

External and Middle Ear

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Chair

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ACR head and Neck Course



@bpoliceni



**American College
of Radiology**

Focused. Forward. Together.



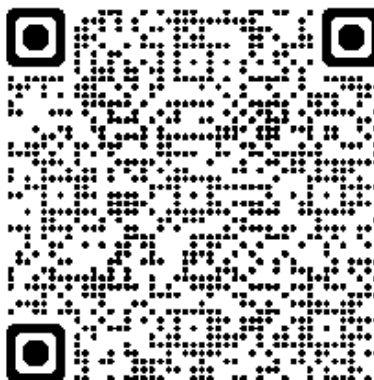
Financial Disclosure

No conflict of interest relevant to
this topic

External Ear

Imaging the External Ear: Practical Approach to Normal and Pathologic Conditions

 Niedja S. G. Tsuno ,  Marco Y. Tsuno, Carlos A. F. Coelho Neto,  Samir E. Noujaim,
 Marcos Decnop, Felipe T. Pacheco, Soraia A. Souza,  Ana P. A. Fonseca,  Marcio R. T. Garcia



External auditory canal

- Osseous-cartilaginous structure.
- Auricle to the tympanic membrane
- Most of the lesions are diagnosed clinically
- Extent of disease, complications and surgical planning.
- CT typically the first study of choice. MRI have a complementary role.



External Auditory Canal Exostosis

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- Exostosis of the external auditory canal (also known as surfer's ear), is a benign bony overgrowth of the bony external auditory canal brought about by exposure to cold wind and water combined.
 - Broad bases circumferential bone growth
 - Not related to bone-cartilage junction
 - Usually, bilateral



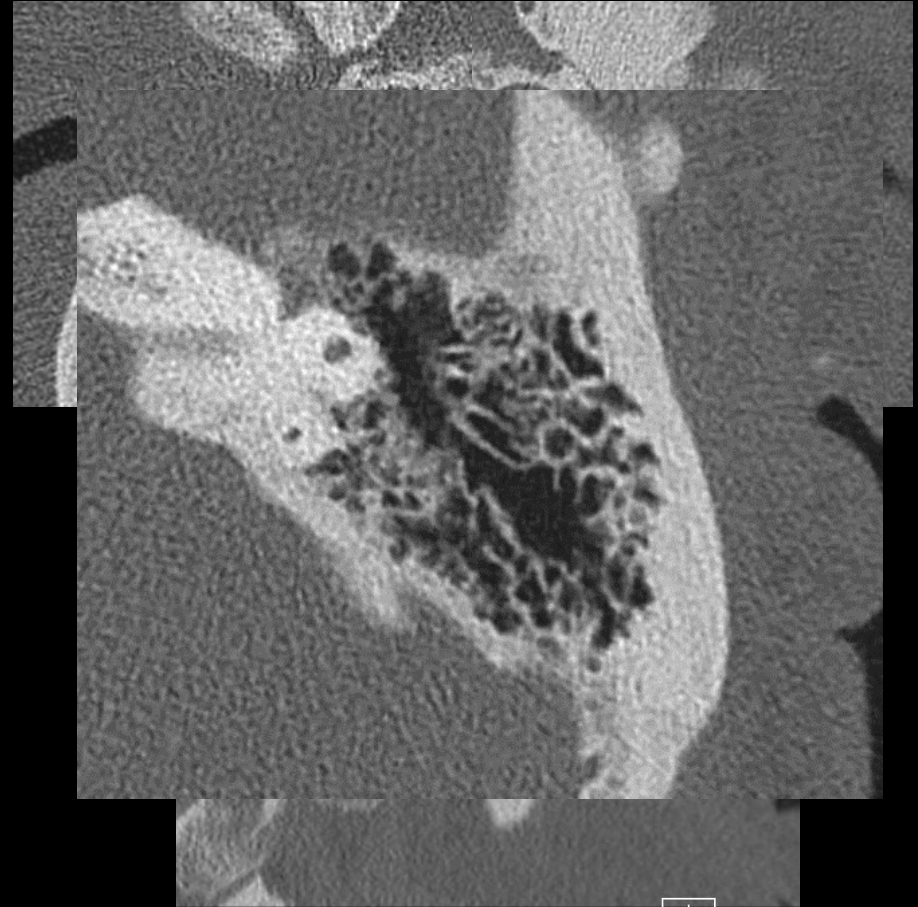
External Auditory Canal Osteoma

- External auditory canal osteomas are rare focal pedunculated bony overgrowths of the osseous EAC, usually located at the bony cartilaginous junction.
- Usually, unilateral
- Located at bone-cartilaginous junction of EAC
- Can cause formation of cholesteatoma EAC (as in this case)



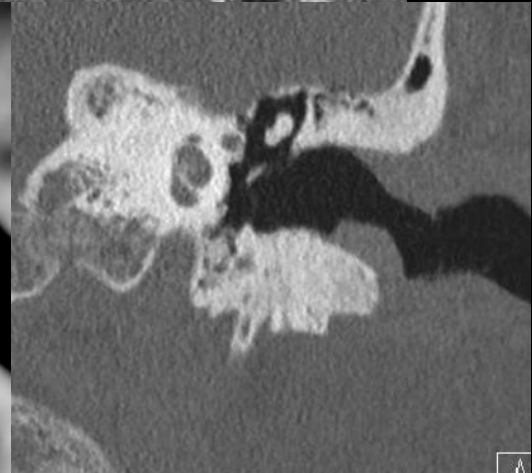
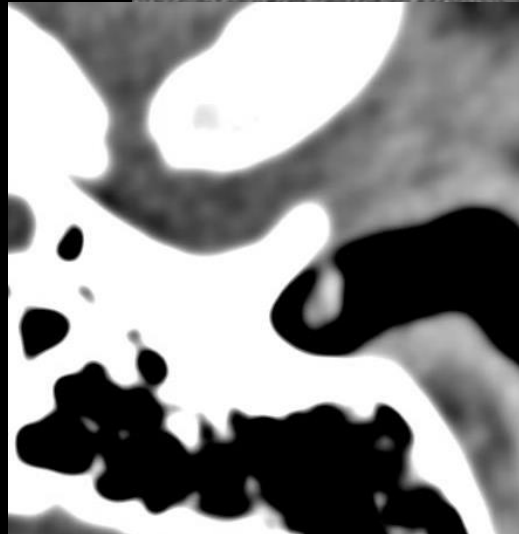
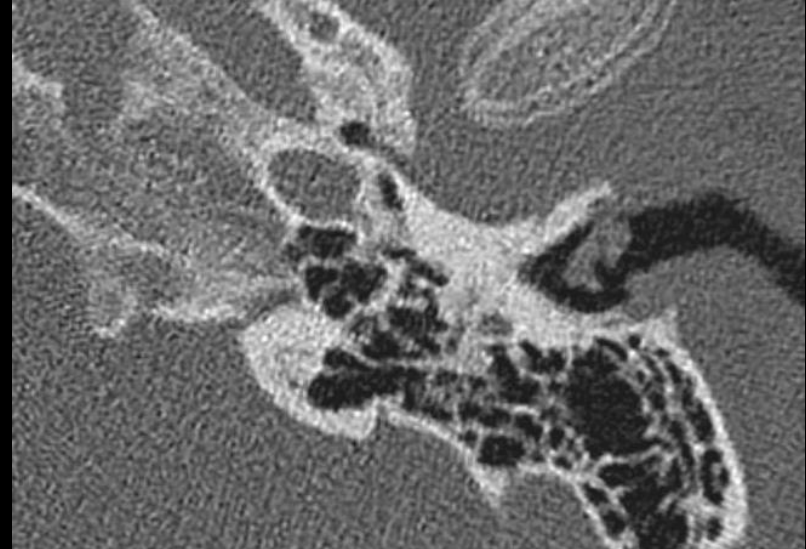
EAC Cholesteatoma

- Layers of defoliating keratin lined by keratinizing stratified squamous epithelium with associated periostitis and bone erosion.
- Bone invasion w/ squamous epithelium
- Most idiopathic affecting inferior post wall
- Secondary affect any area of EAC
- Causes: Radiation Tx, trauma, surgery, canal stenosis



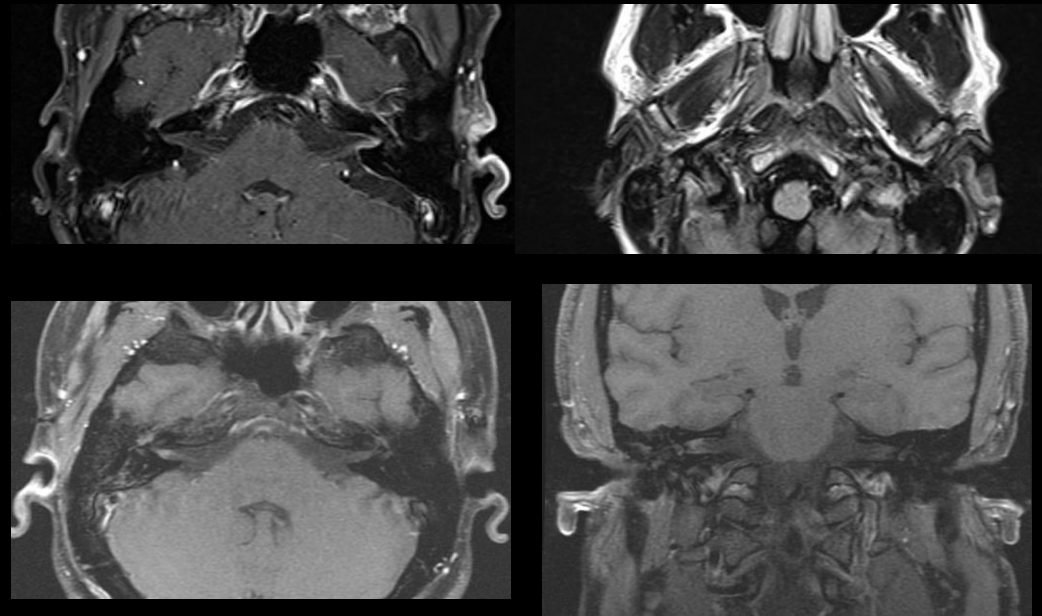
Cerumen – Ear Wax

- Cerumen (earwax) is a natural secretion produced by ceruminous gland (apocrine sweat gland) in concert with sebaceous glands and is found within the EAC.



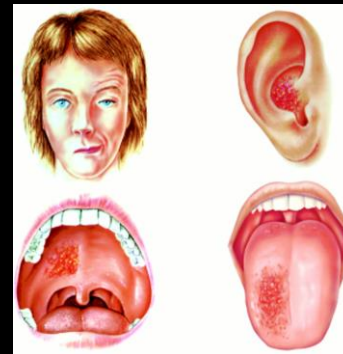
Ramsey Hunt Facial Neuritis

Herpes zoster oticus (Ramsay Hunt syndrome) results from reactivation of latent varicella zoster virus in the geniculate ganglion that is triggered by stress, aging, or immunosuppression. This syndrome may be a more widespread inflammatory process of the seventh and eighth nerves rather than an entity centered principally at the geniculate ganglion.



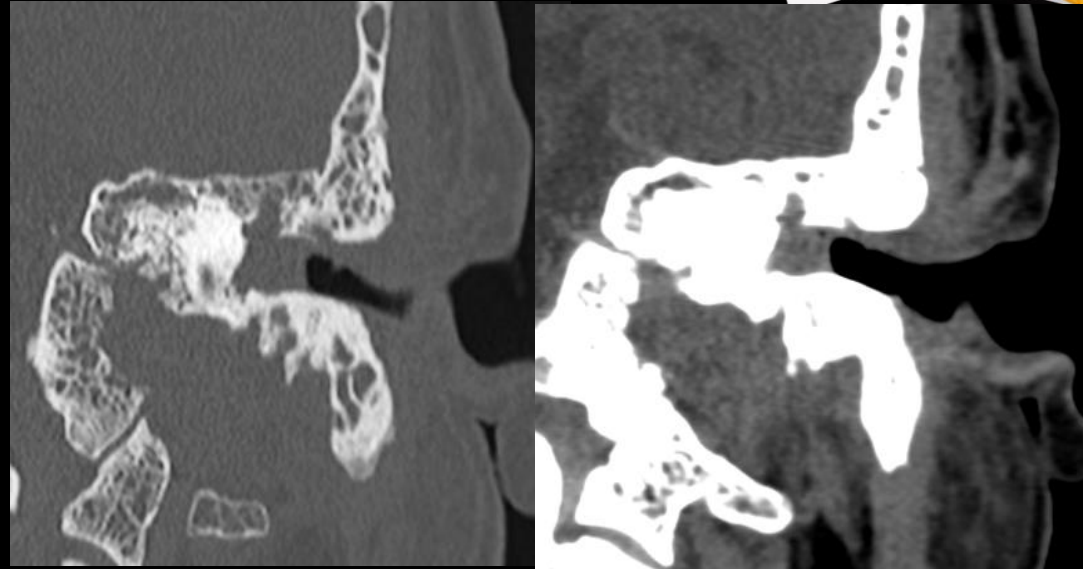
TRIAD:

- Otic pain
- Facial nerve palsy (Bell's palsy)
- Vesicular eruption (painful) – External ear (pinna-EAC), tongue, hard palate.



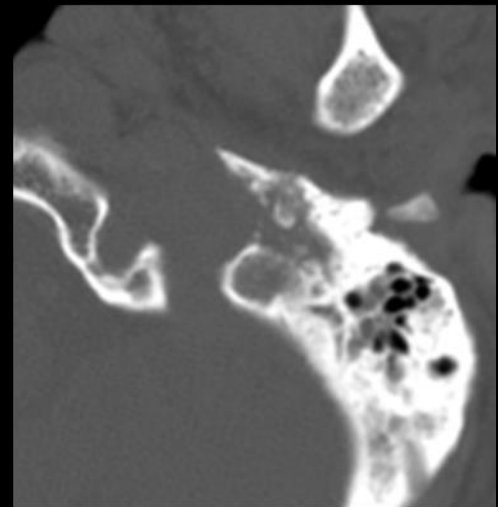
Necrotizing Otitis Externa

- Severe invasive infection of the EAC
- Can spread rapidly to involve adjacent soft tissue, neck spaces and skull base
- Common in diabetes mellitus and immunosuppressed
- Old population more affected
- > 90% *Pseudomonas aeruginosa*, 2nd is *staphylococcus aureus* (> in external otitis)
- Severe complications: brain abscess, osteomyelitis skull base, sinus venous thrombosis, meningitis, facial nerve paralysis.



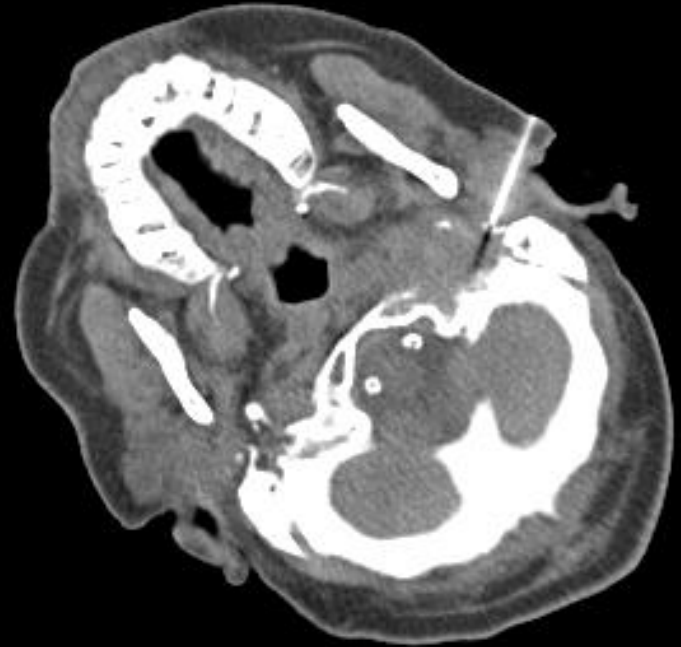
87 yo male with facial palsy and left sensorineural hearing loss

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Skull base osteomyelitis

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FNA aspiration: Muscle necrosis
Culture: *Pseudomonas aeruginosa*

Keratosis Obturans

- Sympathetic reflex stimulation of ceruminous glands within the EAC, leading to hyperemia and epidermal plugging.

Table 1: Diagnostic Features That Distinguish KO from EAC Cholesteatoma

Feature	KO	EAC Cholesteatoma
Age	Younger	Elderly
Pain	Acute	Chronic
Lateralization	Bilateral	Unilateral
Bone involvement	Circumferential remodeling	Focal erosion
Meatal skin	Normal	Focal ulceration



24 yo female

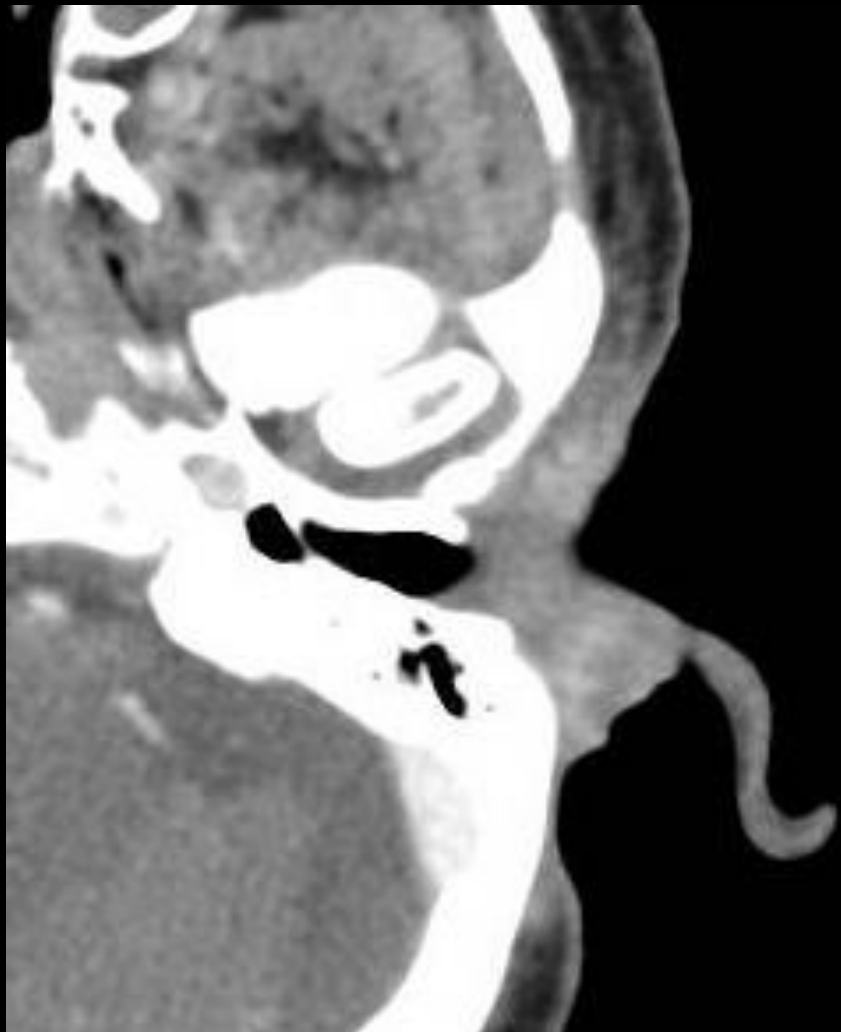
Epithelial Tumors of External Ear

Epithelial Tumors:

- Squamous cell carcinoma (SCC) **most common**
- Basal cell carcinoma (BCC)
- Adenoid cystic carcinoma (ACC)
- Ceruminous adenocarcinoma
- Adenoid cystic carcinoma

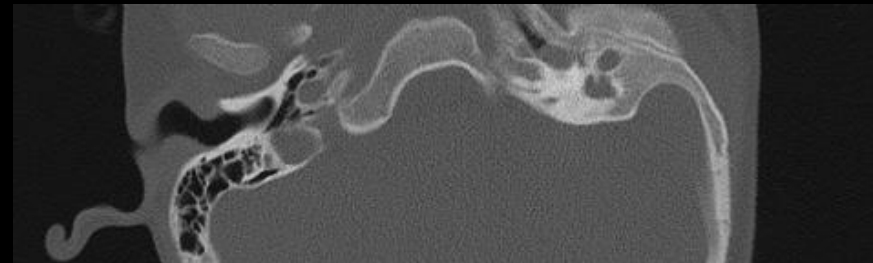
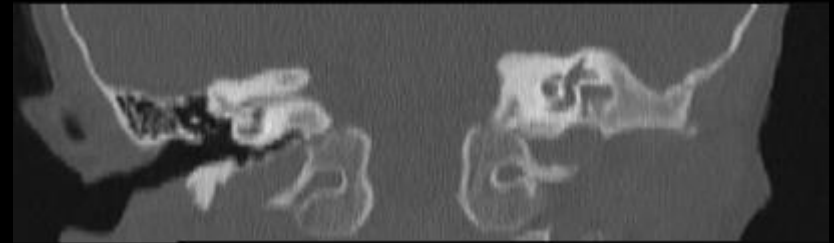
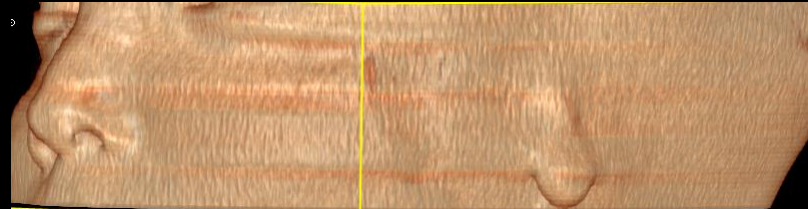
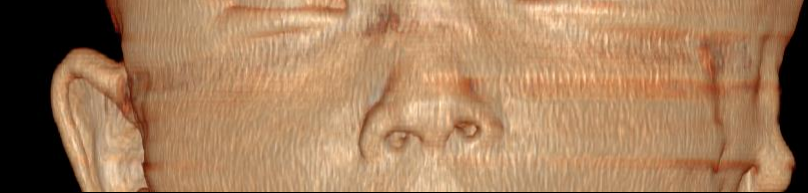
Non-epithelial:

- Melanoma

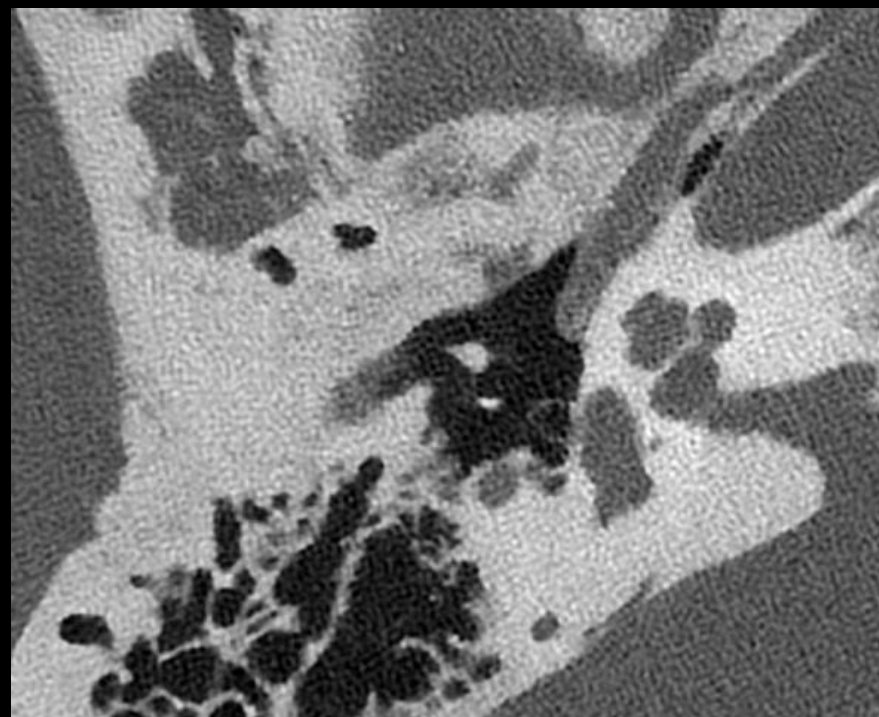
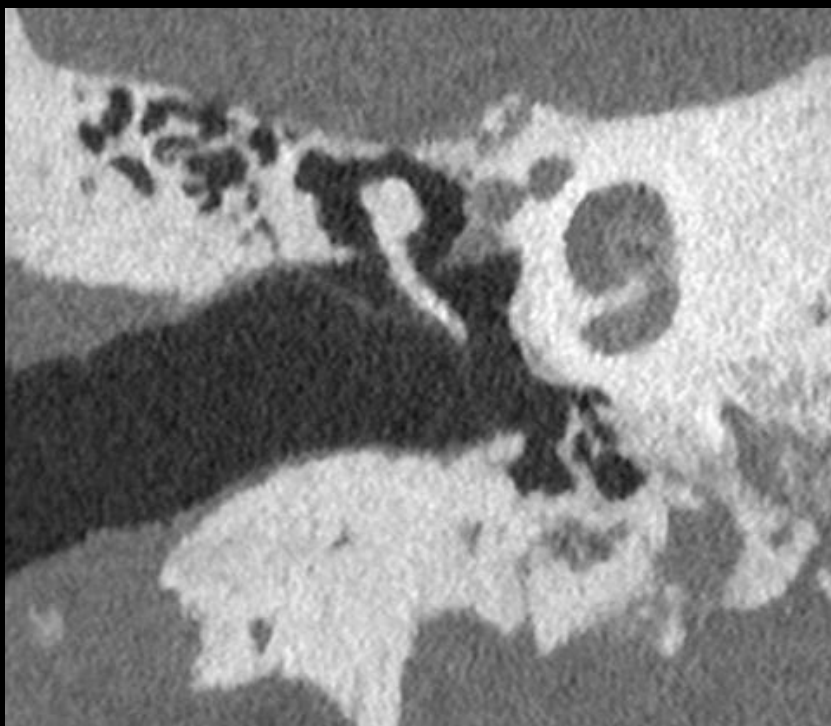


External Auditory Canal Atresia

- External auditory canal atresia, also known as congenital aural atresia, is characterized by complete or incomplete bony atresia of the external auditory canal (EAC), often in association with a dysplastic auricle and an abnormal middle ear cavity or ossicles.
 - 1:10,000-20,000
 - Bilateral in 1/3 or less
 - EAC atretic or absent
 - Middle ear findings variable
 - Inner ear and IAC normal
 - Small auricle - tag
 - Associations Syndromes: Goldenhar, Crouzon, Treacher Collins, Pierre Robin

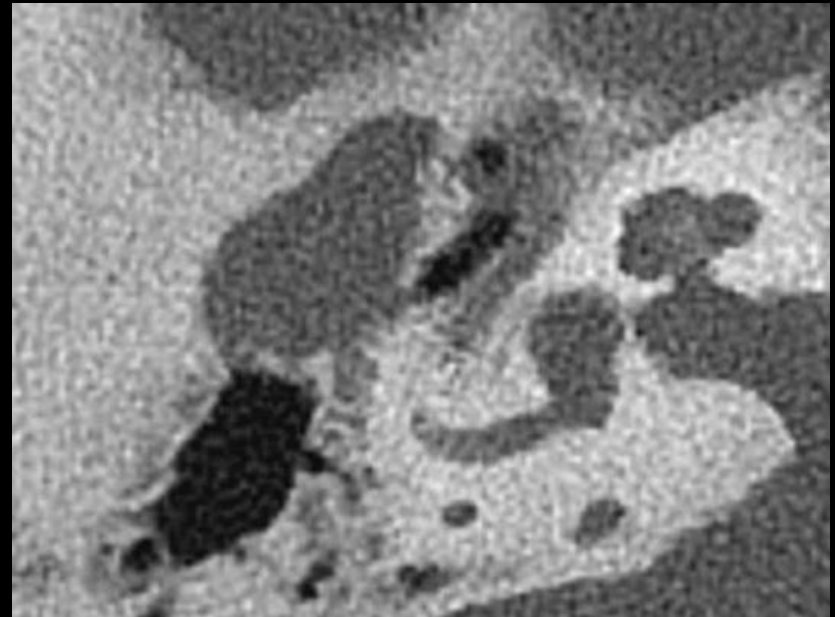
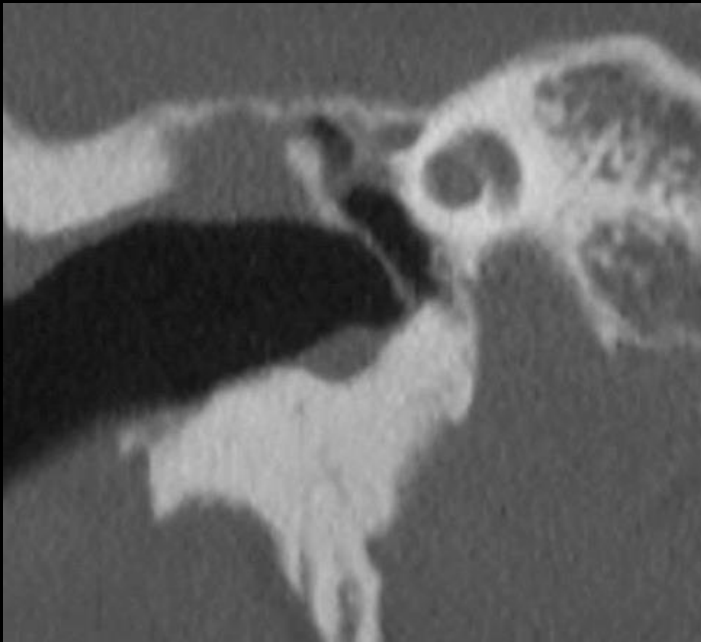


Middle ear



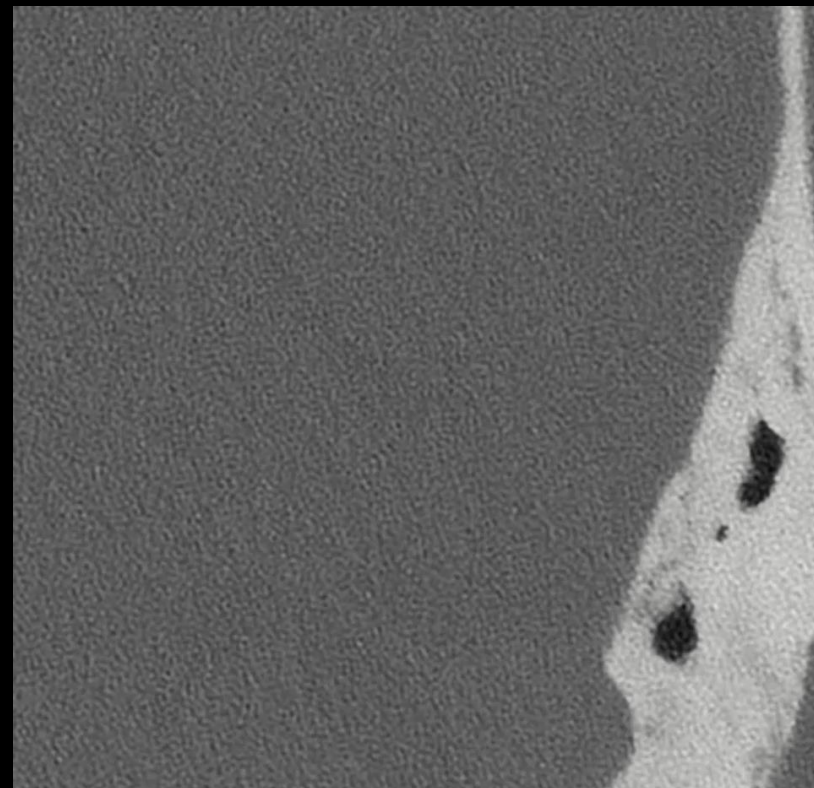
Cholesteatoma

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Temporal bone fractures

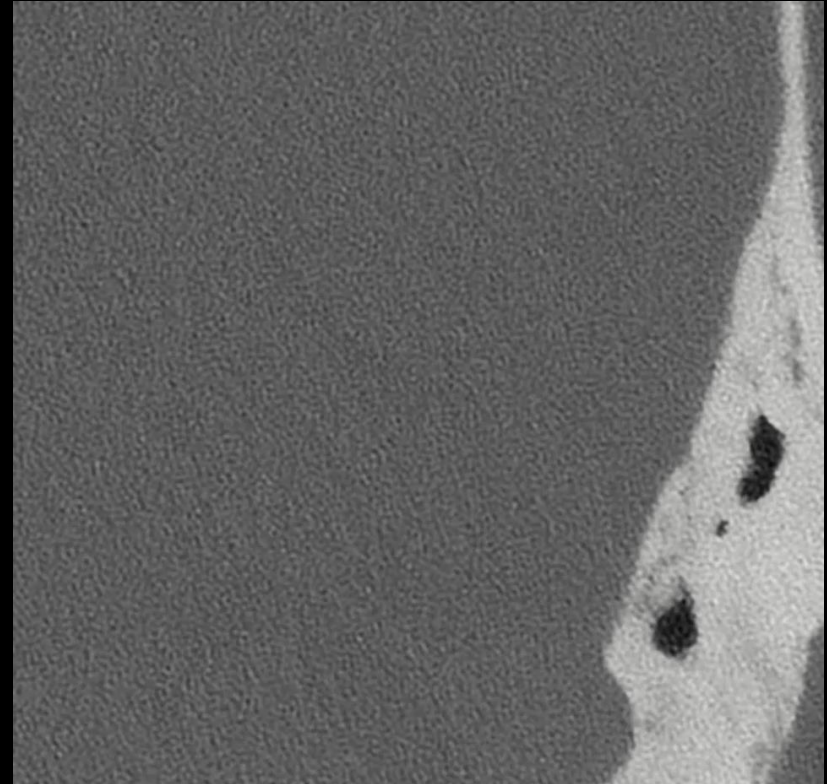
- Traditional fracture type based on orientation:
 - Longitudinal
 - Parallel to the axis of the temporal bone
 - Facial nerve paralysis 15%
 - Conductive hearing loss 50%
 - Inner ear spared
 - Transverse
 - Perpendicular to the axis
 - Labyrinth usually disrupted
 - Sensorineural hearing loss
 - Mixed



Temporal bone fractures

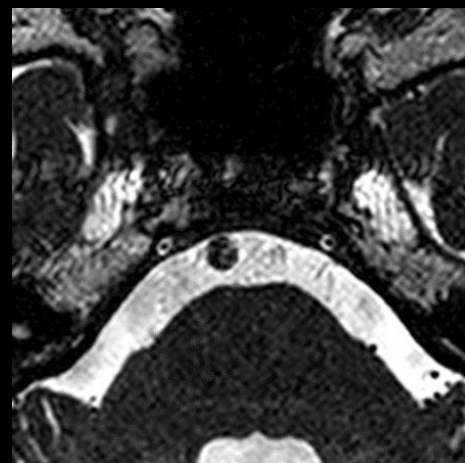
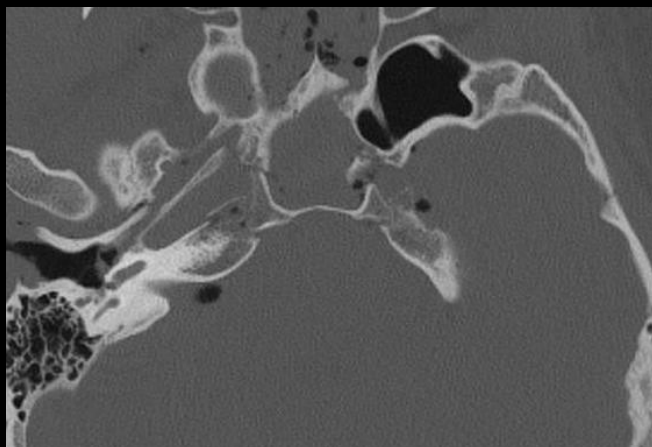
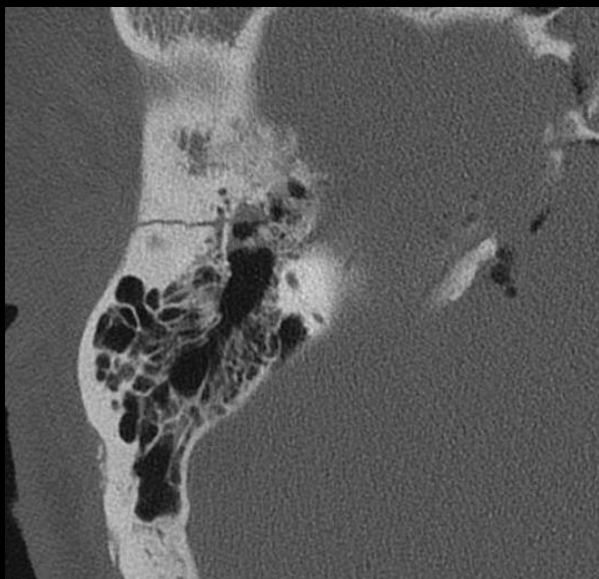
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- Orientation-agnostic CT-driven classification
- Otic capsule violating
 - Petrous
- Otic capsule sparing
 - Nonpetrous
 - Mastoid
 - Middle ear



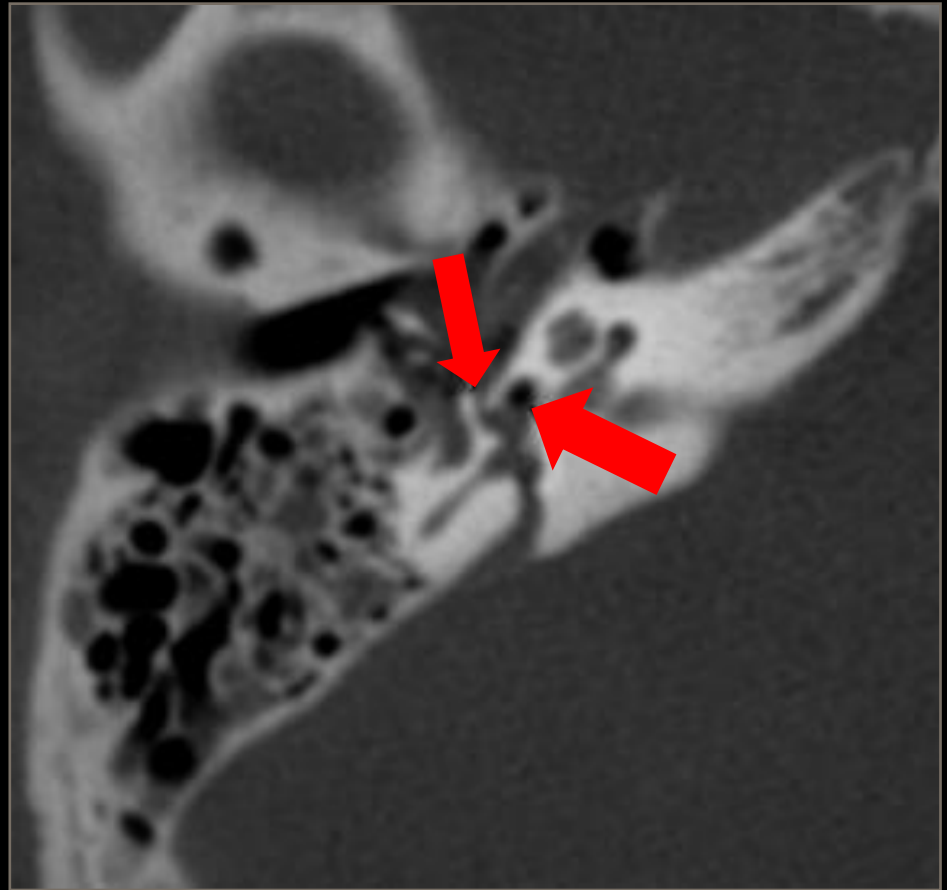
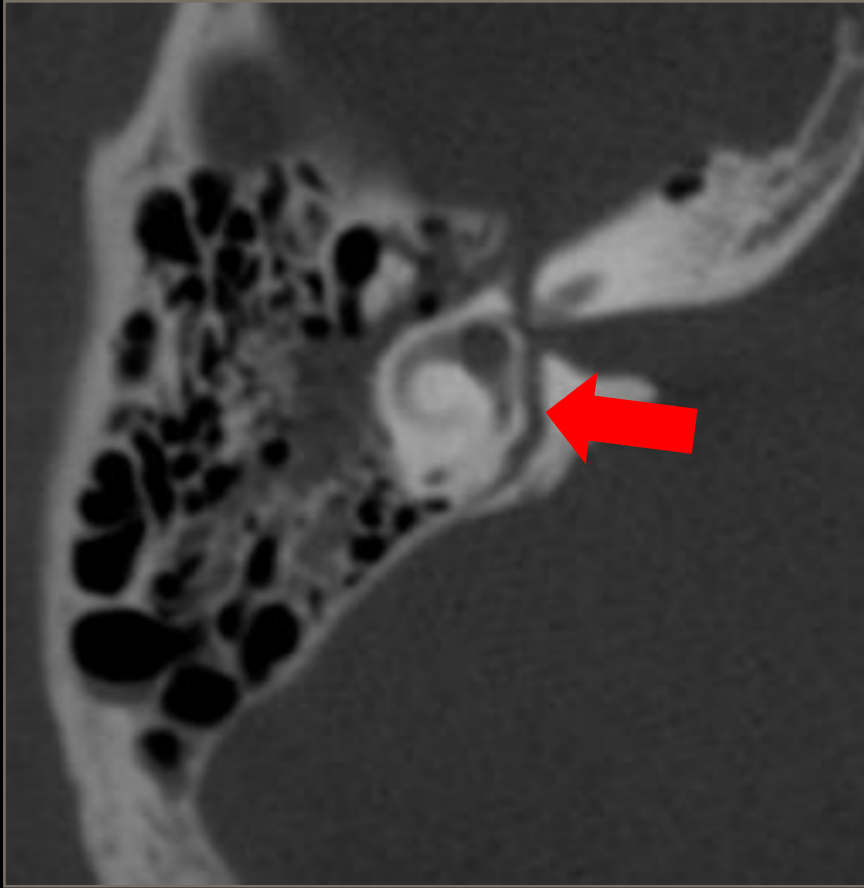
41 y.o. male with bilateral temporal bone fractures, bilateral sphenoid sinus fractures

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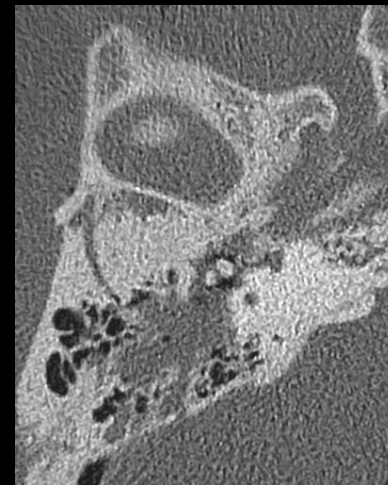
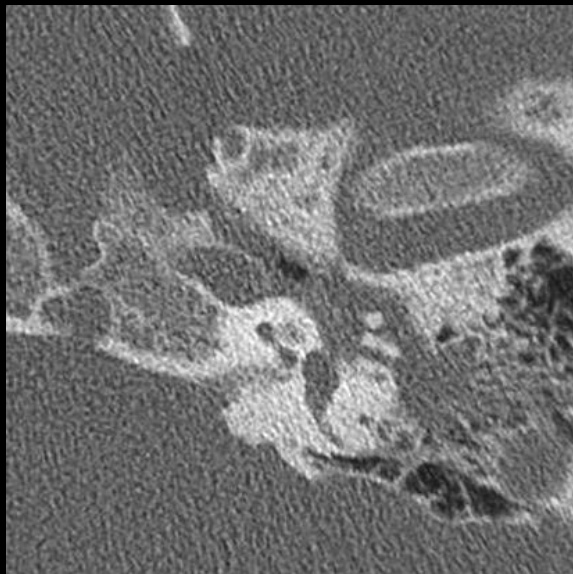
Otic capsule violating

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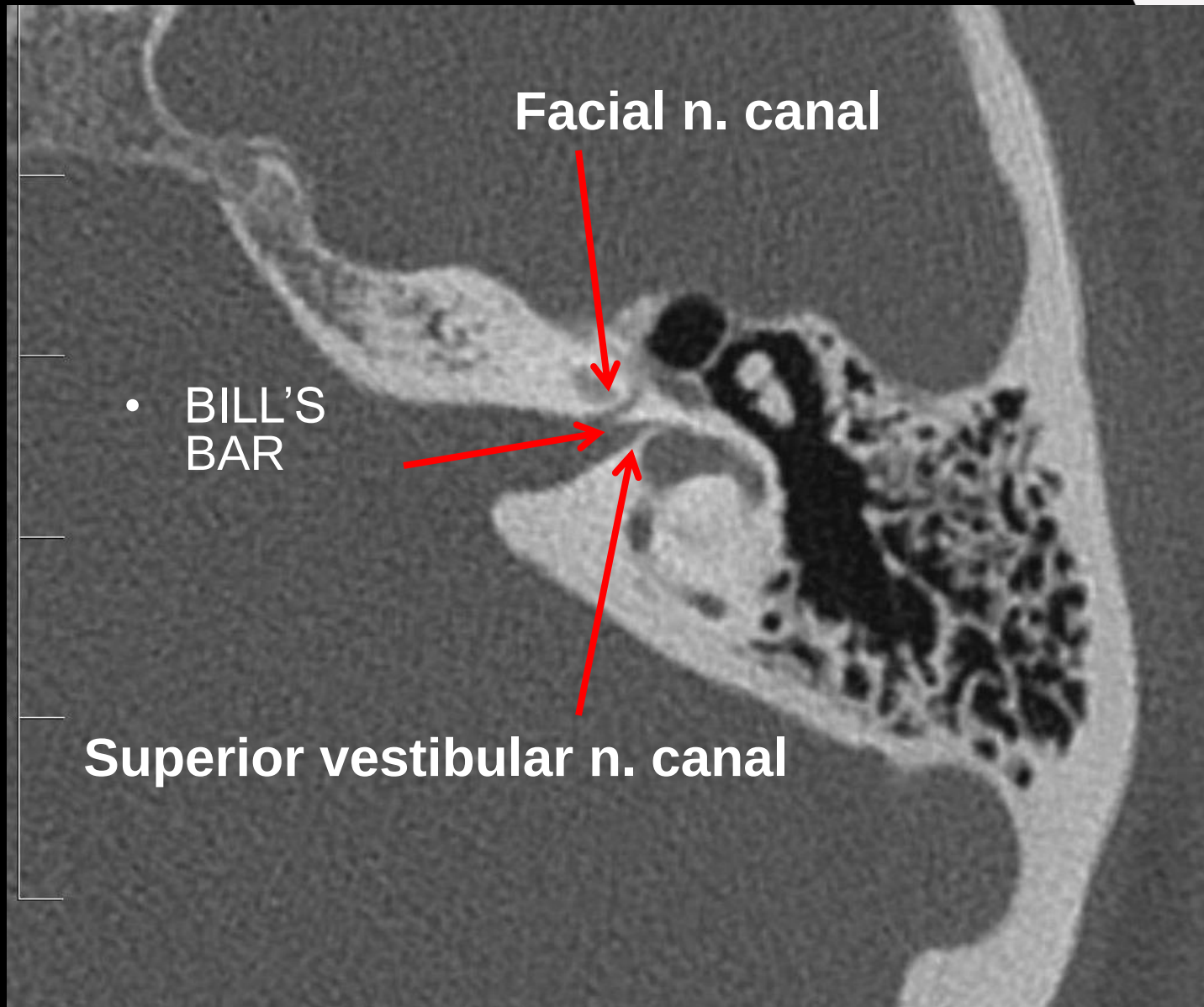
Ossicular Disruption

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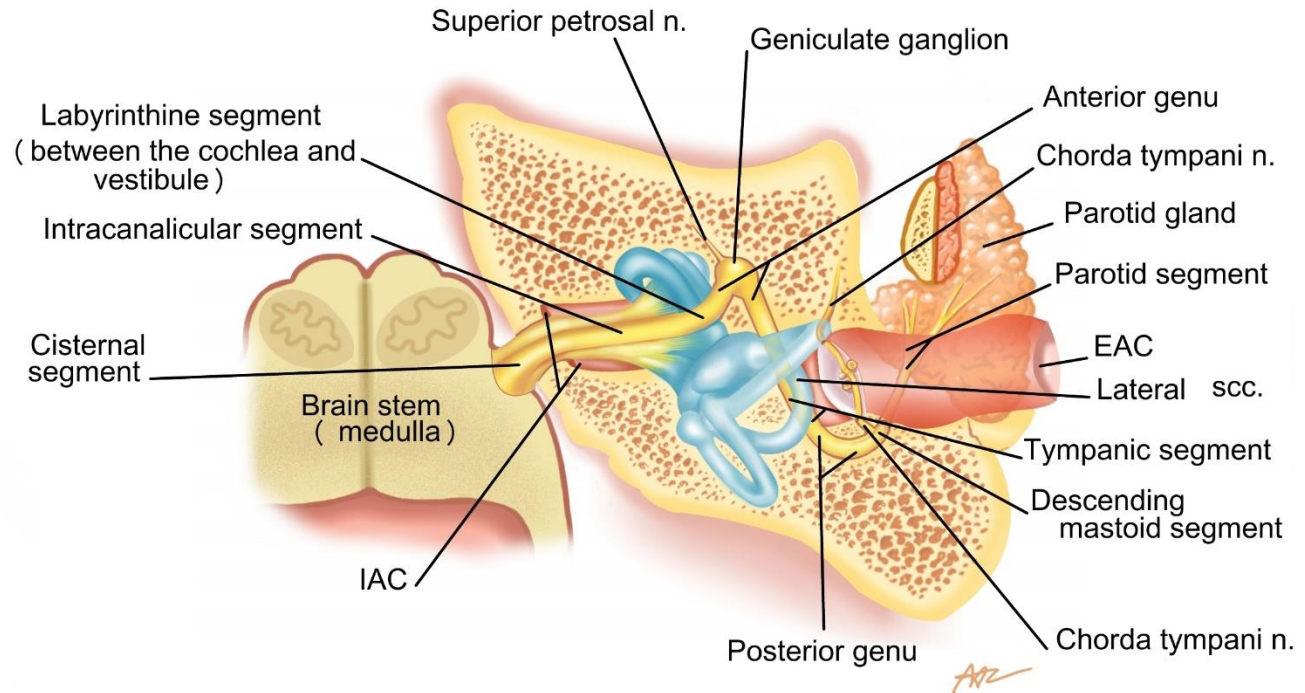
Compartment Above Crista Falciform:

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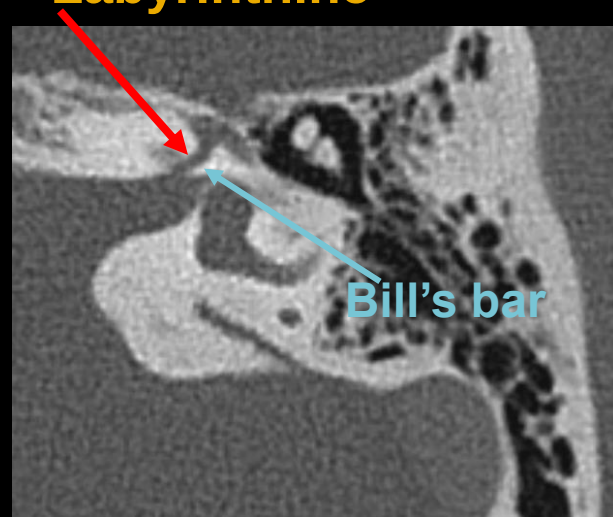
Facial Nerve segments

- Cisternal
- Canalicular
- Labyrinthine
- Geniculate
- Tympanic
- Mastoid
- Extracranial

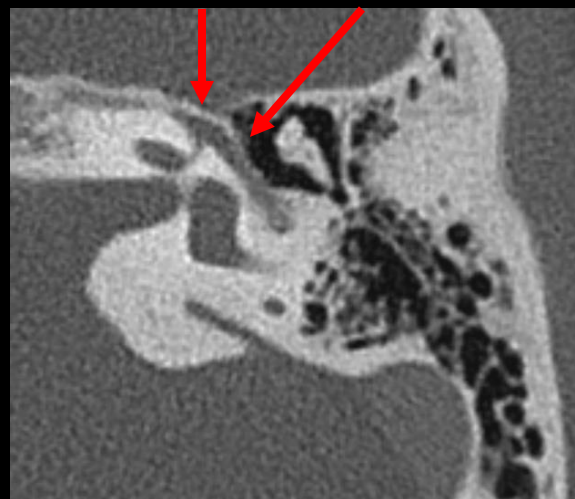


SEGMENTS OF THE FACIAL NERVE

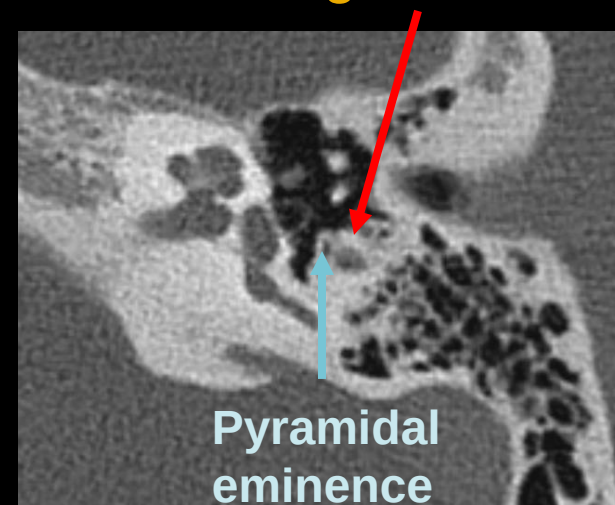
Labyrinthine



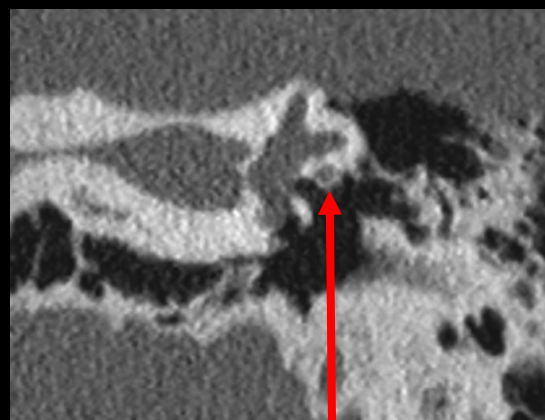
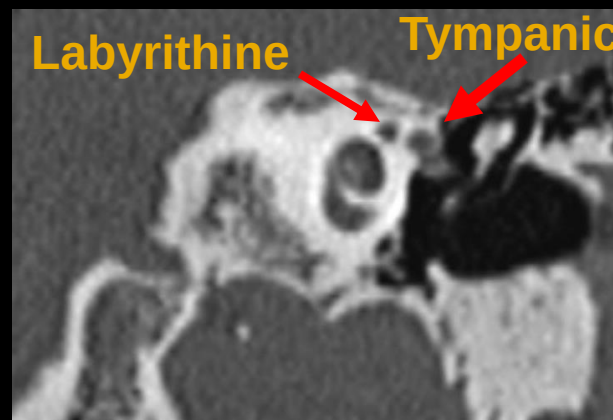
Geniculate - Tympanic



Descending Mastoid

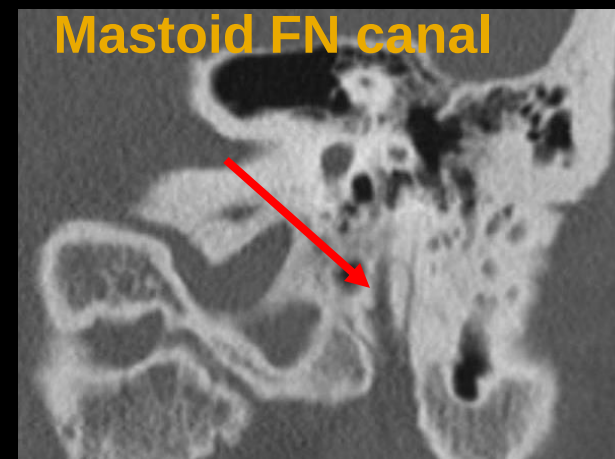


Labyrinthine Tympanic



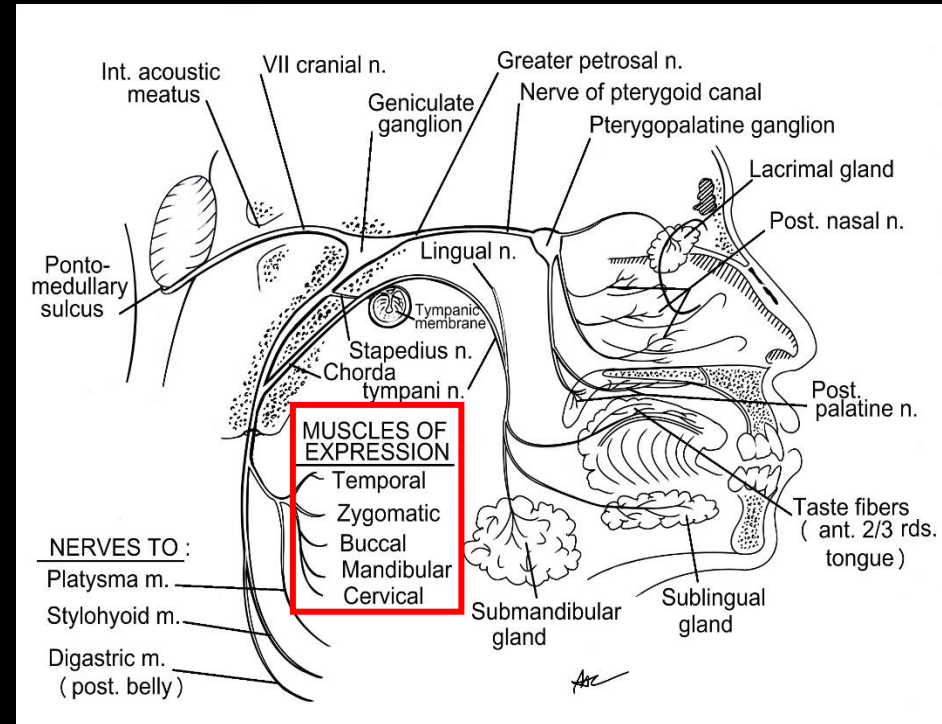
Tympanic FN canal

Mastoid FN canal

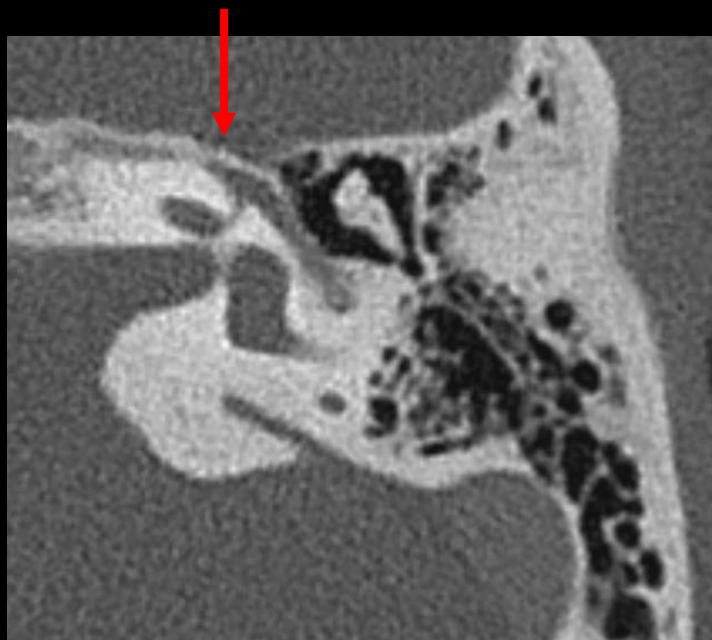


Facial Nerve Branches

- Geniculate segment
 - Greater superficial petrosal nerve
 - Lesser petrosal nerve
 - Parasympathetic fibers to lacrimal and parotid glands
- Mastoid segment
 - Stapedius
 - Chorda tympani
- Extracranial segment
 - Superior temporozygomatic
 - Inferior cervicofacial
 - Temporal
 - Zygomatic
 - Buccal
 - Mandibular
 - Cervical branches



Great Sup. Petrosal Nerve



Chorda tympany



Posterior belly of digastric

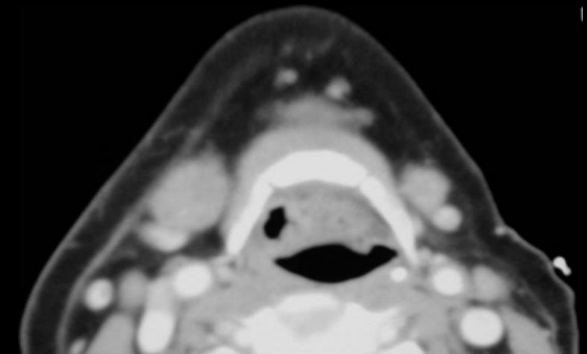
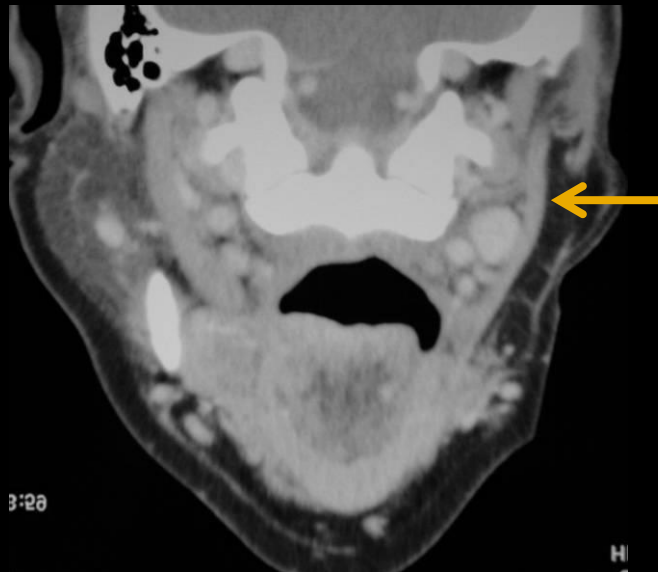
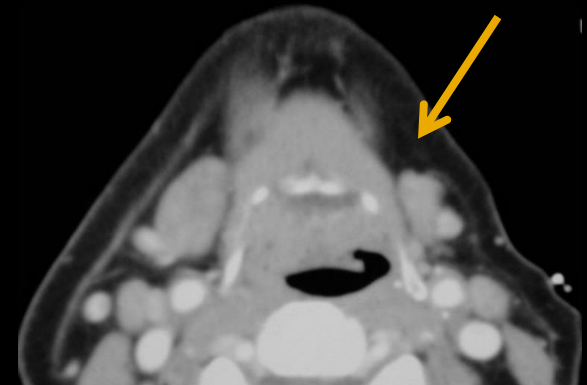
Levator labii
superioris/Zygomaticus

Buccinator

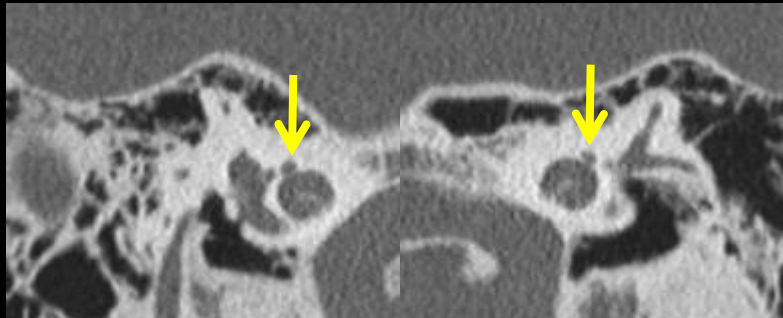
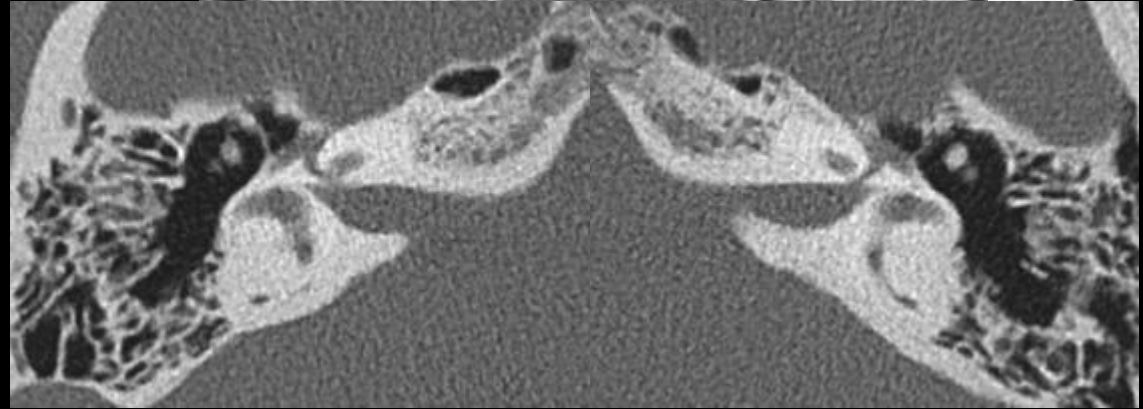
Platysma

47 F s/p left parotid tumor removal

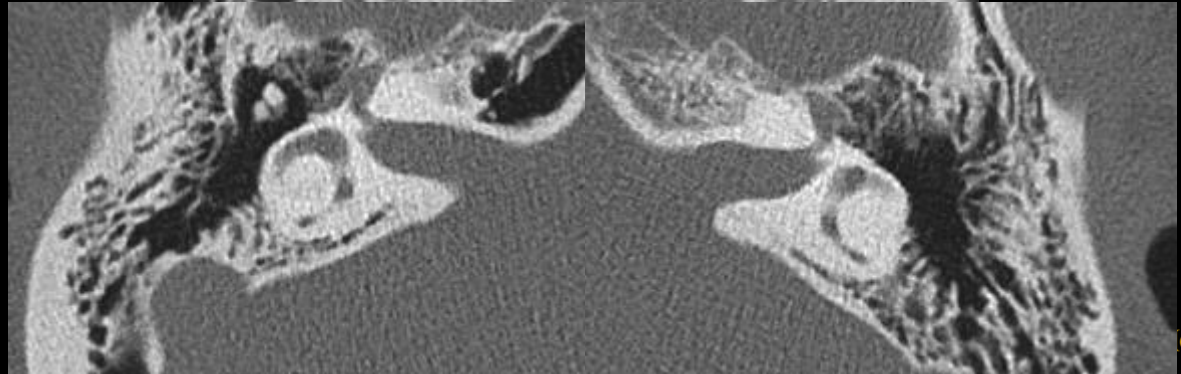
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22 yo male with
bilateral
recurrent facial
nerve palsy

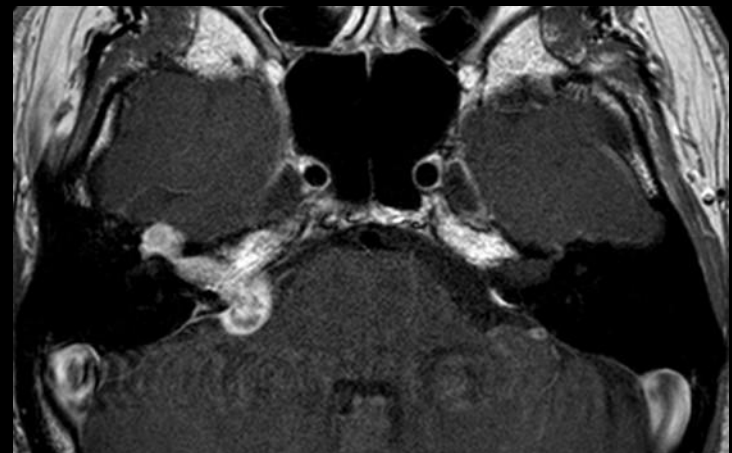
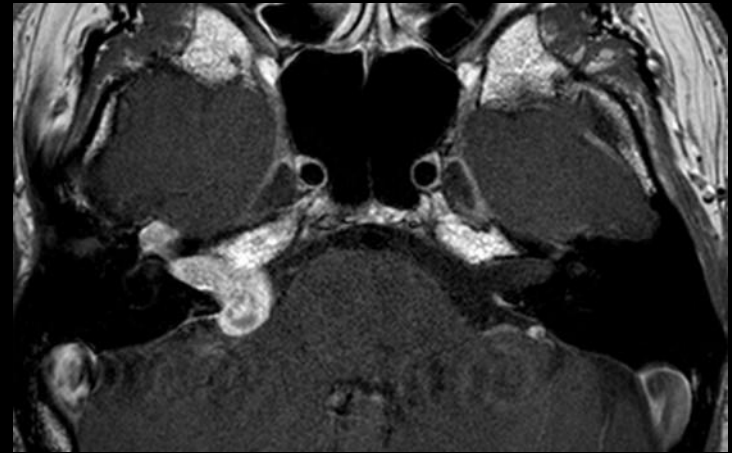


32 yo male
asymptomatic
for comparison



IAC/labyrinthine/Genicular Ganglion

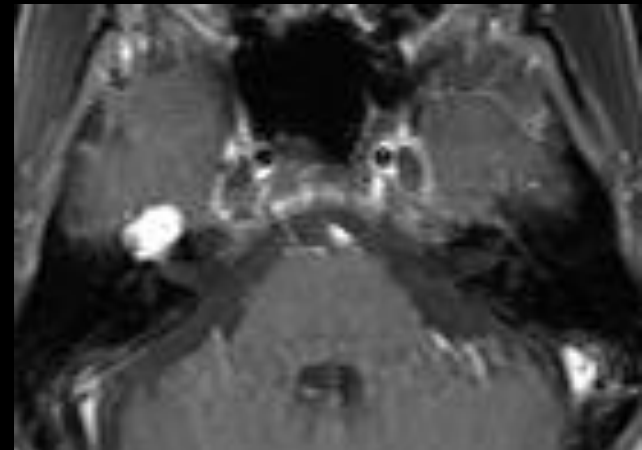
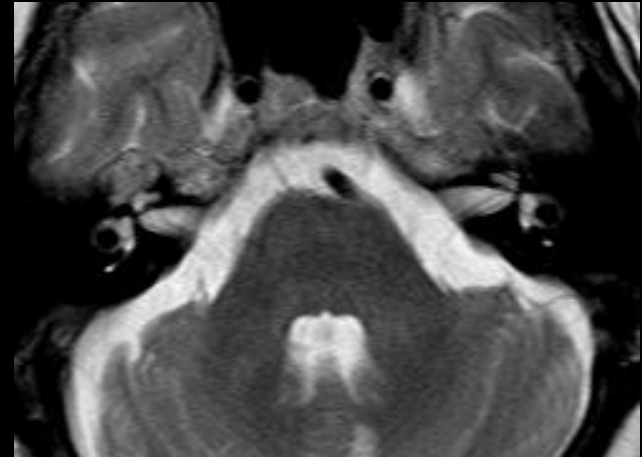
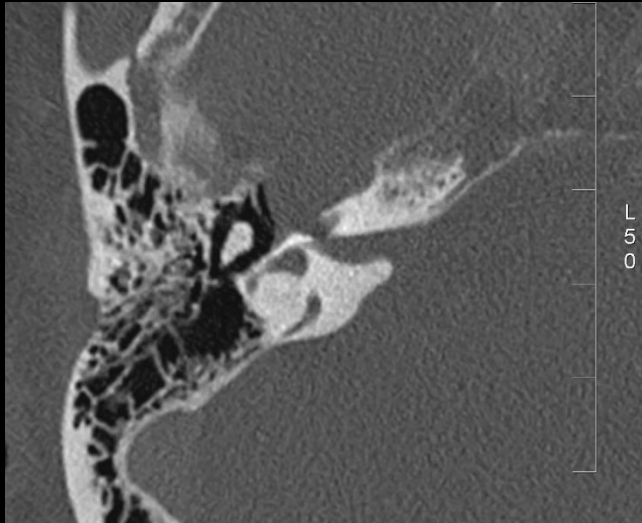
- Indistinguishable from acoustic schwannomas
- Labyrinthine tail
- Sensorineural hearing loss
- Dumbbell



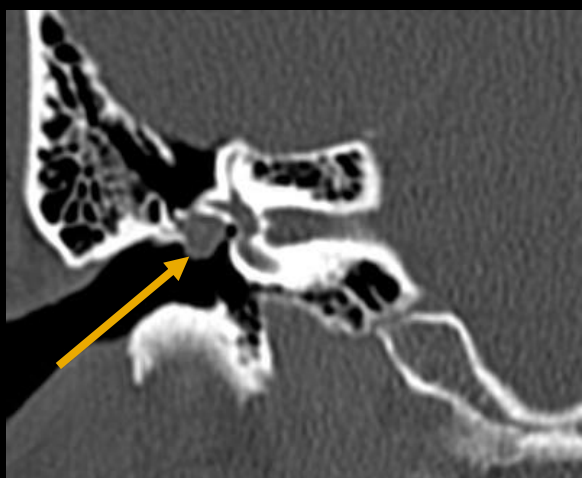
Courtesy: Amy Juliano MD

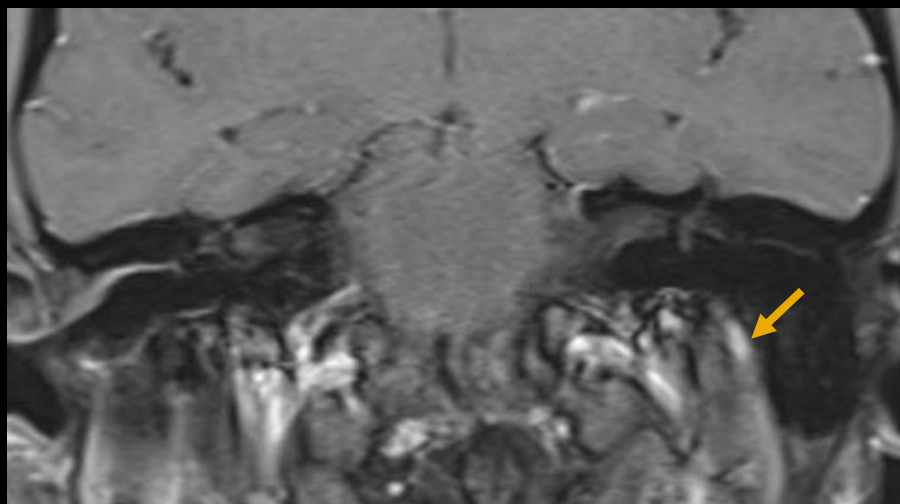
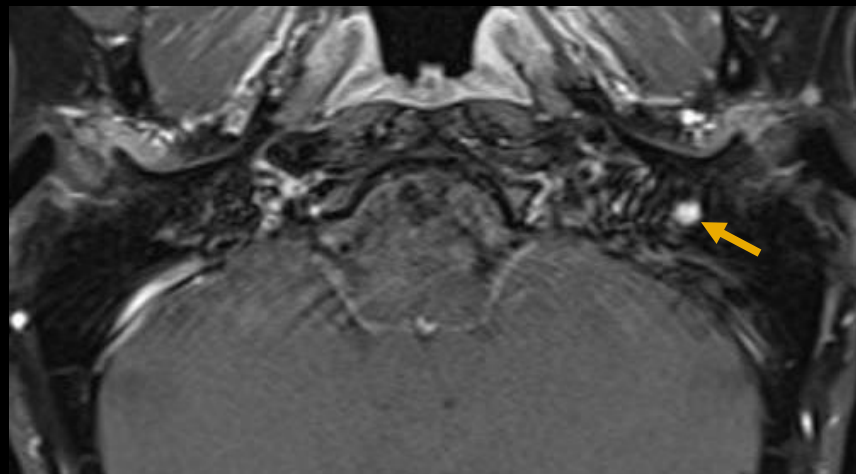
Facial Nerve Schwannoma

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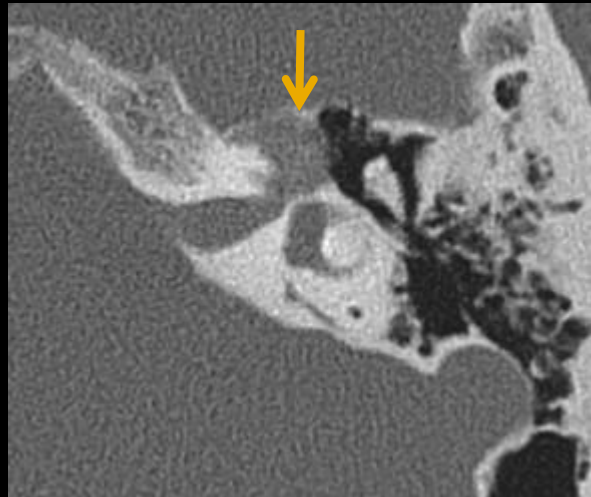
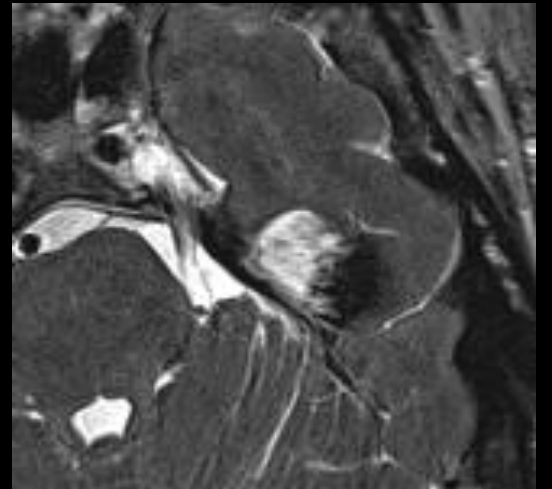
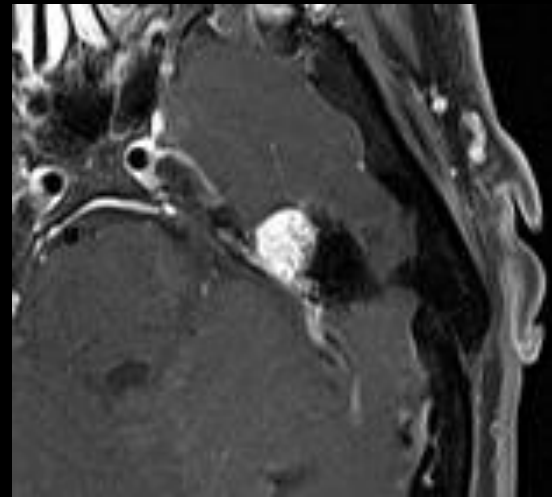


Tympanic segment

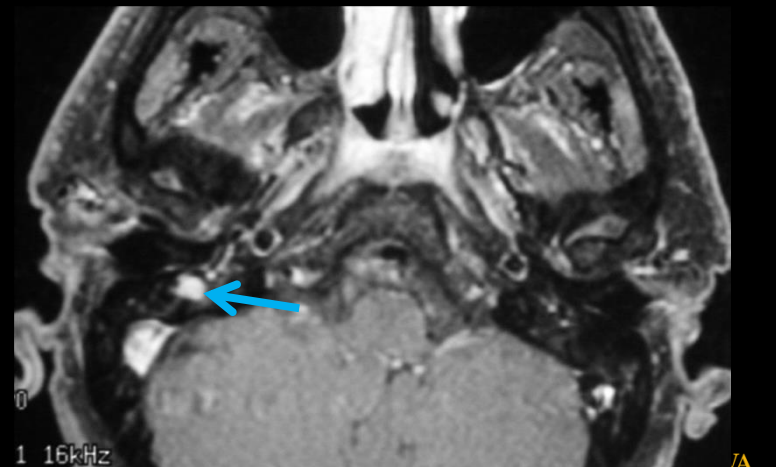
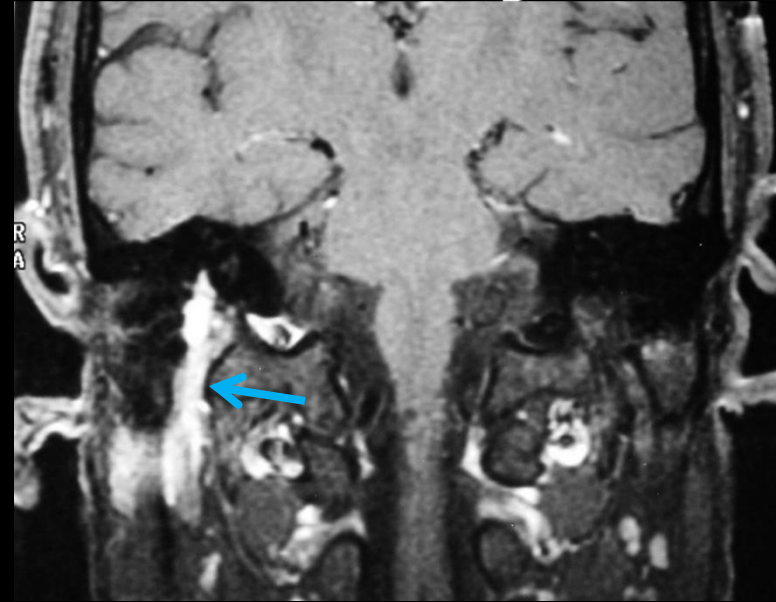
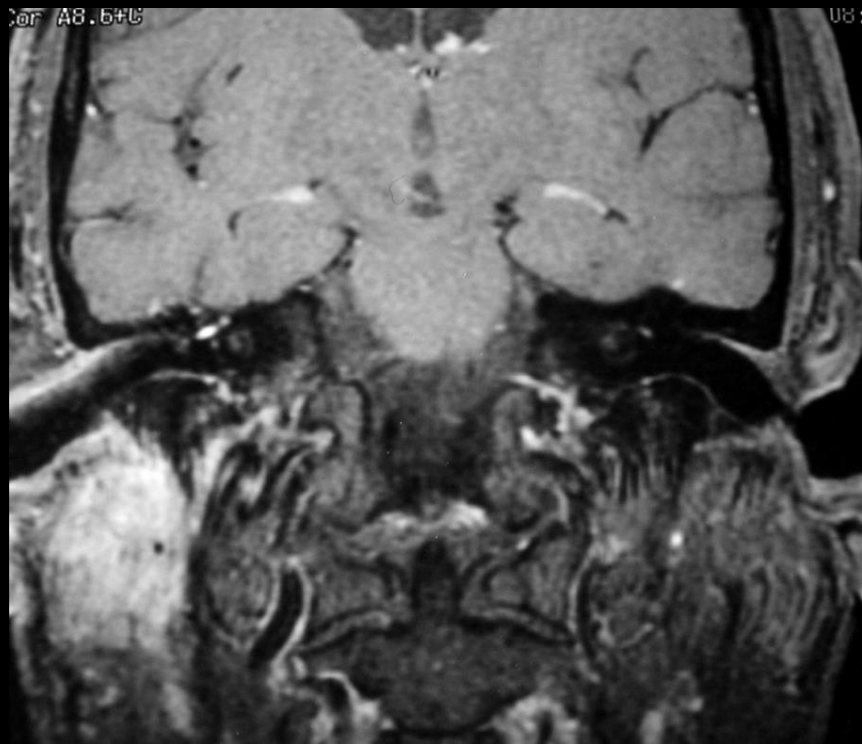




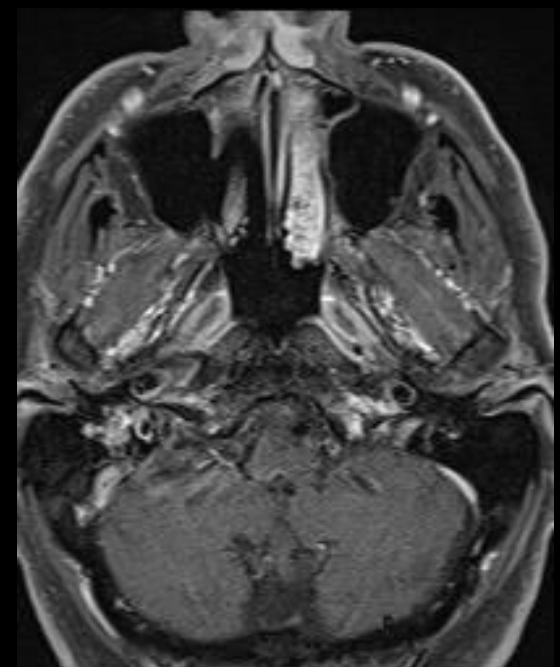
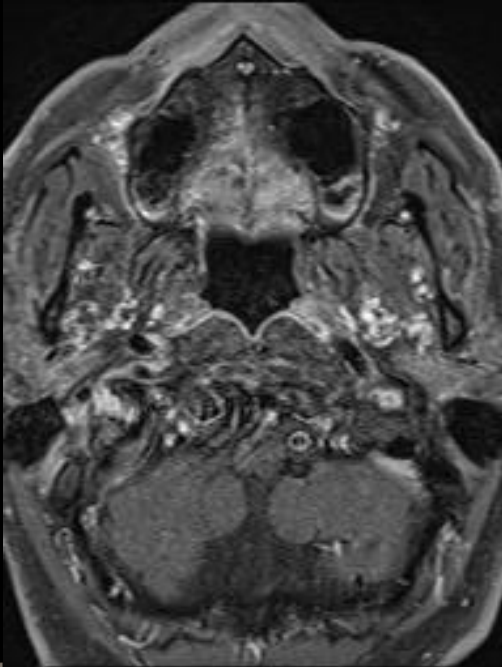
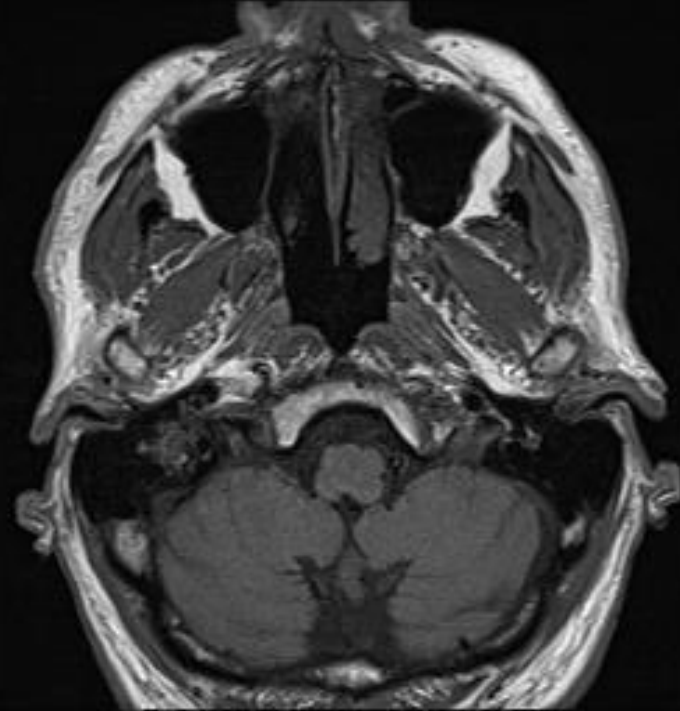
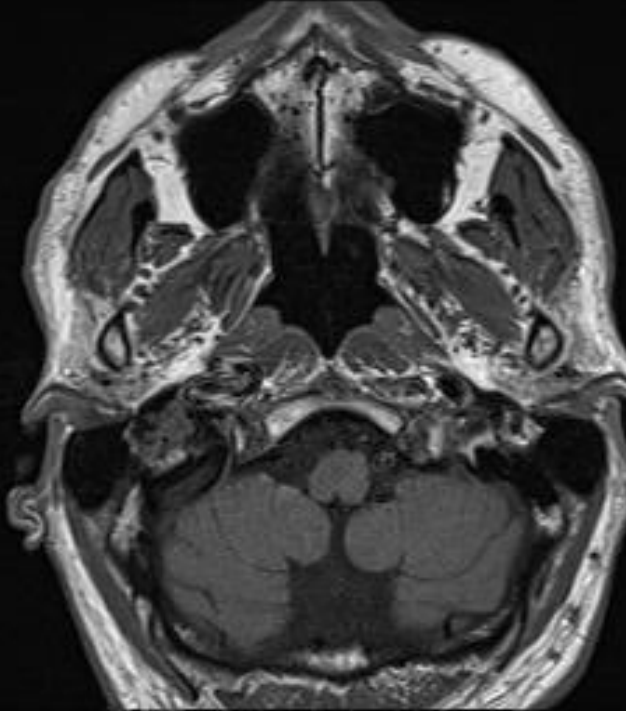
Venous vascular malformation of the Facial Nerve (AKA Facial Nerve Hemangioma)

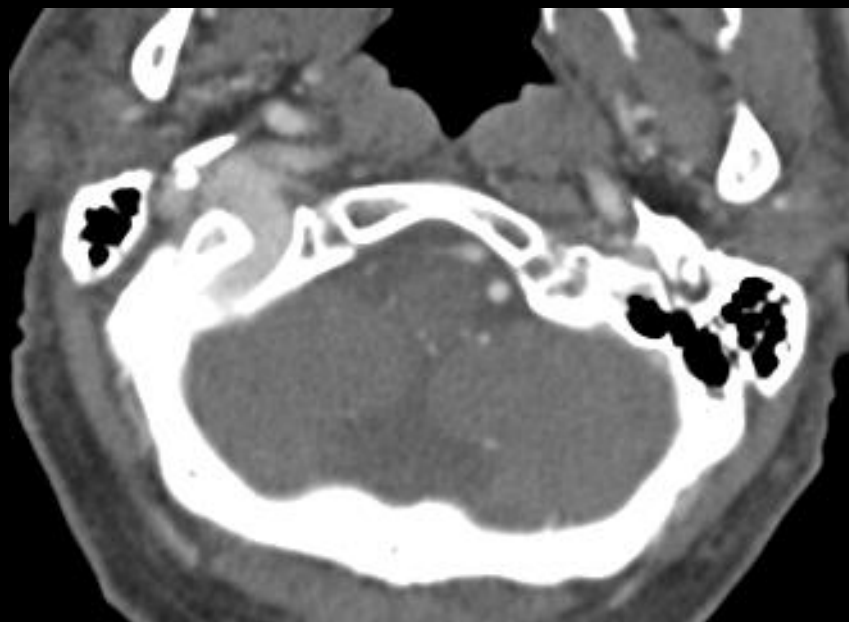


Facial perineural spread



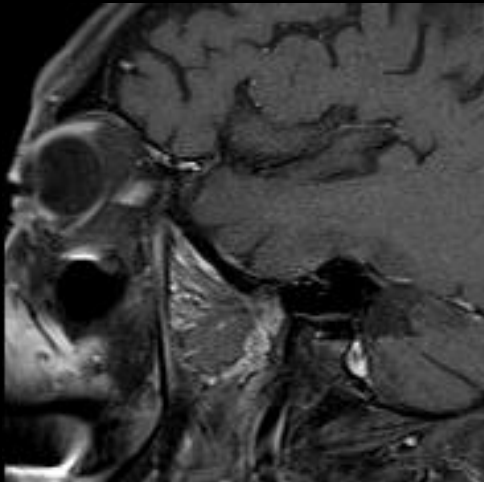
- 74 y.o. male with a history of right facial weakness.
- Started by having right eye dryness

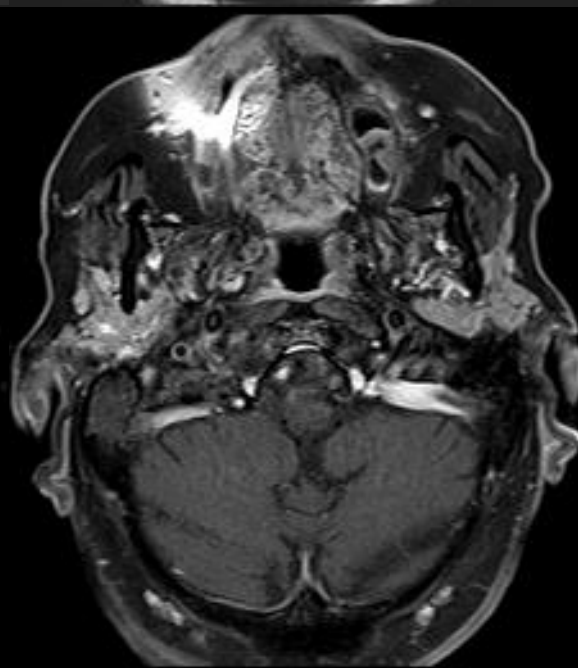
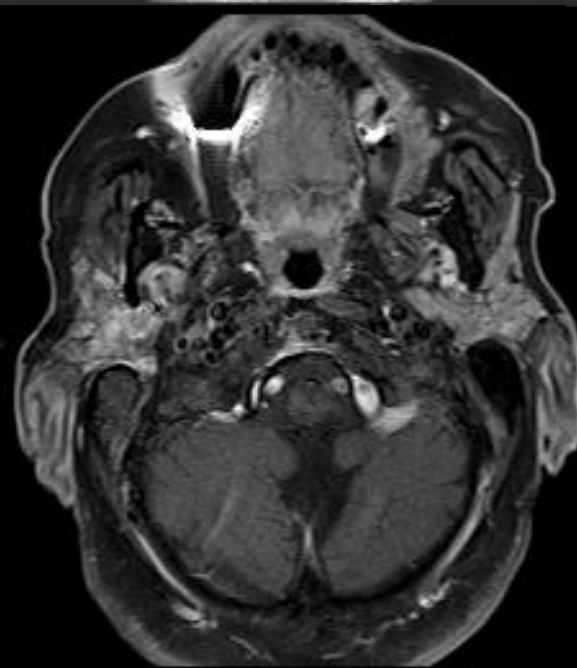
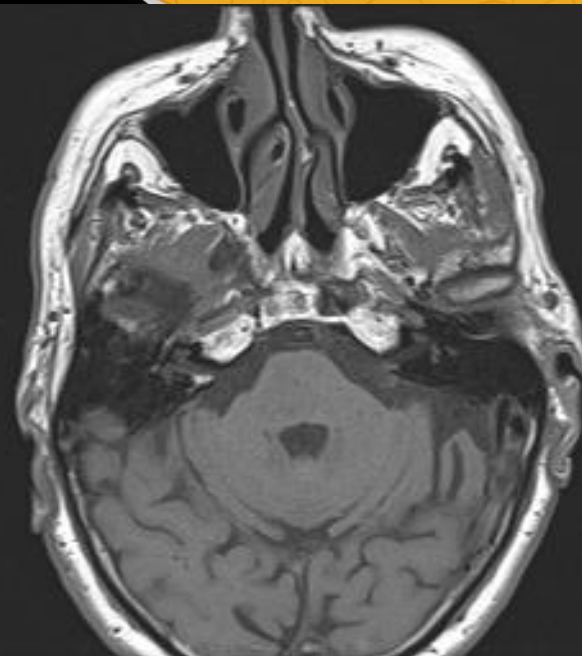
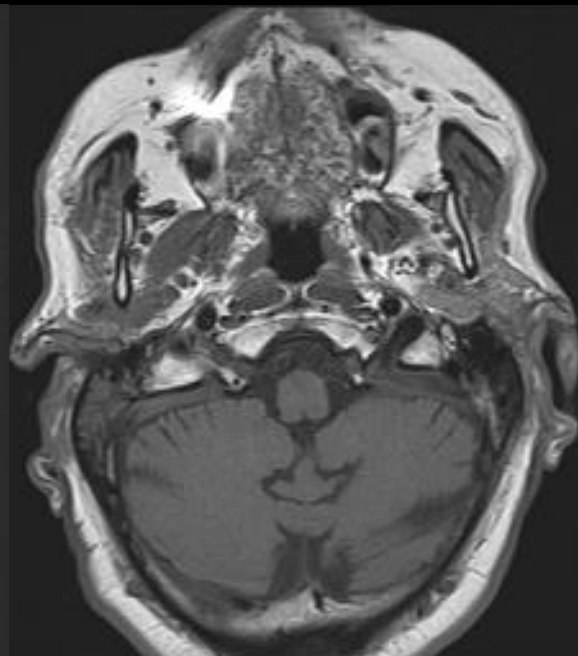
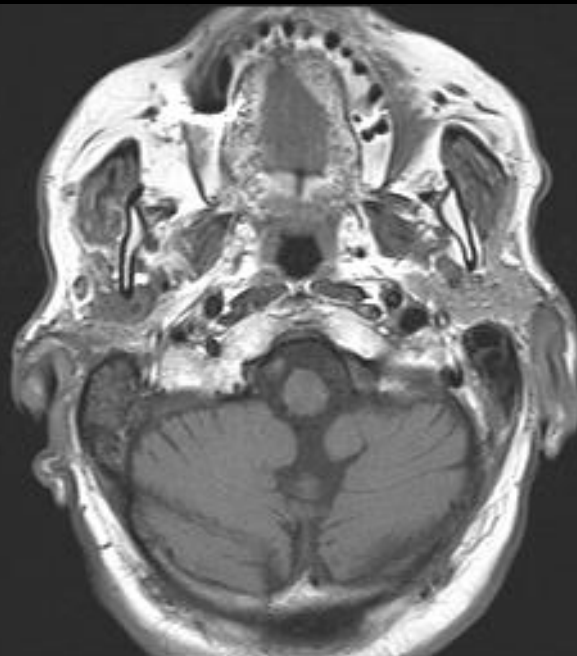




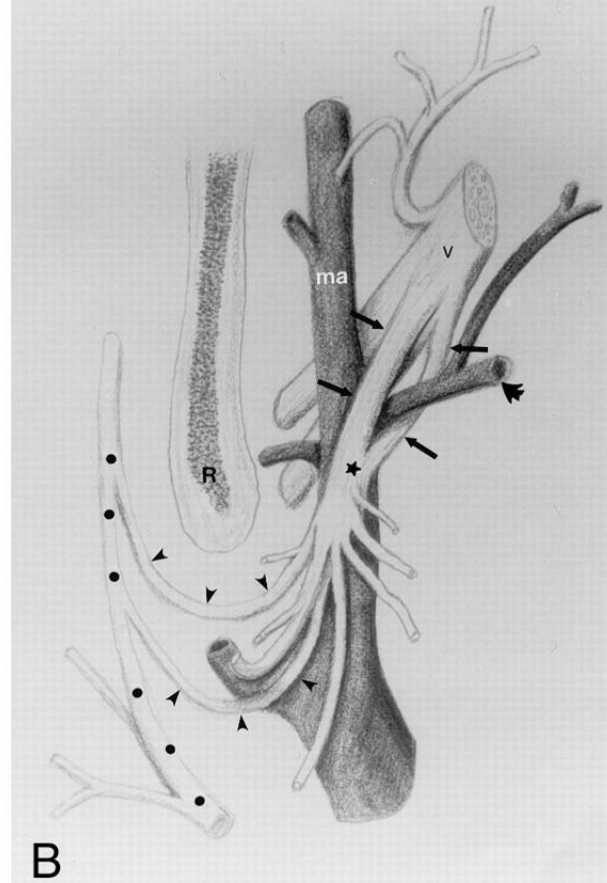
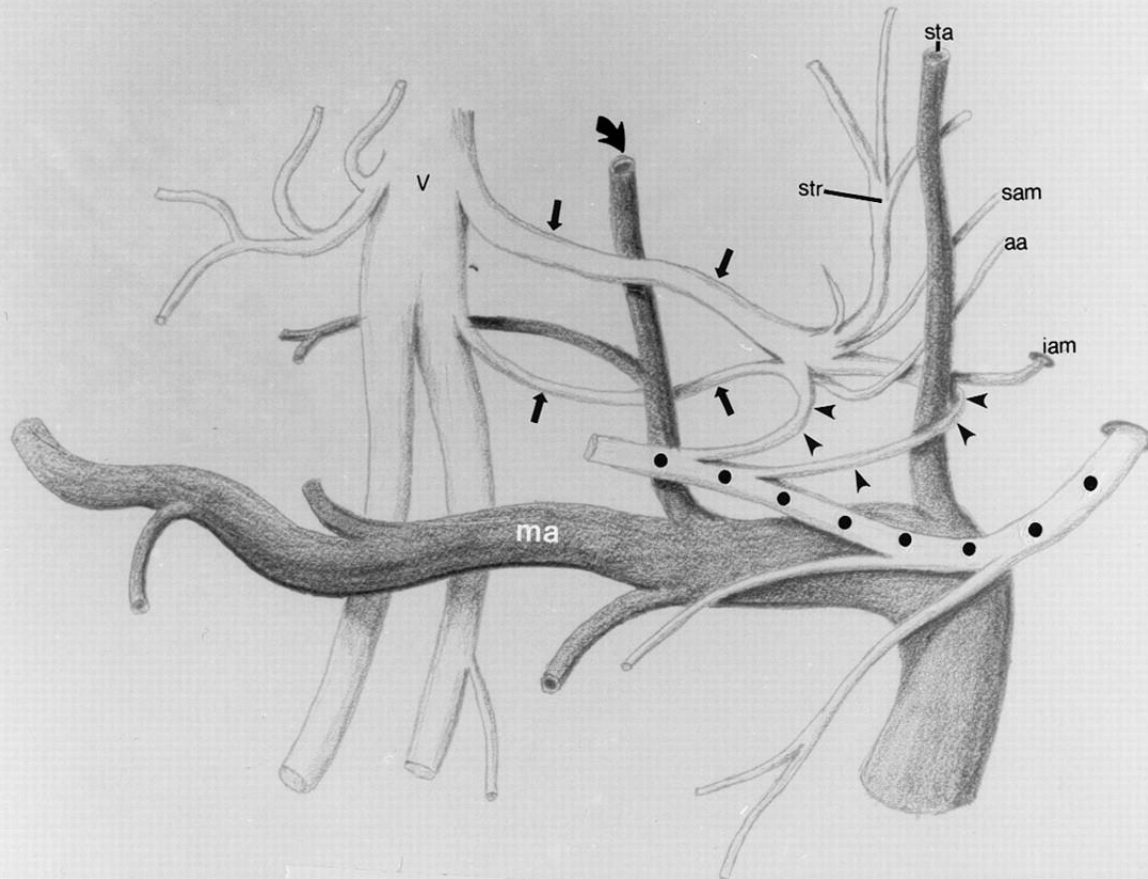
92 y.o. female with right facial paralysis

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Auriculotemporal Nerve



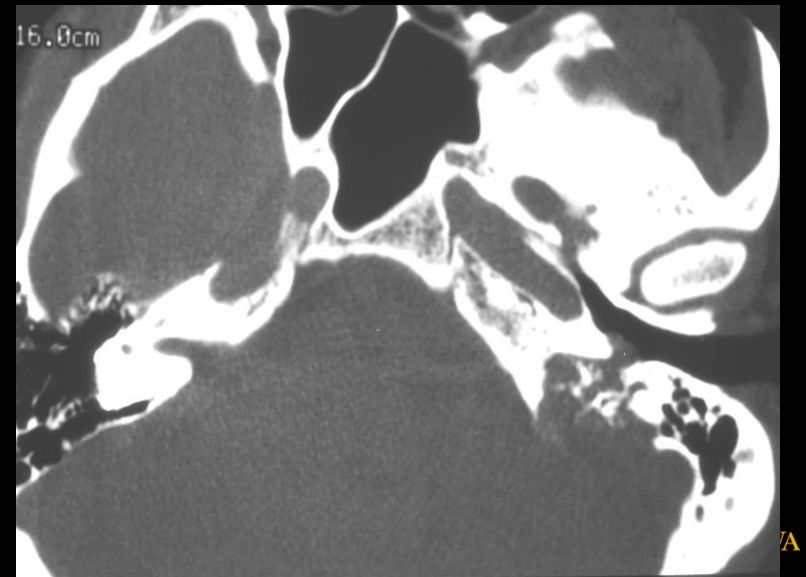
AJNR Am J Neuroradiol 23:303-311, February 2002

Perineural Tumor Spread Along the Auriculotemporal Nerve

Ilona M. Schmalfuss, Roger P. Tart, Suresh Mukherji, and Anthony A. Mancuso

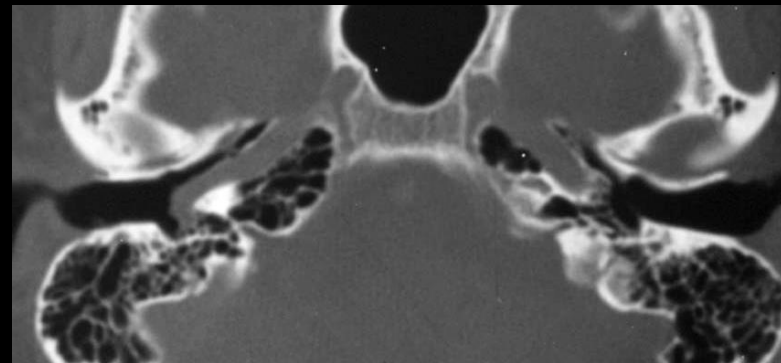
Endolymphatic sac tumor

- Sensorineural hearing loss
- Tinnitus and vertigo
- VHL



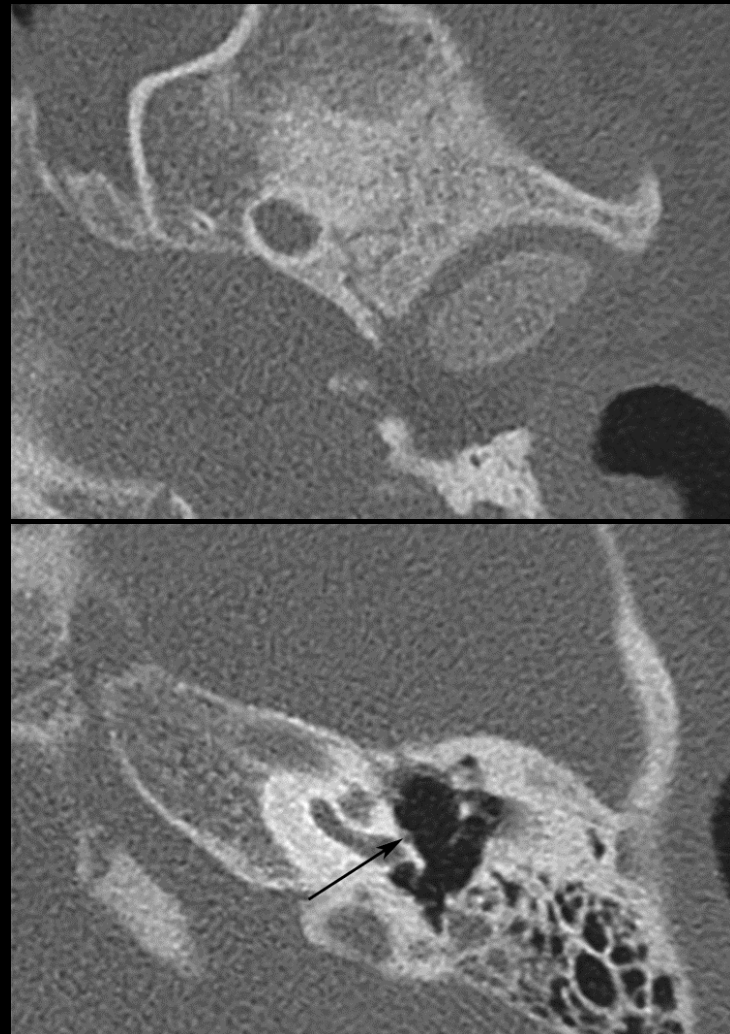
Aberrant ICA

- Females > males
- Right > left
- Bilateral aberrant ICAs have been reported
- Symptoms present in adulthood due to ICA elongation
- Subjective PT, vertigo, aural fullness, CHL
- Vascular tympanic membrane



Persistent Stapedial artery

- It is transiently present in normal fetal development, connecting the future external carotid artery to the internal carotid artery.
- The second aortic arch gives rise to the hyoid artery that, in turn, gives rise to the stapedial artery.
- Middle meningeal artery
- petrous ICA → hypotympanum → crura of the stapes → tympanic segment facial canal



Tympanic Paraganglioma

- Benign tumor arising from glomus bodies situated on **cochlear promontory**
- Tumors can occur anywhere along the Jacobson nerve
- Floor of the middle ear is intact
- Vascular retrotympanic mass
- DDX: **Aberrant internal carotid artery**





That's all Folks!