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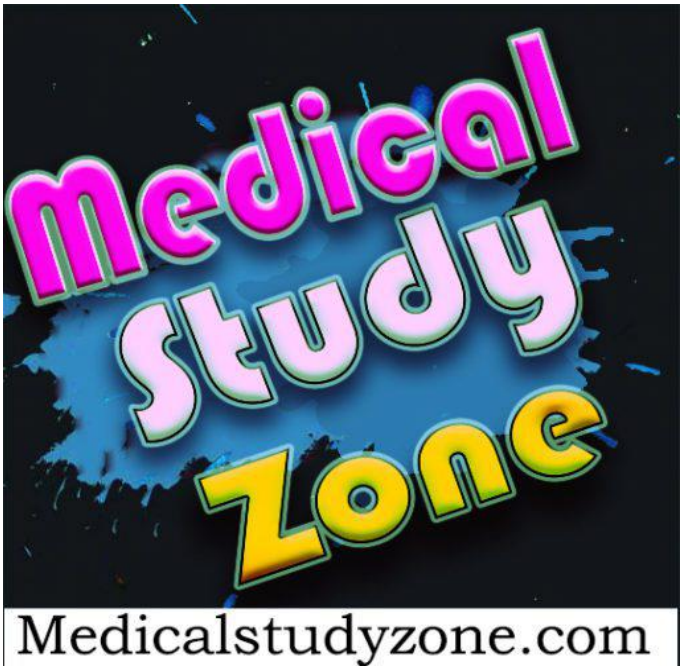


Ear

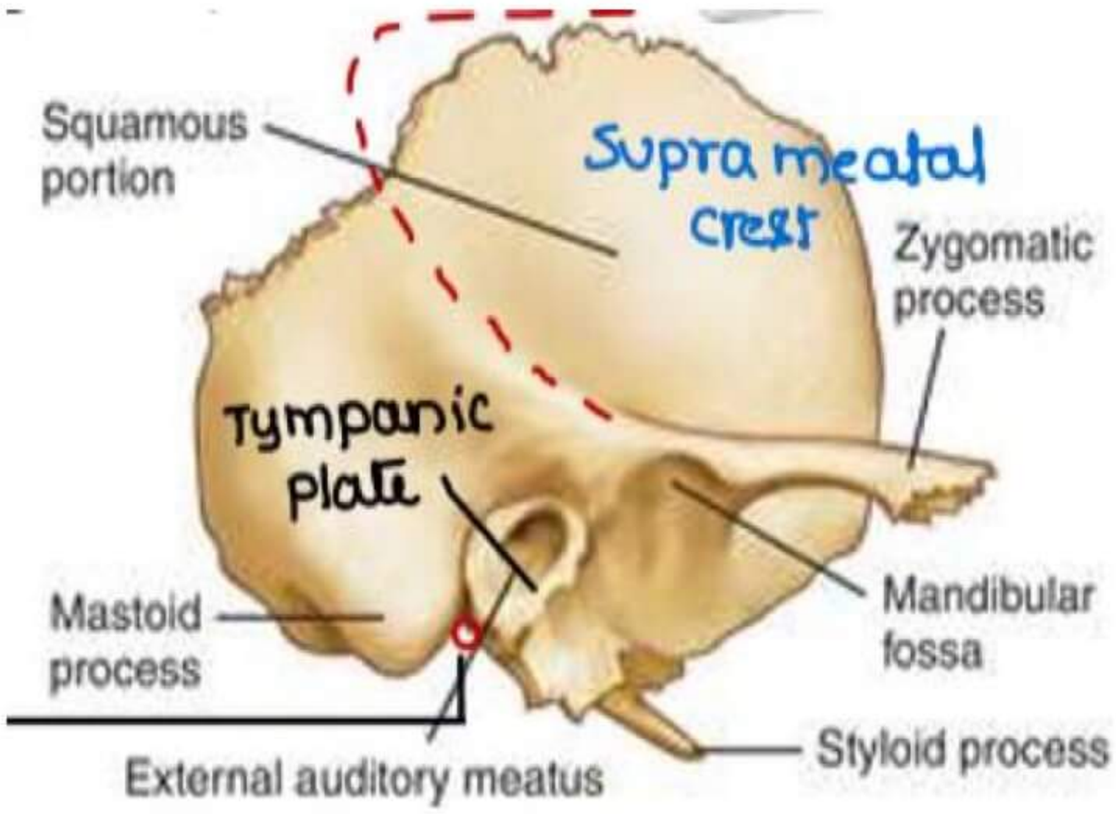
(Fundamentals of Ear)

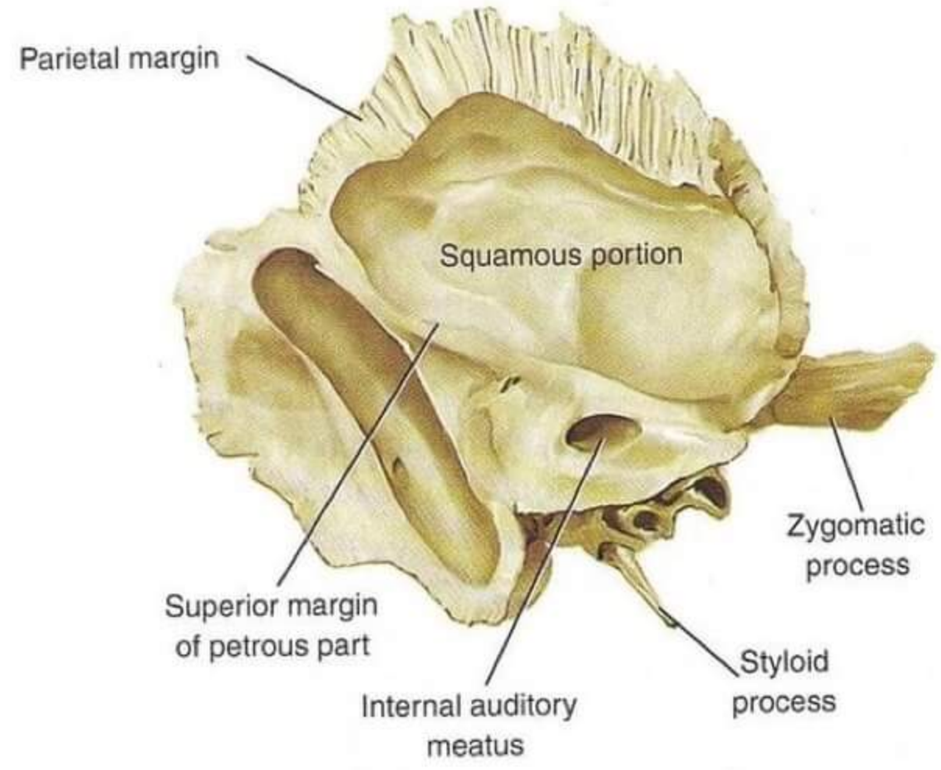
Osteology of Temporal Bone

→ Most complex bone in the body [20 ossification centers]

Parts of Temporal Bone

1. Squamous
2. Petro mastoid { Petrous, Mastoid } Differentiates after birth
3. Tympanic
4. Styloid process





medial view of temporal bone.

→ **Squamous part**
- Covers temporal lobe of brain
- Forms zygomatic process of temporal bone
- Supra meatal crest: Part of inferior temporal line

→ **Mastoid process**
- Starts developing 6 months after birth (Due to pull of Sternocleidomastoid muscle)
- Mastoid tip appears by 2 years of Age
- Reaches adult size by 18-19 years of age
- Cancellous bone: consist of air cells
  - Largest → mastoid antrum
- Antrum is of adult size at the time of birth

→ **Petrous part**
- On medial side of Temporal bone inner ear is present
- Most complex part of Temporal bone (14 ossification centers)
- Densest / hardest bone in body
- Internal Auditory Canal / IA Meatus opens into posterior surface

Contents of Internal Auditory Canal:

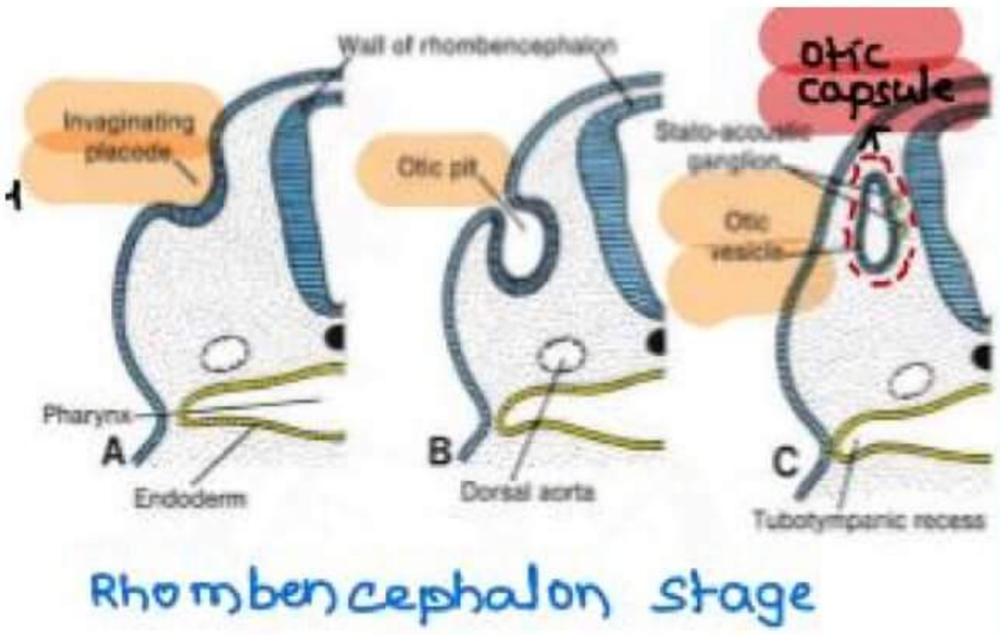
- 7th & 8th cranial nerve
- Labyrinthine artery (**Branch of AICA**)
- Vestibular ganglion (Superior and inferior vestibular nerves)
- Nerve of wrisberg (Nervus Intermedius)- carries sensory and secretomotor fibers for facial nerve

Embryology Of Inner Ear Formation

→ In rhombencephalon stage, near 1st and 2nd Pharyngeal arches there is formation of Otic placode

→ Otic placode formed from surface ectoderm

→ Otic placode converts to Otic pit and leads to formation of Otic vesicle / Auditory vesicle /Otocyst



Rhombencephalon stage

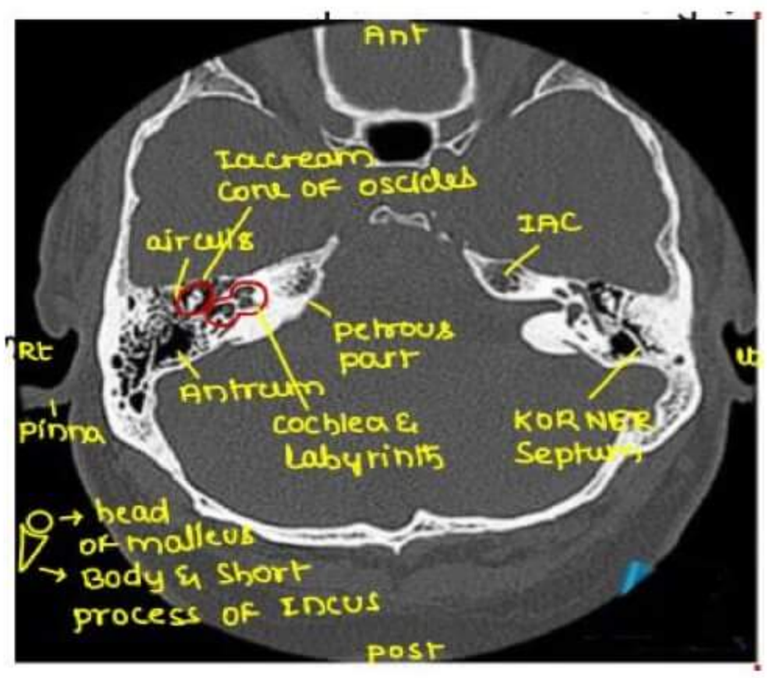
→ Otic vesicle forms →
Membranous labyrinth
(Sensory part of Inner ear)

→ Otic capsule is the embryological cartilaginous structure developed from 2° mesoderm
It is cartilaginous framework for inner ear

Calcifications by → Enchondral Ossification
↓
14 ossification centers
Inner ear [Bony Labyrinth] → Enchondral Bone

→ Stylomastoid foramen
- Facial nerve [VII CN] comes out
- Stylomastoid artery goes in
- Post aural incision is not given to a child < 2yrs of age

→ Between squamous & petrous part, Petro squamous suture present in embryo, disappears after birth
- Koerner's Septum
  - Persistent petro squamous suture
  - Significant in mastoid Surgery
  - Koerner's septum is lateral to antrum

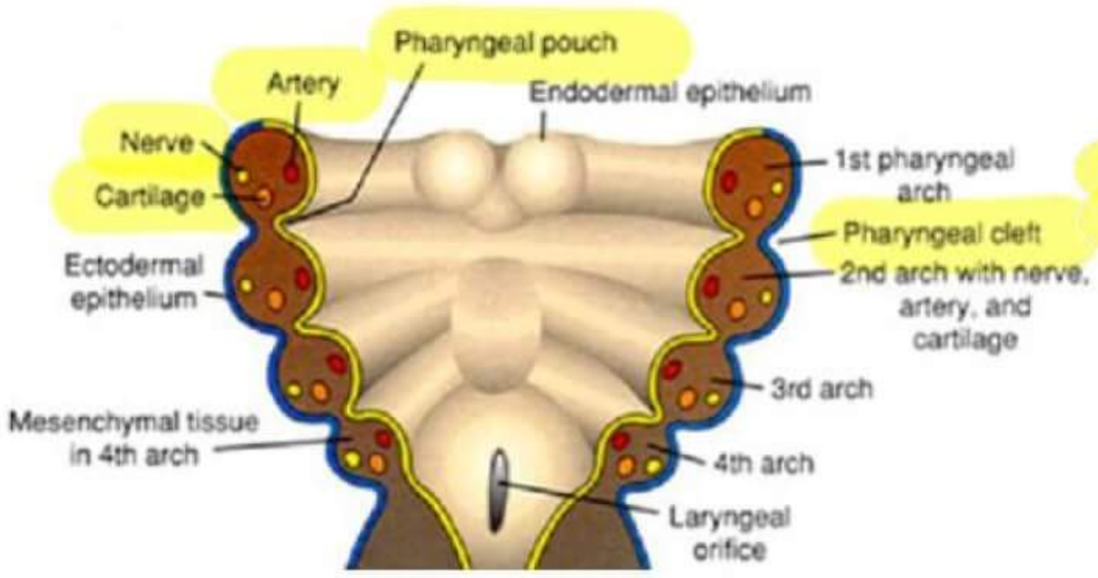


Pharyngeal / Branchial Arches

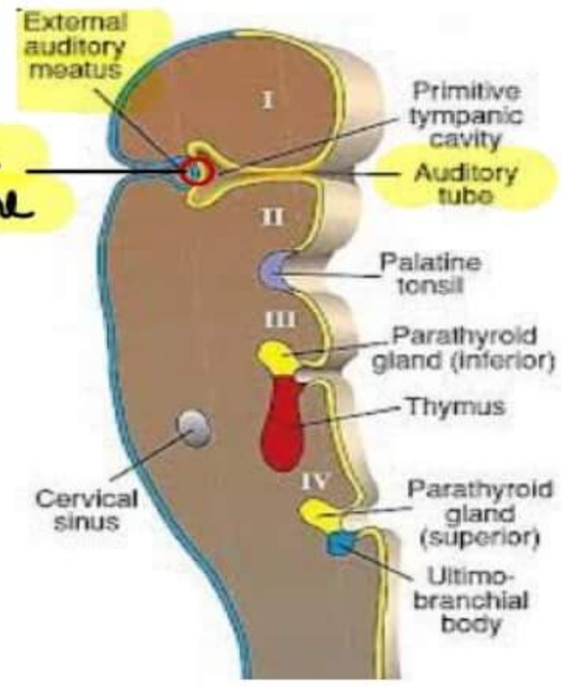
→ 5 on each side [1, 2, 3, 4, 6]

→ All 3 germs layers are present

→ Own blood & nerve supply and forms its own Musculo-cartilaginous structure



Tympanic membrane



→ Structures formed from clefts and pouches

Clefts	Pouches
1st arch – EAC	1st pouch -Tubotympanic recess
2nd to 4th clefts are obliterated	2nd pouch – Tonsillar fossa, Palatine fossa
	3rd pouch – Inferior Parathyroid gland
	4th pouch – Superior Parathyroid gland
	5th pouch – Ultimobranchial body (Parafollicular 'C' cells)

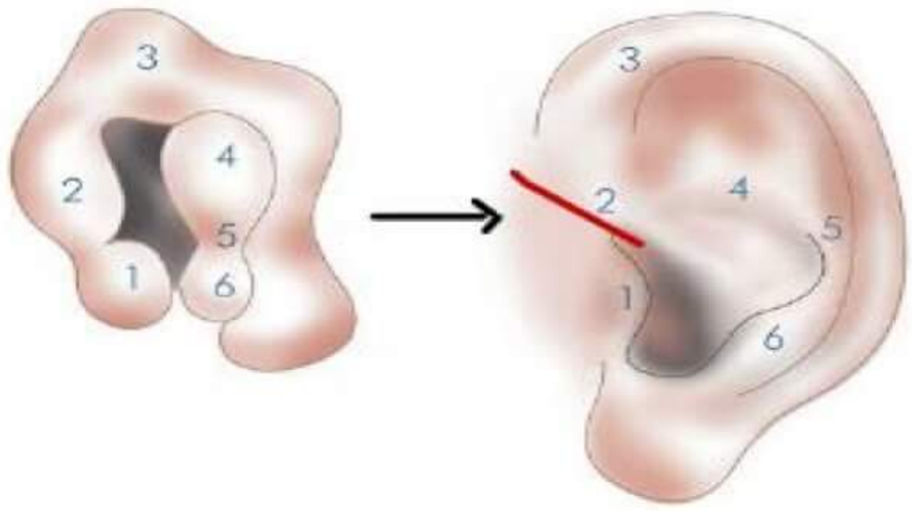
→ Around the EAC, the 1st & 2nd arch forms

→ HILLOCKS OF HIS

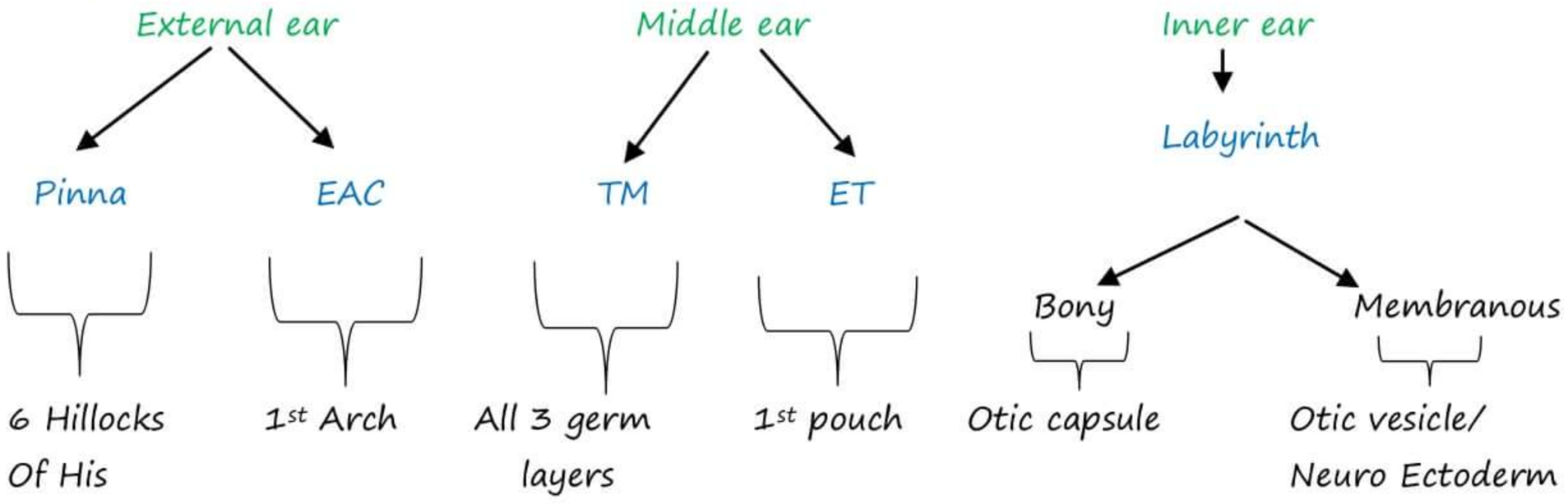
- 1ST HILLOCK forms from 1st arch

  Remaining Hillocks forms from 2nd

- 1st hillocks forms tragus



Embryology Of Ear



Anatomy of External Ear

1) Pinna

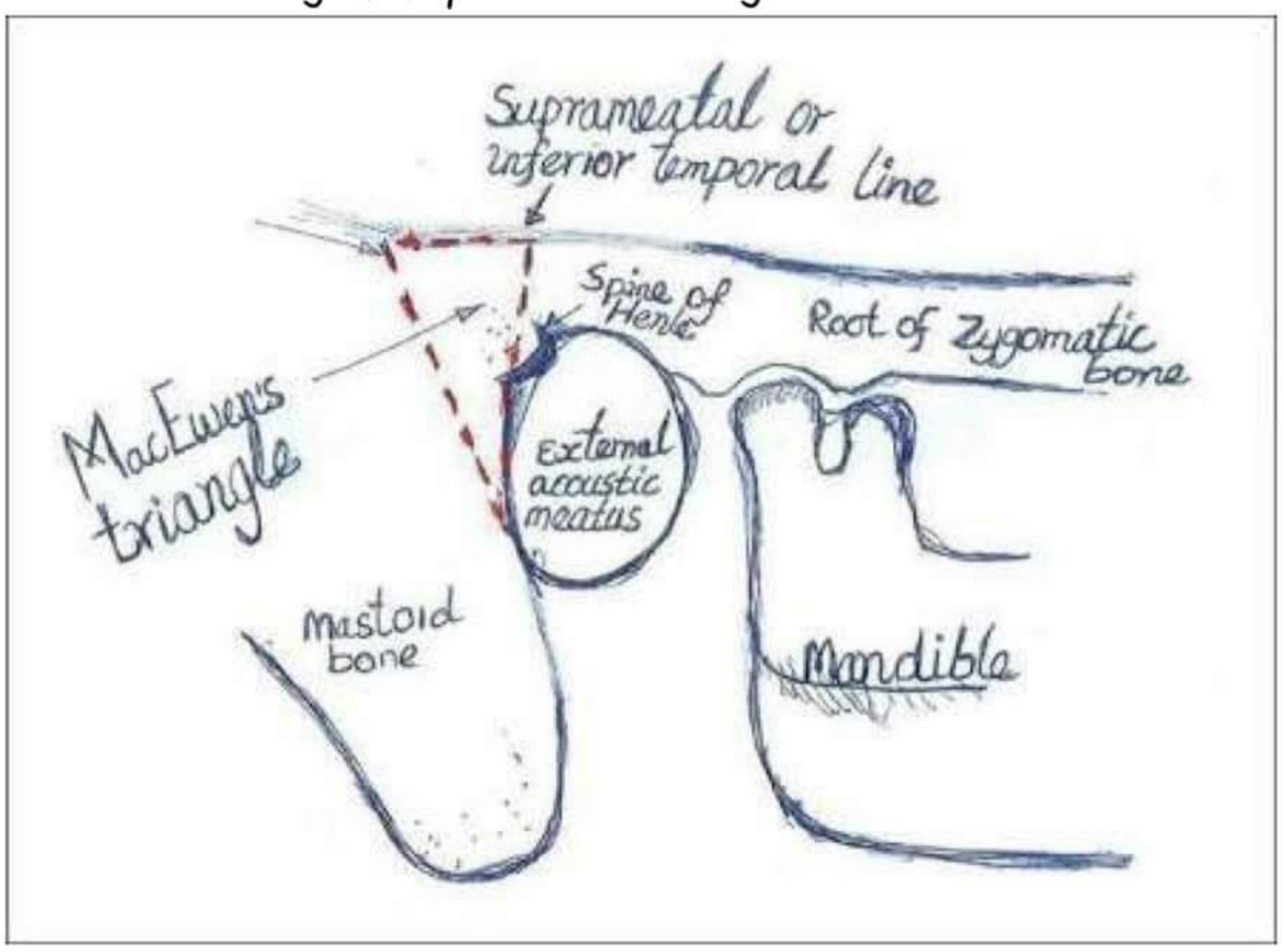
→ Formed from single piece of yellow elastic cartilage expect lobule
- Never ossifies
- Also seen in tip of nose and epiglottis

→ **Incisura Terminalis**
- Place of fusion of 1st and 2nd hillock.
- End-aural approach done by giving LEMPERT'S INCISION here.

(Post aural approach by William Wilde's approach behind pinna
Trans canal approach / Permeatal approach / Endomeatal approach by Rosen's Incision)

→ Cymba concha is the anatomical landmark of mastoid antrum. (Surface Landmark)

MacEwen's Triangle / Suprameatal Triangle



Surgical landmark of Mastoid Antrum

Mastoid antrum is present 1.25-1.5 cm deep to MacEwen`s triangle

Boundaries:

1. Suprameatal crest / Inferior Temporal line
2. Postero-superior wall of EAC
3. Tangent between above (2)

- Antrum is 1.25 – 1.5 cm deep to MacEwan's triangle

2) External Auditory Canal

Length = 24mm

Lateral 1/3rd = Cartilaginous

Medial/Inner 2/3rd = Bony

Isthmus – Narrowest point, 6mm lateral to Tympanic membrane

→ Cartilaginous part → Lateral / outer 1/3rd (8mm) of EAC

→ Cartilaginous part has sweat glands, Sebaceous, Ceruminous glands & hairs

→ Ceruminous glands → are modified sweat gland- secretes cerumen.

Sweat Glands	
Eccrine / Typical	**Apocrine / Atypical (AAA)**
- Present all over the body - Opens on skin surface - Supplied by cholinergic nerve fibers	- Only at axilla, nipple / areola, pubic area, perianal or circumanal area - Open inside hair follicles - Supplied by adrenergic nerve fibers - Modifications Ceruminous – EAC Ciliary (Moll's) glands – Eye lids Mammary glands

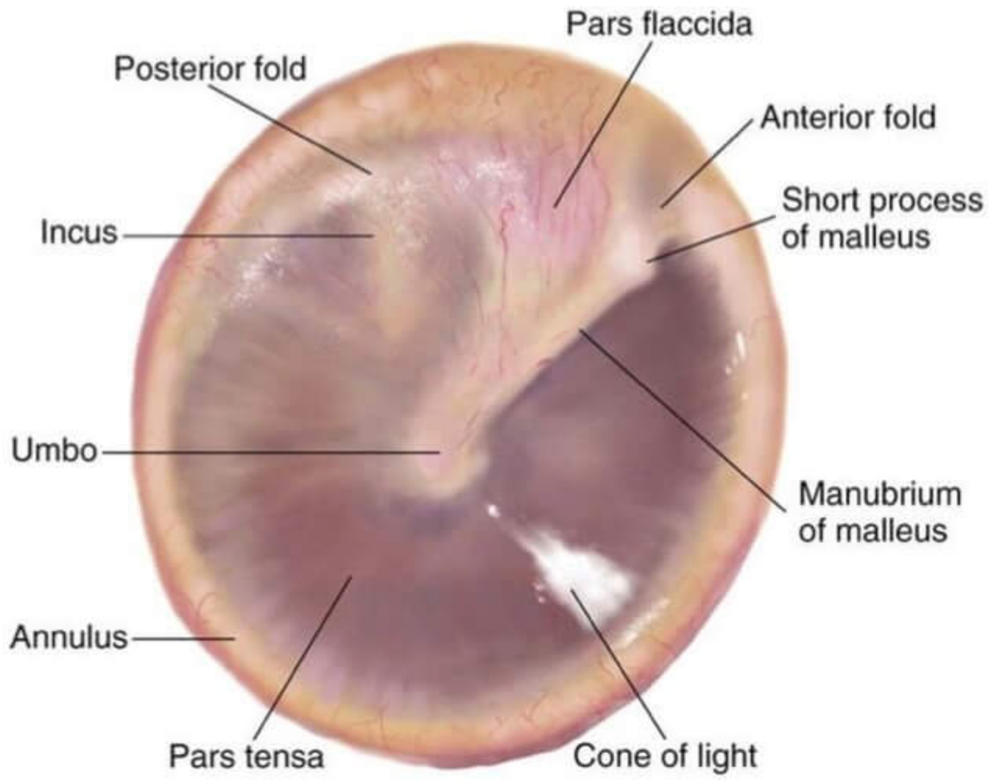
→ All secretory glands in the body are supplied by parasympathetic system expect SWEAT glands (By Sympathetic system)

→ Ceruminous glands secrete cerumen

→ Wax is formed by mixture of all secretions + dead epithelial cells & hairs.

→ Wax has pH of 4

Tympanic Membrane



TYMPANIC MEMBRANE

→ Trimeric structure formed from all three germ layers

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

→ Pearly grey / Translucent grey in color

→ TM is divided into two parts: 1. Pars Flaccida (Shrapnel's membrane)
2. Pars Tensa

→ Fibrous layer is scanty and unorganized in Pars flaccida.

→ Fibrous layer forms Annulus tympanicum.

- It attaches the TM to bony EAC. [Bony annulus]
- Is fibrocartilaginous in nature
- Notch of RIVINUS → Deficiency in bony annulus superiorly covered by P. Flaccida

→ TM is attached at an angle of 55° with Anteroinferior wall of EAC.

- At birth TM is almost horizontal
- At 4 yrs of age it attains 55° angle with Anteroinferior [Floor] wall of EAC
- Anteroinferior wall is longest wall of EAC
- Posterosuperior is shortest wall.

Foreign body in EAC removal

I) Probing

II) Micro forceps

III) Syringing
- Posterosuperior direction
- Water at 37° C
- C/I
  1. FB beyond isthmus
  2. Acute infection of external and middle ear
  3. Big impacted foreign body
  4. Vegetative Foreign body

IV) Micro suction
- Best way of foreign body removal
- Creates negative pressure, minimum damage.

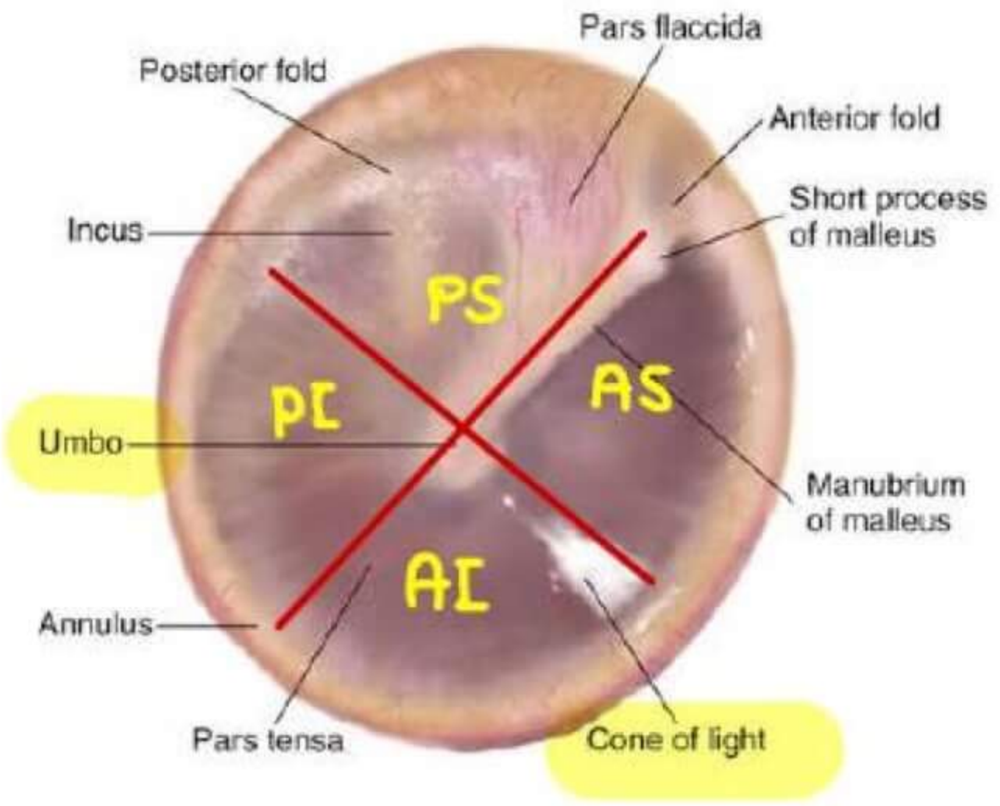
- Removal of live insects: With Lukewarm oil

→ **UMBO**

- Most visible anatomical landmark of Tympanic membrane
- 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

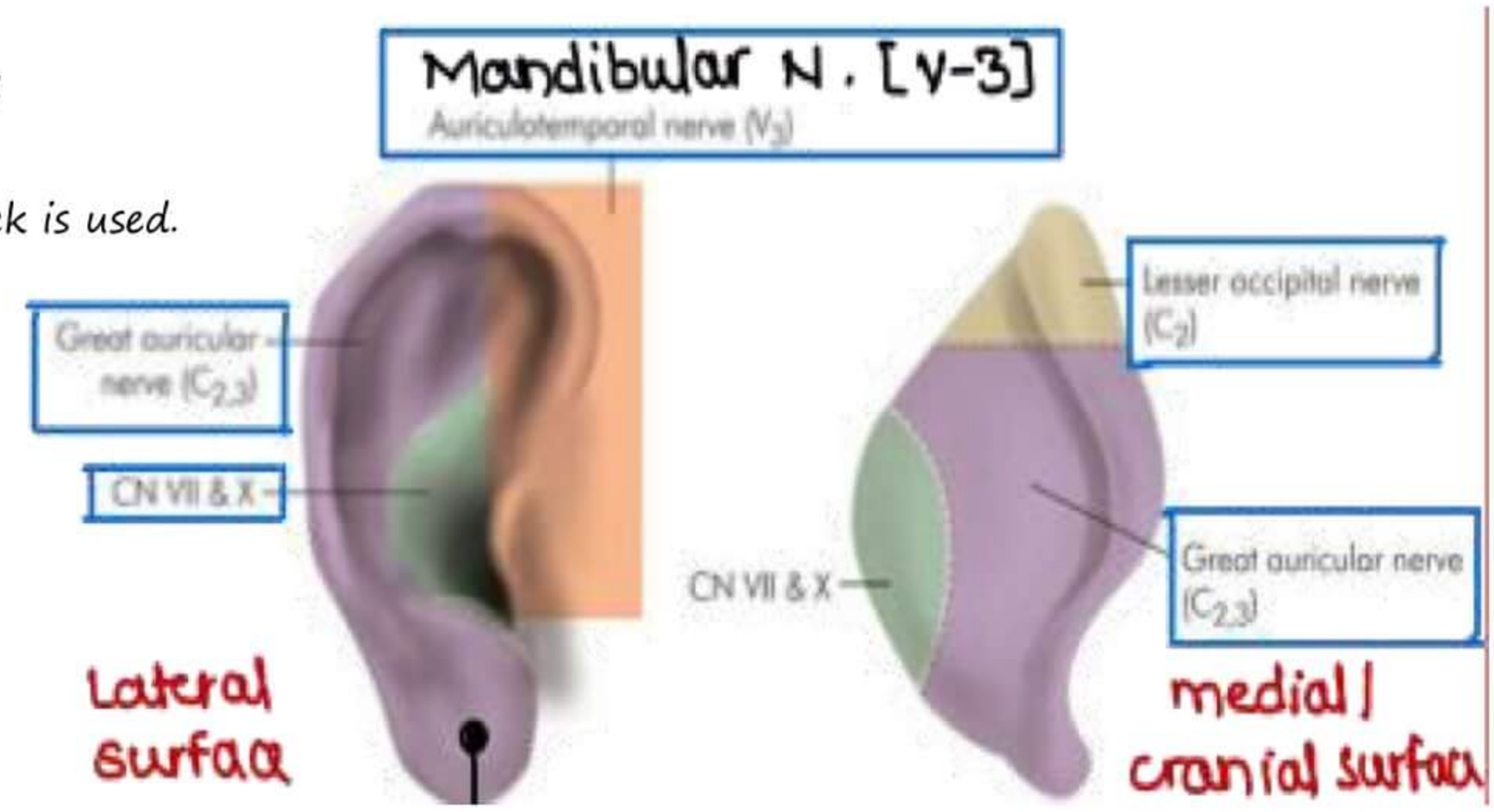
Because pulling of handle of malleus, AI quadrant becomes perpendicular → cone of light.



Nerve Supply to Pinna

→ Split lobule due to Ear piercing

- Rx by Lobuloplasty
  - Greater Auricular Nerve block is used.



Rhytidectomy

→ Removal of rhytids (Facial wrinkles)

→ Incisions done behind pinna and mastoid

→ M/C nerve involved – Greater Auricular nerve

→ M/C motor nerve involved – Zygomatic br. of facial nerve

Rhytidectomy Incision (Facelift Incision)

Nerve Supply to EAC

I) Antero-superior → Auriculotemporal nerve

II) Floor/Antero-inferior → ARNOLD'S branch of Vagus

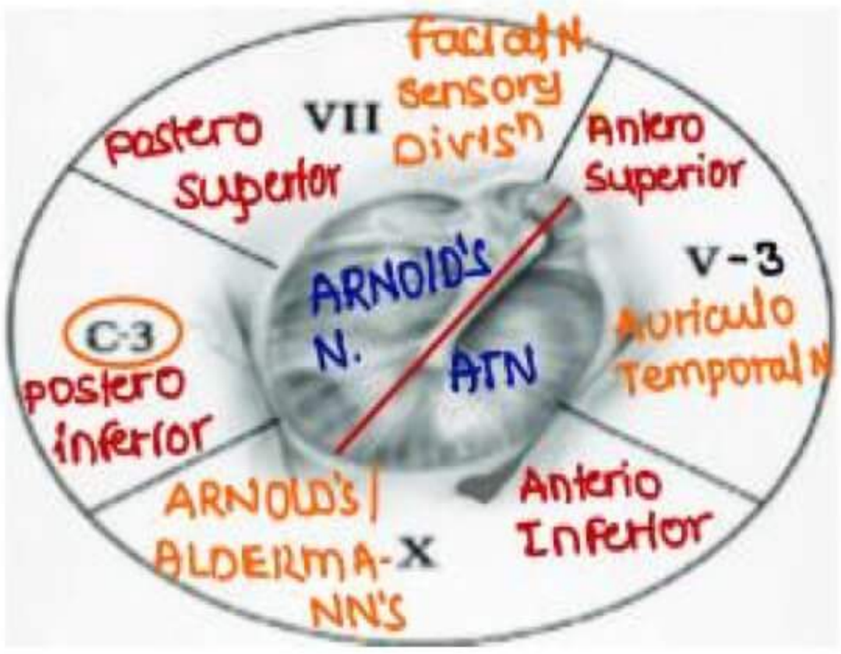
→ Cough reflex is due to Internal laryngeal nerve (Branch of Vagus)

→ Cough reflex during syringing is d/t → Arnold's nerve

III) Posterior-superior → Facial nerve

↓

Loss of sensory sensation in this part → HITZELBERGER sign seen in vestibular schwannoma



Nerve Supply to Tympanic Membrane

Lateral Aspect

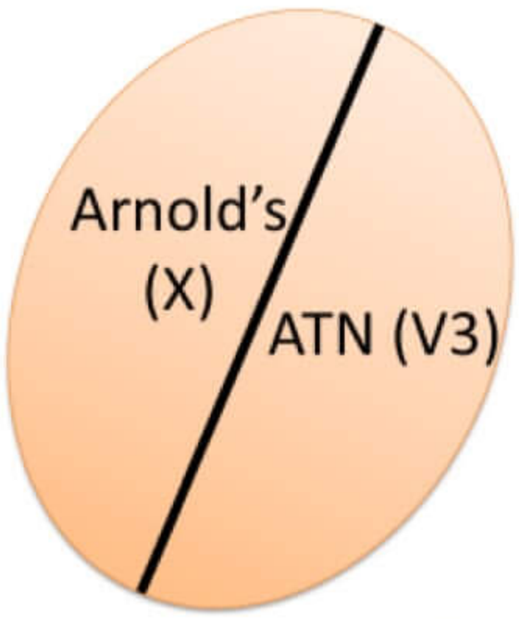
Anterior half - Auriculotemporal Nerve

Posterior half – Arnold's Nerve

Medial Aspect

Jacobson's nerve (Branch of CN)

[Sensory supply to middle ear also.]



Lateral Aspect

Medial Aspect

Diseases of External Ear

Congenital Disorders

Anotia/Microtia

→ Anotia → Absent pinna → R_x → Pinnaplasty

→ Microtia → Small pinna → R_x → Pinnaplasty

→ Pinnaplasty

- Done by rib / costal cartilage
- Rib cartilage develops by 4-5 years of age
- Pinnaplasty done at 5-7 years age.

Anotia

Microtia

EAC Atresia

→ Defect in 1ST Arch

→ R_X → Canaloplasty

→ U/L EAC Atresia + Anotia

Rx- Pinnaplasty first then Canaloplasty

→ B/L EAC Atresia + Anotia

Rx → BAHA (Bone Anchored Hearing Aid)

- Titanium screw has Osseo-integration property
- Requires 2.5 – 3 mm bone thickness achieved around 5 yrs of age

FDA norms → Can't implant < 5yrs

NHS norms → Allow after 3 years after doing CT scan [2.5 mm ⊕]

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

EAC Atresia

BAHA

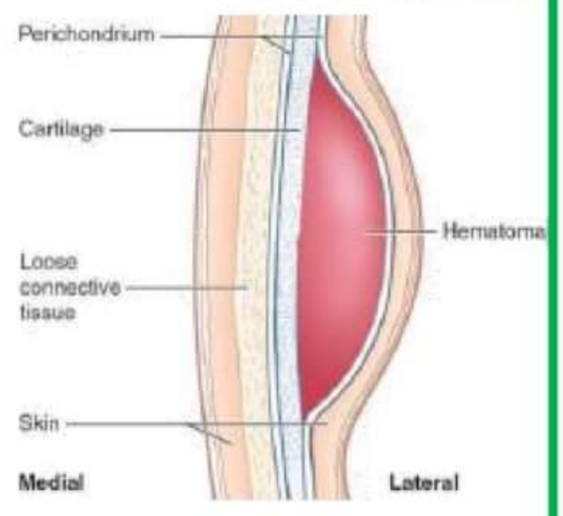
Trauma

PINNA HEMATOMA (CAULIFLOWER EAR / BOXER'S EAR)

→ Due to blunt trauma to pinna

→ Collection of blood between cartilage and perichondrium

→ R_X → needle aspiration pressure dressing



Cauliflower Ear

Perichondritis of Pinna

M/c causative organism → Pseudomonas

R_x → 1. Ciprofloxacin (Antibiotic of choice)

2. Analgesics

3. Incision and Drainage

Perichondritis of the Ear

Keratosis Obturans

→ Deposition of wax along with dead epithelial cells in EAC

→ Can erode the bone & can even cause facial palsy

ACUTE OTITIS EXTERNA / TROPICAL / SWIMMER'S EAR

→ Acute infection of EAC

→ More common in hot and humid climate

→ Types

- Localized / Furunculosis
- Diffuse

→ Localized / Furunculosis

- Staph. aureus infection of hair follicles → furuncle
- Localized to outer 1/3rd
- Obliteration of post. aural groove [Furuncle on posterior wall]

FURUNCULOSIS

DIFFUSE

→ Diffuse

- Mc causative organism → Pseudomonas

Presentation: Severe pain/ excruciating pain

O/E: Tragal sign → POSITIVE

Patient moves always when pressure is applied on tragus
Present in both localized & Diffuse Otitis externa

→ Rx

- Antibiotics
- Analgesics
- 10% Ichthammol glycerin packing

Ichthammol → Local antiseptic
Glycerin → Hygroscopic

A. niger

A. fumigatus

candida albicans

Otomycosis (Singapore Ear)

→ Fungal infection of EAC

→ Causative organism

Aspergillus Niger (M/C) - Forms black colonies
Aspergillus Fumigatus – Forms green colonies
Candida albicans - Forms white cottony colonies

→ Severe itching present, ↓ Hearing, discharge, mild pain.

→ O/E → Wet blotting paper appearance of TM

→ Rx → Aural toilet by micro suction

Topical antifungal ear drops × 4 weeks
Keratolytic agents → Salicylic/ Acetic Acid

Gentian Violet → Prevent biofilm formation

SODIUM BICARBONATE DROPS NOT USED

Exostosis (Surfer's Ear)

→ Benign growth of bony EAC

→ Found mainly in surfers

→ Broad based, multiple growths

→ Way of body defense mechanism

MYRINGITIS BULLOSA HAEMORRHAGICA (BULLOUS MYRINGITIS)

→ Formation of bleeding blebs on TM

Blood mixed discharge present, painful & ↓ hearing

"Sago-grain appearance of TM" in healing phase.

→ Caused by pneumococcus (Streptococcus pneumoniae)

{Earlier believed d/t Virus/ Mycoplasma}

→ R_X – Topical antibiotics+ topical steroids ear drops

MALIGNANT OTITIS EXTERNA / ACUTE NECROTISING OTITIS EXTERNA

Term Malignant → Misnomer (Mitotic figures are not high)

Caused by "Pseudomonas Aeruginosa"

→ Rapidly spreading in (Predisposing factor)

I) Immunocompromised patients

II) Elderly uncontrolled diabetics

III) Chemotherapy

C/F – Pain, greenish black discharge

O/E: Granulations in EAC

It spreads to Skull Base: Lateral skull base osteomyelitis

- Multiple CN palsies (M/C CN involved is facial nerve)
- Spread to skull bone through Fissures of Santorini in cartilaginous part of EAC

{In bony EAC via Foramen of Huschke (Closes by 4yrs of age)

In floor → cause parotitis in < 4 yrs of age}

Investigation

- Confirmed by bone scan (Tc -99m)

(Diagnostic, IOC – Specific)

→ R_x

→ DOC is Ciprofloxacin

Anti-pseudomonal antibiotics

I) Ceftazidime } 3rd gen Cephalosporins

II) Cefoperazone + Sulbactam

III) Piperacillin + Tazobactam

IV) Carbapenem → Imipenem, Meropenem

→ After 6 weeks, check ESR → (N) → Discharge with Tab. Ciprofloxacin [Double dose]

Gallium scan [Ga-67] [Prognostic Investigation of Choice] – Non specific

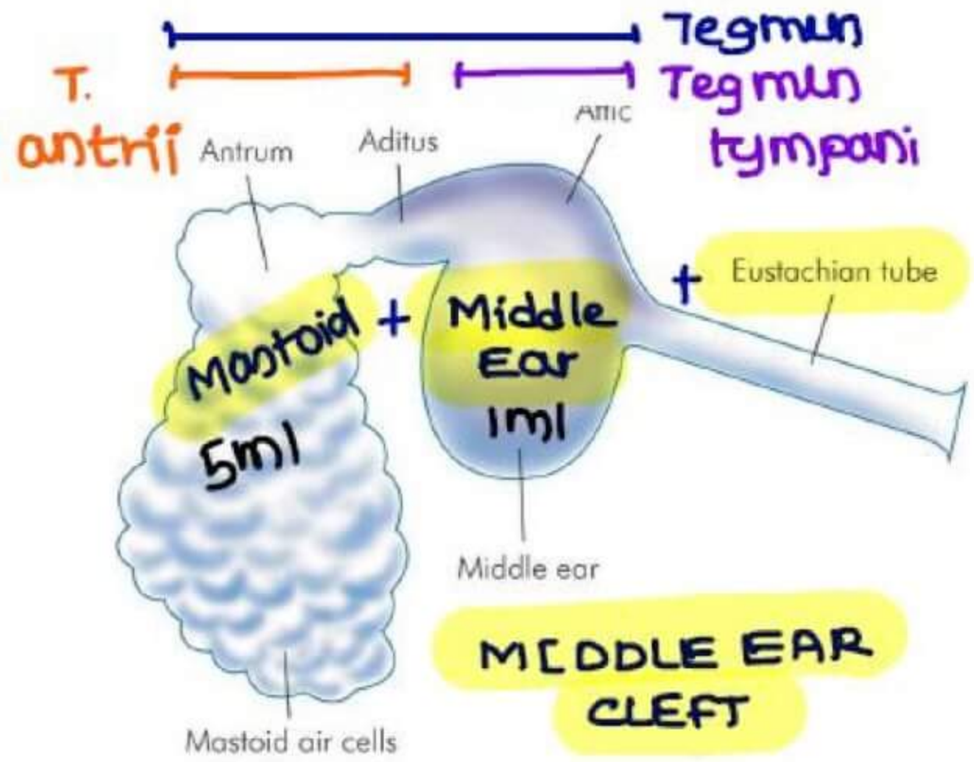
Anatomy of Middle Ear

Middle Ear Cleft

→ Mastoid + Middle ear + Eustachian tube

→ Volume = 5ml (Mastoid) + 1 ml (ME) → 6ml

Eustachian tube is closed in resting position



Middle Ear

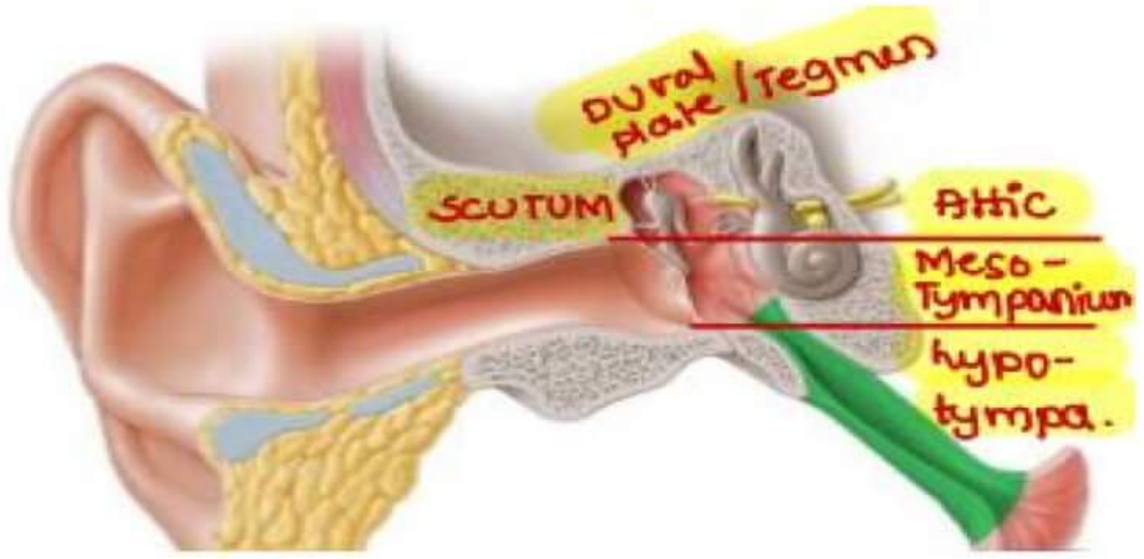
→ **Lateral wall** formed by Tympanic Membrane

→ TM divides middle ear into

I) Epitympanum/Attic

II) Mesotympanum: Narrowest part

III) Hypotympanum



→ Bony lateral wall of Attic → Scutum

- Erosion of scutum is characteristic CT scan finding of cholesteatoma.

→ **Roof** separates ME from Middle cranial fossa.

→ Bony plate above the Middle ear & Mastoid – TEGMEN / DURAL PLATE.

Part above the ME – Tegmen Tympani.

Part above the antrum – T. Antri.

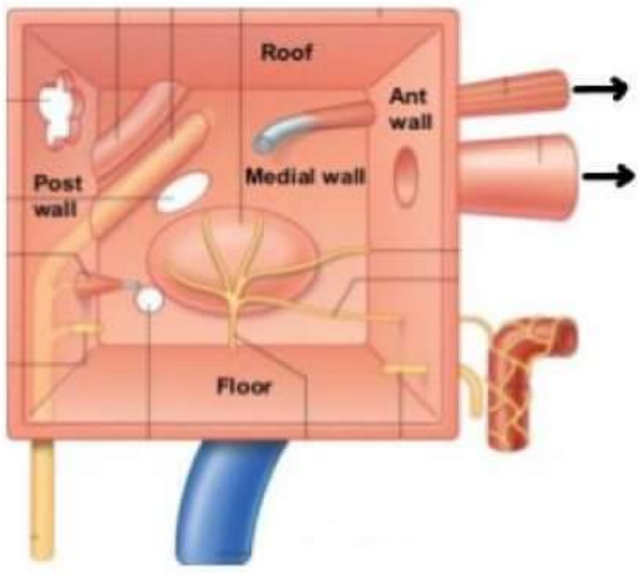
→ Aditus connects ME/Attic to antrum.

→ Arcuate Eminence

Bulge in Tegmen due to superior semicircular canal

Landmark for Facial Nerve in Middle Cranial Fossa Approach

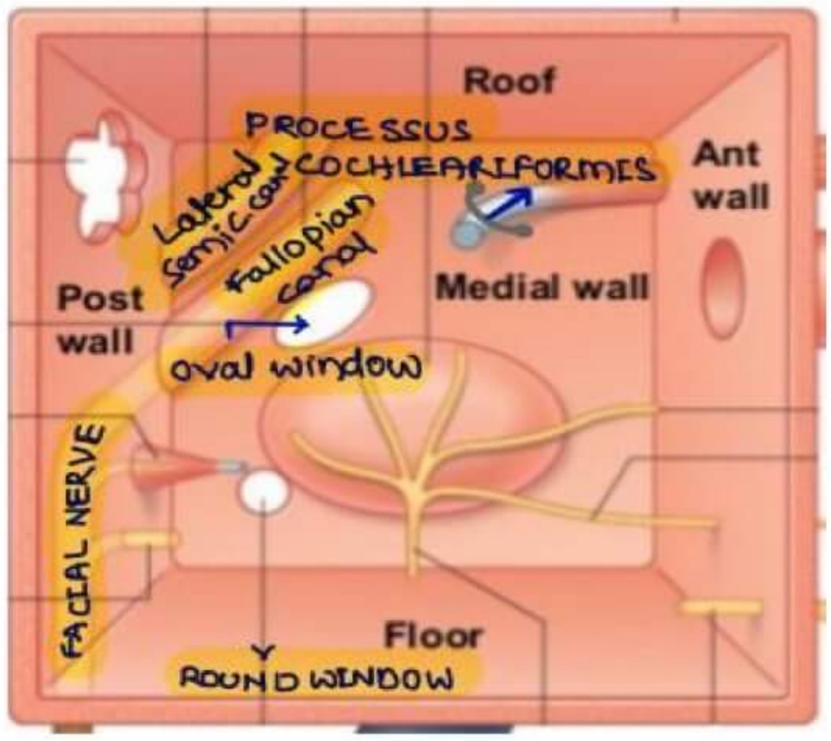
→ **Anterior wall** has 2 openings for



1. Tensor tympani (upper small opening)
2. Eustachian tube / Auditory tube (Lower big opening)

→ Medial wall → Has 2 windows

1. Oval window / Fenestra Vestibuli
2. Round window / Fenestra Cochlea



→ Oval window is covered by Foot plate of stapes.

→ Round window by secondary tympanic membrane

→ Processus cochleariformis is a hook

- Tensor Tympani hooks around Processus cochleariformis and comes out and attaches to handle of malleus.
- Tensor tympani and Tensor veli palatini both supplied by Mandibular nerve (br. of Trigeminal nerve)

→ Horizontal / Tympanic segment of Facial nerve present in fallopian canal (Intra Temporal part) (Bony canal)

→ Fallopian canal is longest canal for any cranial nerve.

Length = 27 mm

Above it dome of lateral semicircular canal is present.

M/c site of labyrinthine fistula → Dome of lateral SC canal

→ Promontory - Outward bulge due to 1st turn / Basal turn of Cochlea.

→ Narrowest part of ME - Mesotympanum

→ Surgical floor of ME - Medial wall

→ Shallowest part of Middle ear in Surgical position - Meso tympanum

→ Posterior wall

→ Vertical segment / Mastoid segment of facial nerve present.

→ Pyramid → From pyramid, arises stapedius (Smallest named muscle in body), goes and attaches neck of stapes.

→ Opens into mastoid through Aditus.

→ Chorda Tympani Nerve - Branch from Mastoid segment, hangs like a cord in the ME, and exits from anterior wall through Canal of Huguier

→ Facial Recess [2D area]

- Lateral to Facial Nerve
- Boundaries

  Medial → Facial N

  Inferior → Chorda Facial angle
- Significance – Site for posterior tympanotomy [Opening the ME from Mastoid]

→ Sinus Tympani [3D space]

- Lies medial to Facial Nerve, hidden place in Middle ear
- Boundaries

  Lateral → Facial nerve

  Posterior → Posterior wall

  Medial → Medial wall

  Ponticulus – Superior bony ridge

  Subiculum – Inferior bony ridge
- Mc site for recurrent/ residual cholesteatoma

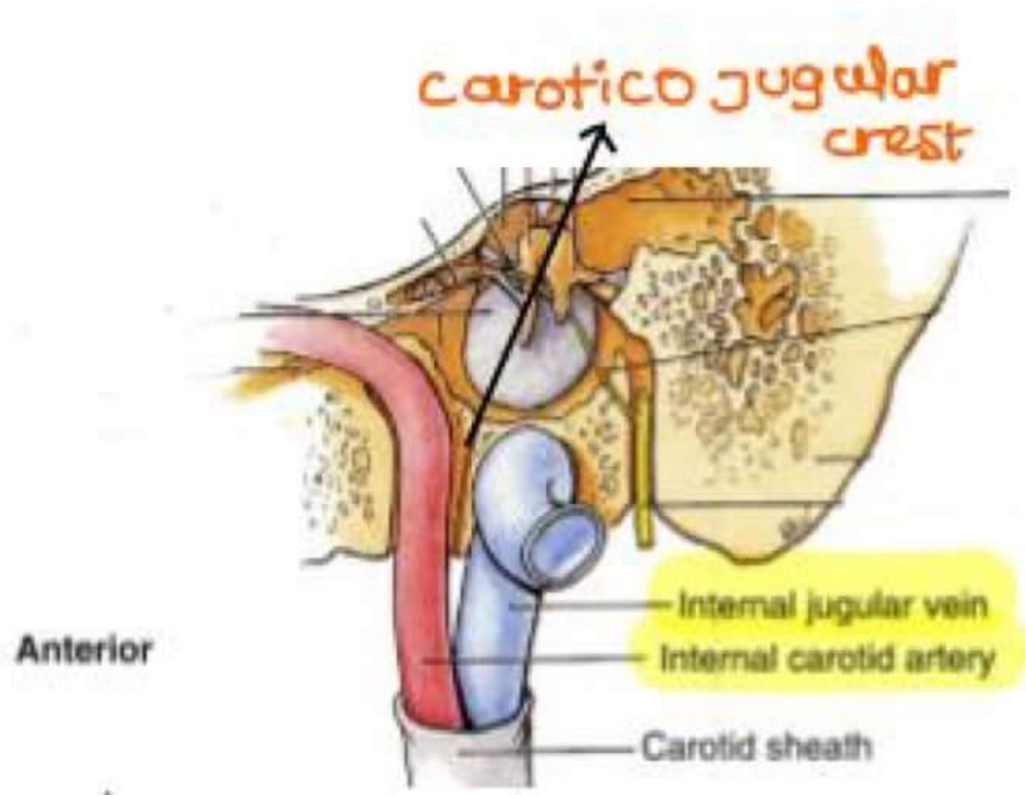
→ Floor

→ Separates ME from jugular bulb and ICA.

→ Carotico Jugular Crest

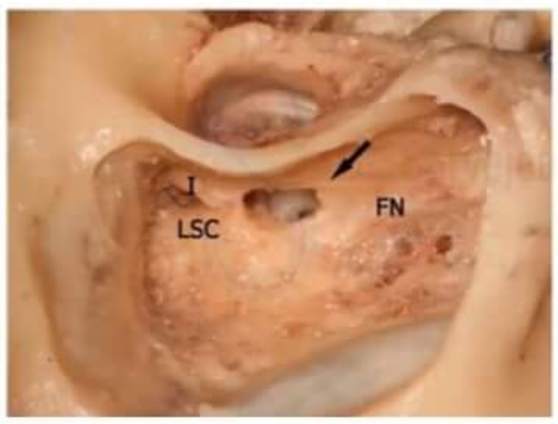
- ICA present anterior to it
- Jugular bulb present posterior to it.
- Helps in distinguishing b/w ICA & Jugular bulb

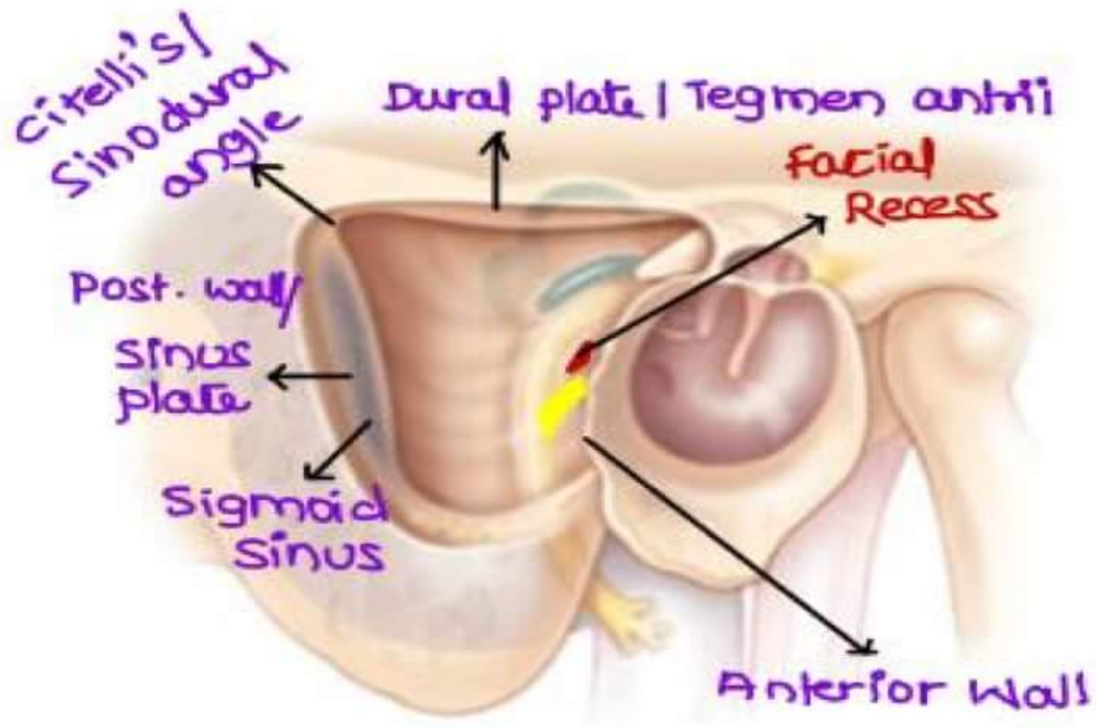
PHELP SIGN: In ability to distinguish b/w ICA & Jugular bulb d/t erosion of Carotico jugular crest Seen in CECT scan of Glomus tumor



Mastoid Process

Posterior Tympanotomy





→ TRAUTMANN's Triangle

→ Boundaries

Anteriorly → Bony labyrinth

Posteriorly → Sigmoid sinus

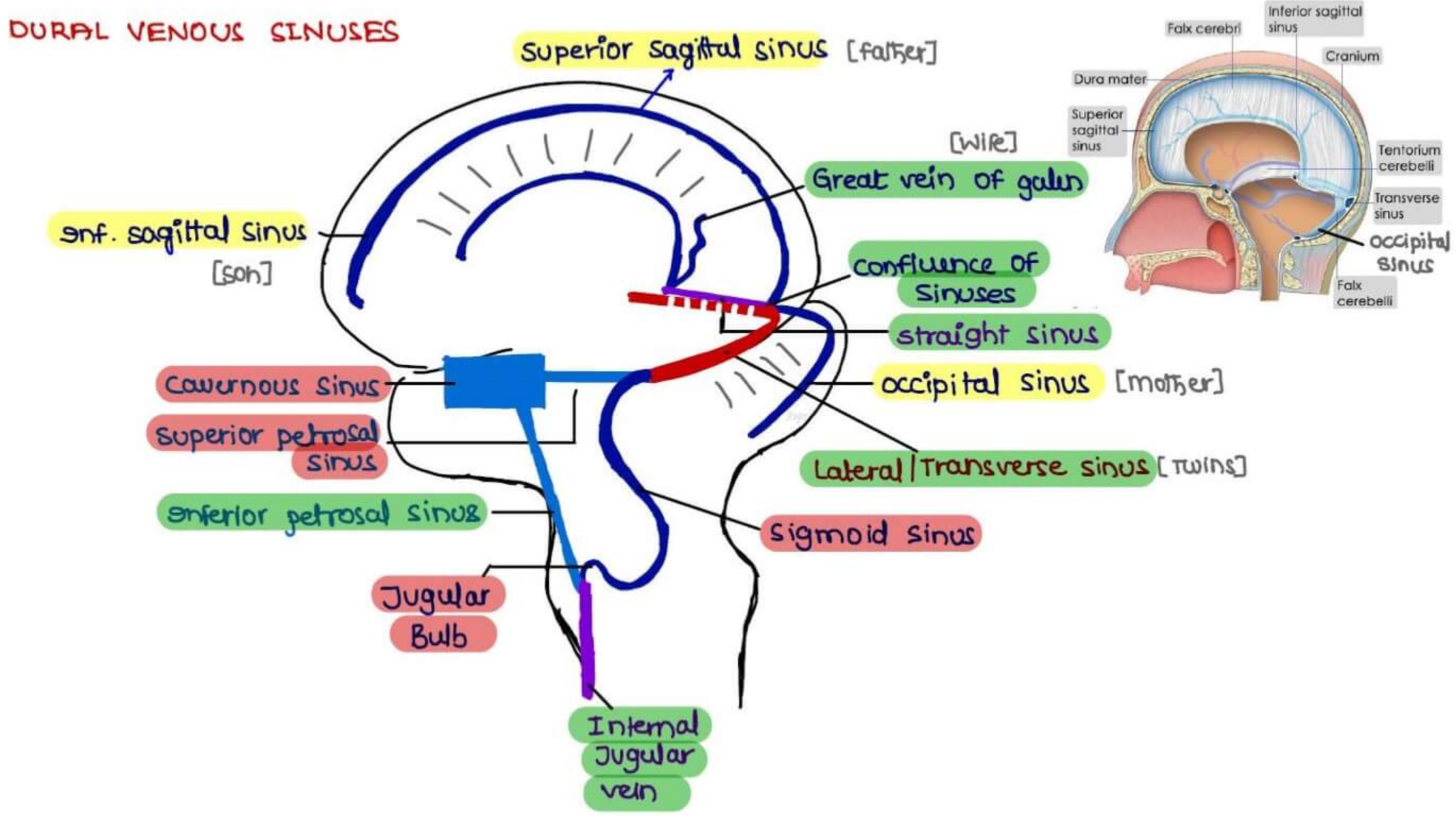
Superiorly → Superior Petrosal sinus

→ Cholesteatoma erodes the bone and goes into posterior cranial fossa from here.

→ Donaldson's line is a surgical landmark for endolymphatic sac

- It is a line that goes along the lateral semicircular canal, bisecting posterior semicircular canal
- Endolymphatic sac is situated just below this point where the line meets the sigmoid sinus

Dural Venous Sinuses



Contents of Middle ear

1) 2 Muscles

- Tensor Tympani

Origin → At canal for Tensor Tympani

Insertion → Handle of Malleus

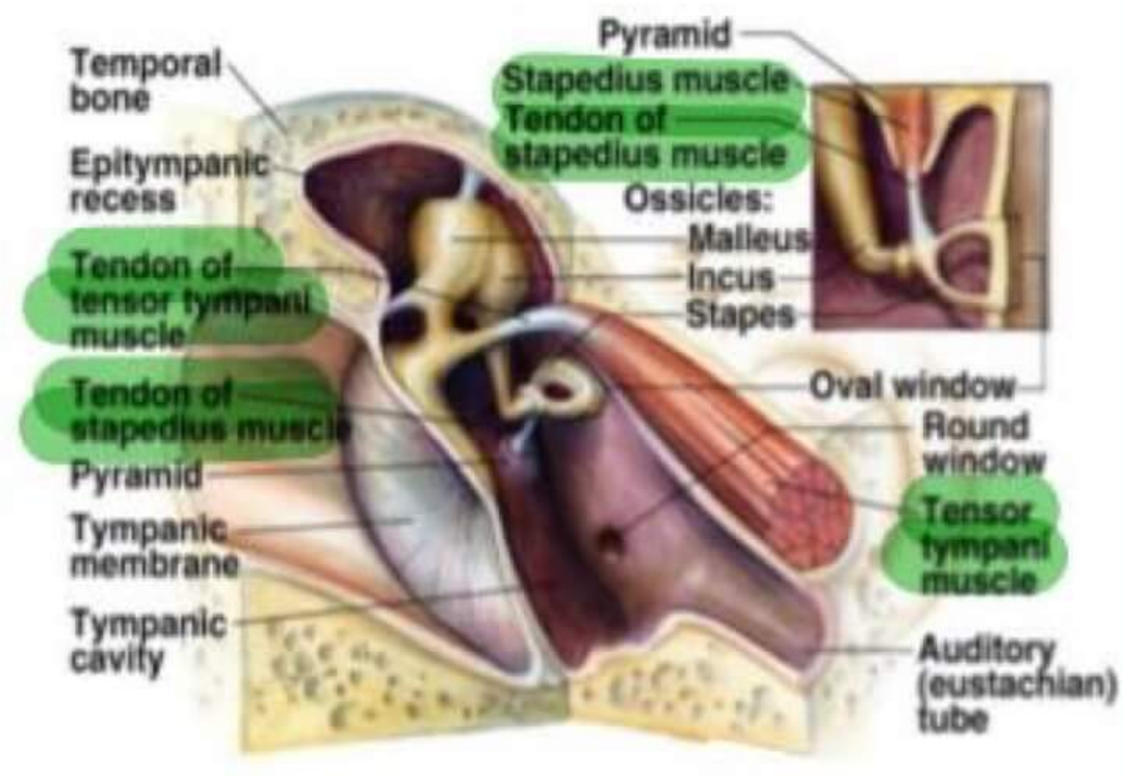
Nerve supply → Mandibular nerve

- Stapedius

Origin → Pyramid

Insertion → Neck of stapes

Nerve supply → Facial nerve



2) 3 Ossicles

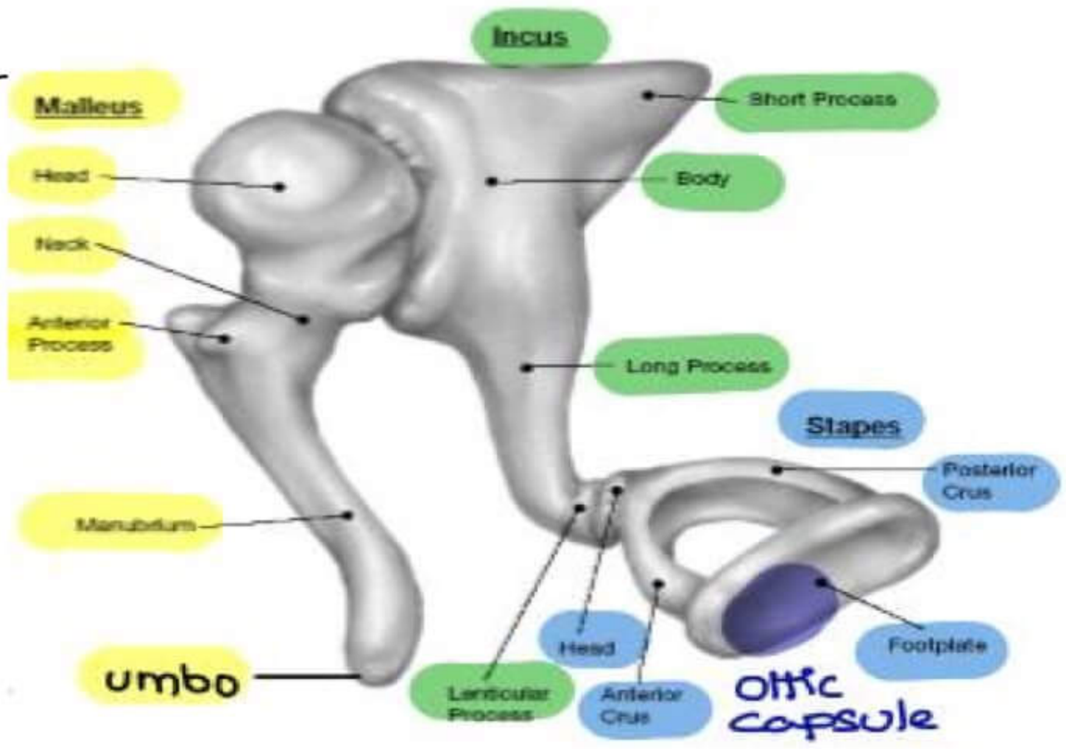
- Malleus and Incus formed by (I) Mandibular arch → Meckel's cartilage
- Stapes by (II) Hyoid arch, expect the medial surface of stapes foot plate (From otic capsule)

Ossicles reach adult size at → 15 weeks of IUL

Adult configuration at → 20 weeks of IUL

Organ of Corti starts hearing at → 20 weeks of IUL

Organ of Corti adult configuration → 25 weeks of IUL



→ Structure attaining adult size at the time of birth

I) Ossicles

II) ME/Tympanic cavity

III) Cochlea/labyrinth

IV) Mastoid Antrum

Mastoid process/ Maxillary Antrum/ Orbital Cavity: Not of Adult Size

Types of Joints of Ossicles → Synovial joint

B/w Malleus & Incus → Saddle type

B/w Incus & Stapes → Ball & socket type

M/c or 1st part to be eroded → Lenticular process of stapes

2nd M/c part to be eroded → Long process of Incus

Last to undergo erosion is → Foot plate of Stapes

EUSTACHIAN TUBE

→ Eustachian tube / Auditory tube / Pharyngo tympanic tube

Connects anterior wall of middle ear to lateral wall of nasopharynx.

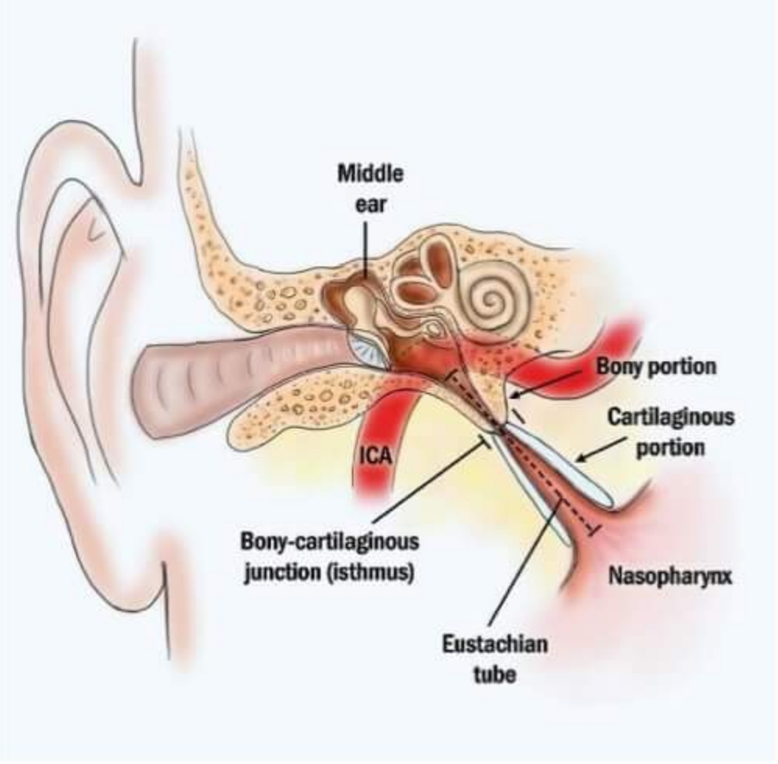
36 mm length

Lateral 1/3rd is bony – 12 mm

Medial 2/3rd is cartilaginous – 24 mm

Isthmus → Narrowest part of ET, lies at bony cartilaginous junction

Lies at an angle of 45° with horizontal



Functions

1. Maintains the Middle ear air pressure = Atm. air pressure
2. Drains the secretions of ME
3. Prevents infections from going to Middle ear
   - Generally, ET is closed by OSTMANN's PAD OF FAT
     - During swallowing / yawning, it opens b/c of medial fibers of TENSOR VELI PALATINI [Dilator tubae]

INFANT ET	ADULT ET
- 16-18mm in length	- 36mm in length
- Almost horizontal	- At an angle of 45° with the horizontal

Eustachian tube function tests:

Passive test or non-physiological tests: Tensor veli palatini is not involved in it.

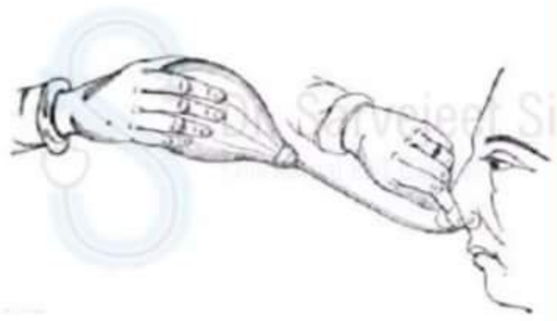
1. **Valsalva test/maneuver:**

   Principle- Positive pressure in the nasopharynx causes air to enter the eustachian tube and reach middle ear which causes pop up sound d/t bulging of TM.

   TM Movement can also be seen by examiner with otoscope

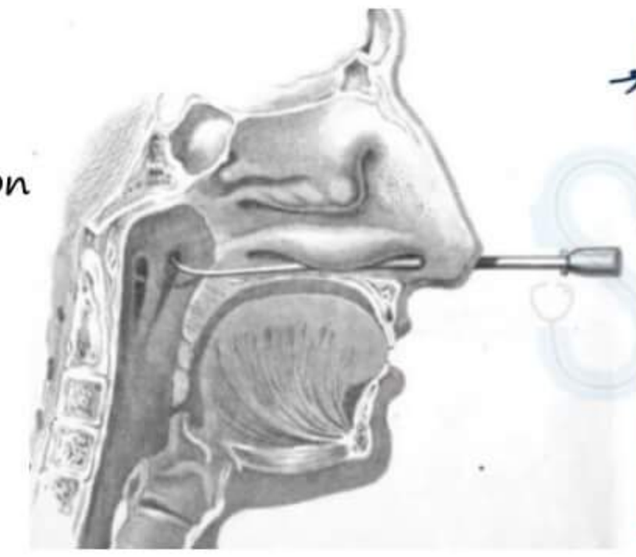
2. **Politzer test:** designed for those who can`t perform Valsalva test eg. Children

- Politzer bag is connected to rubber tube
- Tube is placed in one nostril and other is closed
- Air is blown with pressure by pressing the bulb
- Air enters nasopharynx → opens eustachian tube & enters middle ear→ pops out TM



3. **E.T. Catheterization:**

   Done using ET Catheter- curved tube/catheter with ring attached which tells about the direction of curve



ET catheter is inserted into nose and nasopharynx

↓

rotated by 90° to medial side and pulled back

↓

catheter engages behind nasal septum

↓

now catheter rotated at 180°

↓

enters eustachian tube

↓

air blown using syringe or Politzer bag

↓

air will enter middle ear and pops out TM

↓

Can be seen using otoscope or pt. informs pop up sound in ear

Active test or Physiological test:

1. **Toynbee test:**

Ask the pt. to close the nose and swallow small amount of liquid

↓

Negative pressure is created in nasopharynx

↓

Eustachian tube opens up d/t action of Tensor veli palatini

↓

Air is sucked out of middle ear

↓

TM gets retracted

↓

Movement can be seen with otoscope by examiner

2. **Tympanometry:**

A.k.a. Inflation Deflation test

Tympanometry device can measure the pressure changes in EAC

It has 2 parts: 1st is non physiological and 2nd is physiological

a. Device is placed in EAC and pt. is asked to perform Valsalva

↓

Air enters middle ear and TM bulges out

↓

Pressure in EAC rises and is noted

b. Deflation part of test is done using Toynbee test

↓

Pt. is asked to swallow against closed nose

↓

Negative pressure is created in nasopharynx

↓

Air moves out of middle ear

↓

TM gets retracted and pressure can be measured

Test for perforated Tympanic membrane

1. **Radiological test:** Instill radio-opaque dye into middle ear against perforated TM

↓

Take x-ray

↓

Dye goes through whole eustachian tube to reach nasopharynx

↓

Eustachian tube anatomy can be seen

2. **Saccharine or Methylene blue test:**

Instill methylene blue dye against perforated TM into middle ear

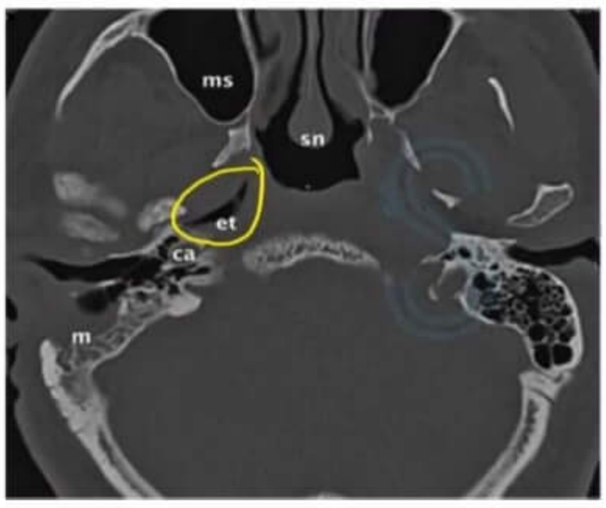
↓

Dye comes into nasopharynx and oropharynx through eustachian tube & can be seen coming out

Saccharine is a sweet agent so, sweet taste sensed

3. CT scan:

- **Patulous ET**- when eustachian tube has air in it
- Predisposing factors: Thyroid disorder
  Pregnancy
  Rapid wt. loss
- Pt. can have autophony i.e hears own voice
- Rx: inject silicon paste



4. Sono-tubometry:

Sound signal is given in nose and nasopharynx, through eustachian tube it reaches middle ear and a microphone is placed in EAC to detect it
So, we can detect the functioning of Eustachian tube

Eustachian tube balloon dilatation:

- To open the eustachian tube in case of chronic obstruction
- A balloon catheter is inserted through nose till nasopharynx against endoscopic vision and is rotated so that balloon can be inserted into ET and is then blown up. This produces micro fractures in eustachian tube and open up eustachian tube which remain open afterwards.

Anatomy of Inner Ear

→ Consist of 2 parts

1) Bony labyrinth (Outer part)
   - derived from the Otic capsule which itself formed from Neural crest cells
2) Membranous labyrinth (Inner part)
   - derived from Otic vesicle which itself formed from surface ectoderm

→ Based on function inner ear has 2 parts

1) Auditory part

   Cochlea

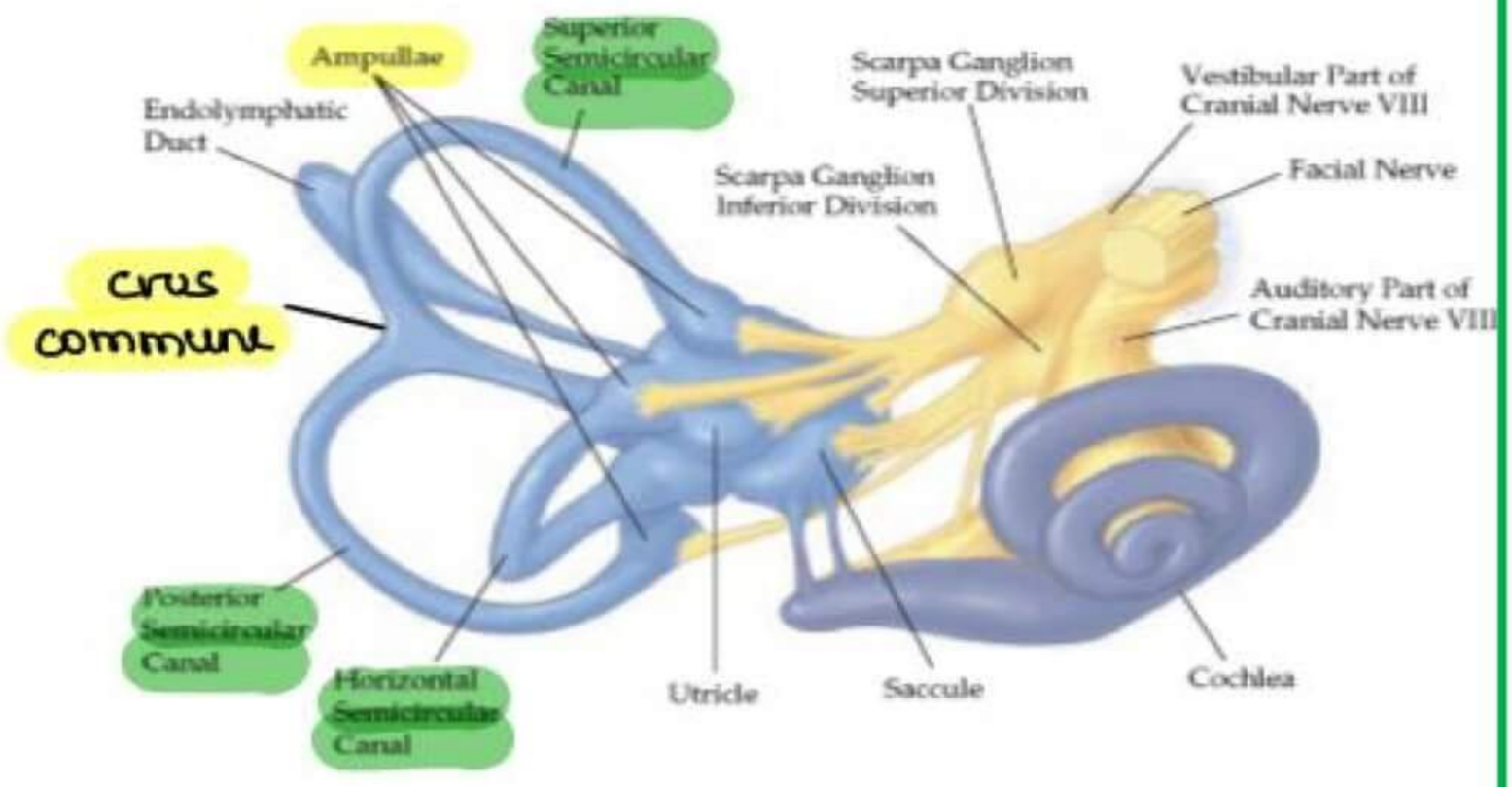
   - Spiral structure
   - 2.75 turns around central bony axis MODIOLUS

2) Vestibular part

   3 Semicircular canals &

   2 sacs

   - Utricle
   - Saccule/ Sacculus



→3 semicircular canals

- Posterior / Vertical
- Lateral/ Horizontal
- Superior /Anterior

→ The space between the bony labyrinth and the membranous labyrinth is filled with fluid known as Perilymph; therefore, space is known as Peri lymphatic space.

→ Whereas; the membranous labyrinth is filled with Endolymph; therefore, space is known as endolymphatic space.

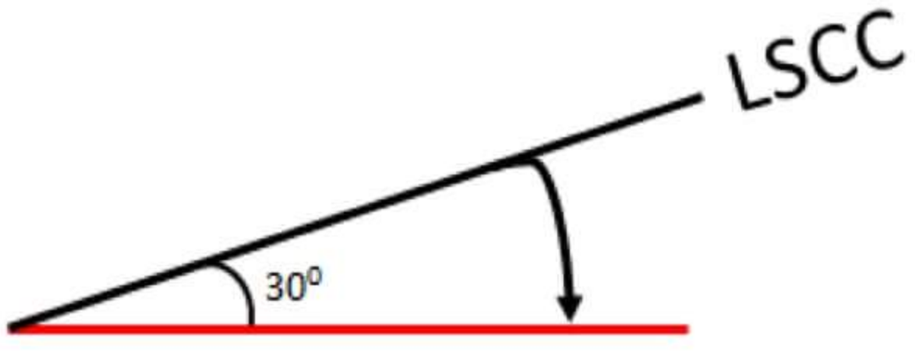
Angles of Lateral Semicircular Canal

→ The Lateral SCC may be known as Horizontal canal but it is not horizontal

→ It is at an angle of 30° to the horizontal line

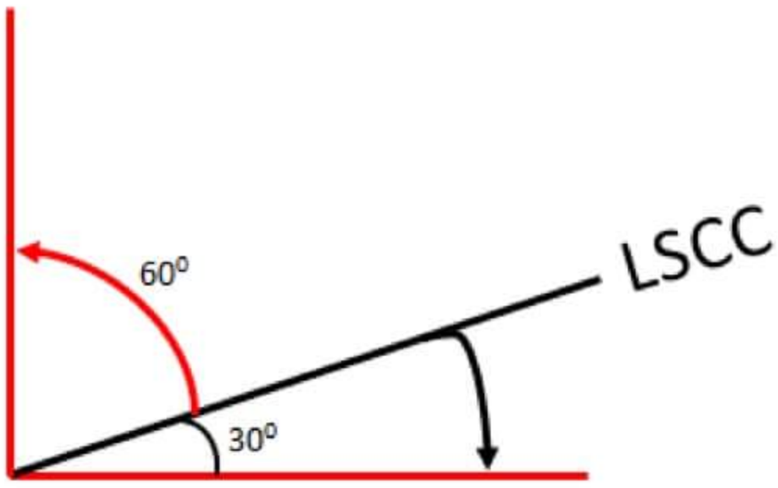
→ **How to make Lateral SCC to Horizontal??**

Ans: Ask the patient to bend his head forwards by 30°



→ **How to make Lateral SCC to vertical??**

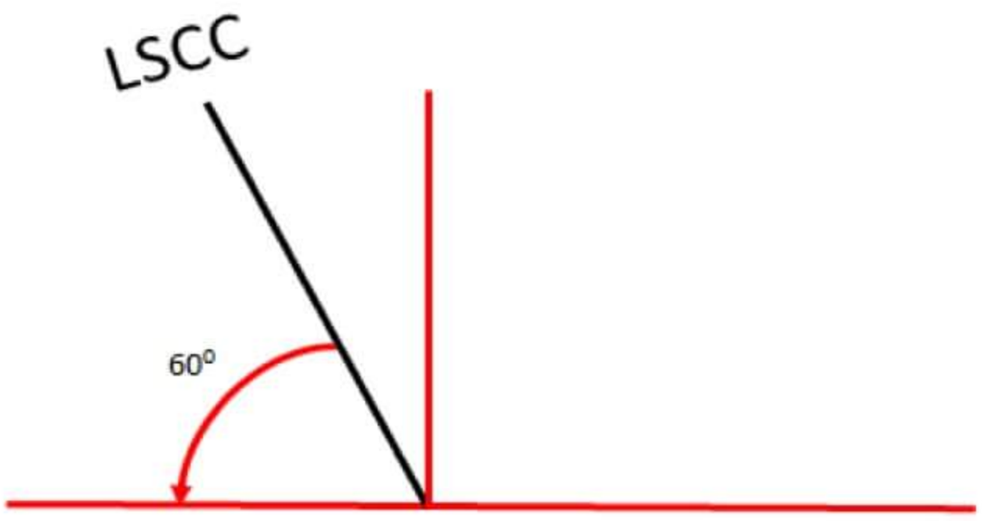
Ans: Ask the patient to turn his head backwards by 60°



→ If the patient is in supine position, that means Lateral SCC has turned backwards by another 90°

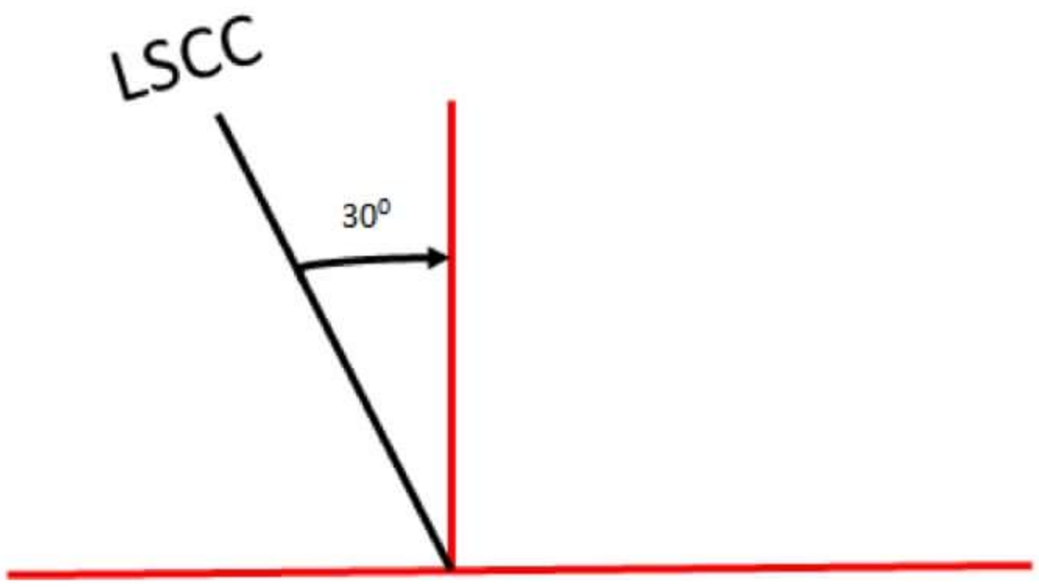
→ **How to make Lateral SCC in horizontal position if patient is supine??**

Ans: Ask the patient to turn his head backwards by 60°



→ **How to make Lateral SCC in vertical position if patient is supine??**

Ans: Ask the patient to bend his head forwards by 30°



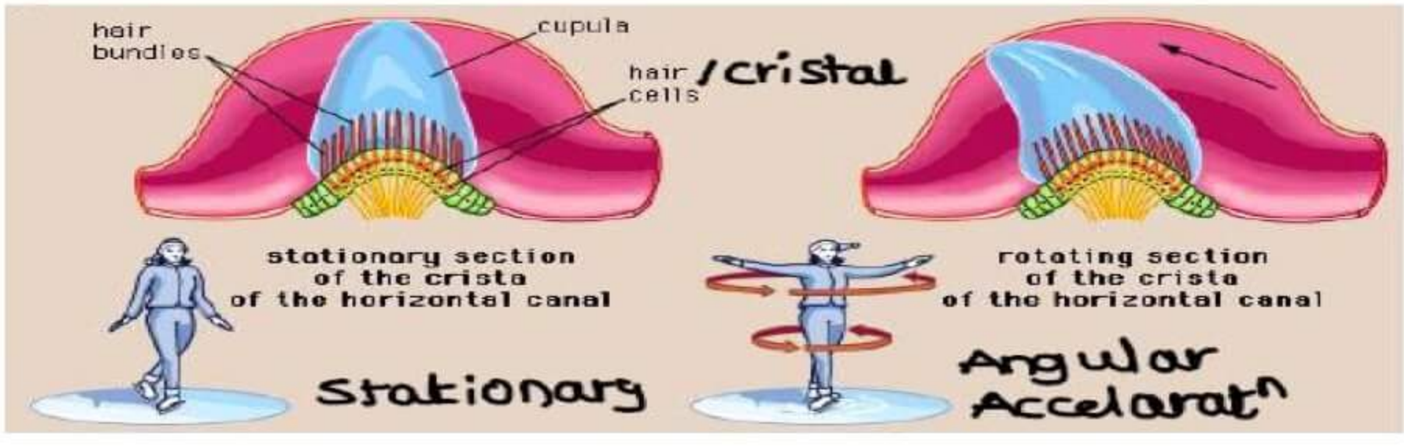
→ Each canal has one ampullated end and one non-ampullated end.

→ The non-ampullated ends of superior and posterior SCC unites to form "CRUS COMMUNE" (Total 5 opening)

→ Ampulla-

Cristae Ampullaris → Individual hair cells

Cupula Ampullaris → Cristae together



Function of SCC → Angular acceleration by cristae OR cupula

→ Irritation to SCC produce – Nystagmus

→ Lateral SCC – Horizontal nystagmus

→ Posterior SCC – Vertical nystagmus

→ Superior SCC – Torsional nystagmus

Nystagmus

→ Involuntary, Rapid, To & Fro, movement of eyeballs

→ 2 types

- Peripheral
- Central

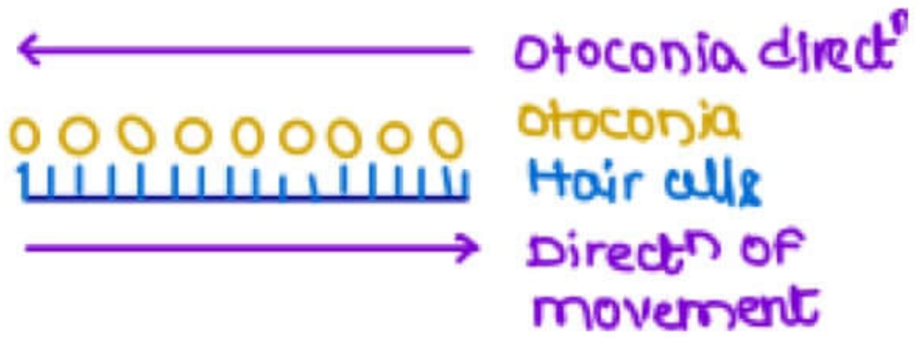
→Peripheral nystagmus characteristics – 5D's

1) Delay
2) Duration
3) Decay (On repeated stimulus)
4) Decreases on gaze fixation (Frenzel glasses +20 D lenses)
5) Direction
   - Fast & Slow Components
   - Fast component gives the direction
   - Vertical nystagmus can be Geotropic or Ageotropic nystagmus
   - Torsional nystagmus can be clockwise Or anticlockwise

Utricle and Saccule:

→ Detects Linear acceleration

→ Macula – Sensory epithelium of utricle and saccule
- Consist of hair cells
- Otoconia (Calcium carbonate crystals)



→ Utricle – Detects horizontal linear acceleration

→ $accule – Detects vertical linear acceleration

BPPV: /Benign Paroxysmal Positional Vertigo OR Otolithiasis/Canalolithiasis/Cupulolithiasis

→ Vertigo: Few seconds to minutes

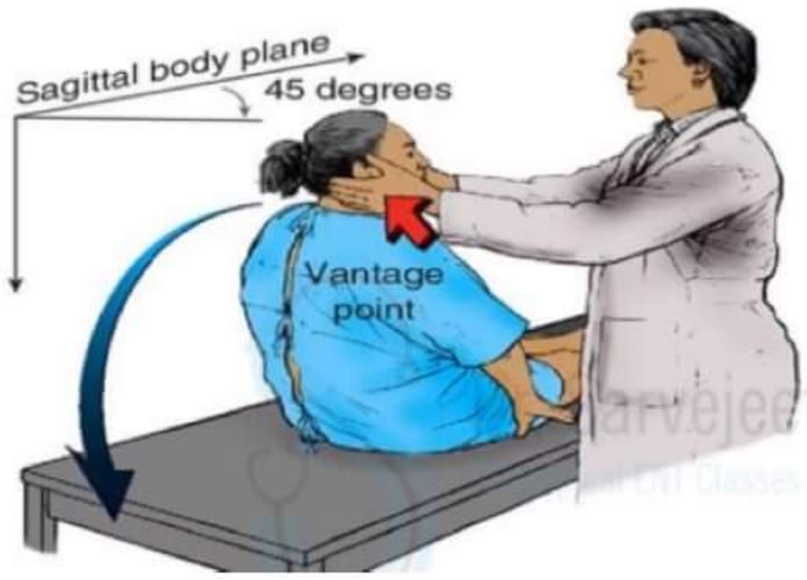
→ Positional: Due to change in head position

→ Due to displacement of otoconia into Posterior SCC → OTOLITH

→ Diagnosis confirmed by → DIX-HALLPIKE's MANOEUVRE

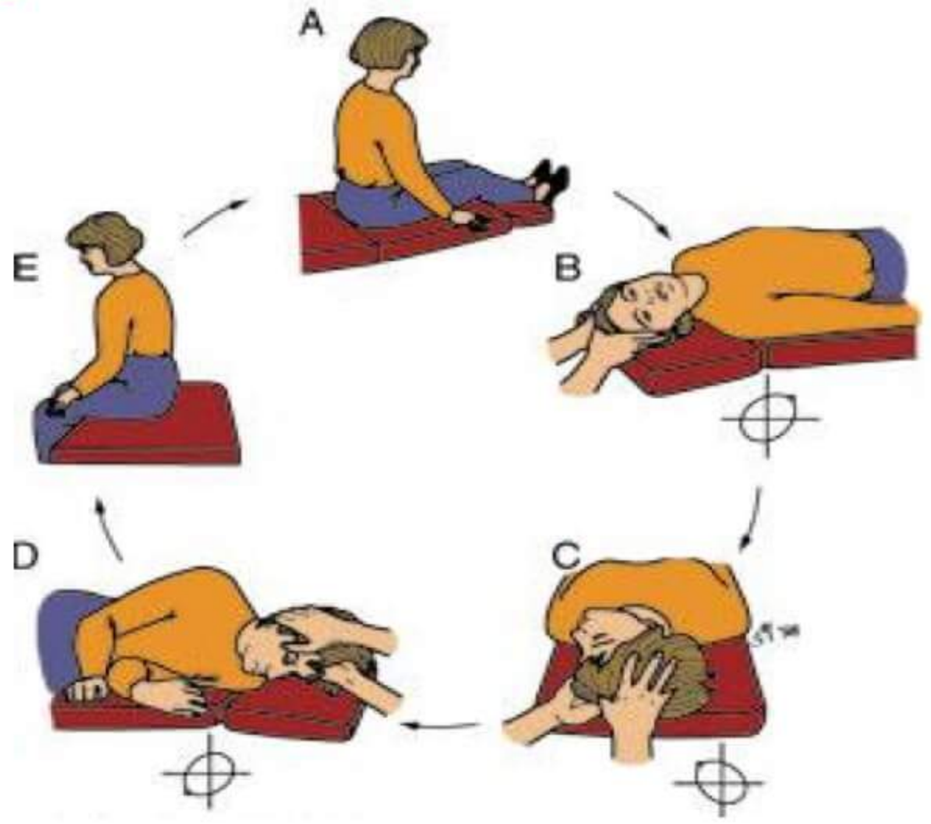
5D's of Peripheral Nystagmus are observed during Dix-Hallpike manoeuver, Direction of Nystagmus is mainly vertical (Geotropic / ageotropic with torsional component present)

Dix-Hallpike's Maneuver



→ $R_x$oc → EPLEY's MANOEUVRE

(1st sitting treats → 80-90%)



Epley's

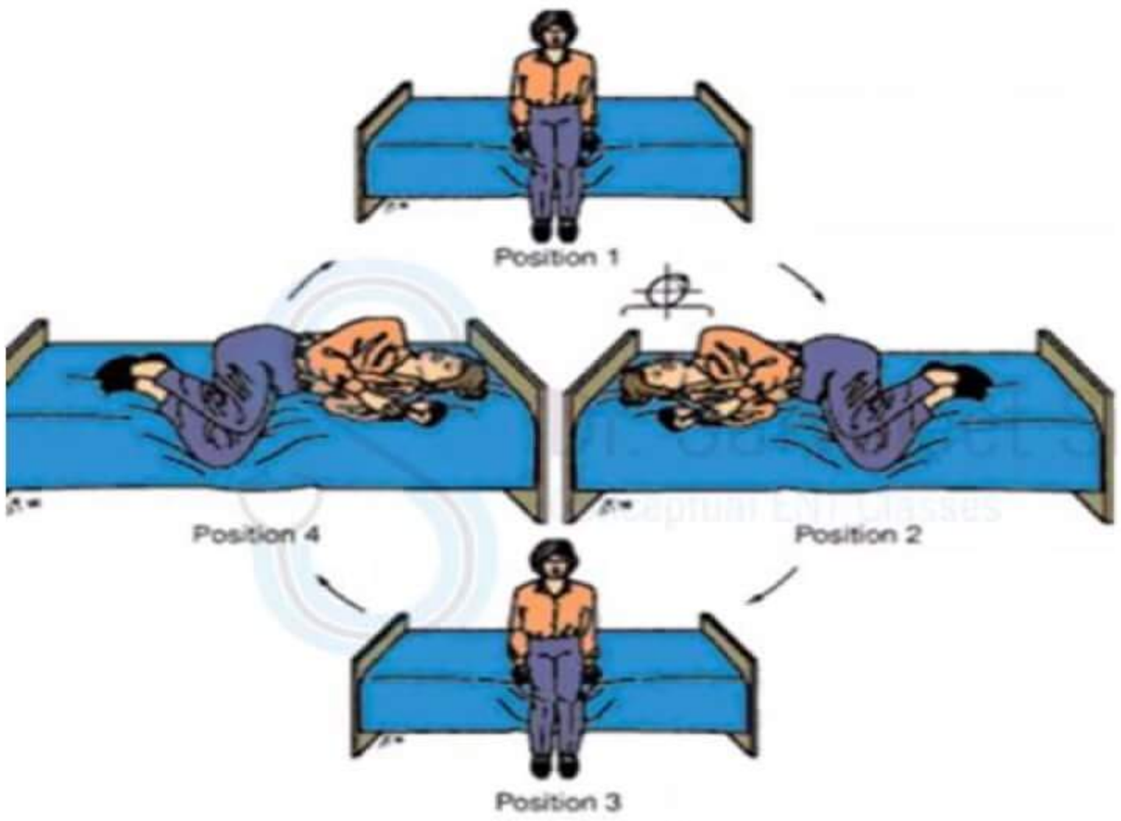
Other Maneuvers for R_x

1. SEMONT'S / LIBERATORY MANEUVER

→ After any of these 2 manoeuver ask the pt. to lay down in FOWLER'S position for 24hrs

Fowler's Position

→ Repeated BPPV attacks recommend the patient for some home exercises
i.e BRANDT-DAROFF



→ Lateral canal BPPV patients we do 2 maneuvers for Rx

1. LEMPERTS MANEUVER
   - Complete rotation
2. LOG ROLL (BARBECUE)

Log Roll (barbecue)

→ Tests of Vestibular Labyrinth

I) Caloric testing –

Fitzgerald Hallpike test → Syringing at 37 ± 7° c done

30° c → Cold stimulus

44° c → Warm stimulus

- COWS

Cold → Opposite
Warm → Same side of lateral sec. } Nystagmus d/t irritation

Modified Kobrak test (Cold Caloric Test)

Syringing with 0°C water

Dundas Grant test

→ Syringing is C/I in perforated Tympanic membrane

→ In such cases, cold air blown through a Copper coil tube

2) VEMP (Vestibular Evoked Myogenic Potential)

- Give stimulus in vestibular system and check the response in muscles

2 types

CERVICAL VEMP

↓

Evaluates saccule and inferior vestibular nerve

Cervical VEMP

OCCULAR VEMP

↓

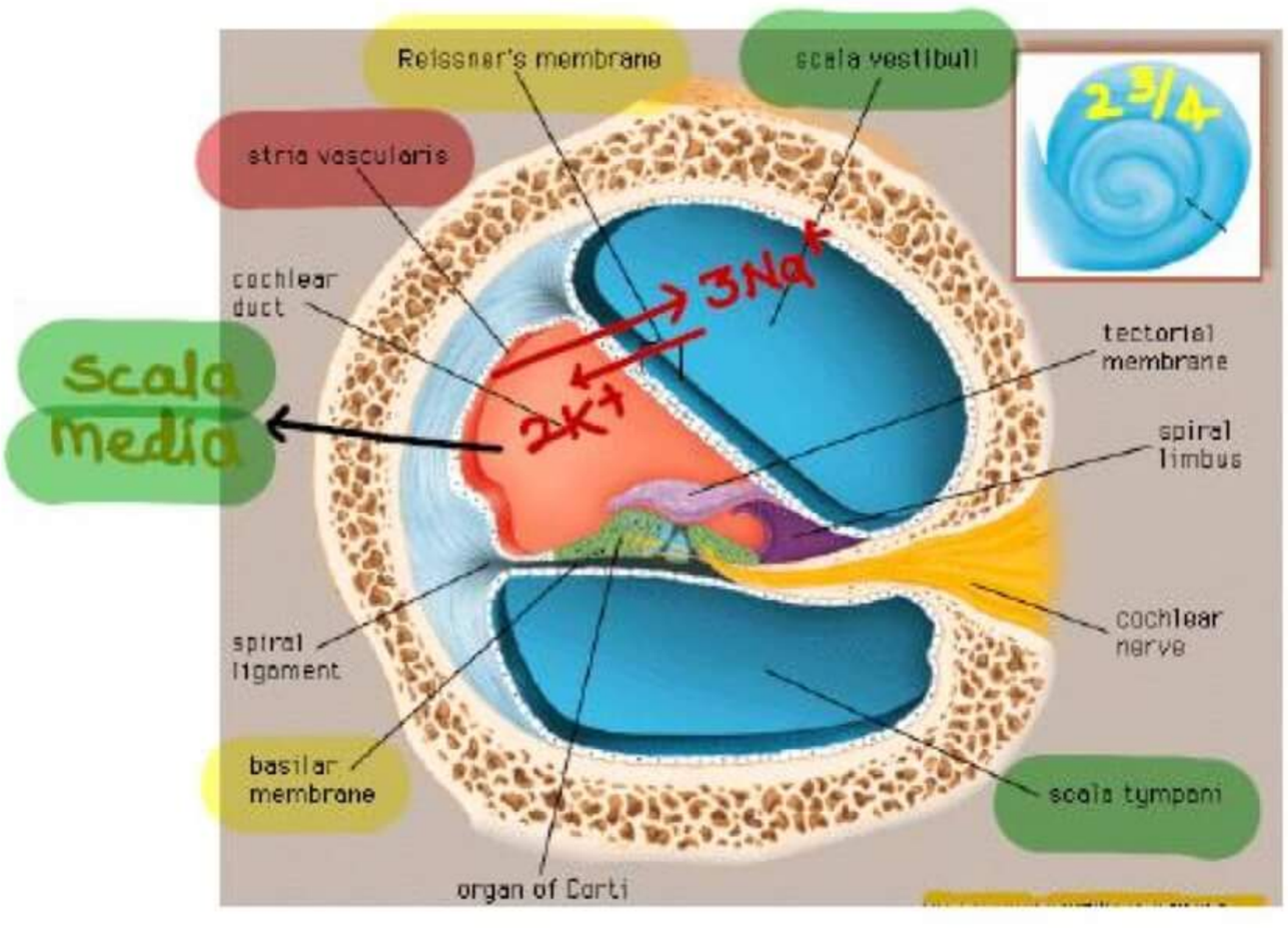
Evaluates saccule and superior vestibular nerve

Ocular VEMP

Galvanic Vestibular Stimulation

- Test of vestibular nerve with small voltage of current

COCHLEA (Auditoru Laburinth)



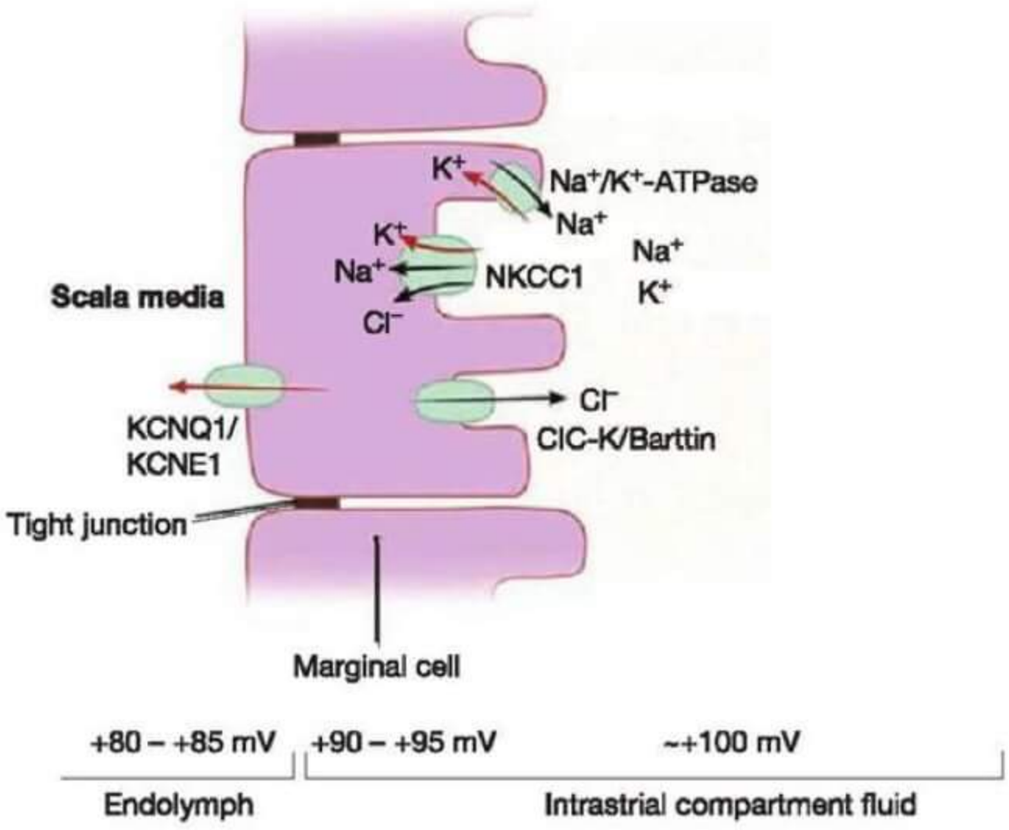
→ Divided into Scala vestibuli, Scala media, Scala tympani — By — Reisner's membrane, Basilar membrane

→ Scala vestibuli & Scala tympani filled with → Perilymph

Scala media filled with → Endolymph

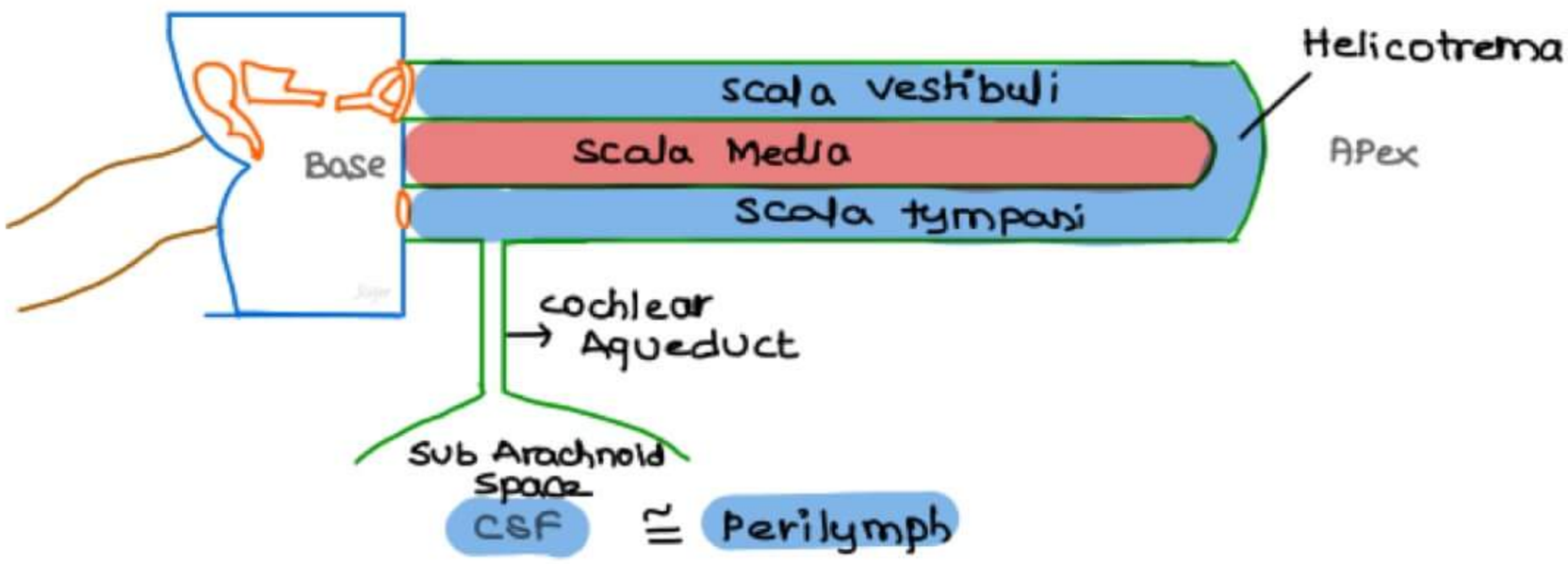
Endolymph secreted by stria vascularis [Na^+ K^+ ATPase pump]

Exchange $3Na^+$ τ $2K^+$ → responsible for **ENDO CHOCHLEAR POTENTIAL**



ENDO CHOCHLEAR POTENTIAL

- Normal physiological potential
- +80-85 mV
- Not dependent on sound
- DC potential



Endolymph is also produced by Dark cells of Macula

Cochlear Aqueduct: Connects Scala Tympani to Subarachnoid space, Perilymph is same as CSF

During meningitis, M/C route of infection from brain to inner ear → Cochlear aqueduct

↓

LABYRINTHITIS

Labyrinthitis

Infection of Inner ear. It can be of 2 types:

1. Serous – d/t toxins

2. Suppurative – d/t bacteria itself

→ C/F

a. Sensory Neural Hearing Loss (SNHL)

b. Vertigo

c. Tinnitus

→ SNHL is reversible in serous labyrinthitis

→ LABYRINTHITIS OSSIFICANS

- D/t Suppurative labyrinthitis (Bacteria) → fibrosis → calcification
- Progressive SNHL
- IxOC : MRI
- R_X by cochlear implant

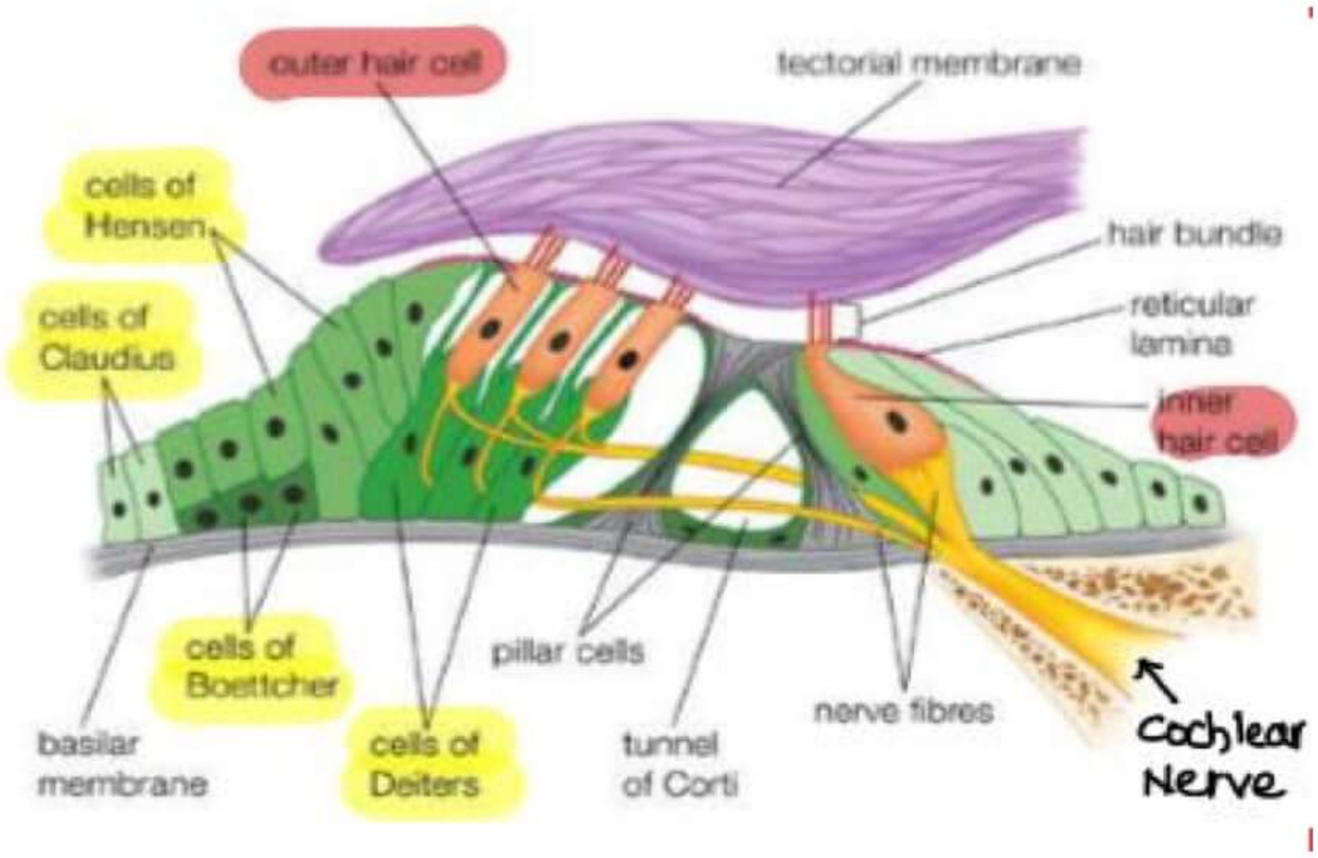
Organ of Corti:

Present on basilar membrane

→ **Outer hair cells**	**Inner hair cells**
13-14k in no	3500 in no
More in rows (3-5)	Single row
Tubular	Flask Shaped
Develop late	Develop early
More sensitive to NIHL	

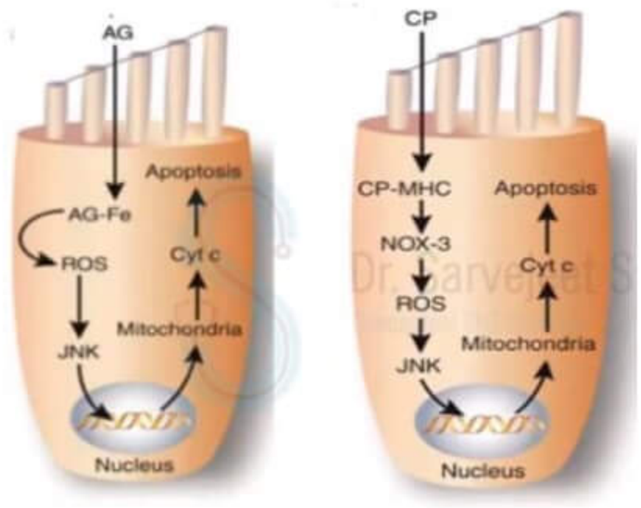
(3000- 6000Hz; Max. peak at 4000Hz)

More Sensitive to Ototoxic drugs



Ototoxic Drugs

1. Aminoglycosides (Irreversible)
   - → Streptomycin
   - → Gentamycin — Preferential vestibulo toxic
   - → Kanamycin
   - → Amikacin — More cochleotoxic



2. Loop Diuretics: Furosemide, Ethacrynic Acid → Dose dependent

3. Platinum based Chemotherapy drugs: Cisplatin/ Carboplatin [Reversible → Irreversible]

4. Macrolides → Erythromycin

5. Antimalarial: Quinine / Chloroquine

6. NSAIDS – Ibuprofen, Naproxen

7. Chemicals – Alcohol, Tobacco, Marijuana, Carbon monoxide poisoning

Outer hair cells produce – Oto-Acoustic emissions – objective test

- Low intensity sounds in response to a sound stimulus
- Spontaneous OAE: No clinical Significance
- Evoked OAE

1. Transient Evoked OAE (TE – OAE) single frequency sound
2. Distortion Product OAE (DP – OAE) double frequency sound

OAE is the most sensitive test to detect NIHL (TE-OAE)
OAE is also used as a screening test for Neonatal Deafness

Ototoxicity first affects high frequency sounds, so earlier High Frequency Audiometry was done for Ototoxicity. Now OAE is the most sensitive test to Detect Ototoxicity

Auditory Neural Pathway

E-COLI-MA

E – Eighth nerve (Vestibulocochlear nerve)

C – Cochlear nucleus (Spiral ganglion)

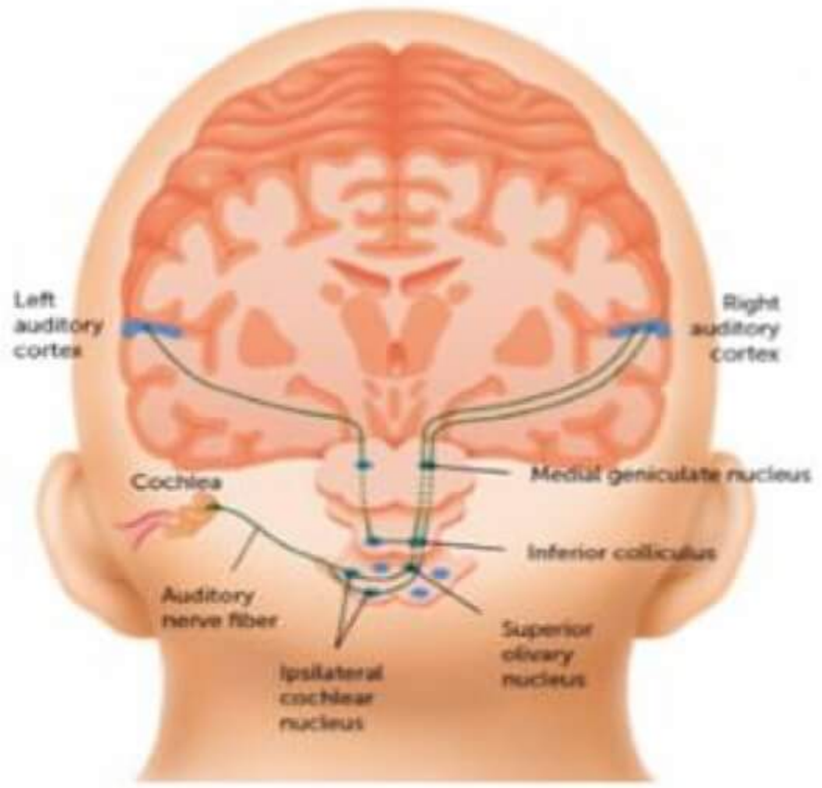
O – Superior Olivary complex (Opposite)

L – Lateral lemniscus (Largest)

I – Inferior colliculus

M – Medial geniculate body

A – Auditory cortex (Brodmann area 41)



E – 8th nerve COLI → Brainstem MA → Cerebrum

Cochlear nucleus is in brain stem

Cross over of sound takes place at superior olivary nucleus (Through TRAPEZOID BODY)

BRAINSTEM EVOKED RESPONSE AUDIOMETRY (BERA/ABR)

→ Study of electric waves produced along the neural pathway of sound.

E – Wave I → Produced by distal part of Eighth nerve

E – Wave II → Produced by proximal part of Eighth nerve

Distal → away from the brain

Proximal → near the brain

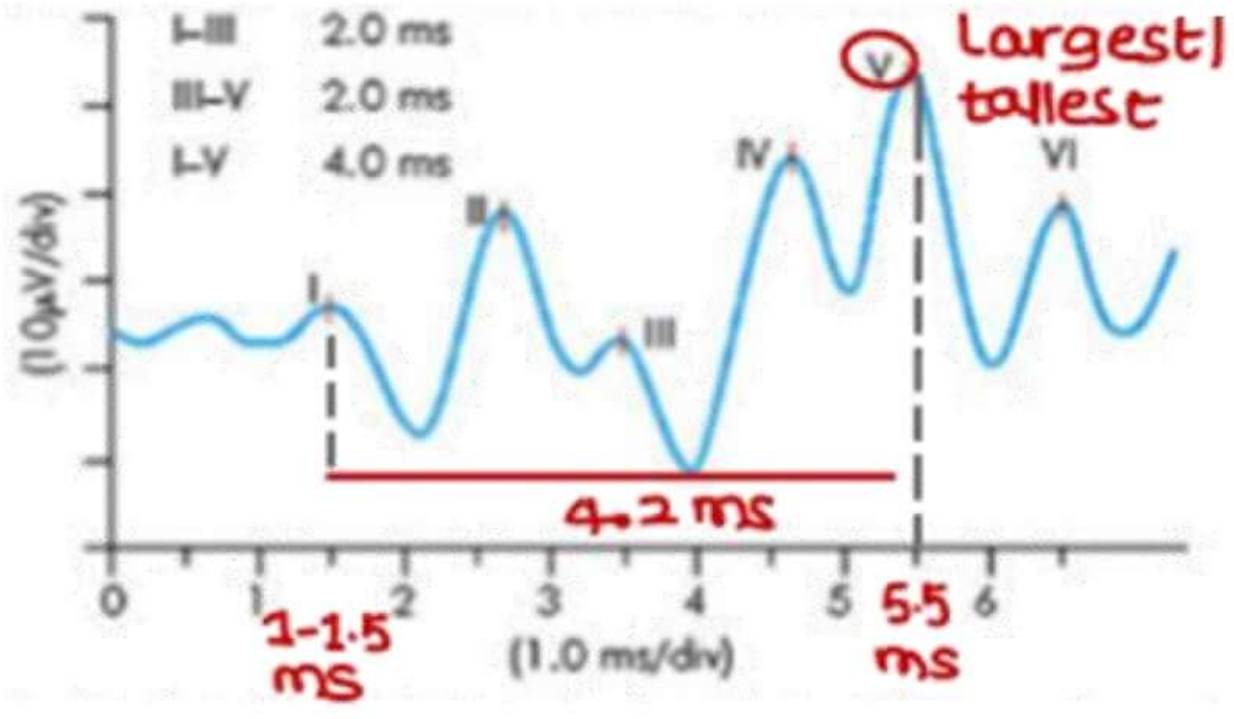
C – Wave III → Produced from cochlear nucleus

O – Wave IV → Produced from superior olivary complex

L – Wave V → Produced from Lateral lemniscus

I – Wave VI → Produced from Inferior colliculus

→ Wave V → Largest / Tallest/ Most stable / Most significant wave



Interpretation of BERA:

→ If no waves /not identifiable waves/wave I absent / all waves absent → pt. has cochlear hearing loss

→ If wave I is present and wave V is absent → Retro- cochlear hearing loss and even delayed wave V (Wave I-V interpeak Latency ≥ 4.4 ms) → Retro- cochlear hearing loss.

→ BERA is used as confirmatory test for neonatal deafness.
Best test for neonatal deafness → BERA/ABR

→ Also used to detect Malingering

→ BERA is an objective test

Hearing Devices

Hearing Aids:

2 types:

(i) Analog

(ii) Digital: These can be further classified based upon their placement:

a. BTE: Behind The ear

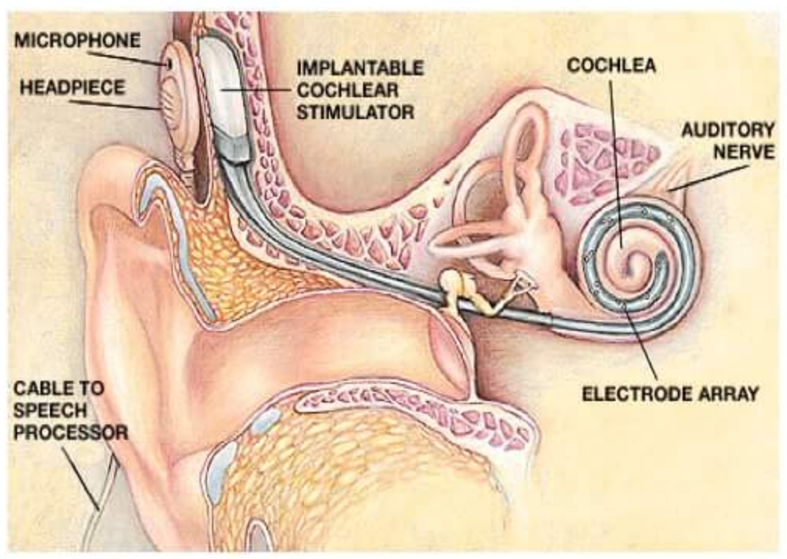
b. RIC: Receiver In Canal

c. ITC: In the Canal

d. CIC: Completely in Canal

e. IIC: Invisible in Canal

Cochlear Implant



→ Implant an electrode in Scala tympani [Nearest to VIIIth nerve]

→ We enter Scala tympani through cochleostomy near round window or through round window

Parts

1) External body worn part

I) Microphone → Receives sound

II) Speech processor → Converts sound to electromagnetic waves

III) Transmitter → Transfers EMW across the layer of skin

2) Internal/ Implantable part –

→ Receiver stimulator → Stimulates electrode array

→ Electrode array: Implanted inside Cochlea (Scala Tympani) and stimulate Eighth Nerve

Indications

I. B/L SNHL

≥70dB in Adults & ≥90dB in Children (Severe to Profound SNHL)

Condition:- Patient should have tried hearing aid for atleast 6 months

Preference

Post-Lingual Deaf Child is given maximum preference

Contraindications

Absolute C/I for cochlear implant

I. Michel's aplasia
   - Absence of cochlea

II. 8th nerve aplasia

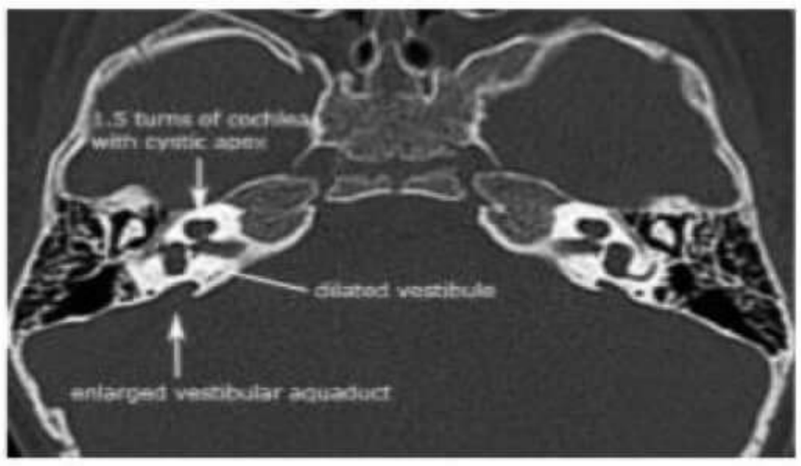
III. 8th nerve tumor

IV. Scheibe dysplasia (Cochleosaccular dysplasia)
   - M/C congenital anomaly of inner ear

Relative C/I for cochlear implant

V. Mondini's dysplasia
   Cochlea has only 1.5 turns
   Can do cochlear implantation
   - M/C congenital anomaly of Cochlea

MICHEL'S APLASIA



MONDINI'S DYSPLASIA

2. Auditory Brainstem Implant (ABI)

→ Implantation on brain stem

→ Cochlear nucleus is in 4th ventricle

→ 4th ventricle is entered through Foramen of Lushka

Physiology of Hearing

Binaural hearing → Hearing by 2 ears → help in sound localization → d/t head shadow effect

Monoaural hearing → Hearing by 1 ear

→ Total surface area of Tympanic membrane = 90 mm^2

Effective vibratory area of Tm = 55 mm^2

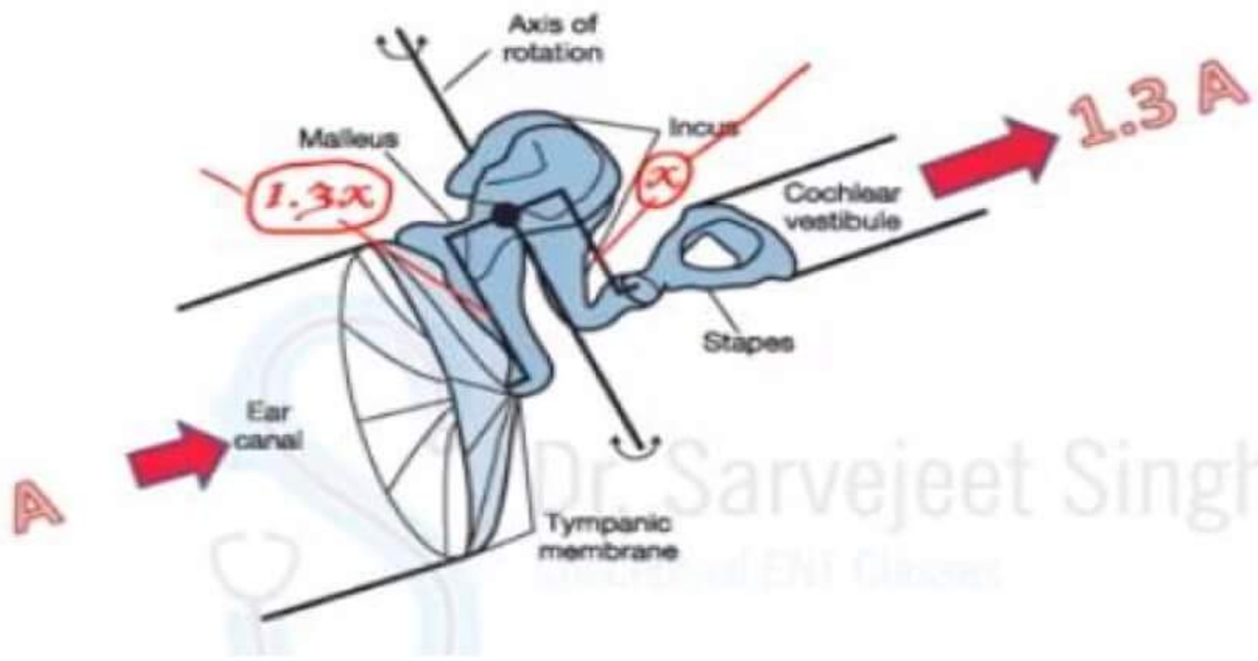
Surface area of stapes foot plate = 3.2 mm^2

Areal ratio = 17: 1

Lever ratio = 1.3:1

(Between length of Handle of Malleus & long process of Incus)

→ TORQUE = Force X length

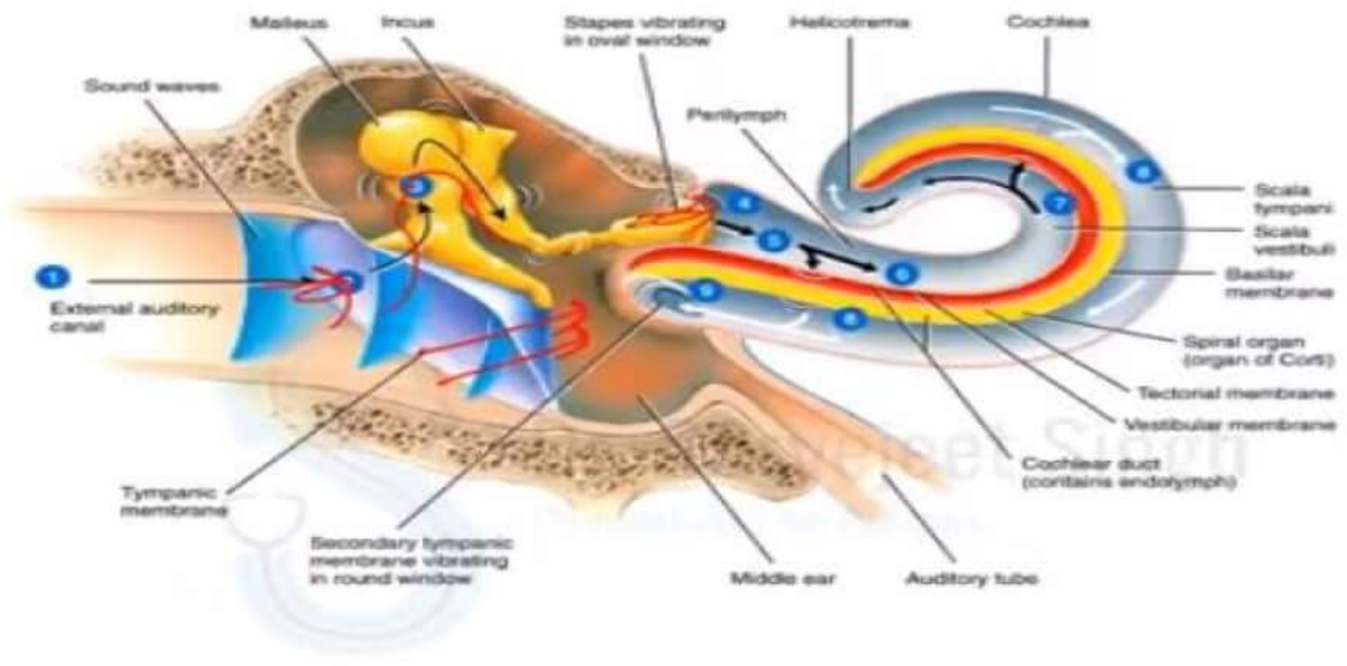


→ Middle ear transformer ratio (Ossicular Coupling) = 22:1

→ Most mobile part of Tympanic Membrane is periphery of Pars Tensa.

→ Sound travels faster in solids than air due to which the 2 windows are in phase difference

→ Middle ear → Also Amplifies sound by creating phase difference between Oval & Round Window (Acoustic Coupling)



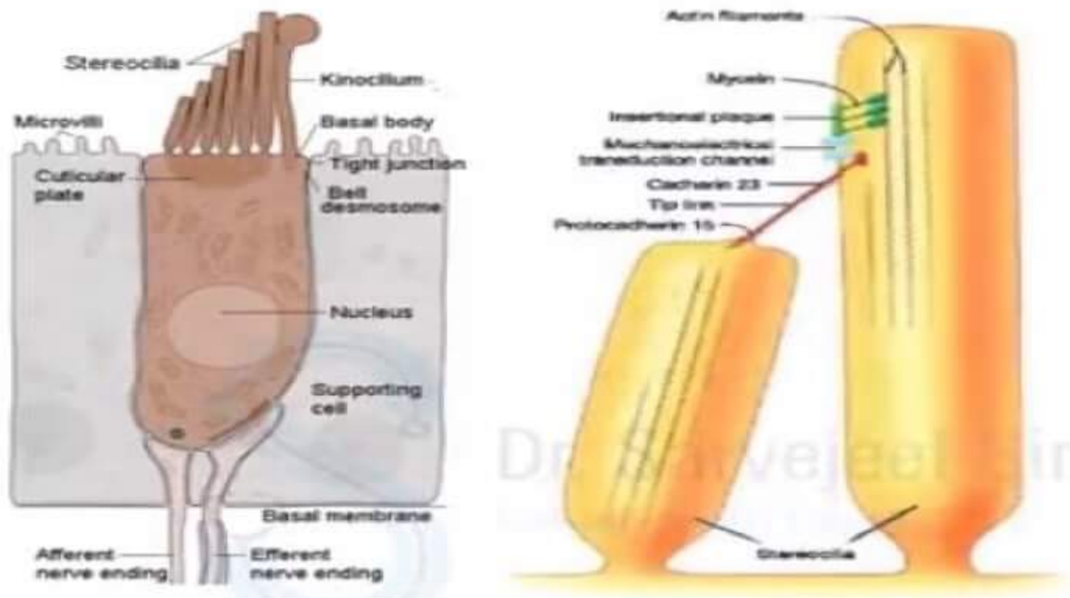
Middle Ear Mechanics: Impedance Matching

Ossicular Coupling + Acoustic Coupling

In inner ear – Sound waves move perilymph in Scala vestibuli → this movement reaches Scala tympani

→ Above Scala tympani there is basilar membrane which has Organ of Corti

→ The stereocilia on Hair cells in Organ of Corti have "**tip link**" which join one stereocilia to next bigger stereocilia



→ Sound waves move the Basilar membrane which in turn move the stereocilia of the hair cells

↓

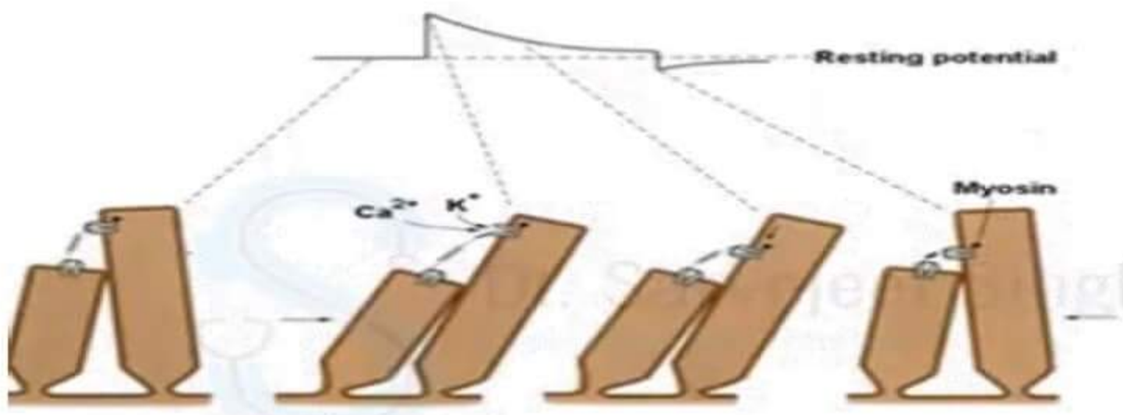
This leads to stretching of tip link and opening of cation (Positive ion) Channels

↓

Movement of K^+ and Ca^{2+} from Scala media into Stereocilia (Hair cells)

↓

This movement of ions create a potential inside the inner ear called as Cochlear microphonics. Ca^{2+} ions stimulate Myosin protein inside the stereocilia and close the cation channel by moving it down and relaxing tip link.



→ **Usher Syndrome**

- SNHL + Vision loss (Retinitis pigmentosa)
- Mutation of gene encoding: Cadherin 23 or Protocadherin 15
- Autosomal recessive inheritance
- Finnish population and Ashkenazi Jewish Heritage

→ **Cochlear Microphonics**

- Electrical potential in the inner ear
- Produced d/t influx of K^+ due to 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 K^+ ions
- Have higher latency period than cochlear microphonics
- DC potential

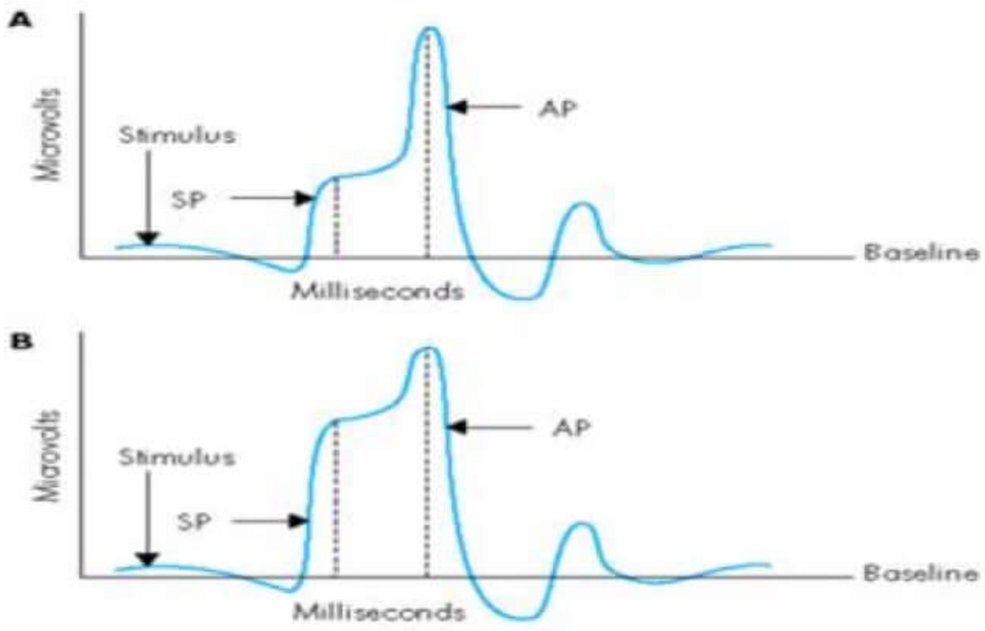
→ **Eighth Nerve Action Potential**

- All or None Phenomenon: Produced Only when Sound stimulus is above hearing threshold

Electrocochleography

→ Summating Potential vs Action Potential

In normal ear → SP < 30% AP
In Meniere's disease → SP > 70% AP is confirmatory
→ SP > 45% AP is Indicative



→ Electrocochleography is the confirmatory test for Meniere's disease

→ Invasive investigation: have to make a hole in Tympanic Membrane to place electrode on Round Window

Frequency Localization In Cochlea

→ Normal hearing range → 20-20000 HZ
→ 20Hz is heard at apex of Cochlea, 20,000Hz is heard at Base of Cochlea
→ 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 who got noble prize in physiology or medicine [1961]

→ Neural Pathway is Frequency coded.

Speech Intensity

→ It is measured in dB

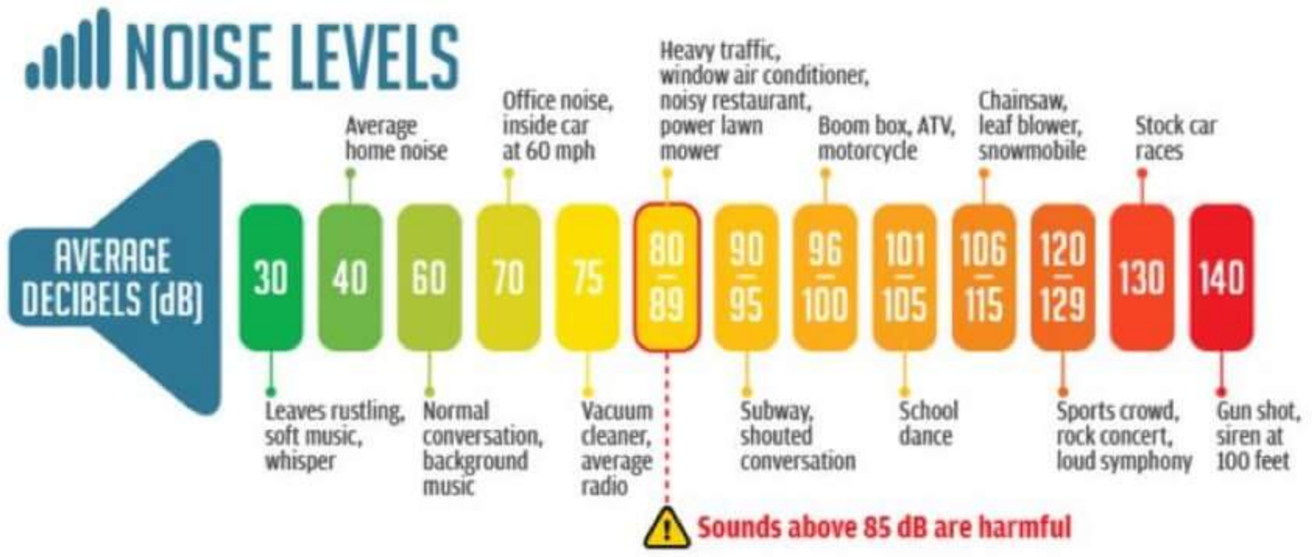
→ Sound of whisper – 30 dB

→ Normal conversation – 45-60 dB

→ Noisy market – 60 dB

→ > 80 dB sound is dangerous

→ As per WHO guidelines, sound intensity > 140 dB can lead to deafness even if for few μsec



Q. Maximum audible tolerance is??

A. 90 dB for 6hr

B. 90 dB for 8hr

C. 85 dB for 6hr

D. 85 dB for 8hr

Ans: D

→ Maximum audible tolerance of sound according to WHO guidelines and "Factory act 1948" (**G.O.I**) guidelines is 85 dB for 8 hrs

→ After this WHO follows 3 dB exchange rate i.e if you ↑ the sound intensity by 3 dB you ↓ the time duration by half

Eg. 88 dB - 4hrs

91 dB – 2hrs

→ For G.O.I there is 5 dB exchange rate

Eg. 90 dB – 4 hrs

→ According to G.O.I there should not be any sound exposure to the factory worker above 110 dB

→ How to protect yourself??

1. Use earphones
   (This protect noise upto 20 dB)
2. Ear plugs
3. Sound protectors
   (This protect noise upto 35 dB)
4. Sound barriers

Tests of Hearing

(1) Tuning fork tests

Mc used ⟶ 512 Hz

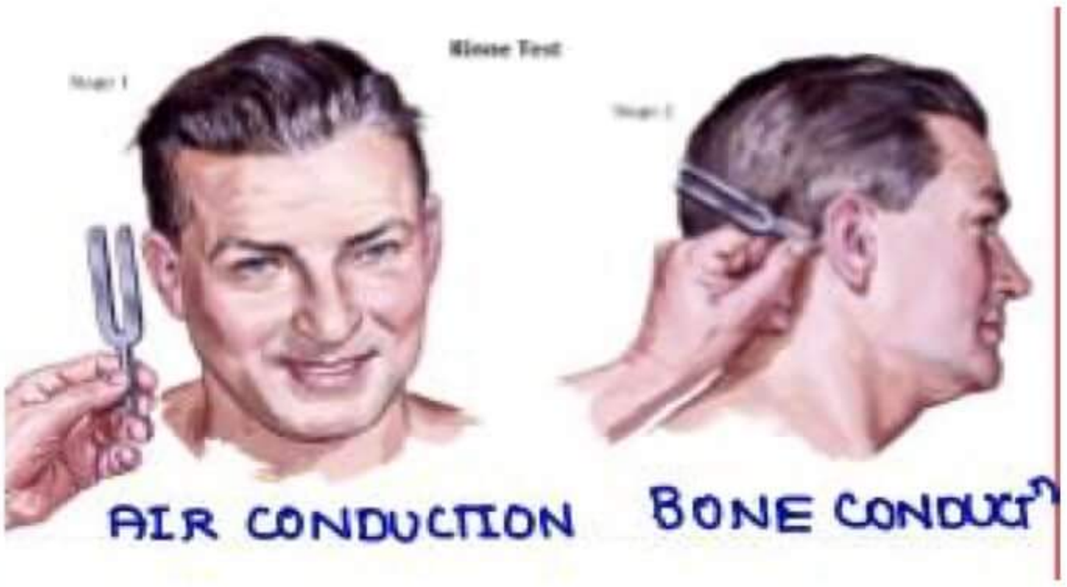
Not used ⟶ 128 Hz [Used in neurological hearing]

Rinne's Test

AC > BC ⟶ Rinne's +ve → Normal, SNHL

BC > AC ⟶ Rinne's -ve → CHL

- Diseases of External ear
- Disease of Middle ear



AC > BC ⟶ SNHL (U/L)

BC > AC ⟶ Severe SNHL (Dead ear)/ False -ve Rinne's
(Bone conduction by other ear)

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

→ Most sensitive tuning fork – 256 Hz

Min CHL required to make at least one tuning fork -ve: 20 Hz
(First one to become -ve is 256Hz)

M/C used – 512 HZ

Weber's Test

→ Tuning fork placed in the midline of vertex.

→ Sound heard in the better ear ⟶ SNHL

→ Sound heard in the bad ear ⟶ CHL

→ Normal is heard in the center.

→ More sensitive than Rinne's test. (5 db)

Simple funda: Always check the weber's first in tuning fork test questions

4 step method of Tuning fork test

Step 1: Check weber's

Step 2: Check patient`s complaints

Step 3: Check Rinne's negative side

Step 4: Rinne's positive both sides (Then it is SNHL)

Absolute Bone Conduction Test (ABC)

→ Comparison test between pt. & examiner

Examiner is assumed to be normal

Press Tragus to close the air conduction

→ Patient BC < Examiner's BC ⟶ SNHL

Patient BC = Examiner's BC ⟶ Normal

Schwabach Test

→ Comparison test between pt. & examiner

Examiner is assumed to be normal

No pressing of Tragus

→ Patient BC < Examiner BC ⟶ SNHL

Patient BC = Examiner BC

↓

Repeat test c̄ reverse order

↓

Same result → Normal

Pt`s BC > Examiner BC → CHL

Siegel's Speculum (M3GF)

Used for **M**agnification

Mobility

Medication of Tympanic membrane

Galle's Test

Fistula Test

→ Cannot remove F.B.

Bing Test

→ Modification of Weber's test → Vibrate TF & keep at Mastoid ↓ As soon as patient stops hearing ↓ Close EAC ↓ If he hears again ↓ BING'S POSITIVE ↓ Seen in Normal hearing & SNHL	→ Vibrate TF & keep at Mastoid ↓ As soon as patient stops hearing ↓ Close EAC ↓ If he hears nothing ↓ BING'S NEGATIVE ↓ Seen in CHL

Galle's Test

→ Vibrate TF & keep at mastoid ↓ Raise the pressure with Siegel's speculum ↓ ↓ Loudness of sound ↓ Seen in Normal hearing & SNHL	→ Vibrate TF & keep at mastoid ↓ Raise the pressure with Siegel's speculum ↓ No change in loudness ↓ Seen in otosclerosis

For Malingering

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

(2) Pure Tone Audiometry (PTA)

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

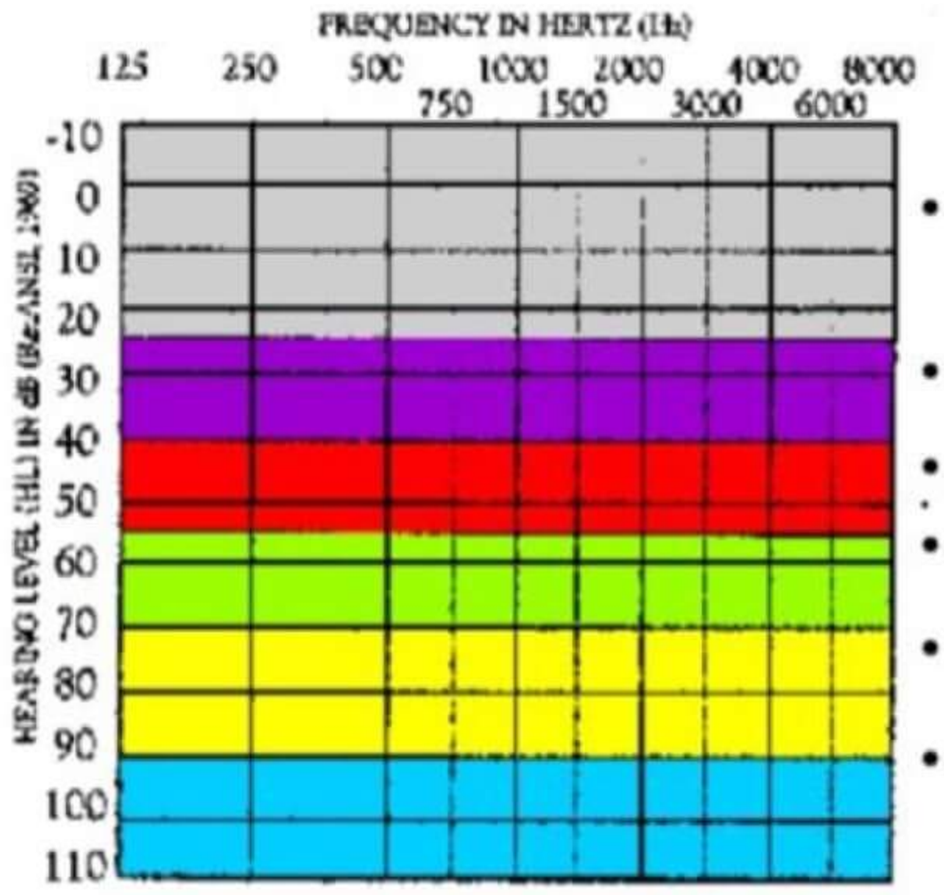
→ 'O' (Zero) values doesn't mean 'O' in true sense, it is hearing threshold of a normal person. It is different for different frequencies

→ AC & BC = O for Normal person

Right side		Left side
Red		Blue
O O O O	AC	X X X
< < < <	BC	> > > >
[[[[	BC c̄ masking (Sound in non test ear)	]]]]

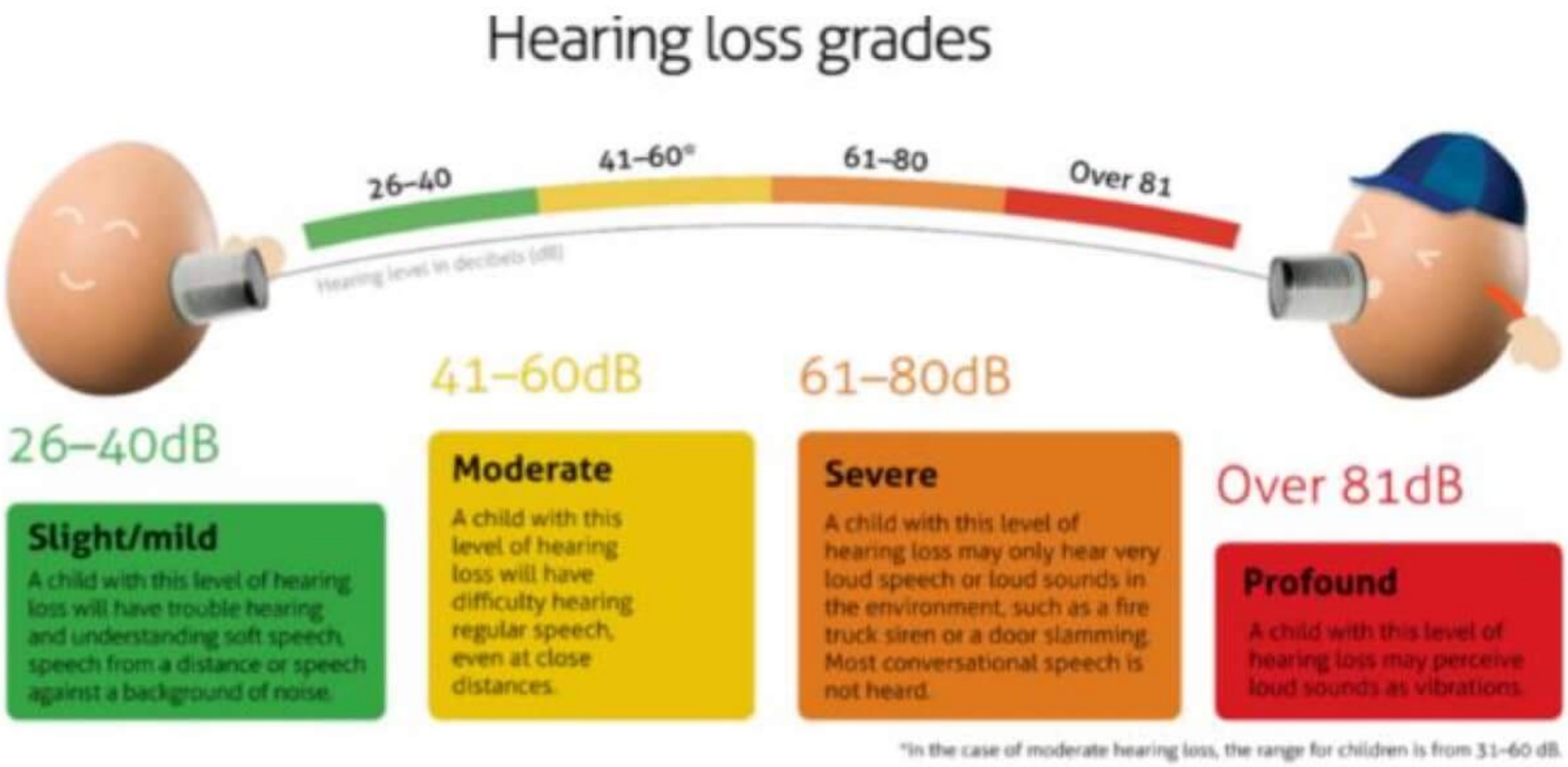
Range of SNHL: Clarke's (1981)

- -10 – + 25 dB → Normal
- 26 – 40 dB → Mild
- 41 – 55 dB → Moderate
- 56 – 70 dB → Moderate severe
- 71 – 90 dB → Severe
- ≥91 dB → Profound



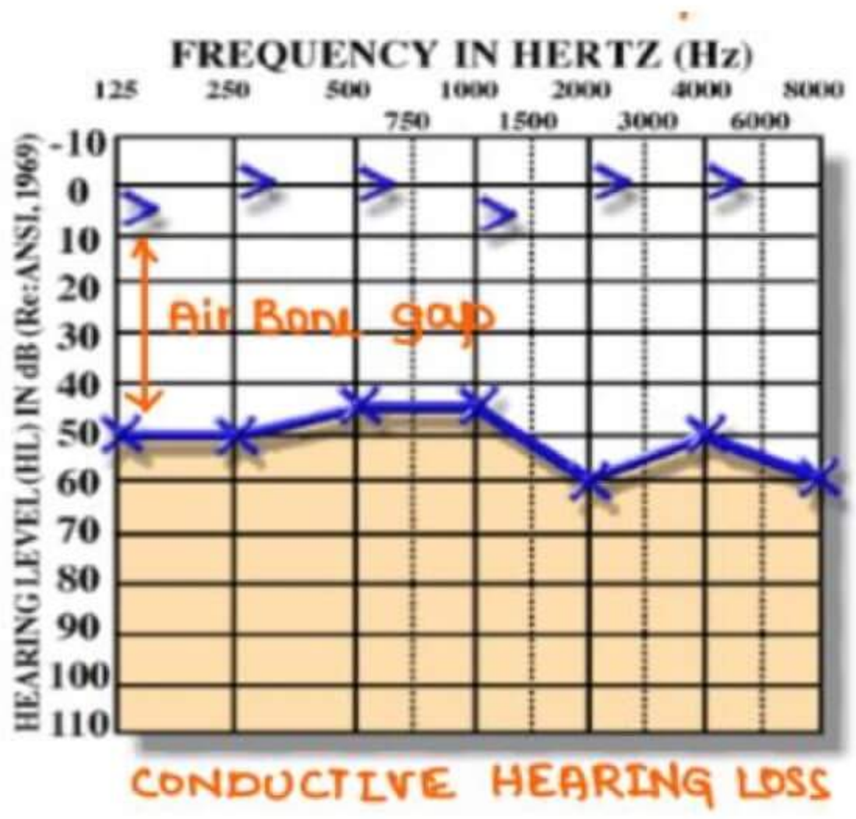
- -10 – 25 dB HL = Normal range
- 26 – 40 dB HL = Mild hearing loss
- 41 – 55 dB HL = Moderate
- 56 – 70 dB HL = Moderately Severe
- 71 – 90 dB HL= Severe
- Greater than 90 dB HL = Profound

According to WHO



Types of Hearing Loss

a. **Conductive Hearing Loss**: AB gap (Air Bone gap) is seen



b. Noise Induced Hearing Loss (NIHL)

→ Boiler's notch at 4000 HZ

→ Max. Seen at 3000 - 6000 HZ

Sounds causing Max. Noise induced HL: 2000-3000 HZ

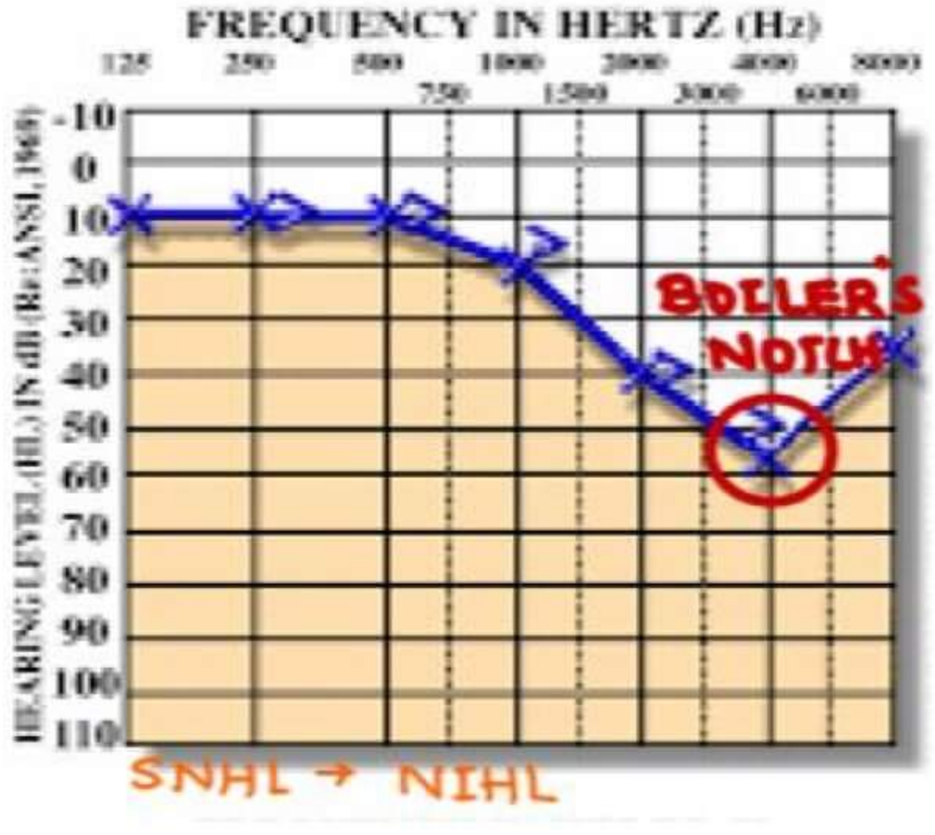
→ Stereocilia of outer hair cells are 1st to be affected

→ Test to find out NIHL even before on audiometry → OAE

→ NO AB gap

Notch is seen only in BC curves

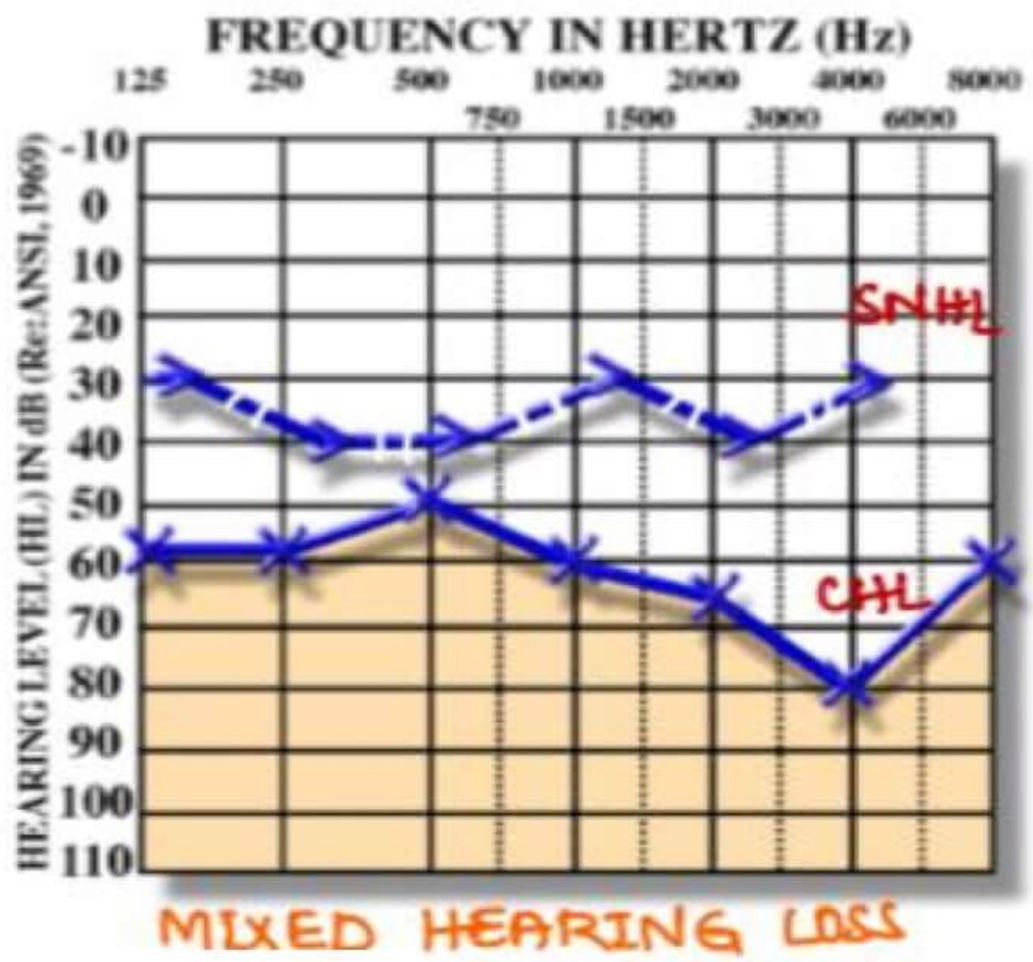
(AC curve Notch are insignificant)



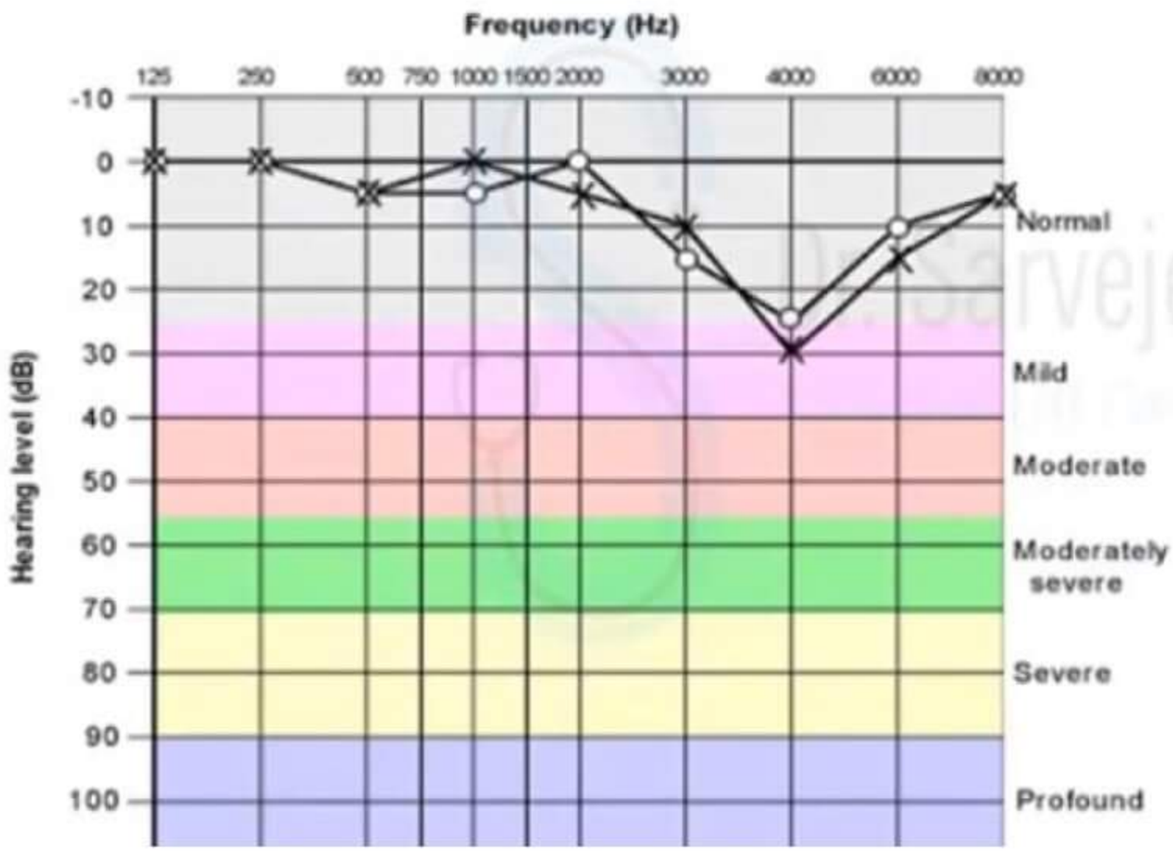
c. Mixed Hearing loss

→ AB gap present

→ Both SNHL & CHL



Q Identify the cause of hearing loss??

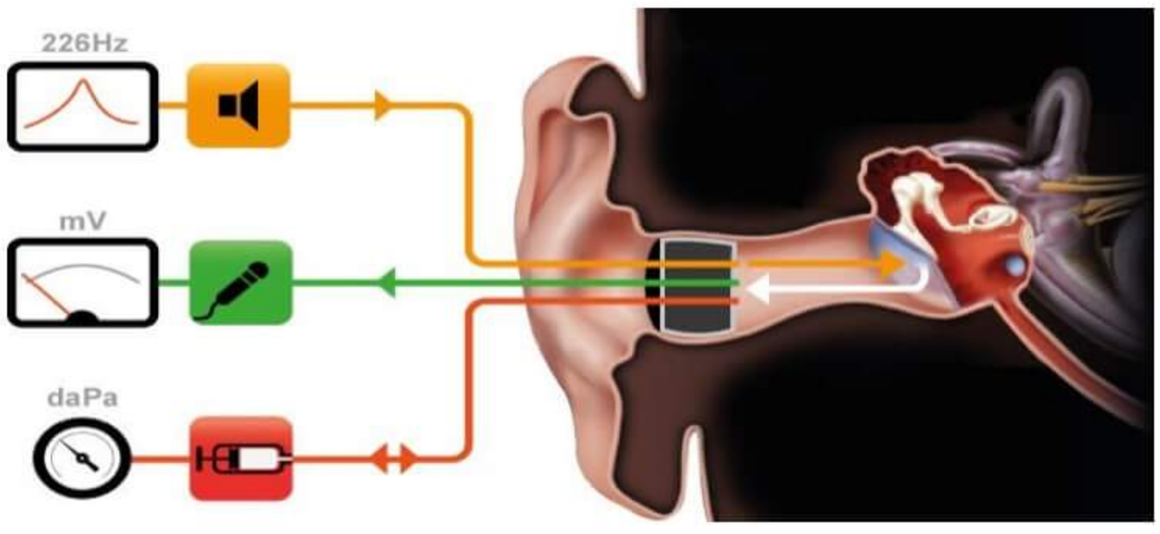


→ B/L Noise Induced Hearing Loss

(3) Impendence Audiometry

Consist of → (I) Tympanometry

(II) Stapedial reflex / Acoustic reflex



Types of Curves seen in Tympanometry:

Type A → Seen in Normal Individual

Type A_S → Seen in **S**tiffness/ **S**mall/ **S**clerosis

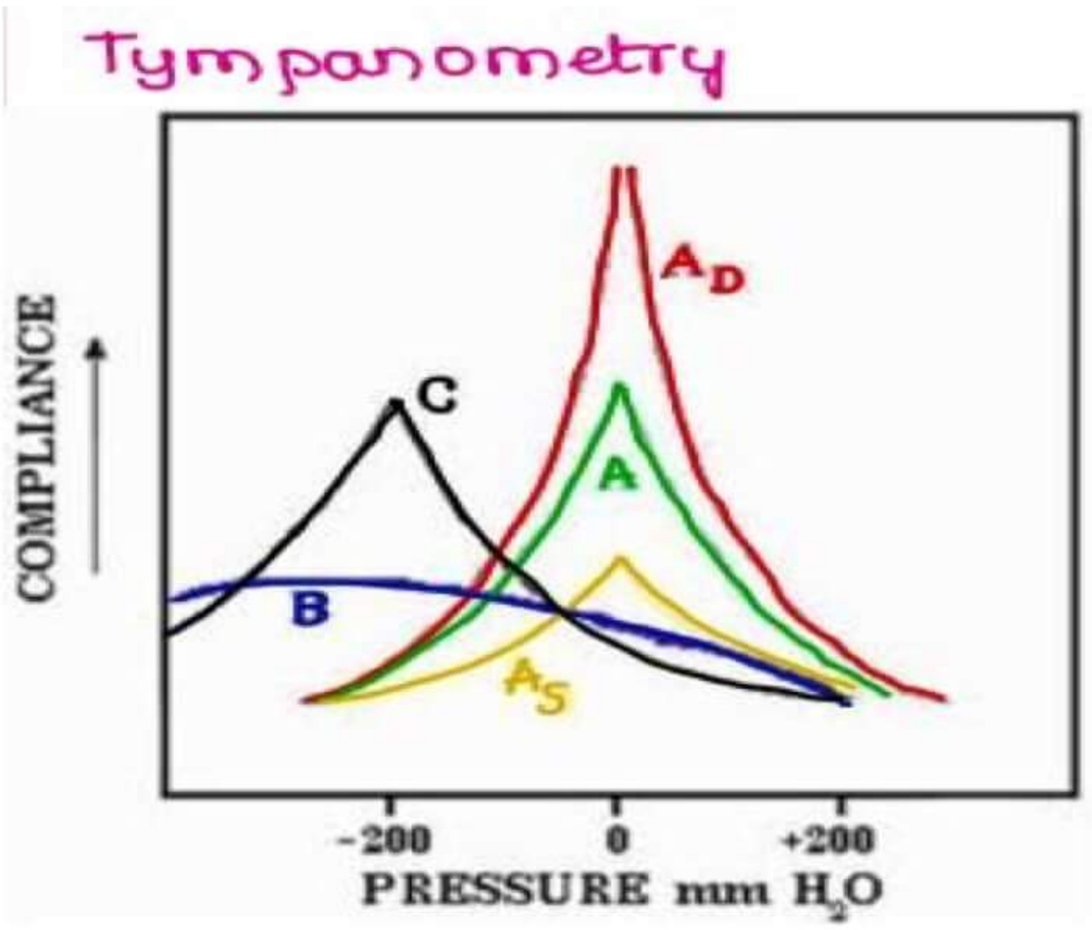
- Otosclerosis [Stapes becomes stiff]
- Tympanosclerosis

Type A_D → Seen in Ossicular **D**iscontinuity/ **D**ecrease in stiffness/ **D**imeric

Type B → Seen Fluid in the ME

- Glue ear (Serous otitis)

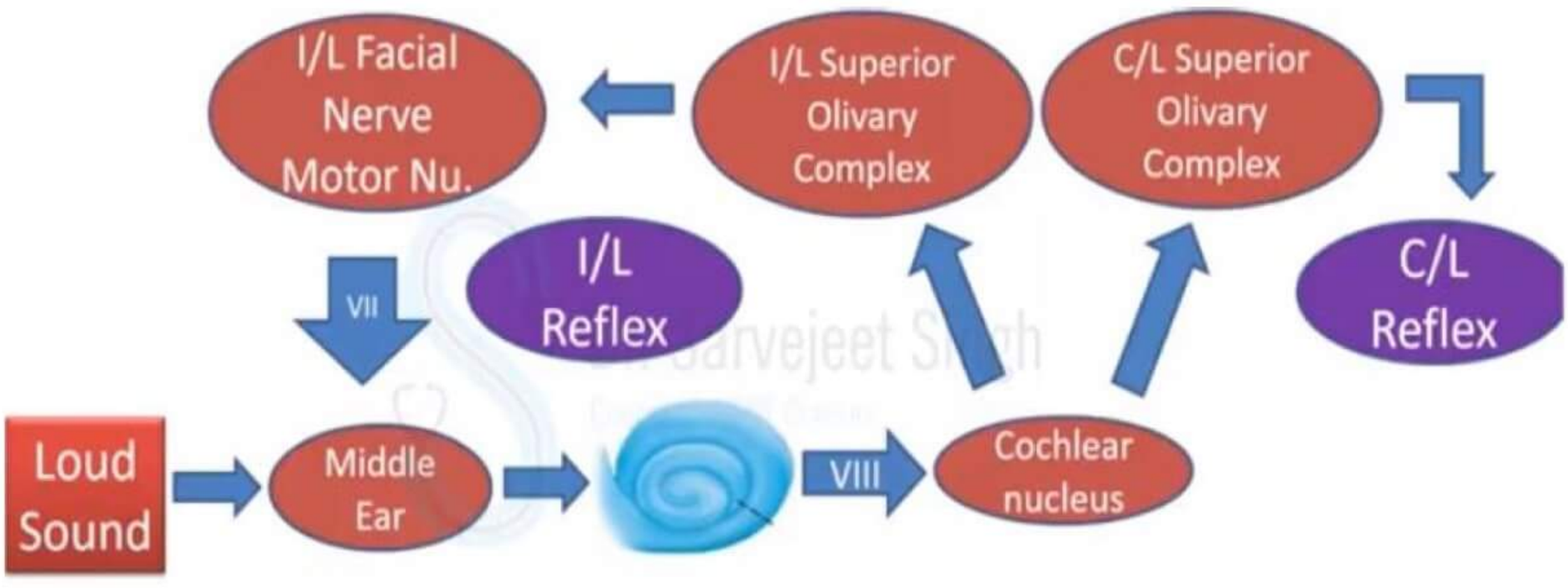
Type C → Seen in Retracted Tympanic membrane [We will apply same negative pressure first as TM is retracted]



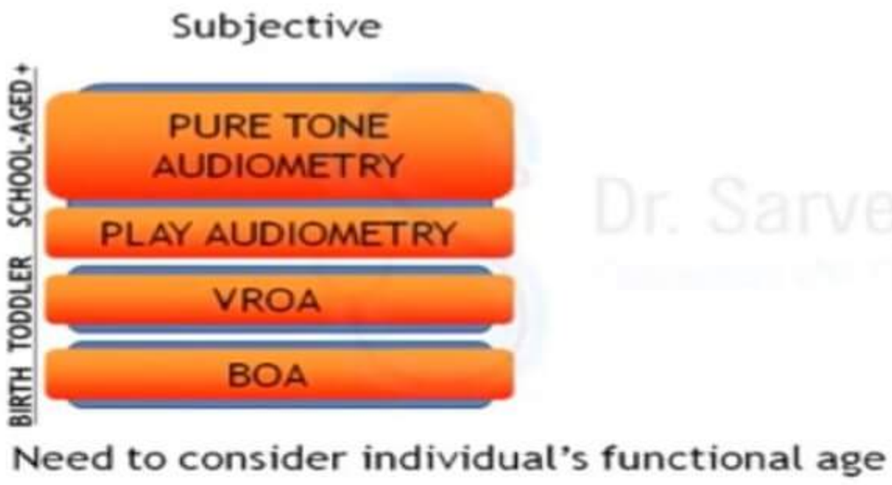
Stapedial Reflex:-

→ Protects inner ear from noise trauma

→ Stapedius muscle contracts on hearing loud sound



Age wise hearing assessment



Behavioural Observation Audiometry (BOA)

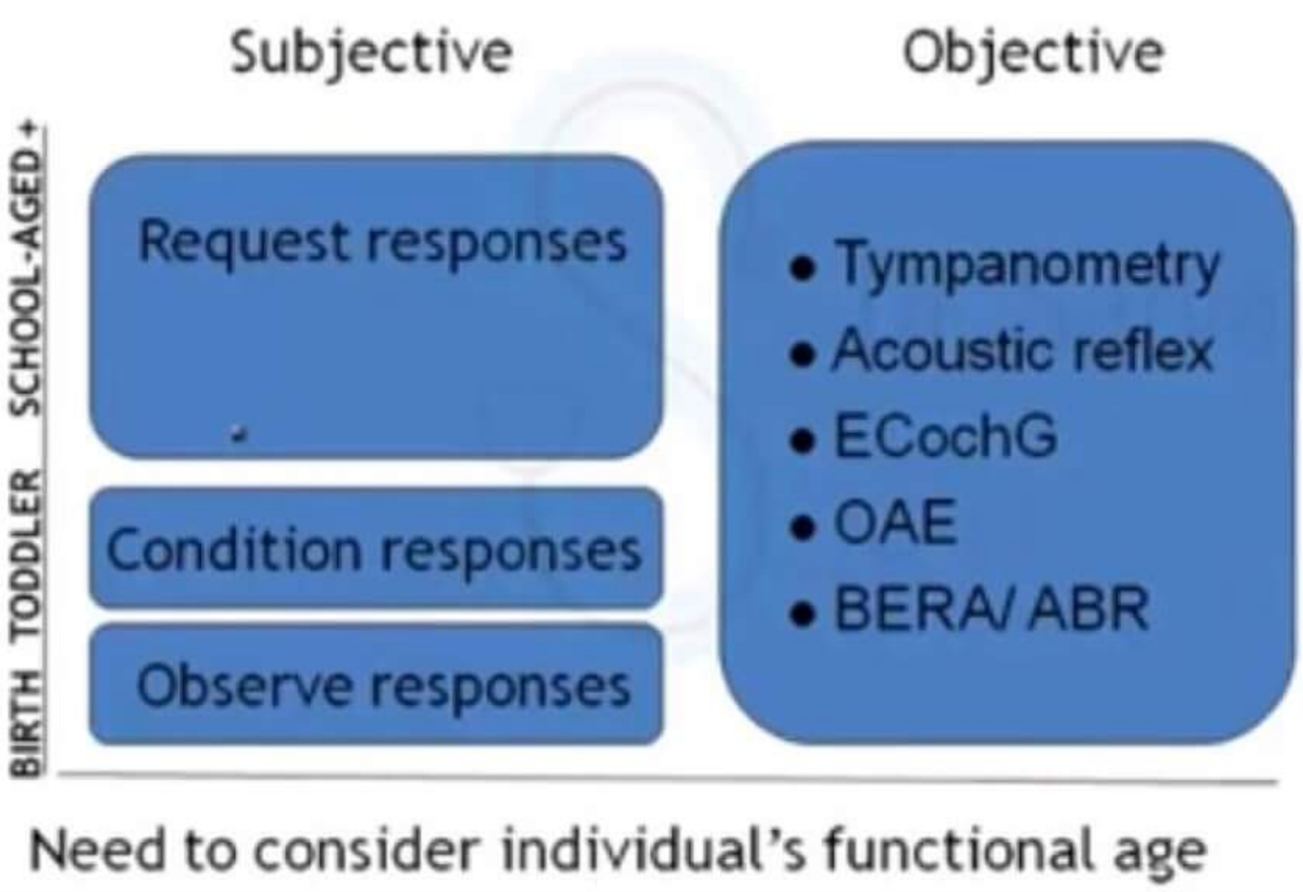
Baby moves head in towards the sound

Visual Reinforcement Orientation Audiometry (VROA)

Signal can be reinforced to child with visual clues

Play Audiometry (3-9YEARS)

On hearing sound child has to pick a toy and put it in a bucket



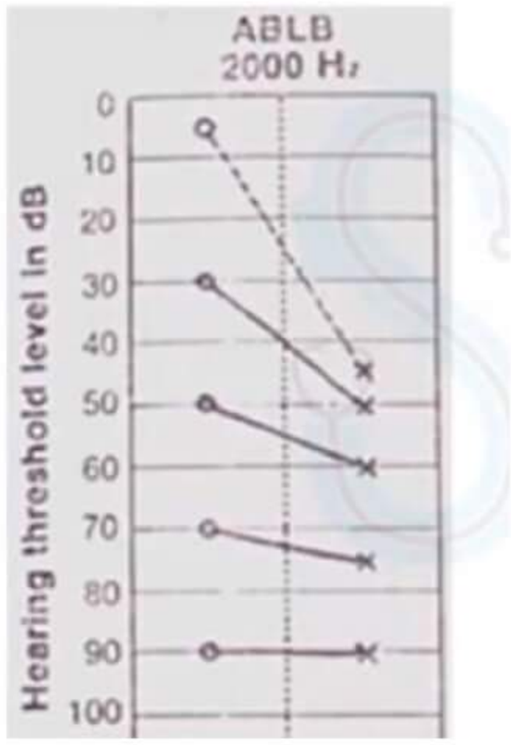
Special Audiometry Tests:

Recruitment

→ Present in cochlear hearing loss

→ The sound that is given appears louder than actual

ABLB LADDERGRAM (Alternate Binaural Loudness Balance Test)

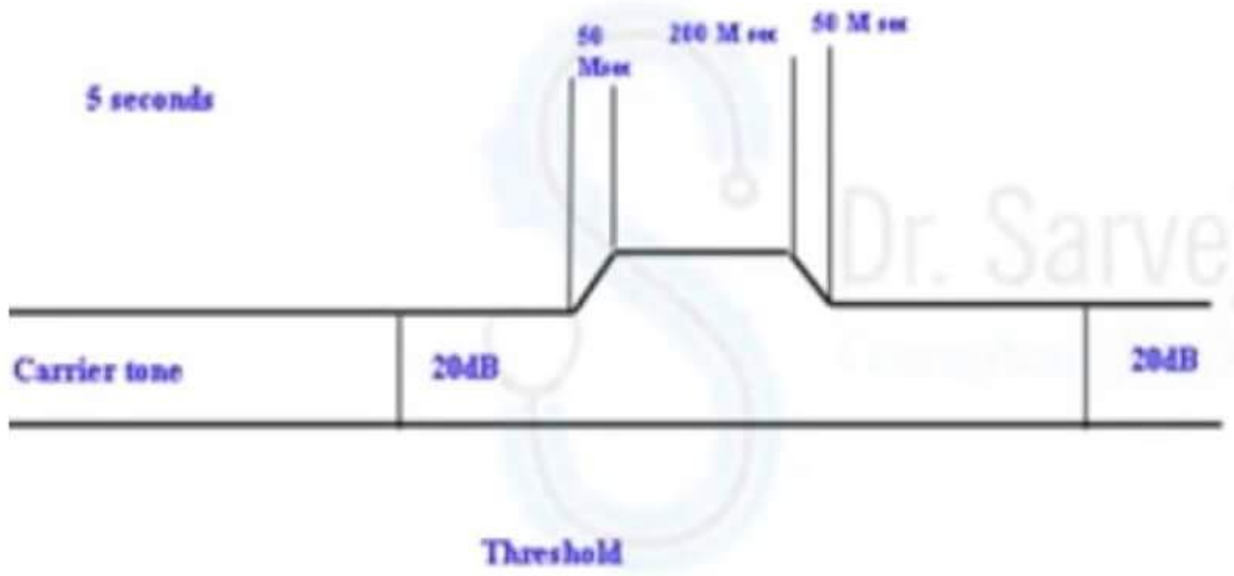


Laddergram is converging in Meniere's Disease (Cochlear deafness) due to recruitment

SISI (Short Increment Sensitivity Index) –

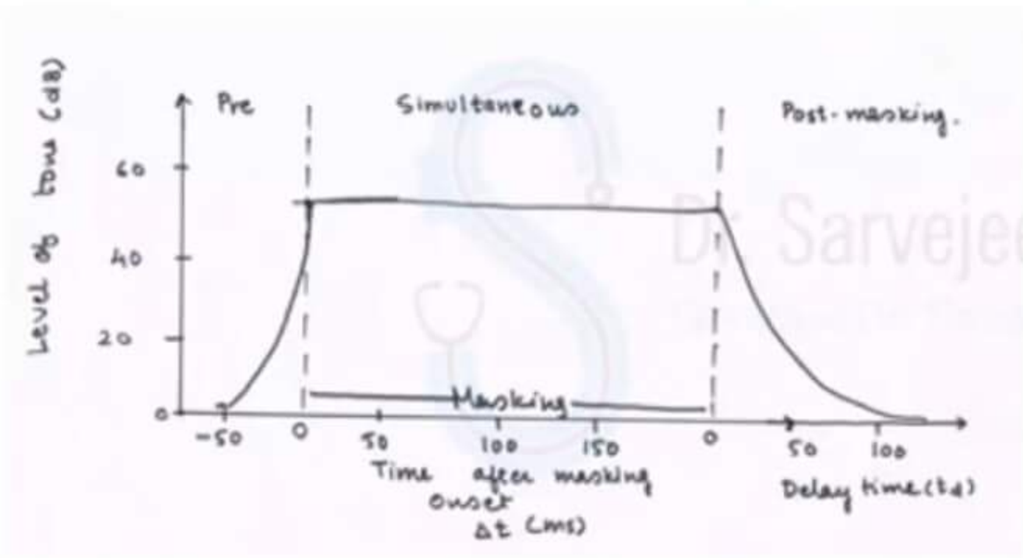
→ Pt. is given 1 dB increasing clicks above the 20 dB of his hearing threshold, and observed how many clicks he can be able identify

→ Test for cochlear hearing loss (Recruitment phenomenon) >70% correct identification



Tone Decay Test

→ If a normal individual is given a sound tone within his hearing threshold or 5 dB within 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	Retrocochlear

→ Identifies retro cochlear hearing loss > 25 dB increase in sound intensity so that patient can hear tone for 60 seconds.

Speech Audiometry

Speech Reception Threshold (SRT)

- Minimum intensity at which 50% of spondee (Disyllable with equal stress) words are correctly identified
- Spondaic words

  Pancake

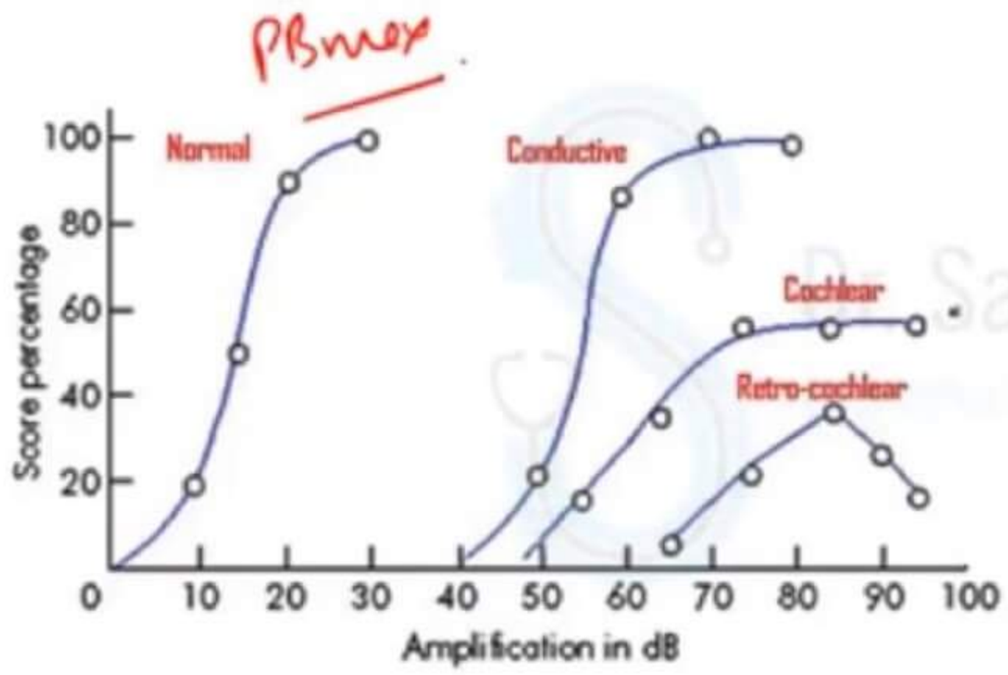
  Hardware

  Playground

  Bat ball

Speech Discrimination Score (SDS)

- Percentage of potentially balanced (Single syllable) words correctly identified at 40dB above SRT
- Phonetically balanced words – Hit, Pin, Tin, Bin
- PB max score normally reaches 100% 40dB above SRT
- IDENTIFIES RETROCOCHLEAR HEARING LOSS by ROLLOVER Phenomenon



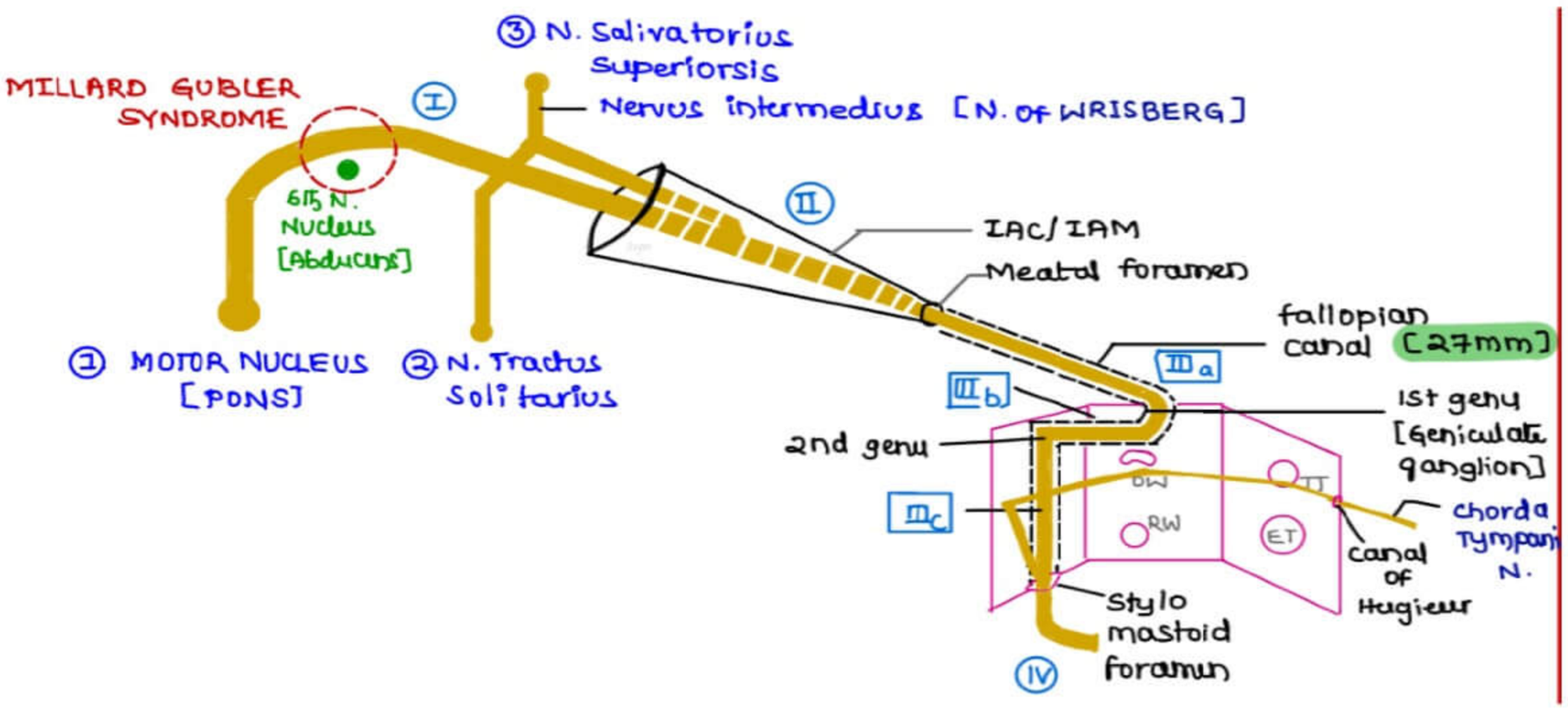
Cochlear Vs Retro-Cochlear

Test	Cochlear	Retro- Cochlear
Speech Audiometry	SDS = 60-80%	<40%, Roll over phenomenon
Tone Decay	Negative(<25 dB)	Positive (>25dB)
S.I.S.I	Positive (>70%)	Negative
A.B.L.B Laddergram	Converging	Diverging
B.E.R.A (Wave V Latency)	</= 4.2 msec	>4.2 msec

Facial Nerve

→ Mixed CRANIAL NERVE: Motor, sensory, secretomotor

Sensory part → N. of wrisberg



Segments

1) Intracranial segment (15 – 20 mm)
2) Intra meatal segment (8 – 10 mm)
3) Intra temporal segment / Fallopian canal
   - 3a) Labyrinthine segment [Shortest (3mm) / Narrowest (0.68mm)] 1st genu (3 – 5 mm)
   - 3b) Tympanic / Horizontal segment 2nd genu (8 – 12mm)
   - 3c) Mastoid / vertical segment stylomastoid foramen
4) Extra temporal segment (15 – 20 mm)

→ Fallopian canal – 27 mm

Longest bony canal of any Cranial Nerve.

→ Facial N. is accompanied by 8th nerve in Intra Auditory Meatus.

→ Millard Gubler Syndrome: - Lesion around 6th Nerve nucleus along c̄ 7th Nerve nucleus and facial nerve

→ 1st & 2nd genu present in intra temporal segment.

Ist genu has Geniculate ganglion

Branches of Facial Nerve

→ No branches from segment I, II & IIIa

→ From 1st genu – 3 branches

i) Greater Superficial Petrosal N. → carries preganglionic parasympathetic fibers.

ii) Lesser Petrosal Nerve

iii) External Petrosal Nerve

1st GSPN
Preganglionic
Parasympathetic

Petrotympanic Fissure → Middle cranial Fossa ← Deep petrosal Nerve

[Sympathetic fibers]

VIDIAN NERVE
[N. Of Pterygoid canal]

[In Pterygo palatine fossa]

PTERYGO PALATINE / SPHENO PALATINE GANGLION → Post ganglionic fibers

[Largest Peripheral Parasympathetic Ganglion]

Supplies

Lacrimal Glands | Nasal Glands | Minor Salivary glands & Taste In palate

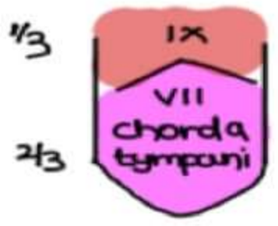
No Branches for III b

→ Just after 2nd genu, Facial N. gives a branch → N. to Stapedius
[1st motor branch of Facial Nerve]

→ Before Facial N. goes into stylomastoid foramen it gives a branch→ Chorda Tympani nerve (First embryological branch)

- comes in from the posterior wall and comes out from anterior wall through Canal of Hugier

Chorda tympani nerve
↓
supplies
Ant 2/3rd of tongue + submandibular & sub - lingual salivary glands.
← Taste – Chorda Tympani
Temp – Lingual N



→ Sub mandibular & Sub lingual salivary glands supplied by → Chorda tympani [VII]
Parotid gland supplied by → Glossopharyngeal N. [IX]

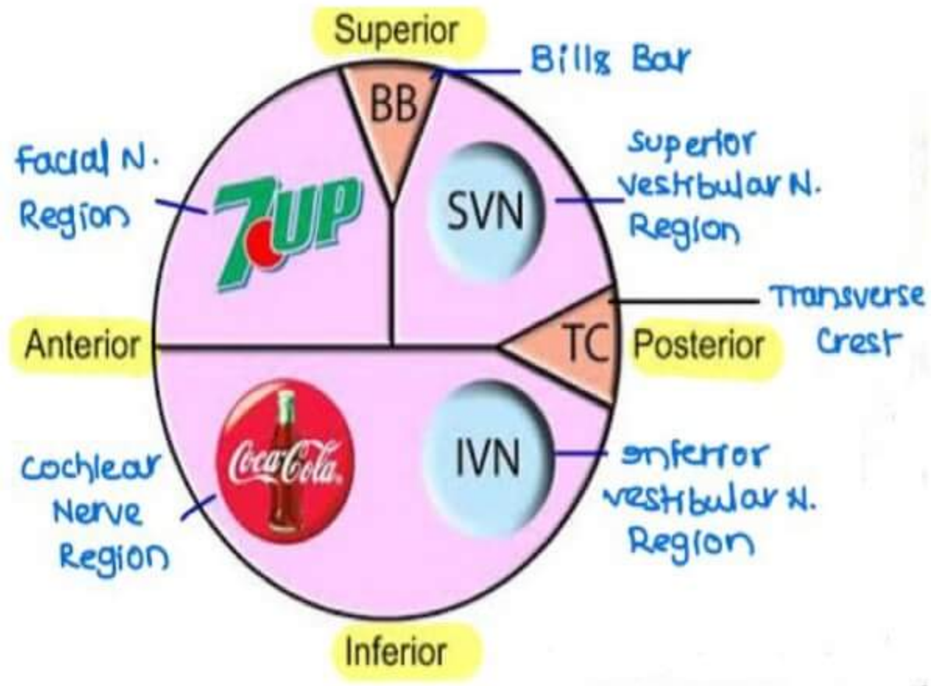
→ After coming out of stylomastoid foramen, Facial nerve goes into the Parotid gland and divides Parotid gland into 2 lobes

1. Superficial lobe
2. Deep lobe.

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

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

GOOSE FEET ARRANGEMENT
(or)
PES ANSERINUS



→ Bill's Bar

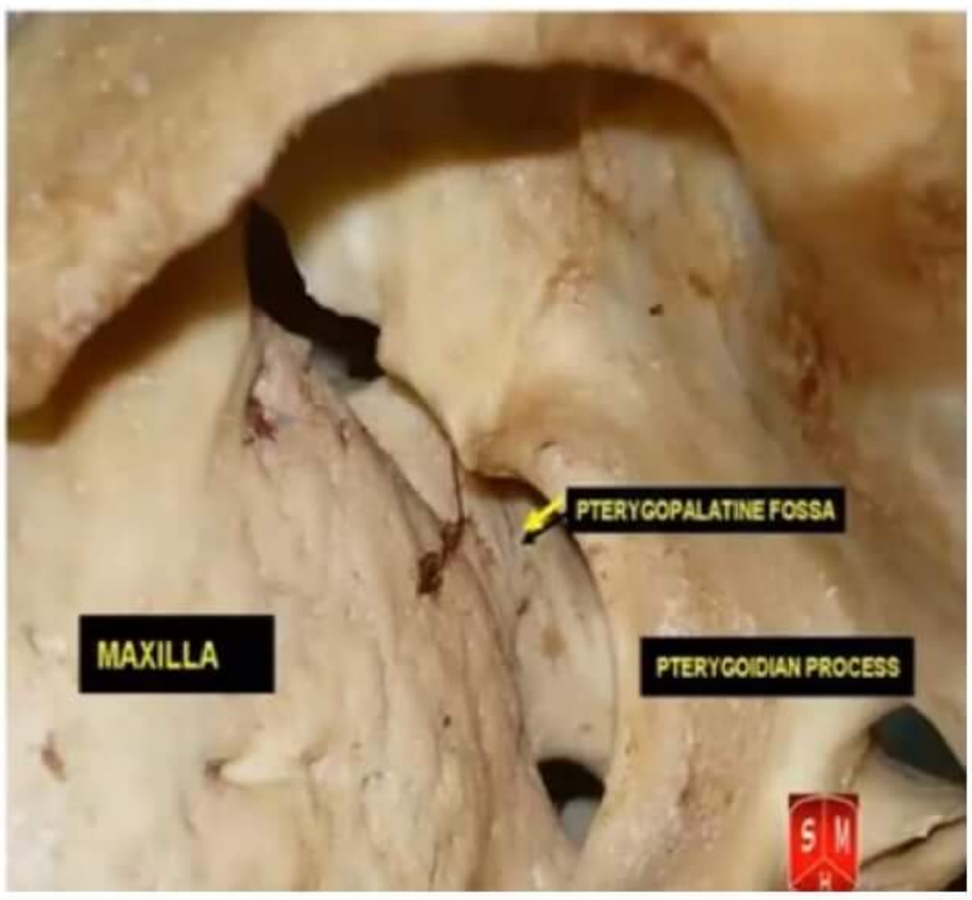
-Vertical edge of bone separates 7th CN & Sup. Vestibular N.

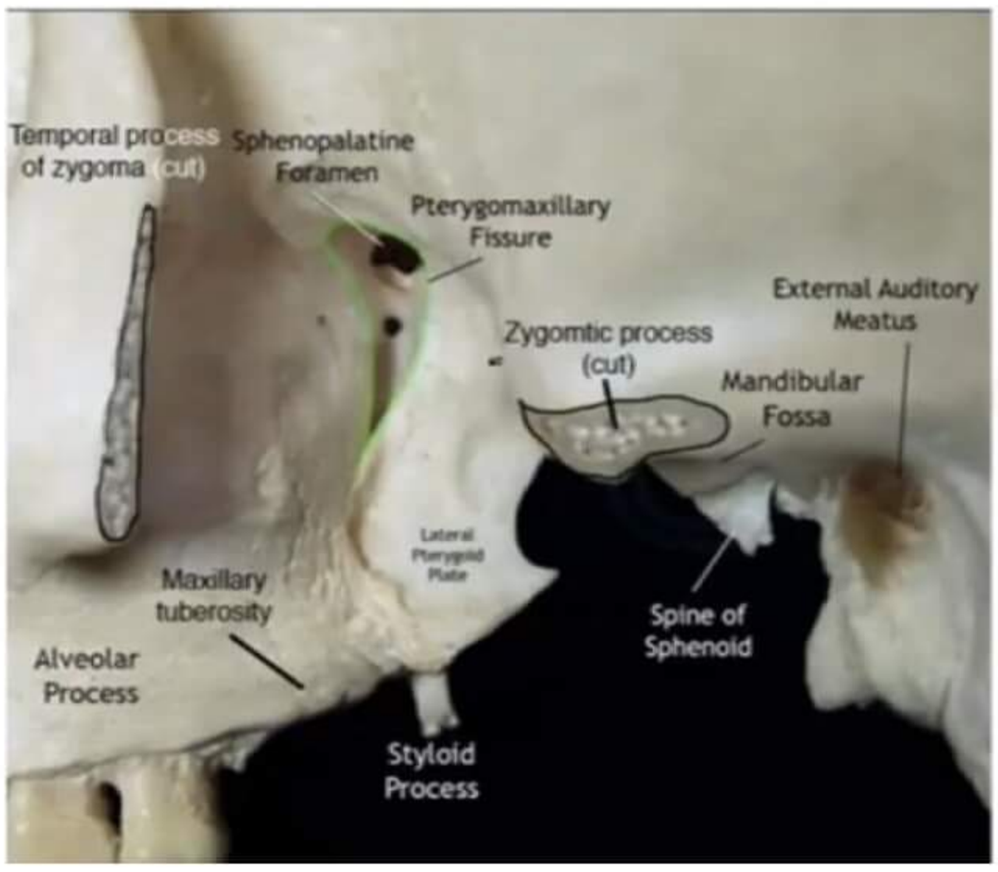
-Named after Dr. William House.

-Important surgical landmark for Facial N.

(Tympano-mastoid suture)

Pterygo Palatine Fossa





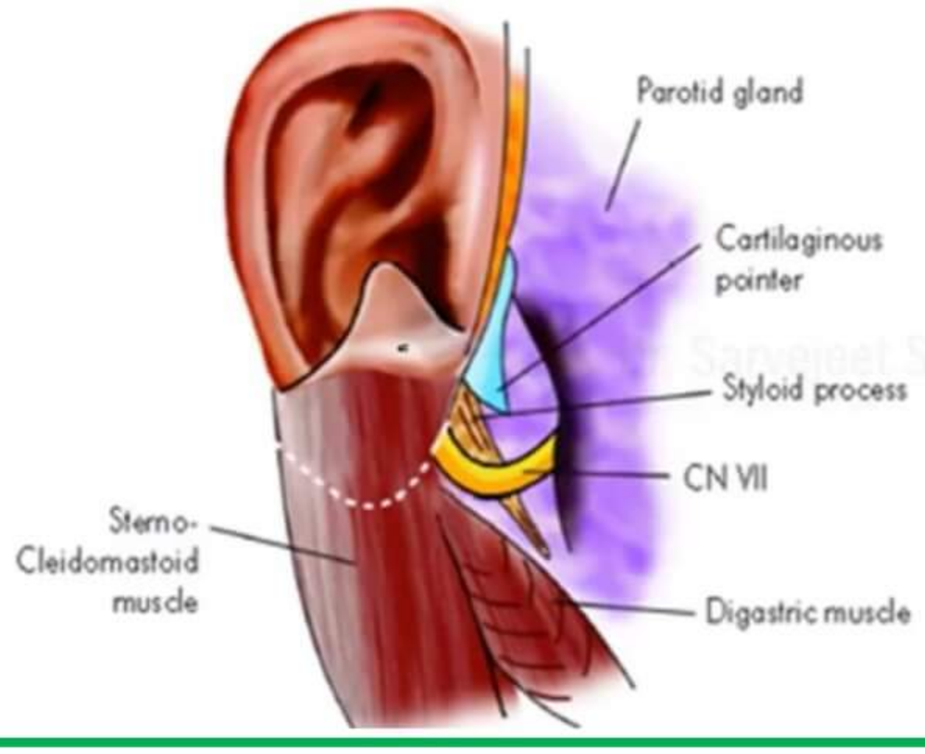
Sx LANDMARKS OF FACIAL NERVE FOR PAROTID Sx

→ Facial nerve lies 2.5cm deep and internal to the cartilaginous tragal pointer

→ Facial nerve is anterior and superior to the digastric muscle

→ Facial nerve is superficial and anterior to the styloid process

→ Tympanomastoid suture



Test and Diseases of Facial Nerve

Topo Diagnostic Tests

→ Used to identify the location of injury to the Facial nerve

1) Schirmer's Test /Tear Test/ Lacrimation Test

→ - ve → Both sides lacrimation is equal → Normal

→ GSPN is Normal → Facial nerve is normal till 1st genu.

→ + ve → One side lacrimation is decreased

→ GSPN is affected → injury to Facial nerve is at (or) above 1st genu

2) Stapedial Reflex Test

→ Protective reflex

→ Positive in Normal ears – Facial N. is Normal till 2nd genu

→ If it is - ve - Injury may be at or above 2nd genu

3) Taste Test

→ Ant 2/3rd of tongue → by Chorda tympani nerve

→ Taste present → + ve → Facial N. is Normal till stylomastoid foramen

→ Taste absent → - ve → Injury is above the stylomastoid foramen

4) Submandibular Salivary Flow Rate

→ Supplied by chorda tympani

→ Salivation on both sides Normal → - ve → Normal →Facial N. Normal till Stylomastoid foramen

→ Salivation on both sides different → + ve → Abnormal→ Injury is above stylo - mastoid foramen

Q. Patient of RTA, C/o Rt sided VII Nerve palsy.

Schirmer, Stapedial reflex, Taste test → - ve

Site of Injury?

A. Seg IIIa C. Seg IIIc

B. Seg IIIb D. Seg IV

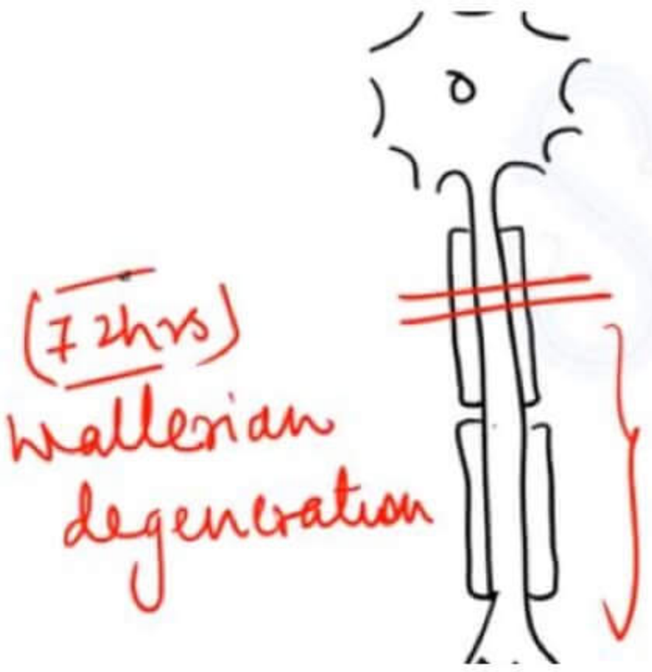
Answer: B- Seg IIIb

Electro Physiological Nerve Testing

→ Electrical stimulus is given proximal to injury

Response is recorded distal to stimulus } Normally

→ For Facial N.



- Test is done after 72 hrs
- Prognostic test

→ Sometimes, stimulus can be given proximal to injury a response is recorded distal to stimulus even in facial Palsy

Q. Not a Topo diagnostic test of VII nerve

a. Schirmer's test

b. Taste test

c. Impedance Audiometry

d. Electro Physiological Testing

Q. Not a Topo diagnostic test of VII nerve

a. Schirmer's test

b. Taste test

c. Tympanometry

d. Electro Physiological Testing

Diseases of Facial Nerve

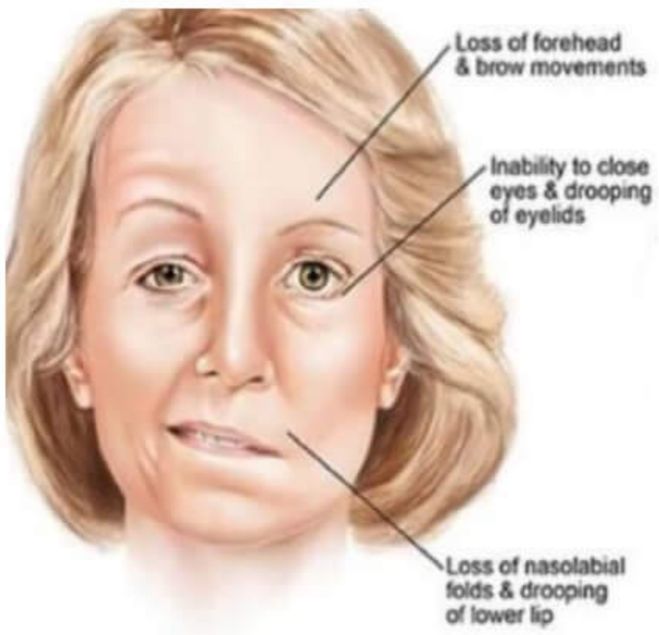
1) Bell's Palsy

→ MCC of Facial Nerve Palsy

→ Ipsilateral

→ Idiopathic (MCC)

→ LMN palsy



LMN	Vs	UMN
- Ipsilateral		- Contralateral
- Forehead not spared		- Lower half of face involved (Forehead spared)

Theories

1) Viral infection (Herpes)
2) Autoimmune theory
3) Hypersensitivity / Allergy theory

} Edema of facial nerve

But fallopian canal doesn't expand → compresses FN → Bell's Palsy

Ramsay Hunt Syndrome / Herpes Zoster Oticus

→ LMN Facial palsy + Vesicular rash in external ear + otalgia

70 % of Bell's palsy – Complete recovery
15 % of Bell's palsy – Incomplete recovery

} 85% recovery without treatment

→ 50% of HZ Oticus → 50% partial Recovery [Poor prognosis]
→ Involves other nerves also.

Treatment of Bell's palsy

1. Steroids

→ Prednisolone – for 7 days
↓ No improvement
7 days more
↓ No improvement
Taper the dose & stop
Electrophysiological N. testing
Surgical compression of the nerve

2. Antiviral

→ Acyclovir 800mg, 5 times/day, 5 days
(Only $\bar{c}$ in 72 hours)

3. Eye protective

→ Artificial Tear 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 protection
4. Physiotherapy,

} To be continued for 7 days more

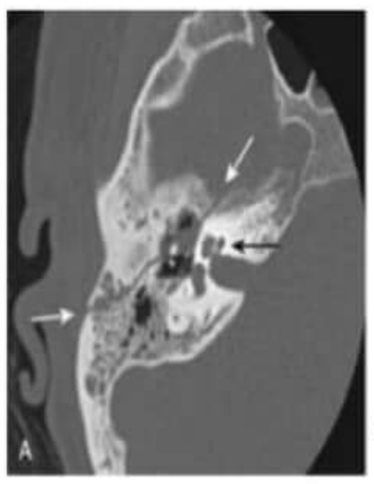
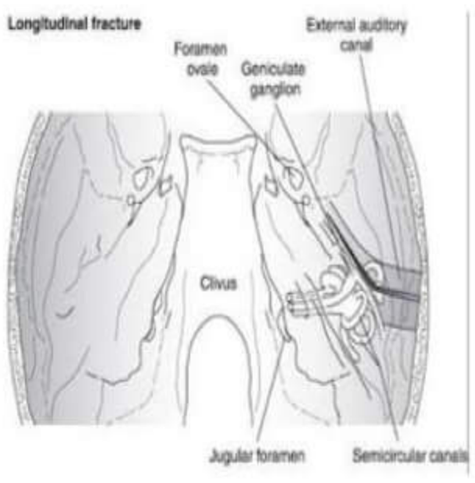
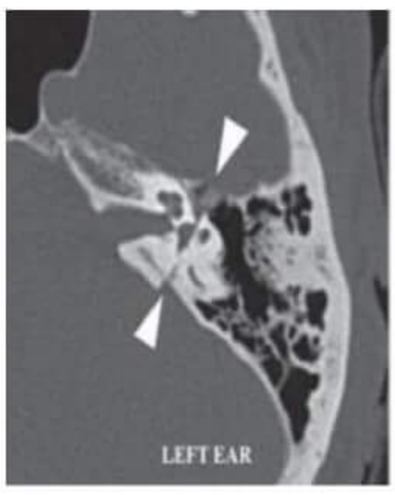
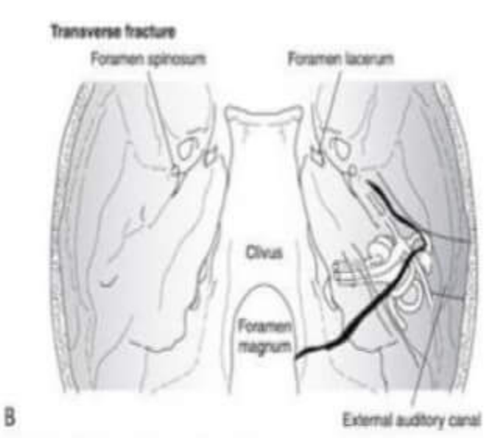
2. Antivirals → stopped

→ After 2 wKs → No improvement
1. Steroids → Taper the dose & stop

↓

Electrophysiological Nerve testing → Not much damage → Electro physiotherapy
If Bad Prognosis → S_x [Labyrinthine decompression of Facial Nerve]

Temporal Bone Fracture

Longitudinal Fracture	Transverse 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  	→ Perpendicular to the axis of temp. bone → D/t occipital blow → 20% • 50% have Facial palsy → Less chances of bleeding from EAC → Less chances of CSF otorrhea  

→ MC Temporal bone fractures → Mixed [54%]

→ Now a days, Temporal bone # are known as

Otic capsule sparing → less complications

Otic capsule involving → more complications

R_x

RTA, sudden & complete palsy ⟶ Facial N decompressing
Relayed & complete ⟶ Steroids
Sudden & incomplete ⟶ Steroids

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

Lesser Petrosal Nerve:

→ Lesser Petrosal Nerve is majorly contributed from Glossopharyngeal Nerve (IX) CN. But some fibers also come from Facial Nerve

↓

Carries preganglionic parasympathetic fibers

↓

Goes to otic ganglion

↓ [Also taken by 5th nerve (V3) Auriculotemporal nerve]

Supplies the Parotid gland

FREY'S Syndrome (BAILLARGER'S SYNDROME, DUPUY'S SYNDROME, AURICULOTEMPORAL SYNDROME, OR FREY-BAILLARGER SYNDROME)

→ Injury to Auriculotemporal nerve which is caring fibers of 9th nerve

→ Injury can take place in Parotidectomy, Rhytidectomy

→ C/F: Flushing and redness on the face while having food

Frey's Syndrome

Crocodile Tears Syndrome/Bogorad's Syndrome

→ Injury to Facial nerve before 1st genu of Facial nerve

→ C/F : lacrimation while eating.

Diseases of Middle Ear

(Otitis Media)

I) ASOM (Acute Suppurative Otitis Media)/AOM (Acute Otitis Media)

Causes

→ MC causative organism – Streptococcus pneumonia

→ Others: - H. influenza

Moraxella catarrhalis

→ These bacteria come from nose and pharynx through the Eustachian tube

- Functions of Eustachian tube

1. Maintains the middle ear pressure equals to the outside atmospheric pressure.
2. It drains the secretion of middle ear

→ M/C seen in children

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

O/E Dull & Luster less, Non-shiny

No cone of light

Stage 1

Stage 2

Stage II → Stage of Pre-Suppuration

→ Sterile, serous, mucoid secretion

→ TM bulges out, Blood vessels become prominent → CARTWHEEL APPEARANCE

→ O/E pain ↑es, Hearing ↓es

Stage III → Stage of Suppuration

→ Infection reaches ME

→ Fluid → pus

→ Severe pain + nt

→ Tragus sign - ive

→ Red congested bulging TM ready to burst

Stage 3

Stage IV → Stage of Resolution

→ TM burst

→ Pus comes out, pain ↓es

→ M/c site of TM Perforation → Antero inferior quadrant of Pars Tensa

Stage 4

→ After few weeks, perforation heals within 3-6 weeks & hearing becomes normal

→ A healed TM → Dimeric [No fibrous layer]

→ **LIGHT HOUSE SIGN** → Pus is coming out constantly

↓

Light is reflected back

Rx

Stage I and II → Antibiotics, Analgesics, Nasal decongestant drops

Stage III → Myringotomy (performed in Posteroinferior quadrant)

Rate of growth: PS > PI > AI > AS

Stage IV → 90% → leave alone

Complications

1) Acute Mastoiditis

→ Mc complication

→ Sign - Pain & tenderness on / Cymba concha

→ Ironed out mastoid

R_x → IV Antibiotics – 7 days

Battle sign → Hematoma over mastoid d/t # of middle cranial fossa

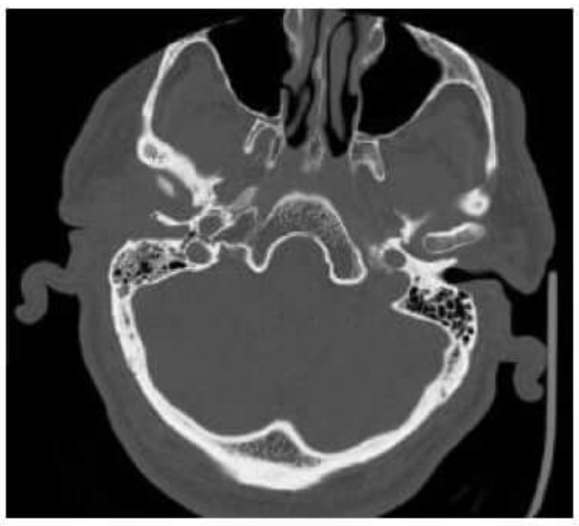
Grisseinger sign → Pitting edema over mastoid due to Sigmoid Sinus Thrombosis.

2) Coalescent Mastoiditis

- ME inflammation resolved
- But there is clouding of Mastoid air cells [Filled with fluid]
- Rx – IV Antibiotics x 3 weeks (Rxoc)

↓

Sx



2) Glue ear / Serous Otitis Media (SOM)/Secretory Otitis Media

→ Long standing collection of serous (or) mucoid fluid in the middle ear.

→ Mucoid otitis media or secretory otitis media / Non suppurative otitis media (or) Glue ear

→ Due to tumor, adenoids etc.

→ No pain

→ Conductive hearing loss (MC cause)

→ O/E – fluid filled middle ear - thin bulging TM c̄ fluid behind.

Blue TM (Sometimes) → Haemotympanum

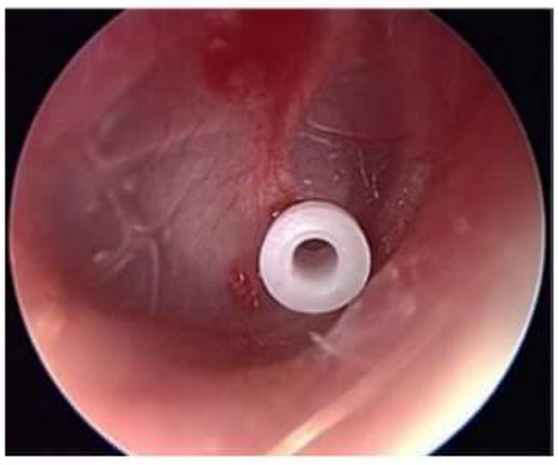
Laugier's sign →

Seen in 1. Glue ear [SOM]

2. Blood

3. Cholesterol granuloma

Glomus tumor (Reddish blue)



→ Pure Tone Audiometry

AB gap (25 – 30 dB) → CHL

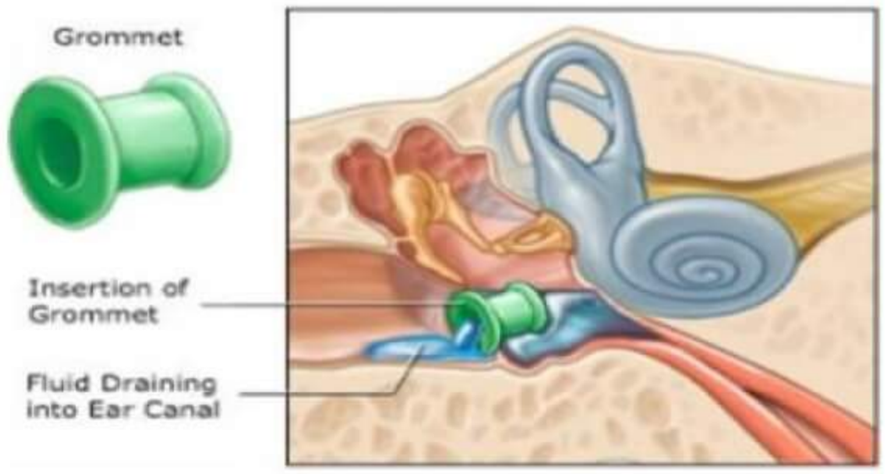
Tympanotomy – B curve

Management

→ Treat the cause (Tumor or Adenoids)

→ Myringotomy & drain the fluid (In Anteroinferior quadrant)

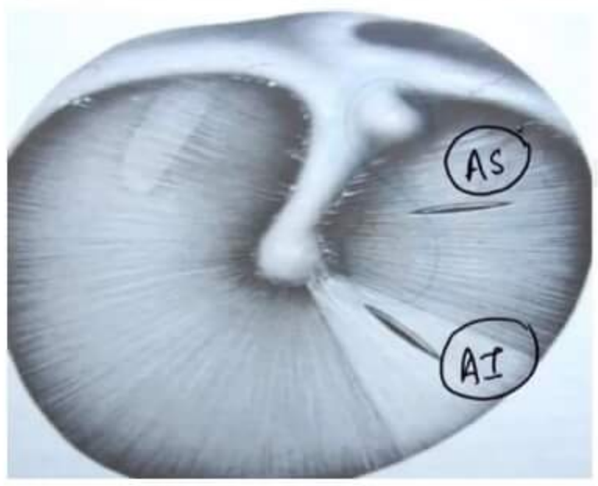
With grommet insertion.



Beer Can Principle

→ 2 Incisions, 1 in Antero superior quadrant for air entry

Other in Antero inferior quadrant for pus drainage



4) CSOM (Chronic Suppurative Otitis Media)/ Chronic Otitis Media

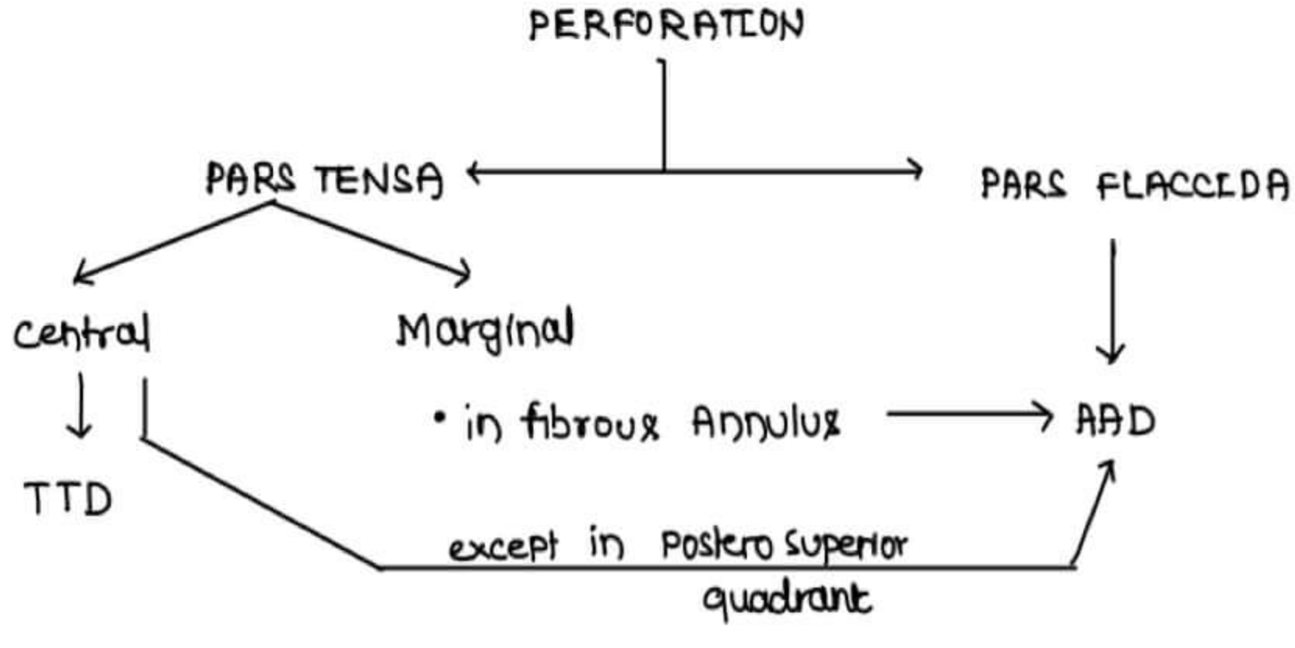
TYPES

→ Tubo tympamic disease (TTD) / safe CSOM

→ Attico-antral disease (AAD) / unsafe CSOM

} Perforation present

Tympanic membrane perforations



Tubo Tympanic diseases / Safe CSOM

→ CHL [AB gap -10-40 dB] [Depends on site & size of perforation]

→ Ear discharge

- Mucoid (or) mucopurulent
- Profuse
- Non foul smelling or foul smelling
- Continuous or intermittent

→ Central perforation +nt

- small → 1 quadrant
- medium → 2 quadrants
- large → 3 quadrants
- subtotal → 4 quadrants

→ Marginal perforation

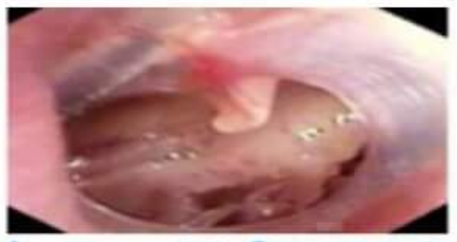
- Total → subtotal + fibrous annulus perforation

→ Rx

1. Active – Antibiotics (For discharge)
2. Tympanoplasty [Myringoplasty +repair of ossicles] → RxOC Myringoplasty [repair of TM]


small perforatn


medium perforatn


Large perforation


sub total perforatn


Total perforatn

Traumatic Perforation	Diseased Perforation
→ Irregular, rough margins → Blood clots around perforation  traumatic	→ Circular, kidney shaped margins → Smooth margins
	Sieve like perforation [Multiple perforations]
	→ seen in TB  diseased sieve like

Atticoantral Disease / Unsafe CSOM.

Cholesteatoma [Keratoma]

→ Normal keratinizing Stratified squamous epithelium

→ In abnormal place [Middle ear cleft]

→ Types

1. CONGENITAL (Mckenzie)
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

- Due to chronic infection / inflammation, mucous epithelium in ME transforms into squamous epithelium

1° Acquired Cholesteatoma

1) WITTMACK 'S Invagination / Retraction Pocket Theory

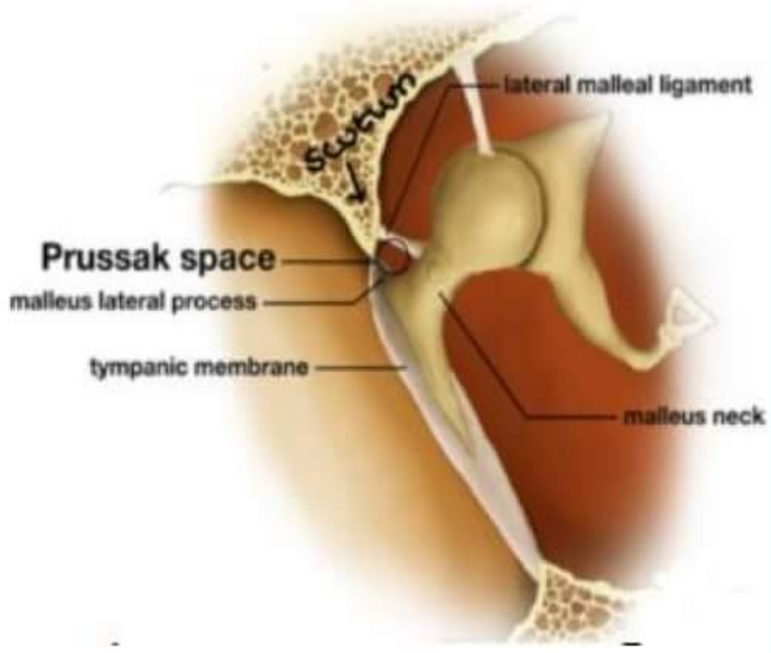
→ PRUSSACK'S SPACE - BOUNDARIES

→ SUPERIOR → Lateral malleal ligament

→ MEDIAL → Neck Of malleus

→ INFERIOR → Lateral process of malleus

→ LATERAL → Pars Flaccida & Scutum



→ In Acute Otitis Media

Stage I

→ 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 a cycle continues
- After a point, it starts eroding surrounding bones
- Erosion of bones is d/t release of enzymes from lysosomes of dead cells, whichactivates osteoclasts
- Erosion of scutum is characteristic feature of I° acquired cholesteotoma

→ Subsequently erodes antrum → ATTICO ANTRAL DISEASE

→ Most accepted theory
→ MC site of Iº acquired cholesteatoma
Formation → Prussack's Space
→ Prussack 's space located in Epitympanum

POSTERO SUPERIOR RETRACTN POCKET
1° Acq. cholesteatoma

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 Sx
6. Medico Legal case

→ HRCT and 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 mastoiditis
→ Cochlear implant
- After cortical mastoidectomy, posterior tympanotomy done
- MC site for cholesteatoma → Ant. inf. to round window
- KORNER 'S SEPTUM → Persistent petrous squamous suture
→ Makes difficult to find antrum
→ Lateral semicircular canal identification confirms the antrum

Radical Mastoidectomy
1. We open the mastoid and middle ear and common wall b/w 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 2nd 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)
b/w mastoid and ME is preserved

→ **Advantages**
- Hearing results are better d/t normal positioning of TM during Tympanoplasty
- Can go for swimming

→ **Disadvantages**
- Rate of recurrence is higher
- Advised to follow up by relook
  2nd stage Sx after 6 months

Complications of Otitis Media

→ Acute Otitis Media [AOM] Complications

- M/C complication of AOM is TYMPANIC MEMBRANE PERFORATION
- Acute Mastoiditis [2nd mc complication of OTITIS MEDIA]

→ Chronic Suppurative Otitis Media [CSOM/COM] Complications

→ Ossicular Chain Erosion [Mc complication 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 (Which can cross Blood brain barrier) like cephalosporins ceftriaxone

4. Labyrinthine Fistula

→ Mc site → dome of lateral Semicircular canal

FISTULA SIGN /TEST → Pressing on tragus with finger vertigo or nystagmus occurs

SEIGELIZATION → Tragus pressure with Seigel speculum

→ True +ve fistula Test → Fistula present
Fistula sign +ve

False - ve fistula Test → Fistula present
Fistula sign - ve

→ Seen in

Dead ear

Cholesteatoma covering fistula

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

→ Seen in

Congenital syphilis & Meniere's Disease } HENNEBERT'S SIGN

5. Petrositis

Clinical Features

→ Long standing discharge
→ Deep seated retro orbital pain
→ Diplopia of lateral gaze

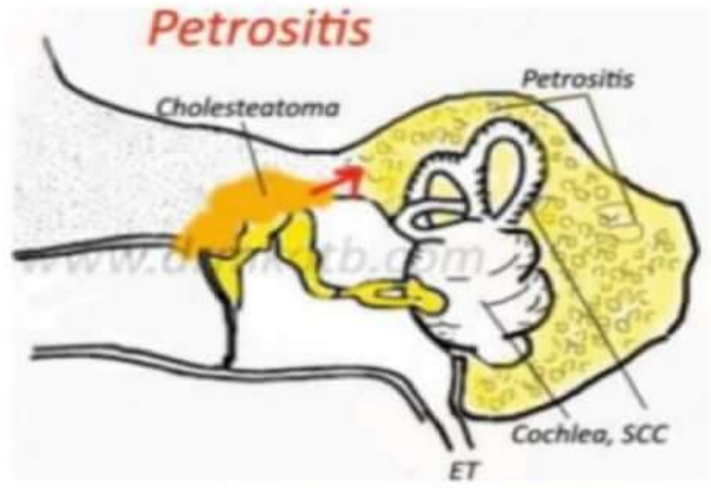
} GRADENIGO SYNDROME

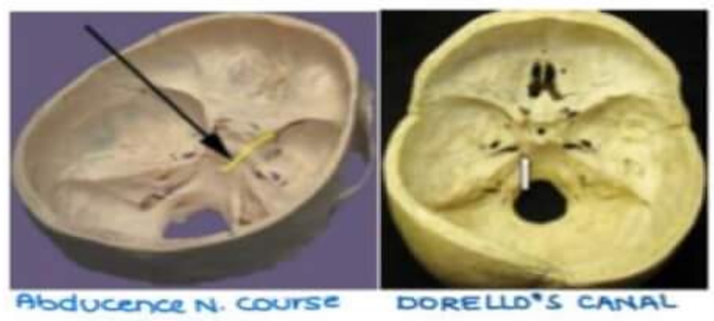
- D/t Lateral Rectus palsy
  D/t Abducent nerve palsy [6th CN]
  [D/t inflamed DORELLO's CANAL [6th n. canal]

→ Gradenigo syndrome

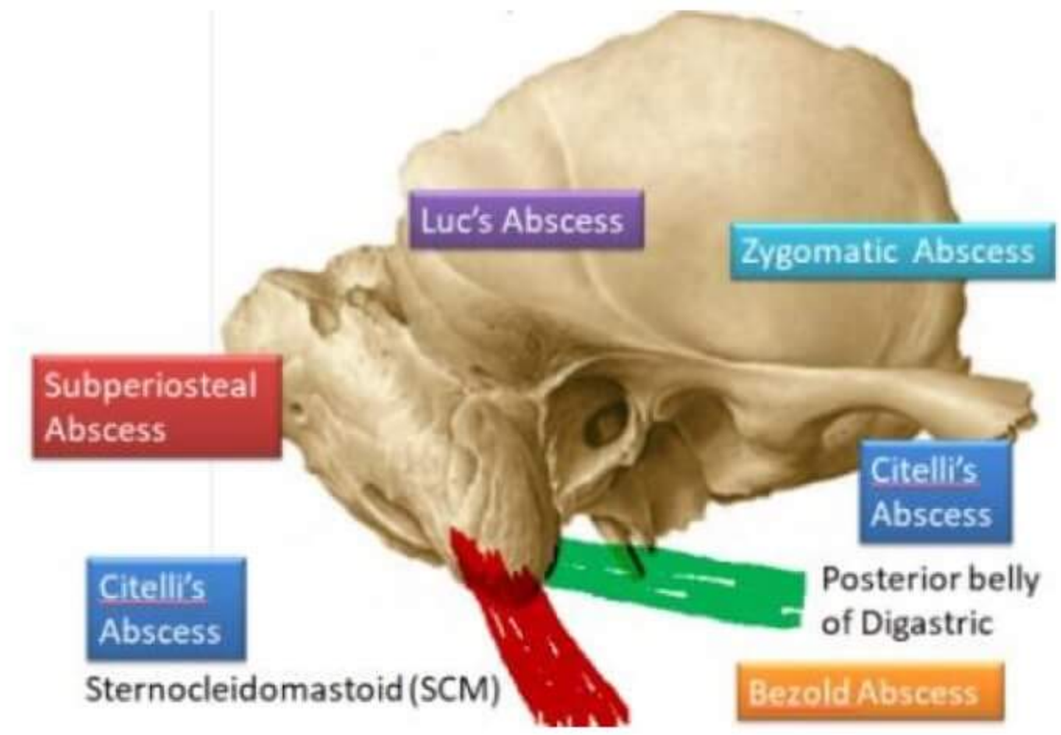
Grade D syndrome

D → Long standing Discharge
D → Deep seated retro orbital pain
D → Diplopia
D → Dorello's canal



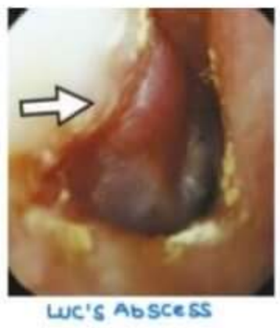


Extra Temporal Complications



1. POST AURAL / SUB PERIOSTEAL ABSCESS
2. BEZOLD ABSCESS
   → Present with torticollis [Spasm OF Scm]
3. LUC's Abscess
4. Zygomatic abscess
5. CITELLI's abscess → Anterior to mastoid along the posterior belly of digastric or
   → Posterior to mastoid


Post aural abscess


Luc's Abscess


Citelli's abscess


Zygomatic Abscess

Intra Cranial Complications

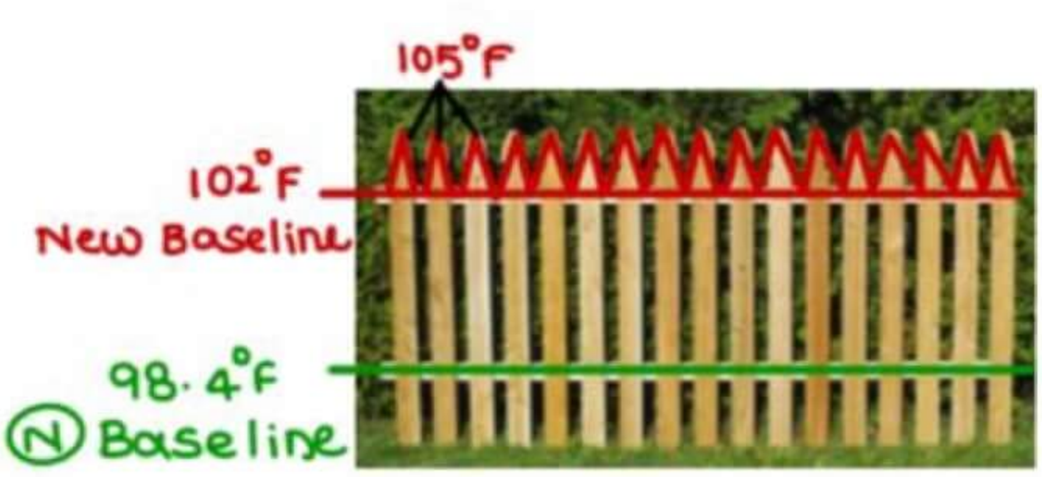
→ Meningitis (M/C)
→ Extra dural abscess
→ Sub dural abscess
→ Brain abscess
→ Otitic hydrocephalus
→ Sigmoid / lateral sinus thrombosis

Sigmoid / Lateral Sinus Thrombosis

→ C/F → Pallor
→ Headache
→ Picket Fence Fever

- Temperature does not come to normal base line
- Remittent fever

[Intermittent fever seen in malaria]



Management

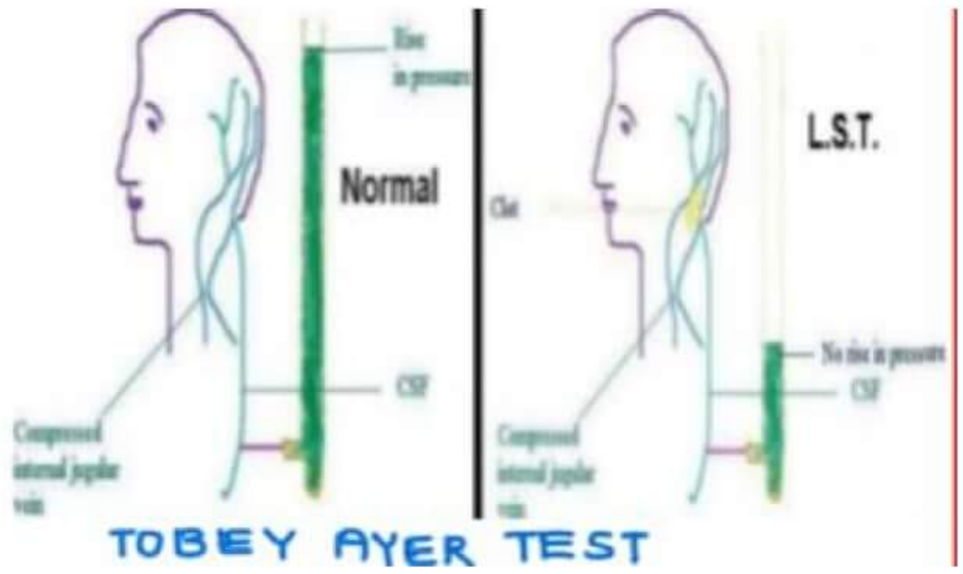
1) Tobey Ayer / Queckenstedt test.
→ Compression over IJV on normal side, increases CSF pressure in lateral sinus thrombosis
→ Invasive test

2) Crow beck test
→ Compression over IJV on same side leads to engorgement of Retinal veins.

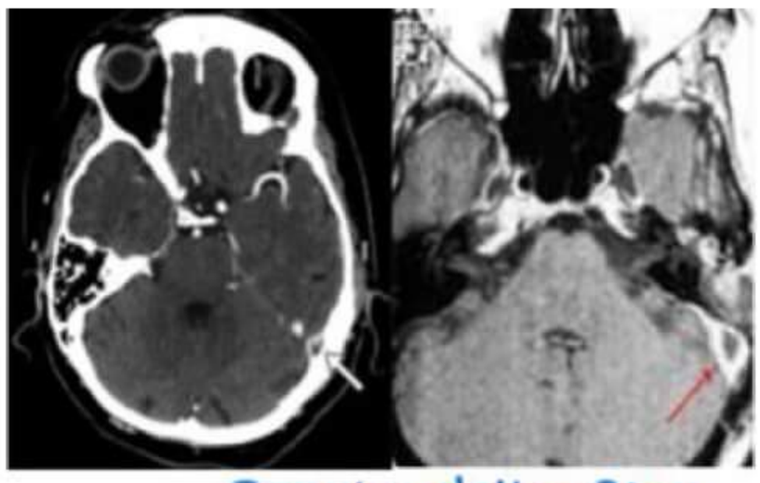
3) CECT / MRI
→ Empty Delta sign
→ Confirmatory

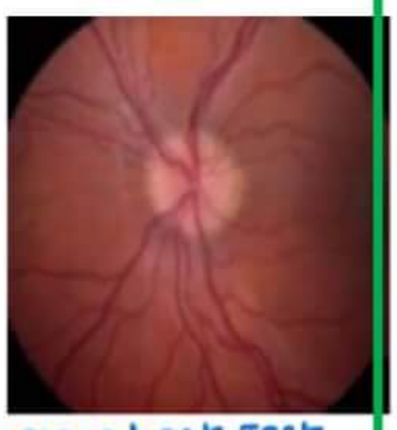
R_x

Surgery + IV Antibiotics



TOBEY AYER TEST


Empty delta Sign


crow beck Test

Otosclerosis

ENCHONDRAL BONE ⟶ SPONGY BONE

[Most commonly at Fissula ante Fenestram]

↓

Unorganized Bone

↓

Engulfs the Stapes foot plate

↓

↓ Hearing

→ Predominant in Females (20-30 yrs).

→ Increased Incidence in pregnancy.

→ AD (50% pts have +ve family history)

→ B/L hearing loss.

→ Tympanic membrane

- Usually normal
- Sometimes, show flamingo pink colour → Schwartz sign

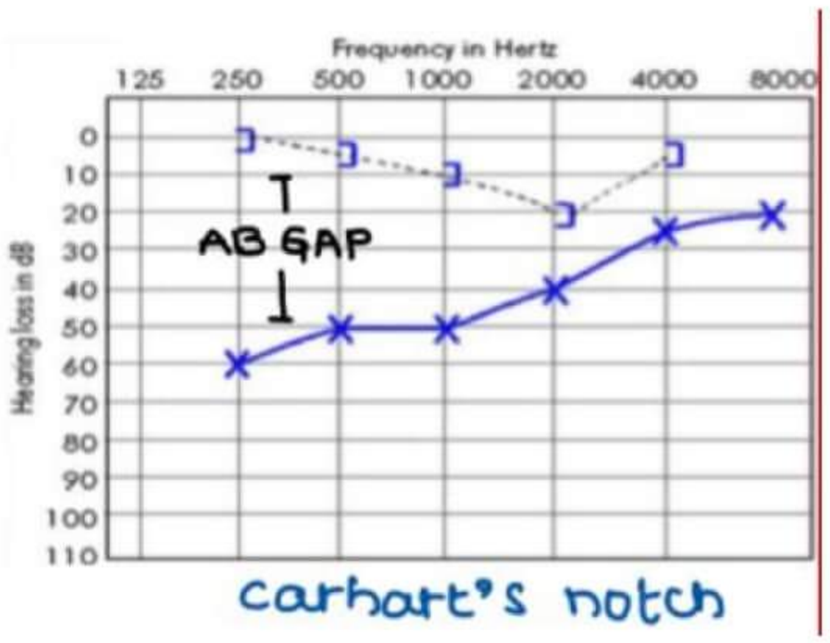
Seen when enchondral bone changes to spongy bone (Active/Early phase of disease)→ Otospongiosis

→ Dx

1) Pure Tone Audiometry

→ Otosclerosis is a disease of conductive hearing loss

DISEASE		AB GAP
SOM	→	25 - 30 dB
TM Perforatn	→	10 - 40 dB
TM Perforatn + 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 → (In NIHL) dip at 4000 Hz in bone conduction seen

2) Impedance Audiometry: As curve seen

3) Stapedial reflex is absent b/c stapes footplate is fixed.

→ Paracussis willisii - Pt. hears better in noisy places

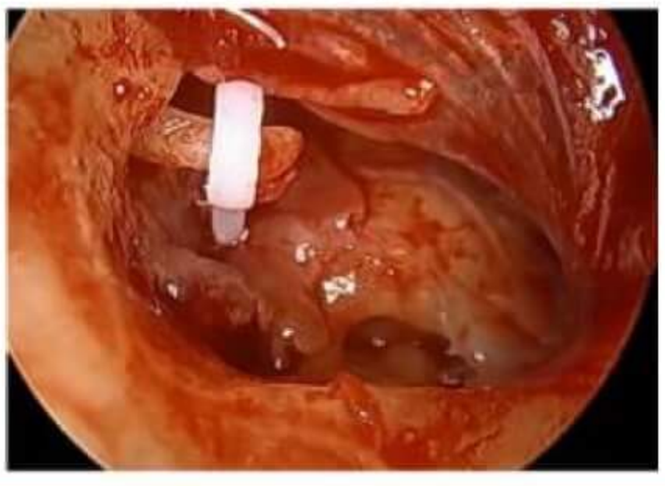
Also seen in pts. with B/L CHL.

→ Tx :-

1) Stapedectomy → Remove stapes & graft is placed at the oval window & piston is placed.

→ Risk of SNHL present

2) Stapedotomy (R_xOC) → Hole made in stapes footplate and anchored with piston



Glomus Tumor

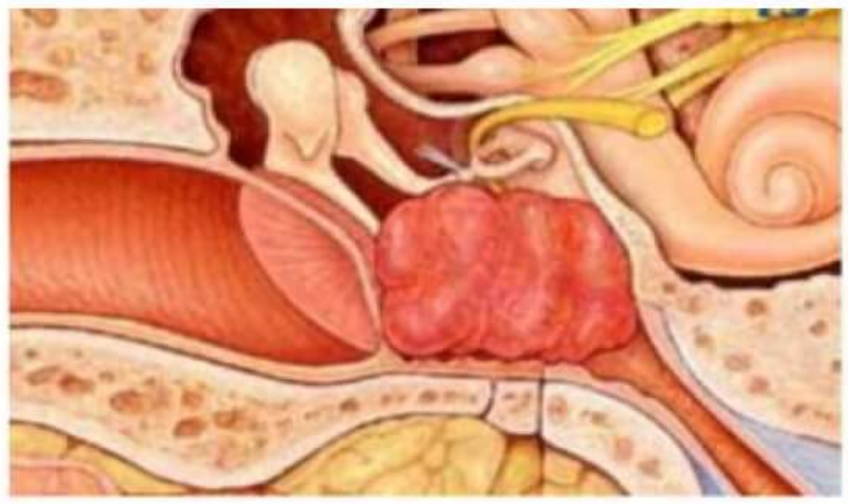
→ MC benign tumor of middle ear.

→ Arises from jugulotympanic paraganglions

(In association with Jacobson's and Arnold's nerves)

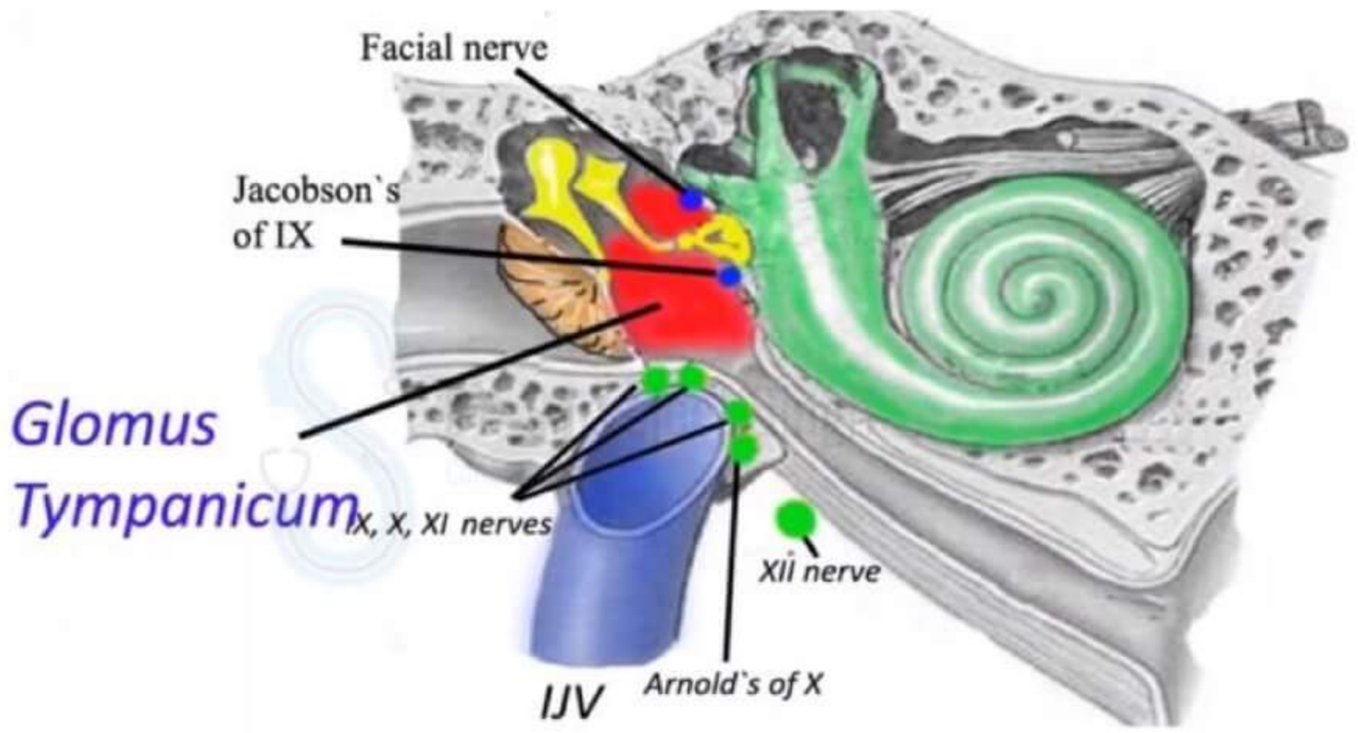
Paraganglionic cells

Glomus Jugulare | Glomus Tympanicum



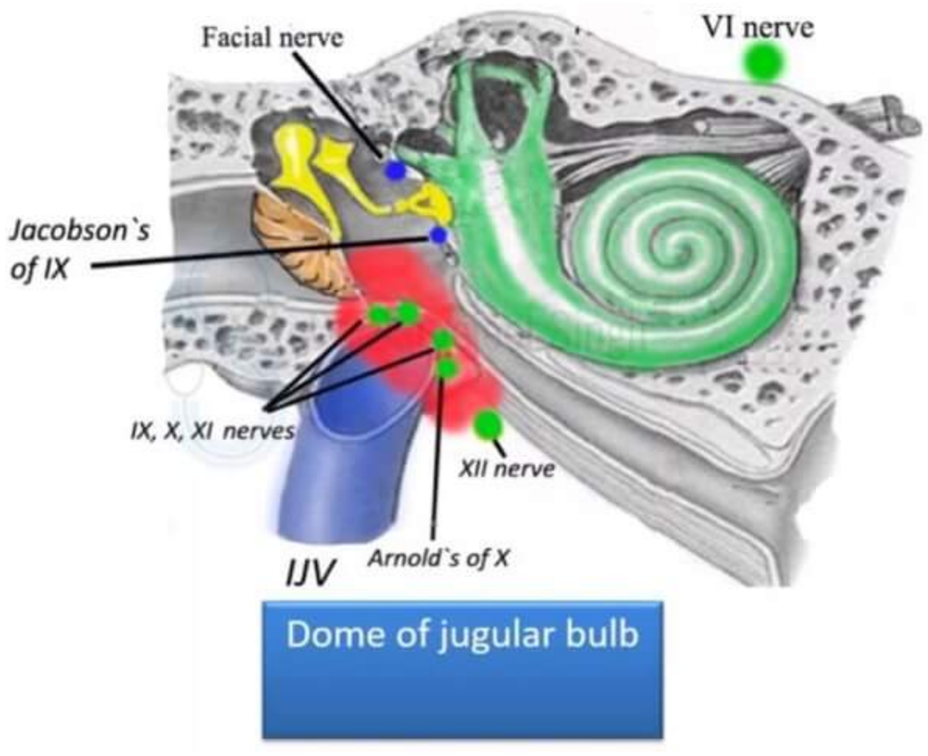
→Glomus Tympanicum

- Arises from the promontory along the course of jacobson's nerve
- Leads to facial nerve palsy most commonly



→Glomus Jugulare

- Arises from the dome of jugular bulb
- Leads to palsy of IX , X , XI , XII cranial nerves



→ **Bleeding Aural Polyp**

- If there is a bleeding polyp in EAC then, **biopsy is absolutely contra indicated**

→ Glomus tumor is locally invasive & highly vascular

→ MC blood supply of glomus tumor – Inferior tympanic branch of the Ascending pharyngeal artery

→ **C/F of glomus tumor**

- Age : 40-50yrs
- Female : Male ratio – 5:1
- Symptoms : CHL
  - Pulsatile tinnitus present
  - Profusely bleeding polyp in EAC

→ O/E – **RISING SUN / AQUINO / BROWN SIGN**

Rising sun sign → Reddish blue rising from hypotympanum

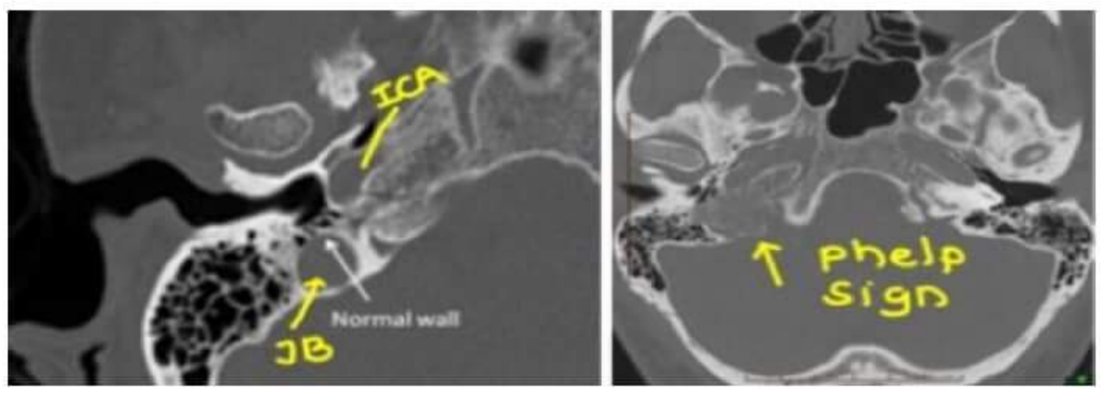
Aquino sign → Jugular pressure c̄ finger leads to ↓ Tinnitus.

Brown sign → On seigelization, tumor blanches & becomes white

→ Sometimes Blue Tympanic membrane is seen.

→ CECT (IOC)

- Confirmatory Test.
- Phlep sign seen on CT. (Inability to distinguish b/w internal carotid Artery & jugular bulb d/t erosion of caroticojugular crest.)



→ Staging of glomus tumor

Fisch Classification (Glomus Tympanicum)

TYPE A – Middle ear cleft

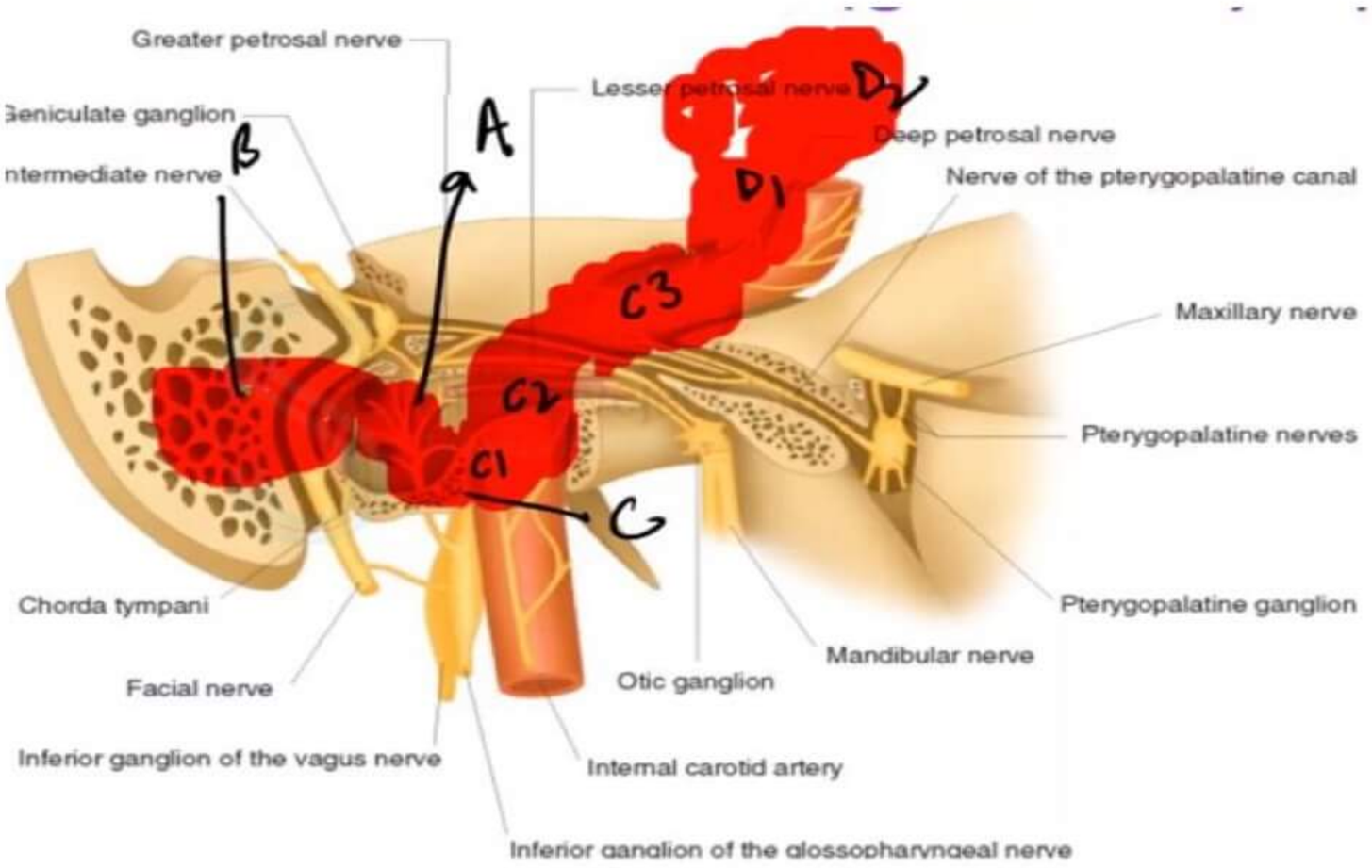
TYPE B - Tympano mastoid area

TYPE C -Infra labyrinthine compartment / petrous apex

- C1 : Limited involvement of vertical portion of carotid canal
- C2 : Invasion of vertical portion of carotid canal
- C3 : Invasion of horizontal portion of carotid canal

TYPE D -Intra cranial involvement

- D1 : I/C extension (< 2cm in diameter)
- D2 : I/C extension (> 2cm in diameter)



Rx

→ Surgical excision (TOC)

→ 10% Rule → 10% multicentric

→ 10% familial

→ 10% secretory (Secretes catecholamines)

Diseases of Inner Ear

Congenital Deformities

1. **Michel's Aplasia**
   - → Absence of cochlea
   - → Absolute C/I of cochlear implant
2. **Scheibe's Dysplasia (Cochleosaccular Dysplasia)**
   - → M/C congenital anomaly
   - → Absolute C/I of cochlear implant
3. **Mondini's Dysplasia**
   - → M/C congenital anomaly of cochlea
   - → Cochlea have only 1.5 turns
   - → Can do cochlear implantation
4. **Alexender's Dysplasia**
   - → Basal turn of cochlea is absent
   - → Absolute C/I for cochlear implant

Meniere's Disease / Endolymphatic Hydrops

→ **Endolymph** – Normal Physiology

- → Secreted by stria vascularis
- → Transported to endolymphatic sac by endo lymphatic duct
- → Endolymph absorbed by endolymphatic sac

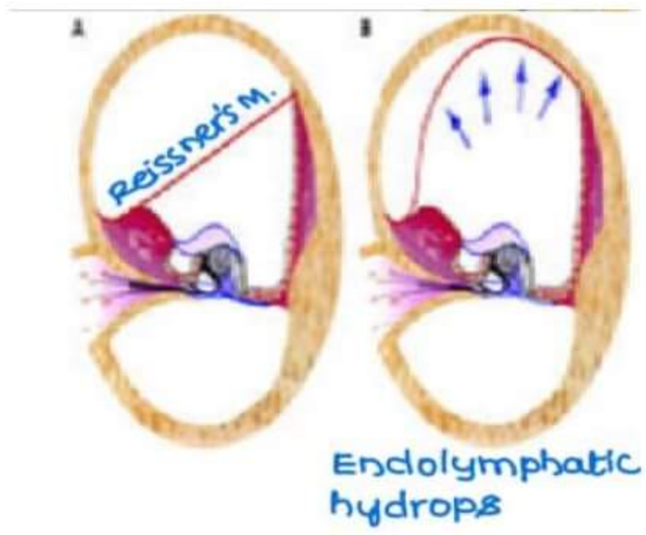
→ **Endo Lymphatic Hydrops**

Collection of endolymph in inner ear due to

- Excessive production
- Blockage of duct
- Defective absorption

→ D/t ↑ing pressure, at some point Reissner's membrane breaks, & Causes

- → VERTIGO [d/t K^+ entry into perilymph and causes irritation]
- → SNHL [d/t ion gradient imbalance]
- → Tinnitus / Aural fullness



→ After some time, Reissner's membrane heals, ion gradient returns → Hearing comes back to normal

K^+ restores in endolymph → Vertigo subsides

→ And again the above cycle continues, leading to

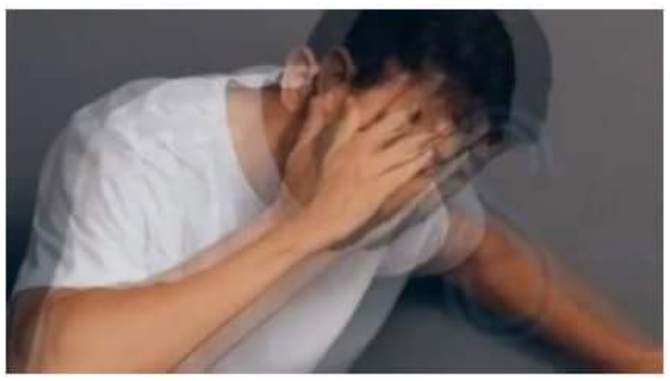
1. Episodic Vertigo
2. Fluctuating SNHL
3. Tinnitus [Remains even btw 2 episodes]
4. Aural Fullness

} TRIAD

→ U/L disease, Common in 35 – 40 yr, Male

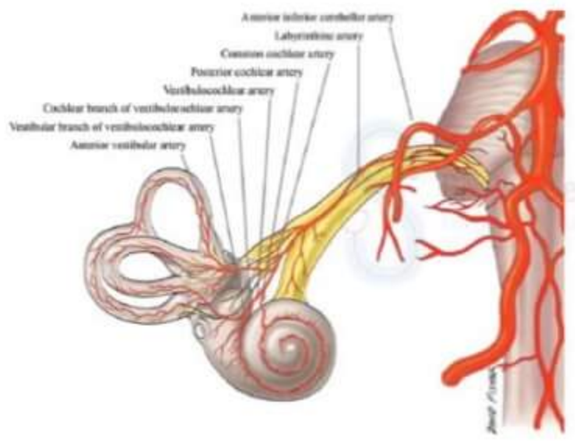
Other Phenomenon:

1. **Tullio's Phenomenon:** Loud Nose Precipitates Vertigo
2. **Tumarkin's Crisis**: Sudden Fall Attack
3. **Lermoyz syndrome**: Vertigo Relieves SNHL
4. **Hennebert's Sign**: Fistula Test False +ve



TULLIO

TUMARKIN



LERMOYEZ

Diagnosis

1. Pure Tone Audiometry → SNHL

↓

IV glycerol [1.5 ml/kg] [Glycerol test]

↓

Repeat Puretone audiometry after 30 min

↓

Hearing improved > 10 dB

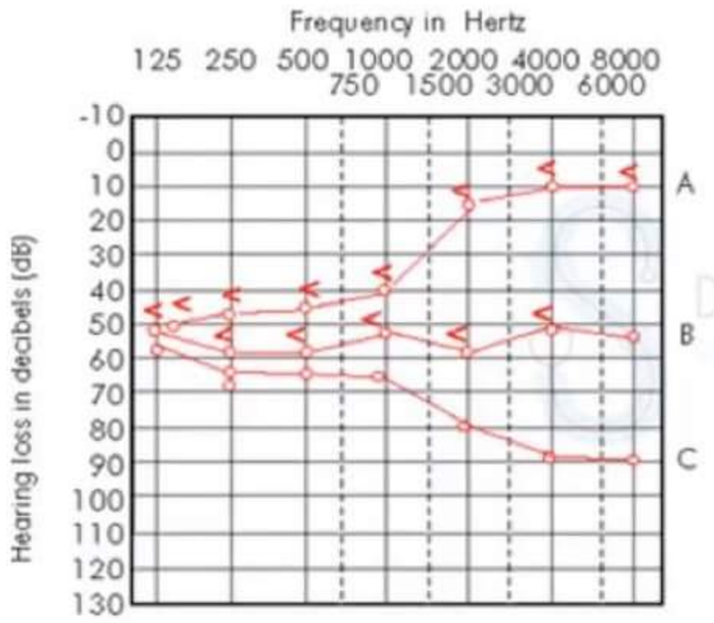
↓

MENIERE'S disease

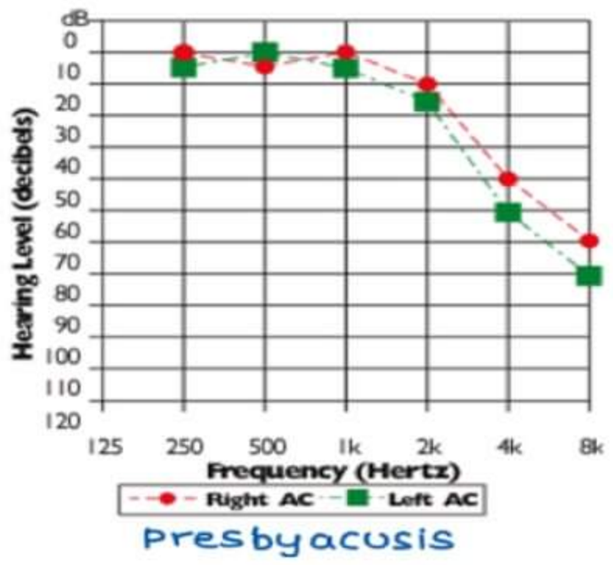
2. Electro cochleography
   → Confirmatory test

Pure Tone Audiometry

A. Early Meniere's disease → Rising curve
→ More hearing loss at low frequencies
→ High hearing loss at less frequencies



B. Late Meniere's disease → Sloping curve
→ More hearing loss at high frequencies
→ U/L sloping curve
[B/L Sloping curve → Presbyacusis
→ Ototoxicity]



Presbyacusis

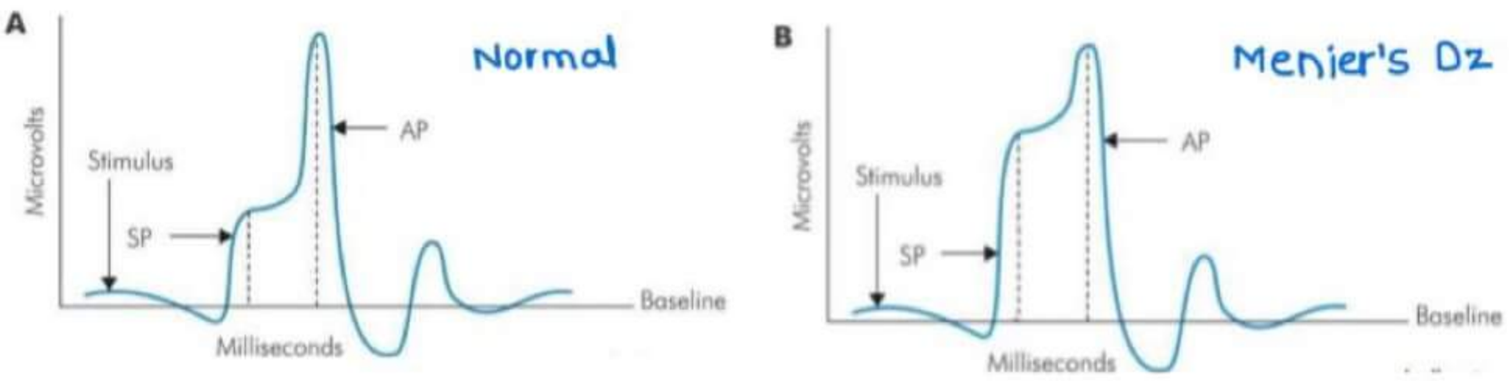
Electro Cochleography

→ Confirmatory test

→ In Normal ear, summating potential (SP) < 30 % AP

→ In Meniere's disease, SP > 70% AP

→ Invasive procedure



Tx

I) Acute episode: - Labyrinthine sedatives

II) Maintenance phase

a) Medical

→ k^+ sparing diuretics

→ β Blockers

→ Antihistamines – cystaminics

b) Surgical

→ Conservative: Endolymphatic sac decompression, vestibular neurectomy

→ Radical: Surgical labyrinthectomy

↓

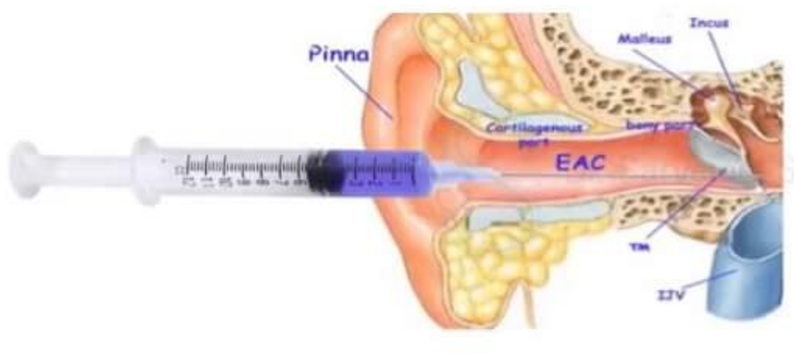
Surgical landmark's Donaldson's line

Surgical labyrinthectomy is done in a patient with chronic Menier's disease with sever SNHL because of which U/L ear is not serviceable for hearing and patient has vertigo

Q. Gold standard treatment for intractable vertigo in a patient of Menier's disease??

Ans: Surgical labyrinthectomy

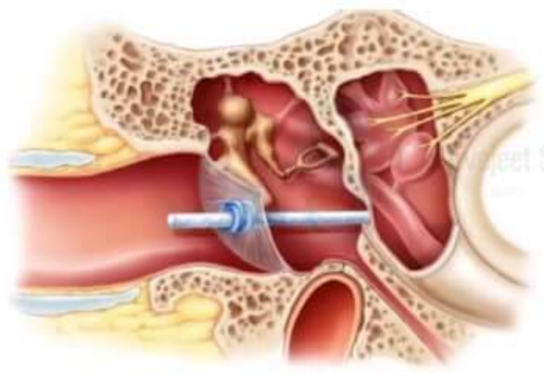
C) Intra Tympanic Gentamycin Therapy



→ Chemical Labyrinthectomy

D) Silverstein Microwick Microcatheter

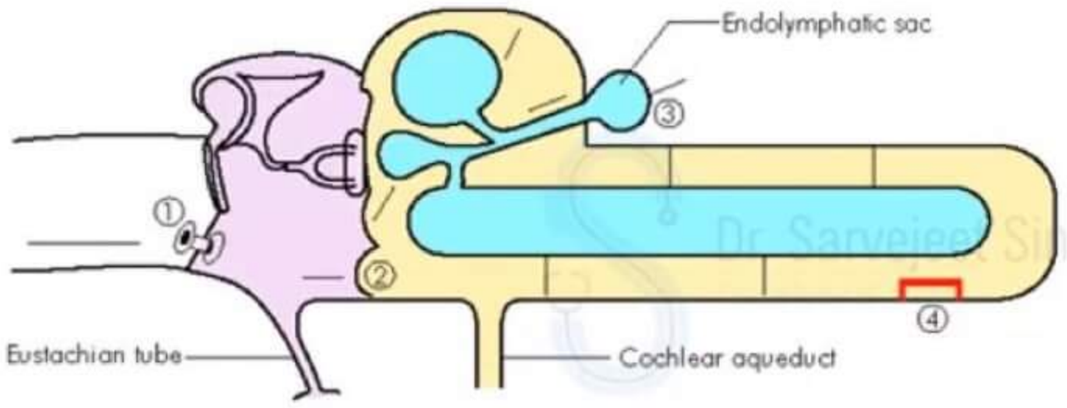
→ Drug delivery system to the inner ear



E) Meniett's Device

→ Intermittent low-pressure therapy device

→ US FDA approved



Note: 1. Ds of external ear + Ds of middle ear cause CHL
2. Ds of inner ear +8th nerve cause SNHL (Cochlear / Retro cochlear)

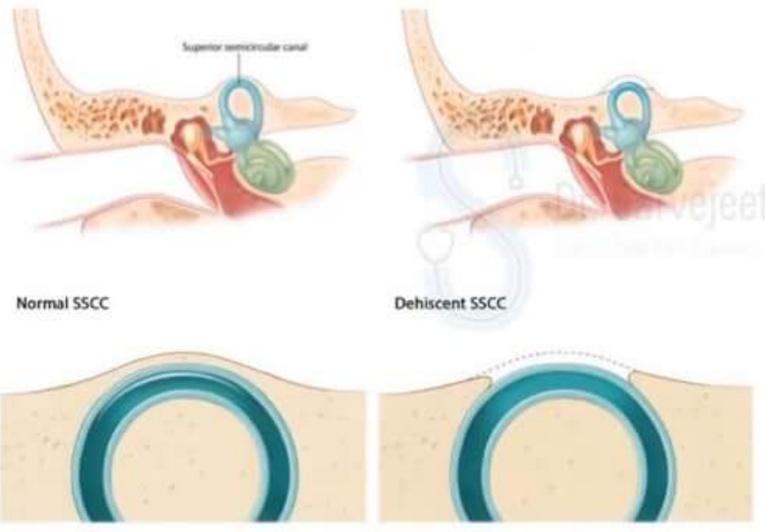
Superior Semi-Circular Canal Dehiscence /3rd Window Syndrome

→ 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

→ C/F: Vertigo
Oscillopsia
Autophony
Tullio's phenomenon
Fullness / pressure in the ears

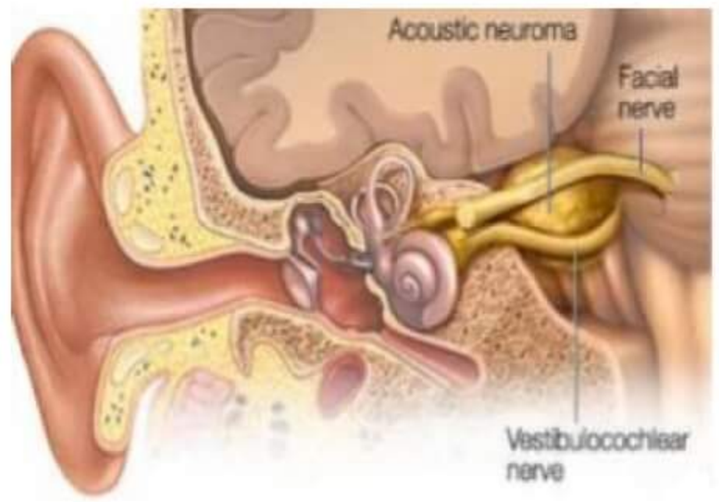


→ Patients bone conduction is super normal

→ Diagnosis – HRCT temporal bone

→ Rx – Repair the SCC dehiscence through middle cranial fossa approach

Vestibular Schwannoma / Acoustic Neuroma



→ Earlier name – Acoustic neuroma (Obsolete now)
→ MC Benign tumor of cerebellopontine angle. (CP angle)
→ Usually U/L But B/L in Neurofibromatosis II.
→ Site of origin
  - Inf vestibular Nerve in IAC (60-90%) → M/C
  - Sometimes sup vestibular N.
  - Rarely from cochlear N.

→ Arises from Schwann cells in the myelin sheath, not from the nerve → SCHWANNOMA

→C/F

→ SNHL
  - Slow & progressive
  - Most common presentation
→ Tinnitus
→ Vertigo/Dizziness (Not prominent)

→ Signs

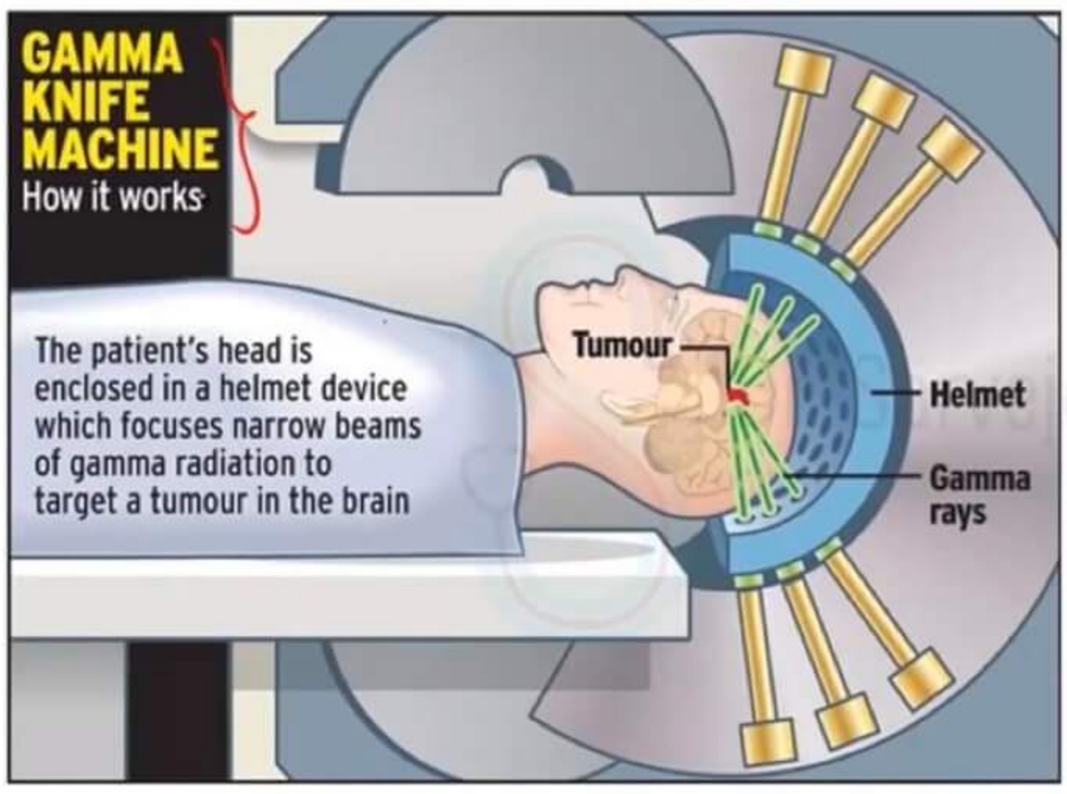
→ Earliest: Loss of corneal reflex (Due to 5th nerve Involvement)
→ Hitzelberger sign: - Loss of sensory supply by the facial Nerve in the postero-superior Wall of EAC

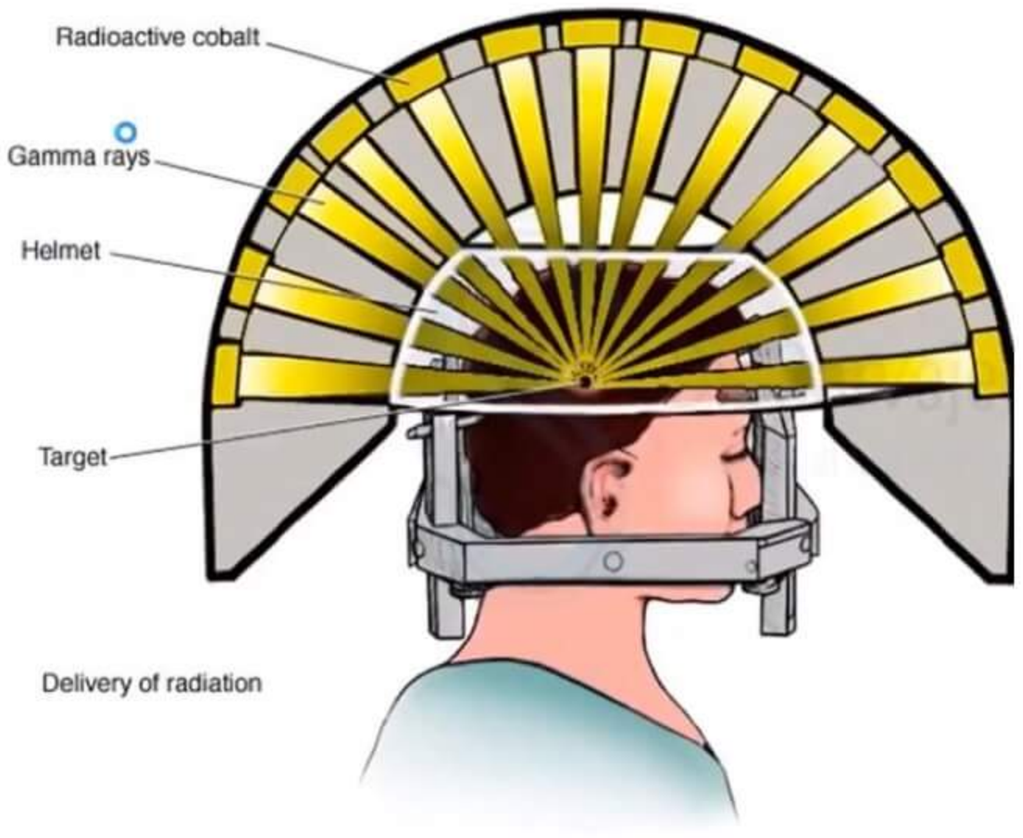
→ Dx

→ Gadolinium Enhanced MRI→ (IOC)

Treatment

1) Large Tumor– Surgical excision
2) Small Tumor
   → Old patient, slow growing tumor - Serial MRI every 6M
   → Young patient, fast growing tumor - Gamma knife excision





Approaches For Surgical Excision

→ When there is no hearing present

- TRANSLABYRINTHINE approach

→ If hearing present

- Middle cranial fossa approach (Limited access)
- Retro sigmoid /sub occipital approach

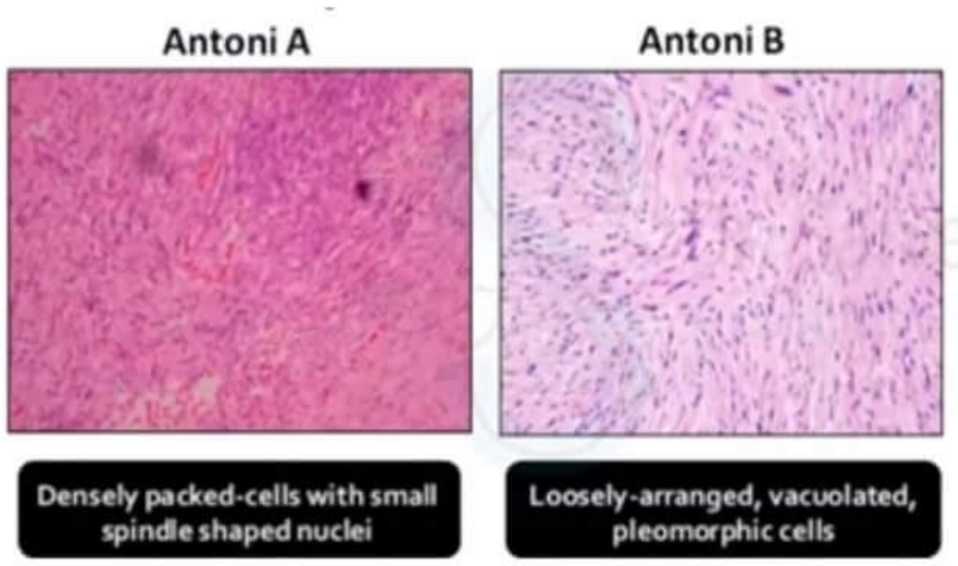
→ After Sx excision, tumor is sent for histopathology

- ANTONY A CELLS

  More common

  Densely packed cells with small spindle shaped nuclei
- ANTONY B CELLS

  Loosely arranged, vacuolated pleomorphic cells



Nose & Paranasal Sinuses

Paranasal Sinuses

Paranasal Sinuses → Ant. group → Frontal, Maxillary, Ant ethmoidal.

Paranasal Sinuses → Post. group → Sphenoid, post ethmoidal

Lined by → Ciliated pseudostratified columnar epithelium

1) Maxillary Sinus

→ 1st to develop at 12 wks (3M): present at birth.

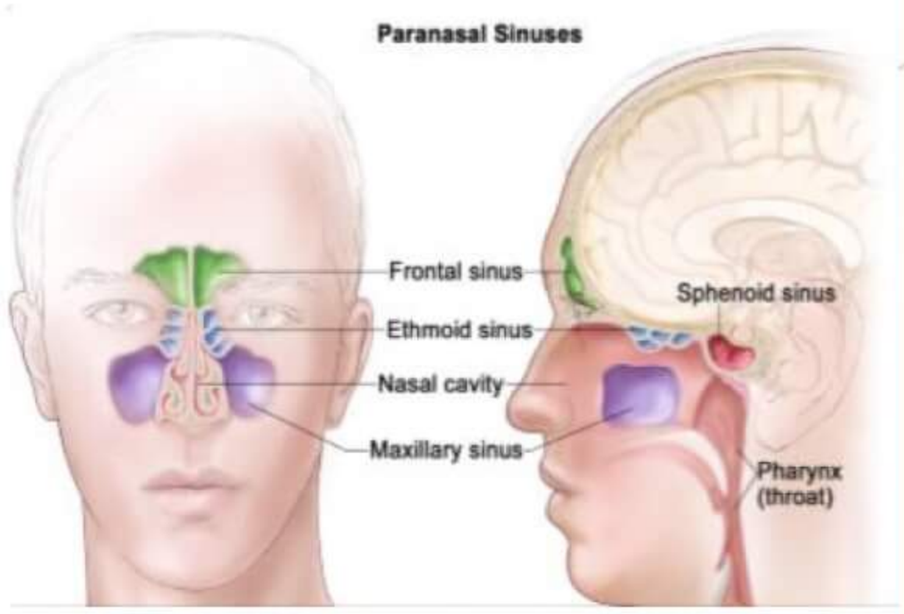
→ Reaches adult size 15 – 18 years

→ Largest Paranasal sinus – adult volume 15ml

→ AKA Antrum of Highmore / Maxillary Antrum

→ Visible on X – Ray ⟶ 4 – 5 M after birth

CT Scan ⟶ at Birth



2) Ethmoid Sinus

→ Location – Ethmoid bone (Unpaired)

Cribriform plate – Roof of nasal activity

Thinnest bone in the body. **Danger area of Nose**

→ Contain multiple small air cells

→ Present at Birth, Adult size 12 years.

→ Visible on X – Ray ⟶ 1 years.

CT Scan ⟶ at Birth

→ 2 groups → Anterior, Posterior

3) Sphenoid Sinus

Location: Sphenoid Bone – Unpaired

Body → Inter sinus septum → Right sphenoid sinus, Left sphenoid sinus

→ Present at Birth as a small cavity.

→ Pneumatization – 2 years

→ Adult size – 15 years

4) Frontal Sinus

→ Location: Frontal bone – Unpaired

↓

Inter Sinus Septum

Right frontal sinus Left frontal sinus

→ Last to develop – (Early Adulthood)

→ Present as a small cavity at Birth, but indistinguishable from Anterior Ethmoid. **(Not present at Birth)**

→ Pneumatization – After 2 years

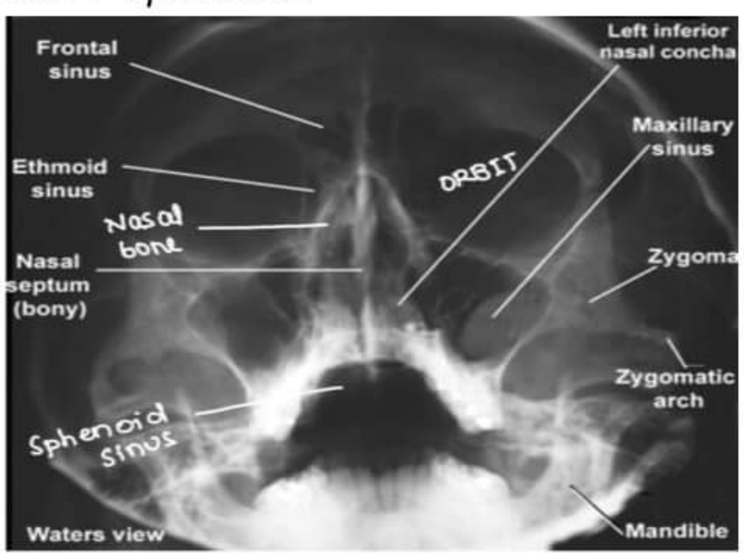
Sinuses	Present (at Birth)	First X-Ray Appr.	Adult size
Maxillary (M)	Yes	4 – 5 M after birth	15 – 18 years
Ethmoid (E)	Yes	1 year	12 years
Sphenoid (S)	Yes	6 -7 years	15 years
Frontal (F)	Yes (NOT in CT Scan)	4 – 5 years	18 years

Plane X – Ray views for PNS

→ Mc done: Water's view / occipitomental view / Nose – chin position

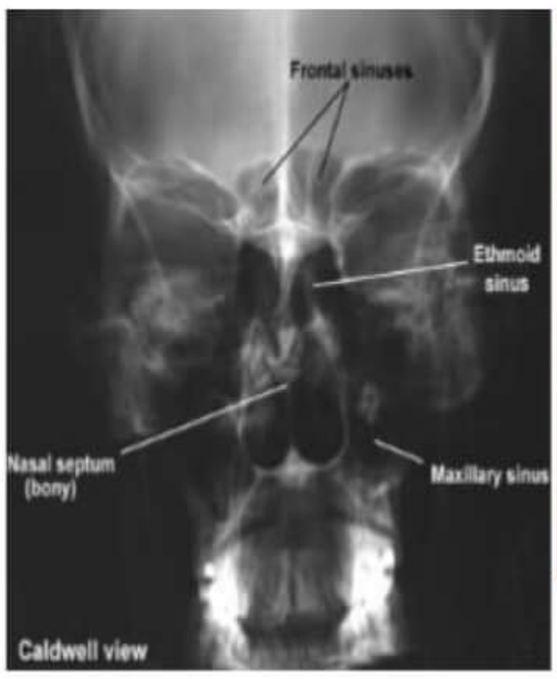
I) Sinuses best seen: - Maxillary sinus, Anterior Ethmoidal

II) Sinuses not seen: - Posterior Ethmoidal > Sphenoid



→ Sphenoid sinus is seen in water's view with open mouth: Pierre's view

→ Best view for Frontal sinus- Caldwell's view / occipitofrontal view /nose forehead position



→ Lateral view: - All the paranasal sinuses are seen

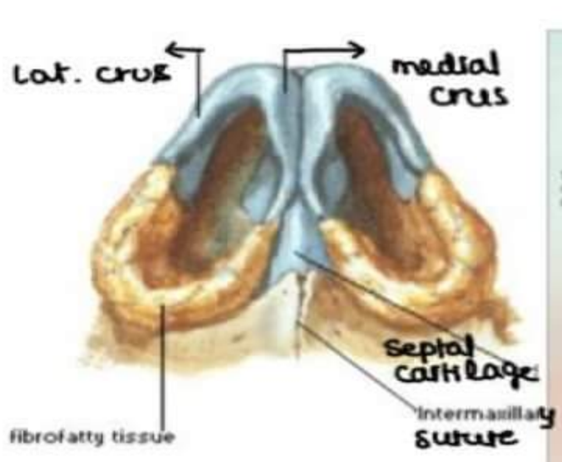
External Nose

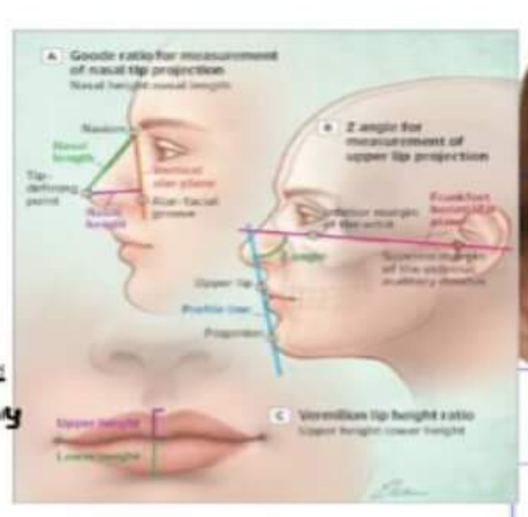
Anatomy

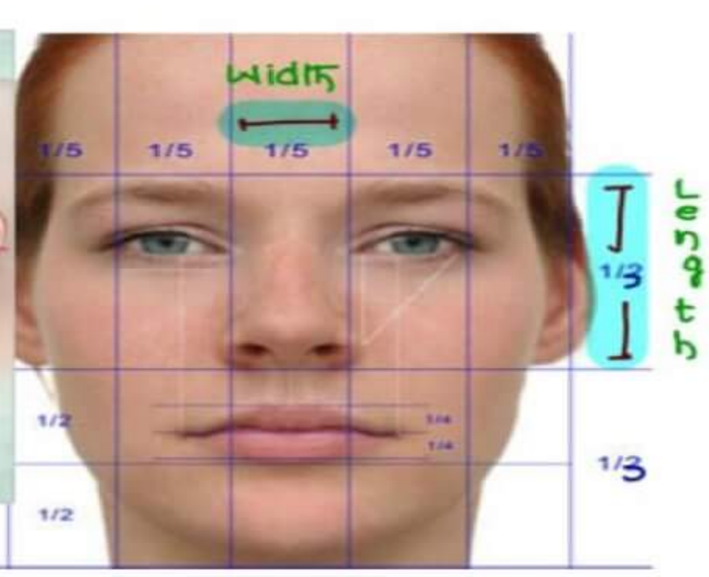
Good Nose

→ Lateral profile: -

GOODE RATIO: ———— Ideal: 0.55 – 0.6



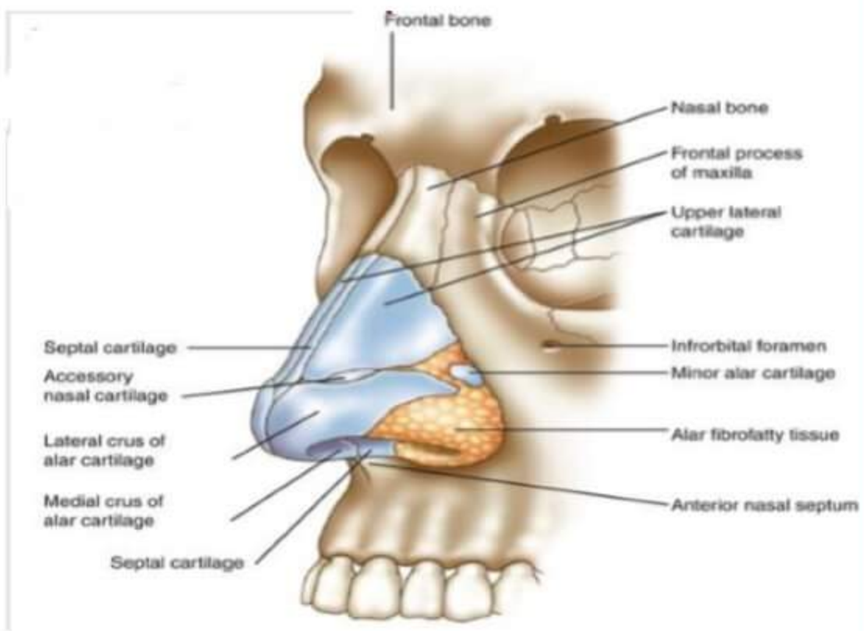




External Nose

→ Upper 1/3rd → Bony, formed by nasal bone supported by frontal process of maxilla

→ Lower 2/3rd – Cartilaginous (3 paired & 1 unpaired)



- **Paired**
  1. Upper Lateral
  2. Lower Lateral [Alar] – mainly
  3. Lesser Lateral /Alar /Minor Alar

- **Unpaired** → Septal/Quadrilateral/ Quadrangular cartilage

→ Main Component of Alar Cartilage – Fibrofatty Tissue

Alar crus have 2 parts: Lateral crus (forms Ala of nose)

Medial Crus of Alar Cartilage forms Columellar Septum

Deformities & Diseases of External Nose

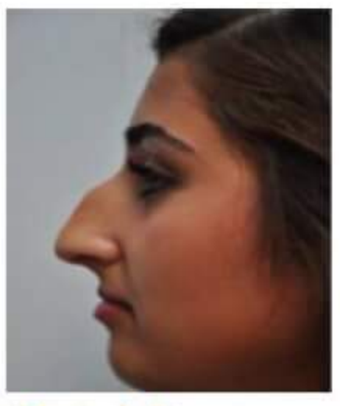
1) Deviated Nose
   → External deformity
   → R_x – Rhinoplasty

2) Crooked Nose / C – shape deformity
   → R_x Rhinoplasty
3) Nasal Hump
   → R_X: - Reduction Rhinoplasty

4) Saddle NOSE (Dorsum has collapsed inside)
   → R_x Augmentation Rhinoplasty


Deviated NOSE

Crooked Nose


Nasal Hump


Saddle Nose

5) Rhinophyma / potato tumors

→ MC seen in males, 35 – 40 years.

→ A/W long standing Acne Rosacea (Pilosebaceous duct is blocked)

→ Benign hypertrophy of sebaceous glands.

→ Presence of lobulated mass

→ Not a tumor (No hyperplasia)

R_x → Dermabrasion $\bar{c}$ co_2 laser (Rx of choice)

Rhinophyma

6) Rodent ulcer / basal cell carcinoma

→ MC malignancy of the skin

→ Sun exposed Areas- Face, Dorsum of hands

→ Locally invasive malignancy

→ Distant metastasis are rare

→ More common in fair people

Rx: - Wide local excision

Nasal Cavity

Boundaries of Nasal Cavity

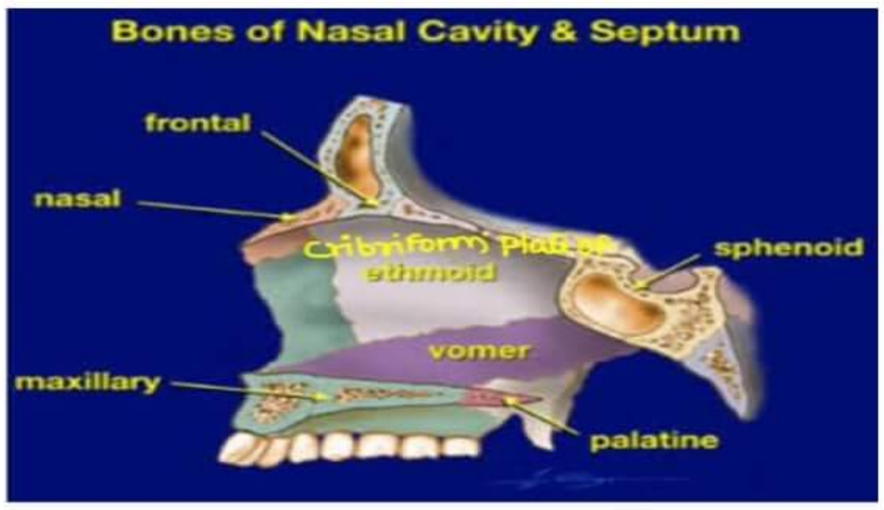
Roof – Cribriform plate of Ethmoid.

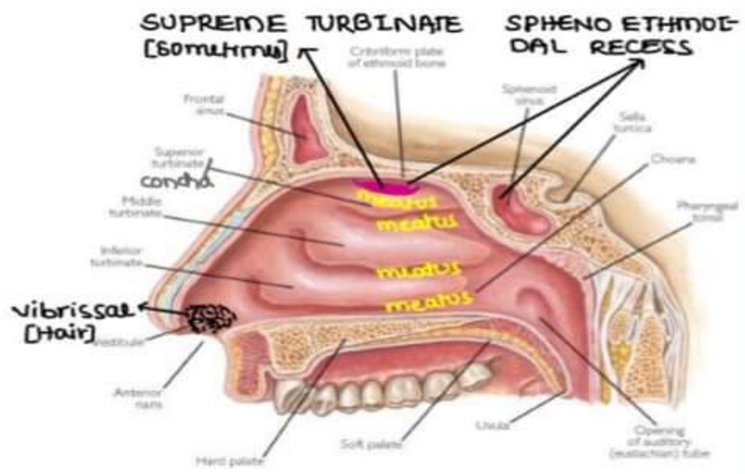
Floor - Hard Palate → Anteriorly - Maxilla
Posteriorly - Palatine bone

Medial wall - Nasal Septum

Lateral wall - I) Anterior openings – Anterior nares
II) Posterior openings – Posterior choana
III) 3 projection / concha's / Turbinate
- Superior concha → **Supreme Turbinate** → **Space above superior concha**
- Middle concha
- Inferior concha

IV) Space between turbinate's is meatus
- Superior meatus
- Middle meatus
- Inferior meatus (Largest)

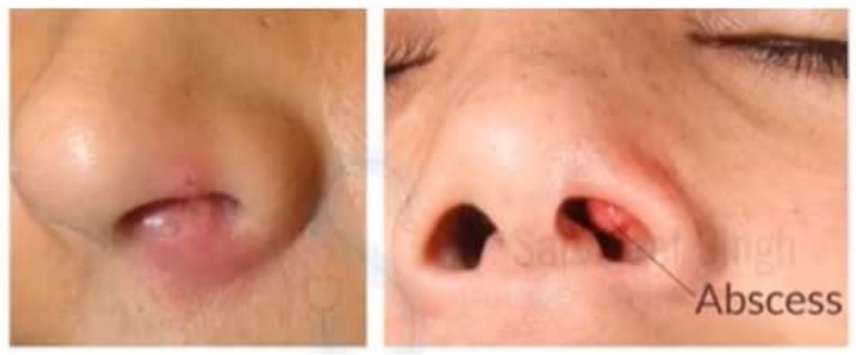




Lateral Wall Of The Nose

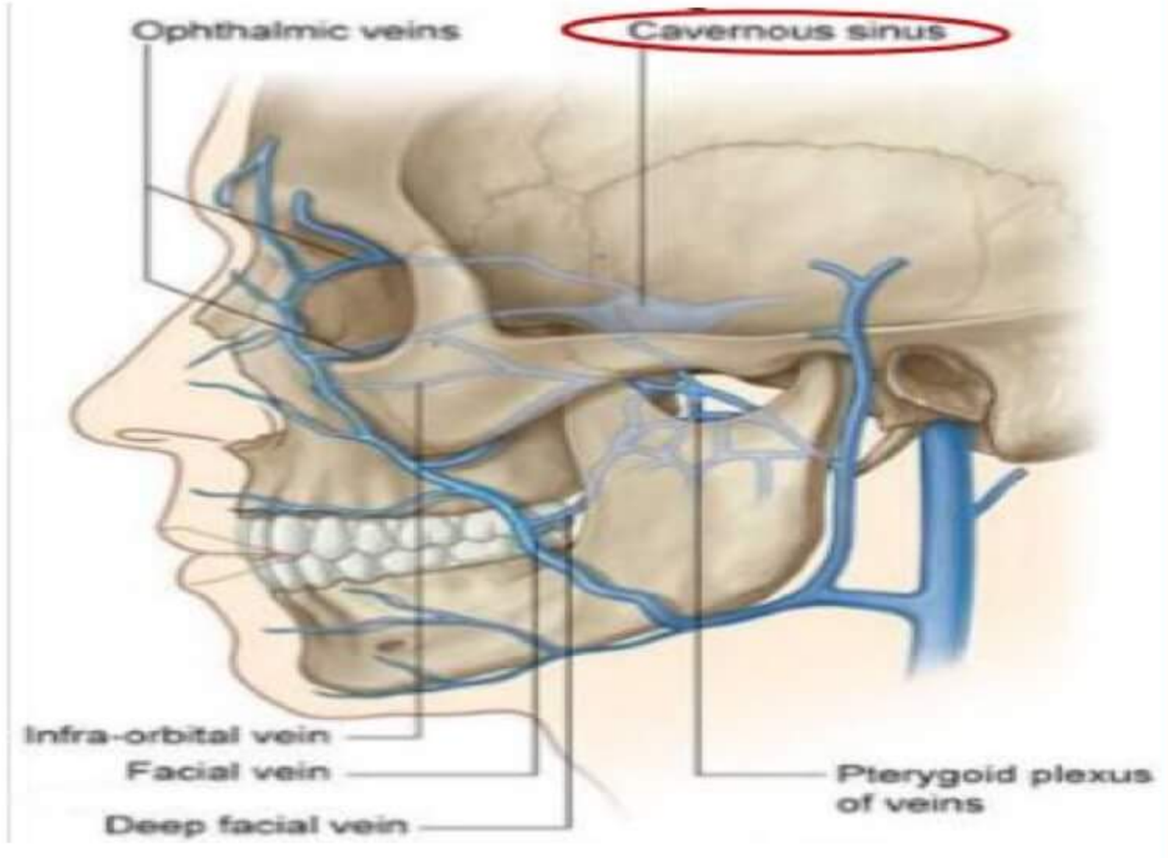
Nasal Vestibulitis

→ Any Furuncle in nasal vestibule
→ Presents with Pain & swelling (Red & Hard), Abscess
→ Infection by Staph aureus.
→ R_x : systemic Antibiotics & Analgesics.



Dangerous Area of Face

→ Area between upper lip & lower part of nose.
→ Veins drain into cavernous sinus through pterygoid plexus.
→ Infection of this area causes cavernous sinus thrombosis.



Nasolacrimal Duct (NLD)

→ Opens into inferior meatus through valve of Hasner

→ Direction

N → Inwards

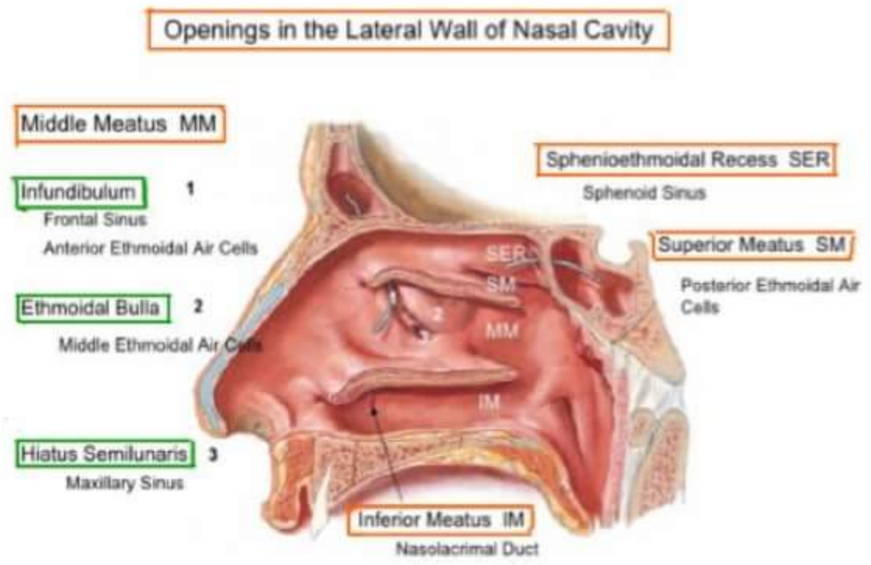
L → Laterally

D → Downwards

→ After DCR (Dacryocystorhinostomy)

[Done for chronic dacryocystitis]

NLD opens into middle meatus.

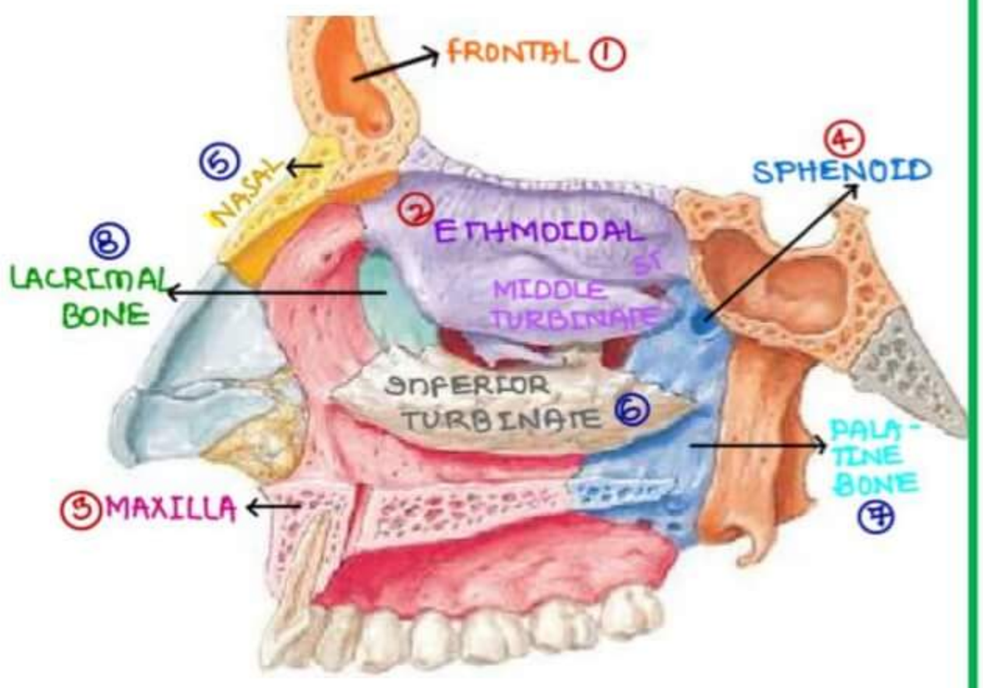


Osteo Meatal Complex (OMC)

→ Present in middle meatus

→ 3 sinuses open → Frontal
→ Anterior ethmoidal
→ Maxillary sinus

Infection / Mass will block all 3 sinuses



Lateral Wall-Bony Anatomy

1) Total 8 Bones → 4

2) (4) Frontal bone
Ethmoid bone
Sphenoid bone
Maxilla
} All 4 PNS bones

3) (4) Nasal bone
Inferior Turbinate* Individual bone
Palatine bone → L shaped
Lacrimal bone (exclusive)

Medial Wall / Nasal Septum

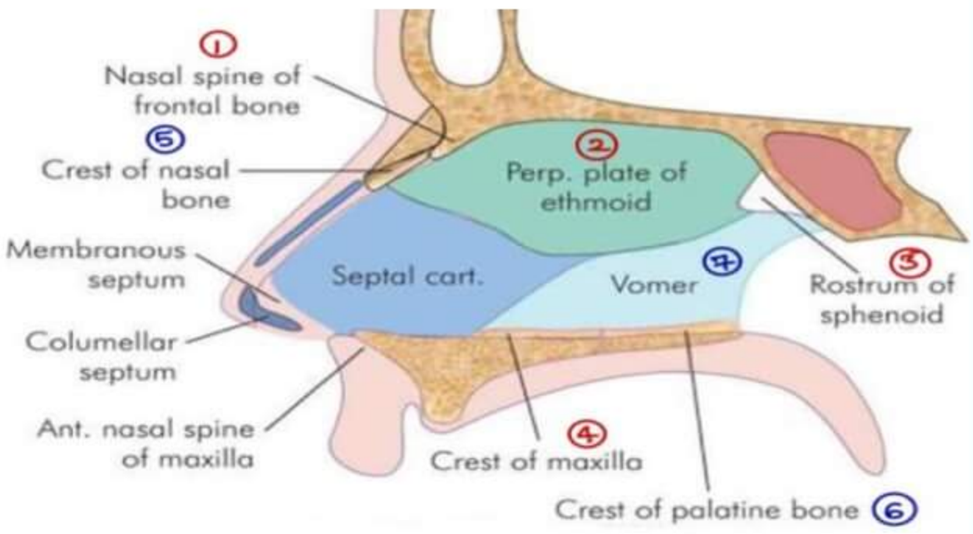
3 parts

1) Columellar septum – Medial crus of alar cartilage
2) Membranous septum – Septal piercing
– No bone & cartilage
3) Septum proper

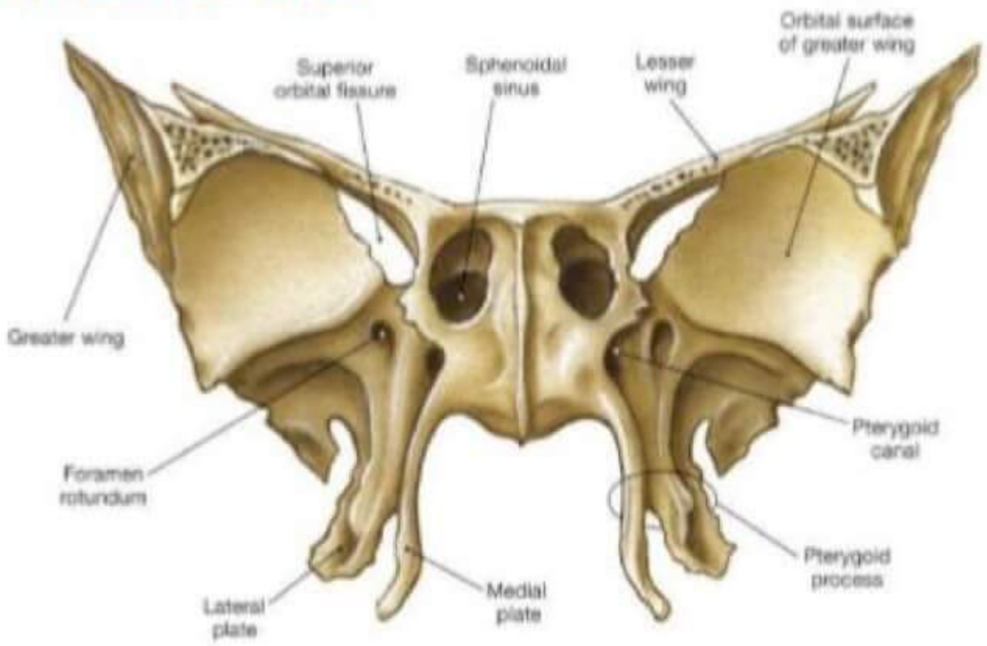
7 bones → 3

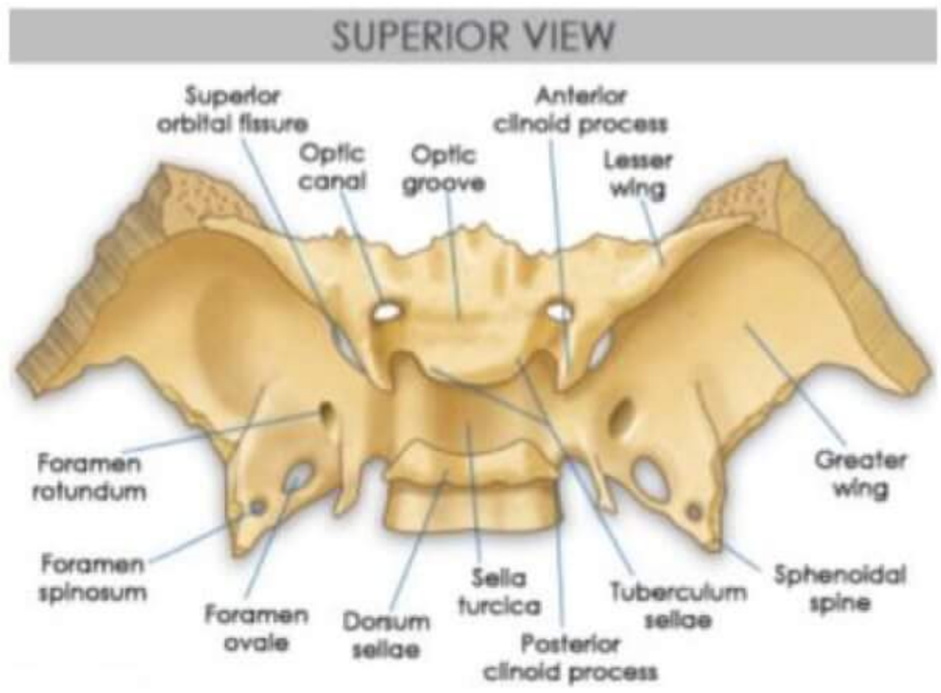
4 → Nasal spine of frontal bone
Perpendicular plate of Ethmoid
Rostrum of sphenoid
Maxilla

3 → Nasal bone
Crest of palatine bone
Vomer (Doesn't contribute to lateral wall)

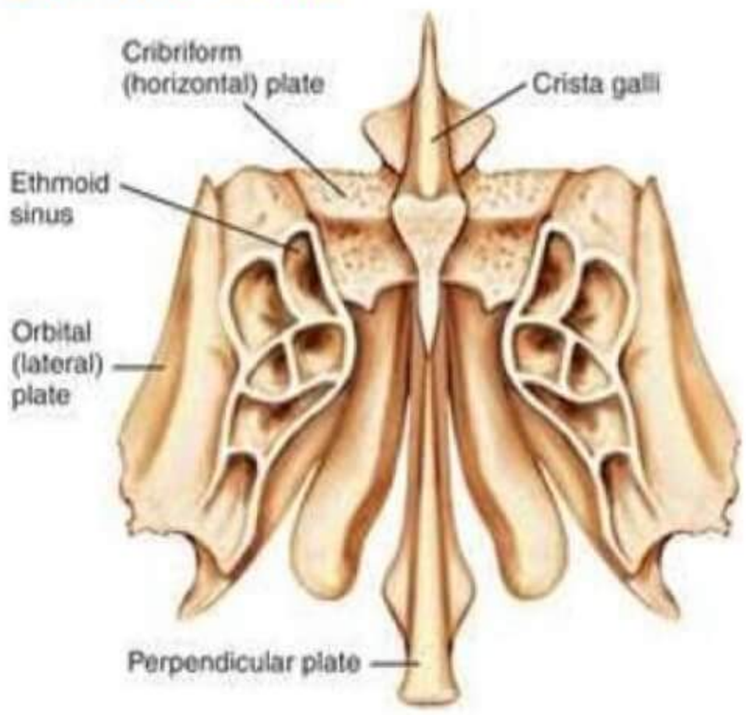


SPHENOID BONE

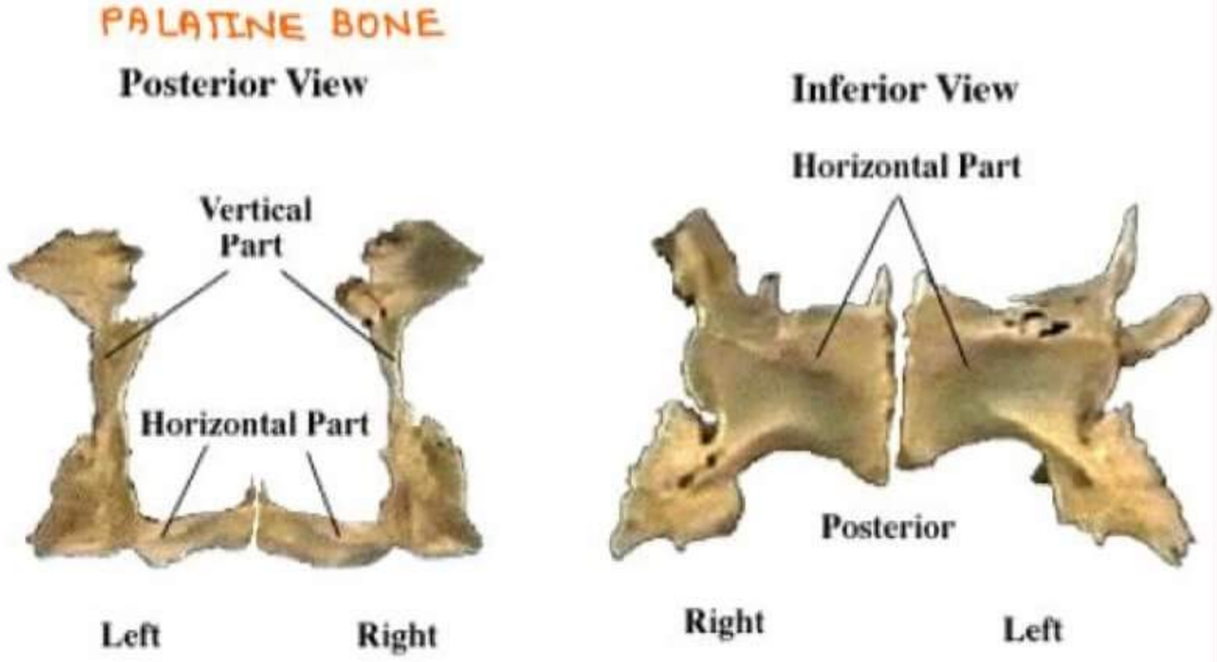




ETHMOID BONE

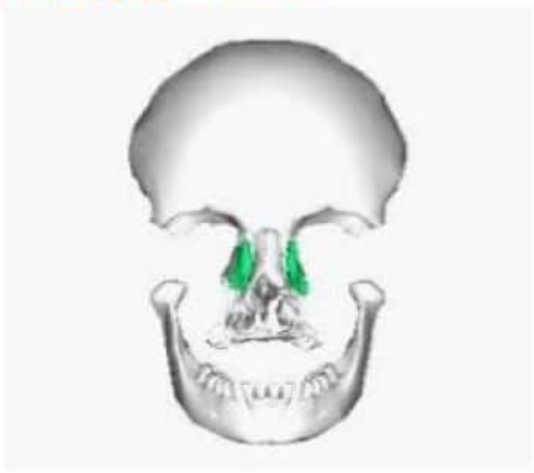


PALATINE BONE

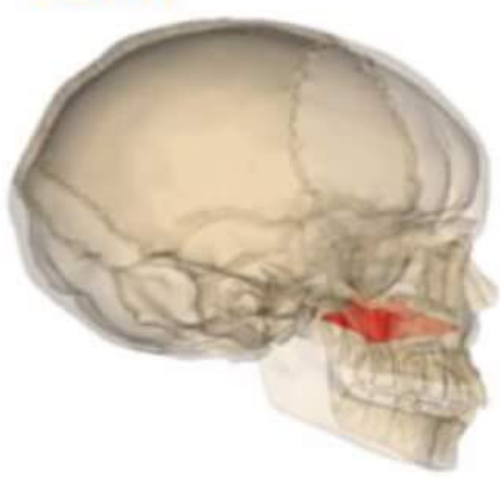


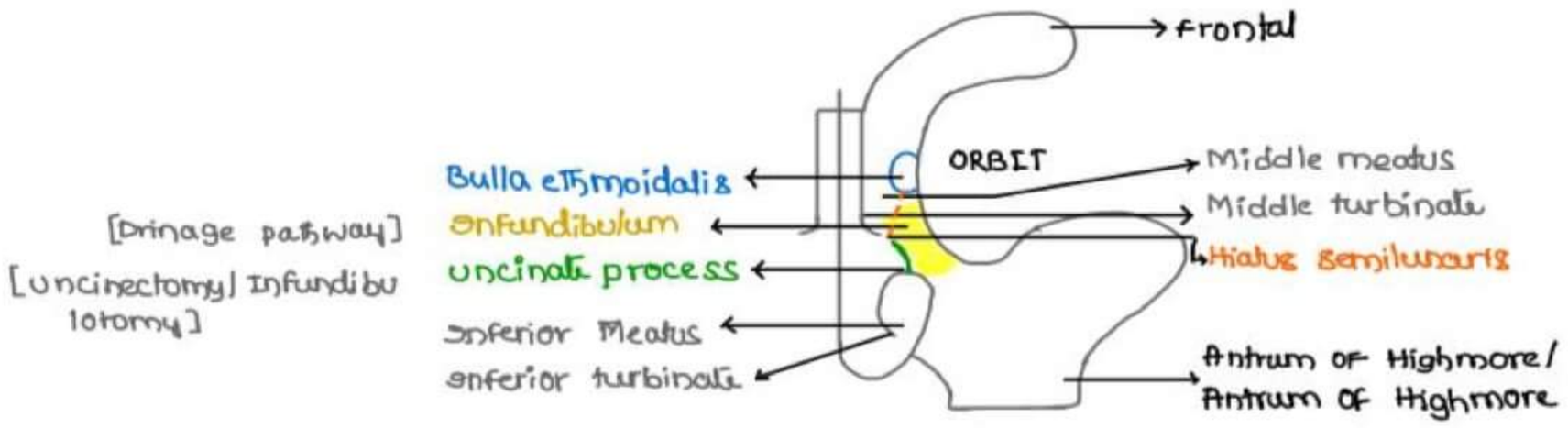
→ Dangerous area of NOSE → Cribriform plate of ethmoid [Olfactory nerve fibers]

LACRIMAL BONE



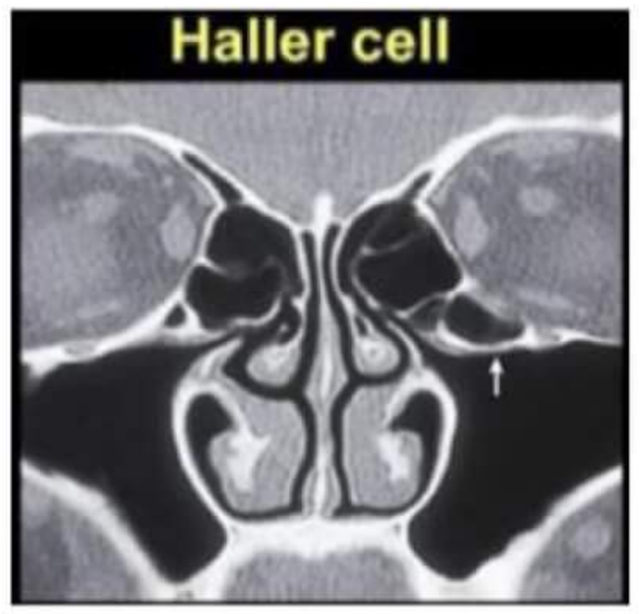
VOMER



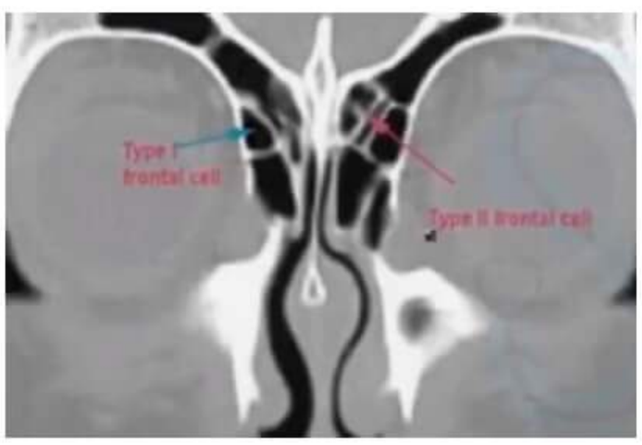


Anterior Ethmoidal Cells

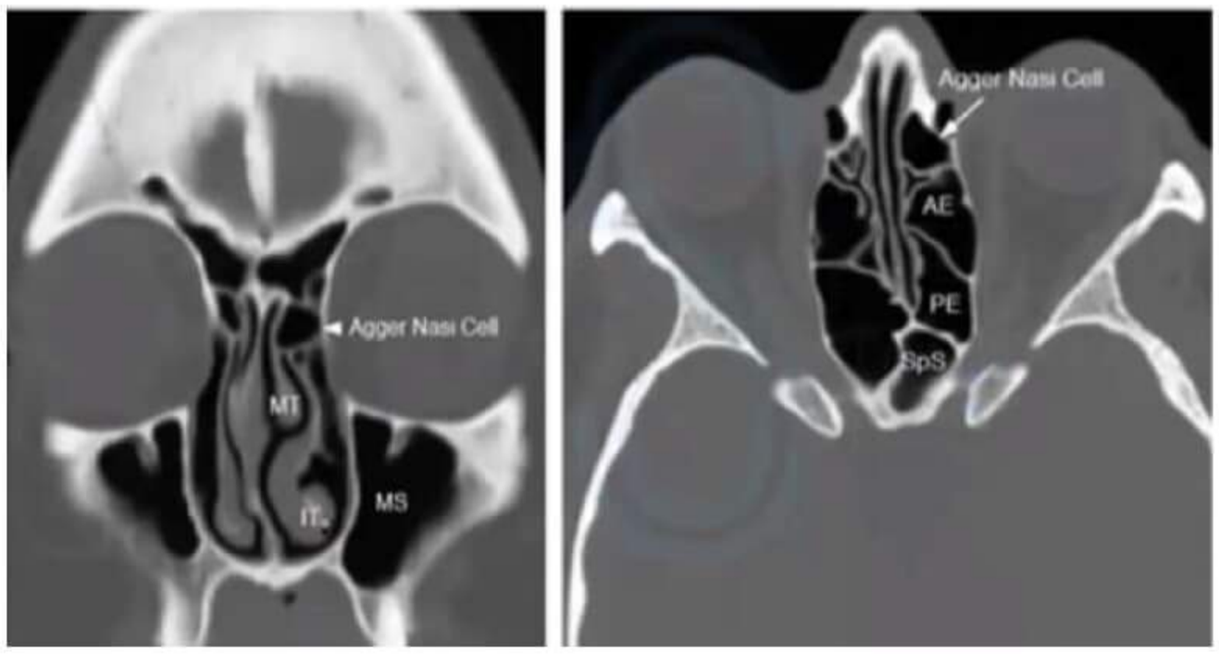
1) Bullae Ethmoidalis
   → Most consistent cell of Ethmoid.
   → Drains into middle meatus. (Anterior ethmoid)
2) Supra bullar cell
3) Infraorbital cell / Haller cell
   → Infection can easily block drainage pathway.
4) Agar Nasi cells
   → Anterior most cell of ethmoid.
   → Close relation with lacrimal bone.



→ Left haller cell is larger than Right. Any inflammation can easily block drainage pathway.



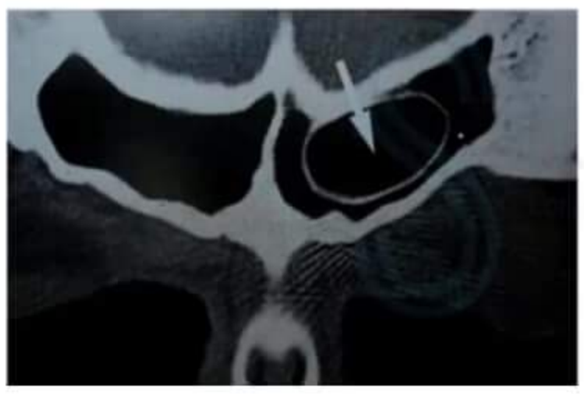
Type 1 & 2 Frontal Cell



Type 3

Supraorbital cell

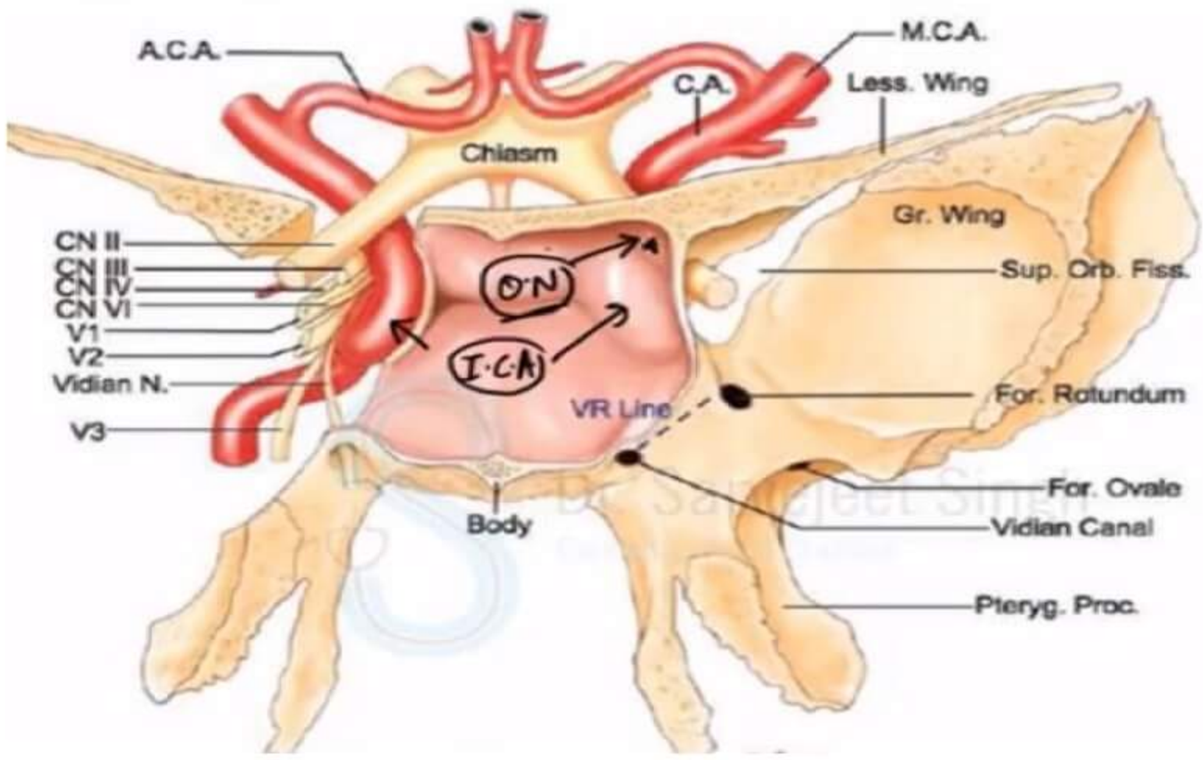
Type 4: Loner cell



KUHN'S Classification Of Frontal Cells

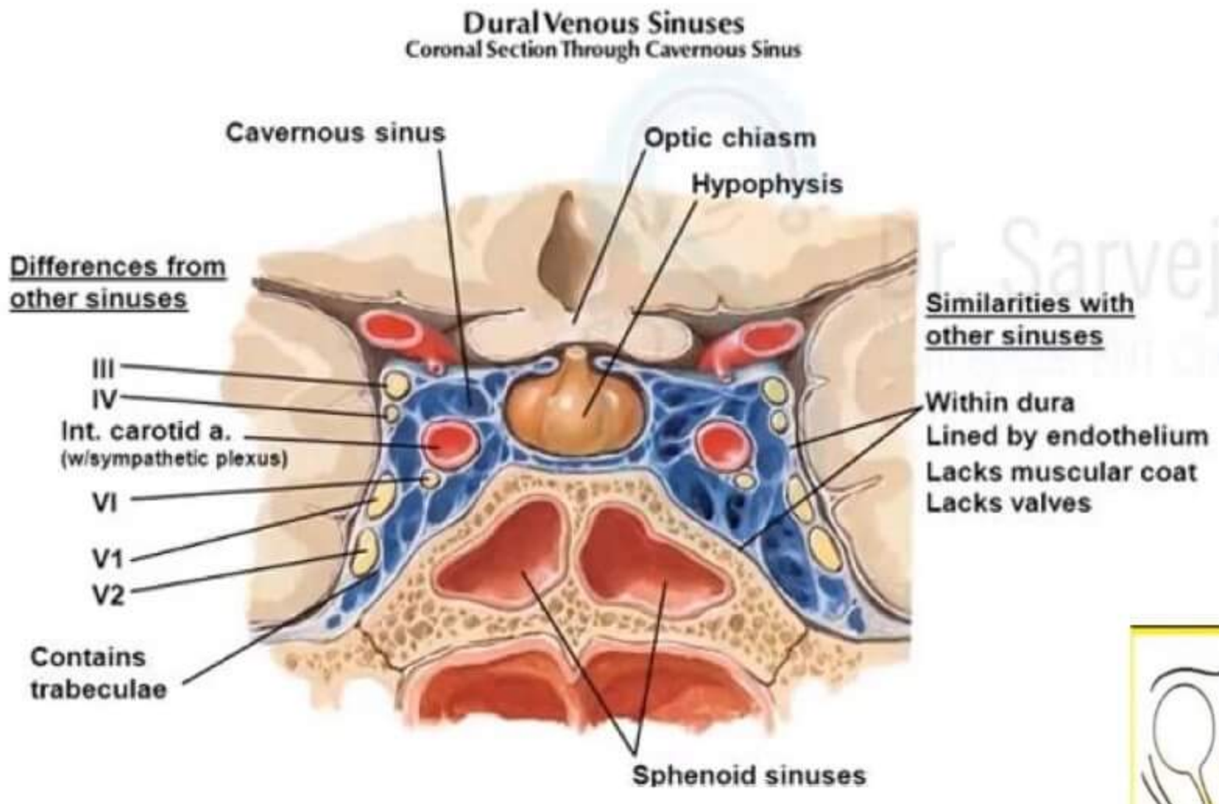
→ 4 Types
→ Type 1 – Single cell above agger nasi
  Type 2 – Multiple cells above agger nasi
  Type 3 – Inside the frontal sinus causes frontal headache (Office headache)
  Type 4 – aka loner /satellite cell
→ Type 1, 2 cells present outside the frontal sinus

→ Optic nerve is present in the lateral wall of sphenoid postero – superior aspect.
→ ICA [Internal carotid artery] also present in Lateral wall of sphenoid sinus.



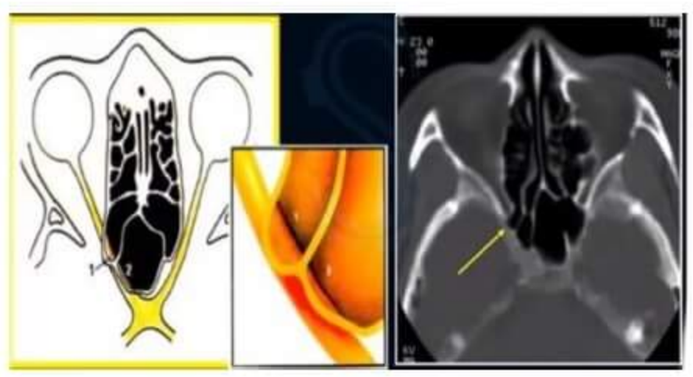
Cavernous Sinus

→ Only cavernous sinus has nerves and arteries compared to all other Dural venous sinuses



Posterior Ethmoid Cells

1) Onodi cell
   - → Posterior most cell of ethmoid
   - → Present lateral to sphenoid sinus
   - → Closely related with optic N. **(Surgical significance)**



ONODI CELL

Sphenoid Pneumatization

1. CONCHAL PNEUMATIZATION [LC, 1-4%]
2. PRE SELLAR PNEUMATIZATION
3. SELLAR PNEUMATIZATION [M/c, 54%]
4. MIXED PNEUMATIZATION [2nd M/c] [27%]

→ Has surgical importance – during pituitary Sx , sophisticated instruments are required.
- Requires more time.
- More rate of complication in Conchal Pneumatization.
- Experience surgeon needed
- Care to be taken for not to damage optic nerve and ICA

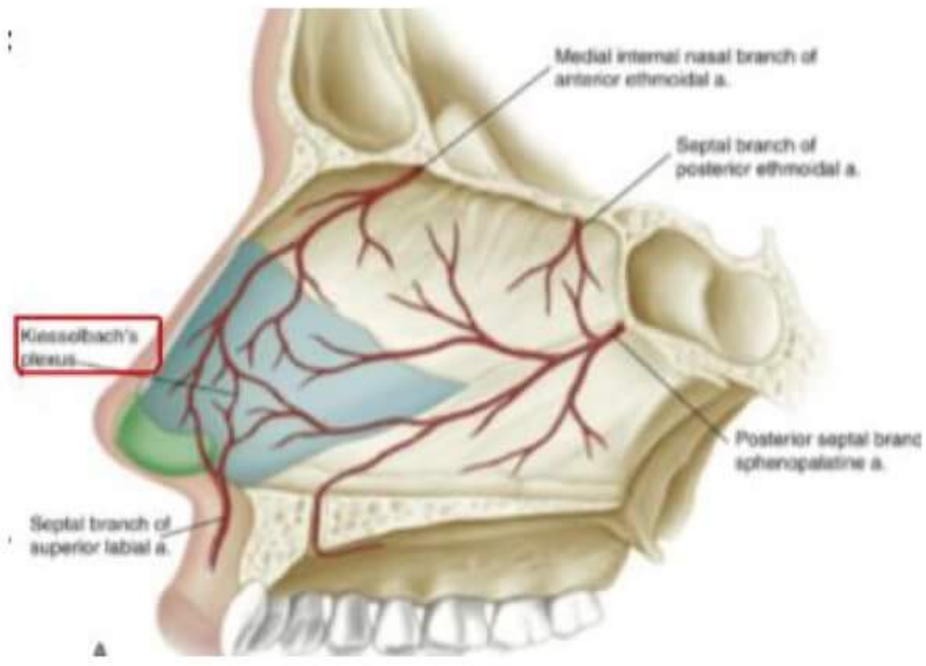
Epistaxis

Blood Supply Of Nasal Septum

→ Supplied by 5 Arteries

1) Anterior Ethmoidal A. ⟩
2) Posterior Ethmoidal A. ⟩ Ophthalmic A. → ICA
3) Sphenopalatine A. ⟩
4) Greater palatine A. ⟩ Interior maxillary A. ⟩ ECA
5) Superior labial A. → Facial A. ⟩

MCC of Epistaxis → Nose Picking

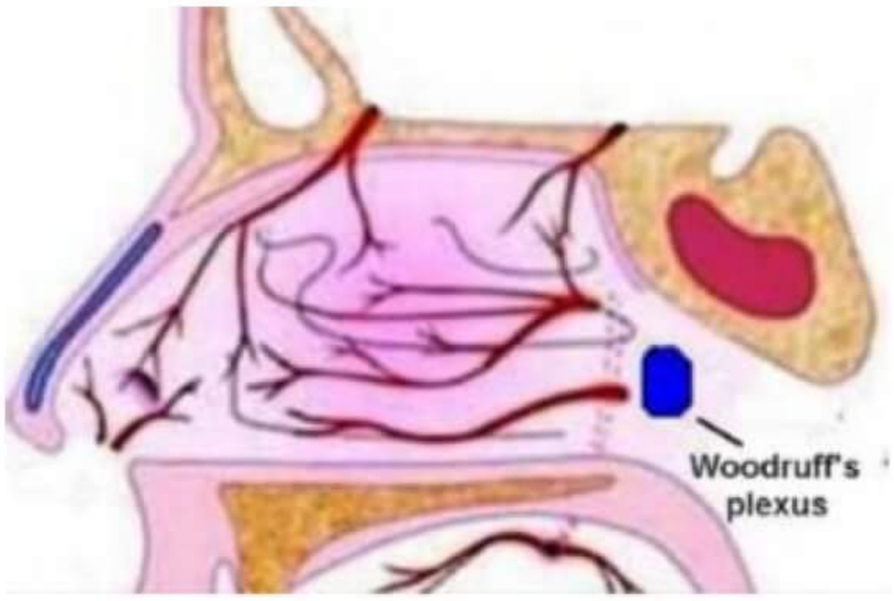


Little's Area / Kiesselbach's plexus

→ Formed by 4 branches anastomosis.
→ Posterior Ethmoidal Artery does not contribute
→ Mc site of Epistaxis (Nasal bleeding)
→ Ant. Epistaxis present from Little's area
→ Present On the medial wall

Posterior Epistaxis

→ MC Site - woodruff's plexus
→ Woodruff's plexus
- Venous plexus



- Posterior to inferior turbinate
- Supplied by Sphenopalatine A.
  Posterior Pharyngeal A

→ MCC – Idiopathic
→ On lateral wall.
→ HTN is not a cause.
→ Causes – In elderly → winter / autumn season.
- $NSAIDs$
- Alcohol (last 24 hours)

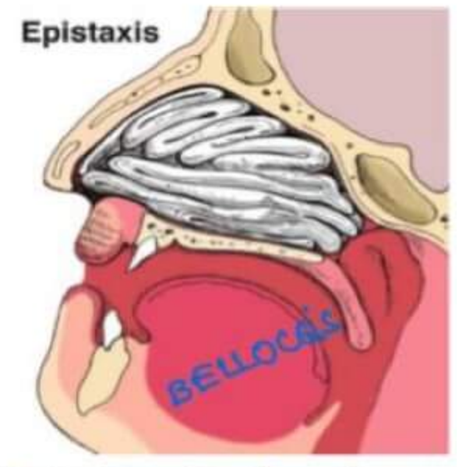
Management of Epistaxis

1) Anterior Epistaxis

→ Anterior to piriform aperture.
R_x → Nose pinching for 3 – 5 minutes
Trotter's method

→ Child c̄ recurrent epistaxis
- Chemical cautery [$AgNO_3$, TCA] ⟩ Under local anesthesia
- Electrocautery ⟩

TROTTER'S METHOD



Anterior Nasal packing

2) Posterior Epistaxis

→ Bleeding point not visible.

TOC → Endoscopic electrocautery/ligation (80%) RxOC

→ Anterior Nasal packing in case of profuse bleeding

Not responding.

B/L Nasal Packing

Posterior Nasal packing c̄ foley's catheter under local anesthesia.

Not responding

Combined classical anterior + posterior nasal packing

→ Epistaxis catheters / Balloon catheters

→ **Artery of Epistaxis – Sphenopalatine Artery**

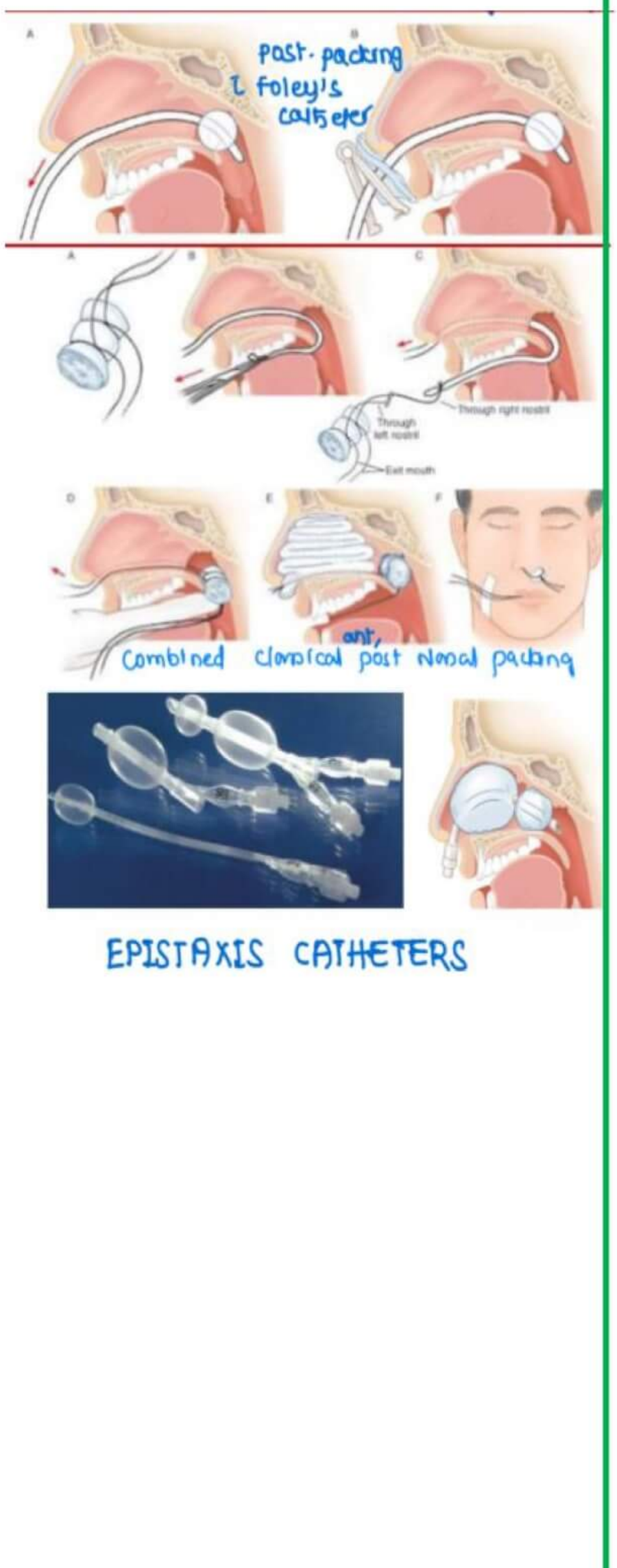
Endoscopic sphenopalatine A. ligation. (ESPAL)

Done in recurrent epistaxis

Not responding

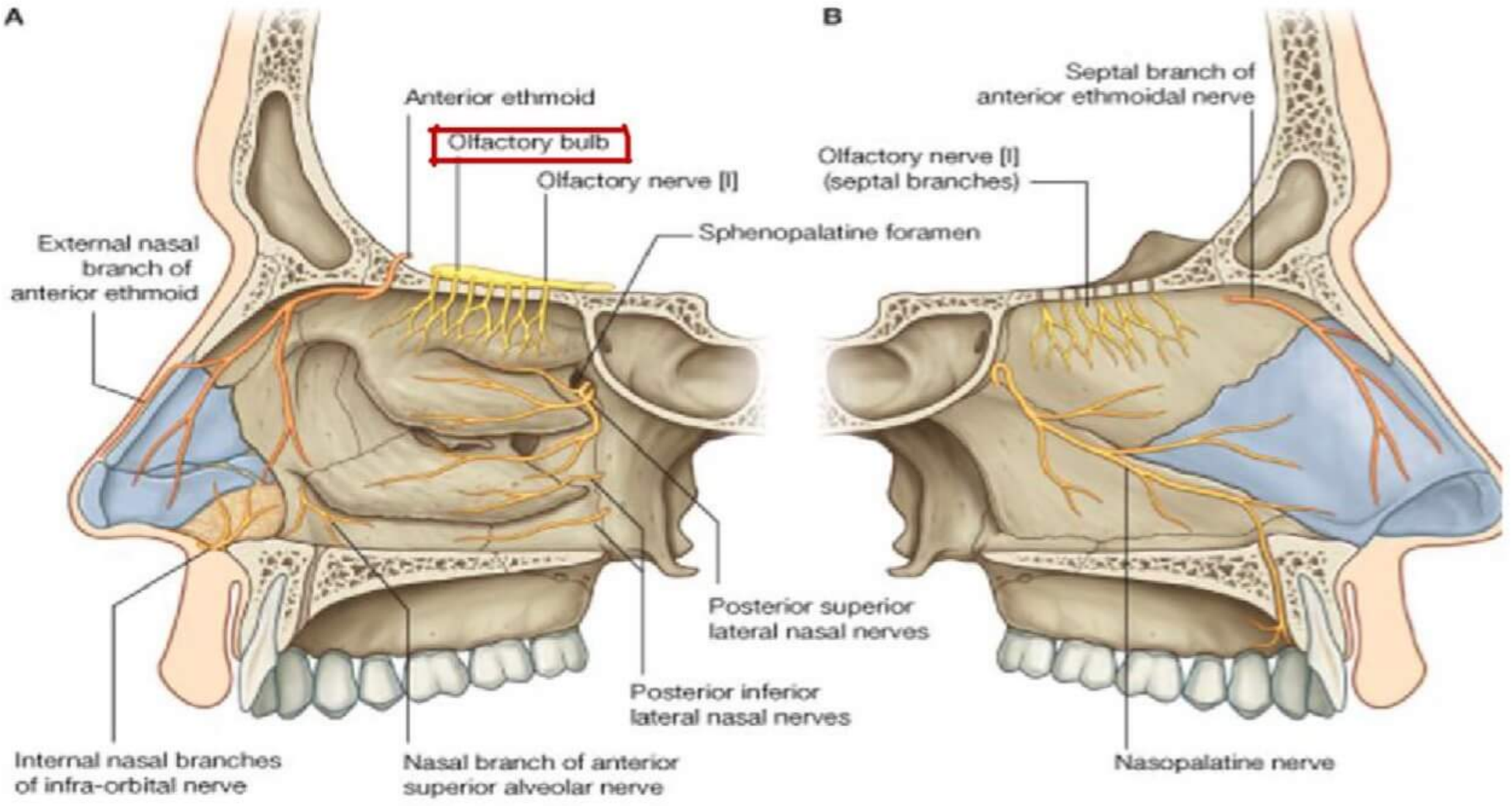
Int. Maxillary ligation / ECA ligation.

→ **ICA is never ligated.**



Physiology of Nose

Nerve Supply of Nasal Cavity



→ **Inspiration**

During normal tidal inspiration, the maximum air passes through middle meatus in parabolic curve.

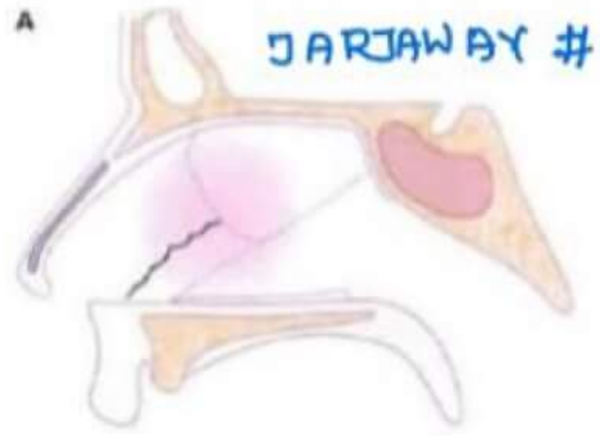
→ **Expiration**

During expiration, the paranasal sinuses are aerated & air comes out during inspiration

- BERNOULLI'S PHENOMENON: During inspiration it creates –ve pressure.
- PNS role: Air conditioning during inspiration and helps preserving heat & moisture during expiration.

→ **Olfaction** – Olfactory bulb is present in anterior cranial fossa above cribriform plate.
Olfactory nerve fibers are present in upper $^{1}/_{3}^{rd}$ of nasal cavity.

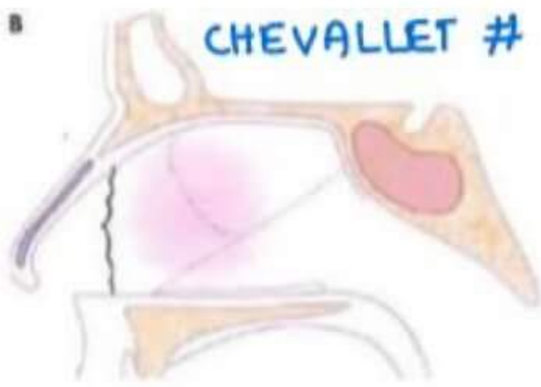
Diseases of Nasal Septum



1) JARJAWAY # → # Line parallel to cartilage vomer junction.

2) CHEVALLET # → # Line starts from anterior most point to maxillary crest (Nasal spine of maxilla) to the nasal spine of frontal bone

→ Punch / impact from below



3) Septal Hematoma

→ B/L Nasal obstruction

→ Collection of blood between septal cartilage & Mucoperichondrium

R_x

→ I & D → Prophylactic Antibiotics

→ B/L Anterior Nasal packing to stop the bleeding.

4) Septal Abscess → Collection of pus between cartilage & its mucoperichondrium

→ Pain, swelling, Nasal obstruction

R_x

→ I & D

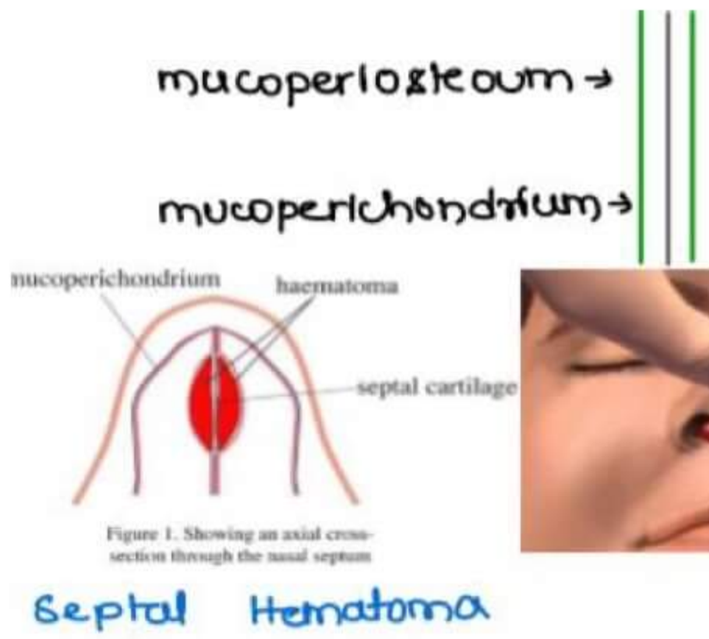
↓

B/L Anterior Nasal packing

↓

I.V. Antibiotics

→ M.C. complication: - Septal perforation



5) Septal Perforation

→ Hole in the septum

→ Causes

I) Trauma – MCC
- Digital
- S_x

II) Cocaine Abuse

III) Granulomatous:
- TB
- Leprosy
- Lupus vulgaris → **Apple jelly nodules in nose**

→ Bony: Syphilis Vulgaris

→ Bony & Cartilage: Wegner's Granulomatosis

↓

C-ANCA

IV) Septal Piercing

→ Septal Surgeries

SMR (Sub Mucus Resection)	Septoplasty
- Rise the mucoperichondrium & Mucoperiosteal flaps on both sides & remove bone & cartilage leaving 'L' Shaped cartilage.	- Rise both flaps on one side & remove only deviated septum - More conservative S_x - Low chances of perforation

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 S_x

1. DNS causing nasal obstruction
2. DNS causing recurrent epistaxis
3. DNS causing chronic infection

} DNS itself is not an indication

4. As a part of other S_x
5. To give access to other S_x

Diseases of Nose & Paranasal Sinuses

Inflammations

Rhinitis	Sinusitis
→ Nose is lined by Pseudo stratified ciliated columnar epithelium [Respiratory epithelium]	→ PNS lined by pseudo stratified ciliated columnar epithelium

→ Common term - Rhinosinusitis

1) Acute Rhinosinusitis / Common Cold

MC causative agent - Rhino virus

- Mucoid discharge

R_x - Symptomatic

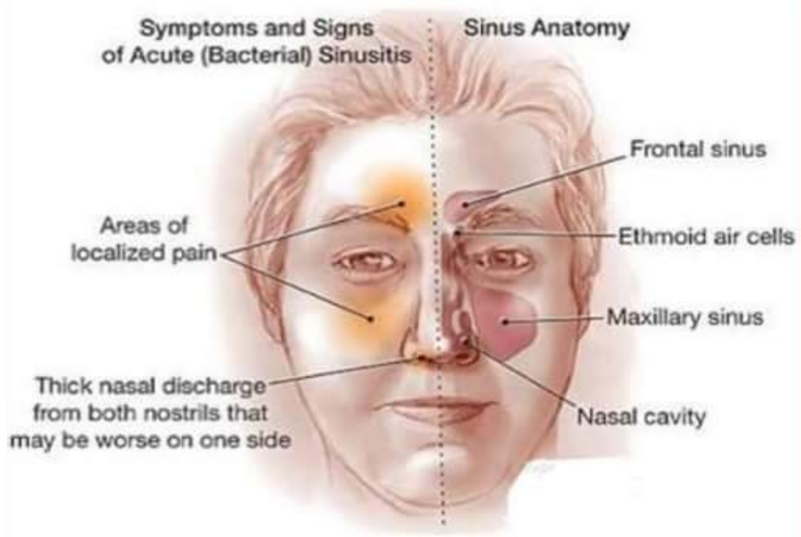
2) Acute Bacterial Rhinosinusitis

→ Mcc: Strep. pneumonia
Moraxella catarrhal
H. Influenza

→ Yellowish / mucopurulent discharge

→ Mc sinus involved – Maxillary sinus

R_x: - Antibiotics



3) Chronic Rhinosinusitis

→ Infection >12 wks (3m)

→ 2w - >3m: - subacute

→ Mc causative: Staph Aureus

→ Chronic infection + chronic hypertrophy & obstruction

→ Management

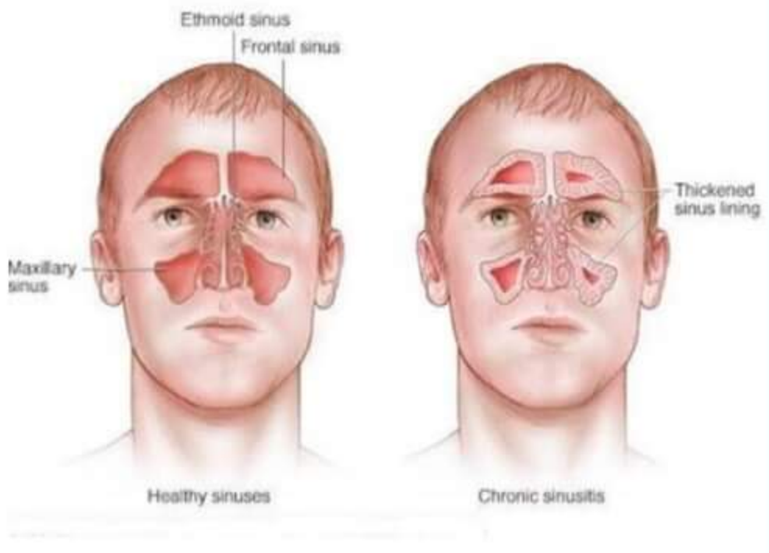
TOC → I) Culture directed antibiotics + Nasal decongestant.

↓ Not improving

Antral puncture & lavage / Antral wash (Obsolete)

↓ Recurrence

FESS (Functional endoscopic sinus s_x)



Frontal sinusitis: Office headache / frontal headache

Sphenoid sinusitis: Occipital headache

4) Allergic Rhinosinusitis

→ Mc allergen - House dust mite / carpet dust

→ Mc in urban areas & developed countries

→ Mc in snow covered areas

Symptoms

Intermittent Symptoms	Persistent Symptoms
- < 4 days per week - Or < 4 weeks	- > 4 days per week & - Or > 4 weeks
Mild • Normal Sleep • Normal daily activities • Normal Work & School • Normal troublesome symptoms	**Moderate – Severe one or more items** • Abnormal Sleep • Impairment of daily activities, sports etc. • Problems at school or work • Troublesome Symptoms

On Examination

→ Lethargic

→ Allergic / Atopic facies

→ Allergic shiners / Denni Morgan lines

→ Allergic salute / Nasal crease


Allergic/Atopic Facies


Allergic Shiners/ DENNI MORGAN LINES


Allergic Salute/ Nasal Crease

On Nasal Examination

→ Mucoid secretion in nasal cavity

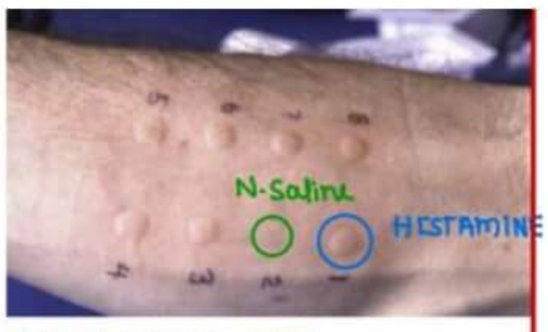
→ Mulberry appearance of Nasal mucosa

→ Nasal mucosa is hypertrophied

→ Confirmatory Test

→ Skin prick test – IOC

- 1 is histamine used (As positive control)
- 2 is normal saline (Negative control)



SKIN PRICK TEST

→Nasal allergen challenge test/provocation test (Gold std.)

- Not commonly done

R_x

→ Steroids (Intra nasal spray) - DOC

→ Non respondent to pharmacotherapy → Immunotherapy

5) Vasomotor Rhinosinusitis

→ d/t ↑ Parasympathetic discharge

→ MC in emotional females

→ Non allergic non infective perennial Rhinosinusitis (NANIPER)

R_x → Anticholinergic spray (Ipratropium Bromide)

→ Vidian Neurectomy – Gold std.

6) Rhinitis medicamentosa

→ Excess usage of Nasal decongestant drops

Xylo / oxymetazolines

↓

REBOUND PHENOMENON

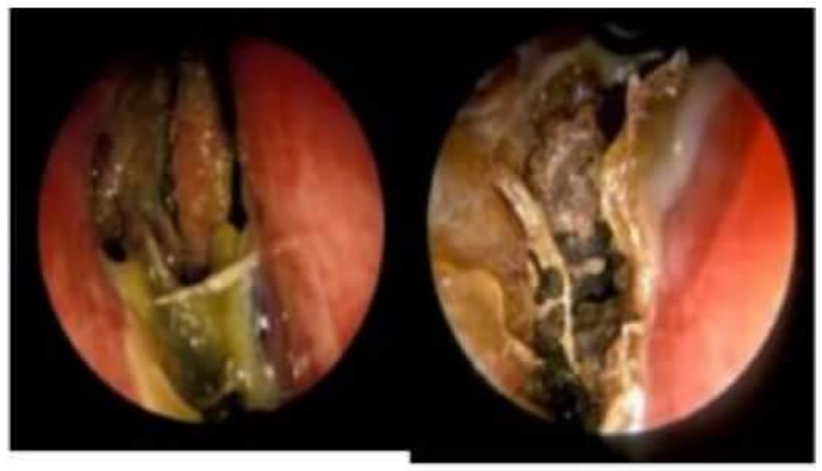
R_x

-Stop decongestants

DOC – Intra nasal corticosteroid spray (Topical)

Atrophic Diseases

1) Atrophic rhinosinusitis (Ozaena)



→ Causative organism: Klebsiella ozaena /Perez Bacillus

→ Young females, low socioeconomic status.

- Iron deficiency.
- Multivitamin def/vit D deficiency.

→ Pseudostratified ciliated columnar epithelium is replaced by stratified squamous Epithelium.

→ M.C. complaint → Nasal obstruction (Crust formed)

→ Foul smell

→ Anosmia (Merciful Anosmia)

→ O/E

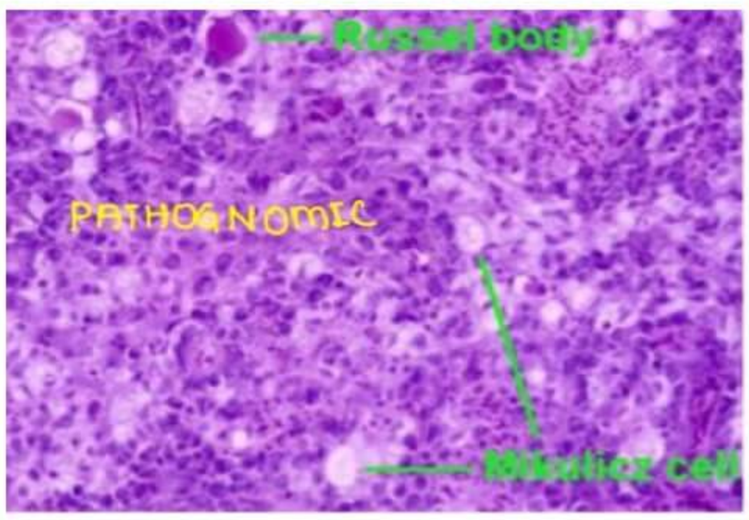
- Large roomy nasal cavity c̄ foul smelling crusts.

R_x

1. Alkaline nasal douching (Nacl + $NaHCO_3$ + Na biborate)
2. 25% glucose (Nourishment) in glycerin (Hygroscopic)
3. Iron & vitamin D supplements
4. Antibiotics
5. Estrogen spray
6. Kimecetine nasal sol^n / Anti – Ozaena solution
   a. Chloromycetin / Chloramphenicol
   b. Vitamin D
   c. Estradiol
7. Sx → Young's operation → Alternative closure of each nasal cavity for 6 months

Modified Young's Operation (1 – 3 mm)

2) Rhinoscleroma / Respiratory Scleroma



→ Caused by klebsiella Rhinoscelromatis / Frisch Bacillus

Stages

I) Stage of Atrophy

II) Stage of granuloma formation

Biopsy + HPE } for confirmation

→ Miculicz Cells & Russell Bodies Are Seen

III) Stage of sclerosis / fibrosis/cicatrization

- AKA woody nose / Hebra nose / Tapir nose

↓

→ Seen in stage 3

→ Woody induration

(Seen in stage 2)

R_x

DOC → Rifampicin

R_x OC → Laser excision + Base electrocautery

→ Rhinoscleroma → Disease of Respiratory, Epithelium

- New Name → Respiratory scleroma

3) Rhinosporidiosis / Strawberry Granuloma

→ Caused by Rhinosporidium seeberi

↓

I) Aquatic protozoa

II) Affects only mucosal surfaces

→ Seen in southern – Eastern coast of India, Sri-lanka, Bangladesh.

→ Rural population, Pond bathing – cause infection from animals.

→ Strawberry granuloma

→ Nasal obstruction present

→ Confirmatory tests: - B_x + HPE

Multiple thick-walled sporangia

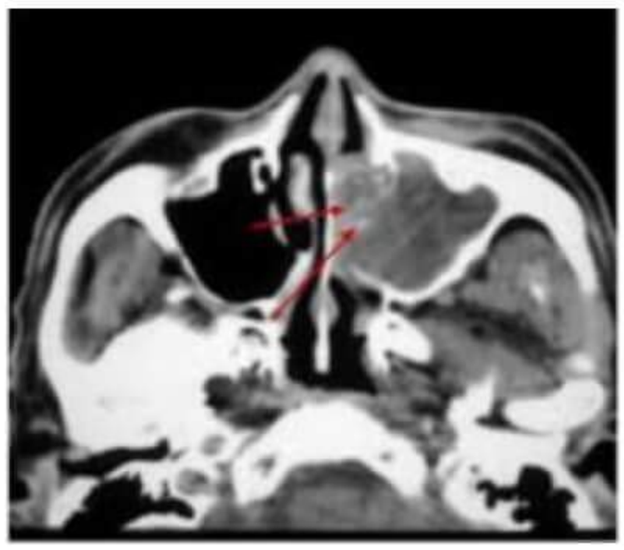
R_x DOC → Dapsone

Amphotericin – B

TOC → Laser excision c̄ Base electrocautry

Fungal Rhino Sinusitis

I) Fungal Ball / Mycetoma / Aspergilloma



→ Mc : Aspergillus fumigatus
→ Immuno competent patients; No mucosal sensitivity
→ No invasion by fungus, No reaction from nasal mucosa

R_x : - Evacuation c̄ FESS
No role of Antifungal

2) Allergic Fungal Rhinosinusitis (AFRS)

→ Mc causative organism – Bipolaris
Others – Curvilaria
- A. fumigatus

→ Criteria - Bent & Kuhn Diagnostic 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

→ CT findings - U/L generally, but can be B/L
- Bone erosion w/o invasion
- Hyper densities [due to ca^{2+} deposition in dense fungal hyphae.]

→ Type 1 Hyper Sensitivity – Allergic mucin release
→ Patient is immunocompetent
→ Multiple nasal polyps, No invasion
→ +ve fungal stain
→ Characteristic of CT scan – Double dense appearance

R_x

- FESS & removal of fungus
- Steroids oral → short course & prolonged nasal steroids
- Immunotherapy

3) Rhinocerebral Mucormycosis

→ Mucor / Rhizopus (Saprophytic fungus)

→ Acute invasion fulminant fungal disease

→ Immunocompromised patients – (Diabetic patients with uncontrolled sugar)

→ Necrotizing vasculitis due to invasion of arteries.

Ophthalmic involvement → Sudden blindness

ICA involvement → Stroke

→ DOC/ TOC → Amphotericin – B

Surgical debridement

Diabetes control

INVASIVE FUNGAL RHINOSINUSITIS

Nasal Polyps

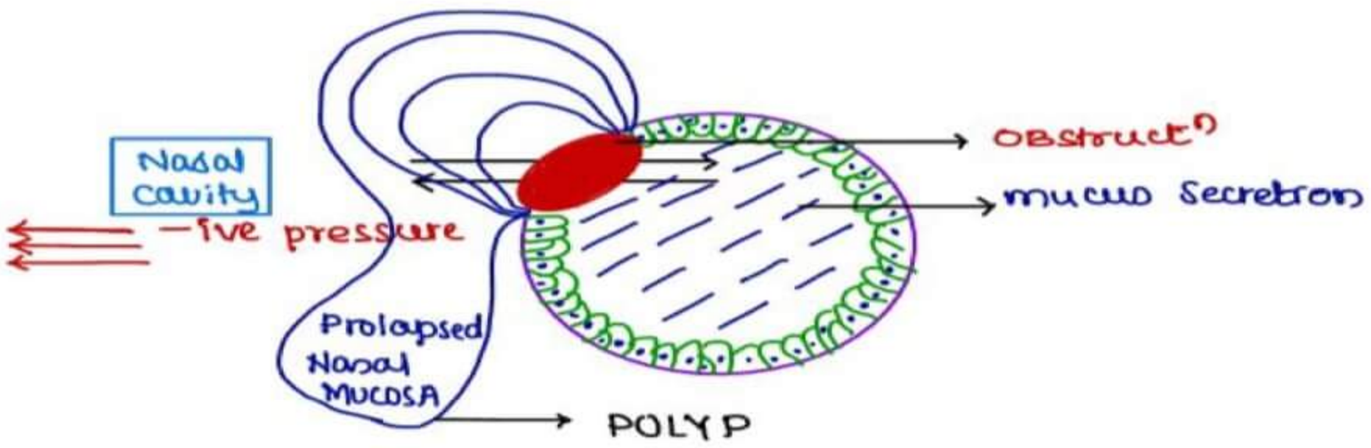
Antrochoanal Polyp [AC Polyp]

→ Starts from maxillary antrum
→ Single, large, U/L
→ Grows posteriorly towards choana
→ Children c̄ an infection
→ C/F: Both U/L & B/L obstruction

Ethmoidal Polyp

→ Starts from ethmoidal air cells
→ Small, multiple, B/L
→ Comes out anteriorly
→ Adults c̄ allergy
→ B/L Nasal obstruction

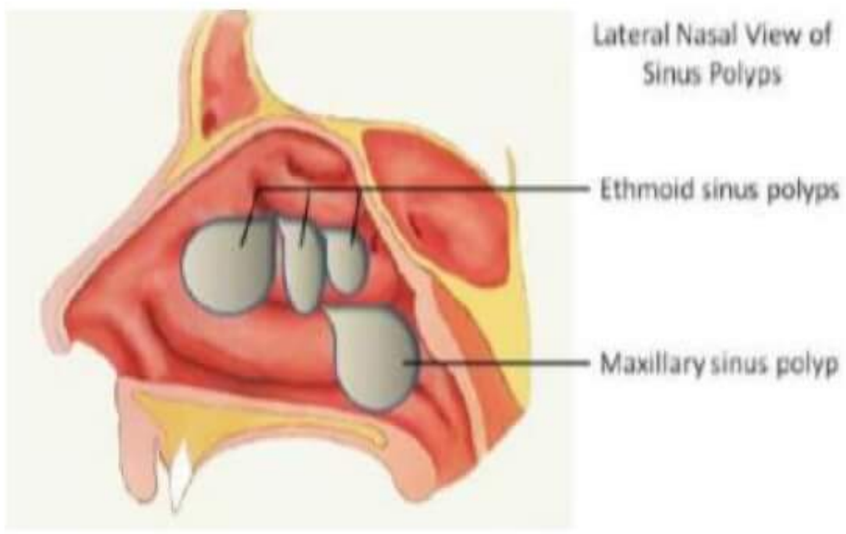
Pathophysiology of a Polyp



→ Prolapsed sinus mucosa due to -ve pressure in Nasal cavity.
→ No Nerve Supply, No Blood supply
  - No bleeding or pain on touch
  - Pale & Glistening polyps

IOC → NCCT of Nose & PNS

R_x → FESS (TOC)



Tumors of Nose & PNS

Benign Tumors

1) Osteoma

- M/C benign tumor of PNS
- M/C location – Frontal sinus > Ethmoid sinus

→ **Presentation:**

- Sinus Blockage c̄ obstructive symptoms
- Mass pressing on the orbit

R_x → Surgical Excision by endoscopic approach

2) Inverted Papilloma / Ringertz Tumor

→ M/C benign tumor of Nasal cavity

→ M:F – 3.5:1

50-60 years

→ Arises from Schneiderian Membrane

↓

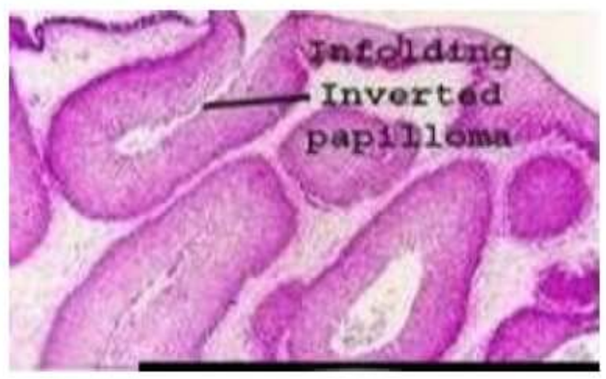
(Transitional cell epithelium)

→ Presentation

- Polypoidal mass arising from lateral wall of nasal cavity
- Nasal obstruction
- Bleeding

→ Investigations

IOC → B_x → HPE: Shows inverted Infolding papilloma (Confirmatory).



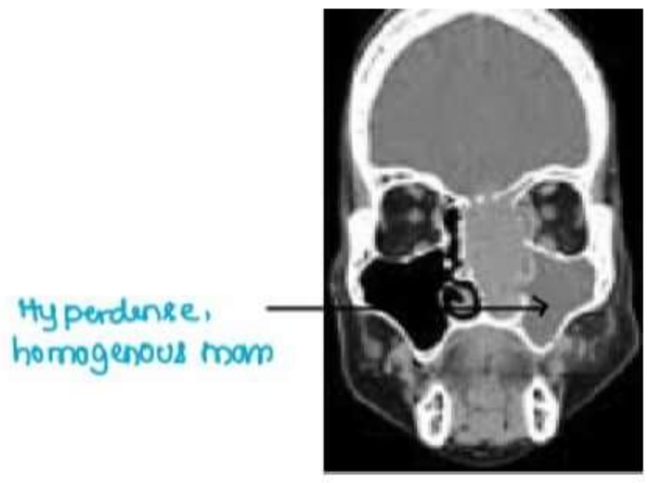
CECT – To know the spread

- Hyperdense homogenous mass

→ R_x

- Endoscopic Excision – (TOC)

→ Chances of Recurrence & conversion into sq. cell carcinoma.



Malignant Tumors

1) Squamous Cell Carcinoma (80%)

→ M/C PNS: maxillary sinus

→ M/C malignancy of PNS & Nasal cavity

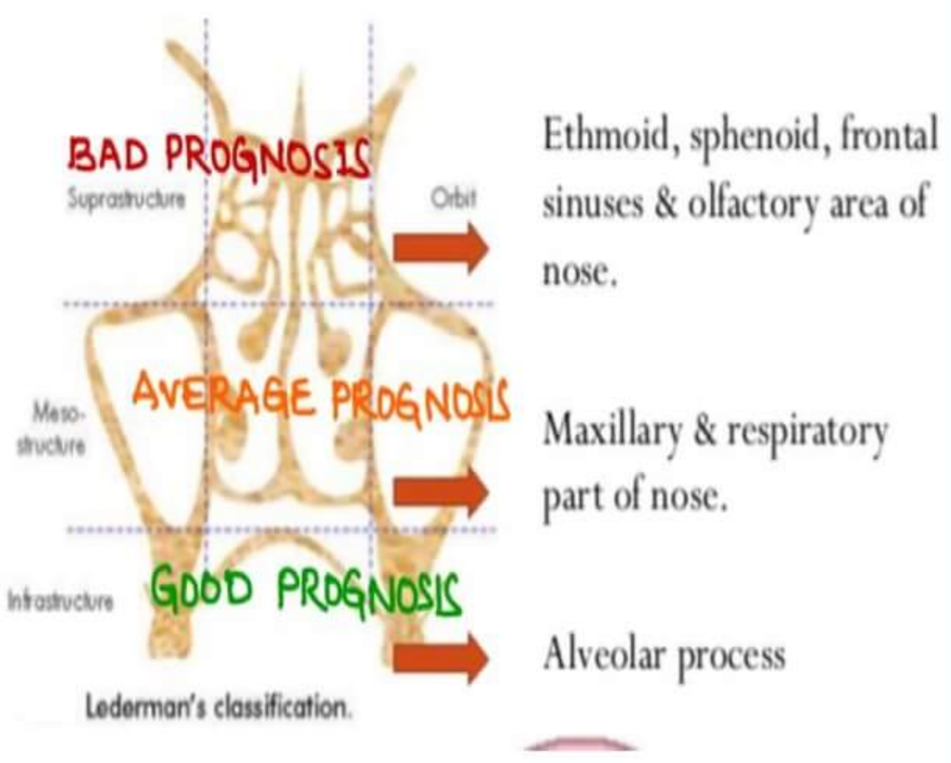
→ Occupational malignancy

- Furniture industry – Adeno CA
- Nickel Industry – Sq. CA

→ M.C. in males

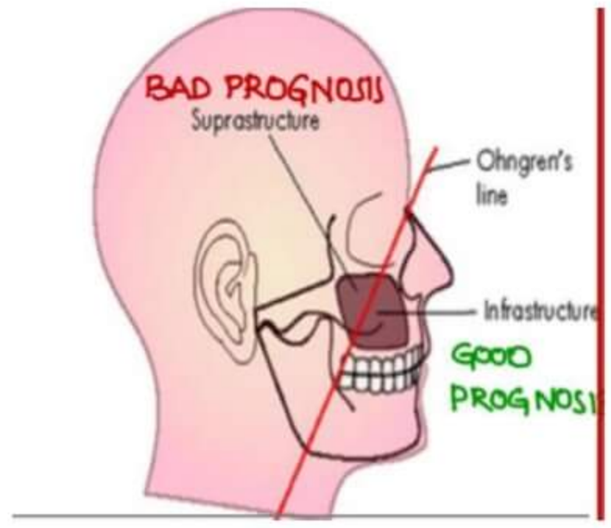
→ sq. cell CA of the septum: - Nose Picker's tumor

→ MC lymph Nodes involved: Submandibular



Classification

1) Ohngren's line: Hypothetical line from medial canthus to angle of mandible
   - Above the line / Suprastructure: poor prognosis
   - Below the line / Infrastructure: Good Prognosis
2) Lederman's classification
   - Uses two lines of sebileau.



TNM Staging

T

T_1 → Involvement of sinus mucosa

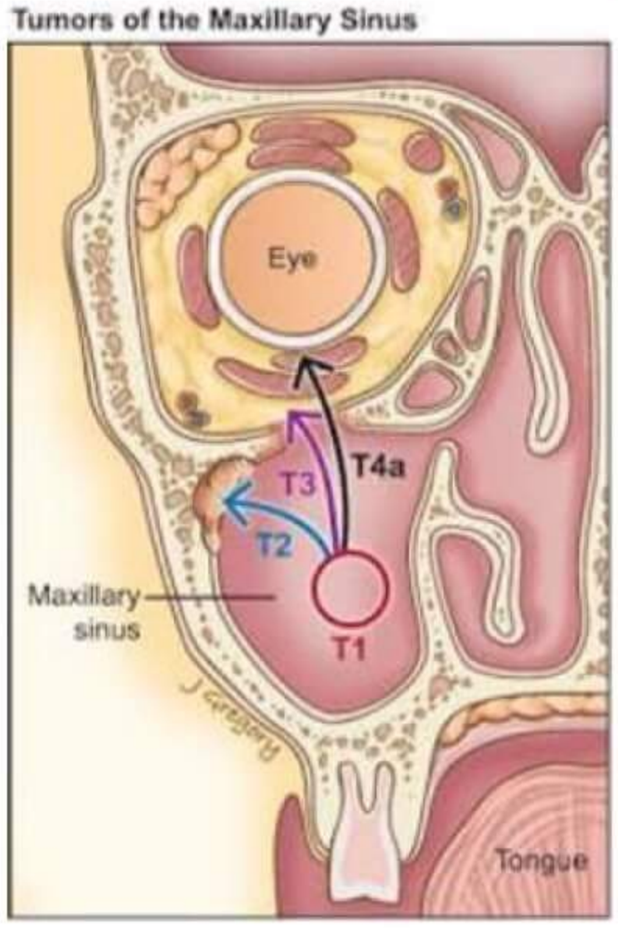
T_2 → Bone (Except the superior wall of maxillary sinus)

T_3 → superior wall or Ethmoid air cells or subcutaneous tissue.

T_4 → Orbital content + skin + eyeball

Investigation → Biopsy (Confirmatory)

T_x → S_x + Radiotherapy ± Chemo



MISC

Esthesio-Neuroblastoma/Olfactory Neuroblastoma

→ Rare

→ Aries from olfactory neuroepithelium

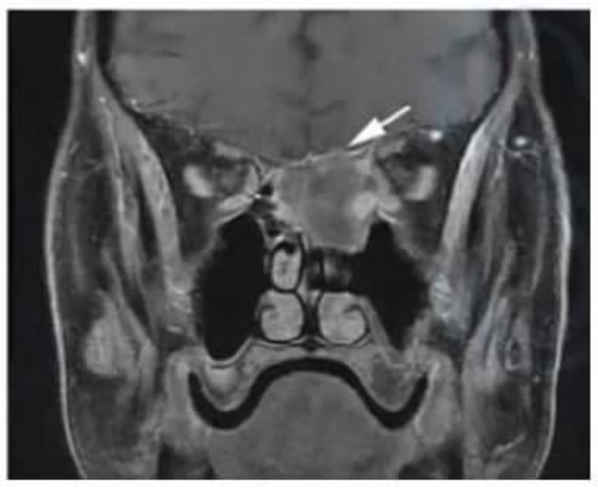
→ M/C site – Roof of nasal cavity

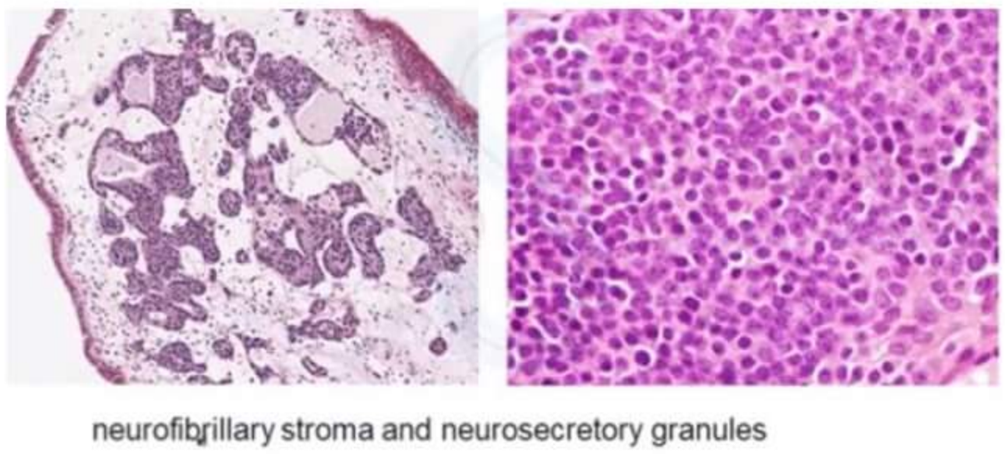
→ Histology shows neurofibrillary stroma and neurosecretory granule

→ Rx – Endoscopic excision

↓ f/b

Radiotherapy





neurofibrillary stroma and neurosecretory granules

Midline Lethal Granuloma/ Stewart's Granuloma

→ T cell /NK cell lymphoma

→ Rapidly spreading, destructive lymphoma

→ Rx – chemotherapy

Miscellaneous Topics

1) Nasal Myiasis / Maggots

Causative – Chrysomia fly larvae

T_x – 10 % chloroform → (To anesthetize maggots)

↓

Removal

2) Foreign Body in NOSE

→ MC seen in children

→ U/L mucopurulent discharge or blood-stained discharge in child

→ Investigation

- Endoscopy (For confirmation)
- X-Ray

→ Rhinolith formation due to calcification [stone in nose]

→ R_x: Removal c̄ a probe / eustachian tube catheter

→ Posterior fb → Endoscopic removal under general anesthesia

3) Facial Trauma

→ MC bone to undergo # – Nasal Bone

→ Open book deformity ↘

Due to the fracture

→ Closed book deformity ↗

→ C/F

→ Cosmetic deformity

→ Nasal obstruction

R_x

→ Closed reduction with external fixation

Time → c̄ in 24 hours (Before onset of edema)

→ After 4 -5 days (After reduction)

→ Not done between 2 weeks – 3 weeks (Callus is formed)

→ Complete rhinoplasty after 3M (Complete bone is formed)

4) Zygomatic Bone # / Tripod

→ 2nd mc facial bone #

→ Now known as Quadripod #

→ Malar prominence is lost

→ Step deformity on palpation

→ R_x → ORIF

5) Blowout # / Orbit

→ Weakest wall of orbit: Floor

→ Thinnest: Medial wall / Lamina papyracea

→ Orbit hangs in the maxillary antrum

- Tear drop sign

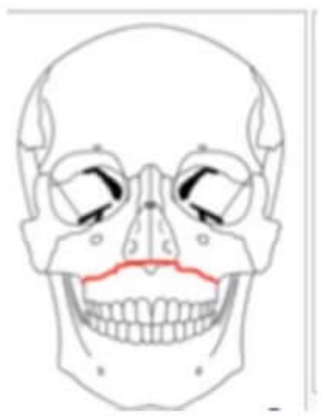
→ Diplopia due to Inferior Rectus intrapment

→ R_x: - Mesh application & reduction

5) Maxillary # / Le fort

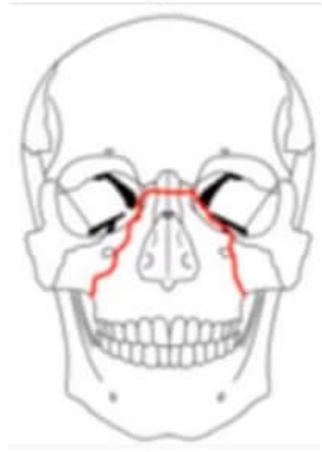
→ Le fort 1 # / Transverse #

- Line parallel to hard palate
- Floating palate



→ Le fort 2 # / Pyramidal #

- Floating maxilla



→ Le fort 3 # / cranio facial dysfunction

- Most dangerous, Morbidity

6) CSF Rhinorrhea

→ MCC: - Head Trauma

→ Clear, watery discharge

- ↑ On coughing, sneezing, straining, bending forward ⟶ (Tea pot sign)
- Reservoir sign

→ MC site :- # Cribriform plate of Ethmoid

→ Sniff test:- Cannot sniff back

→ Handkerchief test:- Mucoid discharge will make it stiff.

→ Glucose test:- $^{2}/_{3}^{rd}$ of blood glucose levels present in CSF (40 – 60 mg/dl)

→ In case of blood in CSF

1) Halo sign / Target sign / double ring sign
2) β_2 Transferrin test (Gold std)
   Only found in CSF

→ IOC :- HRCT →

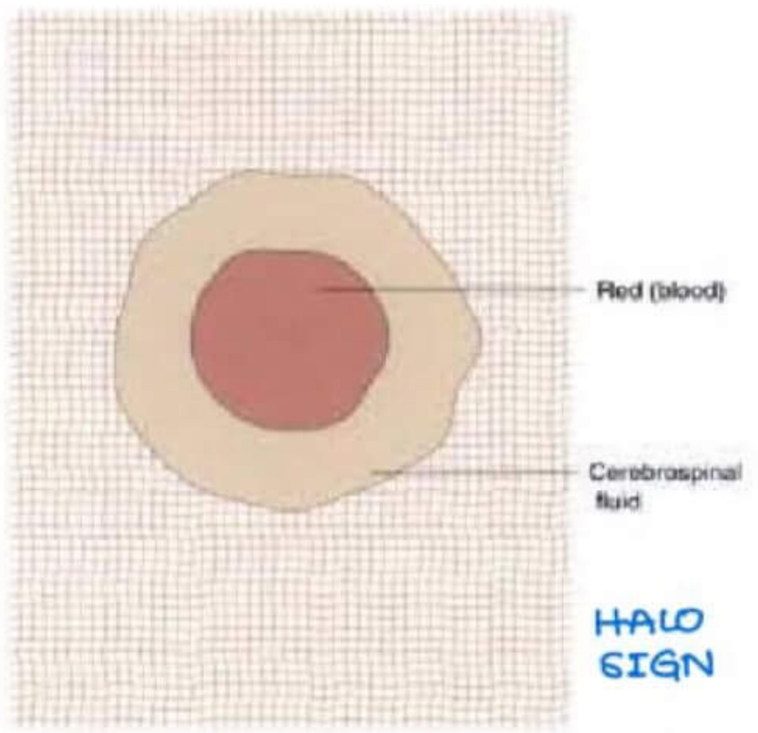
→ **Gold standard investigation in CSF rhinorrhea??**

a. β_2 transferrin levels (Not done because diagnose already done)

b. HRCT of nose and PNS (To find site of leak) 1st inv./IOC

c. MRI – T2 weighted images (Can't see both # the CSF at once

d. CT cisternography (Can see both #and the CSF)



Halo sign. Clear drainage that separates from bloody drainage suggests the presence of cerebrospinal fluid.

Management

1) Traumatic

Q. 38 yrs old pt presented after RTA few hrs back with CSF Rhinorrhea. Next line of M_x :-

a. Conservative M_x [No active Surgical mid → heal on itself

b. B/L Ant. nasal packing to stop CSF leak → Nasal packing C/I

c. Immediate endoscopic repair of Skull base

d. Open neurosurgical Repair of skull base

→ Conservative Management

→ Prophylactic Antibiotics (Wait for 7 days)
Acetazolamide

→ Stool softners & bed rest

→ B/L anterior Nasal packing C/I (Causes meningitis)

→ No relief :- Lumbar drain for 2 wks

→ No relief :- Endoscopic repair

2) Spontaneous CSF Rhinorrhea

→ No injury
Causes → Brain tumor – Do MRI for R/O cause of ICT

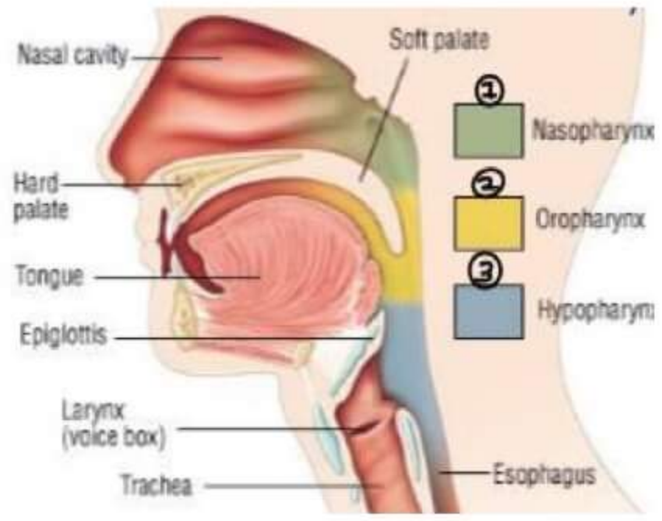
→ Repair (Endoscopic)

3) Paradoxical CSF Rhinorrhea

→ # Temporal bone (Petrous part), can cause CSF otorrhea

Pharynx

Extends from skull base to C_6 Vertebrae divided into 3 parts



1) Nasopharynx → From skull base to hard plate
2) Oropharynx → From hard palate to hyoid bone
3) Hypo / Laryngopharynx → From hyoid bone to esophagus

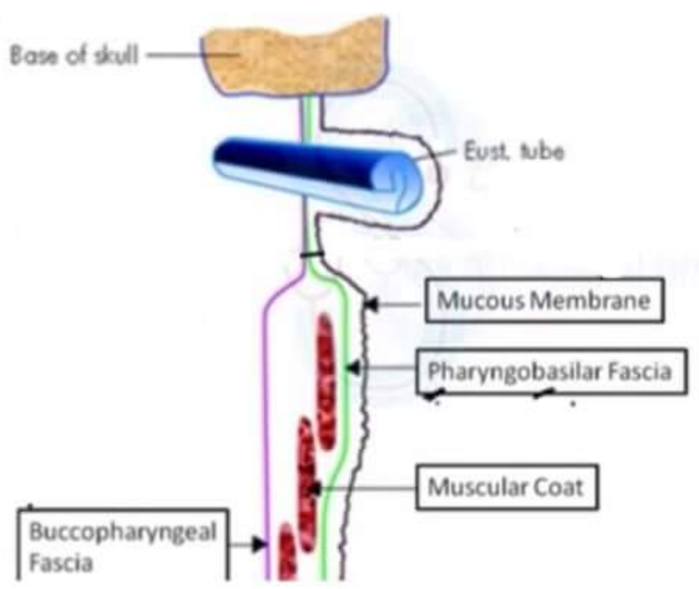
MUSCULAR LAYER

→ 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 veli palatini
  3. Ascending palatine artery

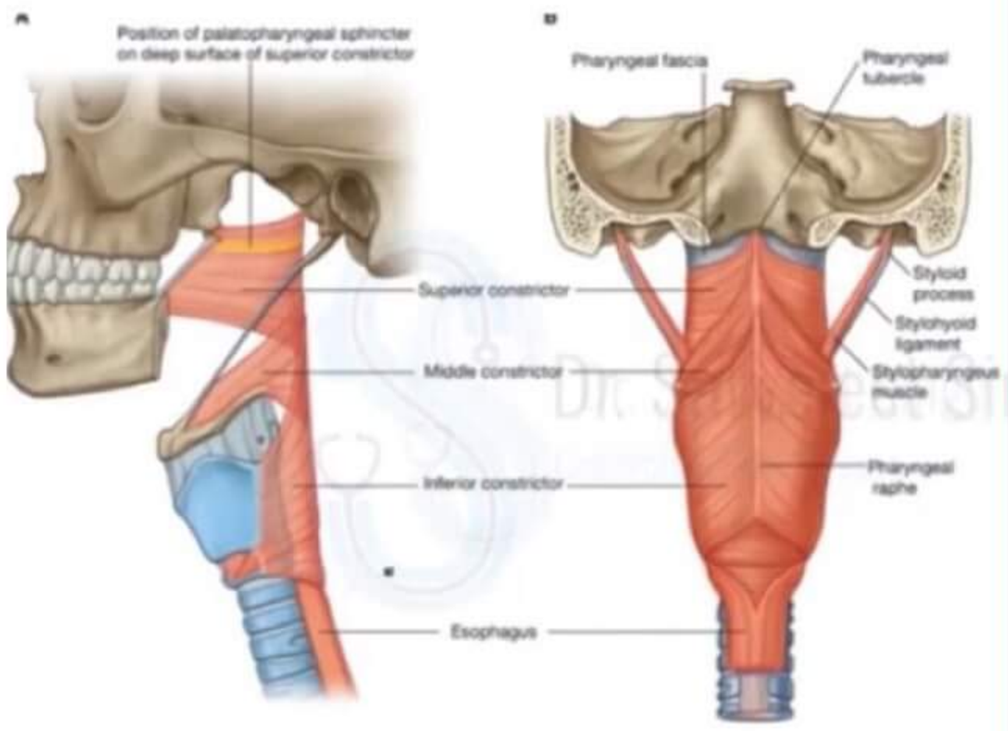
→ Stylopharyngeus muscle with glossopharyngeal nerve (9th)
Pass b/w superior and middle constrictor



Deep Layer

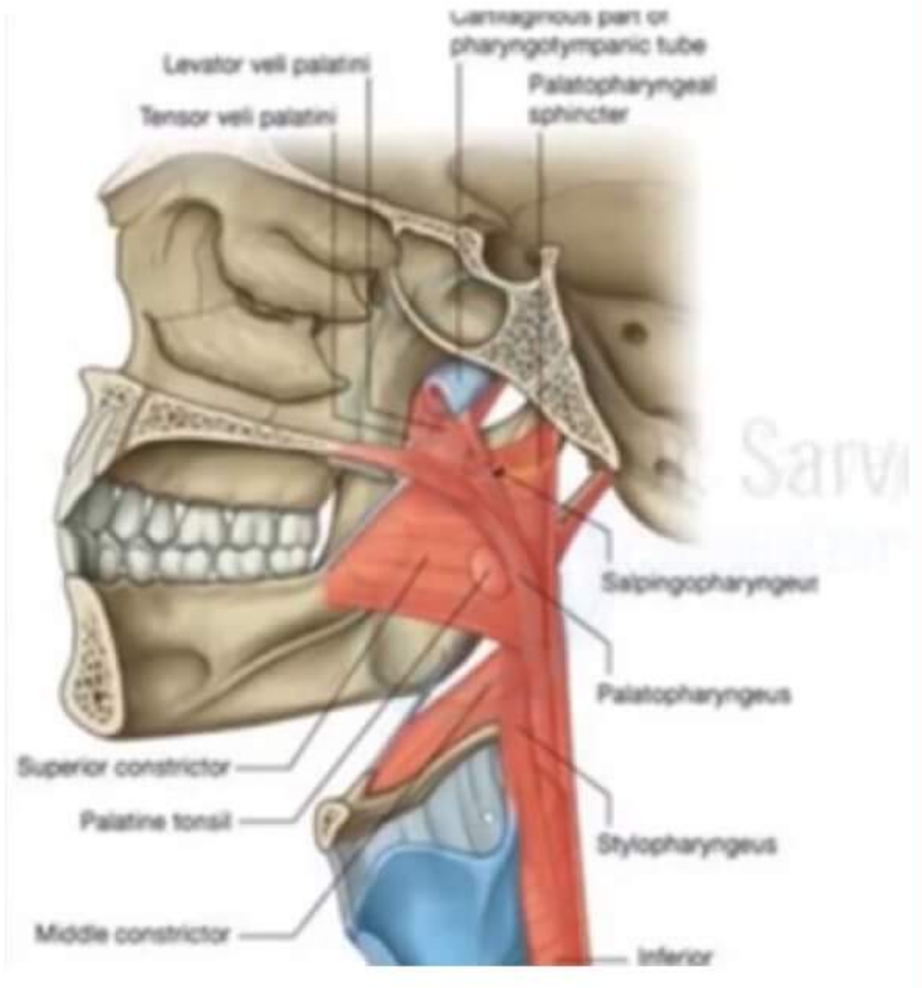
→ Salpingopharyngeus
→ Palatopharyngeus
- Forms a ridge – PASSAVANT'S RIDGE
  Prevents regurgitation

→ Stylopharyngeus
→ Superior constrictor forms bed of palatine tonsils



Structures That Pass

a. **Through sinus of Morgagni**
   PA – Ascending **P**alatine **A**rtery
   L – **L**evator veli palatini
   AT e – Eustachian tube (**A**uditory **T**ube)
b. **b/w middle and inferior constrictor**
   Internal laryngeal nerve
   Superior laryngeal vessels
c. **Below the inferior constrictor**
   Recurrent laryngeal nerve
   Inferior laryngeal vessels

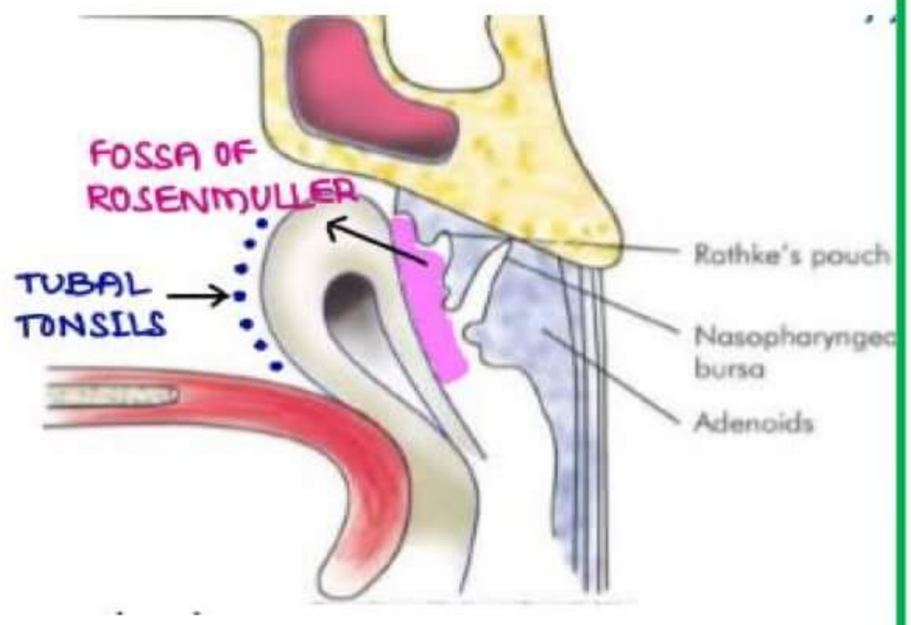


Nasopharynx / Epipharynx

Eustachian Tube

→ Opens on lateral wall

→ Torus tubarius – cartilagenous protrusion



Adenoids

– Lymphoid tissue on posterior superior wall

- Nasopharyngeal bursa →Mid line recess.

Represents the attachment of notochord 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.

M/C site for origin of nasopharyngeal carcinoma.

Tubal Tonsils

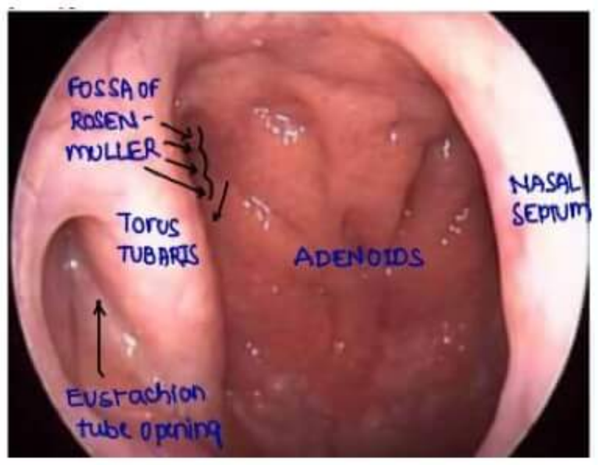
– Lymphoid nodules around ET

Diseases of Nasopharynx

1) Thornwaldt's Disease

- Abscess or cyst formation in nasopharyngeal bursa due to blockage.
- B/L nasal obstruction

R_x – Incision and drainage (Cruciate incision)



2) Adenoids – Chronic Adenoiditis / Chronic Adenoid Hypertrophy

- Normal physiological growth pattern

3-5 years age = Growth starts

5-7 years age = Max size

>7 years age = Growth size decreases

→ B/L nasal obstruction → Result in mouth breathing

↓

High arched palate

- Elongated face
  Pinched nose
  Overcrowding of anterior teeth
  } ADENOID FACIES
- B/L serous otitis media → B/L conductive hearing loss

→ Recurrent upper respiratory infection

→ Obstructive sleep apnea

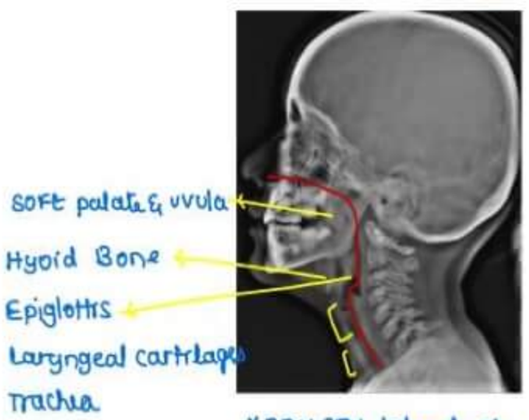
↓

Pulmonary HTN

Rt ventricular hyper trophy

Cor pulmonale

- Indication of adenoidectomy → all above



XRAY STN lateral view

X-Ray STN (Soft tissue of neck)

→ Adenoid hypertrophy

→ Crescent sign / dodd's sign

– Air in postero superior to mass.

R_x → Adenoidectomy

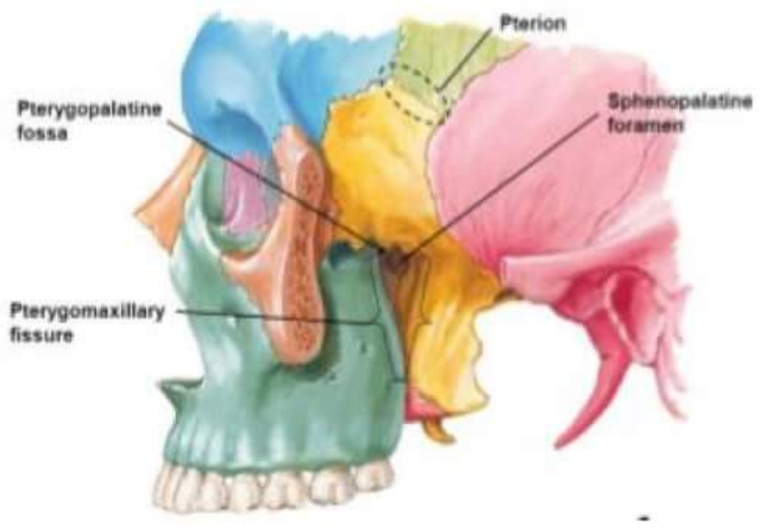
3) Juvenile Nasopharyngeal Angiofibroma / JNA

→ M/C benign tumor of nasopharynx

→ M/C in young male (Androgen dependent tumor) (8-22 years)

→ Site of origin

1. Sphenopalatine foramen
2. Vidian canal
3. Basi sphenoid



→ Sphenopalatine foramen connects the nasal cavity with pterygopalatine fossa

→ Inside pterygopalatine fossa/ sphenopalatine fossa, pterygopalatine ganglion (Largest peripheral parasympathetic ganglion)

→ PTERYGOMAXILLARY TUNNEL

MEDIAL

PTERYGOPALATINE FOSSA

LATERAL

NASAL CAVITY → SPENOPALATINE FORAMEN → PTERYGO MAXILLARY FISSURE → INFRATEMPORAL FOSSA

→ Vascular tumor

- MC blood supply or JAF → Sphenopalatine artery (Br. Of internal maxillary Artery)

→ Exclusively seen in adolescent males (Androgen dependent tumor) → 8 -22 yrs

→ Symptoms: No tunica media → Profuse recurrent epistaxis → anemia

Nasal obstruction

Swelling in cheek⊕

O/E → Reddish polypoid mass → Bleed on touch

→ Proptosis

→ Tele canthus (Intercanthus length ↑, eye ball pushed laterally) } FROG – Face deformity

Dx

CECT –

→ Anterior bowing of posterior maxillary wall = ANTRAL/ (HOLMAN MILLER sign)

→ Hyperdense, spindle shape tumor – DUMBELL SHAPED TUMOR

→ Widening of pterygo maxillary tunnel – HONDUSA SIGN

→ Biopsy is C/I

→ Rx – RxOC - 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 (better exposure)
- Endoscopic excision (Preferred method (RxOC) now) – blood loss is minimum

4) NASO Pharyngeal Carcinoma (NPC)

→ Male, 8-12 years or 60-70 year age

→ Common in Chinese – dry salted fish consumption

→ Cause – EBV Association

1. Hoggikin's lymphoma
2. Burkitt's (Non- hodgkin's lymphoma)
3. Gastric adeno ca
4. NPC
5. Immune deficiency associated non- hodgkin's lymphoma

→ M/c site → Fossa of Rosenmuller

→ M/c type → sq. cell ca (>85%)

→ M/c presentation

- Neck mass (Cervical Lymphnode Metastasis) [75%]

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

1) NPC
2) Thyroid CA

→ U/L serous otitis media – U/L conductive hearing loss

→ Multiple CN palsy –

Earliest CN → 6th nerve

Olfactory nerve is spared

Trotter's Triad – [Sinus of Morgagni Syndrome]

Ipsilateral trigeminal neuralgia -5th CN involvement

Ipsilateral palatal palsy – 10th CN involvement

U/L SOM

TNM Staging

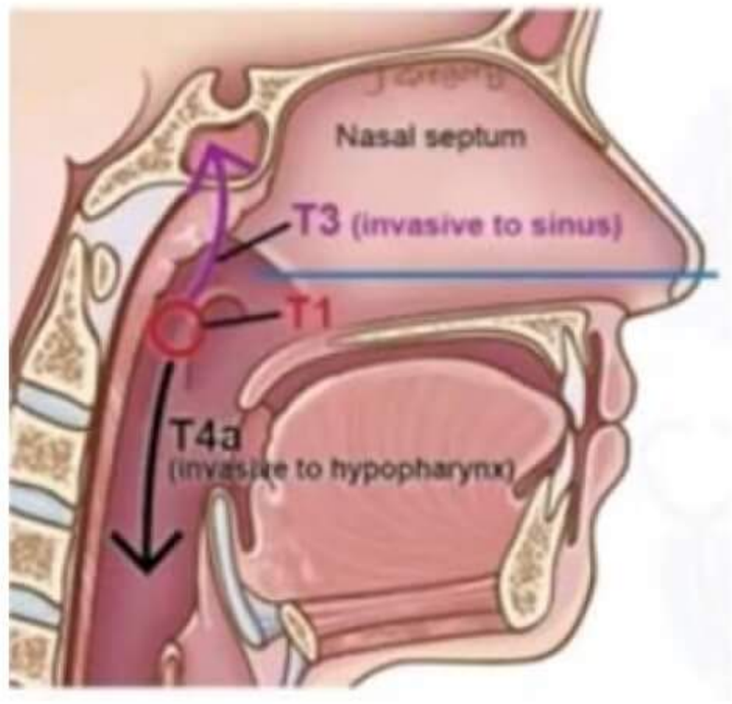
T

T 1 → Limited to Soft tissues of NP

T2 → To nasal cavity or oropharynx

T-3 → To bone / PNS

T-4 → To cranial cavity or hypo pharynx or cranial nerves



M

Mo → No Distant metastasis

M1 → Distant metastasis

N For all Head & Neck malignancies except CA NASOPHARYNX

N_1 → < 3cm Ipsilateral, Single

N_2 → 3 - < 6 cm

N_{2a} → Ipsilateral / single

N_{2b} → Ipsilateral / multiple

N_{2c} → B/L Or contra lateral

N_3 → ≥6cm

N

N= → < 6cm, Any one Side

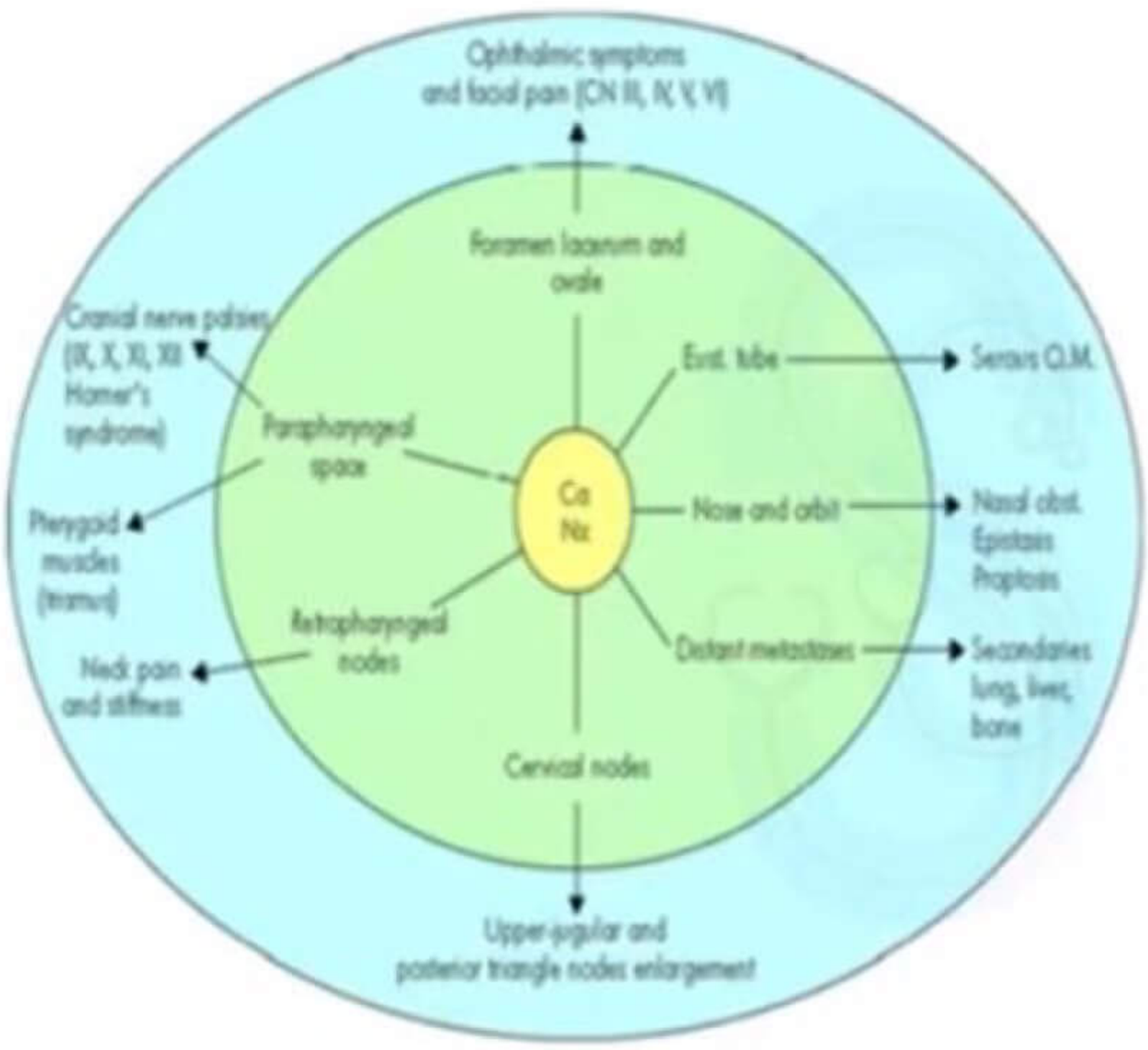
N_2 → < 6cm, B/L

N_3 → N_{3a} → ≥6cm

N_{3b} → HO 'S Triangle or Supraclavicular fossa

Supraclavicular Fossa / Ho's Triangle

Spread OF CA Nasopharynx



D_x IOC→ Endoscopic Biopsy

R_x → Rxoc – Radiotherapy

→ Chemotherapy in advanced cases.

Prognostic Markers

→ EBV

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

→ IgA

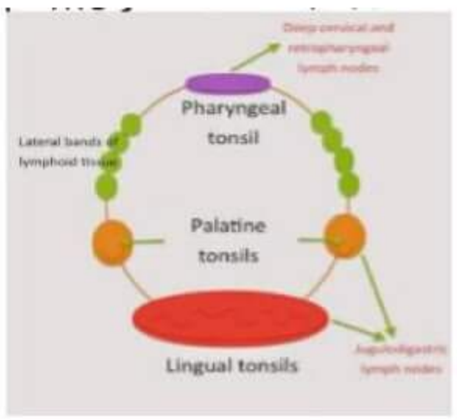
- IgA to VCA – 97% - Specific, 95 % sensitive [Screening Test]

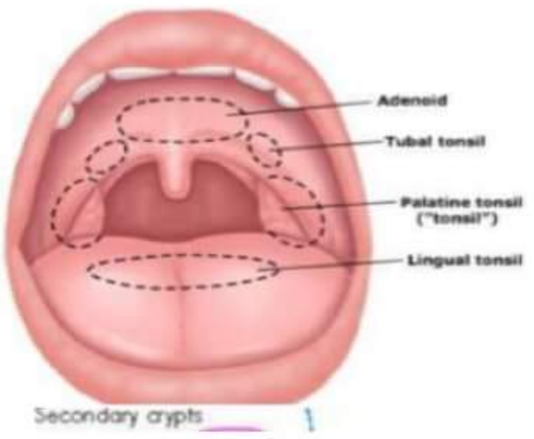
IgA to EA – 99% Specific, 90% Sensitive

Oropharynx

WALDEYER's Ring

- 1st line of defense





Tonsils

→ B/L, covered by fibrous capsule and forms crypts

→ Tonsillar bed formed by superior constrictor muscle

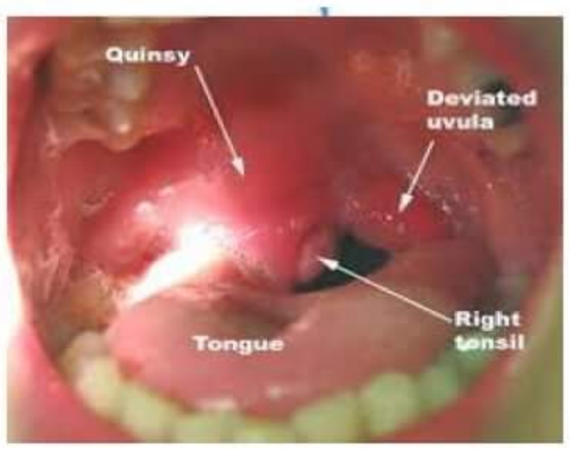
→ **Peritonsillar Space** → Between fibrous capsule and superior Constrictor muscle.

Infection of this space is known as – Quinsy / peritonsillar Abscess

Presentation → Pain in throat, Fever, dysphagia, odynophagia

Red enlarged congested tonsil pushing soft palate and uvula.

"Hot potato voice "



Rx

→ Incision and drainage

→ IV Anti-biotics

→ Interval tonsillectomy done 6 weeks after quinsy

→ Hot tonsillectomy (Tonsillectomy at the time of quinsy) is not advisable

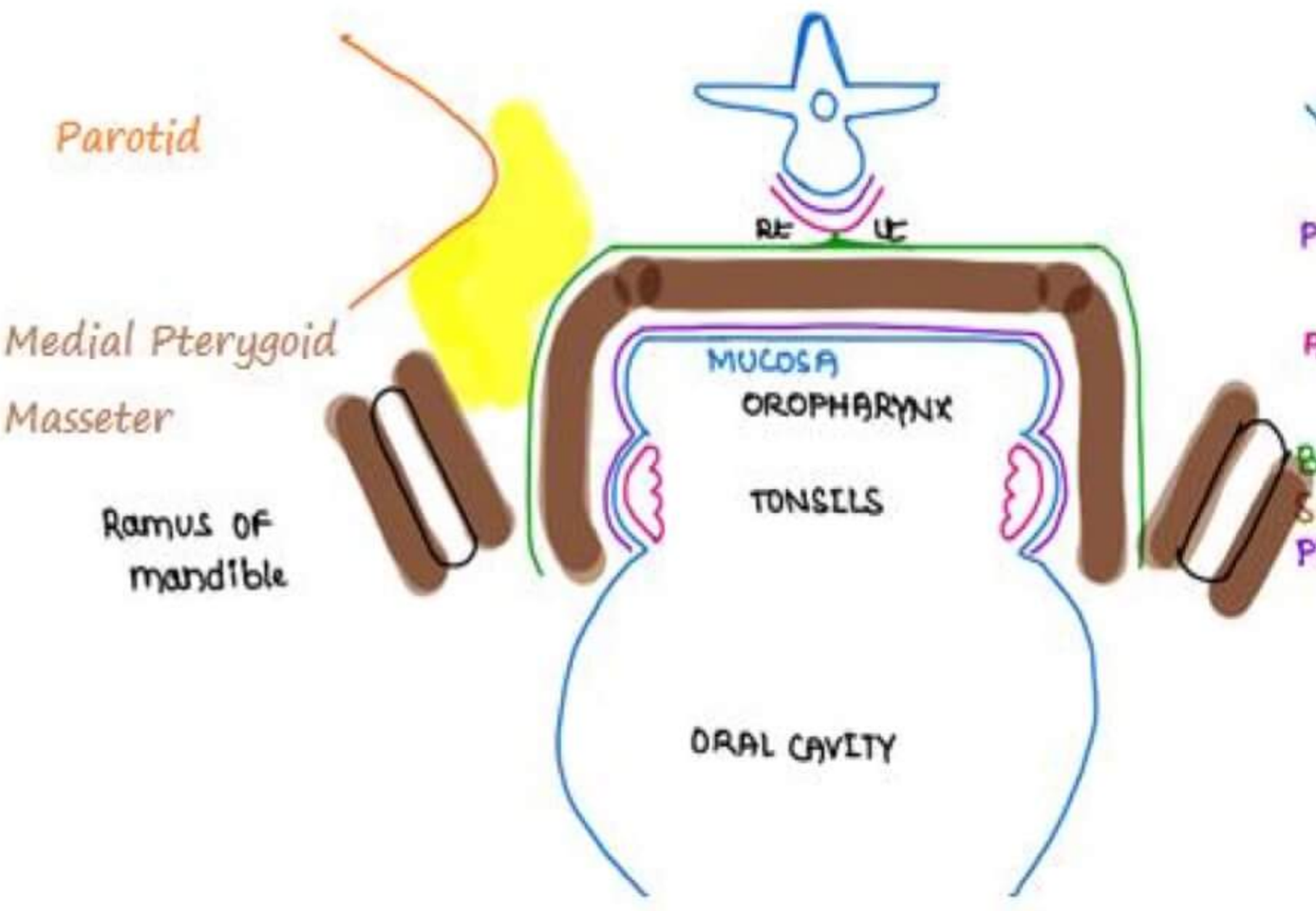
Retropharyngeal Space

→ Divided into 2 parts by midline band which are called space of gilette

→ Infection of LN of Rouviere cause acute retropharyngeal abscess.

→ Retropharyngeal abscess will be on one side (RT.&LT.)

Prevertebral abscess will be in midline.



Vertebra
PRE VERTEBRAL SPACE
prevertebral Fascia
DANGER SPACE [Mediastinitis can occur]
Alar fascia
RETROPHARYNGEAL SPACE
BuccoPharyngeal fascia
Superior Constrictor muscle
PharyngoBasilar Fascia

Boundaries

Superior → Skull bone

Lateral → Parotid gland, ramus of mandible, medial pterygoid muscle

Medial → Oropharynx with superior constrictor muscle, palatine tonsil

Inferior → Hyoid bone

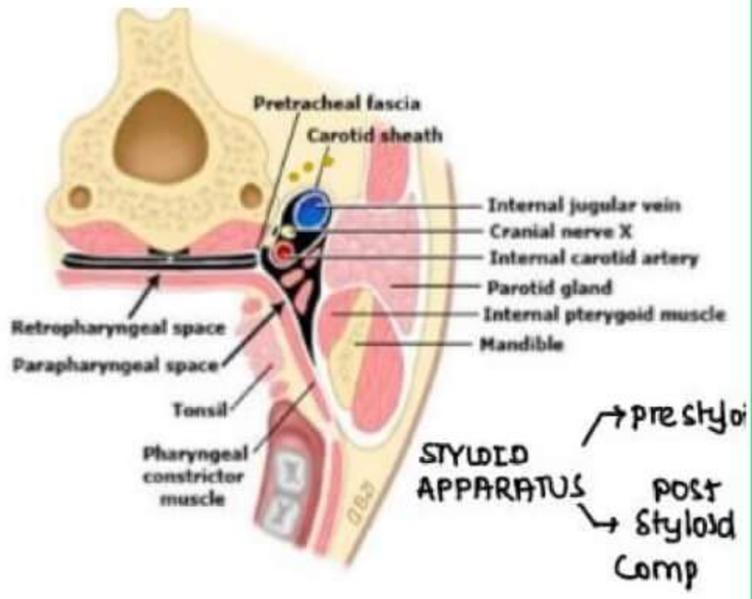
Contents

- Styloid process along with muscles – STYLOID APPARATUS
- Styloid process divides PPS into
    - Pre styloid compartment – Consist of fat – Trismus
    - Post styloid compartment –

        ICA (Internal carotid artery)

        Internal jugular vein

        CN X, IX, XI, XII



Q 7 YR OLD CHILD WITH QUINSY AND SEVERE TRISMUS, NEXT LINE OF MANAGEMENT /RxOC?

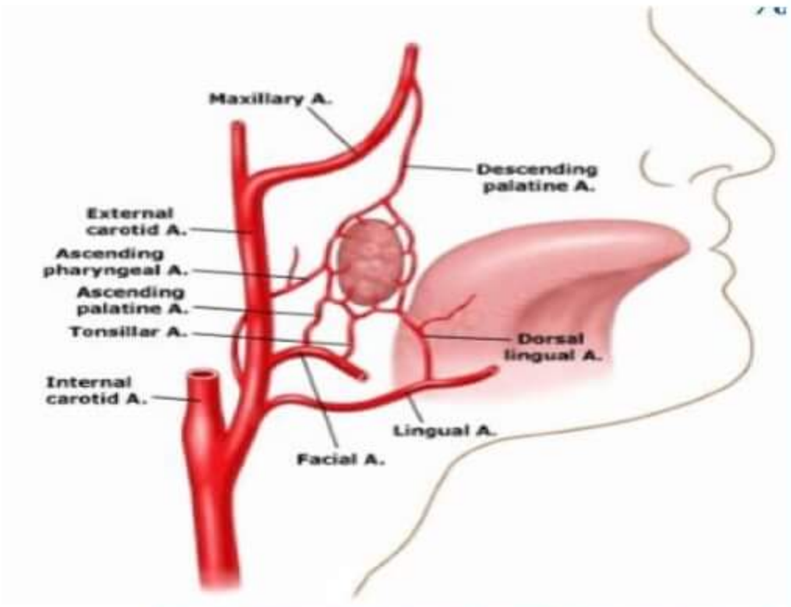
A. Intra oral drainage B. IV antibiotics for 48hrs

C. Ext. drainage D. Tracheostomy

Blood Supply of Tonsils

1) Tonsillar artery (Branch of facial artery)
    - Main blood supply
2) Ascending palatine artery
3) Descending palatine artery
4) Ascending pharyngeal
5) Dorsal lingual artery

→ Venous drainage by PARA TONSILLAR VEIN.



Acute Tonsillitis

→ Common in children

1. Acute catarrhal tonsillitis
    - Red, congested, seen in viral infection
2. Acute follicular tonsillitis
3. Acute parenchymal tonsillitis
4. Acute membranous tonsillitis

→ M/C organism – Streptococcus

→ Symptoms → Enlarged and tender jugular digastric node

→ R_X – Penicillin → Doc

Chronic Tonsillitis

→ Bacteria grow and resides in crypts

→ Recurrent sore throat

→ IRWIN MOORE Sign: Pus comes out on pressing the anterior pillar.

→ R_x – Tonsillectomy

Tonsillectomy

Indication

1. Recurrent sore throat – PARADISE CRITERIA OF SORE THROAT (Detailed one)

   ≥ 7 episodes in one yr or

   ≥ 5 episodes / yr for last 2 yrs or

   ≥ 3 episodes / yr for last 3 consecutive yrs or if a child misses school for ≥ 14 days in 1 yr because of sore throat

2. Quinsy
   a. Episode in child
   b. Episode in an adult
   } Absolute indication
3. Obstruction
4. Malignancy
5. Febrile seizures
6. Rheumatic Tonsillitis (GABHS – Gr. A β haemolytic Streptococcus) infection

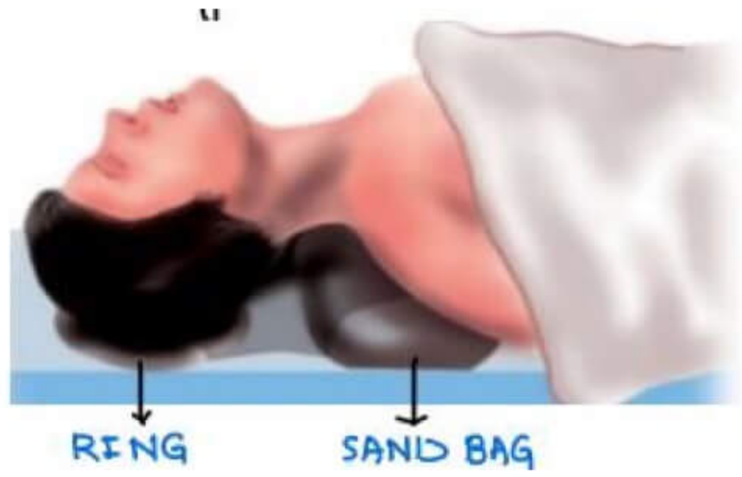
→ Position

1. Rose's position [For adenoidectomy too]

   - Thoraco cervical joints are extended.

Advantage

- Prevents the entry of blood in airways



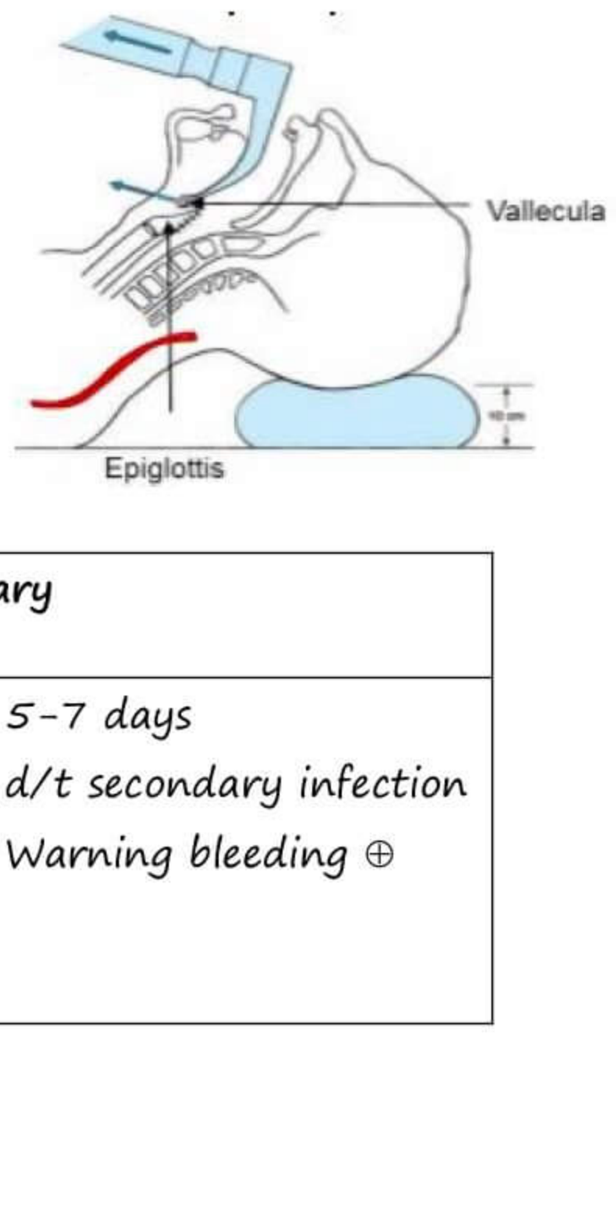
2. Boyce position / Morning sniff / BARKING DOG

   Cervical joint – Extended

   Thoracic joint – Flexed

   Used for laryngoscopy, esophagoscopy, Bronchoscopy

   Complication of tonsillectomy → Bleeding (m/c)



Primary	Reactionary	Secondary
• Intra operative • Venous bleeding • Mc source → para tonsillar vein • Rx → ligation	• Within 24 hrs • Slippage of ligature • Most dangerous • Rx → Re ligation	• 5-7 days • d/t secondary infection • Warning bleeding ⊕

- Referred pain to ear (D/t glossopharyngeal N.)

Classical Method – DISSECTION & SNARE METHOD / COLD STEEL INSTRUMENTS

- Crushed & cut with EVE's Tonsillar snare
- Pain minimal (No heat used)
- Bleeding is maximum

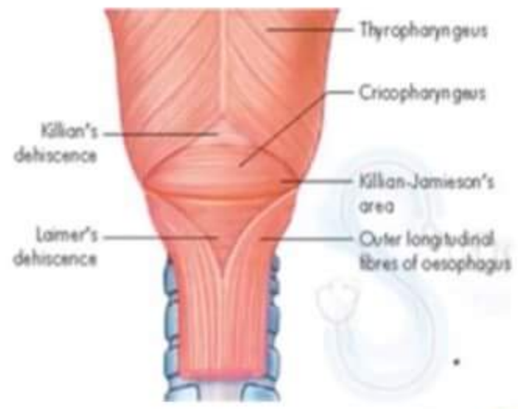
Electro Cautery

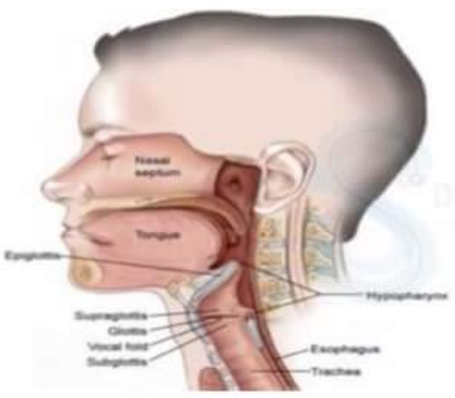
- No bleeding
- Post op pain is maximum

CO- Ablation

- Uses radiofrequency to break Nacl to Na^+ & cl^- ions
- Na^x 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

→ M/C SITE → KILLIAN's Dehiscence

Also develop from laimer's dehiscence and

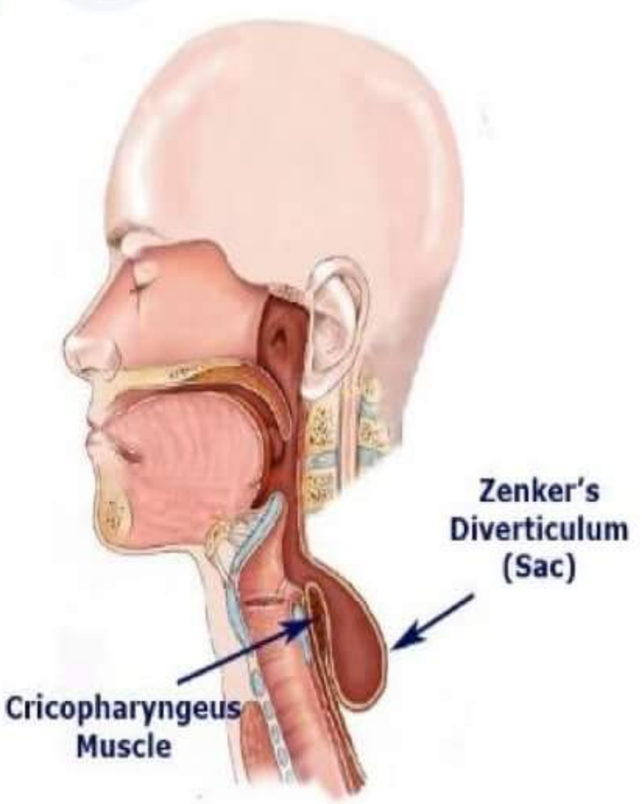
Killian – Jameison diverticulum

→ C/F

- Regurgitation of old eaten food at night times
- Dysphagia (M/c)
- Halitosis

→ Dx

- Barium swallow
    - In case of malignancy
        - Irregular margins present
        - Filling defect present
            - It is also present in case of food particles
            - To d/t repeat barium swallow after some time
        - Video fluoroscopy
            - Can check filling detects
        - Esophagus copy or Endoscopy are c/I [Risk of perforation]
            - To take Biopsy, it is indicated [Not for Dx].



→ Rx

- Excision

- DOHLMAN 'S Operation / Endoscopic Diathermy → R_xOC

    - Common wall btw diverticulum & esophagus removed

→ ZD develops above the upper esophageal sphincter epiphrenic diverticulum develops above the lower esophageal sphincter

→ ZD is a pseudodiverticulum

→ TRACTION DIVERTRTICULUM is a true diverticulum

Plummer Vinson Syndrome/ Patterson Brown Kelly Syndrome

1. Post corticoid webs
2. Fe- deficiency anaemia → More common in Females, low socio economic status & developing countries
3. Koilonychias

→ Post cricoids webs → Pre malignant

→ More common in ♀ → post cricoid cancer

→ O/E

- Post cricoid crepitus absence – Moure sign
  Moure sign is that in hypopharyngeal CA

- CHEVALIER JACKSON'S SIGN
  Collection of secretion in pyriform fossa

→ Rx

- Depends on stage of CA
  Early stages – Sx
  Late stages – Chemo radiation

Larynx

Embryology of Larynx

→ Formed from fusion of 4th and 6th branchial arches (Cartilaginous structure)

→ 4th arch blood supply
- Rt. – Rt. Subclavian artery
- Lt. – Arch of aorta

→ 6th arch blood supply
- Rt. – Rt. Pulmonary artery
- Lt. – Ductus Arteriosus

→ Nerve supply by vagus nerve (X)
- SLN – 4TH arch
- RLN – 6th arch

→ Muscles formed by

4th arch – All constrictor muscles of pharynx **except** cricopharyngeus

6th arch – Cricopharyngeus

All intrinsic muscles of larynx **except** cricothyroid

→ Cartilages

4th arch – Cu – Cuneiform

T - Thyroid

E - Epiglottis

6th arch – Co – Corniculate

C – Cricoid

Aine – Arytenoid

Cartilage of Larynx

LARYNX is placed at the level of $C_3 - C_6$ vertebra

Larynx is placed a little higher in children's and females

→ Formed by 3 unpaired and 3 paired cartilage

Unpaired –
I) Epiglottis
II) Thyroid
III) Cricoid

Paired-
I) Arytenoid – Make posterior $^1/_3$ of vocal cord
2) Corniculate
3) Cuneiform

Epiglottis → Elastic cartilage

In adult → Leaf shaped

Children → Omega-shape

Thyroid Cartilage – 'v' shape with right and left lamina, both lamina meet → C_3 - C_4 / upper border of C_4

- Thyroid cartilage Anteriority from 90° angle in male
  120° angle in female
- Prominence of thyroid cartilage in male – Adam's apple

Cricoid Cartilage – It is combined to the trachea with the help of crico-tracheal ligament
- Is only cartilage forming a complete ring.
- Synovial joints in cricoid cartilages are 1. Crico-arytenoid
  2. Crico-thyroid

Arytenoid Cartilage – Has 2 important processes 1. Vocal process
2. Muscular process

Corniculate Cartilage – They are fibroelastic in nature

Cuneiform Cartilage – They are club shaped cartilages
- Present in the free fold of aryepiglottic folds
- They are fibroelastic in nature

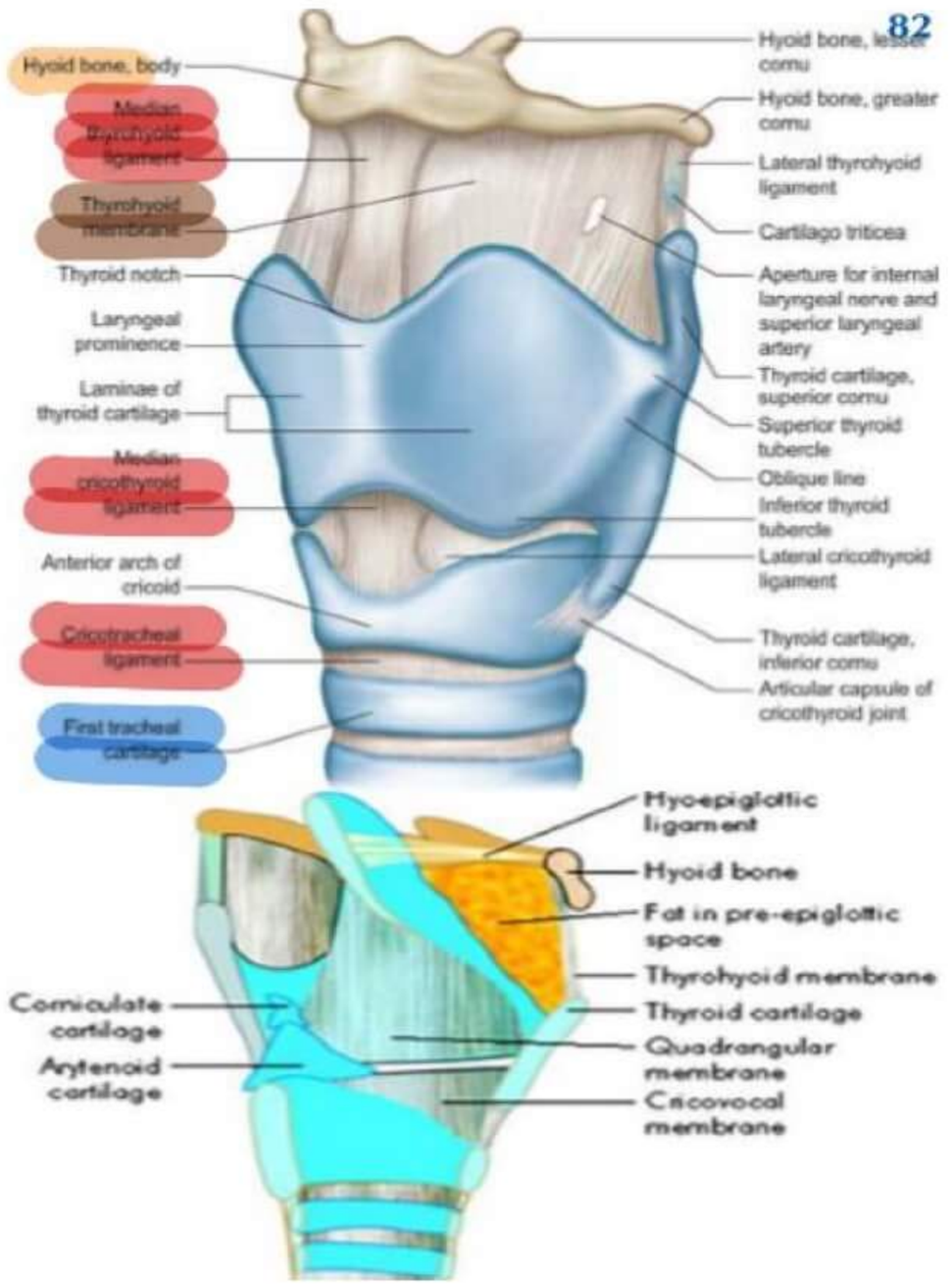
→ Any muscle/ membrane / ligament that present in b/w 2 cartilages → INTRINSIC

→ Any muscle/membrane/ligament that connects Cartilages to external structure → EXTRINSIC

- Thyrohyoid membrane
  Thyrohyoid ligament
  Cricotracheal ligament
  } EXTRINSIC

  Cricothyroid membrane
  Cricothyroid ligament
  Cricothyroid muscle
  } INTRINSIC

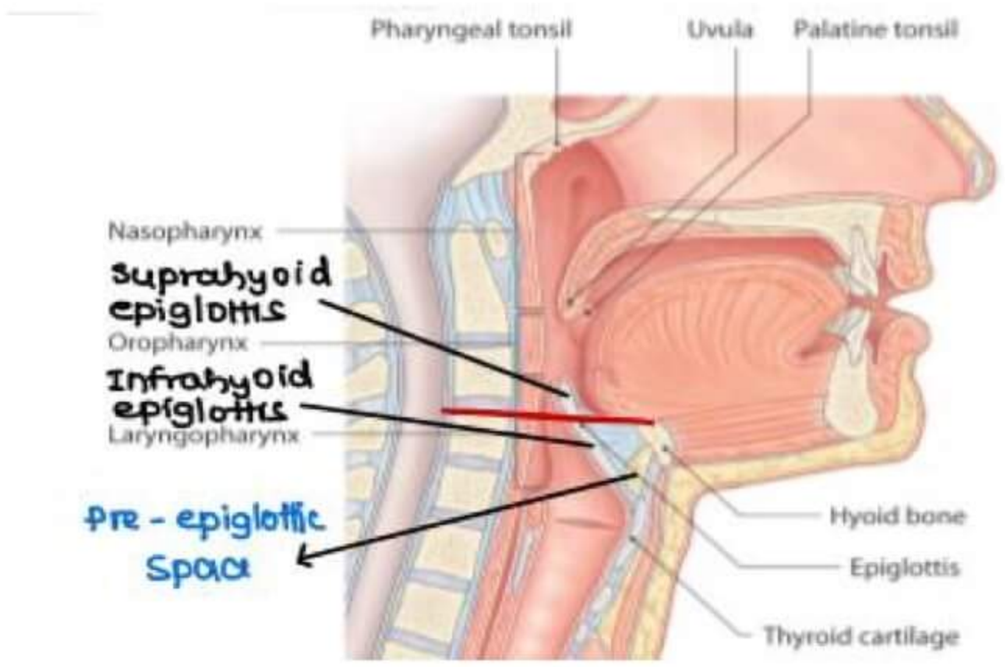
  [Only intrinsic muscle of larynx]



→ PRE Epiglottic Space

- **Boundaries**
  1. Superior → Hyo epiglottic ligament
  2. Posterior → Epiglottis
     Thyro epiglottic ligament
  3. Anterior → Body of Hyoid
     Thyrohyoid ligament
     Thyroid cartilage [Small part]

  Space is open on 2 sides & communication with paraglottic space



- Fat filled space
- Potential space [Not a actual space]
  - Spread of malignancy into it → T_3

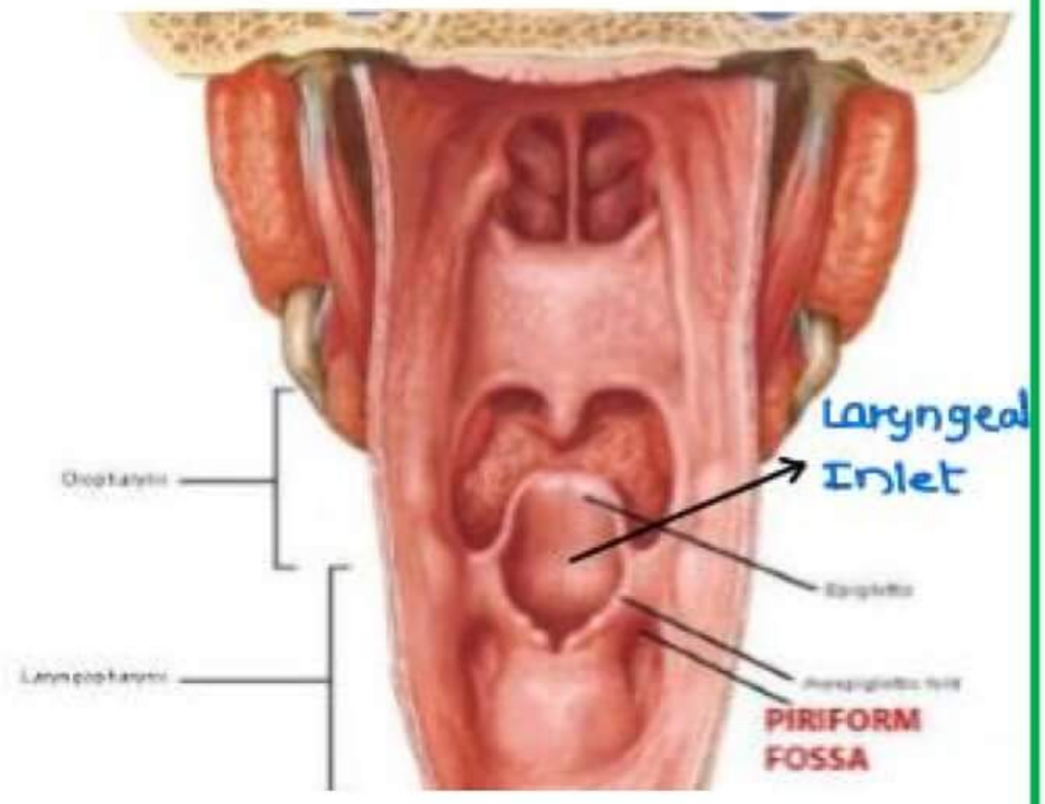
- Epiglottis is divided into 2 parts:
  1. Suprahyoid epiglottis
  2. Infrahyoid epiglottis

  } For malignancy purposes

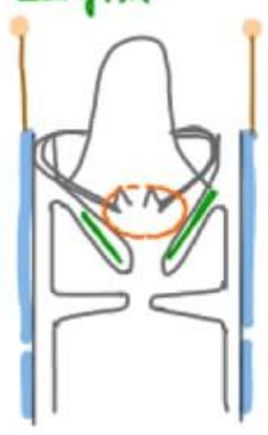
  [Suprahyoid malignancy goes to tongue base
  Infrahyoid malignancy goes to pre epiglottic space]

Laryngeal Inlet

→ Anteriorly → Epiglottis
  Posteriorly → Arytenoids [Pair]
  Ary Epiglottic fold in B/w them
→ Part of larynx that contains vocal fold is Glottis
Supra glottis → Part above the glottis
Sub glottis → Part below the glottis



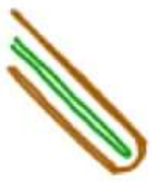
Cross sectional anatomy of Larynx



Ventricle → Forms ventricle
→ Only true space of larynx

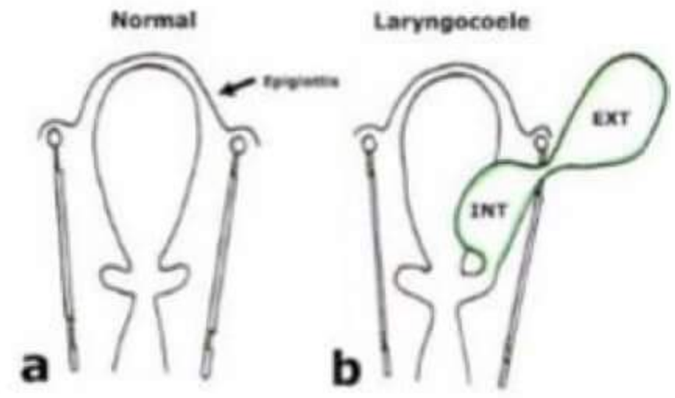
False Vocal Cords / vestibular Folds / Ventricular Folds

→ mucosa
Basement membrane ⟶



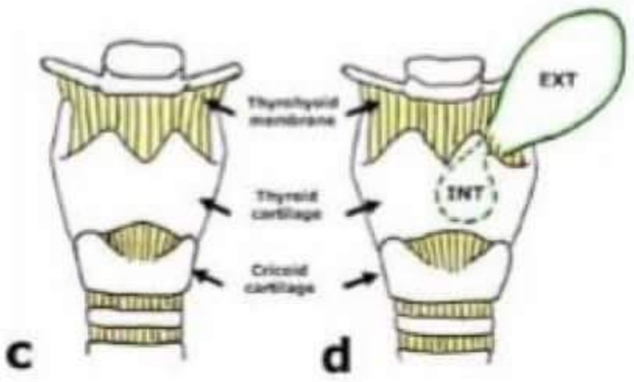
Quadrangular membrane

→ In glass blowers, wt lifters, trumpet players,
Pressure produced by glottis closure
↓
Ventricles starts increasing in size [Upside]
↓
Laryngocele



Laryngocele

→ Air filled cystic swelling in neck
→ Arises from anterior most part of ventricle - SACCULE
Types → I) External – BRYCE sign



[On compressing, the swelling ↓ size with a gurgling sound of air escape]

(BOYCE SIGN – seen in zenker's diverticulum (Sound of fluid escape)

II) Internal – Foreign body sensation in throat cough, noisy breath.
O/E → Smooth swelling of vestibular fold & Ary epiglottic fold

D_X - CT – Scan in Valsalva procedure

R_X External → Sx excision

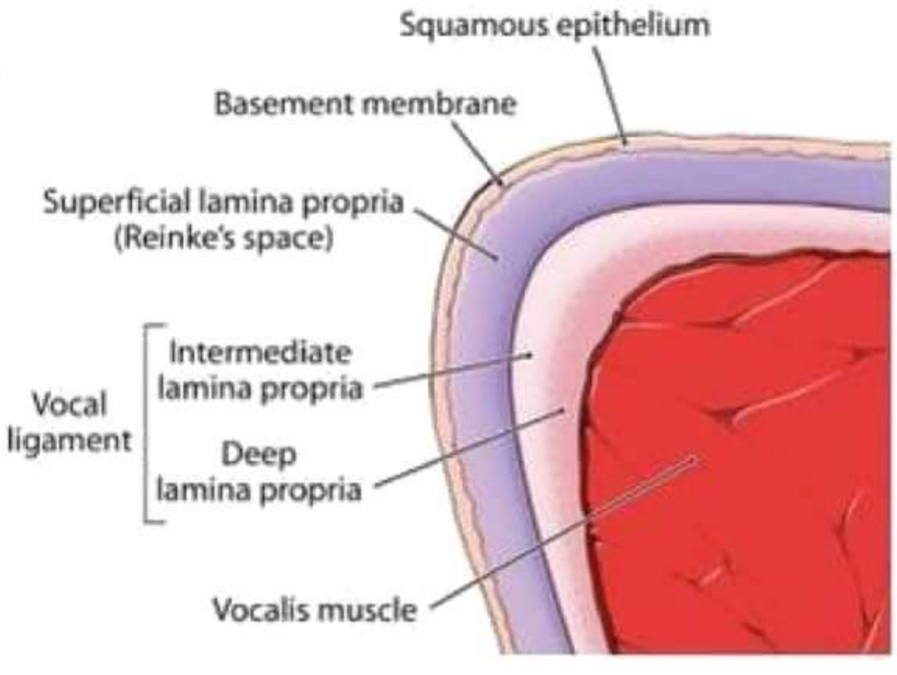
Internal → Transoral micro laryngeal Sx

Combined → Sx excision

Glottis

- Consist of 2 vocal folds (One on each side)
- Earlier they were named as (True vocal cords)
- Vocal folds are lined by non-keratinizing stratified squamous epithelium
- Sub epithelium space is known as Reinke's space
- Junction between columnar epithelium and squamous epithelium is known as arcuate line
- 5 layers in the vocal folds
  1. Non-keratinizing stratified squamous epithelium
  2. Lamina propria
     - Superficial
     - Intermediate
     - Deep
  3. Vocalis muscle

→ Narrowest part of larynx in child – Sub glottis
→ Narrowest part of larynx in adult – Glottis



Sub Glottis

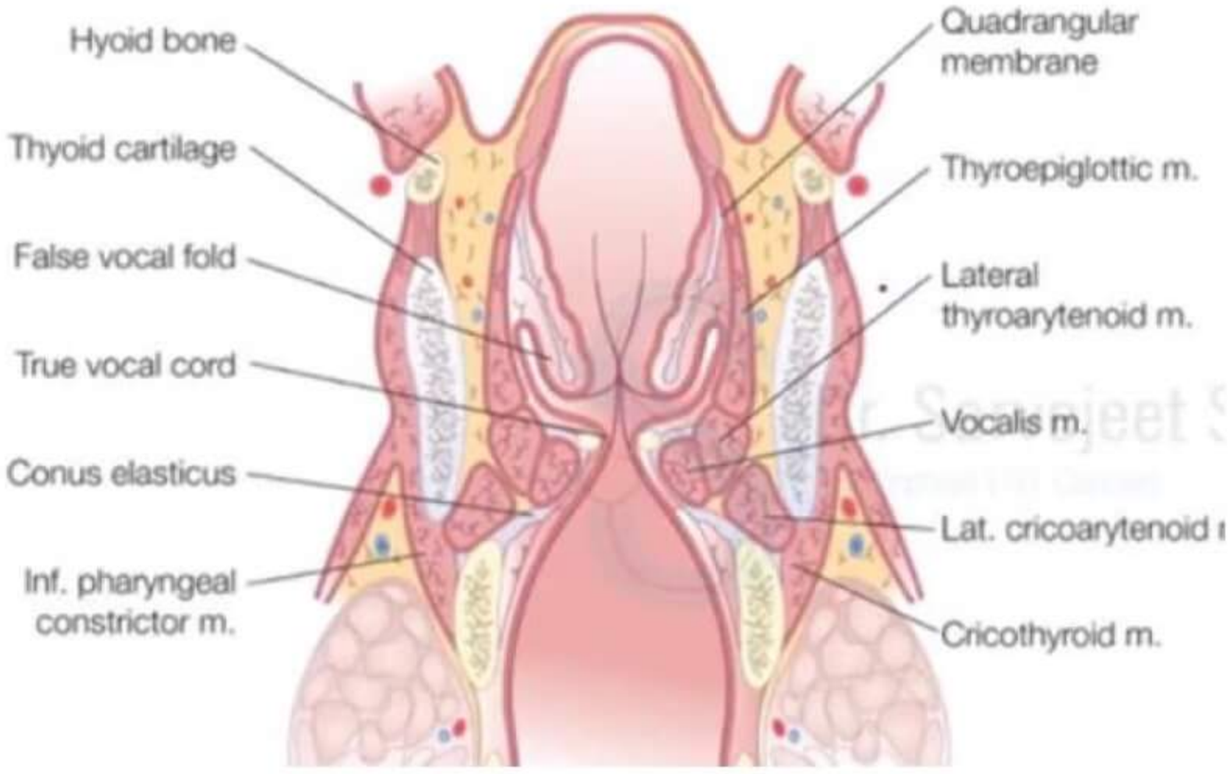
→ Consists of ring of cricoid cartilage

Para Glottic Space

Boundaries

1. Antero laterally – Thyroid cartilage
2. Supero medially - Quadrangular membrane and vestibular fold
3. Infero medially – Conus elasticus
4. Posteriorly – Pyriform fossa

→ Para glottic space is communicating anteriorly with pre epiglottic space



Nerve Supply of Larynx

→ Xth Cranial nerve

1. Superior laryngeal nerve

Internal laryngeal nerve → Supplies supra glottis

External laryngeal nerve → Supplies Cricothyroid muscle

2. Recurrent laryngeal nerve → supplies sub glottis

+

All intrinsic muscles of larynx **except cricothyroid**

→ At level of glottis ILN (above) and RLN (below) supplies via Galen's anastomosis

Functions of Larynx –

Primary function – Protection of lower airways

Other – Voice production.

Muscles of Larynx –

1. Abductor – Posterior cricoarytenoid
2. Adductors – Inter arytenoid
   Thyroarytenoid
   Lateral cricoarytenoid
3. Tensor muscle – Cricothyroid
   Vocalis

All muscles lie inside larynx expect cricothyroid.
All muscle of larynx are supplied by Recurrent laryngeal nerve (RLN) expect cricothyroid.
Which is supplied by External branch of superior laryngeal nerve.

Congenital Disease of Larynx

1. Laryngomalacia

→ M/C congenital abnormality of larynx

→ Soft laryngeal cartilage

C/F - Inspiratory stridor → from birth cry is normal [Expiratory phenomenon] crying ↑ stridor

- In prone position → stridor improve

→ O/E - Omega shaped epiglottis

→ R_x - Reassurance
Conservative

Laryngomalacia disappear by 2 years of age.

2. Subglottic Hemangioma

→ Vascular malformation

→ C/F stridor at 3 -6 months of age

- Normal
  - Glottis and sub glottis → Biphasic stridor
  - Supraglottis and above → Inspiratory stridor
  - Below sub glottis → Expiratory stridor
- In sub glottic hemangioma has inspiratory stridor (Because of vascular malformation)

→ D_x - Fiberoptic / direct laryngoscopy → Reddish blue mass in sub glottis

→ R_x - (I) Save the airway → Tracheostomy (First)
(II) CO_2 laser excision or injection of steroid or sclerotherapy

3. Larnygeal WEB

→ Membrane formed d/t incomplete canalization of airway

→ M/C site → Anterior glottis

→ C/F → Biphasic stridor from birth

→ O/E → Web is seen

→ Types - congenital → cartilaginous

Acquired → membranous

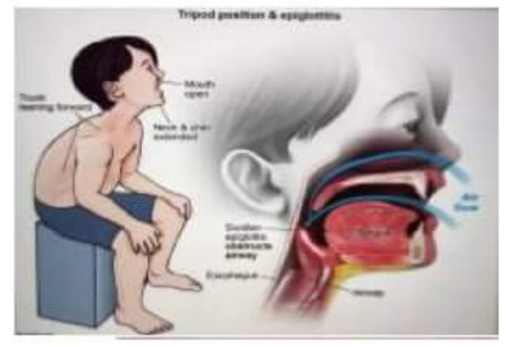
MCC → long-term intubation

→ R_x

→ CO_2 laser excision ± silicon is placed between vocal folds for few weeks to months to prevent recurrence.

Acute & Chronic Inflammation of Larynx

Acute Epiglottitis / Supra Glottitis



→ Mcc :- Hemophilus influenza type B (HIB)
in developed countries – streptococcus pneumoniae

→ Children = 2 – 7 years

C/F →

Drooling→ Not able to swallow even saliva
Dyspnea
Tachypnea
Tachycardia
Tripod sign
Rising sun sign' → red inflamed epiglottis

→ Instrumentation is C/I

→ D_x

- X – Ray
- Thumb sign
- Thickening of epiglottis

→ R_x → Doc → ceftriaxone
Steroid nebulization
Tracheostomy (If stridor is present)

Cricothyrotomy

→ Used to open up the airway in emergency situation (Done outside the hospital)

Tracheostomy

Indications

5R's

Respiratory obstruction → High tracheostomy
- b/w 1/2nd rings

Respiratory collapse
Respiratory secretions
Respiratory insufficiency → Low tracheostomy
- b/w 3/4th rings

To secure the Respiratory pathway

4. Acute Laryngo-Tracheo Bronchitis [CROUP]

→ Mcc - Para influenza virus type 1, 2

→ Children – 3 months- 3 years

C/F → Fever, cough (Barking cough)
Expiratory stridor

O/E → Sub coastal, inter coastal retraction
B/L conducted sound on Auscultation

C – X – Ray → Steeple sign

R_x → Symptomatic

5. Laryngeal TB

→ Always associated with pulmonary TB

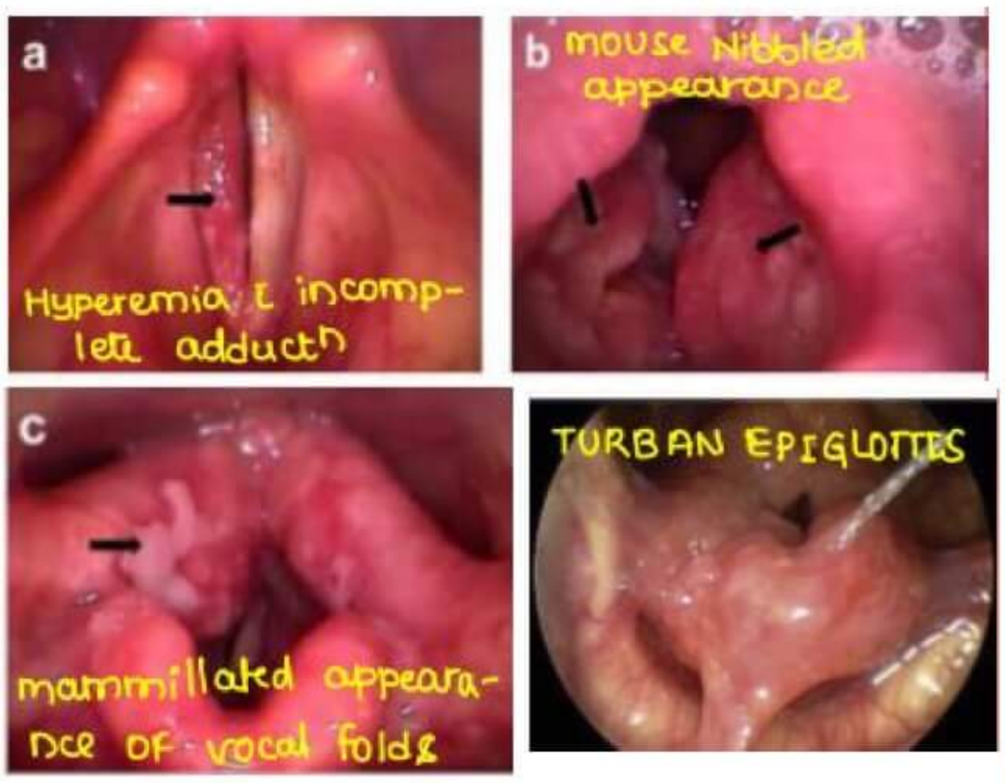
→ Submucosal nodules

- M/C site → Posterior larynx
- 1st sign → Hyperemia of vocal fold c̄ Incomplete adduction

→ Mamillated appearance of nodules
Mouse nibbled appearance of vocal folds
Turban epiglottis

→ R_x

- R_x pulmonary TB



6. Contact Ulcer / Granuloma

→ M/C site → posterior 1/3 of vocal folds
MCC → LPR (Laryngo – pharyngeal reflux)
Other → vocal abuse

→ C/F → Hoarseness of voice

→ In long term intubation - Intubation granuloma

→ R^x

- PPIs c̄ speech therapy (For LPR)
- Intubation granuloma
- R_x → Antibiotics and steroids

Benign Lesions of Larynx

1. REINKE'S Edema

→ Mcc - Smoking

Other- Faulty speech

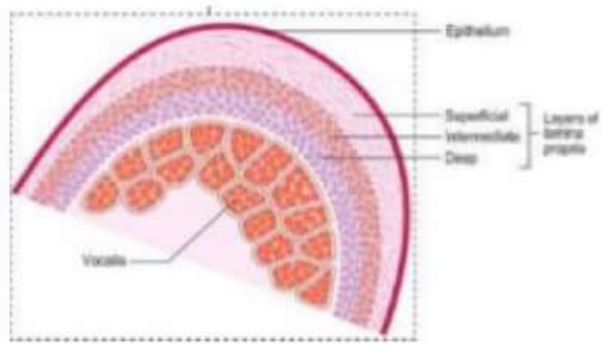
→ Boggy spindle shaped vocal folds → SMOKER's POLYPS

→ Females

→ R_x - Cessation of smoking

R_x → Stripping of epithelium from vocal folds

2 stages S_x → do one side at a time



2. Vocal Nodule / Singer's Nodule / Screamer's Nodule

→ Due to - Chronic misuse of voice

→ Seen in - Singer's teachers

→ B/L, Sessile (Fixed on free margins)

→ M/C site at the junction of anterior $^{1}/_{3}^{rd}$ and posterior $^{2}/_{3}^{rd}$.

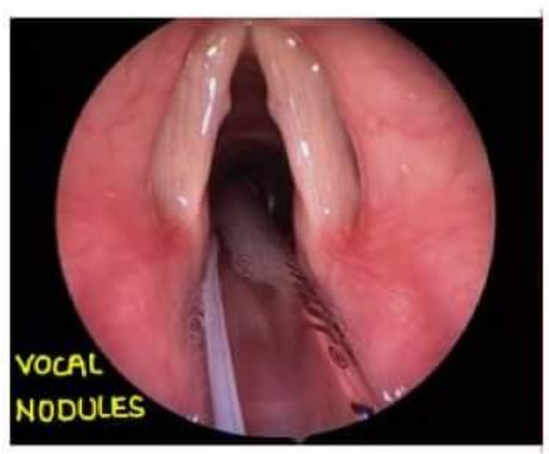
[Area of maximum vibration]

→ C/F → Hoarseness of voice

→ R_x

- Speech therapy
- PPI (LPR's is a major contributor).
- Early / soft nodules
  - With speech therapy & PPI
- Late/ hard nodules
  - R_xOC – speech therapy & PPI
  - S_x


Vocal Nodules



3. Vocal Polyp

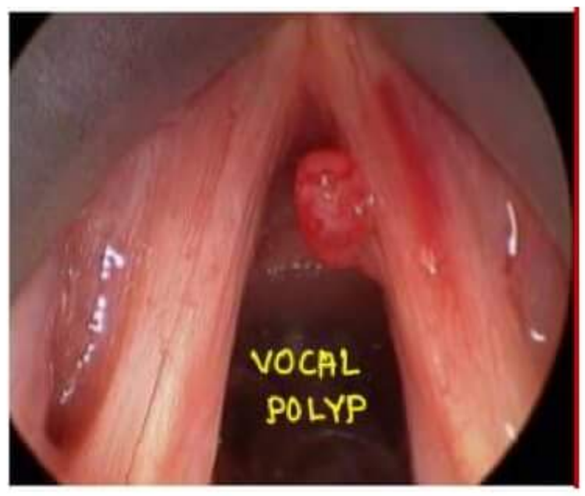
→ Single, U/L, pedunculated, moves $\bar{c}$ Respiration

→ M/C site → Anterior $^{1}/_{3}^{rd}$ and post $^{2}/_{3}^{rd}$

→ Cause - Sudden vocal abuse

→ C/F - Hoarseness, diplo phonia

R_x → Micro laryngeal S_x



4. Recurrent Respiratory Papilloma

→ A/w → HPV 6, 11

→ Types

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

Juvenile → Multiple, B/L, stridor positive, highly recurrent
vertical transmission positive

→ M/C → Site anterior part of glottis

Juvenile → Tracheostomy is C/I
Risk of spread
But in emergency → Low tracheostomy

R_x → Co_2 laser excision

Micro debrider excision→ Now preferred.

Medical Rx

- Chemotherapy
- Newer – photodynamic therapy
- Interferon α (↓ recurrence)

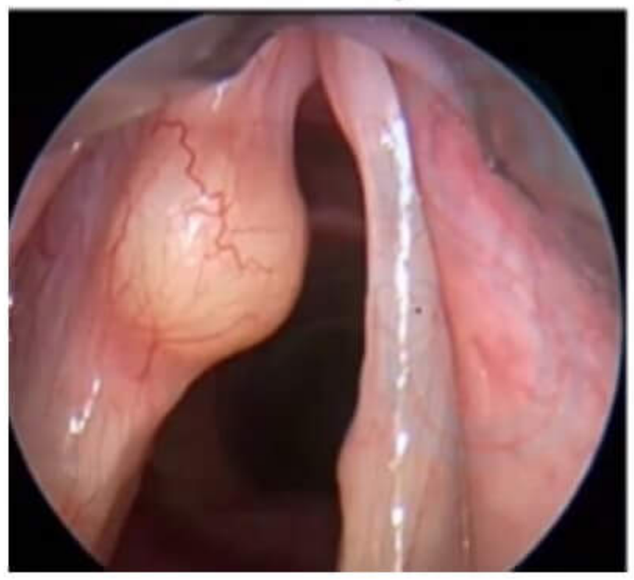
Vocal Cyst

→ Collection of fluid in vocal fold

→ Rx – Micro laryngeal Sx

→ D/D- Lipoma

Dx made during Sx



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

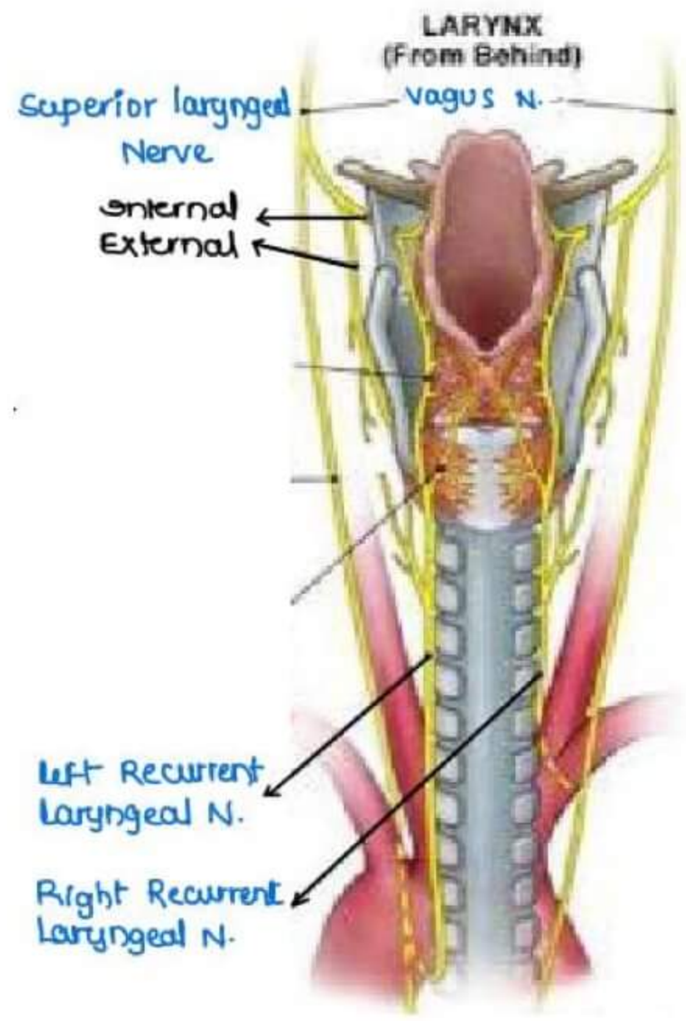
Also

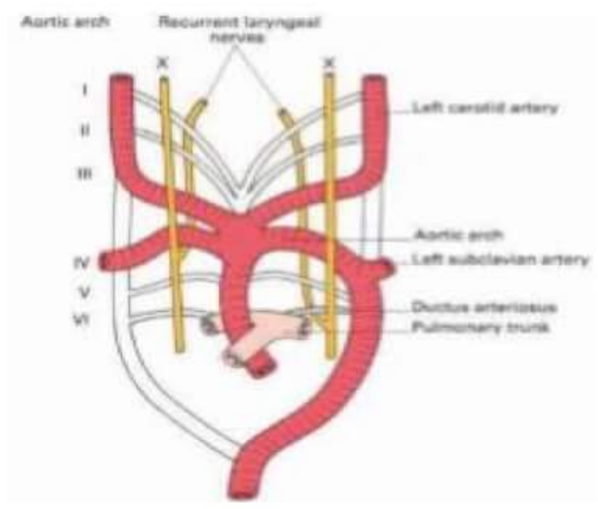
→ MC nerve injured in total thyroidectomy – Ext. laryngeal nerve

→ Injured during CT S_x → Lt. RLN

→ More commonly injured in total thyroidectomy

Among RLN → Rt. RLN [superficial]





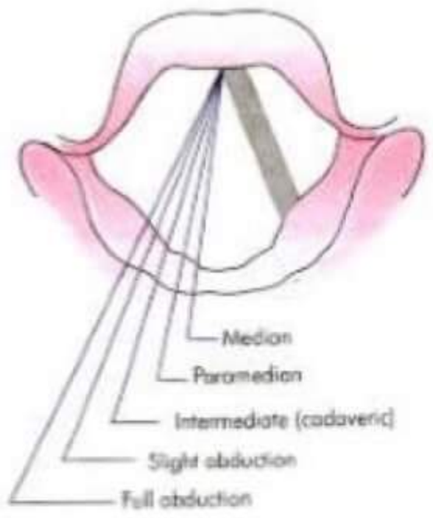
Semon's Law

→ In case of any progressive neurological disorders, the Abductor fibres of RLN are 1st to be affected [Phylogenetically new] → Vocal folds lie in adduction

Wagner & Grossman Hypothesis

→ All muscle are causing adduction in larynx, In RLN palsy all undergo palsy except cricothyroid [Supplied by external laryngeal Nerve] which is the reason for unopposed adduction

Positions Of Vocal Folds



1. U/L ELN palsy
   → Production of high pitched voice problem only
   → Go unnoticed

2. B/L ELN palsy
   → Go unnoticed
   → Severe problem in production of high pitched voice

3. U/L RLN injury
   → Para median position d/t incomplete adduction
   → No problem in airway
   → Compensatory hypertrophy of other vocal fold in few weeks-months → voice with will improve

4. U/L RLN + U/L ELN injury
   → Cadaveric position of vocal fold on one side
   → No problem in breathing
   → Voice will not improve

→ R_1 → Push the paralytic vocal fold to midline

→ U/L vagus Nerve injury [ILN also included]

- Problem of aspiration also present

→ Manual Compression test is done

→ Type I ISSHIKI THYROPLASTY

- 4 types – I, II, III, IV present
- Aka – medialization thyroplasty / Approximation laryngoplasty
- Benefits :-

- Improves the voice
- In X nerve palsy, it prevents aspiration

5. B/L SLN injury

→ Cough reflex on both sides gone → Aspiration

Gold std R_x in intractable aspiration → Tracheal separation & permanent Tracheostomy

6. B/L RLN Palsy / B/L Abductor palsy

→ Both vocal cords in para median position

→ Only 2-3 mm airway to breath

→ Biphasic stridor (+)

→ Voice is good

→ R_x – Type 2 Thyroplasty / Lateralization Thyroplasty

→ Laryngo fissure

Type III Thyroplasty

→ Done for Puberphonia [Female like voice in a male]

→ GUTZZMANN TEST – done to confirm whether the patient will improve with type 3 thyroplasty

Type 4 Thyroplasty

→ Done for Androphonia [Male like voice in a female]

Carcinoma Larynx

M/C in a male – smokers, Alcoholics

M/C type → sq. cell ca

M/C site → ca glottis

M/C presentation - Hoarseness

Best prognosis – Early presentation, late spread

→ M/c presentation of ca supra glottis → Foreign body sensation
Pain of swallowing

→ M/c presentation of ca sub glottis – Stridor [Poor prognosis]

CA GLOTITIS

→ D_x + IOC - direct larynogoscopic biopsy
CT scan of neck – I) extent of neck (T)
X – Ray chest – distant metastasis (M)

→ TNM staging for Glottic CA

T_1 → Normal vocal fold mobility
→ T_1a → one
→ T_1b → two

T_2 → Impaired vocal fold mobility

T_3 → Fixed vocal folds [Palsy]
3P → Pre epiglottic
Para glottic
Post cricoid area

T_4 → Outside larynx
T_4a
T_4b → Superior mediastinum
Prevertebral 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_1 → 1 subsite

T_2 → > 1 subsite
Mucosa of base of tongue or glottic spread (No vocal fold palsy)

T_3 → Vocal fold palsy

T_4 → Outside larynx (Same as glottic CA)

→ TNM staging for CA sub glottis

- T_1, T_2 } Not considered (Present late)
- T_3, T_4 } Same as glottic CA

→ R_x

- T_1 / T_2 Stage of CA Glottis
  - Radiotherapy → R_1OC [Follow up of 6 Wks required]
  - T1a → Laser cordotomy
    - Poor voice results
    - Single sitting is enough

→ T_3 Lesions

- Concurrent chemo radiotherapy [CCRT] – R_1OC
  - Exception → Bulky lesion, Associated lymph nodes, Multiple sites involvement } S_x is the R_1
  - Perichondritis is absolute C/I for radiotherapy → S_x is R_4

→ T_4a

- Combined modality

  Sx → Radiotherapy & chemotherapy

→ T_4b – Palliative R_x

Total Laryngectomy

→ High tracheostomy done in total laryngectomy

Post Laryngectomy Voice Rehabilitation

1) **Electro Larynx**

→ Small hand held device mechanical vibration

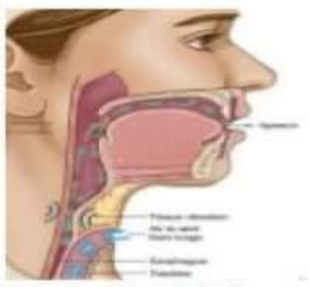
→ Disadvantage → Produces monotonous sound

ELECTROLARYNX

2) **Oesophageal Speech**

→ Airway is separated from digestive pathway.

Disadvantage → Only speaks few words at a time



oesophageal Speech

3) **Tracheo-Oesophageal Speech**

→ Consist a one way valve, Placed between trachea and esophagus } TEP (Tracheoesophageal voice prosthesis)

→ Can speak complete sentences

→ Best way of voice rehabilitation

→ Disadvantage - Has to be replaced once from 6 months – 2 years

- Costly