

Skull Base / Facial Nerve

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Learning Objectives

Causes and effects of infections in the temporal bone

Trauma of the temporal bone

Facial nerve palsy – indication for surgical interventions

Tumors of the temporal bone

Lateral skull base

- Lifeline for the brain.
- Exit of many cranial nerves.
- Thin boarder between endocranial and mucosal compartments.

Major pathologies:

- Infections and infammation – otitis media
- Trauma with typical fractures
- Tumors – mostly benign but with local destruction



Temporal bone fractures

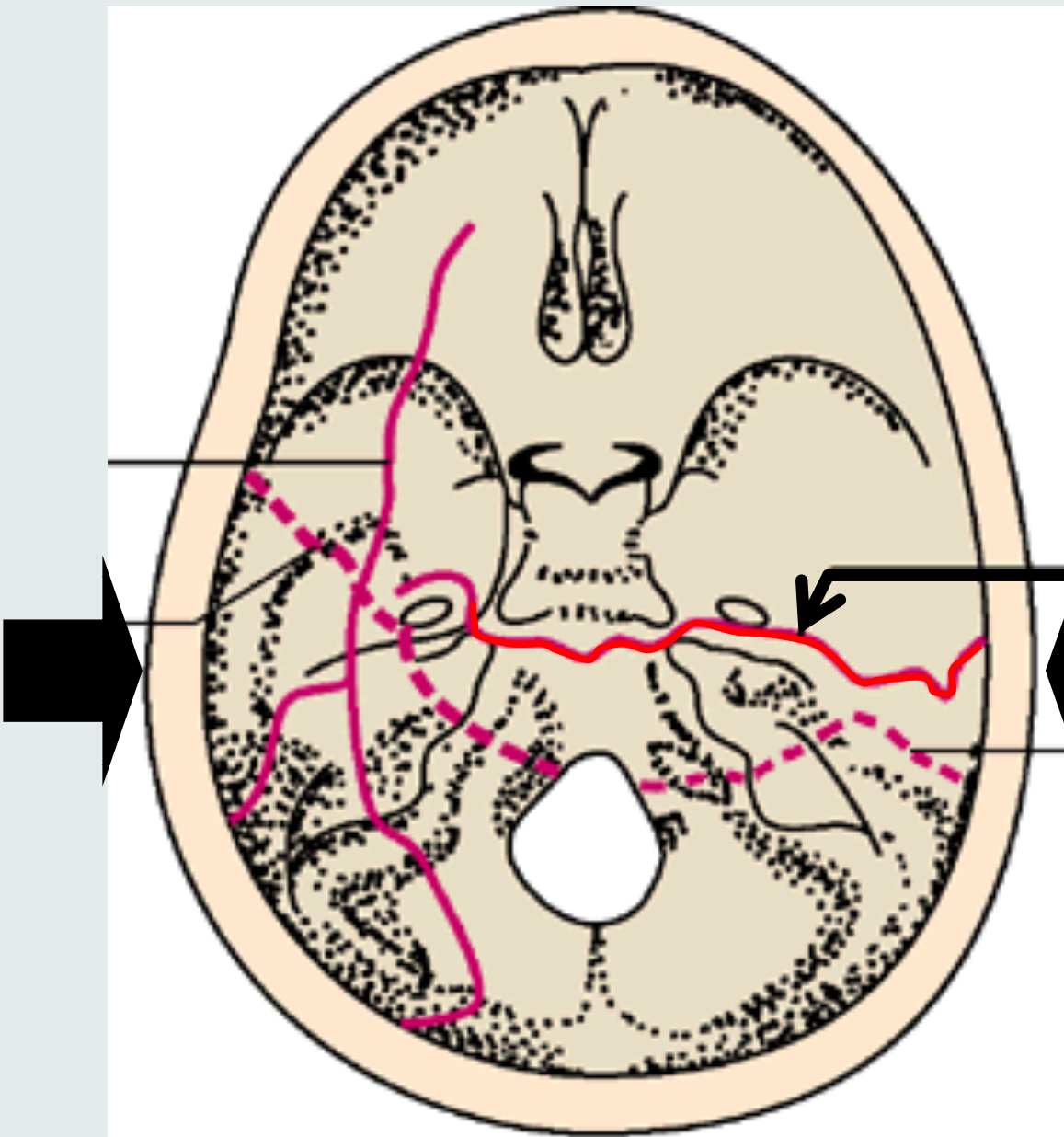
Mostly blunt trauma – “cracking”

Do not forget: trauma to the inner ear (noise, contusion)

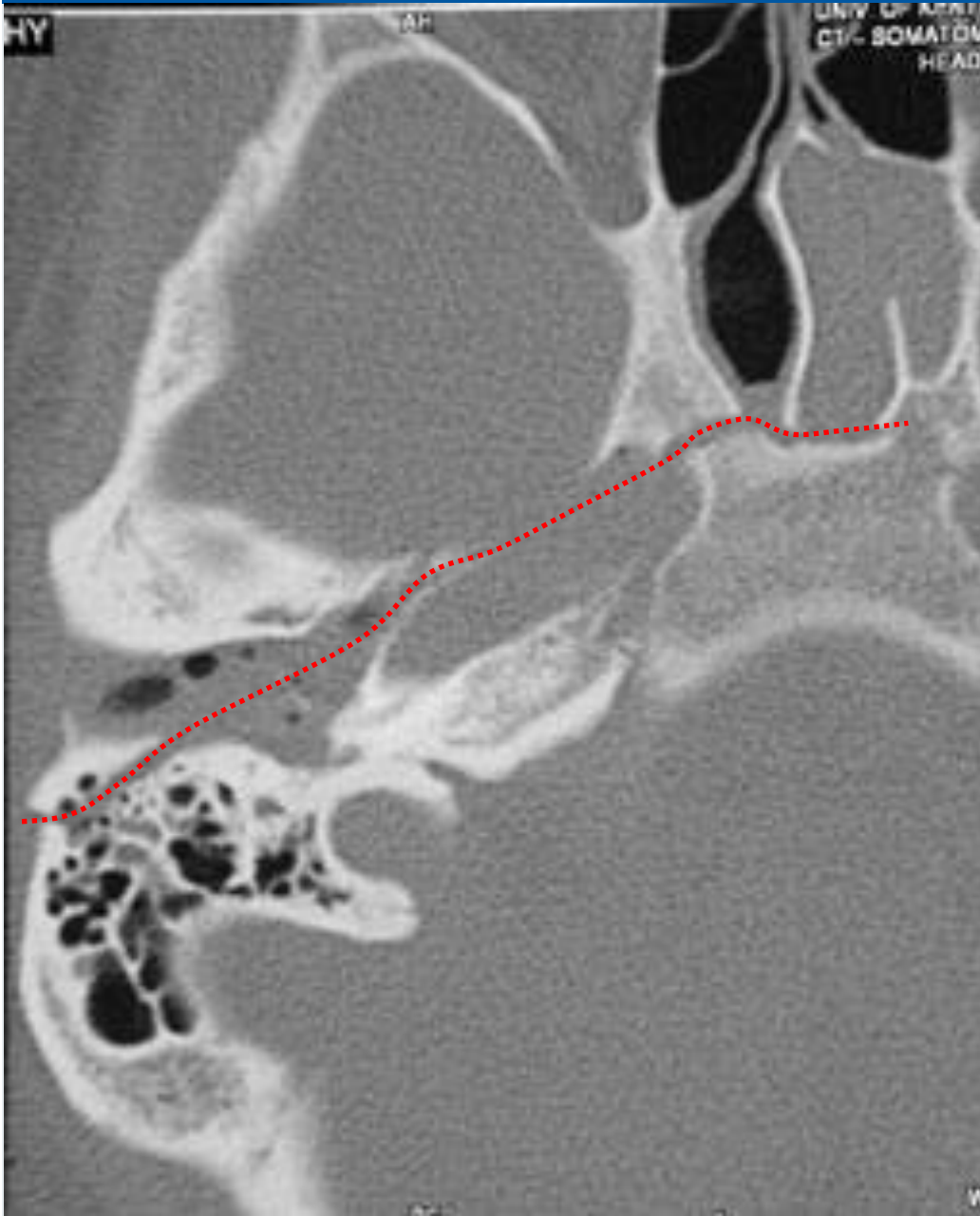
Presentations:

- Isolated fracture of the outer ear canal
- Squama-mastoid fracture (lateral)
- Longitudinal fracture of the t.b. / pyramid
- Transverse fracture of the t.b. / pyramid
- Complex fracture





longitudinal
fracture



Longitudinal fracture:

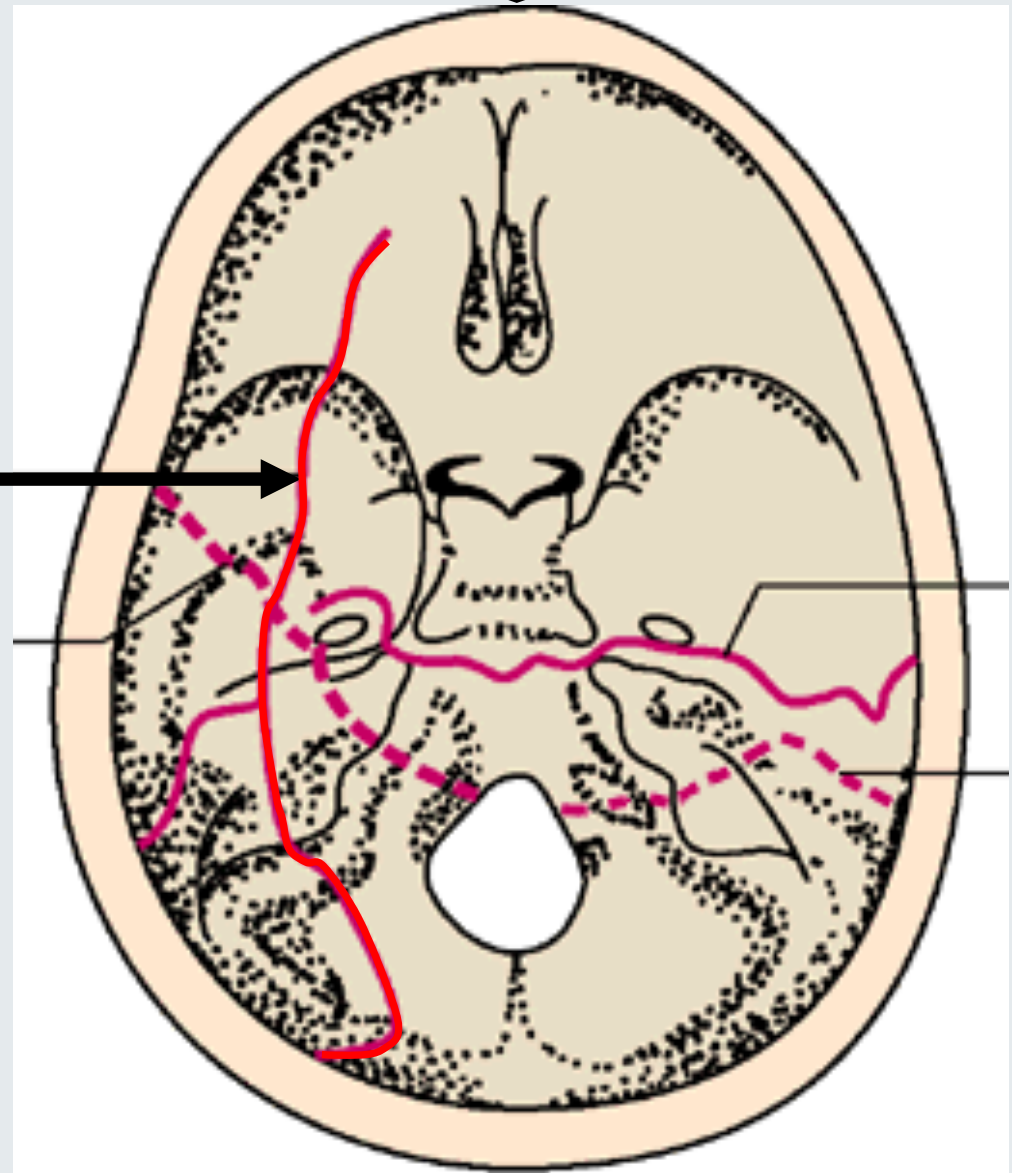
- Outer ear canal
- Tympanic space
- Carotid canal
- Sphenoid sinus

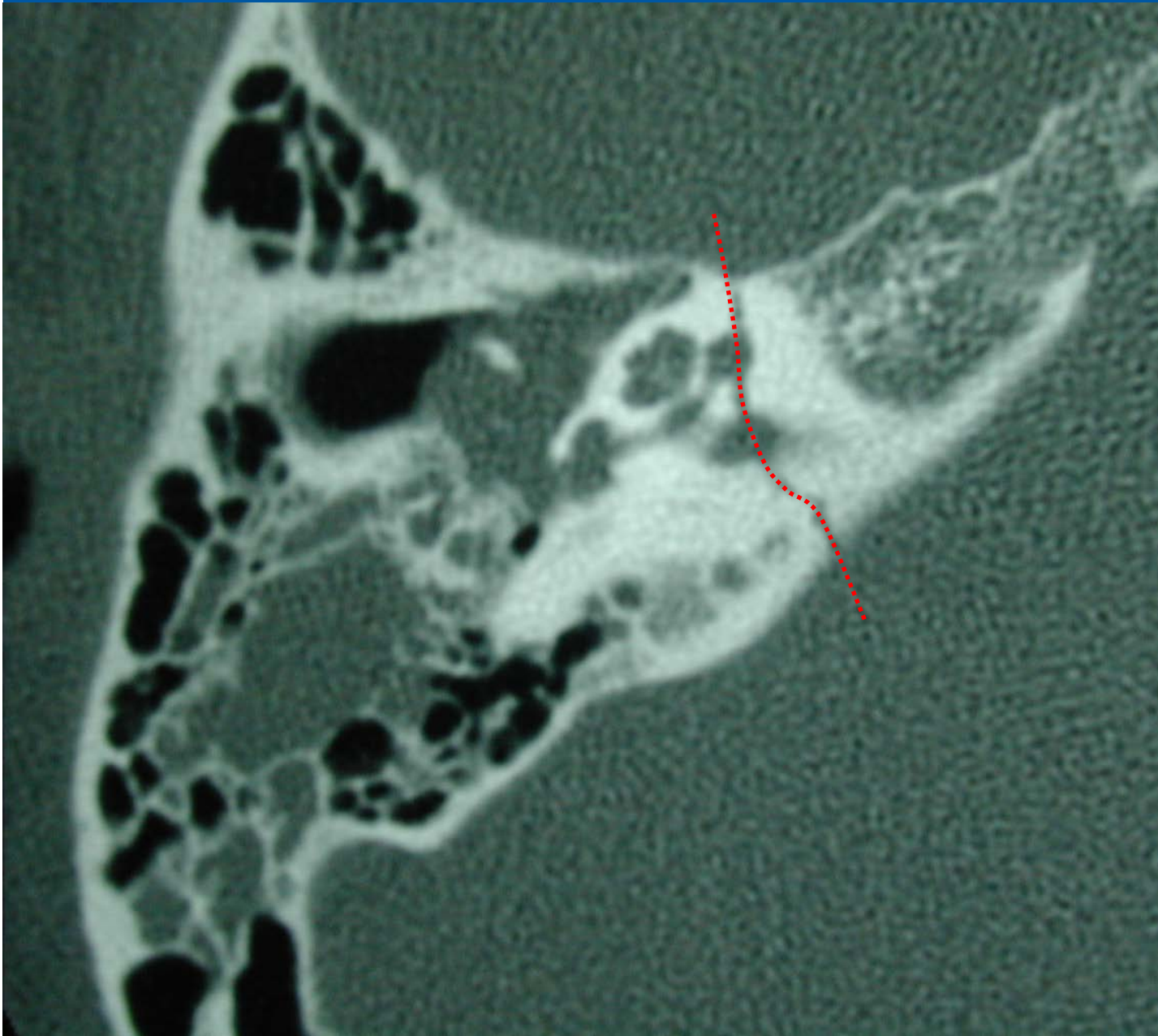
Rupture of TM

Blood / CSF:

- Outer ear canal
- Nose

transverse
fracture



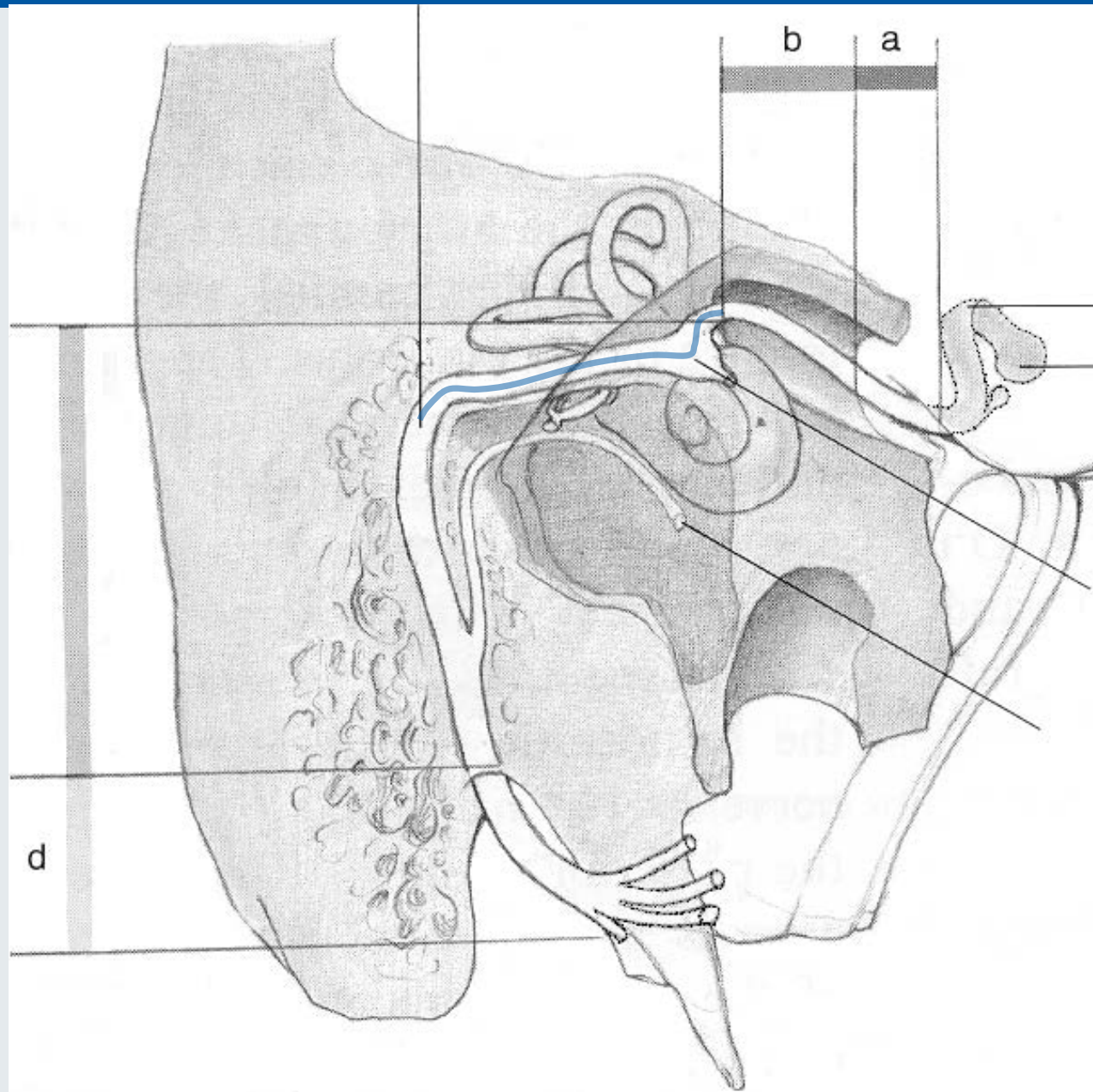


Transverse fracture:

- Labyrinth
- Meatus
- TM intact

Blood / CSF:

- Eustachian tube
- Nose

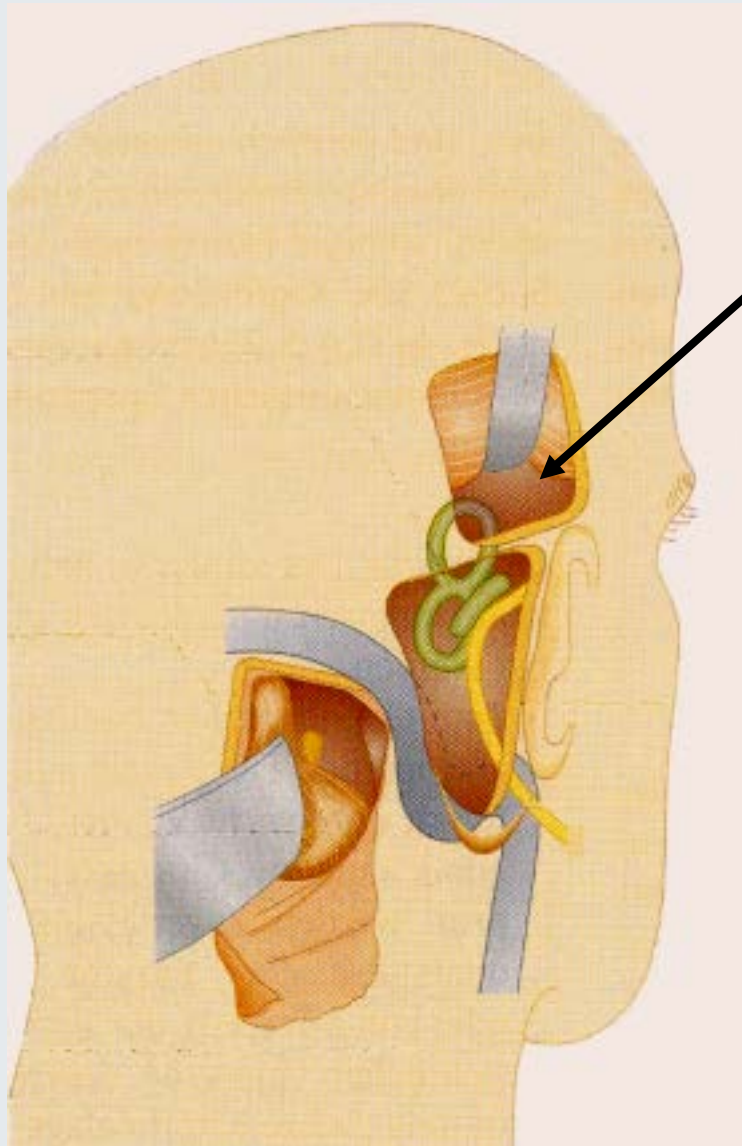


Lesion of the facial nerve:

transverse 50%

longitudinal 20%

Tympanal and
labyrinthine
segment



Transtemporal
approach

Facial Nerve – Paralysis

First major division: traumatic – non-traumatic

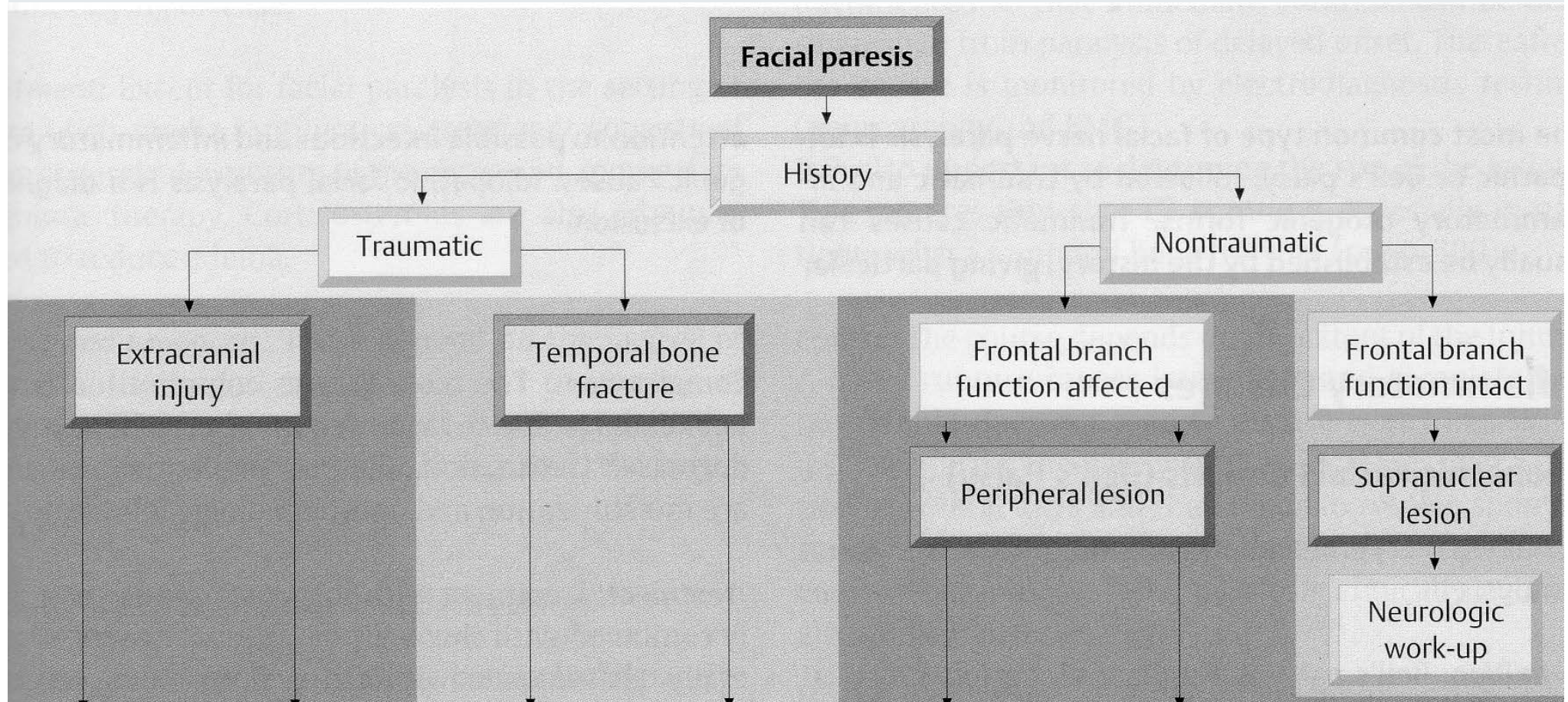
Second major division (non-t): idiopathic - symptomatic

Presentations:

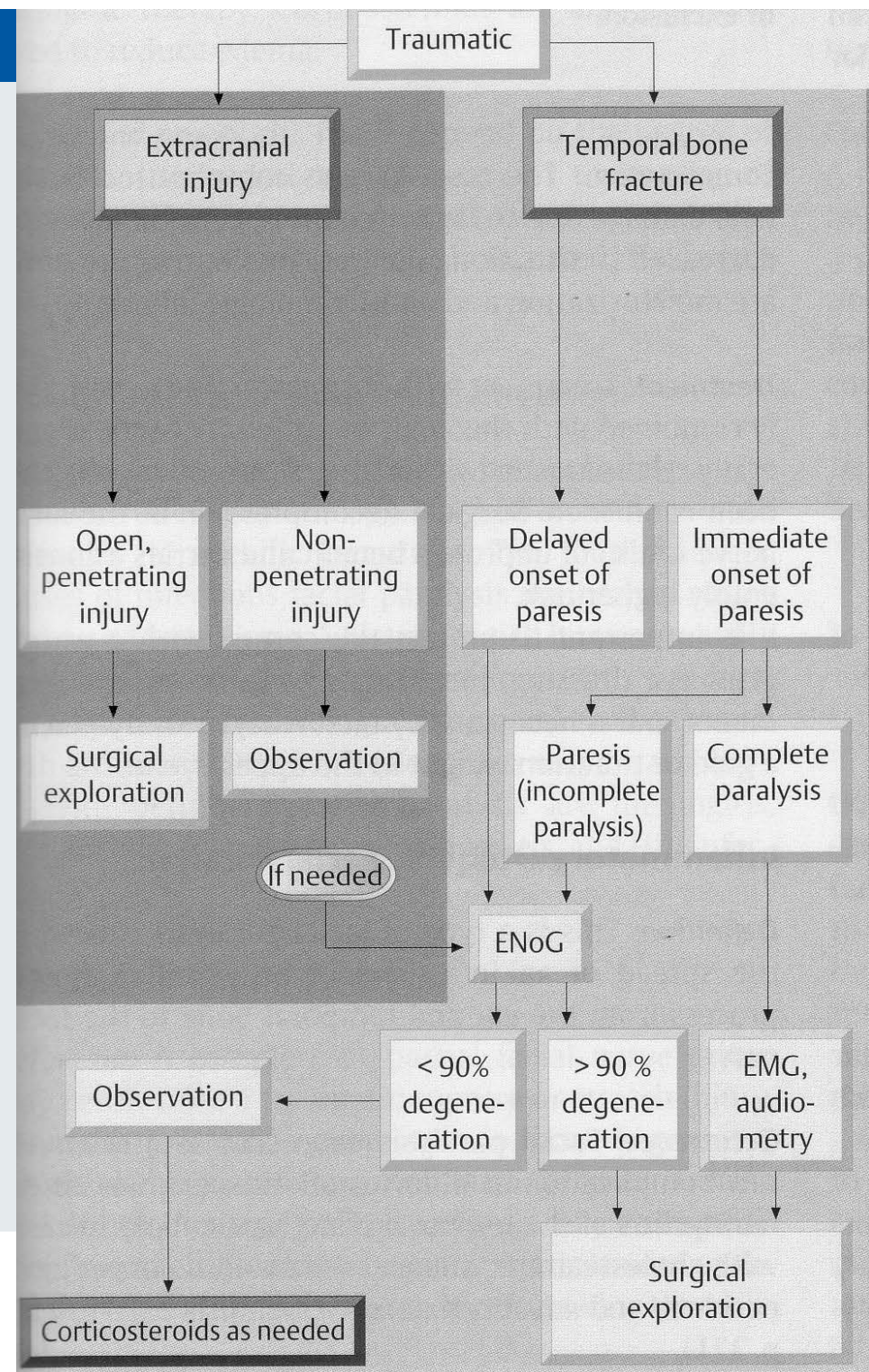
- Bells Palsy
- Herpes zoster oticus (Ramsay Hunt)
- Tumors
- Otitis-related



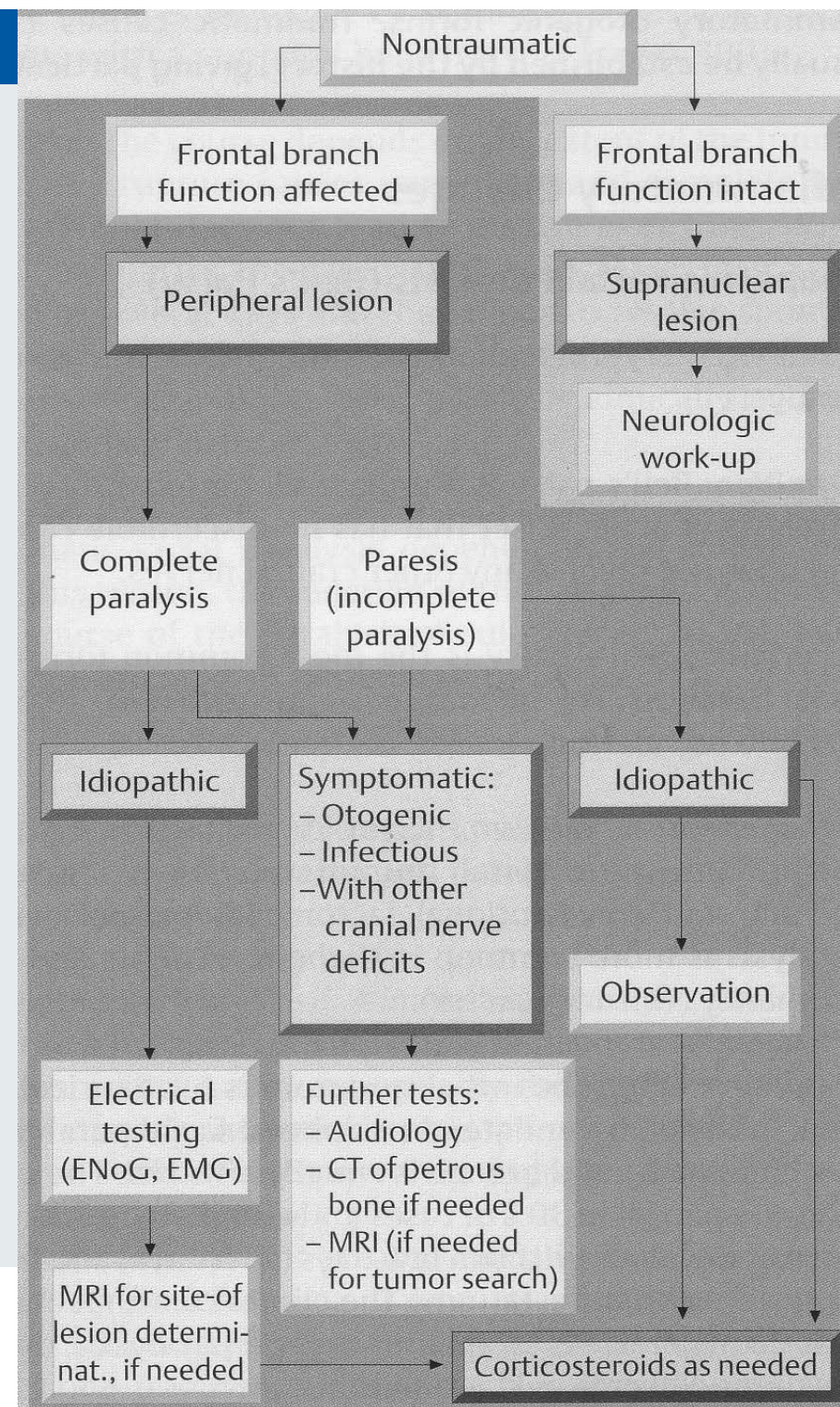
Facial Nerve – Paralysis



Facial Nerve – Paralysis Trauma



Facial Nerve – Paralysis Nontraumatic



Paraganglioma of the lateral skull base

Main forms:

- Glomus tympanicum:
 - Early symptoms – more a tumor of the middle ear than the lateral skull base
- Glomus caroticum
 - Present as cervical tumor – head&neck tumor more than lateral skull base
- Glomus jugulare
 - Late symptoms – typical lateral base tumor
- Glomus vagale

Table 1 Classification System of Temporal Bone Paragangliomas

- Class A Tumors arise along the tympanic plexus on the promontory of the middle ear. Blood supply is from the tympanic artery, a branch of the ascending pharyngeal artery. They produce minimal erosion of the promontory.
- Class B Tumors originate in the canalis tympanicus of the hypotympanum and invade the middle ear and mastoid. The carotid foramen and canal are intact. These tumors invade bone, but the cortical bone over the jugular bulb is intact. The distinction between class B tumors and a C1 tumor may be difficult.
- Class C Tumors arise in the dome of the jugular bulb and destroy the overlying cortical bone. They spread inferiorly along the jugular vein and lower cranial nerves, posteriorly into the sigmoid sinus, superiorly toward the otic capsule and IAM, laterally to the hypotympanum and middle ear, medially to the jugular foramen and CPA.
- Subclassification is made according to the degree of erosion of the carotid canal:
- C1: erode carotid foramen but do not invade the carotid artery
 - C2: destroy the vertical carotid canal between the carotid foramen and carotid bend
 - C3: grow along the horizontal portion of the carotid artery but do not reach the foramen lacerum
 - C4: grow to the foramen lacerum and along the carotid artery to the cavernous sinus
- Class D Tumors that have intracranial extension are further subclassified as follows:
- De: intracranial but extradural:
 - De 1: displace posterior fossa dura < 2 cm
 - De 2: displace posterior fossa dura > 2 cm
 - Di: intracranial with intradural extension:
 - Di 1: intradural extension < 2 cm
 - Di 2: intradural extension > 2 cm
 - Di 3: intradural extension that makes the tumor unresectable

IAM, internal auditory meatus; CPA, cerebellopontine angle.

Paraganglioma of the lateral skull base

Therapy:

- Watchful waiting:
 - Small tumors, no symptoms
- Embolisation
 - Shrink tumor and prevent further growth
- Surgery
 - Depending on tumor stage
- Radiotherapy
 - Prevent further growth

Tumors of the lateral skull base

Main tumors:

- Schwannom – Neurinom
- Paraganglioma
- Petrous bone cholesteatoma
- Endolymphatic sac tumors
- Rare tumors



Petrous bone cholesteatoma

- “Retrolabyrinthine” cholesteatoma
- Usually “congenital” cholesteatoma, but can also be acquired.
- Leading often to inner ear and facial nerve deficits.

Main forms:

- supralabyrinthine
- infralabyrinthine
- apex



Petrous bone cholesteatoma - classification

Table 1. Sanna classification of PBC

Class	Location	Spread
Class I: supralabyrinthine	geniculate ganglion of facial nerve	anterior: horizontal part of ICA posterior: posterior bony labyrinth medial: IAC, petrous apex inferior: basal turn of the cochlea
Class II: infralabyrinthine	hypotympanic and infralabyrinthine cells	anterior: ICA vertical part, petrous apex, clivus posterior: dura of the posterior cranial fossa and sigmoid sinus medial: IAC, lower clivus, occipital condyle inferior: jugular bulb, lower cranial nerves
Class III: infralabyrinthine-apical	infralabyrinthine compartment, ICA reaching up to petrous apex	anterior: ICA vertical \pm horizontal parts posterior: posterior fossa through the retrofacial air cells medial: petrous apex, clivus, sphenoid sinus, rhinopharynx inferior: jugular bulb, lower cranial nerves
Class IV: massive	entire otic capsule	anterior: ICA vertical \pm horizontal parts posterior: posterior fossa dura and IAC medial: petrous apex, superior and mid clivus, sphenoid sinus inferior: infralabyrinthine compartment
Class V: apical	petrous apex	anterior: Meckel's cave area and may involve the V nerve posterior: IAC and posterior cranial fossa medial: superior or mid clivus, sphenoid sinus inferior: infralabyrinthine compartment

Vestibular Schwannoma Epidemiology

Prevalence in autopsies: 0.8%

Prevalence in MRI: 0.07%

Incidence: 13 Cases / Mio / Year

→ CH: approx 100 new cases / year



Distribution of CPA-tumors

(N = 162)

• Vestibular Schwannoma	125	(77%)
• Meningeoma	25	(15%)
• Epidermoidcyst	4	(2%)
• Trigeminus Schwannoma	3	(2%)
• Others (Lipoma, Angioma)	5	(4%)



Treatment options of VS

- Depending on size, general condition, age, hearing function, and symptoms.
- Surgery:
 - translabyrinthine
 - transtemporal (middle fossa)
 - suboccipital / retrosigmoidal
- Radiation therapy:
 - radiosurgery (one stage procedure, Cyberknife)
 - stereotactic radiation
- Wait & Scan



Patient counseling / Risks

Hospitalisation 7 to 14 days

Unfitness for work 6-12 weeks

Medical risk:

- Dizziness (vestibular „Prehab“)
- Headache (neurology, Carbamazepin)
- Fatigue
- Facial palsy (transient palsy 20-50%)
- Hearing loss
- CSF leakage, Meningitis, Bleeding

Hearing rehabilitation

- Conventional hearing aids
- CROS hearing aids
- Bone conduction hearing aids (BAHA)
- Cochlear implant / Brainstem implant



Internal auditory meatus VS (IAM)

- IAM-tumors cause early cochleovestibular symptoms.
- Symptoms can be transient (sudden HL, “vestibular neuronitis”).
- Internal auditory meatus tumors grow significantly slower (< 0.5 mm/ year) than CPA-tumors (~ 1 -2 mm/year).
- Function improves very rarely after treatment.

Translabyrinthine Approach

Pro

- Good exposure of small intrameatal-lateral tumors
- Facial nerve can be identified easily at its distal part
- Low morbidity, less headache
- Approach can be expanded – exposure of cochlea

Contra

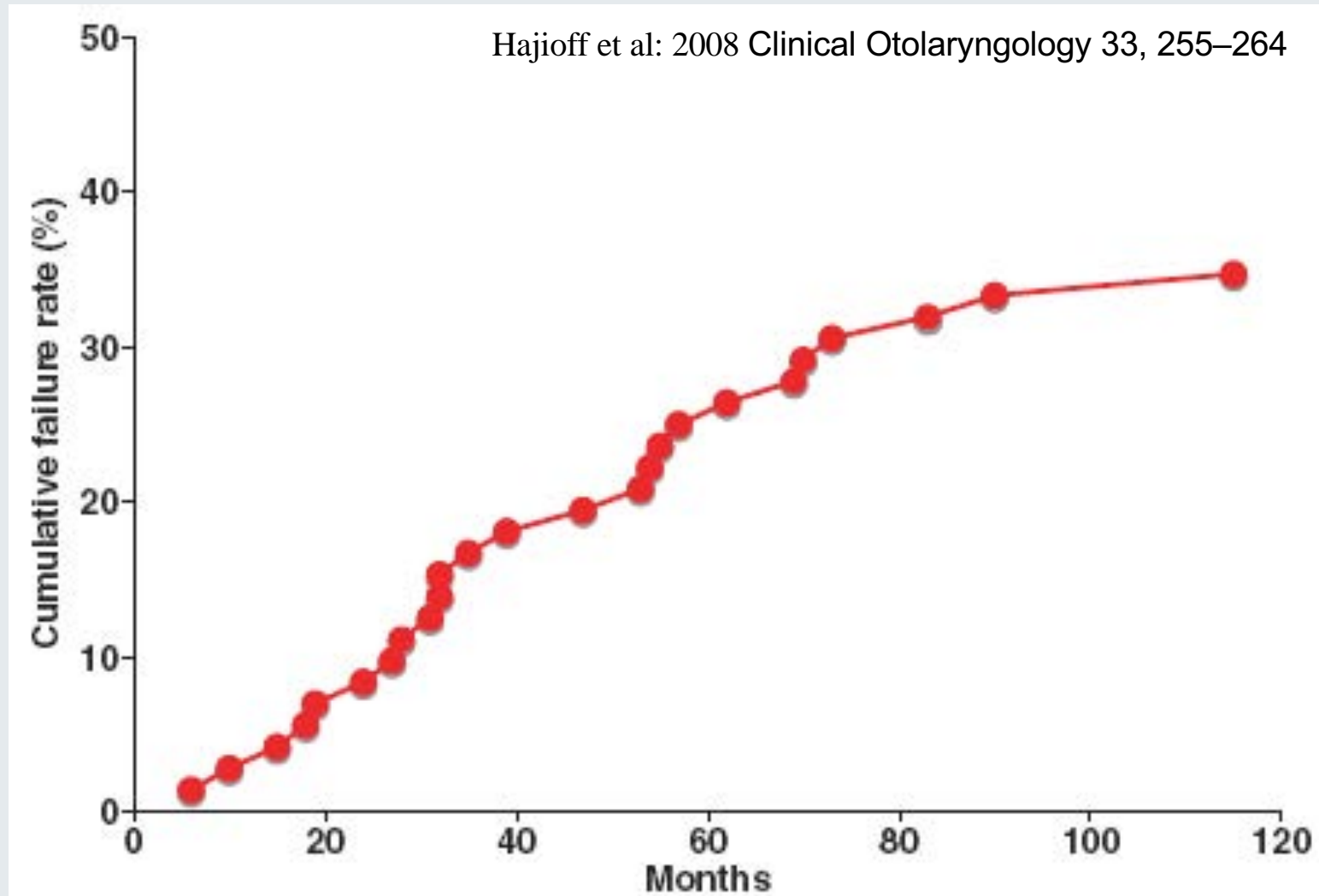
- Always total cochleo-vestibular loss
- Exposure of intracranial parts are less ideal

Cerebro-Pontine Angle VS (CPA - VS)

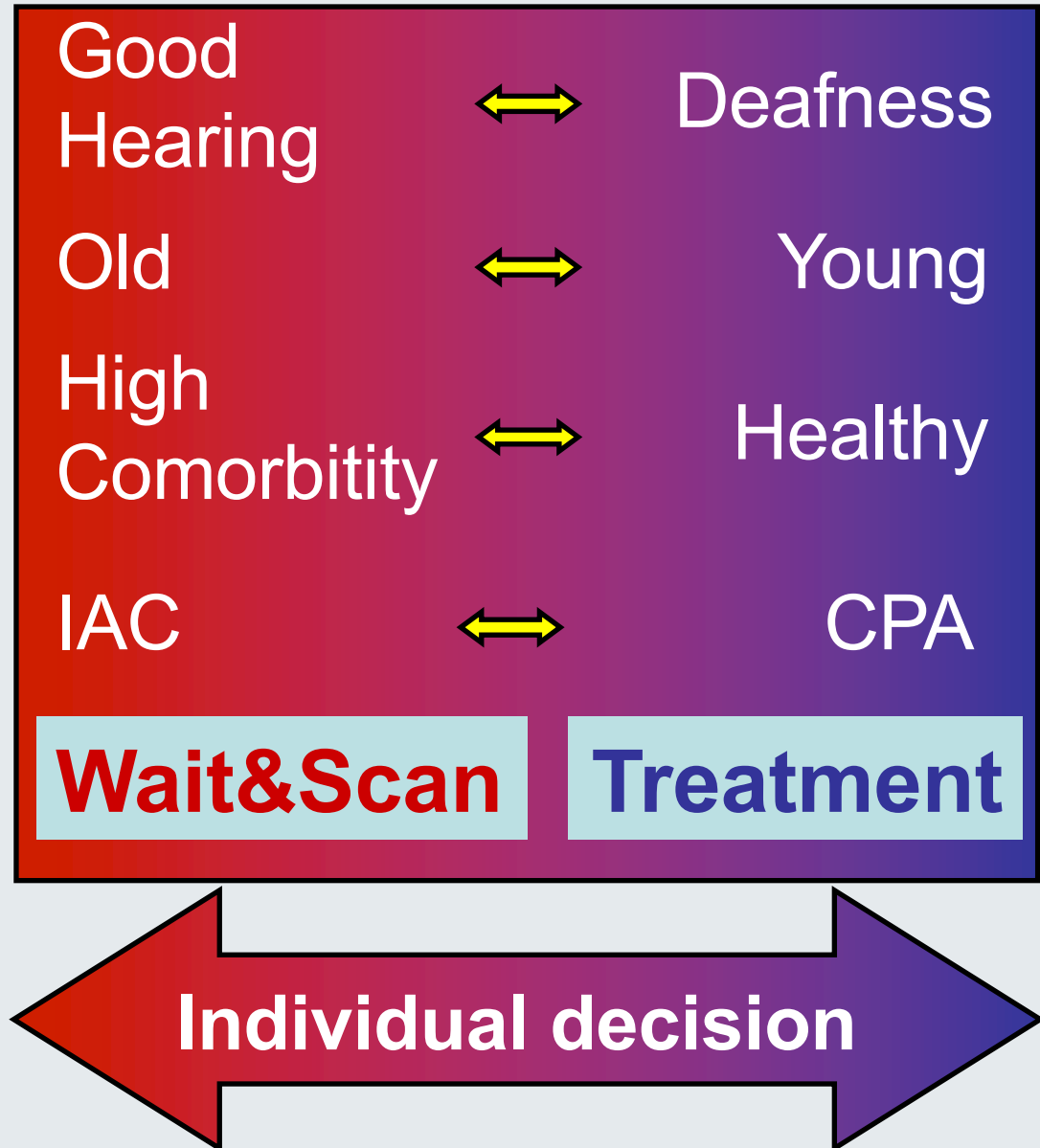
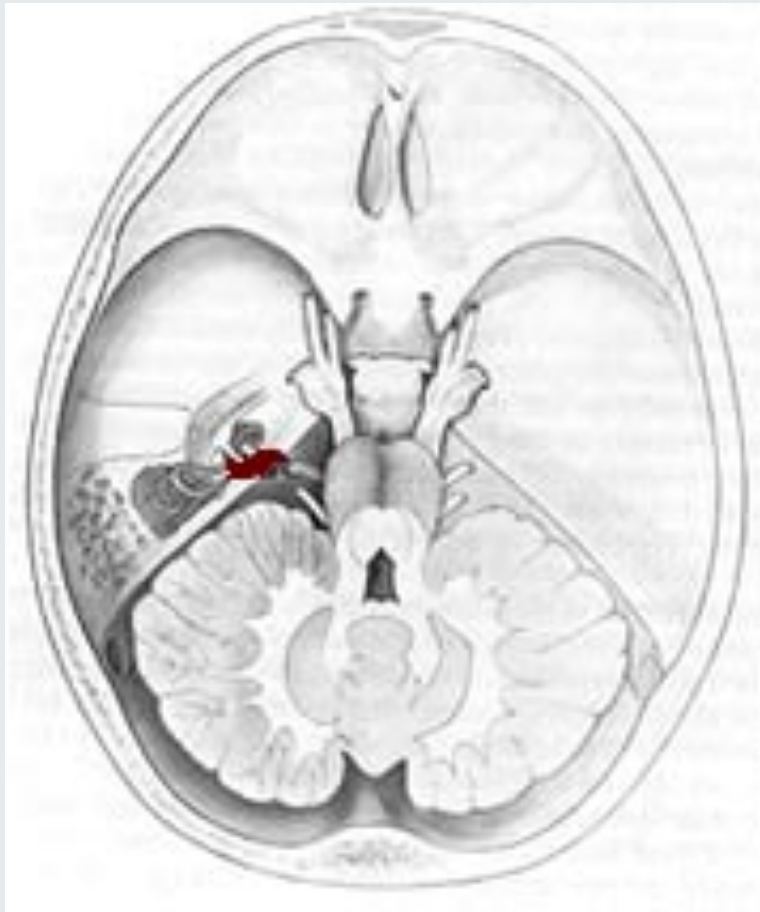
- CPA-tumors cause relatively few cochleovestibular symptoms.
- Symptoms can be transitory, the relationship to tumor growth is poor.
- CPA tumors grow faster than IAM-tumors, but also with a wide individual range.
- Small CPA-tumors can be removed with a relatively high chance of hearing preservation.



“wait & scan” – failure rates



VS – Options in small tumors



VS: tumor growth / medium size tumor

