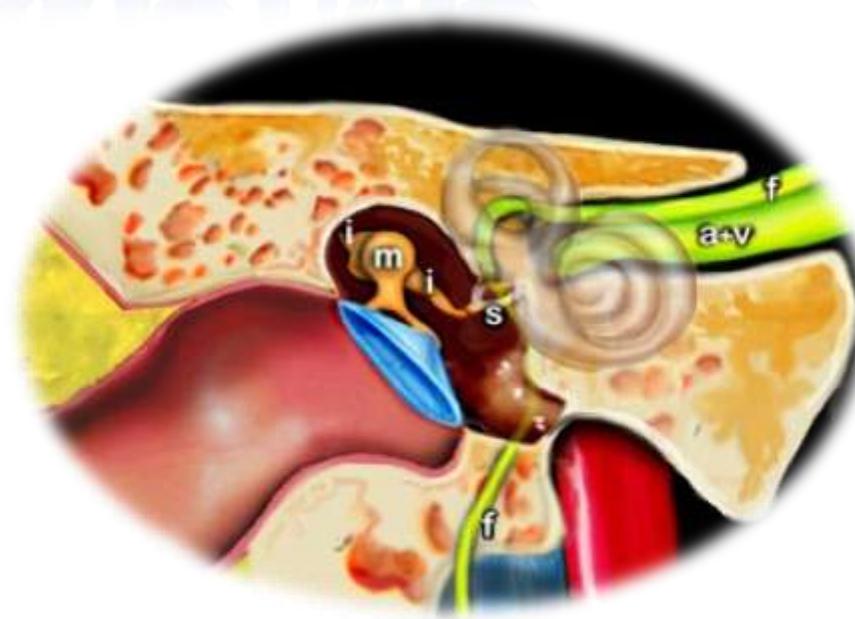


ABC IMAGING

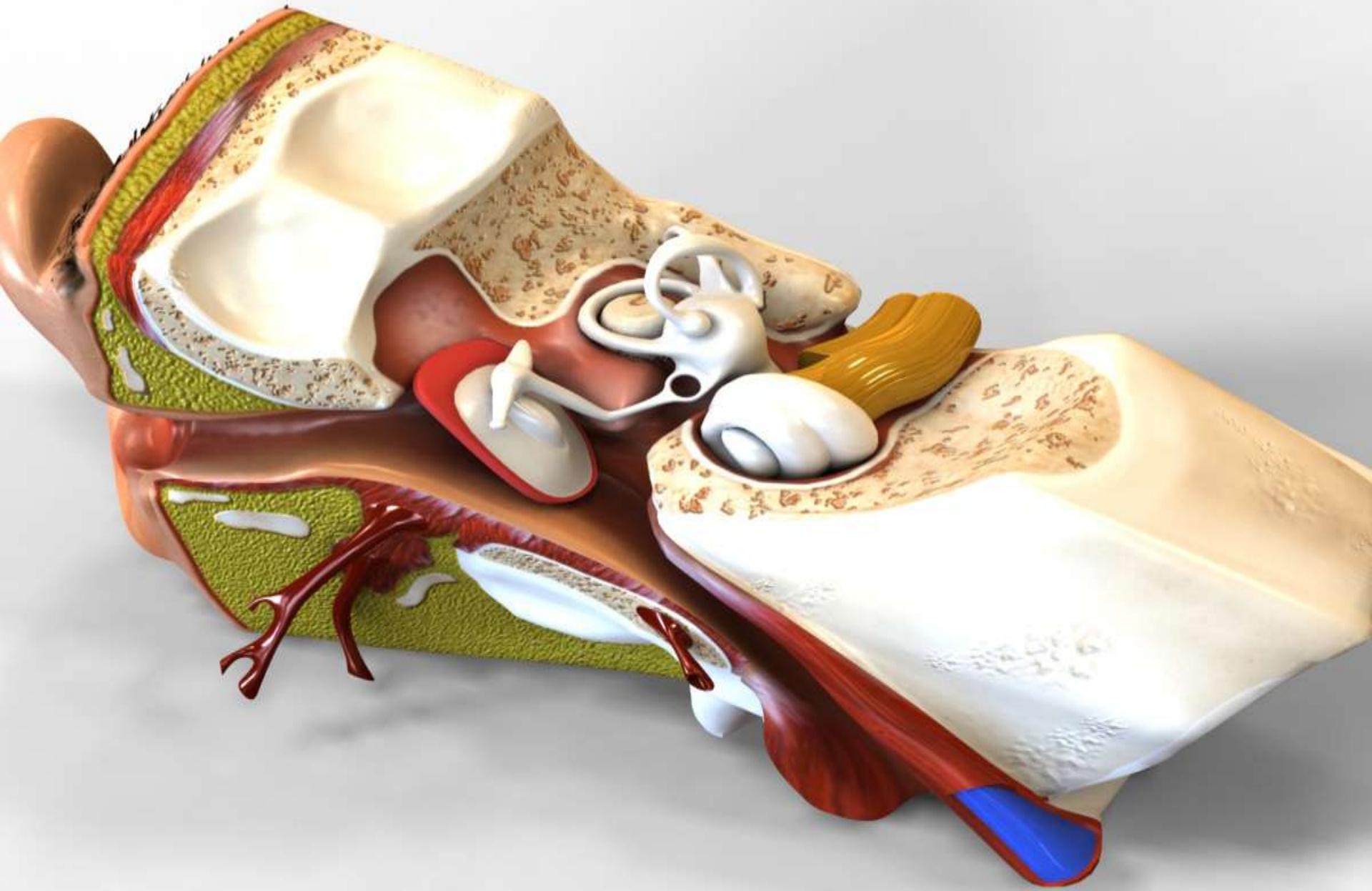
2-PETROUS BONE

FOR RESIDENT RADIOLOGIST



BY

AHMAD MOKHTAR ABODAHAB
ASS. LECTURER OF RADIODIAGNOSIS
SOHAG UNIVERSITY



Sources

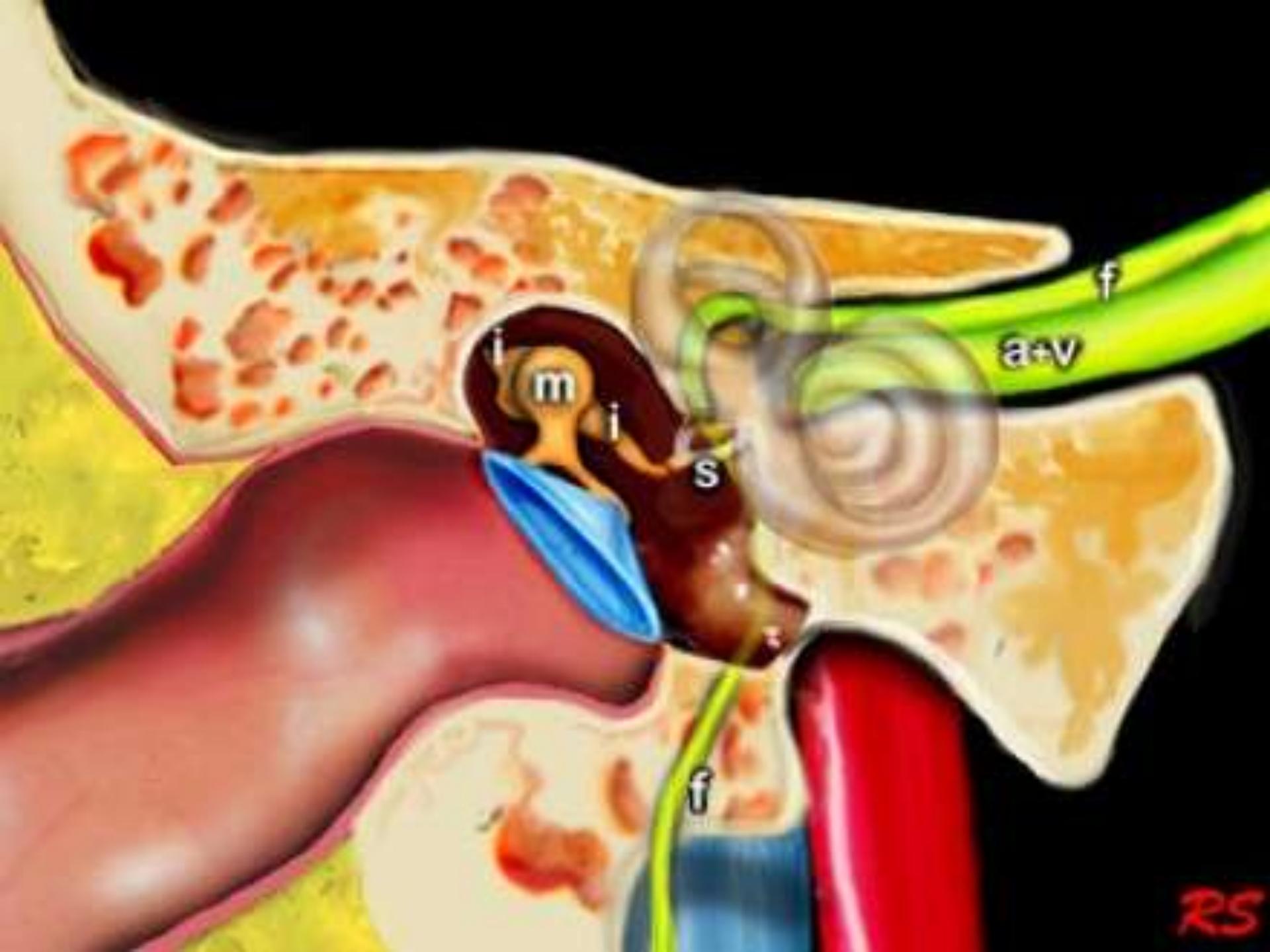
- Lectures of Prof. Mamdouh Mahfouz
- Radiology Assistant web site

<http://www.radiologyassistant.nl/en/p43facba0911f5/temporal-bone-anatomy.html>

• <http://www.slideshare.net/mohammedshafeeq925/anatomy-embryology-ext-ear-middle-ear>

• <http://www.instantanatomy.net/headneck.html>

-



f

av

s

f

RS

Examination technique



- 2 mm slice thickness
- Suitable field of view
- Bone and soft tissue window
- Symmetric patient position
- Contrast injection ?!

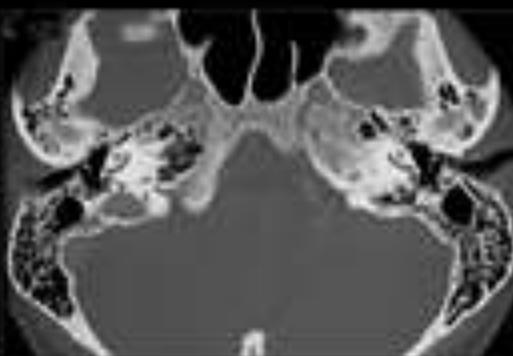


*CT = rare

*MRI = contrast is a must

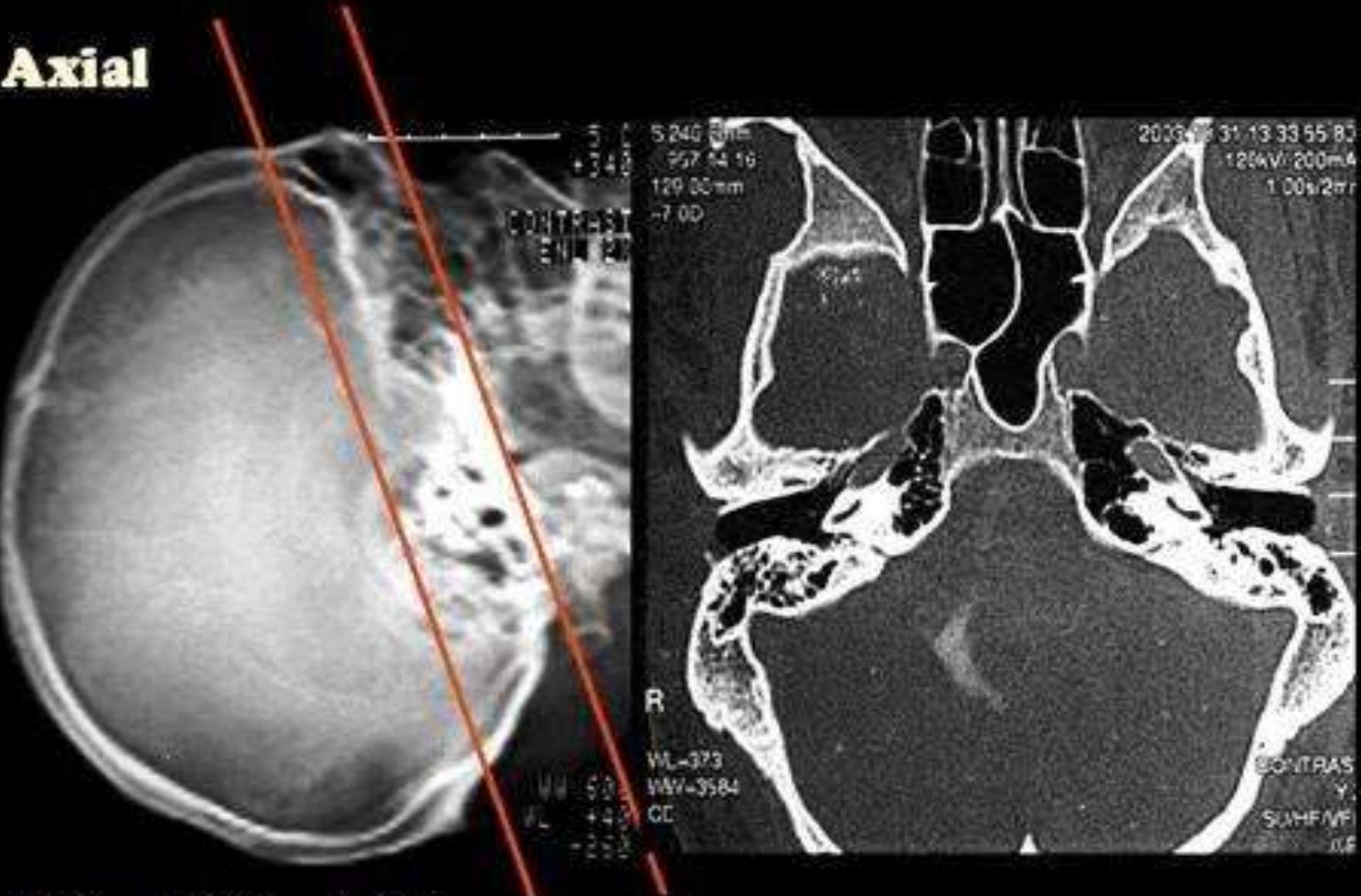
Examination technique

- 2 mm slice thickness
- Suitable field of view
- Bone and soft tissue window
- Symmetric patient position
- Contrast injection ?!



*Accurate Angle
= Accurate Anatomy*

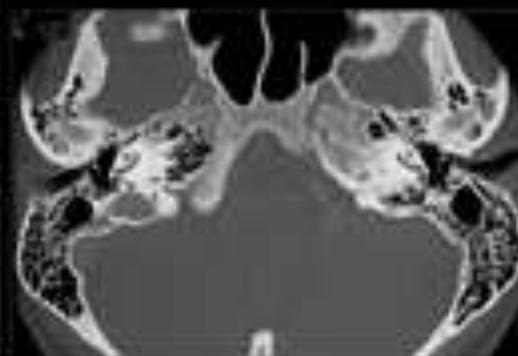
Axial



- Parallel to skull base.
- 2 mm sections
- Axial scan is Main for diagnosis

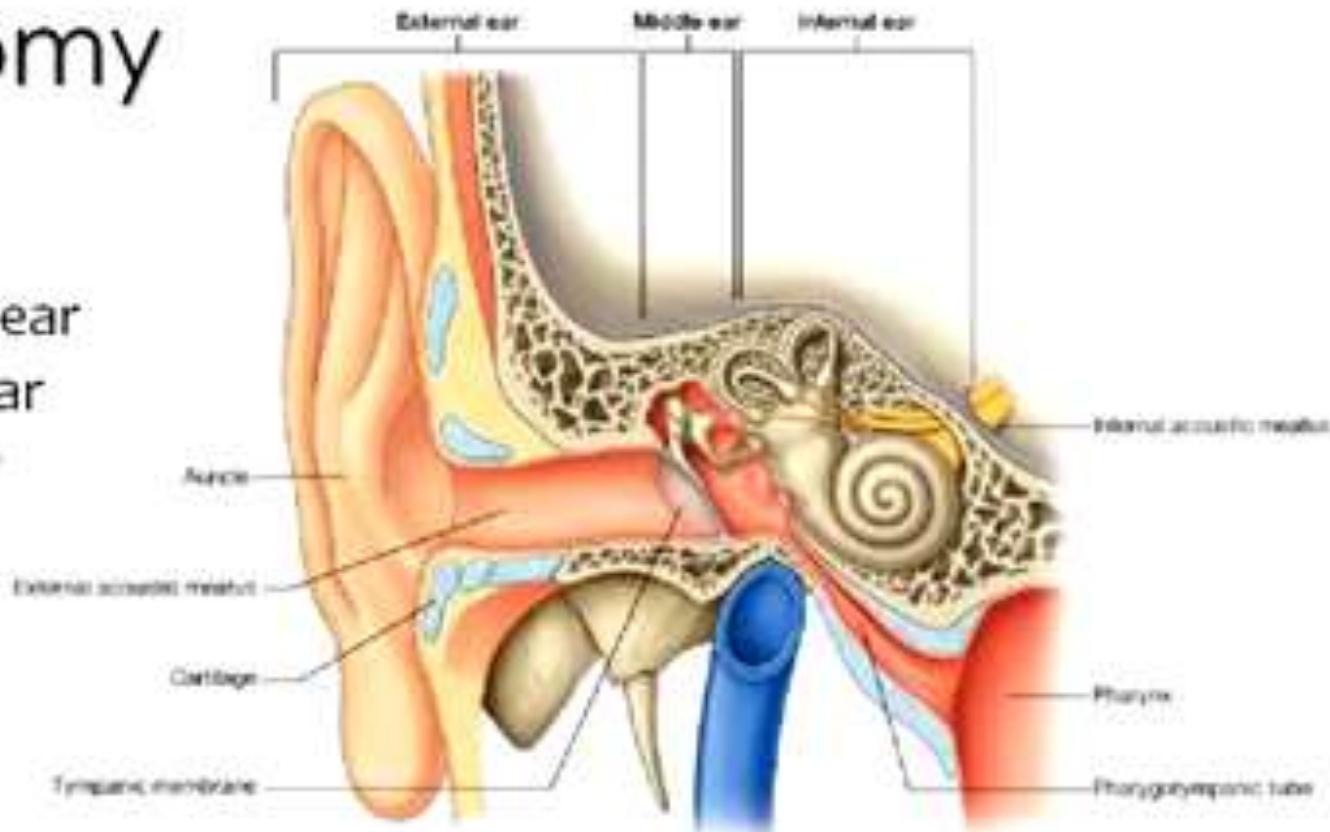
Examination technique

- 2 mm slice thickness
- Suitable field of view
- Bone and soft tissue window
- Symmetric patient position
- Contrast injection ?!



Anatomy

- External ear
- Middle ear
- Inner ear



External EAR

- ▶ Simple anatomy
- ▶ A tube contains air +/- wax “soft tissue like in CT”
- ▶ Outer cartilaginous - Inner bony
- ▶

- External Auditory Canal:

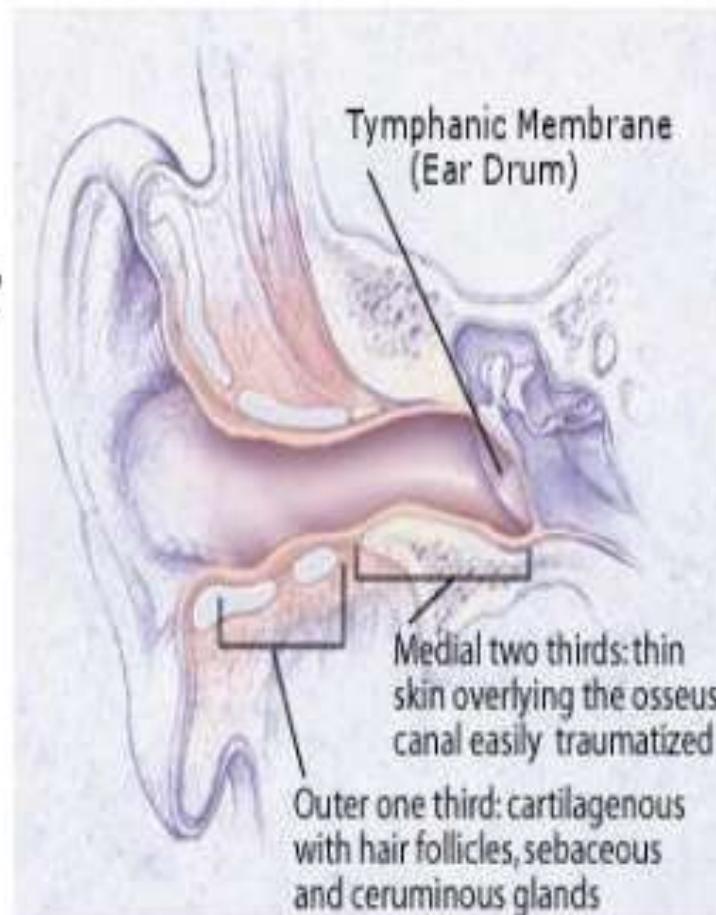
- from concha of auricle to TM
- 2.4cm long, two parts – outer Cartilaginous and inner Bony part

- *Cartilaginous Part:*

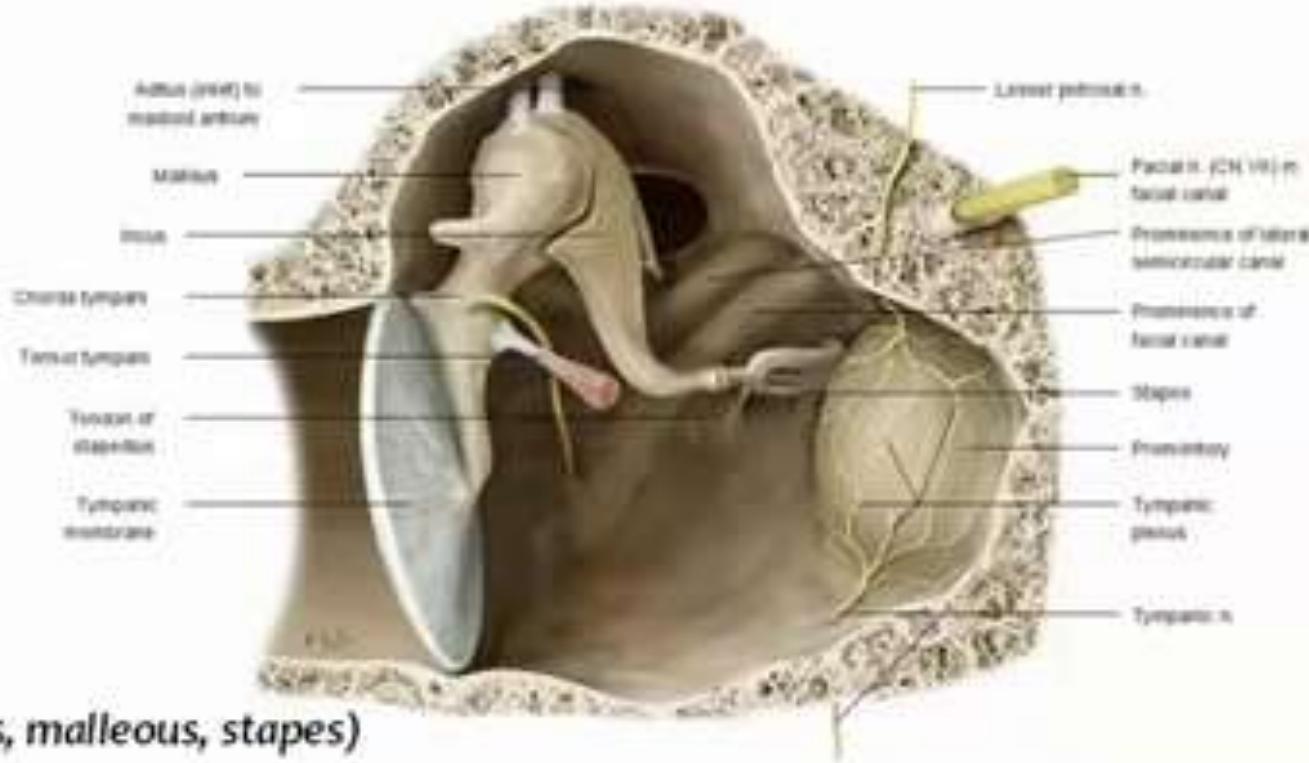
- outer 1/3 of EAC, 8mm
- two deficiencies – 'Fissures of Santorim'

- *Bony Part:*

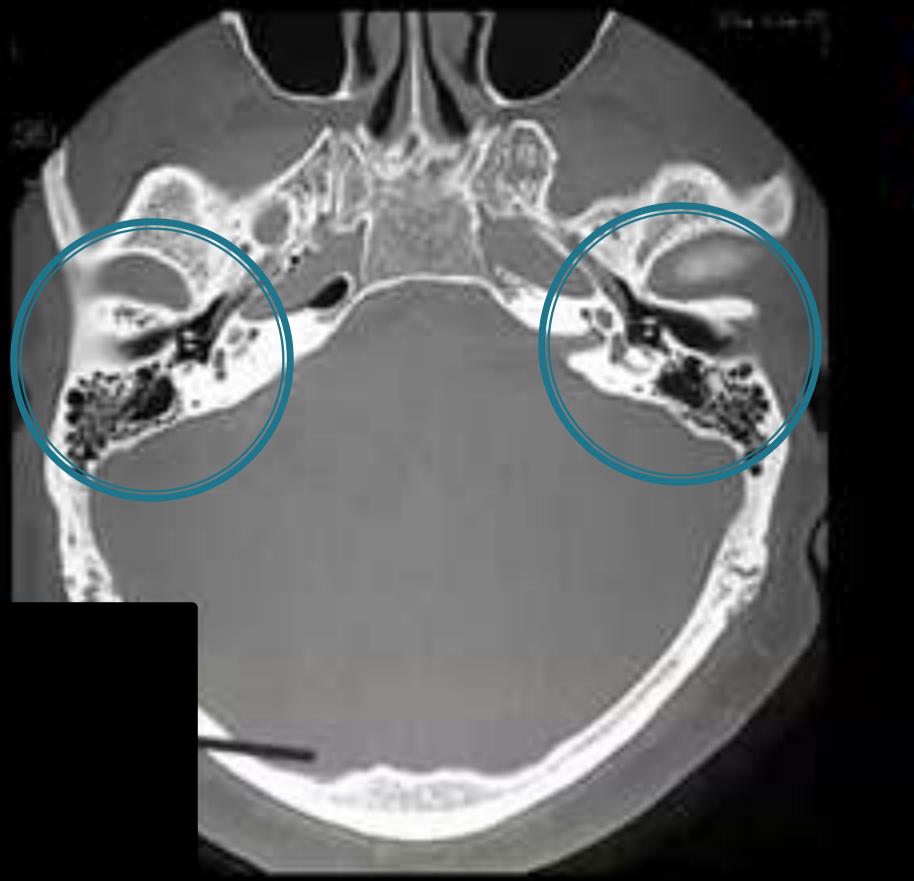
- inner 2/3 of EAC, 16mm
- Isthmus
- Anterior Recess
- Foramen of Huscke
- Tympanic Sulcus



Middle ear anatomy



- Ossicles (Incus, malleous, stapes)
- Muscles and nerves



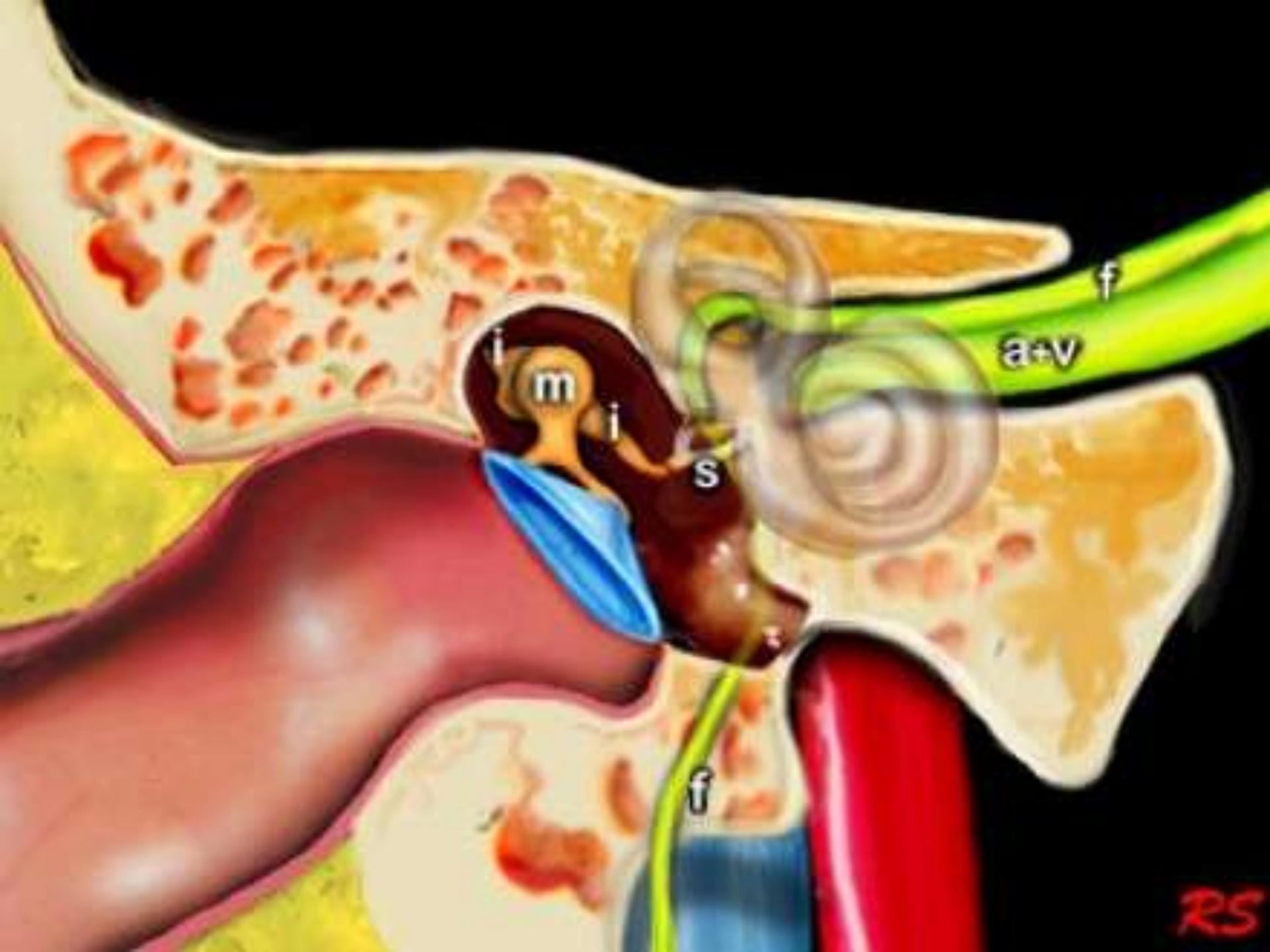
MIDDLE EAR

- ▶ Tympanic membrane “ear drum” , is fixed on a bony tympanic annulus.
- ▶ **Scutum** , is the upper part of annulus “Ant.& sup. Aspects”.
- ▶ Cholesteatoma rise close to it , & is the first bone destroyed.

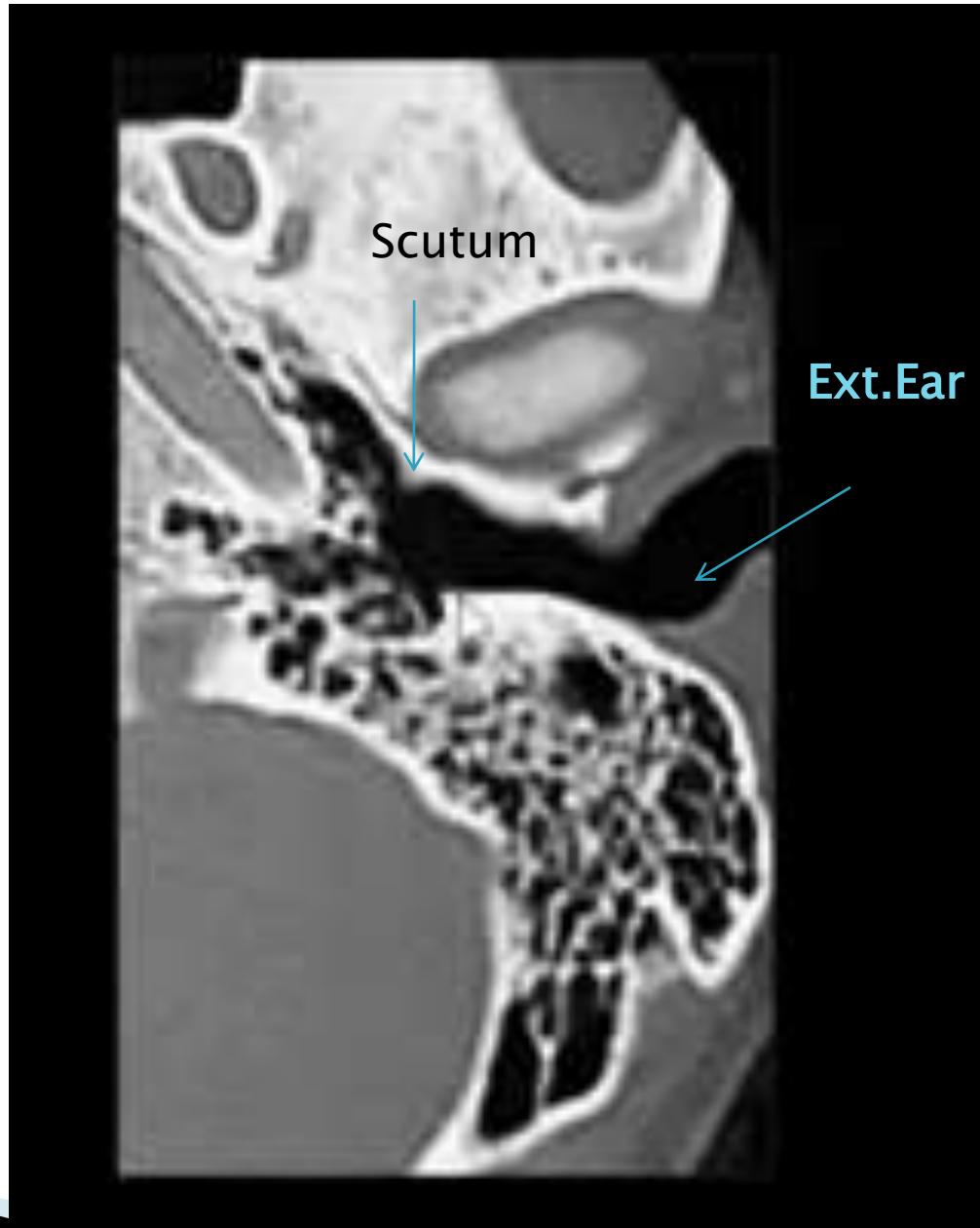
Scutum

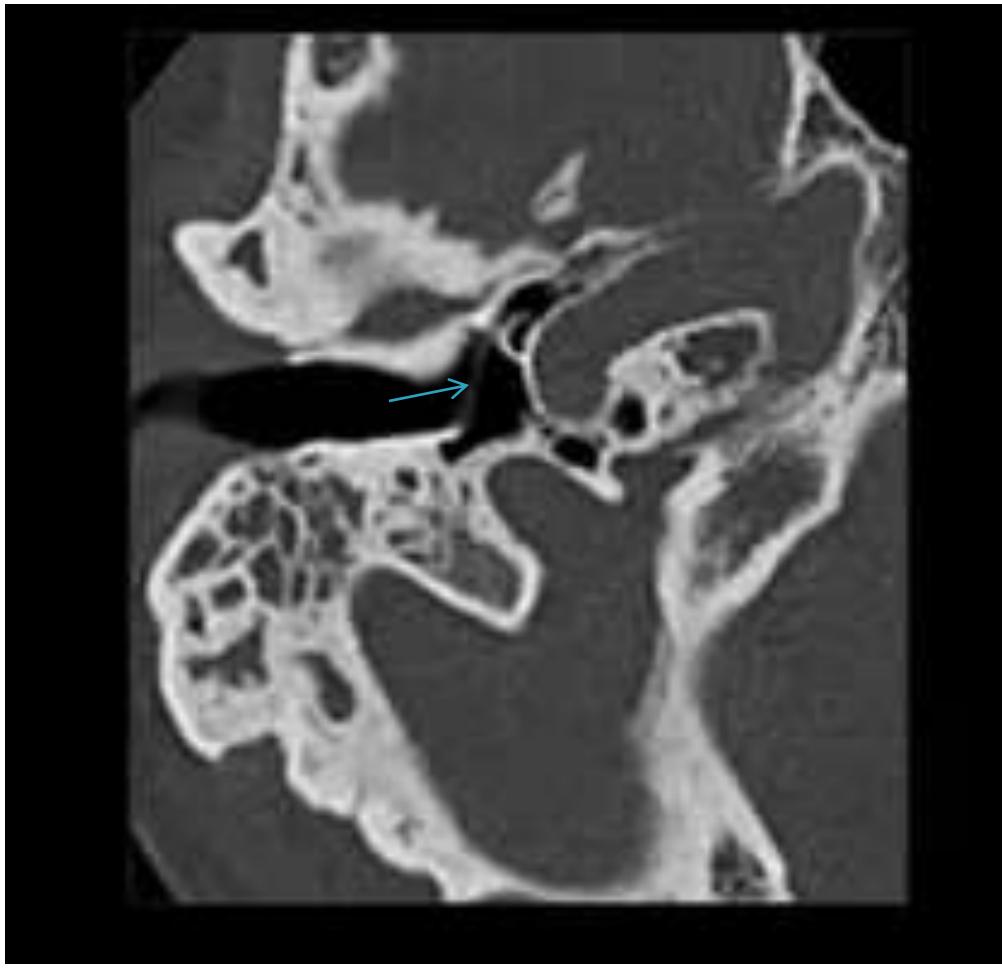
A blue arrow points to the left side of the image, indicating the location of the scutum. The diagram shows a cross-section of a bone with various anatomical features labeled: 'm' for mandibular canal, 's' for scutum, 'f' for articular surface, and 'RS' in the bottom right corner.

- ▶ **M I S** 3 bones of middle ear
 - **Malleus , Incus , & Stapes**
 - Stapes foot plate is closing the oval window
- ▶ **Eustachian tube** : connecting Middle ear cavity to nasopharynx.
- ▶ **Jugular fossa**, containing jugular vein is related to lower part.
 - Absent this bone = **Dehiscent Jugular bulb**. → hearing pulsations.



RS





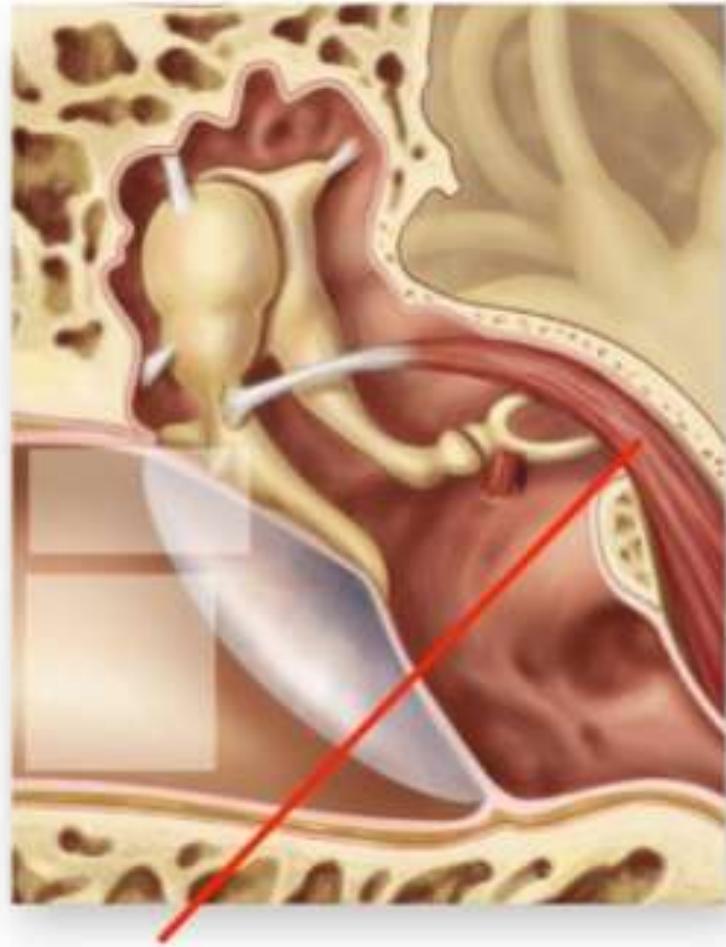
- ▶ Tympanic Membrane is seen in soft CT images
- ▶ Seeing if Not of

- **INTRATYMPANIC MUSCLES:**

Tensor tympani -

- attaches to neck of malleus
- tenses tympanic membrane
- derived from 1st arch
- supplied by branch of

Mandibular N



May or May not seen in CT

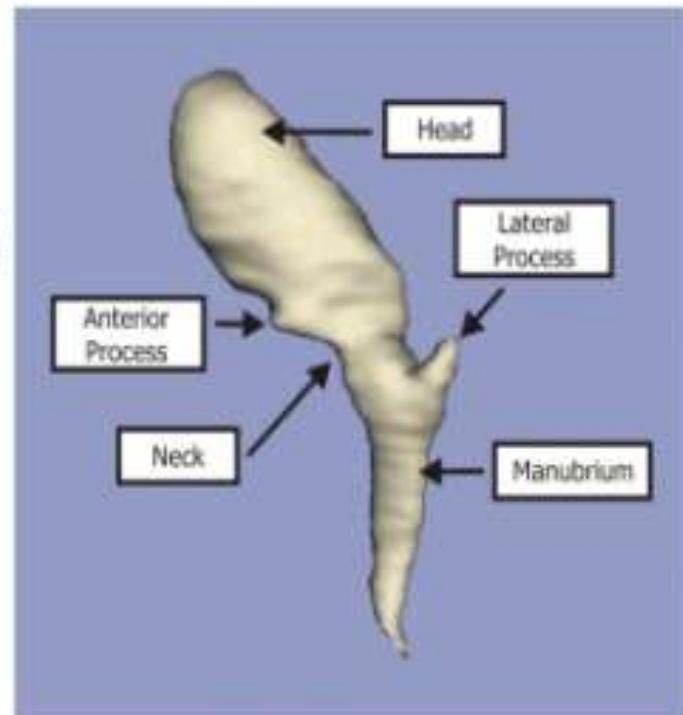
- **Ossicles of middle ear**

- **MALLEUS:**

- head, neck, handle (manubrium)*

- lateral and anterior process*

Head and neck of malleus lie in attic.

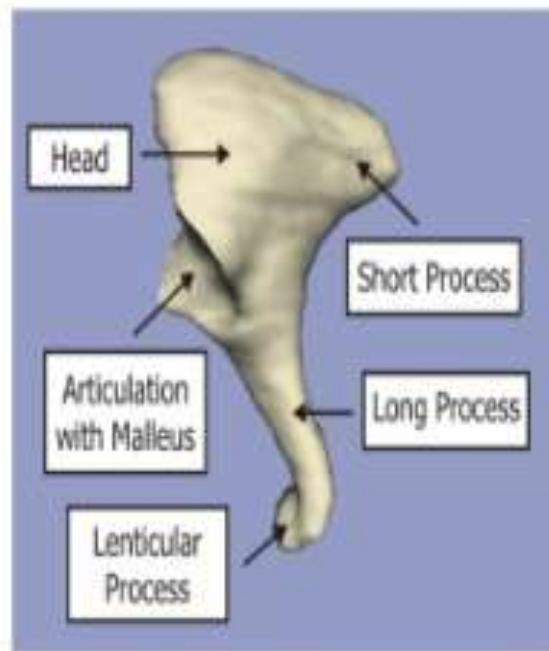


Manubrium lies embedded in fibrous layer of TM

Lateral process forms a projection and attaches to ant. & post. malleolar folds

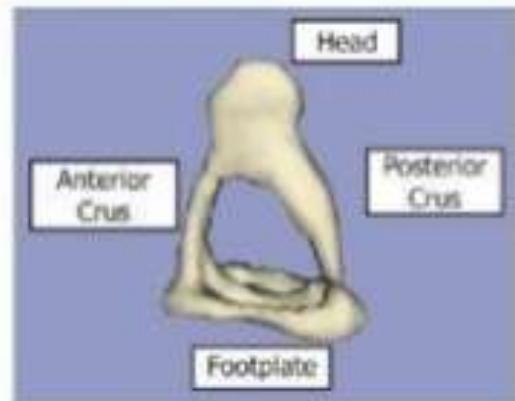
- INCUS:

- body, short process, long process
- body and short process lies in attic
- long process hangs vertically & attaches to head of stapes



- STAPES:

- head, neck, Ant. & Post. Crura, Footplate



- footplate is held in oval window by annular ligament

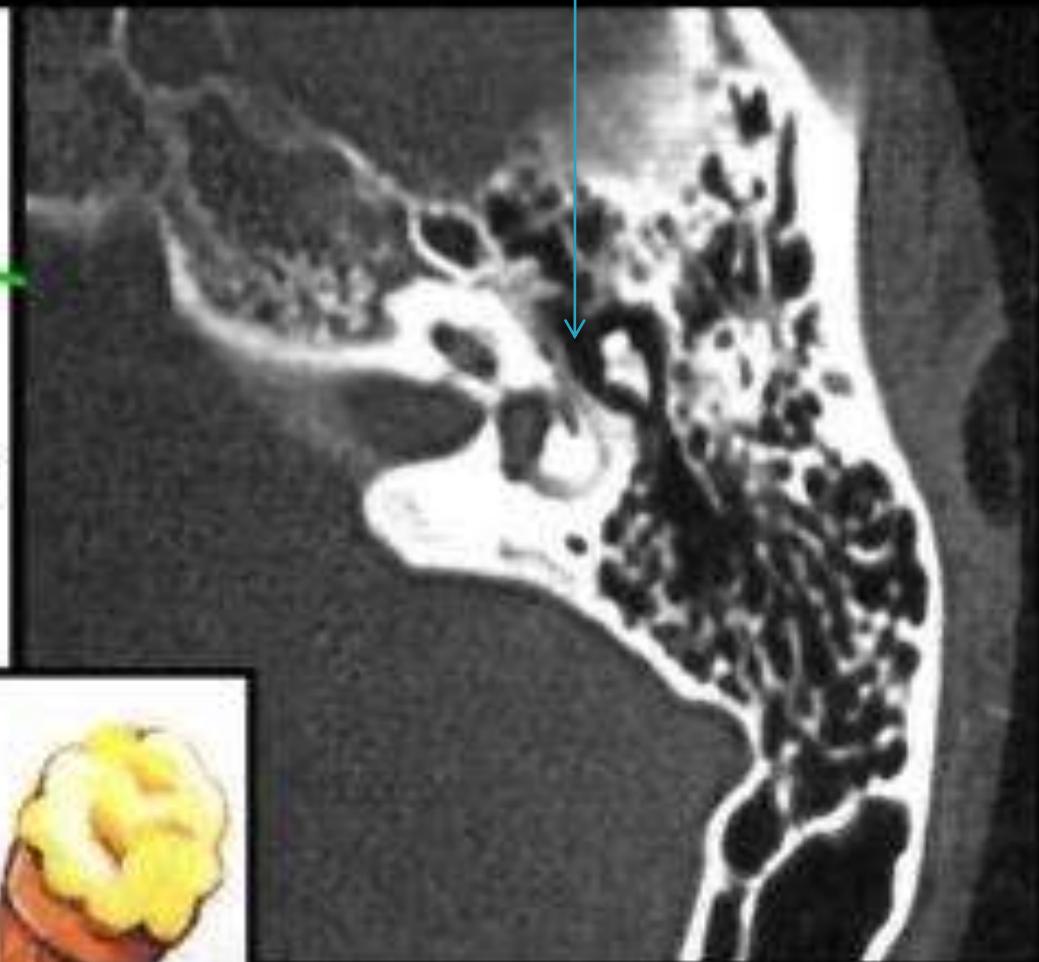
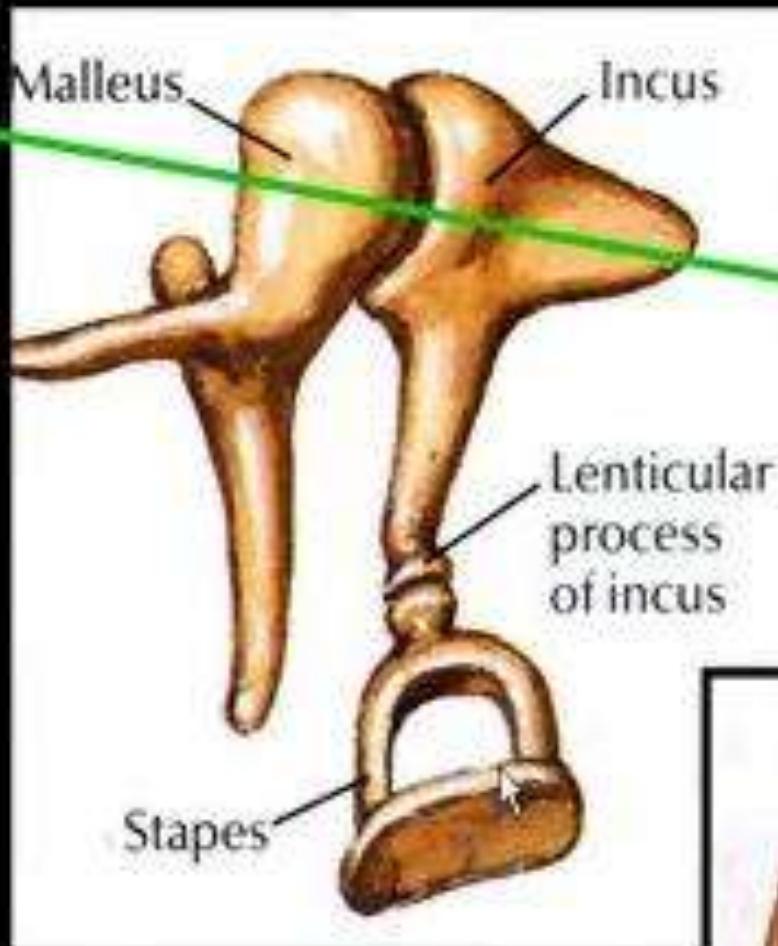
Middle ear anatomic landmark



Ice cream cone

ANATOMIC LANDMARK

of Middle Ear

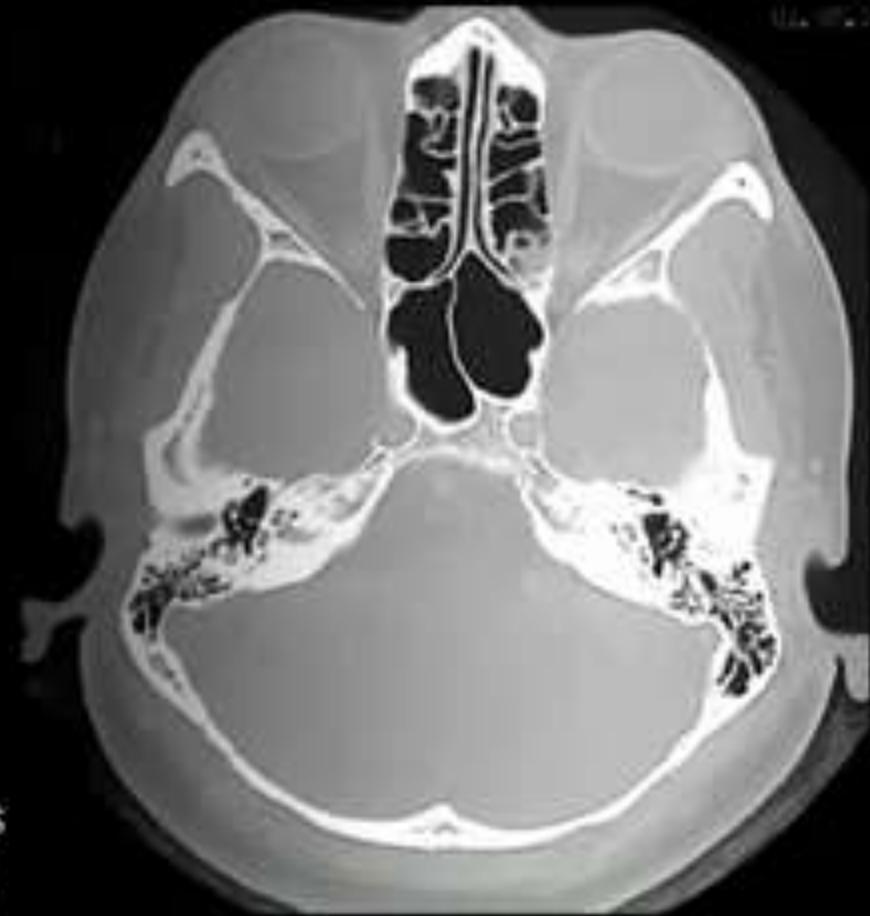


ICE CREAM CONE

Ant.



POST



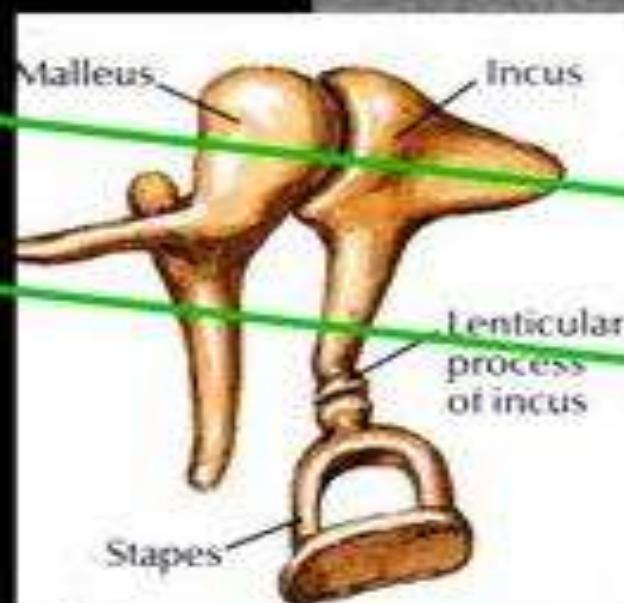
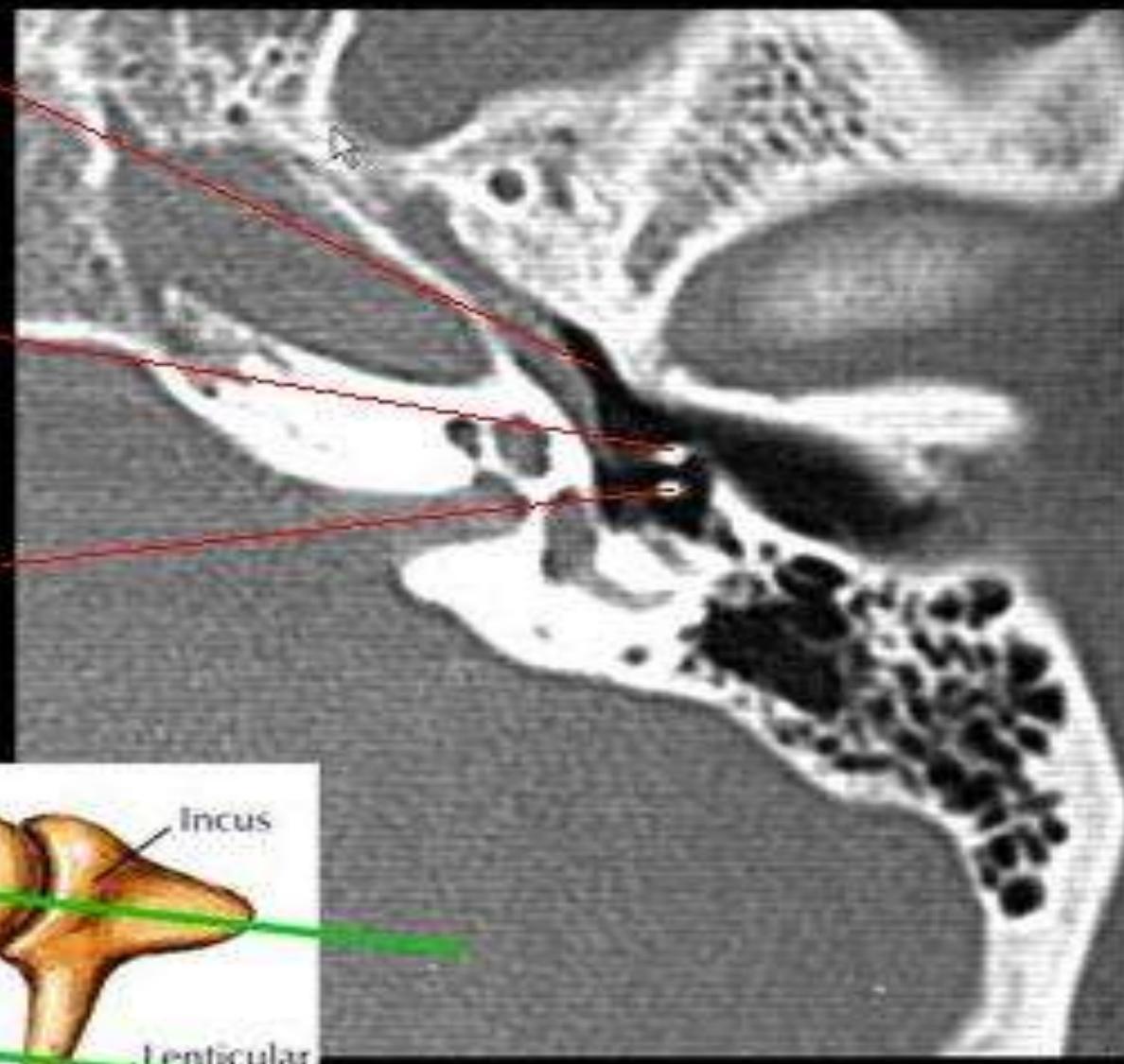
- Incus
- Malleus
- Stapes
- Mastoid

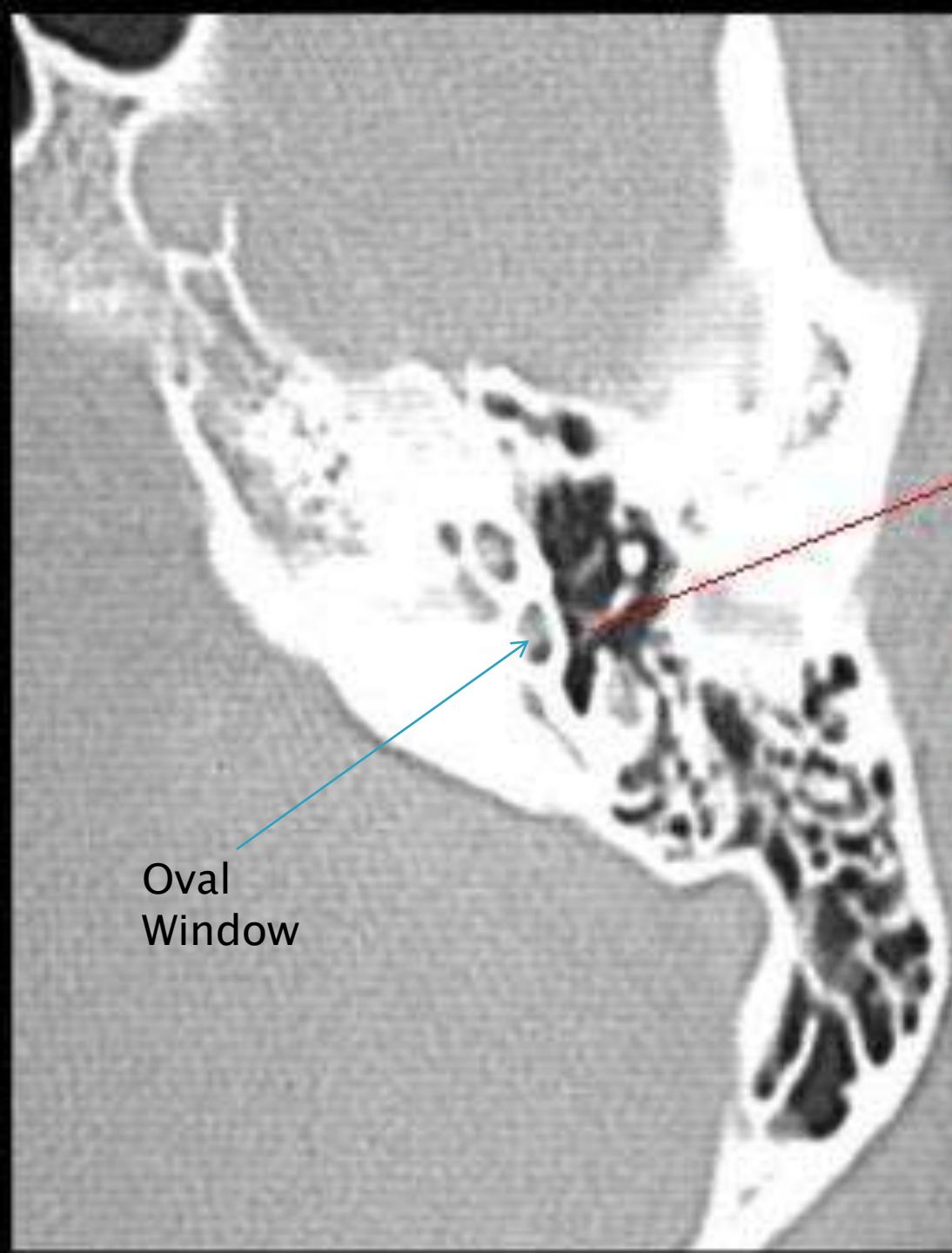


Eustachian tube

Malleus *Handle*

Incus *long process*





*Crura of
the stapes*

Middle Ear Cavity

Aditus Ad
Antrum

Connecting
M.E.Cavity
To Antrum

Antrum

*"Largest Mastoid
air cell "*

Ice cream cone



Middle ear cavity



- Ice cream cone
- Incus
- Malleus
- Aditus ad antrum
- Mastoid antrum
- Incudo - malleal joint

Connections

- To the nasopharynx via Eustachian tube
- To the mastoid antrum via aditus ad antrum
- To the vestibule via oval window
- To the cochlea via the round window



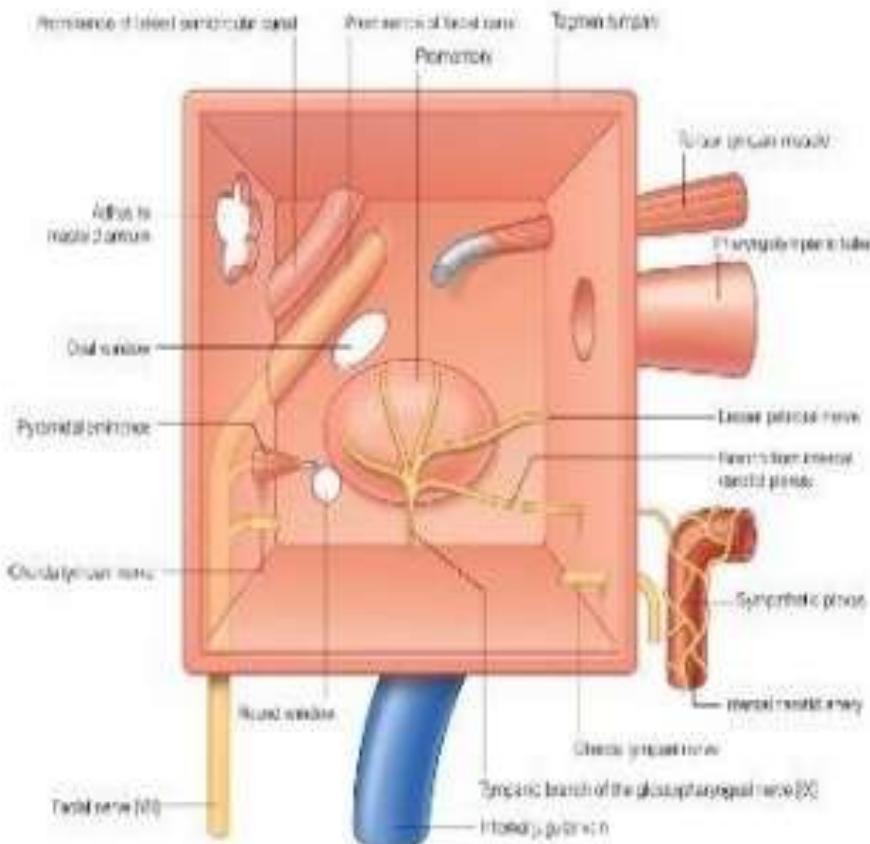
- Posterior wall –

lie close to mastoid air cells, and has following structures:

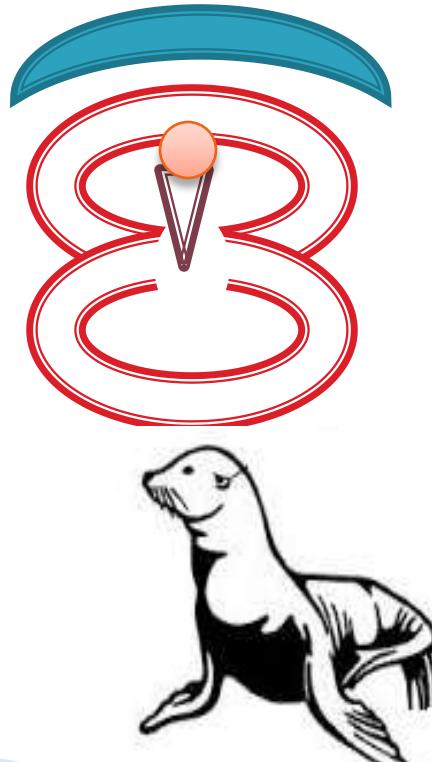
- *Aditus*
- *Fossa Incudis*
- *Pyramid*
- *Facial Recess*

- Lateral wall -

- *TM*
- *Scutum*

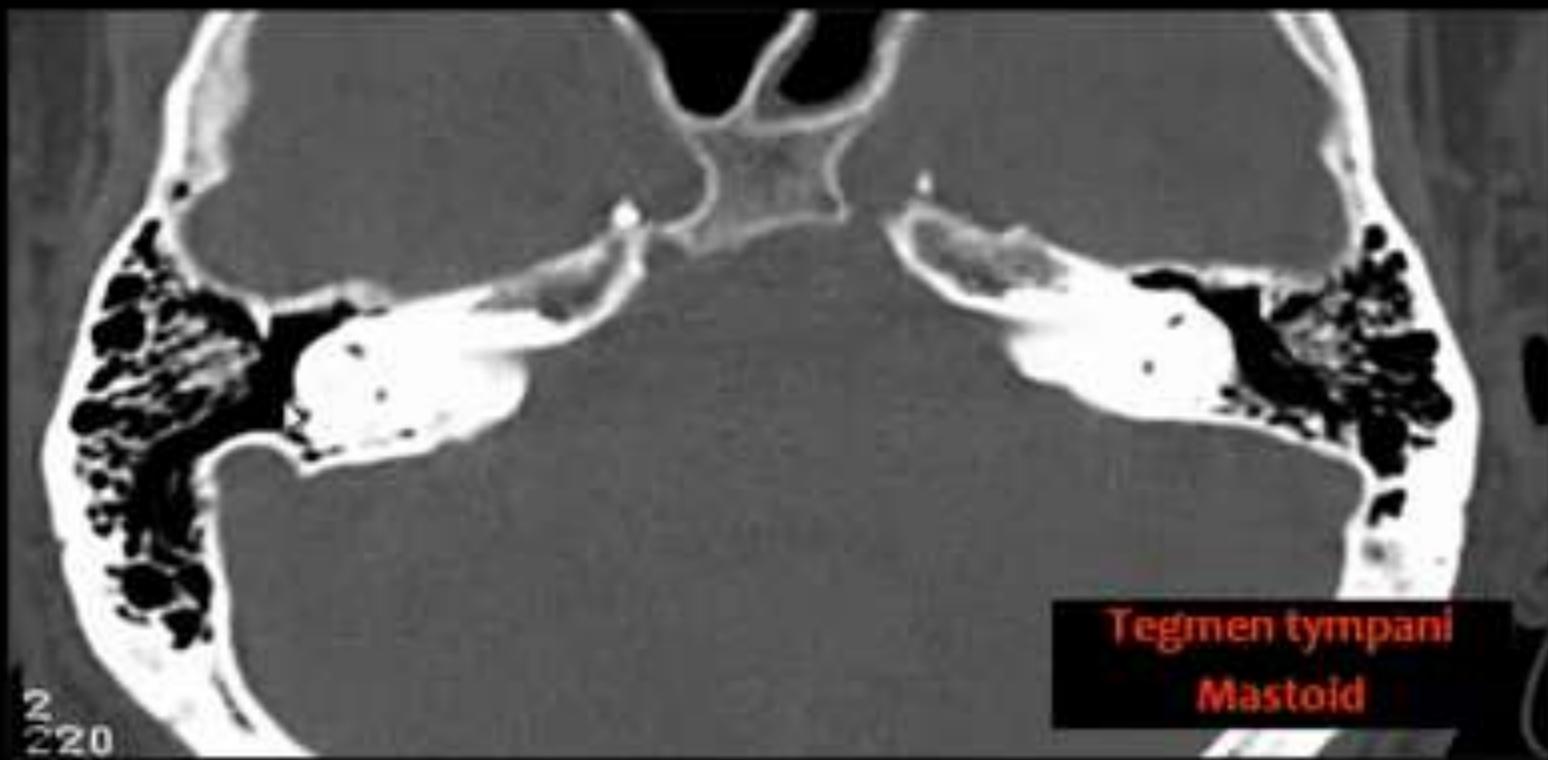


Middle Ear Cavity → Axial CT



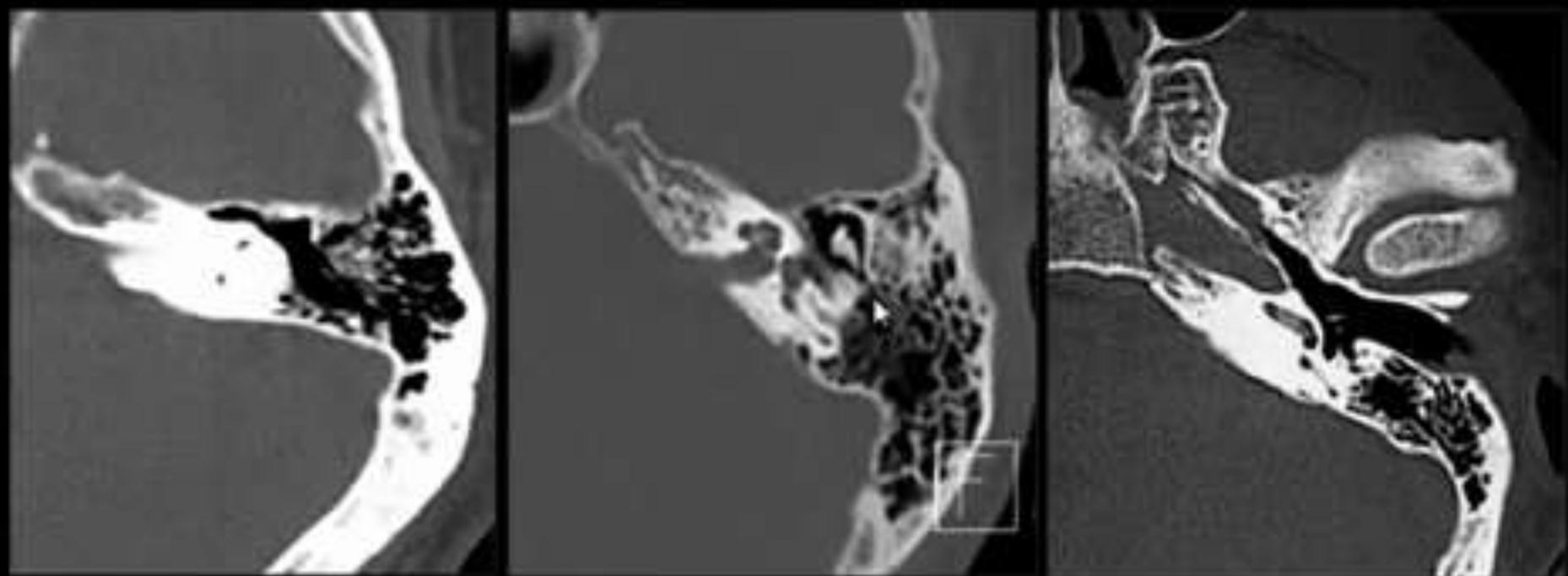
- ▶ **Epi tympanum**
- ▶ **Meso tympanum**
- ▶ **Hypo tympanum**

Epitympanum

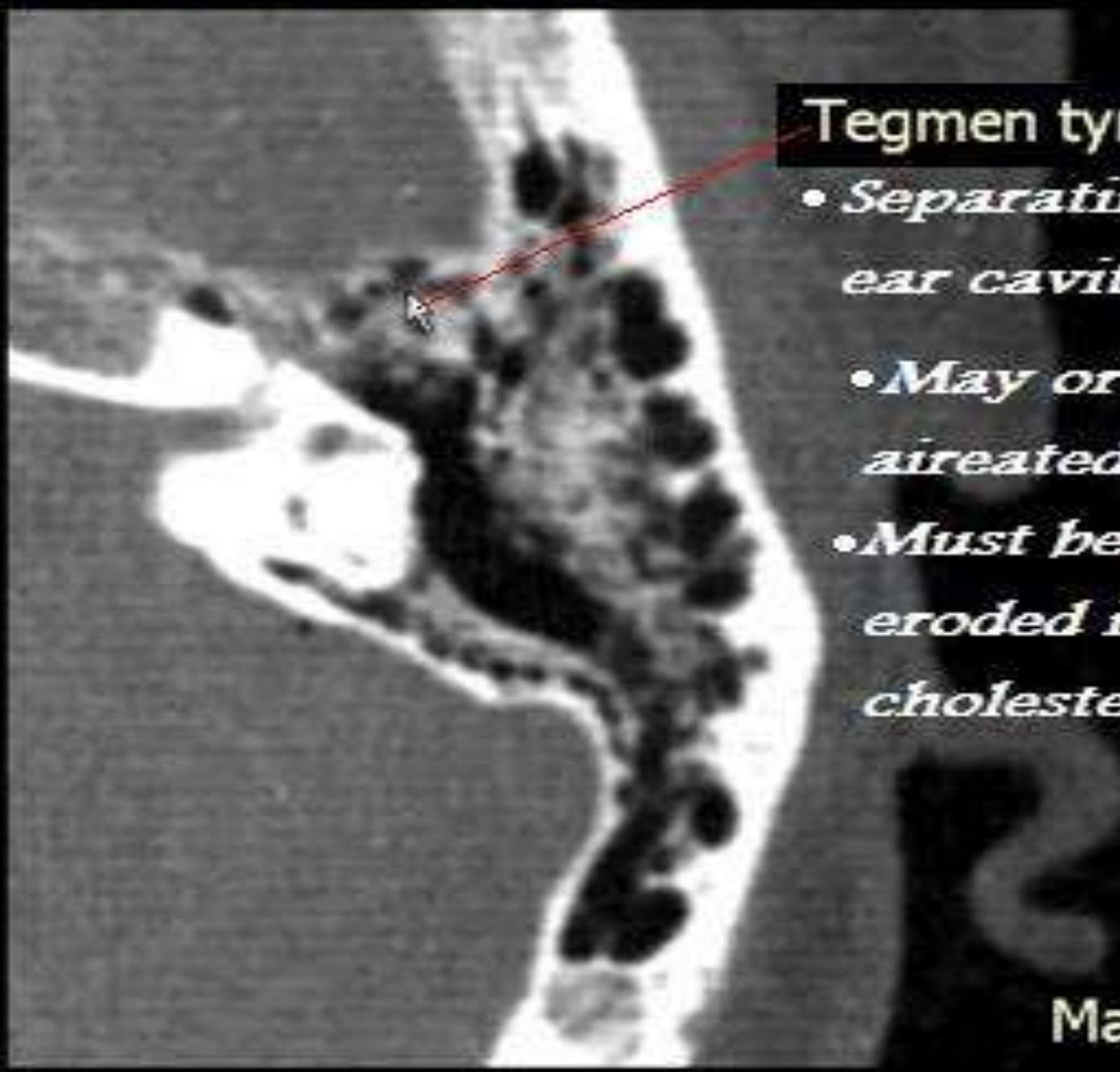


- ▶ Tegmen tympani = Bone separating
Middle ear / Brain
- ▶ **2 Parts :**
 - *Anterior* → Seen in Axial Scan
 - *Superior* → Seen in coronal
- ▶ ***Ice Cream Cone*** is the land Mark of middle ear
... Catch it , then go Up & Down.

Middle ear



Epitympanum



Tegmen tympani

- *Separating middle ear cavity / Brain*
- *May or may not air-eated*
- *Must be noticed if eroded in cholesteatoma*

Mastoid

Mesotympanum

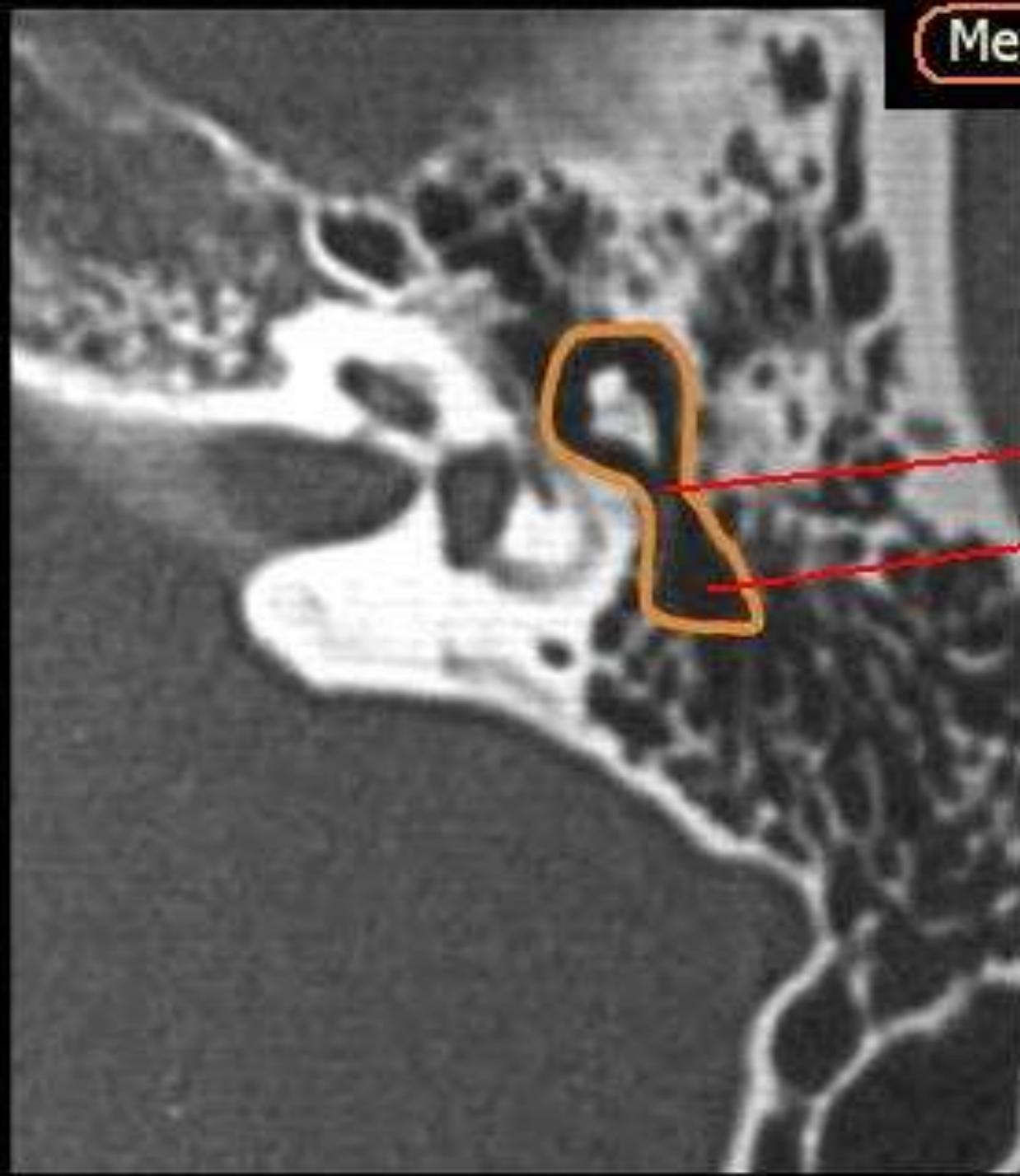
Ice cream

Malleus Incus

Incudo- malleal joint

Aditus ad antrum

Mastoid antrum

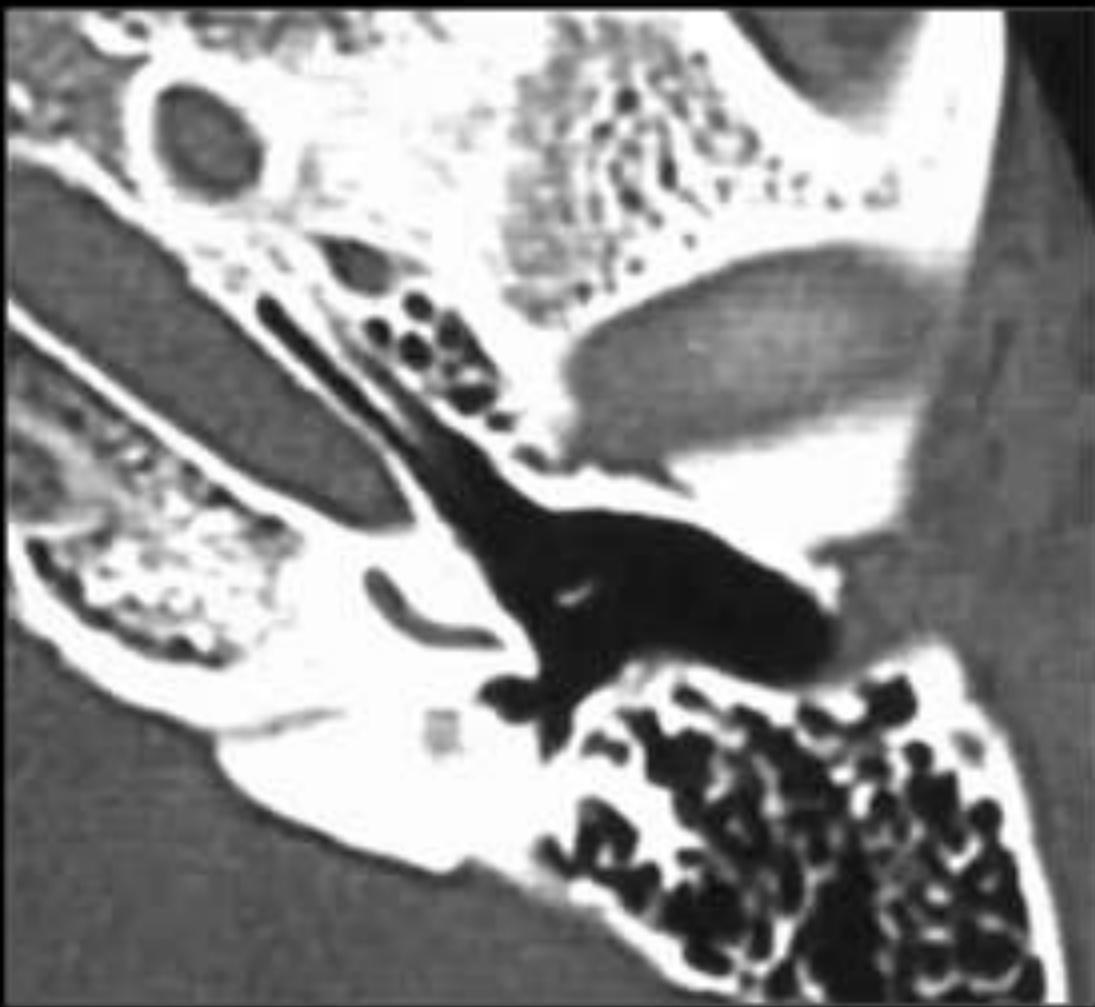




- Sinus tympani
- Facial recess
- Tympanic P.
- Eustachian tube
- Mastoid



Hypo tympanum



- Sinus tympani
- Facial recess
- Tympanic P.
- Eustachian tube
- Mastoid

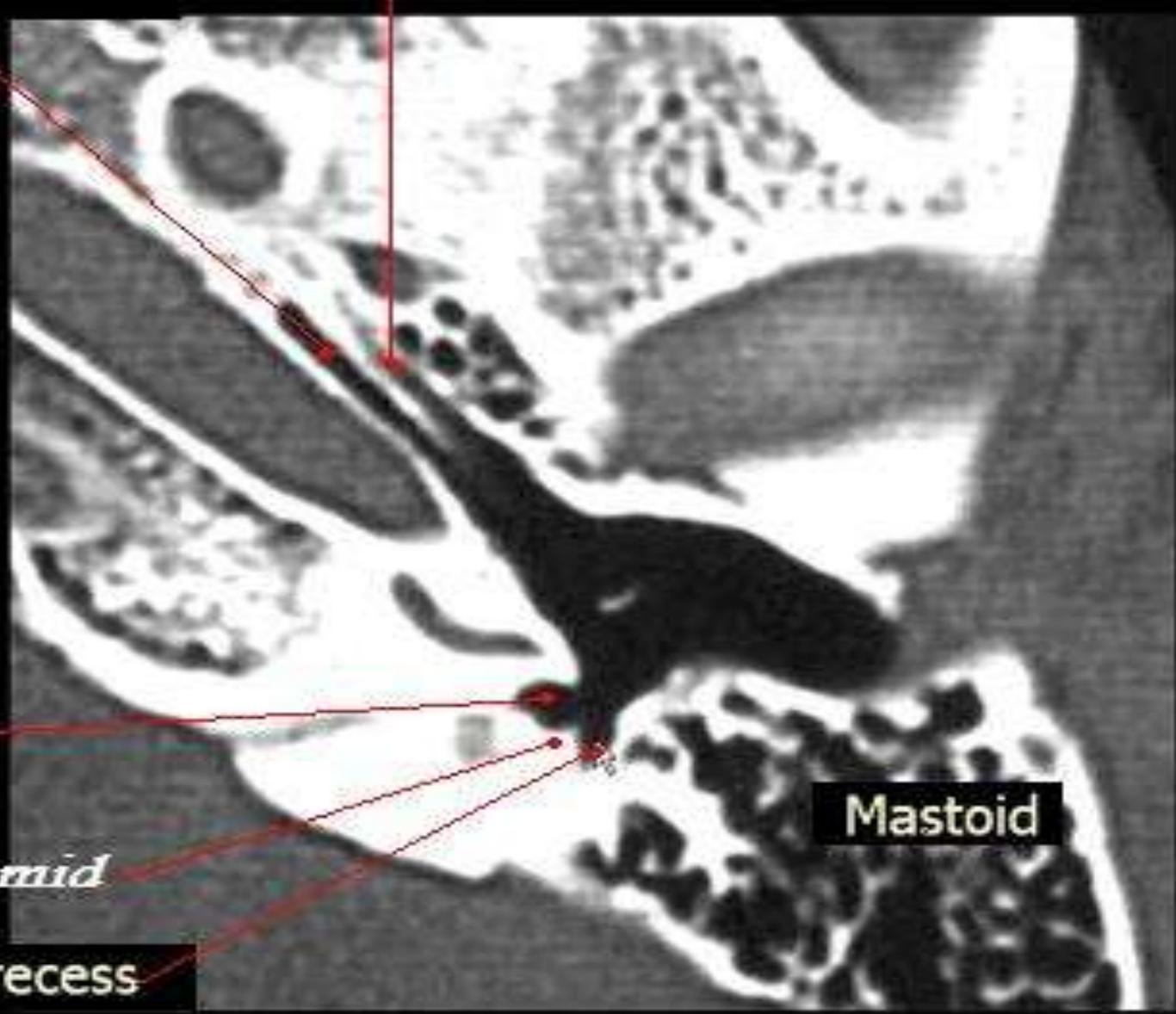


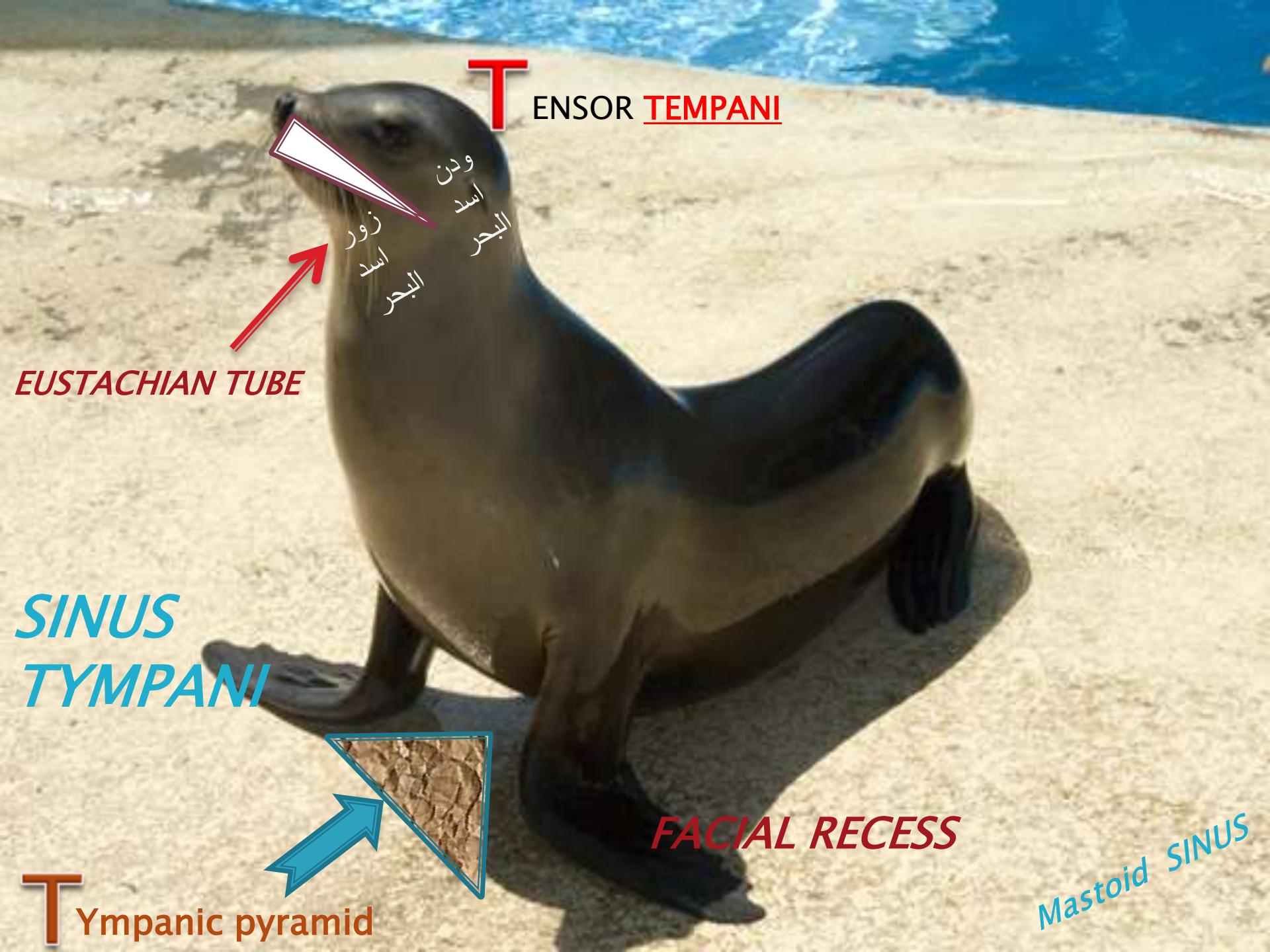
Hypo tympanum

Hypo tympanum

Eustachian tube

tensor tympani M.



A photograph of a seal on a sandy beach. Overlaid on the image are several anatomical labels in English and Arabic. A red arrow points to the seal's ear with the label 'EUSTACHIAN TUBE'. A blue arrow points to the seal's eye area with the label 'Tympanic pyramid'. A large red letter 'T' is positioned above the seal's head, with the text 'ENSOR TEMPANI' to its right. The Arabic word 'البحر' (sea) is written twice near the seal's eye. The text 'SINUS TYMPANI' is written in blue on the left side. The text 'FACIAL RECESS' is written in red at the bottom right. A blue arrow points to the seal's ear with the label 'Mastoid SINUS'.

T

ENSOR TEMPANI



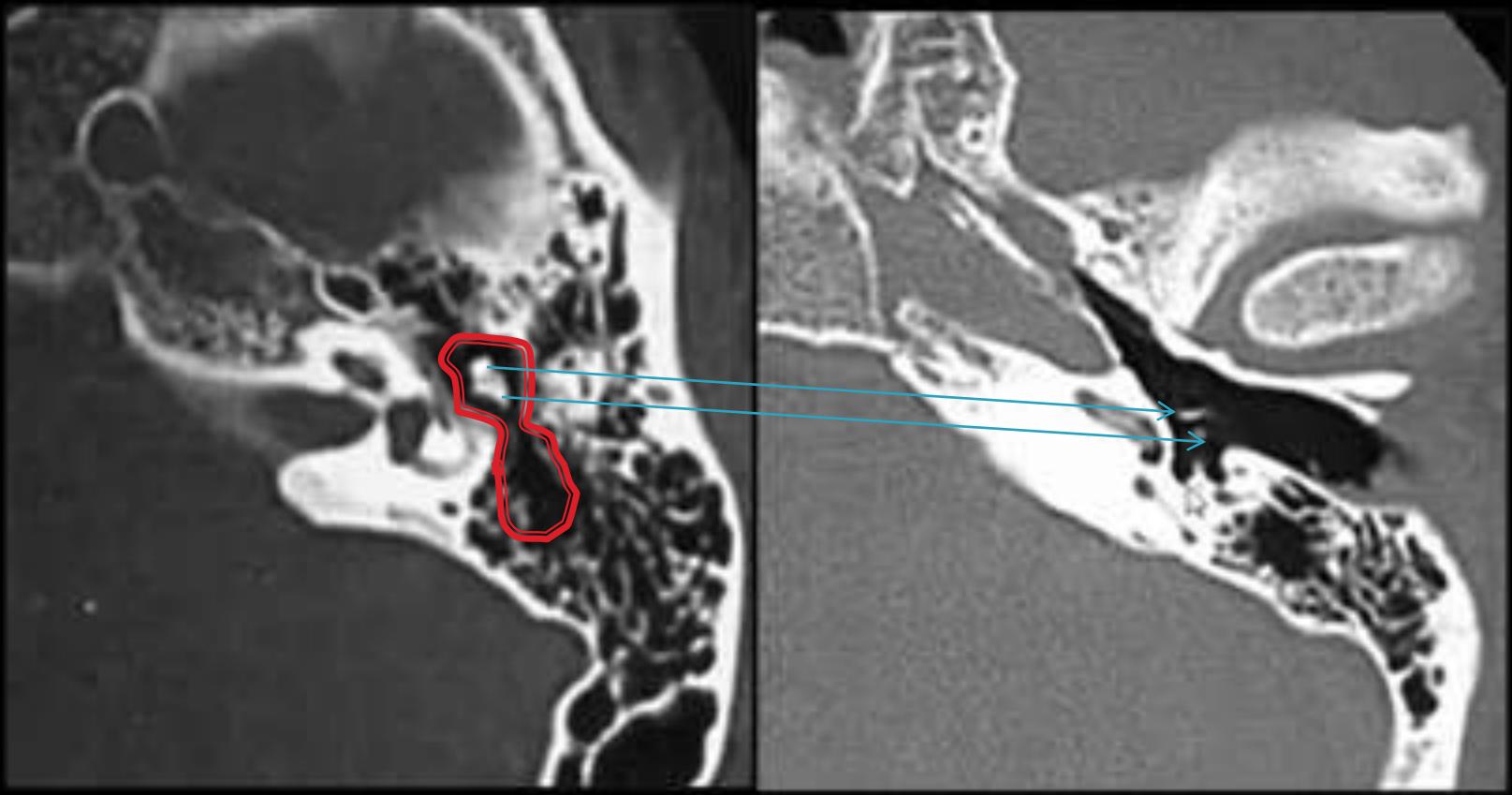
EUSTACHIAN TUBE

SINUS
TYMPANI

T
Ympanic pyramid

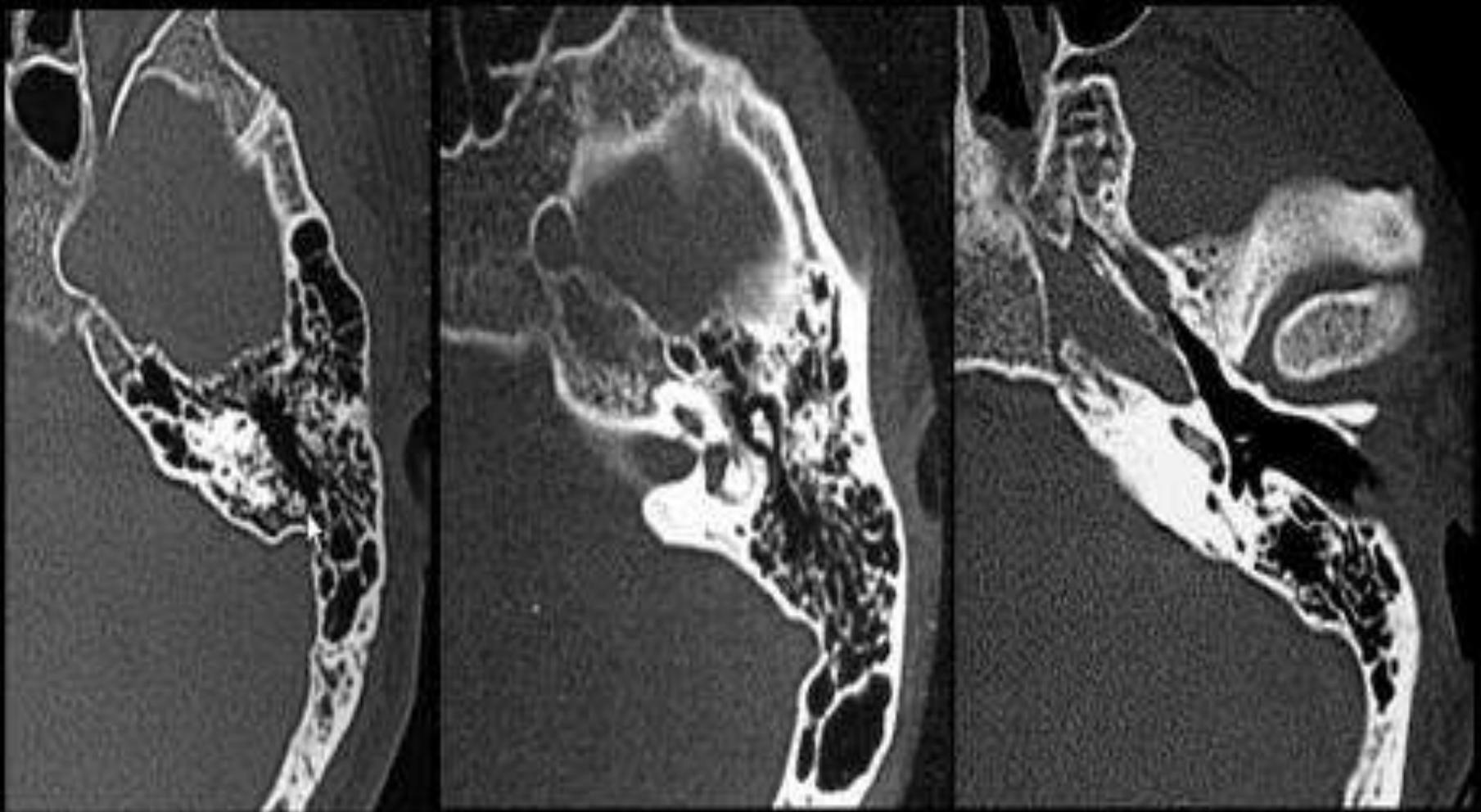
FACIAL RECESS

Mastoid SINUS



MIDDLE EAR ANATOMY

Axial CT



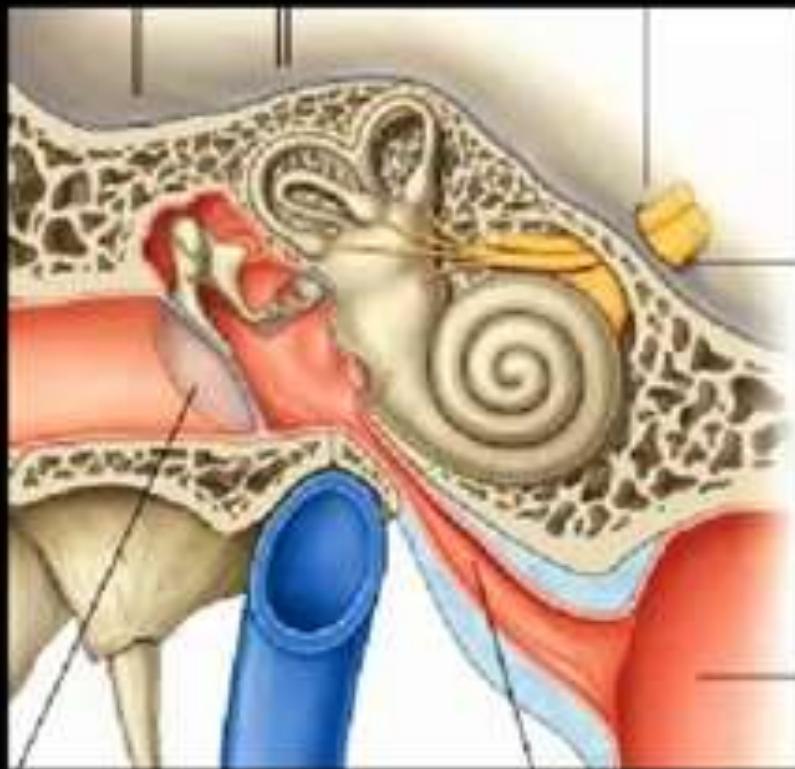
Epi

Meso

Hypo

Inner ear structures

- Vestibule
- Semicircular canals
- Cochlea
- Internal auditory canal
- Cochlear aqueduct
- Vestibular aqueduct



INNER EAR

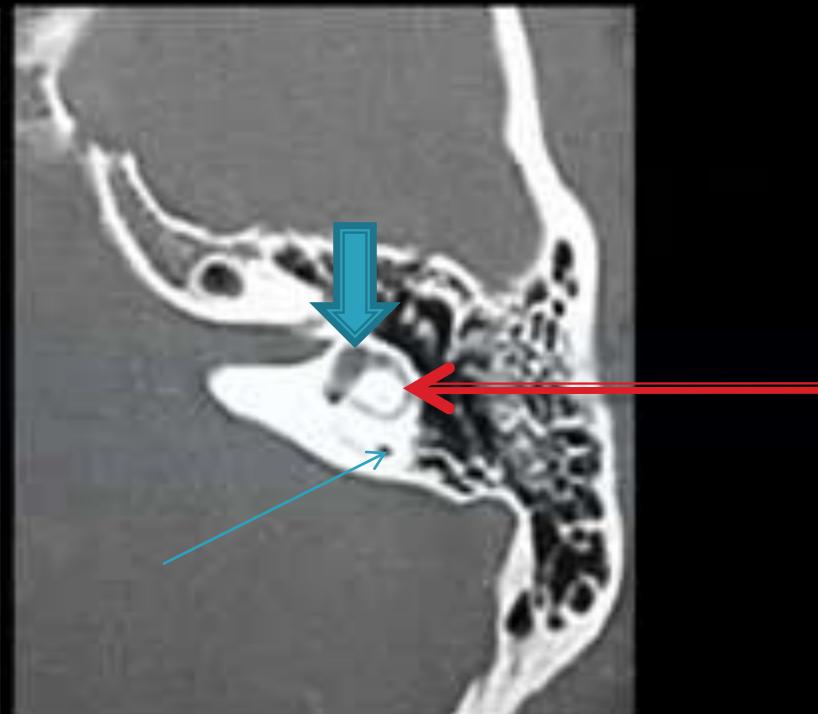
- ▶ Vestibule , Cochlea & 3 semicircular canals.
- ▶ **Vestibular N.** & cochlear N → vestibulo-cochlear N
“8th cranial n.”
- ▶

Inner ear anatomic landmark

Superior

Lateral

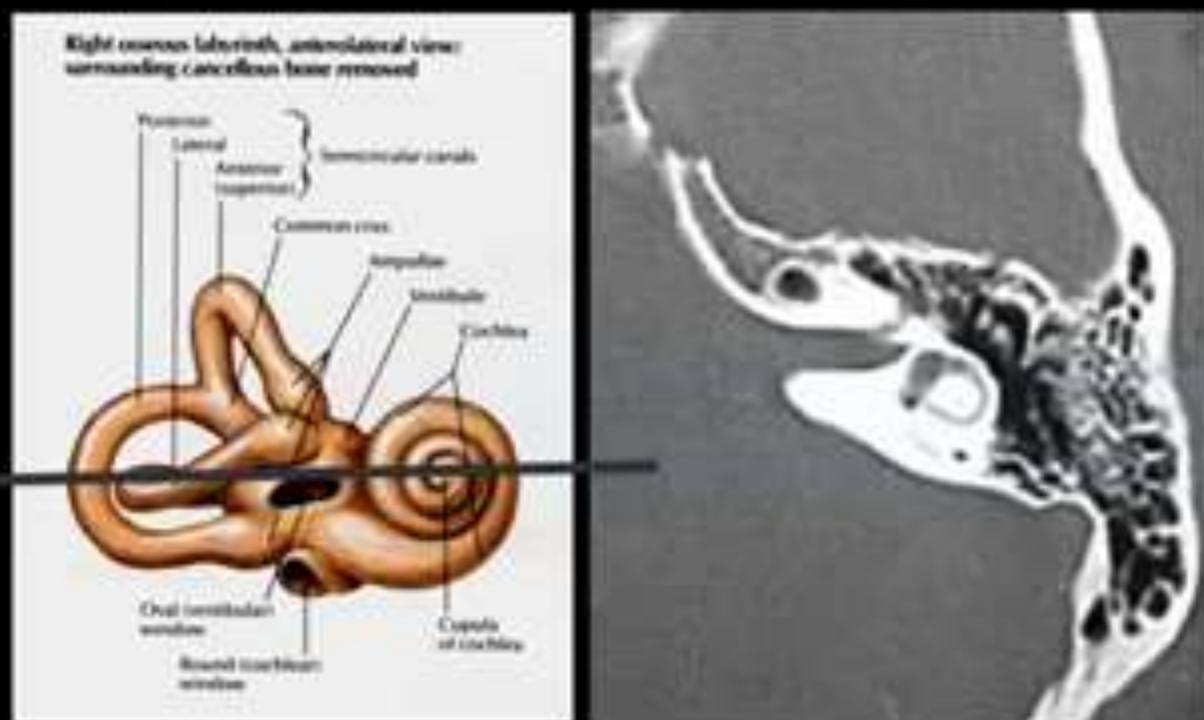
Posterior



Lateral semicircular canal

Or Horizontal Semi circular canal

Inner ear anatomic landmark



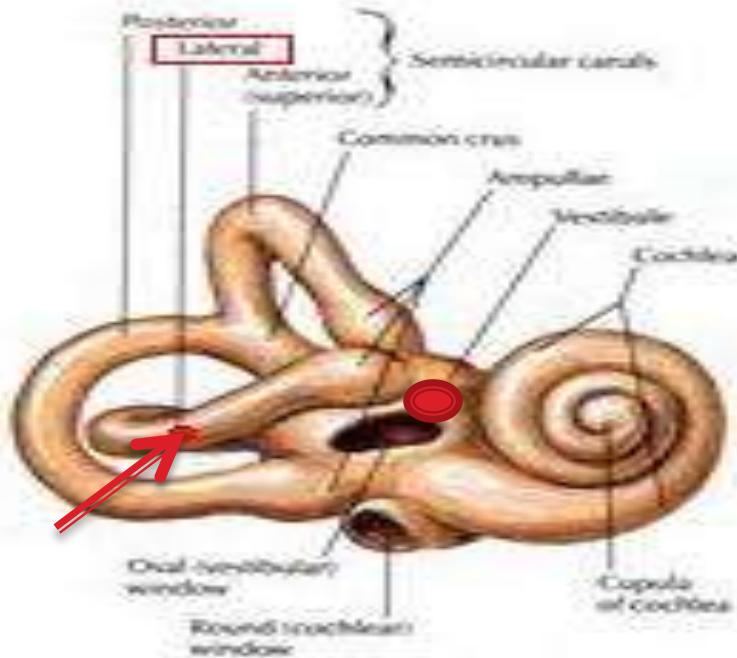
Lateral semicircular canal

INNER EAR

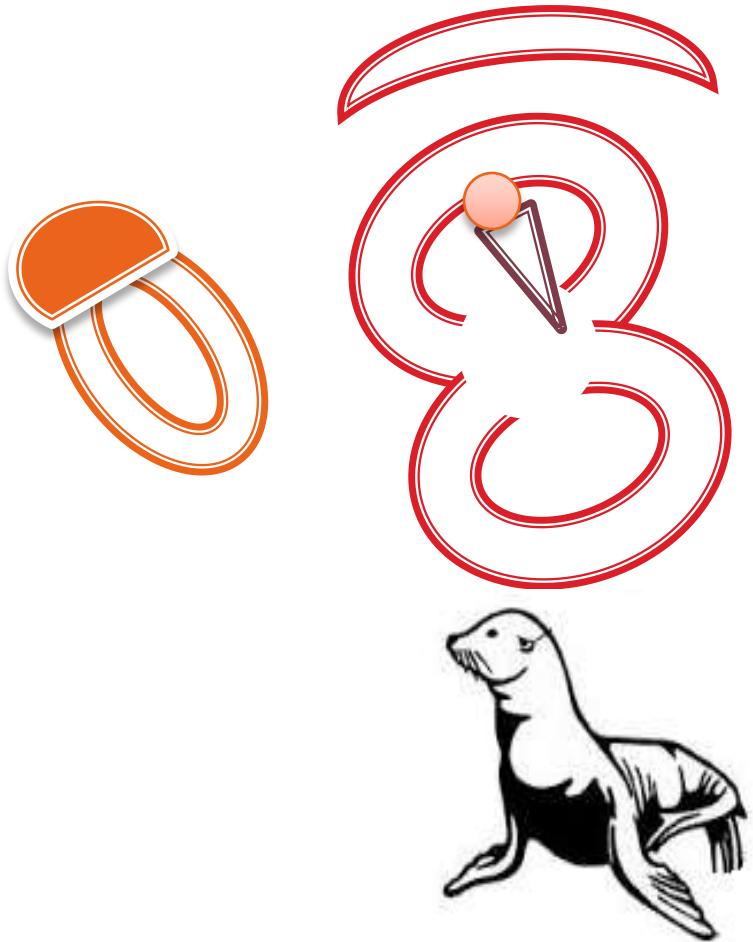
ANATOMIC LANDMARK

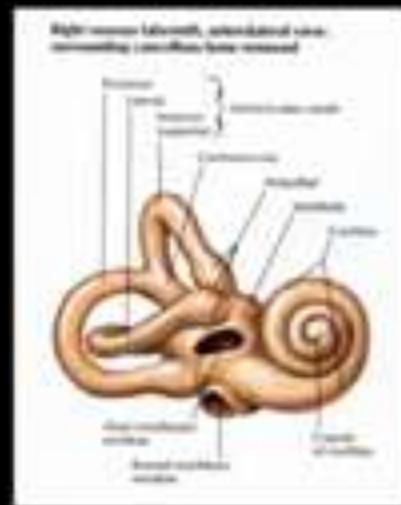
LATERAL SCC

Right osseous labyrinth, anterolateral view:
surrounding cancellous bone removed

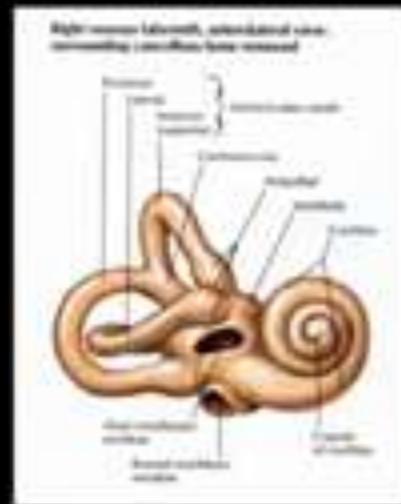
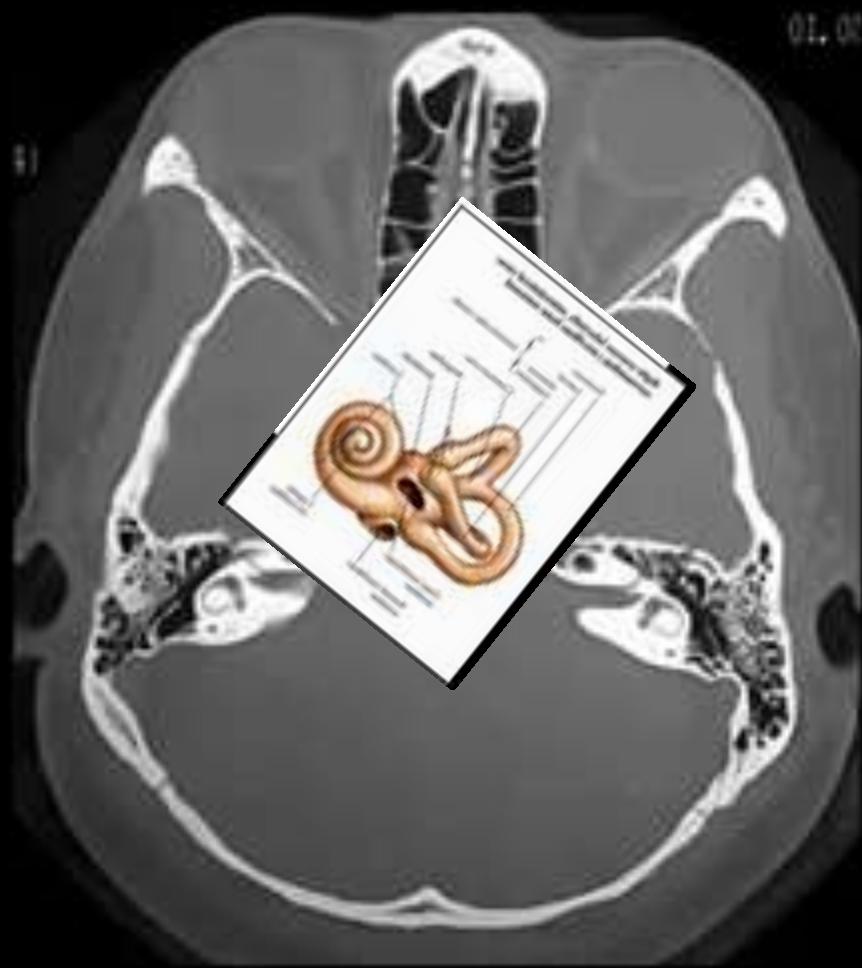


- Lat SCC is Horizontal, so appear totally in axial scan.
- In good adjusted angle it seen with ice cream cone in the same section.

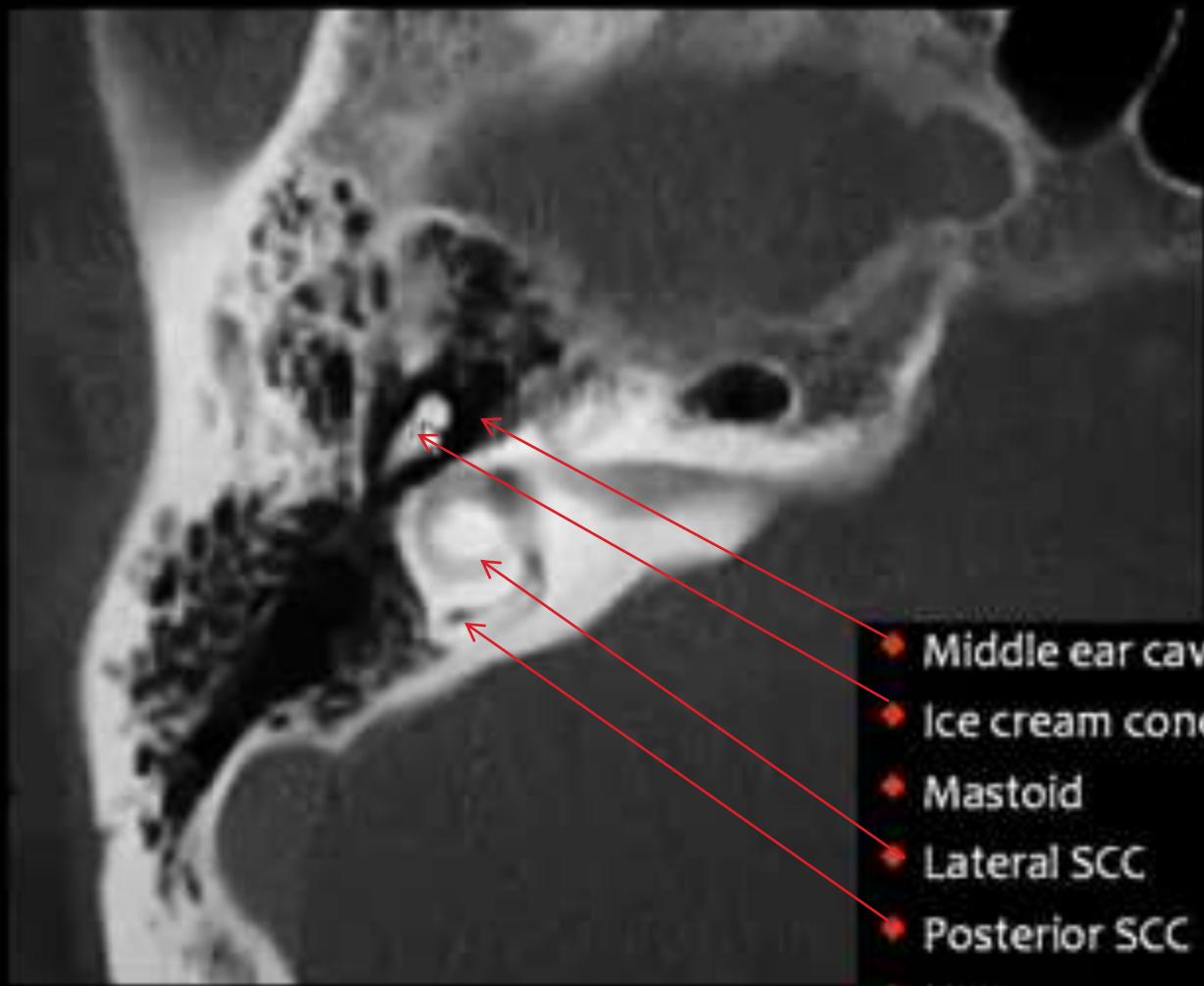




- Lateral SCC
- Posterior SCC
- Vestibule

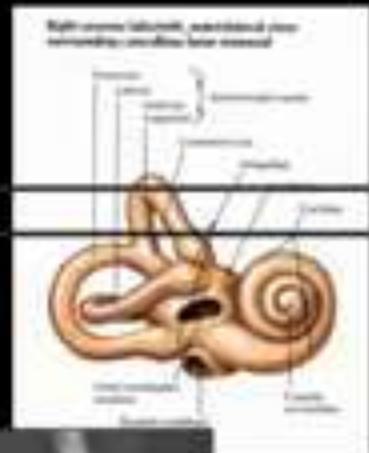
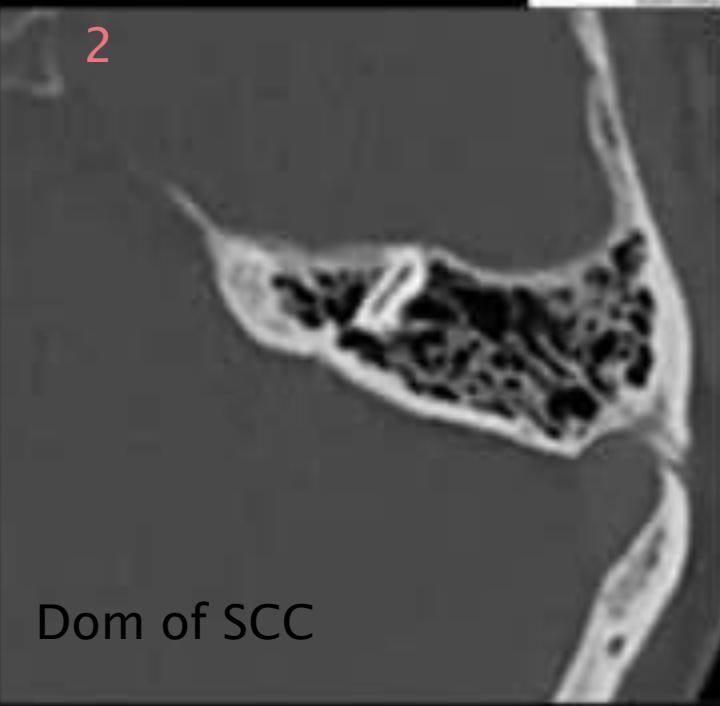


- Lateral SCC
- Posterior SCC
- Vestibule

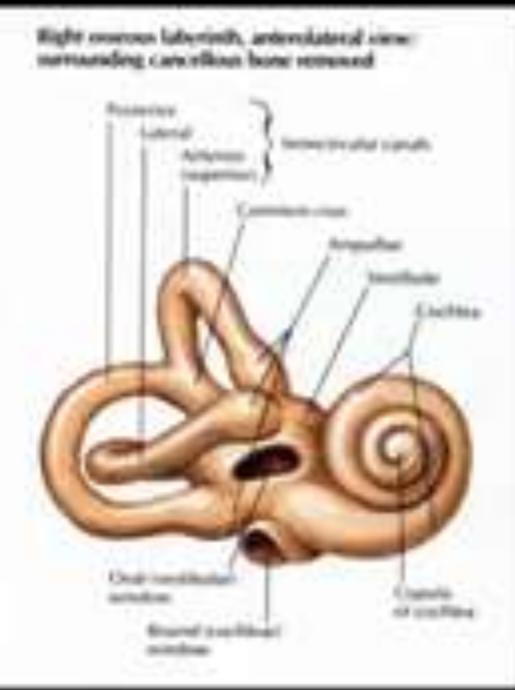
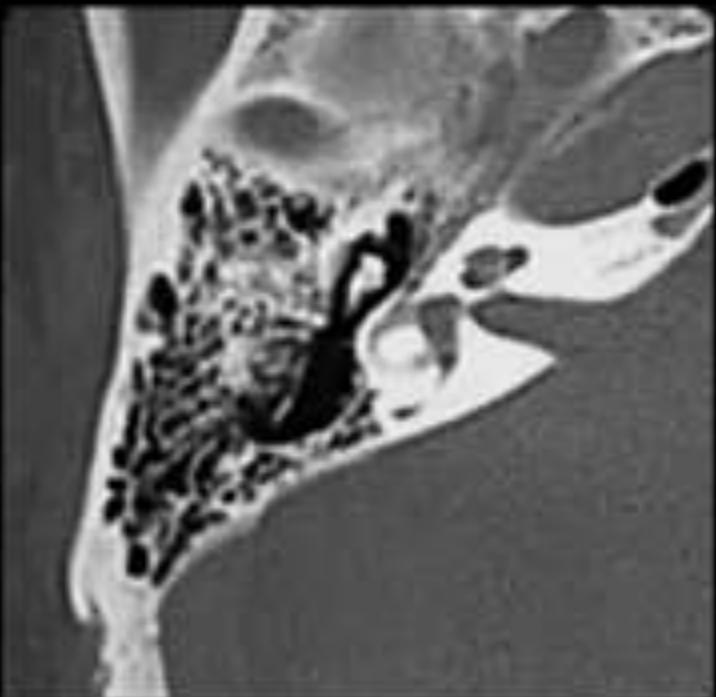


- Middle ear cavity
- Ice cream cone
- Mastoid
- Lateral SCC
- Posterior SCC
- IAC

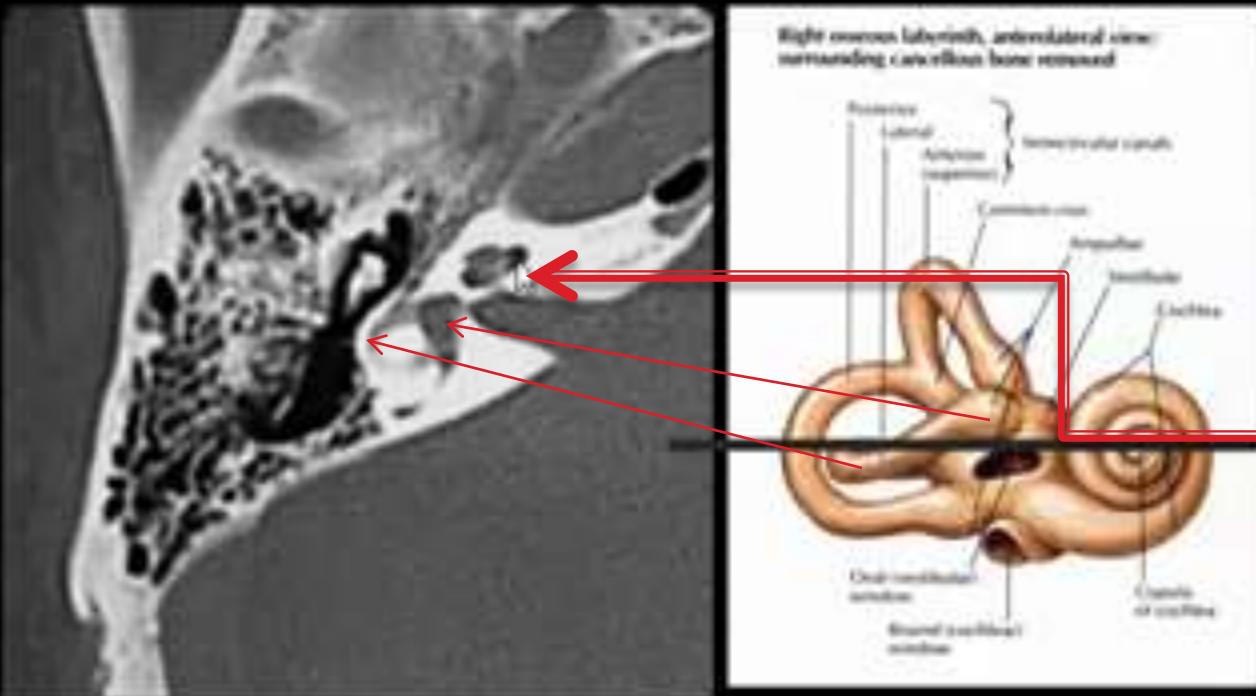
Superior SCC



Cochlea



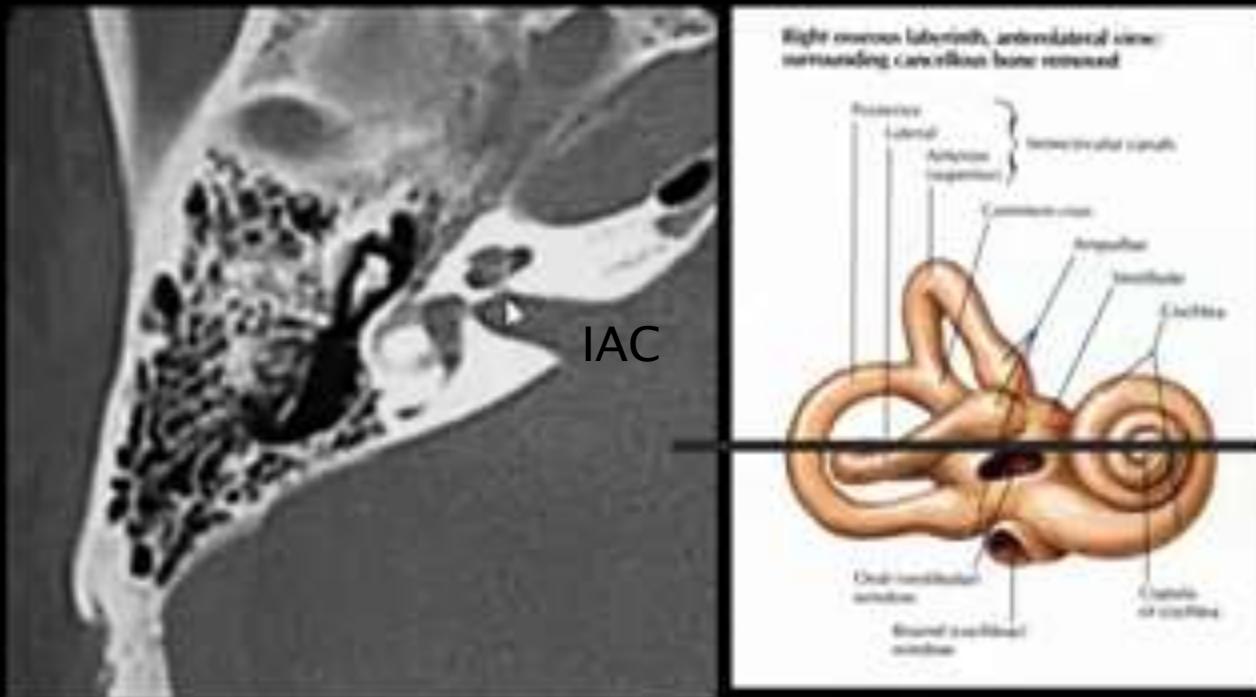
Cochlea



شكل
البرنيطة

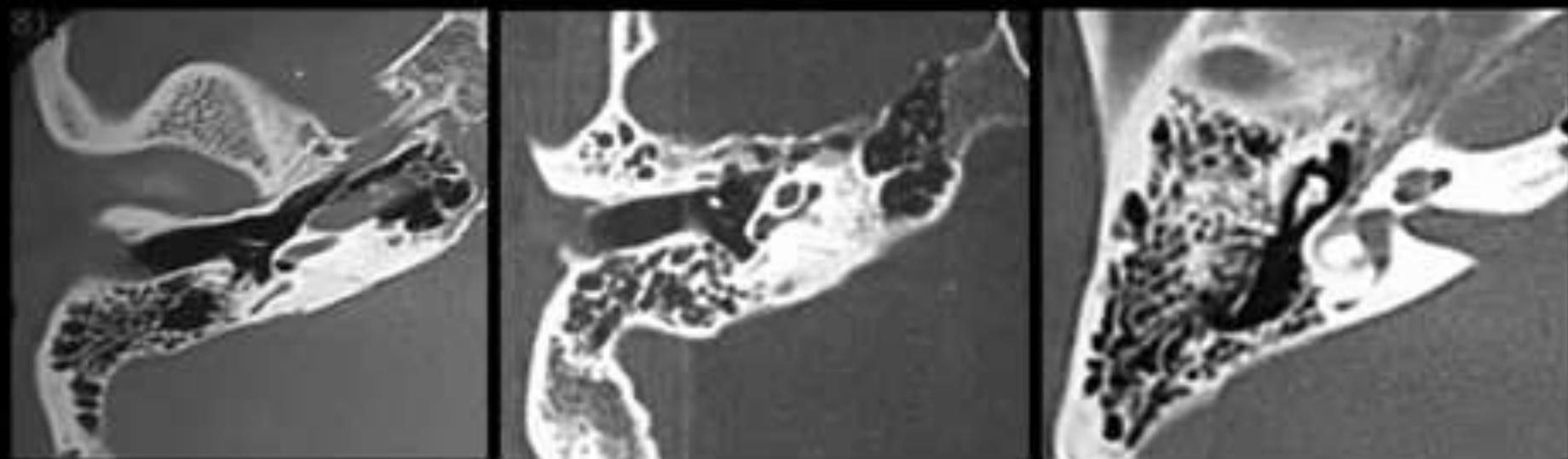
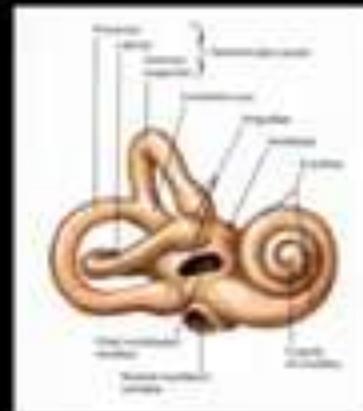
Dom
Of
Cochlea

Cochlea

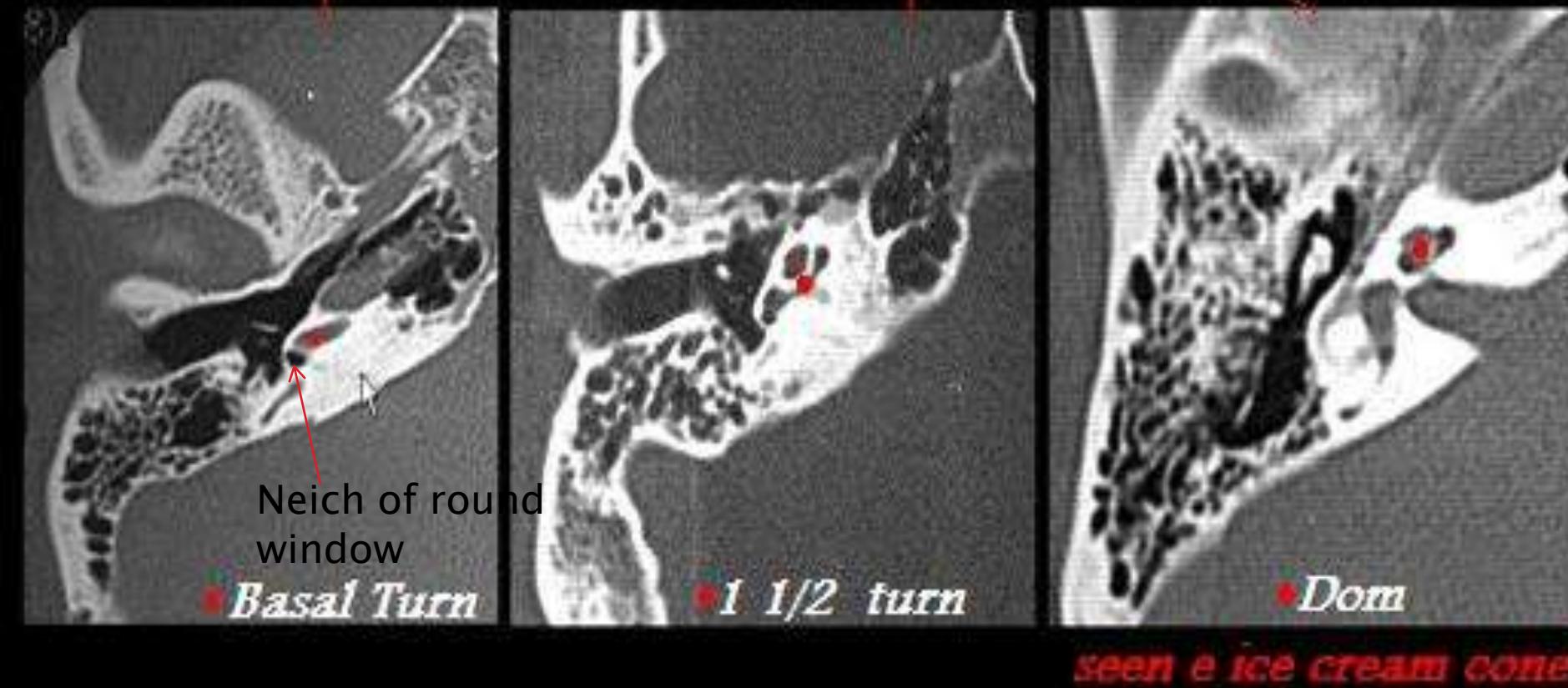
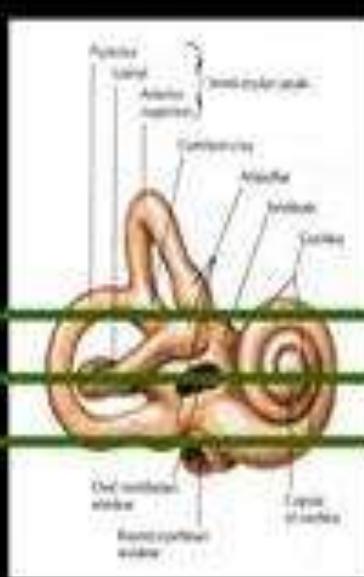


Foramen of Cochlear N
Passed from cochlea to Internal Auditory Canal
White small arrow

Cochlea

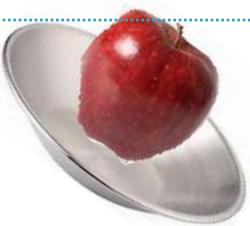


COCHLEA



Inner Ear

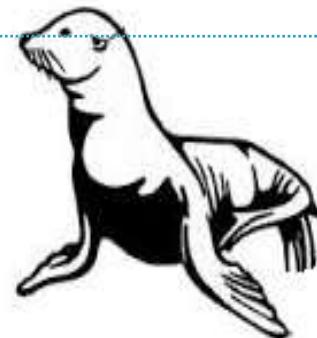
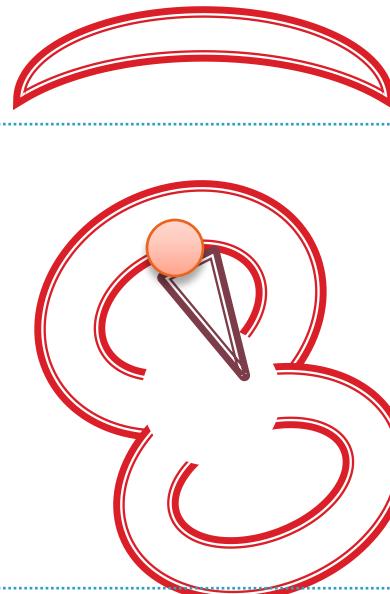
Cochlea

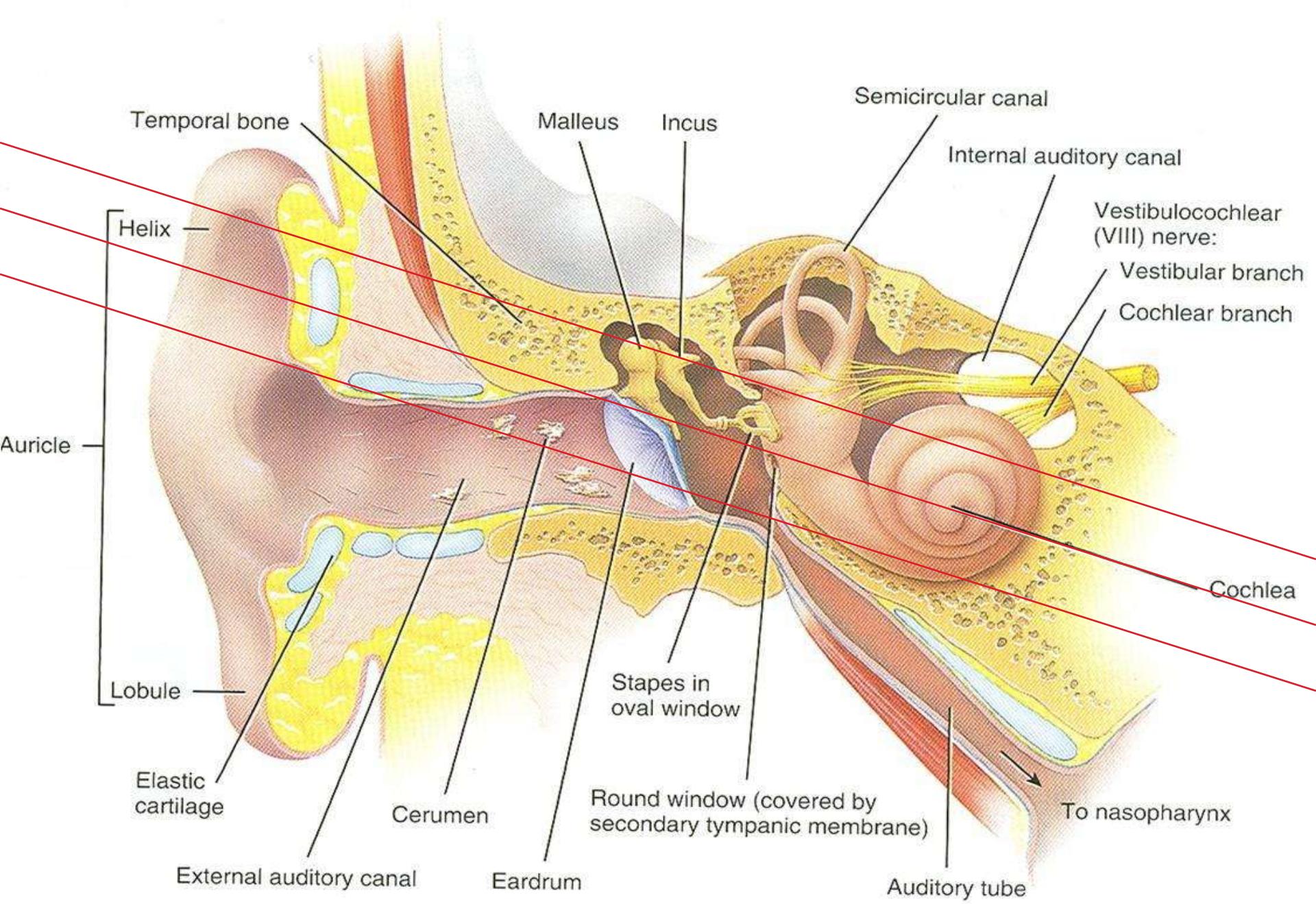


SCC



Middle Ear

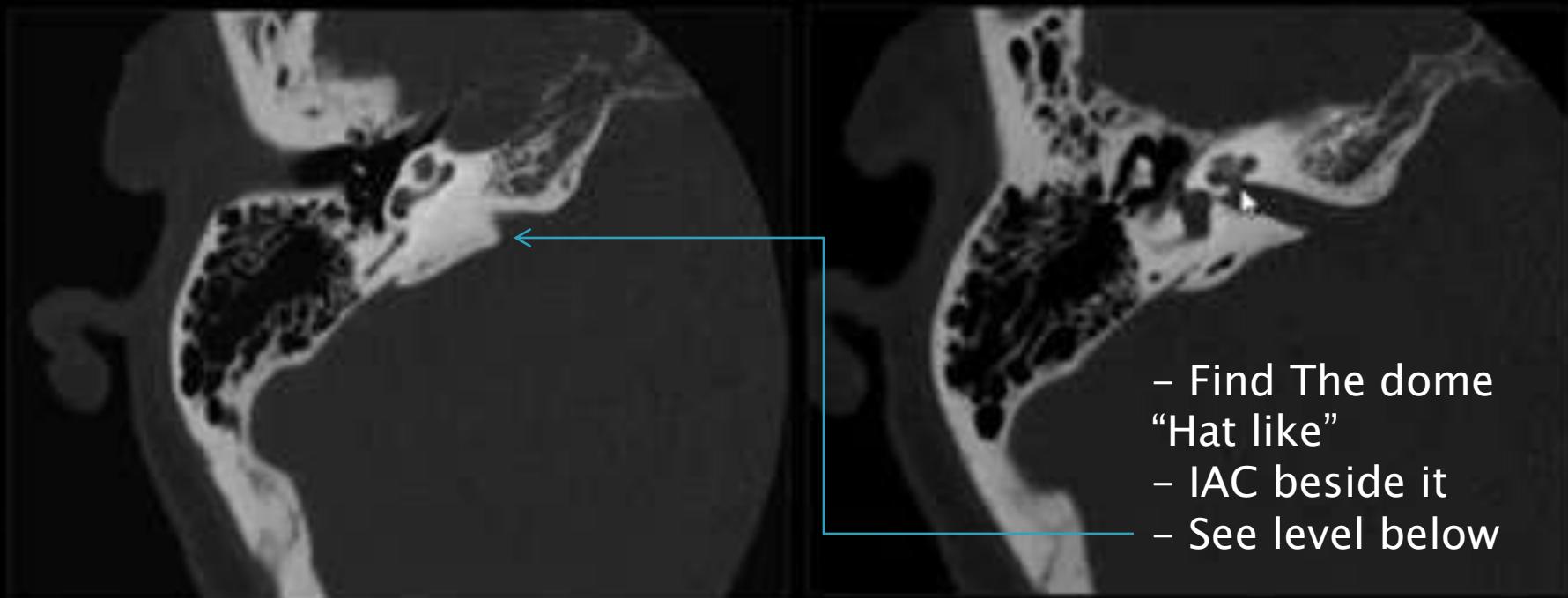




Frontal section through the right side of the skull
showing the three principal regions of the ear

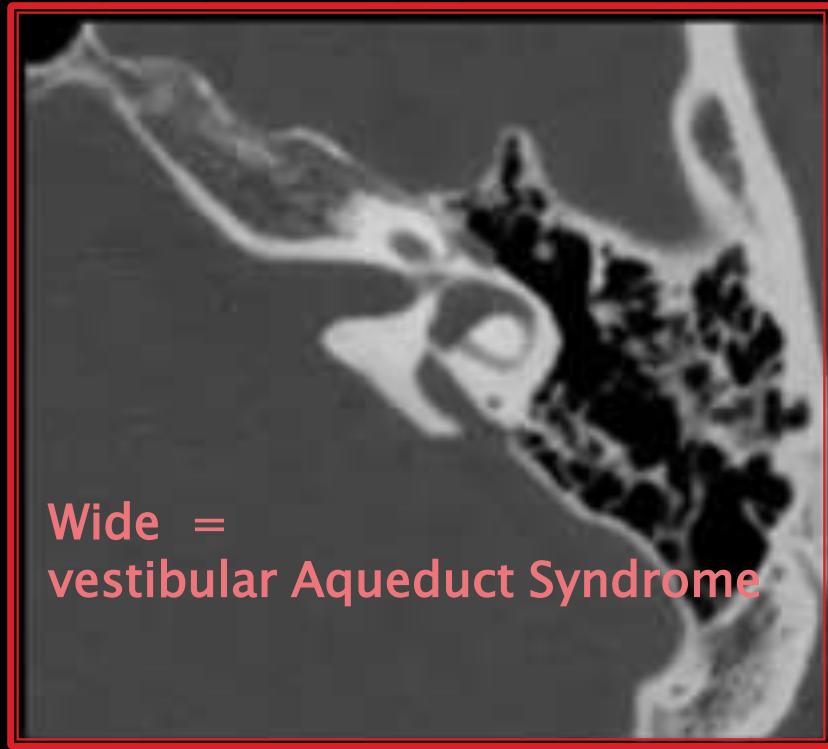
Cochlear aqueduct

To Find It



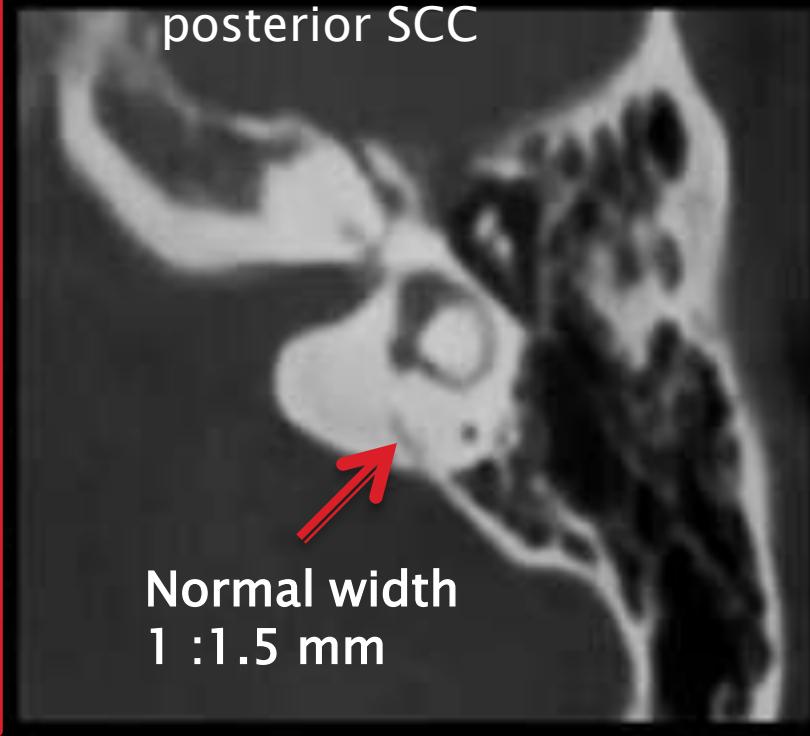
- Find The dome
“Hat like”
- IAC beside it
- See level below

Vestibular aqueduct



Wide =
vestibular Aqueduct Syndrome

Lies Posterior to The
posterior SCC



Normal width
1 :1.5 mm

vestibular Aqueduct Syndrome = one of the most common cause of SNHL
“Sensory Neural Hearing Loss”

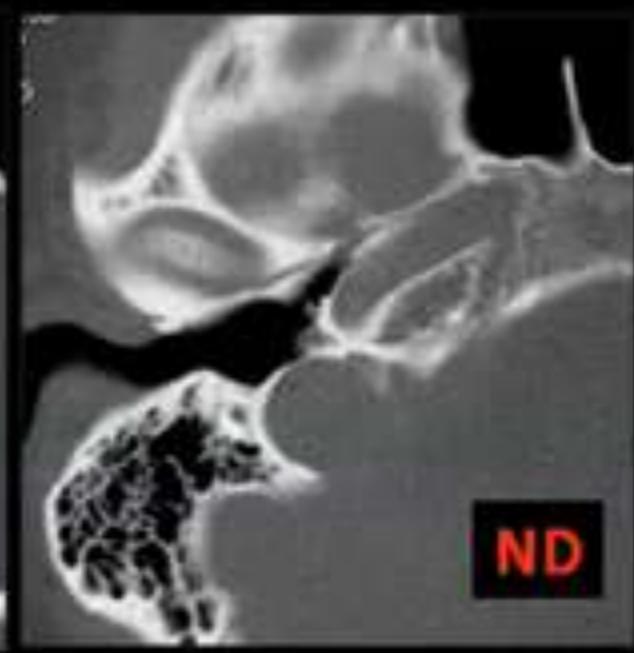
In Patient with SNHL

- ▶ Think in acoustic neuroma If not
 - ▶ Search for Wide vestibular aqueduct > 1.5mm
- = **Vestibular Aqueduct Syndrome .**

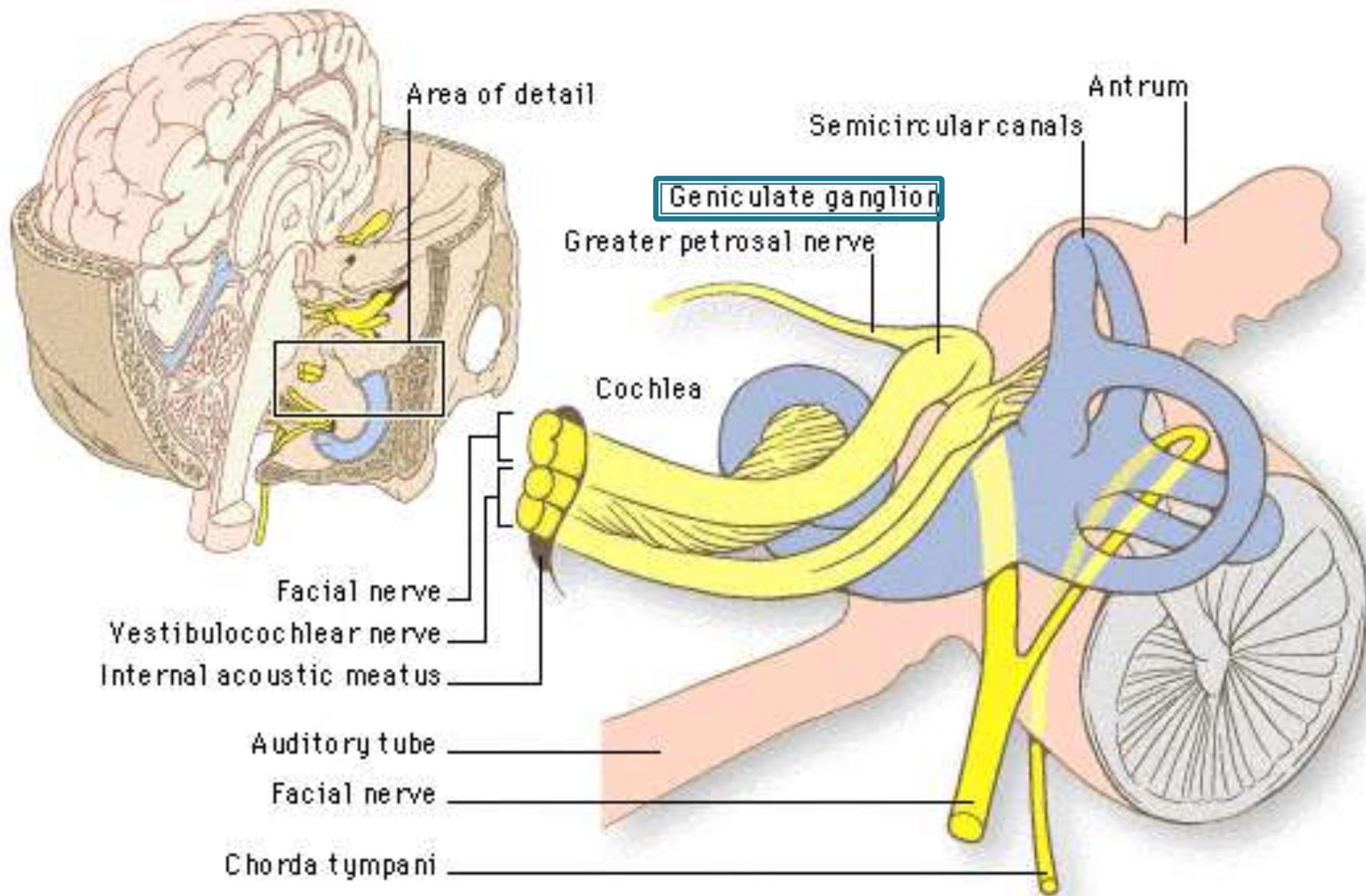
Jugular bulb



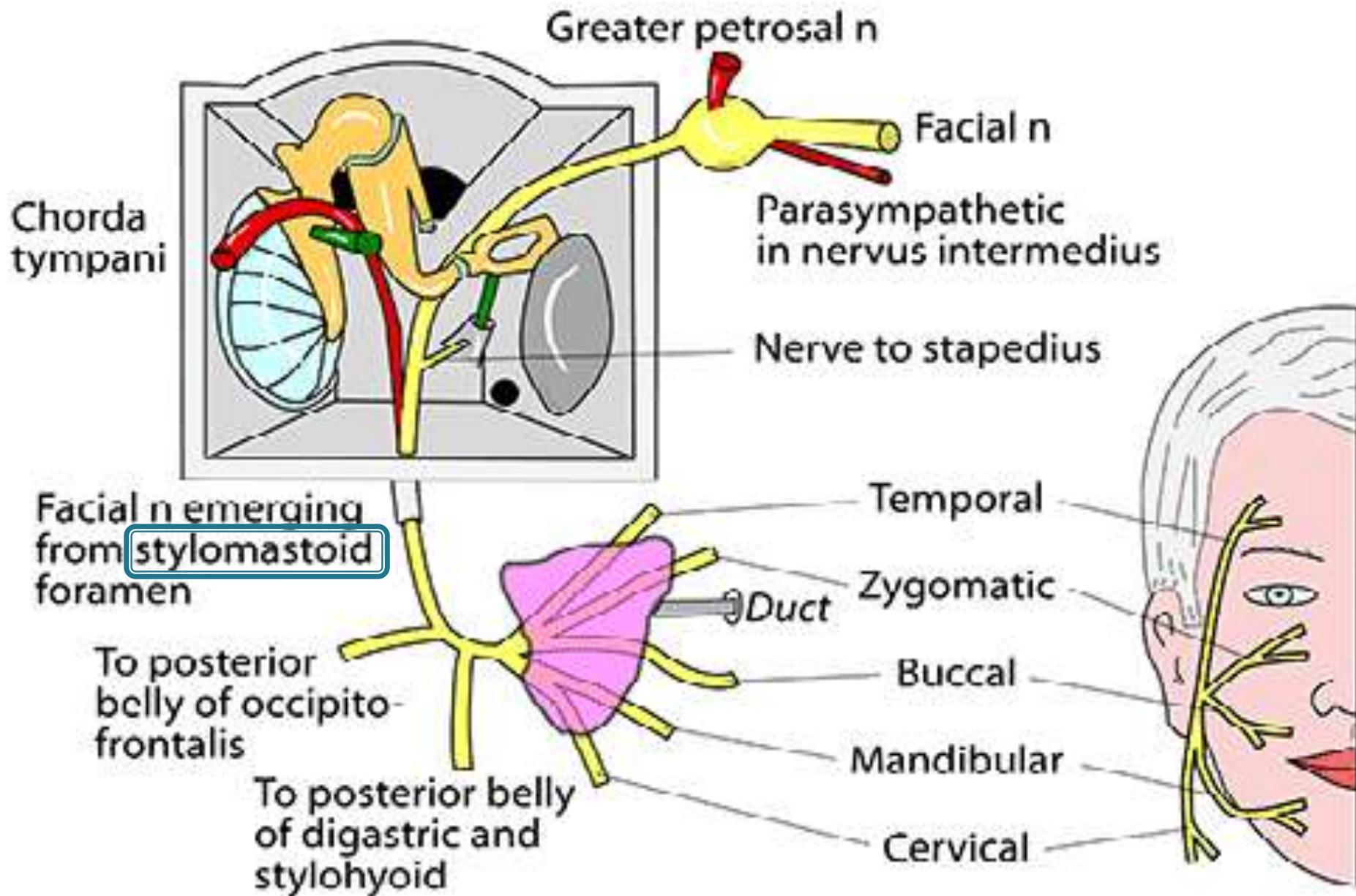
Dehiscent
“non covered by bone”



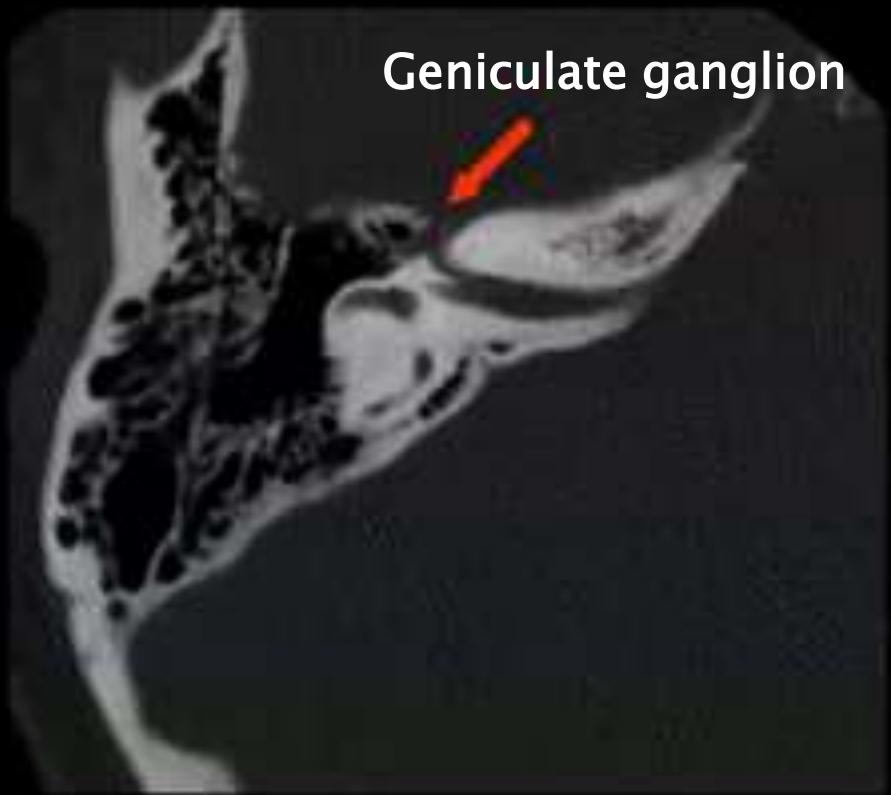
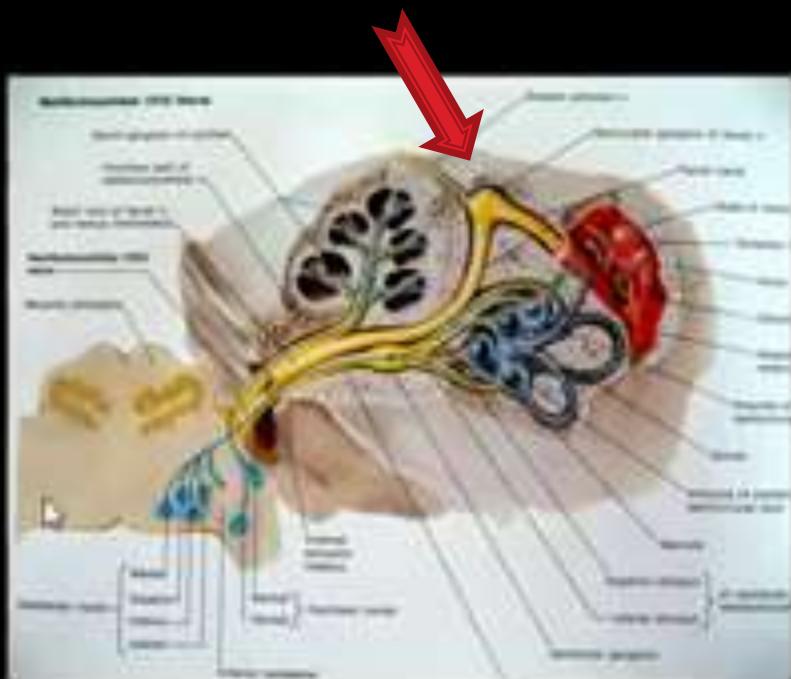
Non Dehiscent
“Liable to injury”



VII FACIAL NERVE

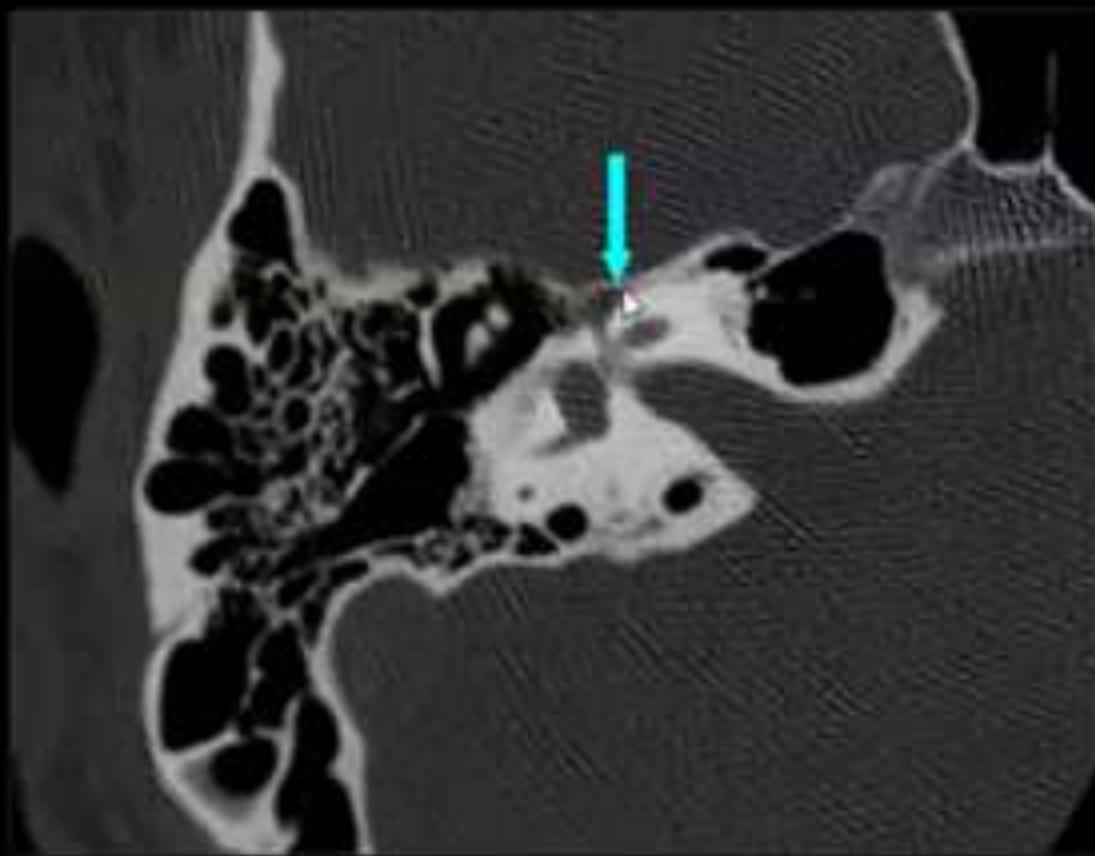


Facial nerve anatomy

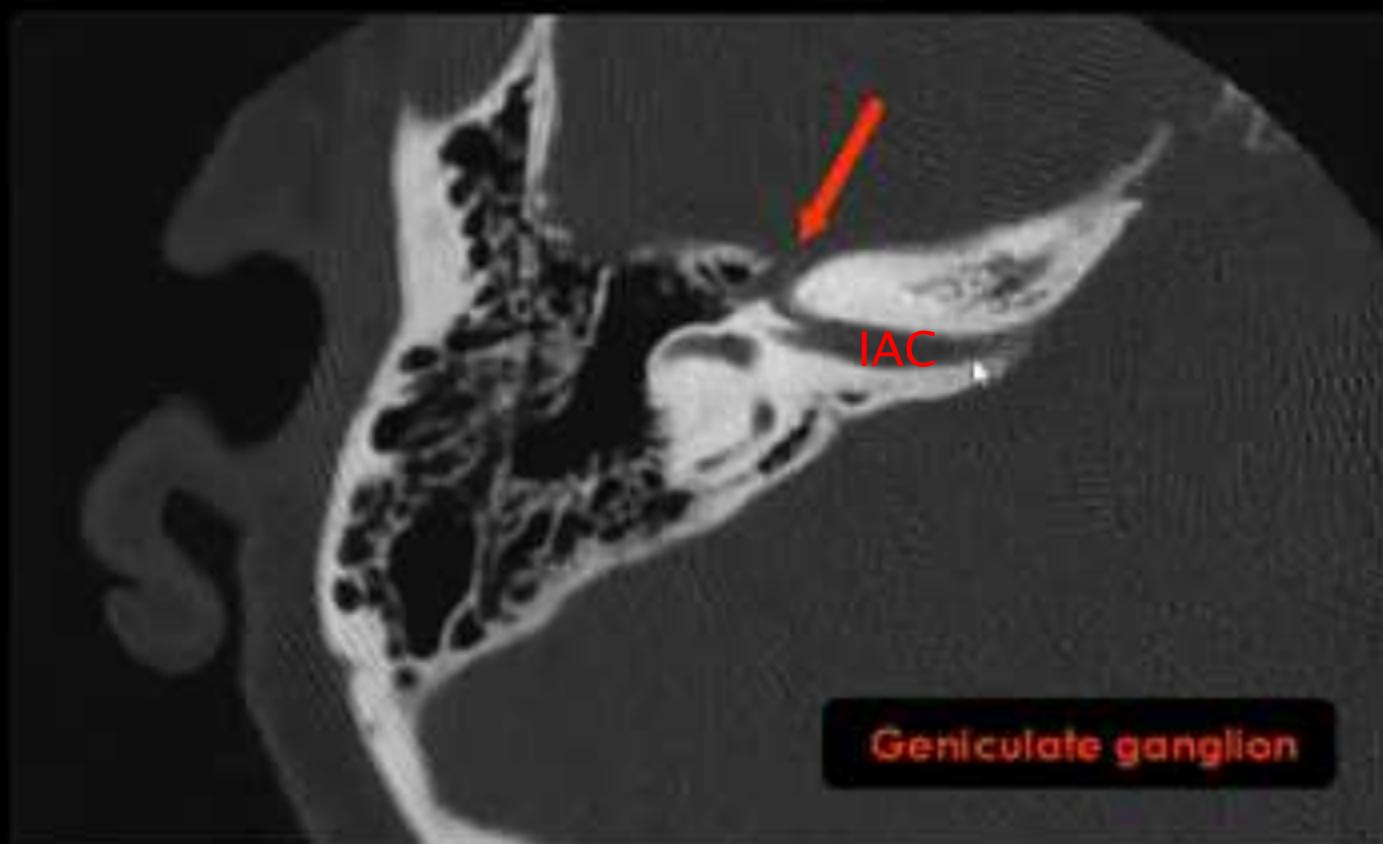


Facial nerve anatomy

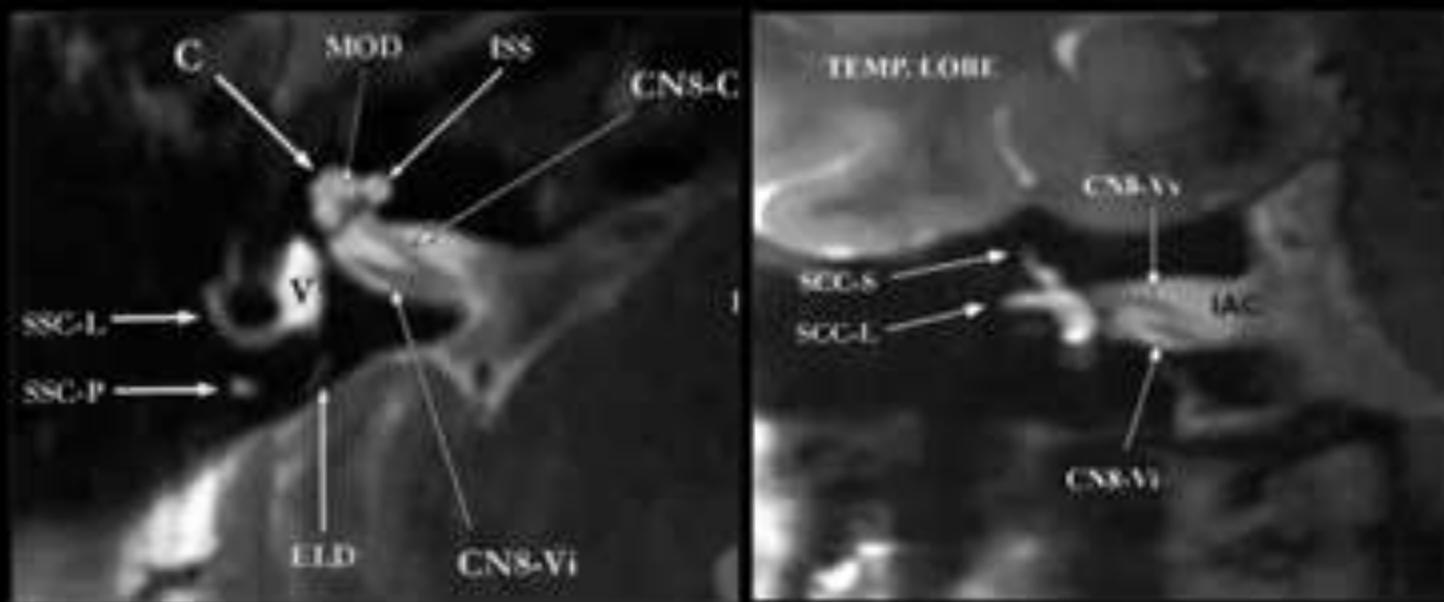
- Middle ear cavity
- Mastoid
- Lateral SCC
- Posterior SCC
- Dome of cochlea
- IAC
- Facial nerve
- Geniculate ganglion



Facial nerve anatomy



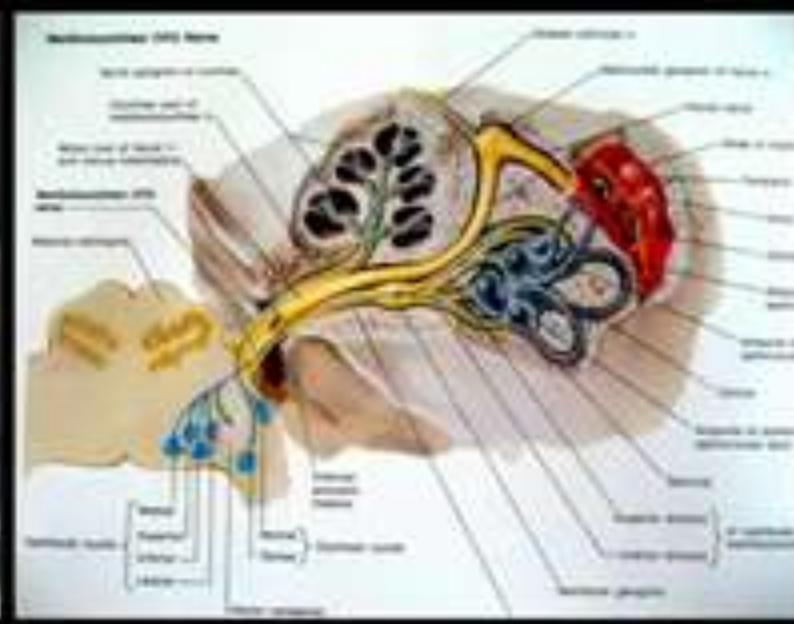
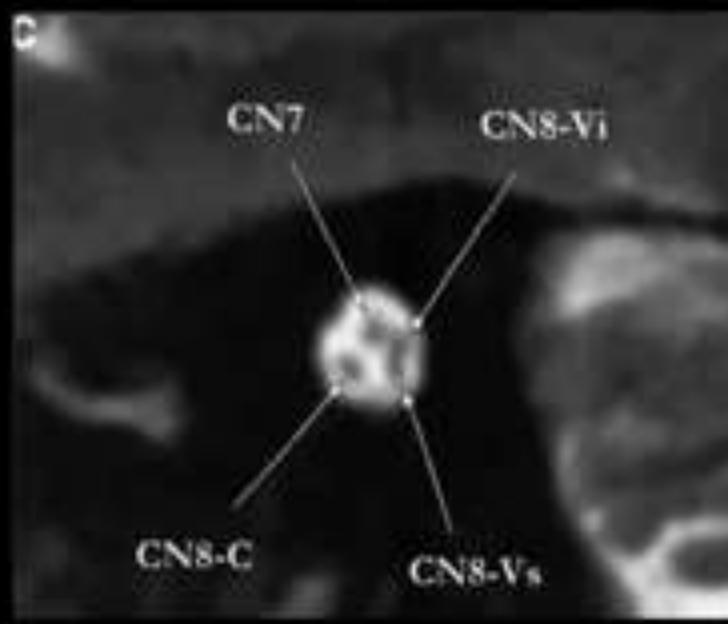
Nerves inside the IAC



- IAC contains 5 nerves pass in it .
- “*2 vestibular+1 cochlear +Facial +Branche of Facial*”

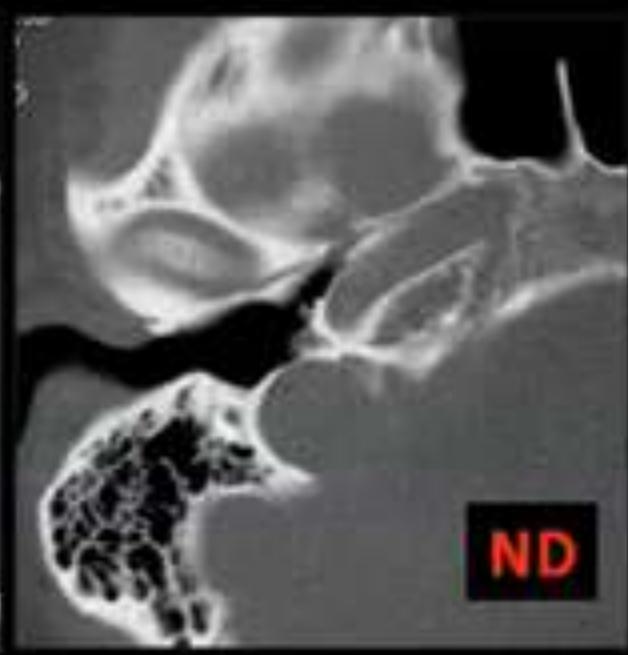
*Graeter Petrosal N ...not
seen by MRI*

Nerves inside the IAC



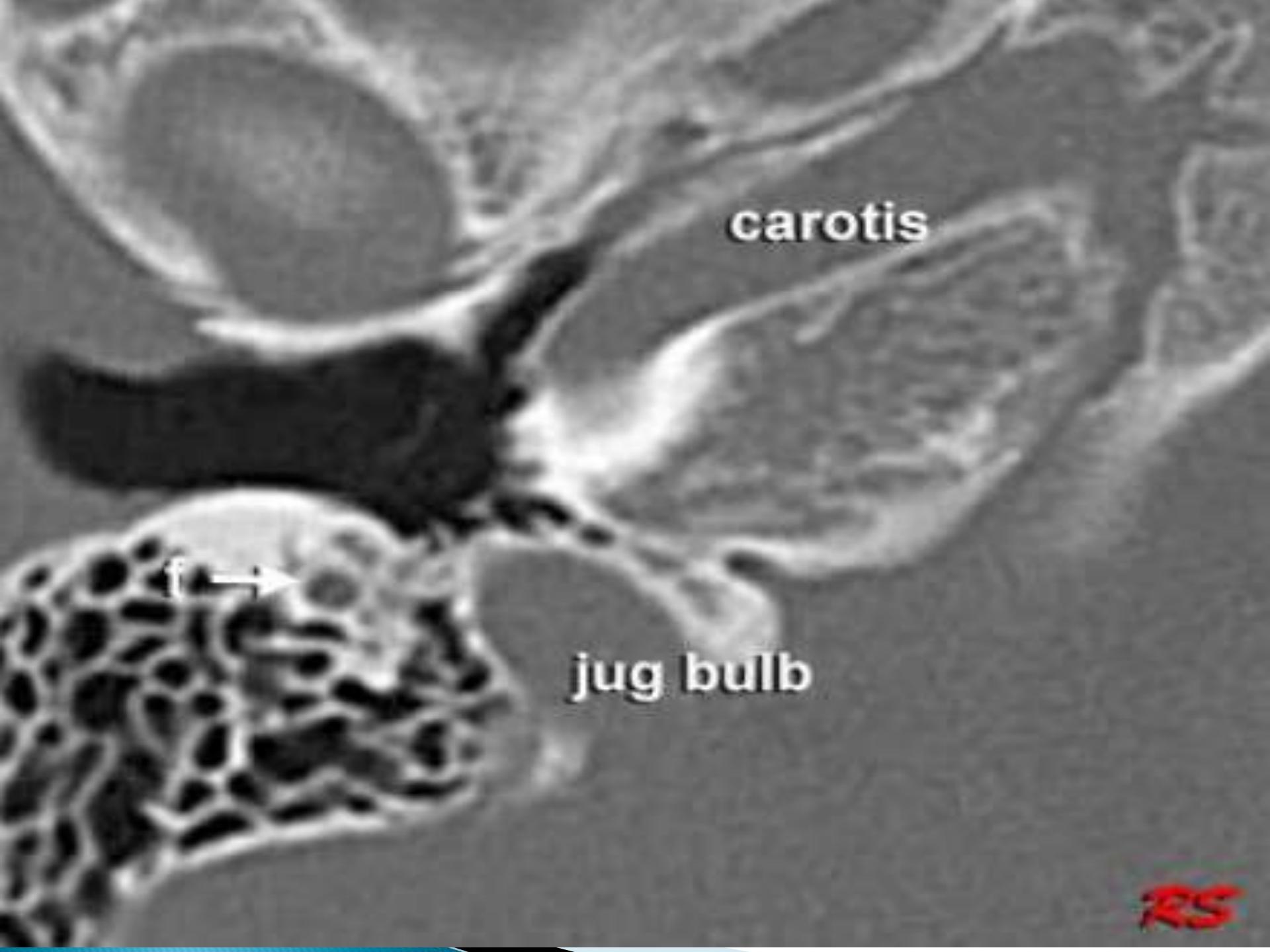
Sagittal MRI Differentiate them

Jugular bulb



Now GO On in

AXIAL ANATOMY



carotis

jug bulb

A grayscale ultrasound image showing a cross-section of the jugular venous system. A large, dark, circular structure on the left is the right atrium. To its right, a prominent, thick-walled vessel is the superior vena cava. Below the superior vena cava, a smaller, more delicate vessel is the inferior vena cava. At the junction where the inferior vena cava joins the superior vena cava, there is a small, localized dilation labeled as the 'jug bulb'. Above the jug bulb, the vessel is labeled 'carotis'.

carotis

f →

jug bulb

A grayscale ultrasound image showing a cross-section of a blood vessel. The vessel has a thick, bright, curved wall. A smaller, darker, curved structure is visible within the lumen of the vessel. The surrounding tissue is dark gray.
carotis

f →

jug bulb

malleus

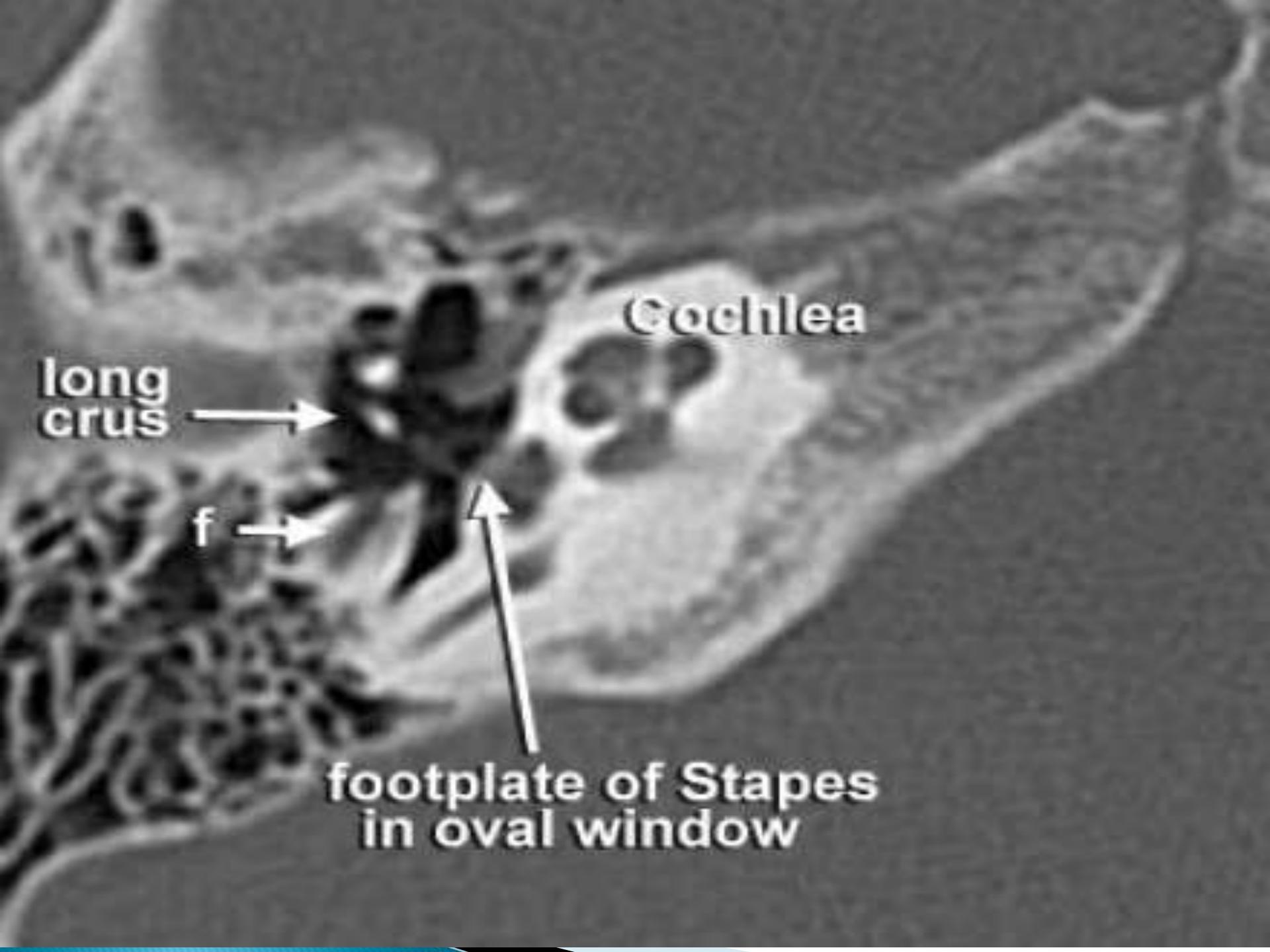
Cochlea

f

Cochlea

long
crus

f

A grayscale micrograph showing a cross-section of the cochlea and the surrounding structures of the middle ear. The cochlea is a spiral-shaped structure on the right side of the image. The stapes bone is visible, with its footplate resting on the oval window of the cochlea. The handle of the malleus is also visible.

Cochlea

long
crus →

f →

footplate of Stapes
in oval window

Cochlea

long
crus



A

f

short
crus →

f f U IAC

A

head of
malleus

genu

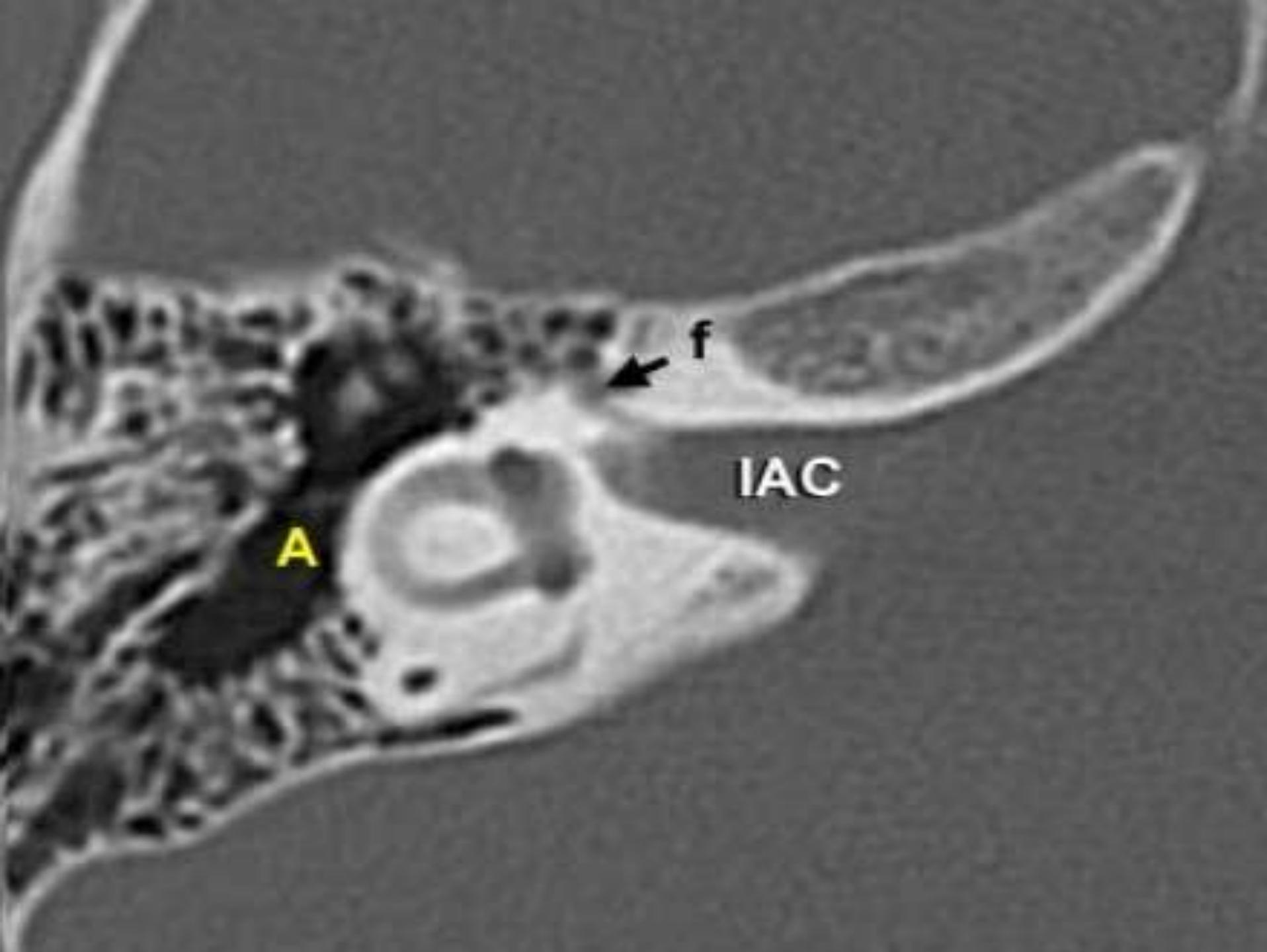
short
crus

aditus
ad antrum

f

f

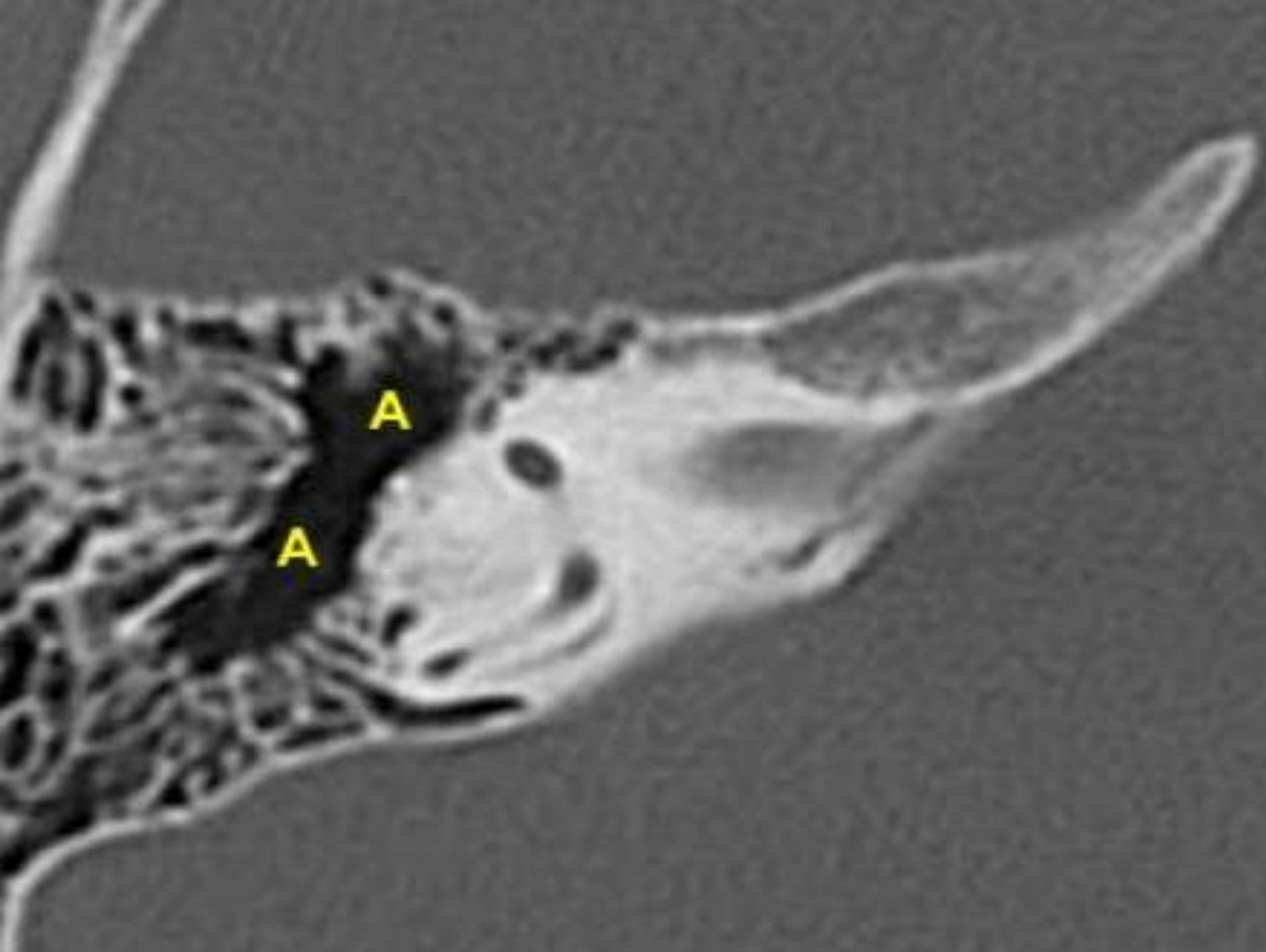
U



IAC

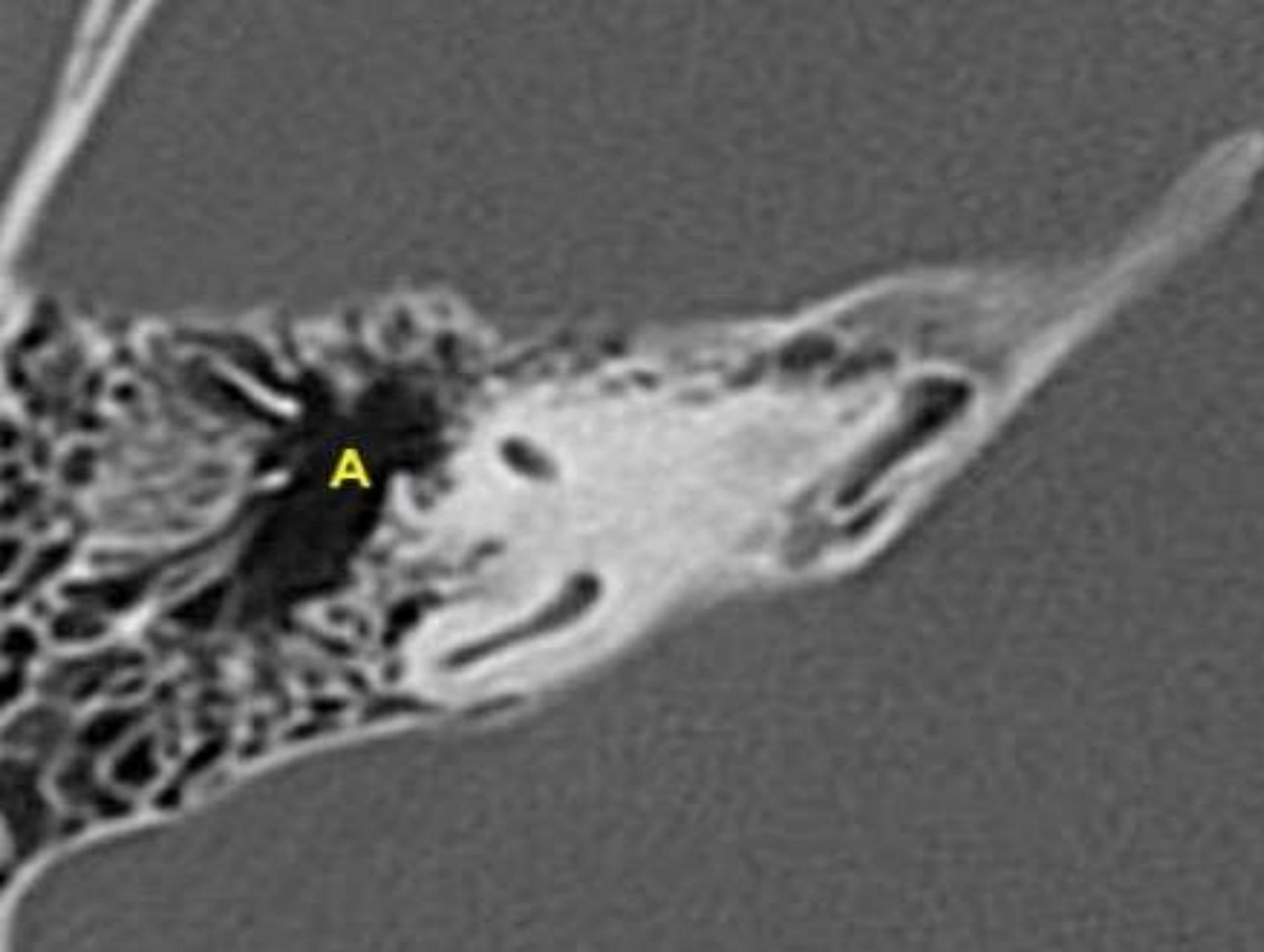
A

f

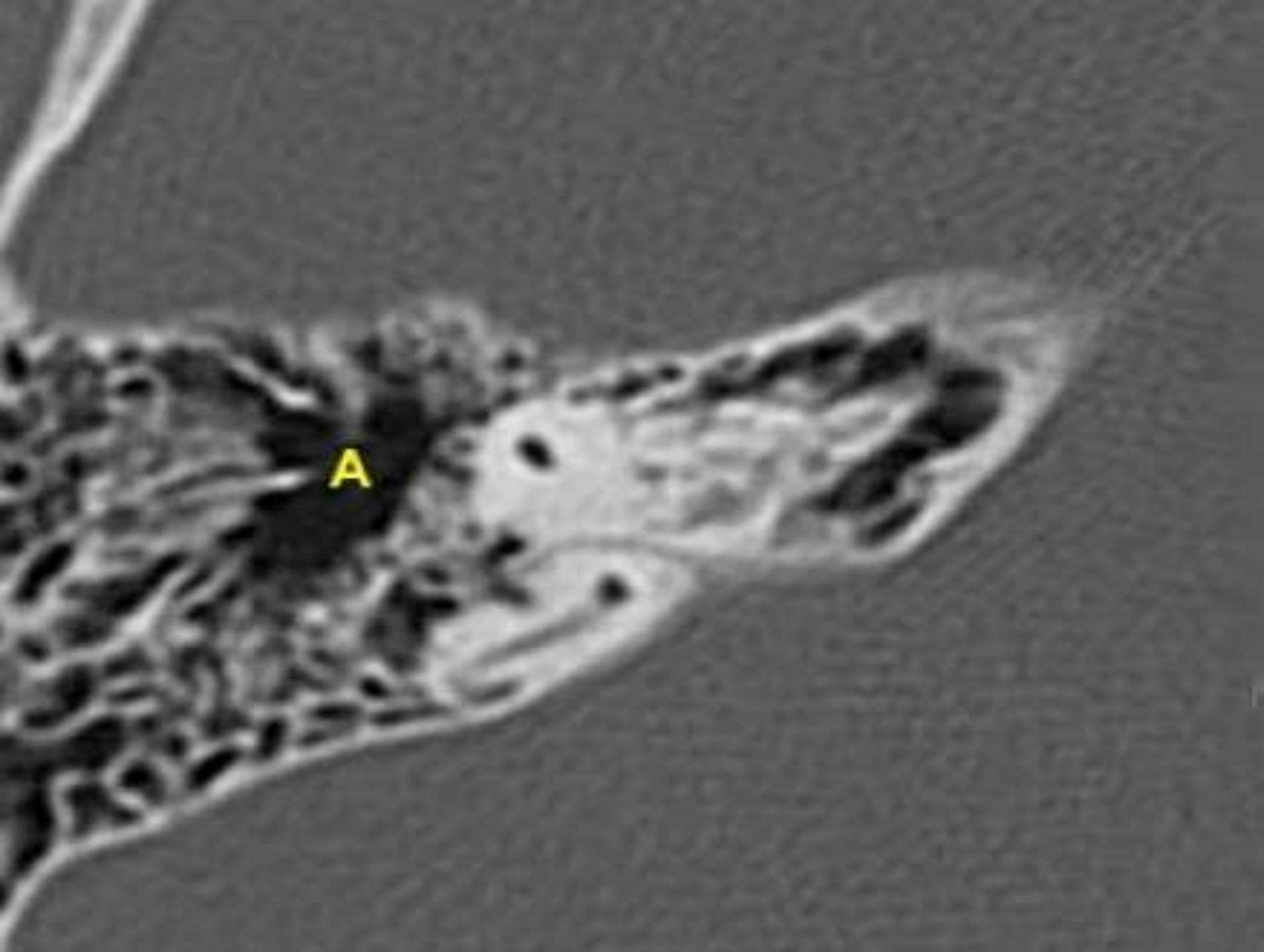


A

A

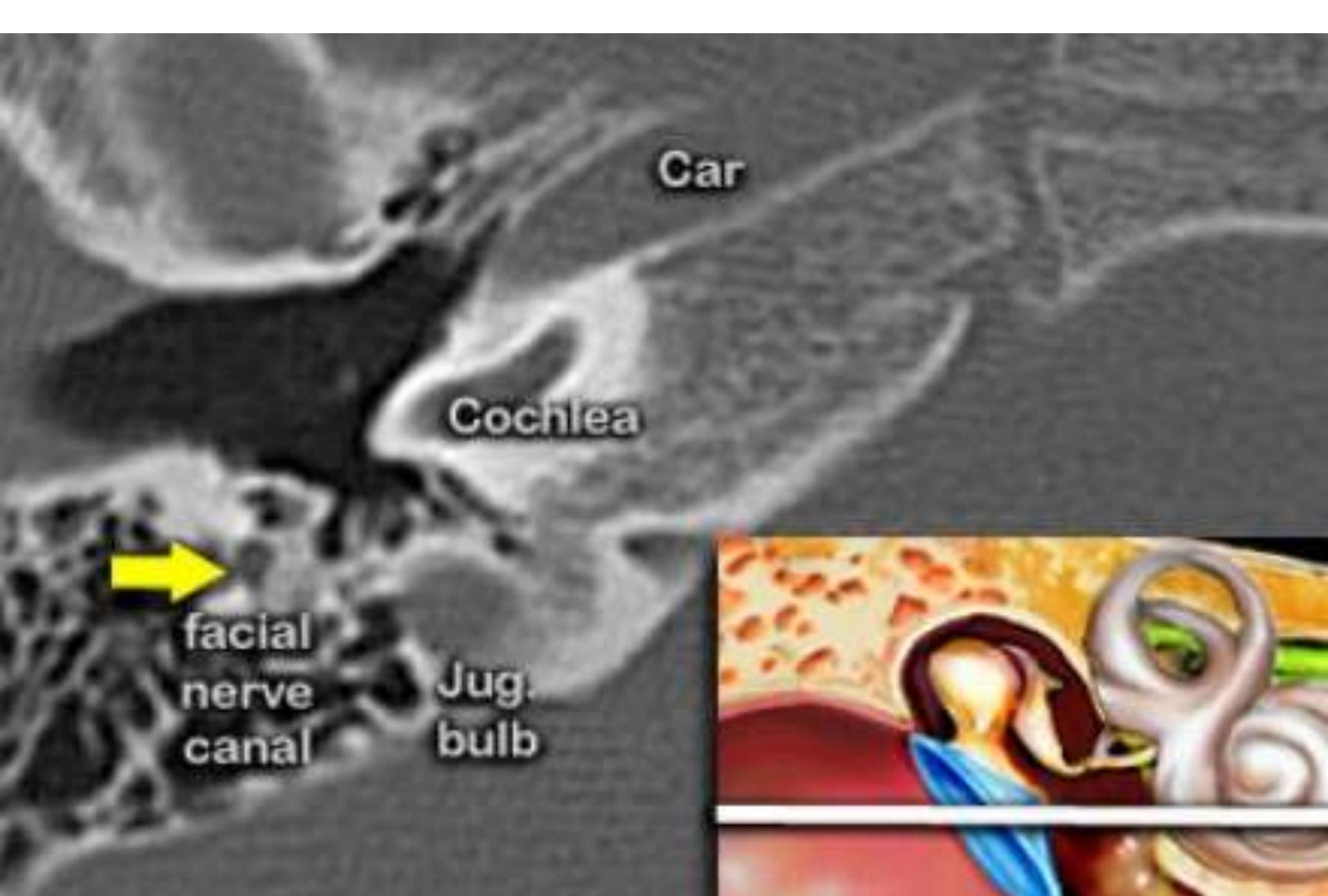


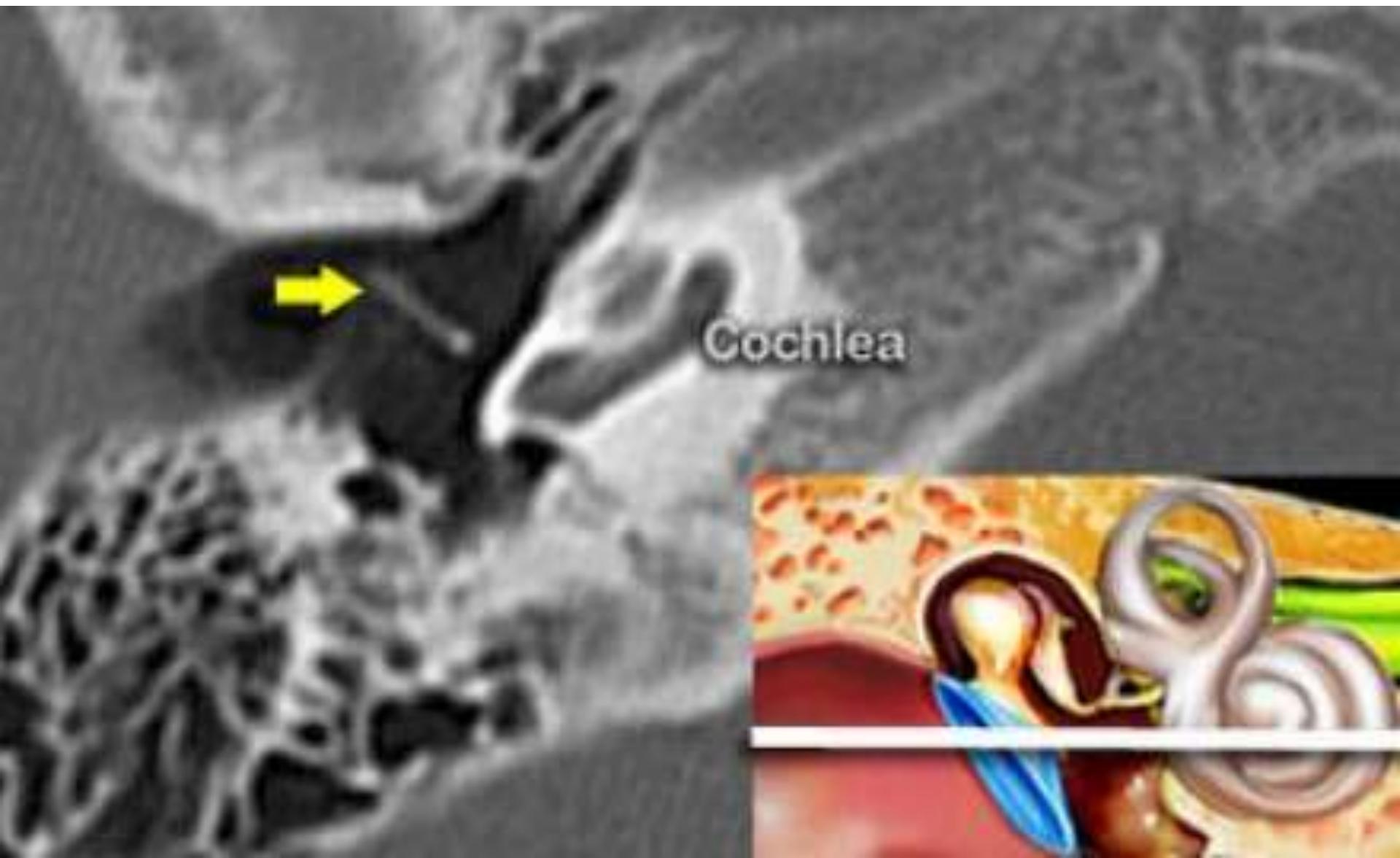
A



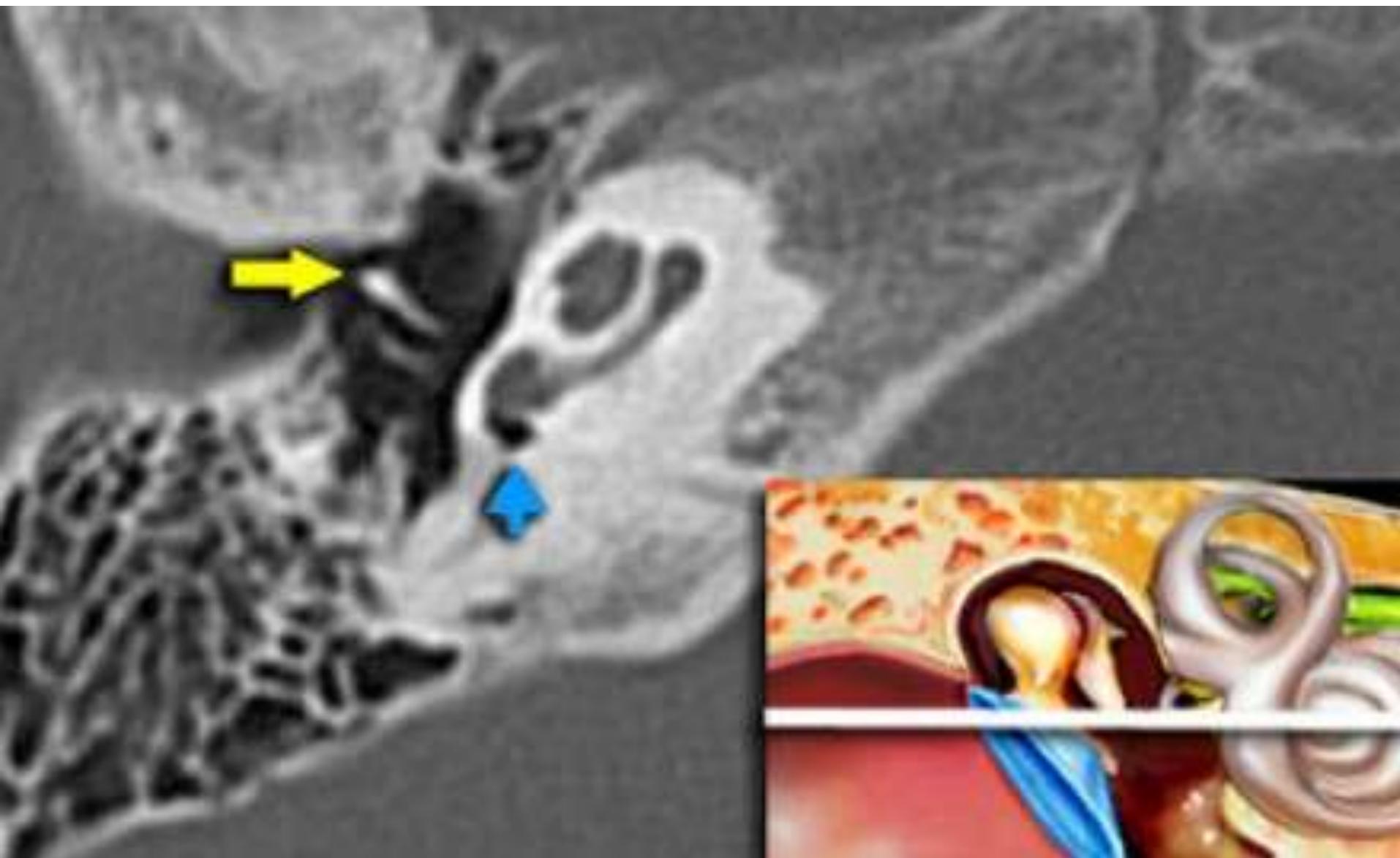
A

AXIAL ANATOMY FROM INFERIOR TO SUPERIOR

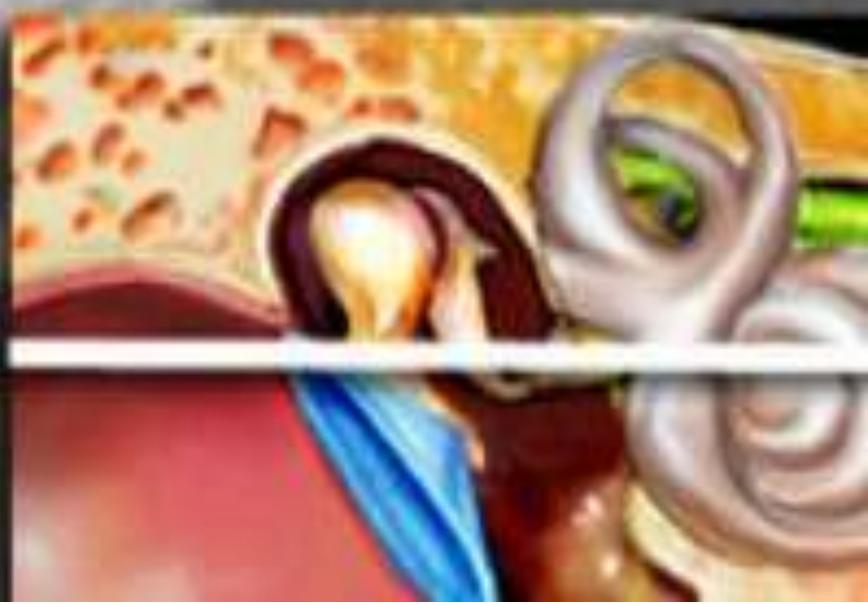
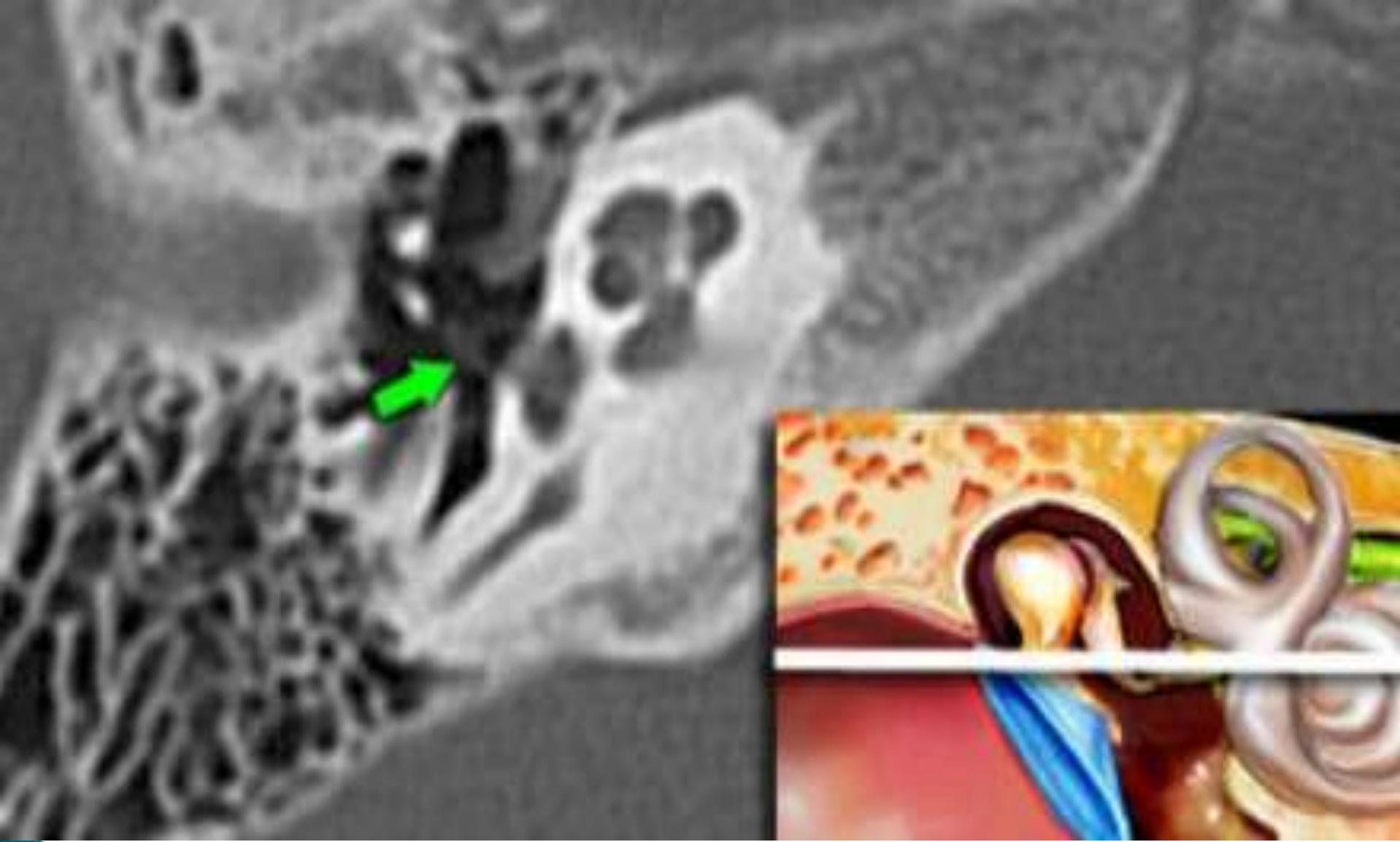




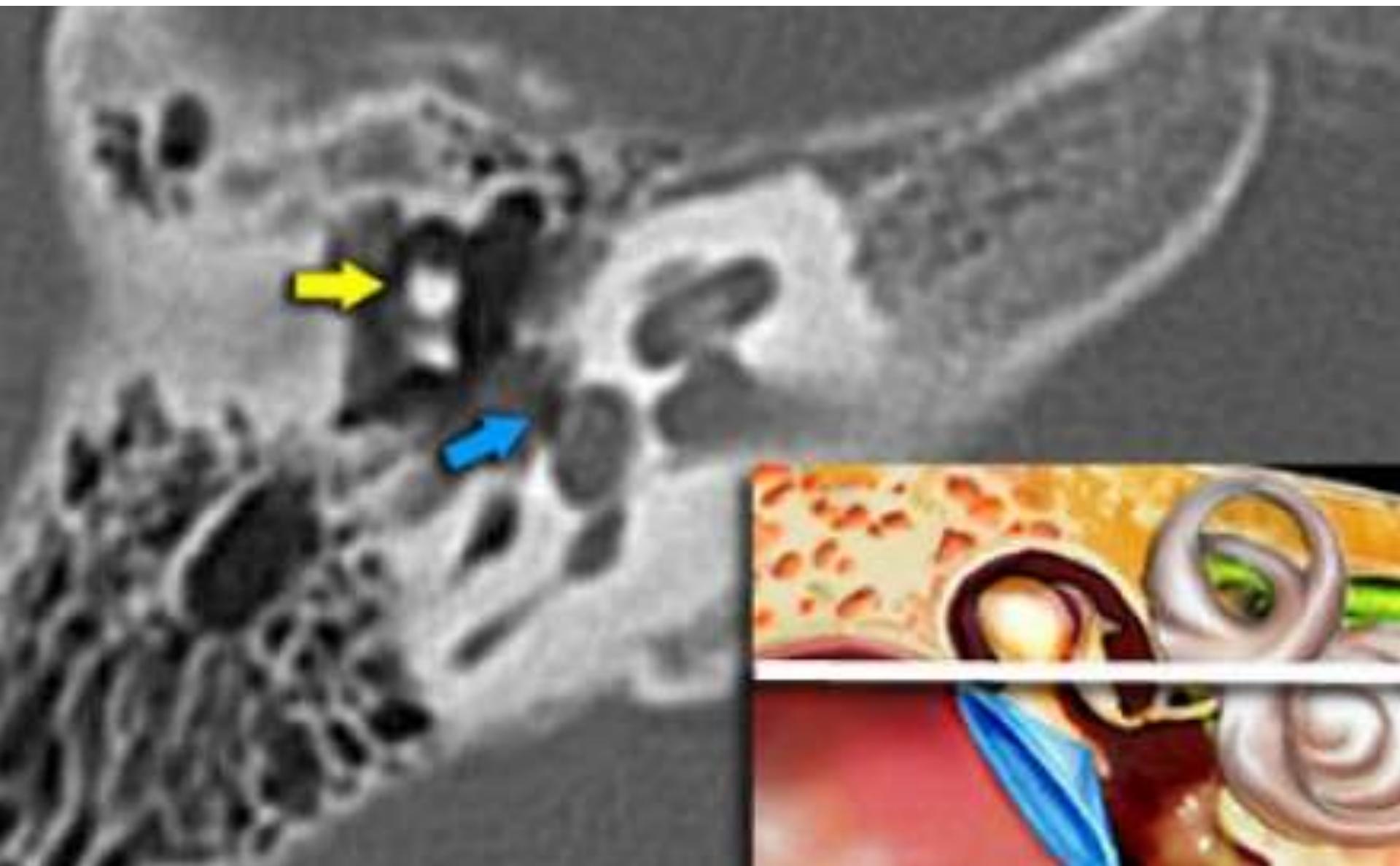
Tympanic membrane
Yellow Arrow



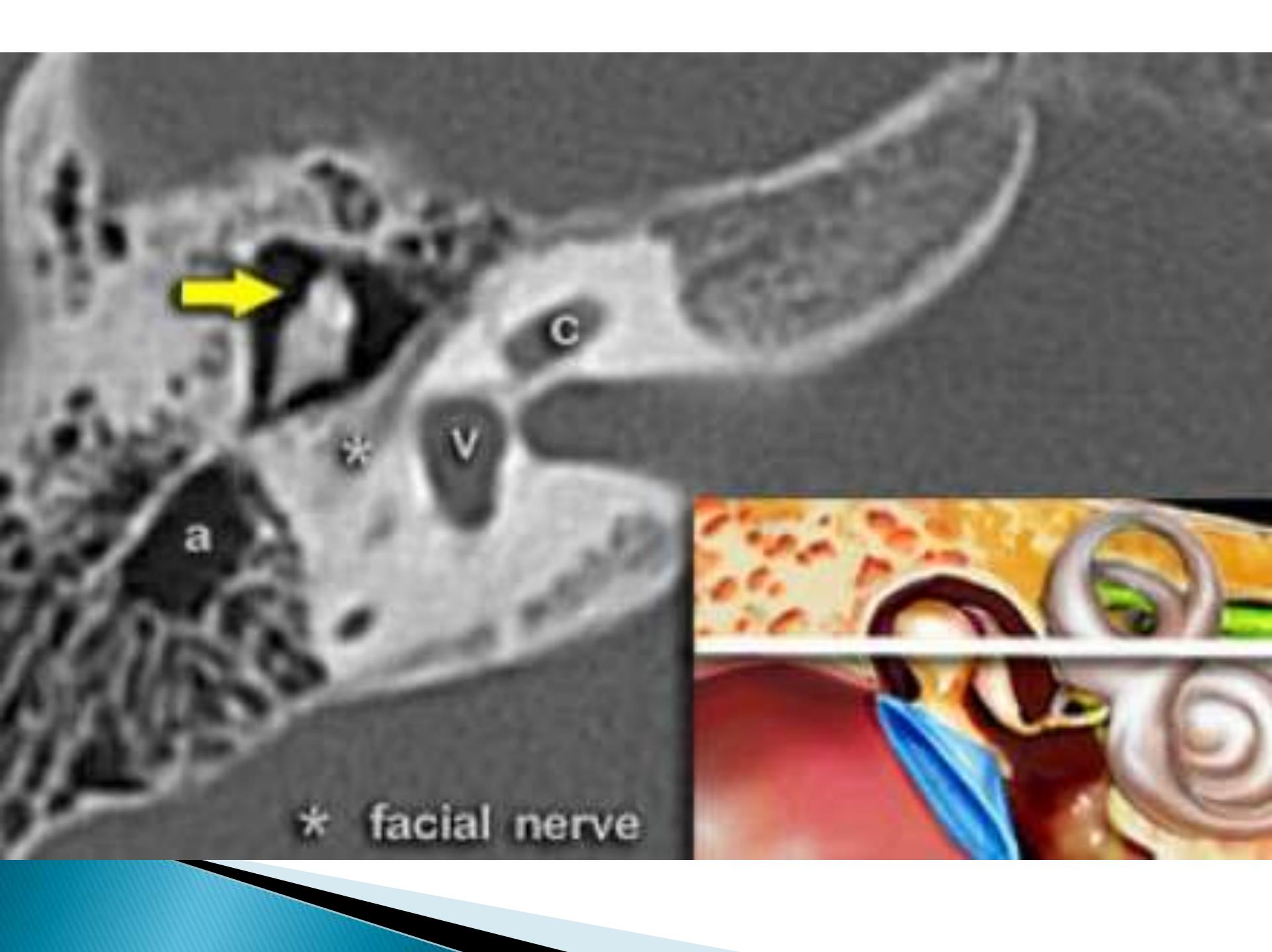
- Malleus (yellow arrow).
- Round window (blue arrow)

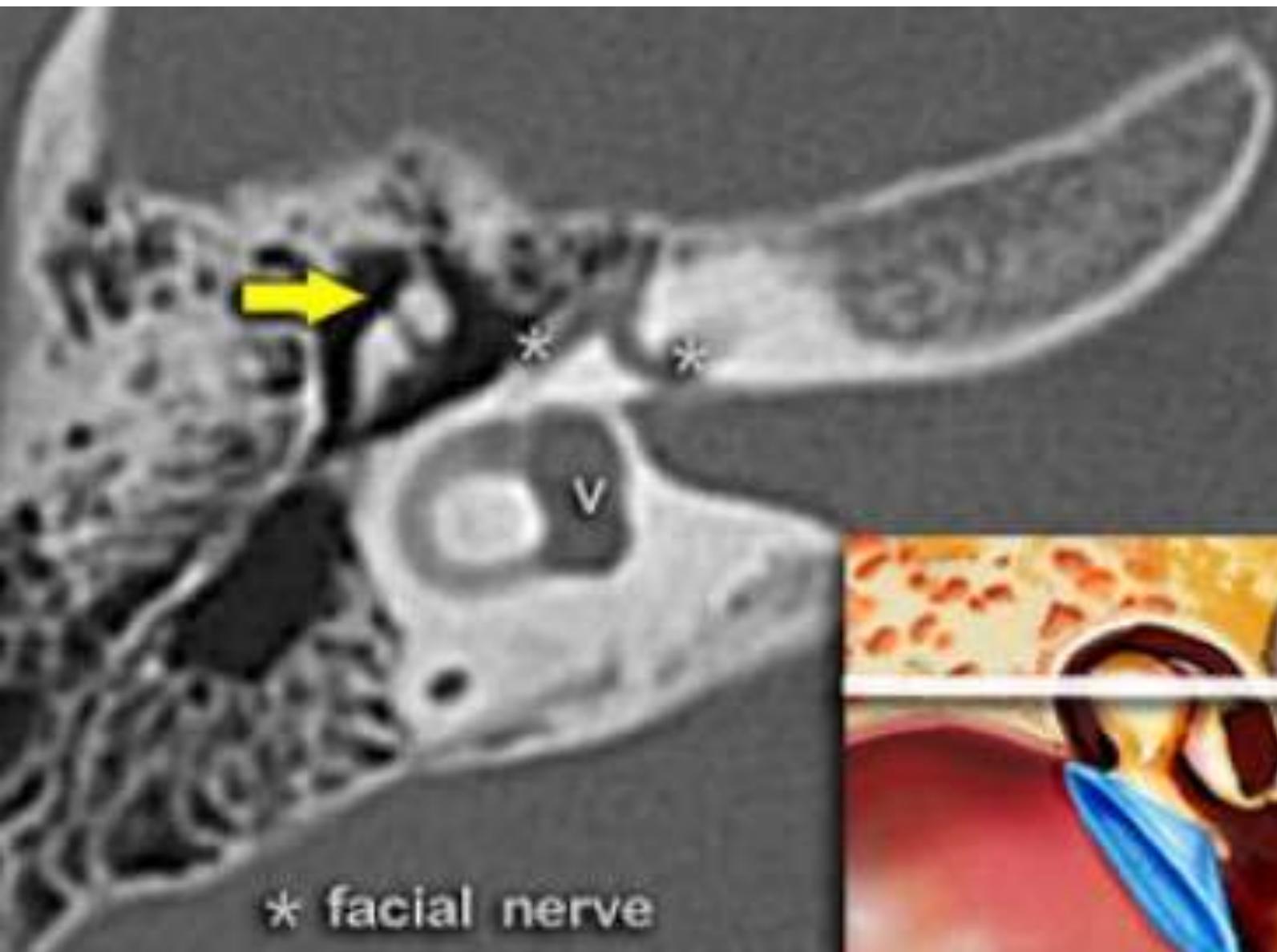


Stapes (green arrow) is seen connecting to the oval window.



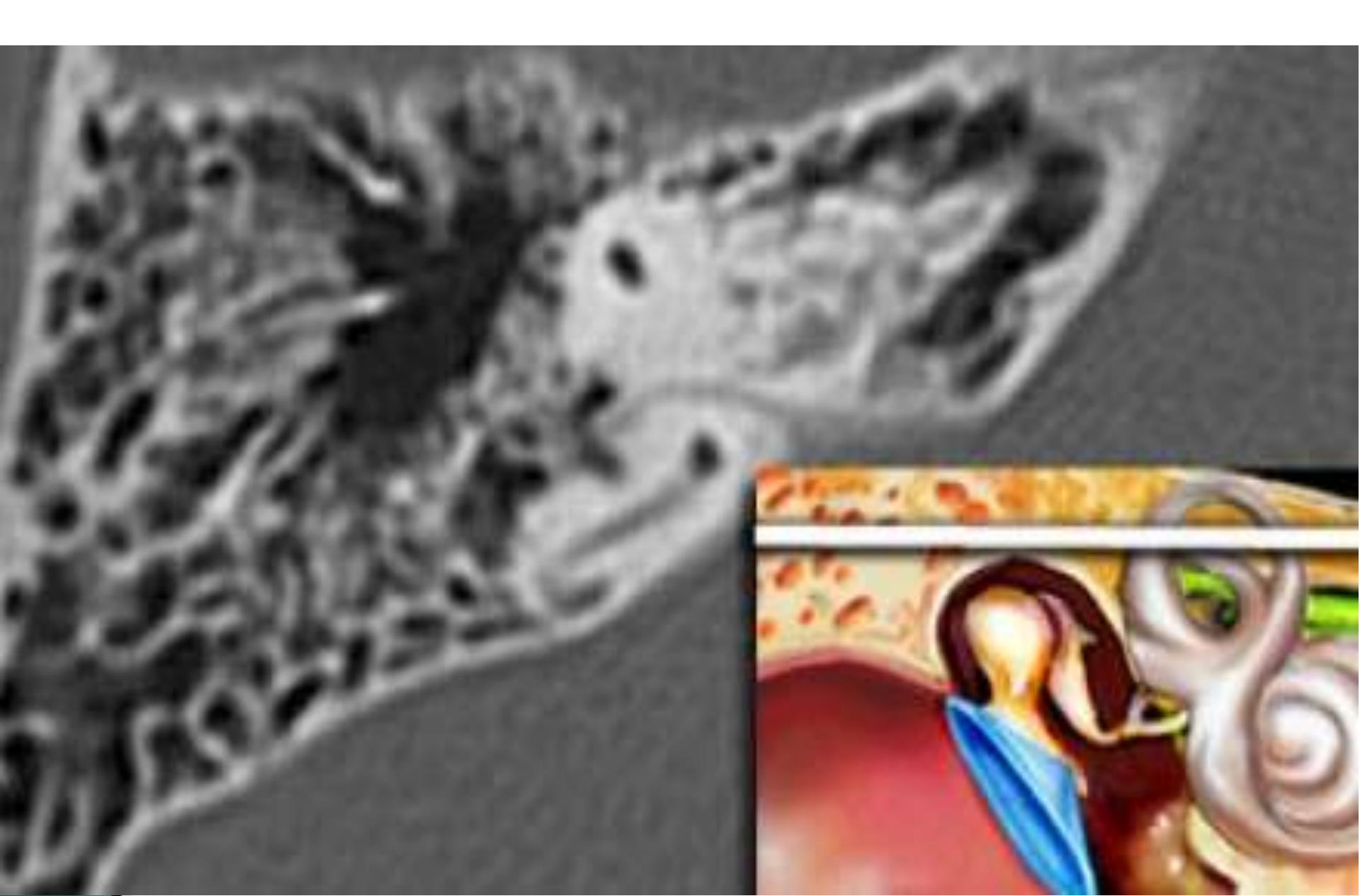
head of the malleus is seen anterior to
the head of the incus (yellow arrow)





* facial nerve



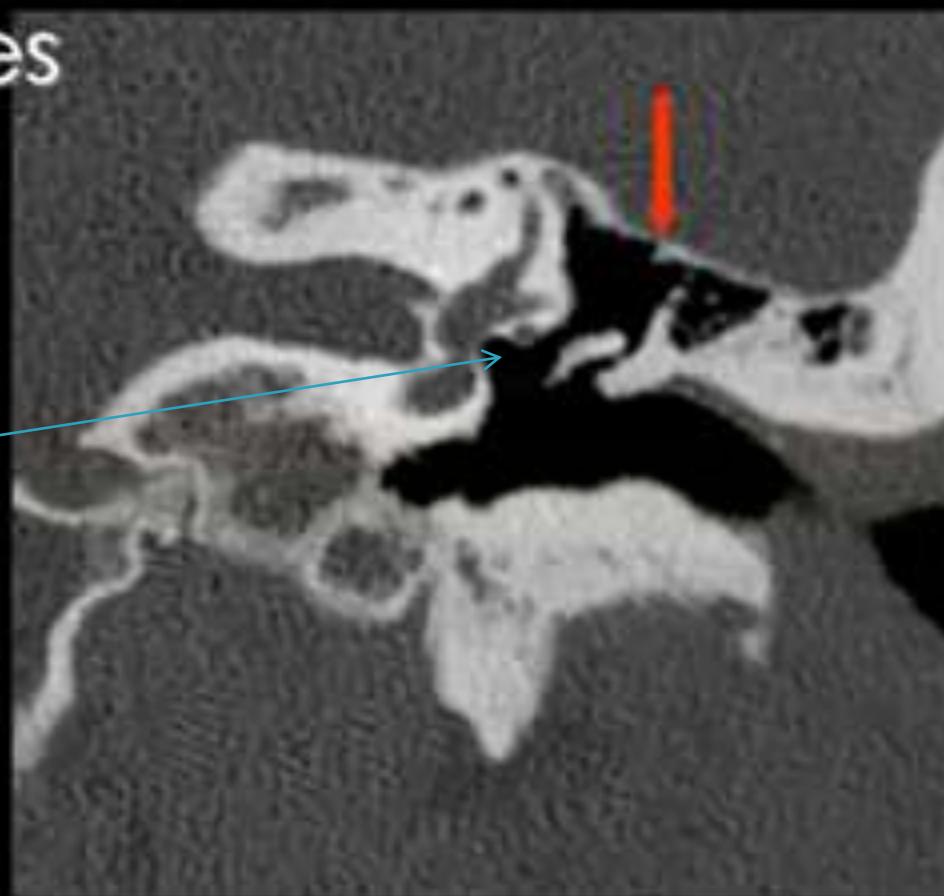


CORONAL CT

- ▶ Has less value than Axial

Coronal images

- Tegmen tympani
- Oval window
- Facial nerve



Superior Tegmen seen in coronal

Facial Nerve pass under lateral semicircular canal

Coronal images

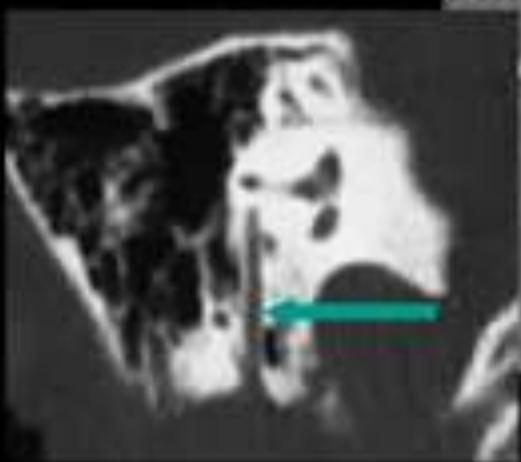
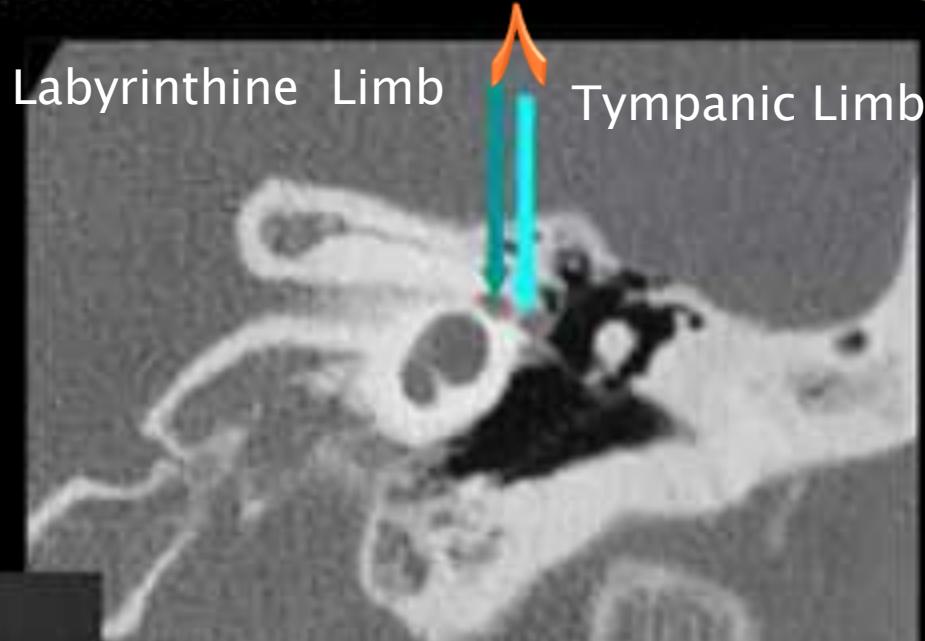
- Tegmen tympani
- Oval window
- Facial nerve



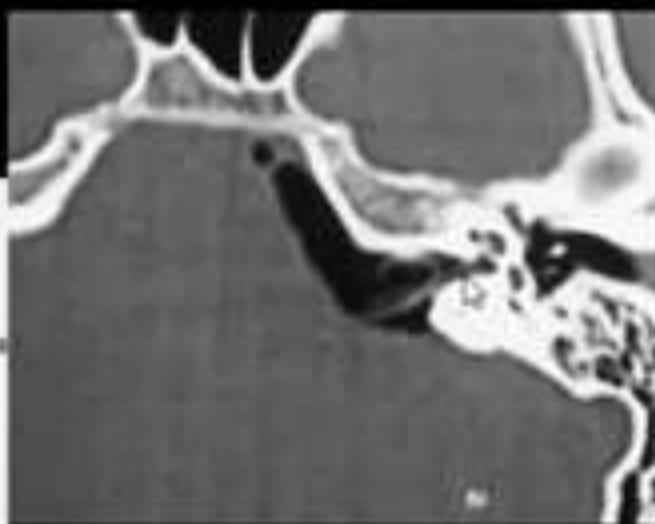
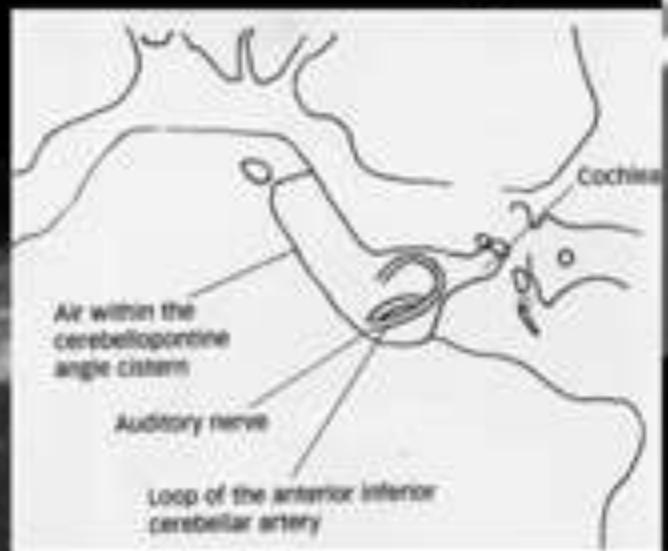
Facial nerve



Facial nerve Geniculate Ganglion



Vessels at the CP angle



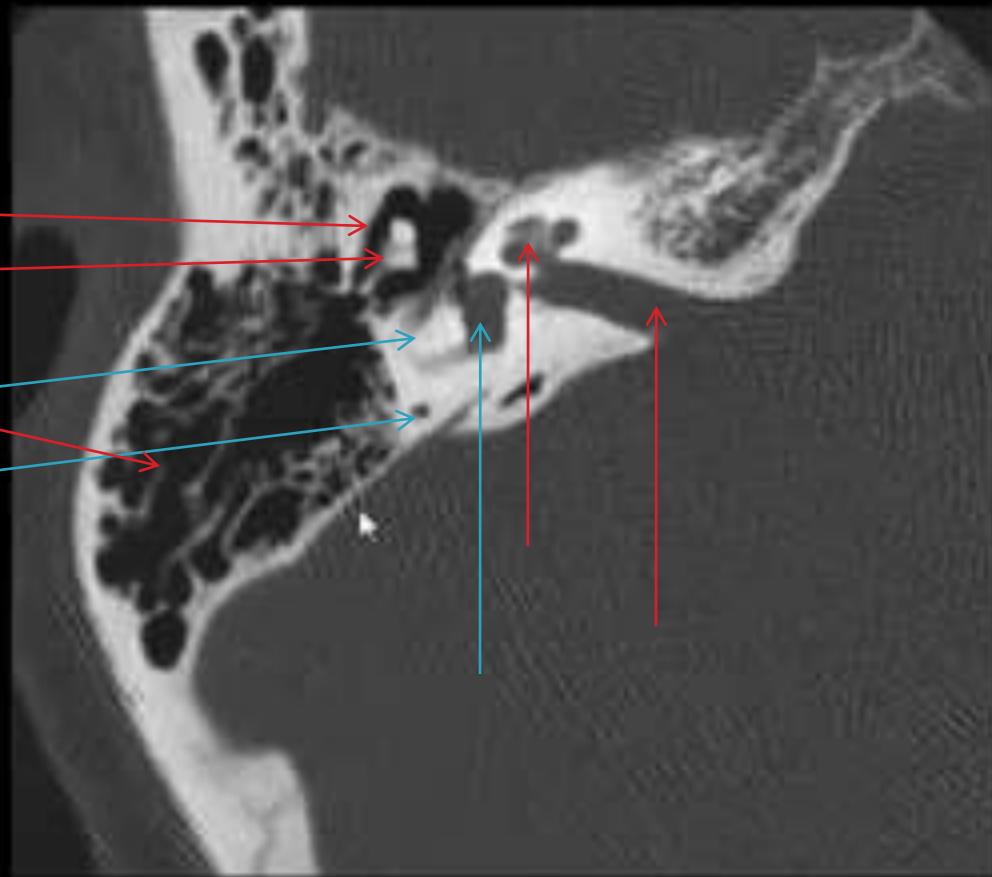
A vascular coil originating from the anterior inferior cerebellar artery (AICA) can be seen indenting the cranial nerves entering the right internal auditory canal.

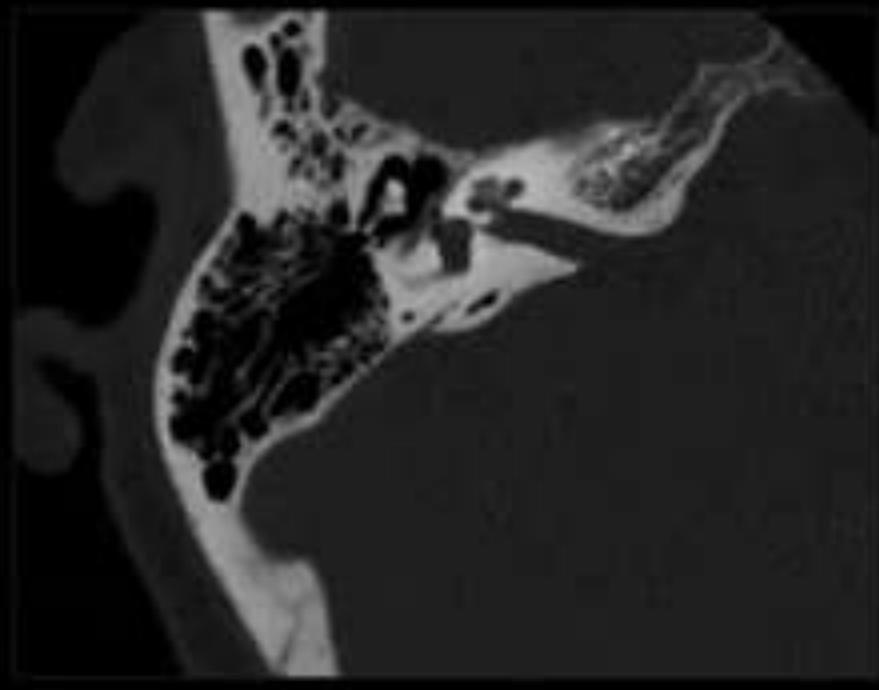
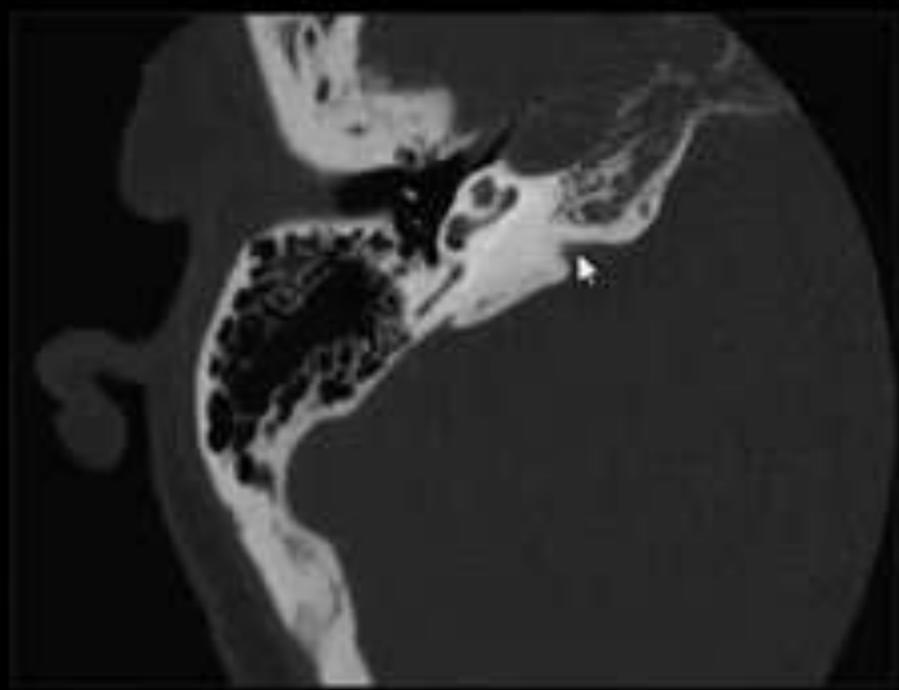
QUIZ





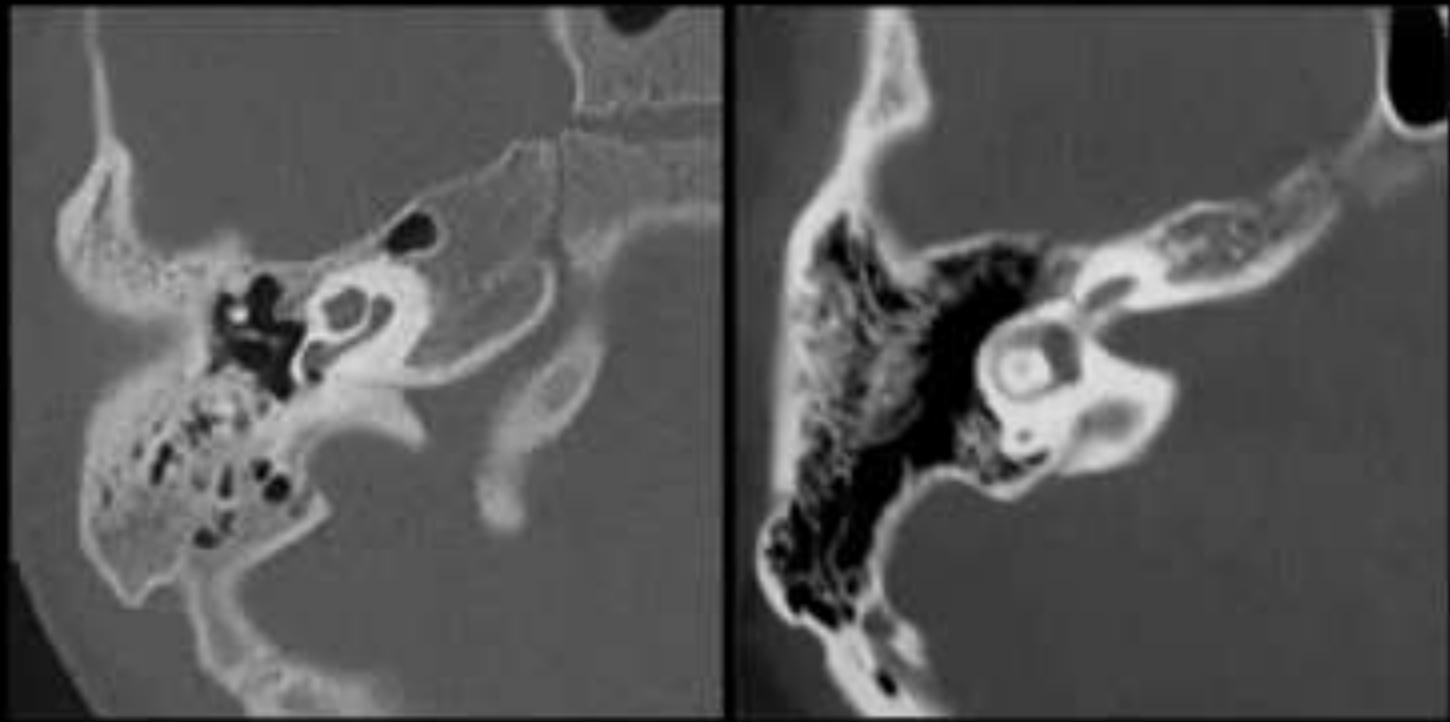
- Middle ear cavity
- Ice cream cone
- Mastoid
- Lateral SCC
- Posterior SCC
- Dome of cochlea
- IAC
- Vestibule





Cochlea





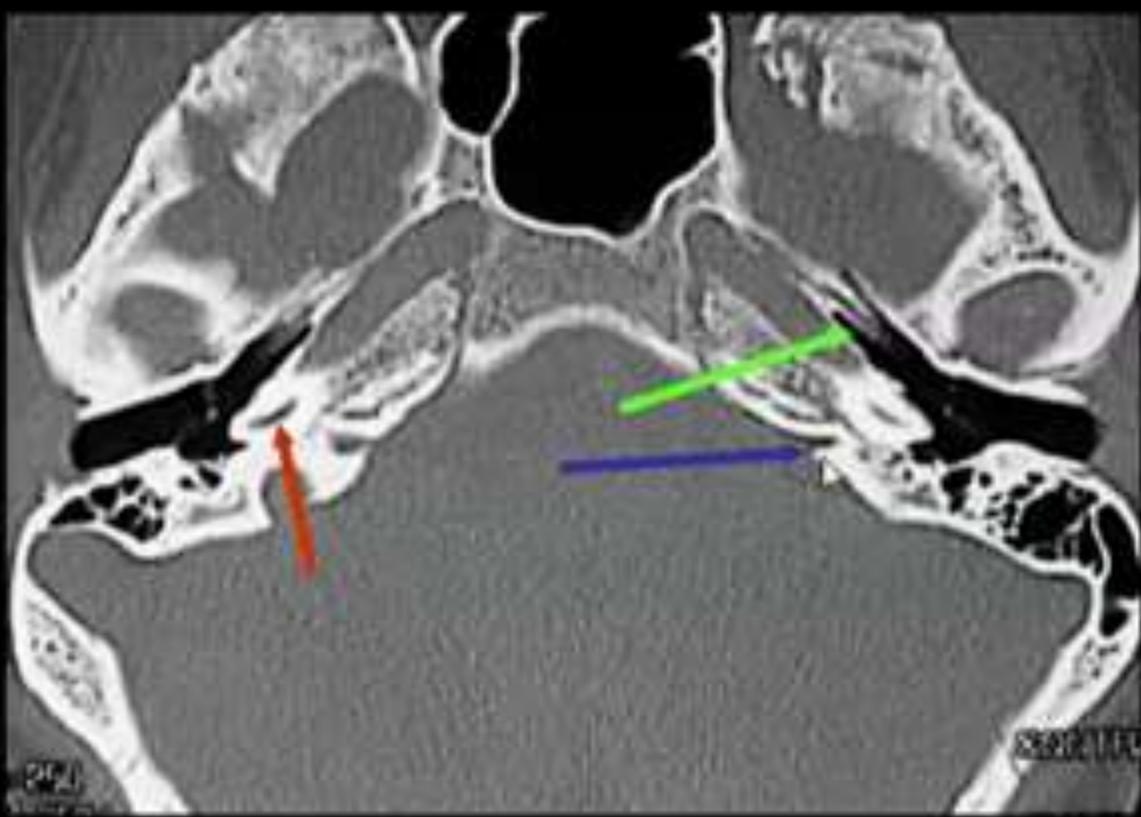
Q.



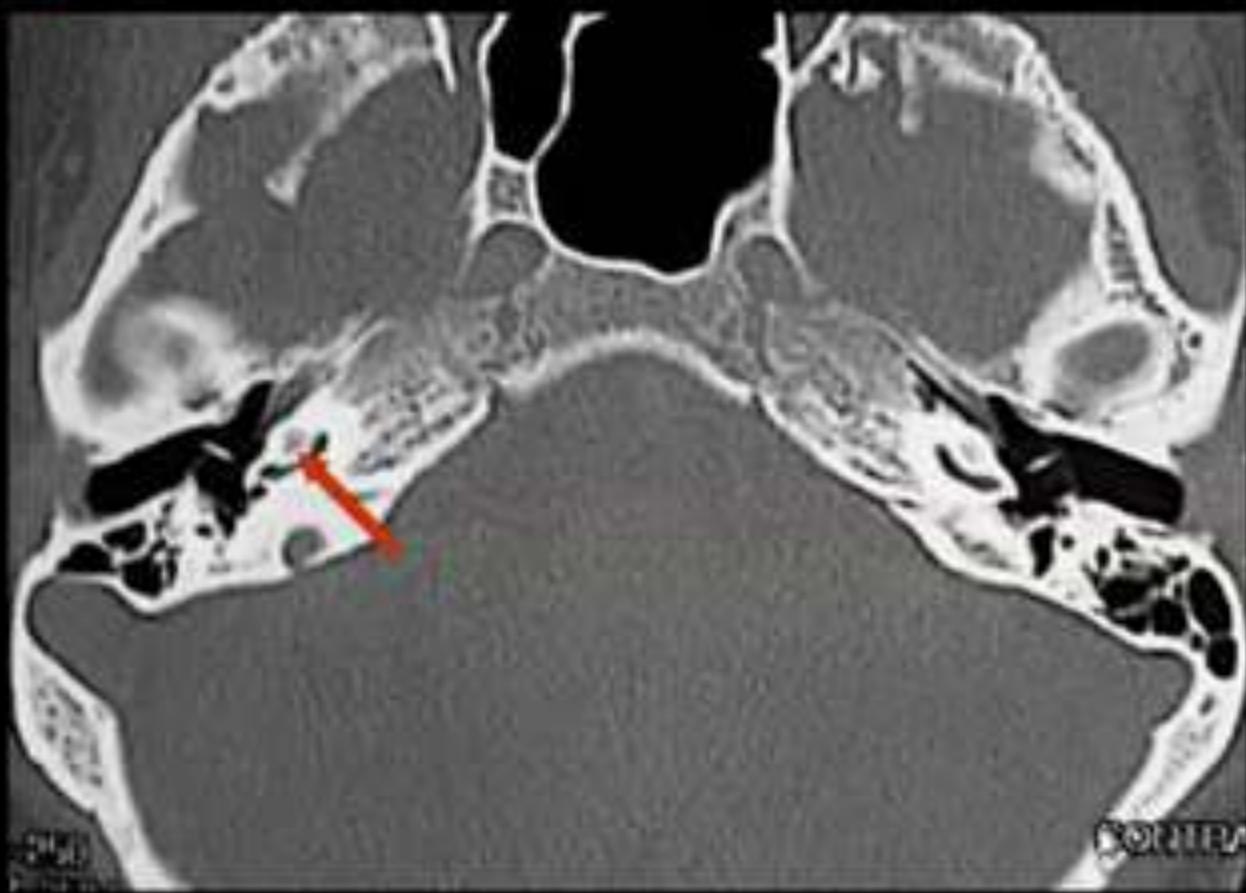
Q



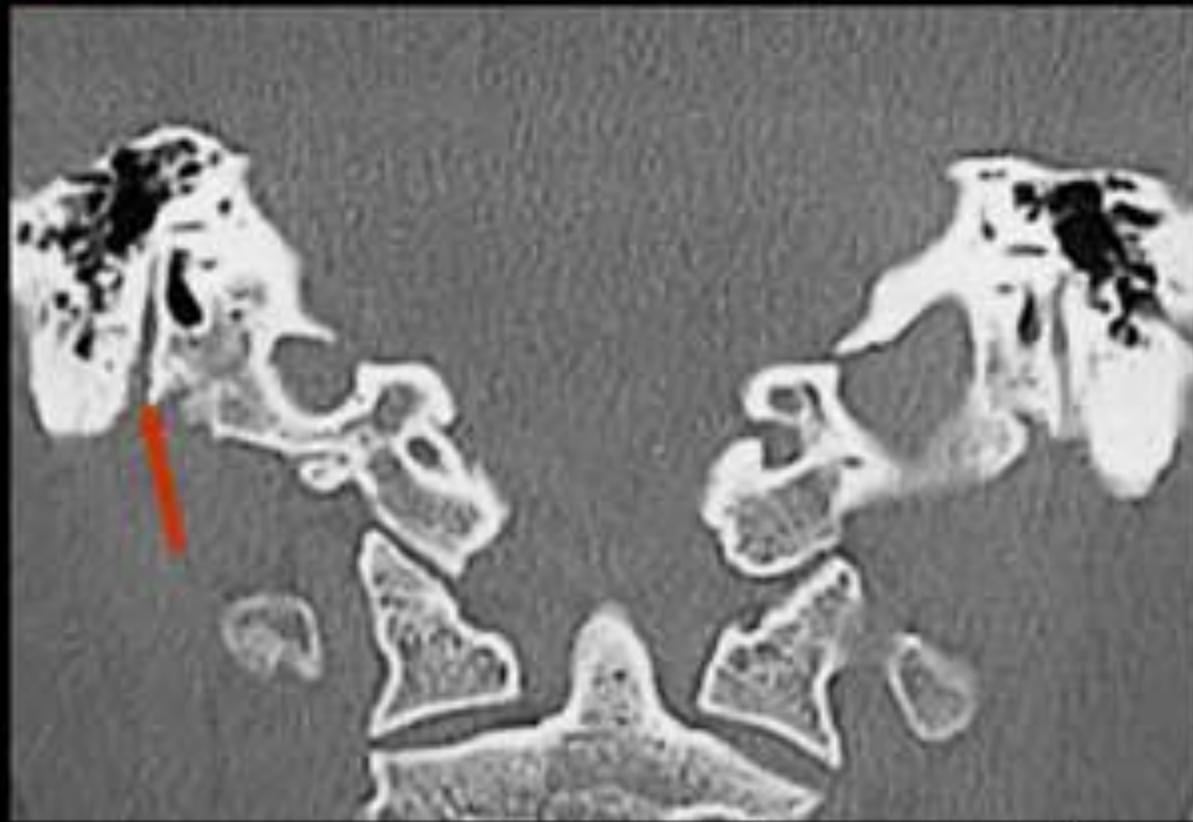
Q



Q



Q



Vertical Part of Facial N

A photograph of a person swimming underwater in a pool. The swimmer is positioned vertically, facing downwards, with their arms extended forward and legs kicked back. The water is a clear blue, and the background shows the white tiled floor of the pool.

THANK
YOU