

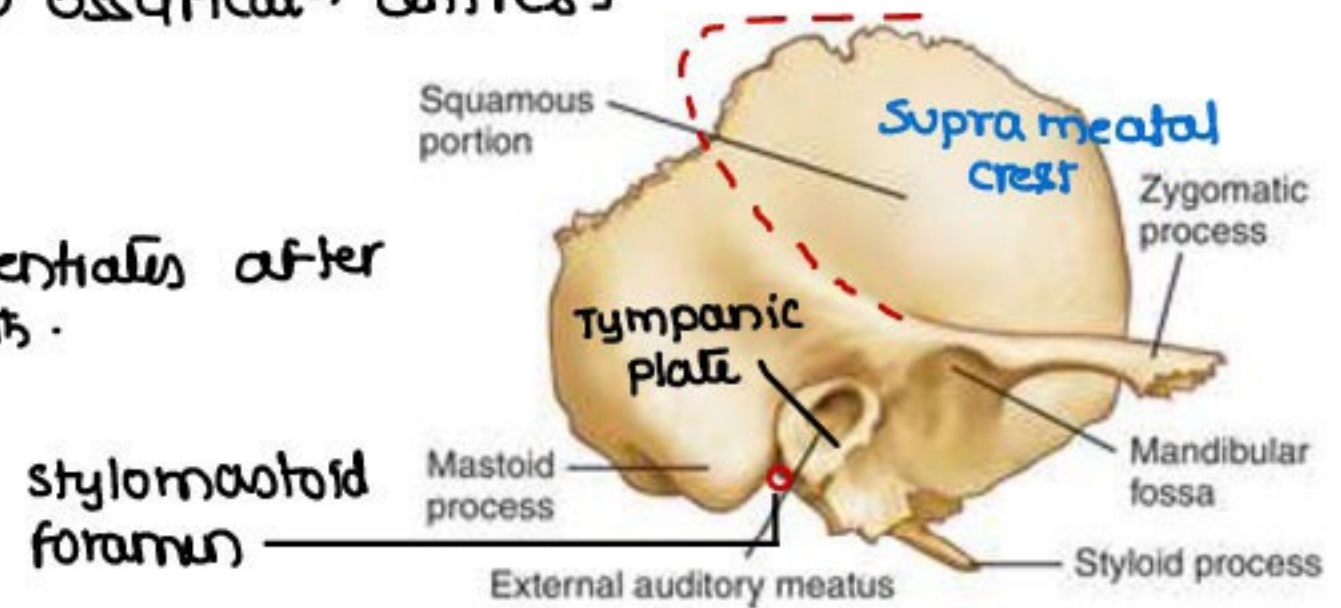
## EAR FUNDAMENTALS OF EAR

### OSTEOLOGY OF TEMPORAL BONE

→ most complex bone in the body [20 ossificat<sup>n</sup> centres]

#### Parts of Temporal Bone

1. Squamous
2. Petromastoid { Petro<sup>u</sup>s  
→ mastoid } differentiates after birth.
3. Tympanic
4. Styloid process



→ Squamous part

- covers temporal lobe
  - arises zygomatic processes
  - Suprameatal crest
- part of inferior temporal

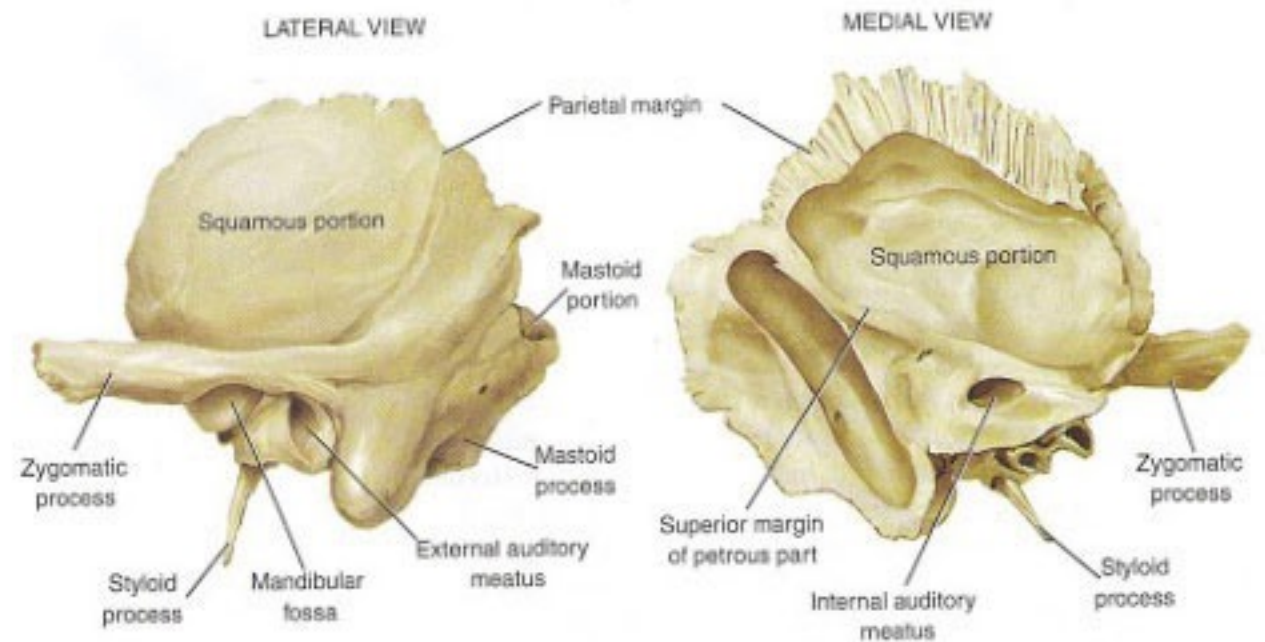


Figure 6-22. Schematic and photo of lateral and medial view of temporal bone.

→ mastoid process

- consists of mastoid air cells
  - largest → mastoid antrum
- starts developing 6 months after birth
- Tip formed by 2 yrs
- reaches adult size by 18-19 yrs
- Antrum is of adult size at the time of birth

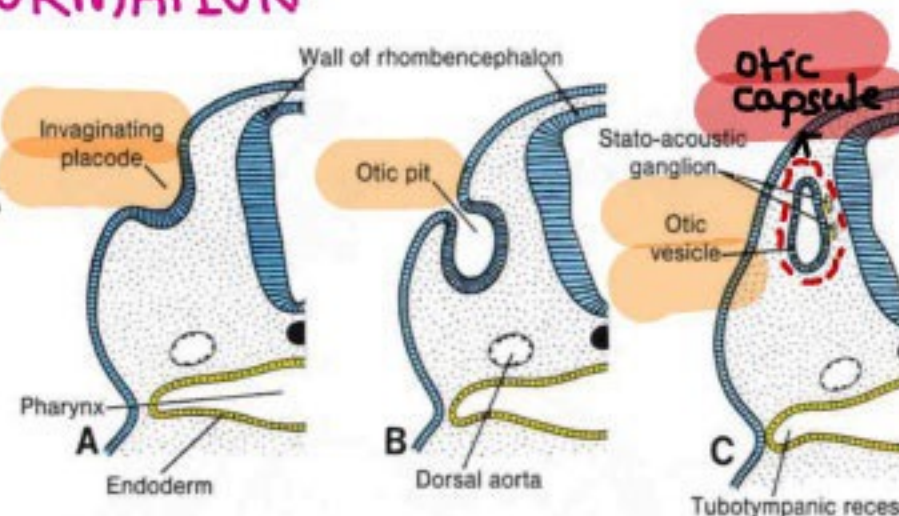
→ Petrous part

- on medial side
- consists of inner ear
- Internal Auditory canal/ IA meatus opens into posterior surface
  - 7<sup>th</sup> & 8<sup>th</sup> nerves pass through it
- most complex part of temporal bone
- densest/hardest bone in body

### EMBRYOLOGY OF INNER EAR FORMATION

→ Otic vesicle forms →  
membranous labyrinth &  
membranous cochlea

→ Otic capsule is the cartila-  
genous frame work of  
inner ear



#### Rhombencephalon stage

calcifications by  
14 ossificat<sup>n</sup> centres

↓

Inner Ear [Bony]

→ Enchondral ossificat<sup>n</sup>

→ Enchondral Bone



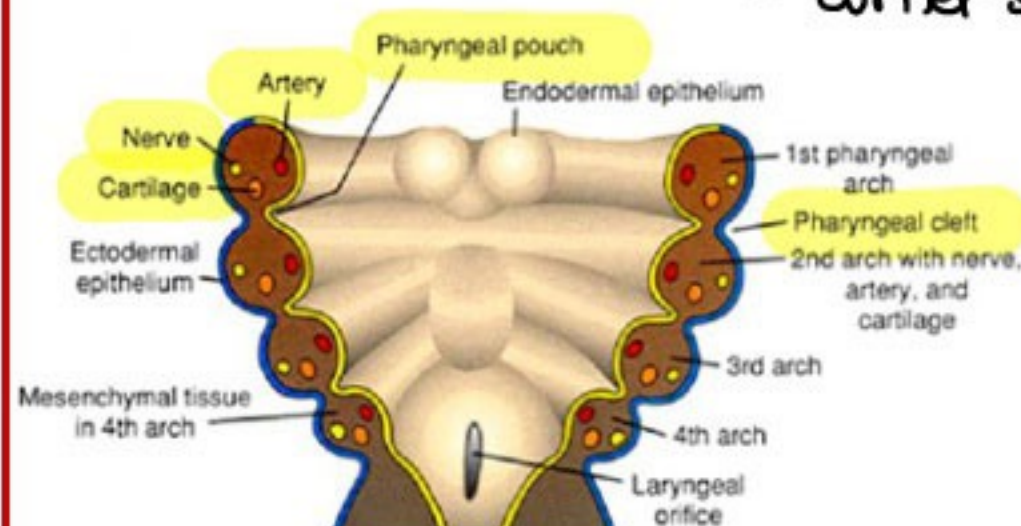
→ Stylomastoid foramen

- Facial Nerve [VII CN] comes out
- Stylomastoid Artery goes in

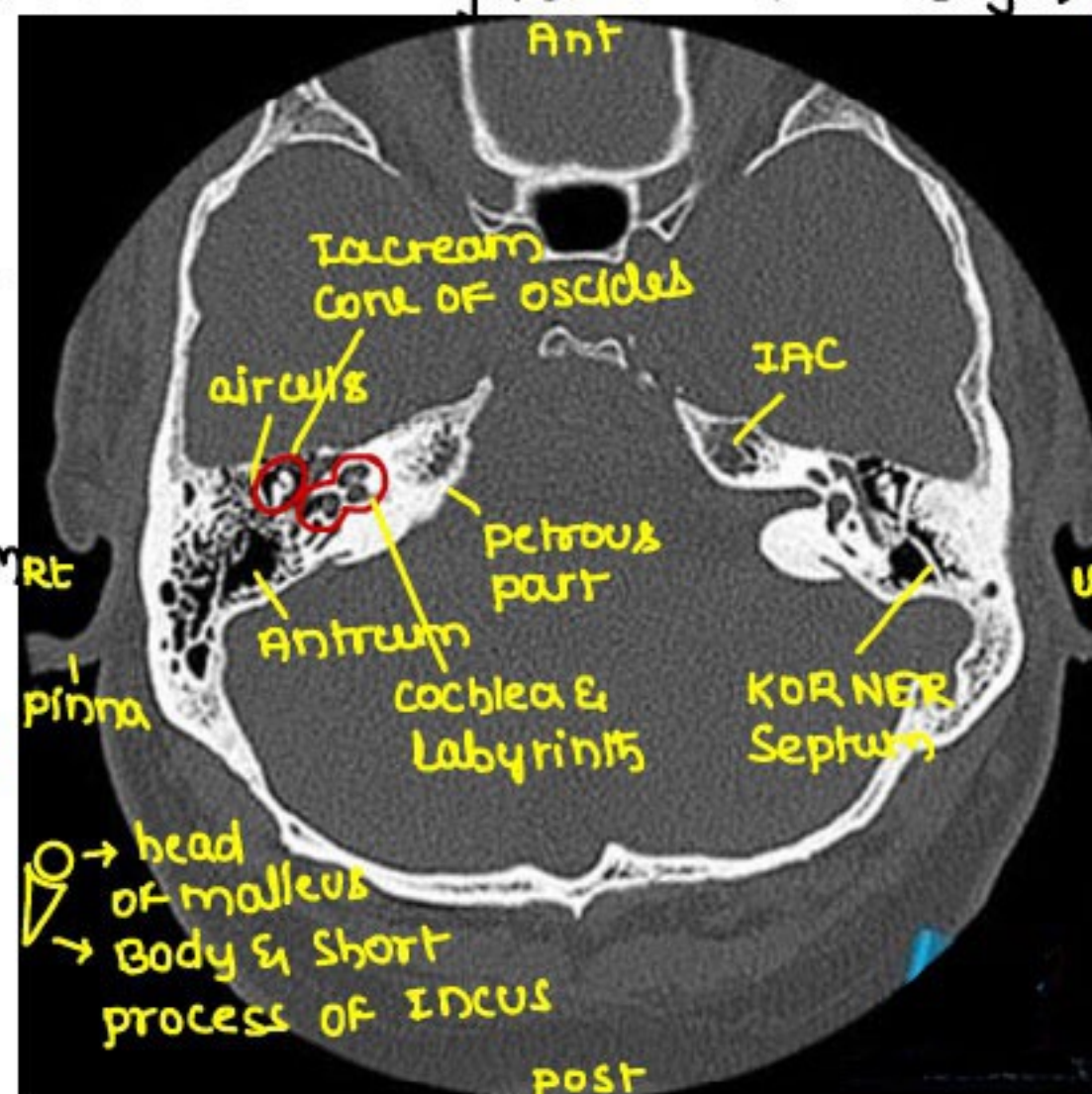
→ B/w Squamous & petrous part, Petrosquamous suture present in embryos, disappears after birth

- KORNER'S SEPTUM

- persistent petrosquamous suture
- separates superficial & deep air cells
- significant in mastoid sx
- corner septum is lateral to antrum



## PHARYNGEAL / BRANCHIAL ARCHES

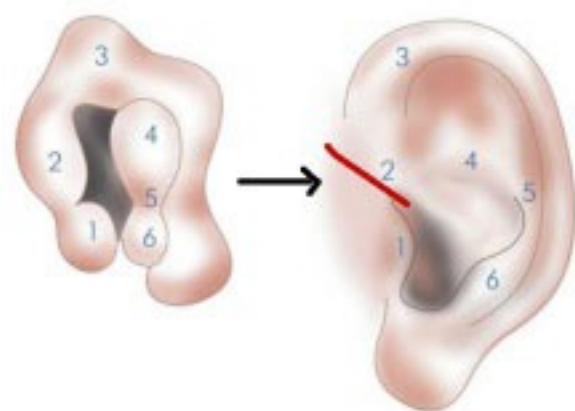


→ 5 on each side [1,2,3,4,6]

→ all 3 germ layers are present

→ own blood & nerve supply and forms its own musculo cartilagenous structure

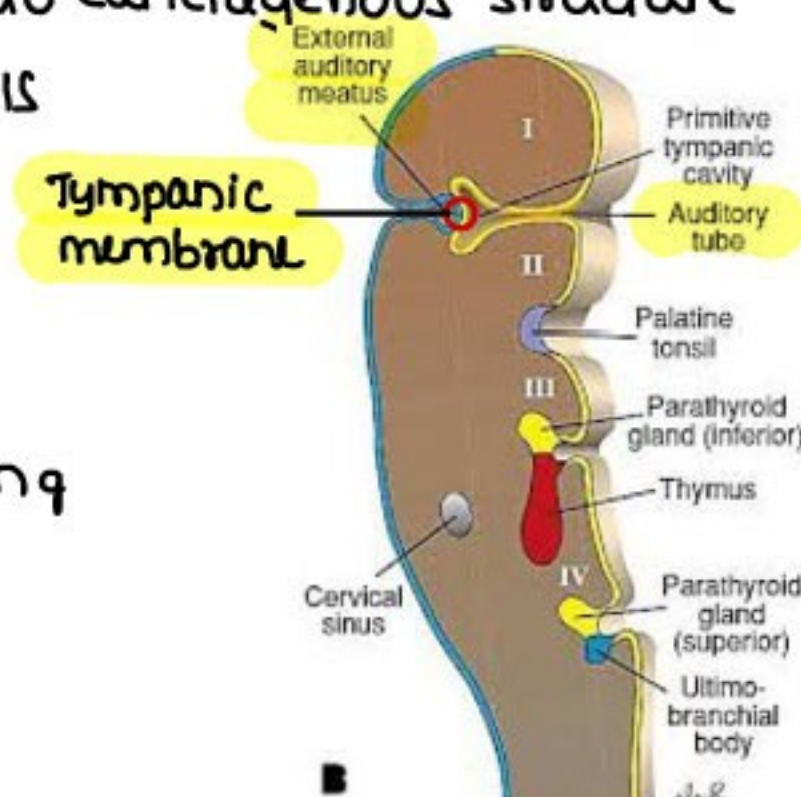
→ around the EAC, the 1st & 2nd arch forms → HILLOCKS OF HIS



- 1st Hillock forms from 1st arch. Remaining Hillocks form from 2nd.

- 1st hillock forms tragus

- incisura terminalis → line separating from 1st hillock to 2nd hillock



## EMBRYOLOGY





## ANATOMY OF EXTERNAL EAR

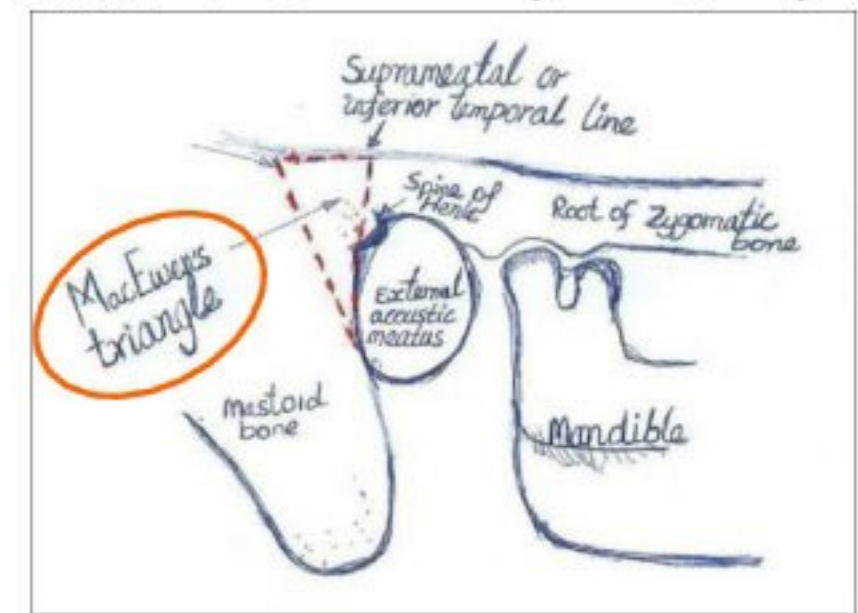
### PINNA

- Forms from single piece of yellow elastic cartilage except at lobule
  - never ossifies
  - also seen in tip of nose & epiglottis
- Incisura Terminalis
  - place of fusion of 1st & 2nd hillock
  - Endaural approach done by giving LEMPERT'S incision here
    - [ Postaural approach by William Wilde's approach behind pinna
    - Trans canal approach / permeal approach / endomeatal approach by Rosen's incision ]
- Cymba concha is the anatomical landmark of mastoid antrum [surface landmark]
- Sx landmark of mastoid antrum
 

1. Suprameatal crest / inferior temporal line
  2. Posterior superior wall of EAC
  3. Tangent b/w above ②

}

  - antrum is 1.25 - 1.5 cm deep to MacEwan's Ale



### EXTERNAL AUDITORY CANAL

- 24 mm in length [ lat. 1/3rd - cartilaginous ; inner 2/3rd [16mm] - Bony ]
- Isthmus - narrowest point
  - 6 mm lateral to Tympanic membrane
- Cartilaginous part has sweat glands, sebaceous, Ceruminous glands & hairs
  - Ceruminous glands → modified sweat glands



- All secretory glands in the body is supplied by Parasympathetic System except sweat-glands [ by Sympathetic system ]



- ceruminous glands secrete cerumen  
wax is formed by mixture of all secretions + dead epithelial cells & hairs

## TYMPANIC MEMBRANE

### → Trimeric structures

- Epithelial layer from ectoderm
- Fibrous layer from mesoderm
- mucosal layer from endoderm

### → Pearly gray / translucent gray in colour

### → fibrous layer is scanty & unorganised in pars flaccida

### → fibrous layer forms annulus tympanicum

- attaches the TM to bony EAC [Bony annulus]
- is fibrocartilaginous in nature

- NOTCH OF RIVINUS → deficiency in bone annulus superiorly covered by P. flaccida

### → attached at an angle of $55^\circ$ to antero inferior wall of EAC

- at birth TM is almost horizontal
- at 4 yrs of age it attains  $55^\circ$  to antero inferior [floor] wall of EAC
- AI wall is longest wall of EAC
- Postero superior is shortest wall

### - FB in EAC Removal

#### 1. Probing

#### 2. Microforceps

#### 3. Syringing

- water at  $37^\circ\text{C}$
- postero superior direction
- C/I
  1. FB beyond isthmus
  2. Acute infection of ext & middle ear
  3. Big impacted FB
  4. Vegetative FB

#### 4. Micro Suction

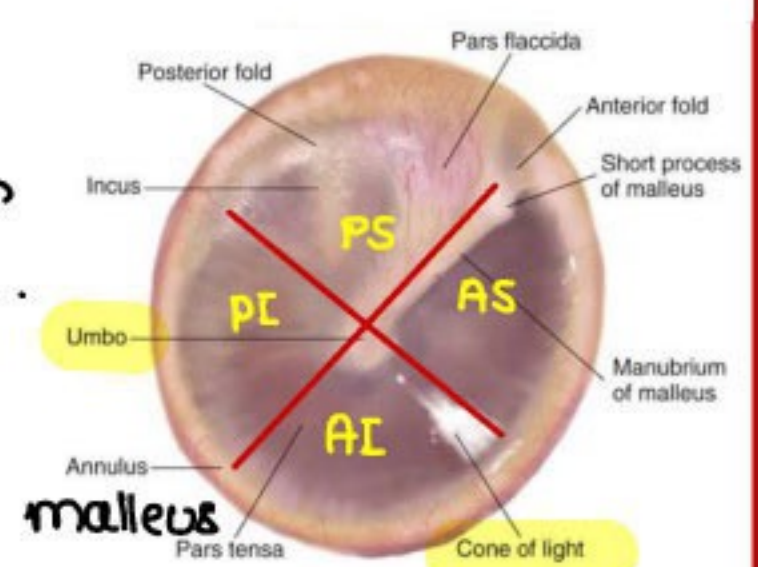
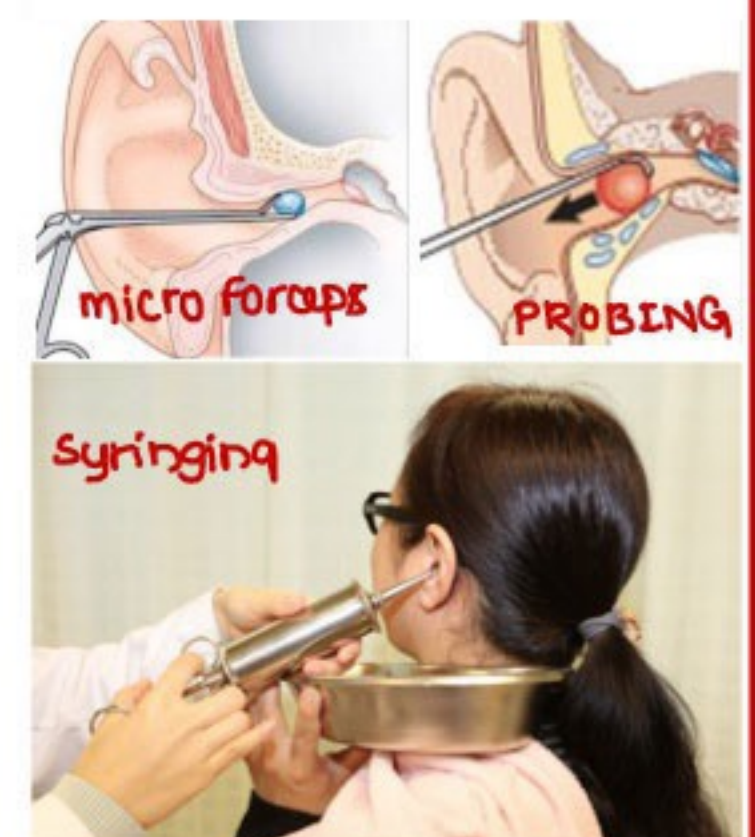
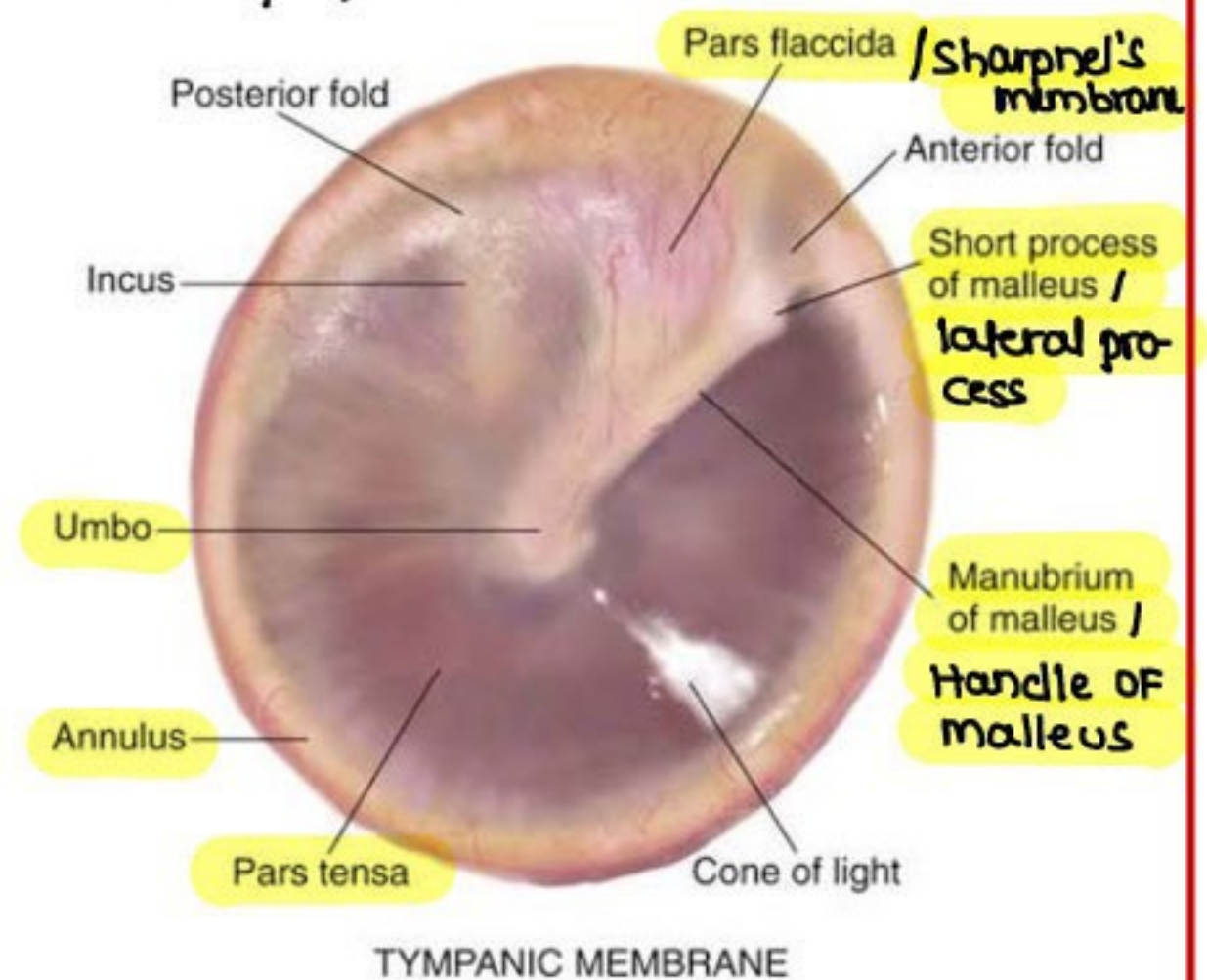
- Best way of FB removal
- creates -ive pressure, minimum damage

### - Removal of Live Insects

- Lukewarm Oil

### → UMBO

- most visible anatomical landmark of tympanic mem
- divides TM into 4 regions
- most mobile part of malleus → UMBO
  - not a reliable landmark
- most reliable landmark of TM → lateral process of malleus

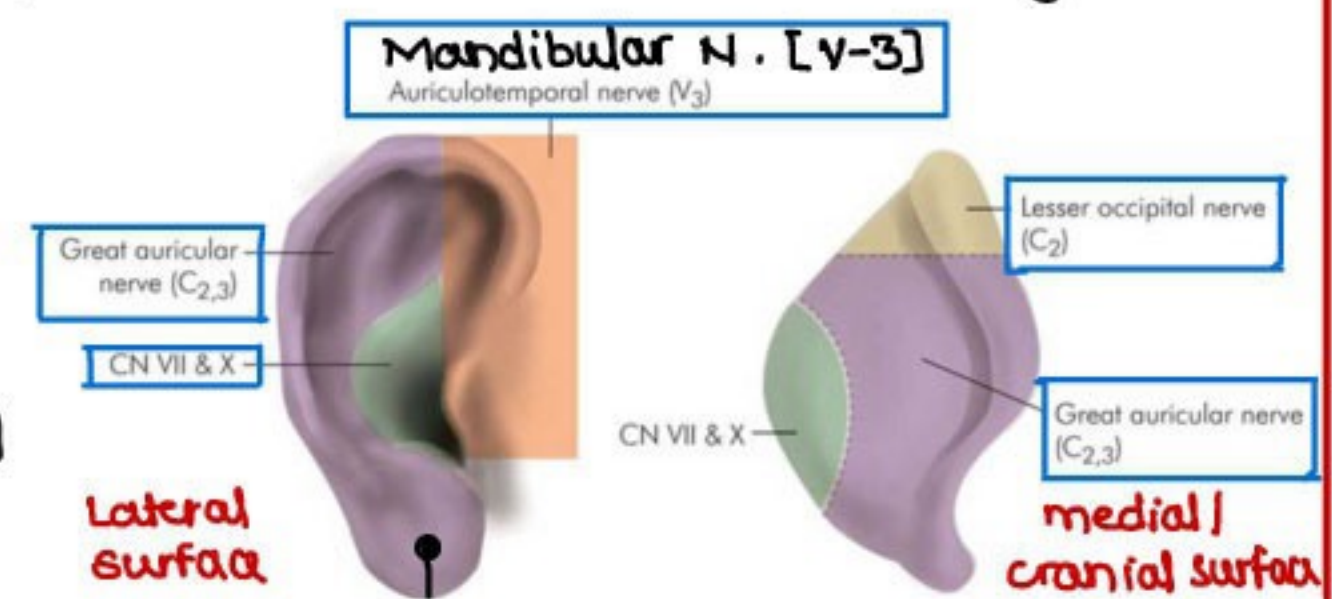




- CONE OF LIGHT - in antero inferior quadrant of pars tensa
  - b/c pull of handle of malleus, AL quadrant becomes flat → cone of light

## NERVE SUPPLY OF PINNA

- SPLIT LOBULE d/t Ear piercing
  - R by Lobuloplasty
    - Greater Auricular N. block is used

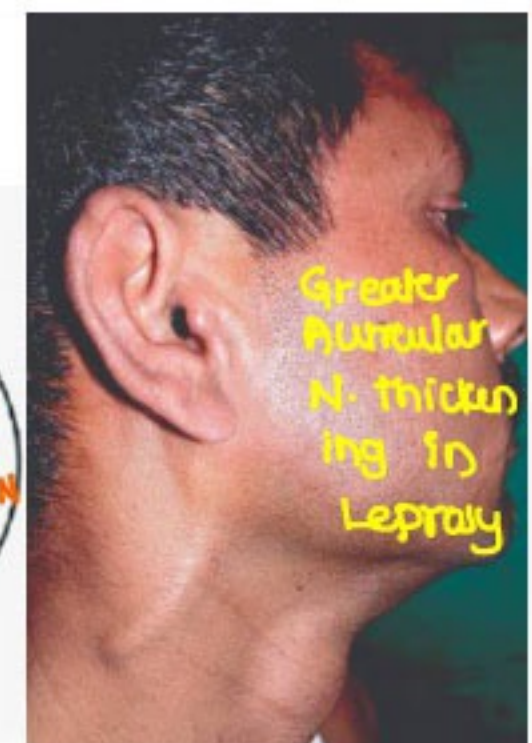


## RHYTIDECTOMY

- Removal of Rhytids [facial wrinkles]
- incisions done behind pinna & mastoid
- mc nerve involved → Greater Auricular Nerve
- mc motor nerve involved → zygomatic br. of facial N.

## Nerve Supply of EAC

- cough reflex is d/t internal laryngeal N. [br. of vagus]
- cough's reflex during syringing is d/t Arnold's Nerve



- HITZELBERGER SIGN - loss of sensory sensat<sup>n</sup> in postero superior quadrant
  - Seen in Vestibular Schwannoma

## NERVE SUPPLY OF TYMPANIC MEMBRANE

### Lateral Aspect

- Anterior half → Auriculo temporal N
- posterior half → Arnold's Nerve

### Medial Aspect

- Jacobson's N [br. of IX CN]
  - sensory supply of middle ear also



## DISEASES OF EXTERNAL EAR

### CONGENITAL DISORDERS

#### ANOTIA / MICROTLA

- Anotia → Absent pinna → Rx - Pinnaplasty  
 Microtia → Small pinna → Rx - Pinnaplasty



ANOTIA

- Pinnaplasty  
 - Done by rib/costal cartilage  
 - Rib cartilage develops by 4-5 yrs  
 - pinnaplasty done at 5-7 yrs



MICROTIA

#### EAC Atresia

- Defect of 1st cleft  
 → Rx → canaloplasty

#### EAC Atresia

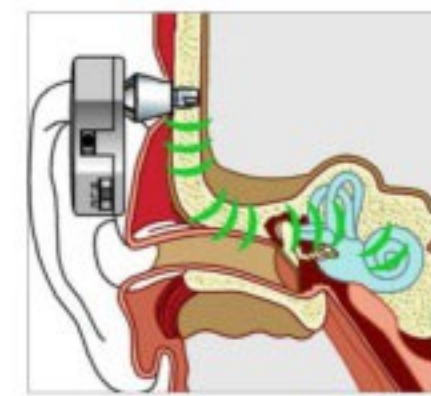


- U/L EAC Atresia + Anotia  
 Rx → Pinnaplasty [first] → canaloplasty

- B/L EAC Atresia + Anotia  
 Rx →

BAHA [Bone Anchored Hearing Aid]

- Titanium screw has osseointegration property
- Requires 2.5 - 3 mm bone thickness achieved around 5 yrs of age  
 FDA norms → can't implant < 5 yrs  
 NHA norms → allow after 3 yrs after doing CT scan [2.5mm ⊕]



BAHA



titanium screw



BAHA



Before prescribed age, we can Rx [ SOFT BAND HEARING AID



SOFT BAND HEARING AID

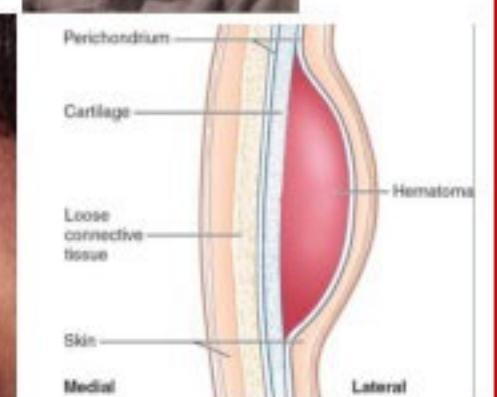
#### TRAUMA

#### PINNA HEMATOMA [ CAULIFLOWER EAR] [BOXER'S EAR]

- d/t blunt trauma to pinna  
 → collect<sup>n</sup> of blood b/w cartilage & perichondrium  
 → Rx → Needle Aspirat<sup>n</sup> → Fib → Pressure dressing



cauliflower Ear



#### PERICHONDRIITIS OF PINNA

- mc causative organism → pseudomonas  
 → Rx  
 1. Ciprofloxacin [ Antibiotic of choice]  
 2. Analgesics  
 3. I & D [Incision & Drainage]



Perichondritis of the Ear



## ACUTE OTITIS EXTERNA / TROPICAL / SWIMMER'S EAR

- Acute infect<sup>n</sup> of EAC
- Types
  - Localised / furunculosis
  - Diffuse
- Localised / furunculosis
  - Staph. aureus infect<sup>n</sup> of hair follicles → furuncle
  - Localised to outer 1/3rd
  - Obliteration of post aural groove [furuncle on posterior wall]
- Diffuse
  - mc causative organism → Pseudomonas
  - Severe pain / excruciating pain
  - Tragal Sign → POSITIVE
    - Patient moves away when pressure is applied on tragus
  - Present both in localised & Diffuse otitis externa
- Rx
  - Antibiotics
  - Analgesics
  - 10% Ichthymol glycerine packing
    - Ichthymol → local anesthetic
    - Glycerine → hygroscopic
- more common in Hot & humid (Tropical) climate.

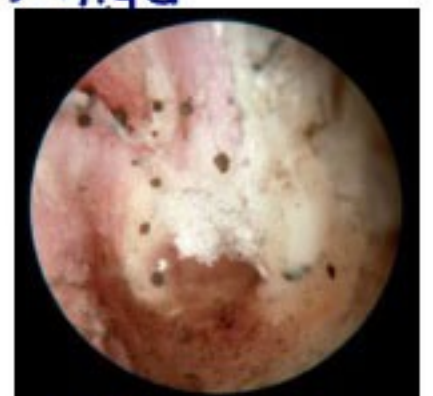


## OTOMYCOSIS / SINGAPORE EAR

- fungal Infect<sup>n</sup> of EAC
- causative Organism
  - Aspergillus niger (mc) - forms black colonies
  - Aspergillus fumigatus - forms green colonies
  - Candida albicans - forms white cottony colonies
- Severe itching + nt  
↓ hearing  
Discharge, mild pain
- O/E → wet bloating paper / wet news paper appearance of tympanic membrane
- Rx → Aural Toilet by micro suction
  - Topical antifungal ear drops x 4 wks
  - Keratinolytic agents → Salicylic / Acetic Acid
  - Gentian violet → Prevent biofilm format<sup>n</sup>
  - SODIUM BICARBONATE DROPS NOT USED



A. niger



A. fumigatus

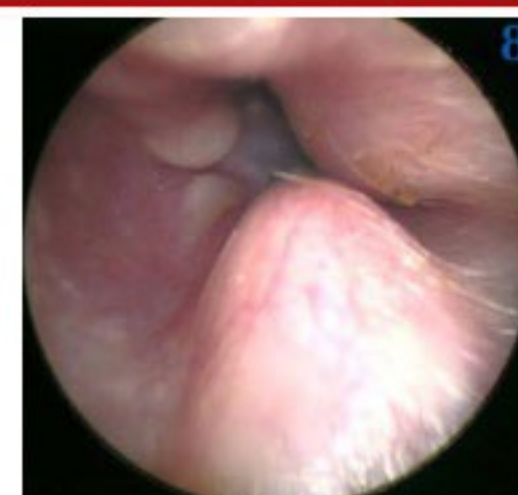


Candida albicans



## EXOSTOSIS [SURFER'S EAR]

- Benign growth of bony EAC
- found mainly in surfers
- Broad based, multiple growths
- way of body defence mechanism



SURFER'S EAR

## MYRINGITIS BULLOSA HAEMORRHAGICA [Bullous Myringitis]

- format<sup>n</sup> of bleeding blebs on tympanic membrane
- Blood mixed discharge + nt
- Painful
- ↓ hearing
- caused by Pneumococcus [strep. pneumoniae]
- Rx
  - Topical Antibiotics
  - Topical steroids



BULLOUS MYRINGITIS

## MALIGNANT OTITIS EXTERNA / ACUTE NECROTISING OTITIS EXTERNA

- Malignant → misnomer [mitotic figures are not high]
- Rapidly spreading Pseudomonas infect<sup>n</sup> in a immunocompromised patient
- Clf

Pain

Greenish Black discharge

Lateral skull base osteomyelitis

- multiple CN palsies [mc → facial N. Palsy]
- spread to skull bone through
  - in cartilage via fissures of Santorini
  - in bony EAC via foramen of Huchka [closes by 4yrs of age]
- in floor → cause Parotiditis in < 4yrs of age
- confirmed by BONE SCAN [Tc-99m] [Diagnostic Ioc] - Specific



MOE

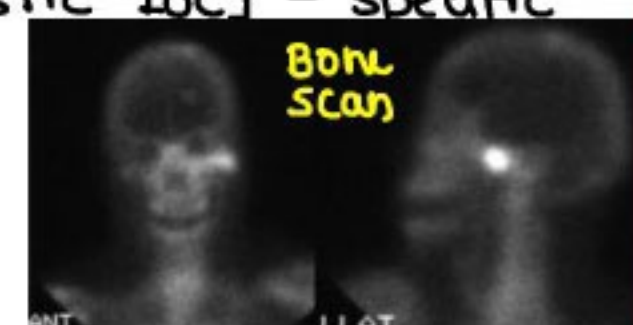
→ Rx

Anti Pseudomonal IV antibiotics

1. ceftazidime
2. cefoperazone + Sulbactam
3. Piperacillin + Tazobactam
4. Carbapenem → Imepenum, Meropenem

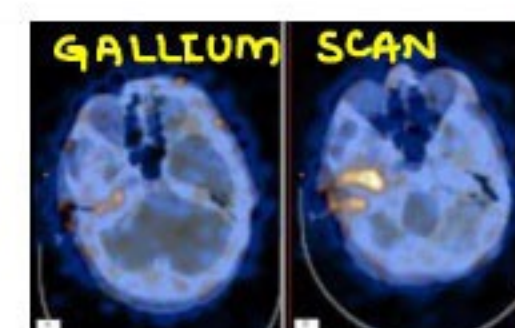
} 3rd Gen  
Cephalosporins

→ Any of 2 from above + IV ciprofloxacin x 6wks  
[preferably from diff. groups]



Bone Scan

→ After 6wks, check ESR → (N) → Discharge + Tab. Cipro [Double dose]  
Gallium Scan [Ga-67] [prognostic Ioc] - non specific



GALLIUM SCAN

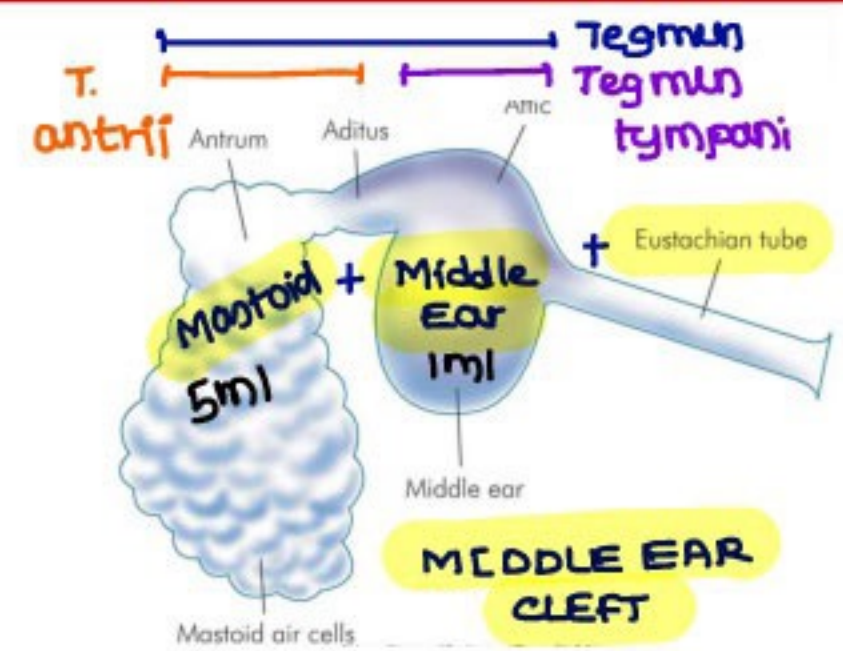
1000 mg BD



## ANATOMY OF MIDDLE EAR

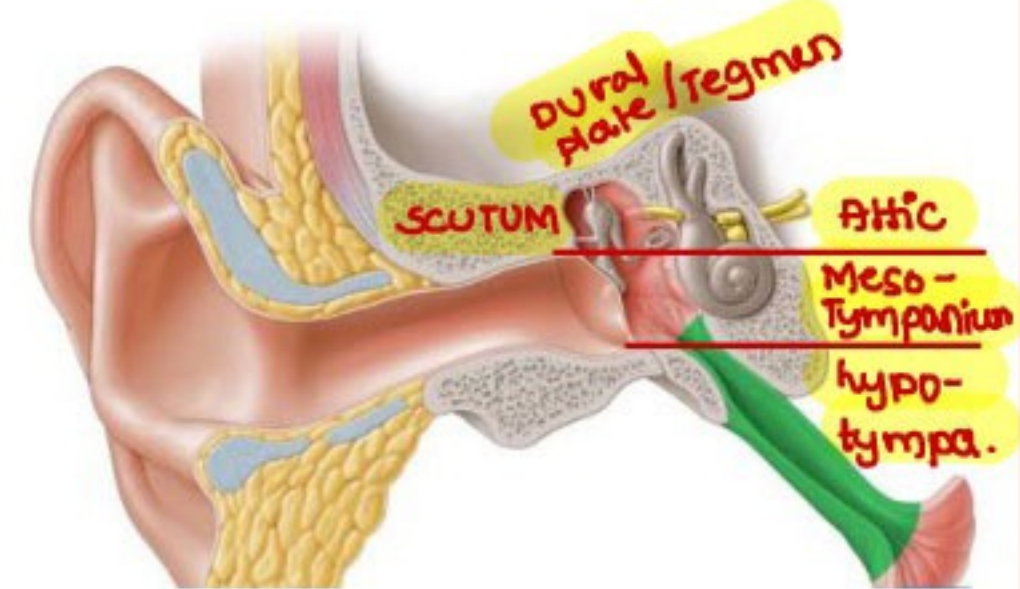
### MIDDLE EAR CLEFT

- Mastoid + Middle Ear + Eustachian tube
- volume → 5ml [mastoid] + 1ml [ME] → 6ml



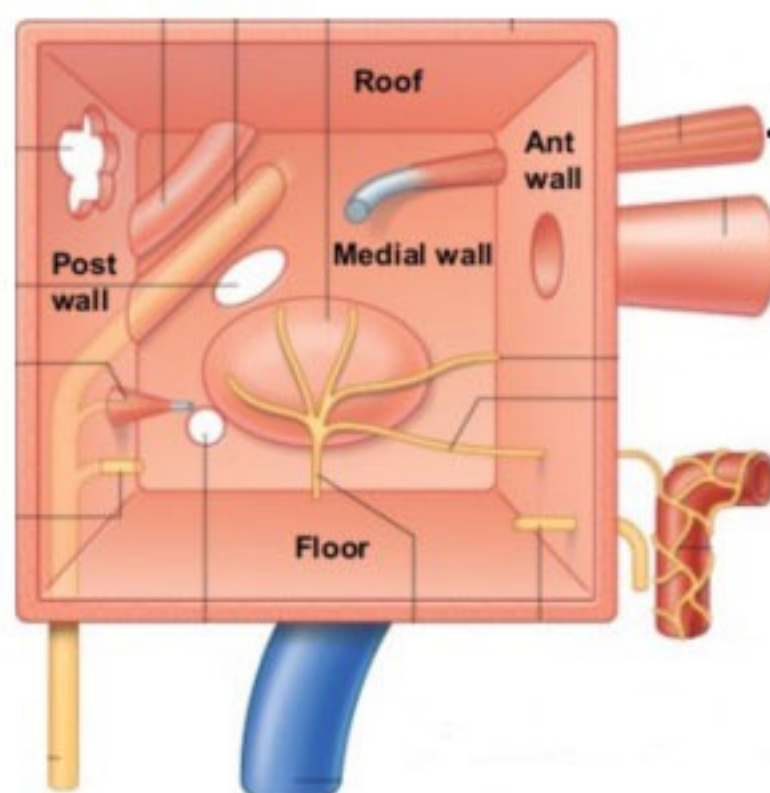
### MIDDLE EAR

- **Lateral wall** formed by Tympanic Membrane
- Tympanic membrane divides ME into
  - 1 Epitympanum / Attic
  - 2 Mesotympanum
  - 3 hypotympanum
- Bony lateral wall of attic → SCUTUM
  - Ero<sup>n</sup> of scutum is characteristic CT scan finding of cholesteatoma



- **ROOF** separates ME from middle cranial fossa
- Bony part above the Antrum & ME → TEGMEN / DURAL PLATE
  - part above the ME → T. tympani
  - part above the antrum → T. antri
- Aditus connects ME / Attic to antrum
- **ARCuate EMINENCE**
  - Bulge in tegmen dlt superior semicircular canal

- **Anterior wall** has 2 Openings for



1. Tensor tympani
2. Eustachian tube / Auditory tube

- **Eustachian tube / Auditory tube / Pharyngo tympanic tube**

Develops from 1st pouch

connects the Ant. wall of ME to lateral wall of Nasopharynx

36 mm length

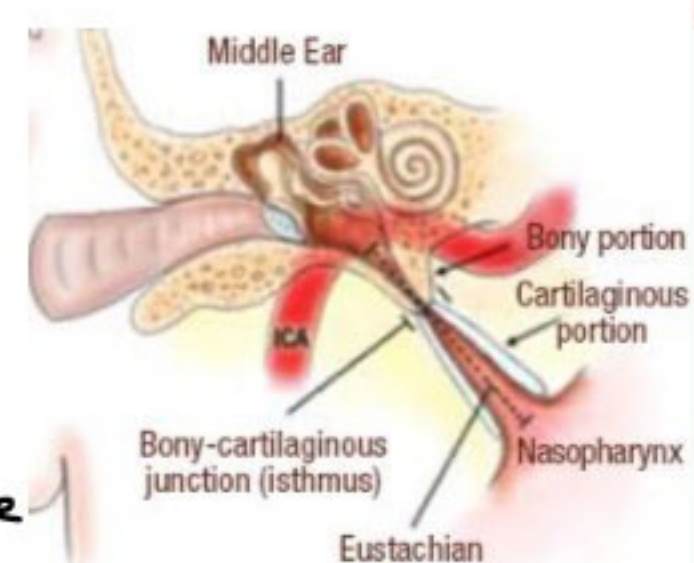
lateral 1/3 rd is bony

medial 2/3 rd is cartilaginous

Isthmus → narrowest part of ET

lies at bony cartilaginous junction

- functions →
1. maintains the middle ear air pressure
  2. Drains the secretions of ME





- Generally ET is closed by OSTMANN'S PAD OF FAT
  - During swallowing / yawning, it opens b/c of medial fibres of TENSOR VELI PALATINI [Dilator tubae]
- ET is at an angle of  $45^\circ$  to the horizontal line in adults  
at time of birth  $\rightarrow$  almost horizontal & 16-18mm in length

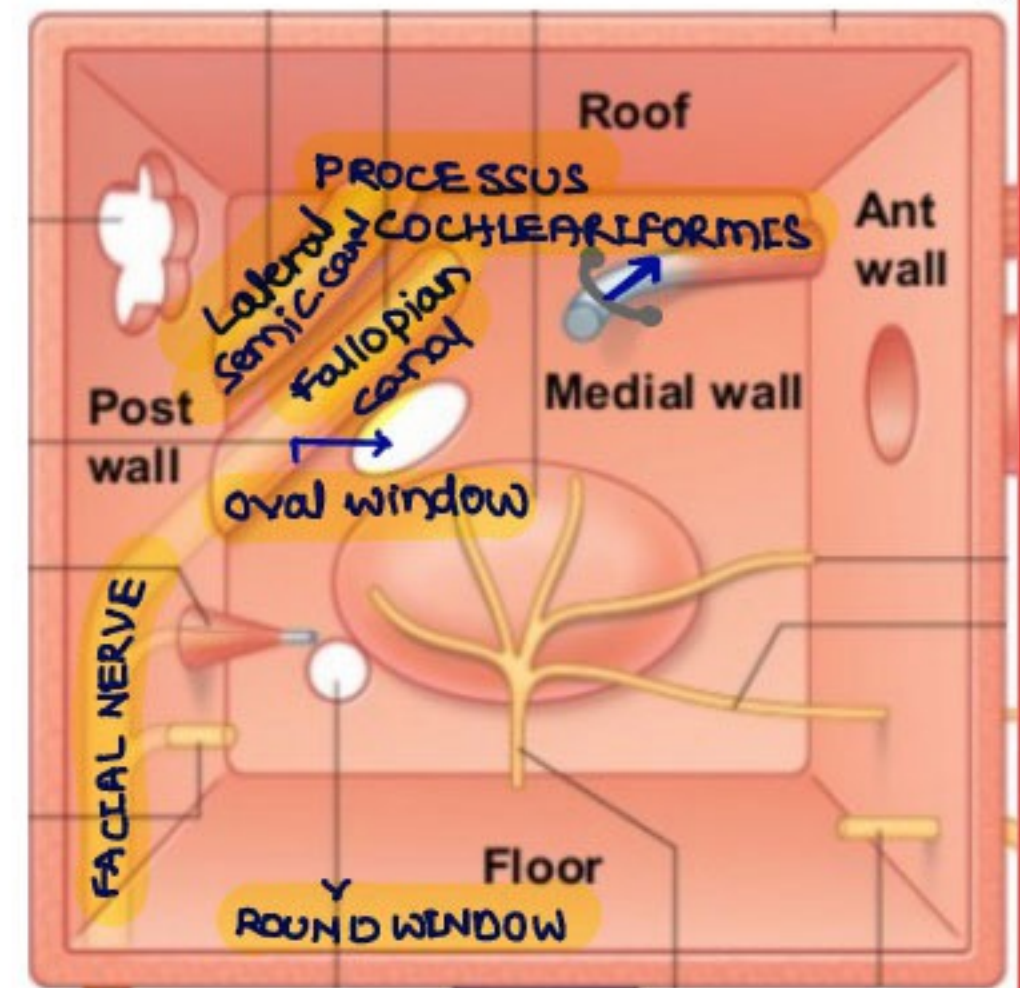
$\rightarrow$  **Medial wall** has 2 windows

1. oval window | fenestra vestibuli
2. Round window | fenestra cochlear

$\rightarrow$  Oval window is covered by foot plate of Stapes  
Round window by Secondary tympanic membrane

$\rightarrow$  Processus cochleariformis

- Tensor tympani hooks around processus cochleariformis & comes out & attaches to the handle of malleus
- Tensor tympani & Tensor veli palatini  
both supplied by Mandibular Nerve [Br. of Trigeminal Nerve]



$\rightarrow$  Horizontal | Tympanic segment of facial nerve present in fallopian canal [intra temporal part] [bony canal]

Fallopian canal is the longest canal for any cranial Nerve  
length  $\rightarrow$  27mm

above it dome of lateral semicircular canal is present

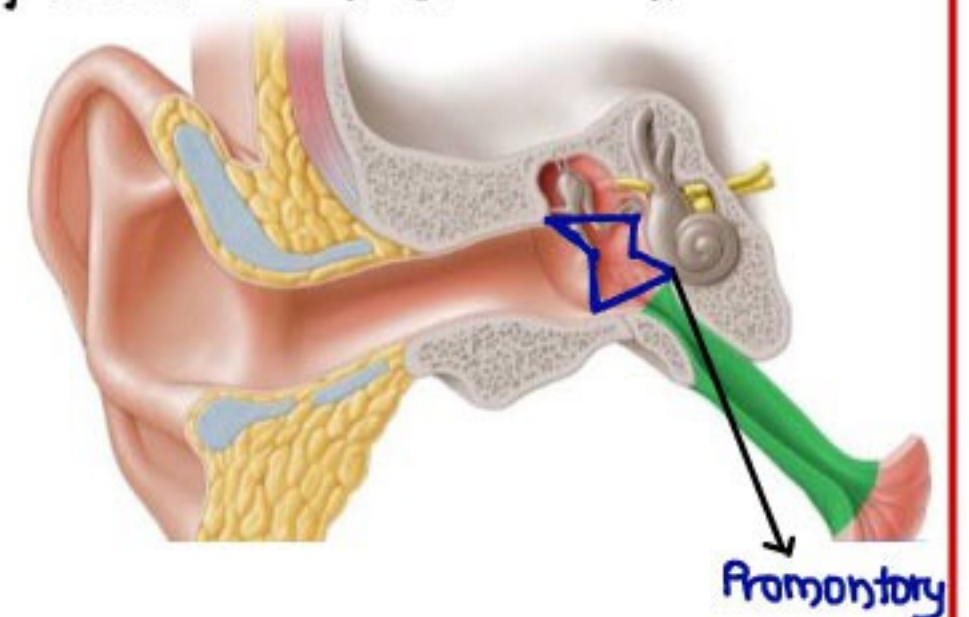
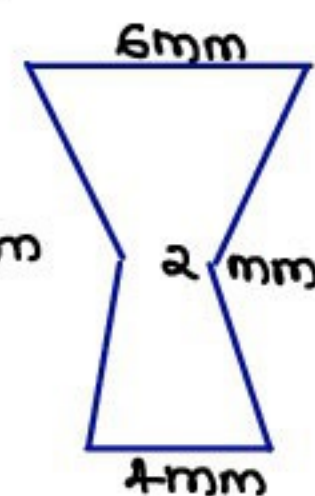
mc site of labyrinthine fistula  $\rightarrow$  Dome of lat. S.C. canal

$\rightarrow$  PROMONTORY  $\rightarrow$  outward bulge d/t first turn / basal turn of cochlea

$\rightarrow$  Narrowest part of ME  $\rightarrow$  mesotympanum

$\rightarrow$  Sx floor of ME  $\rightarrow$  medial wall

Narrowest part in Sx posit<sup>n</sup>  $\rightarrow$  meso-  
tympanum

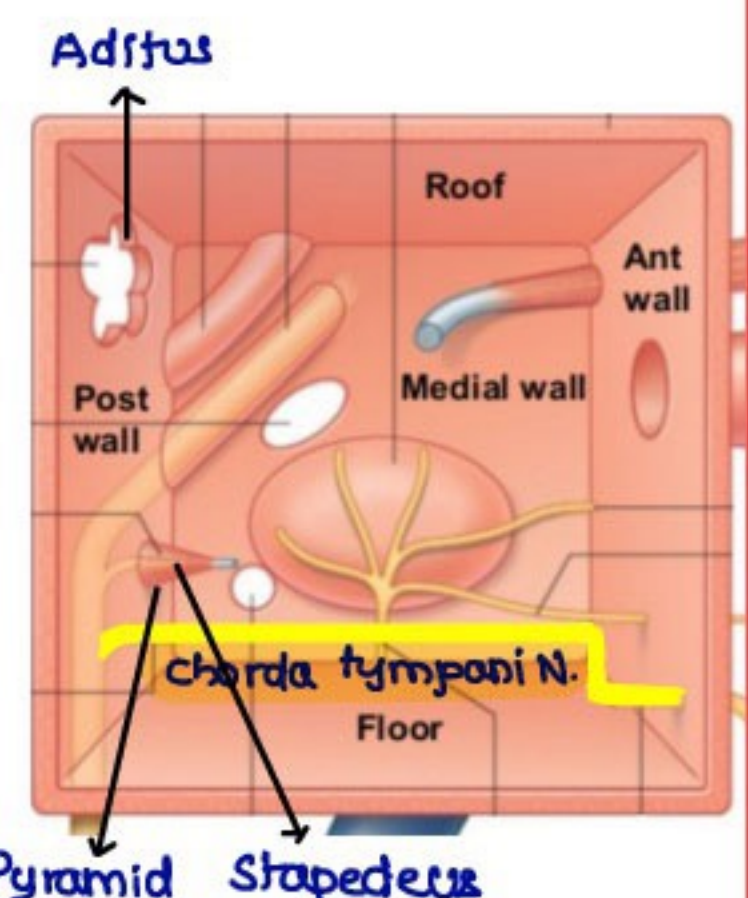


$\rightarrow$  **POSTERIOR WALL**

$\rightarrow$  Vertical segment / Mastoid segment of facial N.  $\oplus$  Chorda tympani Nerve - Branch from Mastoid segment, hangs like a cord in the ME & exits from anterior wall through CANAL OF HUGIER

$\rightarrow$  Opens into mastoid through aditus

$\rightarrow$  Pyramid  $\rightarrow$  from pyramid, arises Stapedius [smallest named muscle in the body], goes & attaches neck of Stapes



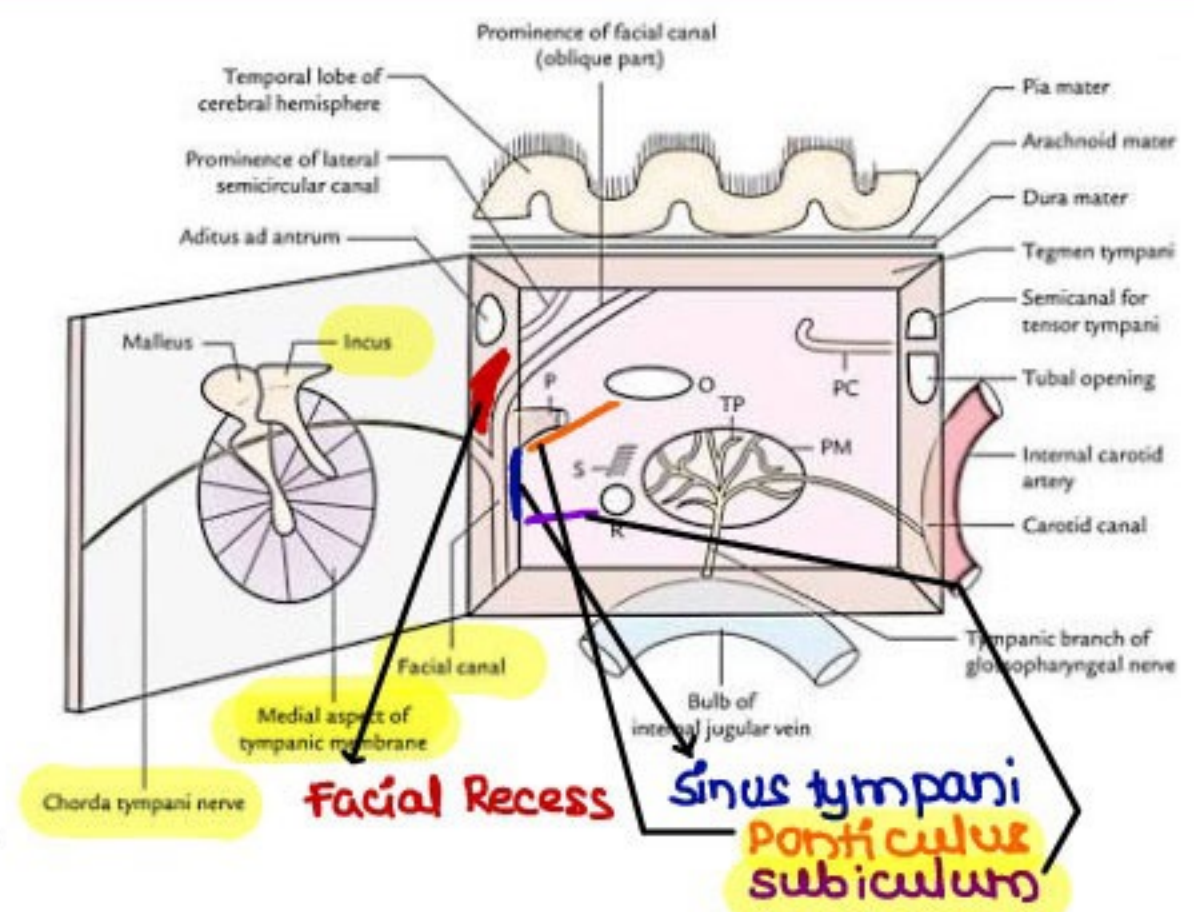


## → Facial Recess [2D area]

- Lateral to facial Nerve
- Boundaries
  - Medial → facial N.
  - Inferior → chorda facial angle
  - Lateral → Annulus
  - Superior → short process of incus

fossa incudis - Place where short process of incus is + nt.

- Significance - Site for posterior tympanotomy [opening the ME]

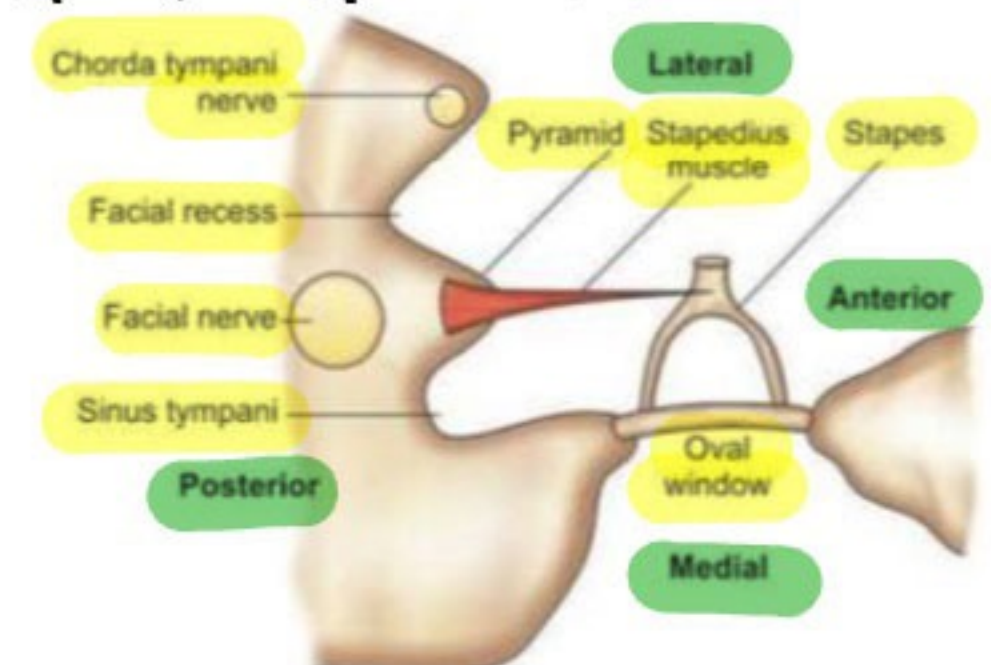


## → SINUS TYMPANI [3D space]

- lies medial to facial Nerve
- Boundaries
  - lateral → facial N
  - Posterior → posterior wall
  - Medial → Medial wall

Ponticulus - superior bony ridge  
Subiculum - inferior bony ridge

- mc site for recurrent/residual cholesteatoma

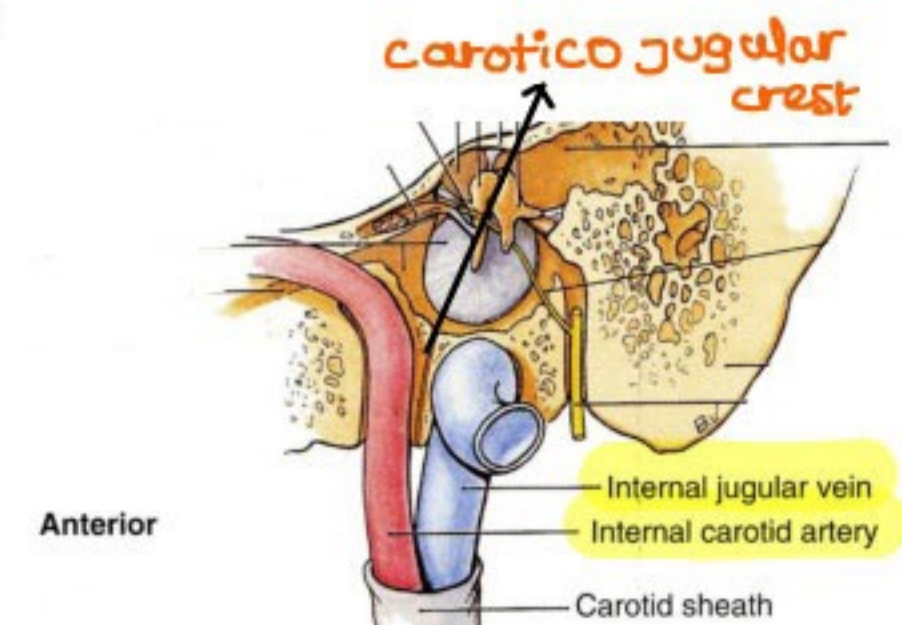


## → FLOOR

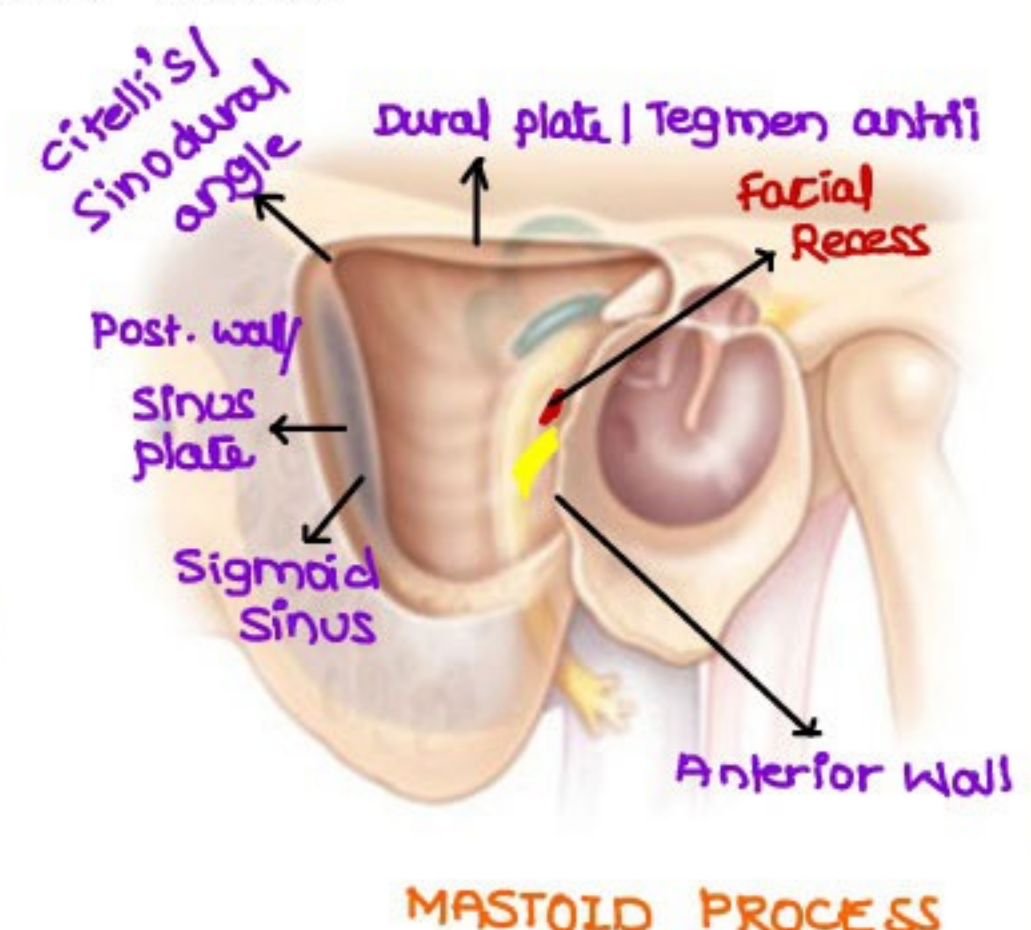
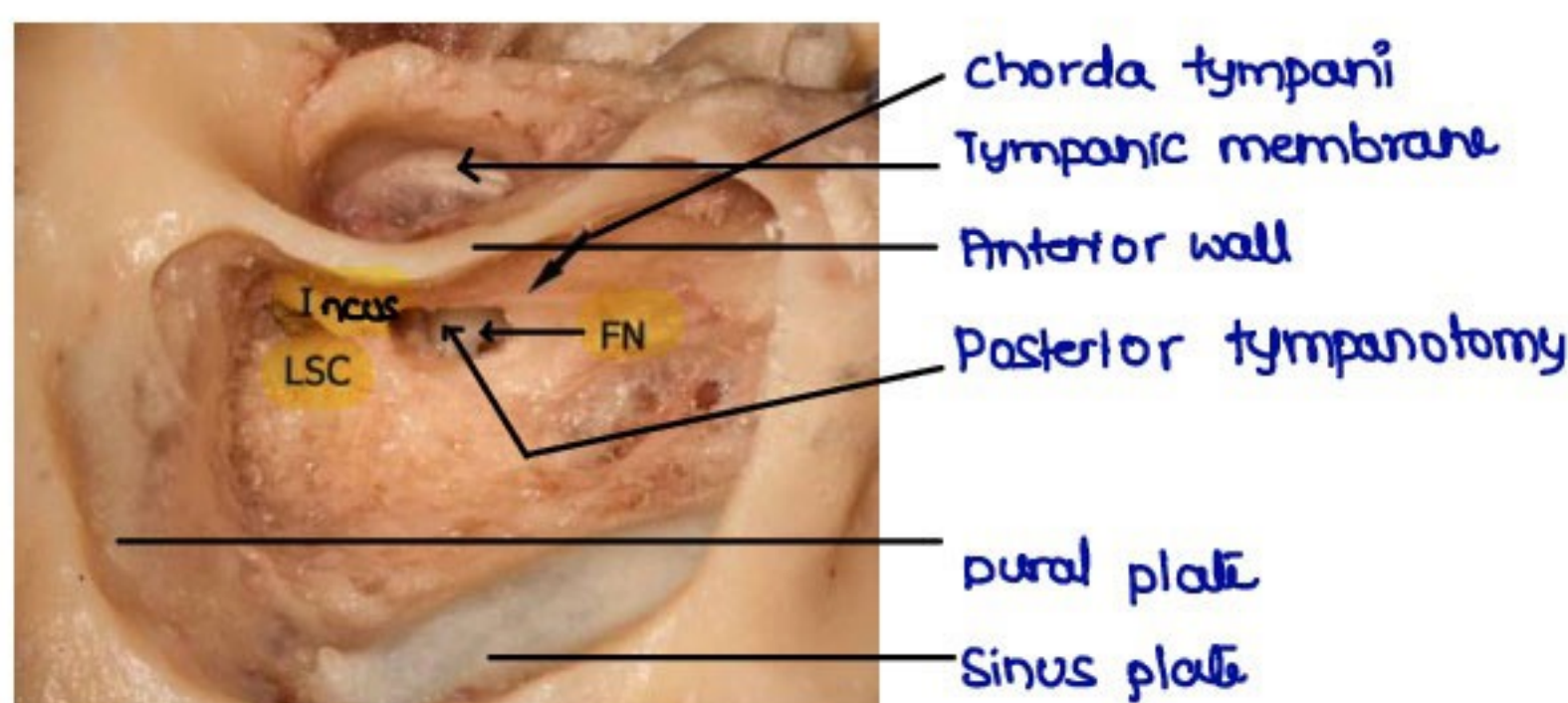
- Separates ME from jugular bulb & ICA
- CAROTICO JUGULAR CREST

- ICA present anterior to it
- Jugular bulb present posterior to it
- helps in distinguishing btw ICA & Jugular bulb
- PHELP SIGN

- Inability to distinguish btw ICA & jugular bulb due to erosion of carotico jugular crest
- Seen in CECT Scan of Glomus tumor



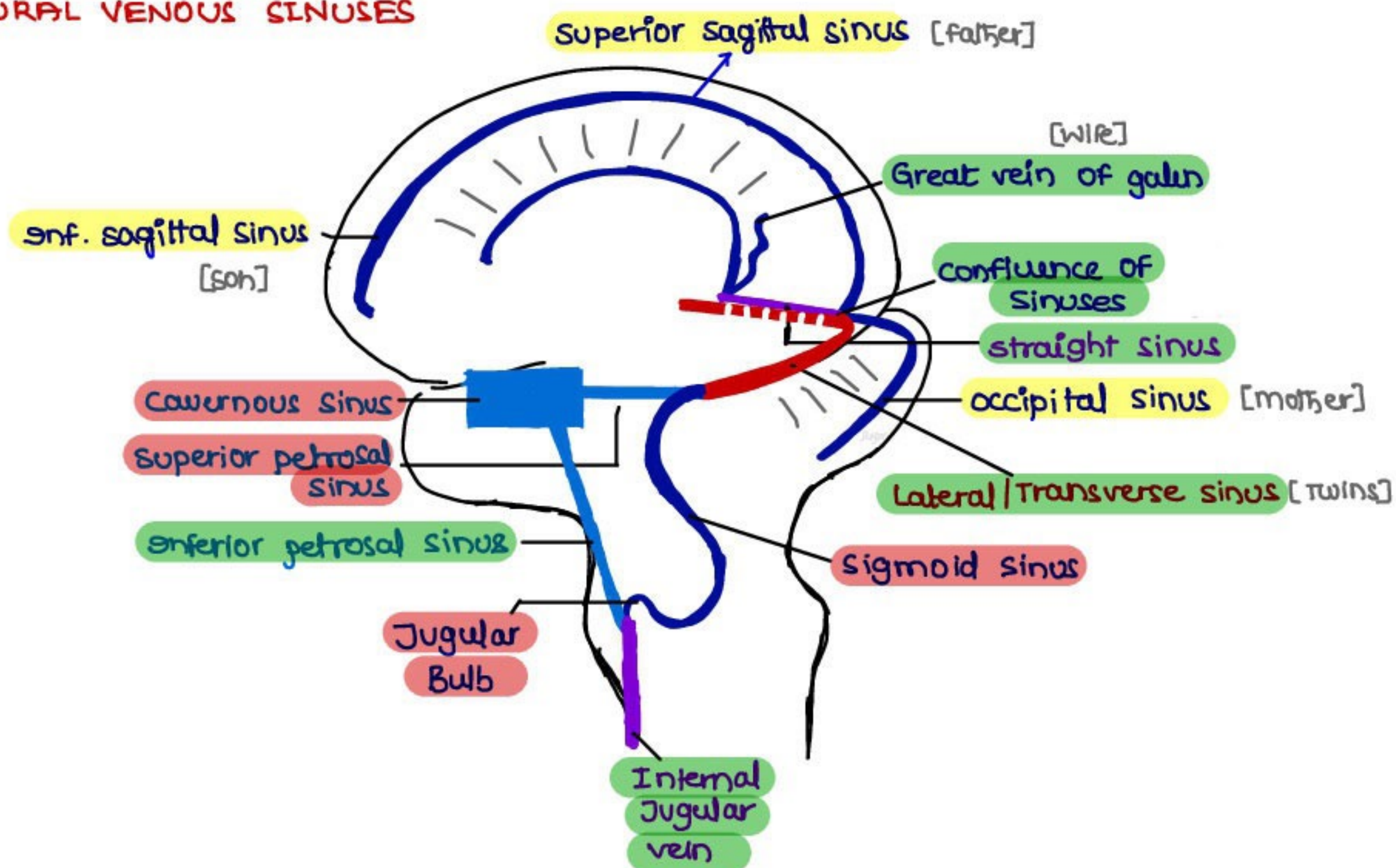
## MASTOID PROCESS



posterior Tympanotomy → used for cochlear implant



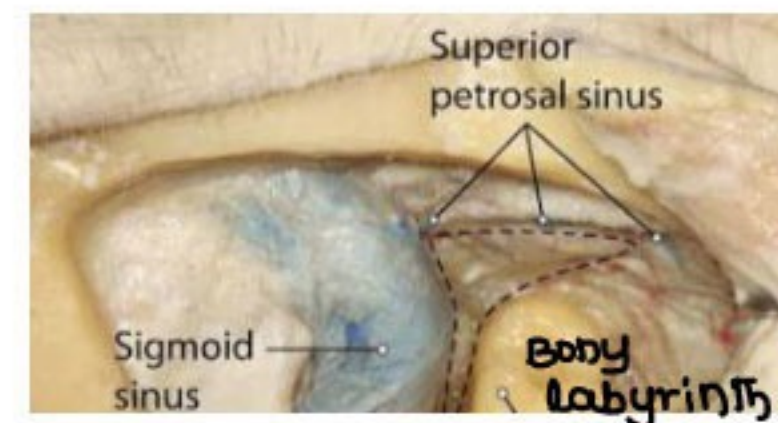
## DURAL VENOUS SINUSES



## TRAUTMANN'S TRIANGLE

→ Boundaries

- Anteriorly → Bony labyrinth
- Posteriorly → Sigmoid sinus
- Superiorly → Superior Petrosal Sinus



→ cholesteatoma erodes the bone & goes into posterior cranial fossa from here

## Contents of Middle Ear

→ 2 Muscles

Tensor tympani

- origin → at canal for tensor tympani
- insert<sup>n</sup> → handle of malleus
- N. supply → Mandibular Nerve

Stapedius

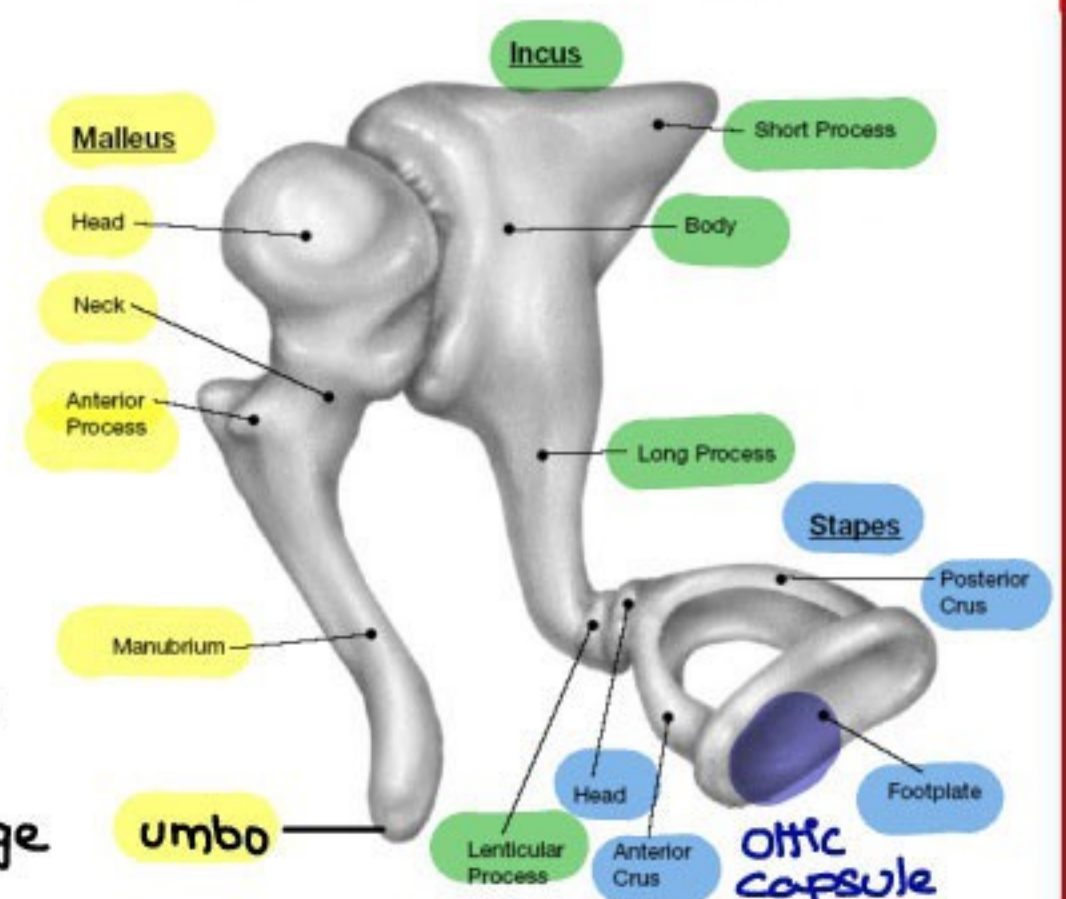
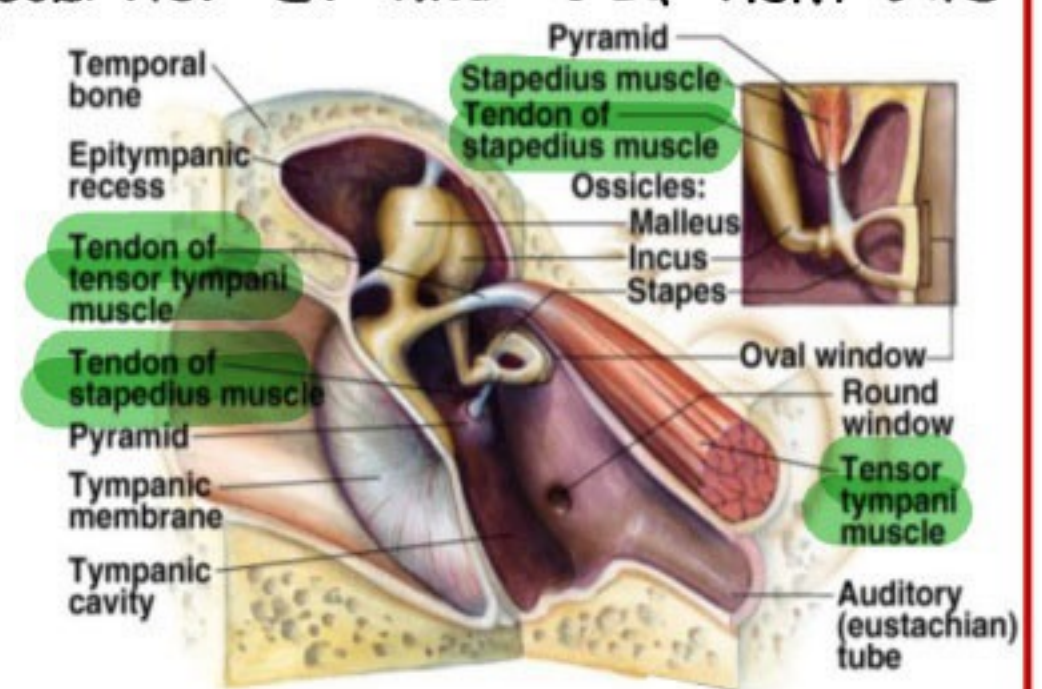
- origin → Pyramid
- insert<sup>n</sup> → neck of stapes
- N. supply → facial nerve

→ 3 Ossicles format<sup>n</sup>

Malleus & Incus by (I) Mandibular Arch

↓  
Meckel's cartilage

Stapes by (II) Hyoid arch → Reichert's cartilage except the medial surface of foot plate [from otic capsule]





Ossicles reach adult size at	→ 15 wks of IUL
adult configurat <sup>n</sup> at	→ 20 wks of IUL
Organ of corti starts hearing at	→ 20 wks of IUL
adult configurat <sup>n</sup> at	→ 25 wks of IUL

### Structures attaining adult size at the time of birth

1. Ossicles
2. ME / Tympanic cavity
3. cochlea / labyrinth
4. Mastoid antrum

Type of Joints of ossicles	→ SYNOVIAL JOINT
B/w Malleus & Incus	→ Saddle type
b/w Incus & stapes	→ ball & socket type

mc or 1 <sup>st</sup> to be eroded is	→ lenticular process of Stapes
2nd mc process to be eroded	→ Long process of Incus
Last to undergo erosion is	→ foot plate of Stapes
Reason for Erosion is	→ Delicate structure

### ANATOMY OF INNER EAR

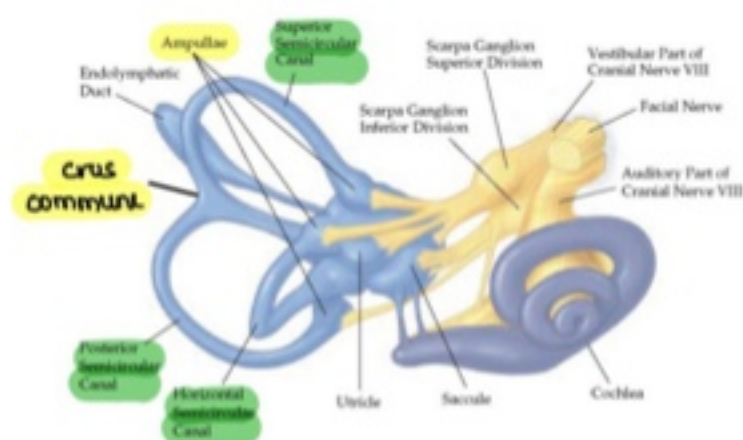
→ consists of

#### Cochlea

- Spiral structure
- 2.5 - 2.75 turns around bony MODIOLUS

#### Labyrinth

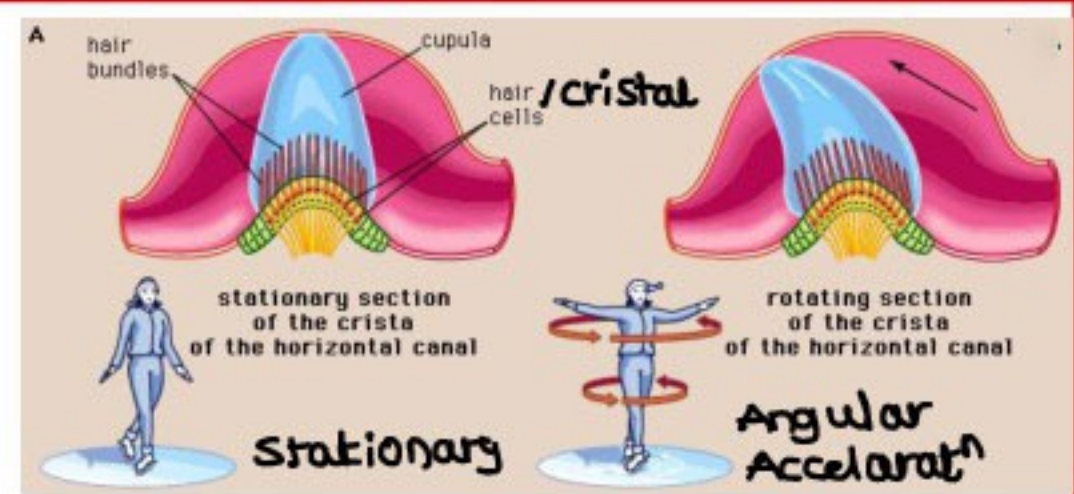
- 3 semi circular canals
- 2 sacs  
Utricle  
Saccule / Sacculus
- 3 Semicircular canals
  - posterior / vertical
  - Lateral / Horizontal
  - Superior



- each canal has one ampullated end & one non ampullated end
- The non ampullated ends of superior & posterior SCC unite to form 'CRUS COMMUNE' [Total 5 openings]



- Ampulla
  - cristae ampullaris - individual hairs
  - Cupula ampullaris - Cristae together
- funct<sup>n</sup> of SCC → Angular Accelerat<sup>n</sup> by Cristae or cupula



Irritation to SCC Produce Nystagmus

- Irritat<sup>n</sup> of Lateral SCC → Horizontal Nystagmus
- Posterior SCC → Vertical Nystagmus
- Superior SCC → Torsional Nystagmus

## NYSTAGMUS

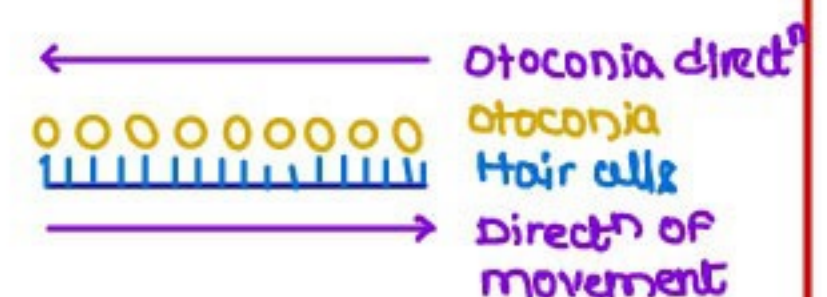
- Rapid to and fro movement of eye balls.
- 2 types
  - Peripheral
  - Central
- Peripheral Nystagmus characteristics - 5Ds
  - 1 Delay
  - 2 Durat<sup>n</sup>
  - 3 Decay
  - 4 Decreases on gaze fixat<sup>n</sup>
  - 5 Direct<sup>n</sup>

fast component gives the direct<sup>n</sup>

vertical nystagmus can be Geotropic or Ageotropic nystagmus

## UTRICLE & SACCULE

- detects linear accelerat<sup>n</sup>
- MACULA - sensory epithelium of utricle & saccule
  - consists of
  - Hair cells
  - Otoconia [calcium carbonate crystals]



- Utricle - detects horizontal linear Accelerat<sup>n</sup>
- Saccule - detects vertical linear Accelerat<sup>n</sup>

## BPPV [Benign Paroxysmal Positional vertigo] / OTOLITHIASIS

- few seconds to minutes
- dit displacement of Otoconia into Posterior SCC → OTOLITH
- Dx confirmed by DIX - HALLPIKE'S MANOEUVRE
  - 5Ds observed
  - mainly vertical [geotropic | ageotropic]
  - also torsional component ⊕ nt
- Rx → EPLEY'S MANOEUVRE [R<sub>1</sub>OC]
  - 1 sitting treats → 80-90%.





## TESTS OF LABYRINTH

### CALORIC TESTING

#### FITZGERALD HALLPIKE TEST

- Syringing at  $37 \pm 7^{\circ}\text{C}$  done [ $30^{\circ}\text{C}$  (cold stimulus)]  
[ $44^{\circ}\text{C}$  (warm stimulus)]
- COWS
  - Cold  $\rightarrow$  Opposite  $\rightarrow$  Nystagmus d/t irritat<sup>n</sup> of Lateral SCC
  - Warm  $\rightarrow$  Same side

#### MODIFIED KOBRAK TEST

- Syringing w/  $0^{\circ}\text{C}$  water

#### DUNDAS GRANT TEST

- Syringing is CI in perforated Tympanic membrane
- on such cases, cold air blown through a tube.

### GALVANIC VESTIBULAR STIMULATION

- Test for vestibular Nerve w/ small voltage of current

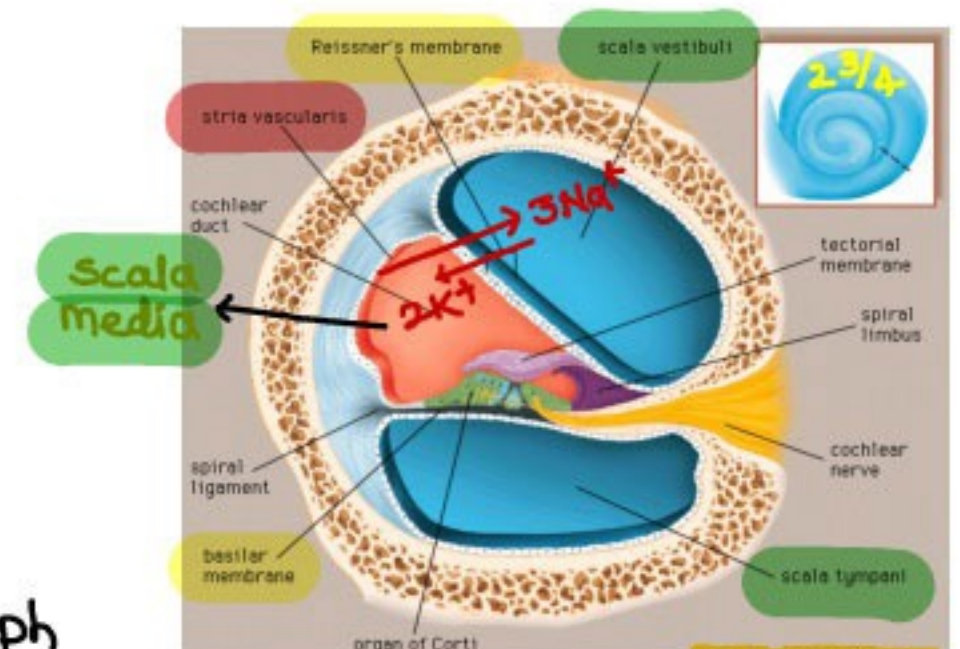


GALVANIC VESTIBULAR STIMULATION

### COCHLEA

- $\rightarrow$  divided into 

Scala vestibuli	} by	Reissner's membrane	
Scala media			Basilar membrane
Scala tympani			

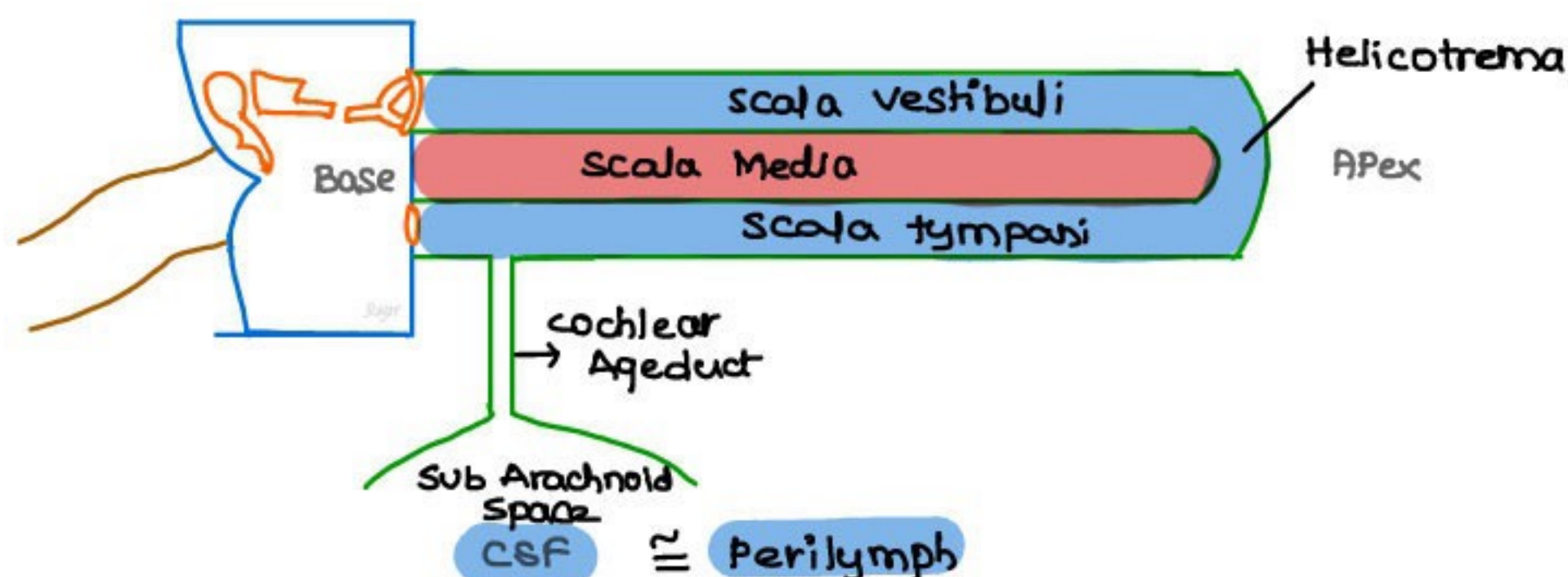


- $\rightarrow$  Scala vestibuli & Scala tympani filled w/  $\rightarrow$  Perilymph
- Scala media filled w/  $\rightarrow$  Endolymph

Endolymph secreted by stria vascularis [ $\text{Na}^+ \text{K}^+$  ATPase pump]

Exchange  $3 \text{Na}^+$  w/  $2 \text{K}^+$  [-ive]  $\rightarrow$  responsible for **ENDO COCHLEAR POTENTIAL**

- Normal physiological potential
- 80 - 85 mV
- Not depend on sound
- DC potential



During meningitis, the mc route of infect<sup>n</sup> from brain to inner ear  $\rightarrow$  Cochlear Aqueduct  
 $\downarrow$   
LABYRINTHITIS



## Labyrinthitis

- 1 Serous → dlt boxing
- 2 suppurative → dlt bacteria itself

→ CF

sensory neural hearing loss  
Vertigo  
Tinnitus

→ SNHL is reversible in Serous Labyrinthitis

→ LABYRINTHITIS OSSIFICANS

- dlt Suppurative Labyrinthitis [Bacteria] → fibrosis → calcificat<sup>n</sup>
- Progressive SNHL
- R<sub>e</sub> by cochlear implant

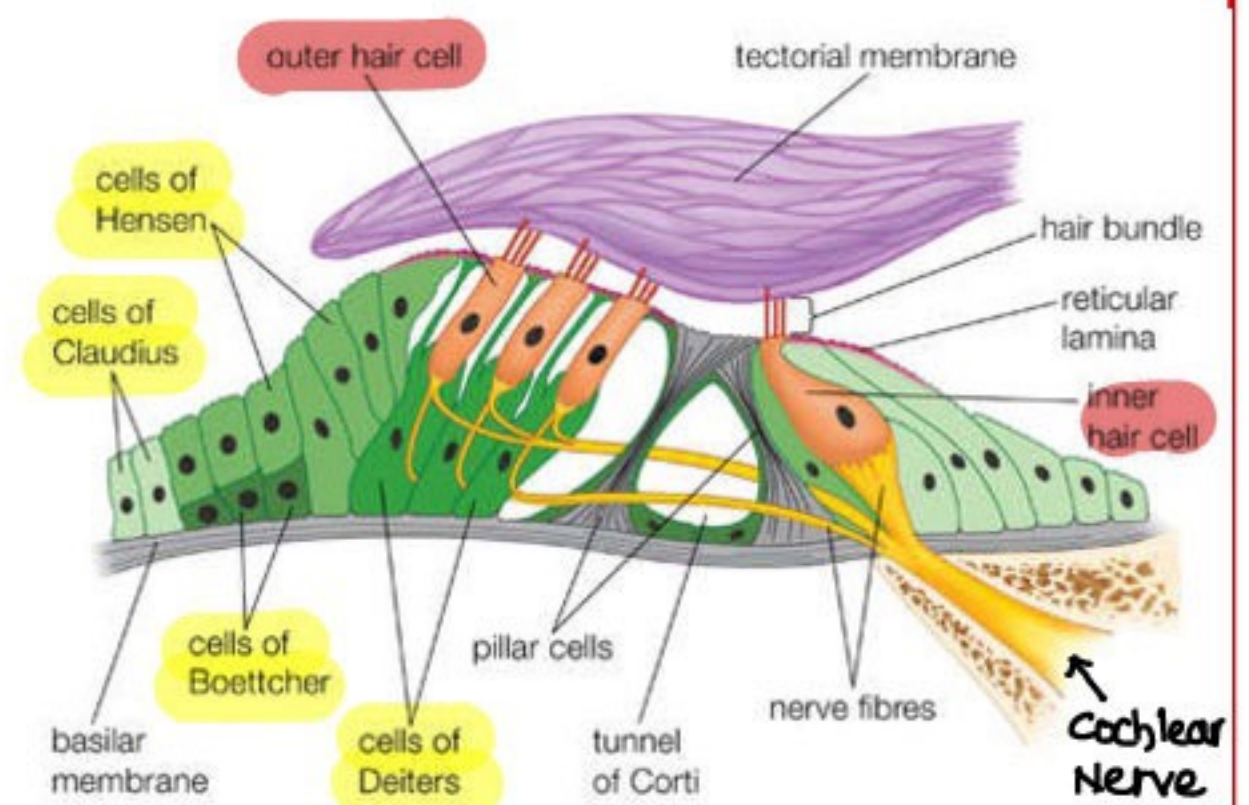
## ORGAN OF CORTI

→ Present on basilar membrane

→ OUTER Hair cells      Inner Hair cells

13-14 K in no.  
more in rows [3-5]  
more sensitive to  
ototoxic Drugs

3500 in no.  
single row



## Ototoxic Drugs

1. Aminoglycosides [Irreversible]

Streptomycin } preferential vestibulotoxic  
Gentamycin }  
Kanamycin } more cochleotoxic  
Amikacin }

2. Cisplatin [Reversible → Irreversible]

3. Furosemide → Dose dependent

4. Quinine

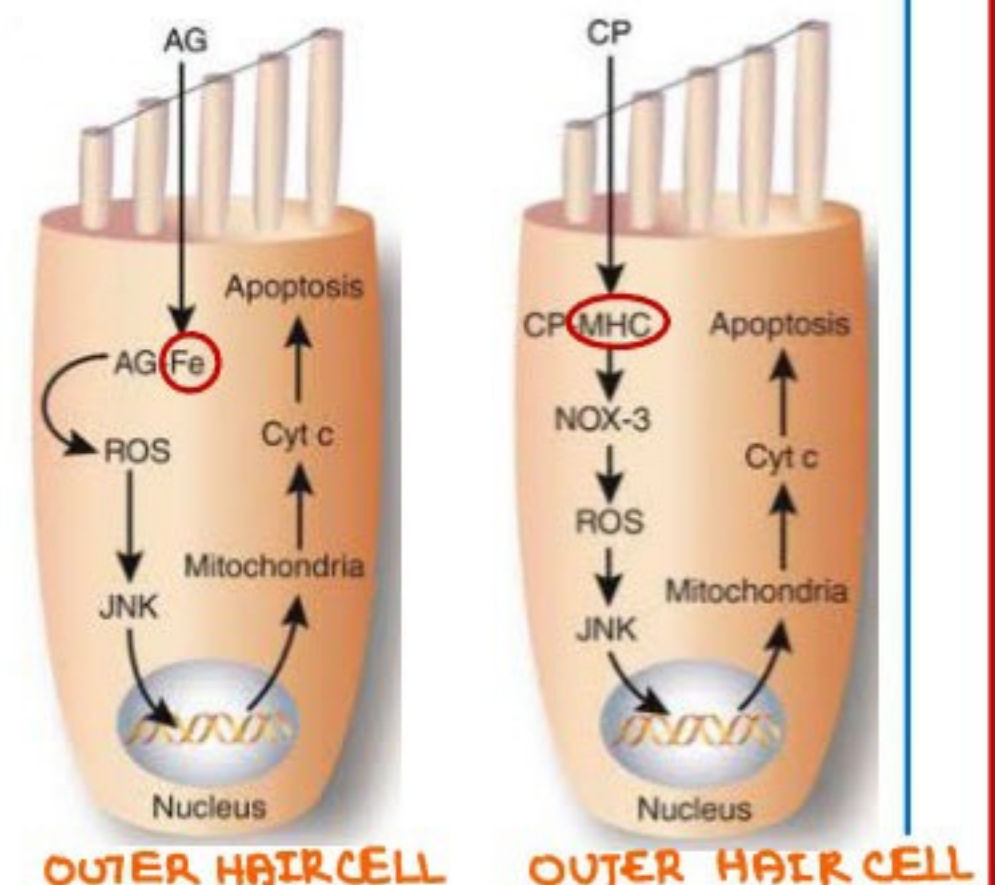
5. NSAIDs

Naproxen

Ibuprofen

6. Macrolides

Erythromycin



→ Outer Hair cells produce **OAE COTO - ACOUSTIC EMISSIONS** - Objective Test

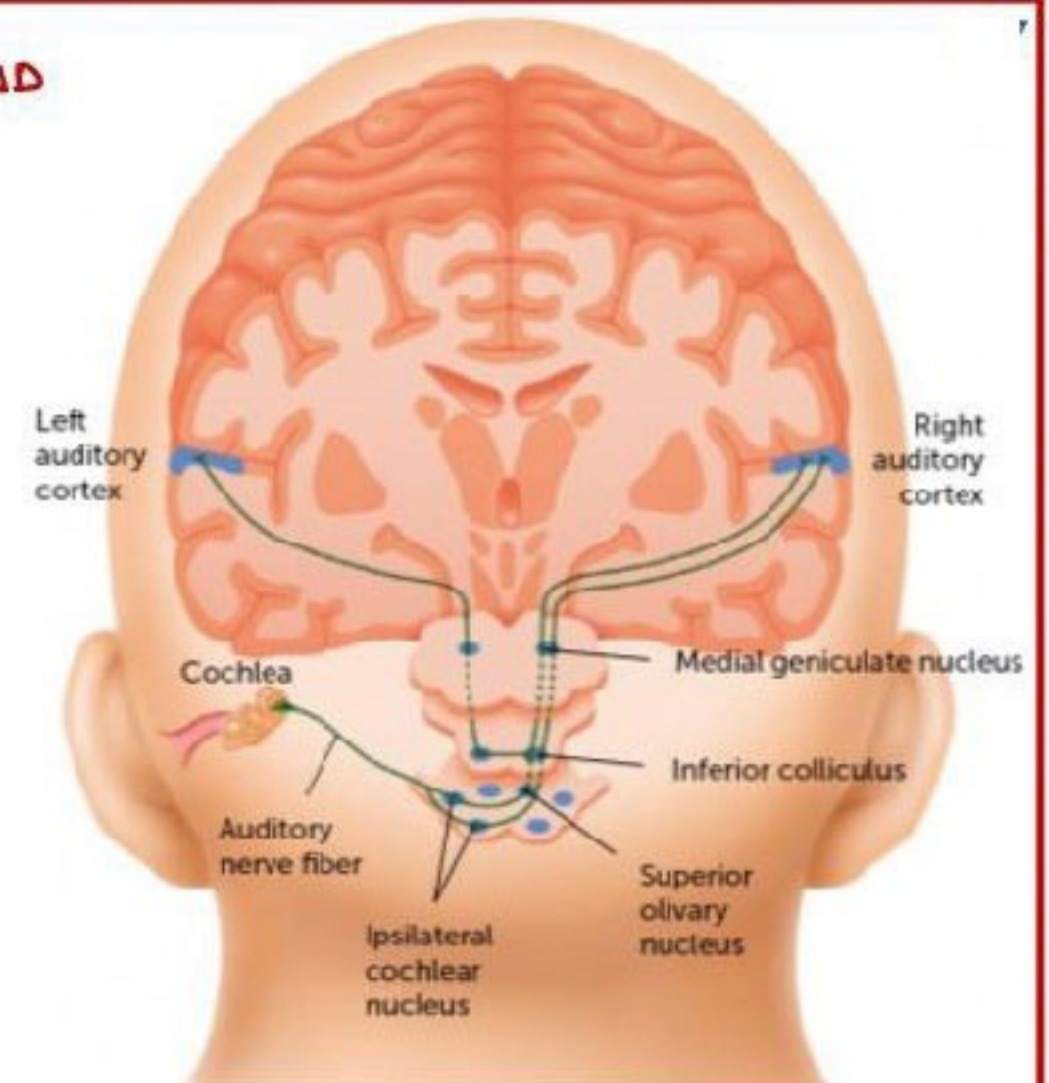
- Low intensity sounds in response to a sound stimulus
- Spontaneous OAE
- Evoked OAE



## NEURAL PATHWAY OF SOUND

- E** → Eighth nerve [vestibulo cochlear nerve]  
**C** → Cochlear nucleus [Spiral ganglion]  
**O** → Superior Olivary complex [Opposite]  
**L** → Lateral Lemniscus [Largest]  
**I** → Inferior colliculus  
**M** → Medial Geniculate Body  
**A** → Auditory cortex [Brodmann Area 41]

**(E)** 8th N.      **(COL)** Brain stem      **(MA)** Cerebrum



Cochlear nucleus is in brain stem

### COCHLEAR IMPLANT

- implant an electrode in scala tympani [nearest to VIII th nerve]
- We enter scala tympani through cochleostomy near round window or some times through round window

#### → PARTS

##### 1 EXTERNAL BODY WORN PART

###### → COMPONENTS

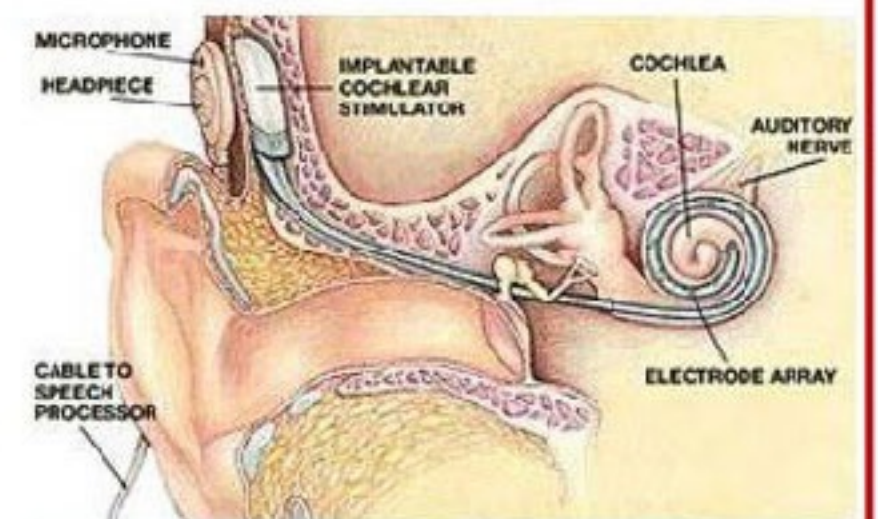
- |                     |  |
|---------------------|--|
| 1. Microphone       | → receives sound                           |
| 2. Speech Processor | → converts sound to Electro Magnetic Waves |
| 3. Transmitter      | → Transfers EMW across the layers of skin  |



##### 2 IMPLANTABLE PART

###### → COMPONENTS

1. Receiver stimulator  
→ stimulates electrode array
2. Electrode Array

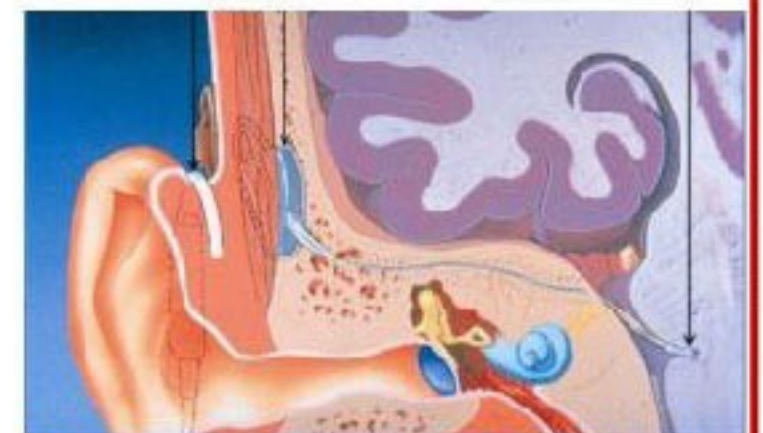


#### → CONTRA INDICATIONS

1. MICHEL'S APLASIA
2. 8th NERVE APLASIA
3. 8th NERVE TUMOR

### AUDITORY BRAIN STEM IMPLANT [ABI]

- Implantation on Brain stem
- Cochlear nucleus is in 4th ventricle  
4th ventricle is entered through foramen of Lushka



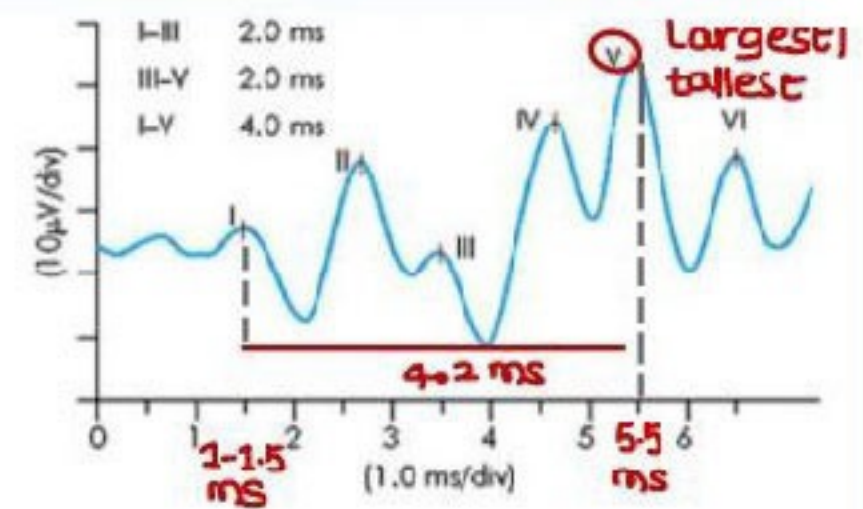
- Cross over of sound takes place at superior olivary nucleus through **TRAPEZOID BODY**



## BRAINSTEM EVOKED RESPONSE AUDIOMETRY /

### AUDITORY BRAINSTEM RESPONSE [BERA / ABR]

→ study of electric waves produced along the neural pathway of sound



→ **E** → Wave I → produced by distal part of **E**ighth nerve  
**E** → Wave II → produced by proximal part of **E**ighth nerve

Distal → away from the brain

proximal → near the brain

**C** → Wave III → produced from **C**ochlear nuclear

**O** → Wave IV → produced from **S**uperior Olivary complex

**L** → Wave V → produced from **L**ateral Lemniscus

**I** → Wave VI, VII → produced from **I**nferior Colliculus

→ Wave V → Largest / tallest / most significant wave

→ If Wave I is present & wave V is absent → RETRO COCHLEAR HL  
& even a delayed Wave V [ $> 4.2 \text{ ms}$ ] → RETRO COCHLEAR HL

→ BERA is used as confirmatory test for neonatal deafness

Best test for neonatal deafness → BERA / ABR

→ also used to detect Malingering

→ BERA is a objective test



## PHYSIOLOGY OF HEARING

**BINAURAL HEARING** → Hearing by 2 ears → helps in Sound Localization

**MONO AURAL HEARING** → Hearing by 1 ear  
d/t Head Shadow Effect

→ Speech procession in neural pathway is involved in Sound Localization

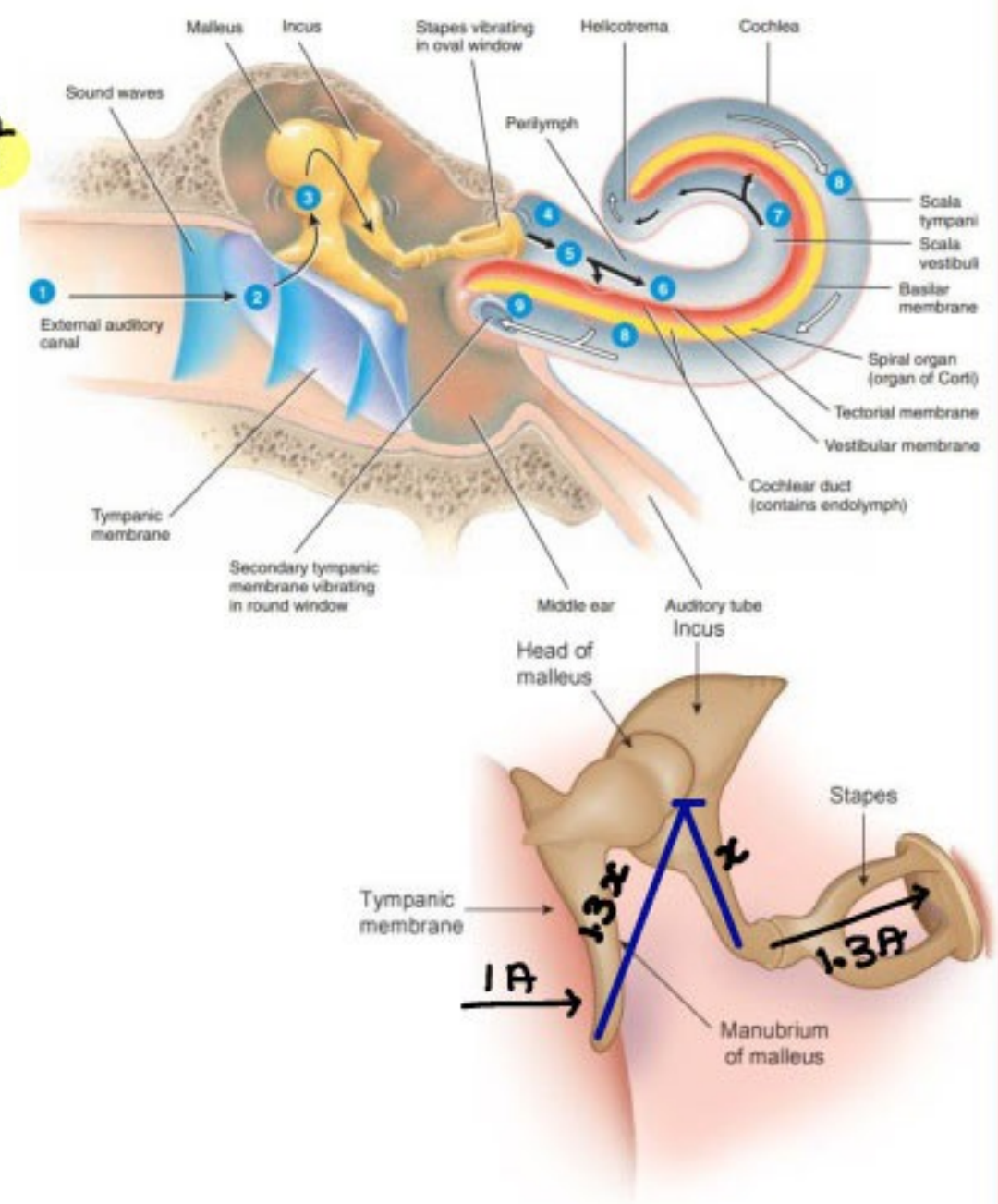
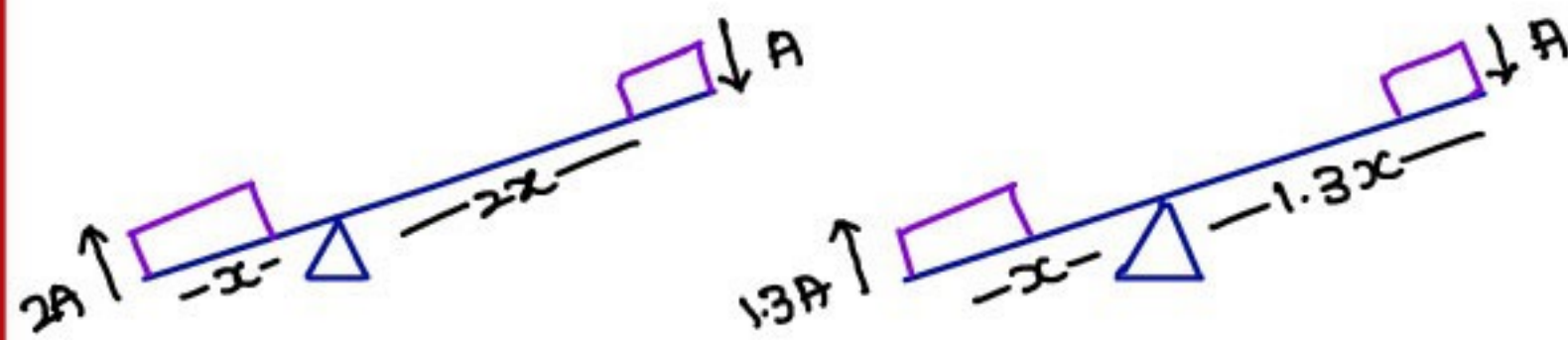
→ Total surface area of Tympanic membrane →  $90 \text{ mm}^2$

Effective vibratory area of TM →  $55 \text{ mm}^2$

Surface area of Stapes foot plate →  $3.2 \text{ mm}^2$

AREAL RATIO →  $17:1$

→ **TORQUE** = force  $\times$  length



**LIVER RATIO** →  $1.3:1$

→ **MIDDLE EAR TRANSFORMER RATIO** →  $22:1$

→ Sound travels faster in Solids than Air

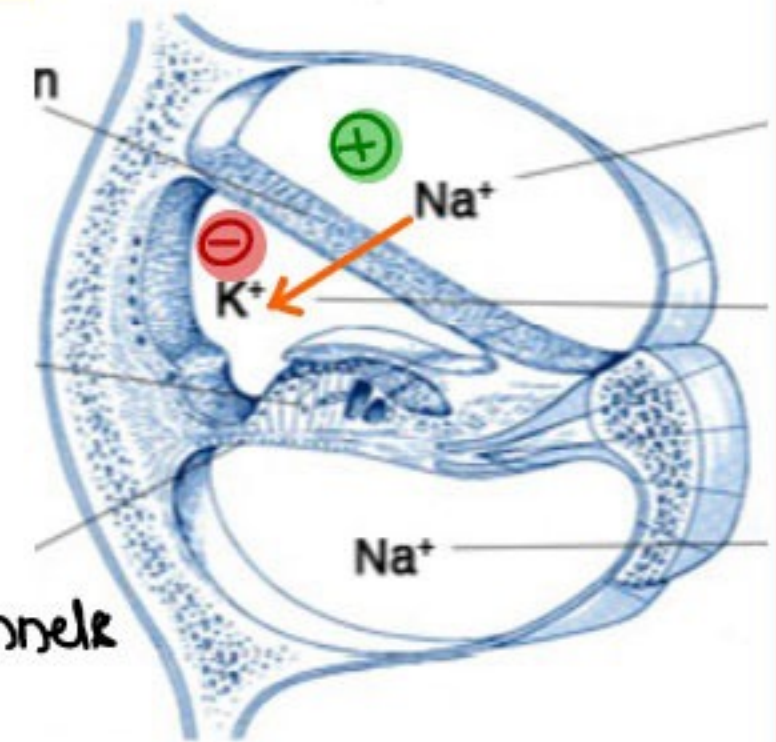
due to which the 2 windows are in **PHASE DIFFERENCE**

→ Middle Ear → Amplifies sound

→ helps in creat<sup>n</sup> of phase difference

### COCHLEAR MICROPHONICS

- electrical potential in the inner ear
- produced d/t influx of  $\text{Na}^+$  d/t opening of Ion channels in response to a **SOUND STIMULUS**
- This is an **AC potential**



### SUMMATING POTENTIAL

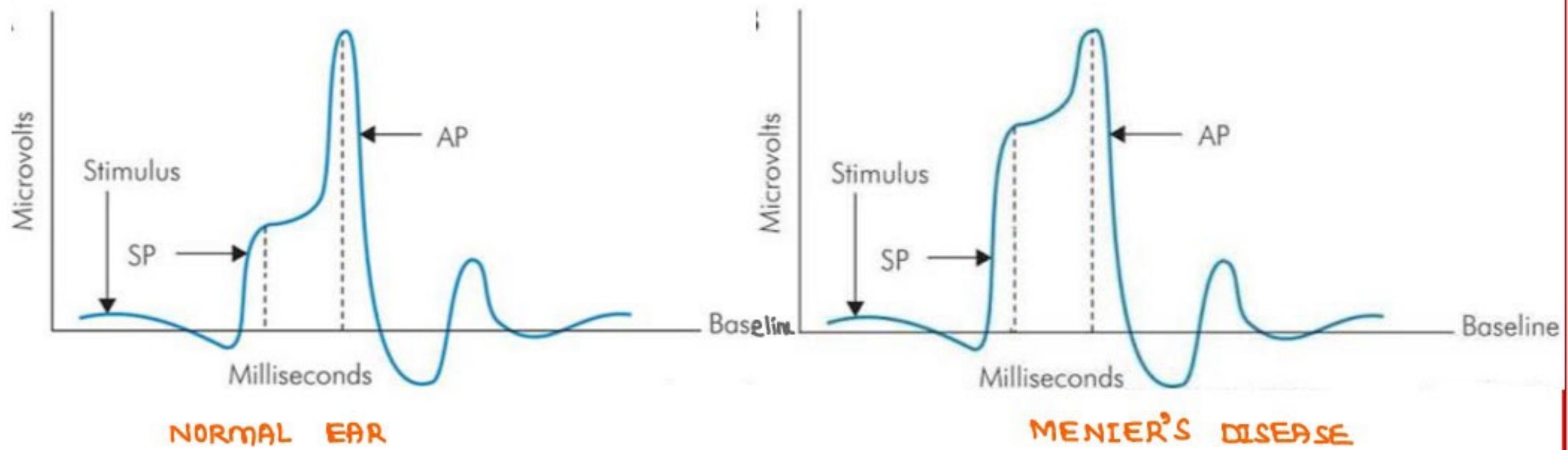
- Potential produced inside the outer Hair cells in response to movement of  $\text{Na}^+$  ions
- have higher latency period than cochlear microphonics
- **DC potential**

### EIGHTH NERVE ACTION POTENTIAL

- only when inner ear potential is above threshold potential



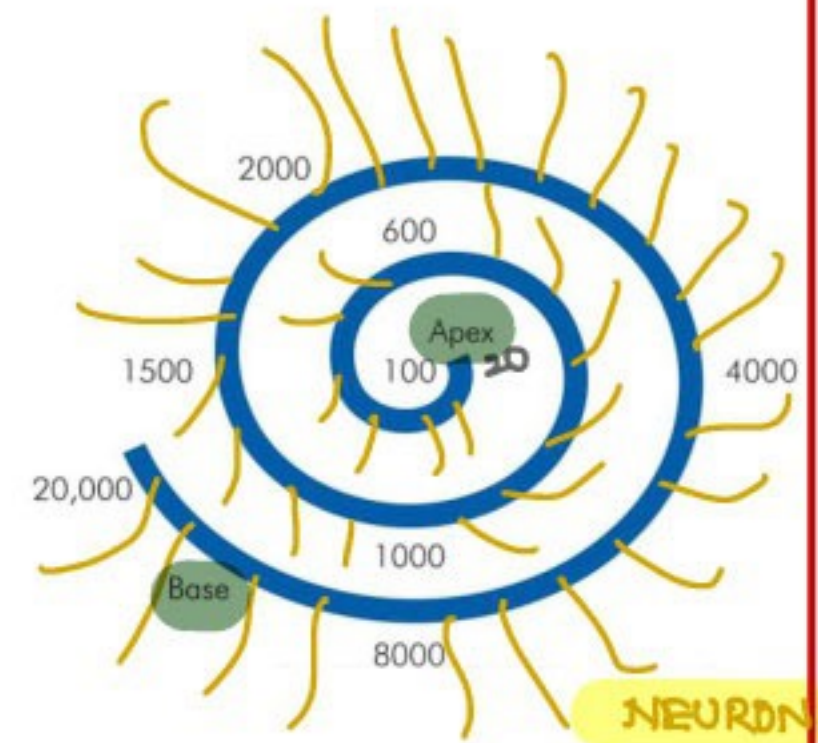
## ELECTROCOCHLEOGRAPHY



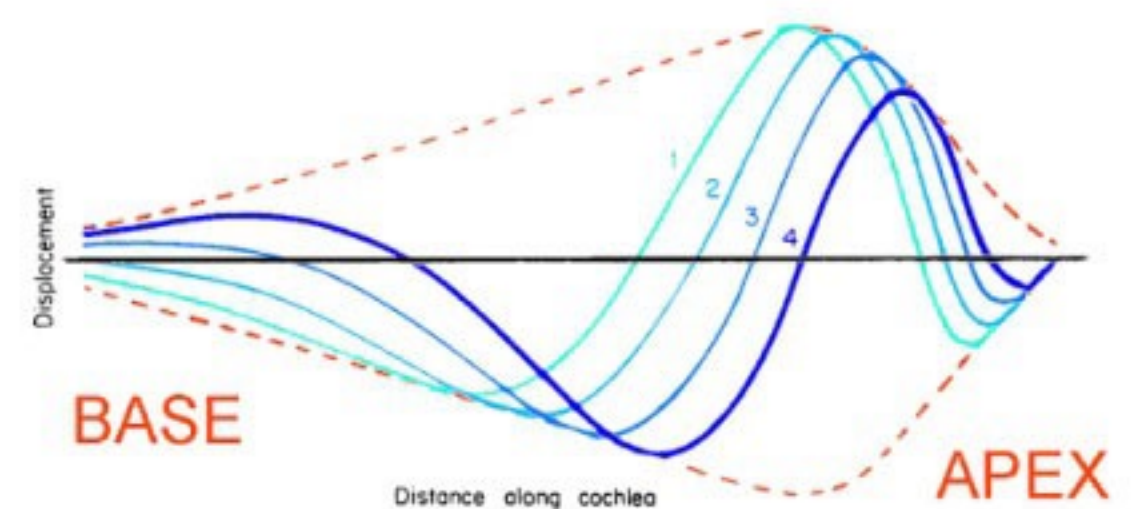
- Summating Potential VS Action Potential
  - on Normal Ear →  $SP < 30\% AP$
  - on Menier's Disease →  $SP > 70\% AP$
- Electrocochleography is the confirmatory test for Menier's disease
- Invasive investigation

## FREQUENCY LOCALIZATION IN COCHLEA

- Normal Hearing Range → 20 – 20000 Hz
- Speech Range → 300 – 3000 Hz
- From every part of cochlea a neuron comes which carries a different frequency



- **TRAVELLING WAVE THEORY**
  - Peak – at which sound heard maximum
  - As frequency increases, the peak shift towards base
  - As frequency decreases, the peak shift towards apex
  - This theory given by **VON BEKESY**  
Got Nobel prize in physiology or Medicine [1961]



- Which part of TM moves maximum → Periphery of Pars Tensa



## TESTS OF HEARING

### TUNING FORK TESTS

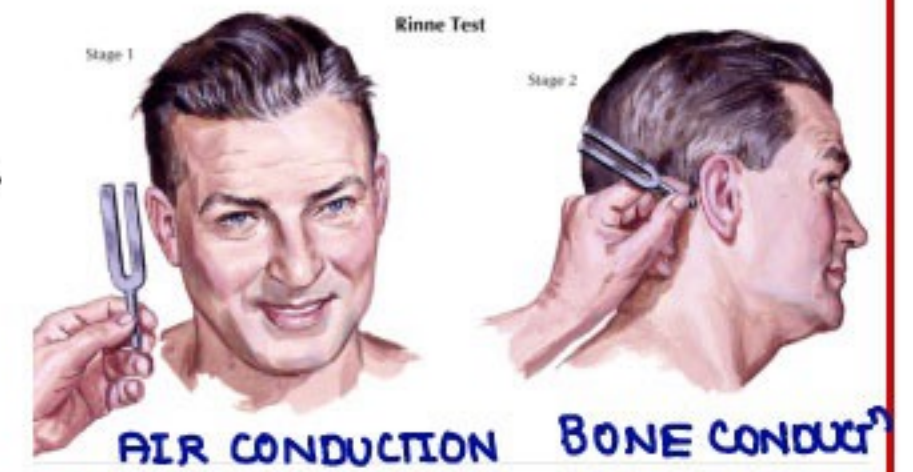
- mc used → 512 Hz
- not used → 128 Hz [used in neurological hearing]

### RINNE'S TEST

- AC > BC → Rinne's Positive → Normal
- BC > AC → Rinne's Negative → Conductive HL
- conductive Hearing loss

Diseases of Ext. ear

Diseases of Middle ear



AC > BC → Sensory Neural Hearing loss [SNHL] U/L

BC > AC → Severe/ Profound SNHL [Dead Ear]

false negative Rinne's Test [Bone conduct<sup>n</sup> by other ear]

→ 256 Hz	512 Hz	1024 Hz	CHL
—	+	+	20-30 dB
—	—	+	30-45 dB
—	—	—	> 45 dB

- most sensitive tuning fork
- min. CHL required to make any Tuning fork negative
- most commonly used

→ 256 Hz

→ 20 Hz

→ 512 Hz

### WEBER'S TEST

- Normal Hearing ↔ W → Centre
- Rt SNHL → Away SNHL
- Rt CHL → Towards CHL
- Weber is more sensitive than Rinne's [5dB]



**SIMPLE FUNDA** → Always check the Weber's first in tuning fork Test Questions

### ABSOLUTE BONE CONDUCTION TEST [ABC]

- comparison test blw patient & examiner
- Examiner presumed to be normal
- Press tragus to close air conduct<sup>n</sup>



- Patient BC < Examiner BC → SNHL
- Patient BC = Examiner BC → Normal

Patient BC = Examiner BC → Repeat → N



## SCHWABACH'S TEST

- comparison test b/w patient & examiner
- Examiner presumed to be normal
- No pressing of tragus

→ Patient BC < Examiner BC → SNHL

Patient BC = Examiner BC → Repeat test  
↗ reverse order

same Result → Normal

Pt BC > Ex BC → CHL

## SEIGLE'S SPECULUM

- used for

Magnificat<sup>n</sup> of tympanic membrane

Mobility of tympanic membrane

Medicat<sup>n</sup> of tympanic membrane

G

F



## BING TEST

- Modificat<sup>n</sup> of Weber's test
- vibrate TF & kept at mastoid

↓  
As soon as patient stops hearing  
↓  
close EAC  
↓  
if he hears again  
↓  
BING'S POSITIVE  
Seen in Normal hearing  
SNHL

vibrate TF & kept at mastoid

↓  
As soon as patient stops hearing  
↓  
close EAC  
↓  
if he hears nothing  
↓  
BING'S NEGATIVE  
↓  
Seen in CHL

## GELLE'S TEST

- vibrate TF & kept at mastoid

↓  
Rise the pressure w/ Siegle's speculum  
↓  
↓ Loudness of sound  
Seen in (N) hearing  
SNHL

vibrate TF & kept at mastoid

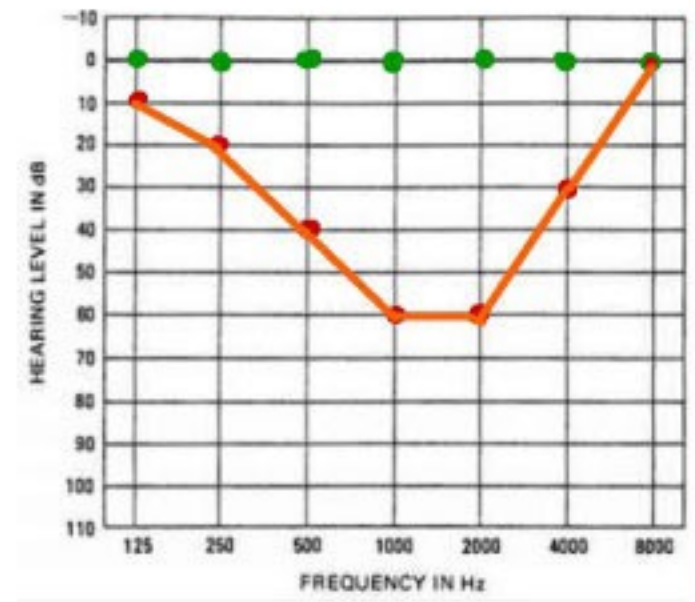
↓  
Rise the pressure w/ Siegle's speculum  
↓  
No change in loudness  
↓  
Seen in Otosclerosis

For Malingering → 1. Chimani - Moos test 2. Stenger's test 3. Lombard test [B/L]



## 2 PURE TONE AUDIOMETRY

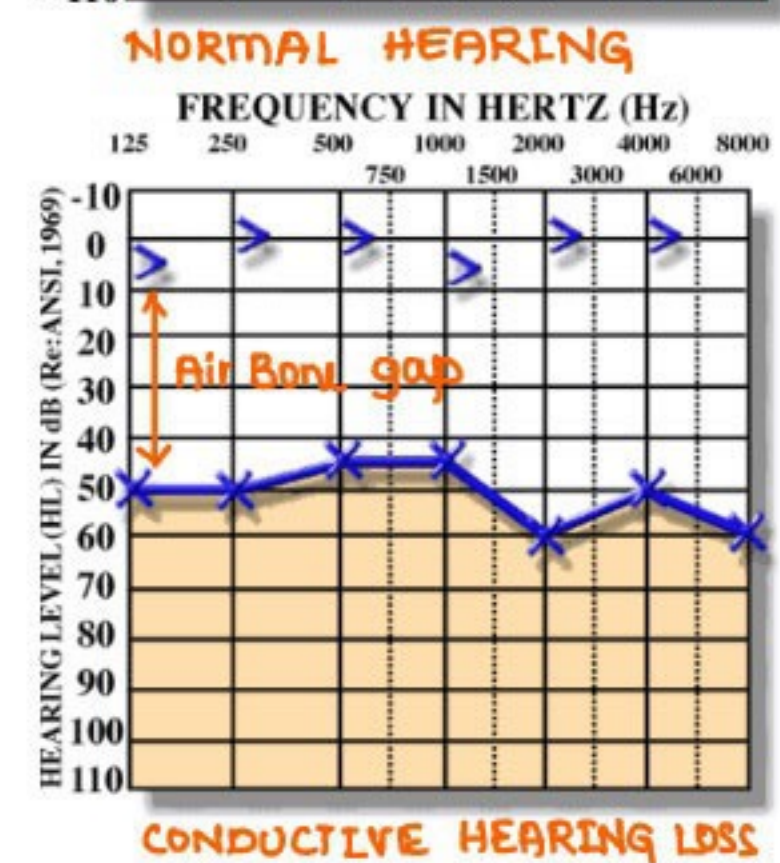
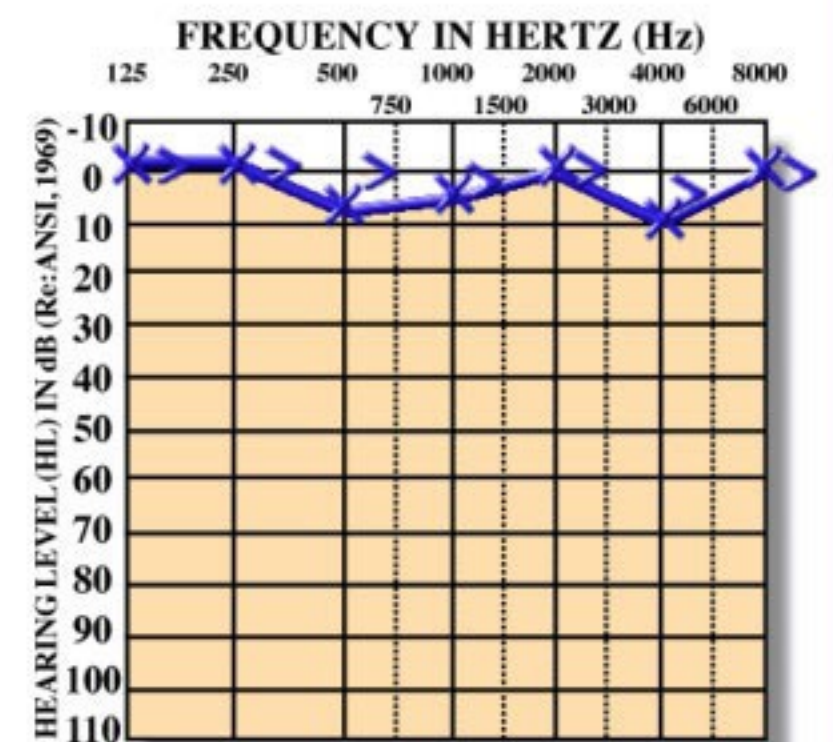
- can determine
  - Degree / Amount of hearing loss
  - Type of hearing loss
- calculates the hearing threshold
- minimum intensity at a particular frequency at which a person starts hearing → Hearing / Auditory Threshold
- Uses single frequency sounds
- '0' value doesn't mean '0' in true sense, it is Normal
- It is different for different frequencies
- AC & BC = 0, in normal individuals



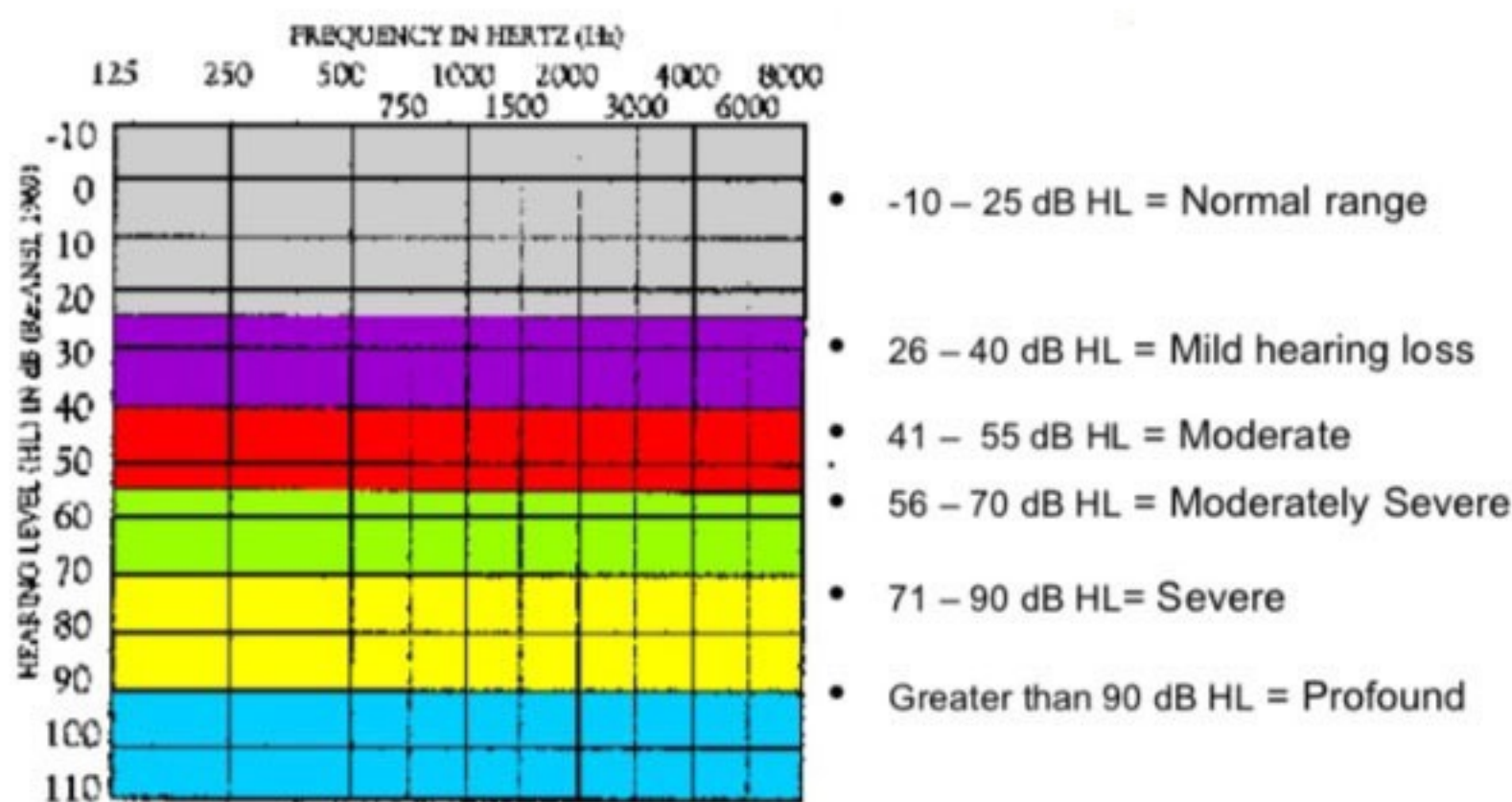
RE side  
RED  
○—○—○—○  
←—←—←—←  
[—[—[—[—[

AC  
BC  
BC & masking  
[sound in  
non test ear]

LE side  
BLUE  
×—×—×—×  
>—>—>—>  
[—[—[—[—[

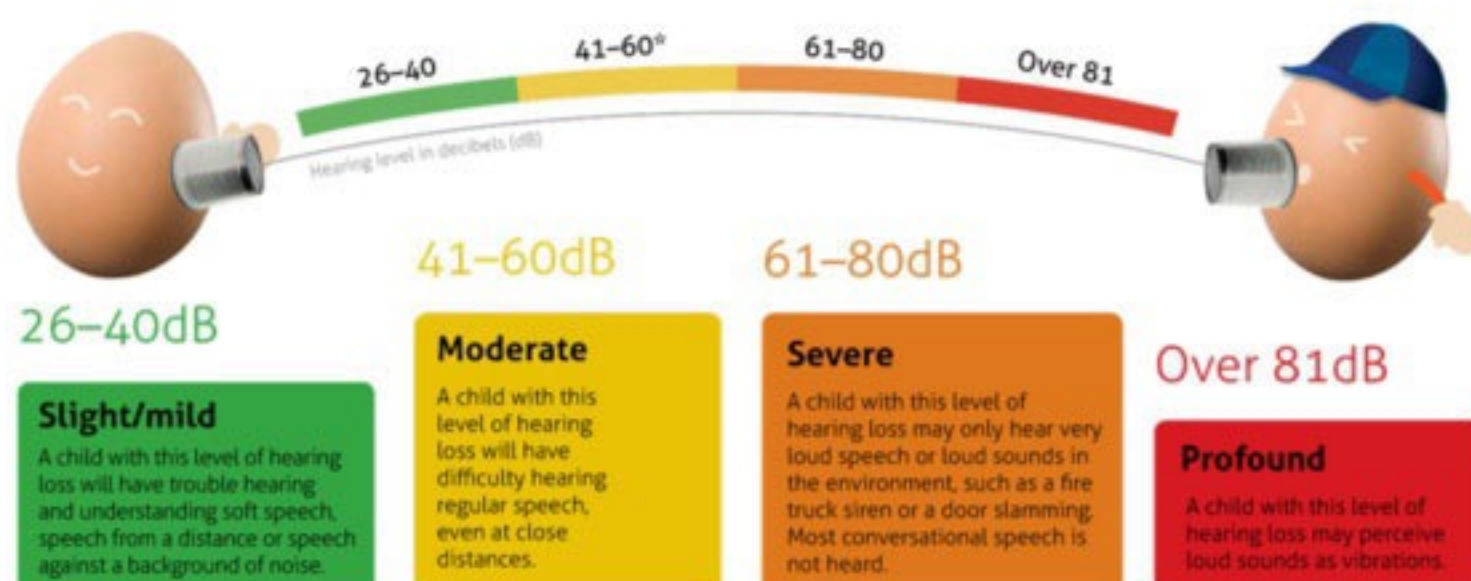


## Range of Sensory Neural Hearing loss : Clarke's [1981]



## WHO classificat<sup>n</sup> of Hearing loss

Hearing loss grades



\*In the case of moderate hearing loss, the range for children is from 31-60 dB.

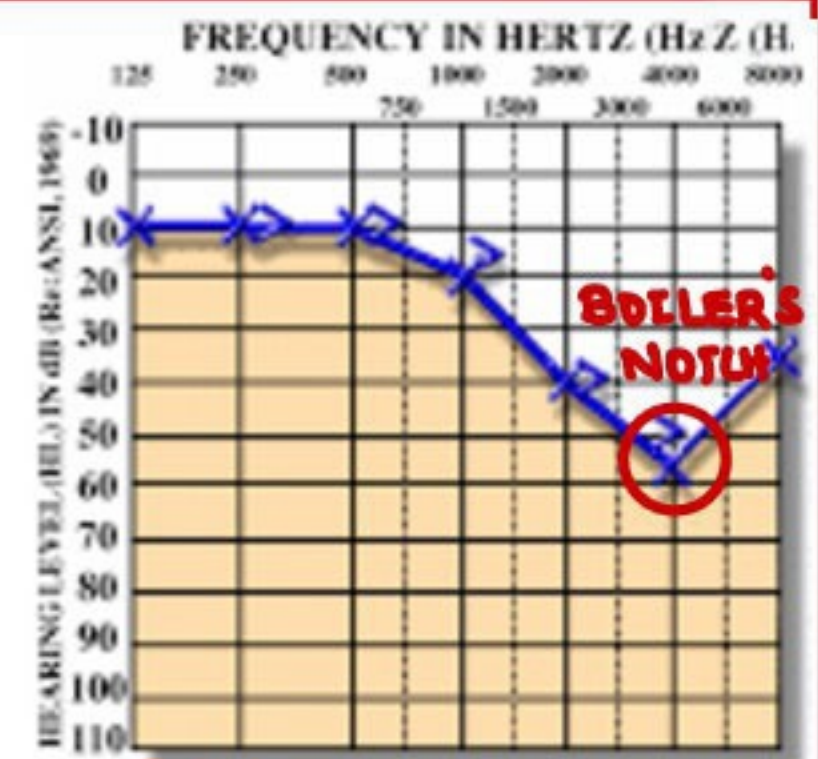


## NOISE INDUCED HEARING LOSS

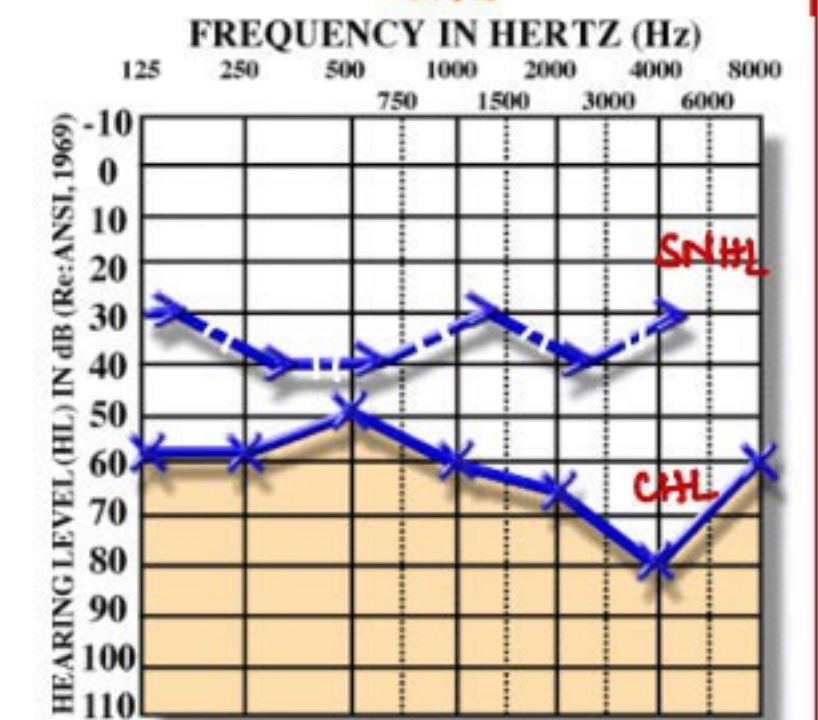
- Boiler's notch at 4000 Hz
- max. seen at 3000 - 6000 Hz
- Sounds causing max. noise induced HL - 2000-3000 Hz
- Stereocilia of outer haircells are 1st to be affected
- Test to find out NIHL even before on audiometry → OAE
- No AB gap



stereocilia of outer haircells



SNHL → NIHL

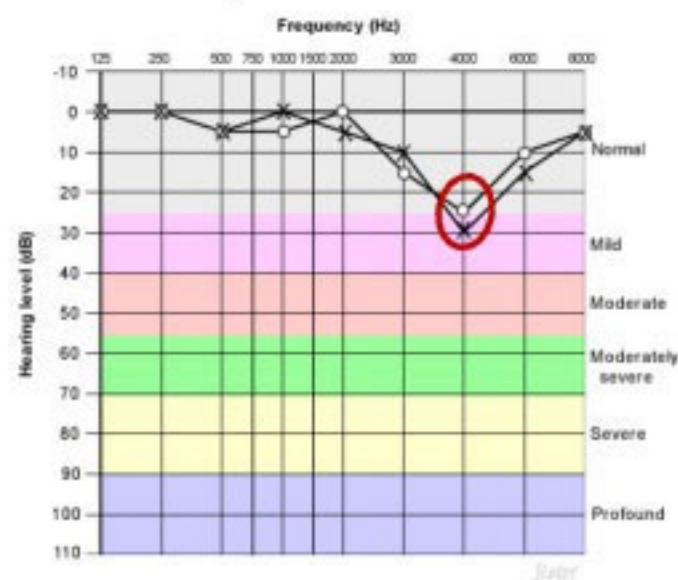


MIXED HEARING LOSS

## MIXED HEARING LOSS

- AB Gap present
- Both SNHL & CHL present

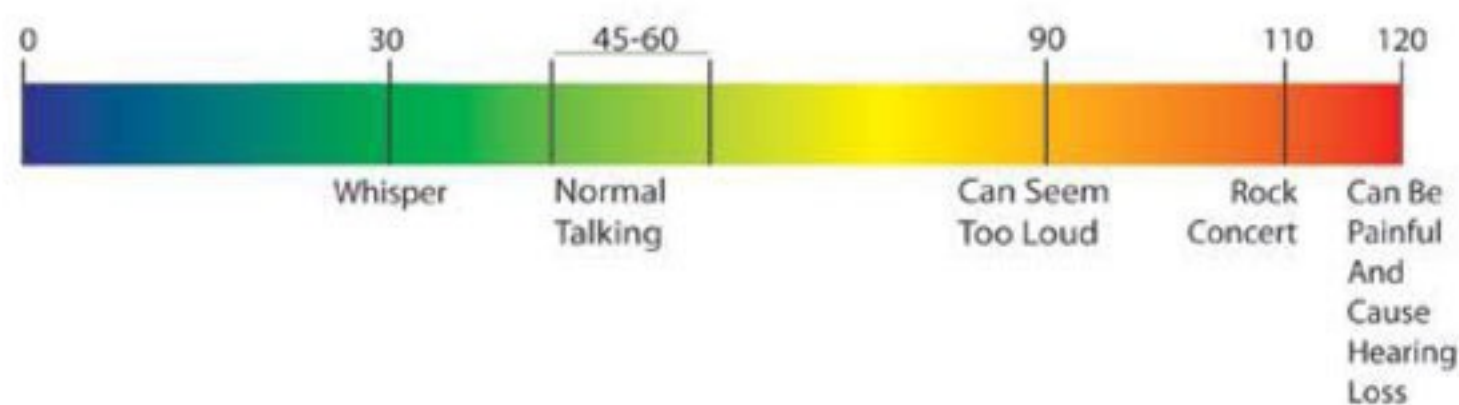
## ⑥ Identify the cause of hearing loss



BIL NOISE INDUCED HEARING LOSS

## SPEECH INTENSITY

Intensity of Sounds (Measured in Decibels (dB))



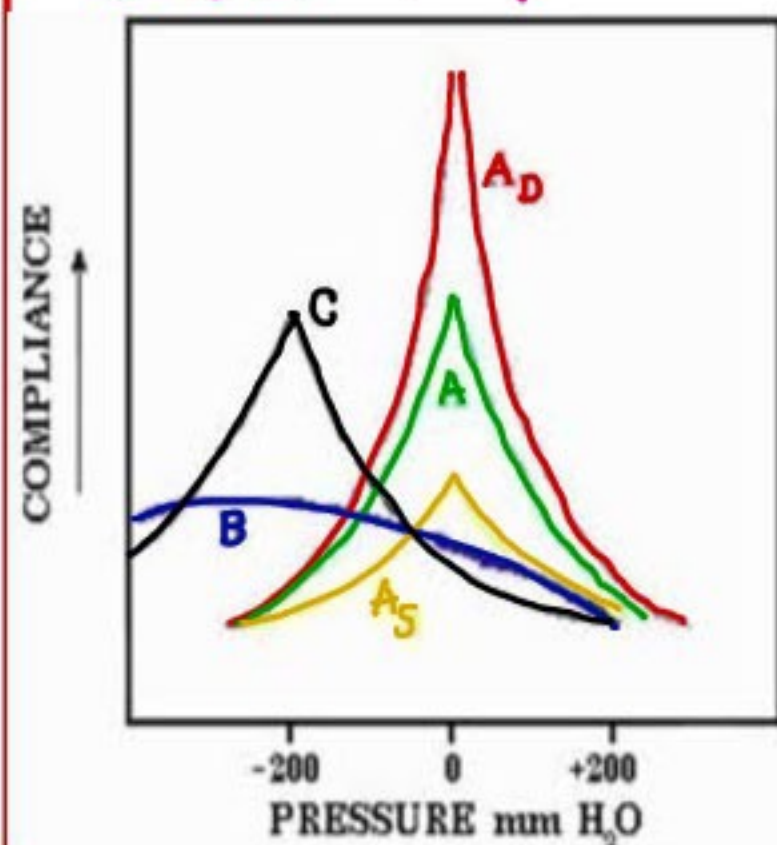


### 3. IMPEDENCE AUDIOMETRY

→ consists of

1. Tympanometry (+)
2. Stapedial Reflex / Acoustic Reflex Test

#### Tympanometry



→ Type A → seen in Normal individual

Type AS → seen in Stiffness / Small / Sclerosis

- Otosclerosis [stapes becomes stiff]
- Tympanosclerosis

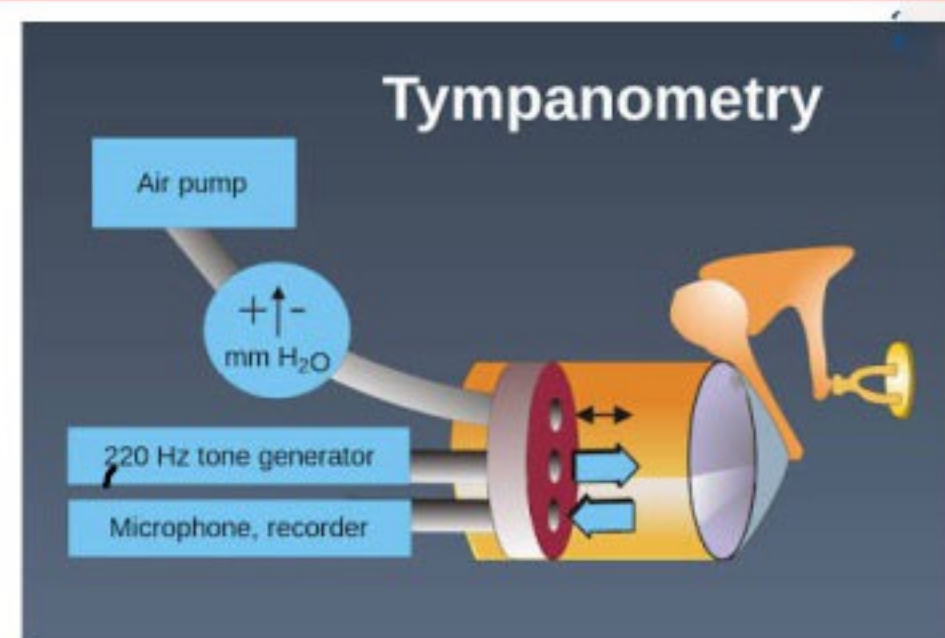
Type AD → seen in ossicular Discontinuity / Decrease in stiffness / Dimeric

Type B → seen in fluid in the ME

- Glue ear (serous otitis)

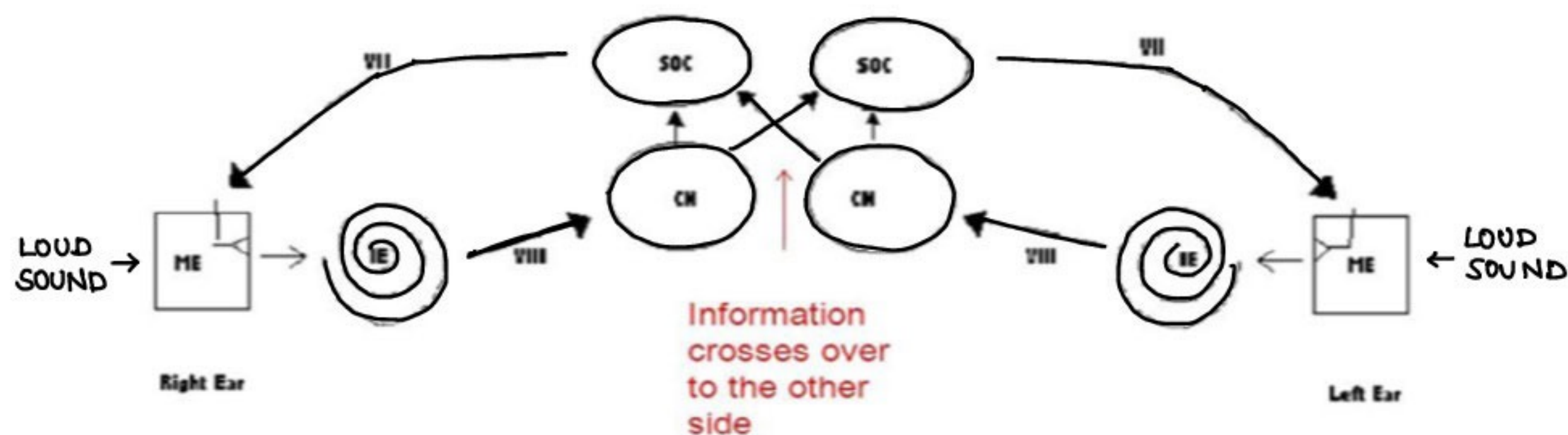
Type C → seen in Retracted Tympanic membrane

[we will apply some -ve pressure first as TM is retracted]



#### Stapedial Reflex / Acoustic reflex / ME muscle Reflex / Attenuat<sup>n</sup> Reflex / Auditory reflex

→ Protects inner ear from noise trauma



Middle Ear → Inner Ear → Vestibulocochlear Nerve (VIII) → Cochlear Nucleus Superior  
→ Olivary complex → Facial Nerve (VII) → Middle Ear (Stapedius Muscle) Contract<sup>n</sup>

#### HEARING ASSESSMENT

##### Subjective

Bir15 Toddler School-Aged +

PURE TONE AUDIOMETRY

PLAY AUDIOMETRY

VROA

→ Condition Responses

BOA

→ Observe Responses

Need to consider individual functional Age

Request  
Responses

##### Objective

Tympanometry  
Acoustic Reflex  
ECoG  
OAE  
BERA / ABR



## Behavioural Observation Audiometry [BOA]



Very young Babies [under 6 months]

## Visual Reinforcement Orientation Audiometry [VROA]



Infants - 7 months - 3 years

## Play Audiometry [3-9 years]



→ Best objective test for Malingering

## SPEECH AUDIOMETRY

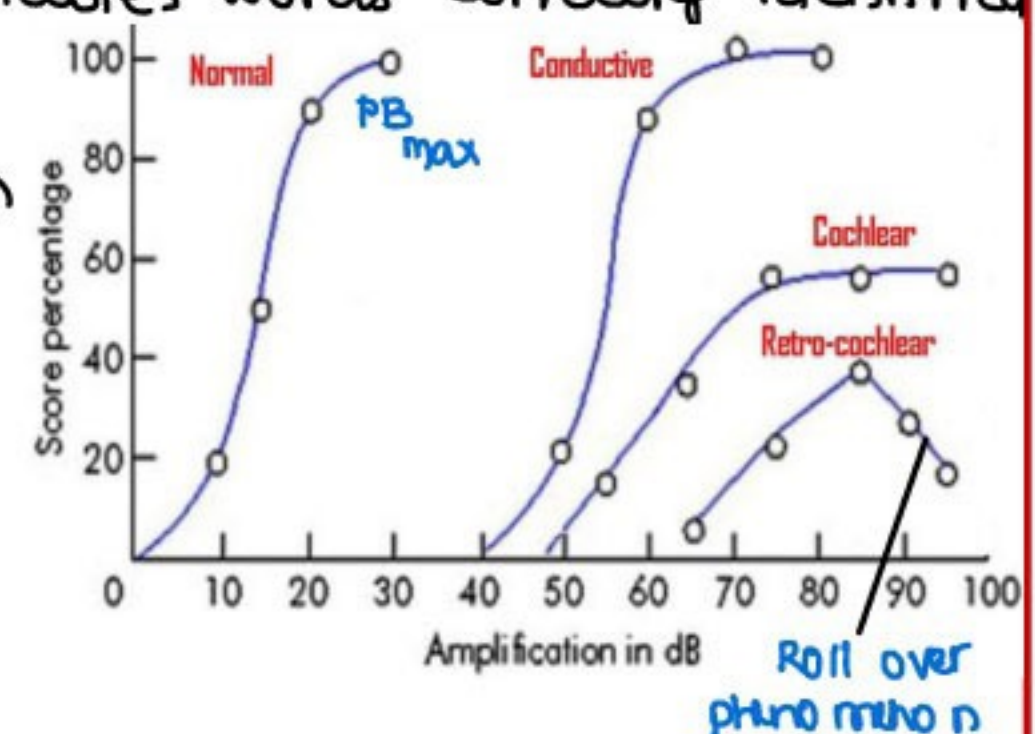
### Speech Reception Threshold [SRT]

- Minimum intensity at which 50% of Spondee [disyllable  $\bar{e}$  equal stress] words are correctly identified
  - Spondaic Words
    - Pancake
    - Hardware
    - Playground

### Speech Discrimination Score [SDS]

- Percentage of phonetically balanced [single syllable] words correctly identified at 40 dB above SRT
  - Phonetically balanced words → Pin, Tin, bin
  - PB<sub>max</sub>

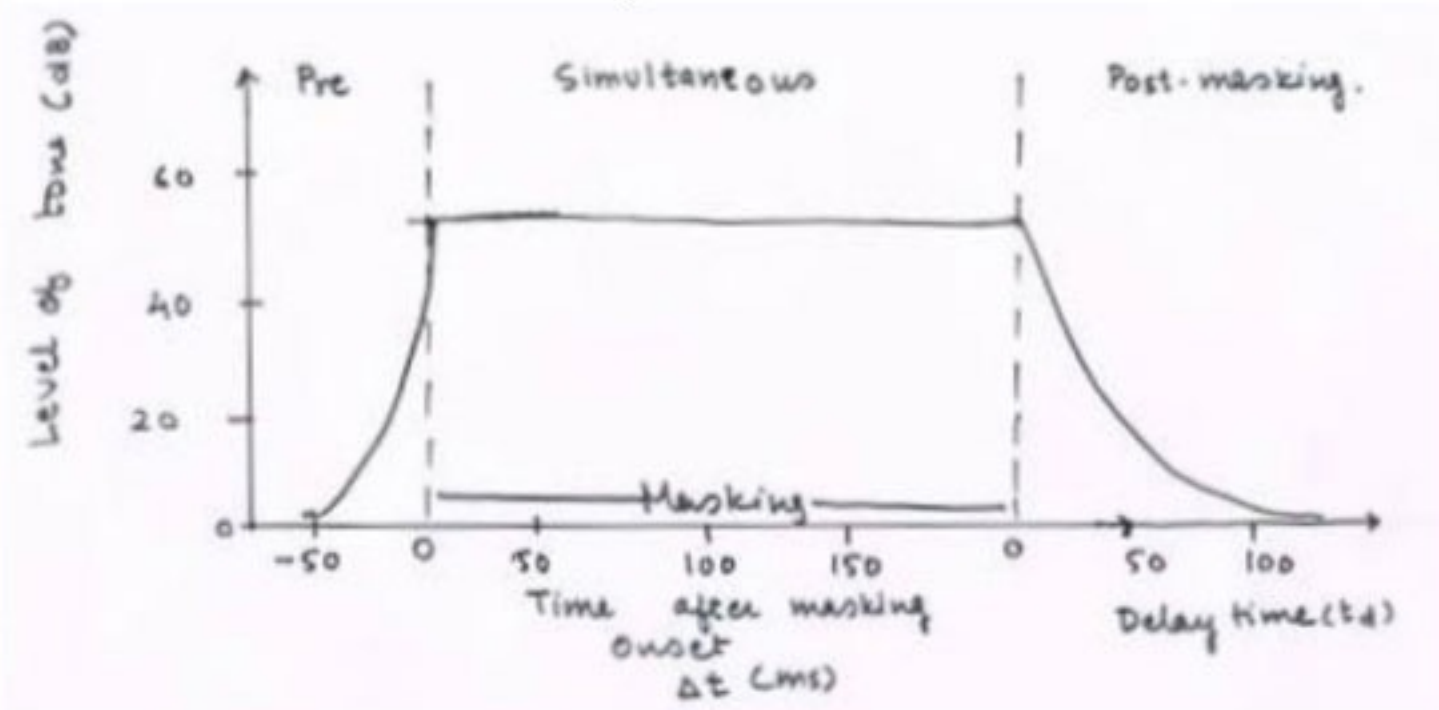
→ Identifies Retro cochlear hearing loss





## TONE DECAY TEST

- If a Normal individual given a sound within his hearing threshold or 5dB in hearing threshold, he should be able to hear the sound for 60 sec.



Tone Decay		Pathology
dB	Type	
0-5	Absent	Normal
10-15	Mild	Cochlear
20-25	Moderate	Cochlear
> 25	Severe	Retro-Cochlear

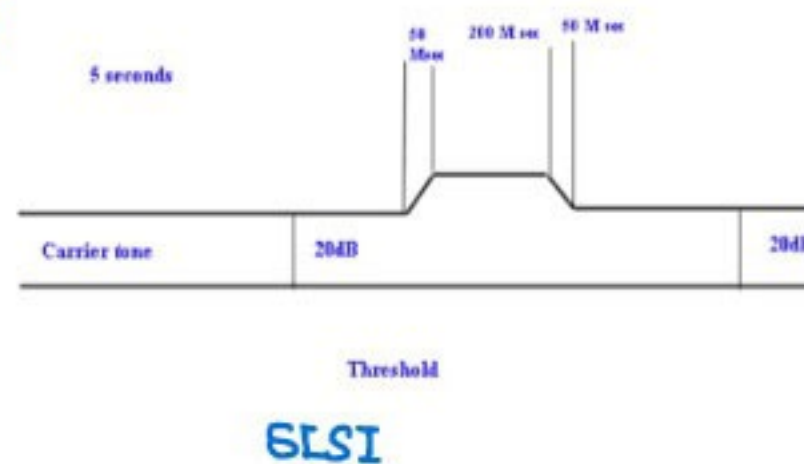
- Identifies Retrocochlear hearing loss

## RECRUITMENT

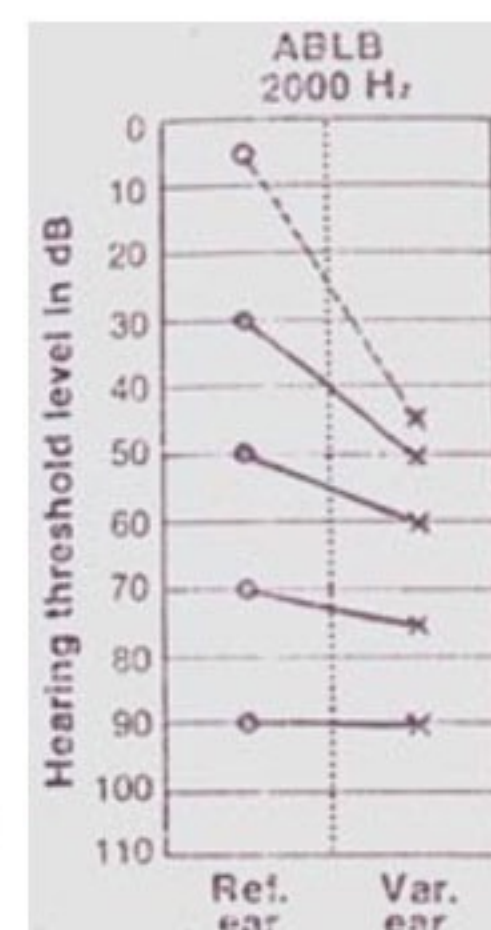
- Present in cochlear hearing loss
- The sound that is given appears LOUDER than actual
  - ABLB LADDERGRAM

## SISI [Short Increment Sensitivity Index]

- Pt is given 1 dB increasing clicks above the 20dB of his hearing threshold, and observes for how many clicks he can able to identify
- Test for cochlear hearing loss



SISI



ABLB LADDERGRAM

## COCHLEAR VS RETRO - COCHLEAR

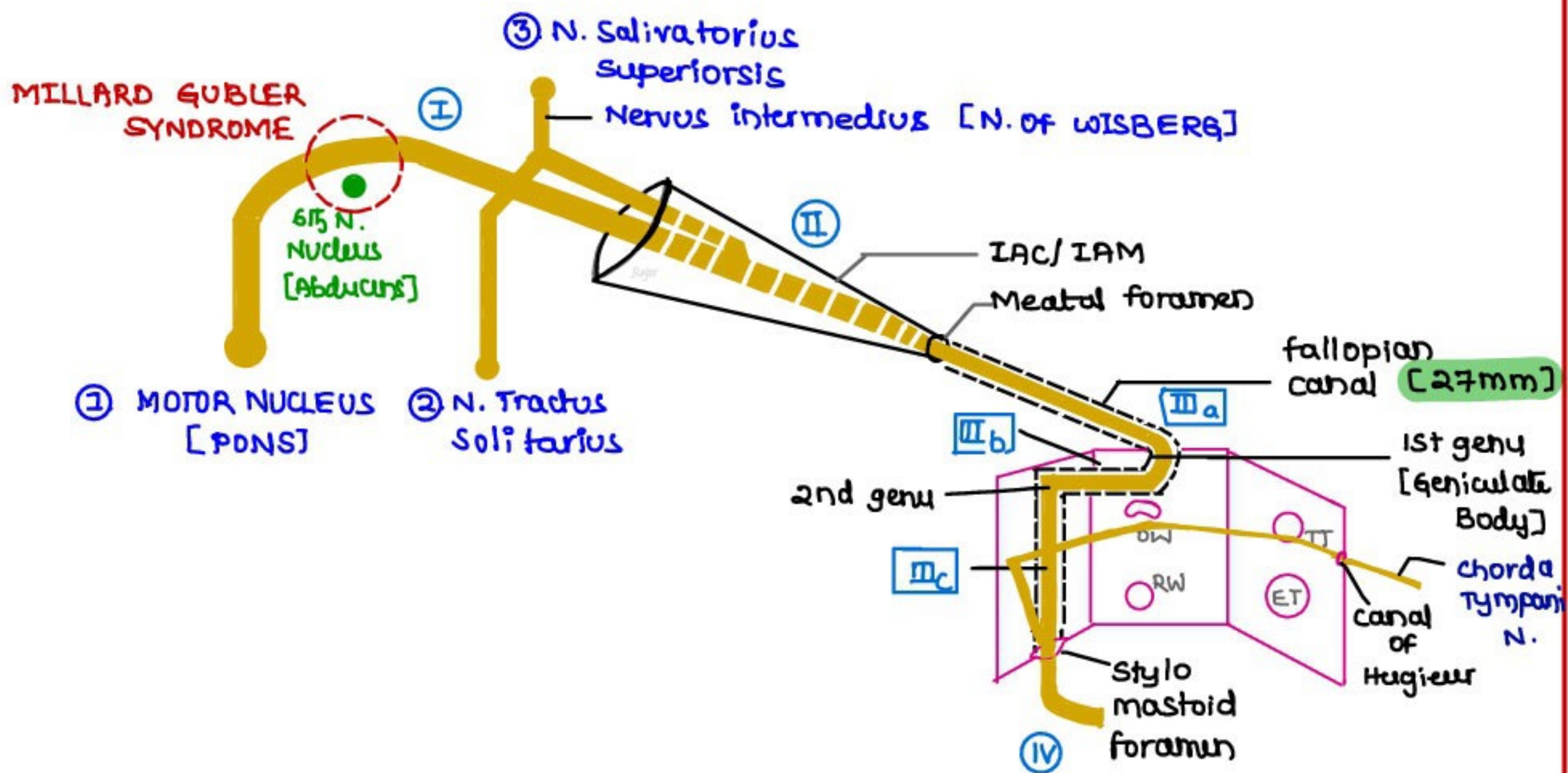
Audio Test	Cochlear	Retro-cochlear
Speech Audiometry	S.D.S. = 60-80 %	< 40 %, Roll over phenomenon
S.I.S.I.	Positive (> 70 %)	Negative
A.B.L.B. laddergram	Converging	Diverging
Tone decay	Negative (< 25dB)	Positive (> 25dB)
Stapedial reflex	Reflex at < 60 db SL; Decay absent	Reflex at > 70 db SL; Decay present
B.E.R.A. (Wave V latency)	≤ 4.2 msec	> 4.2 msec



## FACIAL NERVE & ITS DISORDERS

### FACIAL NERVE

- mixed Nerve
  - motor
  - Sensory
  - Secretomotor



### Segments

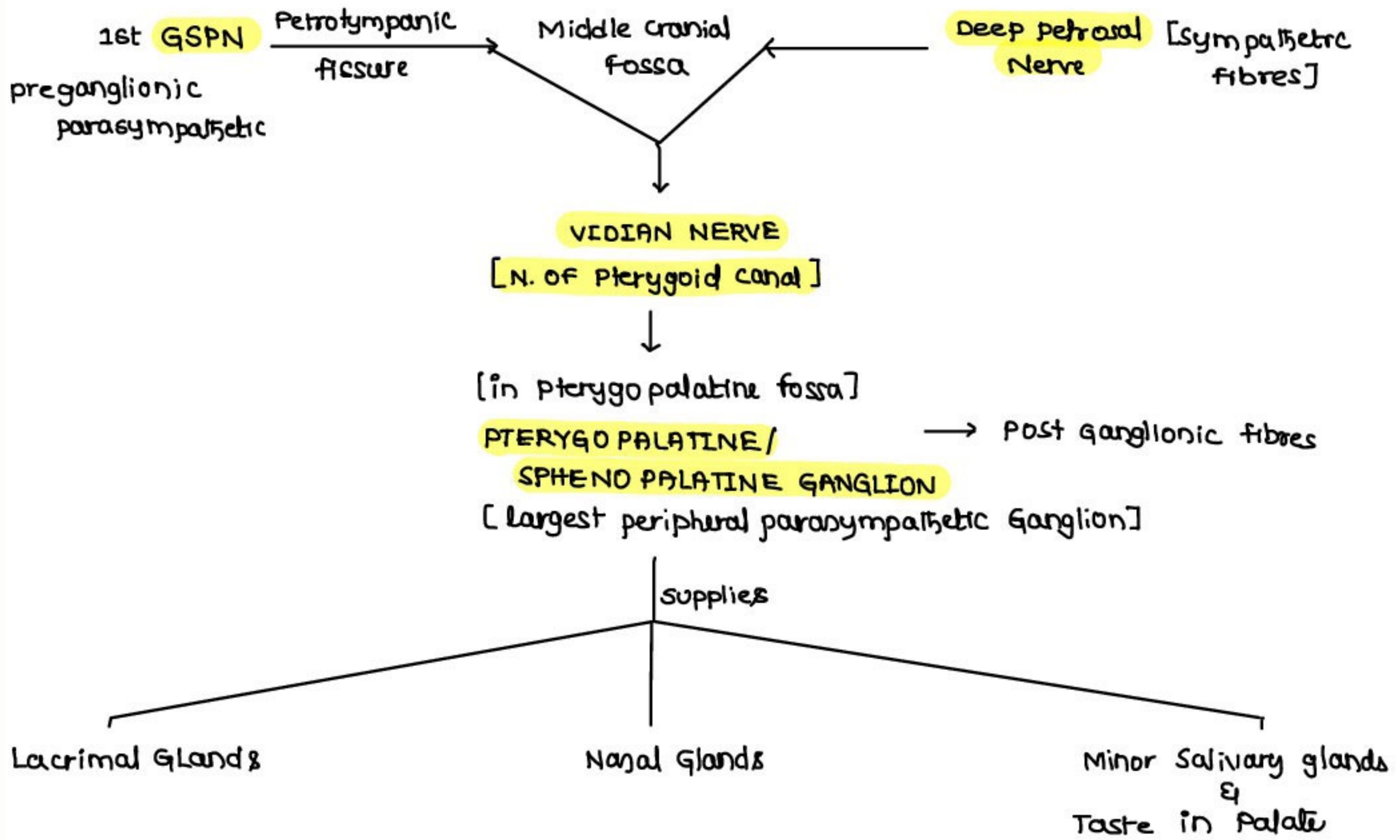
- ① Intracranial segment
- ② Intrameatal segment
- ③ Intra temporal segment
  - III<sub>a</sub> - Labyrinthine segment [Shortest [3mm], Narrowest [0.68mm] Segment]
  - III<sub>b</sub> - Tympanic / Horizontal segment
  - III<sub>c</sub> - Mastoid / Vertical segment
- ④ Extra temporal segment

- fallopian canal → longest bony canal for any cranial Nerve
- 8th Nerve accompanies the facial N. in Intra auditory meatus
- MILLARD GUBLER SYNDROME → Lesion around 6th Nerve nucleus along 7th N. Nucleus & facial Nerve
- 1st & 2nd genu present in intra temporal segment
  - 1st genu has Geniculate ganglion

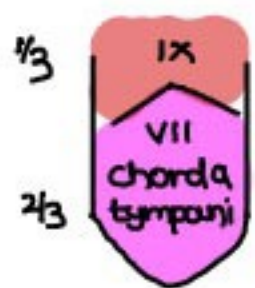
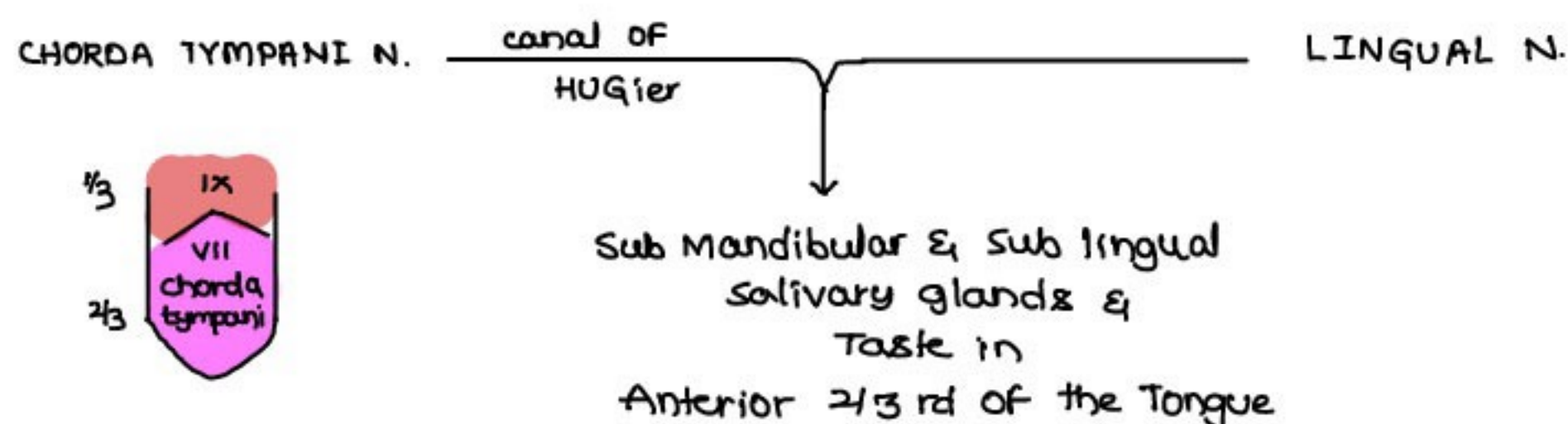


## BRANCHES OF FACIAL NERVE

- No branches in segment I, II, IIIa
- from 1st Genu → 3 branches
  1. GSPN [Greater Superficial Petrosal N.]
    - carries preganglionic parasympathetic fibres
  2. Lesser Petrosal Nerve
  3. External Petrosal Nerve



- No Branches for III<sub>b</sub>
- Just after 2nd genu, facial N. gives a branch → **N. to Stapedius** [1st motor branch of facial Nerve]
- Before facial N. goes out of stylomastoid foramen, gives a branch → **chorda tympani Nerve** [first Embryological branch]
  - comes in from the posterior wall & comes out from anterior wall through canal of HUGIER



- sub mandibular & sub lingual salivary glands supplied by → **chorda tympani [VII]**
- Parotid gland supplied by → **Glossopharyngeal [IX]**



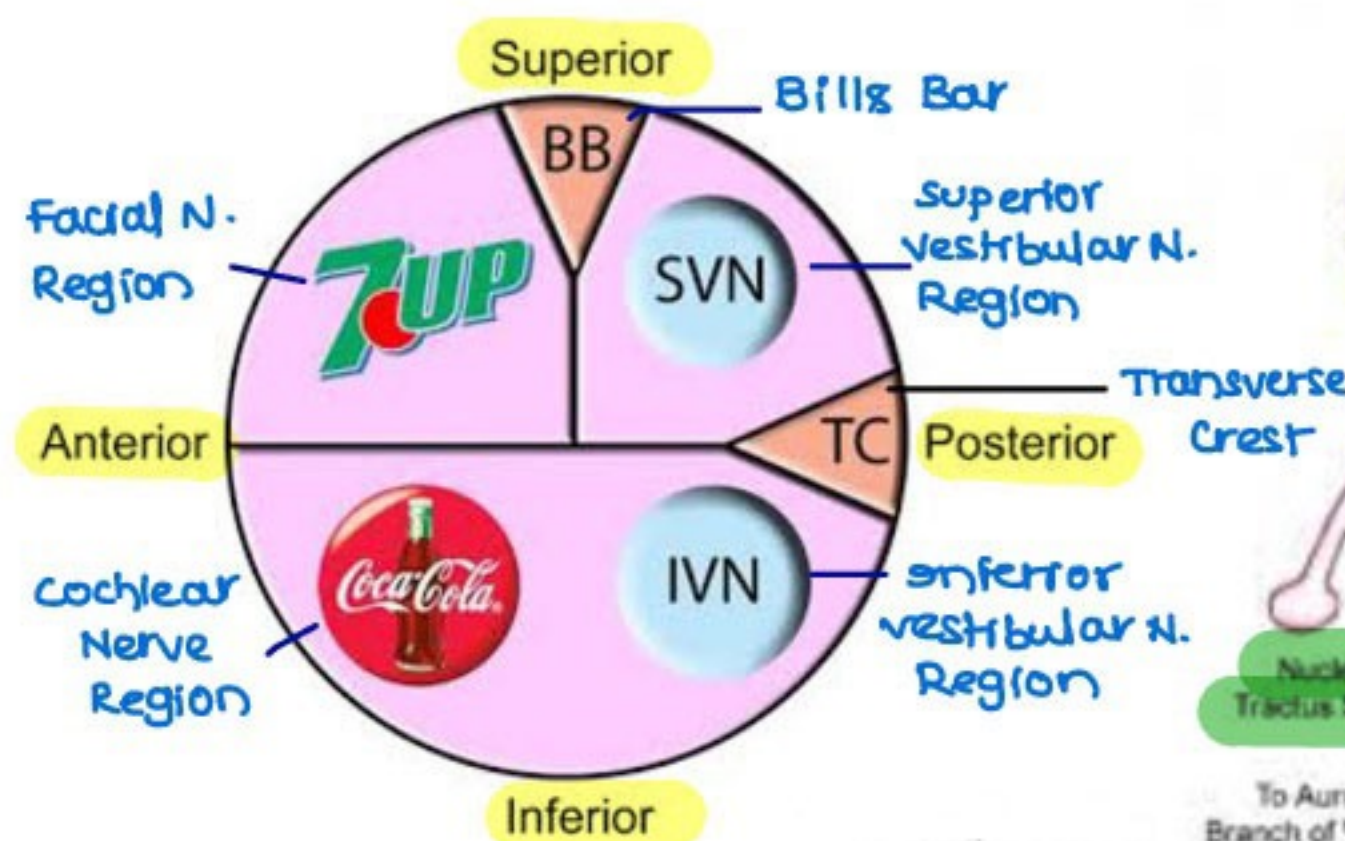
→ After coming out of stylo mastoid foramen, facial N. goes into the Parotid gland & divides Parotid gland into 2 lobes

1. Superficial lobe
2. Deep lobe.

→ In parotid gland, facial N. divides into 5 terminal branches

1. TEMPORAL
2. ZYGOMATIC
3. BUCCAL
4. MARGINAL MANDIBULAR
5. CERVICAL

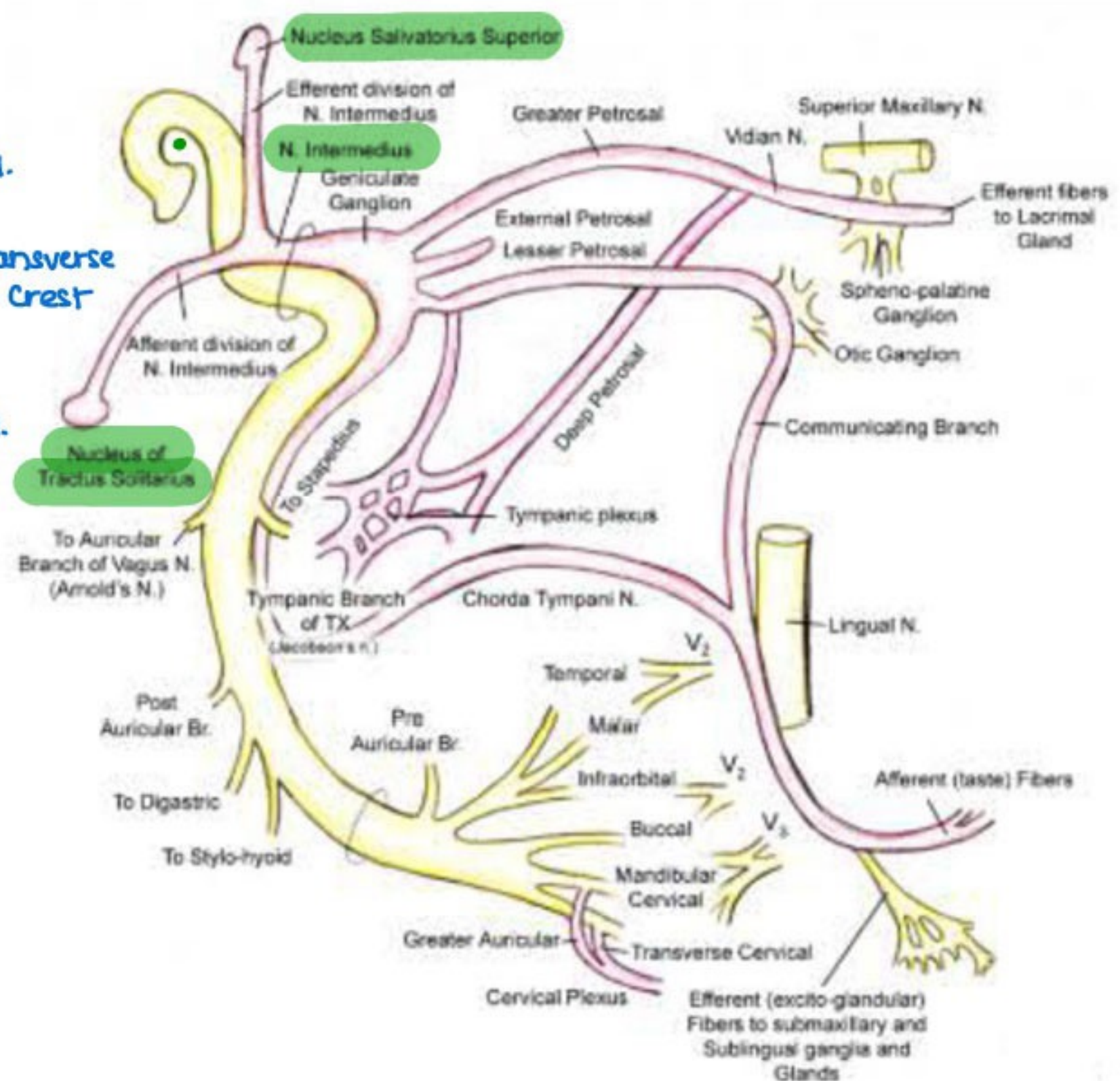
GOOSE FEET ARRANGEMENT  
(or)  
PES ANSERINUS



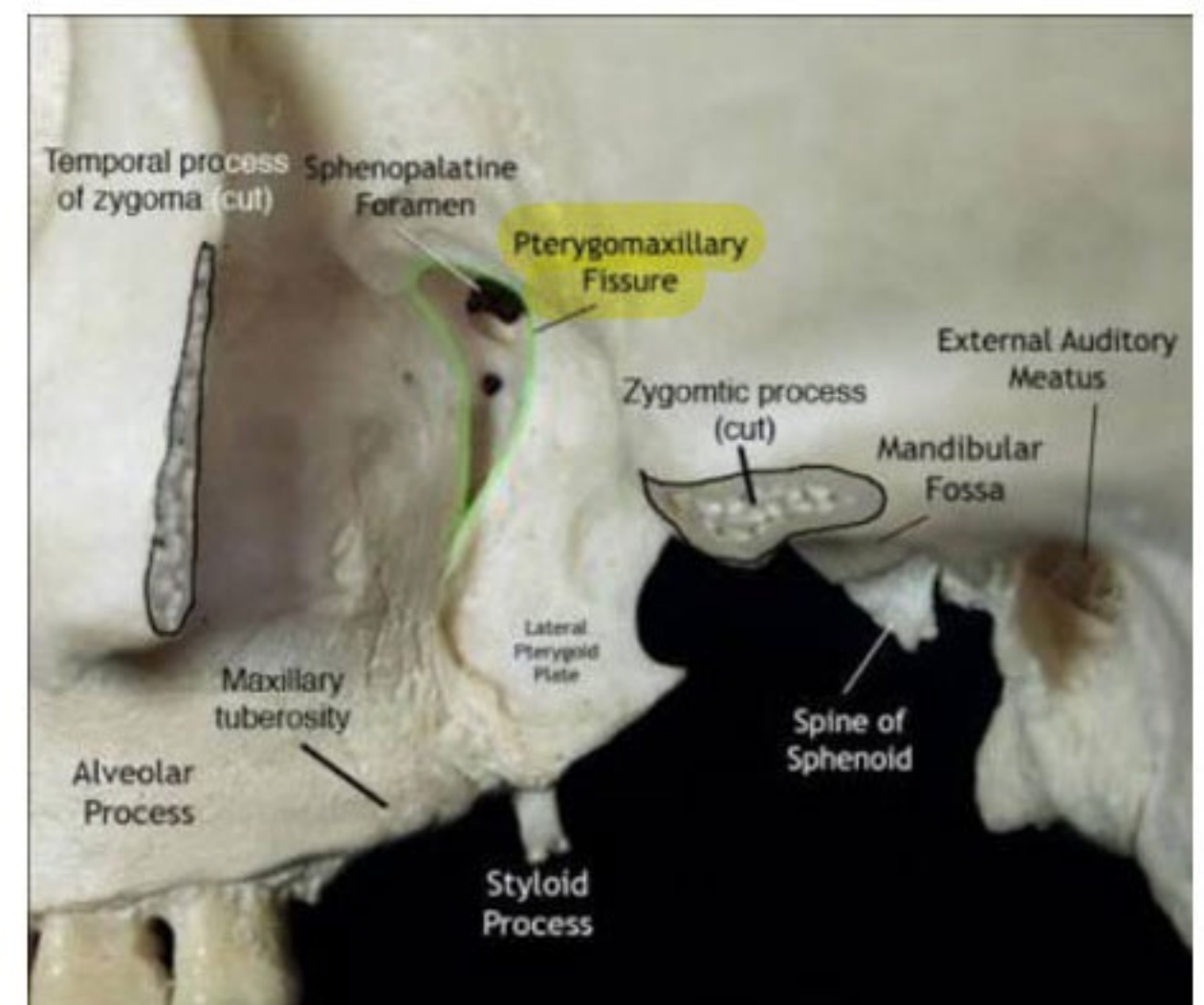
IAM / Int. Auditory canal

**BILL'S BAR** - vertical ledge of bone

- Named after **Dr. William House** [father of Neuro otology]
- Imp. Sx land mark of facial nerve



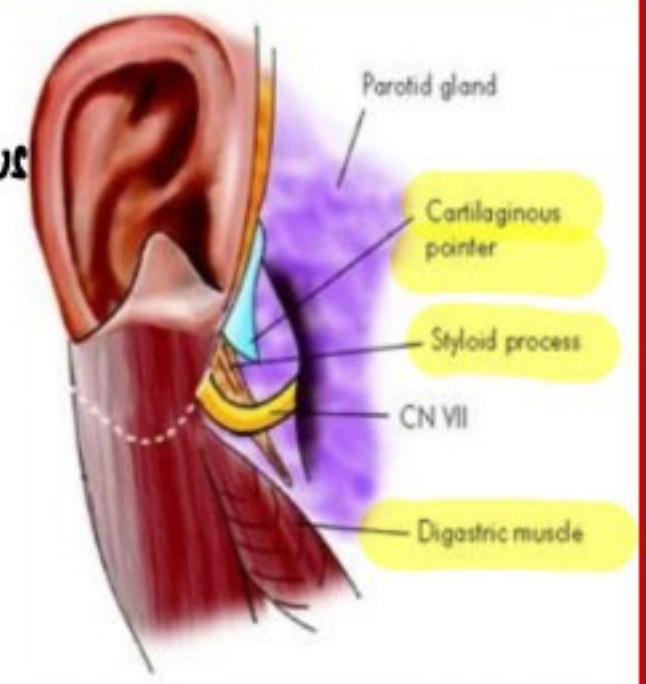
**PTERYGO PALATINE FOSSA**





### Sx Landmarks of facial N. for Parotid Sx

- facial N. lies 2.5 cm deep & internal to the CARTILAGINOUS TRAGAL POINTER
- facial N. is anterior & superior to the Digastric muscle
- facial N. is superficial & anterior to the styloid process



### TOPODIAGNOSTIC TESTS

- used to identify the locat<sup>n</sup> of injury to the facial Nerve

#### 1. SCHIRMERS / TEAR / LACRIMATION TEST

- **-ive** → Both sides lacrimat<sup>n</sup> is equal → Normal  
→ GSPN is Normal → facial N. is normal till 1<sup>st</sup> genu.
- **+ve** → one side lacrimat<sup>n</sup> is decreased  
→ GSPN is affected → injury to facial N. is at (or) above 1<sup>st</sup> genu



#### 2. Stapedial Reflex Test / Acoustic Reflex test

- Protective Reflex
- Positive in (N) ears → FN is (N) till 2<sup>nd</sup> genu
- If it is -ive → Injury may be at or above 2<sup>nd</sup> genu

#### 3. Taste test

- Ant 2/3<sup>rd</sup> of tongue → by chorda tympani nerve
- Taste present → +ive → FN is (N) till stylomastoid foramen
- Taste absent → -ive → Injury is above the stylomastoid foramen

#### 4. Submandibular Salivary flow Rate

- supplied by chorda tympani
- Salivat<sup>n</sup> on both sides (N) → -ive → (N) → FN. (N) till stylomastoid foramen
- Salivat<sup>n</sup> on both sides Different → +ve → Ab(N) → Injury is above stylomastoid foramen

Q Patient of RTA, clo Rt sided VII palsy.  
Schrimers, Stapedial Reflex, Taste test → -ive  
Site of Injury (?)

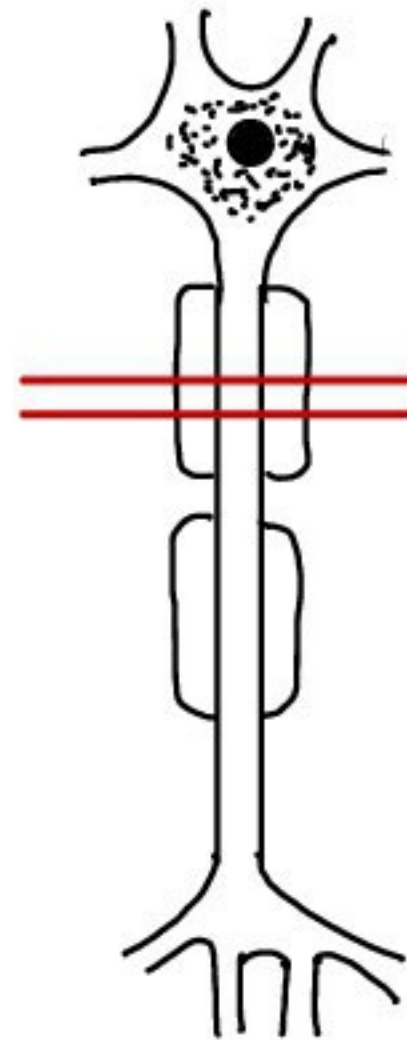
- A. Seg III<sub>a</sub>
- B. Seg III<sub>b</sub>

- C. Seg III<sub>c</sub>
- D. Seg IV



## ELECTRO PHYSIOLOGICAL NERVE TESTING

- Electrical stimulus is given proximal to injury } Normally  
Response is recorded distal to stimulus
- for facial N.



WALLERIAN DEGENERATION  
in  
72 hrs

- Test is done after 72 hrs
- Prognostic test

→ Some times, stimulus can be given proximal to injury & response is recorded distal to stimulus even in facial Palsy

Ⓐ Not a topodiagnostic test of VII Nerve

- A. Schirmers Test
- B. Taste Test
- C. Impedence Audiometry
- D. **Electro Physiological Testing**

Ⓐ Not a topodiagnostic test of VII Nerve

- A. Schirmers Test
- B. Taste Test
- C. **Tympanometry**
- D. Electro Physiological Testing

## DISEASES OF FACIAL NERVE

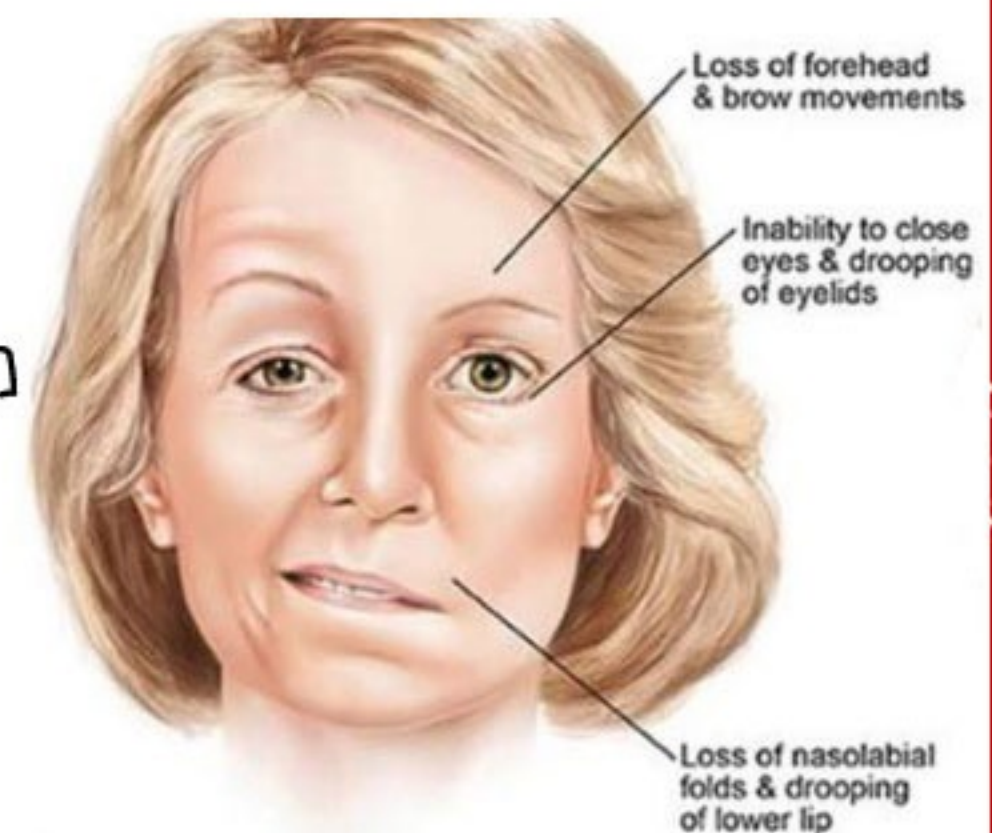
### BELL'S PALSY

- MCC of facial Nerve Palsy
- **Ipsilateral**  
**LMN** [UMN palsy → C/L lower half facial palsy]  
**Idiopathic**

#### Theories

1. Viral Infect<sup>n</sup> [Herpes]
2. Hypersensitivity / Allergic Theory
3. Autoimmune Theory

EDEMA  
OF  
Facial N.



Loss of forehead  
& brow movements

Inability to close  
eyes & drooping  
of eyelids

Loss of nasolabial  
folds & drooping  
of lower lip

But fallopian canal don't → compresses FN → BELL'S PALSY



## RAMSAY HUNT SYNDROME / HERPES ZOSTER OTICUS

- LMN facial Palsy + Vesicular rash in External Ear
- 70% of Bell's palsy → complete Recovery
- 15% of Bell's palsy → Incomplete Recovery
- 85% Recovery (out R)
- 50% of HZ Oticus → 50% Partial Recovery [poor Recovery]
- Involve other Nerves also.

### Rx of Bell's Palsy

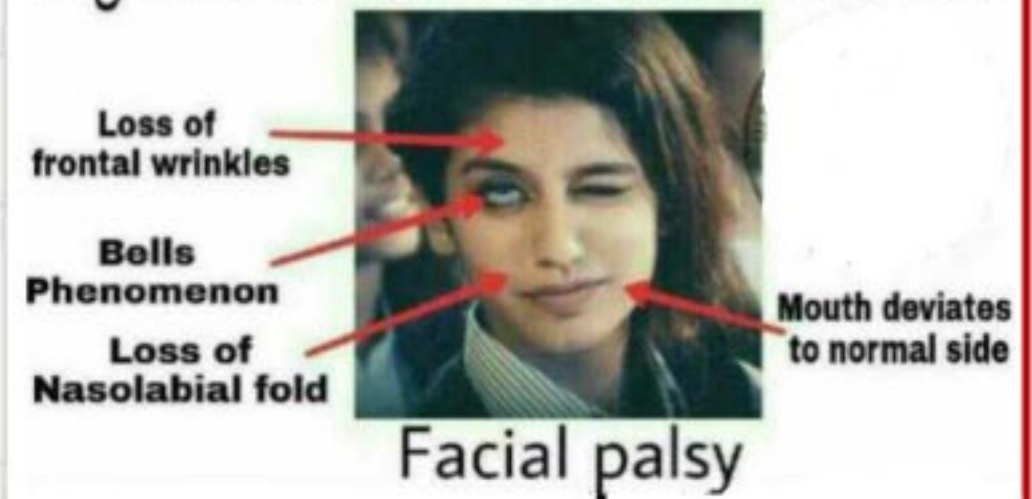
1. Steroids  
Prednisolone 1mg/Kg/Day
  2. Antiviral  
Acyclovir 800mg, 5 times/Day x 5 Days  
Only in 72 hrs
  3. Eye protect<sup>n</sup>  
Artificial eye drops  
Wear goggles, avoid sunny areas, avoid windy areas  
Pad the eye in night times & tape it
  4. Facial Physiotherapy
- ① ② ③ ④ x 7 Days → No improvement
1. Steroids  
3. Eye Protect<sup>n</sup>  
4. Physiotherapy } To be continued for 7 days more
2. Antivirals → stopped
- After 2 wks → No improvement
1. Steroids → Taper the dose & stop
- ↓
- Electrophysiological N. testing
- Not much Damage → Electrophysiotherapy
- Bad Prognosis → Sx [labyrinthine compression of facial Nerve]



## HOUSE BRACKMANN GRADING OF FACIAL NERVE Palsy

Grade	Description	Characteristics
I	Normal	Normal facial function in all areas
II	Mild dysfunction	Slight weakness noticeable on close inspection; may have very slight synkinesis
III	Moderate dysfunction	Obvious, but not disfiguring, difference between 2 sides; noticeable, but not severe, synkinesis, contracture, or hemifacial spasm; complete eye closure with effort
IV	Moderately severe dysfunction	Obvious weakness or disfiguring asymmetry; normal symmetry and tone at rest; incomplete eye closure
V	Severe dysfunction	Only barely perceptible motion; asymmetry at rest
VI	Total paralysis	No movement

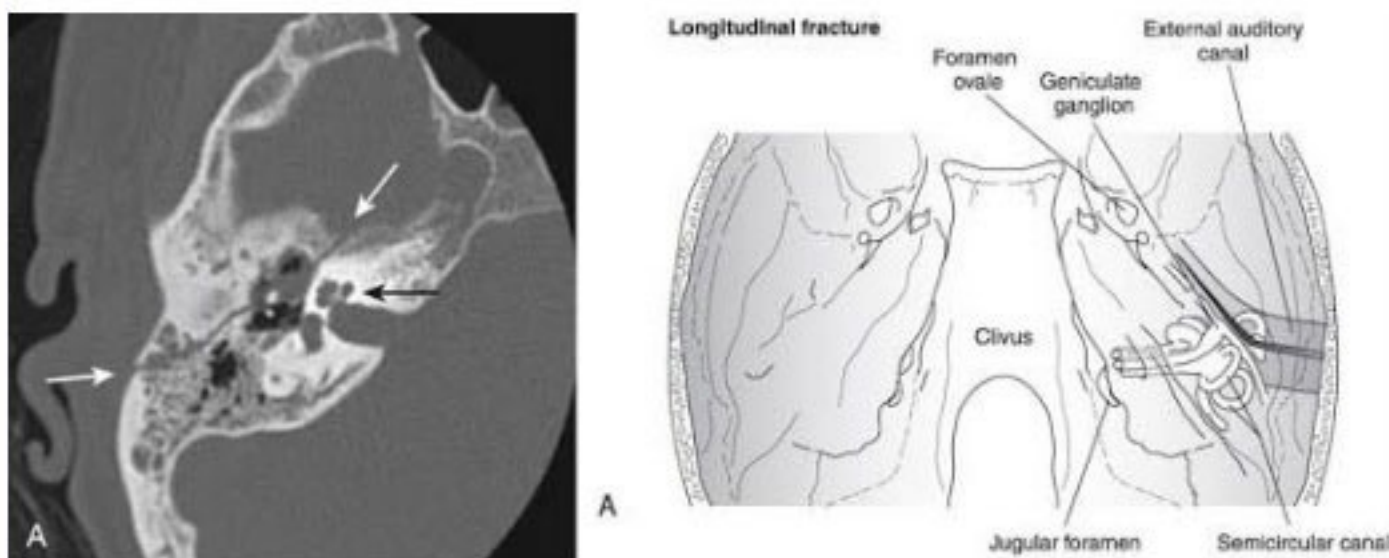
### Right sided Lower Motor Neurone Lesion



## TEMPORAL BONE FRACTURE

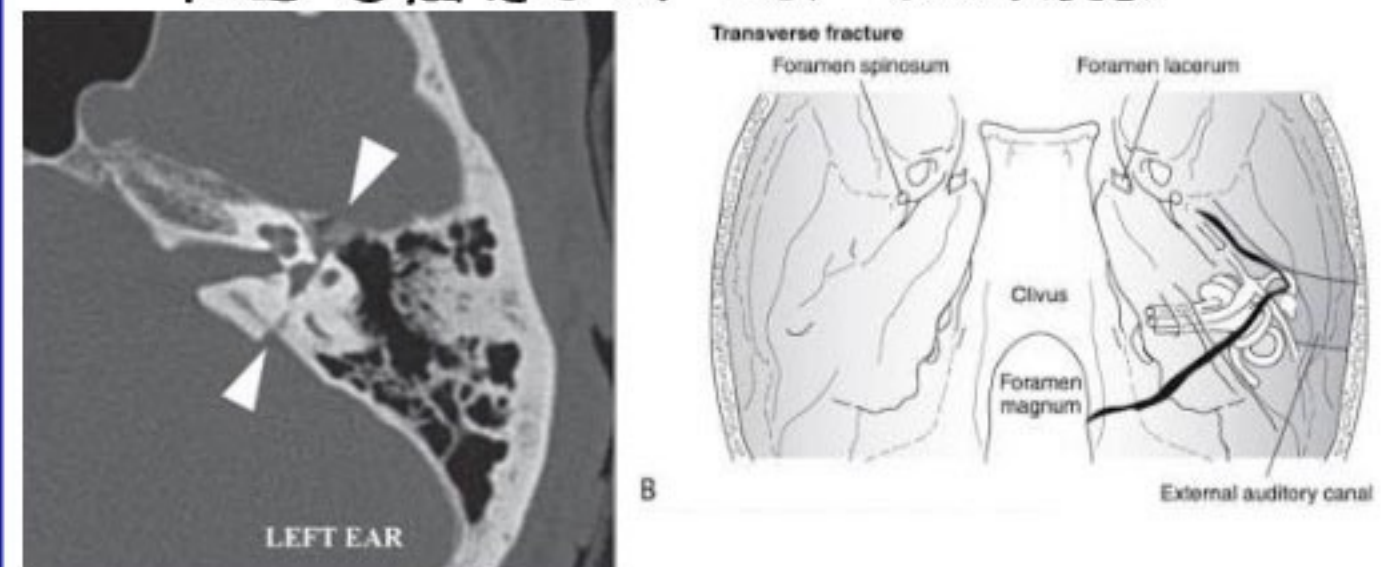
### LONGITUDINAL FRACTURE

- along the axis of temporal bone
- cause → parietal or temporal blow
- 80% [mc]
- only 10% have facial N. palsy
- more chances of bleeding from EAC
- more chances of CSF otorrhea



### TRANSVERSE FRACTURE

- Perpendicular to the axis of temp. bone
- dit occipital blow
- 20%.
- 50% have facial palsy
- less chances of bleeding from EAC
- less chances of CSF otorrhea



- mc temporal bone fractures → Mixed [547.]
- Now a days, Temporal bone # are known as
  - Otic capsule sparing → less complications
  - Otic capsule involving → more complications

- ⓐ RTA, Sudden & complete facial N. Palsy, R<sub>1</sub> → Facial N. decompression
- Delayed & complete FN Palsy, R<sub>1</sub> → Steroids
- Sudden & incomplete FN Palsy, R<sub>1</sub> → Steroids



## DISEASES OF MIDDLE EAR

### ASOM [ACUTE SUPPURATIVE OTITIS MEDIA] / AOM [ACUTE OTITIS MEDIA]

#### Causes

- Streptococcus pneumonia [mc]
- Haemophilus influenzae
- Moraxella catarrhalis

#### Stages

##### Stage I - Stage of Tubal Occlusion

- Nasopharyngeal end (or) cartilaginous end of Eustachian tube is blocked
- ME pressure decreases

↓

Tympanic membrane is pulled / Retracted

↓

Pain, ↓ Hearing

Dull & Lusterless, non-shiny

No cone of light



##### Stage II - Stage of pre suppurat<sup>n</sup>

- Sterile, serous, mucoid secret<sup>n</sup> accumulate in ME
- TM bulges out, Blood vessels become prominent → CART WHEEL APPEARANCE
- Pain ↑, Hearing ↓

##### Stage III - Stage of Suppurat<sup>n</sup>

- infect<sup>n</sup> reaches ME
- Fluid → Pus
- Severe pain + nt
- Tragus sign -ive
- Red congested bulging TM ready to burst



##### Stage IV - Stage of Resolution

- TM burst
- Pus comes out, pain ↓
- mc site of TM Perforat<sup>n</sup> → Antero inferior quadrant of Pars Tensa
- After few weeks, perforat<sup>n</sup> heals & hearing becomes (N)
- A healed TM → Dimeric [No fibrous layer]
- LIGHT HOUSE SIGN → pus is coming out constantly



↓

light is reflected back

Rx

- |              |  |
|--------------|--|
| Stage I & II | → Antibiotics, Analgesics, Nasal decongestant drops    |
| Stage III    | → Myringotomy [performed in Postero inferior quadrant] |
| Stage IV     | → 90% → leave alone                                    |

Rate of Growth  
PS  
PI  
AI  
AS  
↑

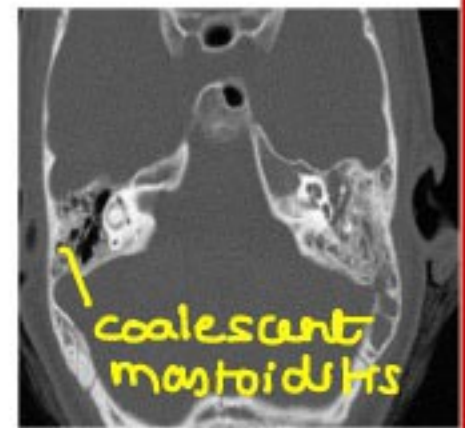


## Complications

### 1. Acute Mastoiditis

- mc complicat<sup>n</sup>
- sign for mastoiditis → Pain & tenderness at Symba concha
- Ironed out mastoid
- Rx → IV Antibiotics x 7 Days
- BATTLE SIGN
  - hematoma over mastoid
  - d/t # middle cranial fossa
- GRESSEINGER SIGN
  - pitting edema over mastoid
  - d/t Sigmoid Sinus thrombosis

Ironed out  
mastoid

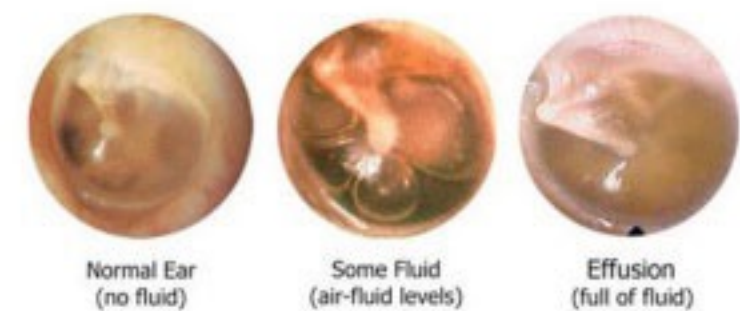


### 2. Coalescent Mastoiditis

- ME inflammation resolved
- But there is clouding of mastoid air cells [Filled w fluid]
- Rx - IV Antibiotics x 3wks [Roc]
- ↓
- Sx

## GLUE EAR / SOM [SEROUS OTITIS MEDIA] [SECRETORY OTITIS MEDIA]

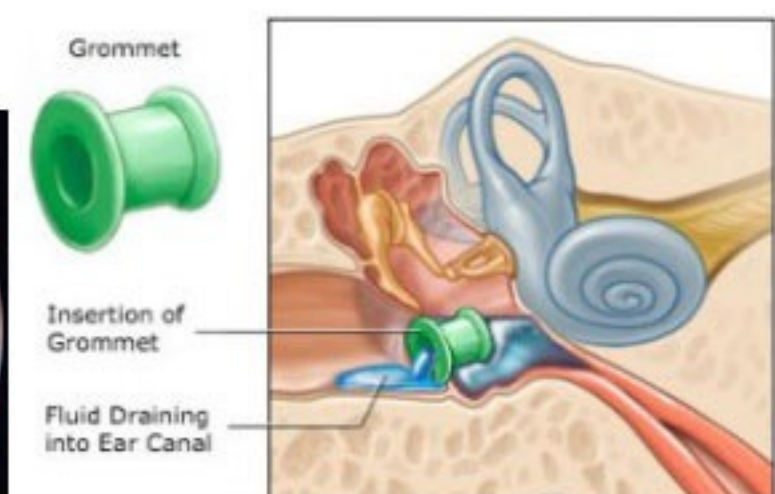
- Long standing collection of serous or mucoid fluid in the middle ear
- mucoid otitis media or secretory otitis media or Non suppurative otitis media or Glue ear
- d/t tumor, adenoids etc
- No pain



- Hearing loss present [CHL - mc cause]
- O/E → Fluid filled ME → Thin bulging TM & fluid behind
- Blue TM [some times] → Haemotympanum → LAUGIER'S SIGN
- seen in 1. Glue ear [SOM]
- 2. Blood
- 3. Glomus tumor



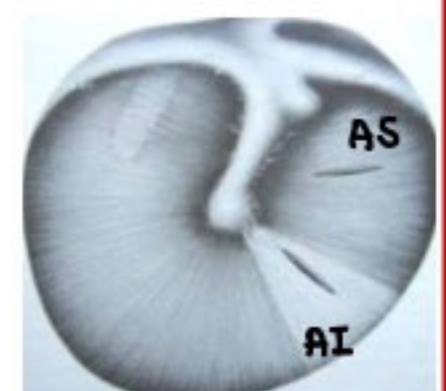
- Pure tone audiometry
  - AB Gap [25-30 dB] → CHL
- Tympanometry → B curve
- Mx



1. Treat the cause
2. Myringotomy & drain the fluid [in Antero inferior quadrant] & Grommet insertion

## BEER CAN PRINCIPLE

- 2 incisions, 1 in Antero inferior quadrant for air entry
- other in Antero superior quadrant for pus drainage



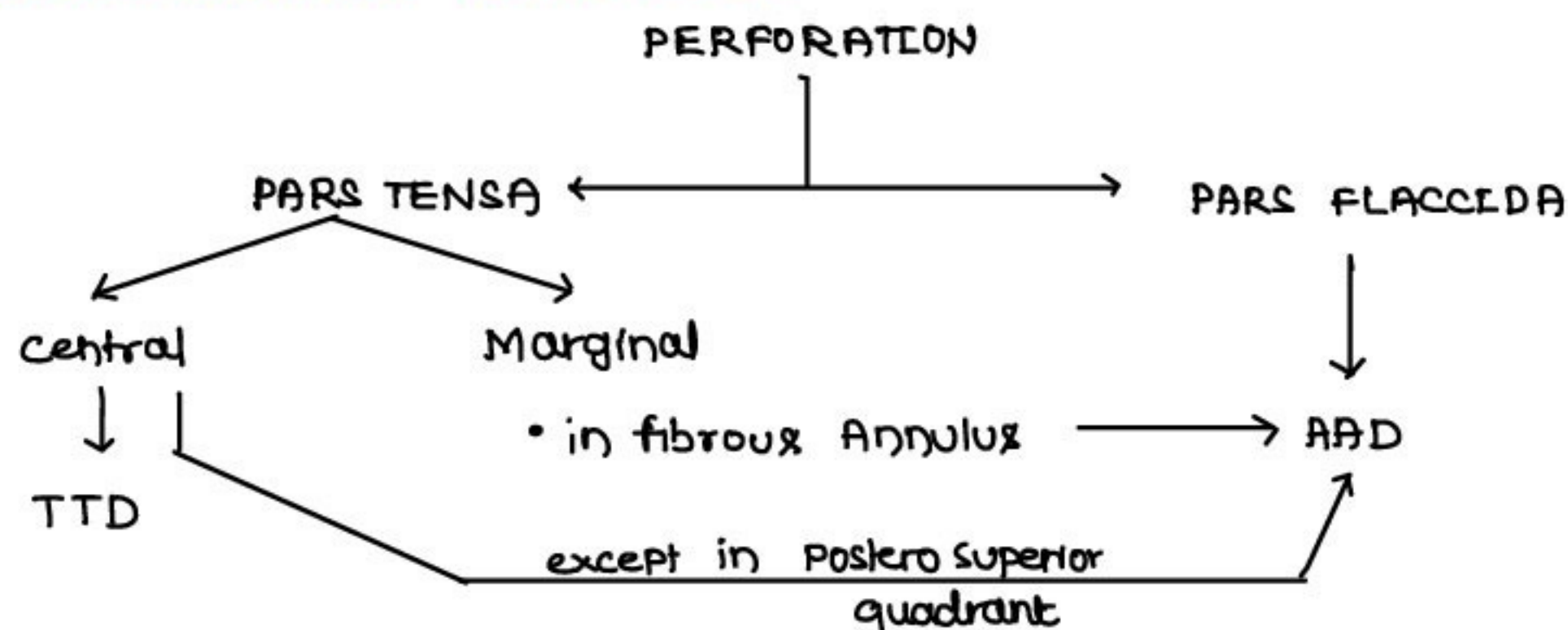


# CSOM [Chronic suppurative otitis media] | COM [Chronic otitis media]

## Types

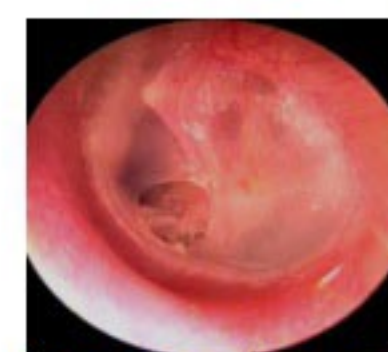
Tubo Tympanic Disease [TTD] } Perforat<sup>n</sup> present  
 Atrophic Antral Disease [AAD]

## Tympanic membrane Perforations



## Tubo Tympanic Disease

- CHL [AB gap - 10-40 dB] [depends on site & size]
- Ear Discharge
  - Mucoid con mucopurulent
  - Profuse
  - NON Foul smelling or foul smelling
  - continuous or intermittent
- central perforat<sup>n</sup> tnt
  - small → 1 Quadrant
  - medium → 2 Quadrants
  - Large → 3 Quadrants
  - Sub total → 4 Quadrants
- Marginal perforation
  - Total → Sub total + Fibrous annulus perforat<sup>n</sup>
- Rx
  1. Active - Antibiotics [For discharge]
  2. Tympanoplasty [Myringoplasty + repair of ossicles] → ROC  
 Myringoplasty [repair of TM]



small perforat<sup>n</sup>



medium perforat<sup>n</sup>






Large perforation



sub total perforat<sup>n</sup>



Total perforat<sup>n</sup>

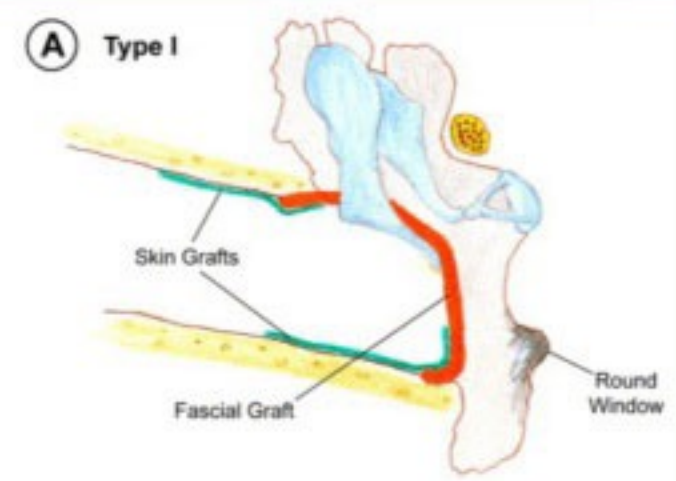
Traumatic Perforat <sup>n</sup>	Diseased perforat <sup>n</sup>
→ Irregular, rough margins	→ Circular, kidney shaped margins
→ Blood clots around perforation	→ Smooth margins
	<b>Sieve like perforation</b>
traumatic	→ Seen in TB
	
	
	diseased      sieve like



## TYPES OF TYMPANOPLASTY

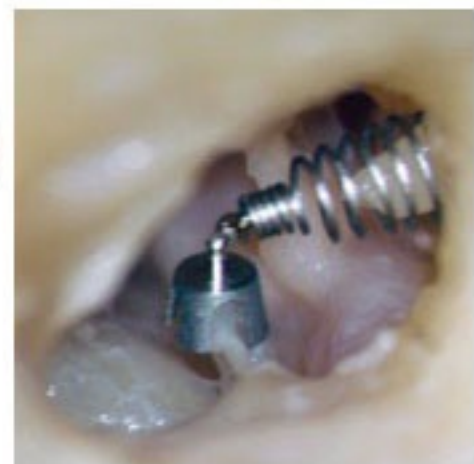
### TYPE I TYMPANOPLASTY / MYRINGOPLASTY

- Simplest tympanoplasty
- Simple repair of tympanic membrane
- TM Perforation,
  - Healed TM perforation is dimeric [no fibrous layer]
  - Surgically repaired TM perforation is → Trimeric
- mc used graft → Temporalis fascia
  - 1. It can be harvested from the same side by same incision [convenient]
  - 2. It's consistency is similar to TM
- We can also use Perichondrium, Fascia Lata, vein graft, cartilage



### TYPE II TYMPANOPLASTY

- TM & ossicles eroded
- Myringoplasty + ossiculoplasty
- Lever ratio is maintained, Areal ratio maintained
- Mc site of erosion → Lenticular process of Incus > Long process of Incus



Type 2 Tympanoplasty

### TYPE III TYMPANOPLASTY / Myringostapediopexy

- malleus & incus are eroded
- Transmission of sound is in straight column
  - COLUMELLA EFFECT
- Type III<sub>a</sub> → Graft directly placed on stapes head
- Type III<sub>b</sub> → PORP [Partial Ossicular Reconstruct<sup>n</sup> Prosthesis]
- Type III<sub>c</sub> → TORP [Total Ossicular Reconstruct<sup>n</sup> Prosthesis]
  - only stapes footplate is present
- Areal Ratio is maintained
- Lever ratio is not present



TORP

### TYPE IV TYMPANOPLASTY

- stapes footplate is diseased
  - Sound striking both the windows at the same time → no sound
- Graft is kept over round window
  - Sound strikes both at same time, but graft delays the sound → phase difference present but no amplification
  - This is known as BAFFLE EFFECT

### TYPE VI TYMPANOPLASTY / SONOINVERSION

- Graft is placed over oval window d/t disease on round window
- round 1st reaches round here then the oval window → SONOINVERSION



## TYPE 2 TYMPANOPLASTY / FENESTRATION OPERATION

- Fenestration [hole] done in Lateral semi circular canal
- earlier done for Otosclerosis, now obsolete

## ATTICO ANTRAL DISEASE

### CHOLESTEATOMA [keratoma]

- Normal keratinized stratified Squamous epithelium
- In abnormal place [middle ear cleft]

#### → TYPES

- 1 CONGENITAL
- 2 ACQUIRED
  - a. PRIMARY ACQUIRED
  - b. SECONDARY ACQUIRED



### CONGENITAL CHOLESTEATOMA

- Epithelium is trapped inside, during or before the formation of middle ear cleft

### ACQUIRED CHOLESTEATOMA

- Epithelium goes into the middle ear cleft after birth

### 2° ACQUIRED CHOLESTEATOMA

- 2° to perforation
- MIGRATION OF SQUAMOUS EPITHELIUM
  - Squamous epithelium from EAC migrates / invades into ME along the marginal perforation
- SQUAMOUS METAPLASIA
  - d/t chronic infect<sup>n</sup> / inflamm<sup>n</sup>, mucous epithelium in ME transforms into squamous epithelium

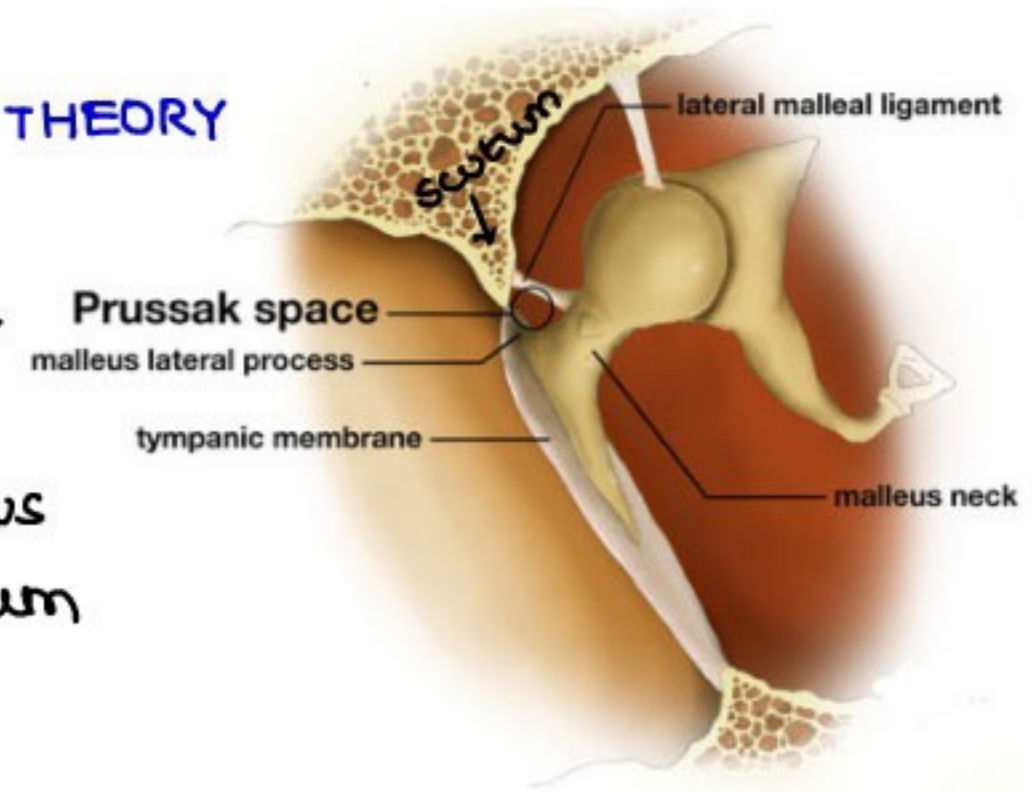


## 1° ACQUIRED CHOLESTEATOMA

### 1 WITTMACK'S INVAGINATION / RETRACTION POCKET THEORY

#### → PRUSSACK'S SPACE - BOUNDARIES

- SUPERIOR → Lateral malleal ligament
- MEDIAL → Neck of malleus
- INFERIOR → Lateral process of malleus
- LATERAL → Pars Flaccida & Scutum



#### → In Acute otitis media Stage 1

→ Negative pressure in ME + nt → TM pulled in

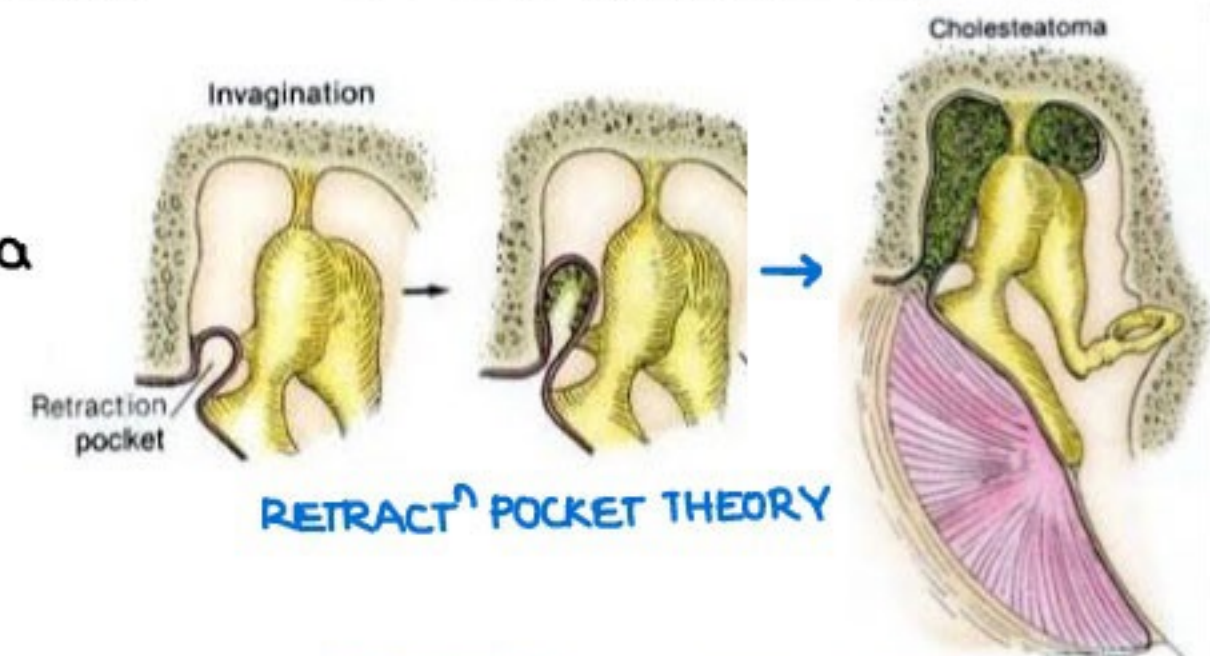
#### → forms RETRACTION POCKET

- has epithelial & mucus layers
- epithelium shed off subsequently & get infected
  - Pus formation occurs
- exerts pressure & pocket grows in size & more epithelium dies & cycle continues
- after a point, it starts eroding surrounding bones
- EROSION OF BONES is dlt release of enzymes from lysosomes of dead cells, which activates osteoclasts
- EROSION OF SCUTUM is characteristic feature of 1° acquired cholesteatoma
- subsequently erodes antrum → ATTICO ANTRAL DISEASE

#### → most accepted theory

→ mc site of 1° acquired cholesteatoma format<sup>n</sup> → Prussack's space

→ Prussack's Space located in Epitympanum



### 2 RUEDI'S BASAL CELL HYPERPLASIA THEORY

### 3 SADE'S SQUAMOUS METAPLASIA THEORY

## CLINICAL FEATURES

- conductive hearing loss
- Discharge
  - scanty
  - purulent
  - foul smelling
  - blood stained



## MANAGEMENT

- Pure Tone audiometry
- HRCT in temporal bone



→ Indications for HRCT

- 1 complications of CSOM
- 2 Pediatric patients
- 3 EAC Polyp
- 4 EAC Atresia [congenital abnormalities]
- 5 Revision
- 6 Medico legal case

→ HRCT & MRI both are indicated for → COCHLEAR IMPLANT

TREATMENT → modified Radical mastoidectomy

MASTOIDECTOMY - TYPES

SIMPLE / CORTICAL / SCHWARTZ MASTOIDECTOMY

→ we don't touch middle ear

→ Just drill in the mastoid

→ Indicated for

→ coalescent mastoidectomy

→ cochlear implant

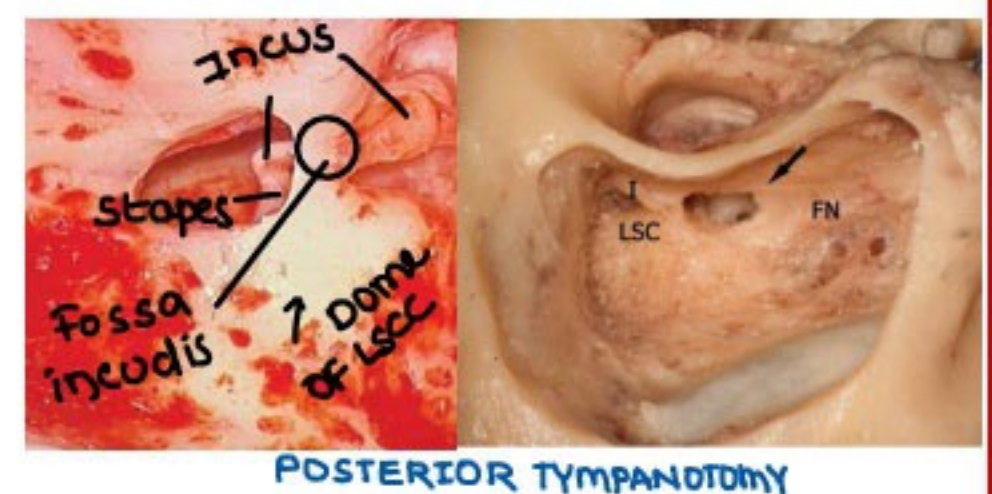
- After cortical mastoidectomy,  
posterior tympanotomy done

- mc site for cochleostomy → Ant. inf. to round window

- KORNER'S SEPTUM → persistent petrous squamous suture

→ makes difficult to find antrum

→ Lateral semicircular canal identificat<sup>n</sup> confirms  
the antrum



POSTERIOR TYMPANOTOMY

RADICAL MASTOIDECTOMY

① We open the mastoid & middle ear and common wall  
blw the two is removed → created common cavity  
→ preserve facial nerve

② We will remove conductive apparatus except stapes

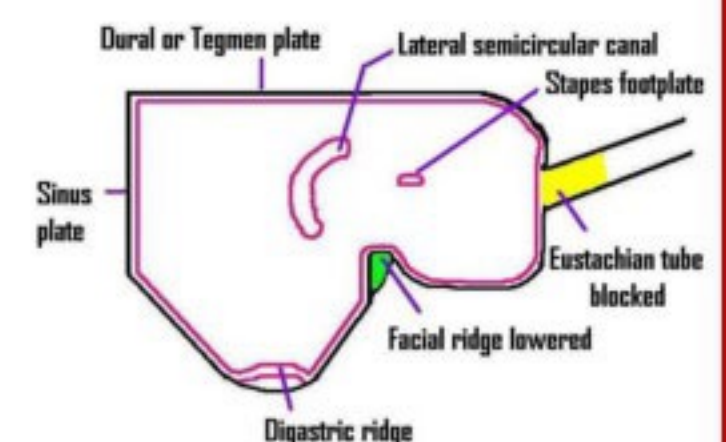
→ mcc of iatrogenic facial N. Palsy → Mastoidectomy

- mc site

→ Vertical segment just after and genu

→ Indication of radical mastoidectomy → Malignancy

→ AIM → complete eradication of disease



MODIFIED RADICAL MASTOIDECTOMY

→ Same as radical mastoidectomy but conductive apparatus also preserved,  
if conductive apparatus has been damaged, it will be repaired

→ Primary AIM → complete eradication of disease

Secondary AIM → Preservation of Conductive HEARING

Never at the cost of primary aim



## CANAL WALL DOWN MASTOIDECTOMY

- classical MRM

## CANAL WALL UP MASTOIDECTOMY

- common wall [posterior wall of ME]  
blw mastoid & ME is preserved

- **Advantages**

- Hearing results are better dlt @  
positioning of TM during tym-  
panoplasty
- can go for swimming

- **Disadvantages**

- rate of recurrence is higher
- Advised to follow up by Relook1  
2nd stage Sx after 6 months



## COMPLICATIONS OF OTITIS MEDIA

### → Acute Otitis Media [AOM] COMPLICATIONS

→ Acute Mastoiditis [mc complication of OTITIS MEDIA]

### → Chronic Suppurative otitis media [CSOM/COM] COMPLICATIONS

→ Ossicular chain erosion [mc complicat<sup>n</sup> of CSOM] → CHL

→ INTRA CRANIAL

EXTRA CRANIAL

INTRA TEMPORAL

EXTRA TEMPORAL

## INTRA TEMPORAL COMPLICATIONS

1. Ossicular chain Erosion

2. Facial Nerve palsy → Rx by facial nerve decompression

3. Labyrinthitis

→ Serous Labyrinthitis → SNHL Reversible

→ Suppurative Labyrinthitis → SNHL Irreversible

→ Rx by

1. Labyrinthine sedative drugs

2. IV antibiotics

4. Labyrinthine Fistula

→ mc site → dome of lateral Semicircular canal

FISTULA SIGN / TEST → pressing on tragus w finger vertigo or nystagmus occurs

SEIGELIZATION → tragus pressure i seigel speculum



→ True +ve Fistula Test → Fistula present  
Fistula Sign +ve

False -ve Fistula Test → Fistula present  
Fistula Sign -ive

→ Seen in  
dead ear  
cholesteatoma covering fistula

→ False +ve Fistula Test → No fistula  
Fistula sign +ve

→ Seen in  
congenital syphilis } HENNEBERT'S SIGN  
Mennier's disease }

## 5. PETROSITIS

### CLINICAL FEATURES

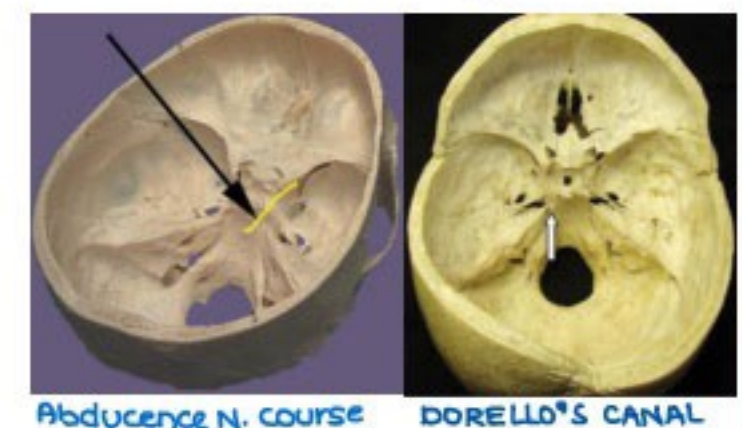
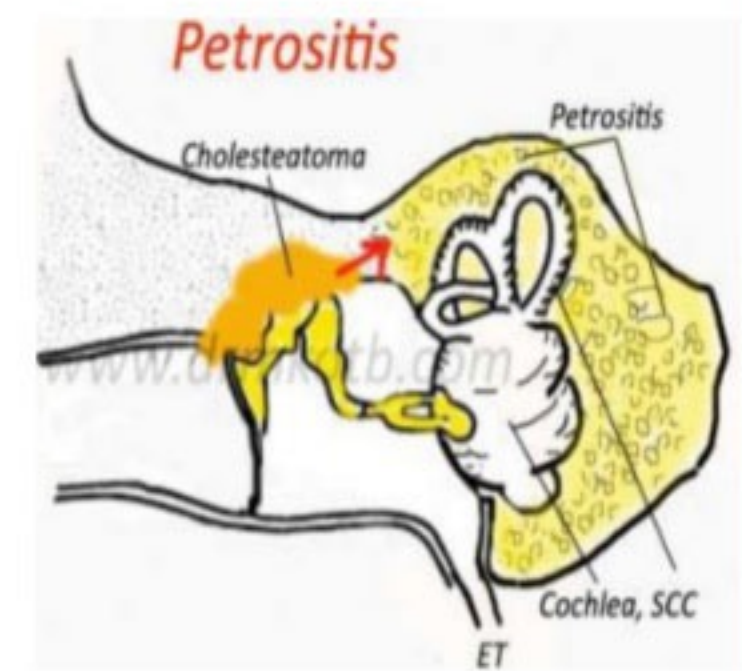
- Long standing discharge
- deep seated retroorbital pain
- Diplopia of lateral gaze
  - dlt lateral rectus palsy
  - dlt abducent nerve palsy [6th CN]
  - [ dlt inflammed DORELLO'S CANAL (6th n. canal) ]

GRADENIGO SYNDROME

### → GRADENIGO SYNDROME

#### GRADE D SYNDROME

- D → Long standing Discharge
- D → Deep seated retroorbital pain
- D → Diplopia
- D → Dorello's canal



## EXTRA TEMPORAL COMPLICATIONS

1. POST AURAL / SUB PERIOSTEAL ABSCESS

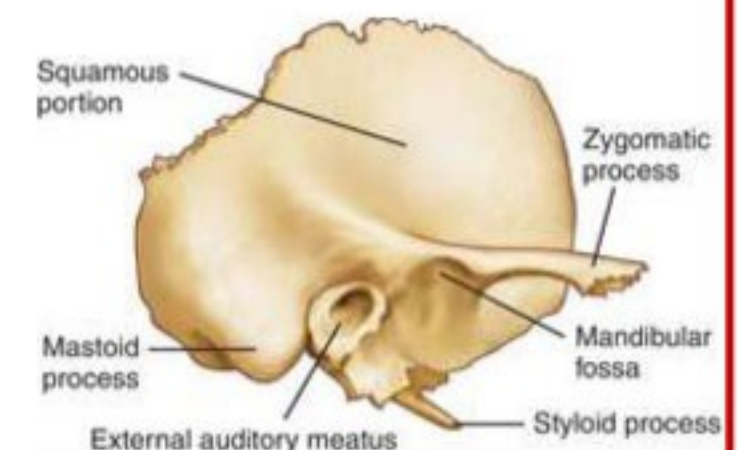
2. BEZOLD ABSCESS

→ present i torticollis [spasm of scm]

3. LUC'S ABSCESS

4. ZYGOMATIC ABSCESS

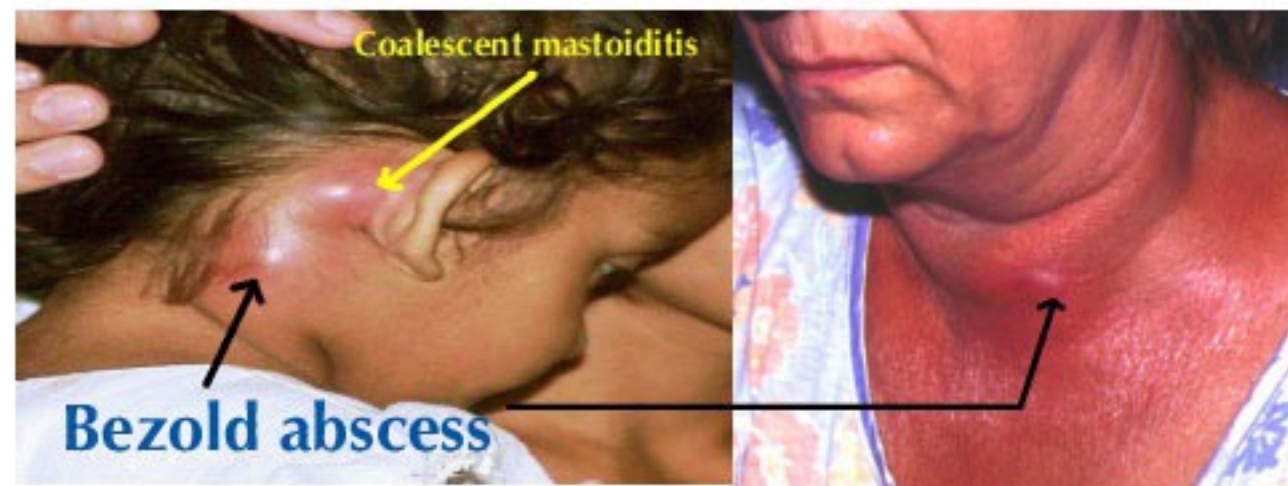
5. CITELI'S ABSCESS → anterior to mastoid along the post. belly of digastric or  
→ posterior to mastoid



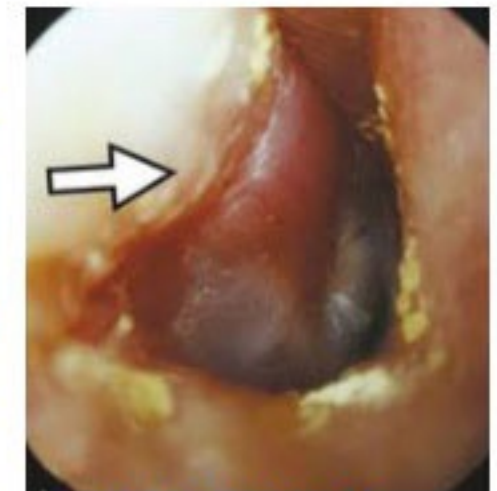




Post aural abscess



Bezold abscess



Luc's Abscess



Citelli's abscess



Zygomatic Abscess

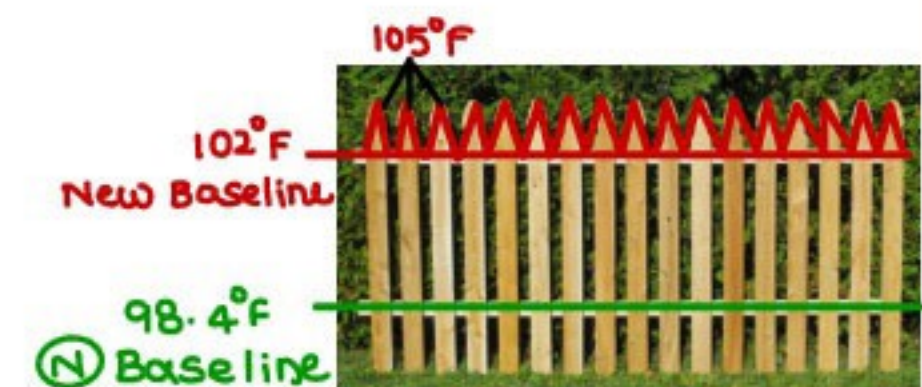
### INTRA CRANIAL COMPLICATIONS

1. MENINGITIS [mc]
2. EXTRA DURAL ABSCESS
3. SUB DURAL ABSCESS
4. BRAIN ABSCESS [mc cause of brain abscess → Orogenic]
5. OTITIC HYDROCEPHALUS
6. SIGMOID / LATERAL SINUS THROMBOSIS

### SIGMOID / LATERAL SINUS THROMBOSIS

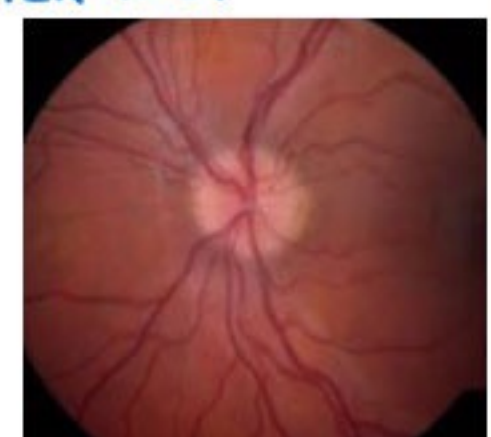
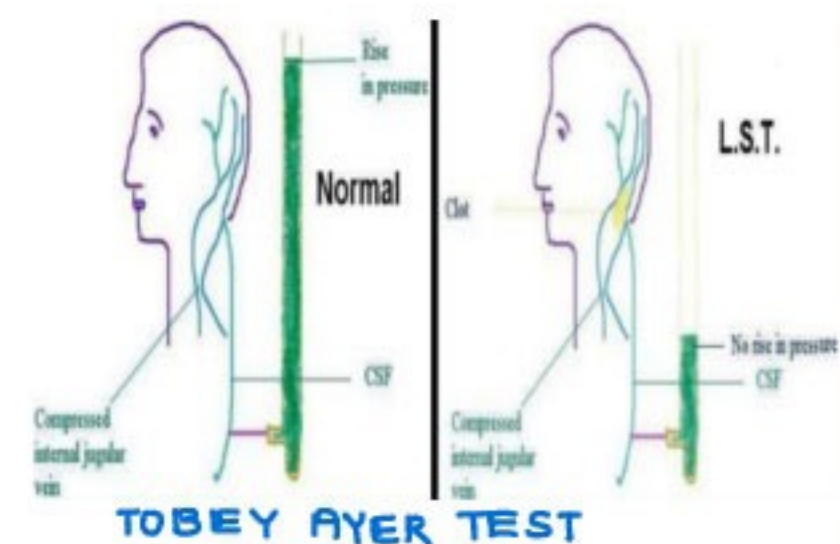
#### CLINICAL FEATURES

- Headache
  - PICKET FENCE FEVER
    - temperature never comes back to Ⓝ base line
    - Remittent fever
- [intermittent fever seen in malaria]



#### MANAGEMENT

- TOBEY AYER / QUECKENSTEDT TEST
  - compression over internal jugular vein on normal side, ↑CSF pressure in lateral Sinus thrombosis
  - Invasive test
- CROW BECK TEST
  - compression over internal jugular vein on same side leads to engorgement of retinal veins
- CECT / MRI
  - EMPTY DELTA SIGN elicited
  - confirmatory Sign
- Rx → Surgery + IV Antibiotics



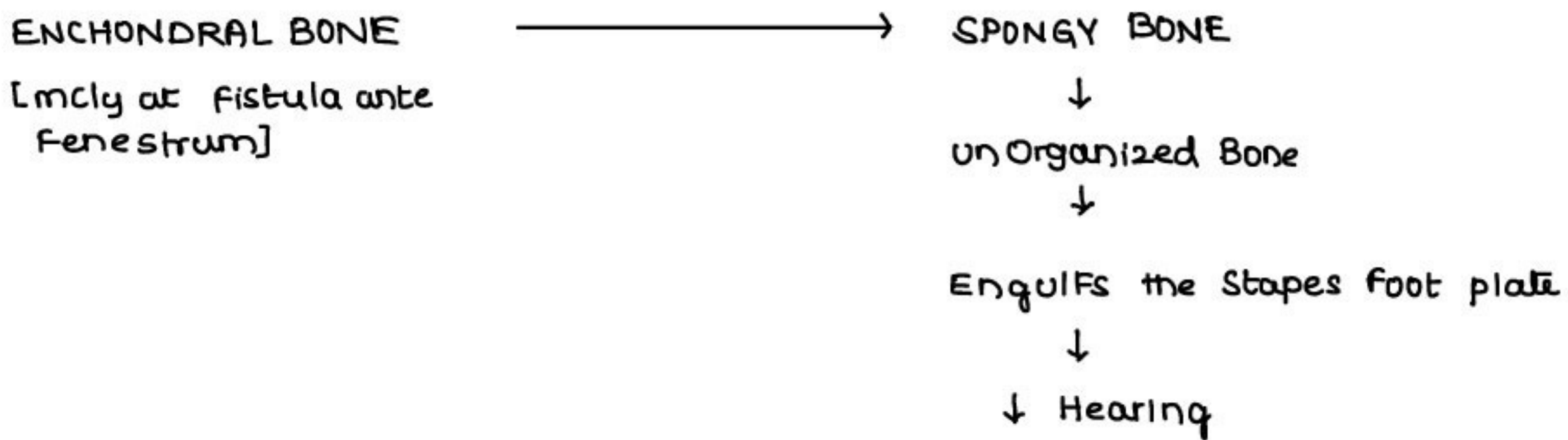
Crow Beck Test



Empty delta Sign



## OTOSCLEROSIS



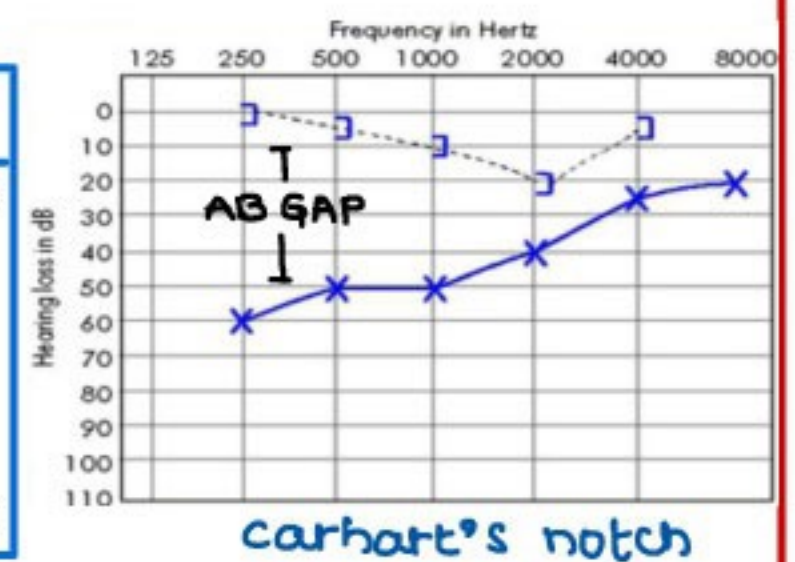
- Female predominance
- 20-30 yrs
- ↑ed incidence in pregnancy
- Autosomal Dominant [50% have +ive family history]
- B/L Hearing loss
- Tympanic membrane
  - usually normal
  - Sometimes, show FLAMINGO PINK COLOUR → SCHWARTZ SIGN
    - Seen in early or Active stage of disease → OTOSPONGIOSIS



### → PURE TONE AUDIOMETRY

- otosclerosis is a disease of conductive hearing loss

DISEASE	AB GAP
Som	→ 25 - 30 dB
Tm Perforat <sup>n</sup>	→ 10 - 40 dB
Tm Perforat <sup>n</sup> + ossicular chain erosion	→ 45 dB
Tm intact + ossicular discontinuity	→ 54 dB
Otosclerosis	→ Upto 60 dB



- CARHART'S NOTCH → dip present at 2000 Hz in bone conduction seen
- [BOILER'S NOTCH → 30 NIHL, dip at 4000 Hz in bone conduct<sup>n</sup> seen]

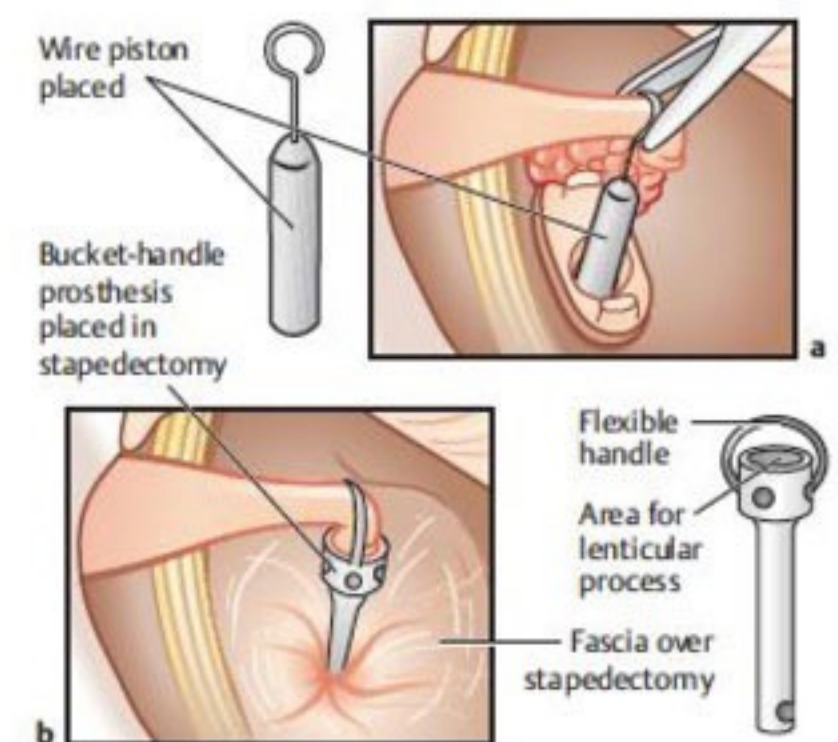
- IMPEDENCE AUDIOMETRY → AS curve Seen
- Stapedial reflexes are absent
- PARACUSSIS WILLISII
  - Pt. hears better in noisy environment
  - also seen in pts w/ B/L CHL of ear

### → TREATMENT

#### STAPEDECTOMY

- remove stapes & graft placed at oval window & placed a piston
- risk of SNHL present

STAPEDOTOMY [ROC] → hole made in stapes footplate & anchored w/ piston



E. a: Stapedotomy with placement of wire piston. b: Stapedectomy with placement of a bucket-handle prosthesis.



## GLOMUS

- MC benign tumor of middle ear
- Arises from paraganglionic cells around the Internal jugular vein



**GLOMUS JUGULARE** → arises anywhere around Int. jugular vein

### GLOMUS TYMPANICUM

- arises from jugular bulb & comes into ME
- MC presentation → Hearing loss
- Pulsatile tinnitus + nt
- RISING SUN / AQUINO / BROWN SIGN

RISING SUN SIGN → reddish blue tumor rising from hypotympanum

AQUINO SIGN → carotid pressure  $\bar{c}$  fingers leads to  $\downarrow$ ed tinitus

BROWN SIGN → on Seigelization, tumor blanches & becomes white



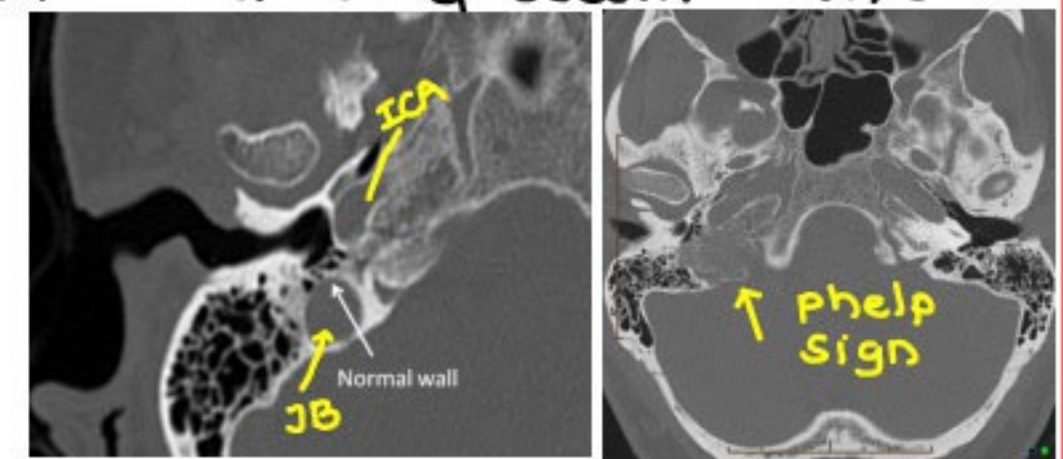
- Sometimes, blue TM seen

### → CECT

→ confirmatory test

→ PHELP SIGN seen

→ inability to distinguish between internal carotid artery & jugular bulb due to erosion of caroticojugular crest



### → Rx

→ Surgical Excision

→ 10% RULE OF GLOMUS

→ 10% multicentric

→ 10% Familial

→ 10% secretory [secrete catecholamines]

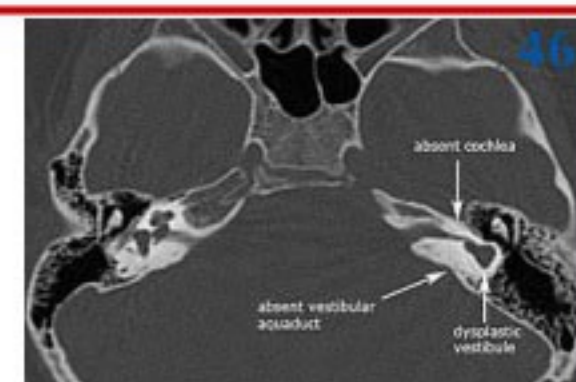


## DISEASES OF INNER EAR

### CONGENITAL DEFORMITIES

#### MICHEL'S APLASIA

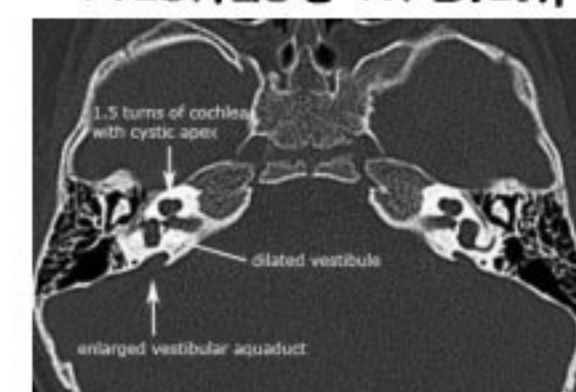
- absence of cochlea
- Absolute CI of cochlear implant



MICHEL'S APLASIA

#### MONDINI'S DYSPLASIA

- cochlea have only 1.5 turns
- can do cochlear implantation



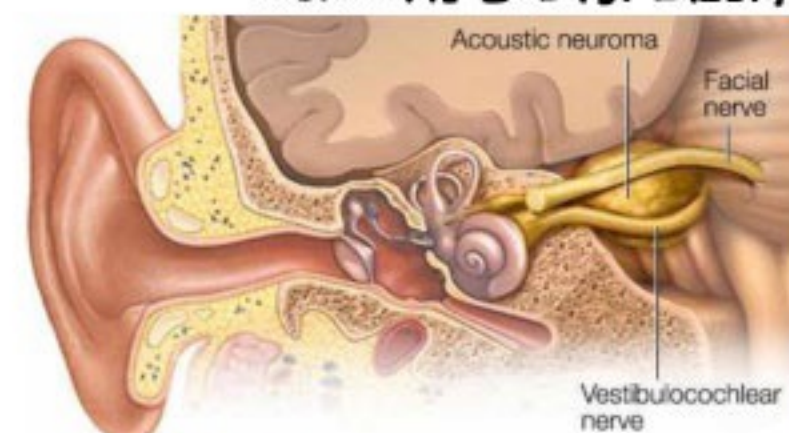
MONDINI'S DYSPLASIA

#### VESTIBULAR SCHWANNOMA

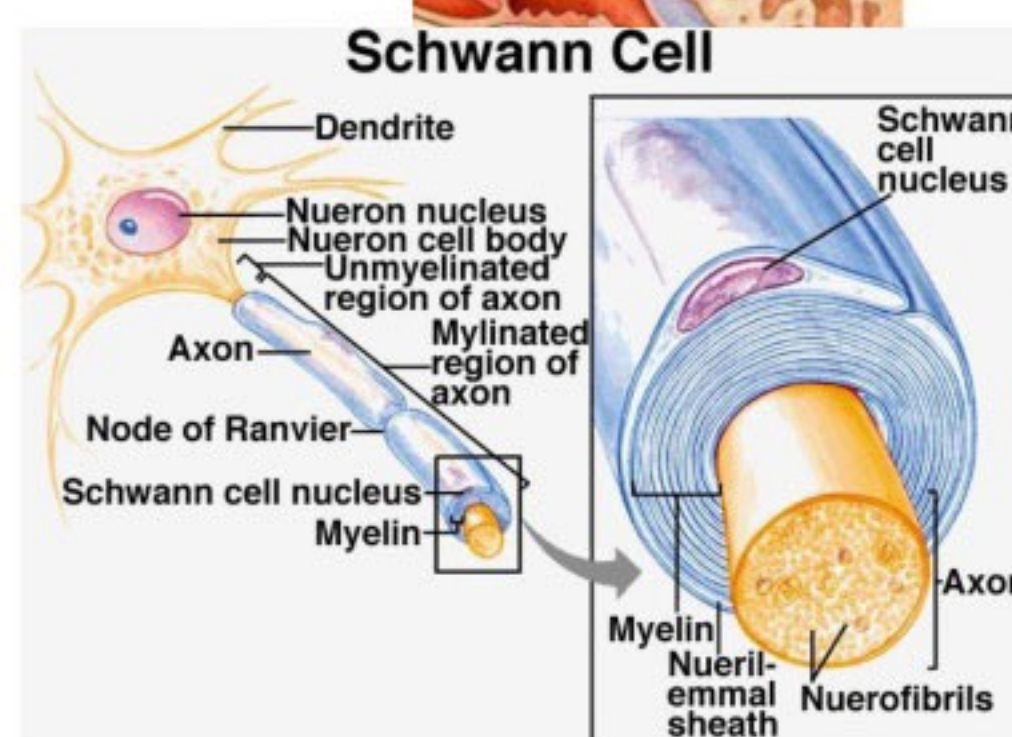
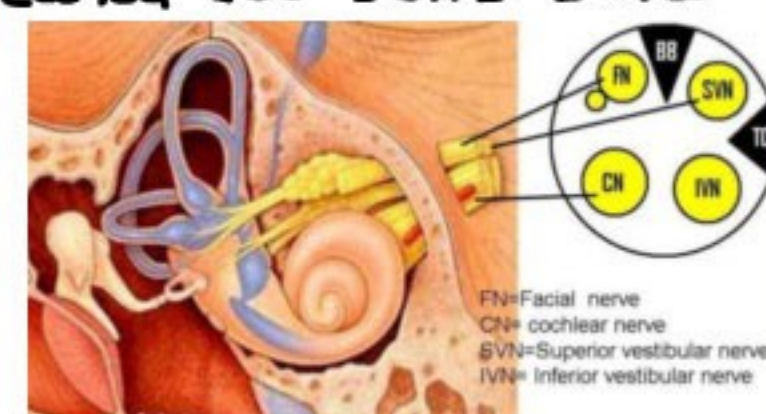
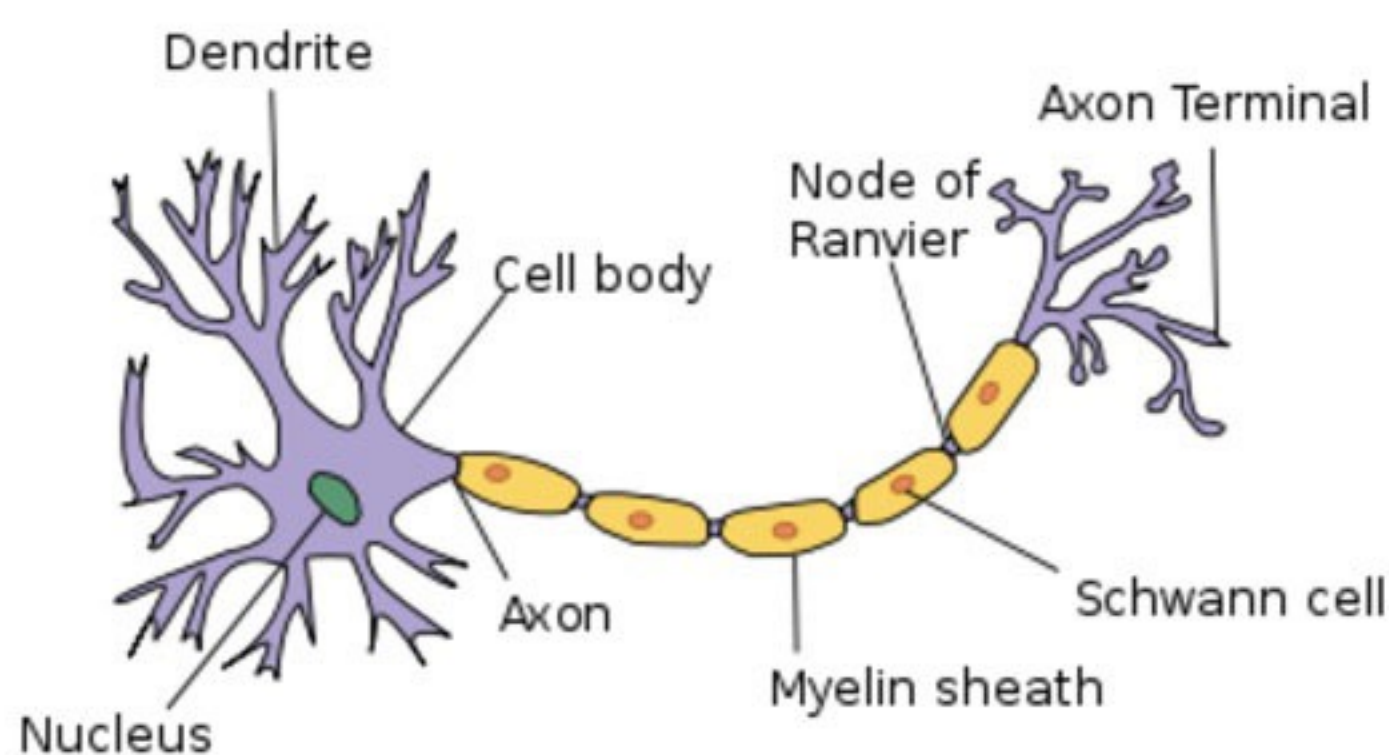
- earlier name → Acoustic neuroma [obsolete now]
- mc benign tumor of Cerebello Pontine angle [CP angle]

##### SITE OF ORIGIN

- Inferior vestibular Nerve in Internal auditory canal [60-90%] [mc]
- Superior vestibular Nerve
- cochlear nerve [rarely]



##### COMPONENTS OF A TYPICAL NEURON



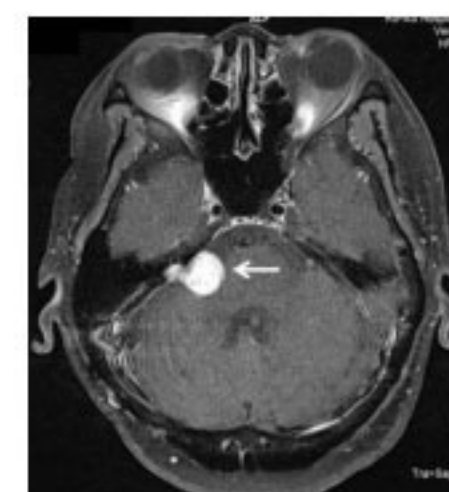
- Tumor arises from Schwann cells not from the nerve → SCHWANNOMA

### CLINICAL FEATURES

- Sensory Neural Hearing Loss
  - Slow & progressive
  - mc presentation
- Tinnitus
- vertigo / Dizziness are not prominent (Other side compensates)
- Loss of corneal reflex (earlier sign) → dlt involvement of V nerve
- HITZELBERGER SIGN → Loss of sensory supply by facial nerve in the postero superior wall of EAC

**DIAGNOSIS** → IOC → Gadolinum enhanced MRI Brain

### TREATMENT





- Large tumor → Sx excision
- Small tumor
  - old patient, slow growing tumor → Serial MRI every 6 months
  - young patient, fast growing tumor → Gamma knife excision
- Approaches for surgical excision
  - When there is no hearing present
    - Translabrynthine approach
  - IF hearing present
    - Middle cranial fossa approach [limited access]
    - Retro sigmoid / Sub occipital approach

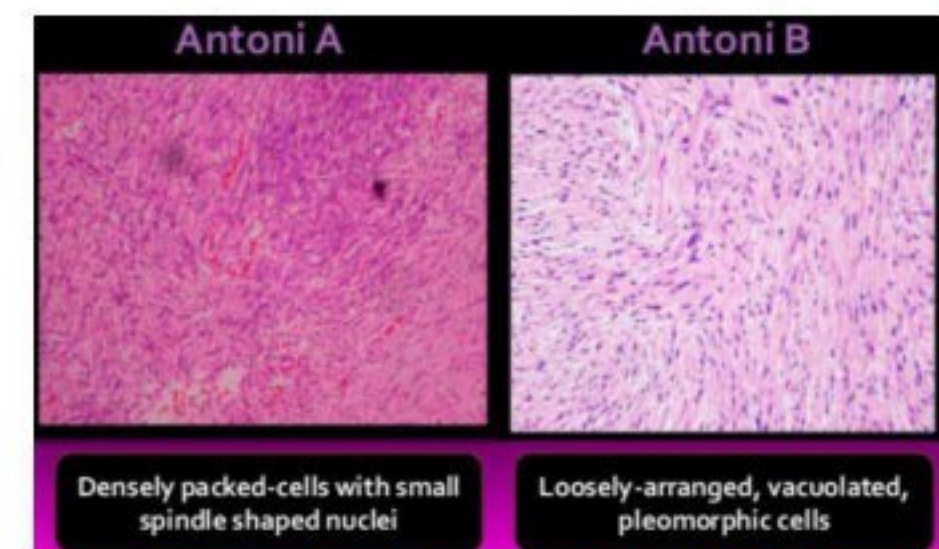
- After Sx excision, tumor sent for histopathology

#### ANTONY A CELLS

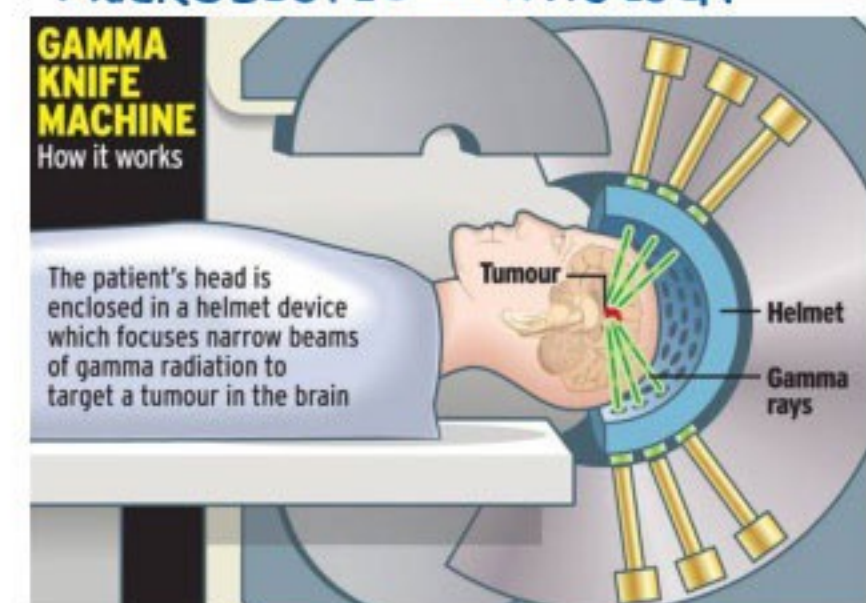
- more common
- densely packed cells & small spindle shaped nuclei

#### ANTONY B CELLS

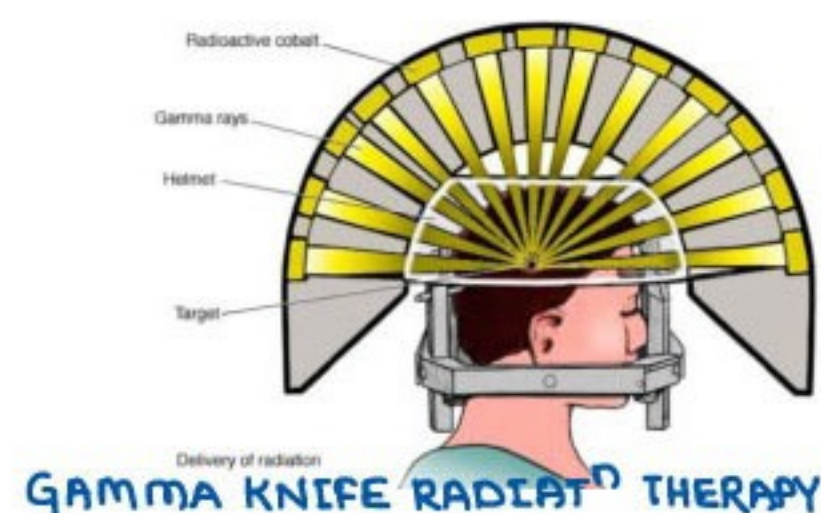
- Loosely arranged, vacuolated pleomorphic cells



#### MICROSCOPIC PATHOLOGY



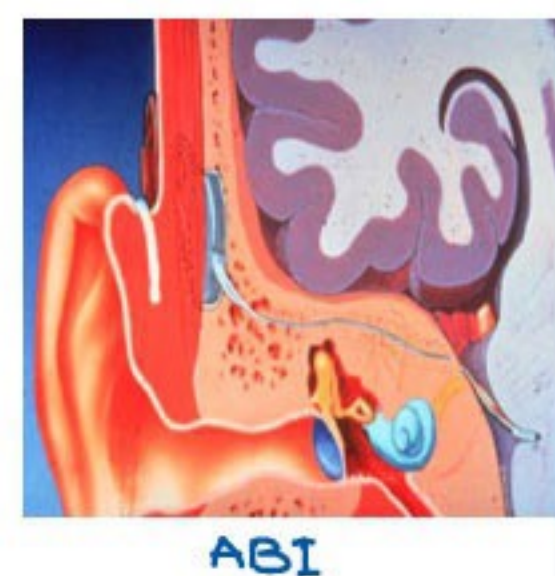
### NEUROFIBROMATOSIS TYPE 2



- MEN 2A SYNDROME
- Schwann cell disease
- NF2 gene  $\xrightarrow{\text{Produces}}$  MERLIN PROTEIN [Tumor suppression protein]
- NF2 gene mutation occurs → no merlin protein

- Leads to B/L vestibular Schwannoma
- multiple meningiomas
- Fibroma

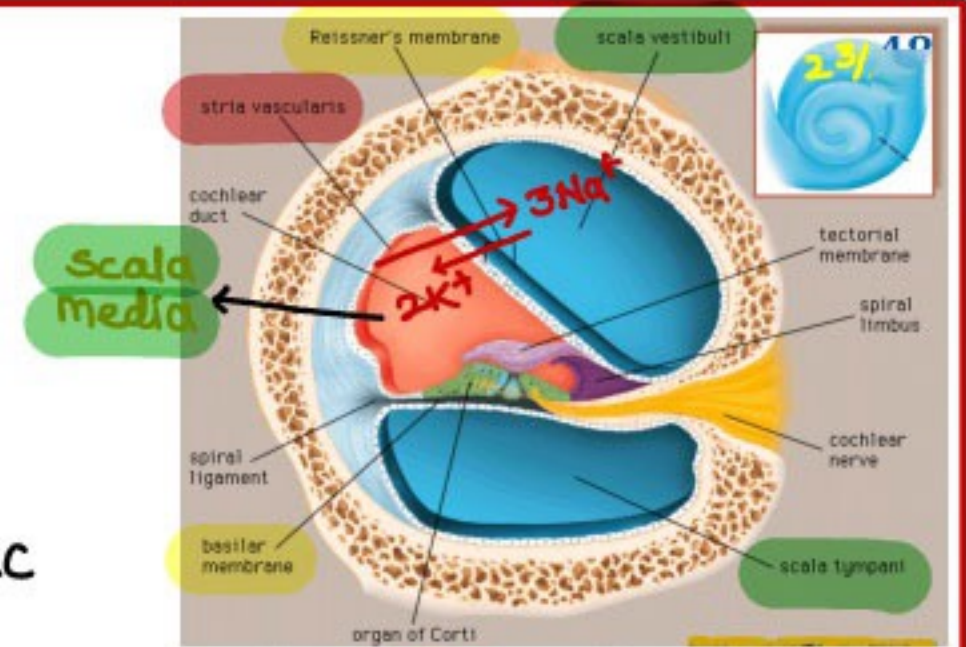
- Age group → younger [20-30 yrs]
- Aggressive tumor
- Rx → Sx excision of tumor along & VIII th nerve excision
- hearing restored by → AUDITORY BRAIN STEM IMPLANT on cochlear nucleus in 4th ventricle





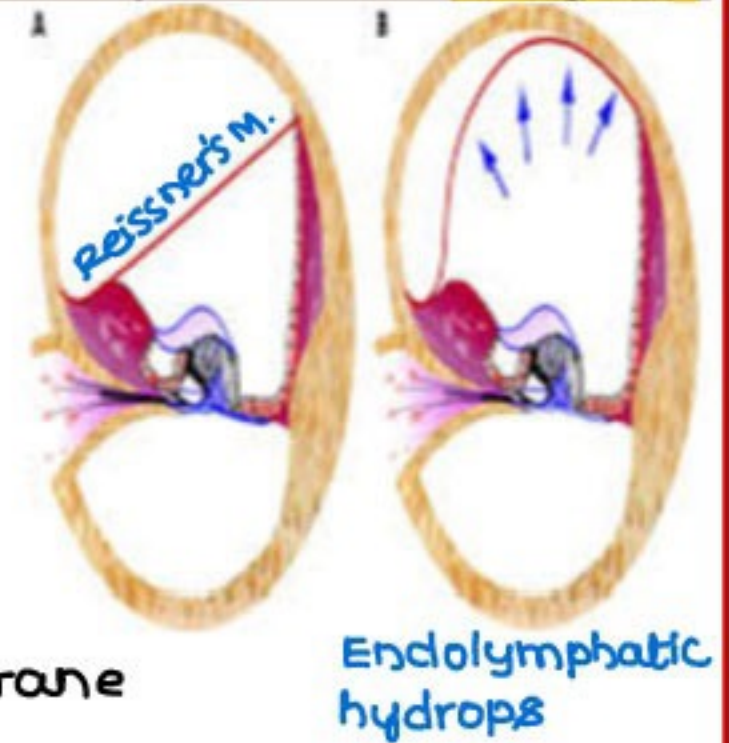
## MENIERE'S DISEASE

- **ENDOLYMPH** - Normal Physiology
  - secreted by stria vascularis
  - transported to endolymphatic sac by endolymphatic duct
  - endolymph absorbed by endolymphatic sac



### → **ENDOLYMPHATIC HYDROPS**

- collection of endolymph in inner ear dlt
  - excessive production
  - blockage of duct
  - defective absorption
- dlt  $\uparrow$ ing pressure, at some point Reissner's membrane breaks, & causes
  - VERTIGO [dlt  $K^+$  entry into perilymph & causes irritat<sup>n</sup>]
  - SNHL [dlt ion gradient imbalance]
  - tinnitus / aural fullness



- After some time, Reissner membrane heals,  
ion gradient returns → Hearing comes to normal  
 $K^+$  restores in endolymph → vertigo subsides
- And again the above cycle continues, leading to
  - 1. EPISODIC VERTIGO
  - 2. FLUCTUATING SNHL
  - 3. TINNITUS [remains even b/w 2 episodes]
  - 4. AURAL FULLNESS

} **TRIAD**

- ILL disease, common in 35-40 yr ♂

## DIAGNOSIS

### 1. **PURE TONE AUDIOMETRY** → SNHL

↓  
IV Glycerol [1.5 ml / kg] [GLYCEROL TEST]

↓  
Repeat Pure tone audiometry after 30 min

↓  
Hearing improved  $\geq 10$  dB

↓  
**MENIER'S DISEASE**

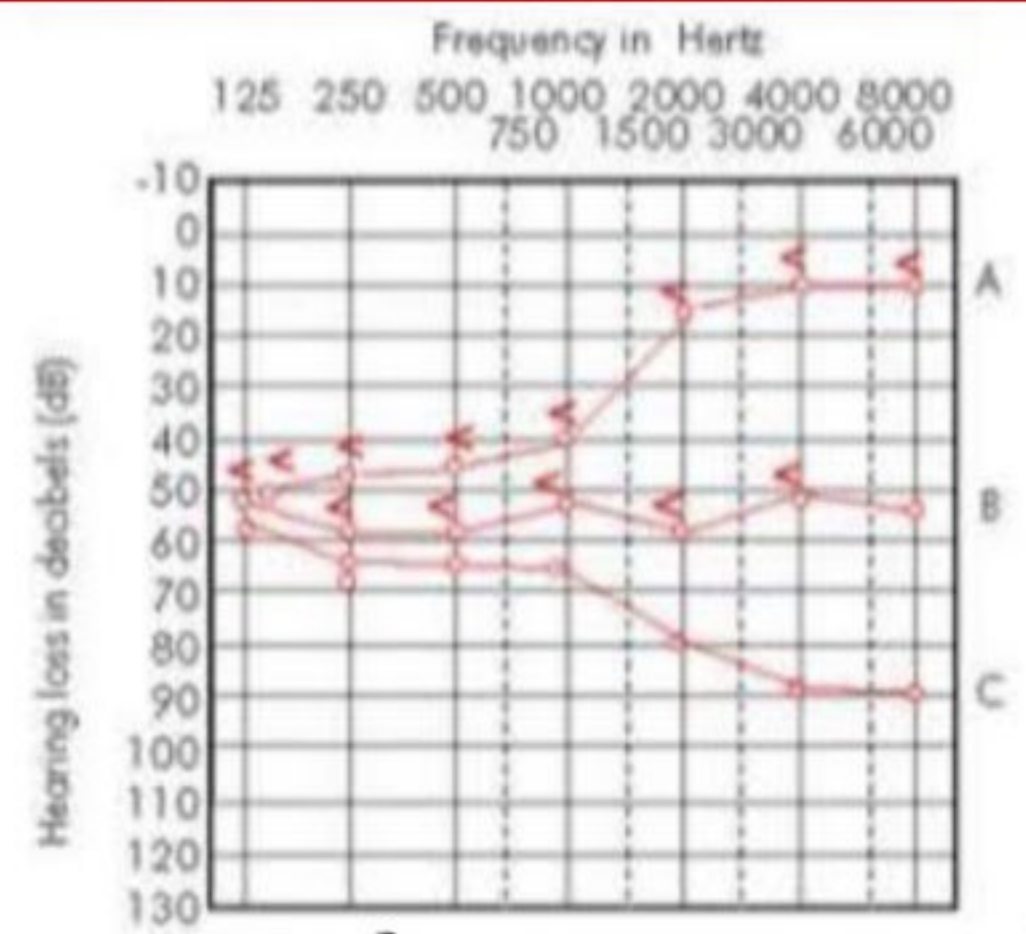
### 2. **ELECTRO COCHLEOGRAPHY**

- confirmatory test



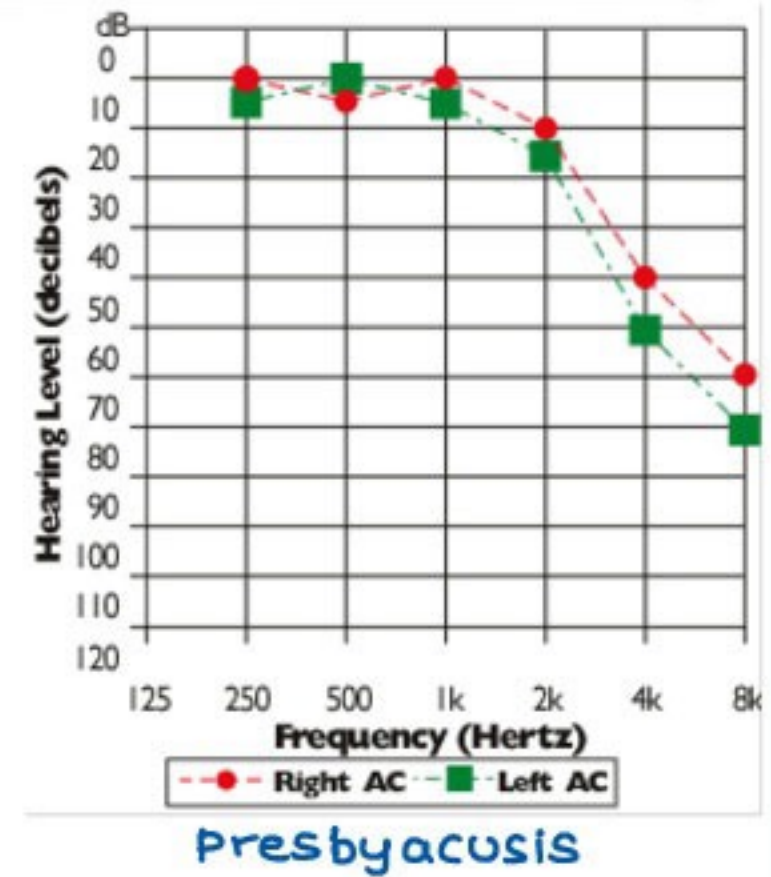
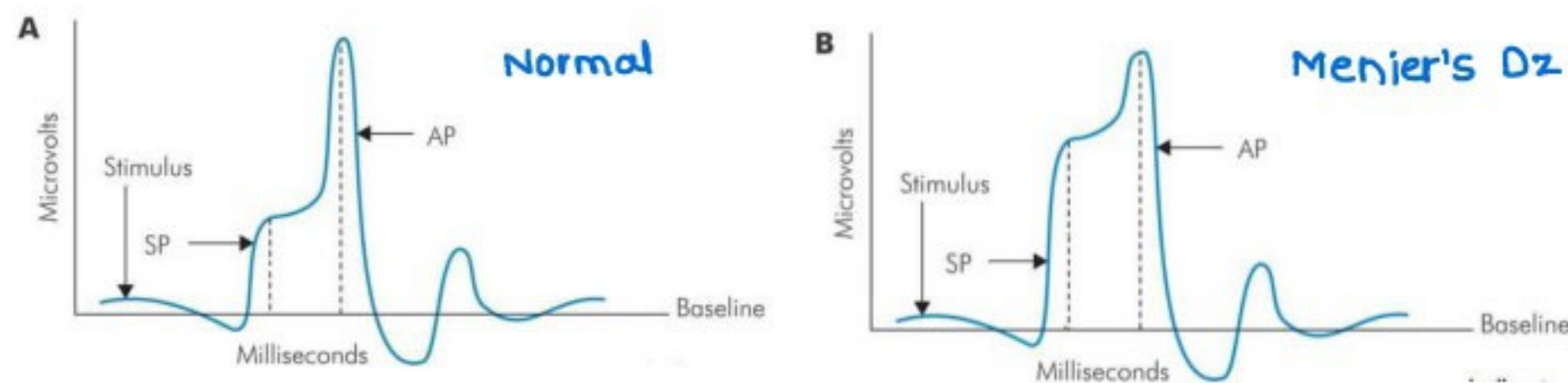
## PURETONE AUDIOMETRY

- A. Early menier's disease → Rising curve  
 → more hearing loss at low frequencies  
 → high hearing loss at less frequencies
- C. Late Menier's disease → sloping curve  
 → more hearing loss at high frequencies  
 → U/L sloping curve  
 [ B/L sloping curve → Presbycusis  
 → Ototoxicity ]



## ELECTROCOCHLEOGRAPHY

- confirmatory test  
 → in a normal ear, Summating potential (SP) < 30% AP  
 → in Menier's disease, SP > 70% AP  
 → invasive procedure



## TREATMENT

### 1 ACUTE EPISODE

- Labyrinthine sedatives

### 2. MAINTAINANCE PHASE

#### a MEDICAL

- K<sup>+</sup> sparing diuretics  
 → β blockers  
 → Antihistaminics

#### b SURGICAL

- i. CONSERVATIVE → Endolymphatic sac decompression  
 ii. RADICAL → Surgical labyrinthectomy

#### c INTRA TYMPANIC GENTAMYCIN THERAPY

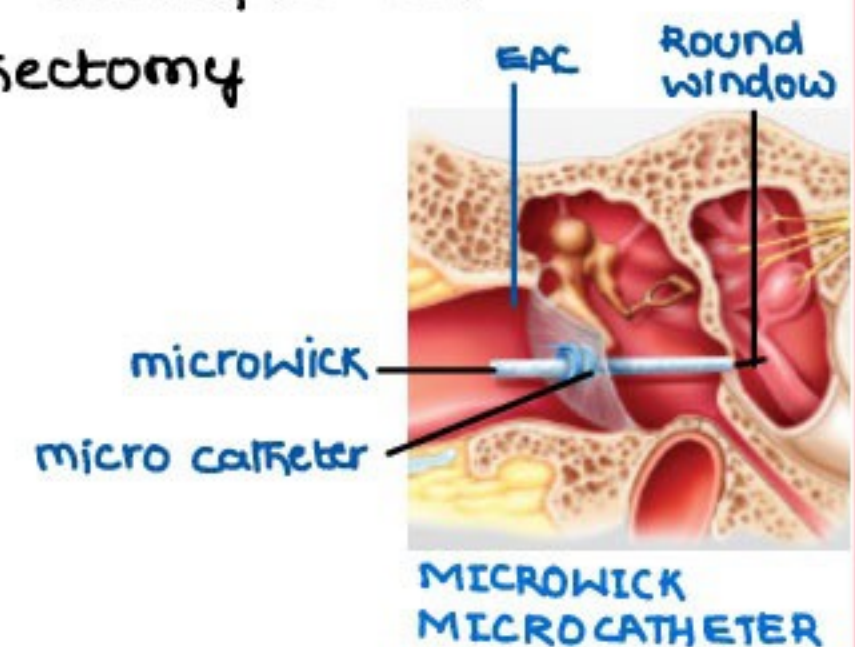
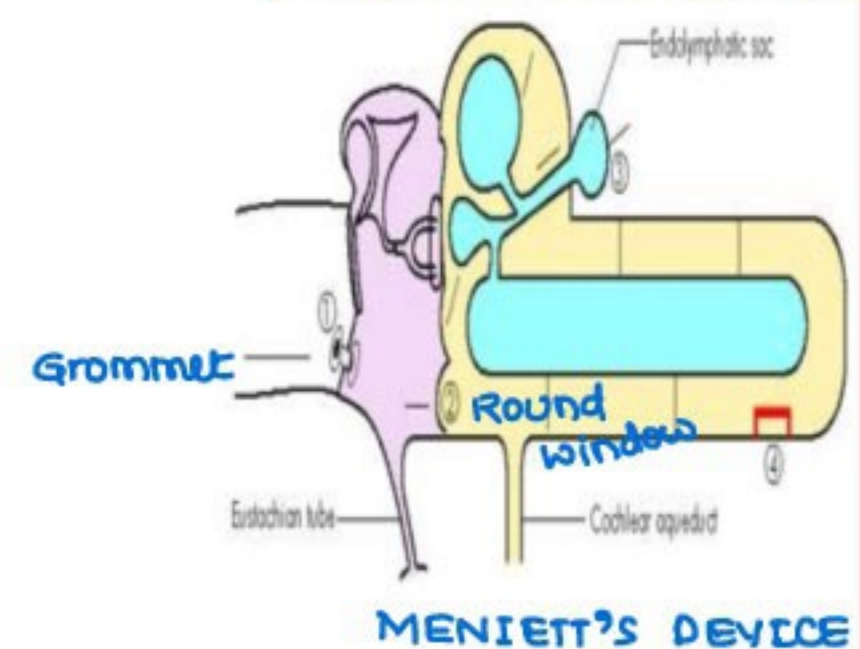
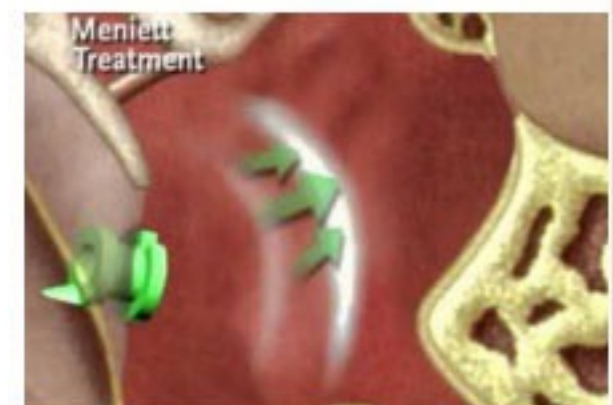
- chemical labyrinthectomy

#### d MICROWICK MICROCATETER

- drug delivery system to the inner ear

#### e. MENIETT'S DEVICE

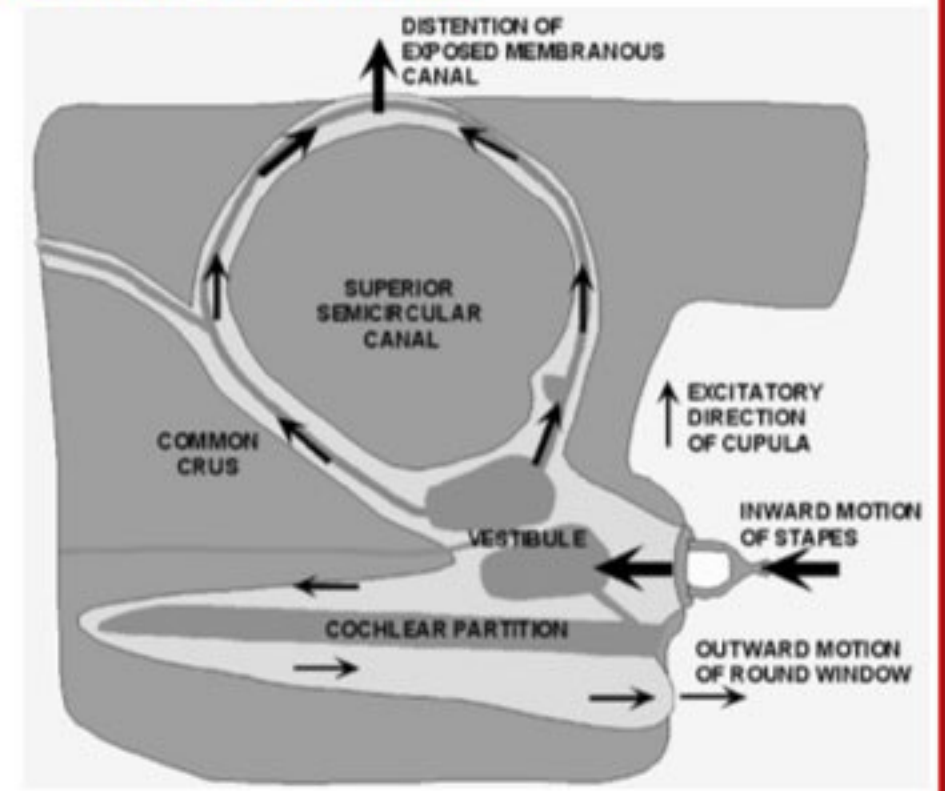
- intermittent low pressure pulse therapy device  
 → US FDA approved





## SUPERIOR SEMI CIRCULAR CANAL DEHISCENCE / 3rd WINDOW SYNDROME

- disease of inner ear leading to CHL
- superior SCC dehiscence creates a 3rd WINDOW
  - when oval window goes in some part of energy is lost via 3rd window
  - leads to CHL
- Patient's bone conduction is Super normal

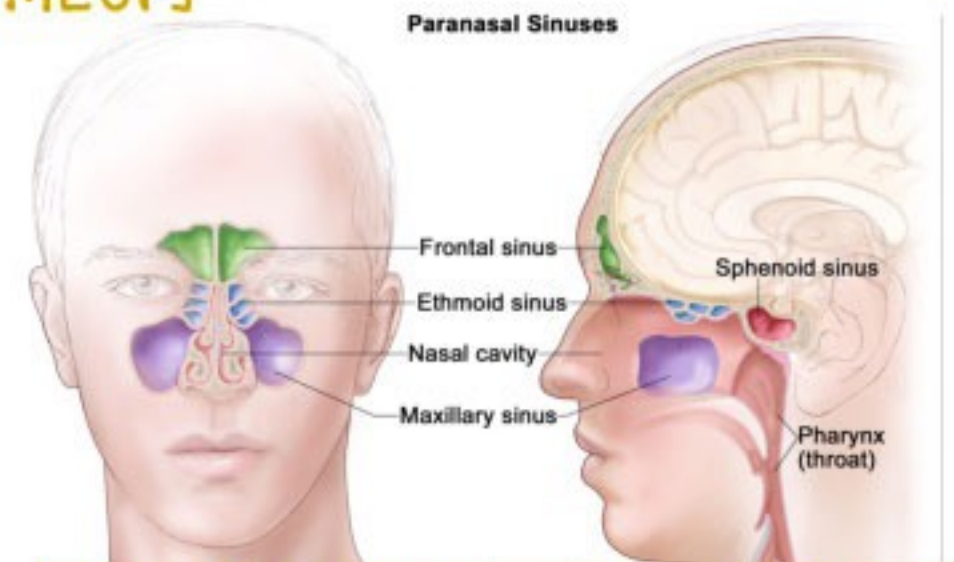




## PARA NASAL SINUSES [MESE]

### 01. MAXILLARY SINUS

- 1st to develop → 12 wks [3 months]
- largest PNS → adult volume [at 15-18y] → 15ml
- aka Antrum or Antrum of Highmore



### 02. ETMOID SINUS

- 2 groups of cells
  - Anterior
  - Posterior

### 03. SPHENOID SINUS

- starts developing 2 yrs of age, but present as small cavity at birth

### 04. FRONTAL SINUS

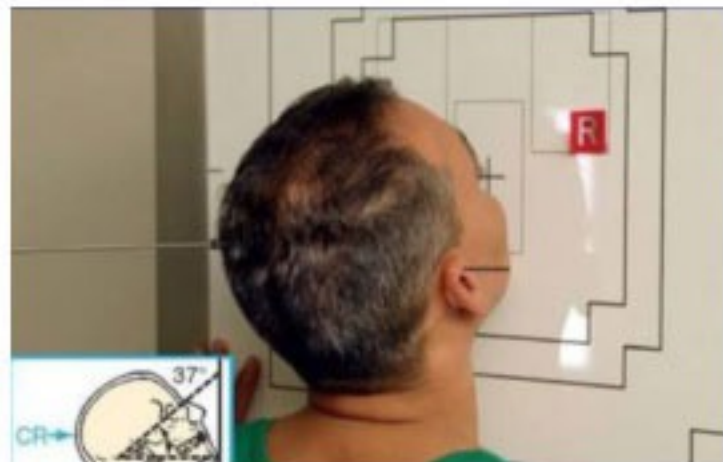
- Starts developing after 2 yrs of age

→ Frontal sinus starts to appear on x ray from 4-5 yrs

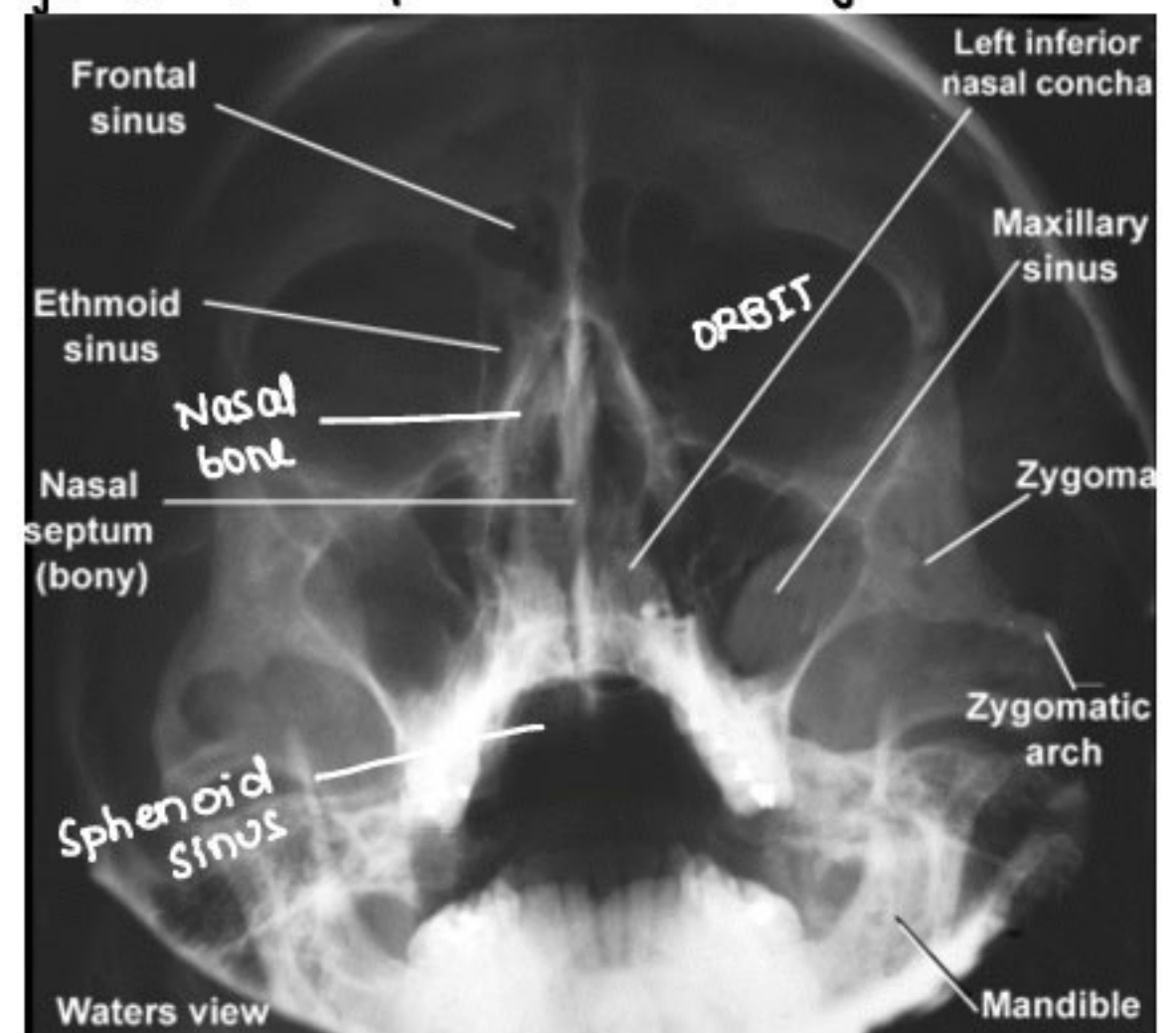
Sphenoid sinus is the last to appear on plane x ray → at 5-7 yrs

### PLANE X RAY VIEWS FOR PNS [Rarely done]

- m/cly done x ray view for PNS → water's view



← occipito mental view  
- nose chin posit°



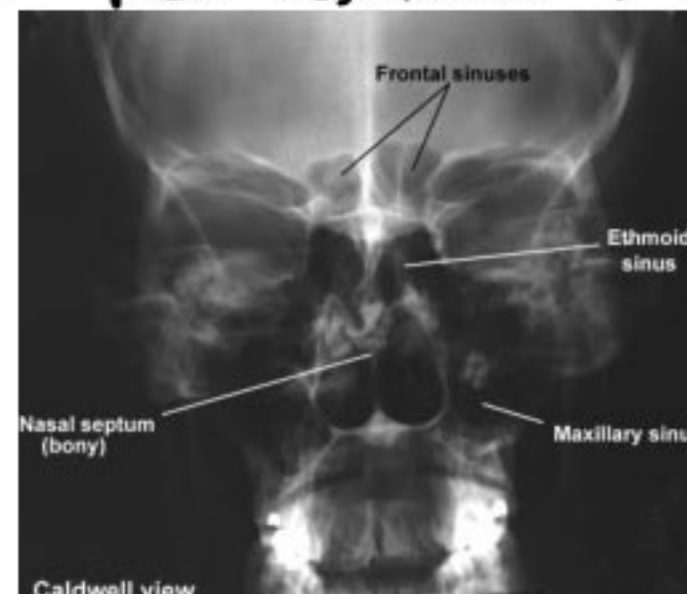
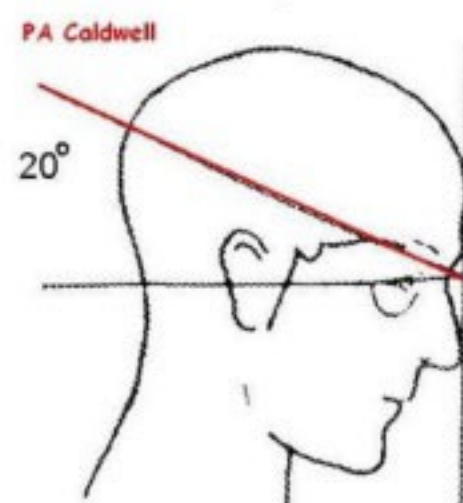
- Water's view & open mouth → PIERRE'S VIEW

- sinuses best seen in water's view -  
frontal

Ant. ethmoid

Sinuses not seen in water's view → post. ethmoidal & sphenoid

- Best view for frontal sinuses is  
CALDWELL'S VIEW/OCCIPITO FRONTAL VIEW



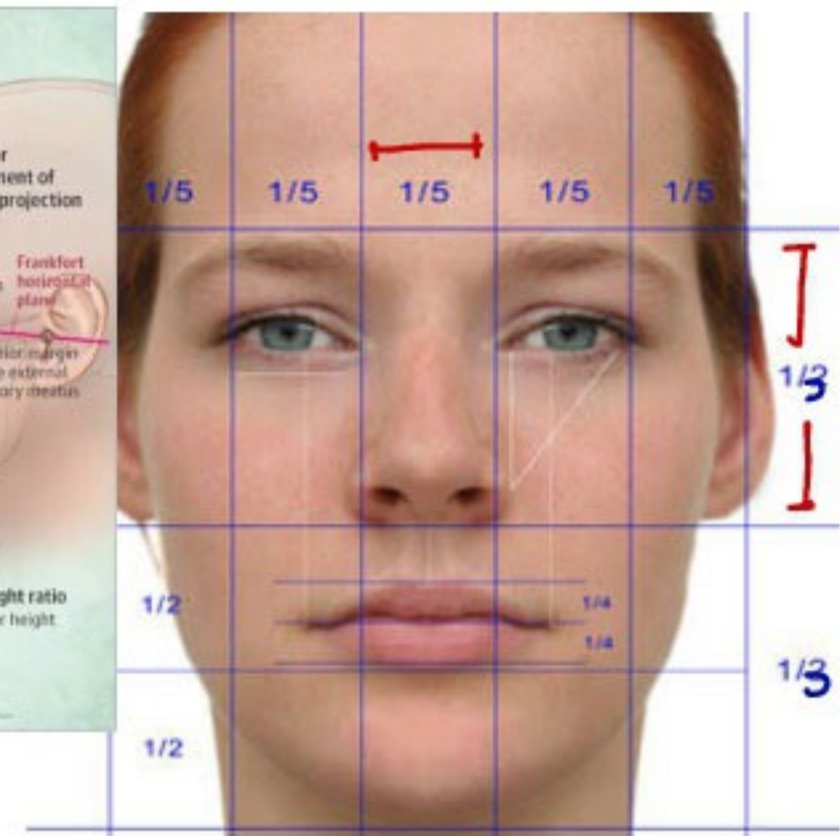
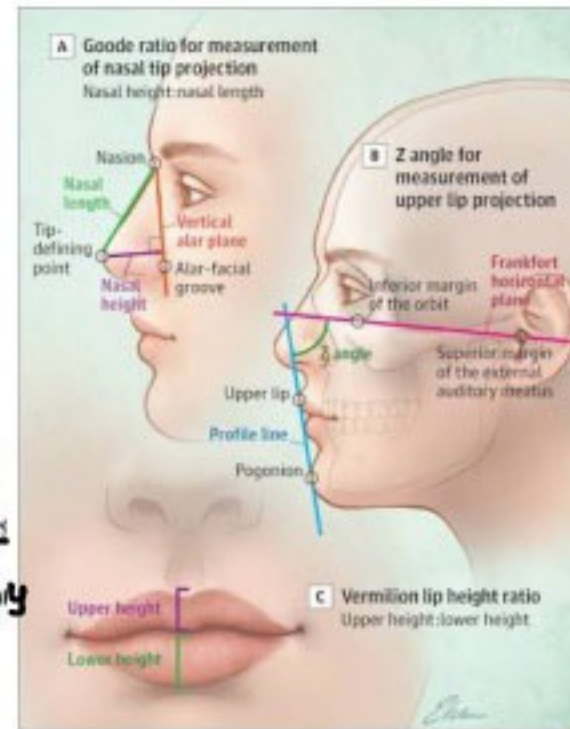
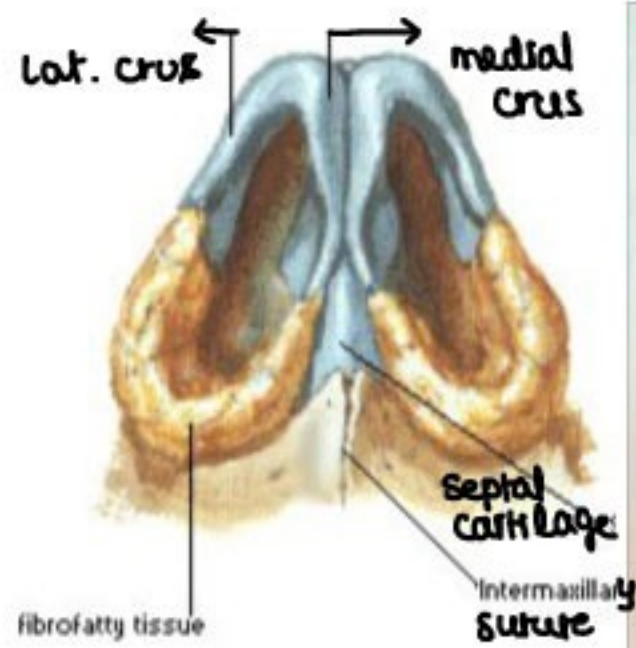


## EXTERNAL NOSE

### GOOD NOSE

#### GOODE RATIO

- $\frac{\text{Nasal height}}{\text{Nasal length}}$
- ideal → 0.55 - 0.6



### EXTERNAL NOSE

- upper 1/3rd → bony, formed by nasal bone supported by frontal process of maxilla

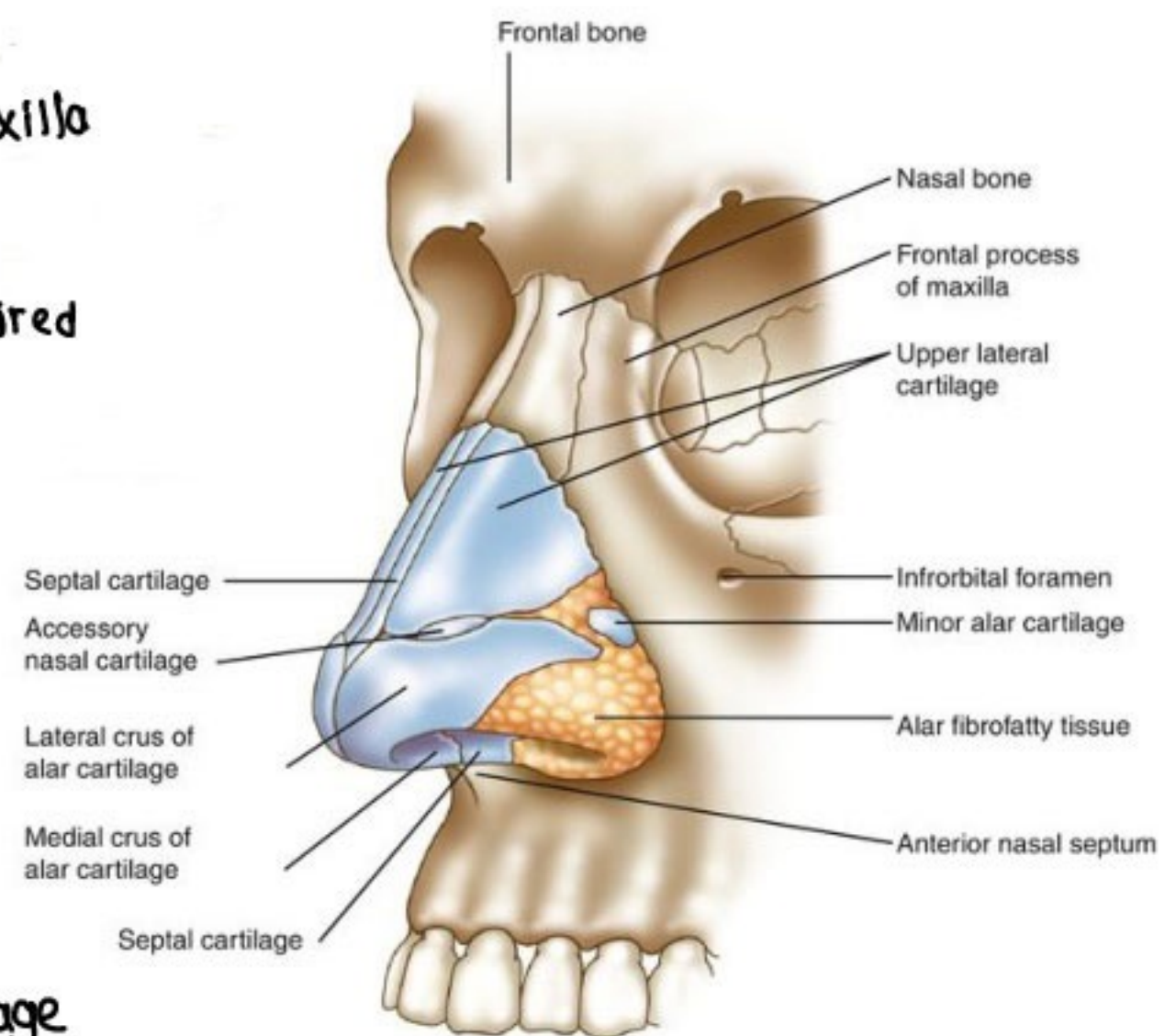
- Lower 2/3rd → cartilaginous, 3 paired & 1 unpaired

#### - Paired

01. Upper lateral
02. Lower lateral [Alar] - mainly
03. Lesser lateral / alar / minor alar

#### - unpaired

- Septal / quadrilateral / quadrangular cartilage



- main component of Alar cartilage → fibrofatty tissue
- medial crus of alar cartilage forms columellar septum

## DEFORMITIES & DISEASES OF EXTERNAL NOSE



### Deviated NOSE

Rx by Rhinoplasty



### Crooked NOSE

Rx by Rhinoplasty



### Nasal Hump

Rx by reduct<sup>n</sup> Rhinoplasty



### Saddle NOSE

Rx - Augmentat<sup>n</sup> Rhinoplasty



### → RHINOPHYMA / POTATO TUMORS

- more common in ♂, 35-40yrs
- pts of Acne rosacea
- Benign Hypertrophy of sebaceous glands [Not tumor (Hyperplasia)]
- (Rx) - DERMA ABRAS<sup>n</sup> & CO<sub>2</sub> Laser is Rx of



## RODENT ULCER / BASAL CELL CARCINOMA

- mc cancer of SKIN
- seen in sun exposed areas
- locally invasive tumor
- more common in fair people
- Rx → wide local excision





# NASAL CAVITY

## BOUNDARIES OF NASAL CAVITY

ROOF - by cribriform plate of ETHMOID

FLOOR - by HARD PALATE

- anteriorly by maxilla
- posteriorly by palatine
- Nasal Septum

Medial wall

Lateral wall

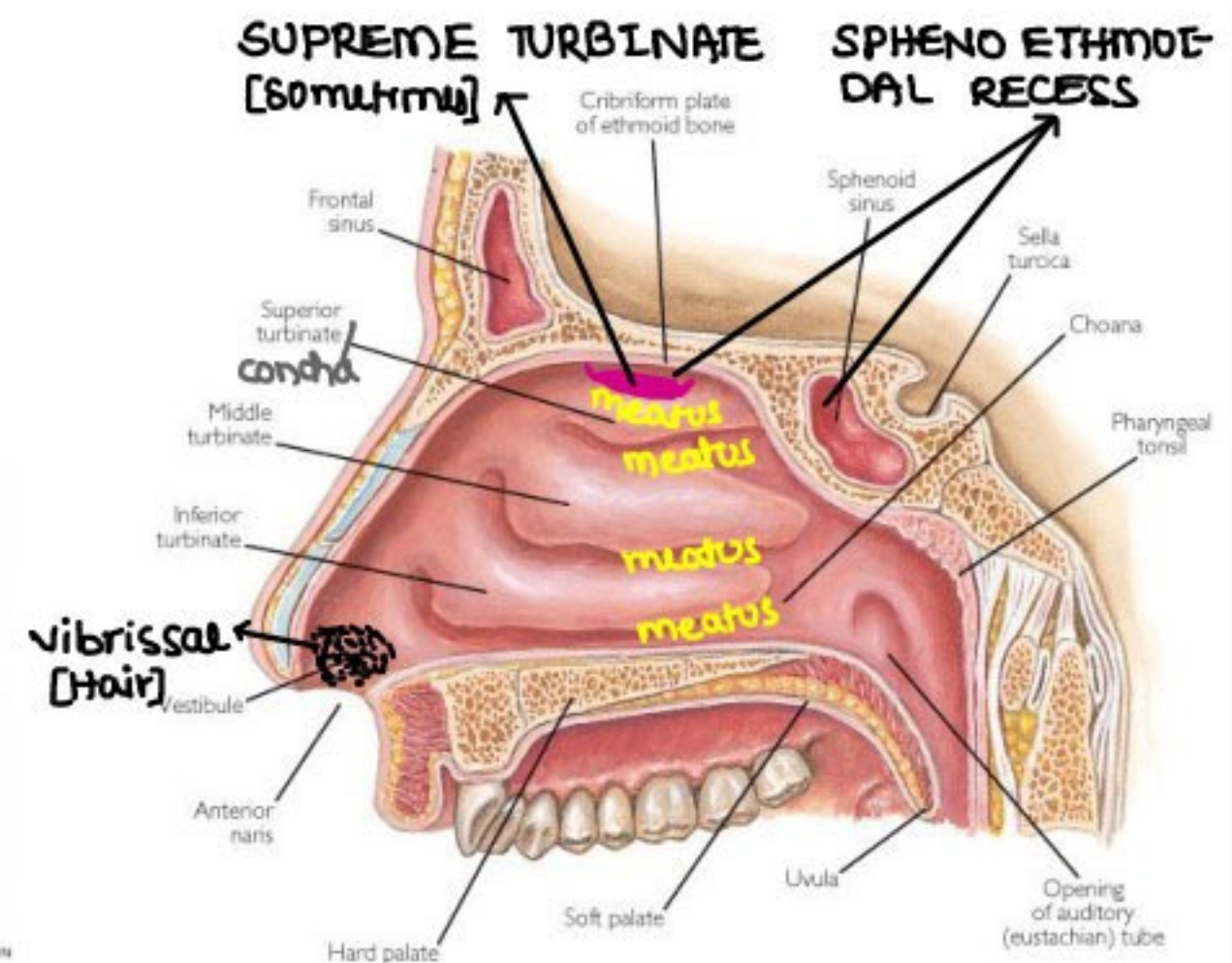
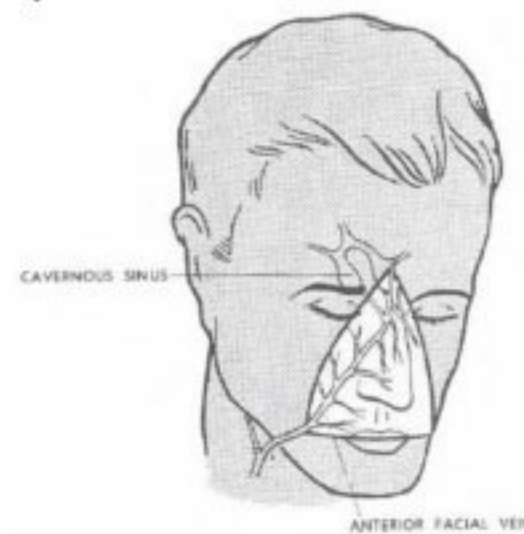
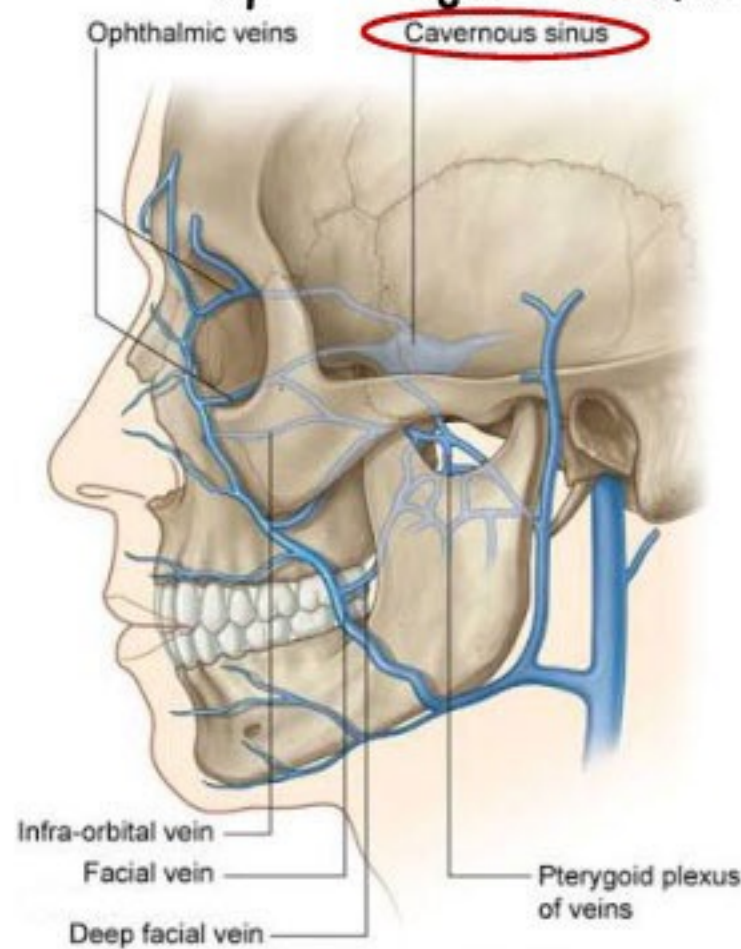
Anterior openings - Anterior nares [2]

Posterior openings - posterior choana

## LATERAL WALL OF THE NOSE

### NASAL VESTIBULITIS

- Any furuncle in nasal vestibule
- presents  $\tau$  pain, swelling
- by Staph. aureus
- Rx - Systemic Antibiotics



### Reasons for Affinity of CAVERNOUS SINUS THROMBOSIS

- 1. Direct<sup>n</sup> of flow
- 2. Amount of flow
- 3. Direct communicat<sup>n</sup>

- space below each turbinate is MEATUS
- inferior meatus is largest



## NASO LACRIMAL DUCT

- opens into inferior meatus
- Direct<sup>n</sup>

9N words [N]

Laterally [L]

Downwards [D]

- after DCR [dacryocystorhinostomy]  
(done for chronic dacryocystitis),  
NLD opens into middle meatus

## OMC [Osteo Meatal Complex]

- present in middle meatus
- 3 sinuses opens here
  - frontal sinus
  - Ant. Ethmoidal air cells
  - Maxillary sinus

## LATERAL WALL - BONY ANATOMY

→ total 8 bones  $\begin{matrix} 4 \\ + \\ 4 \end{matrix}$

→ ④ Frontal bone

Ethmoidal bone

maxilla

sphenoid

④ Nasal bone

Inferior turbinate - individual bone

Palatine bone - L shaped bone

Lacrimal Bone [exclusive]

## MEDIAL WALL / NASAL SEPTUM

→ formed by 7 bones [4 + 3]

→ ④ Frontal bone

perpendicular plate of Ethmoid

Rostrum of sphenoid

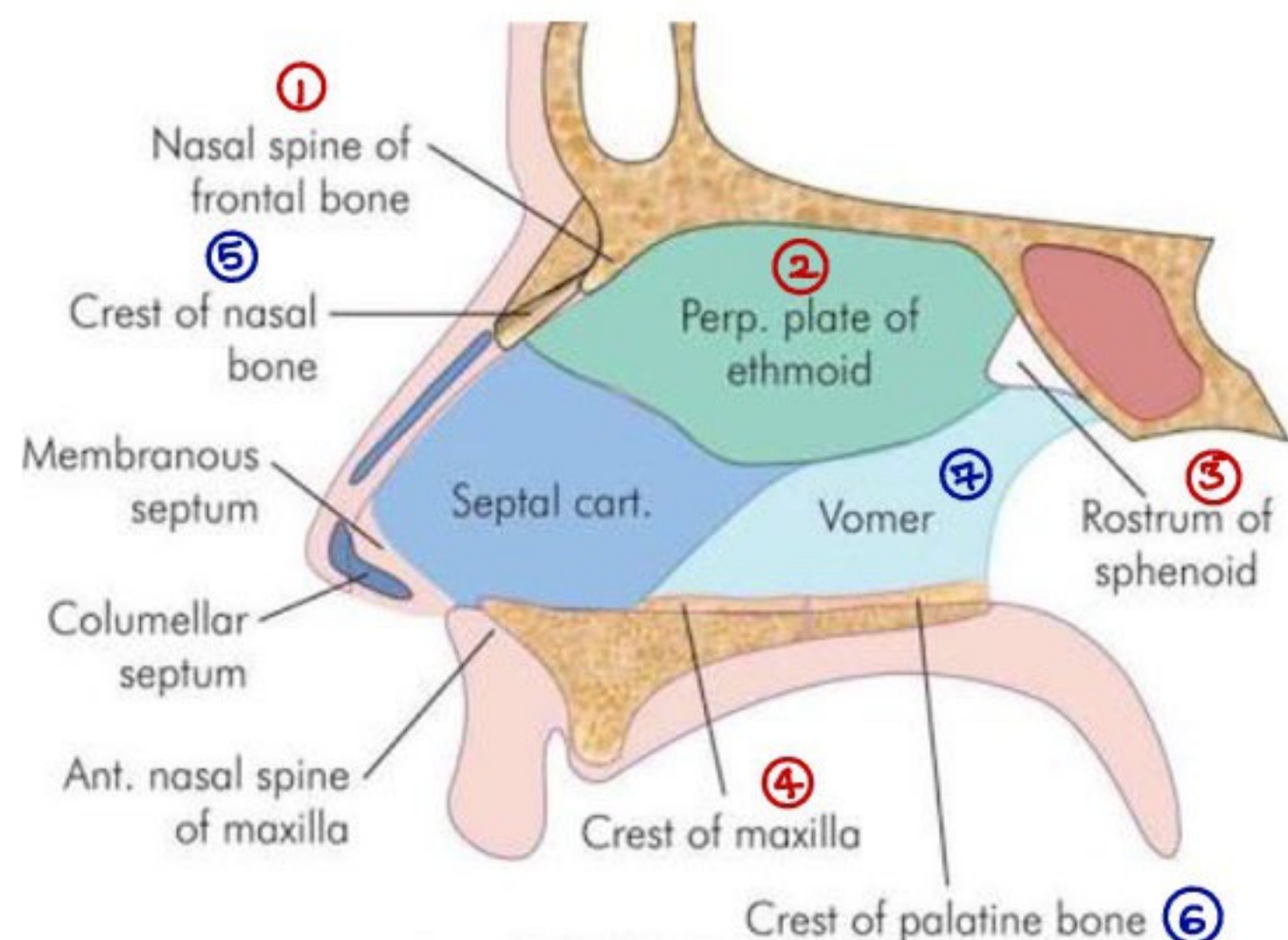
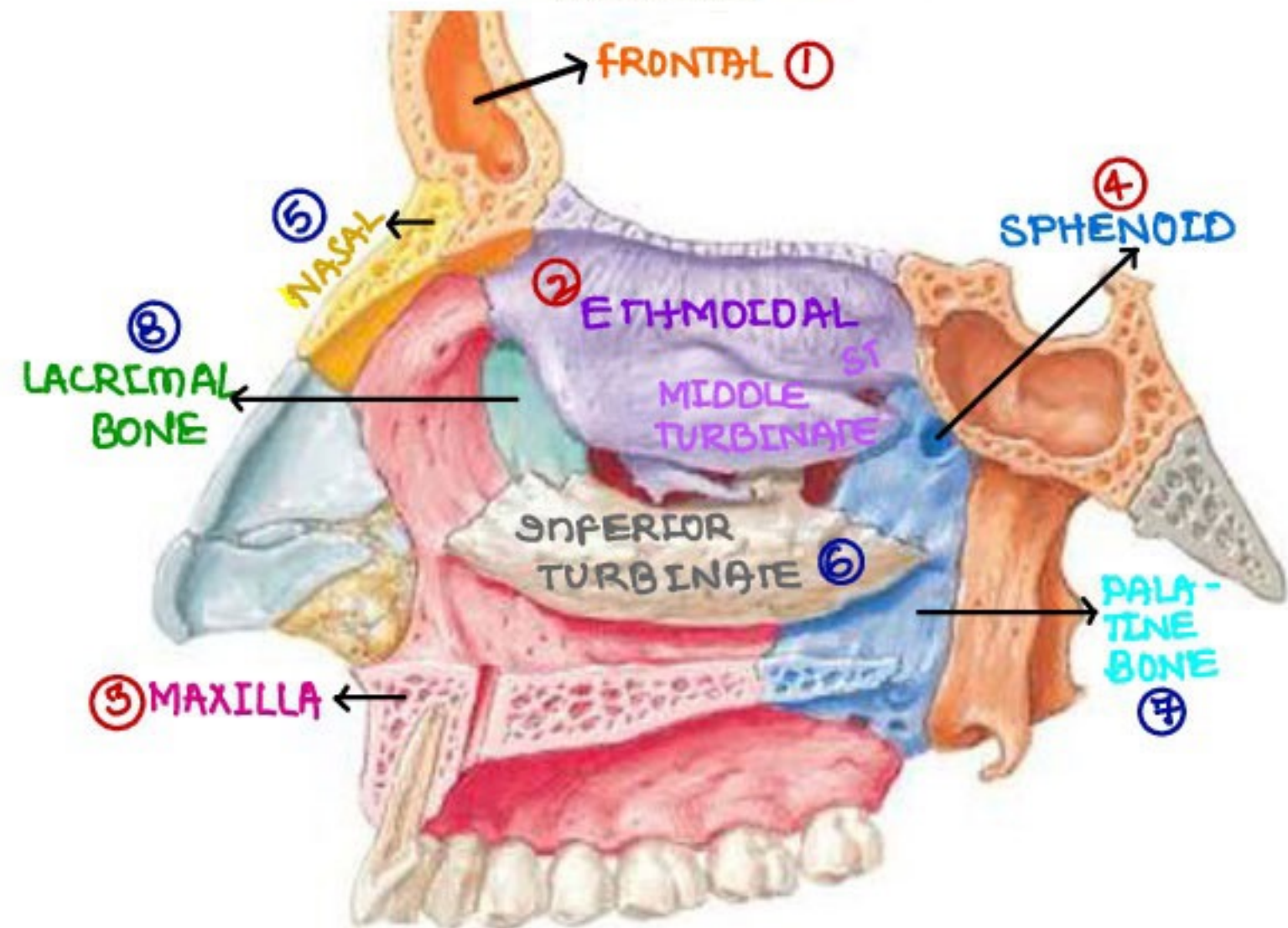
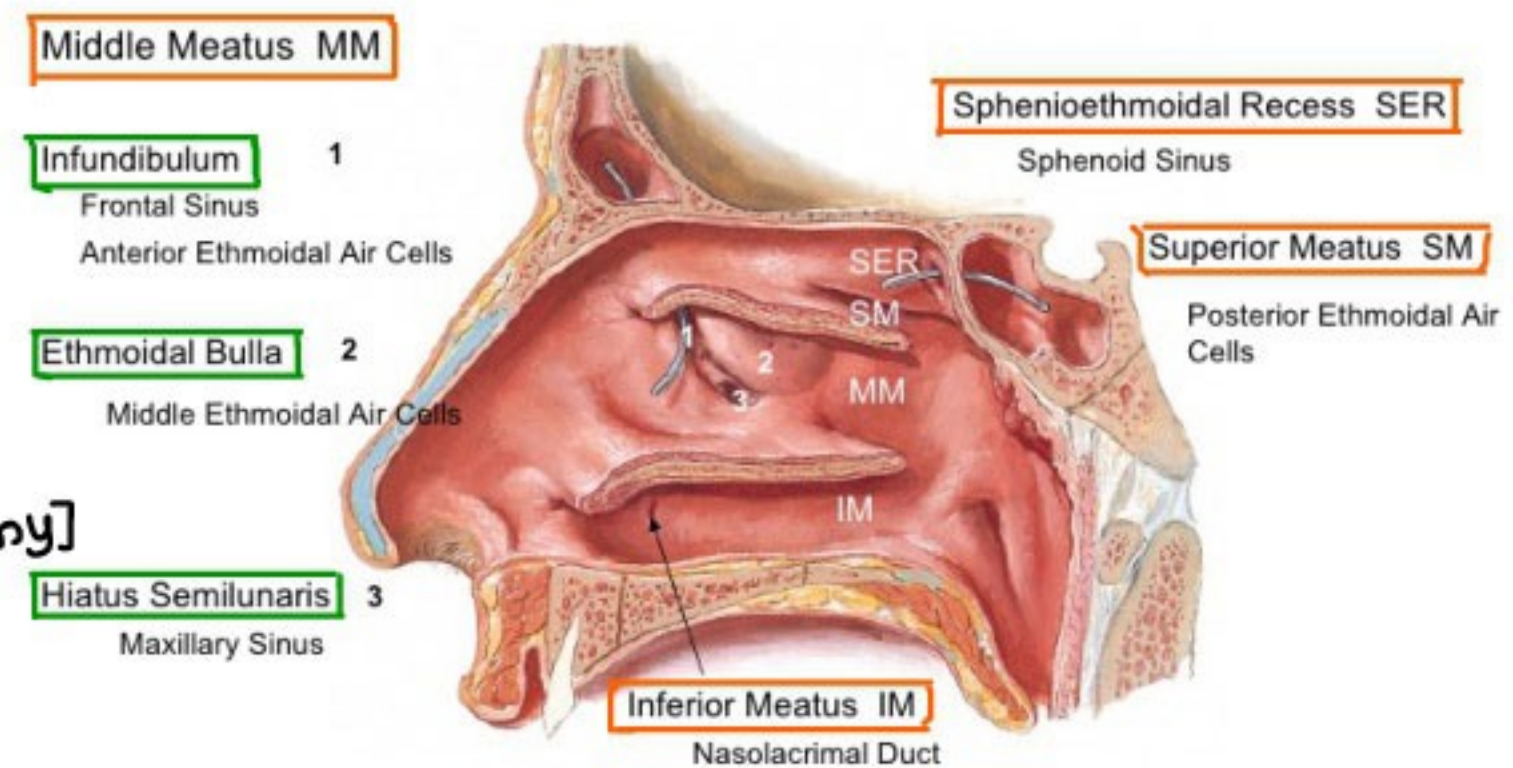
Crest of maxilla

③ Nasal bone

Crest of Palatine bone

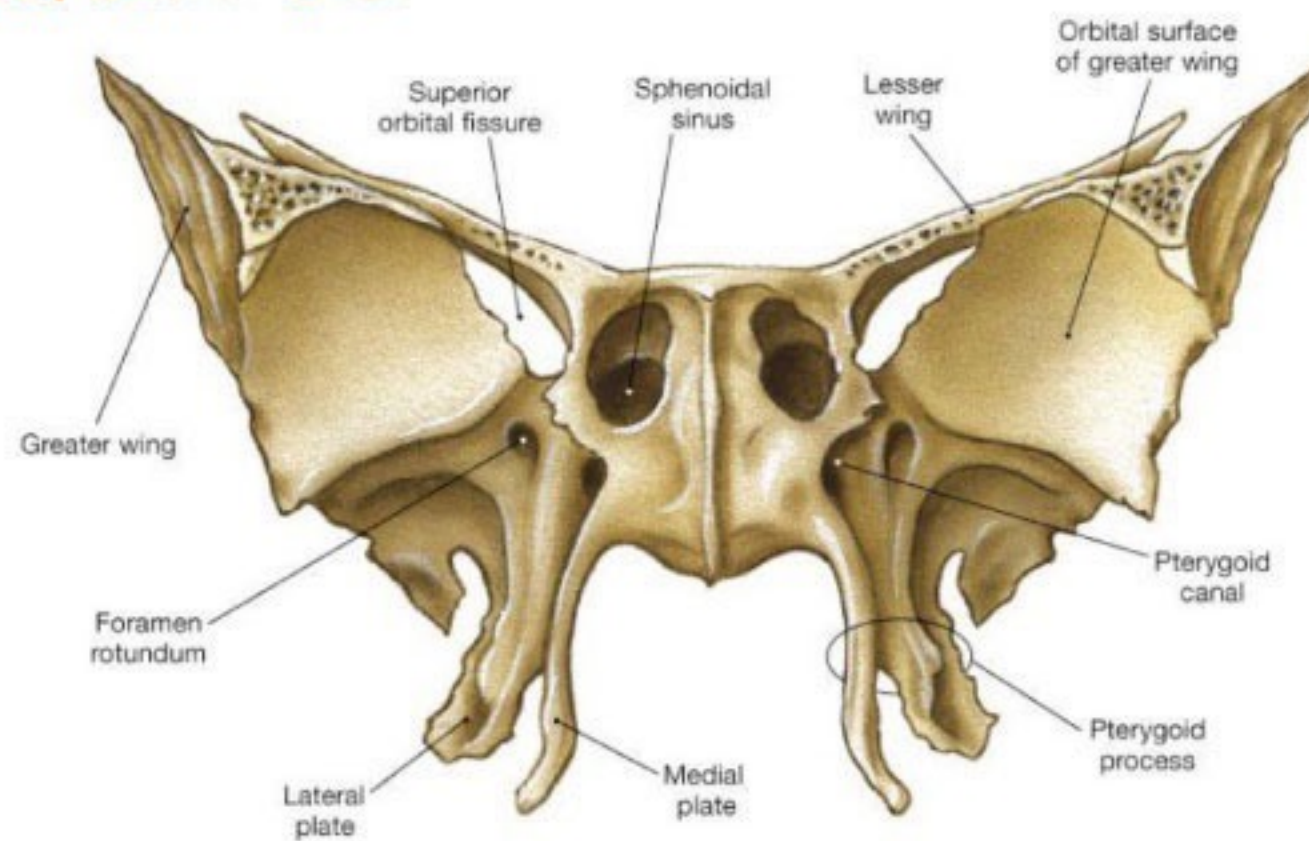
Vomer [doesn't contribute to lateral wall]

## Openings in the Lateral Wall of Nasal Cavity

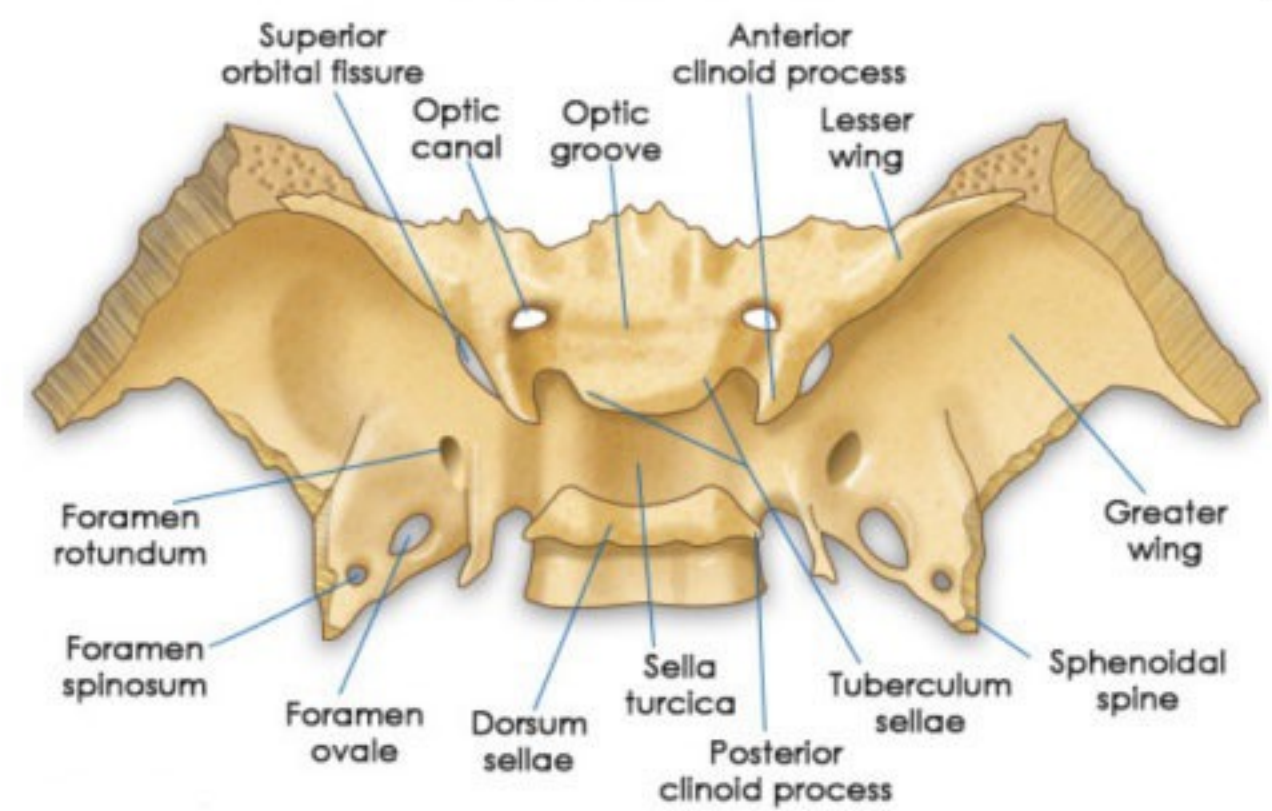




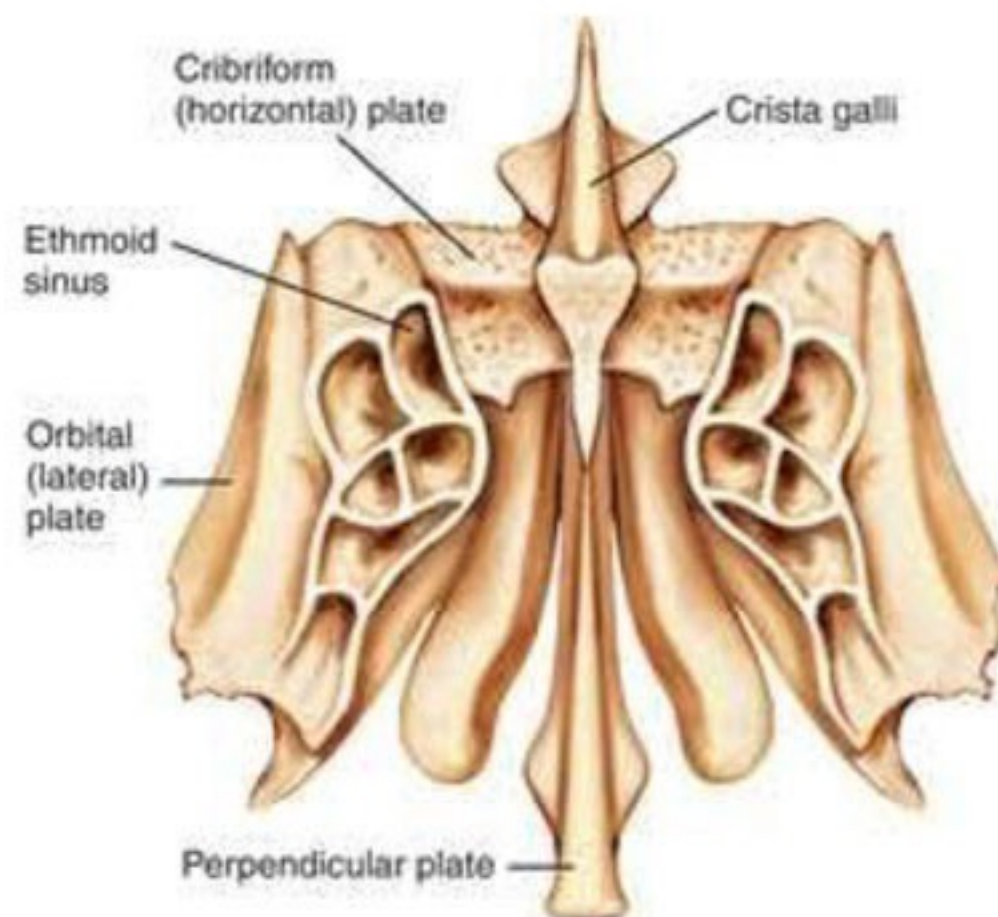
## SPHENOID BONE



## SUPERIOR VIEW

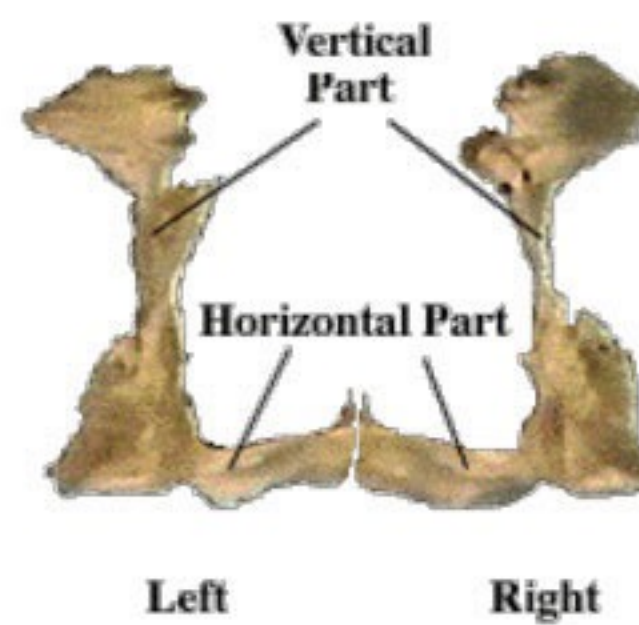


## ETHMOID BONE



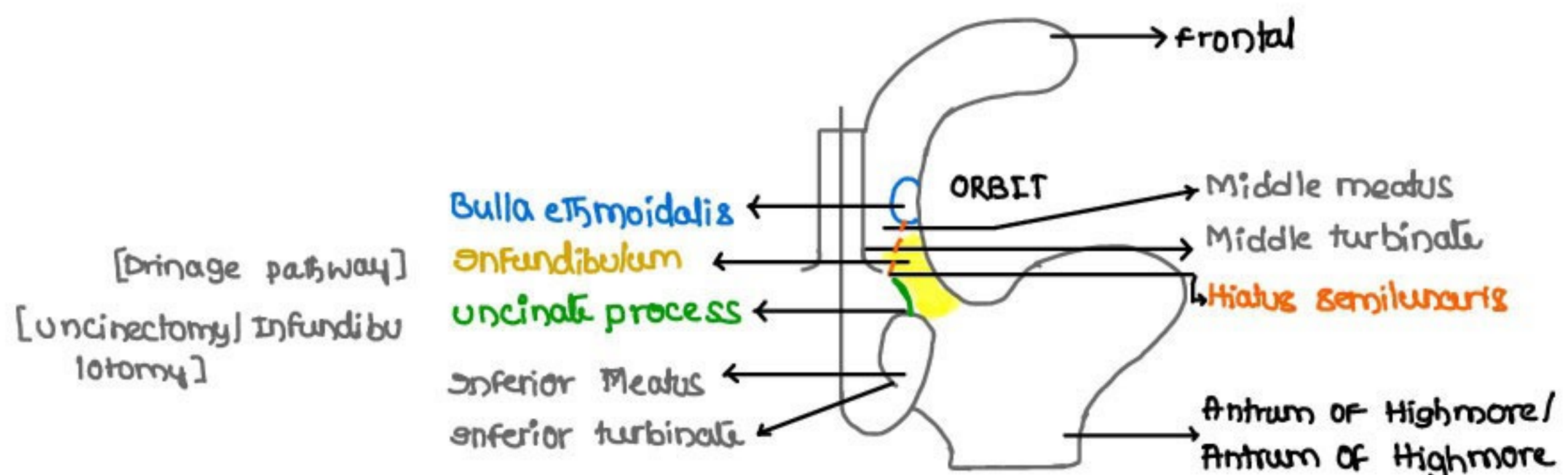
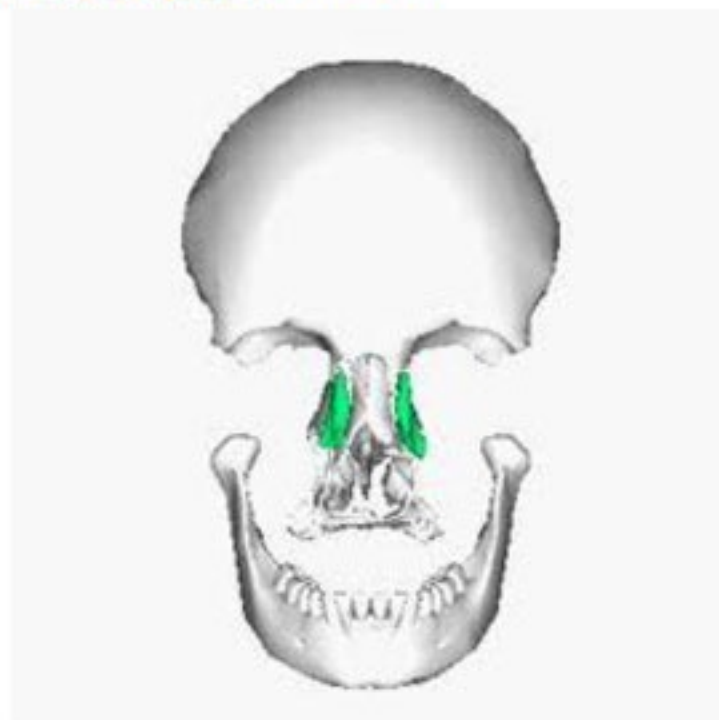
## PALATINE BONE

### Posterior View



→ DANGEROUS AREA OF NOSE → Cribriform plate of ethmoid [olfactory nerve fibres present]

## LACRIMAL BONE





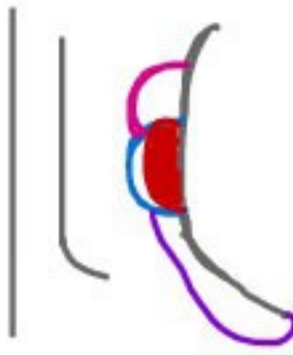
above Agger Nasi cell ← Frontal cell



ant. most cell of ethmoid ← Agger Nasi cell

in close relat<sup>n</sup> to lacrimal bone

Just below frontal sinus opening

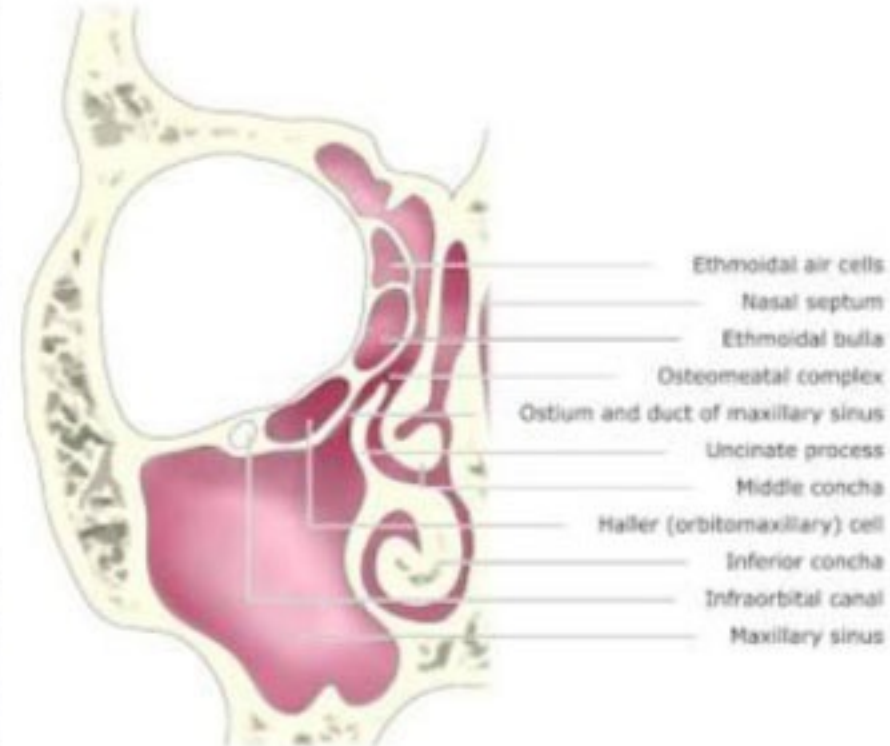
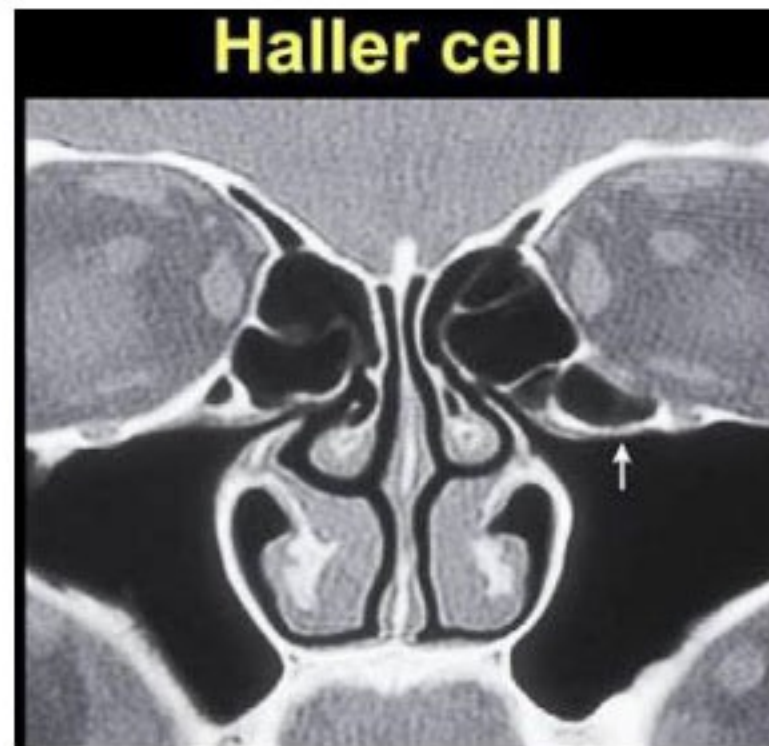


Supra Bulbar cell

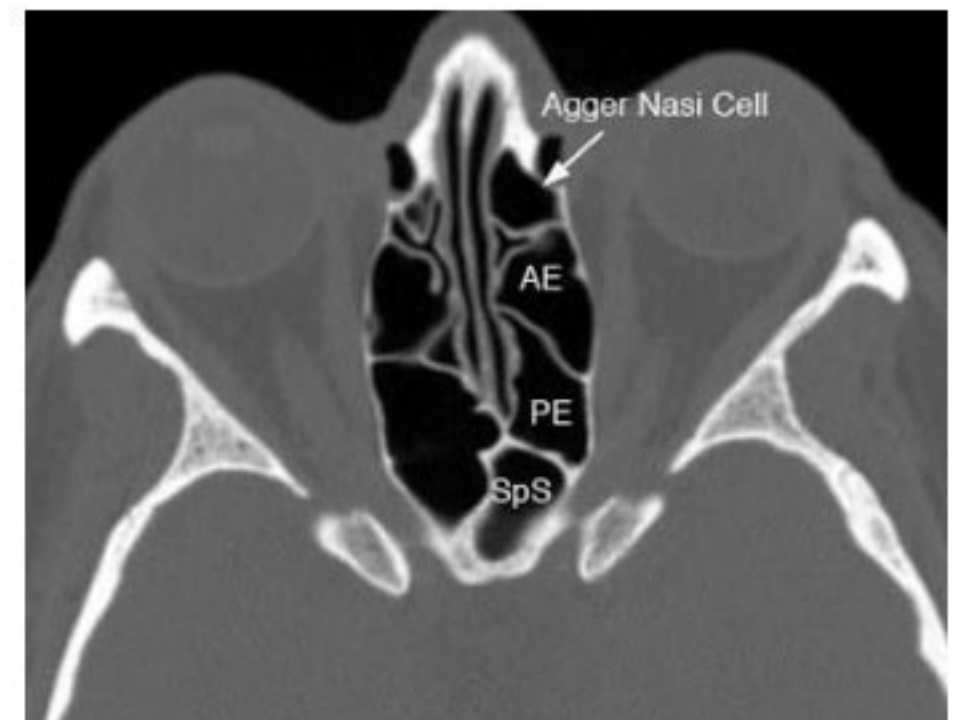
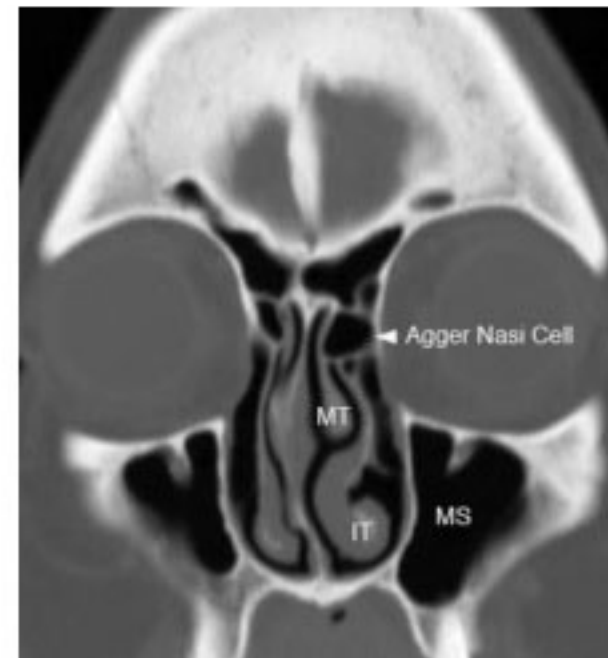
Bulla ethmoidalis

Infra orbital cell [Haller cell]

→ If haller cell is larger than Rt. any inflamm<sup>n</sup> can easily block drainage pathway.



### Type I & II frontal cell



### KUHN'S CLASSIFICATION OF FRONTAL CELLS

→ 4 types

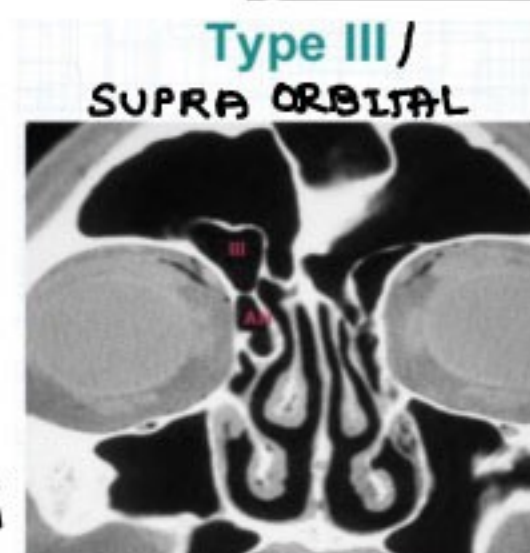
→ Type 1 → Single cell above agger nasi

Type 2 → multiple cells above agger nasi

Type 3 → Inside the frontal sinus  
causes frontal headache [office headache]

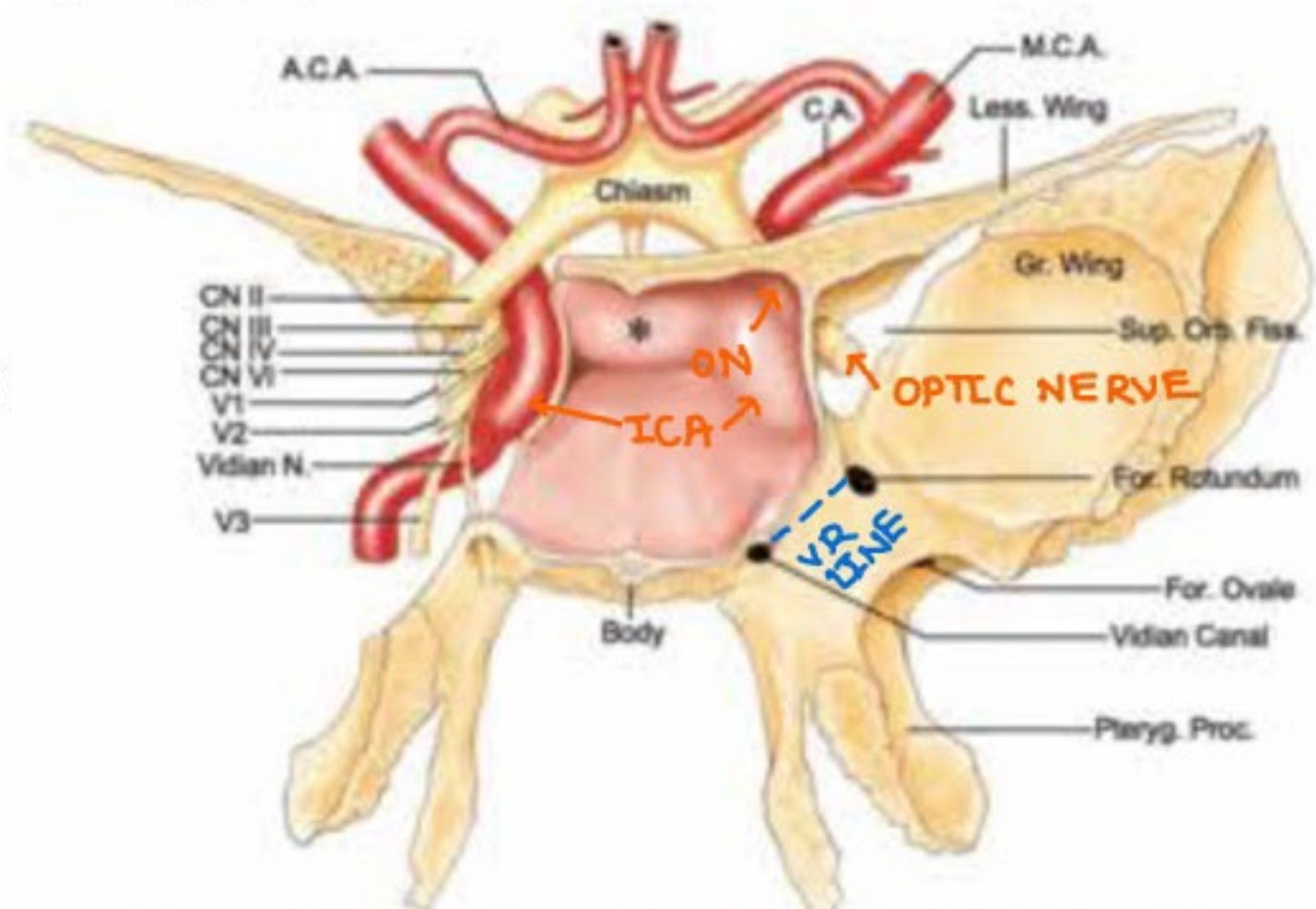
Type 4 → aka loner / satellite cell

→ Type 1, 2 cells present outside the frontal sinus



→ Optic nerve is present in the lateral wall of sphenoid sinus postero superior aspect

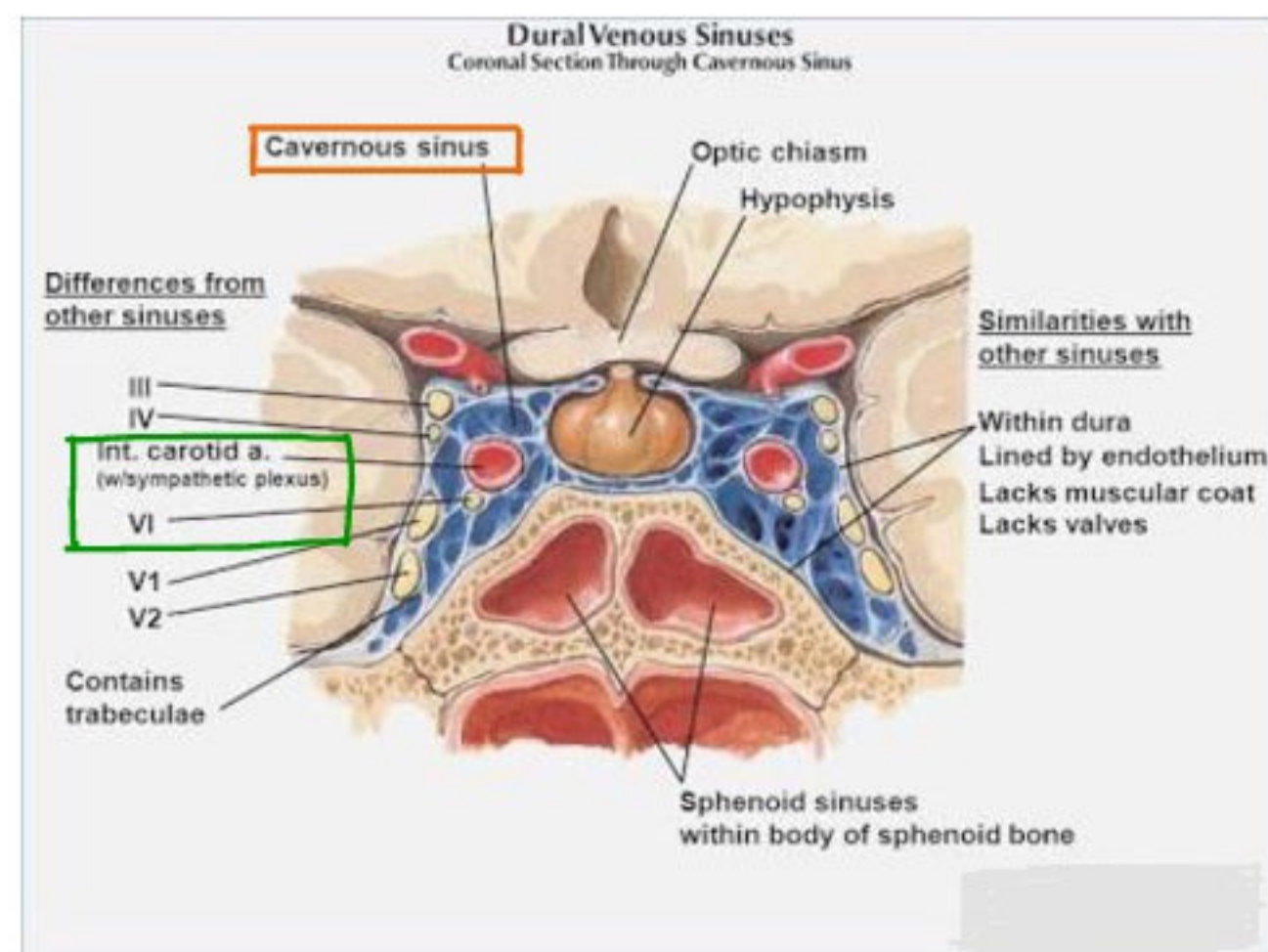
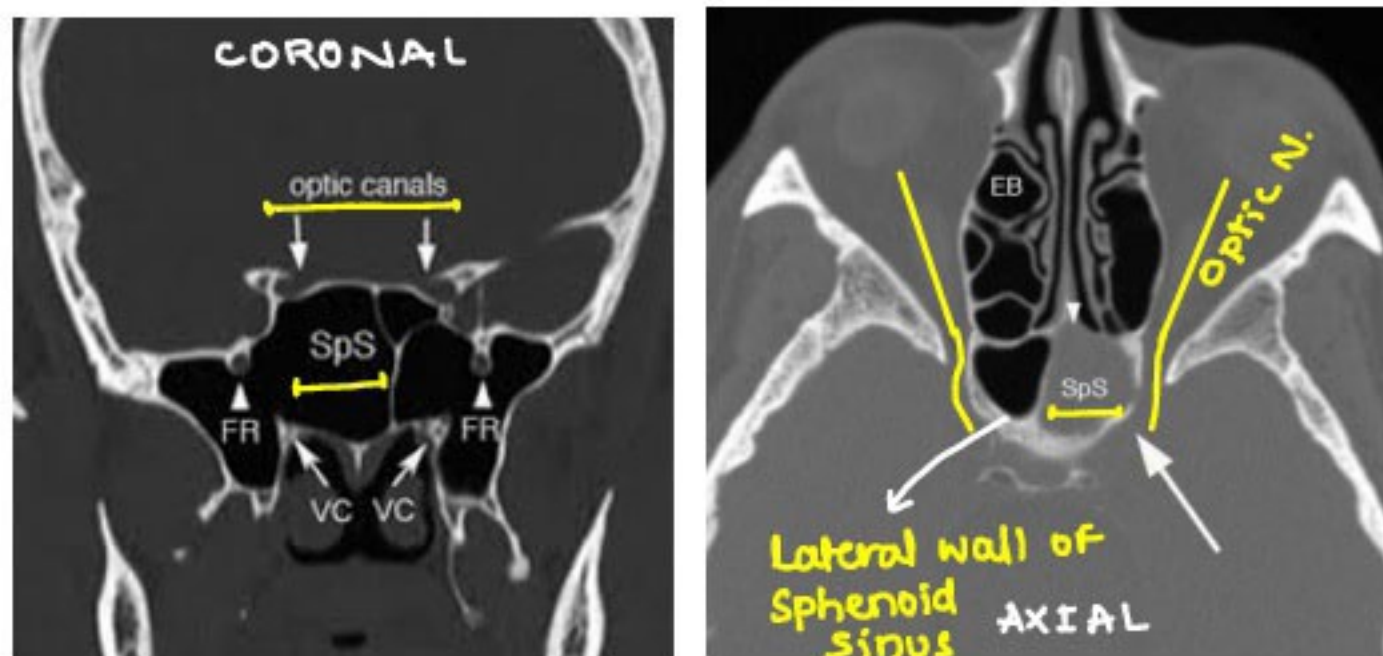
→ ICA [internal carotid artery] also present in lateral wall of sphenoid sinus.





## CAVERNOUS SINUS

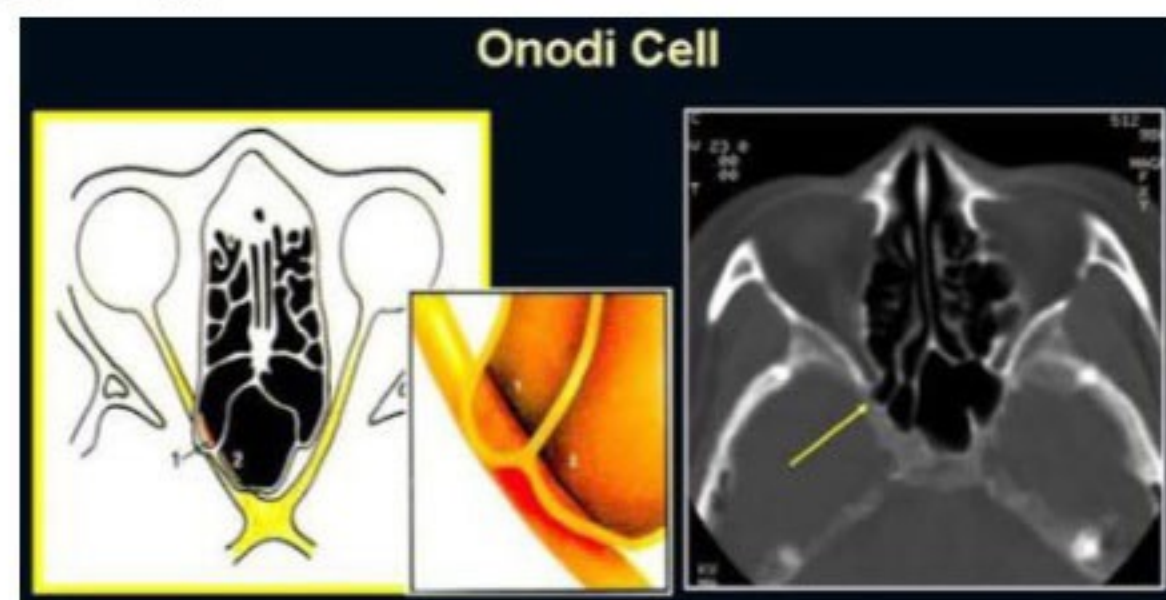
- only cavernous sinus has Nerves & arteries compared to all other dural venous sinuses.



- optic Nerve present in lateral wall of Sphenoid sinus

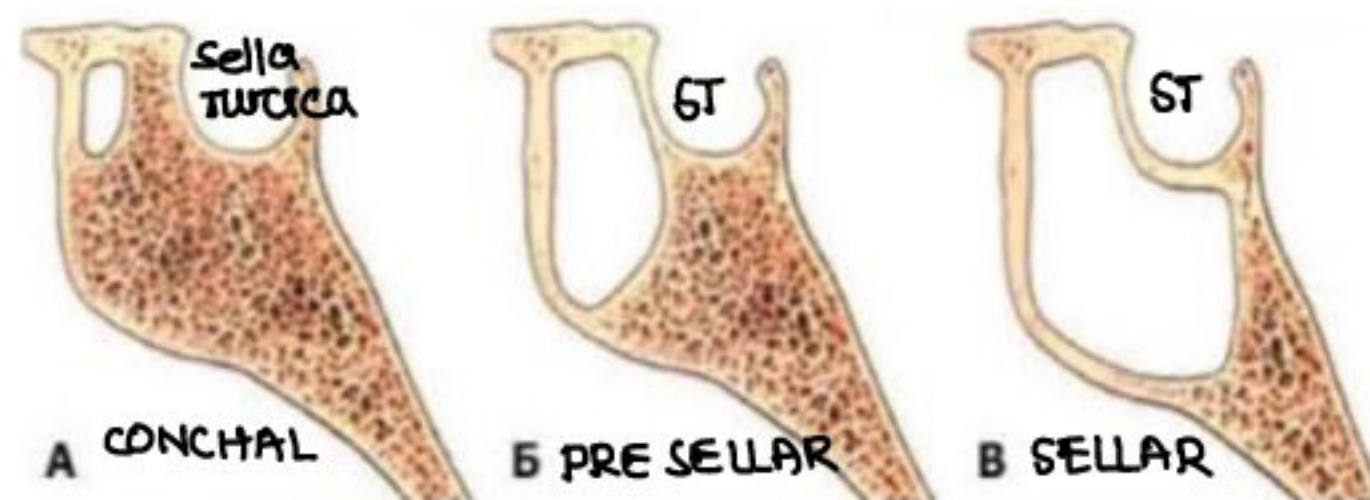
## ONODI CELL

- posterior most of Ethmoid sinus
- present lateral to sphenoid sinus
- optic Nerve present in the Onodi cell
- surgically important.



## SPHENOID PNEUMATIZATION

1. CONCHAL PNEUMATIZATION [LC]
2. PRESELLAR PNEUMATIZATION
3. SELLAR PNEUMATIZATION [mc, 54%]
4. Mixed Pneumatization [2nd mc]



- has surgical importance pituitary Sx.
  - Experience surgeon needed
  - care to be taken for not to damage optic nerve & ICA



# EPISTAXIS

## BLOOD SUPPLY OF NASAL SEPTUM

→ Supplied by 5 Arteries

1. Ant. Ethmoidal Artery
2. post. Ethmoidal Artery
3. Sphenopalatine Artery
4. Greater palatine Artery
5. Superior Labial Artery

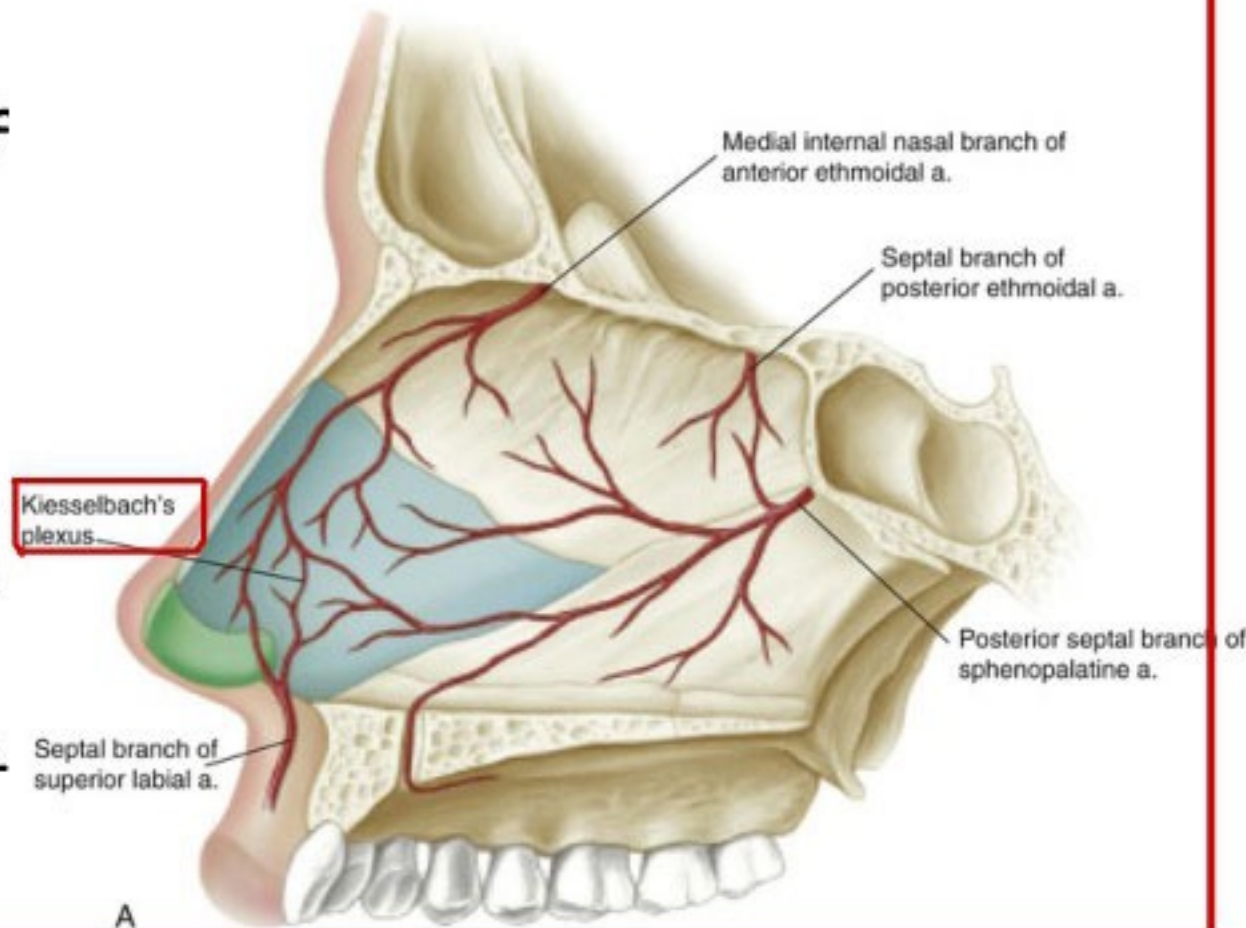
Br. OF ICA

↓  
Branches of  
Ophthalmic  
Artery

Br. of Snt.  
max. Artery

Br. of facial  
artery

↑  
4&5. are br.  
OF ECA



→ mc cause OF epistaxis → Nose picking

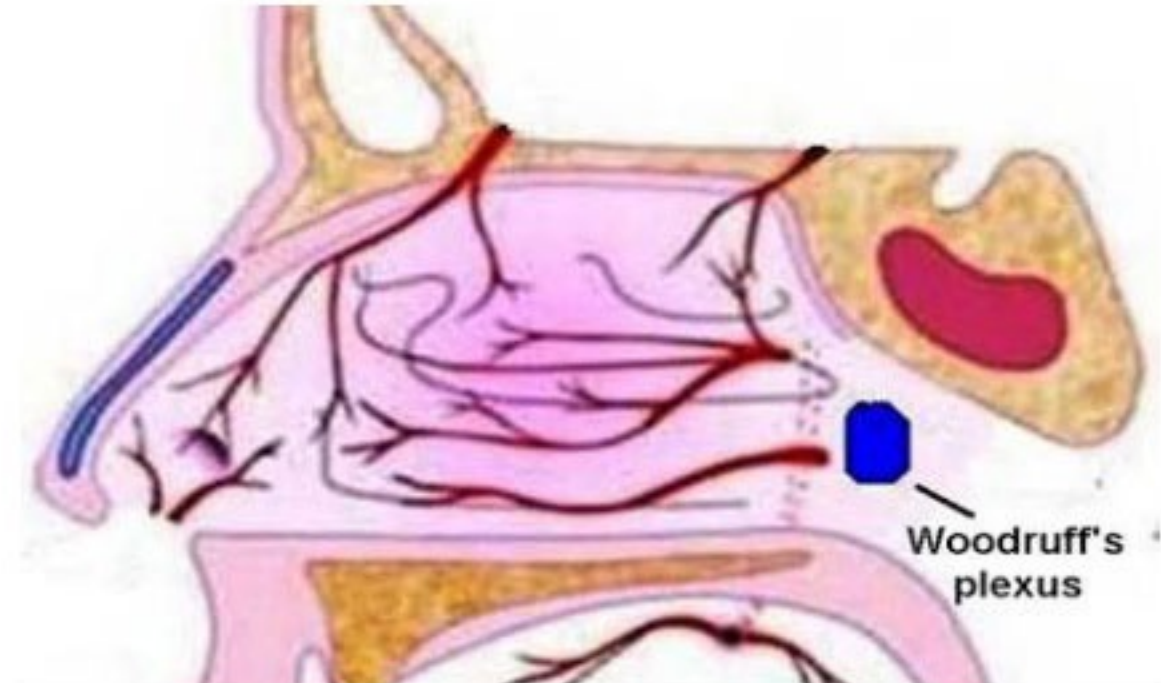


## LITTLE'S AREA

- out of 5 branches 4 form anastomoses & form KIESSELBACH'S PLEXUS
- post. Ethmoidal artery does not contribute.
- mc site for epistaxis [Nasal bleeding]
- Ant. Epistaxis present from Little's area
- on the medial wall

## POSTERIOR EPISTAXIS

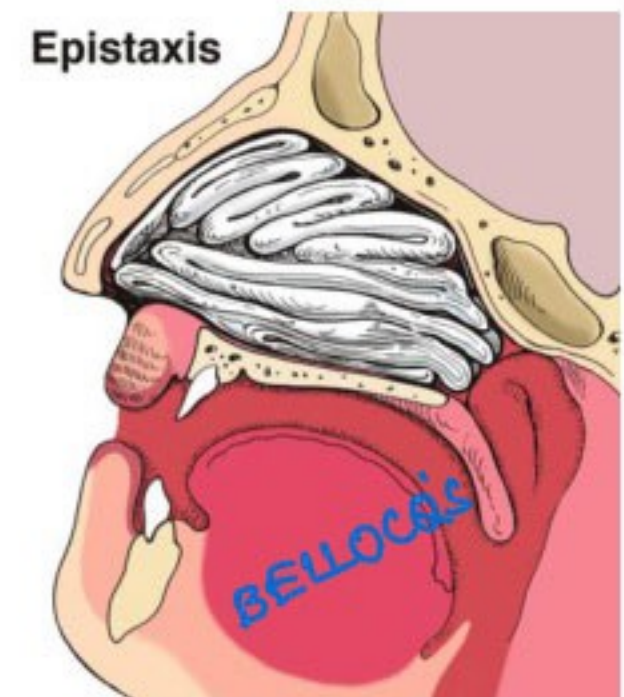
- mc site → from Woodruff's plexus
- WOODRUFF'S plexus
  - venous plexus
  - in posterior to inf. turbinate
  - Supplied by Sphenopalatine Artery
  - Post Pharyngeal Artery
- on lateral wall
- HTN is not a cause
- Causes - in elderly patients
  1. Winter & Autumn Season
  2. NSAIDs
  3. Alcohol [esp in last 24 hrs]



## MANAGEMENT OF EPISTAXIS

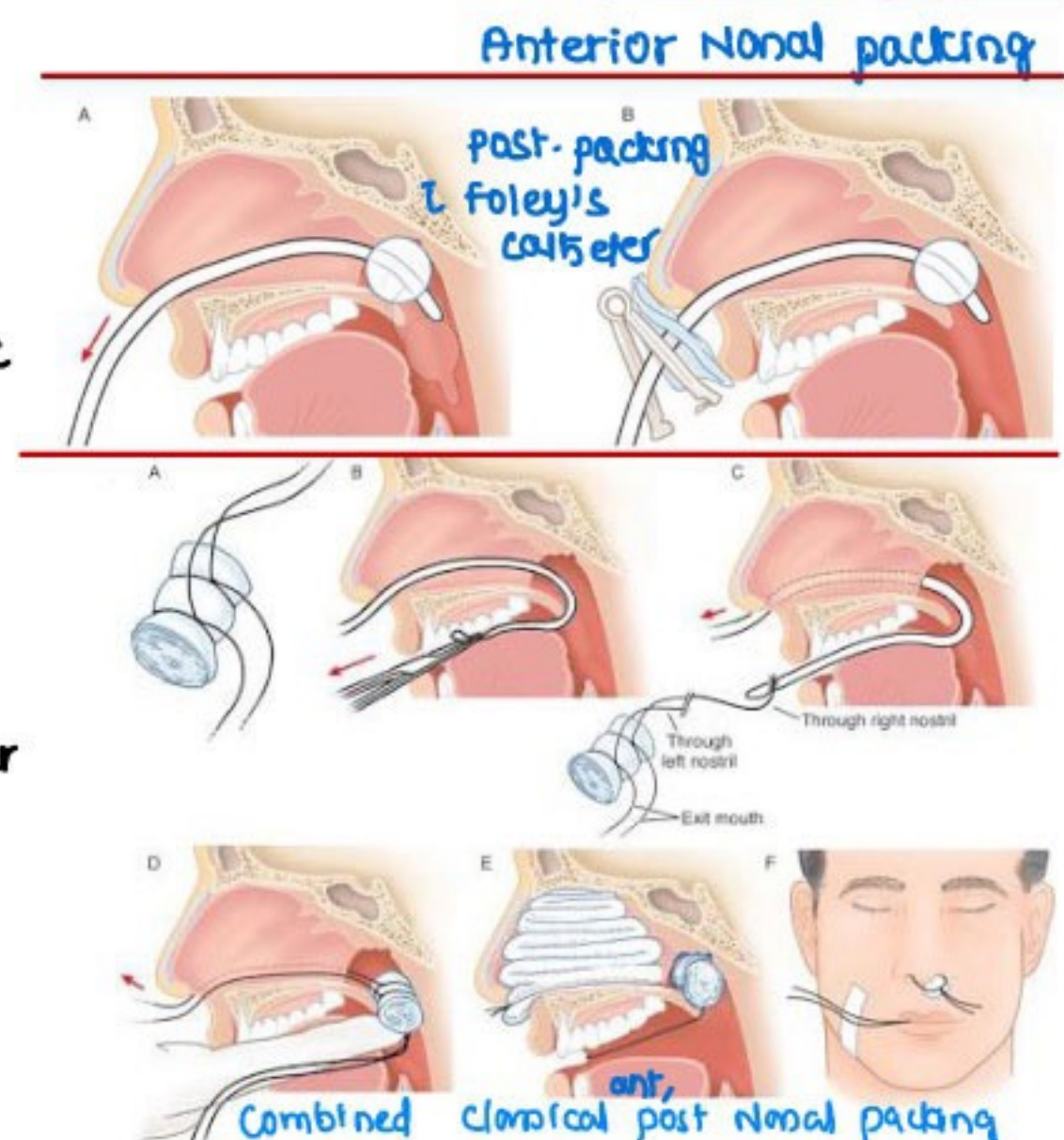
### ANTERIOR EPISTAXIS

- ant. to piriform aperture
- R/Oc → NOSE pinching for 3-5min
- TROTTER'S METHOD
- Child & recurrent epistaxis
  - under local anesthesia, chemical [ $\text{AgNO}_3$ , TCA] cautery
  - Electrocautery



### POSTERIOR EPISTAXIS

- Endoscopic cautery/ ligat<sup>n</sup> [80%] → R/Oc
- Diffuse bleeding on endoscopy
  - anterior nasal packing [Bellocq's]
    - ↓ not responding
  - posterior nasal packing & foley's catheter under local Anesthesia
    - ↓ not responding
  - Combined clinical ant. post. Nasal packing





→ Epistaxis catheters

→ Artery of Epistaxis → Sphenopalatine Artery  
 - Endoscopic sphenopalatine Artery ligation [ESPAL]

done in recurrent epistaxis

↓ Not Responding

Int. maxillary ligation/  
 Ext. carotid Artery ligation

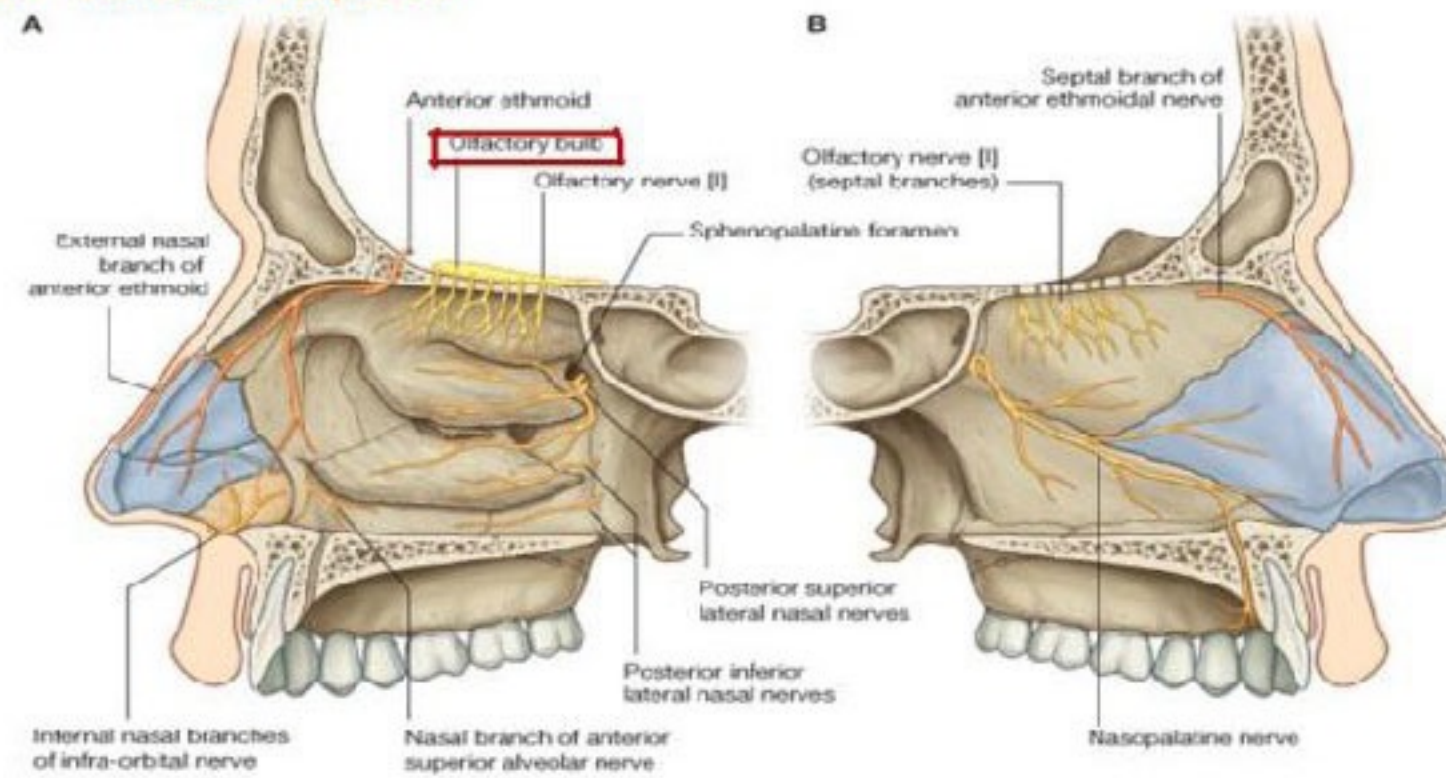


EPISTAXIS CATHETERS



## PHYSIOLOGY OF NOSE

### NERVE SUPPLY OF NASAL CAVITY



### Inspirat<sup>n</sup>

- During normal tidal inspirat<sup>n</sup>, the maximum air pass through middle meatus in a parabolic curve

### Expirat<sup>n</sup>

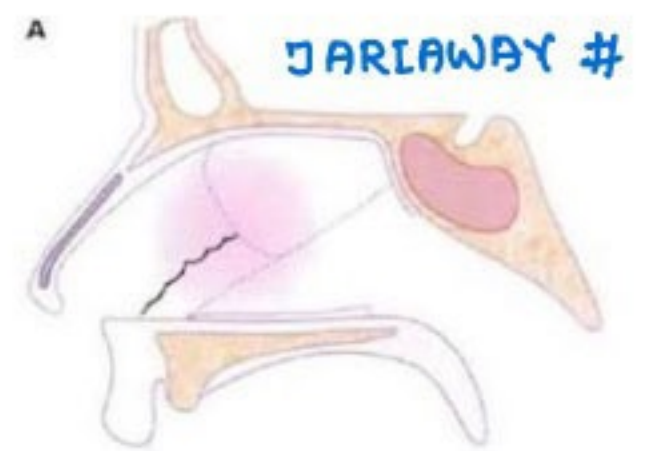
- During expiration, the Paranasal sinuses are aerated & air comes out during inspirat<sup>n</sup>
  - BERNOULLI'S PHENOMENON
    - during inspirat<sup>n</sup>, it creates negative pressure
  - PNS role → Air conditioning during inspiration during expirat<sup>n</sup>, helps in preserving the heat & moisture



## DISEASES OF NASAL SEPTUM

### 01. JARLAWAY #

→ # line runs parallel to cartilage vomer junct<sup>n</sup>.



### 02. CHEVALLET #

→ # line starts from ant. most point of maxillary crest [nasal spine of maxilla] to the nasal spine of frontal bone.

### SEPTAL HEMATOMA

- BIL Nasal obstruct<sup>n</sup>
- Rx → incis<sup>n</sup> & Drainage

↓  
BIL Anterior Nasal packing



mucoperiosteum →

mucoperichondrium →

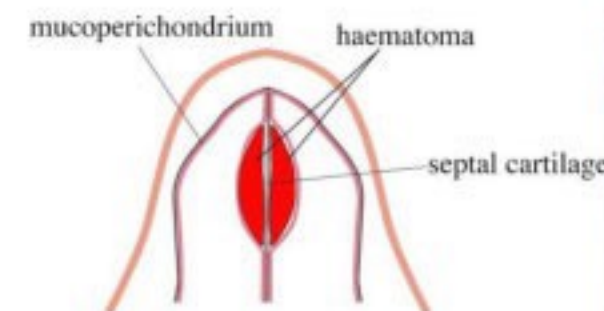


Figure 1. Showing an axial cross-section through the nasal septum



### Septal Hematoma

### SEPTAL ABSCESS

- Rx → Incision & Drainage

↓

BIL Ant. Nasal packing

↓

IV antibiotics

- mc complicat<sup>n</sup> → Septal perforat<sup>n</sup>
- Septal Perforat<sup>n</sup>

- mcc → Trauma
- Other causes
  - cocaine abuse
  - Granulomatous disorders

#### 1. cartilagenous perforat<sup>n</sup>

- TB
- Leprosy
- Lupus vulgaris
  - Apple jelly nodules in nose

- Septal piercing

#### 2. Bony perforat<sup>n</sup>

- Syphilis
- vulgaris

#### 3. BOTH

- Wegner's granulomatosis



### Septal abscess



### Septal Perforat<sup>n</sup>

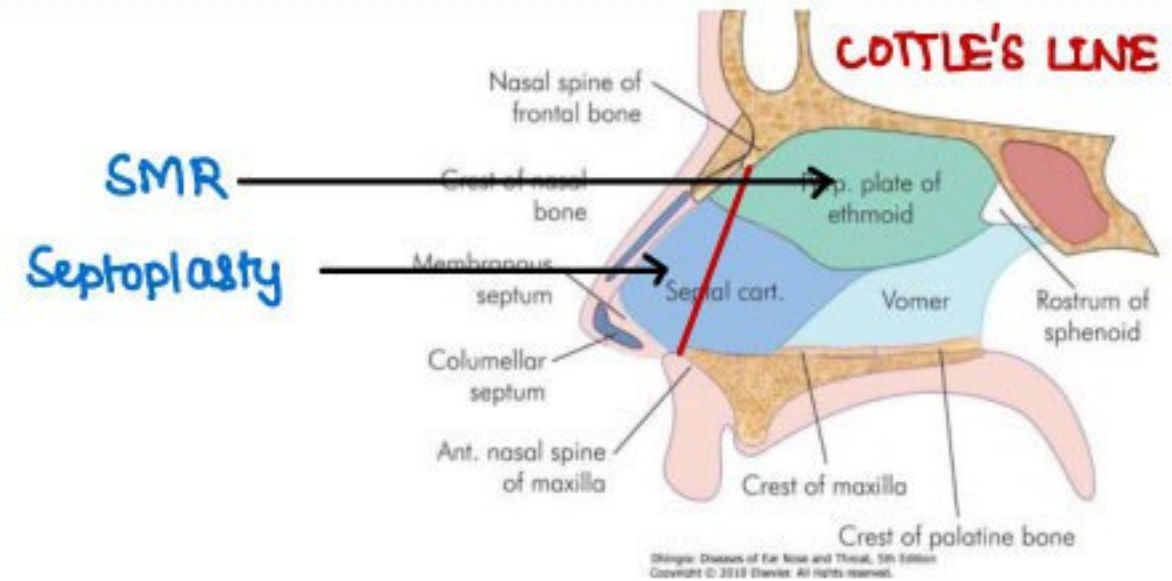
### → SEPTAL SURGERIES

SMR [Sub mucosa Resect <sup>n</sup> ]	Septoplasty
<ul style="list-style-type: none"> <li>- Rise the mucoperiosteal &amp; mucoperichondrial flaps on both sides &amp; remove bone &amp; cartilage leaving 'L' shaped cartilage</li> </ul>	<ul style="list-style-type: none"> <li>- Rise both flaps on one side &amp; remove only deviated septum</li> <li>- more conservative sx</li> <li>- low chance of perforat<sup>n</sup></li> </ul>



## → COTTLE'S Line

- ant. to line - Septoplasty
- post. to line - SMR



## COTTLE'S TEST

- Test of nasal valve / Limen nasi / Limen vestibuli

## Indications of Septal Sx

01. DNS causing nasal obstruct<sup>n</sup>
02. DNS causing recurrent epistaxis
03. DNS causing chronic infect<sup>n</sup>
04. As a part of other Sx
05. To give access to other Sx

} DNS itself is not an indicat<sup>n</sup>



## DISEASES OF NOSE & PARANASAL SINUSES

### INFLAMMATIONS

RHINITIS	SINUSITIS
→ Nose is lined by Pseudostratified ciliated columnar epithelium [Respiratory epithelium]	→ PNS lined by pseudostratified ciliated columnar Epithelium

→ COMMON TERM → RHINOSINUSITIS



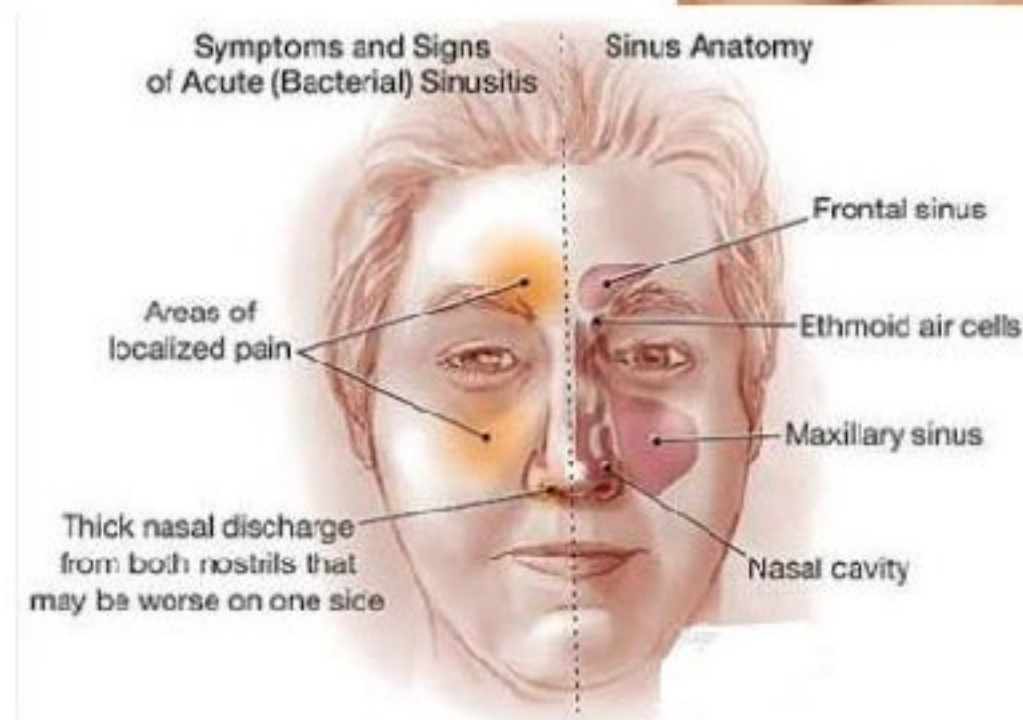
## ACUTE RHINOSINUSITIS

- mc causative agent → Rhinovirus
- Rx → symptomatic



## ACUTE BACTERIAL RHINOSINUSITIS

- mc cause → Streptococcus pneumoniae, Moraxella catarrhalis, H. influenzae
- mc sinus involved → maxillary sinus
- Rx → Antibiotics
- In Acute Rhinosinusitis → mucoid discharge
- In Ac. bacterial Rhinosinusitis → mucopurulent discharge



## CHRONIC RHINOSINUSITIS

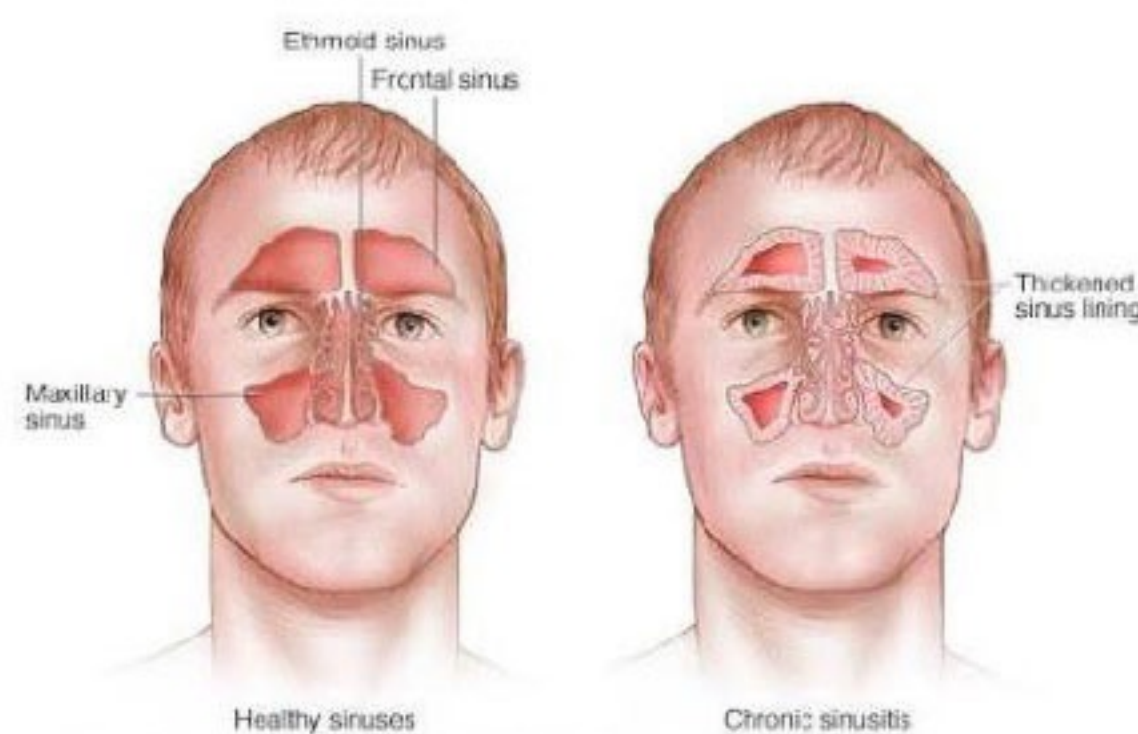
- >12 WKS → chronic Rhinosinusitis
- chronic infection + chr. hypertrophy
- mc causative → Staph. aureus
- Mx

- culture directed Antibiotics } 40C  
Nasal decongestants

↓ Not responding

Antral puncture & lavage / Antral wash  
↓ Recurrence [obsolete now]

FESS  
[functional Endoscopic Sinus Surgery]



## ALLERGIC RHINOSINUSITIS

- mc allergen → carpet dust / House dust mite
- more common in urban [High Socio economic] people
- more in developed countries [Hygiene hypothesis]
- Th2 → Th1 shift not taken place
- more in snow covered areas



Intermittent symptoms	Persistent symptoms
- < 4 days per week	- > 4 days per week &
- Or < 4 weeks	> 4 weeks



→ mild	→ moderate - severe one or more items
<ul style="list-style-type: none"> <li>• Normal sleep</li> <li>• Normal daily activities</li> <li>• Normal work &amp; school</li> <li>• Normal troublesome symptoms</li> </ul>	<ul style="list-style-type: none"> <li>• Abnormal sleep</li> <li>• Impairment of daily activities, sports etc</li> <li>• problems at school or work</li> <li>• Troublesome symptoms</li> </ul>

ON EXAMINATION → Lethargic

- Allergic or Atopic faces
- Allergic shiners / Denni Morgan lines
- Allergic salute → Nasal crease
- mucoid secret<sup>n</sup> in nasal cavity
- mulberry appearance of turbinate
- Nasal mucosa is hypertrophied



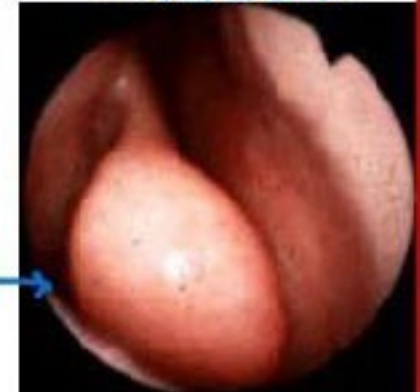
Allergic/Atopic Faces



Allergic Shiners / DENNI MORGAN LINES



Allergic Salute / Nasal crease

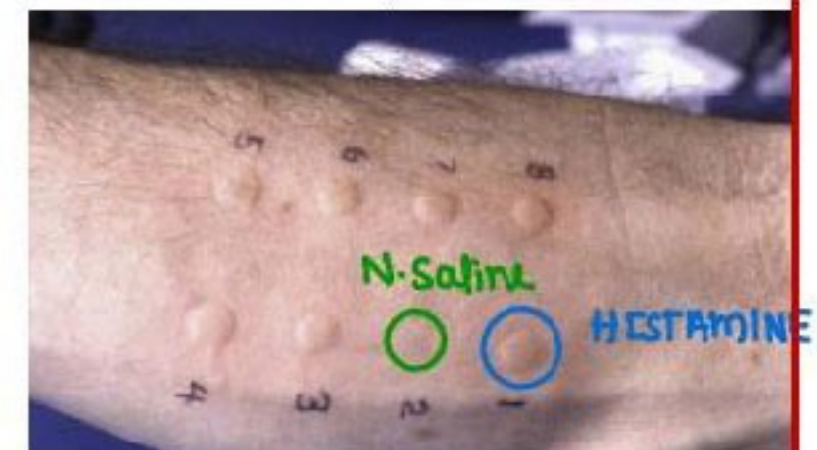


MULBERRY TURBIDITY

→ confirmed by SKIN PRICK TEST

- 1 is histamine - used as positive control
- 2 is Normal saline - negative control

→ Nasal allergen challenge / provocat<sup>n</sup> test [GOLD std]  
- not commonly done



SKIN PRICK TEST

R<sub>x</sub>

- Steroids [Intra nasal spray] - DOC

### VASOMOTOR RHINOSINUSITIS

- due to ↑ parasympathetic discharge
- more common in emotional female
- Non Allergic Non Infective Perennial [NANIPER]

R<sub>x</sub>

- Anticholinergic Spray [Ipratropium Spray]
- GSPN + Deep Petrosal nerve



VIDIAN NERVE

[Vidian Neurectomy] - Gold standard



## RHINITIS MEDICAMENTOSA

→ Excess usage of xyl/oxy metazolinex [Nasal decongestants]



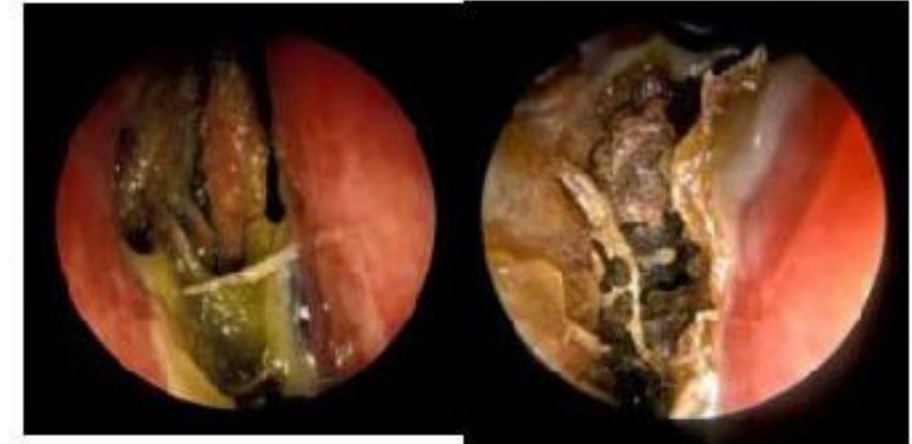
REBOUND PHENOMENON

Rx

- stop decongestants
- Doc - intra nasal corticosteroid spray [Topical]

## ATROPHIC RHINOSINUSITIS [OZALNA]

- causative agents → *Klebsiella ozaena*
- young females of poor socio economic status
- Iron deficiency ⊕
- multi vit [VitD] def ⊕



→



- mc complaint → Nasal obstruct<sup>n</sup> [crust format<sup>n</sup>]
- foul smell ⊕
- Anosmia ⊕ → MERCIFUL ANOSMIA

→ Q/E

large roomy nasal cavity & foul smelling crusts

→ Rx

1. Alkaline Nasal Douching [ $\text{NaCl}$  +  $\text{NaHCO}_3$  +  $\text{Na}$  borate] → crust softens  
Klebsiella doesn't grow

2. 25% Glucose in Glycerine [hygroscopic effect]



Nourishes the columnar cells

3. Antibiotics

4. multivitamins [vit D], Fe Supplements

5. Estrogen Spray

6. Kimecetine / Anti Ozaena Solution

- a. chloromycetin / chloramphenicol
- b. Vitamin D
- c. Estradiol

7. Sx → YOUNG's Operat<sup>n</sup> → alternative closure of each nasal cavity for 6 months  
MODIFIED YOUNG's [1-3mm]

8. Surg. Teflon paste in the Nasal valve area [lower margin of upper lat. cartilage]  
→ Never do Turbinatectomy / Turbinoplasty



## RHINOSCLEROMA

→ caused by *Klebsiella rhinoscleromatis* [aka FRISCH BACILLI]

### STAGES

01. Stage of Atrophy
02. Stage of Granuloma format<sup>n</sup> → Bx → HPE ← IDC
03. Stage of Sclerosis / fibrosis / cicatrizat<sup>n</sup>  
- WOODY NOSE / HEBRA NOSE / TAPIR NOSE

Woody nose formed in stage 3

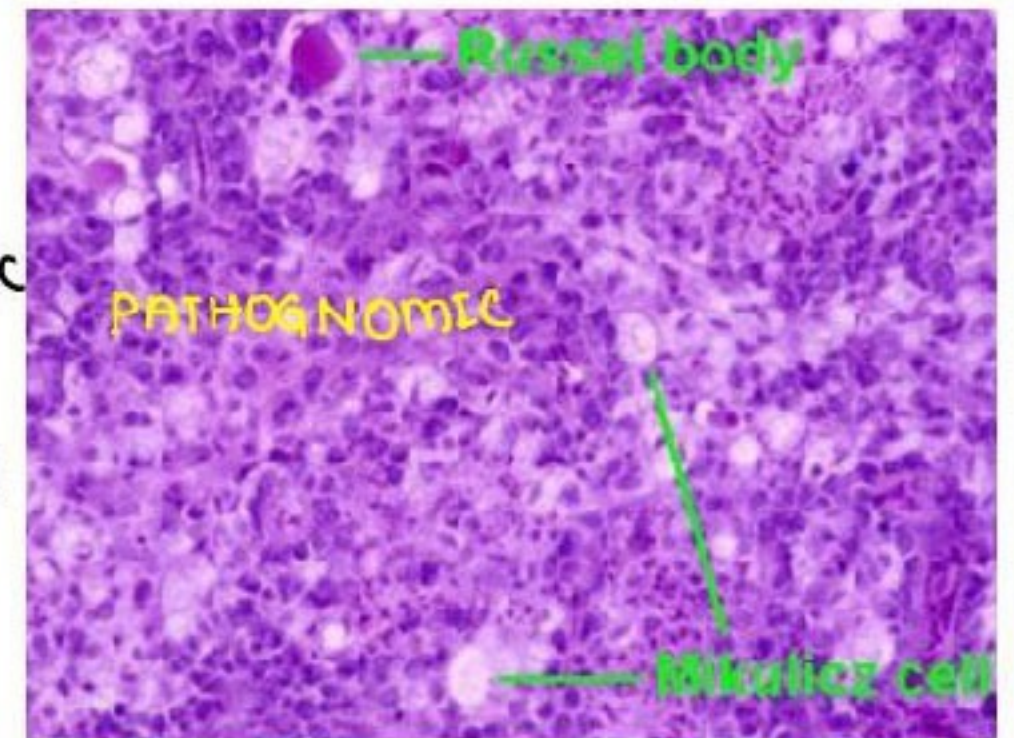
Woody indurat<sup>n</sup> initially seen in stage 2

R<sub>1</sub>

DOC → Rifampicin

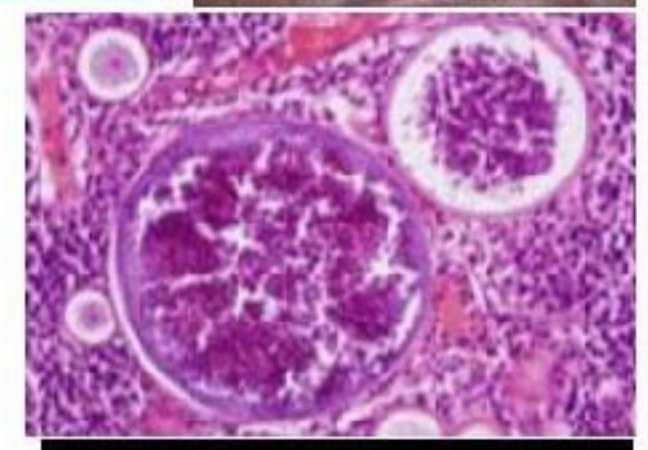
R<sub>2</sub>OC → Laser Exision + Base Electrocautery

→ Rhinoscleroma → Disease of Resp. epithelium  
→ New Name - Respiratory scleroma



## RHINOSPORIDIOSIS

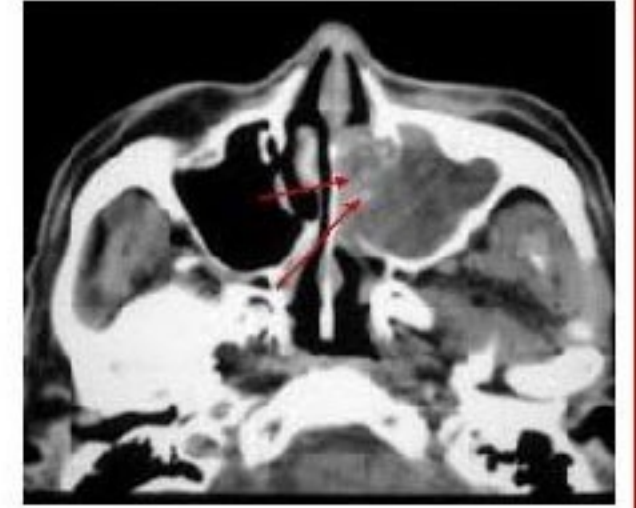
- caused by *Rhinosporidium seeberi*
- Lower aquatic fungi, affects only mucosal surfaces
- seen in Southern Eastern Coast of INDIA, Sri Lanka & Bangladesh  
mainly in rural populat<sup>n</sup> [POND Bathing] → Cross infect<sup>n</sup> from animals
- STRAWBERRY GRANULOMA
- Nasal obstruct<sup>n</sup> ⊕
- Confirmed by Bx + HPE
- on HPE - multiple thick walled sporangia
- R<sub>1</sub>
- DOC → Amphotericin B
- R<sub>2</sub>OC → Laser Exision + Base electrocautery





## FUNGAL BALL / MYCETOMA / ASPERGILLOMA

- mc → *Aspergillus fumigatus*
- NO invas<sup>n</sup>, NO react<sup>n</sup> from nasal mucosa
- Rx → Evacuati<sup>n</sup> & FESS



## ALLERGIC FUNGAL RHINOSINUSITIS [AFRS]

- Causative agents
  - Bipolaris
  - curvilaria
  - A. fumigatus

### → CRITERIA

Bent and Kuhn Diagnostic Criteria

Major	Minor
Type I hypersensitivity	Asthma
Nasal polyposis	Unilateral disease
Characteristic CT findings	Bone erosion
Eosinophilic mucin without invasion	Fungal cultures
Positive fungal stain	Charcot-Leyden crystals
	Serum eosinophilia

- Rx
  - FESS & removal of fungal +
  - steroids +
  - Immunotherapy

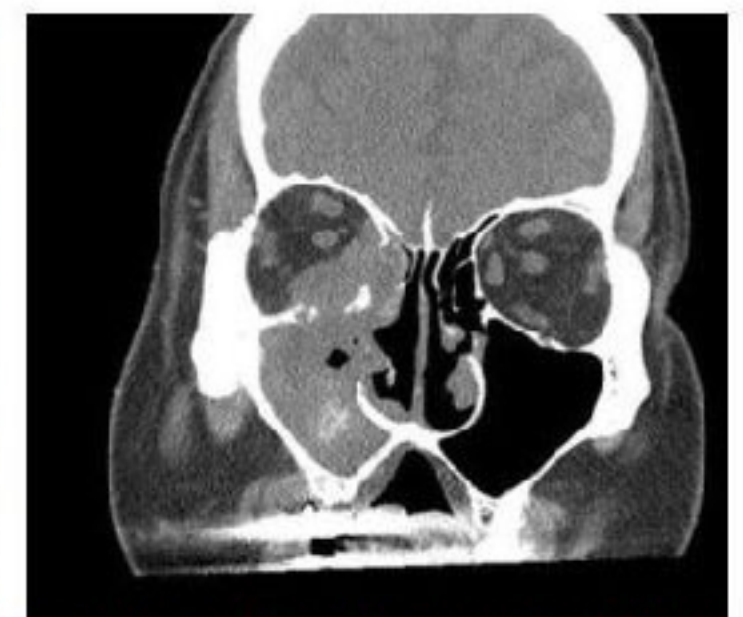
### CT Findings

- General OIL [may be BIL]
- Bone erosion w/out invasion
- Hyperdensities [Ca<sup>2+</sup> deposits in dense fungal hyphae]



## RHINOCEREBRAL MUCORMYCOSES

- Mucor / Rhizopus → Saprophytic
- Acute invasive fulminant fungal disease
- Immunocompromised patients [DM]
- Necrotizing vasculitis ⊕ [involves arteries]
- Ophthalmic involvement → sudden blindness
- ICA involvement → stroke
- DOC → Amphotericin B ← Rx
- Sx debridement
- Diabetes control



INVASIVE FUNGAL RHINOSINUSITIS



## TUMORS OF NOSE & PARANASAL SINUSES

### BENIGN TUMORS

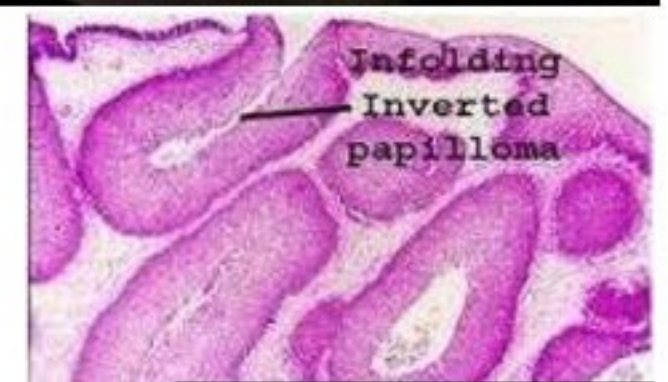
#### OSTEOMA

- mc benign tumor of PNS
- mc is frontal sinus
- Rx is excision

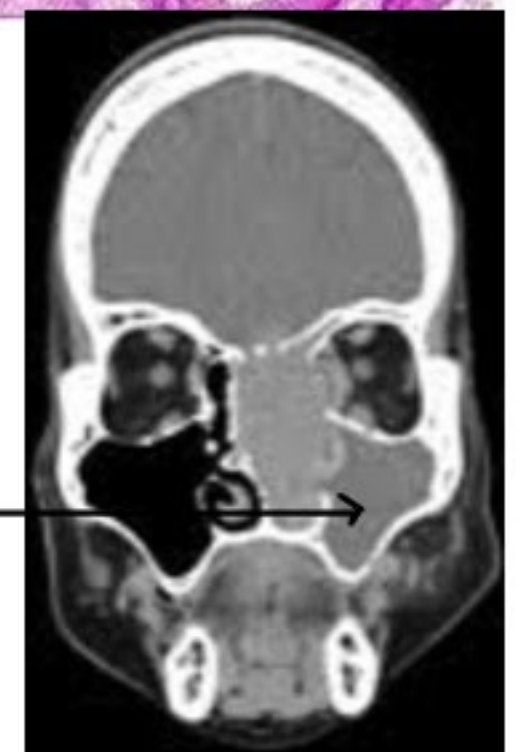


#### INVERTED PAPILLOMA / RINGERTZ TUMOR

- mc Benign tumor of Nasal cavity
- M:F → 3.5:1
- 50-60 yrs age group
- Arises from SCHNEDERIAN membrane [Spl. epithelium on lateral wall] consists of Transitional epithelium
- presents 2 polypoidal mass in nose  
nasal obstruct<sup>n</sup> & may be bleeding
- Bx → HPE - shows Infolding Inverted papilloma [GOC]  
- Confirming Dx
- CECT - to know the spread of tumor  
- hyperdense, homogenous mass  
↓  
secret<sup>n</sup>
- Rx  
- Endoscopic Endonasal Excision → R<sub>OC</sub>
- High rate of Recurrence - more the recurrence, more the chances of Squamous Cell CA



Hyperdense,  
homogenous mass



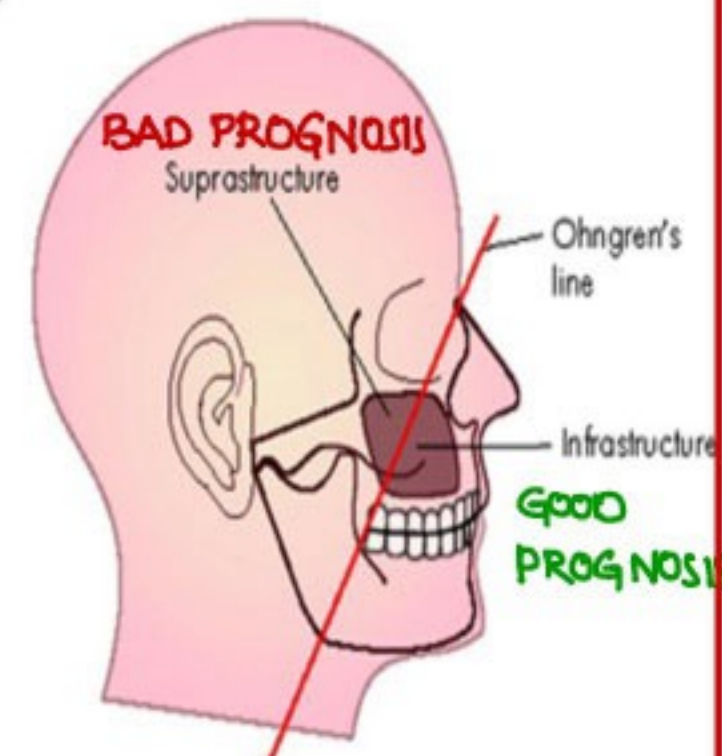
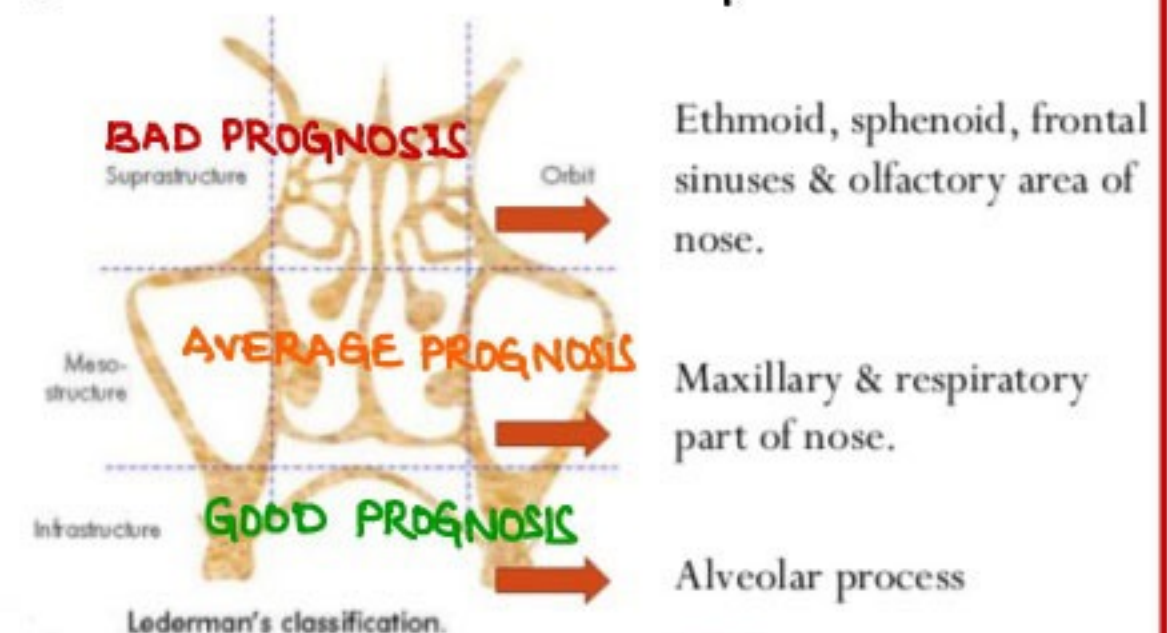
### MALIGNANCIES

#### SQUAMOUS CELL CA

- mc PNS involved → maxillary sinus
- mc malignancy of PNS & Nasal cavity
- associated 2 Occupation
  - furniture industry → Adeno CA
  - Nickel industry → Squamous cell CA

#### → classificat<sup>n</sup>

- Ohngren's line → from canthus to angle of mandible  
supra structure malignancy → Bad prognosis
- Lederman's classification  
uses two line of Sibelean





## TNM classificat<sup>n</sup>

T

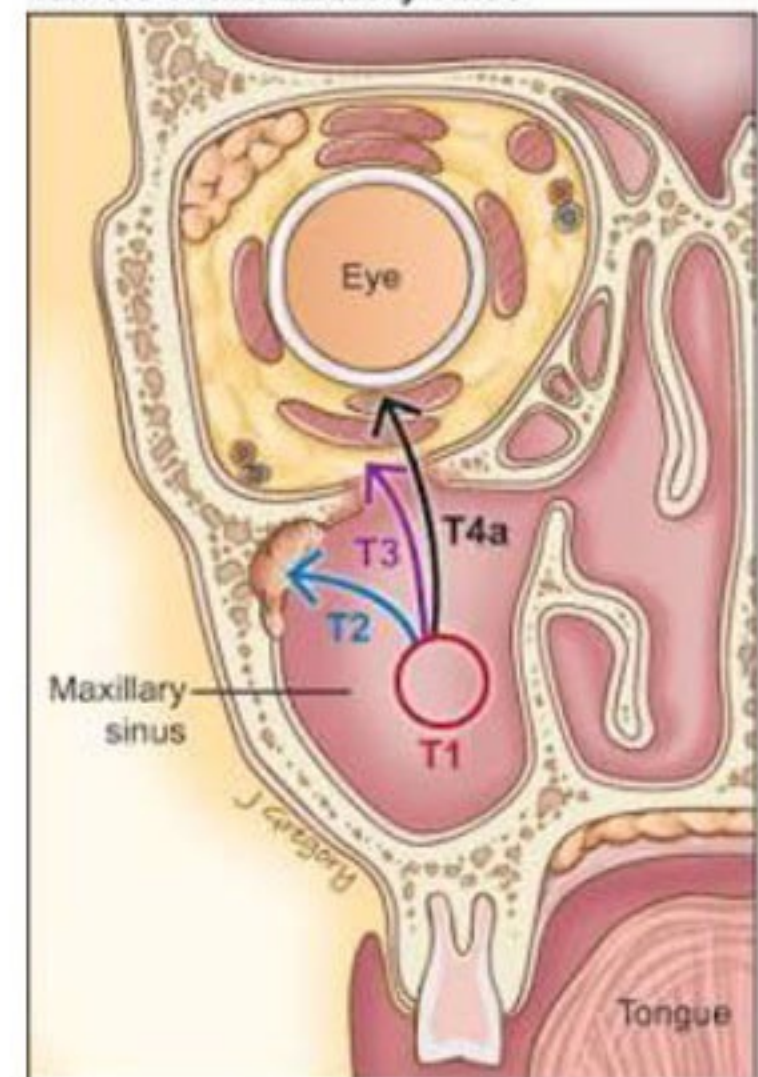
T<sub>1</sub> → involvement of Sinus mucosa

T<sub>2</sub> → involvement of Bone except the superior wall of max. Sinus

T<sub>3</sub> → involves the superior wall or ethmoidal air cells or into subcutaneous tissue

T<sub>4</sub> → involves the eye ball, orbit, skin

Tumors of the Maxillary Sinus



→ confirmatory investigat<sup>n</sup> → Biopsy

→ R<sub>y</sub> → S<sub>x</sub> + Radiotherapy

## MISC

### ESTHESIO - NEUROBLASTOMA / OLFACTORY NEUROBLASTOMA

→ rare

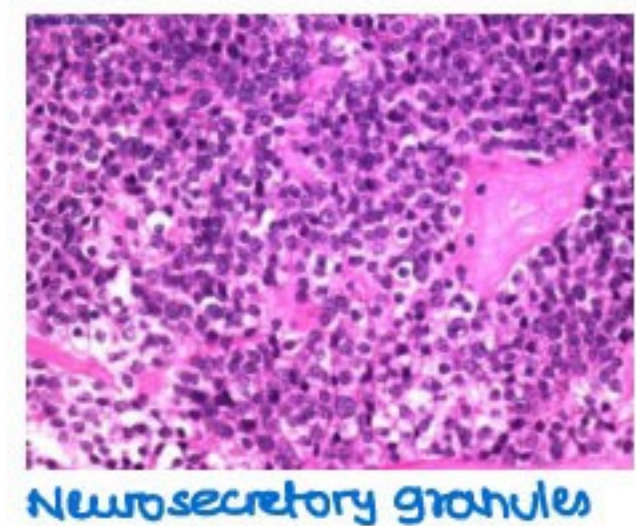
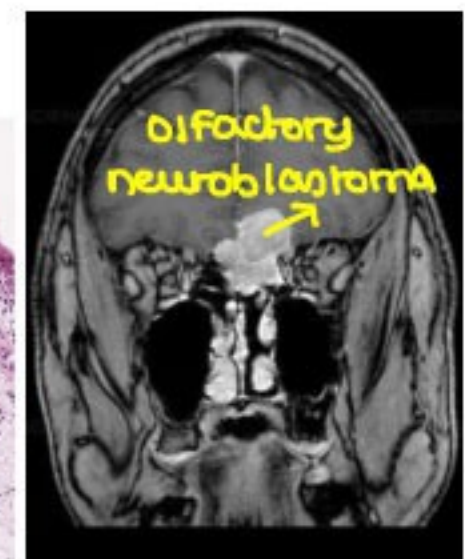
→ arises from olfactory neuroepithelium

→ mc site → Roof of Nasal cavity

→ Histology shows neurofibrillary stroma & neurosecretory granule

→ R<sub>y</sub> - Endoscopic Endonasal Excision

↓ Fib  
Radiotherapy



### MIDLINE LETHAL GRANULOMA / STEWART'S GRANULOMA

→ T cell / NK cell lymphoma

→ Rapidly spreading, destructive lymphoma

→ R<sub>y</sub> → Chemotherapy





## MISCELLANEOUS TOPICS

### NASAL MYIASIS

- caused by chrysomia fly larvae
- Rx → 10% chloroform

### FOREIGN BODY IN NOSE

- mc cause of ULL mucopurulent discharge or blood stained discharge in child
- Rhinolith → stone in nose [calcificat<sup>n</sup>]
- Rx → Removal w a probe





## FACIAL TRAUMA

- mc bone undergo # in facial trauma → Nasal
- cf → cosmetic deformity  
Nasal obstruct<sup>n</sup>
- Rx → Nasal bone # reduct<sup>n</sup>
  - Timing →  $\bar{c}$  in 24 hrs [before onset of edema]
  - after 5-7 days [after edema reduct<sup>n</sup>]
  - Not done b/w 2 wks → 3 months  
↓ [callus formed]



DO complete rhinoplasty after 3 months [complete bone formed]

## ZYGOMATIC # / TRIPOD #

- 2nd most fractured bone in facial trauma
- Now it is known as Quadripod #  
malar prominence is lost
- Rx → ORIF



## BLOW OUT #

- weakest wall of orbit → Floor
- Orbital contents hangs in max. antrum → TEAR DROP SIGN
- Rx → mesh applicat<sup>n</sup> & reduct<sup>n</sup> of contents

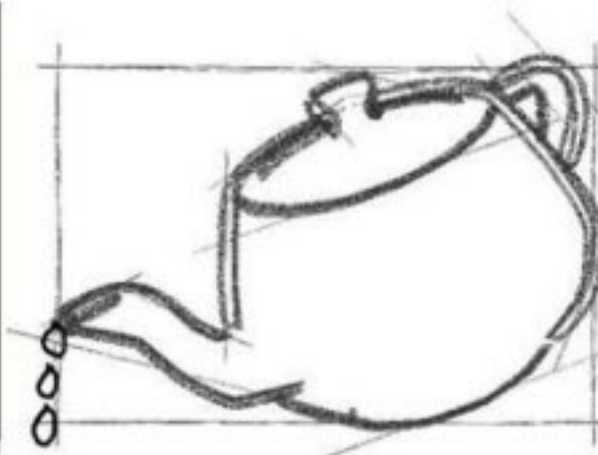


## MAXILLARY # / LEFORT #

- Lefort I # / Transverse #
  - # line parallel to hard palate
- Lefort II / pyramidal #
- Lefort III / Craniofacial Dysjunct<sup>n</sup>
  - most dangerous, max. morbidity
  - Lower part forms PIGSNOUT DEFORMITY

## CSF RHINORRHEA

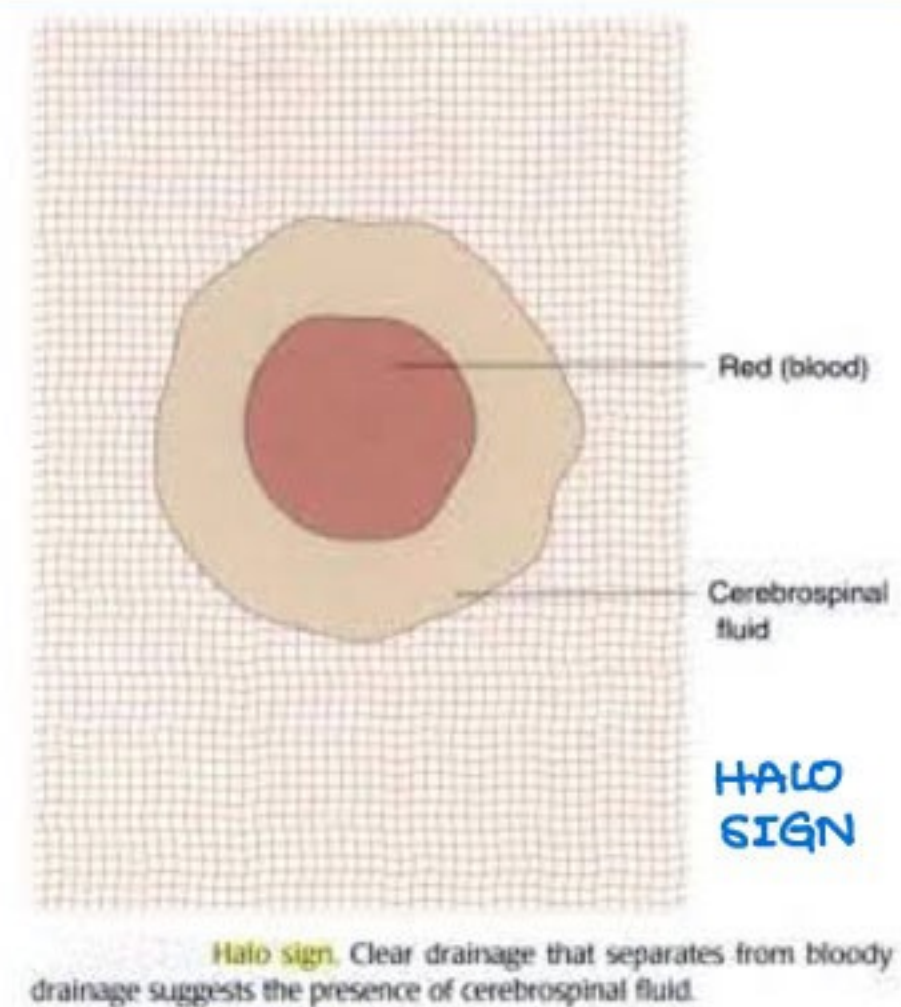
- mc → head injury
- mc SITE → # cribriform plate of ethmoid
- clear watery discharge
  - ↑ on coughing, straining, sneezing, bending forward → TEA POT SIGN
  - Reservoir Sign



TEA POT SIGN /  
RESERVOIR SIGN



- SNIFF TEST → can not sniff back
- Handkerchief Test → not stiffens
- GLUCOSE TEST → 2/3<sup>rd</sup> of (N) BLOOD Glucose level  
→ 40-60 mg/dl
- In case of blood mixed w CSF
  1. HALO SIGN / DOUBLE RING SIGN / TARGET SIGN
  2.  $\beta_2$  Transferrin Test
    - Gold std. for CSF
    - Only found in CSF



- Gold std. inv. in CSF Rhinorrhoea
  - a.  $\beta_2$  transferrin levels [Not done b'coz Dx already done]
  - b. HRCT of NOSE & PNS [to find site of leak] → 1<sup>st</sup> Inv / IOC
  - c. MRI - T<sub>2</sub> weighted images → can't see both # & the CSF at once [MR - cisternography]
  - d. CT cisternography → can see both # & the CSF

## → Management

### Traumatic

a 38 yrs old pt presented after RTA few hrs back w CSF Rhinorrhea. Next line of Mx

- a. Conservative Mx [NO active surgical Mx] → heal on itself
- b. BIL Ant. nasal packing to stop CSF leak → Nasal packing CT [relative]
- c. Immediate endoscopic repair of skull base
- d. Open neurosurgical Repair of skull base

### conservative Mx

- Prophylactic Antibiotics  
Acetazolamide & wait for 7 days
- Stool softeners, Anti tussives



→ No relief → Lumbar Drain for 2 wks [total 3 wks]

→ No relief → Endoscopic Repair

### Spontaneous CSF Rhinorrhea

- Do MRI, rule out any cause of ICT
- Repair

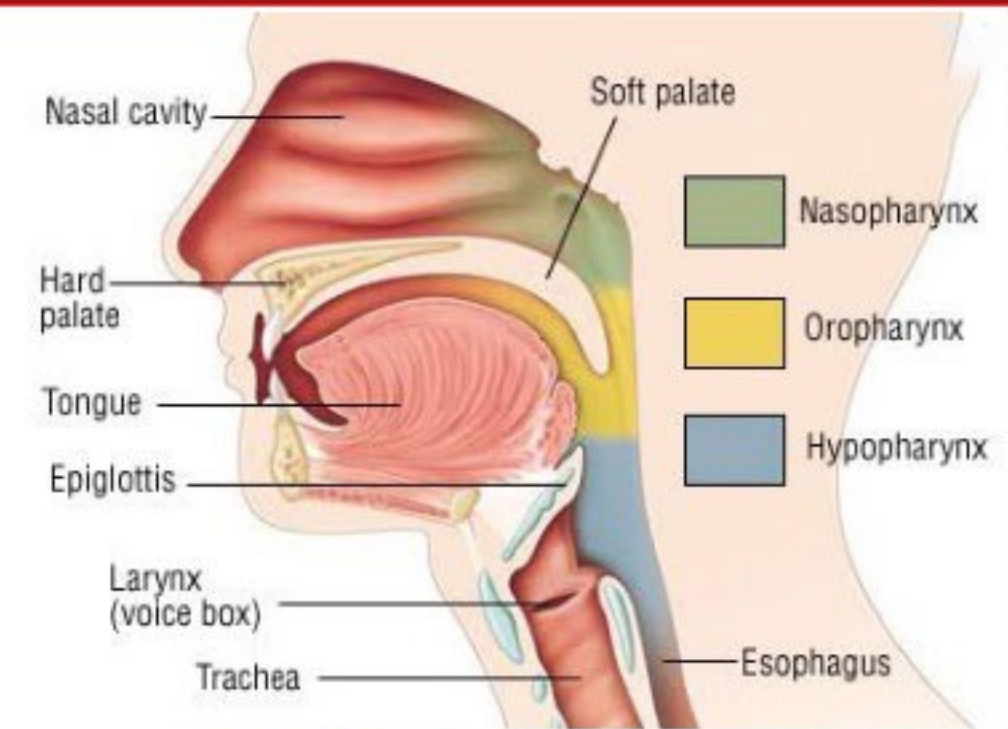
### Paradoxical CSF Rhinorrhea

- # in temporal bone ⊕ [petrous part]
- can cause CSF OTORRHEA also



## PHARYNX

- Nasopharynx → from skull base to hard palate
- Oropharynx → from hard palate to hyoid bone
- Hypopharynx → from hyoid bone to esophagus



## MUSCULAR LAYER

- all supplied by Superior laryngeal nerve of Vagus except cricopharyngeus [by Recurrent laryngeal nerve of Vagus]

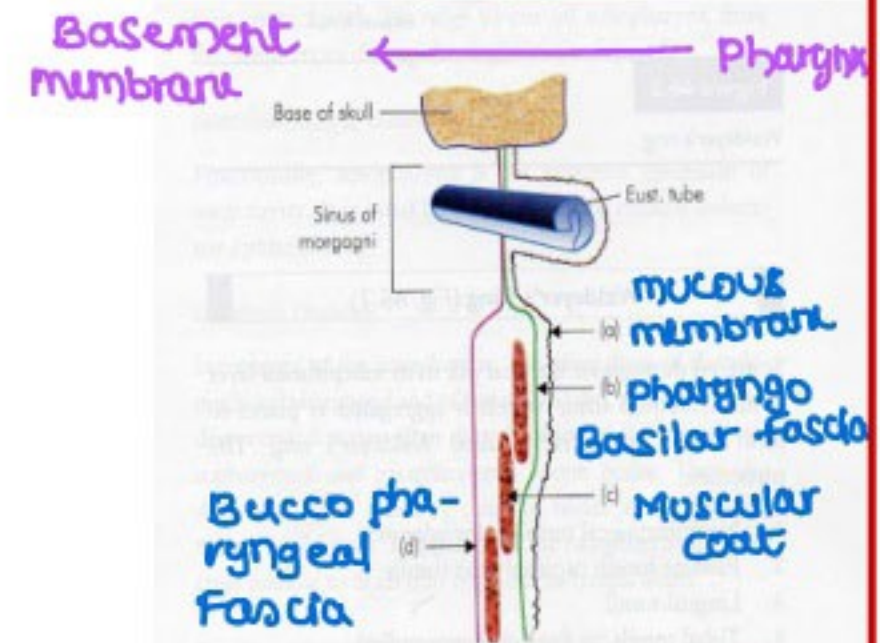
### → SINUS OF MORGAGNI

- Structures passing are

1. Eustachian tube
2. Levator velopalatini
3. Ascending palatine artery

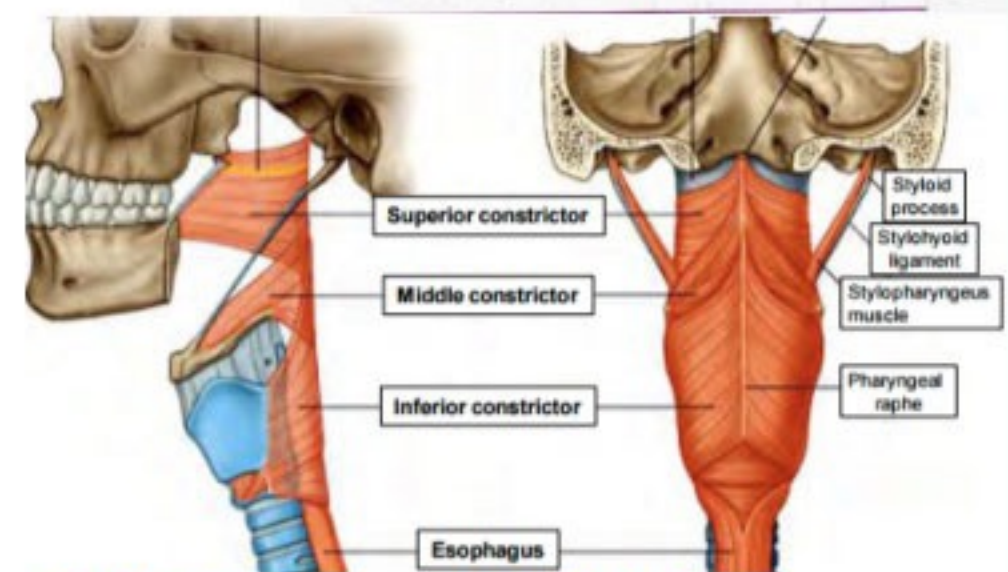
PA L AT E

- Stylopharyngeus muscle is glossopharyngeal N [IX] pass b/w Superior & middle constrictor.

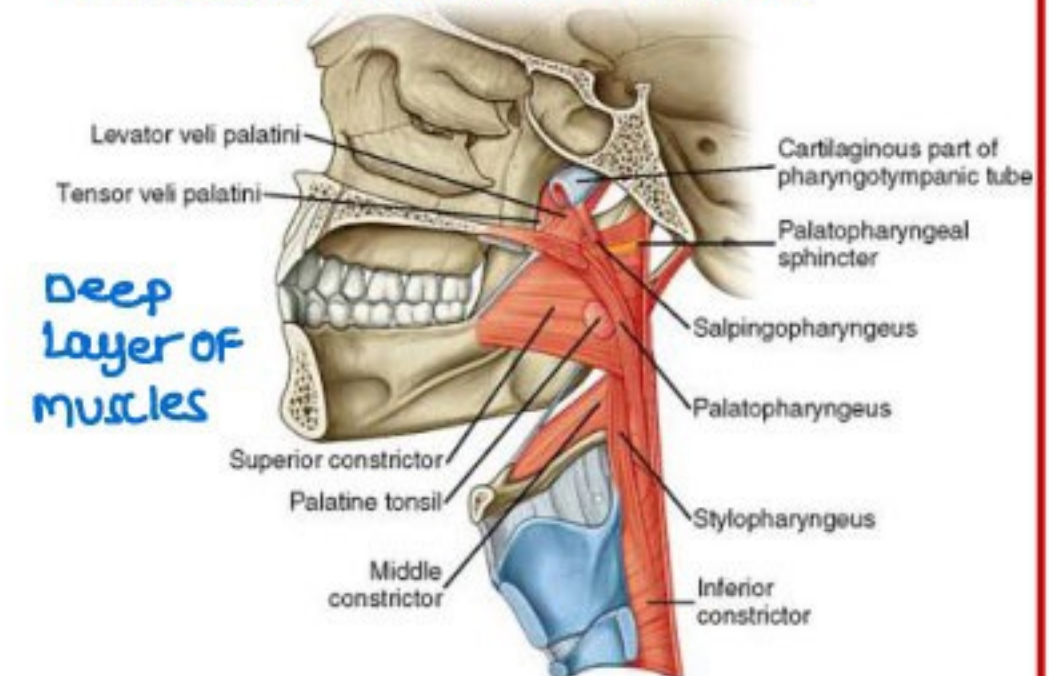


## DEEP LAYER OF MUSCLES

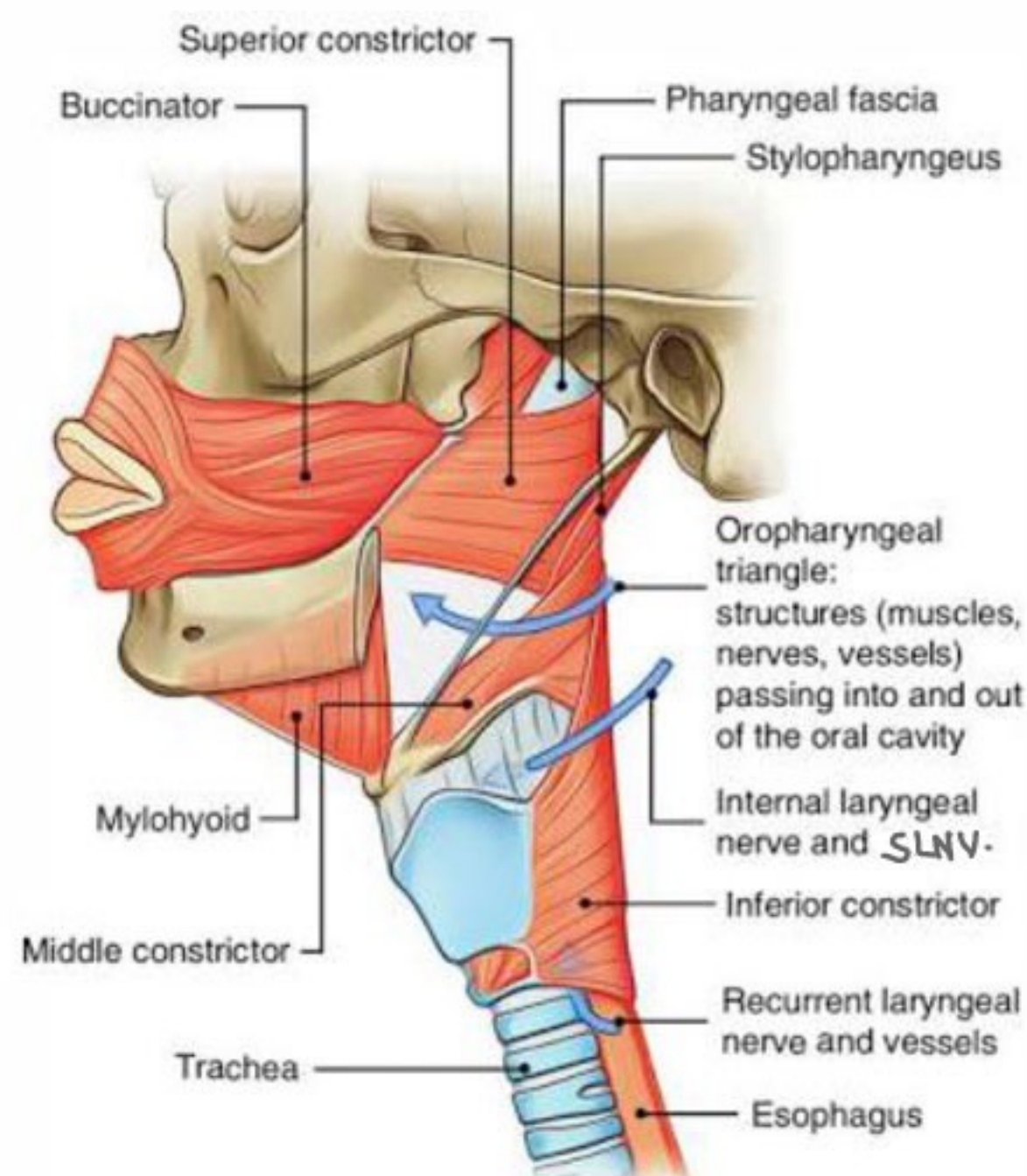
- Salpingopharyngeus
- Palatopharyngeus
  - forms a ridge - PASSAVANT'S RIDGE prevents regurgitation
- Stylopharyngeus
- Superior constrictor forms bed of palatine tonsils



### SUPERIOR LAYER OF MUSCLES



## STRUCTURES THAT PASS



### a. Through sinus of morgagni

- PA** → Ascending **P**alatine **A**rtery
- L** → **L**evator velopalatini
- AT e** → Eustachian tube [**A**uditory **T**ube]

### b. b/w Superior & inferior constrictor

- Internal laryngeal nerve
- Superior laryngeal vessels

### c. below the inferior constrictor

- Recurrent laryngeal nerve
- Inf laryngeal vessels



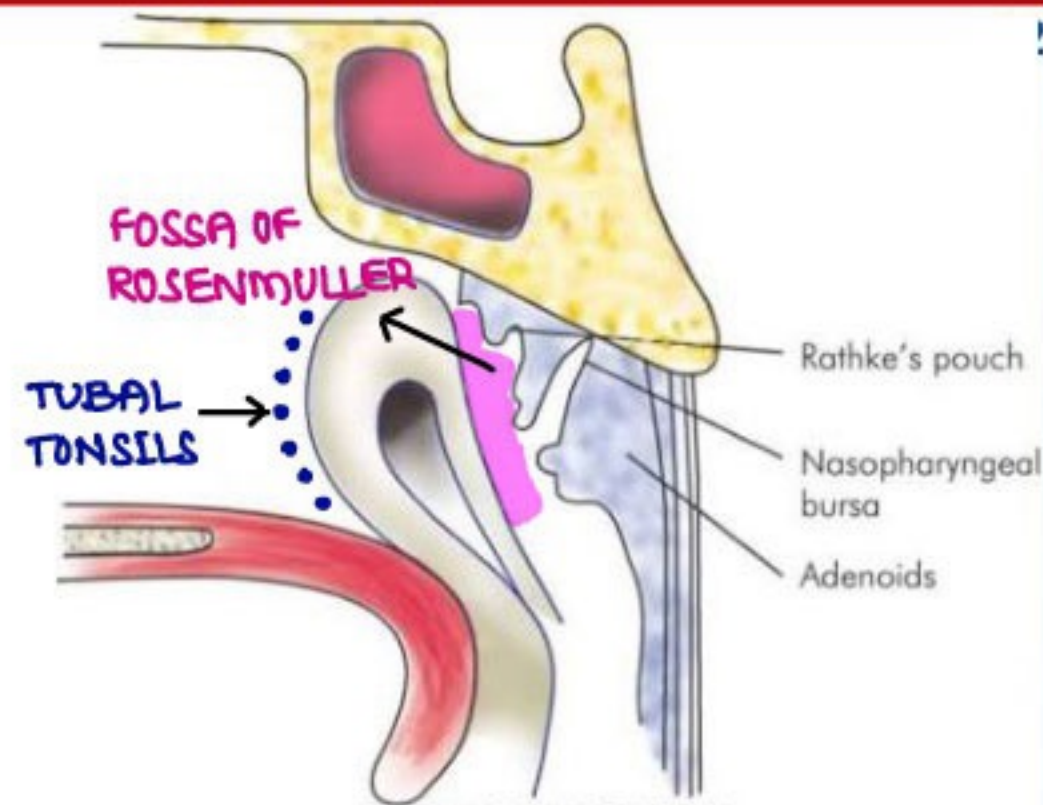
## NASOPHARYNX / EPIPHARYNX

### Eustachian Tube

- opens on lateral wall
- TORUS TUBARIUS - cartilaginous protrusion

### Adenoids

- lymphoid tissue on posterolateral wall
- Nasopharyngeal bursa → midline recess represents the attachment of notocord in embryonic life  
Pharyngeal chordoma arises from here



### Rathke's Pouch

- place from where pharyngeal mucosa invaginates to form pituitary gland
- craniopharyngioma arises from here

### FOSSA OF ROSENMULLER

- Blind recess in posterior superior to eustachian tube opening
- mc site for origin of nasopharyngeal carcinoma

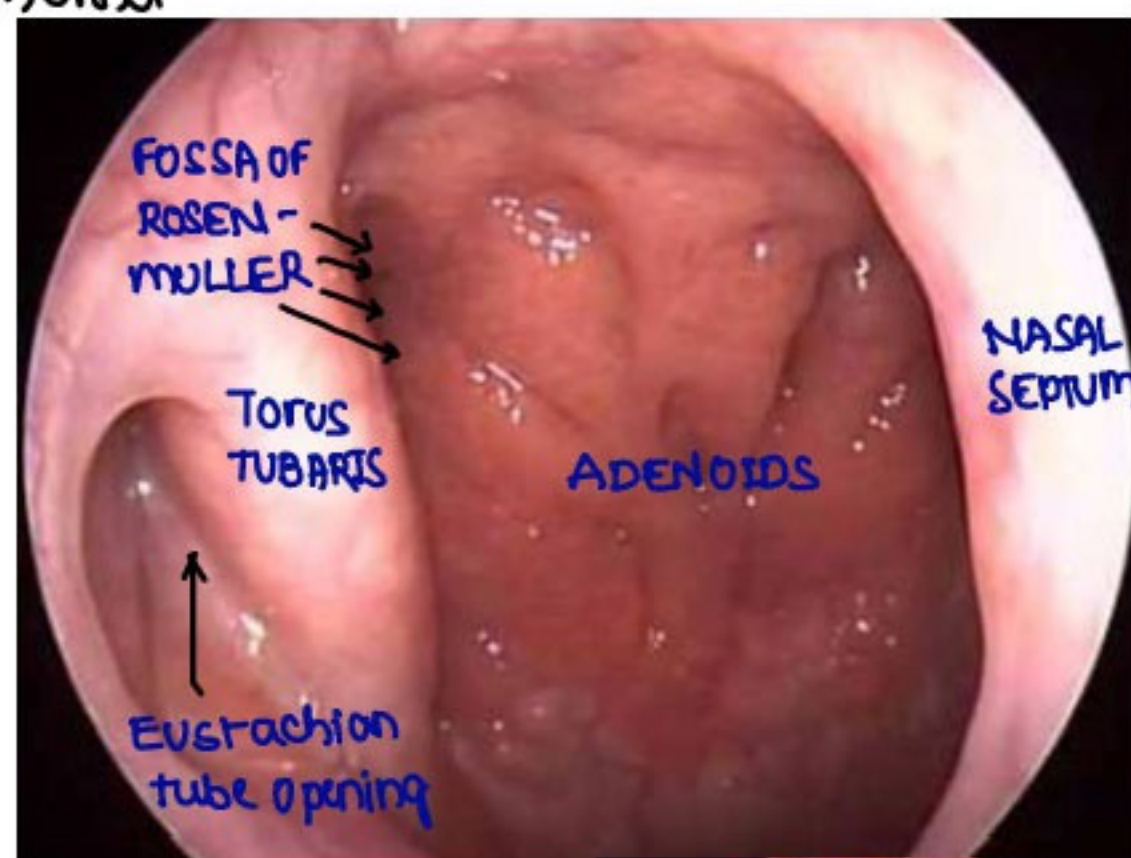
### TUBAL TONSILS

- Lymphoid nodules around ET

## DISEASES OF NASOPHARYNX

### THORNWALDT'S DISEASE

- collect<sup>n</sup> in nasopharyngeal bursa d/t blockage
- can be a cyst/abscess
- BIL nasal obstruct<sup>n</sup> ⊕
- Rx → Incision & Drainage  
- I cruciate incision + [healing will be delayed]



### ADENOIDS - CHRONIC ADENOIDITIS / CHRONIC ADENOID HYPERTROPHY

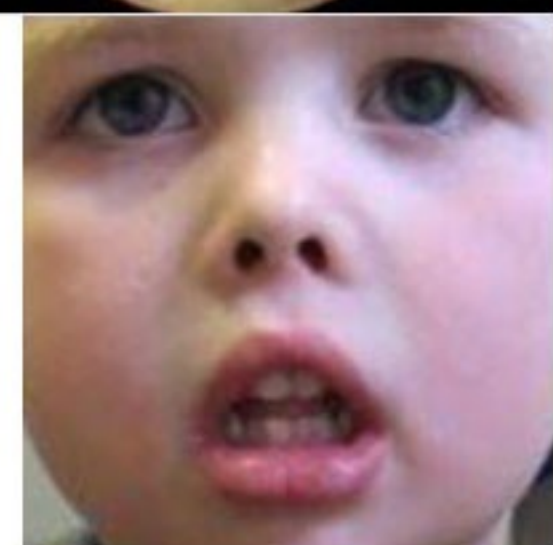
- 3-5 yrs → growth starts } Normal growth pattern of adenoids
- 5-7 yrs → max. growth }
- 7-14 yrs → growth ↓ }

- BIL Nasal obstruct<sup>n</sup> → Mouth breath  
↓  
High arched palate



- Elongated face  
Pinched nose  
Overcrowding of anterior teeth } ADENOID FACIES

- BIL Serous otitis media → BIL conducting hearing loss
- Recurrent attacks of acute otitis media



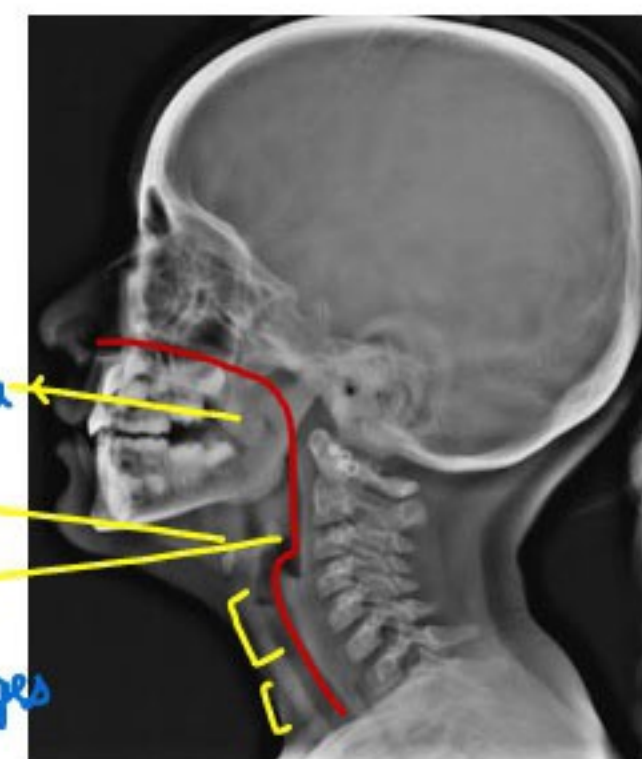


→ Obstructive Sleep apnea

↓  
Pulmonary HTN  
Rt ventricular hypertrophy  
Cor pulmonale

→ Indicat<sup>n</sup> of Adenoidectomy → all above

Soft palate & uvula  
Hyoid Bone  
Epiglottis  
Laryngeal cartilages  
Trachea

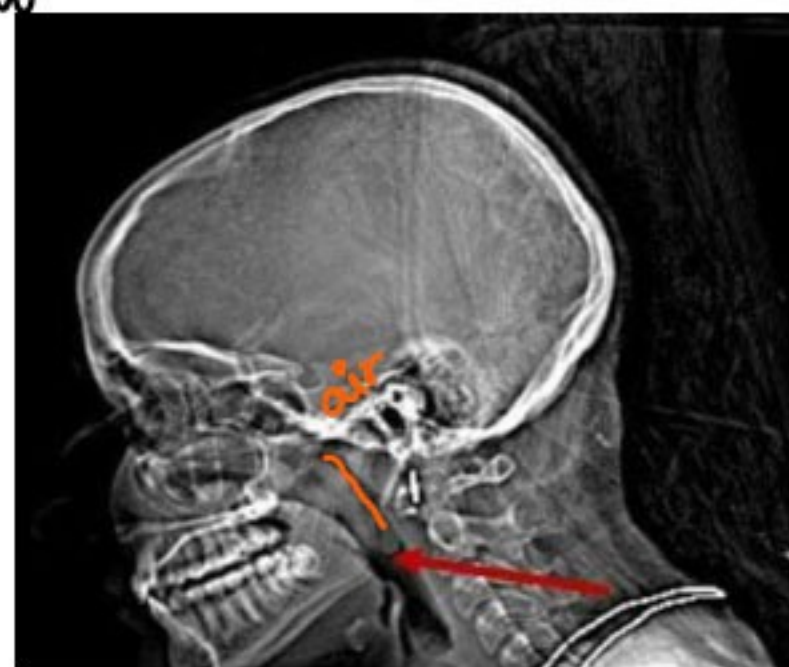


XRAY STM Lateral view

XRAY STM [SOFT TISSUES OF NECK] lateral view

ADENOID HYPERTROPHY

Crescent sign / Dodd's sign → air in postero superior to mass - seen in AC polyp.

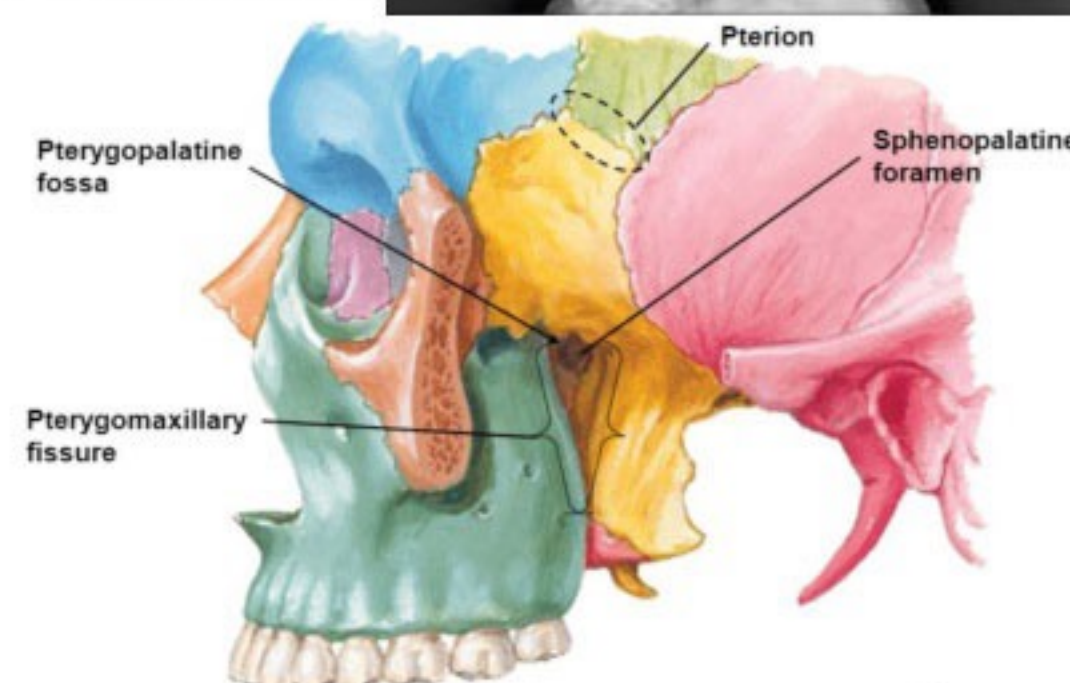


### JUVENILE NASOPHARYNGEAL ADENOFIBROMA / JNA

→ mc benign tumor of nasopharynx

→ Site of origin →

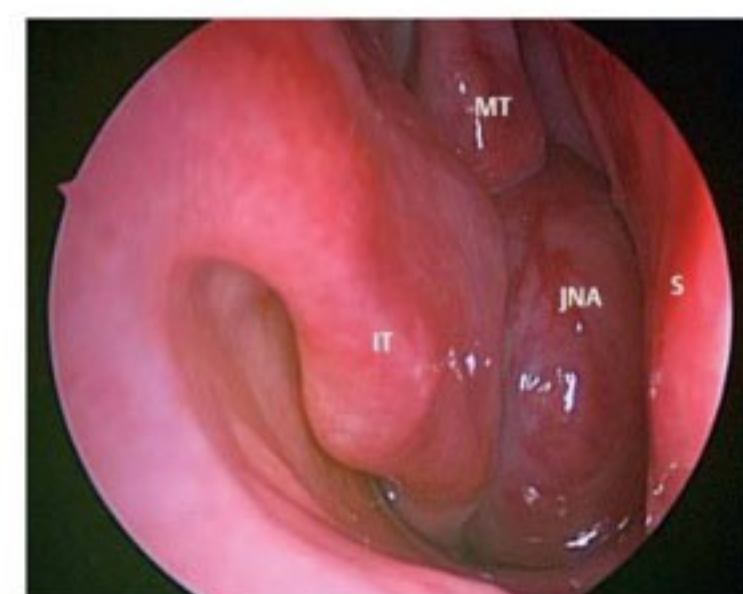
1. Sphenopalatine foramen
2. vidian canal
3. Basal sphenoid



→ Sphenopalatine foramen connects the nasal cavity & pterygopalatine fossa

→ Inside pterygopalatine fossa / sphenopalatine fossa, Pterygopalatine ganglion [largest peripheral parasympathetic ganglion]

→ PTERYGOMAXILLARY TUNNEL



→ vascular Tumor

mc blood supply of JAF → Sphenopalatine Artery [br. of internal max. A]

→ exclusively seen in adolescent males [Androgen dependent tumor] → 8-22 yrs

→ No tunica media → profuse recurrent epistaxis → anemia  
Nasal obstruct<sup>n</sup> ⊕  
Swelling in cheek ⊕



O/E

- Reddish polypoid mass
- Proptosis
- Telecanthus [intercanthus length ↑, eye ball pushed laterally]

FROG FACE  
DEFORMITY

Dx

- CECT
  - anterior bowing of posterior maxillary wall → ANTRAL / HOLMANN MILLER SIGN
  - hyperdense, spindle shaped tumor - DUMBELL SHAPED TUMOR
  - widening of pterygopalatine tunnel - HONDUSA SIGN



Rx

- RPOC - Endoscopic excision
  - Surgical techniques
    - Lateral Rhinotomy approach
- ↓
- Medial maxillectomy



- wide exposure present but Scar present

- Transpalatine Approach
  - exposure limited [limited by teeth]
- SARDANA'S Approach → Transpalatine + Sublabial Approach
- Midfacial Degloving Approach
- Endoscopic Excision [Preferred method (RPOC) now] - blood loss is minimum

## NASOPHARYNGEAL CARCINOMA [NPC]

→ ♂, 8-10 yrs & 60-70 yrs

→ Common in Chinese

- dry salt fish consumpt<sup>n</sup>
- EBV associat<sup>n</sup>

1. Hodgkin's
2. Burkitt's
3. Gastric adenocarcinoma
4. NPC

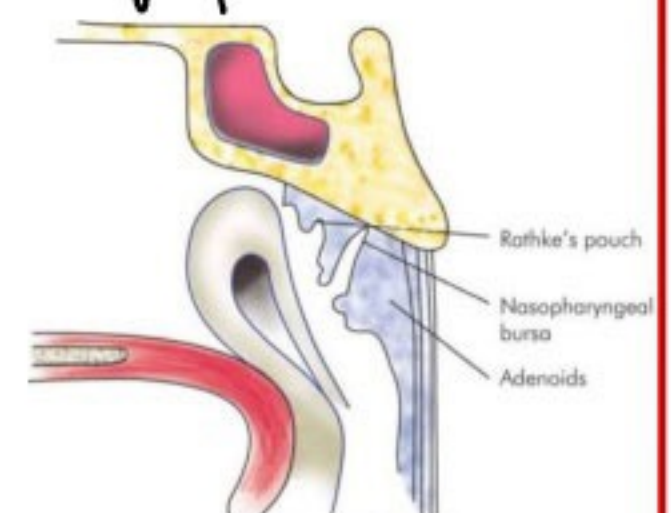
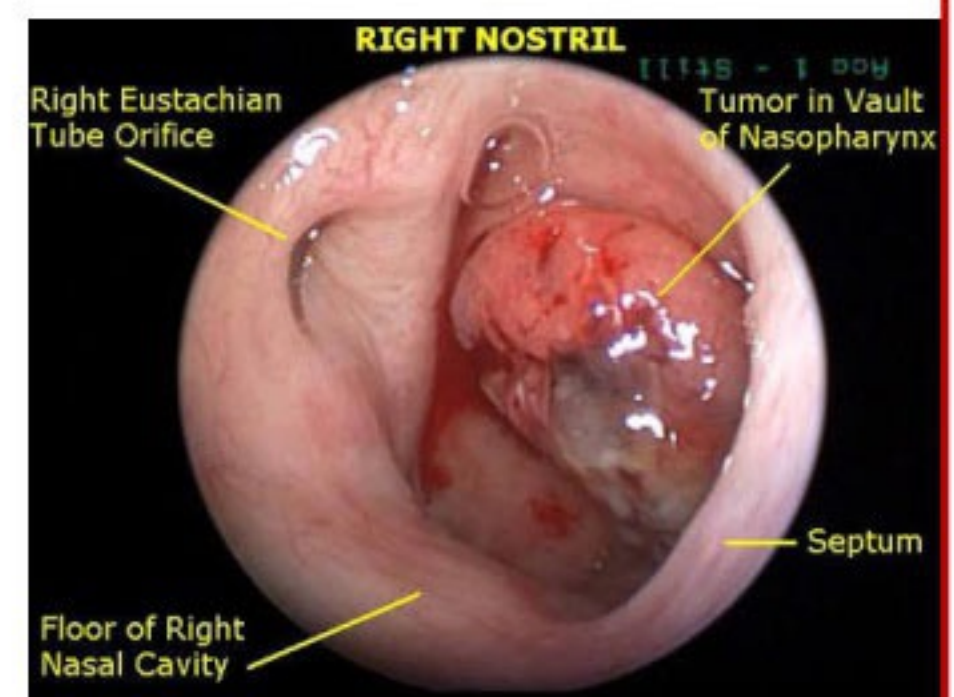
5. Immune deficiency associated non-Hodgkin's lymphoma

→ mc site → fossa of Rosenmuller

→ mc type → Sq. cell CA [ >85% ]

→ Presentat<sup>n</sup>

- mc → Neck Mass [cervical lymphnode Metastasis] [75%]





→ 2 malignancies where LN metastasis is early but prognosis is good are

- NPC
- Thyroid CA

→ U/L Serous otitis media ⊕ → U/L conductive hearing loss

→ multiple cranial nerve palsies [earliest - 6th nerve] [Olfactory N. spared]

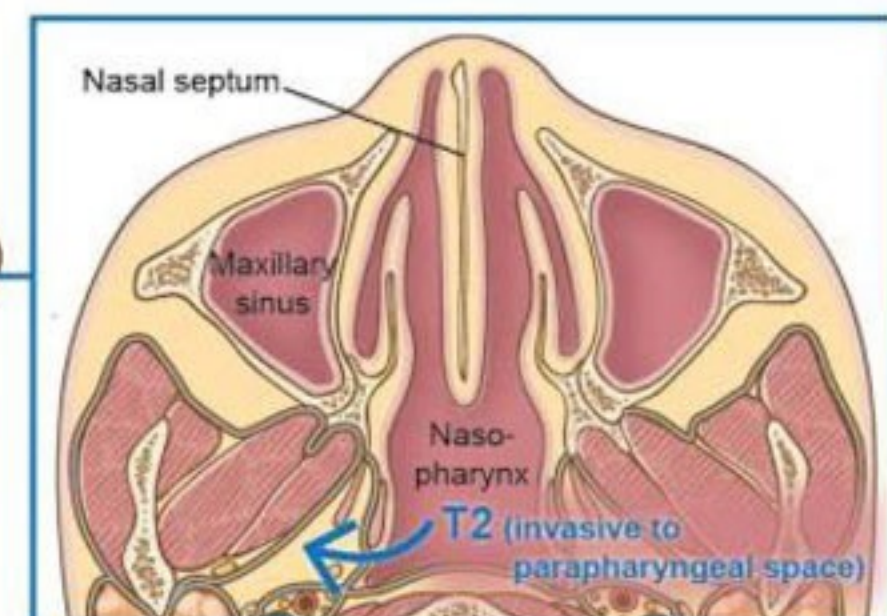
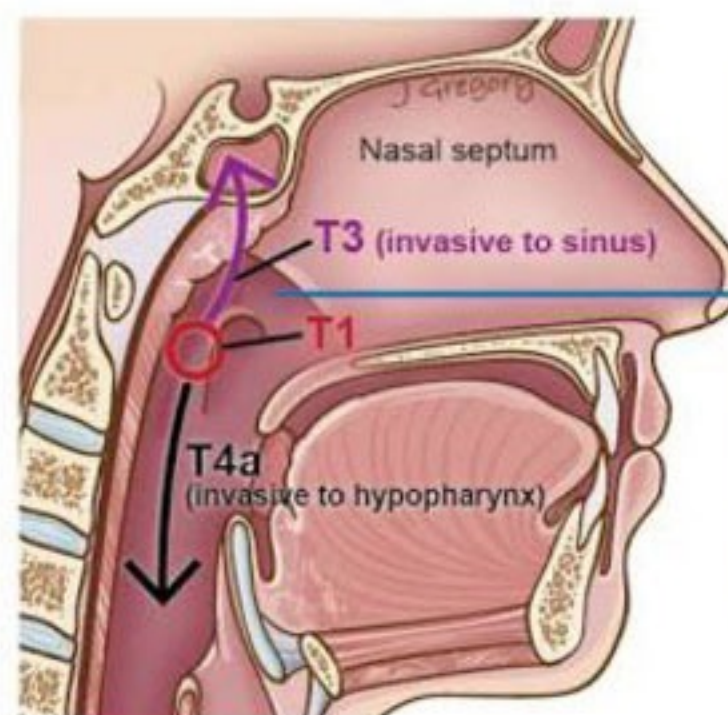
- 5th CN involvement → ipsilateral Trigeminal neuralgia
- 10th CN involvement → ipsilateral palatal palsy

TROTTER'S TRIAD  
or  
SIGN OF MORGAGNI Syndrome

## TNM STAGING

(T)

- T<sub>1</sub> → limited to soft tissues of NP
- T<sub>2</sub> → to nasal cavity or oropharynx
- T<sub>3</sub> → to bone / PNS
- T<sub>4</sub> → to cranial cavity or hypopharynx or cranial nerves



(M)

M<sub>0</sub> → No Distant metastasis

M<sub>1</sub> → Distant metastasis

(N) for all Head & Neck malignancies except CA NASOPHARYNX

N<sub>1</sub> → <3 cm ipsilateral, single

N<sub>2</sub> → 3-6 cm

N<sub>2a</sub> → ipsilateral / single

N<sub>2b</sub> → ipsilateral / multiple

N<sub>2c</sub> → B/L or contra lateral

N<sub>3</sub> → ≥ 6 cm

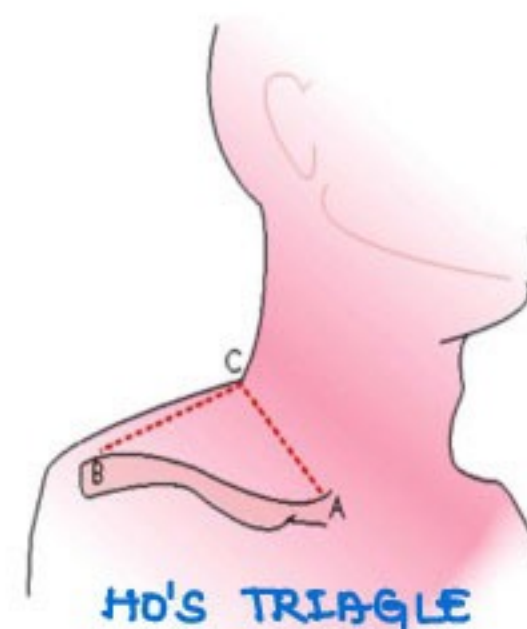
N

N<sub>1</sub> → <6 cm, Any one side

N<sub>2</sub> → <6 cm, B/L

N<sub>3</sub> → N<sub>3a</sub> → > 6 cm

N<sub>3b</sub> → Ho's triangle or Supraclavicular fossa



HO'S TRIANGLE

## SPREAD OF CA NASOPHARYNX

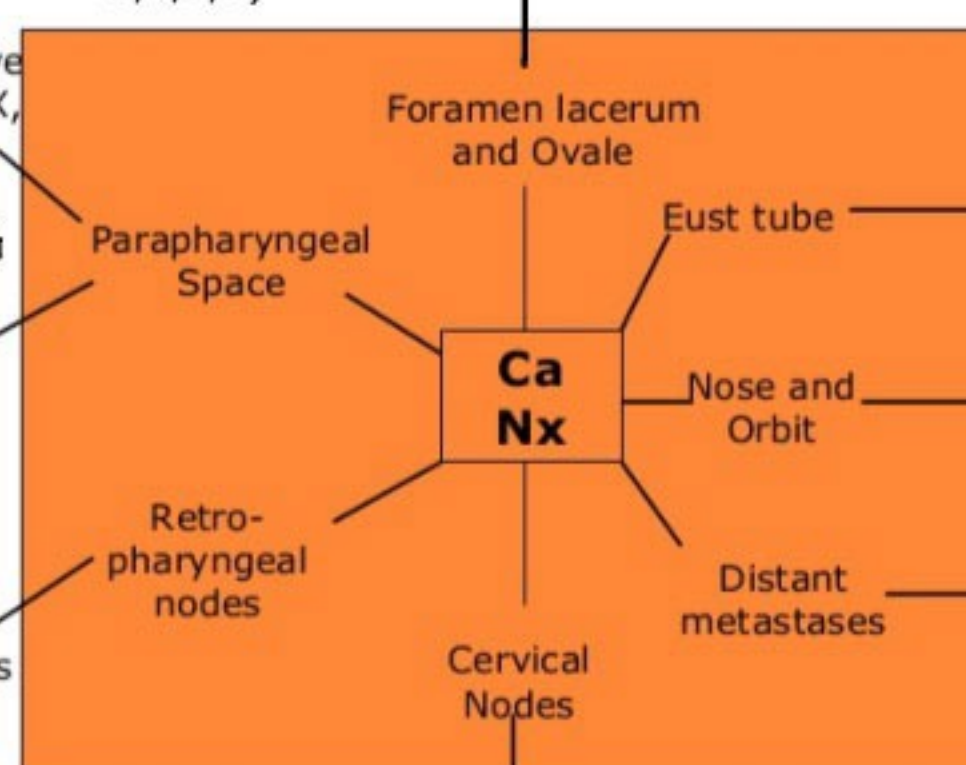
Jugular foramen syndrome / Vernet's syndrome

Cranial nerve palsies IX, X, XI, XII, Horner's syndrome &

Pterygoid muscles Trismus

Neck pain and stiffness

Ophthalmic symptoms & facial pain (CN 3,4,5,6)



Spared CN I



## Management

→ SOC → Endoscopic biopsy

## R<sub>y</sub>

→ R<sub>y</sub>OC → Radiotherapy

→ ⊕ chemotherapy in advanced cases

## Prognostic markers

→ EBV

- Viral capsid Antigen [VCA]
- Early Antigen [EA]

→ IgA

- IgA to VCA - 97% specific, 95% sensitive [Screening Test]
- IgA to EA - 99% specific, 90% sensitive



## OROPHARYNX

### WALDEYER'S RING

→ first line of defense

### TONSILS

→ B/L

→ covered by fibrous capsule & forms crypts

→ Tonsillar bed formed by superior constrictor muscle

→ PERITONSILLAR SPACE → b/w fibrous capsule & Sup. constrictor muscle

- infection → peritonsillar abscess / QUINSY

- presents with

pain in throat

fever

Dysphagia, odynophagia

Red enlarged congested tonsil pushing soft palate

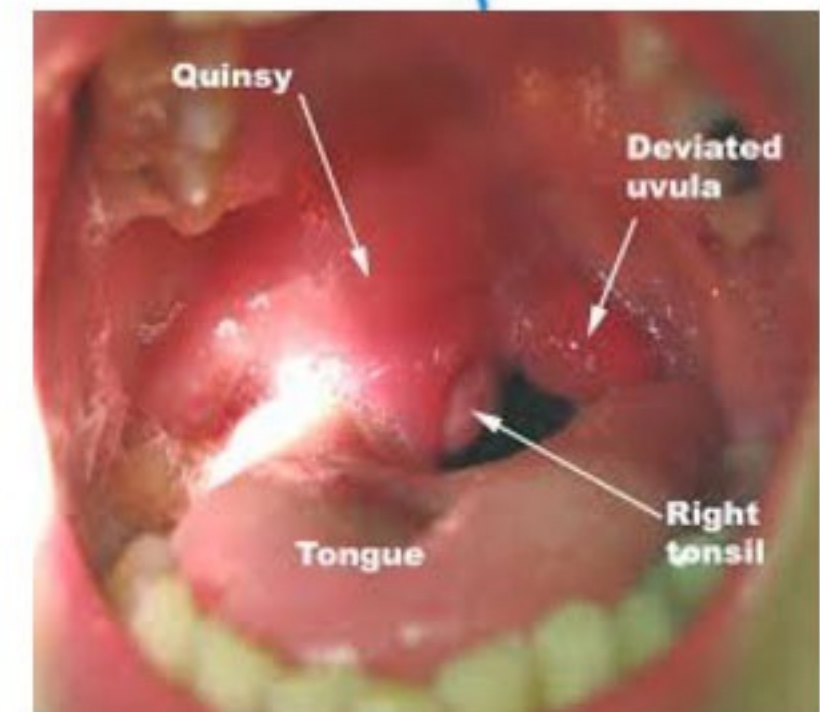
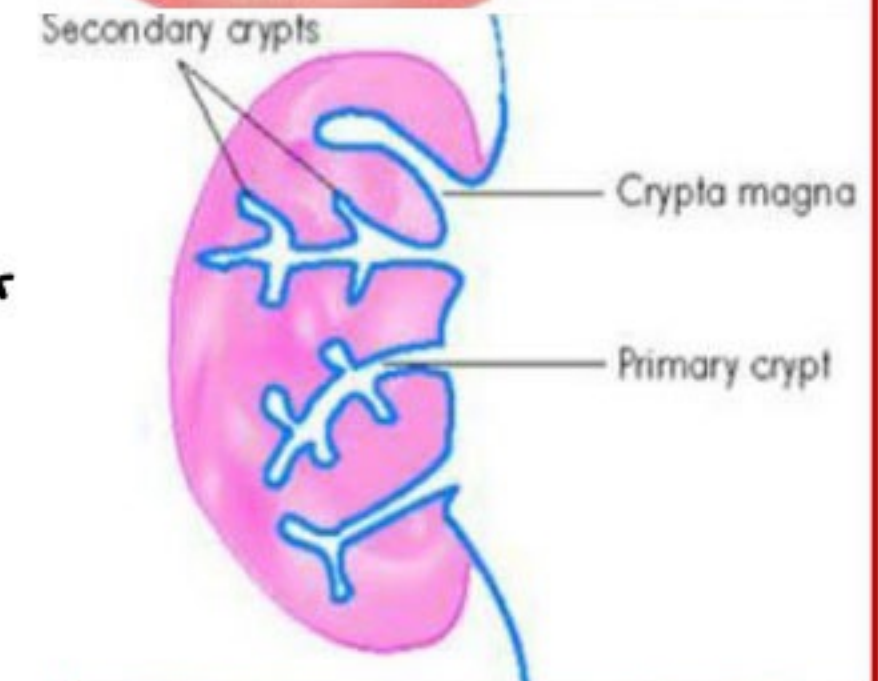
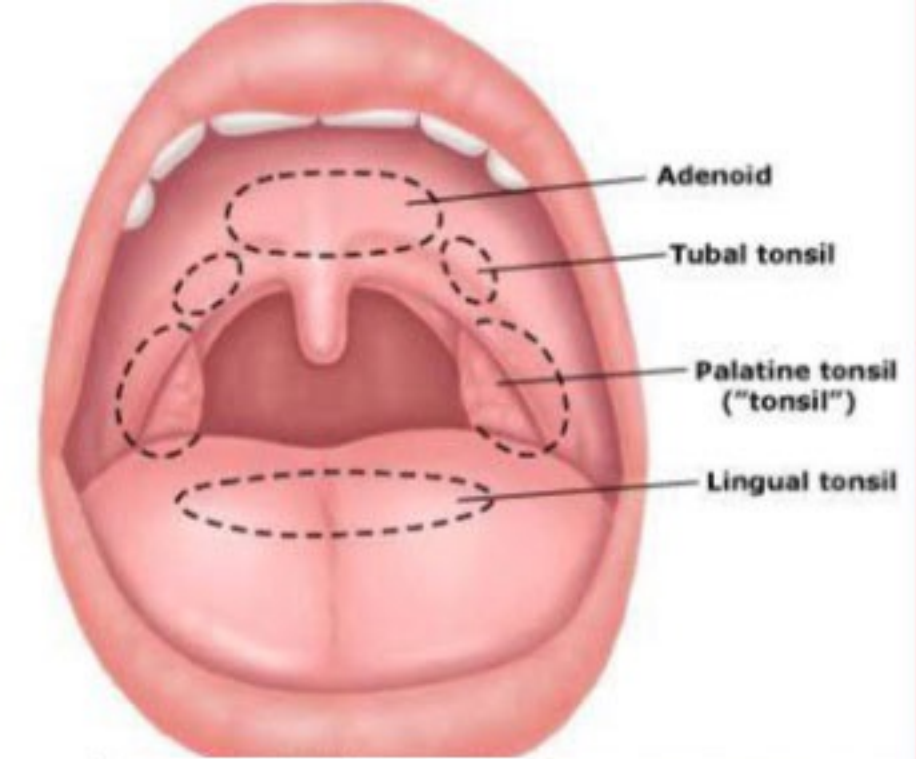
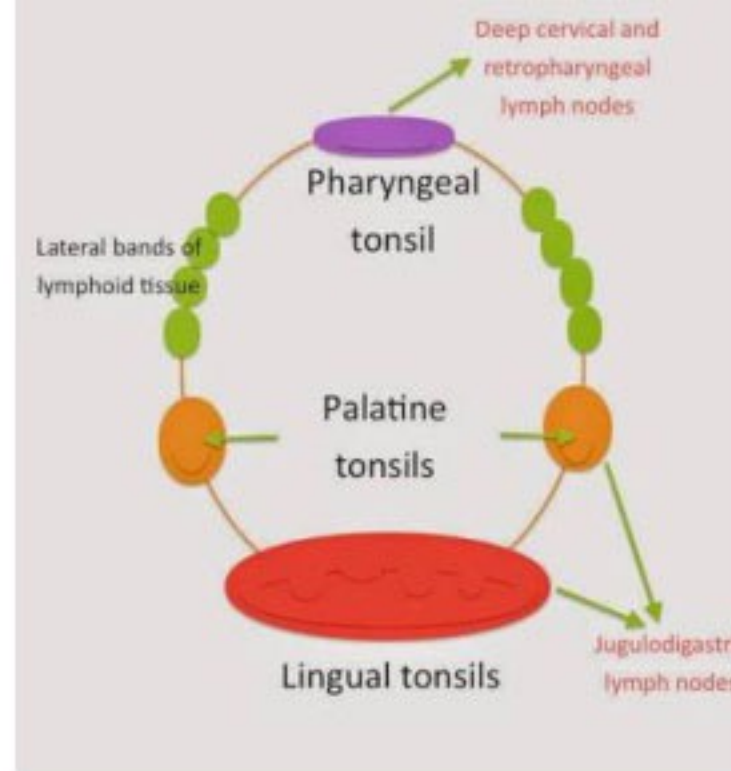
Hot potato voice

- Rx

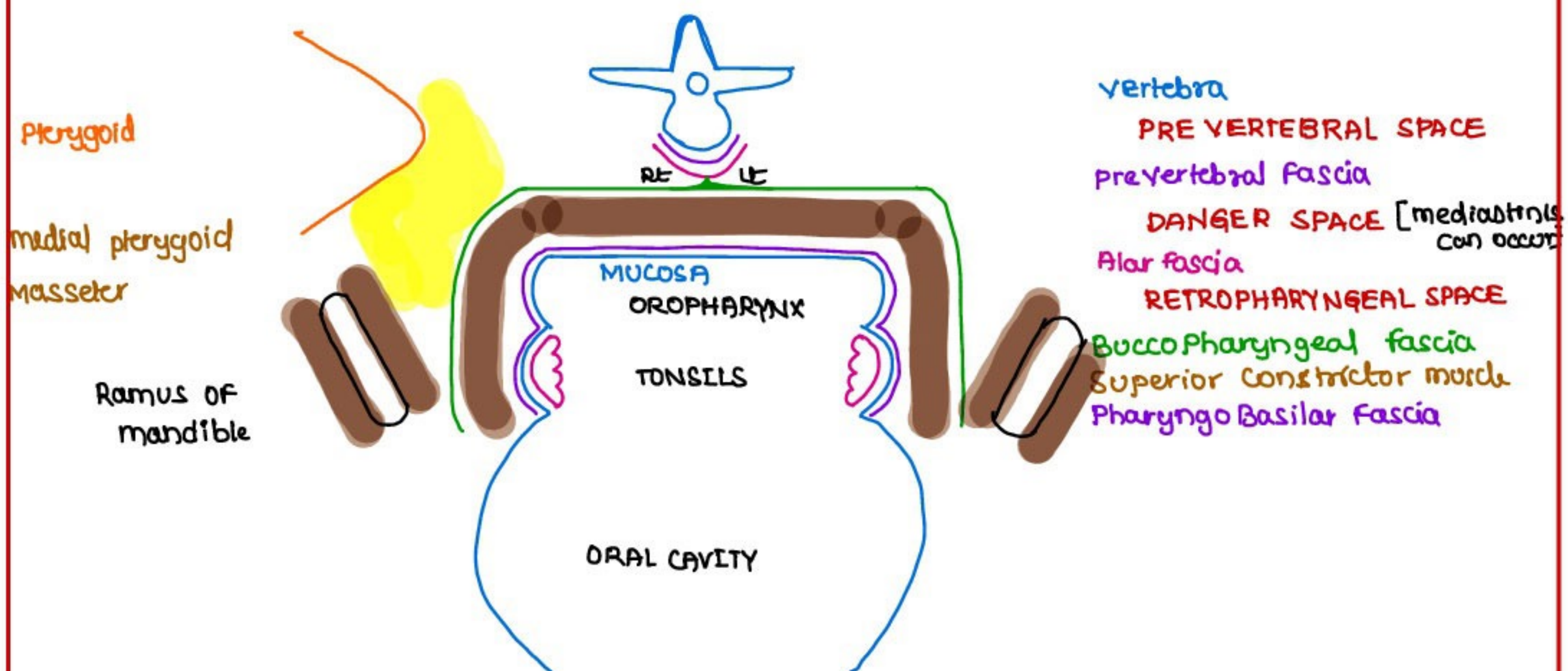
1. Incision & Drainage

2. Antibiotics iv

3. Interval tonsillectomy done 6 wks after quinsy





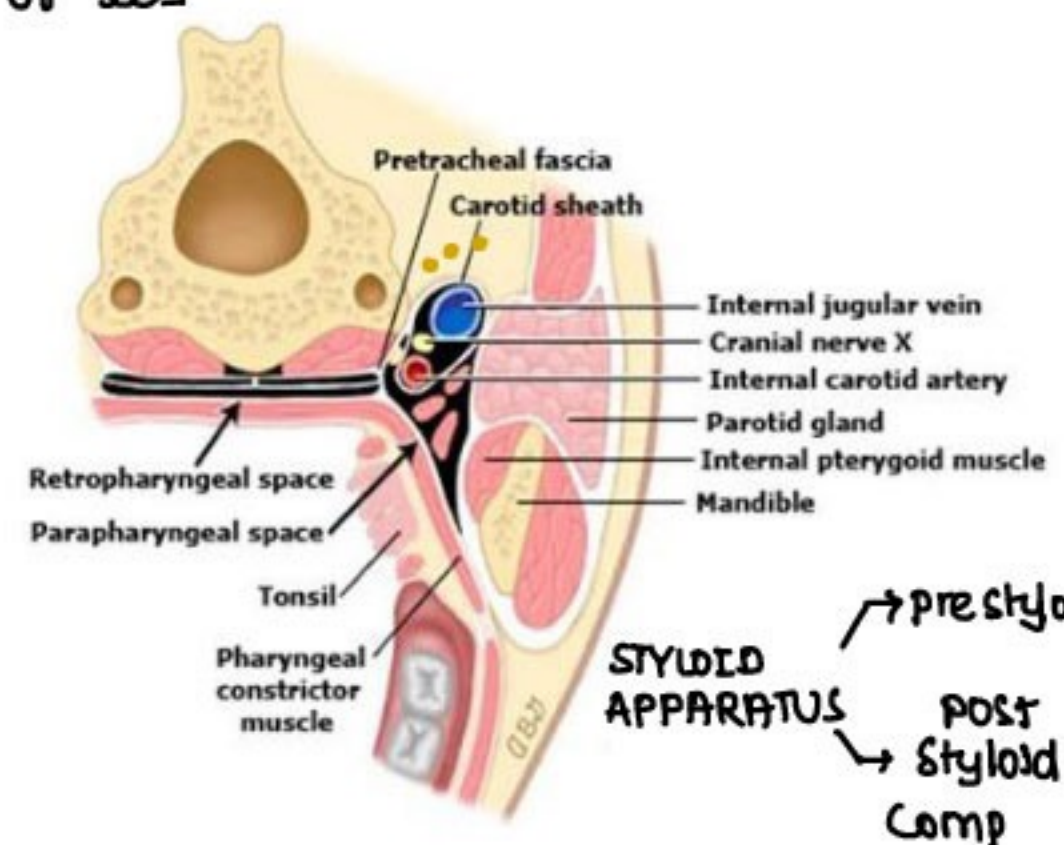


→ Retropharyngeal abscess will be on one side [Rt or Lt]  
Prevertebral abscess will be in midline

→ Parapharyngeal / Lateral pharyngeal Space

- Boundaries

- |              |  |
|--------------|--|
| - Superiorly | - Skull base   |
| - lateral    | - Parotid gland<br>ramus of mandible<br>median pterygoid muscle  |
| - medial     | - Oropharynx &<br>superior constrictor muscle<br>palatine tonsil |
| - inferior   | - Hyoid bone   |



- contents

- styloid process along & muscles → STYLOID APPARATUS
  - styloid apparatus divides PPS into
    - Pre styloid compartment [consists of fat] → ☹ → TRISMUS
    - Post styloid compartment consists
      - ICA [Internal carotid artery]
      - Int. Jugular vein
      - CN X
      - CN IX, X, XI
- } present in  
CAROTID SPACE / LINCOLN'S HIGHWAY  
surrounded by CAROTID SHEATH

⑨ 7yr old child & Quinsy & Severe trismus. next line of Mx / R/Oc ?

a. intra oral drainage

c. IV Antibiotics for 48 hrs

b. Ext. Drainage

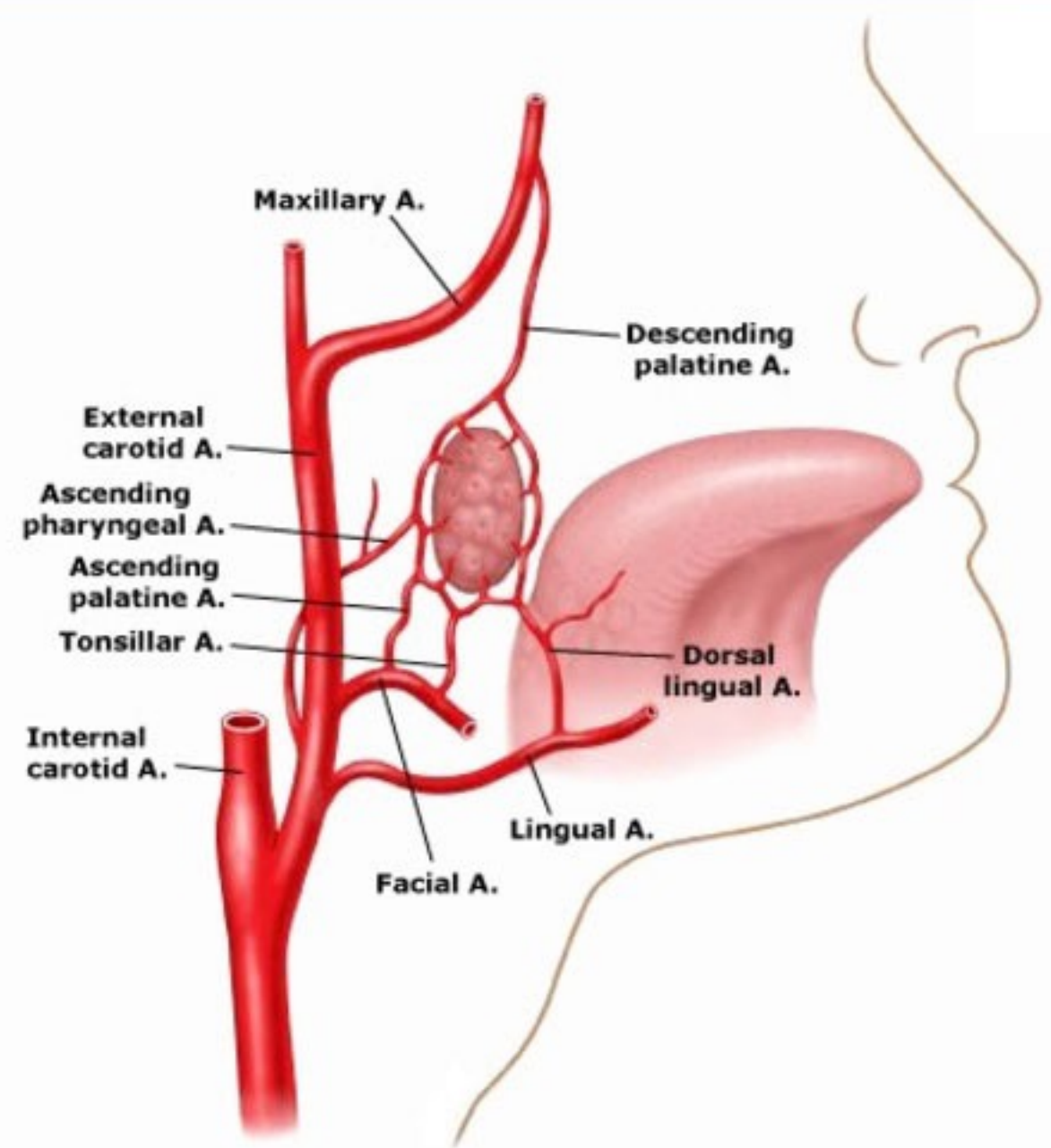
d. Tracheostomy



## BLOOD SUPPLY OF TONSILS

→ by 5 Arteries

1. Tonsillar artery
  - Br. of facial Artery
  - main blood supply
2. Ascending palatine Artery
3. Descending palatine
4. Ascending pharyngeal
5. Dorsal lingual Artery



→ Venous drainage by PARA TONSILLAR VEIN

## ACUTE TONSILLITIS

1. Acute catarrhal tonsillitis
  - red, congested, seen in viral infect<sup>n</sup>
2. Acute follicular tonsillitis
3. Acute Parenchymal tonsillitis
4. Acute Membranous tonsillitis

→ mc organism → Streptococcus

→ Rx → Penicillin → Doc



## CHRONIC TONSILLITIS

- Bacteria grow & resides in crypts
- Recurrent sore throat
- IRWIN MOORE SIGN → pus comes out on pressing the ant. pillars
- Rx → Tonsillectomy

Indicat<sup>n</sup>

1. Recurrent sore throat - PARADISE CRITERIA OF SORE THROAT [detailed one]
  - ≥ 4 episodes in one yr or
  - ≥ 5 episodes /yr/for last 2yrs or
  - ≥ 3 episodes /yr / for last 3 consecutive yrs or
  - If a child misses school for ≥ 14 days in 1 yr b'coz of sore throat

2. Quinsy

1 episode in a child } Absolute  
2 episode in an adult } indicat<sup>n</sup>

3. Obstruct<sup>n</sup>

4. Malignancy

5. febrile seizures

6. Rheumatic Tonsillitis [GABHS - Gr. A β haemolytic streptococcus] infect<sup>n</sup>



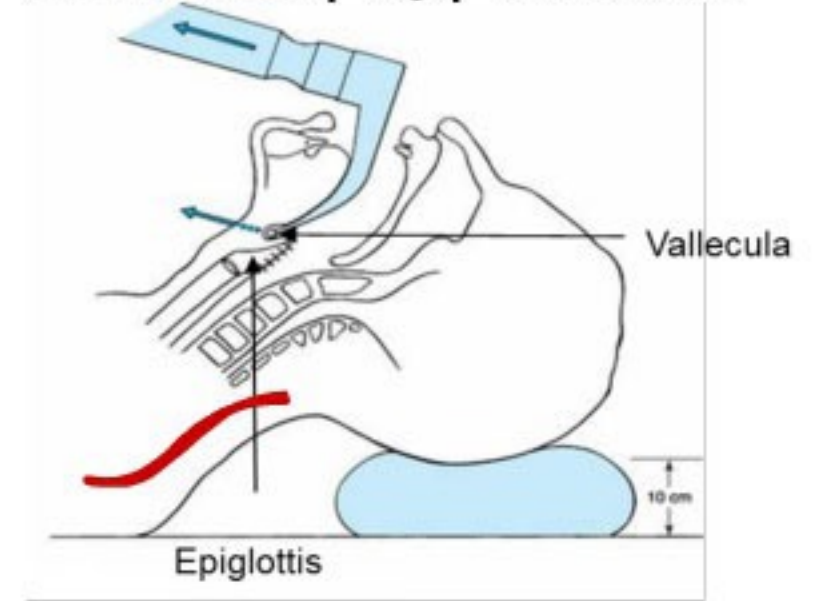
Posit<sup>n</sup> → ROSE'S POSITION [for adenoidectomy too]

- Joints extended are Thoraco Cervical Joints
- Advantage - prevents the entry of blood in airway



→ BOYCE POSITION / MORNING SNIFF POSIT<sup>n</sup> / BARKING DOG POSITION

- cervical joints - extended
- thoracic joints - flexed
- used for laryngoscopy
- esophagoscopy
- Bronchoscopy



## COMPLICATIONS

- Haemorrhage [mc]

### primary

- intra operative
- venous bleeding
- mc source → Para - tonsillar vein
- R<sub>1</sub> → ligat<sup>n</sup>

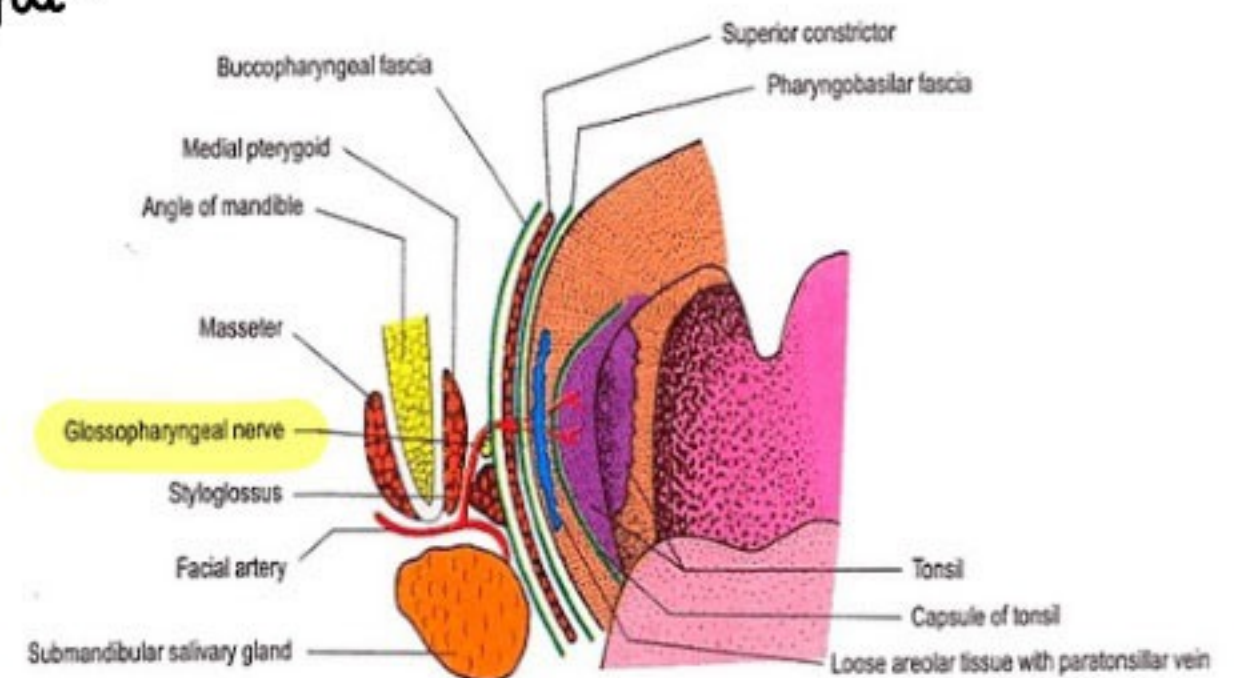
### Reactionary

- in 24hrs
- Slippage of ligature
- most dangerous
- R<sub>1</sub> → Religat<sup>n</sup>

### Secondary

- 5-7 days
- dlt Secondary infect<sup>n</sup>
- Warning bleeding ⊕

- referred pain to ear [dlt glossopharyngeal N. inj]



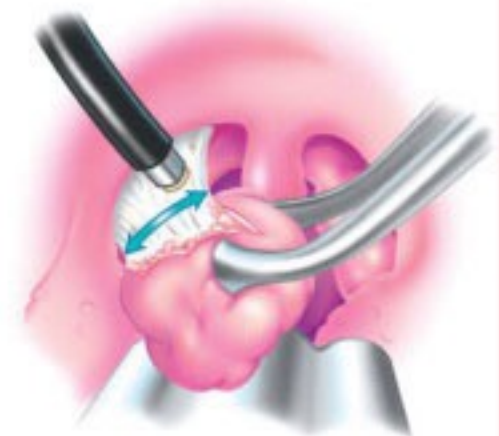
## CLASSICAL METHOD - DISSECTION & SNARE METHOD/COLD STEEL INSTRUMENTS

- crushed & cut E EVE's Tonsillar snare
- pain minimal [no heat used]
- Bleeding is maximum



## ELECTRO CAUTERY

- No bleeding
- post op pain is maximum



## COBLATION

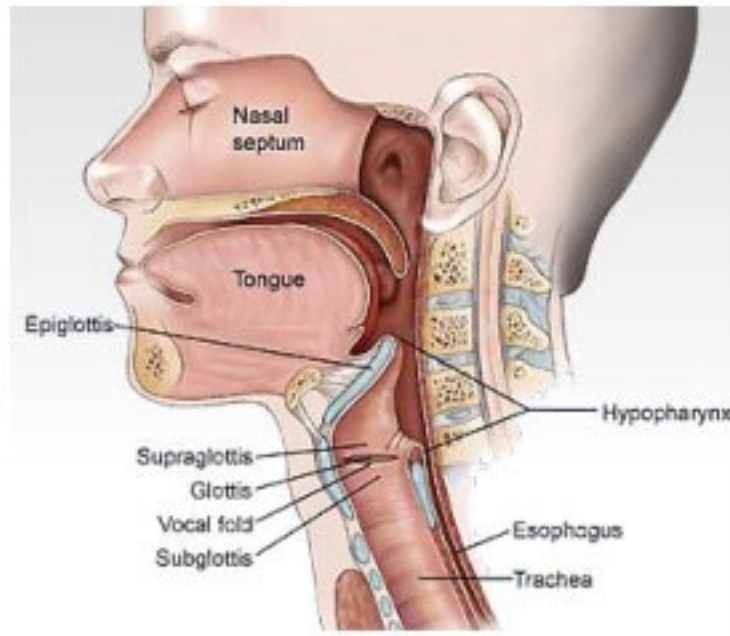
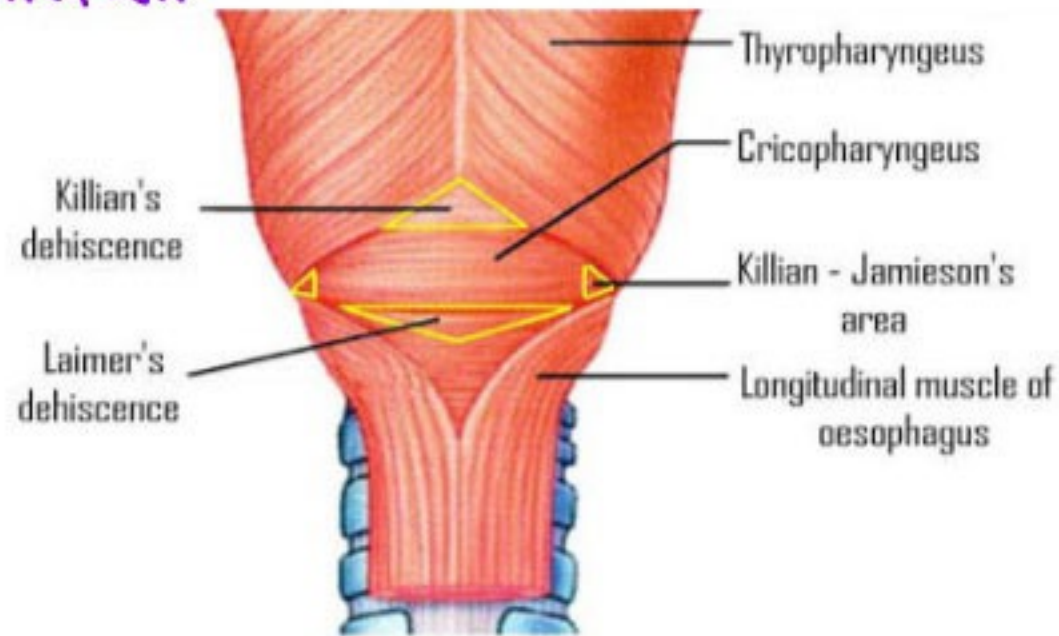
- uses radiofrequency to break NaCl to Na<sup>+</sup> & Cl<sup>-</sup> ions
- Na<sup>+</sup> ions used to dissect the tissue → no bleeding
- minimal post op. pain - no heat used
- high cost & healing is slow



## HYPOPHARYNX / LARYNGO PHARYNX

→ Thyropharyngeus supplied by SLN

→ Cricopharyngeus by RLN





## ZENKER'S / PULSION DIVERTICULUM

→ MC SITE → KILLIAN'S dehiscence  
also develop from Laimer's dehiscence & Killian-Jamieson diverticulum

→ Clf

- regurgitation of old eaten food at night times
- dysphagia [mc]
- Halitosis

→ Dx

- Barium Swallow
  - on case of malignancy
    - irregular margins ⊕nt
    - filling defect ⊕nt
  - It is also ⊕nt in case of food particles
  - to d/d repeat barium swallow after some time
- Video Fluoroscopy
  - can check filling defects
- Esophagoscopy or Endoscopy are Clf [risk of perforation]
  - to take Biopsy, it is indicated [not for Dx].

→ Rx

- Excision
- DOHLMAN'S OPERATION/ ENDOSCOPIC DIATHERMY → RPOC
  - common wall b/w diverticulum & oesophagus removed

→ ZD develops above the upper esophageal sphincter  
Epiphrenic Diverticulum develops above the lower esophageal sphincter

→ ZD is a pseudodiverticulum

→ TRACTION DIVERTICULUM is a true diverticulum

## Plummer Vinson Syndrome/ Patterson Brown Kelly Syndrome

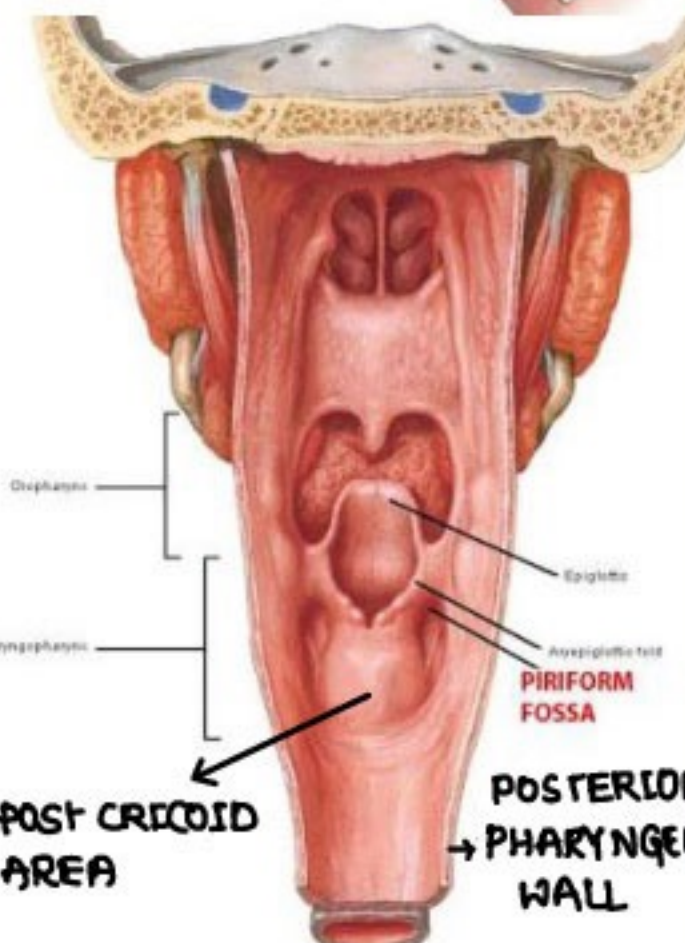
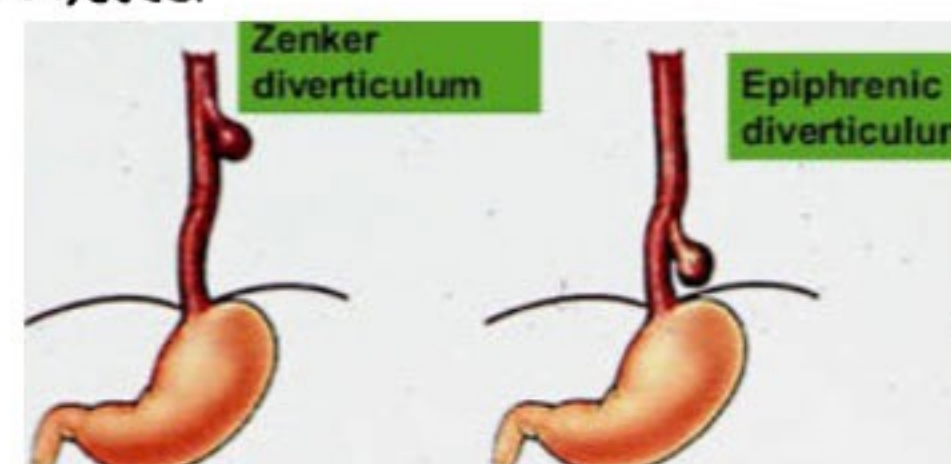
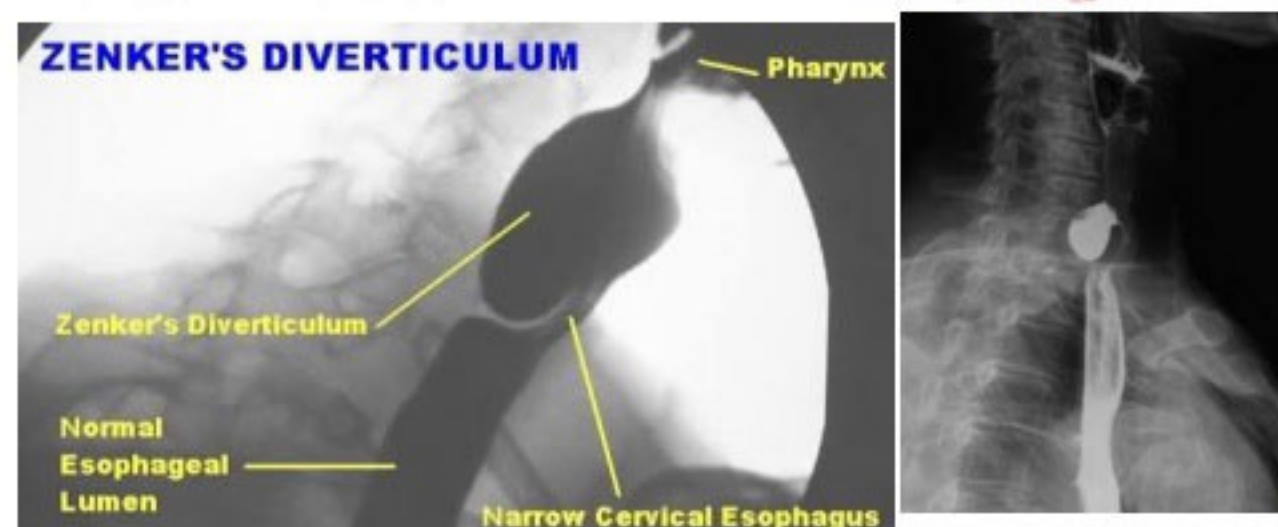
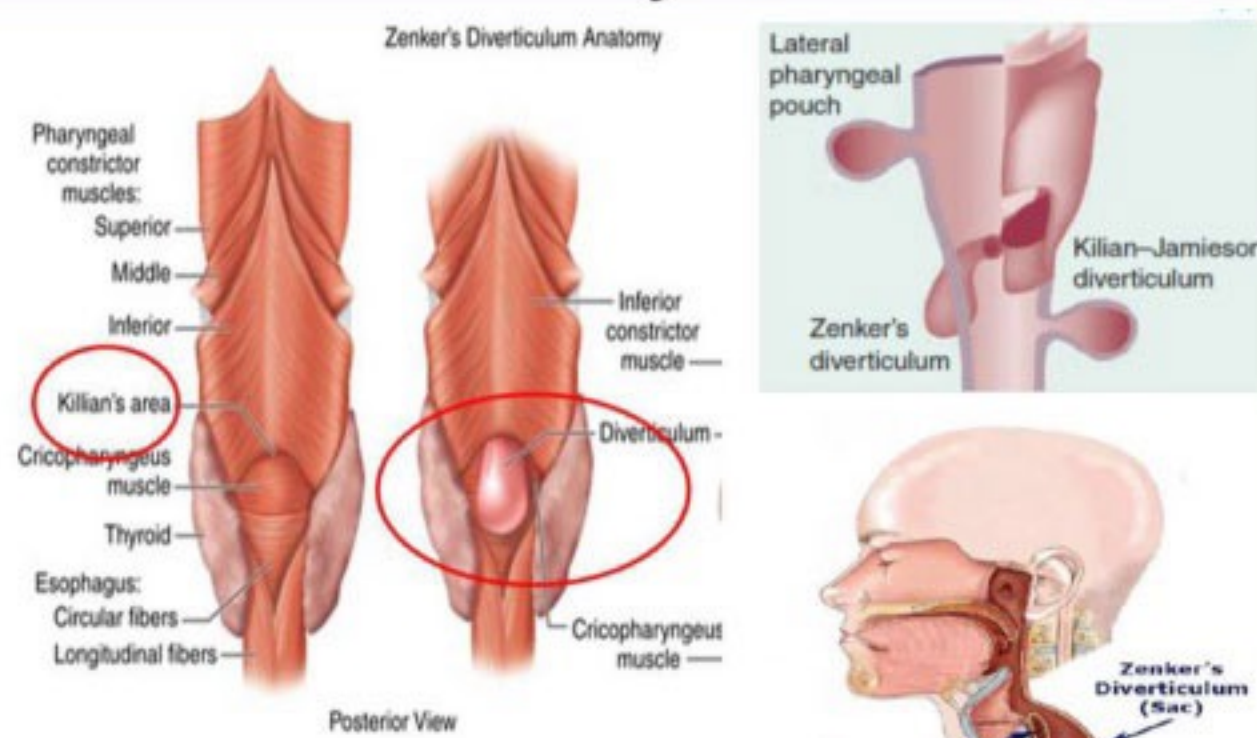
1. Post cricoid webs
2. Fe-deficiency anaemia → more common in females, low social economic status & developing countries
3. Koilonychia

→ Post cricoid webs → Pre Malignant

→ more common in ♀ → CA hypopharynx more common in females

→ Q/E

- Post cricoid crepitus absence → MOURE SIGN
  - Moure sign is +ve in hypopharyngeal CA.





- CHEVALIER JACKSON'S SIGN

- collect<sup>n</sup> of secret<sup>n</sup> in pyriform fossa

→ R<sub>1</sub>

- depends on stage of CA

- early stages → S<sub>x</sub>
- late stages → chemo radiat<sup>n</sup>



## LARYNX

### EMBRYOLOGY & CARTILAGE OF LARYNX

- formed by fus<sup>n</sup> of 4<sup>th</sup> & 6<sup>th</sup> pharyngeal arches [cartilagenous structure]
- 4<sup>th</sup> arch Blood Supply  $\begin{cases} \text{Rt} \rightarrow \text{Rt. subclavian artery} \\ \text{Lt} \rightarrow \text{Arch of Aorta} \end{cases}$
- 6<sup>th</sup> arch Blood Supply  $\begin{cases} \text{Rt} \rightarrow \text{Rt. pulmonary artery} \\ \text{Lt} \rightarrow \text{Ductus arteriosus} \end{cases}$
- Nerve Supply by Vagus N. [X]  $\begin{cases} \text{SLN} \rightarrow 4^{\text{th}} \text{ arch} \\ \text{RLN} \rightarrow 6^{\text{th}} \text{ arch} \end{cases}$
- Muscles formed by
  - 4<sup>th</sup> arch → constrictor muscles of pharynx except cricopharyngeus  
Cricothyroid
  - 6<sup>th</sup> arch → Cricopharyngeus  
All intrinsic muscles of larynx except cricothyroid
- CARTILAGES
  - 4<sup>th</sup> arch →
    - Cu → Cuneiform
    - T → Thyroid
    - E → Epiglottis
  - 6<sup>th</sup> arch →
    - Co → Corniculate
    - C → Cricoid
    - Ain → Arytenoid



## ANATOMY

→ formed by 3 unpaired & 3 paired cartilages

→ unpaired

1. epiglottis

## 2. Thyroid

### 3. Cricoid

- paired

1. Arytenoid

2. corniculate

### 3. Cuneiform



- Any muscle/membrane/ligament that present in b/w 2 cartilages → **INTRINSIC**
- Any muscle/membrane/ligament that connects cartilage to external structure → **EXTRINSIC**

- Thyrohyoid membrane  
 Thyrohyoid ligament  
 cricotracheal ligament

**EXTRINSIC**

cricothyroid membrane  
 Cricothyroid ligament  
 Cricothyroid muscle

**INTRINSIC**

[Only intrinsic muscle of the larynx]

- cricoid cartilage
  - only complete ring of cartilage in whole human airway

### → PRE EPIGLOTTIC SPACE

#### - Boundaries

1. Superior → Hyoepiglottic ligament
2. Posterior → Epiglottis  
Thyroepiglottic ligament
3. Anterior → body of Hyoid  
Thyrohyoid ligament  
Thyroid cartilage [small part]

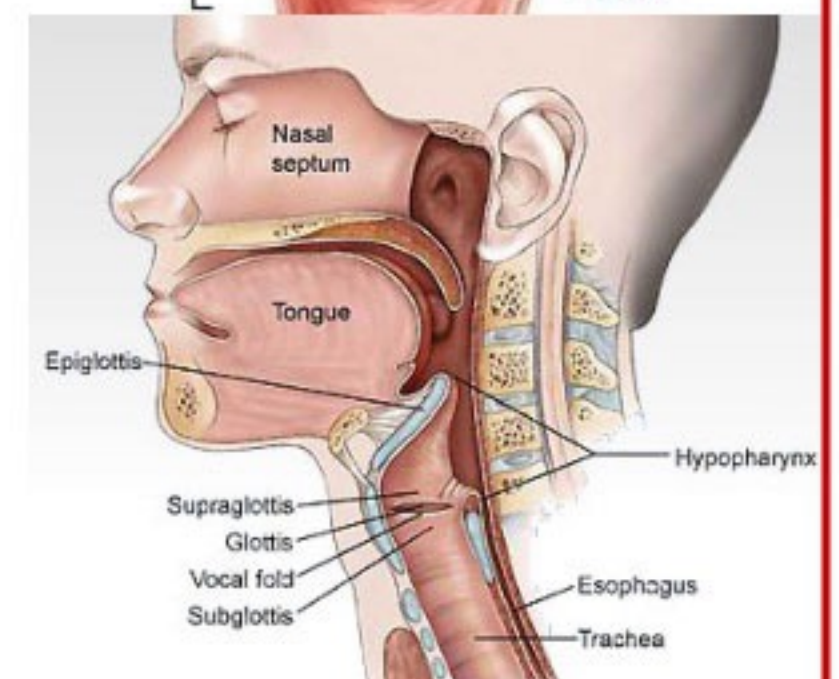
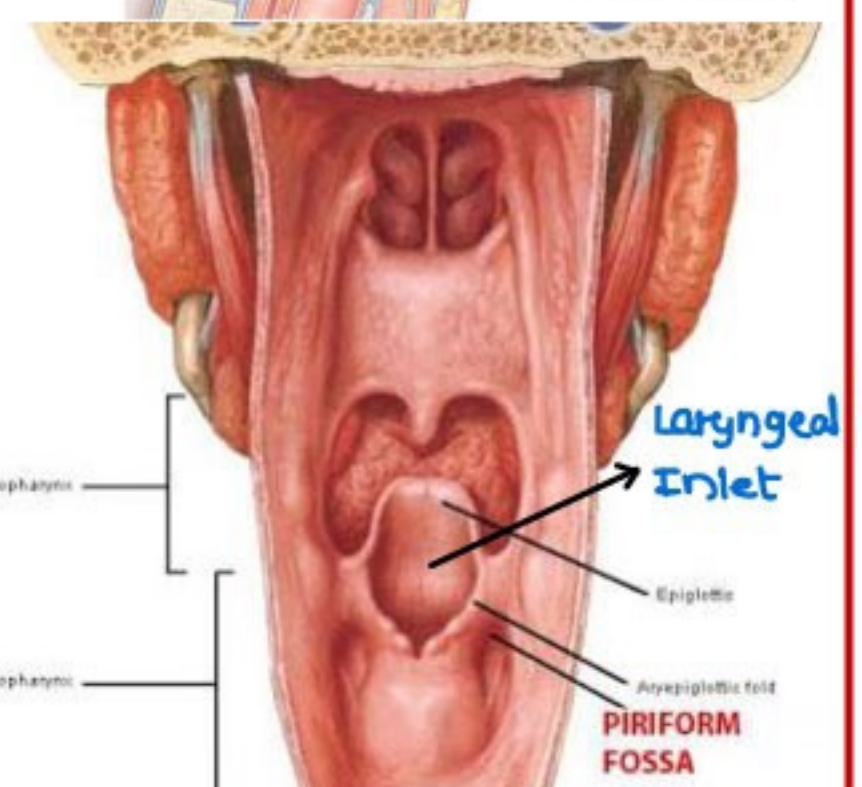
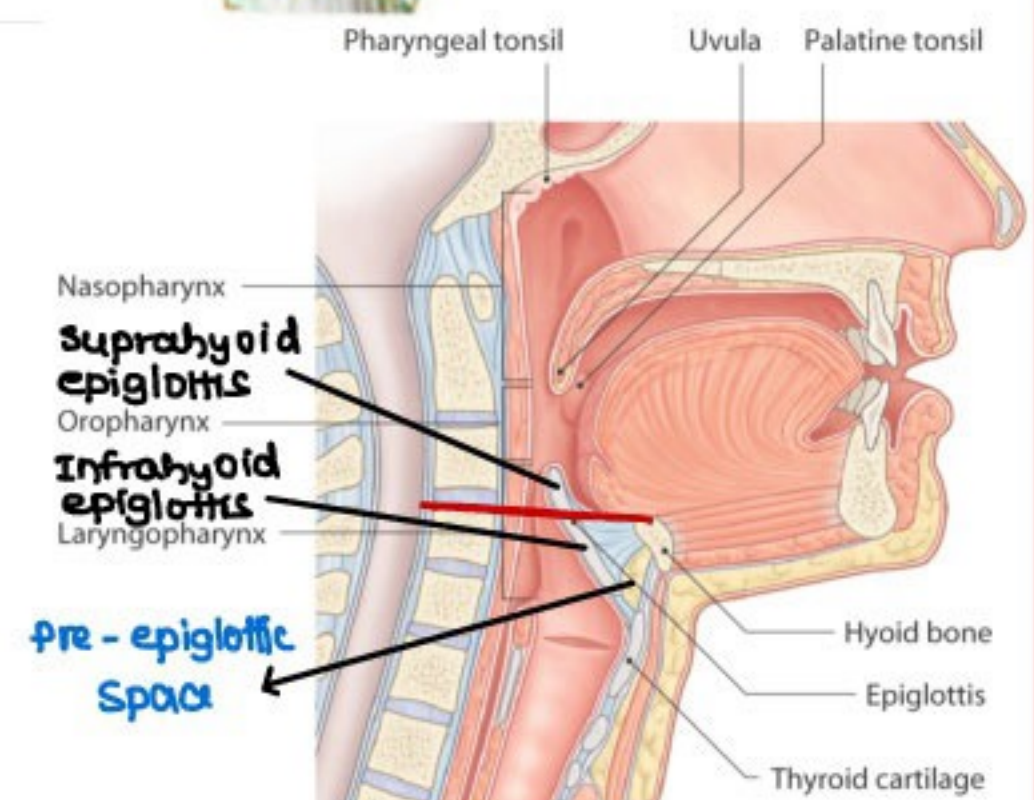
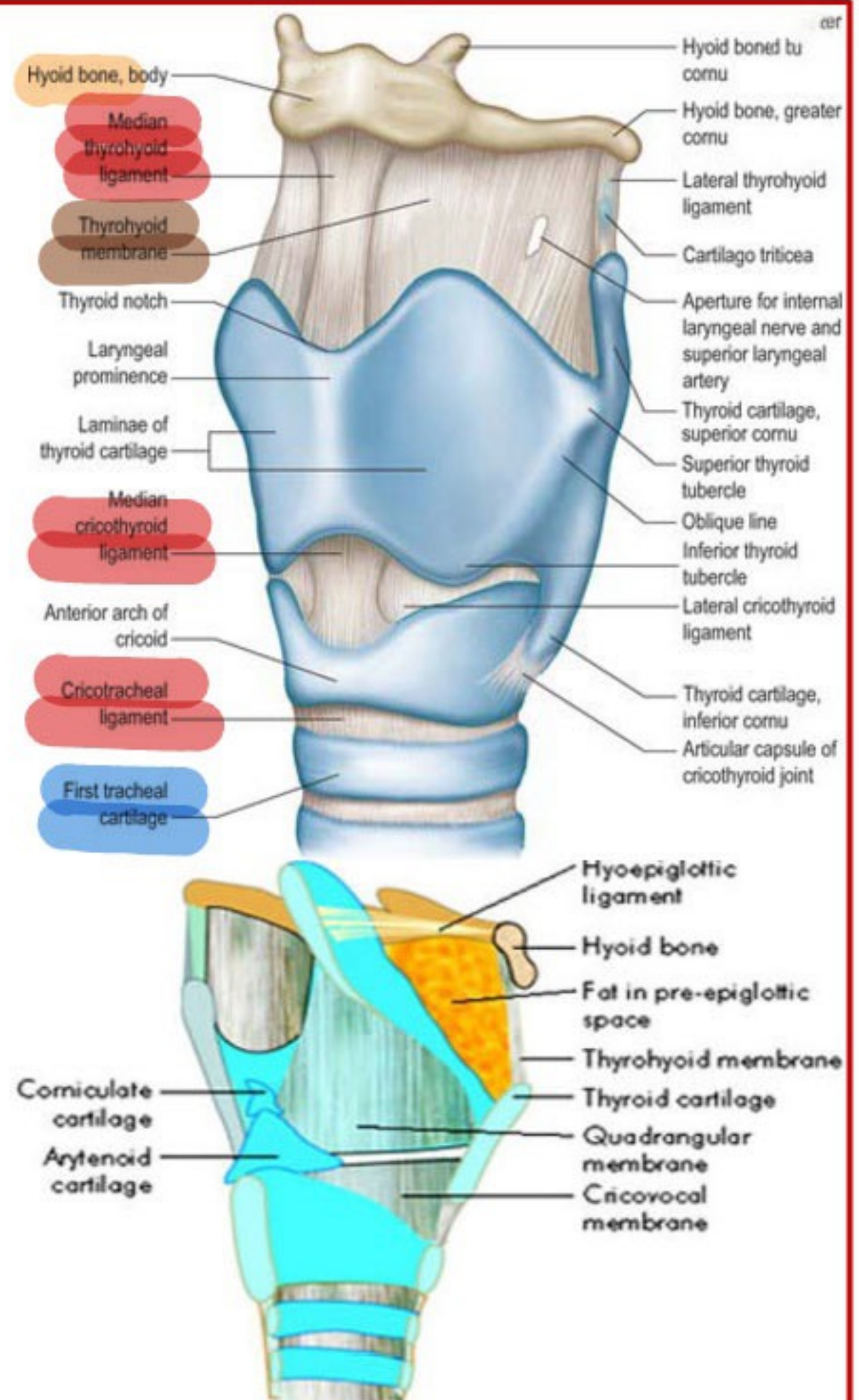
Space is open on 2 sides & communicates w paraglottic space

- fat filled space
- potential space [not a actual space]
  - spread of malignancy into it → T<sub>3</sub>

### → LARYNGEAL INLET

- Anteriorly → Epiglottis
- posteriorly → arytenoids [pair]
- Any Epiglottic fold in b/w them

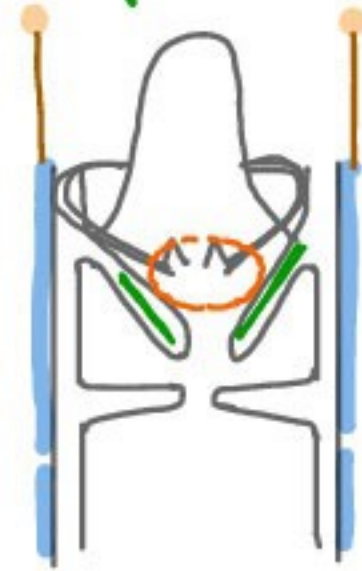
- Part of larynx that contains vocal fold is glottis
- Supraglottis → part above the glottis
- Subglottis → part below the glottis





## Cross sectional anatomy of Larynx

Laryngeal Inlet  
Supra glottis  
ventricle  
Glottis  
Sub glottis



Ary epiglottic fold

Epiglottis

Arytenoid cartilage

false vocal cords / vestibular fold / ventricular folds

vocal fold [True vocal cords]

Laryngeal vestibule

**vestibule** → Starts from the laryngeal inlet [upper boundary]  
ends at false vocal cords [lower boundary]

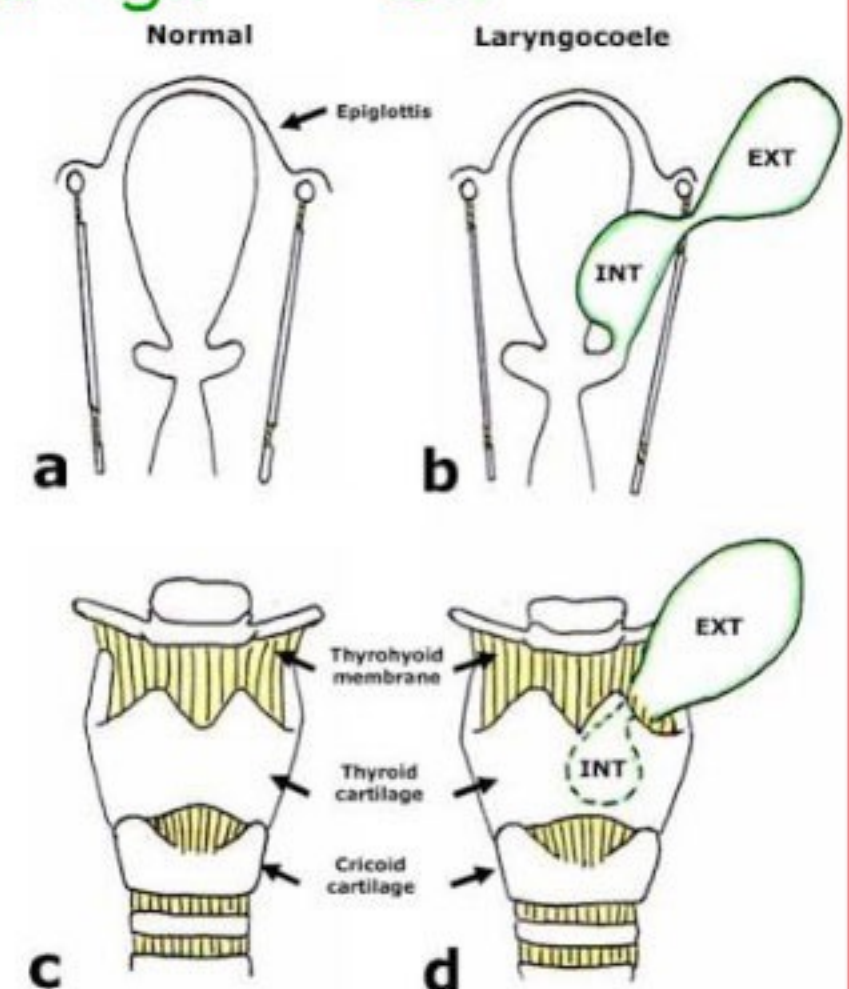
**ventricle** → forms ventricle  
→ only true space of larynx

false vocal cords / vestibular folds / ventricular folds



Quadrangular membrane

→ on glass blowers, wt lifters, trumpet players,  
pressure produced by glottis closure  
↓  
ventricle starts increasing in size [upside]  
↓  
laryngocoele



## Laryngocoele

- air filled cystic swelling in neck
- arises from anterior most part of ventricle → SACULE
- Types

External → BRYCE SIGN - on compressing, the swelling ↓ size & a gurgling sound of air escape  
[BOYCE SIGN - seen in Zenker's diverticulum [sound of fluid escape]

Internal → CF → FB sensat<sup>n</sup> in throat  
cough, difficulty in breathing, noisy breath  
O/E → smooth swelling of vestibular fold & Ary epiglottic fold

Mixed / combined

→ Dx  
CT scan in valsalva procedure

→ Rx  
External → Sx excision  
internal → Transoral micro laryngeal Sx  
combined → Sx excision



## CONGENITAL DISEASES OF LARYNX

### LARYNGOMALACIA

- soft laryngeal cartilages
- Stridor ⊕ during inspirat<sup>n</sup>
  - from birth
  - cry is ⊕ [expiratory phenomenon]
- ↓
  - crying ↑ Stridor
- In prone posit<sup>n</sup> → Stridor improves
- O/E
  - omega shaped epiglottis ⊕
- Rx
  - Conservative Rx
  - disappears by 2 yrs



### SUB GLOTTIC HEMANGIOMA

- vascular malformat<sup>n</sup>
- Clf
  - Stridor at 3-6 months of age [at birth → small]
    - Normal
      - Glottis & subglottis → Biphonic stridor
      - Supraglottis & above → Inspiratory stridor
      - Below subglottis → expiratory stridor
    - In subglottic hemangioma has inspiratory stridor [b/c of vascular malformat<sup>n</sup>]
  - 50% of patients have cutaneous hemangiomas
- Dx
  - Fiberoptic/direct laryngoscopy → Reddish blue mass in subglottis
- Rx
  - Save the airway → Tracheostomy [first]
  - CO<sub>2</sub> laser excision or
  - Inj<sup>n</sup> of steroid or
  - Sclerotherapy



### LARYNGEAL WEB

- membrane formed d/t incomplete canalizat<sup>n</sup> of airway
- mc site → anterior glottis
- Clf
  - Stridor → biphonic from birth
- O/E → web is seen





→ Types → congenital → cartilaginous  
                  Acquired → membranous  
                                  mcc → longterm intubat<sup>n</sup>

→ Rx

→ CO<sub>2</sub> laser Excis<sup>n</sup> & silicon keel b/w vocal folds for few wks to months to prevent recurrence

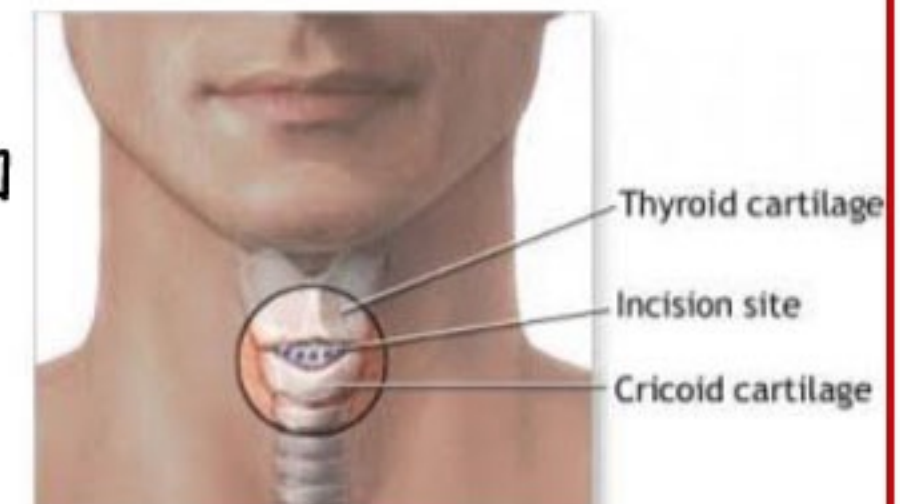
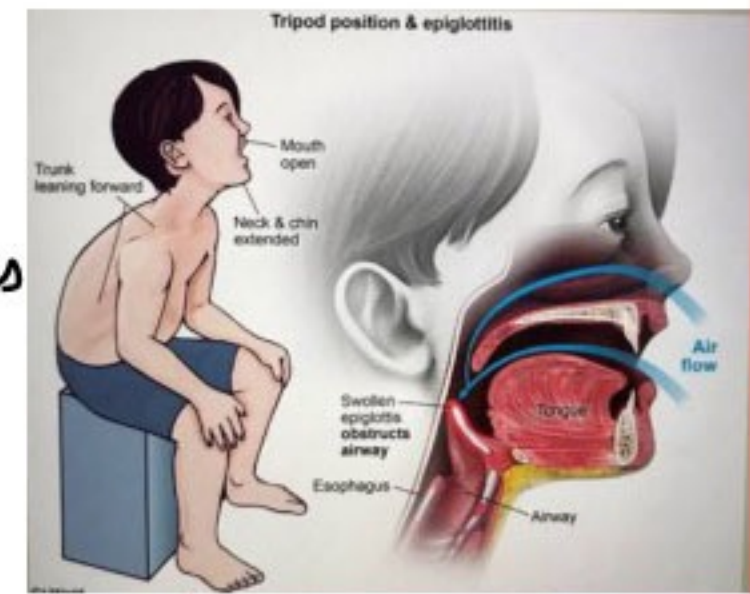




## ACUTE & CHRONIC INFLAMMATION OF LARYNX

### ACUTE EPIGLOTTITIS/SUPRAGLOTTITIS

- mcc → Hib [Haemophilus influenzae B]
- Streptococcus pneumoniae — in developed countries
- children [2-7 yrs]
- Cf
  - Sore throat, fever
  - Warning signs
    - not able to swallow even saliva → drooling
    - Dyspnea
    - Tachypnea
    - Tachycardia
    - Tripod sign/posit<sup>n</sup>
    - Rising sun sign
- instrumentat<sup>n</sup> is Cf
- Dx
  - X ray STN [lateral view]
    - Thumb sign ⊕
    - [Thumb print sign is seen in Ischemic colitis]
- Rx
  - Doc - ceftriaxone
  - Steroid nebulizat<sup>n</sup>
  - Tracheostomy [if stridor is +ve] [late finding]



CRICO THYROTOMY

### CRICOTHYROTOMY

- used open up the airway in emergency situat<sup>n</sup> [done outside the hospital]

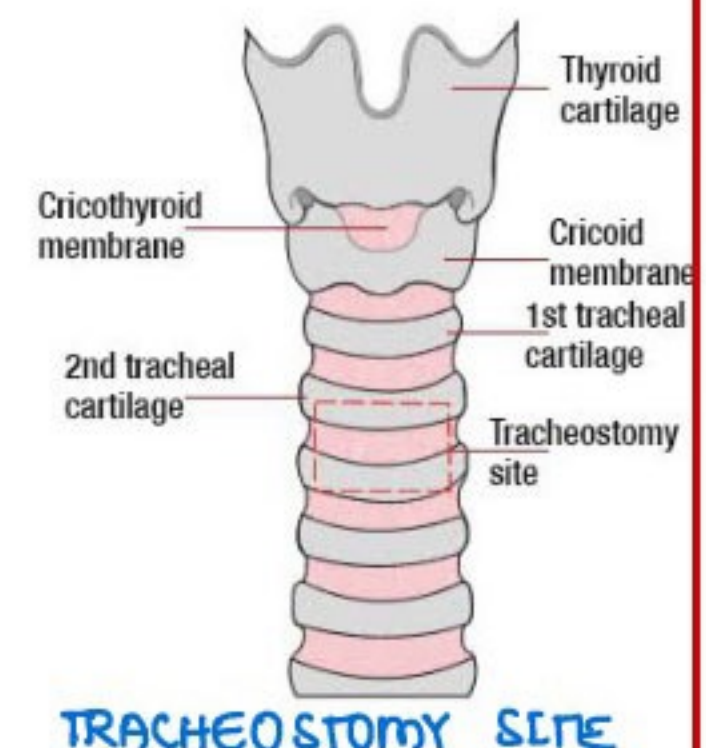
### TRACHEOSTOMY

#### Indications

- Respiratory Obstruct<sup>n</sup>
- Respiratory collapse
- Respiratory secretions
- Respiratory insufficiency
- To secure the Respiratory pathway

- High tracheostomy
  - b/w 1/2 rd

- Low tracheostomy
  - b/w 3/4 th

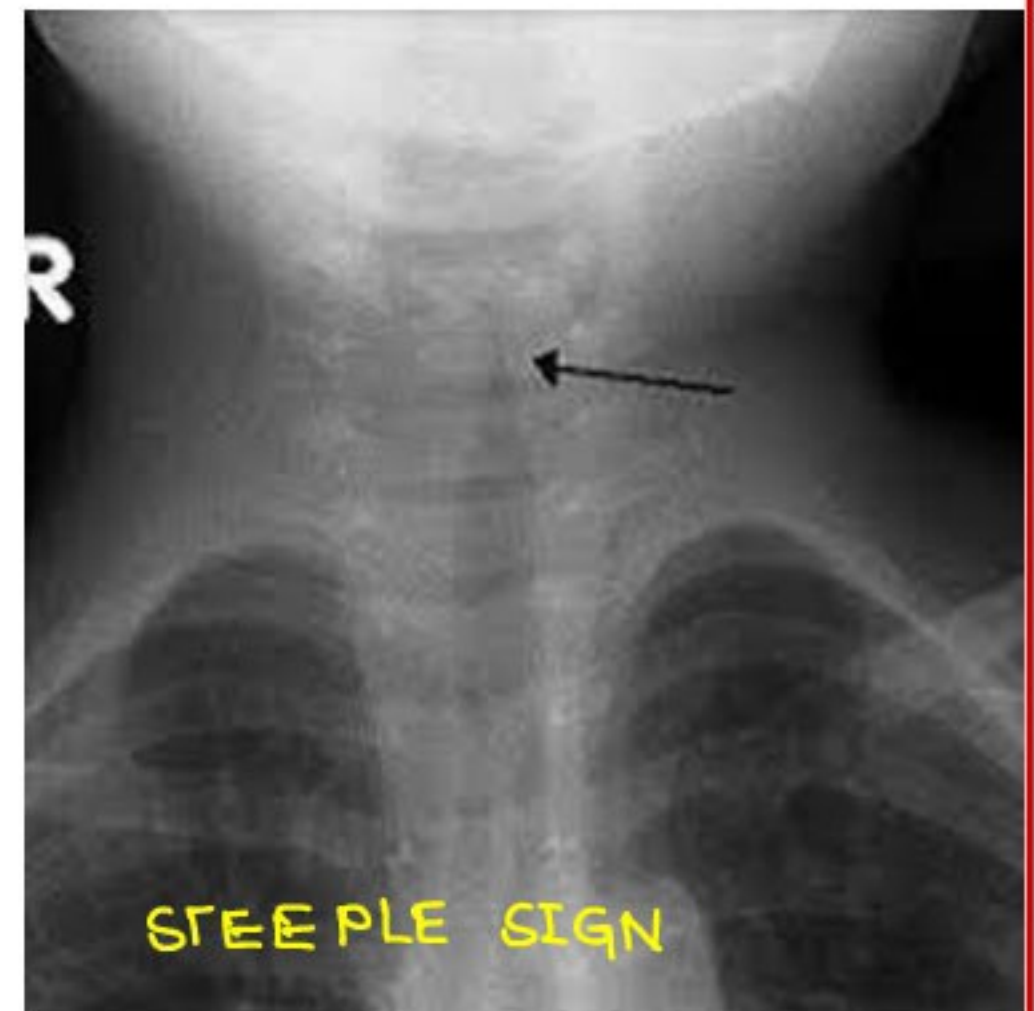


TRACHEOSTOMY SITE



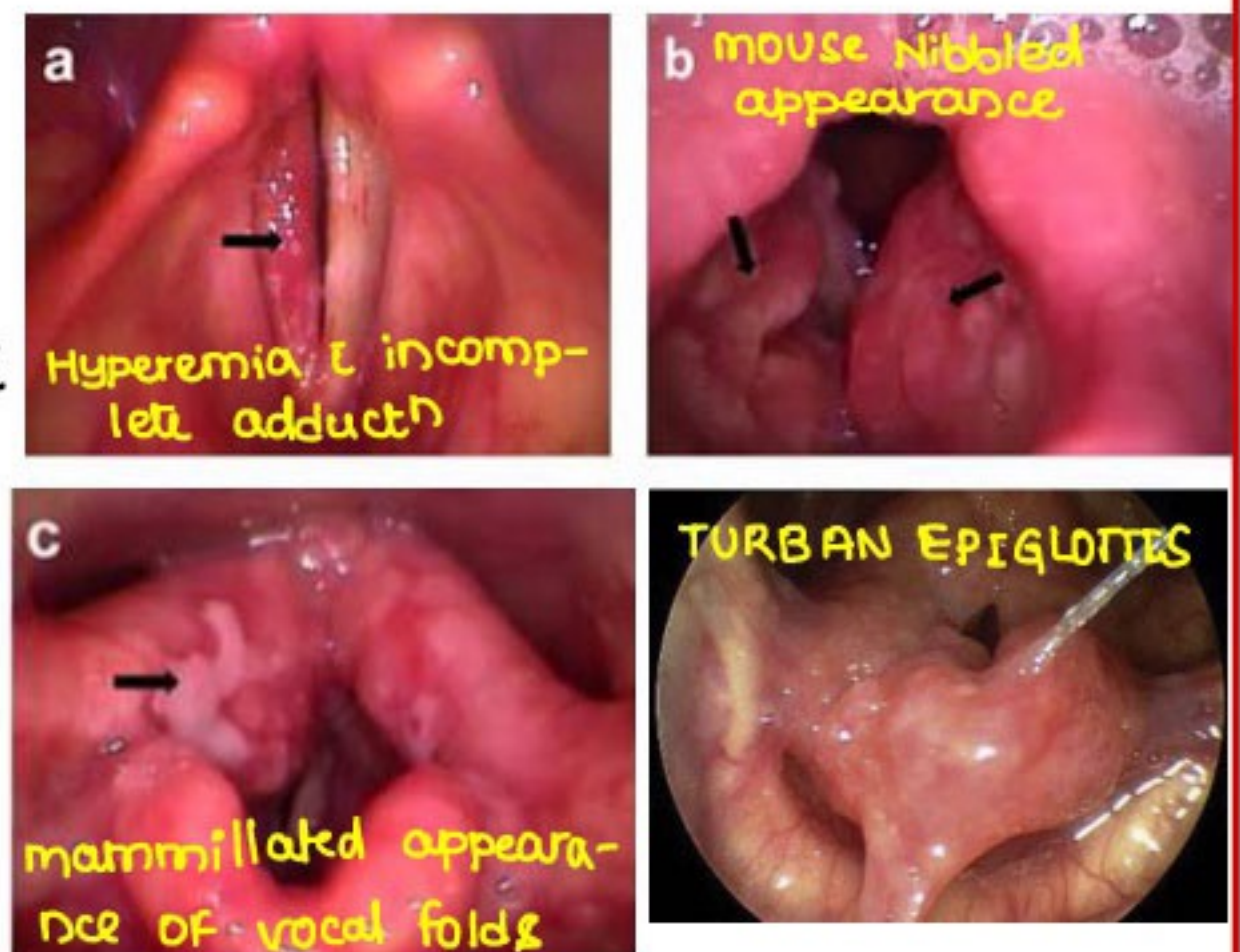
## ACUTE LARYNGO - TRACHEO BRONCHITIS [CROUP]

- MCC - Para influenza virus typus 1,2
- 3 months - 3 yrs
- Fever, cough [Barking cough → CROUP]  
stridor → expiratory
- O/E
  - sub costal, intercostal retract<sup>n</sup>
  - bil conducted sounds on auscultat<sup>n</sup>
- CXR
  - Steeple sign
- Rx
  - symptomatic



## LARYNGEAL TB

- always associated i pulmonary TB
- Submucosal nodules
  - mc site - posterior glottis/larynx
  - first sign → hyperemia of vocal cords i incomplete adduct<sup>n</sup>
  - mammillated appearance of nodules
  - mouse nibbled appearance of vocal folds [multiple ulcerat<sup>n</sup> of vocal folds]
  - Turban epiglottis [dit submucosal nodules] [pseudo edema of epiglottis]
- Rx
  - Rx pulmonary TB



## CONTACT ULCER / GRANULOMA

- On the posterior 1/3 rd of vocal folds
- MCC → LPR [Laryngo Pharyngeal Reflux]  
other → vocal abuse / faulty speech
- CF
  - Hoarsness of voice
- in long term intubat<sup>n</sup> → INTUBAT<sup>n</sup> GRANULOMA
- Rx
  - PPIS i speech therapy [for LPR]
  - entubat<sup>n</sup> granulomas
    - Antibiotics & steroids

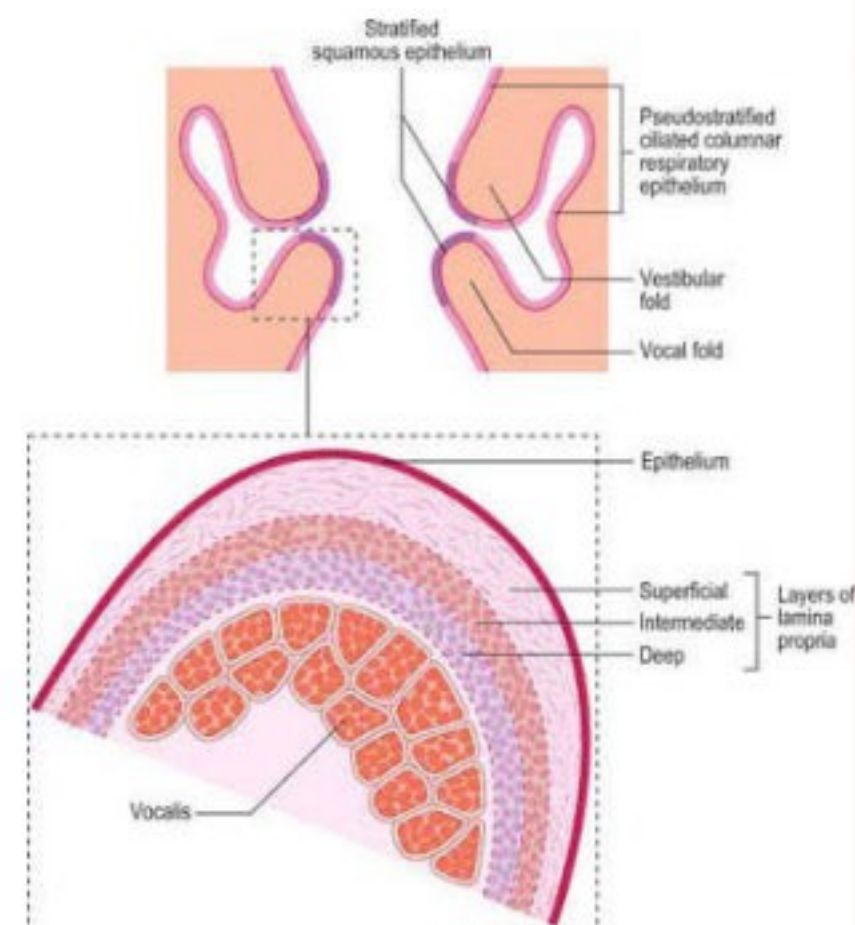




## BENIGN LESIONS OF LARYNX REINKE'S EDEMA



- MCC → Smoking
- other → Faulty speech
- foggy spindle shaped vocal folds → SMOKER'S POLYPS
- Females
- Rx
  - cessation of smoking
  - Rx - stripping of epithelium from vocal folds
  - 2 stage Sx - do one side at a time

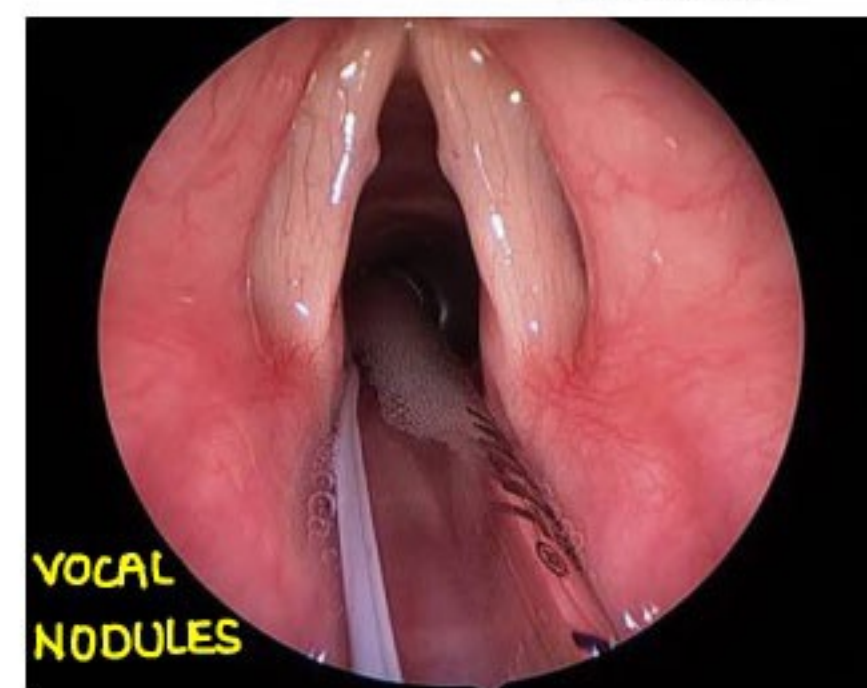


## VOCAL NODULE / SINGER'S NODULE / SCREAMER'S NODULE

- d/t chronic misuse of voice
- B/L, sessile [fixed on free margins]
- at the junct<sup>n</sup> of anterior 1/3<sup>rd</sup> & posterior 2/3<sup>rd</sup> [area of max. vibrat<sup>n</sup>]
- CF - hoarseness of voice
- Rx
  - Speech therapy
  - PPI [LPR is a major contributor]
  - Early/soft nodules
    - I speech therapy & PPI
  - Late/Hard nodules
    - Rx - speech therapy & PPI
    - Sx



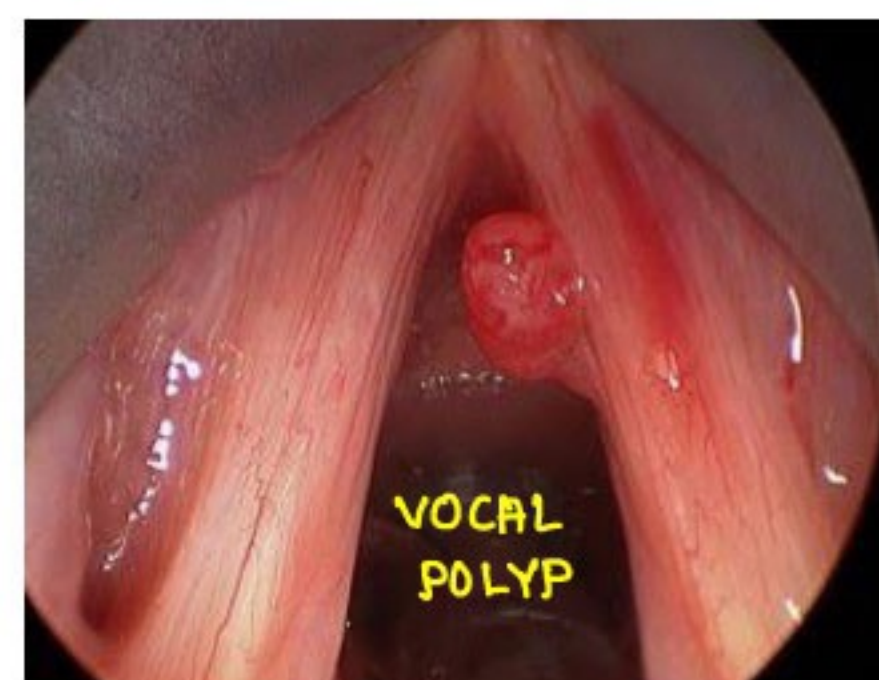
Vocal Nodules



VOCAL NODULES

## VOCAL POLYP

- single, pedunculated, U/L polyp, moves w/ respirat<sup>n</sup>
- at ant 1/3<sup>rd</sup> & posterior 2/3<sup>rd</sup>
- d/t sudden vocal abuse
- CF
  - Hoarseness
  - Diplophonia
- Rx
  - micro laryngeal Sx



VOCAL POLYP

## RECURRENT RESPIRATORY PAPILLOMA

- associated w/ HPV 6, 11
- Types

Adult  
Limited, single, U/L  
doesn't recur after Rx

Juvenile  
multiple, b/L, Stridor ⊕  
highly recurrent  
vertical transmission ⊕



ADULT



JUVENILE



## JUVENILE

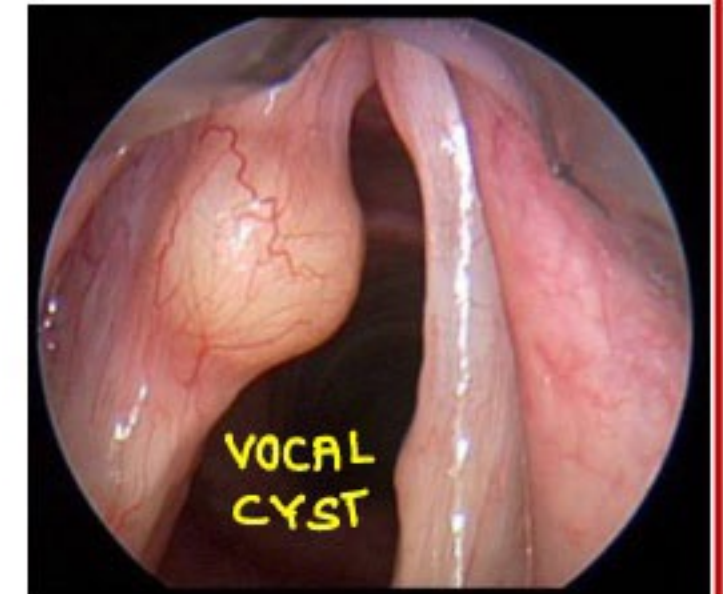
- Tracheostomy C/I
  - RF for spread
  - Relative C/I
  - try to be away from papilloma
    - Low tracheostomy

→ Rx

- CO<sub>2</sub> Laser Excision
  - HPV virus present in furrow
  - not preferred
- Microdebrider Excision
- Medical Rx
  - Chemotherapy
  - Newer - Photodynamic therapy
  - Interferon  $\alpha$  [ $\downarrow$  recurrence]

## VOCAL CYST

- collect<sup>n</sup> of fluid in vocal fold
- Rx - microlaryngeal Sx
- DD → LIPOMA
  - Dx - made during Sx





## CARCINOMA LARYNX

→ more in male - smokers [Rel. Risk - 3.4]  
Alcoholics [RR = 6] } RR = 15

→ mc type → Sq. Cell CA

→ mc site → CA Glottis

• mc presentat<sup>n</sup> - hoarseness

• Best prognosis - early presentat<sup>n</sup>, late spread

mc presentat<sup>n</sup> of supra glottic CA → FB sensit<sup>n</sup>

mc presentat<sup>n</sup> of CA sub glottic → Stridor [poor prognosis]

→ Dx

- SOC → Direct Laryngoscopic Biopsy
- CT
- MRI

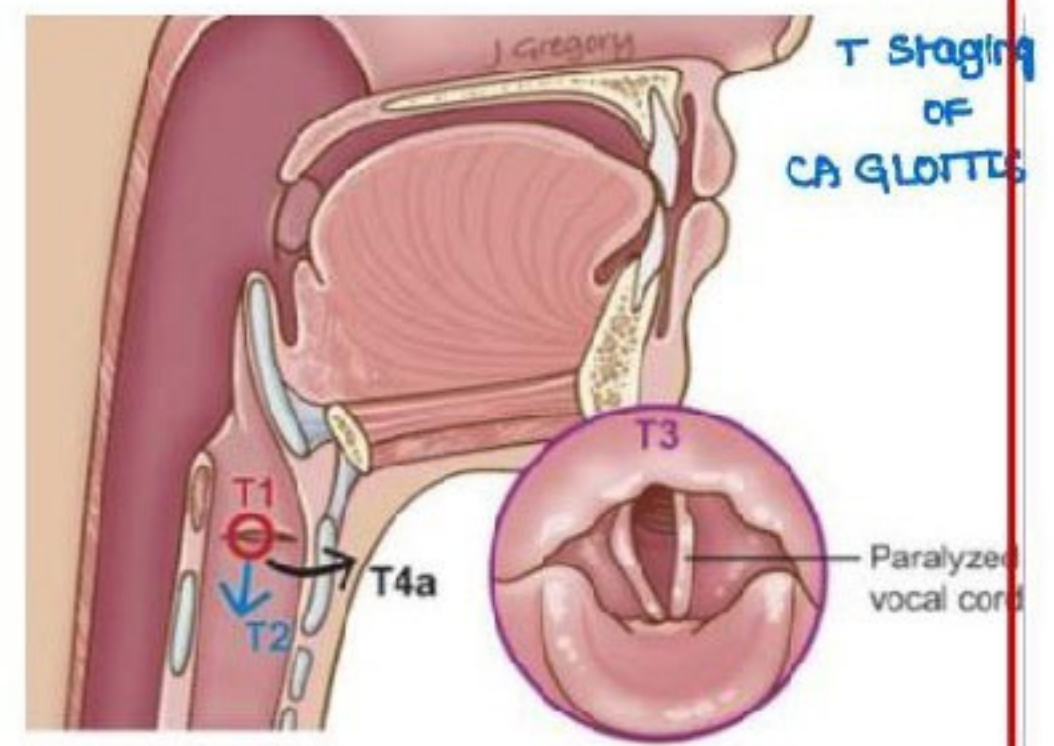


CA GLOTTIS



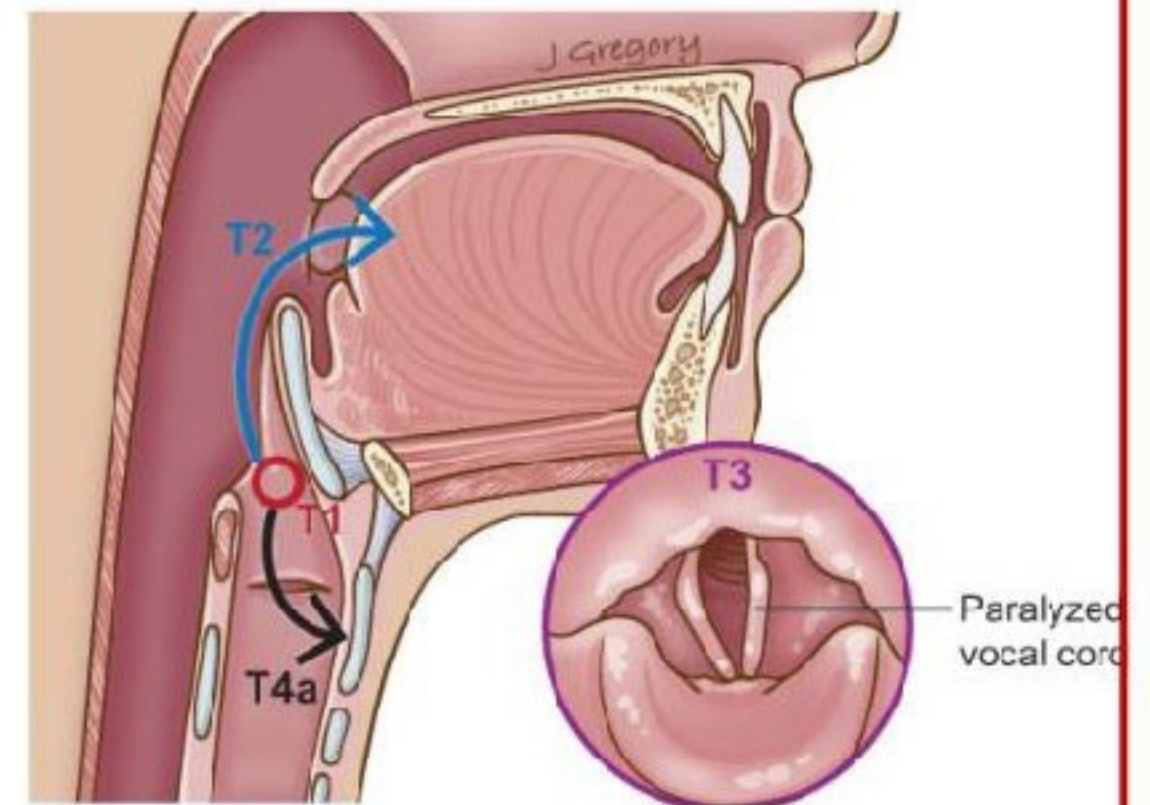
→ TNM Staging for Glottic CA

- T<sub>1</sub> → Normal vocal fold mobility
  - T<sub>1a</sub> → one
  - T<sub>1b</sub> → two
- T<sub>2</sub> → impaired vocal fold mobility
- T<sub>3</sub> → fixed vocal folds [palsy]
  - 3p → pre epiglottic
  - para epiglottic
  - post cricoid area
- T<sub>4</sub> → outside larynx
  - T<sub>4a</sub>
  - T<sub>4b</sub> → Superior mediastinum
  - pre vertebral space
  - encases carotid artery



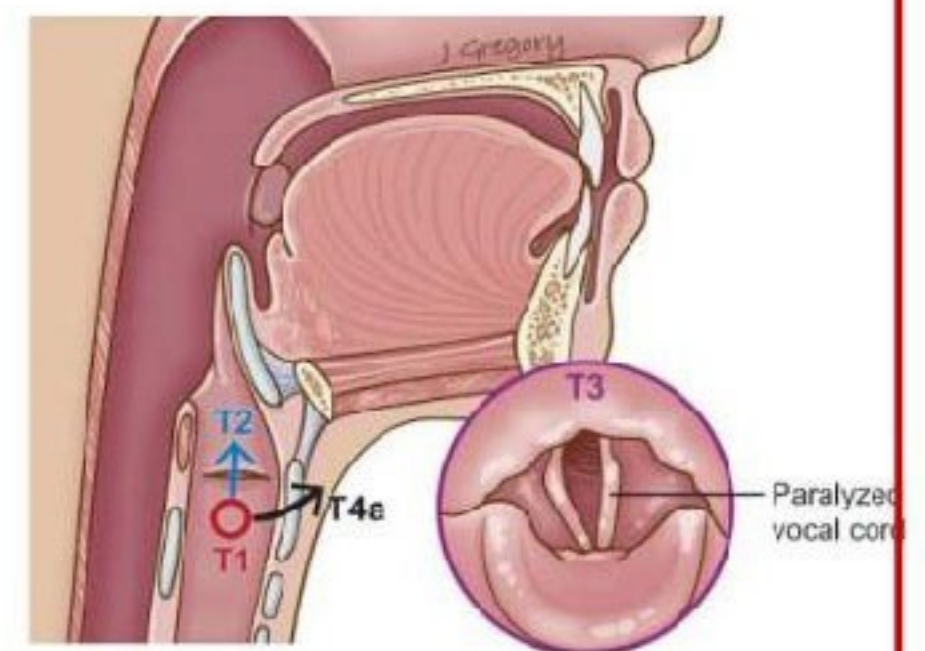
→ TNM Staging for Supra Glottic CA

- 5 Sub sites
  - supra hyoid epiglottis
  - infra hyoid epiglottis
  - arytenoids
  - vestibular folds
  - Aryepiglottic fold
- T<sub>1</sub> → 1 Sub site
- T<sub>2</sub> → >1 Sub site or mucosa of back of tongue or Glottic spread [no vocal fold palsy]
- T<sub>3</sub> → vocal fold palsy
- T<sub>4</sub> → out side larynx [same as Glottic CA]



→ TNM staging for CA Sub Glottis

- T<sub>1</sub> } Not considered [presents late]
- T<sub>2</sub> }
- T<sub>3</sub> } Same as glottic CA
- T<sub>4</sub> }



→ Rx

- T<sub>1</sub> / T<sub>2</sub> stage of CA Glottis
  - Radiotherapy → RxOC [follow up of 6 wks required]
  - T<sub>1a</sub> → Laser cordotomy
    - poor voice results
    - single sitting is enough



## - T3 lesions

### - concurrent chemo Radiotherapy [CCRT] - R<sub>0</sub>C

- except<sup>n</sup> → bulky lesion  
associated lymph nodes  
multiple sites involvement } Sx is the R<sub>y</sub>

- perichondritis is absolute CI for Radiotherapy → Sx is R<sub>y</sub>

## - T4a

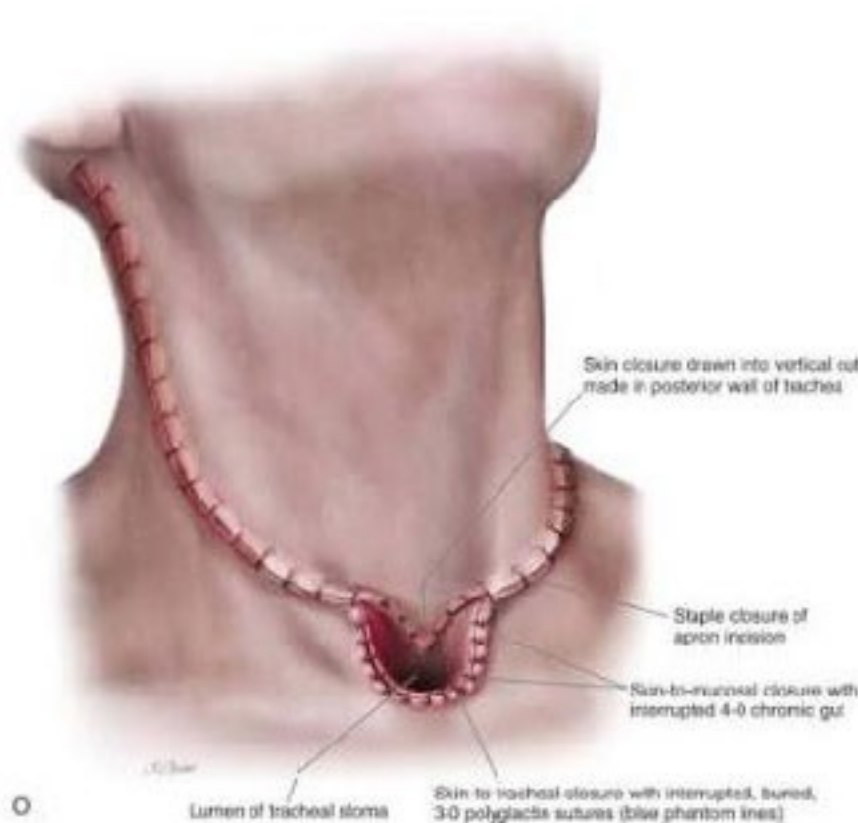
### - combined modality

S<sub>x</sub> → Radiotherapy & chemotherapy

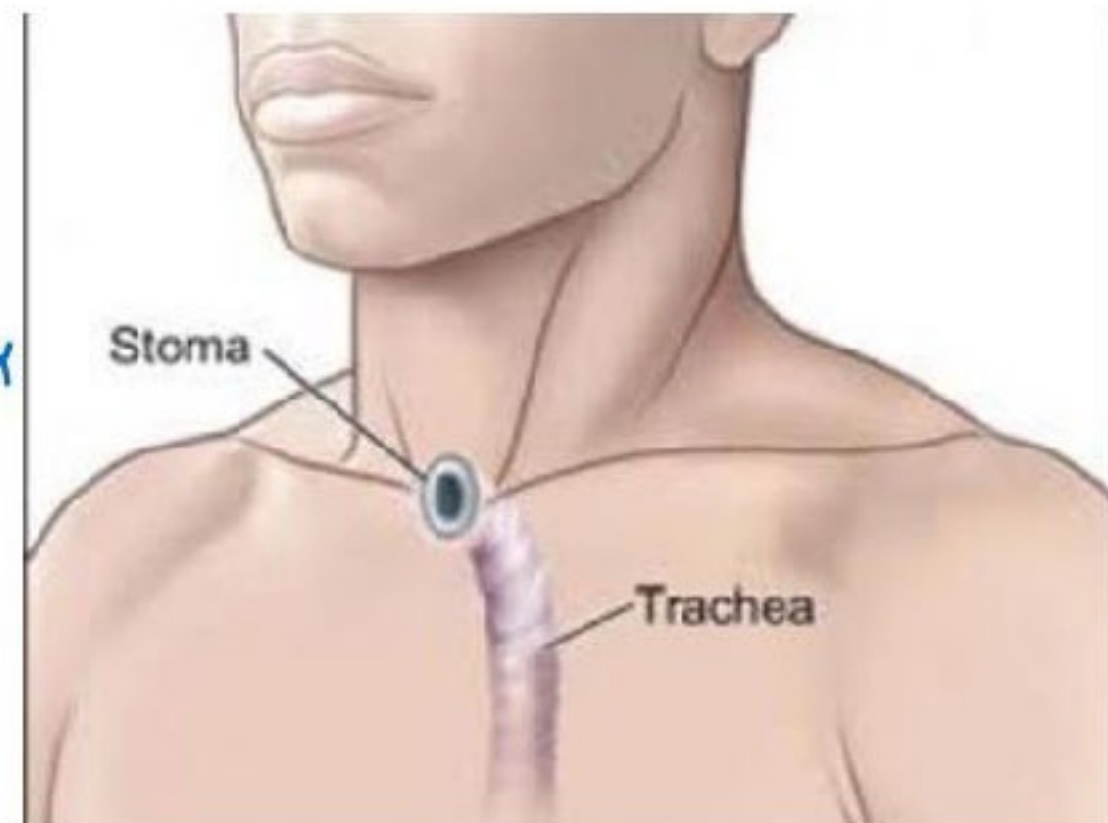
## - T4b - Palliative R<sub>y</sub>

## TOTAL LARYNGECTOMY

→ High tracheostomy done in total laryngectomy



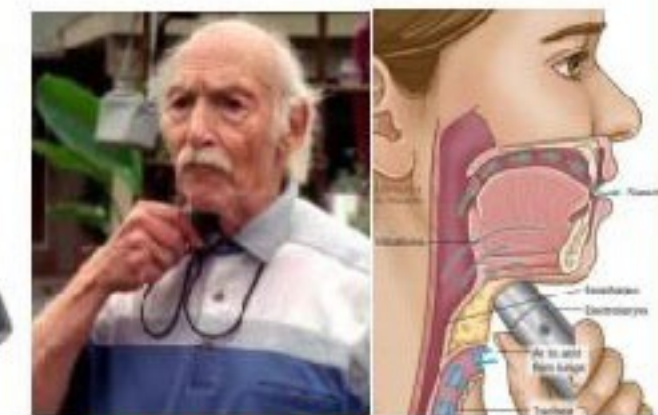
## TOTAL LARYNGECTOMY



## POST LARYNGECTOMY VOICE REHABILITATION

### ELECTROLARYNX

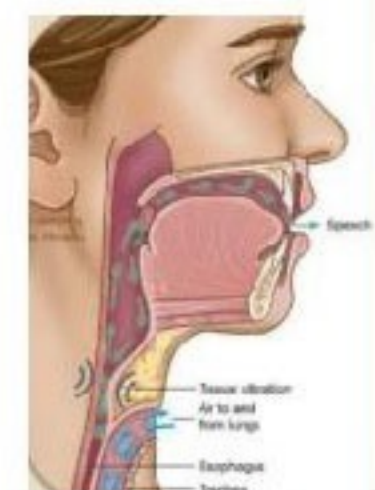
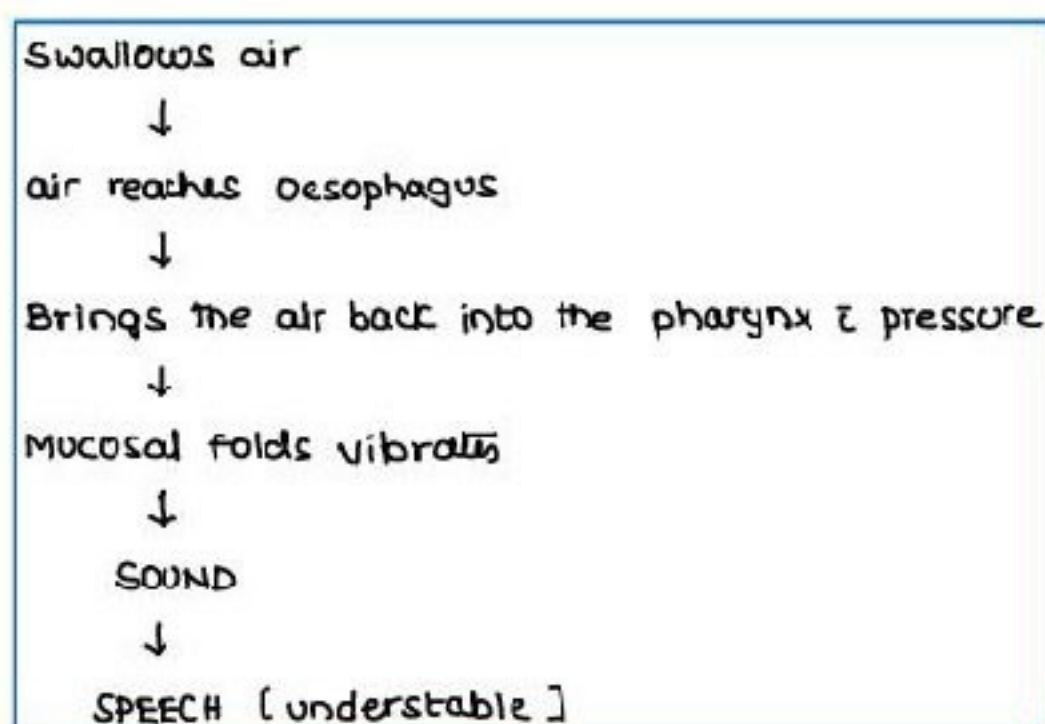
- small handheld device
- easy to use
- Disadvantage → produces monotonous sound



ELECTROLARYNX

### ESOPHAGEAL SPEECH

→ airway is separated from digestive pathway



oesophageal Speech

→ DISADVANTAGE → Only speaks few words at a time



## TRACHEO - OESOPHAGEAL SPEECH

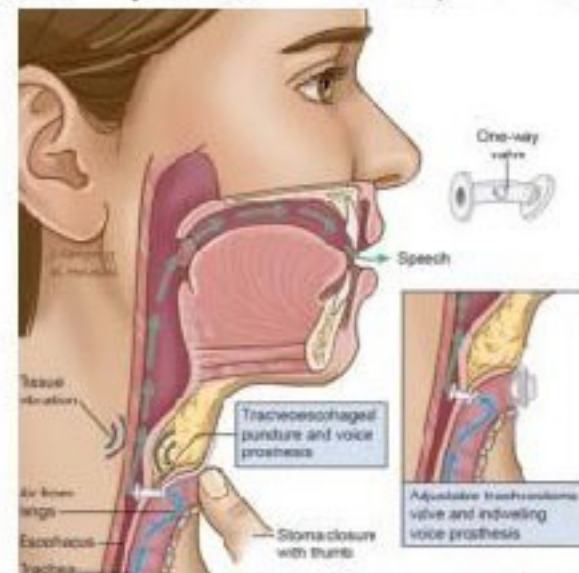
→ consists a ONE-WAY VALVE placed blw trachea & oesophagus

} TEP [Tracheoesophageal voice Prosthesis]

- can speak complete sentences
- Best way of voice rehabilitation
- DISADVANTAGES

→ Costly

→ has to be replaced once for 6 months - 2 yrs



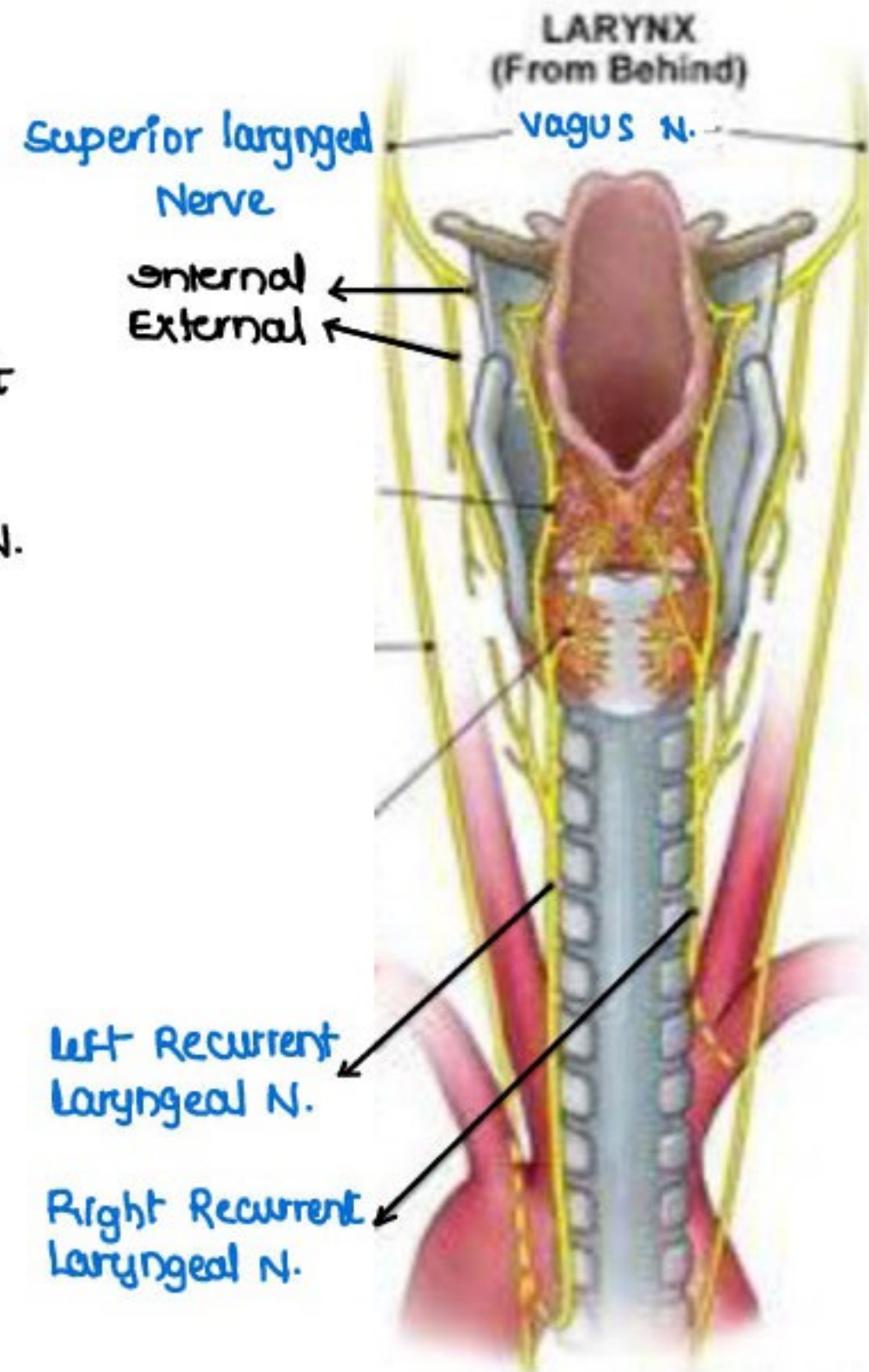
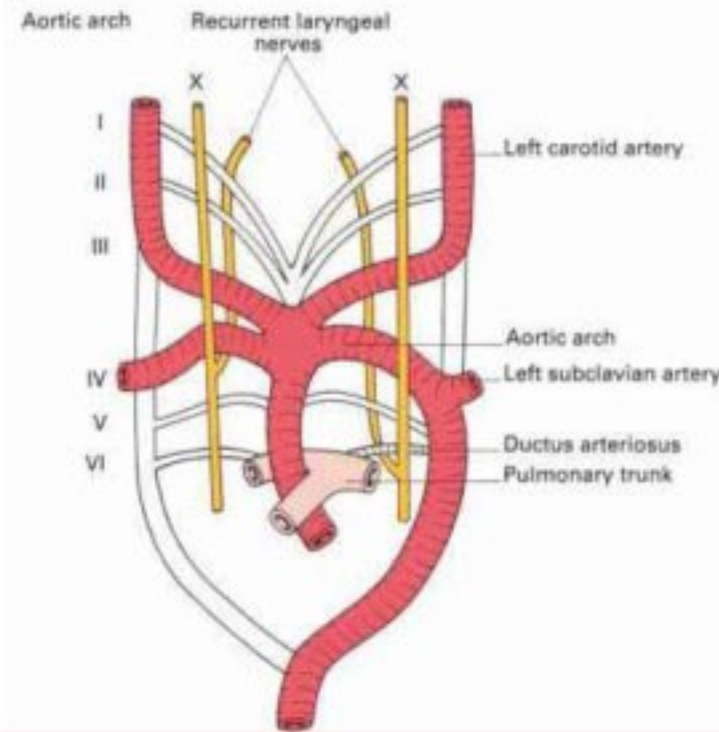
Tracheoesophageal Speech



## VOCAL FOLD PALSY

### Nerve Supply of Larynx

- Lt RLN, longer in course in thorax [takes a turn around arch of aorta]
- In 10% of cases, Rt side may be - Non Recurrent also
- mc nerve injured in total thyroidectomy - Ext. Lar. N.
- injured during CT Sx → Lt RLN
- more commonly injured in total thyroidectomy among RLN → Rt RLN [superficial]





### Semon's Law

- In case of any progressive neurological disorder, the Abductor fibres of RLN are 1<sup>st</sup> to be affected [phylogenetically new] → vocal folds lie in adduction

### Wagner & Grossman Hypothesis

- All muscles are causing adduct<sup>n</sup> in larynx, in RLN palsy all undergo palsy except cricothyroid [supplied by External Laryngeal Nerve] which is the reason for unopposed adduct<sup>n</sup>.

### POSITIONS OF VOCAL FOLDS

#### 1. U/L ELN palsy

- product<sup>n</sup> of high pitched voice problem only
- go unnoticed

#### 2. B/L ELN palsy

- Go unnoticed
- severe problem in product<sup>n</sup> of high pitched voice

#### 3. U/L RLN injury

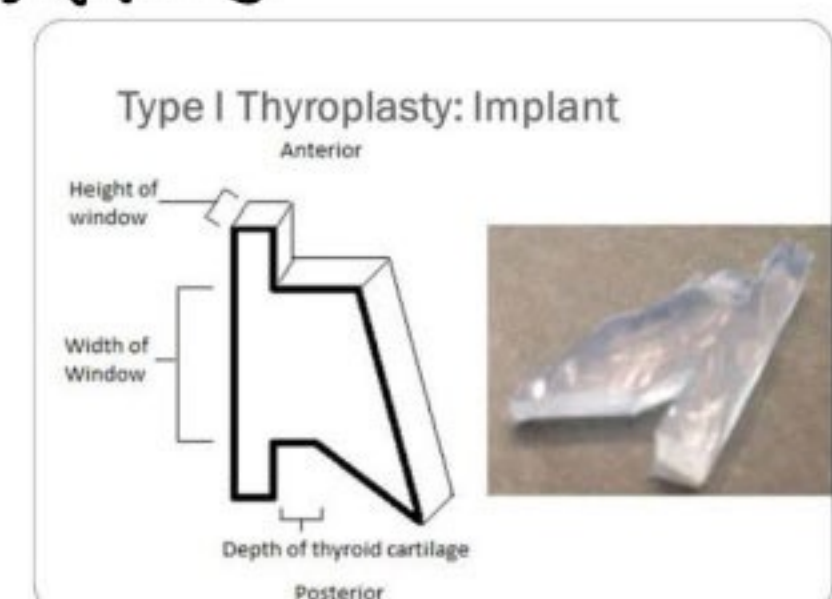
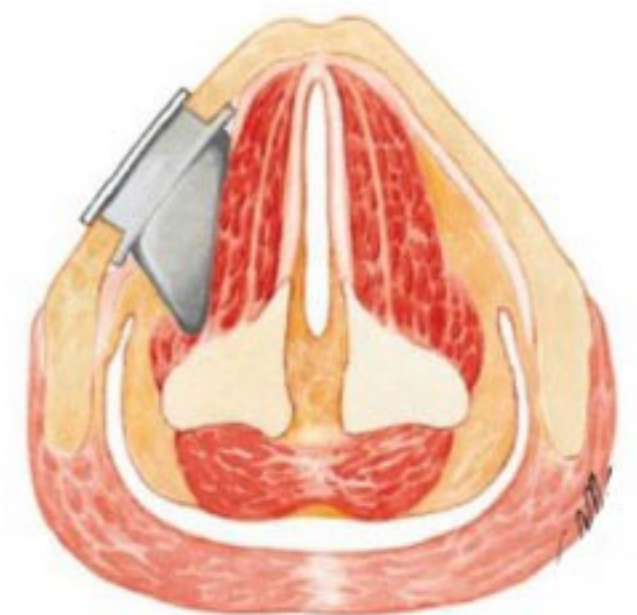
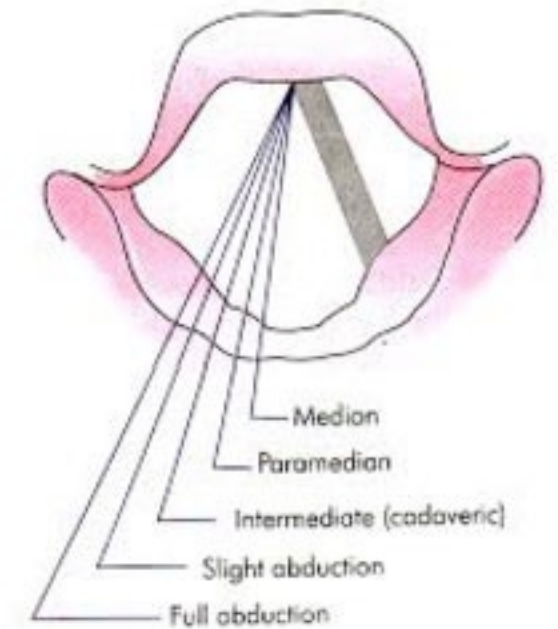
- para median position dlt incomplete adduct<sup>n</sup>
- no problem in airway
- compensatory hypertrophy of other vocal fold in few wks-months → voice will improve

#### 4. U/L RLN + U/L ELN injury

- cadaveric posit<sup>n</sup> of vocal fold on one side
- no problem in breathing
- voice will not improve
- Rx → push the paralytic vocal fold to midline
- U/L vagus Nerve injury [ILN also included]
  - problem of aspirat<sup>n</sup> also present
- Manual Compression test is done
- Type I ISSHIKI THYROPLASTY
  - 4 types - I, II, III, IV present
  - aka - medializat<sup>n</sup> thyroplasty / Approximat<sup>n</sup> Laryngoplasty
  - benefits
    - improves the voice
    - in x Nerve palsy, it prevents aspirat<sup>n</sup>

#### 5. BIL SLN Injury

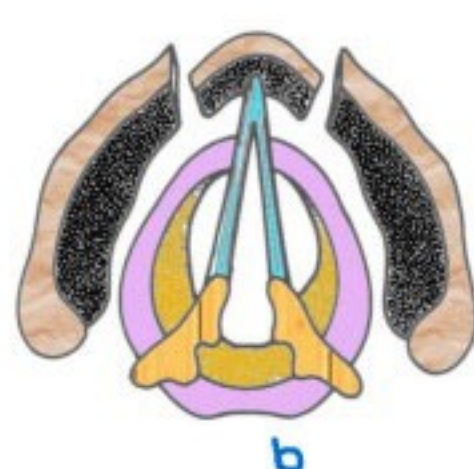
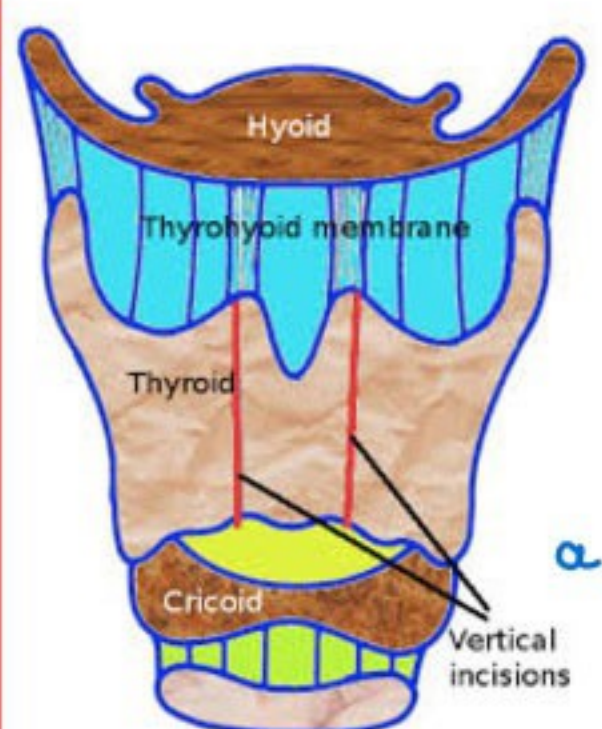
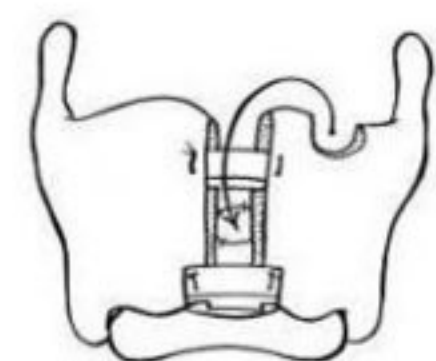
- cough reflex on both sides gone → Aspirat<sup>n</sup>
- Gold std Rx in intractable aspirat<sup>n</sup> → Tracheal Separat<sup>n</sup> & permanent Tracheostomy



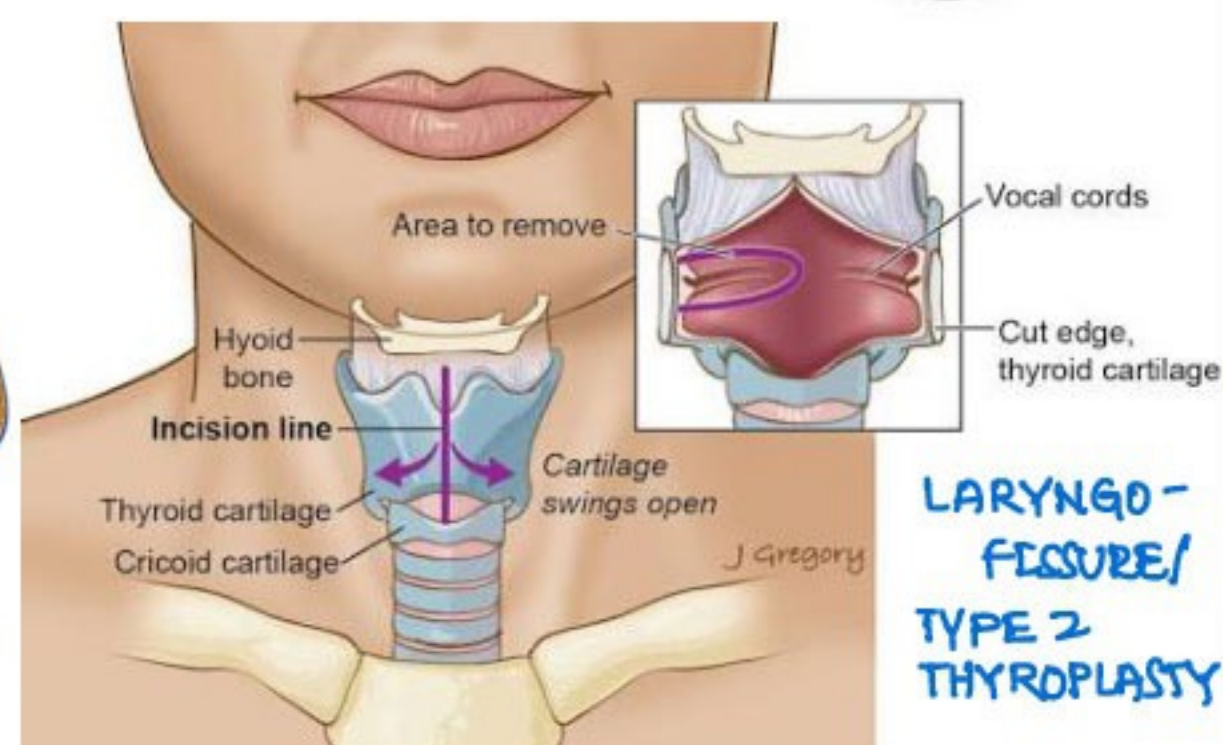


## 6. BIL RLN Palsy / BIL Abductor palsy

- Both vocal cords in para median posit<sup>n</sup>
- Only 2-3 mm airway to breathe
- Biphaseic stridor ⊕
- voice is good
- Rx - Type 2 Thyroplasty / Lateralizat<sup>n</sup> Thyroplasty  
→ Laryngofissure



TYPE 3 THYROPLASTY (a,b,c)



LARYNGO-FISSURE/  
TYPE 2  
THYROPLASTY

## TYPE III THYROPLASTY

- Done for Puberphonia [female like voice in a male]
- GUTZMANN TEST - done to confirm whether the patient will improve [ Type 3 thyroplasty]

## TYPE 4 THYROPLASTY

- Done for Androphonia [male like voice in a female]

