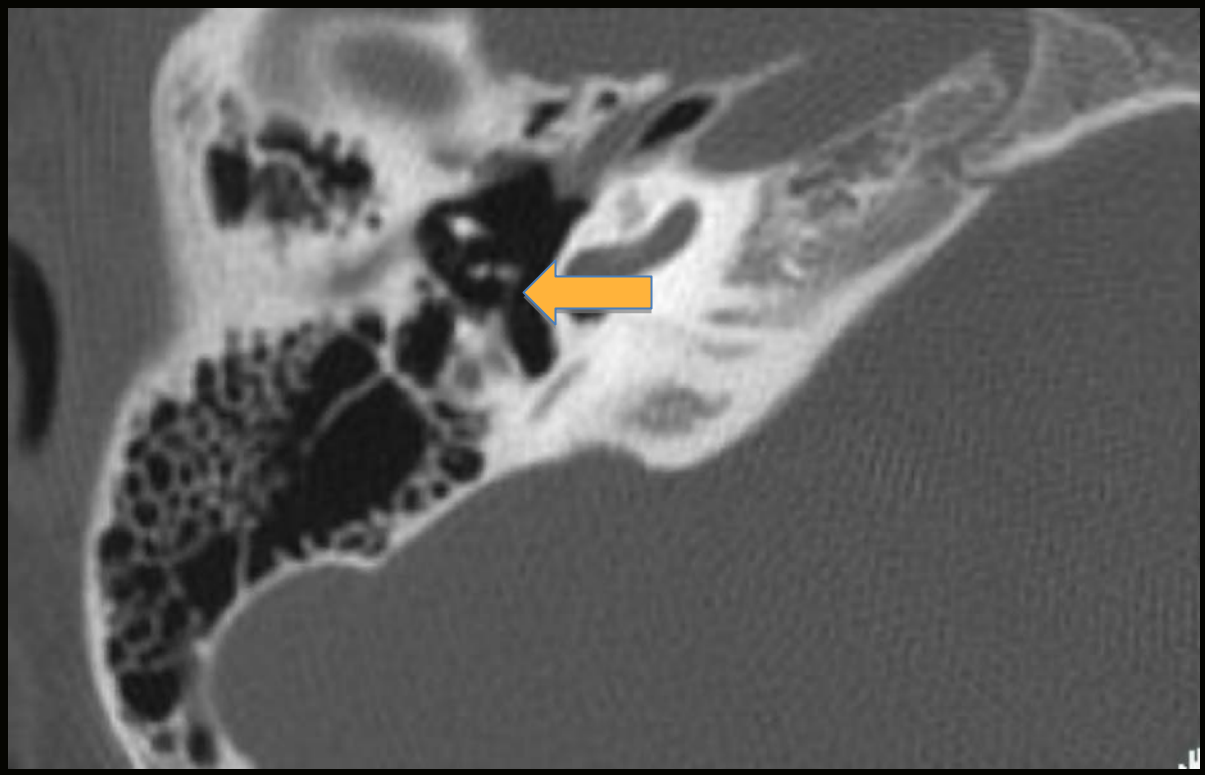
Axial CT Scan – Right side



□□□□□

- Incus lenticular process connects to head of the stapes
- Head of the stapes

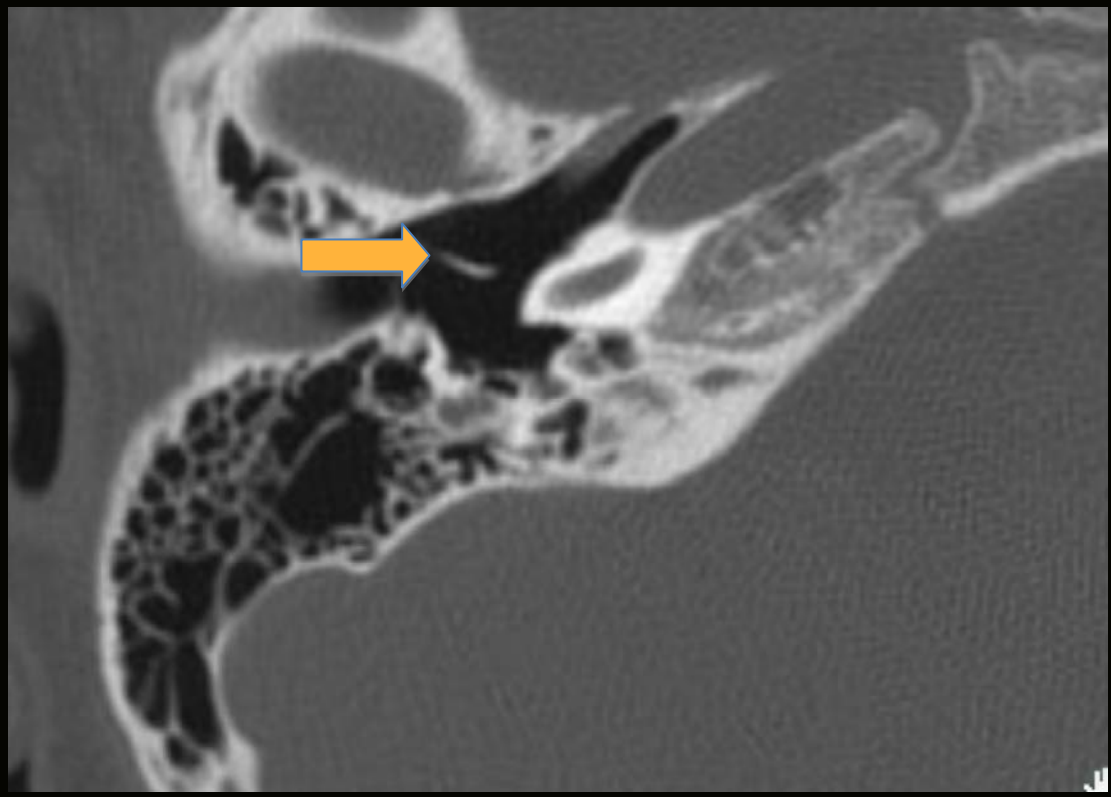
Axial CT Scan – Right side



□□□□□

- Stapedius tendon arising from the pyramidal eminence and inserting on to the stapes

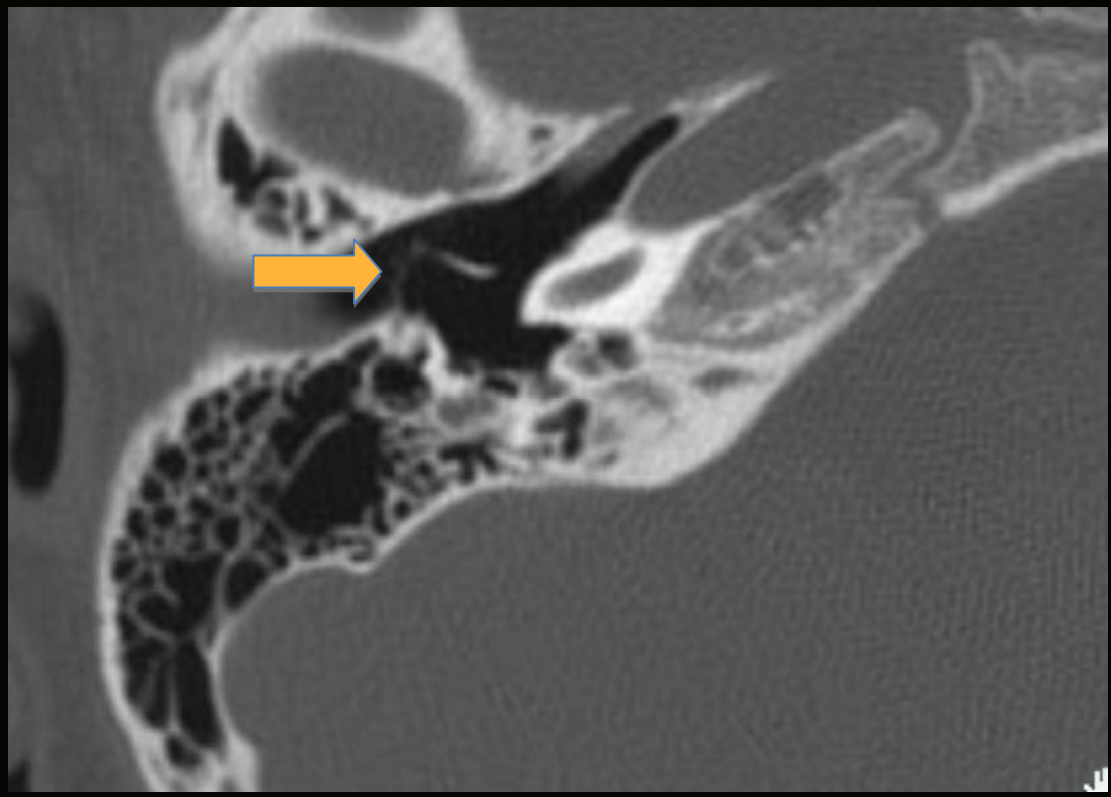
Axial CT Scan – Right side



□□□□□

- Manubrium of the malleus

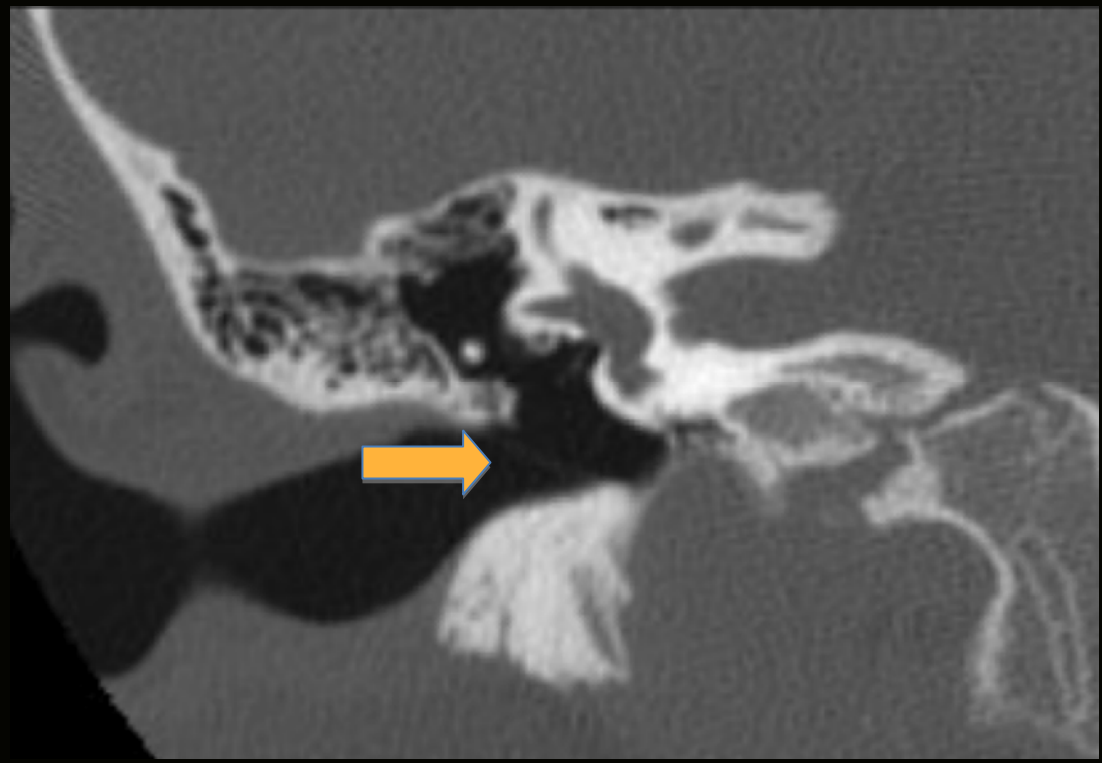
Axial CT Scan – Right side



□□□□□

- Manubrium of the malleus
- Tympanic membrane

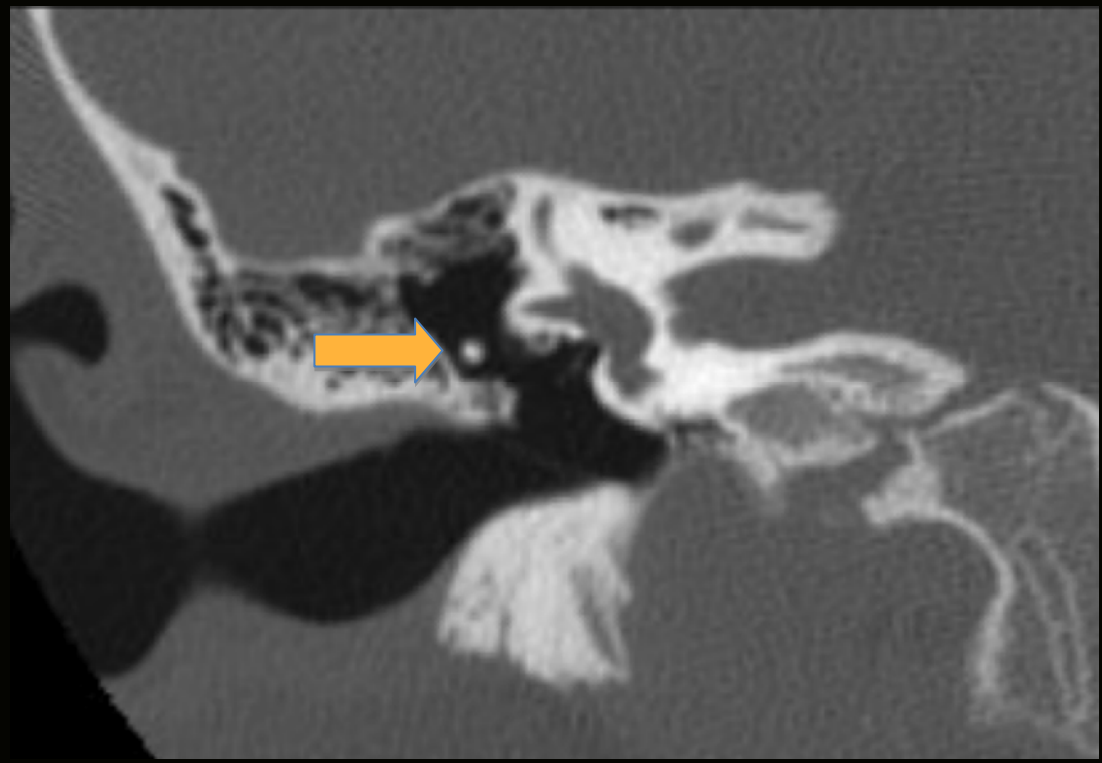
Coronal CT Scan – Right side



□□□□□

- Tympanic membrane

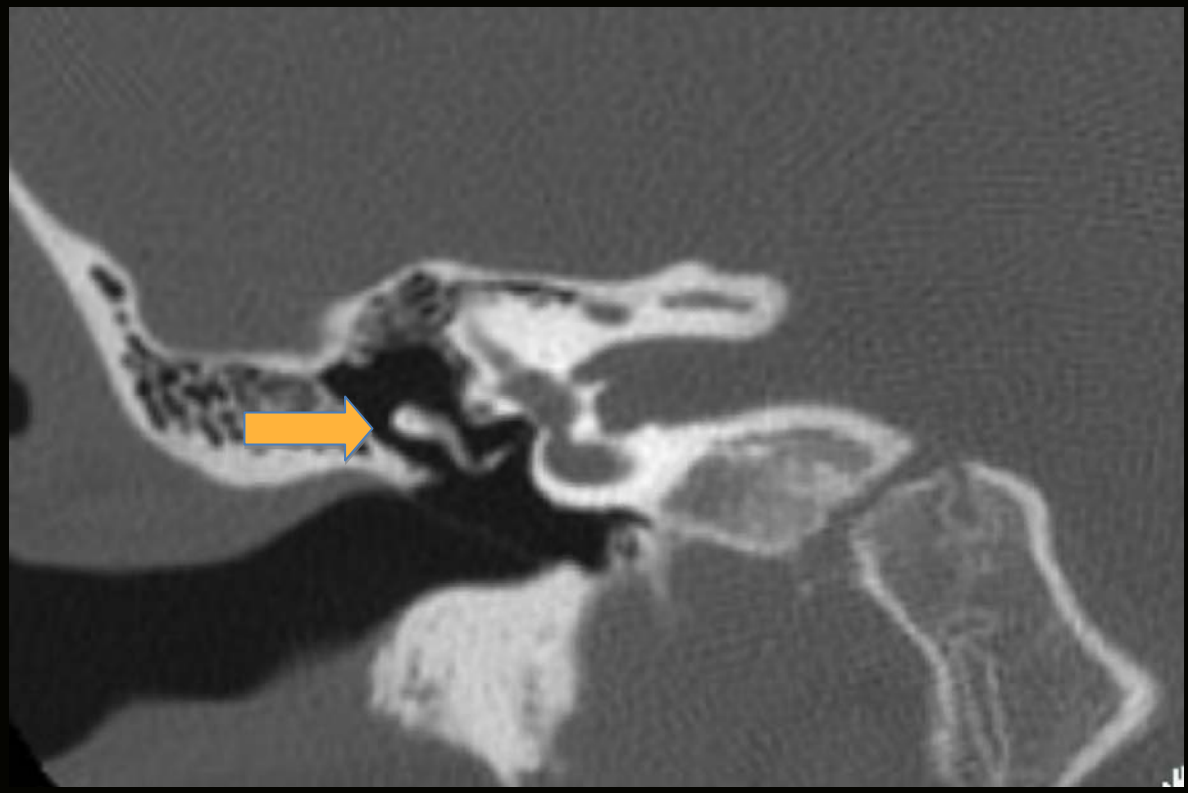
Coronal CT Scan – Right side



□□□□□

- Incus short process (little guy driving the car's head!)

Coronal CT Scan – Right side



□□□□□

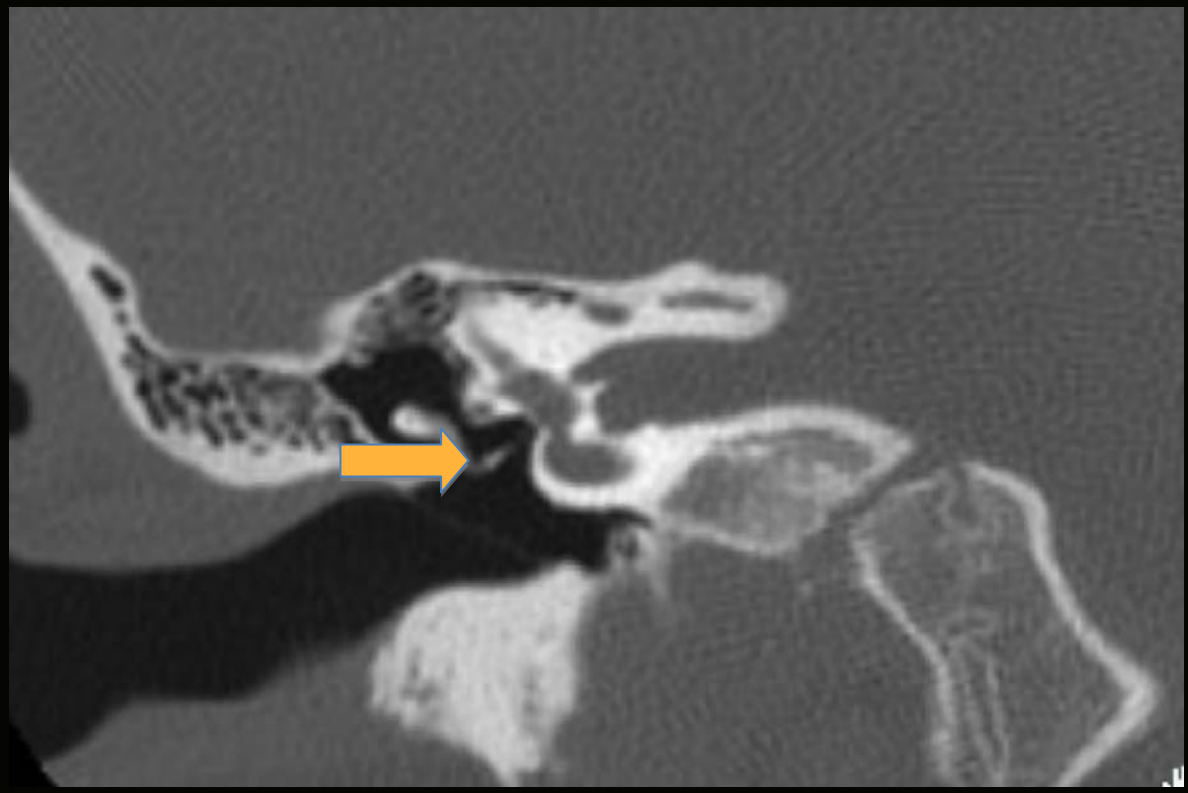
- Incus body (little guy driving the car's body!)

Coronal CT Scan – Right side

□□□□□

- Incus long process (little guy driving the car's long legs!)

Coronal CT Scan – Right side



□□□□□

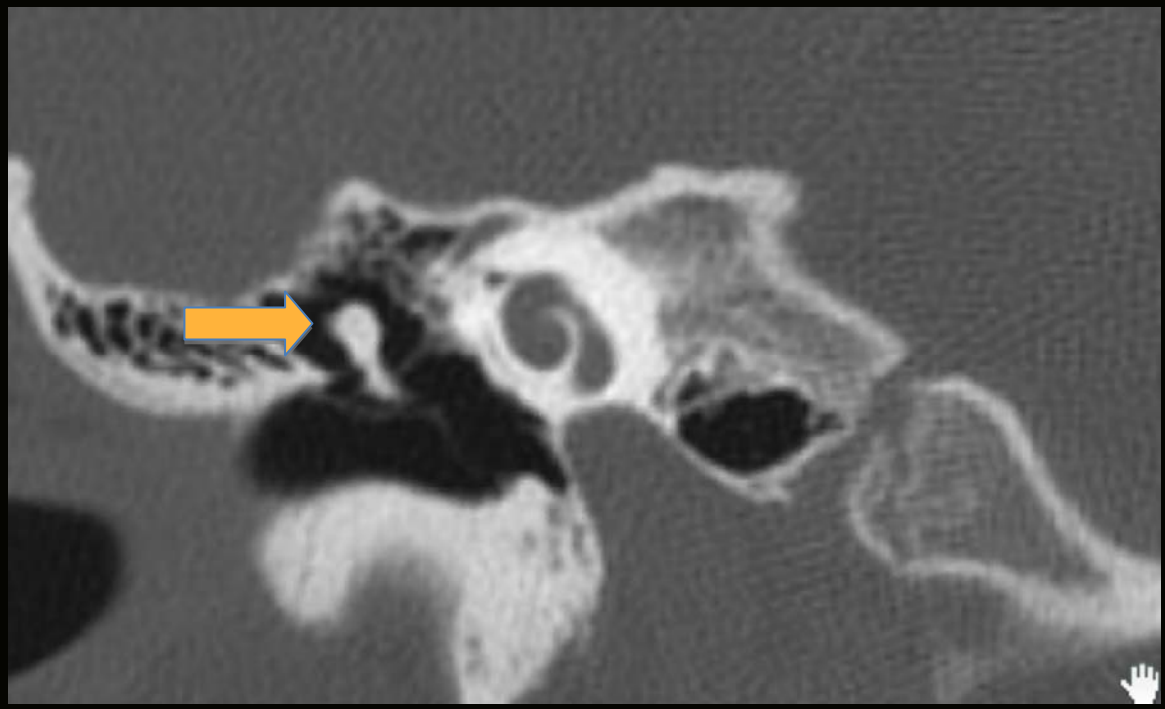
- Incus lenticular process (little guy driving the car's articulating lower leg!)
- Articulating with the head of the stapes

Coronal CT Scan – Right side

□□□□□

- Incustapedial articulation

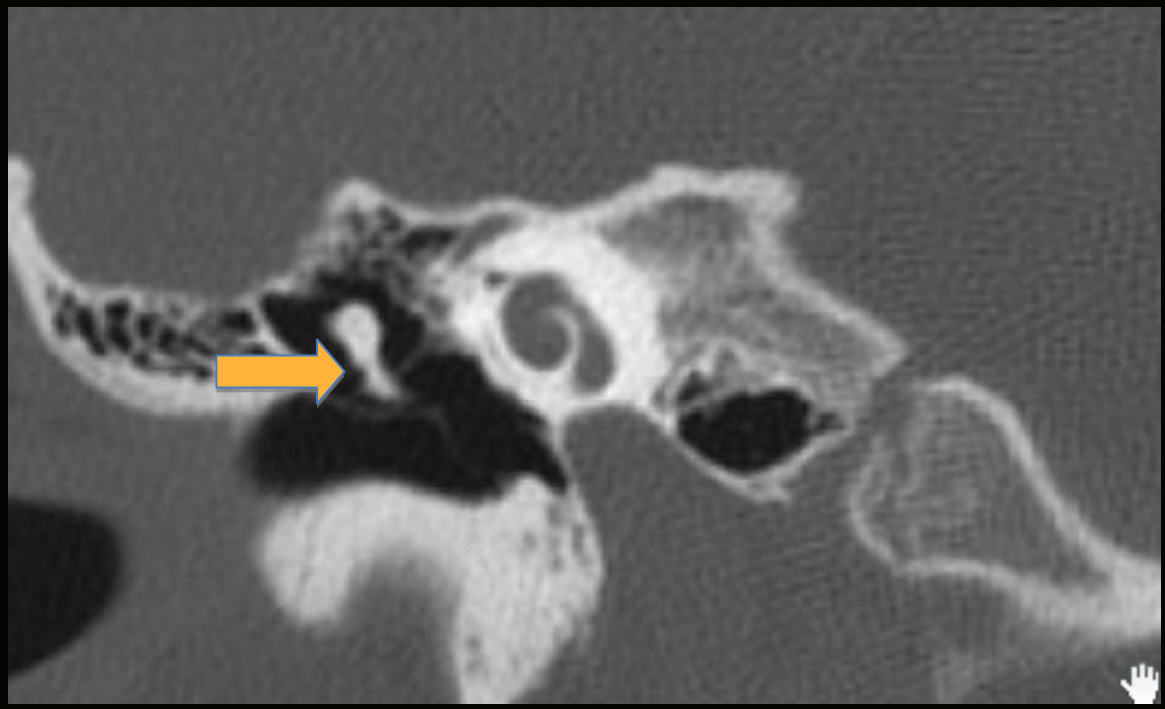
Coronal CT Scan – Right side



□□□□□

- Malleus head

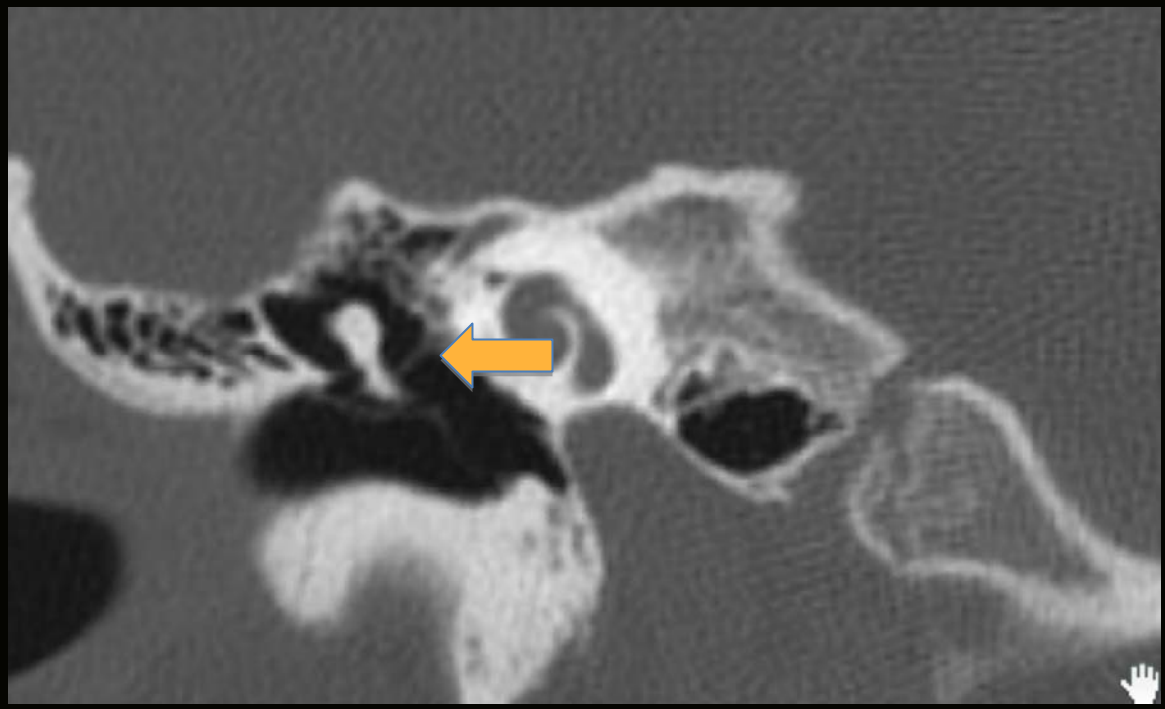
Coronal CT Scan – Right side



□□□□□

- Malleus neck

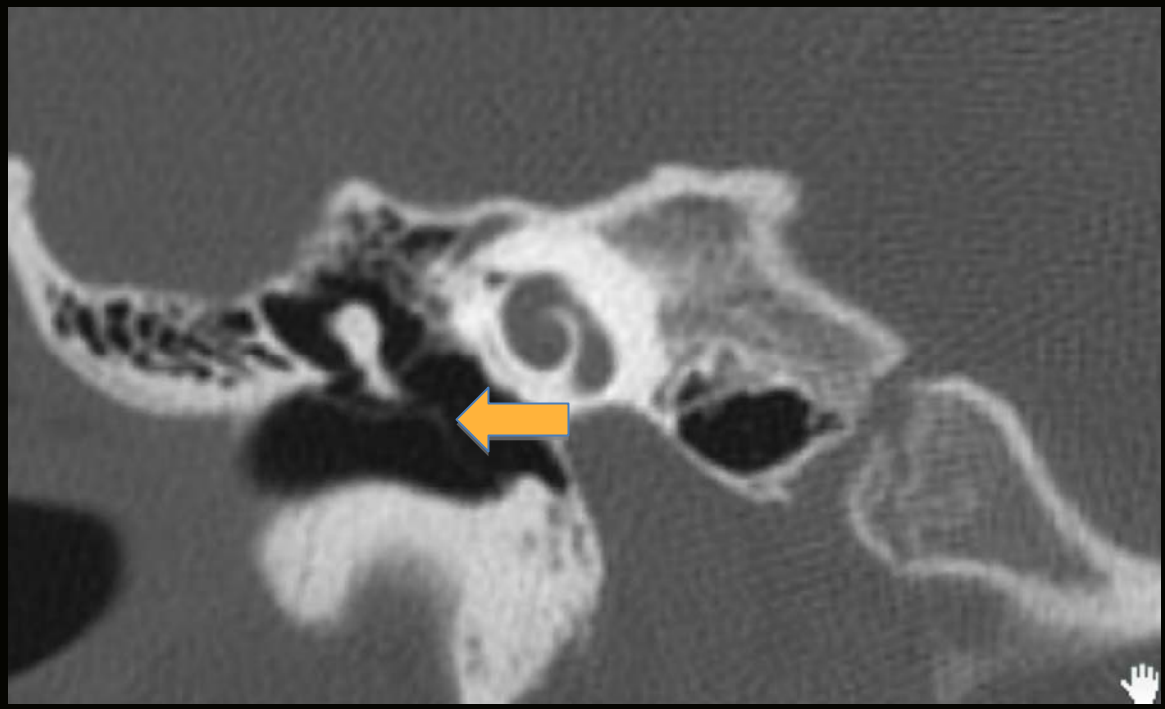
Coronal CT Scan – Right side



□□□□□

- Tensor tympani tendon inserts onto malleus neck

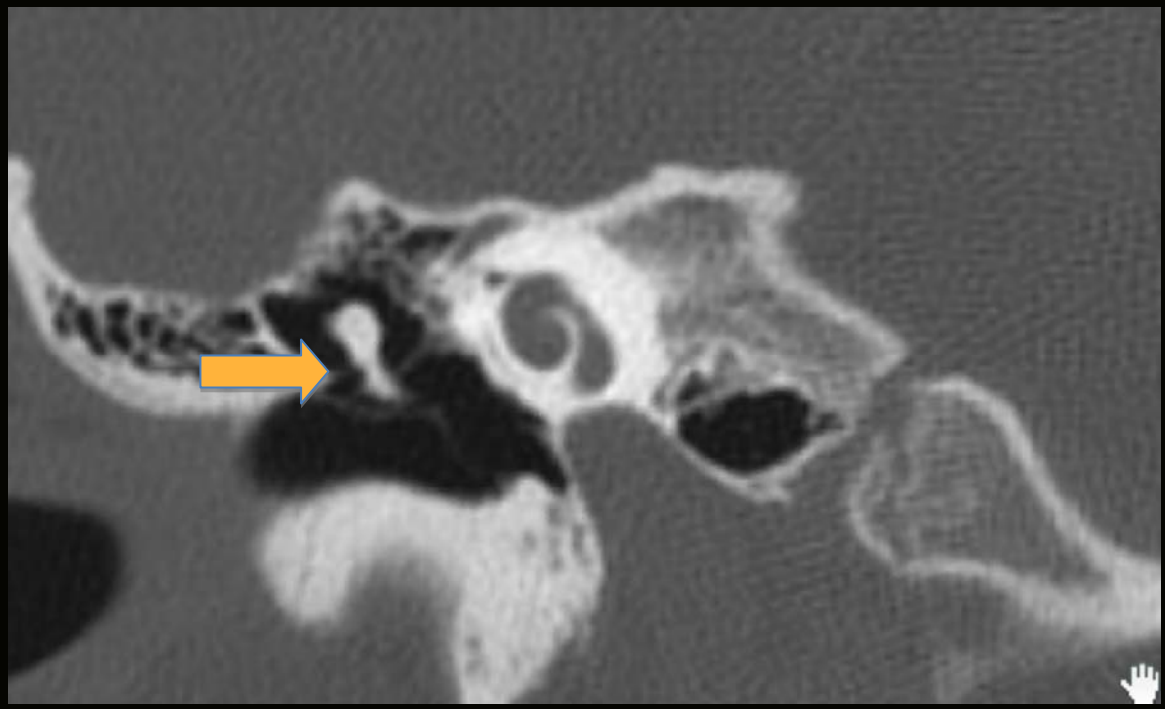
Coronal CT Scan – Right side



□□□□□

- Tympanic membrane

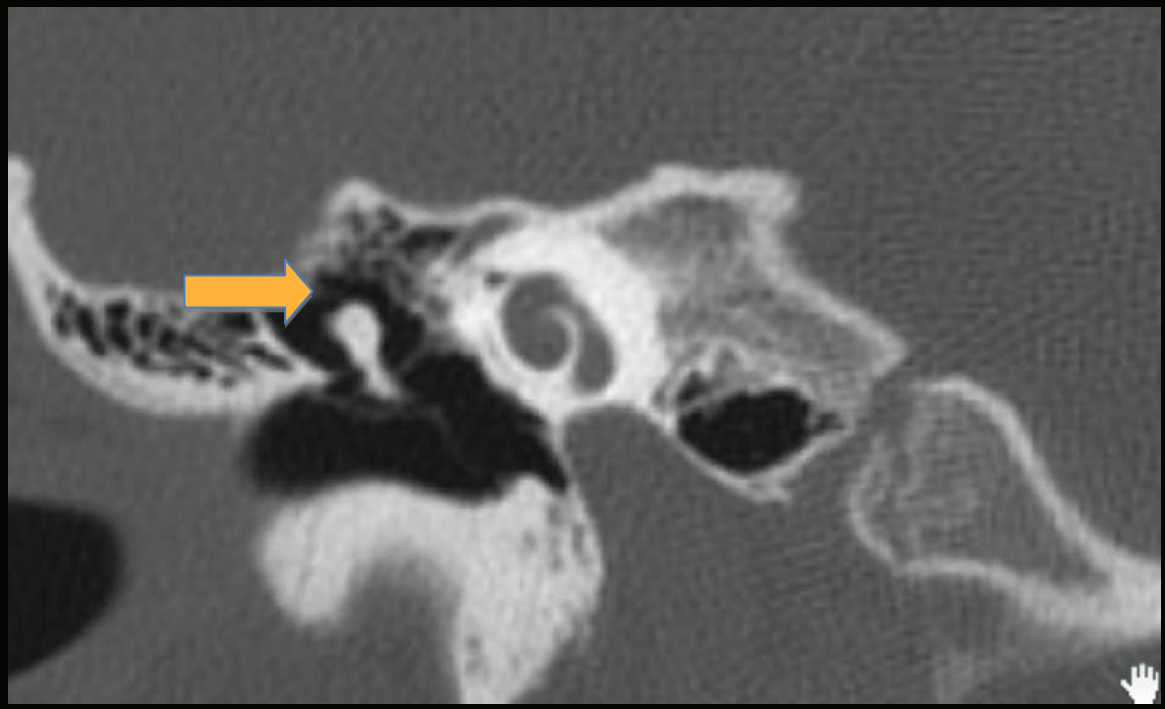
Coronal CT Scan – Right side



□□□□□

- Lateral malleolar ligament

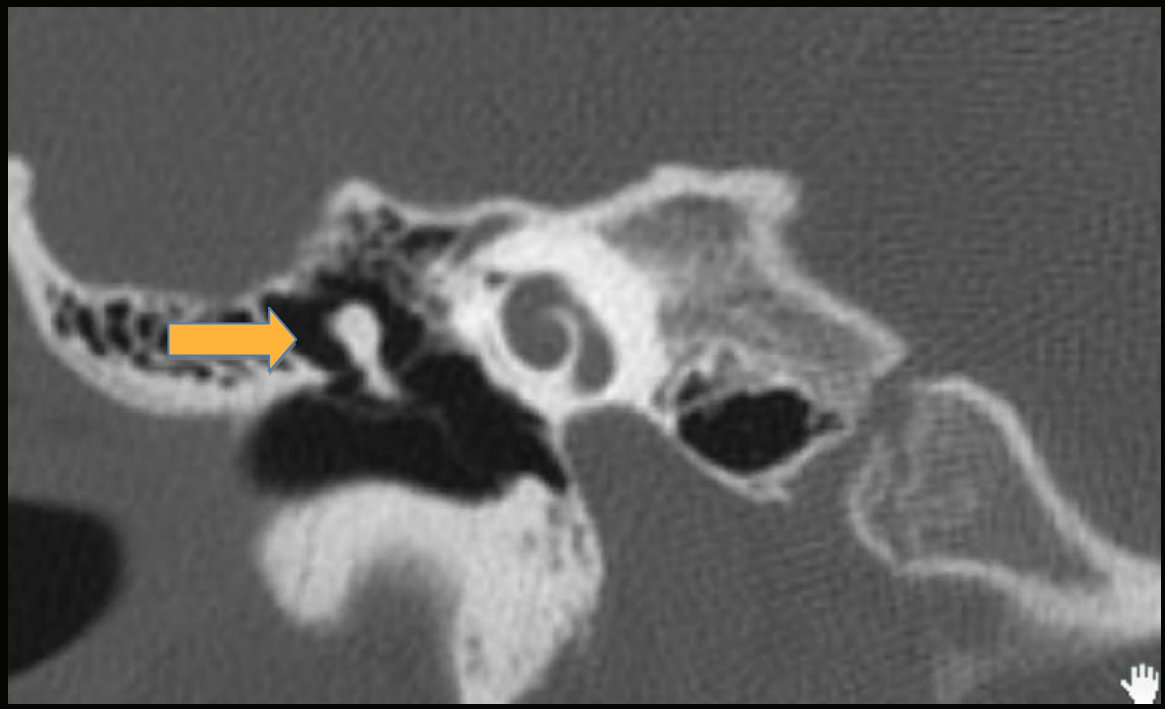
Coronal CT Scan – Right side



□□□□□

- Superior malleolar ligament

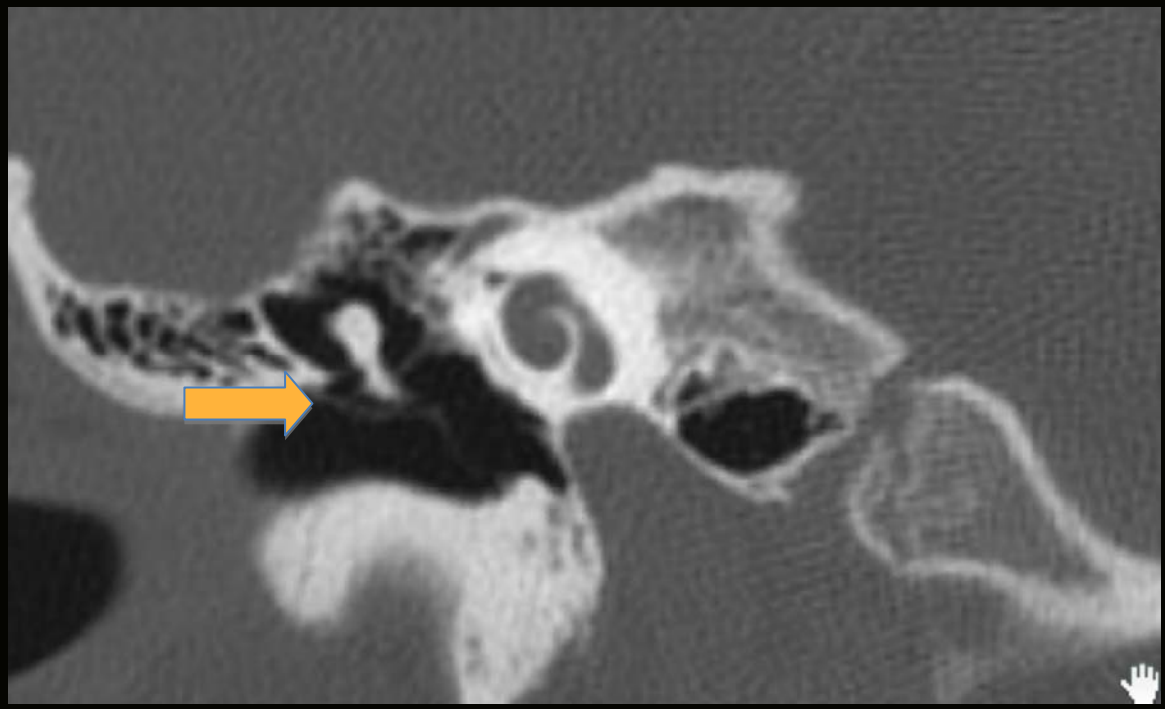
Coronal CT Scan – Right side



□□□□□

- Prussak’s space - lateral epitympanum

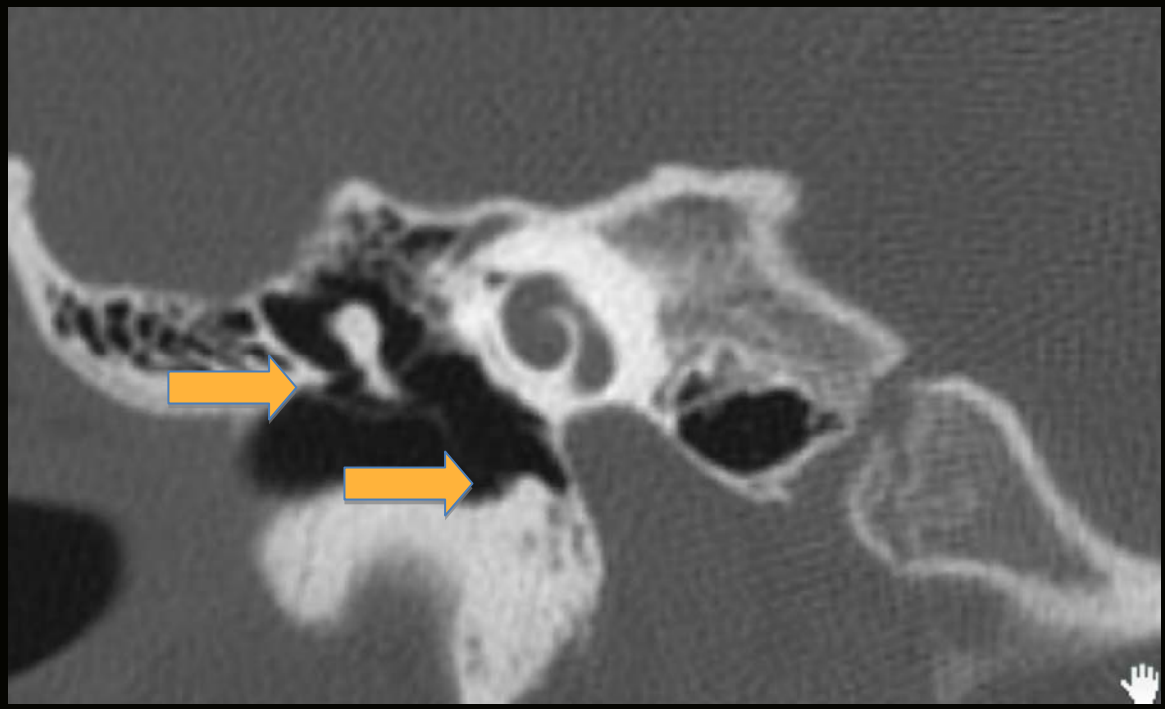
Coronal CT Scan – Right side



□□□□□

- Pars flaccida of the tympanic membrane

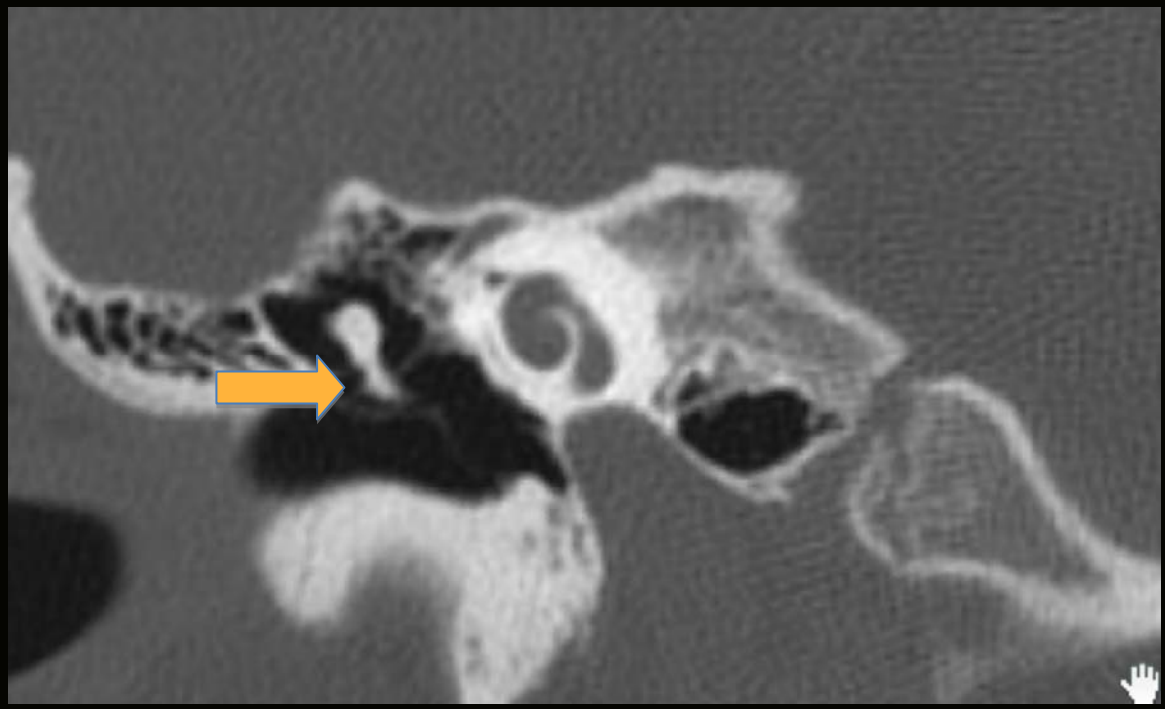
Coronal CT Scan – Right side



□□□□□

- Scutum
- Tympanic annulus

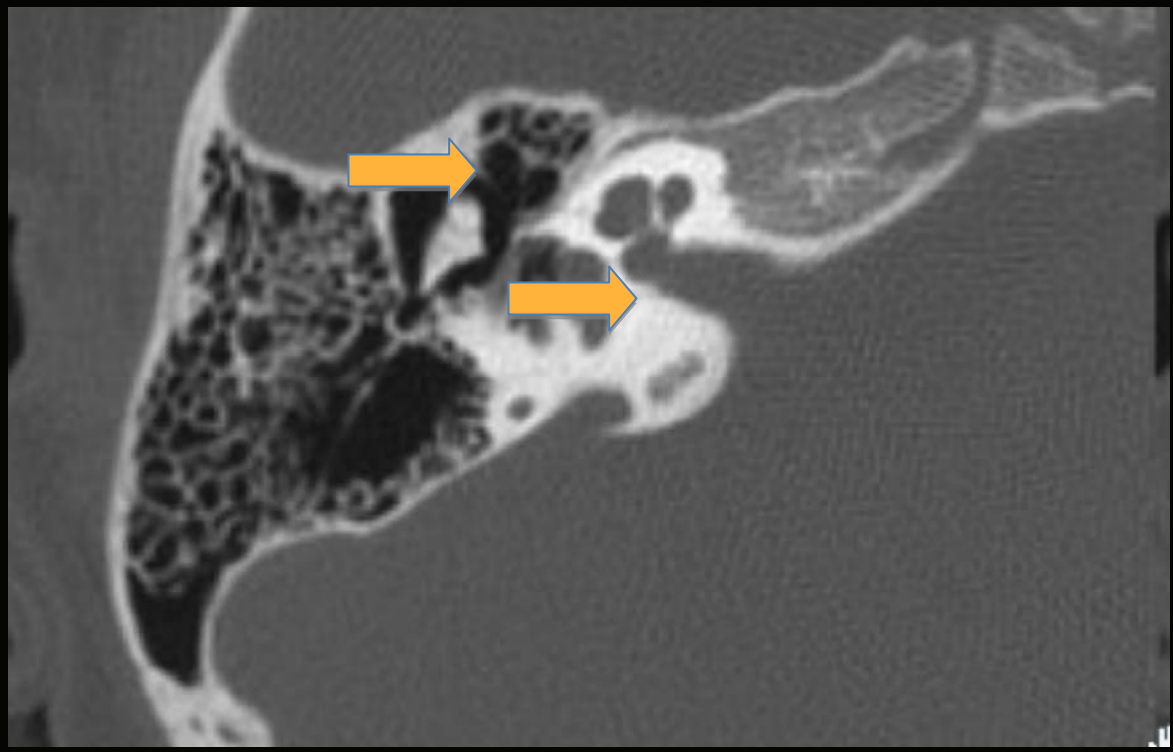
Coronal CT Scan – Right side



□□□□□

- Malleus manubrium within the tympanic membrane

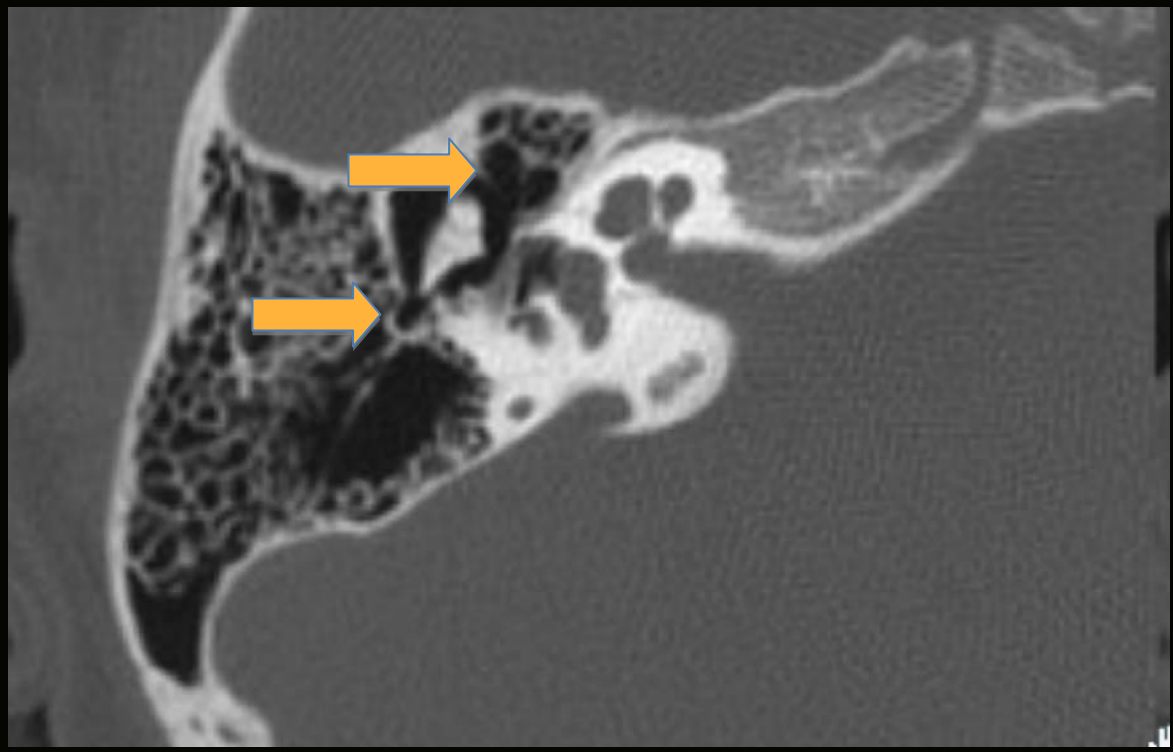
Axial CT Scan – Right side



□□□□□

- Anterior epitympanic recess
- IAC

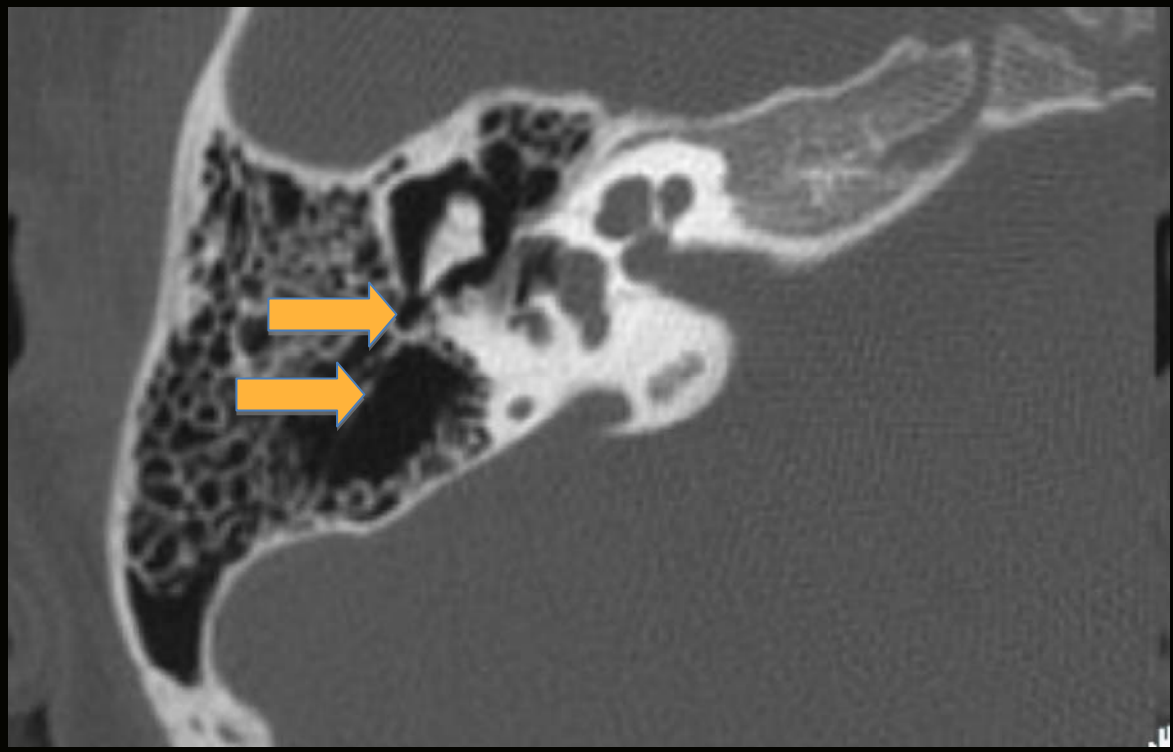
Axial CT Scan – Right side



□□□□□

- Anterior epitympanic recess
- Additus ad antrum

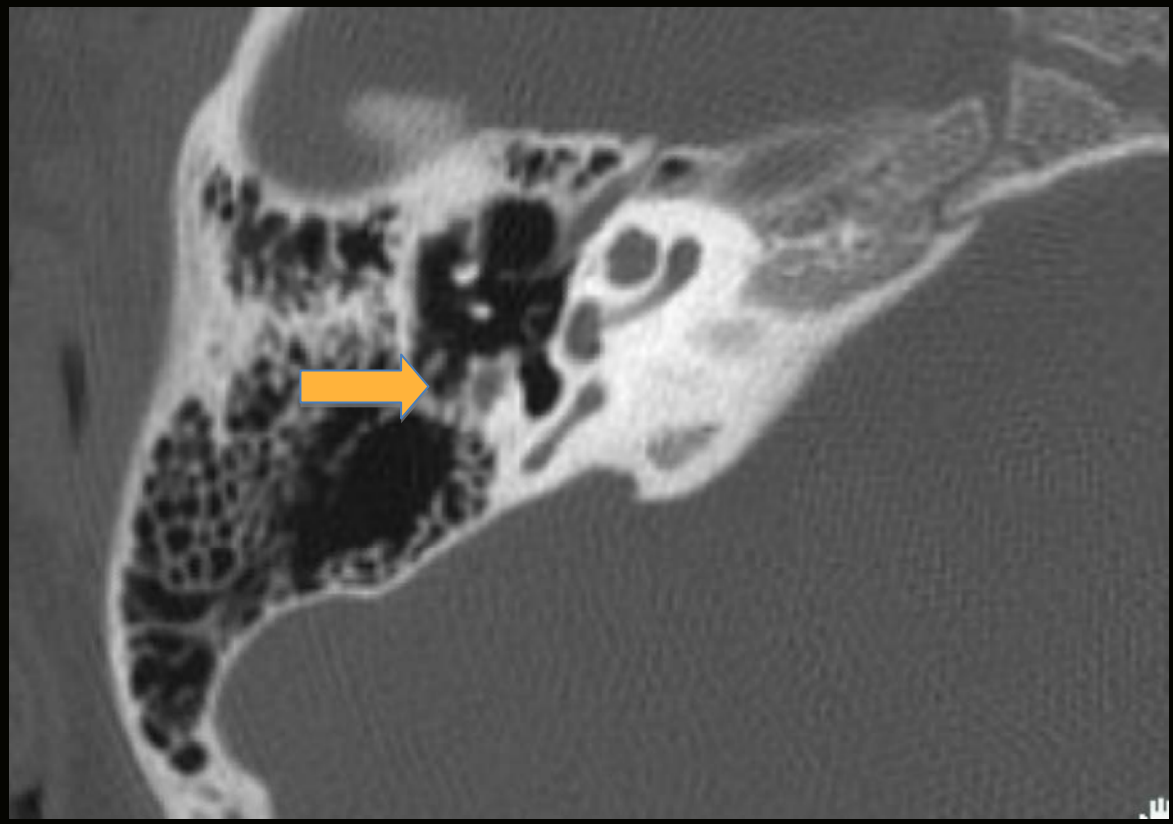
Axial CT Scan – Right side



□□□□□

- Additus ad antrum
- Mastoid antrum

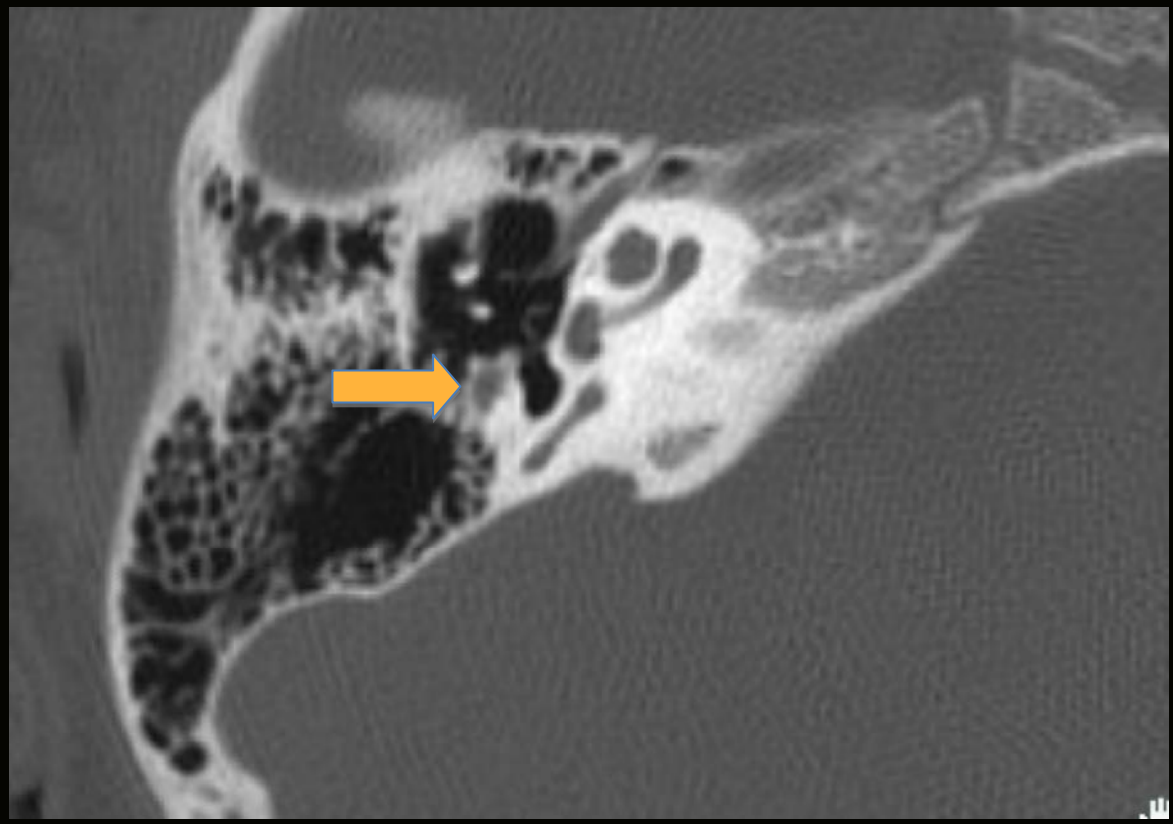
Axial CT Scan – Right side



□□□□□

- Facial recess

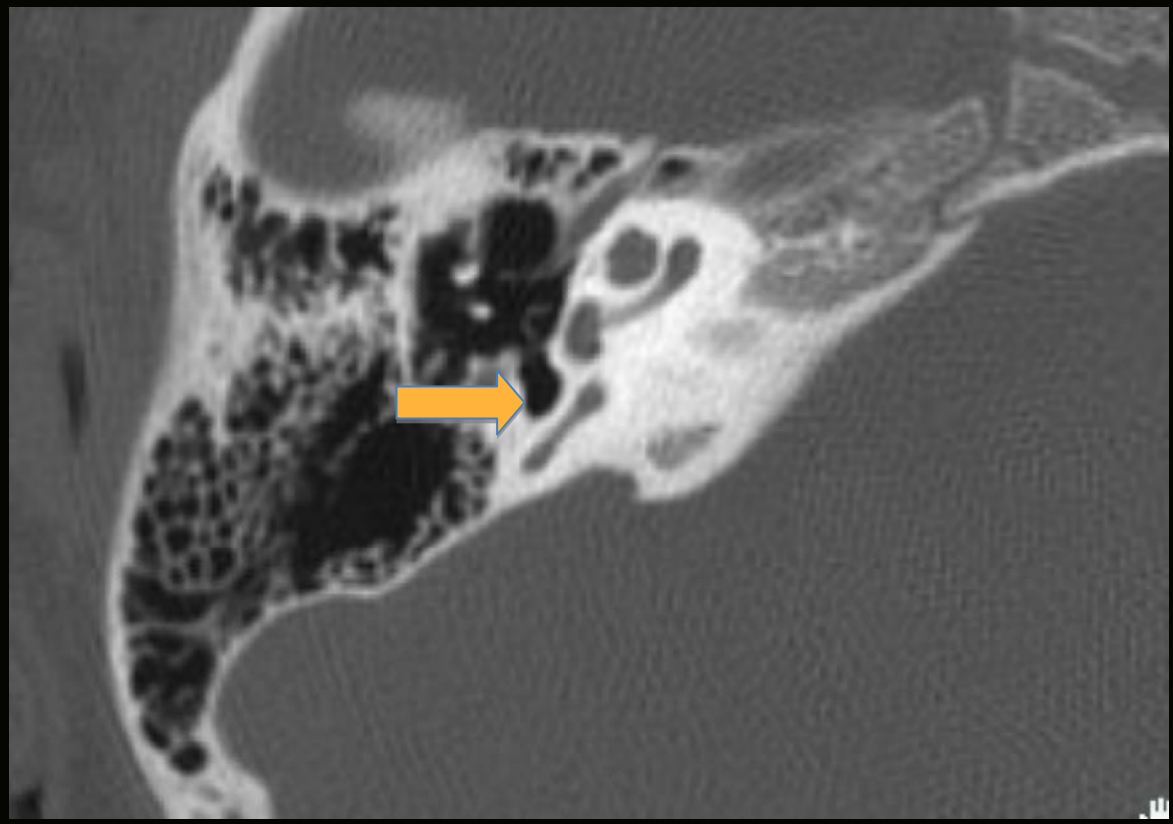
Axial CT Scan – Right side



□□□□□

- Pyramidal eminence - with the 2nd posterior facial nerve genu

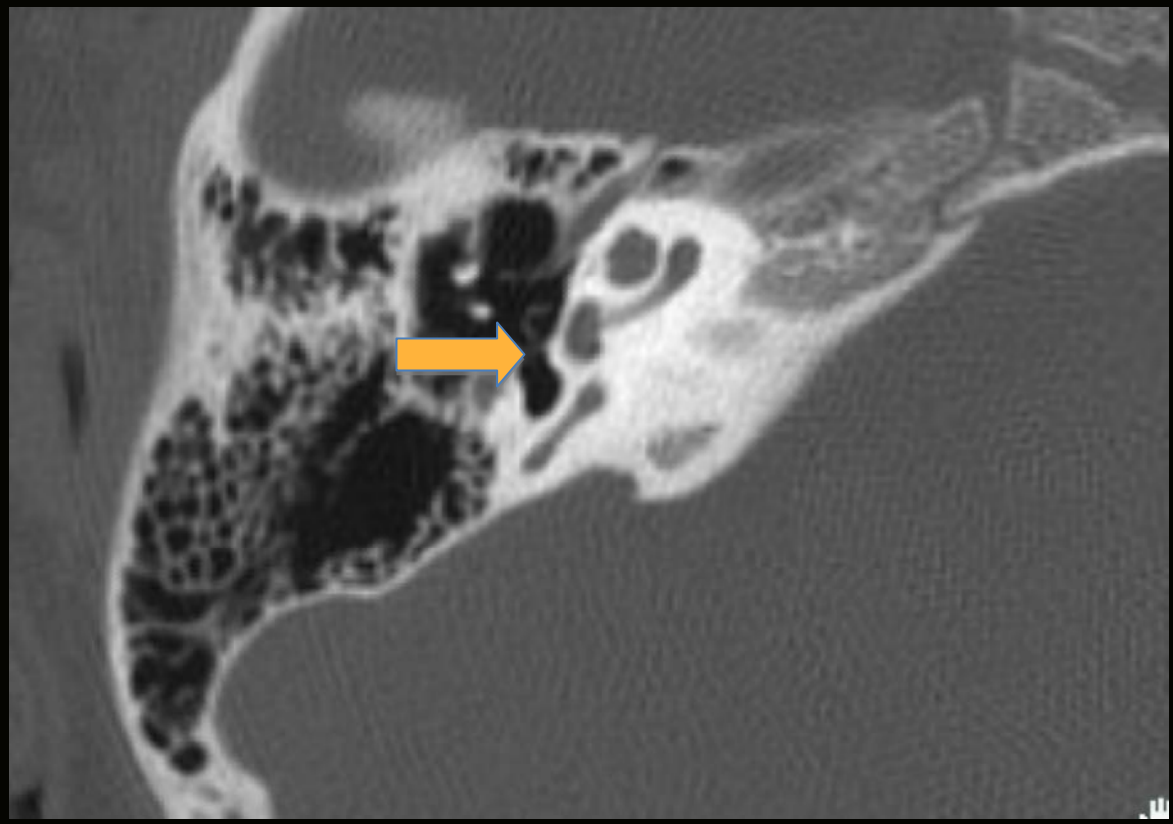
Axial CT Scan – Right side



□□□□□

- Sinus tympani

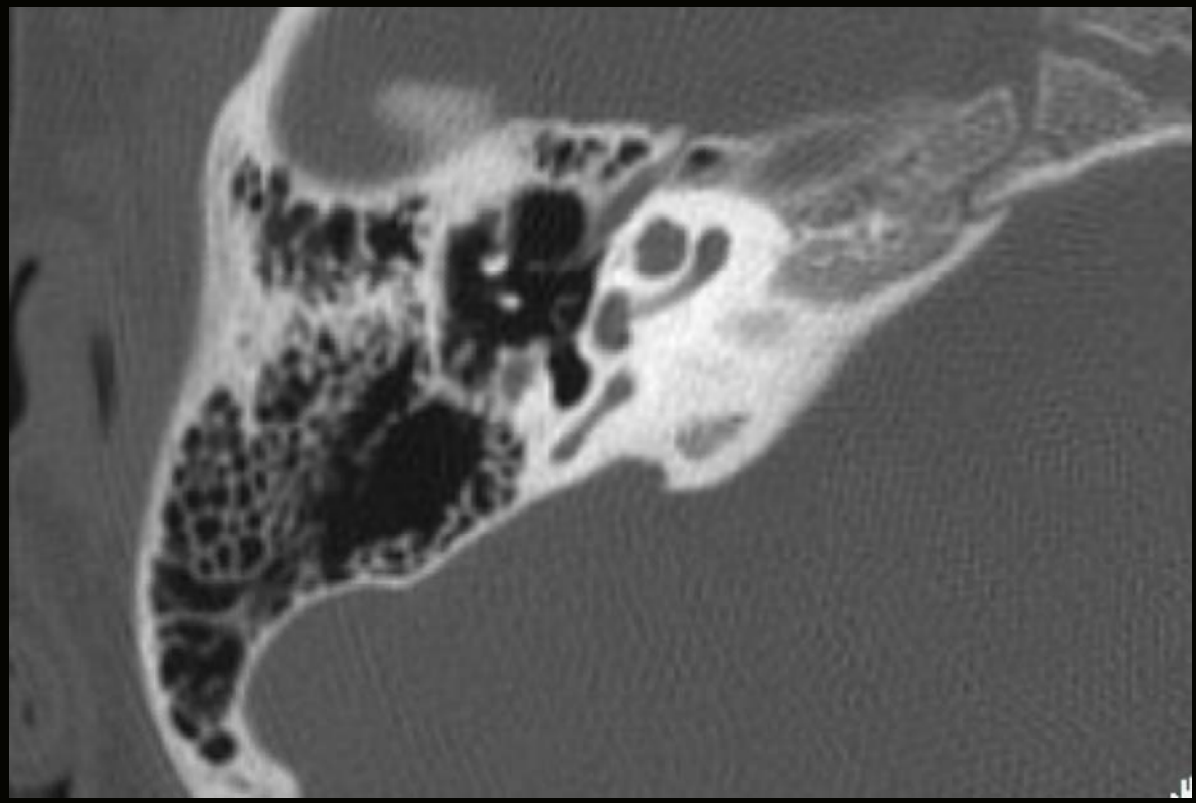
Axial CT Scan – Right side



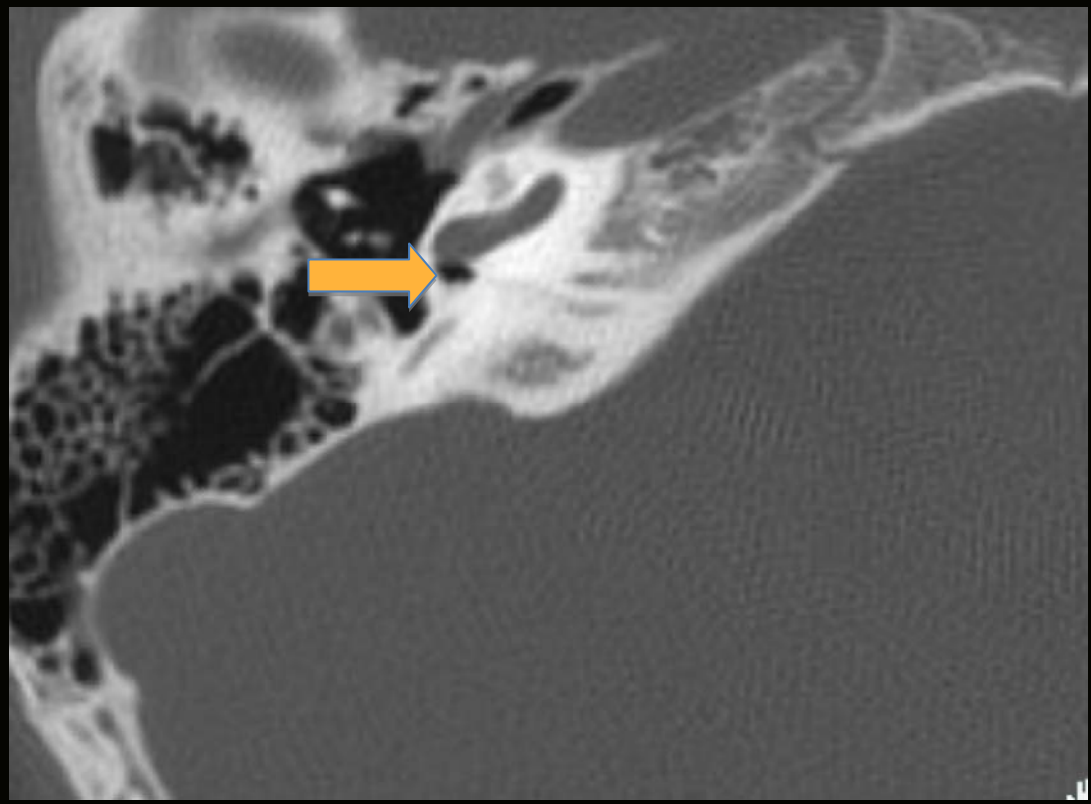
□□□□□

- Cochlear promontory

Axial CT Scan – Right side



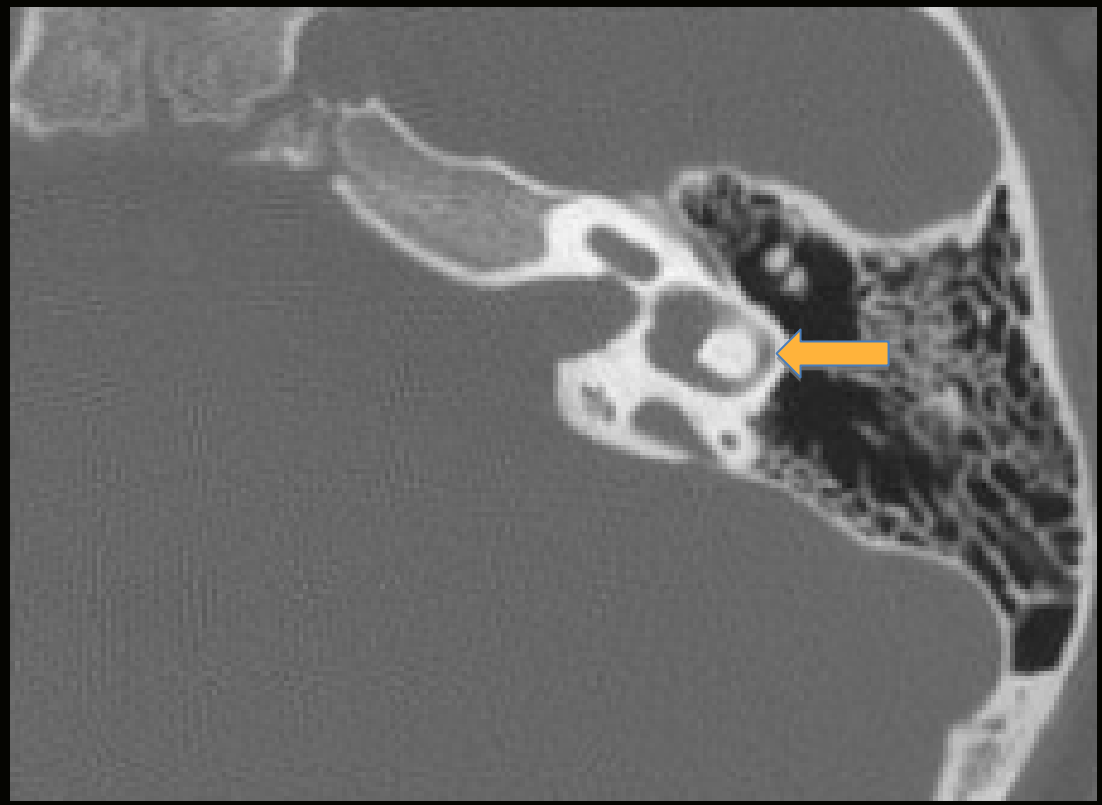
Axial CT Scan – Right side



□□□□□

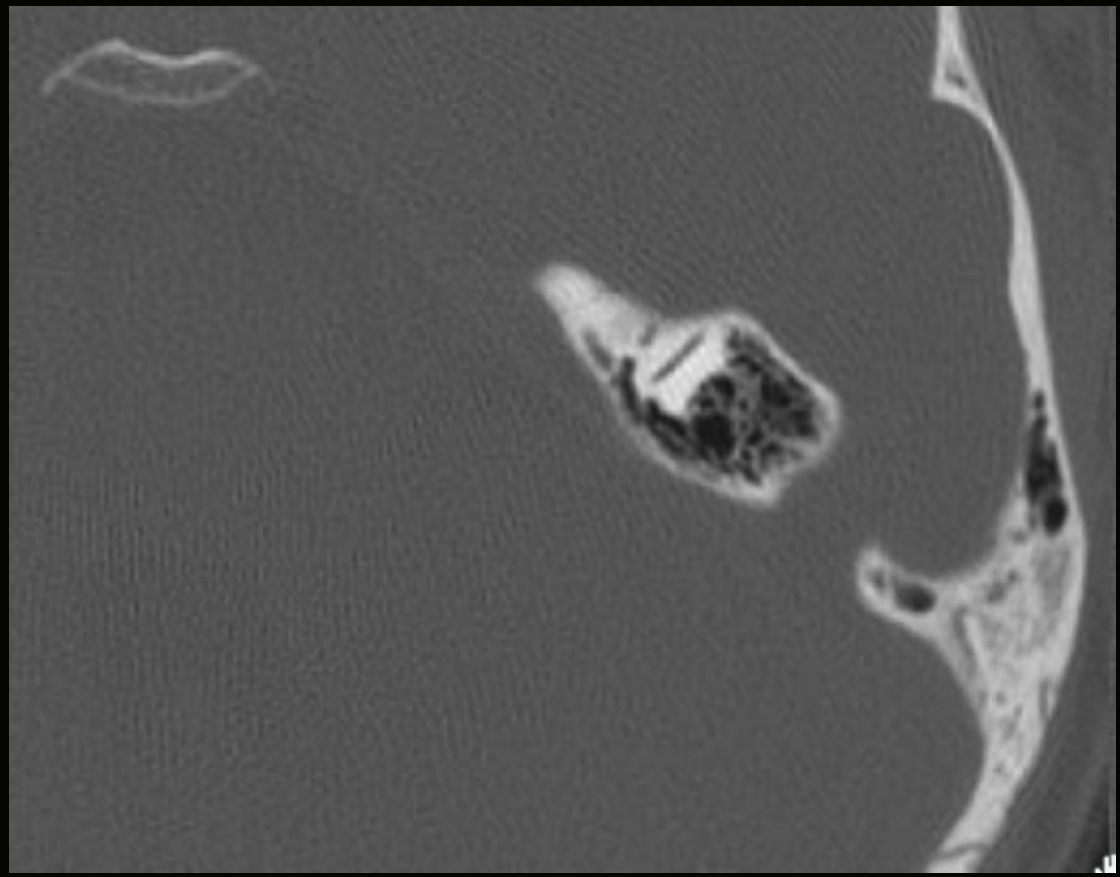
- Round window

Axial CT Scan – Left side

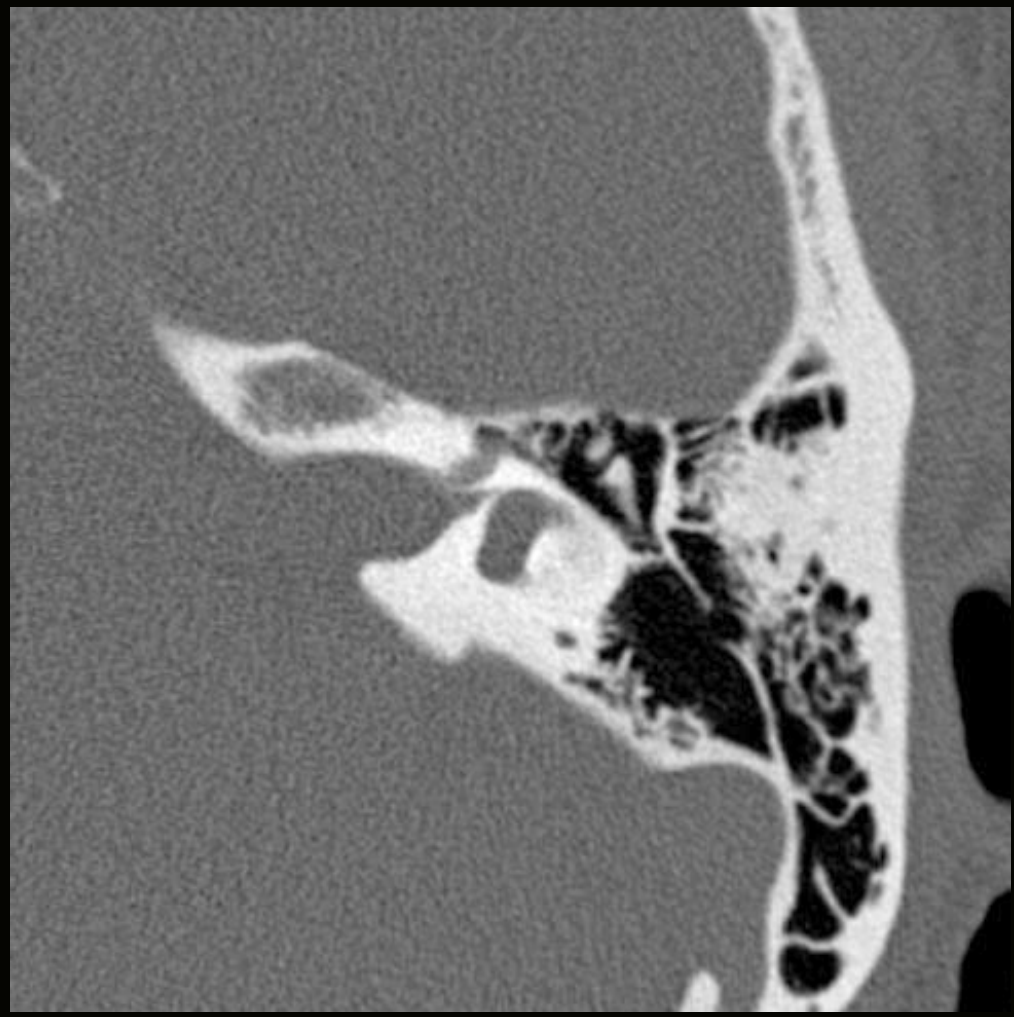


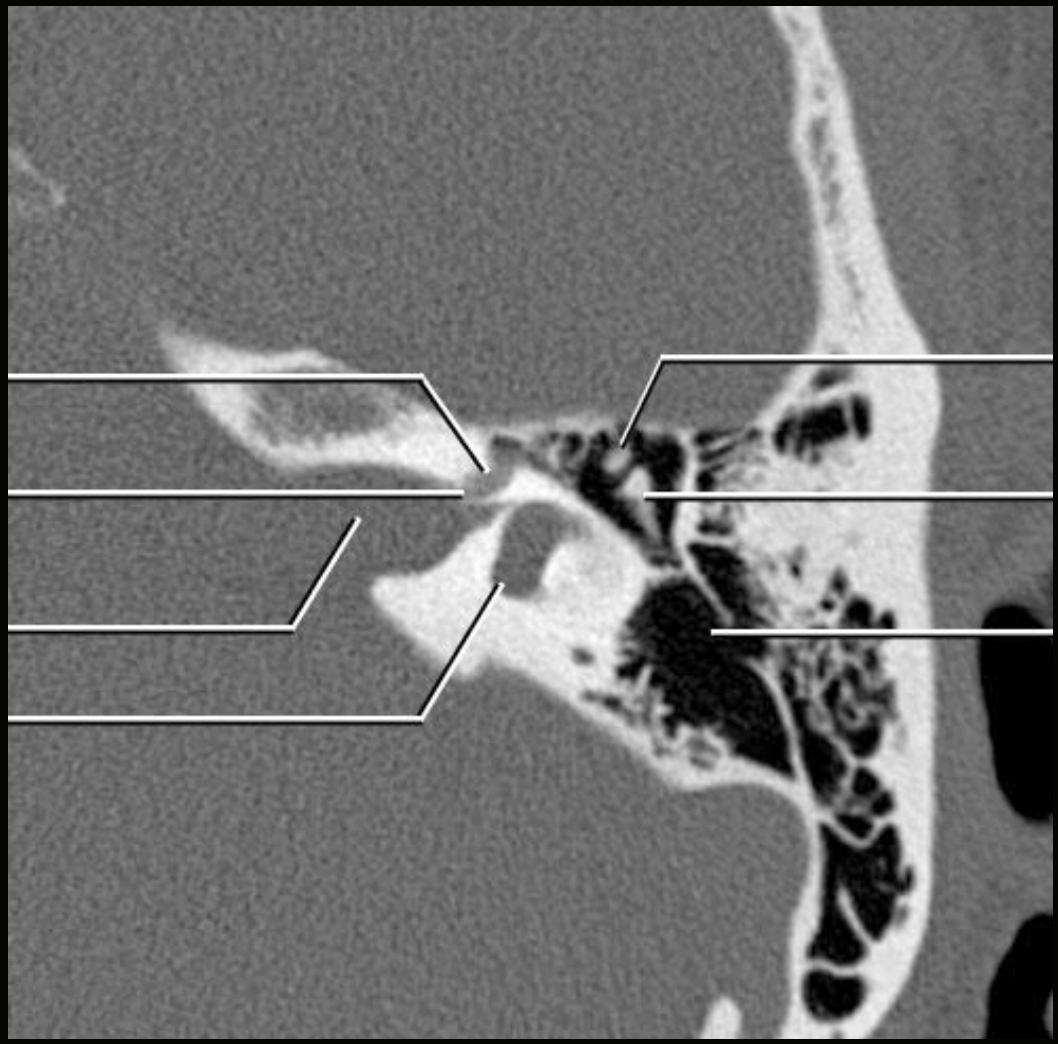
- Horizontal SCC - responds to rotational or angular acceleration

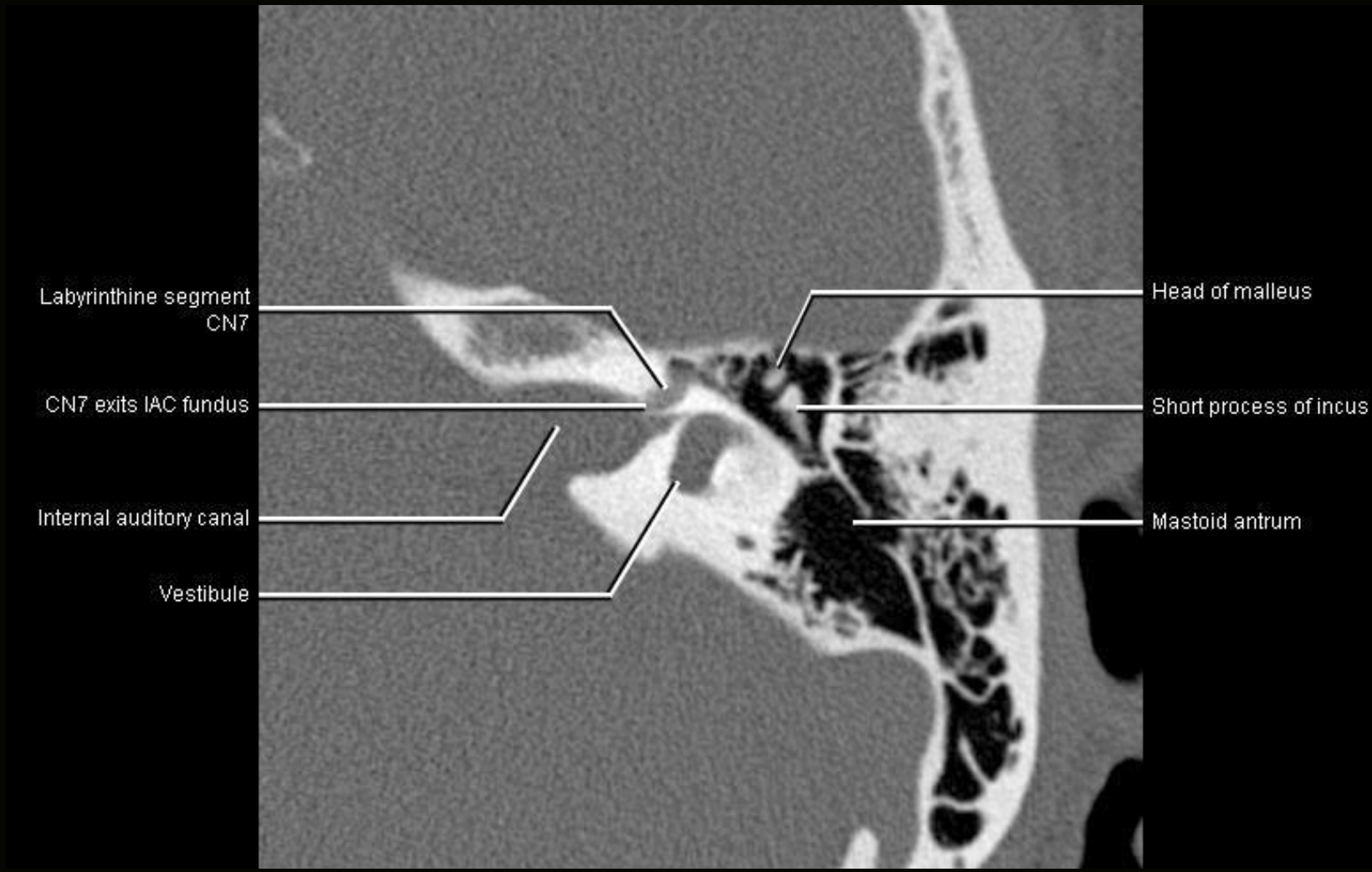
Axial CT Scan – Left side



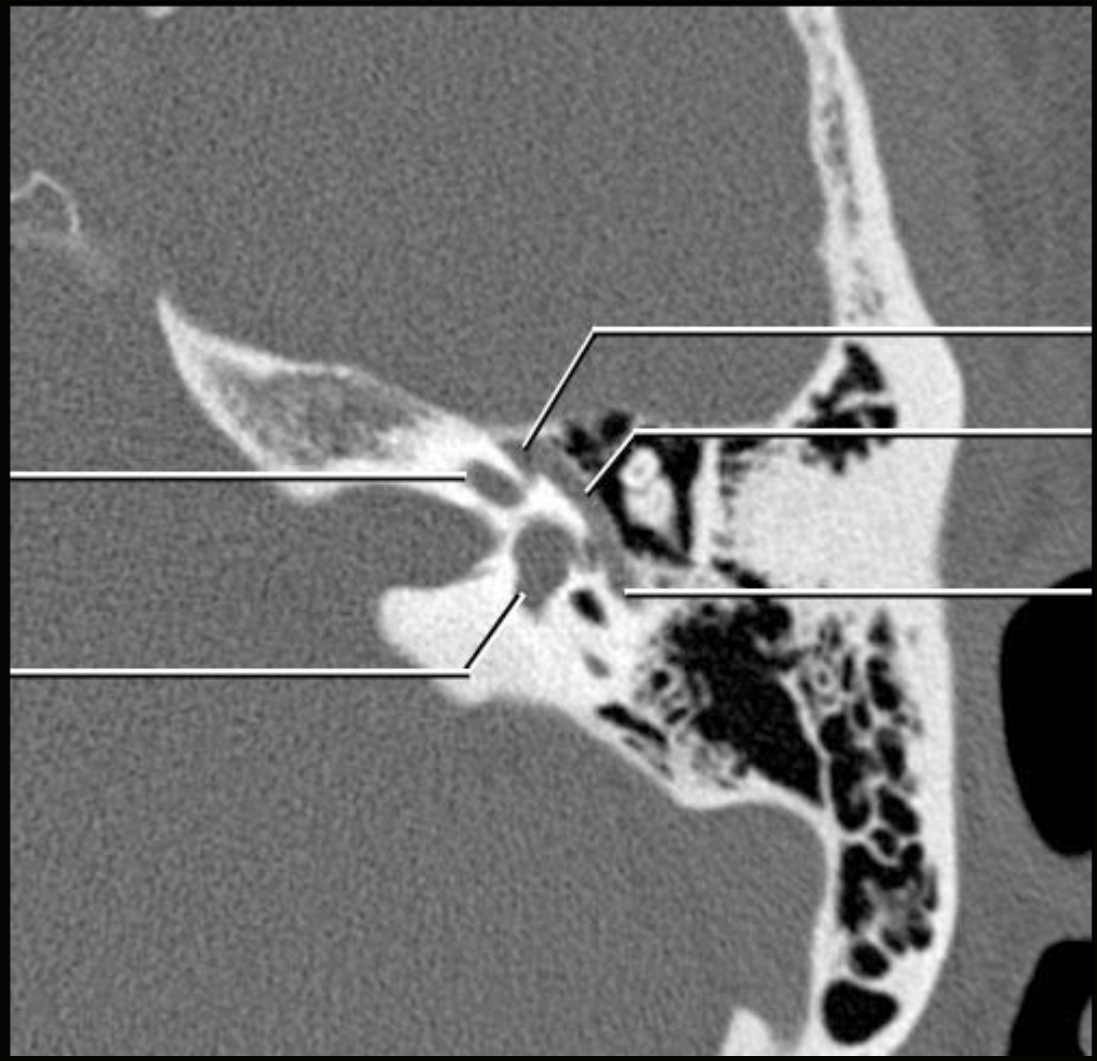
First of six axial bone CT images of the left temporal bone presented from superior to inferior shows the labyrinthine segment of the facial nerve canal as a C-shaped structure arching anterolaterally over the top of the cochlea.

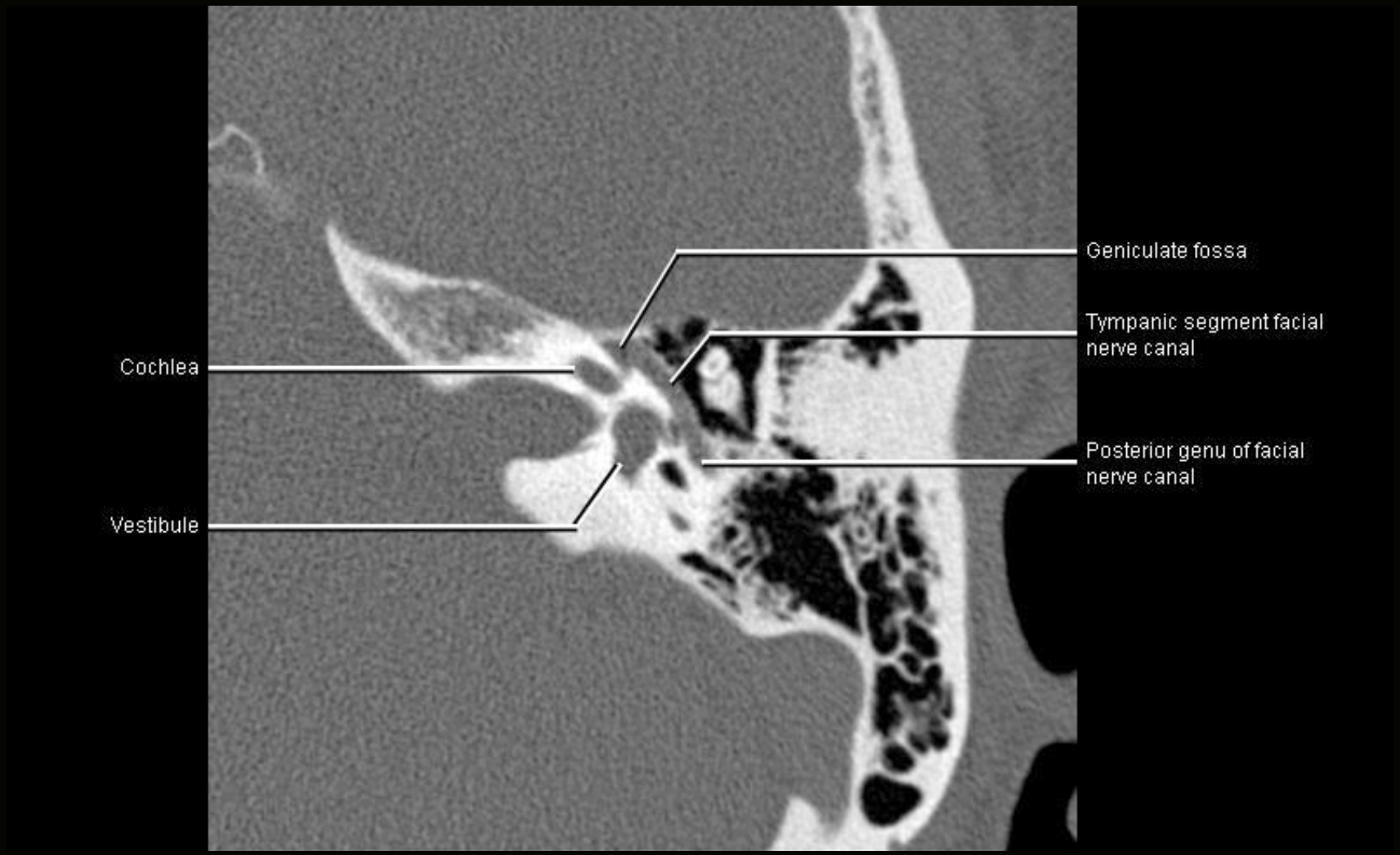




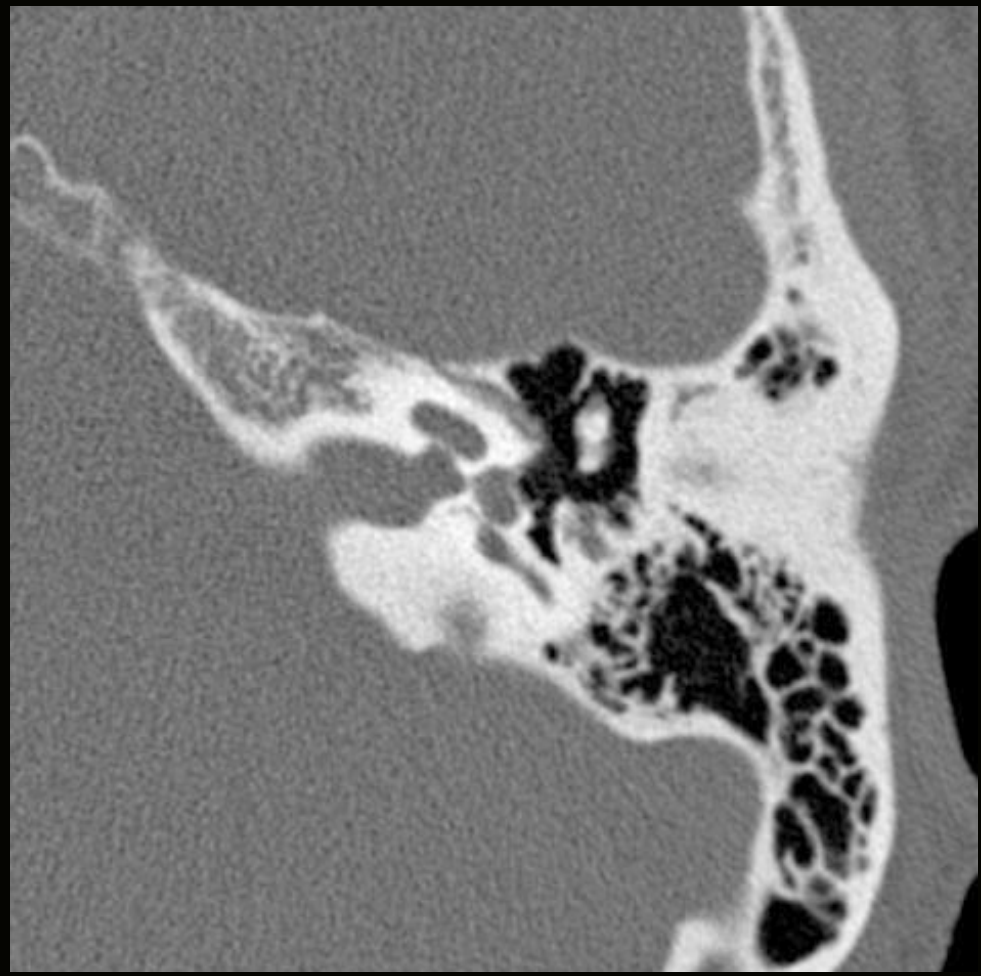

Labyrinthine segment CN7
CN7 exits IAC fundus
Internal auditory canal
Vestibule
Head of malleus
Short process of incus
Mastoid antrum

In this image the labyrinthine segment CN7 canal terminates in geniculate fossa. The facial nerve canal turns abruptly at the geniculate fossa (anterior genu). The tympanic segment arises from geniculate fossa, coursing posterolaterally in axial plane, running under the lateral semicircular canal before turning 90 degrees inferiorly at posterior genu to become the mastoid segment.

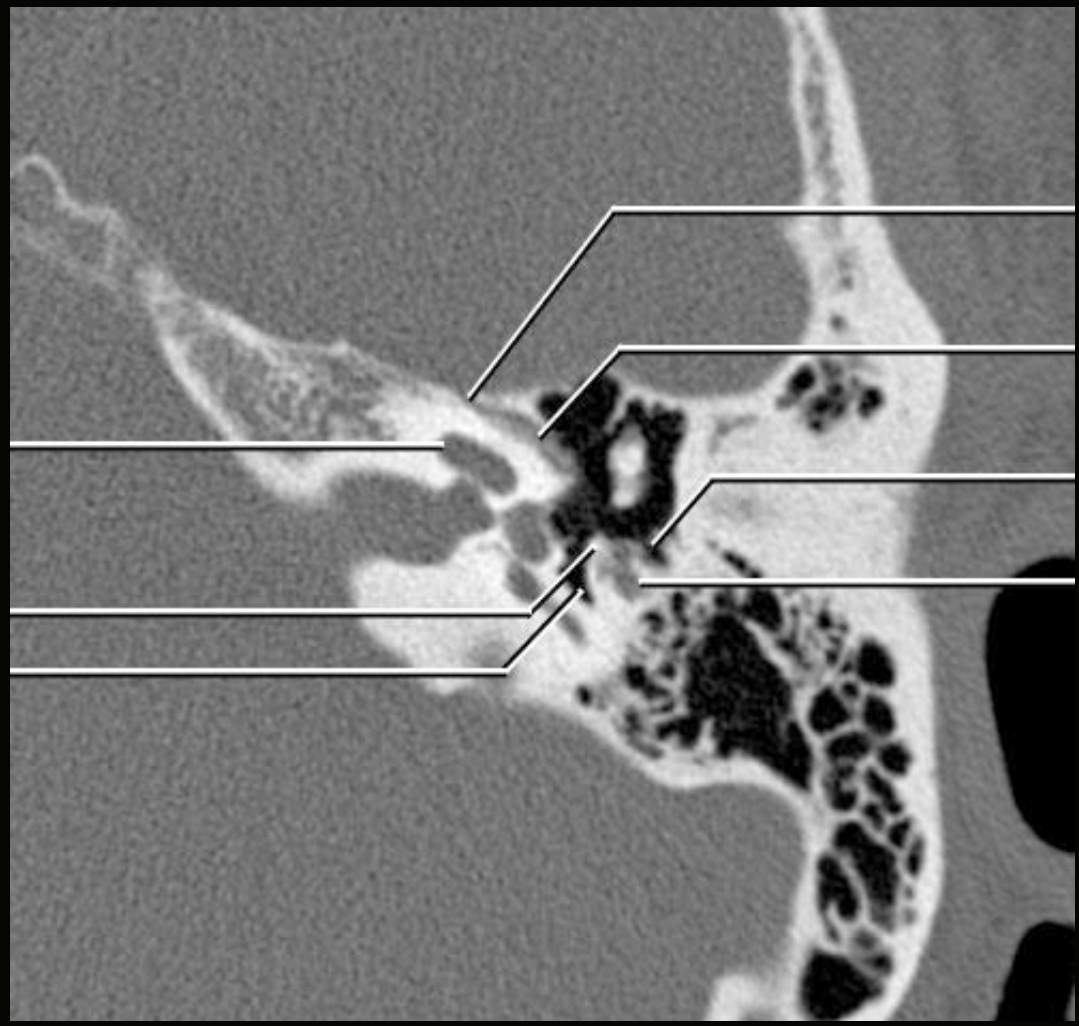


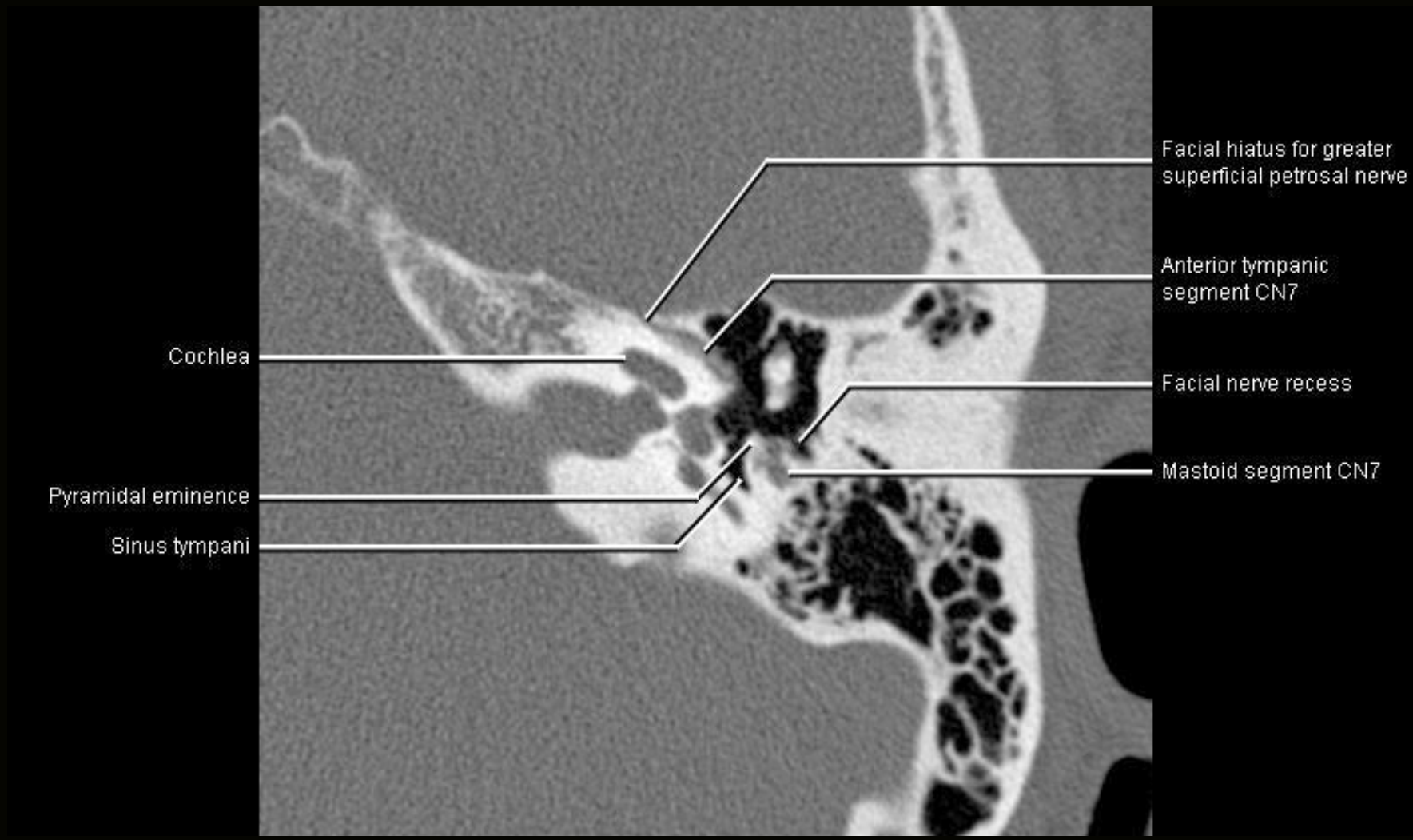

Geniculate fossa
Tympanic segment facial nerve canal
Cochlea
Posterior genu of facial nerve canal
Vestibule

At the level of the oval window, the mastoid segment is visible deep to the facial nerve recess. Notice the more medial pyramidal eminence and sinus tympani.

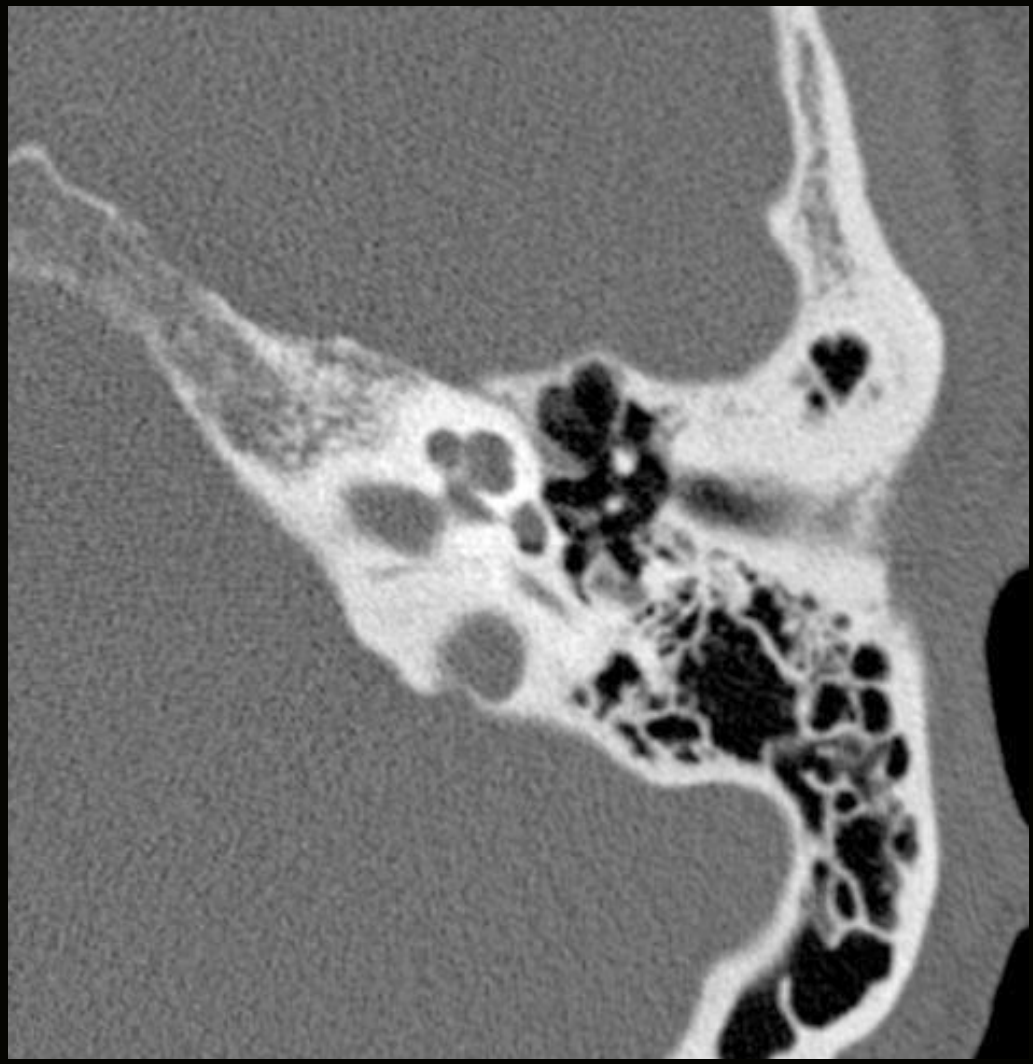


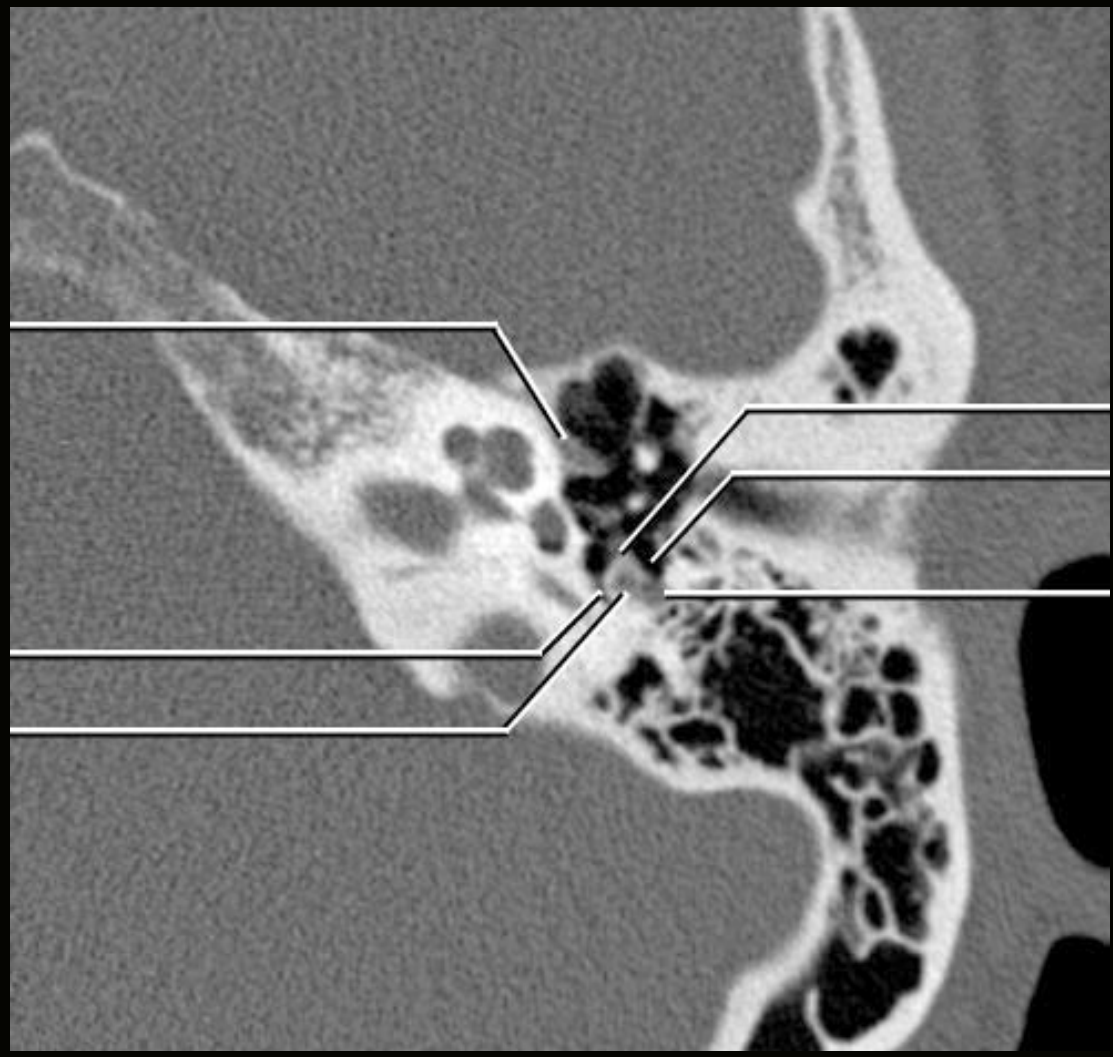
At the level of the oval window, the mastoid segment is visible deep to the facial nerve recess. Notice the more medial pyramidal eminence and sinus tympani.

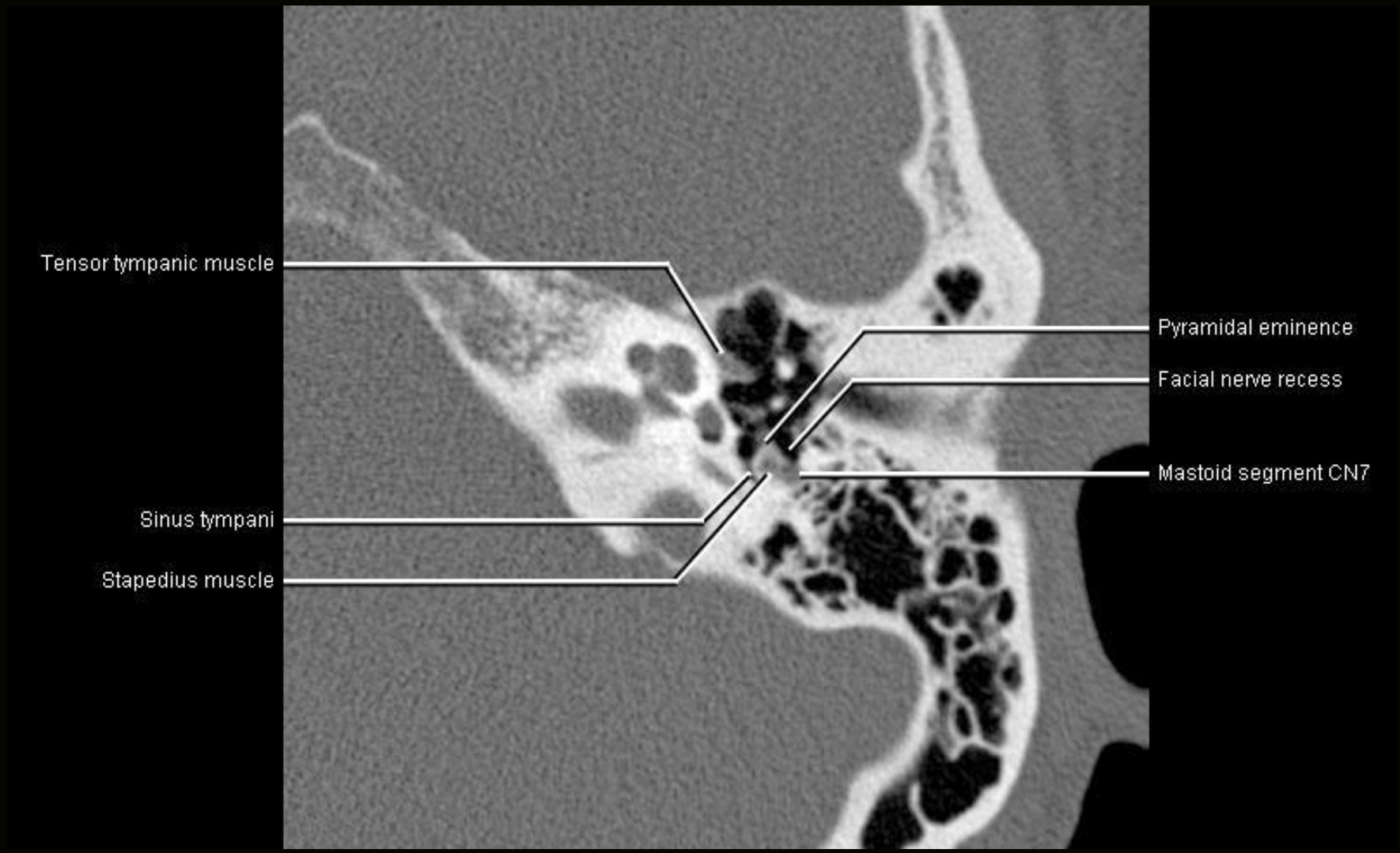



Facial hiatus for greater superficial petrosal nerve
Anterior tympanic segment CN7
Cochlea
Facial nerve recess
Mastoid segment CN7
Pyramidal eminence
Sinus tympani

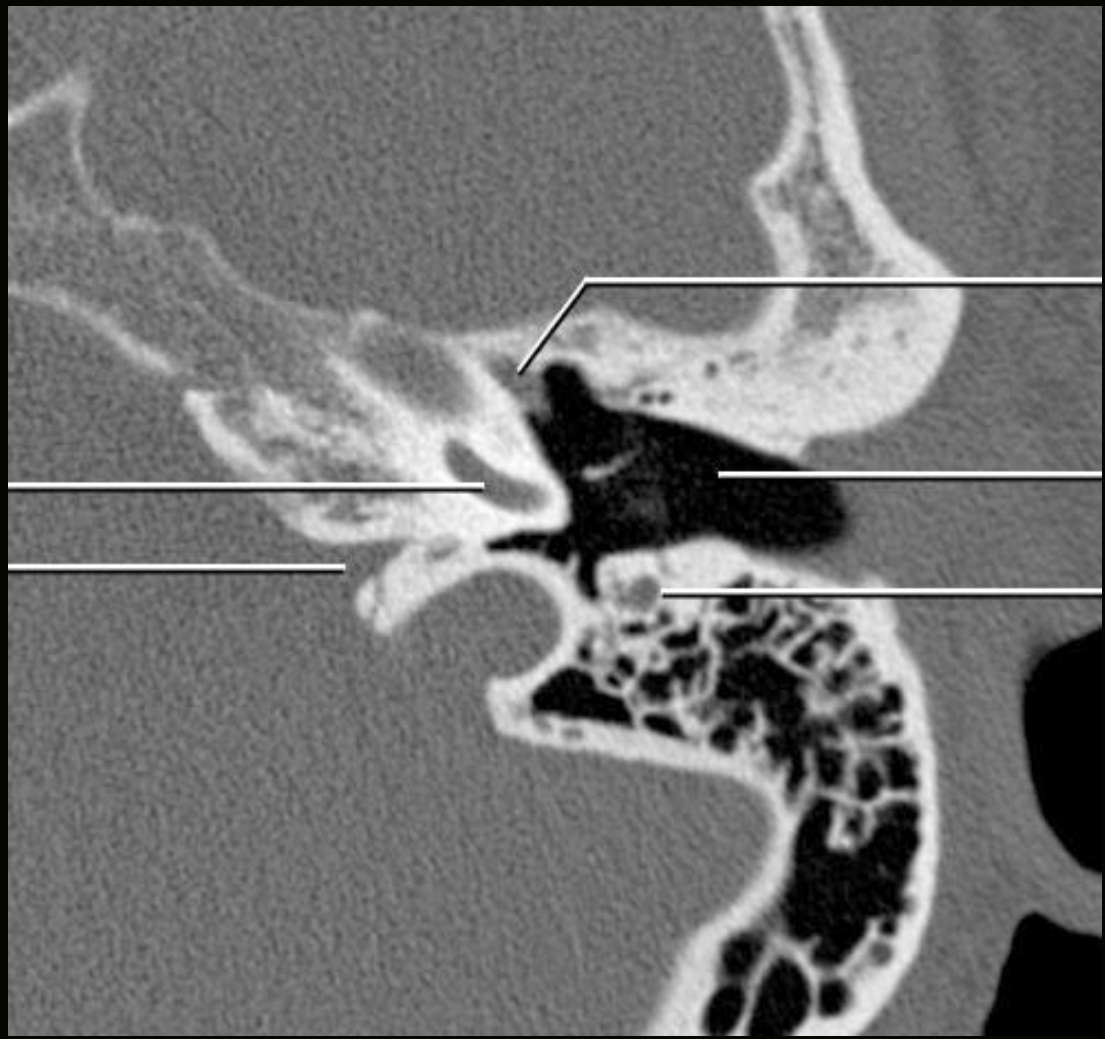
Mastoid segment extends approximately 13 mm from posterior genu to stylomastoid foramen coursing inferiorly within posterior wall of middle ear cavity. Mastoid segment is related anteriorly to facial nerve recess and medially to stapedius muscle within pyramidal eminence on posterior wall of middle ear cavity.

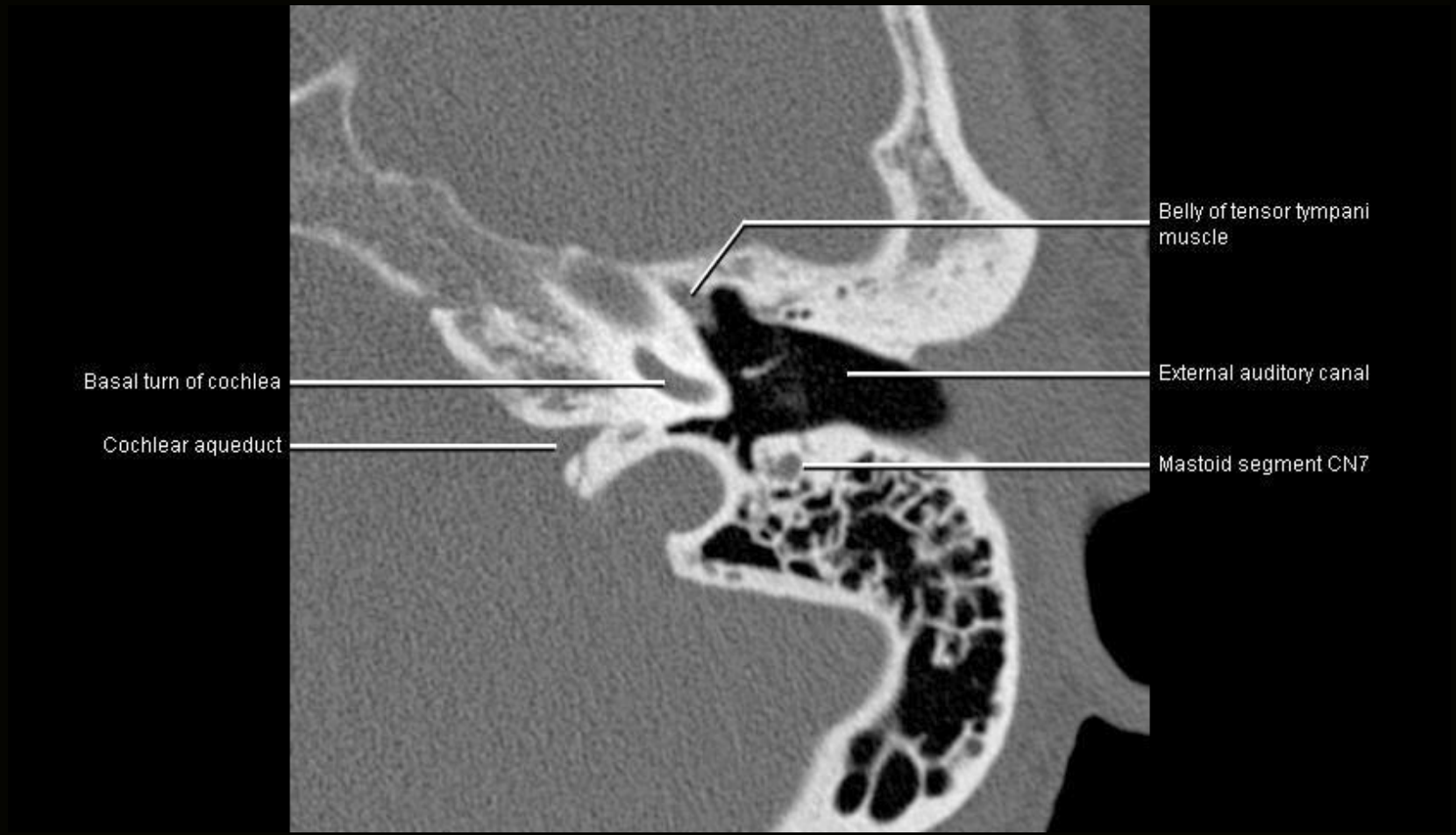




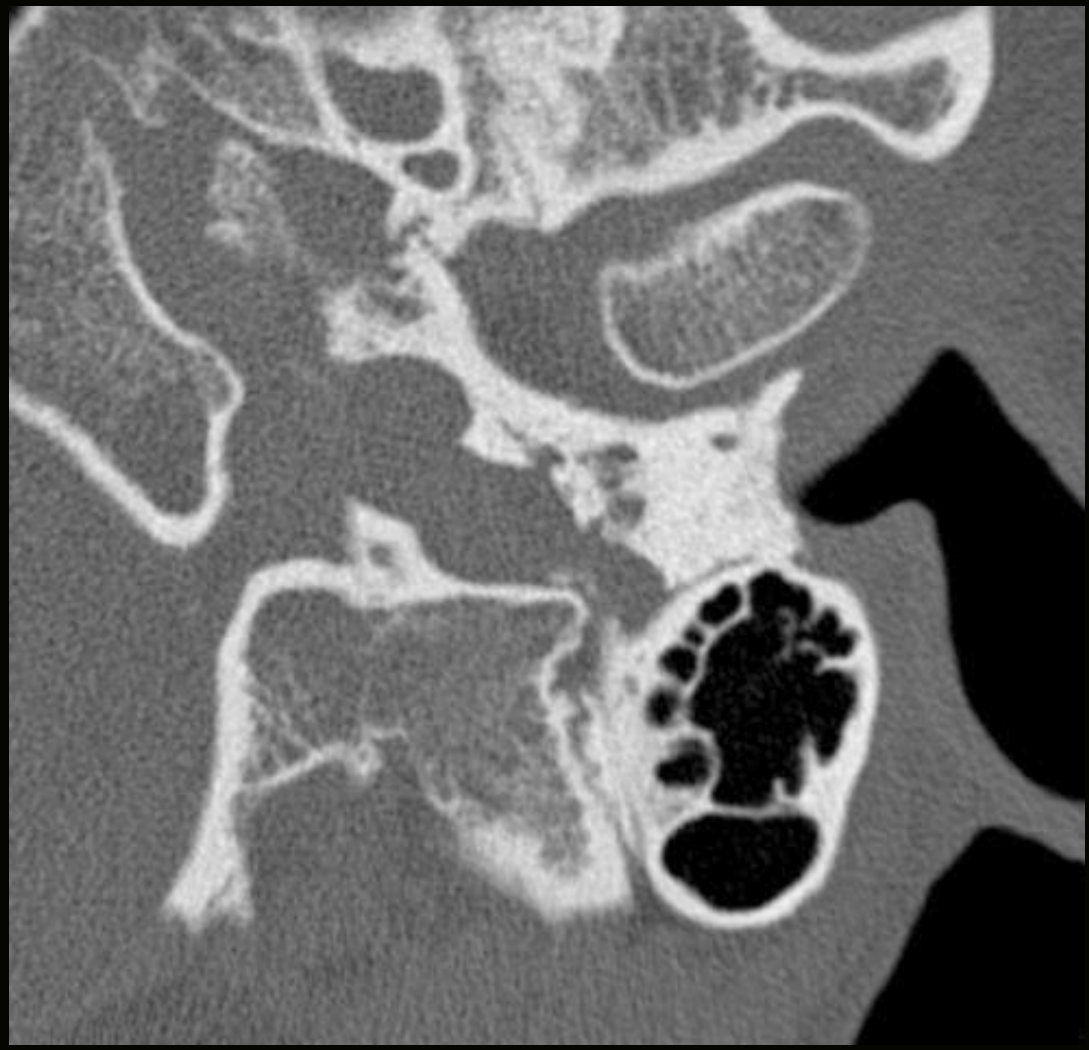

Tensor tympanic muscle
Sinus tympani
Stapedius muscle
Pyramidal eminence
Facial nerve recess
Mastoid segment CN7

At the level of the basal turn of the cochlea the mastoid segment of facial nerve is still visible. Both the nerve to stapedius muscle proximally and chorda tympani distally branch off the mastoid segment CN7.

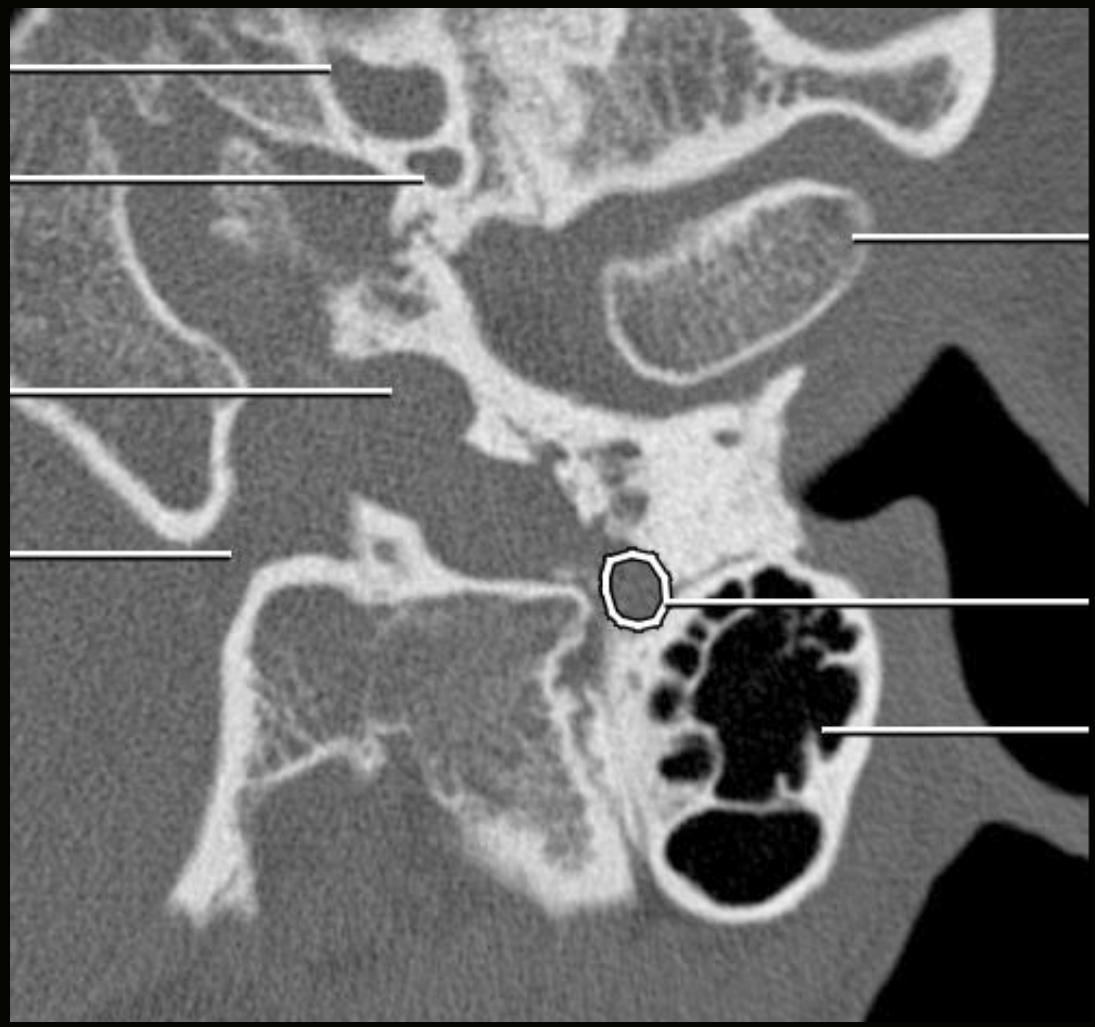



Belly of tensor tympani muscle
External auditory canal
Mastoid segment CN7
Basal turn of cochlea
Cochlear aqueduct

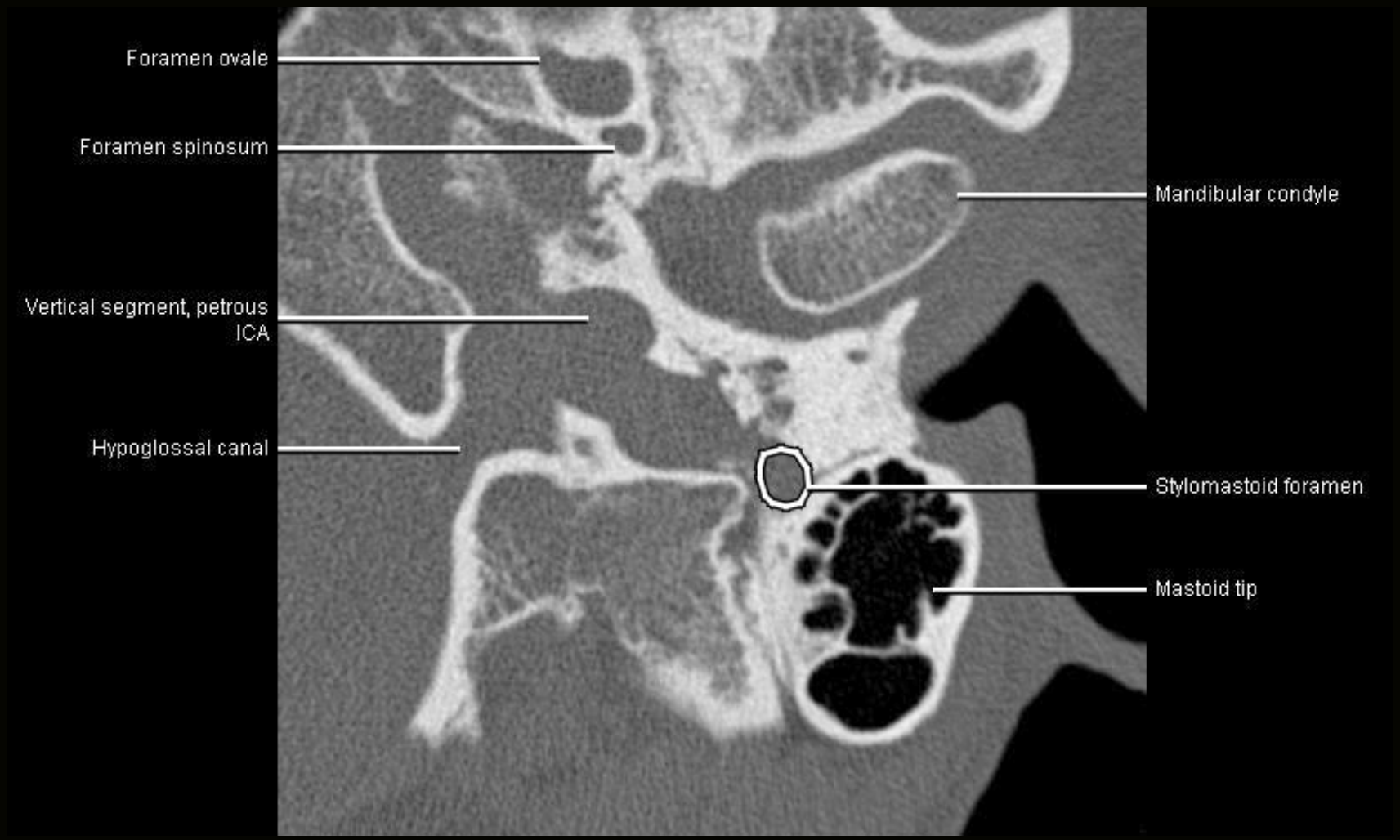
At the level of the stylomastoid foramen, the "bell" of the stylomastoid foramen is just anteromedial to the mastoid tip. The mastoid tip protects the facial nerve from traumatic injury as it exits the skull base.



At the level of the stylomastoid foramen, the "bell" of the stylomastoid foramen is just anteromedial to the mastoid tip. The mastoid tip protects the facial nerve from traumatic injury as it exits the skull base.

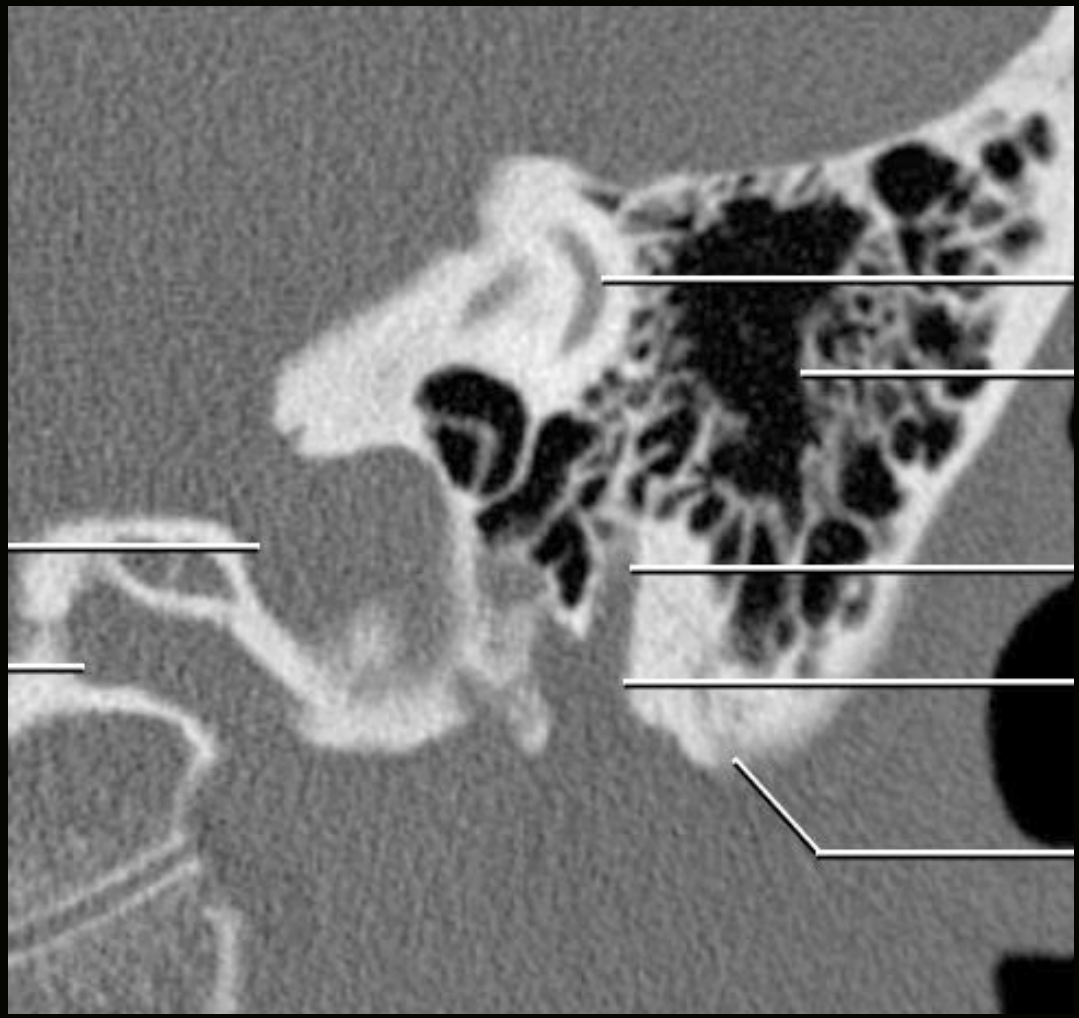


At the level of the stylomastoid foramen, the "bell" of the stylomastoid foramen is just anteromedial to the mastoid tip. The mastoid tip protects the facial nerve from traumatic injury as it exits the skull base.

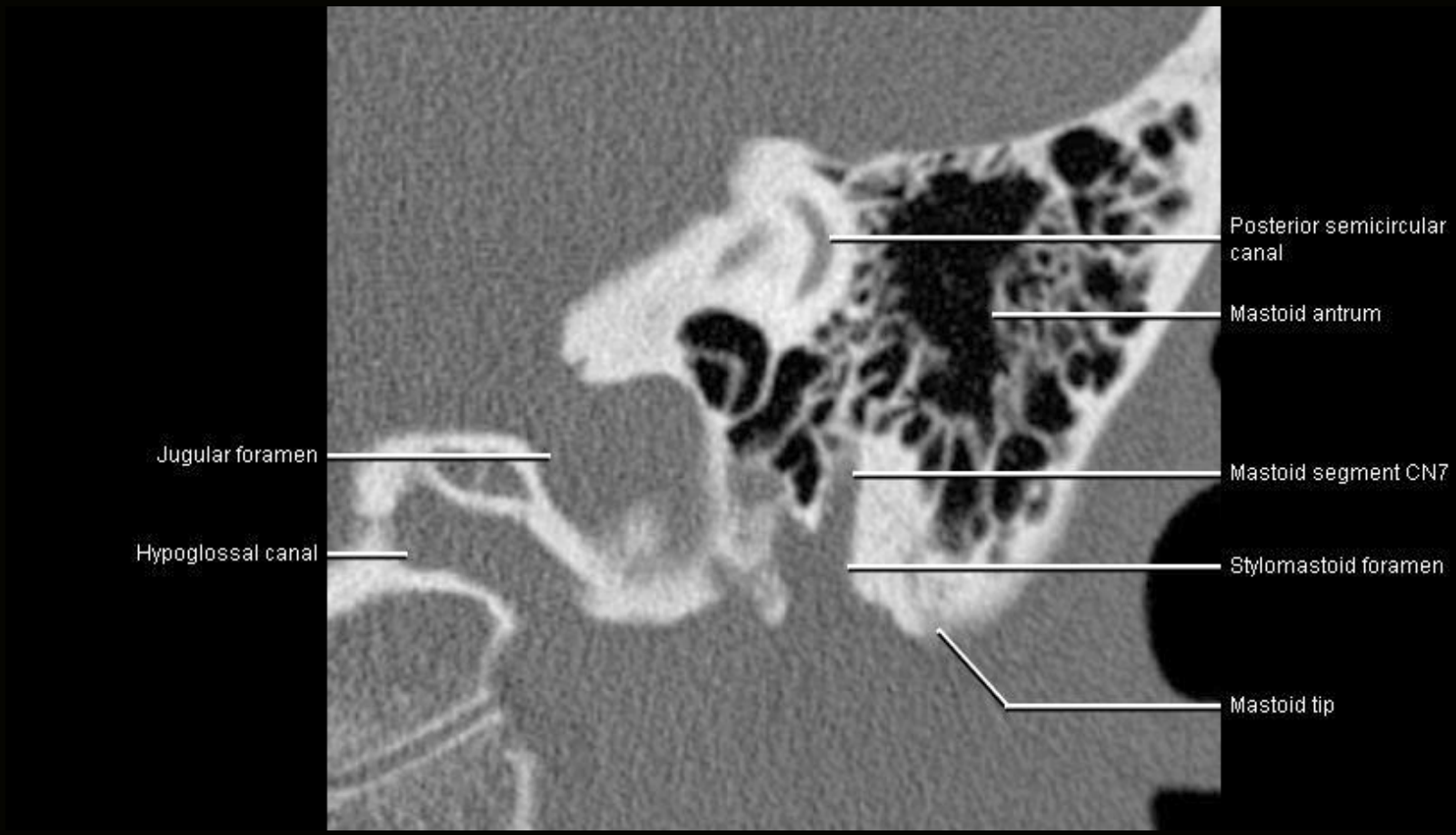


coronal bone CT images of left temporal bone presented from posterior to anterior shows lower mastoid segment of the facial nerve (CN7) and stylomastoid foramen.

coronal bone CT images of left temporal bone presented from posterior to anterior shows lower mastoid segment of the facial nerve (CN7) and stylomastoid foramen.



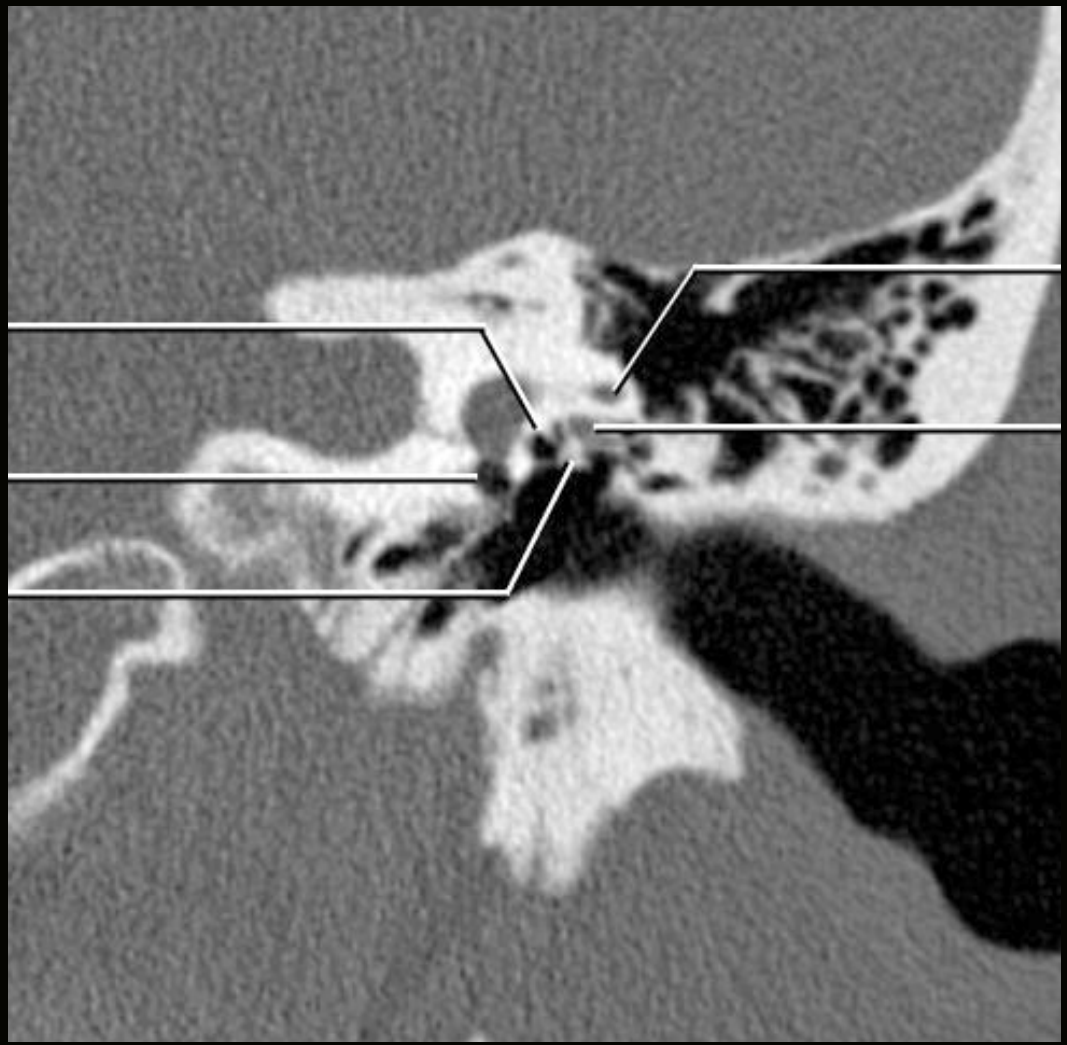
coronal bone CT images of left temporal bone presented from posterior to anterior shows lower mastoid segment of the facial nerve (CN7) and stylomastoid foramen.



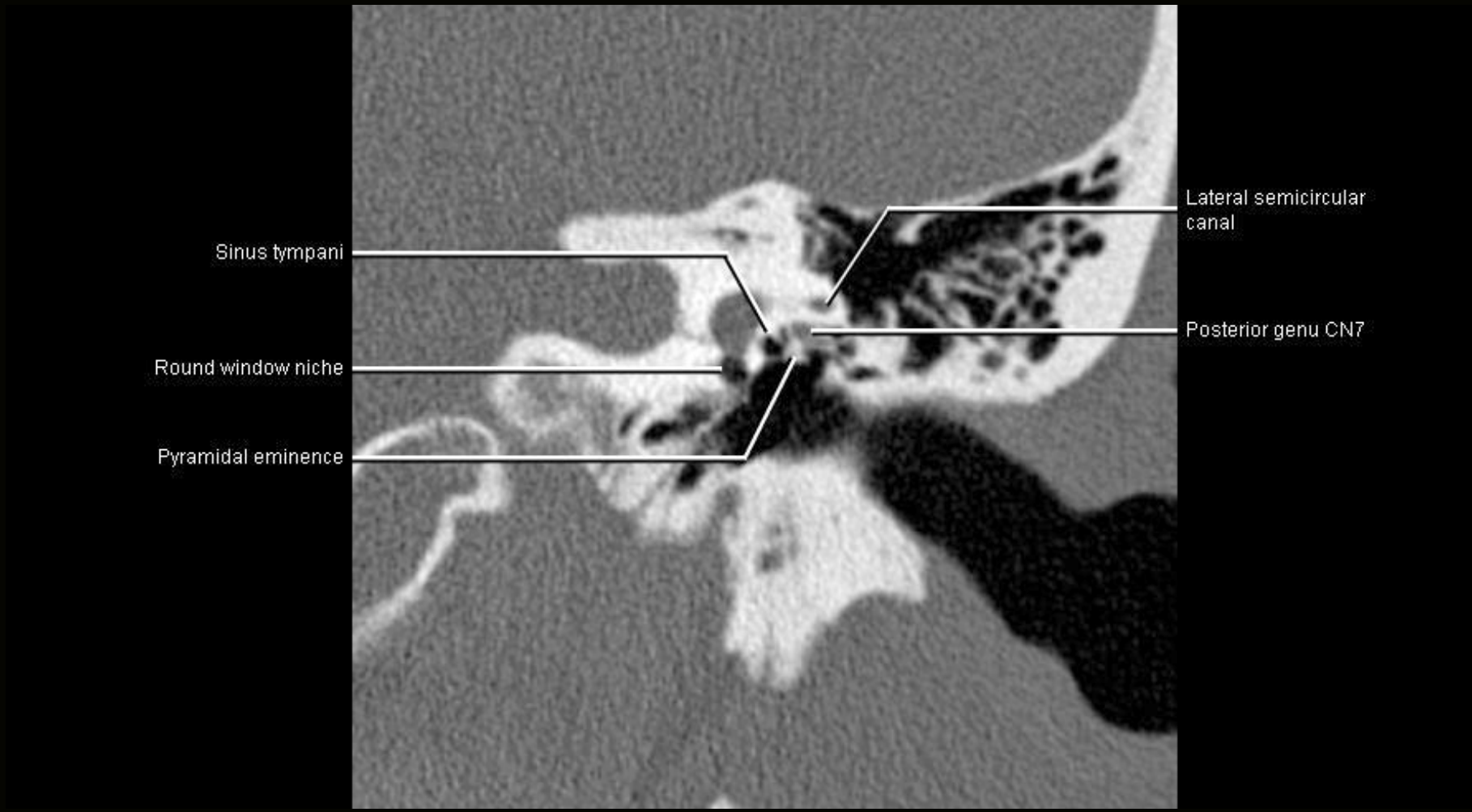
At the level of the round window the posterior genu of the facial nerve can be seen just lateral to the pyramidal eminence. Notice the sinus tympani is medial to the pyramidal eminence.

At the level of the round window the posterior genu of the facial nerve can be seen just lateral to the pyramidal eminence. Notice the sinus tympani is medial to the pyramidal eminence.

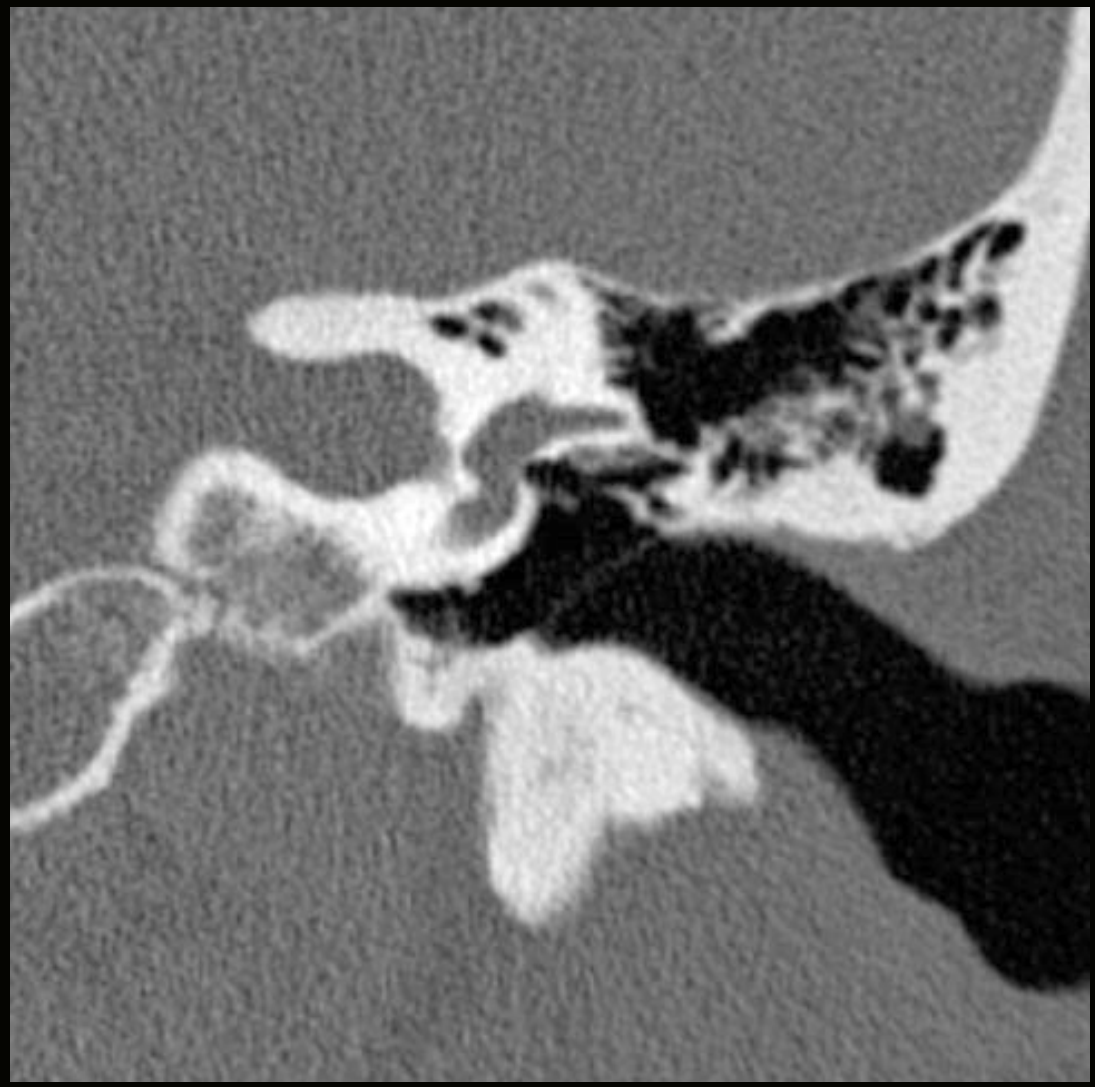
At the level of the round window the posterior genu of the facial nerve can be seen just lateral to the pyramidal eminence. Notice the sinus tympani is medial to the pyramidal eminence.



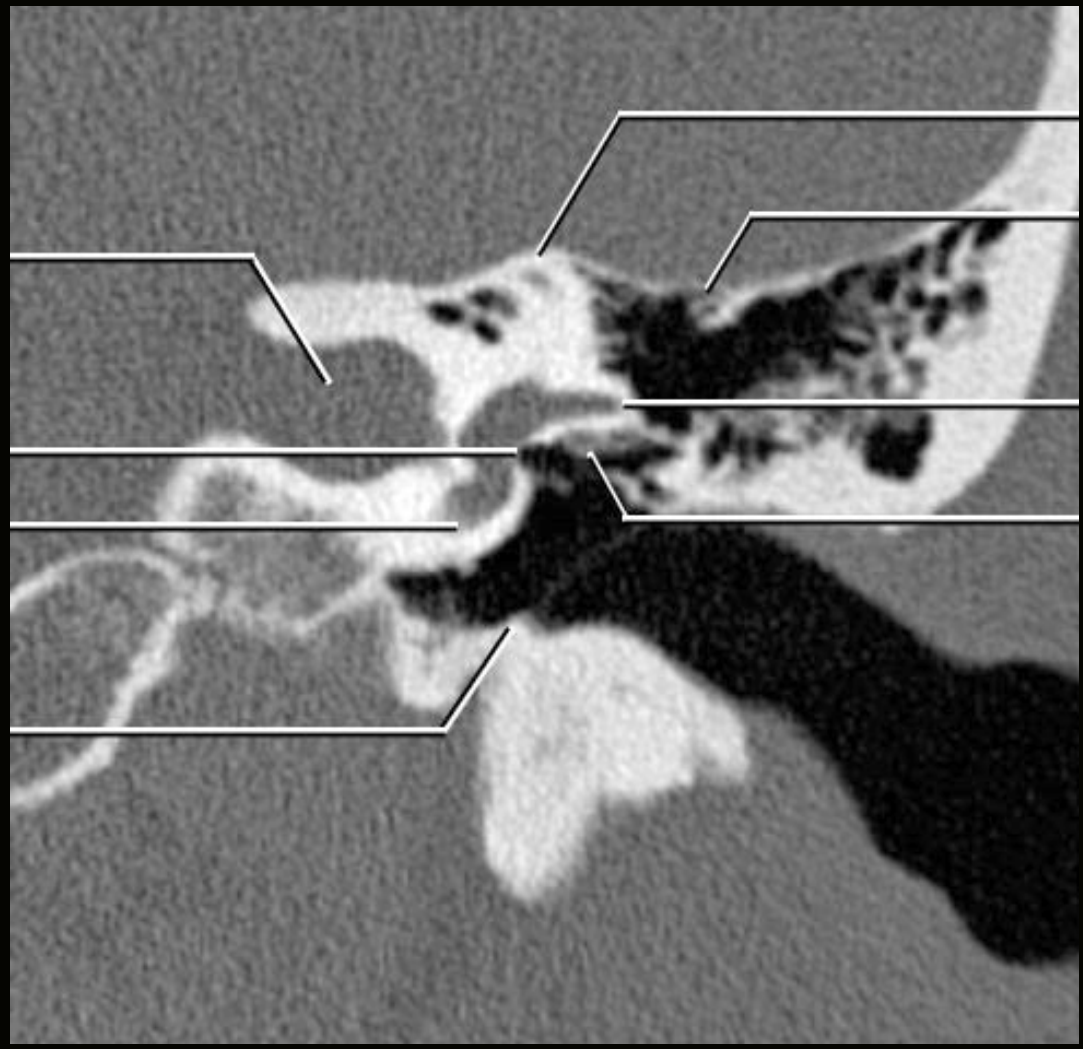
At the level of the round window the posterior genu of the facial nerve can be seen just lateral to the pyramidal eminence. Notice the sinus tympani is medial to the pyramidal eminence.



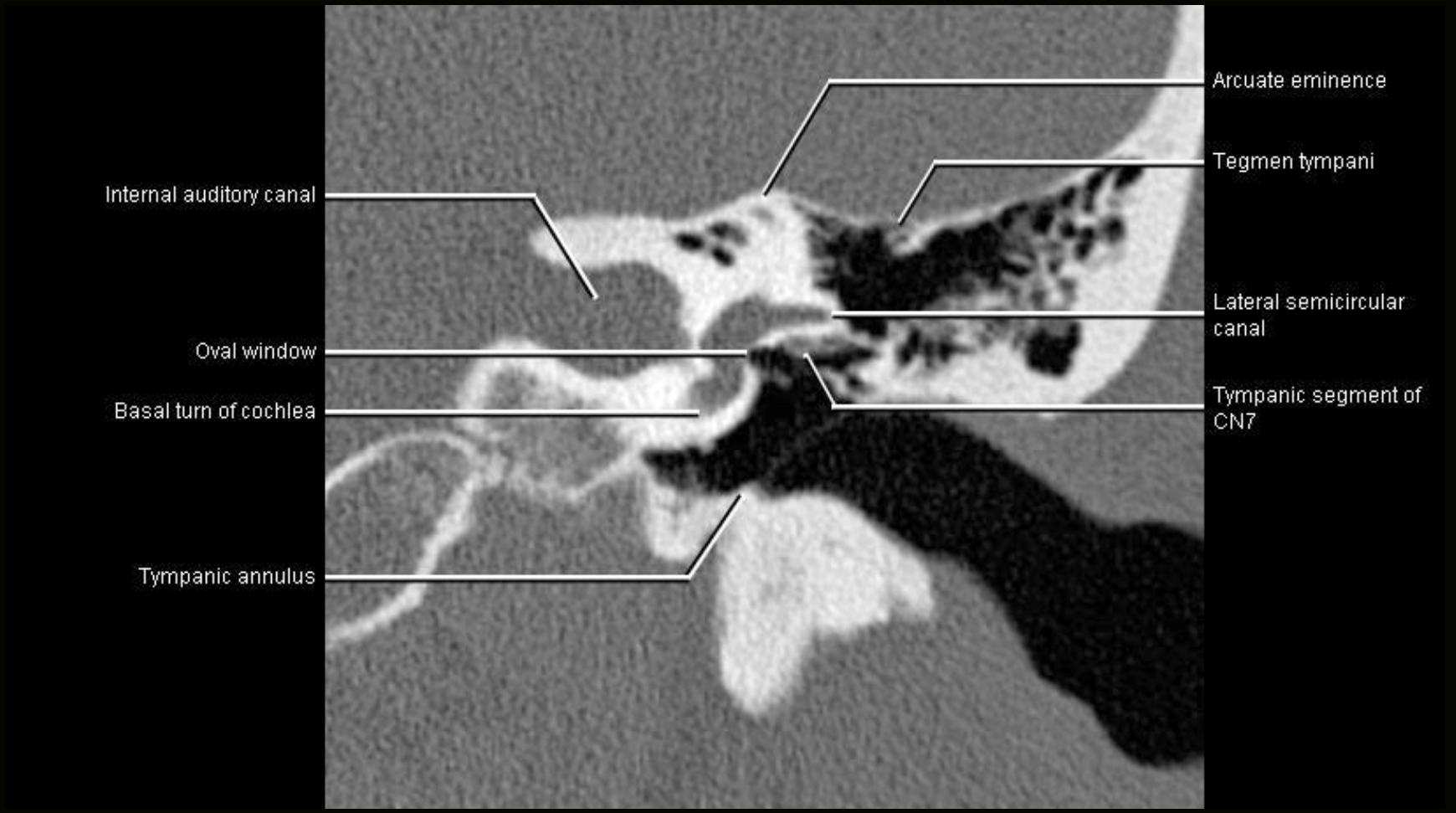
At the level of the oval window the tympanic segment of the facial nerve can be seen coursing under the lateral semicircular canal. Notice the fine bony covering (thin white line) surrounding the facial nerve. Also note the location relative to the upper margin of the oval window.



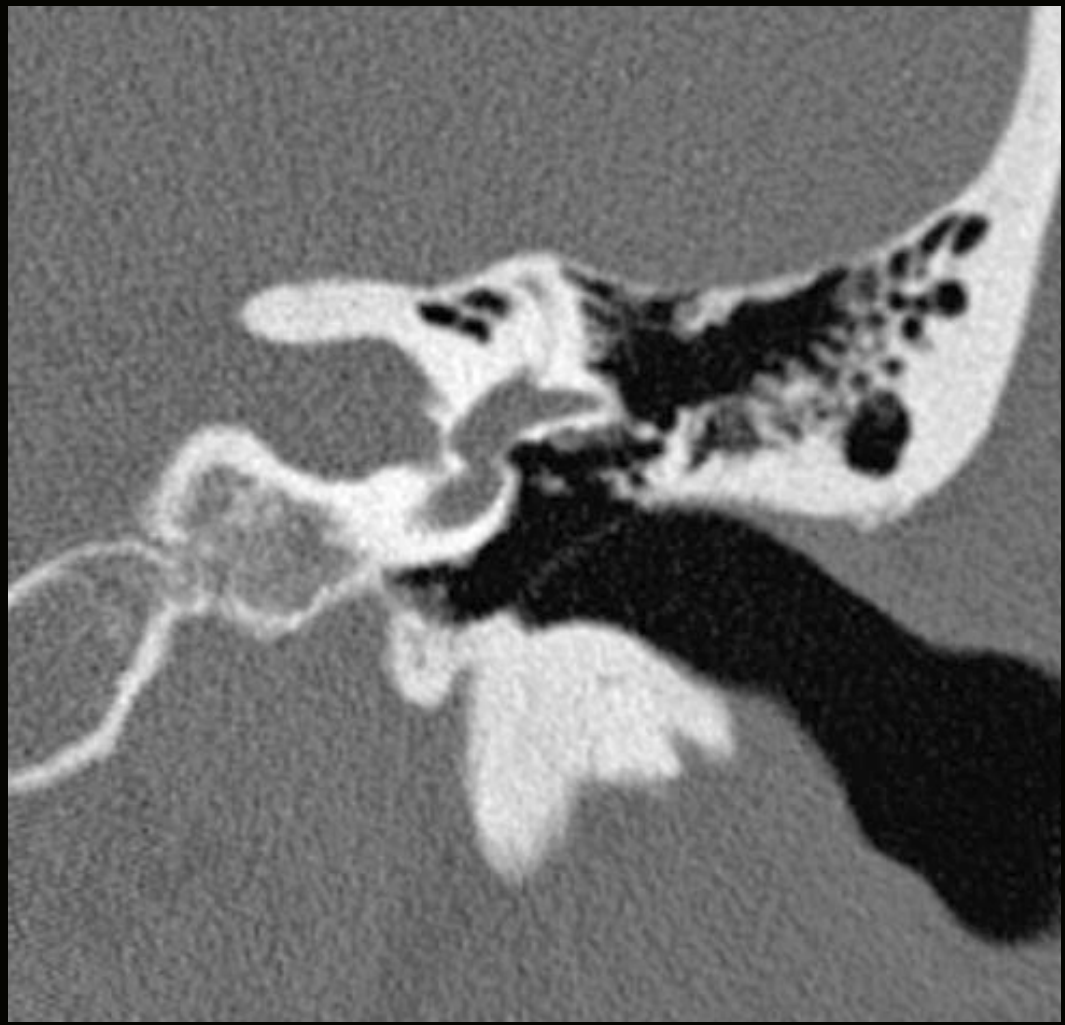
At the level of the oval window the tympanic segment of the facial nerve can be seen coursing under the lateral semicircular canal. A bony covering (thin white line) surrounds the facial nerve. Note the location relative to the upper margin of the oval window. In patients with oval window atresia, the facial nerve is found near or within the oval window niche.



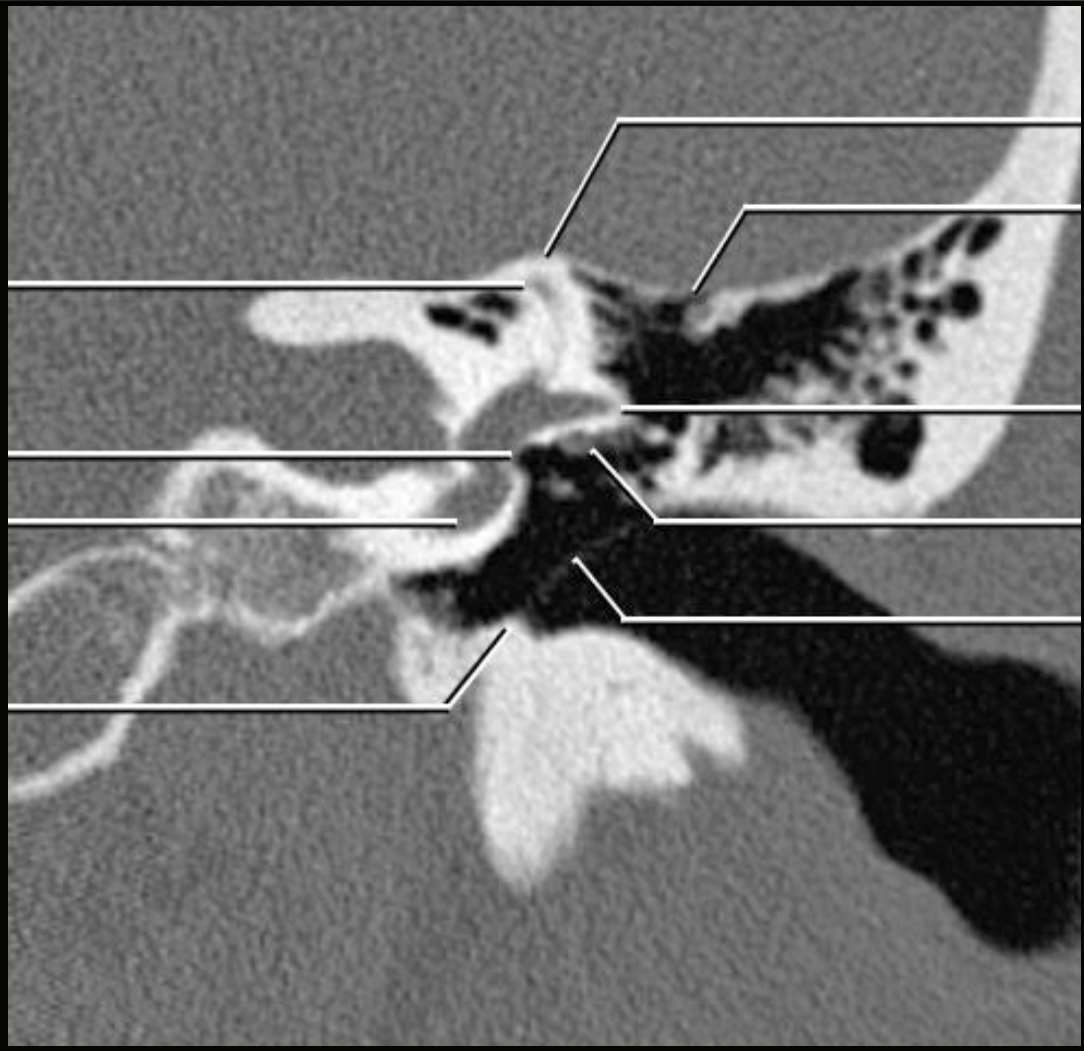
At oval window the tympanic segment of the facial nerve can be seen coursing under the lateral SCC. A fine bony covering (thin white line) surrounds the facial nerve. Also note the location relative to the upper margin of the oval window.



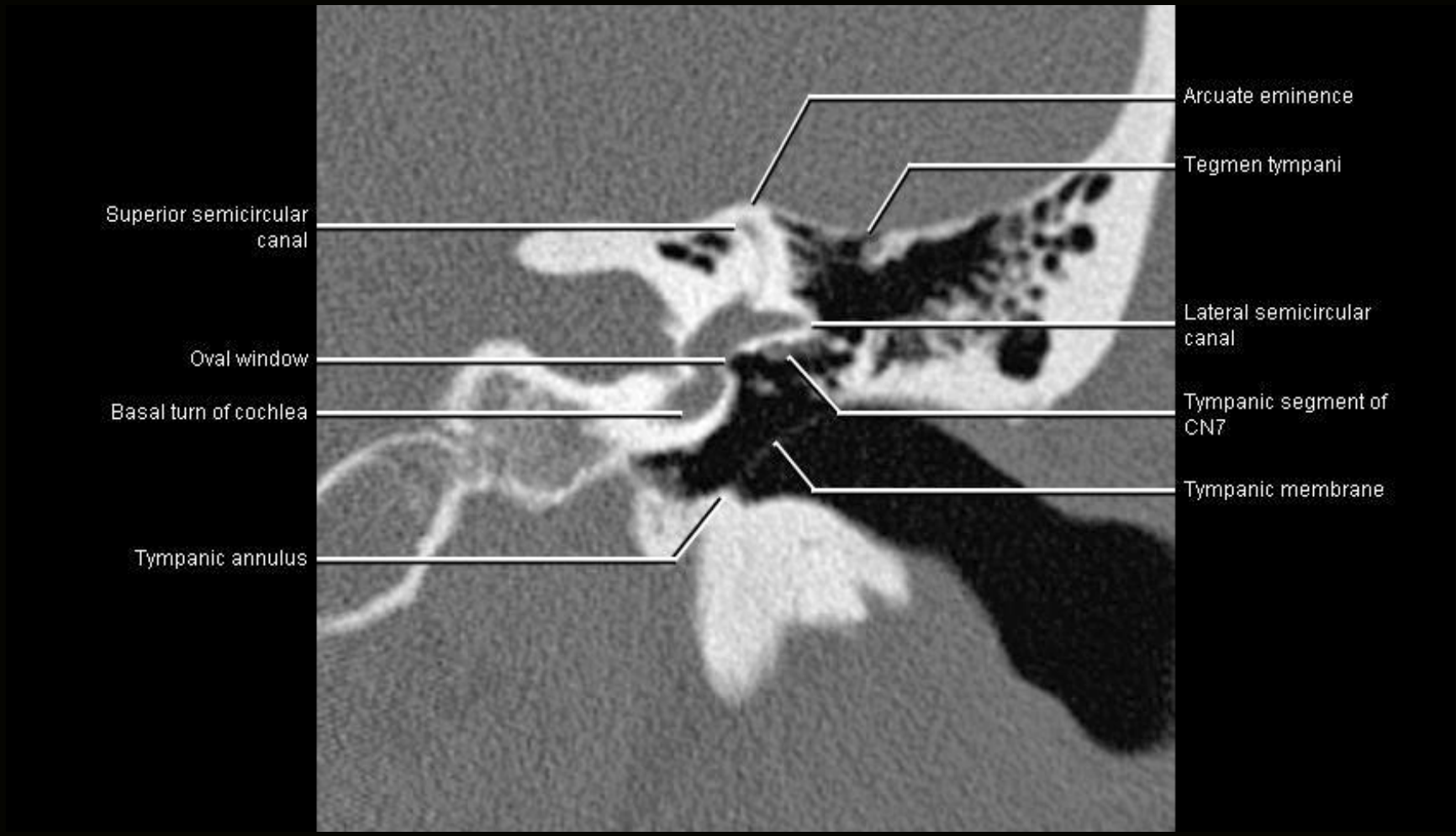
At the level of the anterior margin of the oval window the tympanic segment of the facial nerve can be seen under the lateral semicircular canal.



At anterior margin of the oval window the tympanic segment of the facial nerve can be seen under the lateral SCC. Notice the fine bony covering (thin white line) surrounding the facial nerve is now not seen. The facial nerve canal bony covering in this area is normally incomplete.

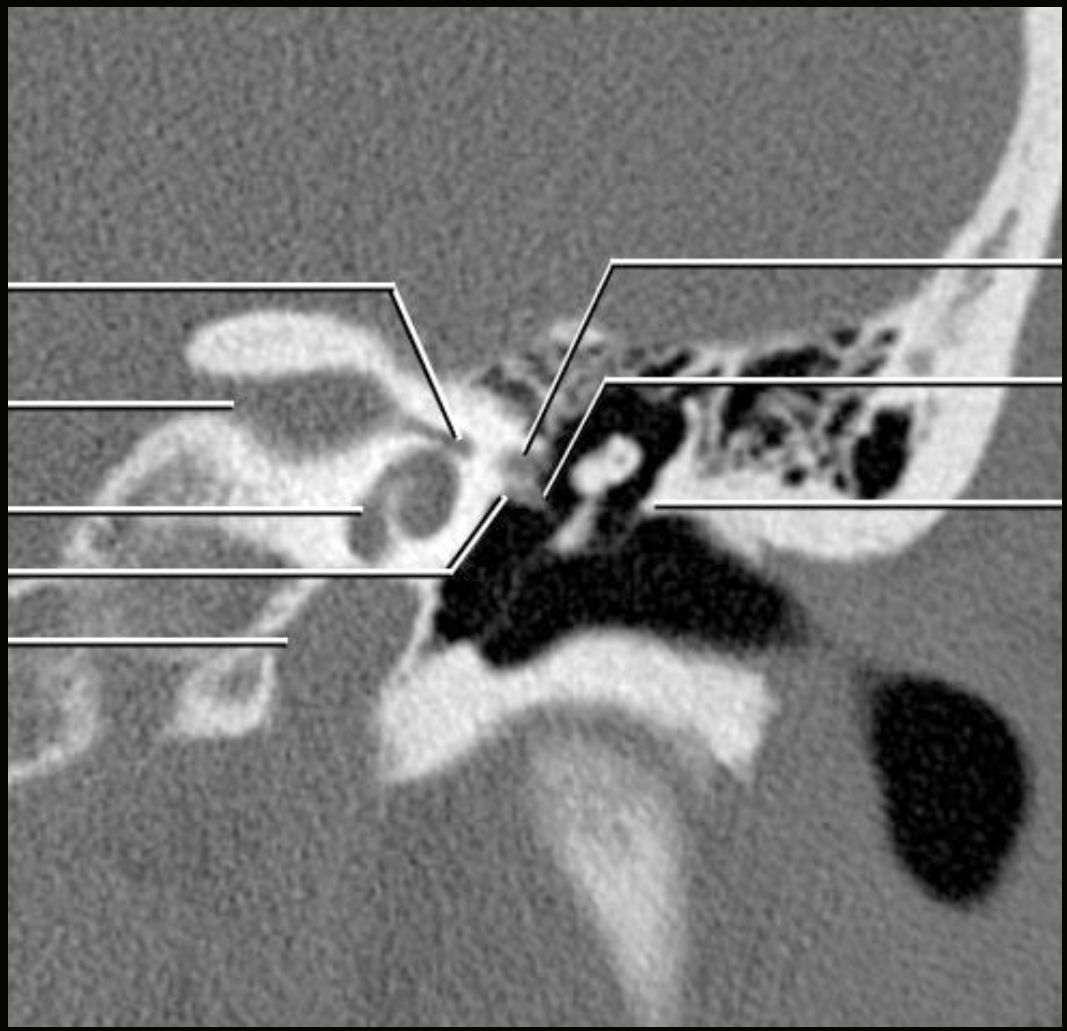


At the level of the anterior margin of the oval window the tympanic segment of the facial nerve can be seen under the lateral semicircular canal. Notice the fine bony covering (thin white line) surrounding the facial nerve is now not seen. The facial nerve canal bony covering in this area is normally incomplete.

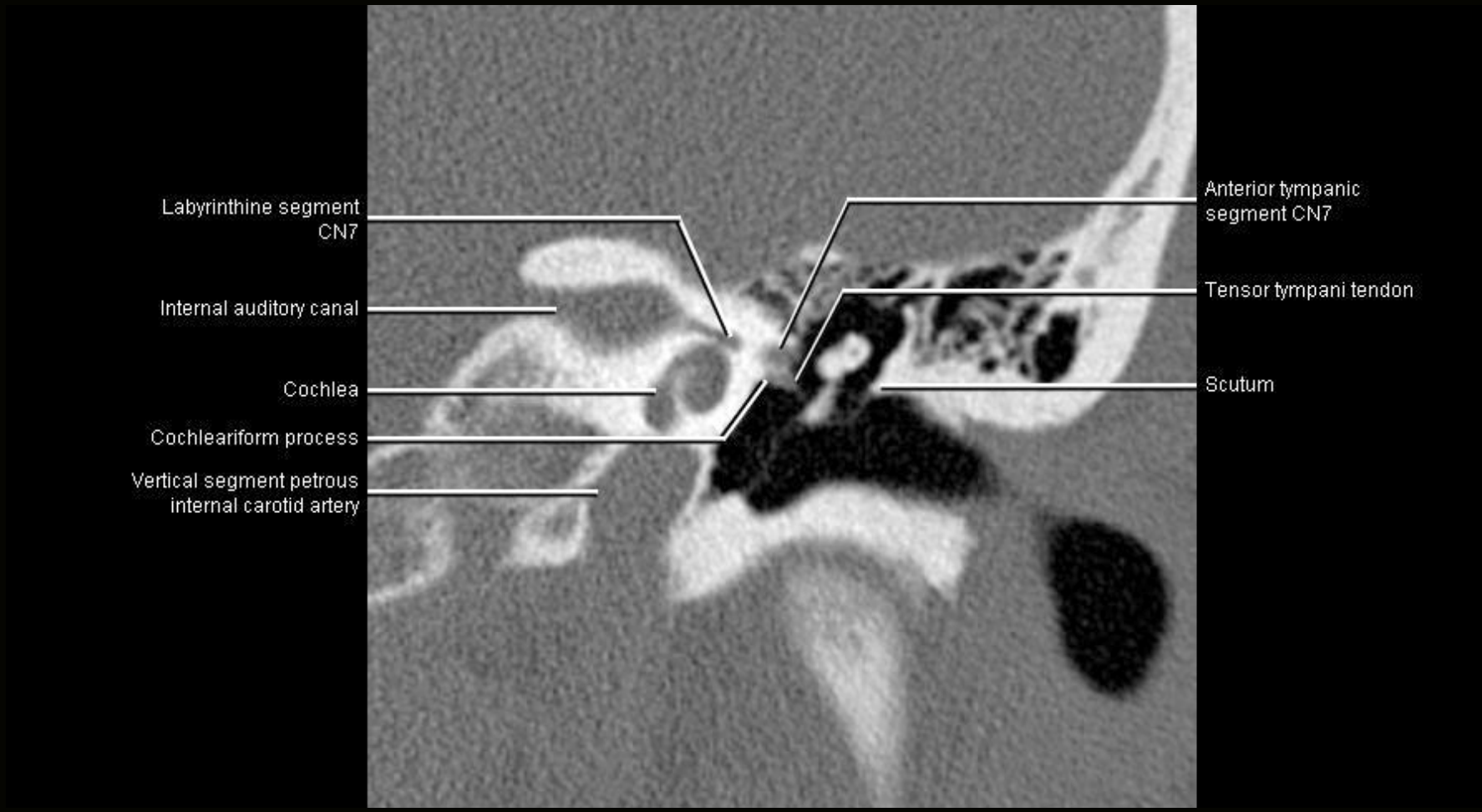


In the anterior middle ear cavity the labyrinthine segment of the facial nerve exits the internal auditory canal over the top of the cochlea.

The labyrinthine segment of the facial nerve exits the IAC over the top of the cochlea. The anterior tympanic segment of the facial nerve is also visible. Do not confuse the muscle-tendon of the tensor tympani in the cochleariform process with the facial nerve.



Remember - not to confuse the muscle-tendon of the tensor tympani in the cochleariform process with the facial nerve!



In the most anterior portion of middle ear cavity (where both the carotid and the cochlea are visible), the geniculate ganglion is seen within the geniculate fossa as an ovoid structure just above the cochlea.

In the most anterior portion of middle ear cavity (where both the carotid and the cochlea are visible), the geniculate ganglion is seen within the geniculate fossa as an ovoid structure just above the cochlea.

In the most anterior portion of middle ear cavity (where both the carotid and the cochlea are visible), the geniculate ganglion is seen within the geniculate fossa as an ovoid structure just above the cochlea.

Thank-you!