EAR

The Ear is divided into

1. **External Ear 2.Middle Ear 3.Inner Ear or Labyrinth**

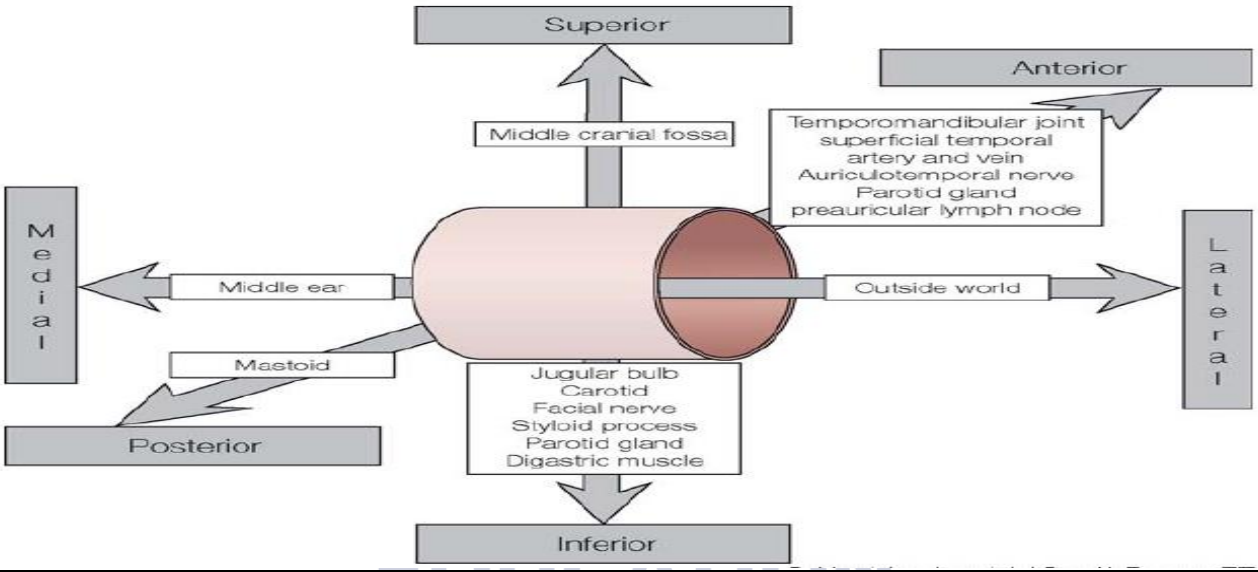
THE EXTERNAL EAR :(1.Auricle 2. External auditory canal 3.tympanic membrane)
ESSENTIAL ANATOMY

EXTERNAL AUDITORY CANAL:

- **Length:24mm** long curved tube. (same as length of adult eye).
- **Outer l/3rd (8mm)is cartilagenous** and **inner 2/3rd(16-mm)is bony**.(opposite of *Eustachian tube).*
- Anterior wall is shorter than posterior wall.
- In neonates, virtually there is no bony EAM.
- Outer part has **hair follicles** as well (furuncle ear seen only in cartilaginous part).
- **Anterior wall &roof**: **Auriculotemporal nerve(CnV3)**
- **Posterior wall & floor** :**auricular br. of Vagus(CnX) (Arnold's nerve).** Stimulation of this nerve during cleaning of wax causes **cough reflex**.
- Posterior wall of the external auditory meatus also receives sensory fibre of facial nerve(CnVII) through auricular branch of Vagus.Anaesthetic ear canal: Absense of sensation over postero-superior part ***(Hitzelbergers sign***).
- In short, the external ear is supplied by **Vth, VIIth, & IXth cranial** nerves along with cervical plexus).

- **It has two deficiencies – the "fissures of Santorini" in this part of the cartilage and through them the parotid or superficial mastoid infections can appear in the canal, or vice versa.**

Relationships of the external auditory canal



AURICLE Or PINNA

- The entire Pinna made up of **single yellow elastic cartilage**
- Cartilage is absent in **lobule and incisura terminalis**.
- I**ncisura terminalis** is the area between the **tragus and crus of helix**.
- Importance:Endaural incision for ear surgeries is sited at the incisura, since there is no risk of cartilage injury
- Skin of pinna is tightly adherent to the perichondrium on the **lateral aspec**t **and loosely adherent on the medial aspect.**
- **Cymba concha** of the pinna directly lies over the mastoid antrum, hence, is the surface **landmark for the antrum** in live subjects.

- **Graft Materials Available from the Pinna:Cartilage from Tragus, perichondrium from tragus&concha** , lobule fat are frequently used for reconstructive surgery of the middle ear

Innervation of Pinna :

- **Greater auricular nerve (a branch of C2,C3): Most of the medial surface and only posterior part lateral aspect**
- **Lesser occipital : (C2) :Upper part of medial surface.**
- **Auriculotemporal branch of the trigeminal nerve:V3:Crus of the Helix(Upper half on lateral aspect)**
- **Auricular br. of Vagus(CnX) (Arnold's nerve): .Root of the Pinna(Concha and corresponding eminence on medial surface)**
- Facial nerve(CnVII):distributed with fibre of auricular branch of Vagus,supplies concha and retroauricular groove.

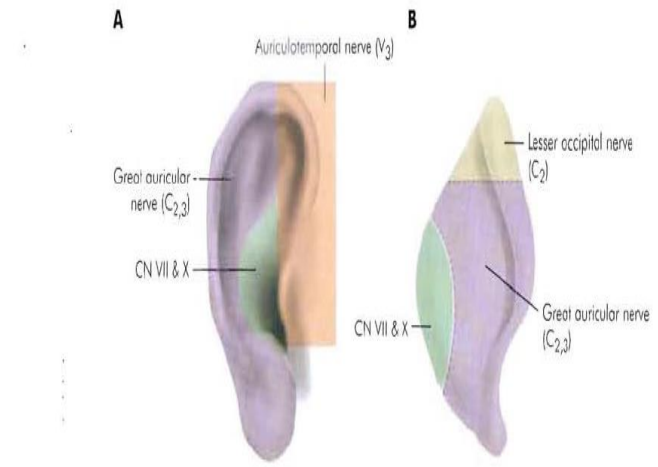
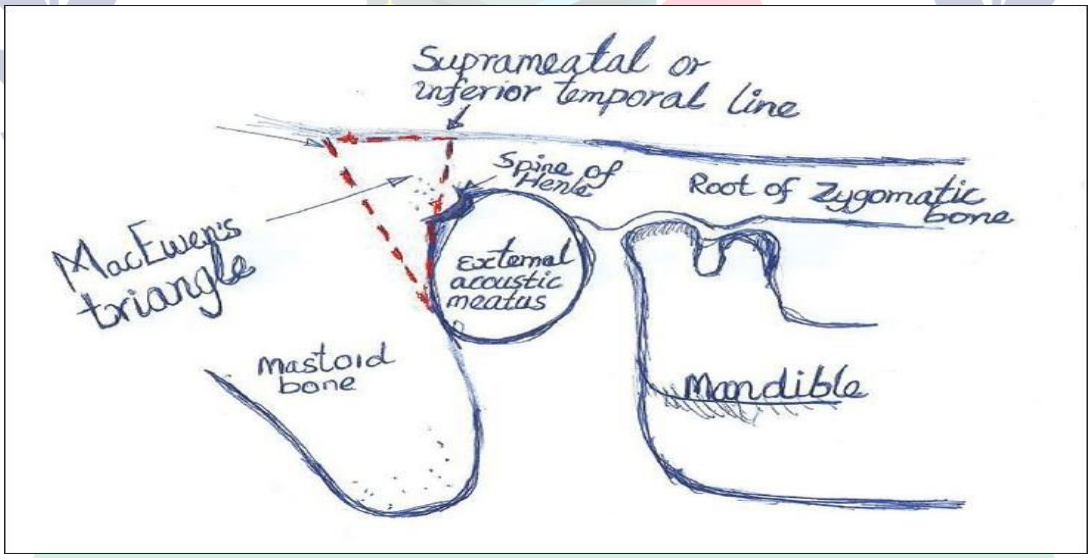


Fig. 1.3 Nerve supply of pinna. (A) Lateral surface of pinna. (B) Medial or cranial surface of pinna.

Mac Ewen's triangle:

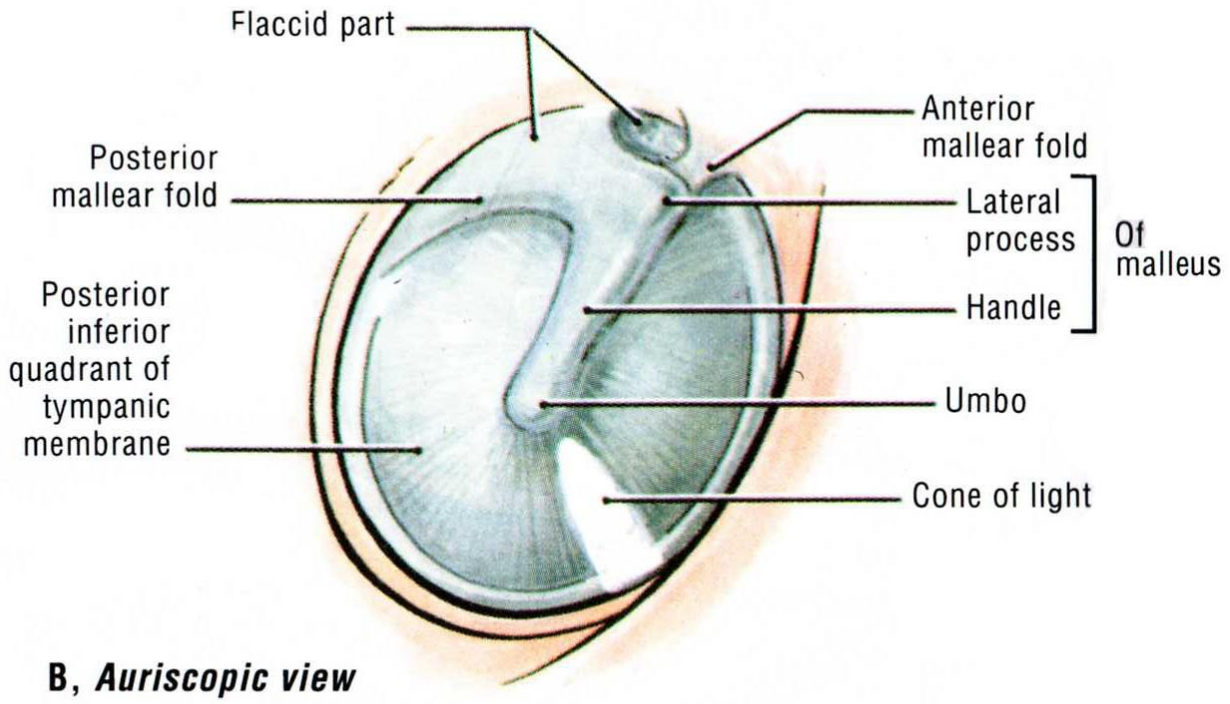


- Also k/as *supra-meatal triangle*. **It is an important landmark to locate the mastoid antrum in mastoid surgery.**
- Spine of Henle is situated in the triangle.

Boundries-

- Above : Suprameatal or inf temporal line
- Ant. : Ext. meatus
- Posteriorly: **the line drawn as a tangent to the external canal**

TYMPANIC MEMBRANE



B, *Auriscopic view*

- Tympanic membrane (TM) seperates the external ear from the middle ear
- **Pearly white in** color, ovoid, 9-10mm in greatest diameter and 0.1 mm thick.

- **Total surface area is 85 sq mm** & out of which only 55mm^2 (**vibrating area is 55 sq** mm) is functional area stapes footplate is 3.2 mm^2 .**area ratio or HYDRAULIC RATIO IS 17:1.**
- TM is **horizontal in infants**
- In adult The TM is situated at **an angle of 55° with** both floor and anterior wall of the External canal
- Divided as pars flaccid and pars tensa.
- Vibrating surface is Pars tensa
- Pars flaccid is also known as Sharpnell's membrane is flaccid to allow movement of head of malleus
- and unlike the pars tensa is devoid of middle fibrous layer and peripheral annulus
- **Most Mobile Portion of Tympanic Membrane;**Periphery is more as compared to center as pars flaccid is not supported by the annulus at the periphery while pars tensa is attached to the handle of malleus at the center.
- Predominant landmark on the tympanic membrane is handle of malleus attached to the pars tensa running posteroinferiorly.
- Tip of the handle of malleus is related to **the point of maximum convexity on the tympanic membrane known as umbo**. It is a reliable **landmark on otoscopy**, which is least altered by disease.
- A cone of light radiates **anteroinferiorly** from the umbo. (Myringotomy incision is made in posterior inferior.)
- Cone of light is ***due to the obliquity of the tympanic membrane***.

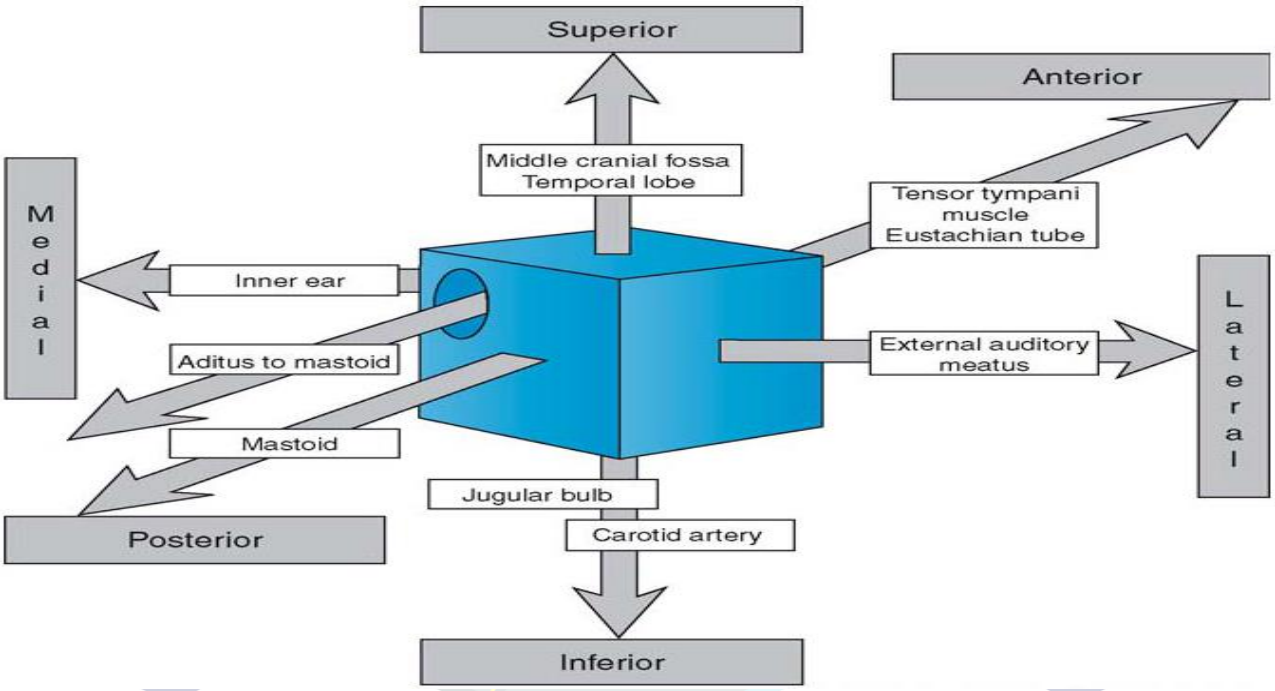
Nerve Supply of Tympanic Membrane:

- Lateral Surface:Anterior part :Auriculotemporal Nerve
  Posterior Part :Vagus Nerve (Arnold's nerve)
- Medial surface : Glossopharyngeal nerve(Jacobson's nv.)

- In malignancy base of tongue and tonsils referred otalgia is mediated through Jacobson;s nerve.

MIDDLE EAR

Relationships of the Middle ear



- **Six walled** air filled cavity.
- Cavity is divided into 3 by two imaginary lines passing through the upper and lower limit of pars tensa-**upper epitympanum, middle mesotympanum, and lower hypotympanum**
- Middle ear ***cleft*** :**middle ear + eustachian tube + aditus +antrum+ mastoid air eell**
- **Roof** of the middle ear (**tegmen tympani**) is related to middle cranial fossa.
- **Floor:by thin plate of bone sepatrating cavity from the jugular bulb**
- **The lateral wall :tympanic membrane**
- **Medial wall:** Promontory is the bulge on the medial wall formed by **basal turn of cochlea.** Behind and above the promontory **is the oval window**.It is a kidney-shaped opening that connects the tympanic cavity with the **vestibule,** which is closed by **the footplate of the stapes .** While round window is closed by **the secondary tympanic membrane.**
- **Anterior wall**:3 structure from above downwards:a.Canal for tensor tympani muscle b.Eustachian tube orifice c.wall for carotid canal
- **Posterior wall**: wider above than below.**Upper part** a large irregular opening - the **aditus ad antrum**, that leads back from the posterior epitympanum into the mastoid antrum.
- **Contents of the Middle Ear:**
  -**Three ossicles** (malleus, incus, and stapes),
  -2 muscles (tensor tympani and stapedius),
  -3 nerves (Tympanic plexus, Chorda tympani & Nerve to Stapedius) along with air.

- *Middle ear ossicles*
  - Outer to inner there are 3 ear ossicles: MIS (Malleus, incus & stapes).help sound transmission for hearing.Malleus, incus, and stapes. Stapes is the smallest bone in the body. Ossicles are seen only in relation epitympanum and mesotympanum. Head of the malleus, body, and short process of the incus are located in the epitympanum; rest of the ossicles in the mesotympanum.
  - **Type of joints between Ossicles:Incudomalleal joint is a saddle variety** and **incudostapedial joint is a ball and socket type of synovial joint**.
  - **Intratympanic Muscles:**Stapedius dampens loud sounds (contracts at 70-100 dB above threshold) to prevent inner ear trauma by acoustic stapedial reflex (since it is a crossed reflex sound stimuli produce B/L contraction of stapedius muscle). Stapedius is the **smallest muscle** in the body. Stapedius is supplied by the facial nerve; hence, patients develop hyperacusis and phonophobia in facial palsy. Tensor tympani (**Toynbee's** muscle) is responsible for non-acoustic reflex e.g., sound of chewing.
  - **Impedance matching of the Middle Ear:**In order to compensate the loss of sound energy when air-conducted sound travels to the cochlear fluid, middle ear converts sound of greater amplitude but lesser force to that of lesser

amplitude but greater force. This function of middle ear is called impedance matching or transformer action. It is accomplished by :Lever action of ossicles: Handle of malleus is 1.3 times longer than the long process of incus, producing a mechanical advantage of 1.3.Areal ratio: The ratio between effective vibratory area of tympanic membrane and foot plate of stapes is 14:1. The product of areal ratio and level action of ossicles is the total transformer ratio = 18.2:1.

- **Narrowest Part of Middle Ear: Narrowest portion of middle ear is mesotympanum.**

- **Scutum:**Outer wall of epitympanum (outer attic wall) is known as scutum. Radiological evidence of erosion of scutum is suggestive of attic cholesteatoma.
- **Prussak's Space:**Situated in the epitympanum, it is a shallow space between the pars flaccid and neck of the malleus. Possible site of origin of **attic cholesteatoma**.
- Sinus tympani and facial recess are posterior mesotympanic spaces medial and lateral to the facial nerve, respectively
- **Facial Recess:**Facial recess is bounded medially by the facial nerve, laterally by the chorda tympani, and superiorly by the fossa incudis. Through the facial recess, middle ear can be accessed from the mastoid aspect, known as posterior tympanotomy (intact canal wall mastoidectomy). This is the surgical approach for cochlear implantation.
- **Processus Cochleariformis:**This is a hook-life projection bone on the medial wall of middle ear anterior to the oval window around which the tendon of tensor tympani muscle turns to attach to the neck of malleus. This marks the level of geniculate ganglion and hence the surgical landmark for the first genu of facial nerve.

MASTOID

- Mastoid antrum is a large, air containing space inside the mastoid bone that **communicates with epitympanum through the auditus**. It is the **most constant mastoid air cell and the earliest to develop**. Roof of the antrum is formed by the tegmen antrii separating it from the temporal lobe of brain, while posterior wall of the antrum is related to the sigmoid sinus. Medial wall is related to the lateral semicircular canal mainly and also the posterior semicircular canal.
- **MacEwen's Triangle:**In adults the antrum lies approximately 1.5 cm deep to an area on the mastoid bone known as the MacEwen's (suprameatal) triangle and hence is he surface landmark for the mastoid antrum during mastoidectomy. Depending on the air cell development, three types of mastoids have been described – **cellular (well pneumatized), sclerotic (acellular), and diploetic** (a few cells with marrow spaces). In the normal population, **almost 80% are cellular** mastoids while 20 are sclerotic.
- **Trautmann's Triangle:**It is an area of vascular cancellous bone within the mastoid, triangular in shape bounded above by the superior petrosal sinus, anteriorly by the bony labyrinth, and posteriorly by the sigmoid sinus. **Osteitis and caries** of this bone leads to formation of perisinus abscess, sigmoid sinus thrombosis, and posterior fossa brain abscess.
- **Citelli's Angle:**Synonym **for sinodural angle**. This is the angle formed by the dural plate (bone separating the antrum from the middle cranial fossa dura) with the sinus plate (separating the antrum from the sigmoid sinus). This is a common site of residual disease after mastoid surgery.

Internal acoustic meatus (IAM)

- Length is 8-10 mm
- There are 4 quadrants; each poses one nerve Anterosuperior (facial), anteroinferior (chochlear),posterosuperior (superior vestibular), posteroinferior (inf. vestibular)

Vertical crest in the fundus of IAM is k/as *Bill's bar*. Bill's bar is the surgical landmark for facial nerve identification during translabyrinthine surgery

INNER EAR

Bony labyrinth:

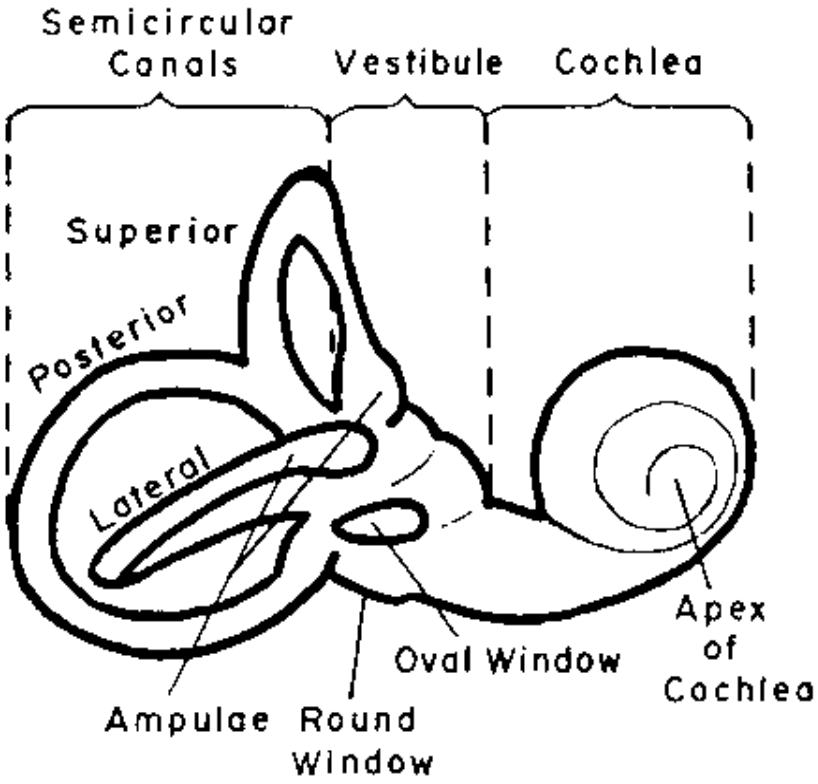
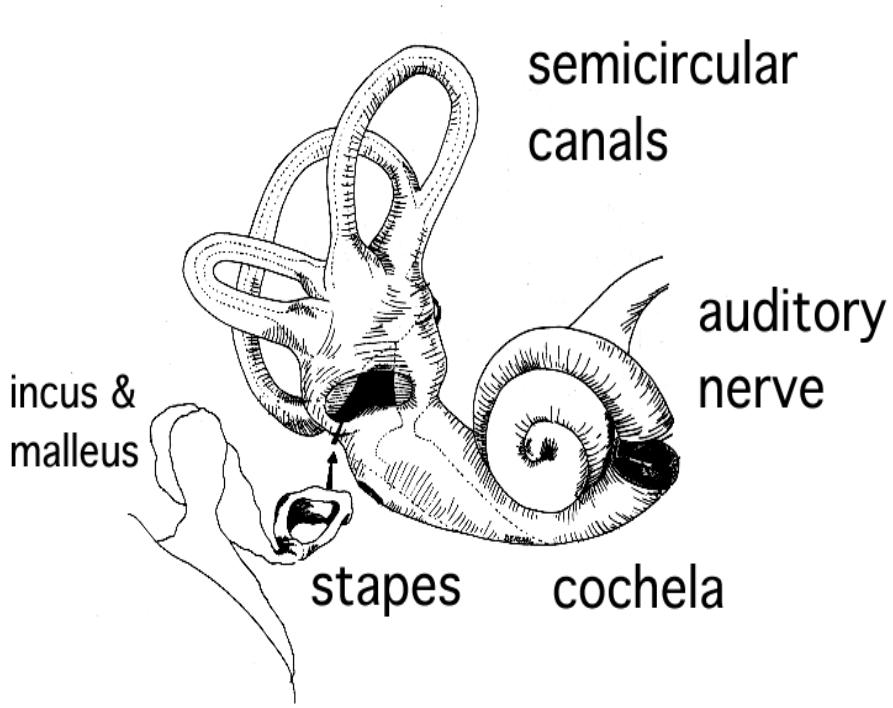


Figure 2.11 The osseous (bony) labyrinth.

- It lies within **the petrous part** of temporal bone.
- Consists of a **bony and membranous** labyrinth.
- **Bony Labyrinth:**It consist of **vestibule, semicircular canals, and cochlea**.
- Semicircular canals are three in number. **Lateral (horizontal), superior (anterior), and posterior. Nystagmus is horizontal from horizontal SCC, rotatory from the superior SCC, and vertical from the posterior SCC.**
- **Crus Commune:**Crus commune is formed by the union of non-ampulated ends of superior and posterior canals.
- **Cochlea :**



Cochlea is a coiled tube making two a three quarter turns around a central modiolus. . Basal coils of it responds to higher frequencies while apex respond to lower frequencies of sound.Cavity of cochlea is divided as **scala vestibule and scala tympani (filled with perilymph) and scala media (filled with endolymph).** Scala vestibule s closed by foot plate of stapes at the oval window, while scala tympani is closed by the secondary tympanic membrane at the round window.

- **Scala Tympani is connected to the subarachnoid space** through **the cochlear aqueduct:**In sensorineural deafness following meningitis and **meningitis following purulent labyrinthitis this is the route of spread.**
- **Membranous Labyrinths:**It consists of ***scala media (membranous cochlea)/utricle and saccule/semicircular ducts/endolymphatic duct and sac***. **Scala media contains organ of corti,** which is the sensory receptor of hearing. Organ of corti rests on the basilar membrane **Utricle and saccule** contain crystals of **calcium carbonate** (otoconia) inside a gelatinous matrix. Hence, they are also known as **otolith organs**.

- **Organ of Corti**
  - Is end organ of hearing located in the cochlear duct
  - Contains *endolymph,* **hair cells,** supporting cells **of Hensen's,** Dieter's cells and ***Claudius cells***^{Q}
  - Endolymph is rich in K^{+}
- ***Outer hair cells*** produce otoacoustic emissions **(efferent),** acts as modulator & more **sensitive to ototoxic drugs and noise**
- *Inner hair cells* are meant mainly for hearing **(afferent)**, less in numbers.
  - **Inner ear fluid :**

ENDOLYMPH	**PERILYMPH**
• is **potassium rich**, • secreted by the stria vascularis. • It reabsorbed by endolymphatic sac.	• is **sodium rich**. • It formed directly from CSF and partially as an ultrafiltrate of blood. • It reabsorbed through aqueduct of cochlea to the subrachnoid space

- **Cochlear aqueduct** connects scala tympani to CSF.
- **Endolymphatic duct is** f/by union of 2 ducts, one each from the saccule & the utricle. Its terminal part is dilated to form endolymphatic sac.
- *Hyrtle's fissure* is an embryonic remnant also k/as tympano-meningeal hiatus as it connects mesotympanum to the CSF of sub-arachnoid space. It is a transient anatomic landmark in the developing fetal petrous temporal bone and is an unusual cause of a perilabyrinthine CSF fistula, congenital CSF otorrhoea, & meningitis.
  - **Blood supply of inner ear:Labyrinthine artery**

ORGAN OF CORTI:

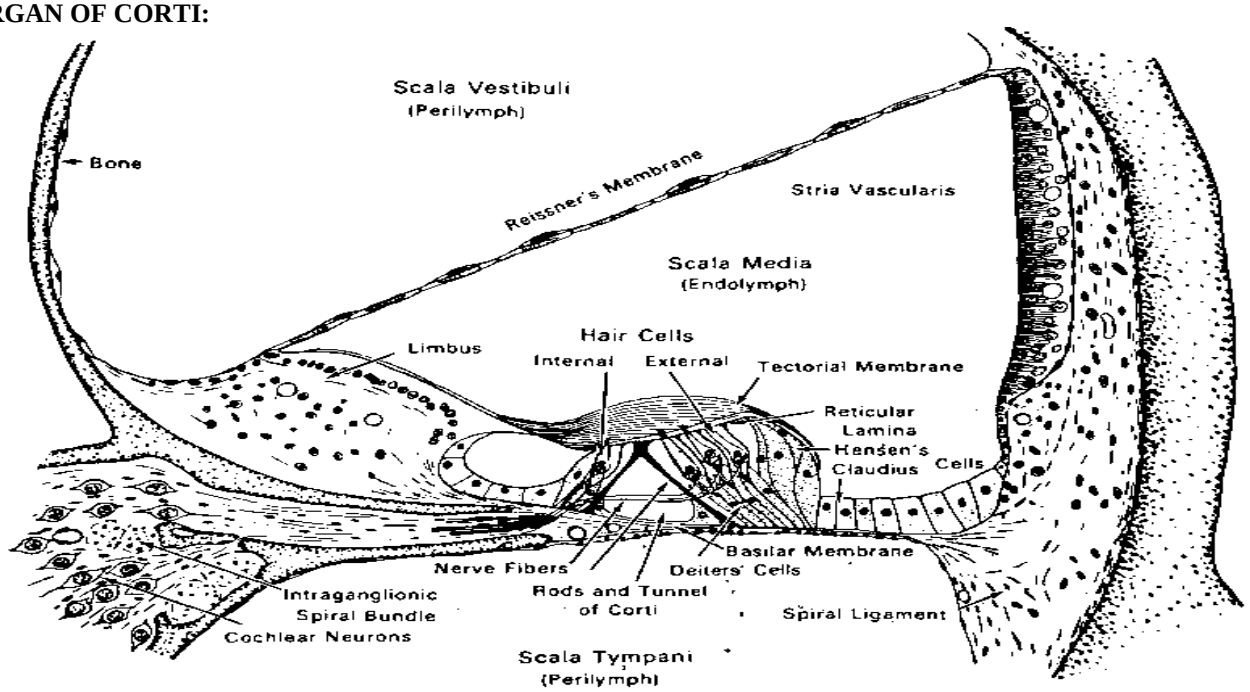


Figure 2.17 Cross-section of the organ of Corti. From Davis (1962), with permission.

- **Functions of inner Ear:**Cochlea is concerned with hearing (Apical turn perceives high-frequency vibrations, while basal turn perceives low-frequency vibrations).
- Semicircular canals contains **A**mpullae- detect **Angular acceleration**. **Utricle and saccule- linear acceleration** during movement and direction of gravity when static. Endolymphatic duct and sac- reabsorption of endolymph.

Balance of body:

- Vestibular apparatus / inner ear - detects position of head in space. The SCC are the body's balance organs, detecting acceleration in the three perpendicular planes.
- These acceleromejers make use of hair cells similar to those on the organ of Corti, but these hair cells detect movements of the fluid in the canals caused by angular acceleration about an axis perpendicular to the plane of the canal.

Feature	Utricle	Saccule	SCC
Sensory receptor	Macula (Otoliths)	Macula (Otoliths)	Cristae
Function as	Static balance, Percieves position of the head in space		Balance organ, detects acceleration in 3 planes
Respond to	Horizontal balance (Linear balance)	Vertical balance (Linear balance)	Angular acceleration

HIGHER AUDITORY PATHWAYS

- The VIIIth cranial nerve (vestibulocochlear nerve) is responsible for perception of hearing and equilibrium.
- The cochlear division of the VIIIth nerve is forme by the axons of the bipolar cells of the spiral ganglion whose dendrites innervate the cochlear hair cells.
- Stations in the auditory pathway are Auditory Nerve-Cochlear Nucleus-Superior Olivary Nucleus-Lateral Lemniscus-Inferior Colliculus-Medial Geniculate Body-Auditory Radiation.
- Auditory fibers crosses over to the opposite side at the level of superior olivary nucleus through the trapezoid body so that there is a binaural representation for auditory processing very early in the auditory pathway.
- **Auditory Area of Brain:**Superior temporal gyrus (**Broadman's area 41); auditory association cortex is area 22.**
- **Central vestibular connections:**The vestibular division of the VIIIth nerve is formed by the central processes of the bipolar cells of the Scarpa's ganglion whose peripheral processes innervate the sensory epithelium of the labyrinth. Vestibulocohlear nerve communicates with the facial nerve inside the internal auditory canal.

- The vestibular nerve ends in vestibular nuclei (medial, lateral, superior, and descending), which also receives afferents from the cerebellum, reticular formation, spinal cord, and vestibular nuclei on the opposite side which is hence important in multi-sensory integration. The vestibular nuclei are located towards the floor of the fourth ventricle seen towards the caudal pons and rostral medulla and is supplied by the posterior inferior cerebellar artery.
- Efferents from vestibular nuclei connect with medial longitudinal fasciculus (and thus III, IV, VI cranial nerves), spinal cord, cerebellum, autonomic nervous system, and temporal lobe of cerebral cortex. These connections explain the vestibule-ocular reflex responsible for nystagmus, coordination of movements of head, neckand trunk to maintain balance, and presence of autonomic symptoms like nausea, vomiting, sweating in vestibular disorders.

DEVELOPMENT

PINNA

- Development of pinna starts by 4th -6th week of intra uterine life(IUL).
- Majority of pinna develops **by 6 Hillock of His.**from **2nd branchial arch except tragus which develops from 1st arch;**
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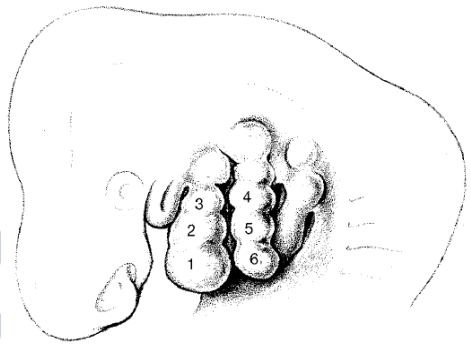


The six hillocks of His at approximately 6 weeks.

Pre-auricular Sinus:

- Pre auricular sinus is due to defective fusion between 1st and 2nd branchial arch, hence, is situated between tragus and rest of the pinna.
- It is fully formed at birth;achieves adult size by 5-6 years.
- Correction of malformed pinna is knownas otoplasty.It is ideally done after pinna achieve adult size, 5-6yrs.

ABNORMAL SHAPES OF THE PINNA :-

- Microtia – small size of pinna. Microtia/ Anotia is best treated with prosthesis after the age of 12-15 years. Conductive hearing loss associated with canal atresia and microtia is treated by **Bone Anchored Hearing Aid. (BAHA).** Minor ear deformities are treated with Surgical reconstruction of the pinna with Rib's /cartilage/silastic after the age of 6 years.

EXTERNAL AUDITORY CANAL

- Develops from 1st branchial cleft. By 4th week of IUL, forms a solid meatal plug that recanalizes from deep to superficial; complete by 28th week.
- Collaural fistula:Communication between external canal and neck; due to incomplete resorption of ventral portion of 1st branchial cleft. At birth, only cartilaginous part of external canal is fully formed, bony part develops later.
- Direction of pull of pinna to examine the tympanic membrane in adults is **upward, outward, and backwar**d, since this brings cartilaginous part of the canal in line with the bony part. In infants, since the bony part is not well- developed, you need to pull the pinna just downward.

TYMPANIC MEMBRANE

- Develops from all three germinal layers-outer epithelium ***from ectoderm, middle fibrous layer from mesoderm, and inner mucosal layer from endoderm.***
- Mass behind an Intact Tympanic Membrane Signify Congenital cholesteatoma i.e -entrapment of squamous epithelial cell rests during development. Commonest site is middle ear. Other sites- skull base, jugular fossa, petrous apex, cerebellopontine angle.

- Congential cholesteatoma is the third most common lesion of CP angle, ***1st – acoustic newroma, 2nd – meningioma***

MIDDLE EAR

- Middle ear cleft develops from ***tubotympanic recess***; formed mainly from 1st and partly from 2nd pharyngeal pouch (3rd week of IUL).

EUSTACHIAN TUBE

- Remember, middle ear cleft includes middle ear cavity along with Eustachian tube, attic and mastoid antrum, So, development of Eustachian tube is similar to that of middle ear-from tubotympanic recess.

OSSICLES

- Roughly, **malleus and incus from 1st arch (meckel's), cartilage and stapes from 2nd arch(Reichert's)cartilage.**
- Stapedial artery is the artery of 2nd branchial arch; it may persist into adulthood.
- PersistentStapedialArtery:
  Seen as a soft tissue mount over stapes footplate, it may cause alarming bleeding during staperdectomy.

INNER EAR

- Development starts by 3rd week of IUL, complete by 16th -25th week. Membranous labyrinth develops from **cranial ectoderm to form otocyst with further** differentiation. Surrounding mesenchyme condenses to form cartilage; ossifies from 14 centers to form bony labyrinth.
- Labyrinth is the 1st special sense organ to difference in the body.
- Importance:Most of the congenital anomalies of inner ear occur during 1st trimester of pregnancy (e.g., congenital Rubella syndrome).
- Inner ear development is independent of external and middle ear. A congenital deformity of external ear is usually associated with a middle ear deformity rather than an inner ear anomaly. On the converse, normal external and middle ear do not rule ot a congenital sensory neural hearing loss.
- Mondini Malformation:Cochlea with only one and a half turns.
- other inner Ear Malformations:

✓ Scheibe dysplasia: Cochleosaccular dysplasia.
✓ Michael's aplasia: total agenesis of labyrinth.
✓ Bing siebenmann's dysplasia: membranous labyrinth agenesis

MASTOID

- Mastoid process is absent at birth, starts developing only **by 2nd year of life,** continues up to 18 years.
- **Surgical Importance:**Post aural incision (William Wilde's) for mastoid surgery should be sited more horizontally in infants to avoid injury to facial nerve, which exits quite superficially at the stylomastoid foramen, due to absence of mastoid process (Note: **mastoid antrum is present at birth).**
- Mastoid is pneumatized by two groups of air cells- superficial squamosal and deep petrosal. A bony lamina may exist between them, which may persist into adulthood known as **Koerner's septum (also known as petrosquamosal lamina).**
- All the structures of the ear except external canal and mastoid process are fully formed at birth.
- Structures of the ear are adult size at birth:**Middle ear, ossicles, and inner ear.**

ALSO KNOW:

- Since majority of the ear develops from 1st & 2nd branchial arch, external/middle ear anomalies may be associated with facial anomalies as well. **Examples:**Treacher Collins syndrome (bilateral 1st & 2nd branchial arch anomaly – mandibulofacial dysostosis), Goldenhar syndrome (unilateral 1st & 2nd branchial arch anomaly – hemifacial microsomia).
- **Investigation of choice for congenital malformations of the ear:**is HRCT.
- Facial palsy at birth is more often traumatic(forcep delivery) rather than developmental.

EUSTACHIAN TUBE

ANATOMY:

- **36-mm long**, it runs **downward, forward, and medially** connecting middle ear and nasopharynx at an angle of 45 degrees horizontally.
- Bony part that is posterolateral forms 1/3rd of the total length (12mm) opening on the anterior wall of middle ear.

- Made up of **elastic fibrocartilage** is anteromedial and forms 2/3rd of the total length (24mm); opens on the lateral wall of nasopharynx.
- The cartilage raises an elevation on the lateral wall of nasopharynx known as **torus tubarius,** situated 1.25cm behind the posterior end of inferior turbinate.
- Main muscle to open the Eustachian tube is **tensor palate.**
- Other muscles are levator palate and salpingopharyngeus.
- Nerve supply-sensory supply from **Jacobson's nerve**. Motor supply **by Mandibular nerve (Tensor Palati) and pharyngeal plexus-cranial accessory through Vagus (Levator palate & salpingopharyngeus).**
- Functions of Eustachian Tube:Eustachian tube ventilates the middle ear maintaining middle ear pressure; it also protects te middle ear against sound pressure and reflux. Eustachian tube remains closed usually and opens during swallowing, yawning, and sneezing.
- Eustachian tube in an infant is shorter, wider and more horizontal as compared to adult, without any angulation at the isthmus.
- Higher incidence of middle ear infections occurs in infants.This is because the tube is shorter and horizontal facilitating spread of infection from the nasopharynx.
- the tests from Eustachian Tube Patency:

✓ Valsalva's maneuver (needs a pressure of 33 mmHg to open the tube).
✓ Frenzel's maneuver (needs only 8mmHg pressure).
✓ Oynbee's test.
✓ Eustachian catheterization
✓ Politzerization
✓ Tympanometry
✓ Saccharine test
✓ Sonotubometry
✓ Endoscopy (nasopharyngoscopy, middle ear endoscopy and Eustachian tube endoscopy)

- Hallmark sign of Eustachian Tube Dysfunction:Retracted tympanic membrance
- Features of Retracted Tympanic Membrane:
  - ✓ Dull and lusture less
  - ✓ Handle of malleus is foreshortened,
  - ✓ The lateral process of malleus malleolar folds and annulus tympanicus appear more prominent and cone of light is distorted or absent.

Sequelae of ETD:

- Tubal dysfunction → negative middle ear pressure → middle ear effusion →atrophy of tympanic membrane →atelectasis → adhesive otitis media →retraction pocket →primary acquired cholesteatoma.
- Tubal dysfunction → recurrent ASOM → permanent performaton →CSOM
- Tubal dysfunction → middle ear effusion → cholesterolIt is a foreign body granuloma
- Tubal dysfunction → hyaline degeneration of middle ear → tympanosclerosis

Cholesterol Granuloma:

- It is a foreign body reaction to blood pigments inside the middle ear effusion.
- Clinical hallmark is a bluish discoloration of the tympanic membrane (Blue drum).
- Other conditions causing blue drum are hemotympanum, arteriovenous malformations of temporal bone, Glue ear (rarely), and barotraumas.
- Cholesterol granuloma is the commonest lesion of petrous apex.

Otitic Barotrauma:

- It is also known as aero-otitis media.
- The pathogenesis is 'locking' of the Eustachian tube at atmospheric pressure cess of the middle ear pressure by a critical level of about 90 mmHg, which is aggravated by edema of the Eustachian tube by URI.
- Treatment includes nasal decongestants along with supportive measures in mild cases. In severe cases with persistent middle ear effusion, myringotomy may have to be done.

DISEASES OF THE EXTERNAL EAR : -

1. **FURUNCULOSIS.(LOCALIZED OTITIS EXTERNAL)**
   - Organism: **Staphylococcus aureus**
   - Site of affection: **Hair- bearing area of the cartilaginous part** of the external auditory canal

Symptoms	**Signs**
Discomfort and pain	Furuncle can seen in the EAC
Aggravated by jaw / pinna movement	EAC wall edema
Deafness if EAC gets occluded Due to the canal edema	In contracted cases, there may be Surrounding cellulitis regional lymphadenitis

- -In severe cases :Retro auricular sulcus obliteration .Forward displacement of the pinna
- Treatment **:**Local – 10% Icthymol glycerine pack.Oral antibiotics if local cellulitis present.Oral analgesics.Incision and drainage → if boil not drained within 24- 48 hrs
- In recurrent furunculosis :Do culture/ sensitivity.Rule out D. mellitus

2) Diffuse Otitis External: [Tropical ear/ Singapore Ear] Swimmer's ear.

- Organisms: **Pseudomonas Aeruginosa**
- Bacillus proteus
- Staphylococcus aureus
- Positive tragus sign (tragus is extremely tender),Pruritus is present
- **Treatment :**Ear toileting,Medicated wicks [Antibiotic + steroids].Oral Antibiotic

3.OTOMYCOSIS:

- Aspergillus niger:
- Sign **:** external ear is filled with wet debris or flates resembling Wet news paper appearance;musty odour
- Treatment : Suction clearance,Antifungal ear drops,Gentian violet(Treatment to be continued for 1 week after apparent cure of the disease)

4.BULLOUS MYRINGITIS: OTITIS EXTERNA HEMORRHAGICA

- Organism: **Viral(Influenzae epidemic**)mycoplsma.
- Features: Hemorrhagic blebs on the lateral surface of the tympanic membrane and the skin of the E.A.C.
- Treatment: -Analgesics,Antibiotic: only if secondary ear infection.Blebs NOT to be incised

5.HERPETIC OTITIS EXTERNA:

- Organism: H.simplex.H.zoster
- Features of **H.zoster/Ramsay Hunt syndrome**
- -Site of affection:- **Geniculate ganglion** of the facila nerve
  - -May also involve the IX & X craninal nerves
- -Symptoms: -Severe otalgia
  - -Vesicular eruptions on the earache, or pinna of the affected ear.
  - -Facial nerve palsy (L.M.N.type)
  - -May show associated vesicular eruptions in the buccal mucosa, hard palate and hypopharynx.
- Treatment:- Oral Acyclovir (to be started within 72 hours of the onset of rash)
  - -Post – herpetic months/year after rashes have disappeared)
  - Treatment:- TRICYCLIC ANTIDEPRESSANTS

6.MALIGNANT EXTERNAL OTITIS (MEO)

- Necrotizing external otitis or invasive external otitis.
- Immunocompromised individuals leading to osteomyelitis of skull base.
- Cranial nerve palsies and even death.
- Commonest cranial nerve **facial nerve**.
- Caused **by Pseudomonas aeruginosa**

Diagnostic Criteria (of Levenson):

- Refractory external otitis
- Severe nocturnal earache
- Purulent otorrhea
- Granulations in deep external canal
- Pseudomonas aeruginosa in culture
- Diabetes or any other immunocompromised state

Investigation of Choice:

- Technetium scan (Diagnosis)
- Culture and sensitivity
- Biopsy:To R/o malignancy
- CT/MRI-to asses the extend

Treatment : Drug used currently is third-generation cephalosporin (ceftazidime),Other Hyperbaric oxygen, local acetic acid

7.KERATOSIS OBTURANS

- Sac of desqumated epithelial debris in the deep canal due to defective epithelial migration
- Canal wall cholesteatoma

8.HEMATOMA PINNA

- Blood beneath the perichondrium ,Also k/a **Boxer's Ear**.

9.PERICHONDRITIS OF AURICLE

- Inflammation of perichondrium following **pseudomonas aeruginosa**

10.CAULIFLOWER EAR

- Shrunken up and shriveled pinna
- Devitalized due to stripping of perichondrium distrupting blood supply
- Occur following hematoma or **perichondritis**.

11.ERYSIPELAS

- Cuticular lymphangitis with a characteristic raised edge
- known as **Milian's ear**
- Agent : **streptococcus pyogenes**.

12.WAX

- Secretion of sebaceous glands;
- Syringing is done withsterile water at body temperature. Precaution should you take during syringing:While syringing, the jet of water should be directed **posterosuperior wall** of the canal to prevent further impaction.

13.FOREIGN BODIES

- Live FB in the ear is a dire emergency.
- Before removal, it should be killed by instillation of oil/spirit, since a struggling insect can produce grievous consequences like tympanic membrane rupture, ossicular disruptin, and even inner ear damage

14.Tumors of the External Auditory Canal :-Bony LESIONS OF External Auditory canal.

Osteoma

Exostoses	**Osteoma**
• Multiple	Solitary
• Sessile hemispherical elevation Ronded,	Pedunculated
• B/L condition	U/L condition
• Arises in the deep part of the external Auditory canal	In the outer part of the E.A.C

- Canal exostosis is hence also known as surfer's ear.
- Extostosis may overlay the tympanomastoid suture line which is in close proximity to facial nerve; possible nerve damage during surgery to be kept in mind.

DISORDERS OF THE MIDDLE EAR

ACUTE SUPPURATIVE OTITIS MEDIA (ASOM)

- Acute inflammation of middle ear cleft of <3weeks, infective in origin.
- Commonest bacterial agents are **Streptococcus pneumonia(35%)**, H. inflenzae, and Moraxella catarrhalis.
- Octoscopic Findings:**Cart Wheel appearance.**Later on, the TM becomes opaque and bulging.

Acute Necrotizing Otitis Media:

- Occurs along with viral exanthema.
- It is caused **by beta-hemolytic streptococcus.**
- May lead to rapid destruction of the entire tympanic membrane including the annulus, middle ear mucosa, and ossicle.
- Necrosis of the drumhead with annulus leads to invasion of middle ear by squamous epithelium from the external canal leading to cholesteatoma. This is known as secondary acquired cholesteatoma
- **Medical treatment of ASOM**:Doc:Amoxycillin high dose .Resisitant case:Amox+clavulanate or cefuroxime
- **Indication of myringotomy**:Incision of TM in POSTERIOR INFERIOR quadrant to drain pus.

✓ Severe pain (bulging red T.M)
✓ AOM going in for complication
✓ Unresolved AOM
✓ AOM occurring during antibiotic therapy
✓ AOM in immunodeficiency
✓ Recurrent AOM

- **Recurrent ASOM:**More **than 3 episodes of ASOM in 6 months, 4-6 episodes** in 12 months. Patient should be free of infection in between the episodes. Predisposing causes include adenoid hypertrophy, nasal allergy, chronic sinusitis, cleft palate, and other causes of velopharyngeal insufficiency, craniofacial anomalies, immunodeficiency, and GERD.

OTITIS MEDIA WITH EFFUSION (OME):

- **Synonyms: Secretory otitis media, serous otitis media, middle ear effusion, glue ear.** Collection of non-purulent, mucoid or serous effusion in the middle ear; **usually sterile**, occasionally may be associated with low-grade infection.
- **Diagnostic Findings:Pneumatic Otoscopy**: TM may be retracted or bulging, has reduced mobility, slightly yellowish or bluish in color.
- Pure tone audiogram: Shows moderate conductive hearing loss.
- Tympanometry: **Type B curve**.
- Myringotomy with aspiration of fluid is the gold standard.
- **Significance of OME in children:**OME is **the commonest cause of conductive** deafness in children.
- **Unilateral OME in an Adult:**An adult presenting with unilateral OME rule out malignancy nasopharynx (since commonest site of malignancy nasopharynx is foss Rosenmuller, which is just posterosuperior to Eustchian tube).
- **Treatment:**
  Medical treatment (anti-allergics, steroids, decongestants, mucolytics, antibiotics) is of questionable benefit.
  Mainstay of treatment is surgical-myringotomy with grommet (ventilation tube) insertion.

CHRONIC SUPPURATIVE OTITIS MEDIA (CSOM)

Long-standing inflammation of middle ear **cleft>3months.**

- **Safe CSOM :** Tubotympanic (Central perforation) - Profuse and mucoid discharge
- **Unsafe CSOM** : Tympanomastoid and atticoantral variety - Purulent bloody discharge
- **M/c** bacteria **— Pseudomonas** > mixed
- *T/t of safe variety*
  1. Active stage—suction clearance under operating microscope.
  2. If discharge is persistent after t/t and mastoid reservoir phenomena (hazy air cells) is present on X-ray —> **Cortical mastoidectoniy (Schwartze's operation)**
  3. Quiescent stage — Only to control cold and allergy.
  4. Inactive stage -— Myringoplasty.

- Pearly white mass behind intact TM in a young patient with conductive HL is seen in — Congenital cholesteatoma.
- Postcro-superior retraction pockets are formed in — 1^0 cholesteatoma.
- Marginal perforation is seen in — 2^0 acquired cholesteatoma.

- *T/t of unsafe variety*
  1. If cholesteatoma does not involve mesotympanum .Unsafe CSOM is a/w atticoantral d/s or hearing loss or facial nerve palsy or vertigo or labyrinthine fistula (+ve fistula sign) —>• *MRM*
  2. Unsafe CSOM + Brain abscess → *Refer to neuro surgeon*
     Unsafe CSOM + Subdural empyema → *Burr hole Sx* Unsafe CSOM + Hydrocephalus → *VP shunt*
  3. When sensory-neural deafness present (inner ear involved) → *Radical Mastoidectomy*
  4. If ossicular chain is disrupted in cholesteatoma, mastoiditis without c/c → *Tympanoplasty*

  - *M/c site of congenital cholestetoma — Petrous part of temporal bone (TM is normal)*
  - *M/c site of acquired cholestetoma — Prussack's space / attic area*
  - *M/c intracranial c/c of CSOM — Brain abscess (temporal lobe abscess).*
  - *M/c effect/ complication of CSOM — Hearing loss.*
  - *M/c nerve involved in CSOM —Facial nerve.*

    - Hearing improves at the time of discharge in a large perforation due to the 'round window shielding effect'.

Atticoantral Disease:- Atticoantral disease is prone for complications since it is associated with cholesteatoma and osteitis.

Attic and Marginal Perforations: Attic perforation is confined to the pars flaccid. Marginal perforation is seen in relation to the pars tensa but unlike central perforation has not rim of tympanic membrane at least on one side. It destroys the annulus and reaches the sulcus tympanicus.

CHOLESTEATOMA :

- Sac of keratinized squamous epithelium in the middle ear cleft resting on a thin fibrous stroma filled with desquamated keratin debris, which has properties of bone erosion/expansion.

Classification of cholesteatoma:

Congenital cholesteatoma is due to entrapment of epithelial cell rests in the middle ear and temporal bone.

- ✓ **Primary acquired cholesteatoma** no pre-existing perforation due to invagination of pars tensa basal cell hyperplasia or metaplasia
- ✓ **Secondary acquired cholesteatoma** is seen following a pre-existing marginal or subtotal perforation due to epithelial migration and metaplasia.
  - **Commonest ossicle to be affected is incus**; specifically long process of incus followed by incudostapedial joint.
  - Treatment is essentially surgical, irrespective of the type of CSOM

Complications of Middle Ear Suppuration:

Intratemporal (Extracranial) Complications	Intracranial Complications
• Mastoiditis & mastoid abscesses • Petrositis • Facial palsy • Labyrinthitis/labyrinthine fistula	• Meningitis • Extradural abscess • Subdural abscess • Brain abscess • Lateral sinus thrombosis • Otitic hydrocephalus

EXTRACRANIAL COMPLICATIONS:

A.Mastoiditis:

- It **is the commonest complication** of middle ear suppuration.

Clinical Signs of Mastoiditis:

- ✓ Tenderness
- ✓ Otoscopically, this is evidenced by edema and sagging of the posterosuperior canal wall due to periostitis of the partition wall with the antrum.
- ✓ There is pulsatile discharge through a small perforation (Reservoir sign/light house effect)

Latent (Masked) Mastoiditis:

- ✓ Persistence of subclinical infection within the mastoid leading to slow destruction of mastoid air cell system; usually due to inadequate and incomplete antibiotic therapy.

Treatment:

Treatment of choice is cortical mastoidectomy for both coalescent mastoiditis and latent mastoiditis.

Mastoid Abscesses : Subperiosteal abscesses in relation to mastoid infections

1. *Post auricular abscess* — **M/c** type. Occurs over mastoid bone (in children over MacEwan's Δ)
2. *Meatal/Luc's abscess* — Pus breaks through the bony wall b/w antrum and EAM from zygomatic cells
3. *Citelli's abscess* — tracking along the **posterior belly of digastrics** muscle.
4. *Bezold's abscess* — In **stemocleidomastoid sheath**
5. *Zygomatic abscess* — Along zygomatic bone (ant.)
6. **Parapharyngeal abscess:** Pus may track to the parapharyngela space from the posterior triangle, along the peritubal cells or down from the petrous apex

B.Petrositis :

- Petrous apex may be pneumatized in about 30% cases with connecting cell tracts from the mastoid.

C. Gradenigo's Syndrome:

- ***The triad of otorrhea, retro-orbital pain (due to trigeminal neuralgia), and diplopia*** (lateral rectus palsy due to abducent nerve involvement) in apical petrositis is known as Gradenigo's syndrome.

D.Labyrinthine Fistula (Circumscribed Labyrinthitis):

- It signifies the erosion of the bony labyrinth, exposing the endosteum leading to circumscribed labyrinthitis. Commonest site of labyrinthine fistula is dome of lateral semi-circular canal. Unchecked infection into the inner ear can lead to purulent labyrinthitis ith irreversible destruction of vestibulocohlear function.

INTRACRANIAL COMPLICATIONS:

A.Brain Abscess :

- **Commonest intracranial** complication of CSOM
- More than 50% of brain abscess in children and 25% of brain abscess in adults are otogenic in origin.
- **Site:temporal**>cerebellum
- Temporal lobe abscess:Characterized by nominal aphasia, hallucianations, and visual field defects.Upper quadrantic homonymous hemianopia, involving the opposite visual field.
- **Cerebellar Abscess :**Patient presents as ataxia, incoordination, spontaneous nystagmus, and other cerebellar signs.

B. Lateral Sinus Thrombosis signs:

- **Picket fence fever:** Hectic type of fever with rigor, chills, and sweating.
- **Griesinger's sign:** Redness and edema of the postaural and occipital region due to thrombosis of mastoid emissary vein.
- **Tobey-Ayer test (Queckenstedt Test):** Compression of the jugular vein on the normal side produces instantaneous increase in CSF pressure but not compression of the thrombosed side.
- **Crowe Beck sign:** Engorgement of retinal vessels as seen by fundoscopy on compression of jugular normal side.

Radiological Investigation of Choice in Lateral Sinus Thrombosis

- MRI scan; both T1 and T2 weighted images show a hyperintense signal on MRI with absent flo
- In contrast enhanced CT scan, the **'delta sign'** is demonstrable where the walls of the sinus enhance while the lumen does not due to the thrombosis.

Features of Tuberculous Otitis Media:

- The hallmark **is multiple perforations** on the tympanic membrane.
- **Painless otorrhea**
- Disproportionate hearing
- Early onset of complications like **labyrinthitis and facial nerve palsy**
- Infection reaches the ear through the Eustachian tube usually secondary to pulmonary tuberculosis.

SURGICAL MANAGEMENT OF MIDDLE EAR SUPPURATION:

MYRINGOTOMY

- Incising the tympanic membrane to drain the middle ear.

Myringotomy is coupled with grommet insertion in:

- OME (SOM)
- Recurrent AOM
- Adhesive otitis media
- Meniere's disease

Preferred site for myringotomy:
In AOM, postero-inferior quadrant is the preferred site of incision . J-shaped incision is used to drain the middle ear exudates.
In OME and other indications for grommet insertion, radial incision antero-inferior quadrant is preferred.

MYRINGOPLASTY
TYMPANOPLASTY

CORTICAL MASTOIDECTOMY

RADICAL MASTOIDECTOMY
MODIFIED RADICAL MASTOIDECTOMY

Fracture of temporal bone:Longitudinal(80%),transeverse(20%),mixed
Longitudianal Fractures (80%)
The fracture line runsparallel to the longitudinal axis of petrous bone; hence, it avoids the inner ear but runs above the middle ear and external canal.
So the features are:

- Tympanic membrane rupture
- Ear bleeding & CSF otorrhea
- Ossicular disruption
- Conductive hearing loss
  (Facial palsy is rare and if present is delayed and incomplete due to edema of the nerve.

Commonest Ossicle Affected by Trauma: is incus.Other causes of conductive deafness after trauma include perforation of tympanic membrane, blood and edema in the middle ear).
Transverse fractures (20%)
Fracture line runs perpendicular to the longitudinal axis of petrous bone, across the inner ear, avoiding the middle and
Salient features are:

- Vertigo
- Sensorineural hearing loss
- Hemotympanum

Facial palsy is present in all cases and is of immediate onset and usually complete (due to nerve transaction or impingement of the nerve by bony spicules).
Investigation of Choice in Fractures of Temporal Bone:
High resolution CT Scan

OTOSCLEROSIS

- M:F ratio – 1:2.
- Age of onset is 20-30 years
- **Pathology:**Mature lamellar bone is replaced by immature spongy bone of more cellularity and vascularity. This change mainly occurs in the endochondral layer of otic capsule where islands of cartilage are left unossified during development. This spongy bone later undergoes neo-osteogenesis.
- These are sometimes referred to as 'blue mantles' (blue mantles of Manasse) since they appear bluish on H & E staining.
- **Commonest Site:**Commonest site is fissula ante fenestram, leads to fixity of footplate of stapes. Include posterior to oval window, on the foot plate, round window, and otic capsule.
- Autosomal dominant **Inheritance**
- A positive family history may be elicited in 50% cases.
- Commoner in whites and Indians>Chinese, Japanese, and Negroes.
- Slowly progressive, bilateral, conductive deafness in a female, aggravated by pregnancy.
- Patients with cochlear otosclerosis may develop **vertigo, tinnitus, and sensorineural deafness**.
- **Paracusis Willis:**Patient hears better in noisy environment. This is because in noisy surroundings people tend to raise their voice which is well above the threshold of hearing for the patient. More importantly otosclerotic patients don't perceive the background noise, which act as masking noise in normal individuals.
- Commonest tympanic membrane findings is a normal TM.
- In 2-10% cases, the active otosclerotic focus that leads to vascularization of promontory is visualized as a **flamingo pink discoloration** of the TM known as **Schwartz sign.**
- Surgery is contraindicated in patients with+ve Schwartz sign and is an indication for sodium fluride therapy.

AUDIOMETRIC EVALUATION :

- Pure tone audiogram shows conductive hearing loss with **Carhart's notch** (dip at 2000 Hz in bone conduction curve).
- Tympanometry shows As type of curve.
- Stapedial reflex is absent once the foot plate is fixed.

MANAGEMENT:

Indications for surgery:

- Negative Rinne, hearing thresholds worse than 25-30 dB with an air-bone gap of 15-20 Db and good speech discrimination.
- Surgery is also indicated in otosclerotic patients with profound hearing loss but having good speech discrimination so as to enable them to use a hearing aid.

Surgical Method:

- Earlier the surgery ***was Stapedectomy***, where foot plate of stapes is removed and oval window covered with a connective tissue seal after inserting the prosthesis.
- This has now been replace with ***Stapedotomy*** where a calibrated hole is made at the center of the footplate after removal of superstructure, and prosthesis (usually Teflon) is inserted between the incus and footplate.
- **Other surgeries** include stapes mobilization and fenestration operation.
- **Hearing aid is used who are unfit for surgery**
- **Medical treatment with sodium fluride**

Contraindications for surgery:

- Only hearing ear (absolute contraindication)
- Active/malignant otosclerosis-it is and indication for fluoride therapy
- Professionals (pilots, airmen, and deep water divers)o-rapid change in middle ear pressure can lead dislodgement of prosthesis and perilymph leak.
- Pregnancy
- Extremes of age.

Sodium fluoride therapy:

- **MOA:Reduces octeoclastic bone resorption and increases osteoblastic bone formation.**Promotes recalcification and reduce bone remodeling in actively expanding osteolytic lesions
- **Inhibits proteolytic enzymes cytotoxic to cochlea**
- Found to significantly arrest the progression of sensorineural hearing loss in low and high frequencies
- Indicated in pt with **positive Schwartz sign**(indicates activity of otosclerotic focus)
- Contraindicated in
  - ***i. Chronic nephritis***
  - ii. Chronic rheumatoid arthritis
  - iii. Pregnancy
  - iv. Lactating
  - v. Children
  - vi. Allergic to fluoride
- Most common side effect is GI disturbance

LESIONS OF THE INNER EAR:

LABYRINTH DYSFUNCTION

- Include -
  - Meniere's d/s
  - Vestibular neuronitis
  - BPPV

- **Vestibular neuronitis :**2nd most common cause of peripheral vertigo.

Thought to be due to reactivation of herpes simplex type 1 infection of vestibular ganglion. Hence, sometimes also known as viral neurolabyrinthitis.

- **Benign paroxysmal positional vertigo (BPPV):**

-Commonest cause of peripheral vertigo and commonest cause of vertigo.

- BPPV produces a sensation of spinning called vertigo that is both paroxysmal and positional, meaning it occurs suddenly and with a change in head position.

-Cause : result of otoconia, tiny crystals of calcium carbonate that are a normal part of the inner ear's anatomy,

-Appley's test is done

MENIERE'S DISEASE

- Also k/ as **endolymphatic hydrops.**
- *Triad of* Episodic **vertigo** + u/L fluctuating/ episodic **deafness** (hearing loss) + **Tinnitus**
- A Meniere's disease gene linked to chromosome I2pl2.3.
- **Usually unilateral** – may become bilateral later on
- Age group: 35-60 years
- **More common in males. A**/w syphilis
- **Pathogenesis:-** Pathogenesis is endolymphatic hydrops- fluid distension of the endolymphatic spaces leading to rupture of the membranous labyrinth-mixing of endolymph and perilymph-ionic disturbances-hence symptoms
- **secondary endolymphatic Hydrops:-** Endolymphatic hydrops is not unique to Meniere's disease. Other conditions producing endolymphatic hydrops (secondary endolymphatic hydrops) are viral infection, syphilis, endocrine (hypothyroidism), autoimmune, trauma, allergy, and Paget's disease.
- **Commonest Presentation:**

✓ **Episodic vertigo (1st symptom**) associated with nausea, vomiting, even abdominal cramps and diarrhea. Tinnitus, aural fullness, and deafness supervene later on.

✓ **Sensorineural hearing** loss is fluctuant initially later becomes constant.

✓ Sometimes the patient is thrown to the ground by the episode-drop attack/Tumarkin's attack, but loss of consciousness is never a feature of Meniere's

✓ Patient may ***experience diplacusis*** (perception of two different frequencies of sound) and Tullio phenomenon (vertigo on exposure to loud sounds).

- **Lermoyez Syndrome:-** Lermoyez syndrome is a variant of Meniere's, where initially there is deafness and tinnitus, **vertigo appear later, when deafness improves.**
- **Audiometric Evaluation:**

- *Cl/tests*
  - **Tullio phenomena** (**loud / noise produce vertigo** d/ to distended saccule lying against the stapes footplate)
  - Recruitment (intolerance to loud / amplified sounds)
  - Diplacusis (distortion of sound)
- *Inv:*
  - PTA show sensorineural hearing loss with loss of lower frequencies **(rising type curve)**
  - SISI score >70% (normal < 15%)
  - Tone decay test >20 dB
  - Electrocochleography- SP/AP ratio >30%

- **Glycerol Test: -** There is improvement of hearing thresholds and SP/AP ratio after oral administration of glycerol, a dehydrating.

Treatment of Meniere's:

- T/t
  - T/t of vertigo (Vasodilators/ nicotinic acid, betahistine)
  - Cawthorne's head exercises
  - Meniet device (intermittent inner car pulse pressure)
  - Microwik
  - Dexamethasone for pt with sudden SNHL

Surgical:

Hearing conserving surgeries- In bilateral disease/young patient

- Vestibular neurectomy
- Endolymphatic shunt surgery
- Myringotomy + grommet
- Cody's operation
- Cervical sympathectomy
- Stellate ganglion block
- Menniet's appears

Hearing destroying surgeries- in unilateral disease

- Labyrinthectomy
- Intratympanic gentamycin (ITG)

➢ **Role of Intratympanic Gentamycin in Meniere's disease:**

- Since gentamycin is selectively vestibulotoxic, locally instilled gentamycin in the middle ear can diffuse into the inner ear through the round window membrane, destroying the dark cells of vestibular labyrinth; thus bringing down vertigo.
- Gentamycin may be instilled into the middle ear by Microwick/Microcatheter (Silverstein) timed release system, kept through a grommet.

OTOTOXICITY :

- Commonest group of durgs causing ototoxicity are aminoglycosides.
- **Least Ototoxic Aminoglycoside:**Netilmicin
- **Ototoxic Drugs:**

✓ Loop diuretics (furosemide, ethacrynic acid)
✓ Antimalarials (quinine)
✓ Cytotxic drugs (nitrogen mustard, cisplatinum)
✓ Salicylates
✓ Antibiotics (Erythromycin, ampicilin, vancomycin, chloramphenicol)
✓ Antivirals (cidofovir, interferon)
✓ Beta-blockers (practolol)
✓ Desferrioxamine
✓ Chemicals (alcohol, tobacco, marijuana)

- **Drugs Cause Ototoxicity by Their Central Action:**Imipramine, carbamazepine, and serotonin tend to affect the central auditory pathway to delay brainstem auditory potentials or alter central auditory function.
- **Drugs cause irreversible ototoxicity:**Aminoglycosides and cisplatinum usually cause irreversible ototoxicity.
- **1st Symptom of Ototoxicity:**Tinnitus. This is followed by high-frequency sensorineural hearing loss.
- **Investigation of Choice:**Otoacoustic emissions. There is also a role for high-frequency audiometry, since there is predominant involvement of higher frequencies in the earlier stages.

GLOMUS TUMOR:-

- **Commonest benign** tumor of middle ear
- Disease of middle age/females predominate (M:F-1:5)
- **Pathology :**It is a non-chromaffin paraganglioma arising from glomus bodies seen in relation to adventitia of jugular bulb (glomus jugulare) or promontory of middle ear along the Jacobson's nerve (glomus tympanicum). Sometimes it may be multicentric.Some tumors may be secretory and may produce catecholamines.
- Vascular tumor, main blood supply is ascending pharyngeal artery.
- Spreads in the skull base to produce multiple cranial nerve palsy. Commonest cranial nerve involved is facial nerve followed by last 4 cranial nerves.
- Commonest symptom is pulsatile tinnitus and conductive deafness.
- In others, it may present as an aural polyp that bleeds profusely on attempted surgical removal.
- **signs on clinical examination:**

✓ **Rising sun sign**
✓ **Browne's sign/pulsation sign/blanching sign-**
✓ **Auscultation of the mastoid may reveal a systolic bruit**

- **Investigation of Choice:**Magnetic resonance angiography (MRA). This has to be supplemented with contrast enhanced CT scan and other investigations like four vessel angiography.
- **Phelp's Sign:-** In CT scan, erosion of jugulo-carotid septum (crest of bone between jugular fossa and carotid canal) can be visualized when glomus tumor enlarges through the skull base; this is Phelp's sign.

➢ **Treatment:-** Large tumors have to be dealt with by skull base surgery. Limited tumors may require only a trans-mastoid or transcanal approach. Radiotherapy is reserved for inoperable lesions, old age, and unfit patients.

Acoustic Neuroma: Remember

- Also called *\vestibular* ***schwanoma.***
- Benign tumour which arises from neunlemmal sheath of the ***superior*** *vestibular nerve/VIII nerve (Acc/to Logan Turner book of ENT and Schwartz)* Most common nerve from which schwannoma arises- Inferior vestibular[Q]>Superior vestibular(Ac to G sambhug 6th ed)
- Affects 40-60 yrs of age. Comprises 80% of all cerebellopontine angle tumour (**m/c** CPA tumour)
- B/L acoustic neuromas are pathognomonic for NF-2

Clinical feature:

- U/L progressive deafness (**SNHL**) with tinnitus is first/ earliest presenting symptom.
- Balance difficulty
- **CN-5 (trigeminal)** is involved earliest with ↓corneal sensitivity. (**↓or -nt corneal reflex** is the earliesi sign)
- *Tympanic function test:*
  -Hitzeliberger sign:Hypoesthesia of posterior meatal wall.
  -Roll over phenomenon is seen
  -Threshold lone decay test show *retro cochlear type* lesion.
- *D/g* - **MRI** is gold standard for d/g., BERA is prefered audiological Ix.
- T/r - Surgery is TOC. Gamma knife (stereotactic radiotherapy) is the recent dvancement- Rehabilitation of SNHL in case of b/L acoustic schwanoma is done by brain stem implant in lateral recess of 4th ventricle.
- *C/c* - Surgery risk include facial palsy.dcad ear
- Most common CP angle tumor-Acoustic Neuroma[Q]
- 2nd Most common CP angle tumor-Meningioma[Q]

Melkersson Rosenthal Syndrome: Idiopathic condition characterized by recurrent alternating facial palsy, edema of lips, face and eyelid+fissured tongue+glossitis

Moebius Syndrome:

Congenital condition. There is B/L facial palsy+VIth nerve palsy+multiple cranial nerve abnormalities (III, IV, V,VIII, IX, XII) malformed extremities, and lack of pectoral muscles.

Heerfordt's Syndrome:

Uveitis, parotitis, and bilateral facial palsy seen in sarcoidosis.

Causes of B/L Facial Palsy:

Guillain-Barre syndrome, infectious mononucleosis, amyloidosis, sarcoidosis,skull trauma, acute prophyria, Lyme's disease, and botulism,

- Commonest tumor of facial nerve is Schwannoma.

Causes of conductive hearing losses : -

- **commonest cause of conductive hearing loss in children:secretory otitis media**
- **commonest cause of conductive hearing loss in adult:wax**
- **commonest cause of sensorineuronal deafness:presbycusis**

Ossicular discontinuity :

- Conductive loss of 60 db usually without sensorineural component
- Flaccid tympanic membrane on pneumatic otoscopy
- Type Ad tympanogram

Congenital stapes fixation :

- Family history less likely (10%)
- Usually detected in the first decade of life
- 25% incidence of other congenital anomalies (3% for juvenile otosclerosis)
- Non-progressive CHL

Malleus head fixation :

- When congenital, associated with other stigmata (aural atresia)
- Presence of tympanosclerosis
- Pneumatic otoscopy
- Almost always associated with type as tympanogram (only in advanced otosclerosis)

Paget's disease :

- Diffuse involvement of the bony skeleton

- Elevated alkaline phosphatase
- CT - diffuse, bilateral, petrous bone involvement with extensive de-mineralization
- More commonly crowds the ossicles in the epitympanum, partially fixing the ossicular chain

Osteogenesis imperfecta :

- Presence of blue sclera
- h/o of multiple bone fractures
- CT – more common involves the otic capsule and to a greater extent

Superior semicircular canal dehiscence :

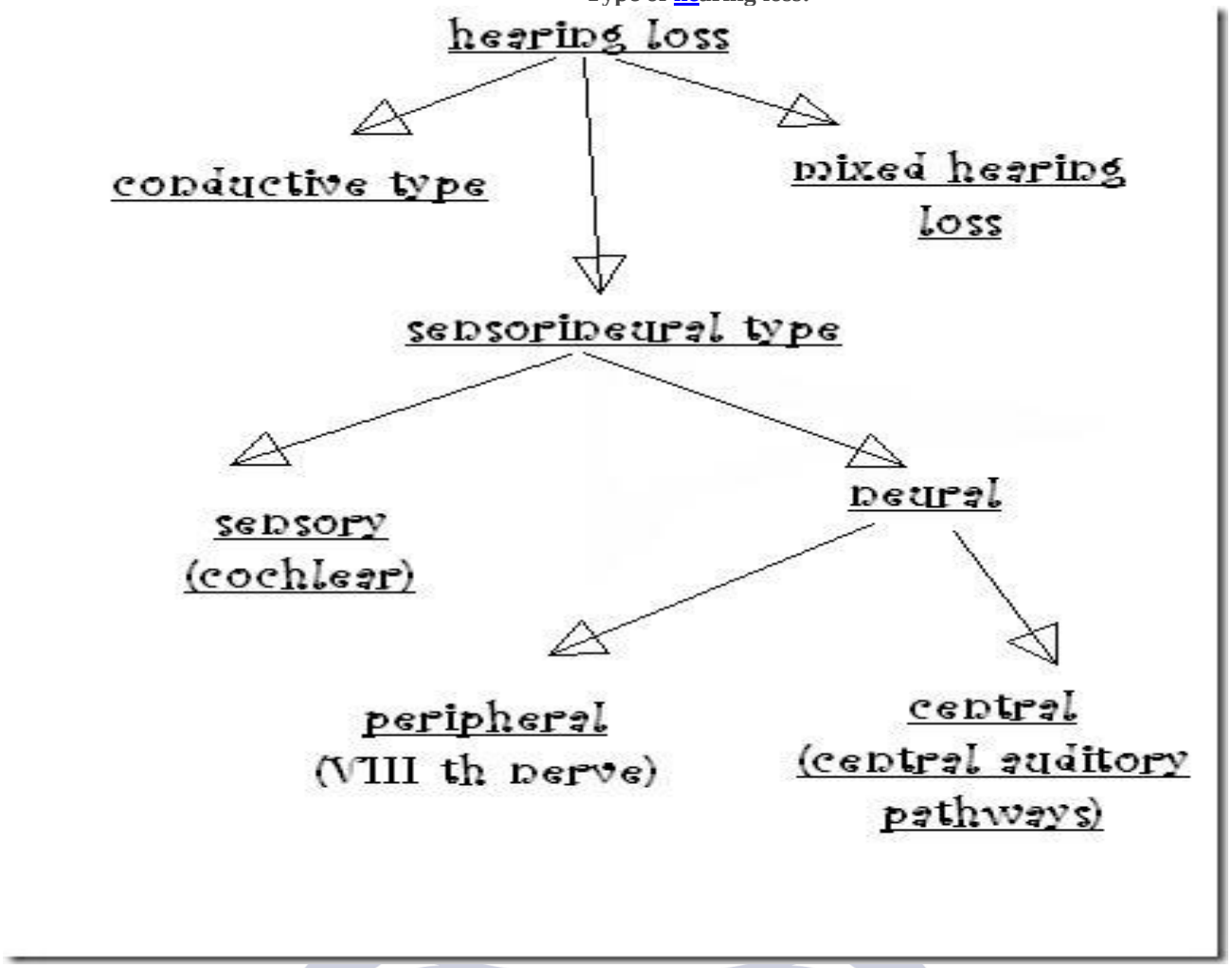
- Conductive hearing loss similar to otosclerosis
- associated with vertigo and positive fistula sign

AUDIOLOGY

ASSESMENT OF HEARING:

The techniques followed to assess auditory function we should be able to know theses 4 things after doing the tests:

- **Type of hearing loss:**



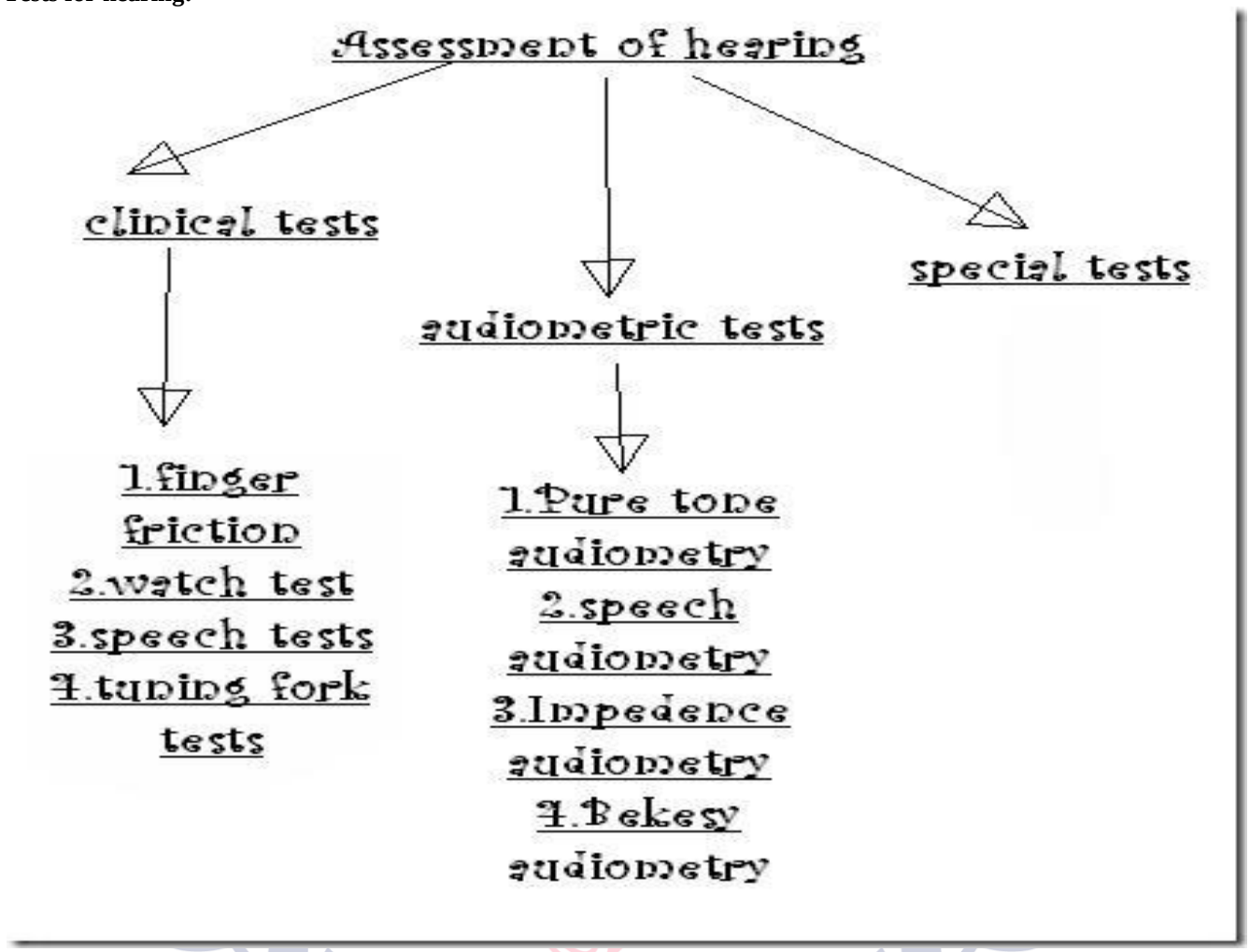
- **degree of hearing loss**

WHO CLASSIFICATION OF DEAFNESS

0Degree of hearing loss	hearing loss range(dB)
Not significant	0-25dB(adults) 0-15dB(children)
Mild	26-40dB
Moderate	41-55dB
Moderately severe	56-70dB
Severe	71-90dB
Profound	more than 91dB
total	

- **site of lesion**
- **cause**

Tests for hearing:



These 3 tests are non-specific & they don't indicate the type of deafness.they only give a rough idea about the hearing loss.

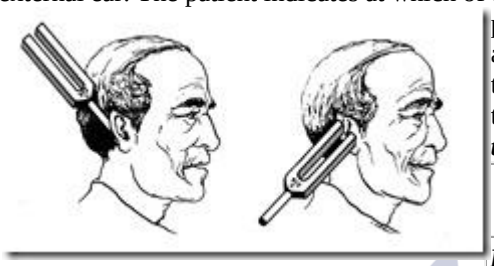
Finger friction test	rubbing or snapping thumb & finger close to patients ear
Watch test	clicking watch brought near the patients ear
Speech test	patient stands with his test ear towards examiner at distance of 6metres.

Tuning fork tests:remember these ,its very important

- 512Hz tuning fork is ideal(forks of lower frequency - produce sense of bone vibration forks of higher frequency-shorter decay time)
- When we test air conduction ,we actually check the functioning of both conductive & sensorineural(cochlea)
- When we test Bone conduction ,we actually measure only cochlear function
- Normally hearing through air conduction is louder & heard twice as long as through bone conduction route(AC better than BC)

Rinne test:

method:To perform this test, a 512Hz vibrating tuning fork is placed on the mastoid bone and then moved next to the external ear. The patient indicates at which of the two sitesthe sound is louder.



principle:Sound transmitted through an external ear traverses the middle ear and is perceived by the cochlea (inner ear). Sound can be transmitted directly to the cochlea, skipping the external and middle ear, by placing the vibrating tuning fork on the mastoid bone directly behind the ear**. *This is the basis for the Rinne hearing test.***

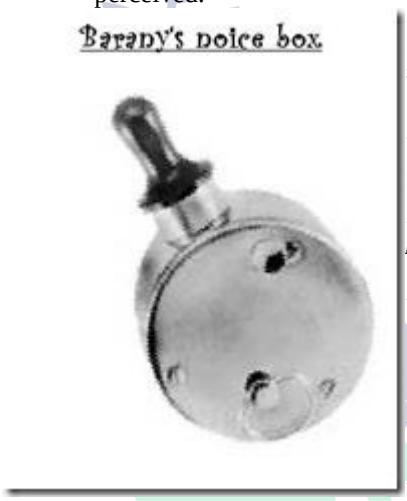
	normal	***conductive deafness***	***SN deafness***
Rinne	***AC>BC (Rinne +)***	***BC>AC (Rinne -)***	***AC>BC***

note:

rinne (-)ve	***256Hz fork***	***512Hz fork***	***1024Hz fork***
minimum air-bone gap	***15dB***	***30dB***	***45dB***

False negative Rinne :

- in Severe Unilateral sensorineural hearing loss.
- Patient does not perceive sound by air conduction ,but responds to bone conduction
- response to bone conduction is because the patient perceives sound from opposite ear because of transcranial transmission of sound.
- corrected by :masking opposite ear with Barany's noise box ,so that transcranial transmission of sound is not perceived.



note:A Barany noise box can also be used to see noise based vertigo (Tullio phenomenon). This commercially available box simply makes a loud (100 dB) noise. When the box is slowly moved towards the patient's symptomatic ear, the vertiginous symptoms may be re-created.

Weber test:

method:Place the tuning fork in the center of the forehead and the physician asks the patient where he or she hears it.

principle:

- The occlusion effect is responsible for this phenomenon. Sound conducted through bone causes the cochlea, the ossicular chain, and the air in the external auditory canal to vibrate. Some lower frequencysound, as produced by the 512 Hz tuning fork, escapes from the canal. When the ear is occluded, these frequencies cannot escape and the sound seems to become louder.
- it is the occlusion effect, rather than elimination of environmental sound, that is responsible for the improved bone conduction threshold when occluding a normal ear.
- Middle ear effusion and ossicular chain disruptions cause a "mass loaded" middle ear, with lowering of the inherent resonant frequency. Ossicular chain fixation causes a phase shift in the sound wave. Both cause preferential transmission ***of lower frequencies to the cochlea***

	normal	***conductive deafness***	***SN deafness***
Weber	***not lateralised***	***lateralised to poorer ear***	***lateralised to better ear***

note:lateralisation of sound in Weber test with a tuning fork of 512Hz implies either

- ***conductive loss of 15-20dB in ipsilateral ear (or)***
- ***sensorineural deafness in contralateral ear***

Absolute bone conduction test(ABC) test:

method:

patients bone conduction compared to that of examiner(presuming that examiner has normal hearing)by keeping on mastoid.

External auditory meatus of both patient & examiner is occluded by pressing tragus inwards ,this is to prevent external ambient noise entering through air conduction route.

	normal	conductive deafness	SN deafness
ABC test	hear the fork for same duration as examiner	hear the fork for same duration as examiner.	reduced

Schwabach test:

method:same as ABC test,but meatus is not occluded.

	normal	***conductive deafness***	***SN deafness***
Schwabach	***equal***	***lengthened in patient(due to absence of external ambient noise the patient hears it for longer time)***	***reduced***

Bing test::

determine whether closing of ear canal results in occlusion effect.

The Bing test can simulate unilateral (one-sided) conductive hearing loss results by placing a finger in one ear while performing the Weber test.

method:tuning fork placed on mastoid while examiner alternately closes & opens ear canal by pressing tragus inwards.

principle:same principle as Weber test(occlusion effect)

	normal	***conductive deafness***	***SN deafness***
Bing test	***louder(when occluded)***	***no effect (bing negative)***	***louder***

Gelle's test:

method:A vibrating tuning fork is applied over the mastoid process; if it is heard, the air in the external auditory canal is compressed, by means of a Siegle's speculum.

a test of the mobility of the ossicles.

principle:

Tympanic Function Tests (TFTs)(IN NUTSHELL)

	Conductive HL	**SNHL**
• Rinne's	-ve (BC > AC)	+ (AC > BC)
• Weber's	Lateralization to poor / diseased ear	To better ear
• ABC	= to examiner	↓ (decrease)compared to examiner
• Schwabacb's	↑ (Increase)	↓(decrease)
• Gelle's	-ve	+ve
• Binge	-ve	+ve

Rinne's Test

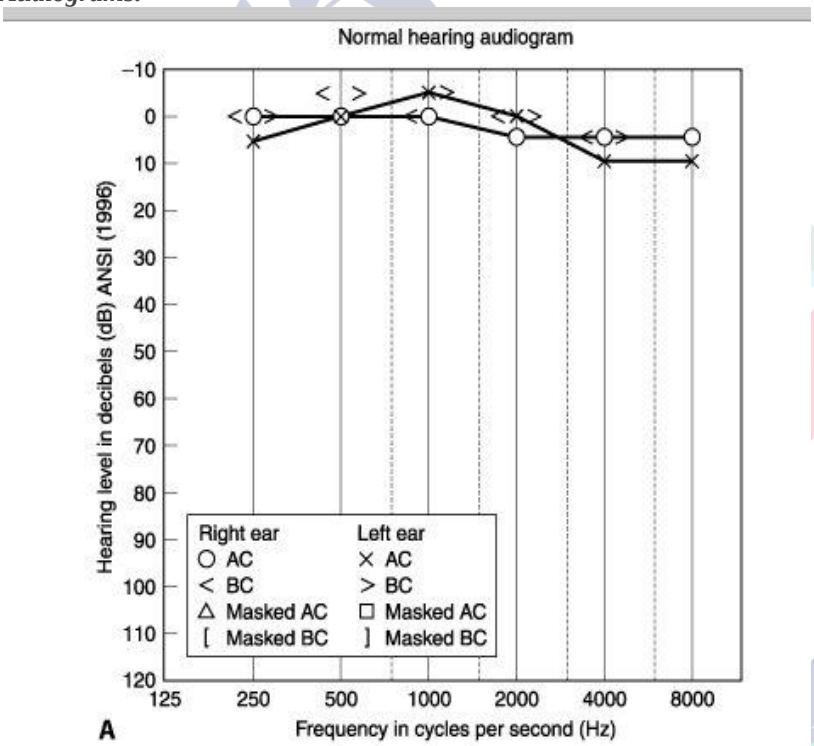
- If AC > BC (Positive) - **Norma**l, SNHL, Prcsbycusis
- If BC > AC (Negative) - Conductive deafness (CSOM)
- False +ve Rinne's is seen in — SNHL
- False -ve in — Dead ear, severe unilateral SNHL d/to transcranial transmission of sound to other ear.

In conductive deafness no change (Bing -ve) while in normal person or with SNHL hears louder when ear canal is occluded and softer when open (Bing +ve)

- *On PTA if AC > BC in right ear, BC>AC in left ear, Weber lateralized to right —Dead ear or severe SNHL*
- *On PTA if A C>BCin both ear, Weber lateralized to left —B/L SHL but more in left*
- *On PTA ifBC > AC in both ear , Weber lateralized to left , ABC normal in both —B/L CHL but more in left*

Audiometry:

Audiograms:



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A.Pure tone audiometry (PTA) :

PTA is the commonest audiometry

- *Human speech ranges from 300 to 4,000 Hz.*
- *A-B gap with Carhart's notch at 2000 Hz in B.C. suggests — otosclerosis.*
- *Frequency which can cause temporary hearing loss(noise induced hearing loss)—2000-4000 Hz.*
- *Sudden dip at 4000 Hz in both AC and BC suggests— acoustic trauma.(noise induced hearing loss)*
- ***R**oll over phenomena/curve is typical of — **R**etrocochlear lesion. On ling the intensify of sound discrimination falls further.*
- *Rising type curve is typical of — **Meniere's d/s***

Cochlear Vs Retrocochlear lesions

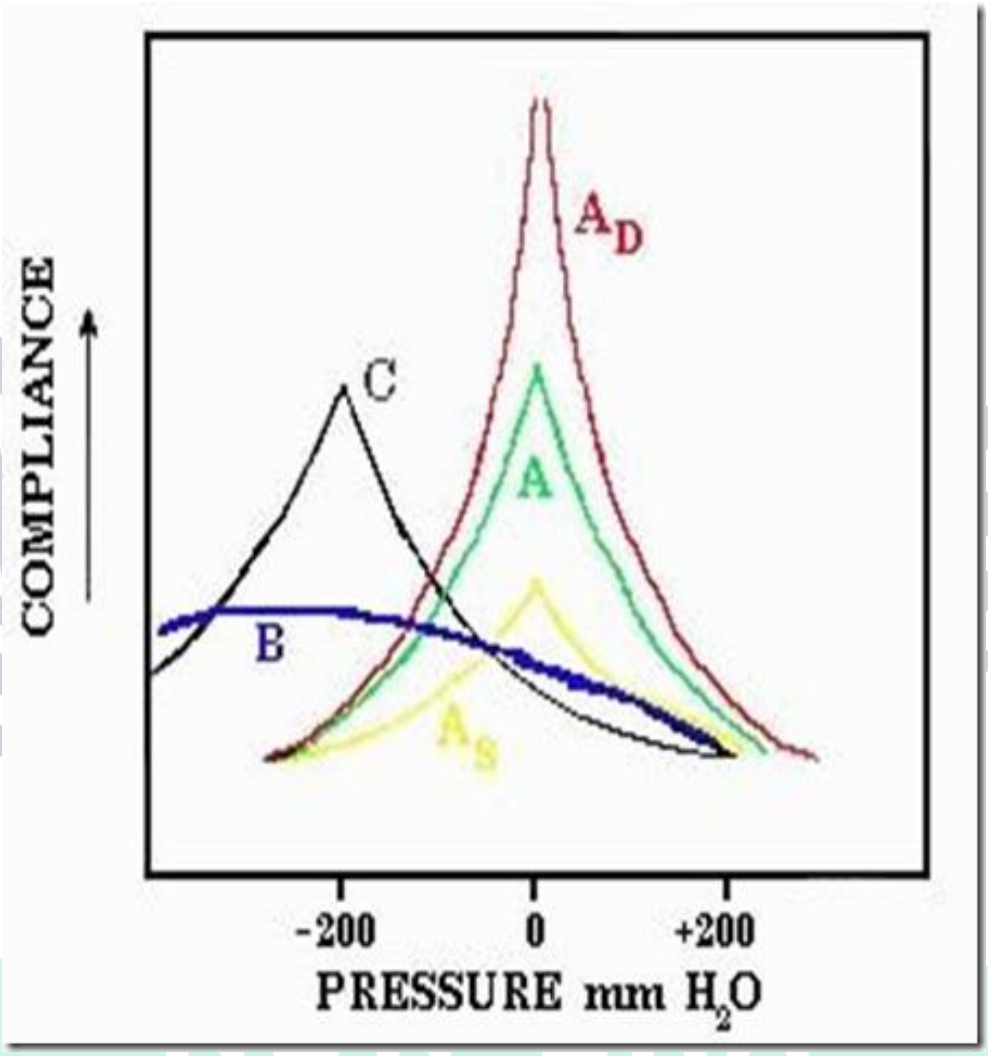
	Cochlea	Retrocochlear
Site of lesion	Cochlea	Distal to cochlea
Tone decay	-	+ (10 sec)
Recruitment	+	-

Curve type	-	Roll over curve

Impedence audiometry & Tympanograms
Used to assess middle ear functions in children. It **includes tympanometry and acoustic reflex assessment.**

TYPES OF TYMPANOGRAM:
The Jerger system is the most commonly used classification system for tympanograms

IN NUTSHELL:



Type A — Normal
Type A**s** — In otoSclerosis or malleus fixation
Type A**d** — In thin or lax TM Ossicular chain **D**iscontinuity
This **Type B** curve must always be interpreted in conjunction with the ear canal volume. **Average ear canal volume in children ranges between 0.42 - 0.97 ml, while in adults it ranges between 0.63 - 1.46 ml.**

1. **Type B curve** (A **flat** /dome shaped graph **with normal ear canal volume suggests otitis media.**
2. **Type B curve with small canal volume suggests that the ear canal could be occluded by the presence of wax, or the probe of the impedance audiometer has not been properly placed.**
3. **Type B curve with large canal volume suggests that there could be perforation of the ear drum. (so middle ear volume is added up to volume of ear canal)**

Type **C** — Eusta**C**hian tube Dysfunction .In retracted TM

Type D — High flat curve seen in perforation /of TM
Negative curve — Glue ear (OME)

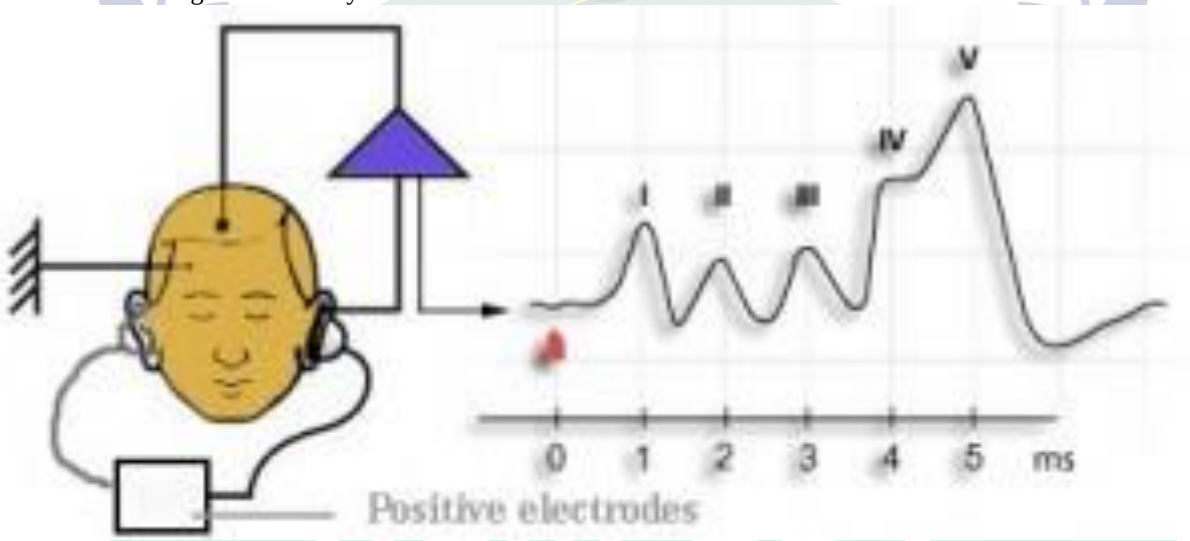
Special Test of hearing:

A.Recruitment
- Is a phenomenon of abnormal growth of loudness.
- Ear which does not hear low intensity sound begins lo hear greater intensity sound as loud.
- Seen in lesion of cochlea (i.e. Meniere's disease, presbycusis). These are poor candidate for hearing aid.

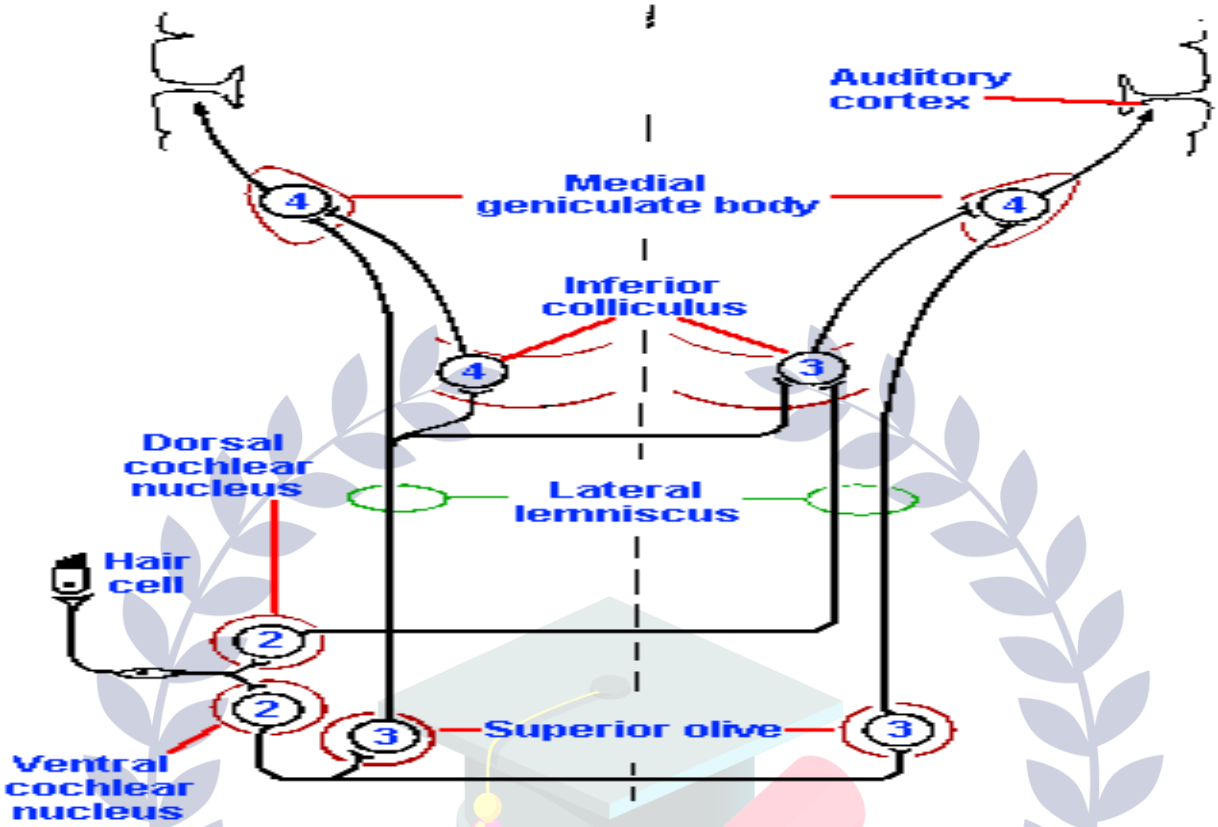
B.Evoked response audiometry (ERA:)
- ERA is a newer advancement, objective test.**U-shaped audiogram** indicates congenital deafness.

- **BERA (Brainstem evoked response audiometry)**

IOC for assessment of hearing loss in neonates/ infants of congenital deafness, mental retardation, CPA tumours (acoustic neuroma) etc.
The waves detected in BERA tests are :-
1. Auditory nerve
2. Cochlear nucleus
3. Superior olivary complex
4. Lateral lemniscus
5. Inferior colliculus (denoted by V **wave**)
6. 6 and 7. Medical geniculate body



Mnemonic:EE COLI (eight,eight,cochlear nucleus, olivary complex,lateral leminiscus,inferior colliculus) compare E COLIMA in pathway of hearing eight nerve,,cochlear nucleus, olivary complex,lateral leminiscus,inferior colliculus,medial geniculate body,Auditory cortex).



- **CERA** (Cortical evoked response audiometry):
  BERA covers whole auditory pathway but does not cover cortex for which CERA c/b used.
- Initial screening test for hearing assesment in newborns is done by **OAE** (Oto-Acoustic Emission produced by outer hair cells of cochlea) test.

  - *Loudness of sound is measured by its intensity.*
  - *Travelling wave theory is most accepted theory of sound transmission*

C.SISI (short increment sensitiivtiy index)
Method : sound used : intensity : 20 dB SL
- Frequency : 1000, 4000 Hz.
- Increments : 1 dB
  No. of increments : 20
- Stimulus : 5 sec.

SISI score = **70-100% cochlear pathology.0-20%in nerve deffness.**

Advantage: Can be performed in nearly all ears.

Disadvantage: A cooperative patient reqd.
- Not used in very severe SNHL

D. OTOACOUSTIC EMISSIONS: (OAE)
(Cochlear Echoes / kemp echoes)

- Principle: OAE: Records the sound generated by the outer cochlear hair cells
- Recording: Deep Extr. Autdiotry meatus.
- Types :a. Spontaneous,Transient
  Or
  Evoked type
- EOAEs : Reduce very rapidly as deafness increases and are undetectable when deafness is > 30 dB HL approx. (click sound used : 80 dB)
- Interpretation: absence of EOAE indicates problem in the middle ear/ cochlea.

Tests of vestibular function:

Caloric test (Fitzgerald and Hallpike technique)

- Based on thermal stimulation **of lateral** (horizontal) **SCC** with water. Results recorded on a calorigram
- Cold water induces nystagmus to opposite side and warm water same side (mnemonic COWS-old opposite, warm same)
- In canal paresis duration of nystagmus is reduced for both hot and cold)signifies peripheral vestibular lesion)
- If labyrinth is dead no nystagmus will be elicited from any ear
- Cold air caloric test (Dundas Grant test) is used when there is perforation of TM
  - External ear is irrigated with 30°C and 44°C water.

Kobraks 's test

Cold caloric test with ice cold water

Fistula test:

Positive test is indicated by vertigo and nystagmus.

Pos**itive** fistula test is seen in— Erosion of horizontal SCC by any *fistula* (i.e. cholesteatoma, fenestration operation). False +ve test in absence of fistula, is seen in congenital syphilis

Ne**gative** test indicates absence of fistula on lateral SCC (norrmal, dead labyrinth d/to old labyrinthitis)

Test used to *differentiate chochlear deafness* from *neural deafness:*

These are the tests used to differentiate vestibular end-organ function and vestibular nerve function.

- **BERA , Recruitment test, & SISI are +ve in chochlear disease**
- **To**ne decay test, speech discriminition score (90 to 100%) +ve in retrochochlear (neural) d/s

Hearing **Dysfunction :**

Tulio ***phenomena:***

Vertigo is produced by loud sounds. It is seen in congenital syphilis, or when 3 functioning windows are present in ear in fistula of SCC, fenestration operation in the presence of mobile footplate of stapes.

- *Pulsatile swelling on peritonsillar region suggests— Aneurysm of external carotid artery*
- **Pulsatile tinnitus** is *seen in — Glomus tumour, palatal myoclonus*
- **Pulsatile otorrhea** is *seen in — ASOM*
- *Fluctuating hearing loss is seen in—Meniere's disease*
- *Earache worsening at night is seen in - Malignancy*

Monaural diplacusis:

- Person hears 2 voices d/to pathology in one ear. Seen in lesions of cochlea. Meniere!s disease

Presbycusis:

- Person hears better in noisy surrounding .Seen in old age d/to degeneration of hair cells in cochlea.

Paracusis Willis:

- Better hearing in noisy surrounding seen in *otosclerosis*

Hyperacusis—

- Normal sound is heard noisy (seen in **stapedial muscle paralysis**)

Tinnitus

- **M/c** cause of Tinnitus —— Impacted cerumen
- **M/c** type of Tinnitus —- Subjective.
- Objective tinnitus is seen in — glomus tumour, palatal myoclonus, patulous ET, TMJ abnormality,spontaneous OAE, AV malformations

- *M/c cause of conductive hearing loss — Impacted cerumen*
- *M/c cause of conductive hearing loss in elderly — Otosclerosis*
- *M/c cause of sensorineural hearing loss •— Presbycusis*
- *M/c cause of vertigo — Physiological*
- *M/c pathological cause of vertigo -— BPPV i.e. benign paroxysmal positional vertigo BPPV*

RHEABILITATION IN OTOLOGY :

- Hearing AIDS:Amplifies sound reaching the ear. Best suited for patients with conductive deafness.
- **Measures to Reduces Recruitment in Hearing Aids**

Peak clipping, compression amplification, and automatic gain control.

- **Absolute Indication for a hearing Aid:**

Absolute indication of hearing aid is congenital deafness, for satisfactory development of speech and language.

- **BAHA:**Bone Anchored Hearing Aid.

  Acts by direct stimulation of cochlea bypassing external and middle ear, since it is anchored to the bone.

COCHLEAR IMPLANT

- Bypasses the cochlea. Used in severe to profound hearing loss, where there is irreversible damage to hair cells. Aims at stimulation of most peripheral part of the auditory nerve- cells of the spiral ganglion.
- Sounds produced by the implants are not like normal hearing; the electrical stimulation by the implant is percerived as auditory sensations that might only improve the communication skill of the patient.
- **Prerequisites**

✓ Intact VIIIth nerve and higher auditory pathways. (Rule out neural lesions)
✓ At least 1 year of age.
✓ Postlingula patients (after acquiring speech and language)

Surgical Approach: Facial recess approach (posterior tympanotomy)

Site of Electrode Placement:

Scala tympani of Cochlea (accessed usually through the round window)

Auditory Brainstem Implant:

✓ Bypasses the damaged cochlear nerves by electrical stimulation of cochlear nucleus.
✓ Indicated in bilateral VIIIth nerve damage –NF2 after B/L acoustic neuroma surgery, where the nerves scarified on both sides.
✓ Site of implant-Lateral recess of 4th ventricle.

Facial Nerve Lesions:

Motor Root :

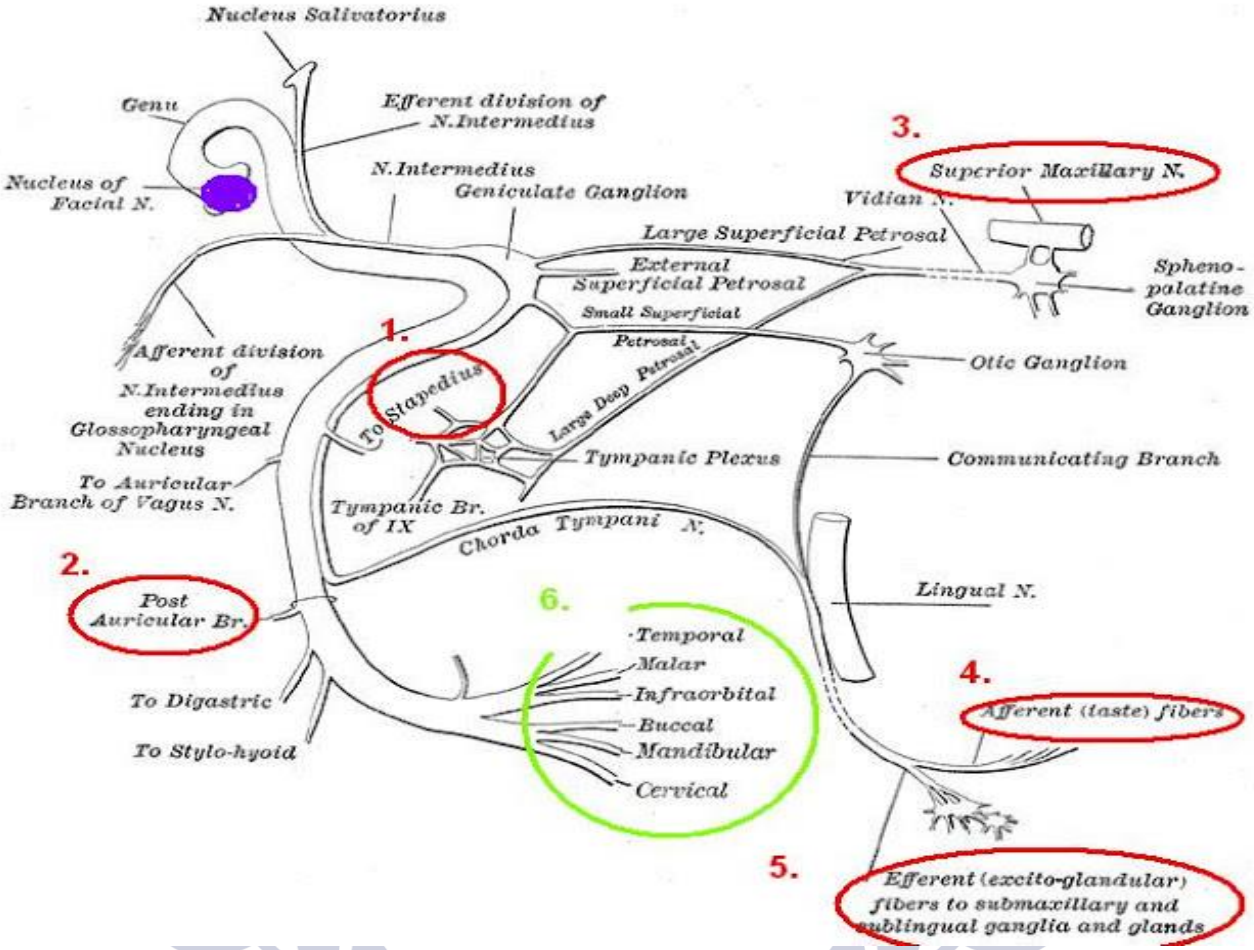
- **Supplies all muscles of facial expression** (except levator palpebrae superioris), auricle, scalp, buccinators, platysma, stapedius, stylohyoid, posterior belly of digastric.

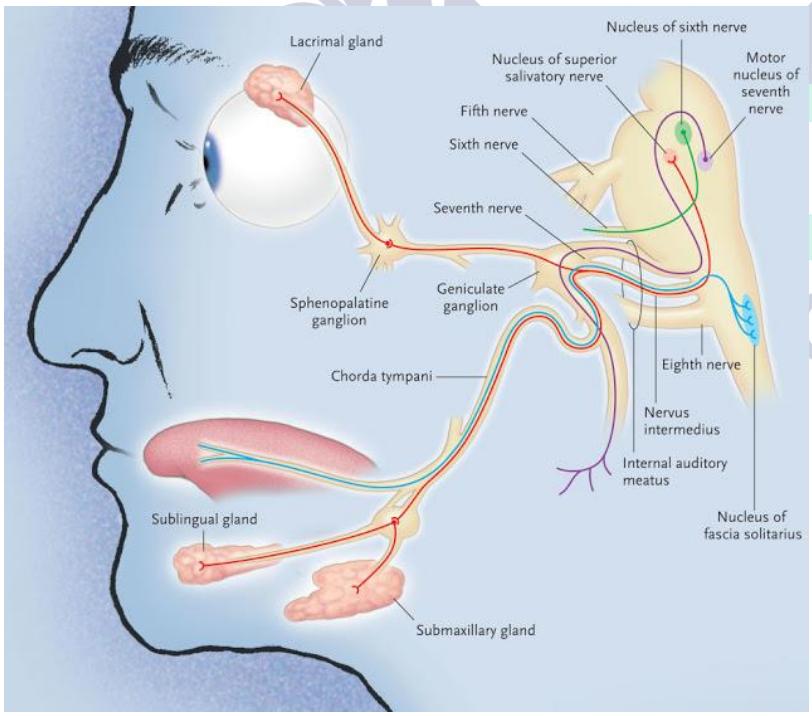
Sensory Root (Nervus Intermedius/Nerve of Wrisberg):

- Conveys taste from **anterior 2/3rd of tongue and palate.**
- Secretomotor fibers to submandibular, sublingual, lacrimal, nasal, and palatal glands; and
- A small area of cutaneous supply at the posteosuperior aspect of the external meatus.
- **Hitslberger's sign:**Hypoesthesia of the posterosuperior wall of external auditory meatus in an enlarging acoustic neuroma at the internal auditory meatus due to involvement of the nervus intermedius. This is known as Hitselberger's sign.
- **Reflexes:**It forms the efferent limbs of acoustic stapedial reflex and corneal reflex.
- **Hyperacusis in Facial Palsy is Due to:**Paralysis of stapedius muscle causing impairment of acoustic stapedial reflex.
- **Most important complication of Facial Palsy:**Exposure keratitis, may lead to corneal ulceration, opacity, and even blindness. This is because of the inability to close the eyelid completely, dryness due to absences of tearing and impaired corneal reflex.
- **Crocodile Tears:**This is gustatory tearing-Epiphora during meals; due to aberrant reanimation of facial nerve after injury. Secretomotor fibers destined to supply the salivary glands on regeneration after injury supply the lacrimal gland –hence tears.
- **UMN vs. LMN Lesions of Facial Nerve:**In unilateral UMN lesions, upper part of the face is spared due to bilateral cortical representation unlike LMN lesions where both upper and lower faces are involved. Further, there is a lack of emotional facial movements in UMN lesions.
- **Topographic diagnosis** (topognosis/site of lesion) in facial palsy is by measuring **tearing. (Shrimer's test**), Contraction of stapedius muscle (acoustic stapedial reflex), taste (electrogustometry), and submandibular salivary flow.
- For example, in a patient with facial palsy showing impairment of lacrimation, taste, and absent stapedial reflex, the site of lesion should be proximal to the geniculate ganglion in the labyrinthine segment, like in Bell's palsy as described above.

Electro diagnostic tests

- Conduction and condition of muscles supplied.
- Nerve-excitability test, Electro neuronography
- Strength - duration curve





Stte of lesion.	Effect
1. *A lesion at the stylomastoid foramen*	Paralyses all muscles of facial expression
2. *In the facial/middle ear canal*	*Chorda tympani is damaged* and in addition to (A) the taste sensation from the anterior 2/3rd of the tongue, is lost on the same side.
3. *A higher lesion in the facial canal*	Results in additional **hyperacusis** as the nerve to the stapedius is paralyzed
4. *At. the genicufate ganglion*	lacrimation and salivation are reduced. Here the 8th nerve raav,als.p. be involved because of its proximity.
5. *In the pons*	usually the 6th nerve is also involved and there are cont/L pyramidal signs – *Millard -Gubler syndrome.*
6. *In supranuclear facial paralysis*	the upper half of the face is less involved as it has B/L innervation. Voluntary movements are involved more than emotional expressions and there are ipsi/L pyramidal signs (UMN type)

Bell's Palsy

- Bell's palsy is the m/c cause of idiopathic u/L facial nerve paralysis
- **T/t:**

- Usually spontaneous recovery.
- Prednisolone is the DOC. if patient reports within 1 week tab prednisolone is advised 1 mg/kg/day for 5 days

→ If recovery starts, dose is tappered for next 5 days

→ If no recovery or paralysis is complete, same dose is repeated for next 10 days then tappered

- Prednisolone is combined with acyclovir for herpes zoster oticus
  - Prognosis is good . Recovery is complete in 85- 90% of cases

D/d of Facial Palsy

- B/L facial nerve paralysis is seen in sarcoidosis, GBS
- Recurrent facial nerve paralysis is seen in **Melkersson Rosanthal syndrome**. It consists of facial paralysis + swelling of lips + fissured tongue
- Vertical segment of facial nerve is damaged m/c by surgeons . Second m/c site is genu area.

Neonatal facial palsy is seen in

- Mobius syndrome (CN agenesis 6& 7)
- Melkerson Rosenthal syndrome (N~ + face edema + fissured tongue)
- Myotonia dystrophica
- Alberg Schoenberg *d/s*
- CHARGE association
- Oculo-auriculo-vertebral syndrome

***Bilateral facial nerve paralysis* is seen in**

- Sarcoidosis (M/c cause)
- DM
- Lyme's d/s
- GBS

Ramsay Hunt *syndrome / Herpes zoster oticus*

- Facial palsy + vesicular eruptions/rashes in EAC, pirma and sometimes in pharynx
- CN 7 + 5 (geniculate ganglion) may be affected
- Prognosis is poor (complete recovery only in 10% of cases)
- T/t: Prednisolone and acyclovir

- *Danger area efface is — Upper lip + lower end of septum + vestibule*
- *Danger area of nose is — Olfactory area*

# of Temporal bone

- 2 types of # are there :

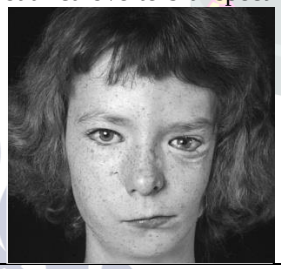
1. Longitudinal # (80%)
2. Transverse # (20%)

- Transverse # results from frontal & occipital blow to head. More likely to cause injury to labyrinth and is more dangerous. Facial nerve palsy is m/c.

Congenital Hearing Loss:

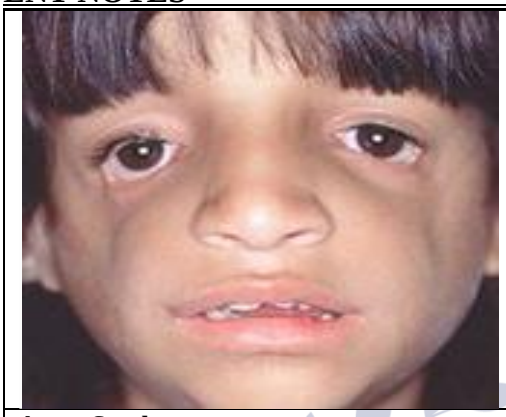
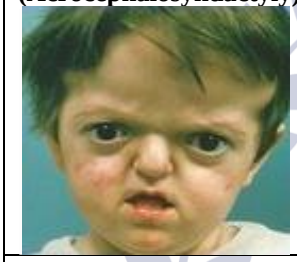
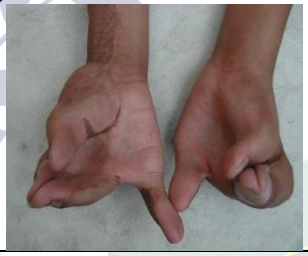
- Congenital HL
  - 50% Genetic. (75% non-syndromal 25% syndromal . 75% autosomal recessive (AR),25% autosomal dominant (AD),1-2% X-linked,Rare mitochondrial.
  - 50% Acquired

Autosomal recessive syndromal HL:

▪ Pendred syndrome	▪ Defect in tyrosine iodination ▪ Gene mutation: affects pendrin, molecule involved in chloride-iodine transport ▪ Sx: severe to profound SNHL, multinodular goiter in childhood ▪ Assoc with Mondini malformation and enlarged vestibular aqueduct ▪ Dx: (+) perchlorate test Tx: thyroid hormone to suppress goiter
▪ Usher syndrome	▪ Retinitis pimentosa and SNHL ▪ Night blindness > field cut > central blindness ▪ Most common cause of congenital deafness ▪ Dx: electroretinography
▪ Jervel and Lange Nielsen	▪ Congenital profound SNHL ▪ Prolonged QT interval with syncope, sudden death ▪ Gene mutation: KVKQT1 = abnormal K+ channel ▪ Dx: EKG Tx: Beta blockers, hearing aids
▪ Goldenhar (Oculoauriculoverterbral spectrum)  	▪ First and second arch derivatives, hemifacial ▪ CHL and SNHL (mixed) ▪ Ocular: epibulbar dermoids, colobomas ▪ Auricular: preauricular appendages, pinna abnormalities, EAC atresia, ▪ Vertebral: fusion/absence of cervical vertebrae
• Refsum disease	RP,cerebellar atxia,peripheral neuropathy,SNHL

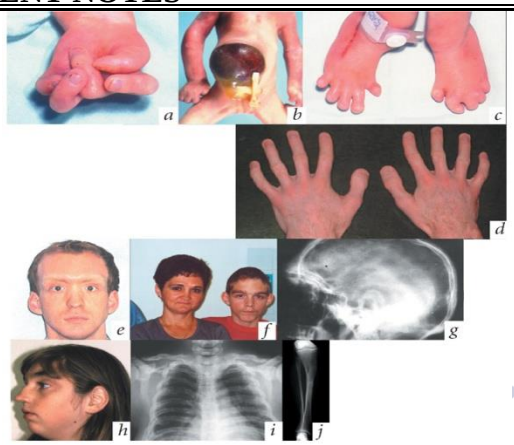
Autosomal Dominant syndromal HL:

Waardenburg Syndrome 	▪ Abnormal tyrosine metabolism ▪ Pigment abnormalities: heterochromic iriditis**, white forelock**, patchy skin depigmentation ▪ Craniofacial abnormalities: dystopia canthorum, synophrys, flat nasal root
Treacher Collins (Mandibulofacial dysostosis)	▪ Hypoplasia of mandible and facial bones ▪ Downsloping palpebral fissures, colobomas ▪ Atretic external and middle ear ▪ Mixed HL ▪ Cleft palate (35%) ▪ Gene mutation on chr 5q: TCOF1 codes for a cell transport protein (treacle) ▪ Tx: BAHA, bone conduction HA, surgical correction

	of aural atresia
Apert Syndrome (Acrocephalosyndactyly)  	▪ Middle and inner ear affected ▪ Stapes fixation (CHL), patent cochlear aqueduct, large subarcuate fossa ▪ Hand syndactyly, midface abnormalities, craniofacial dysostosis, trapezoid **mouth**
Crouzon Syndrome (craniofacial dysostosis) 	▪ Atresia and stenosis of EAC, CHL, ossicular deformities ▪ Cranial synostosis, small maxilla, exophthalmos**, parrot nose, short** upper lip, mandibular prognathism, hypertelorism
Stickler Syndrome	▪ Progressive Arthro-Ophthalmopathy ▪ Progressive SNHL (80%) ▪ Marfanoid body habitus ▪ Severe myopia, retinal detachment ▪ Flat midface ▪ Hypermobile joints ▪ Pierre Robin sequence: micrognathia, glossoptosis, cleft palate
Pierre robin syn	**Hypoplastic mandible,clef palate,glossoptosis,with ear deformity**

X linked recessive syndromal HL:

Alport's Syndrome	▪ X-linked 80%, autosomal dominant 20% ▪ Progressive glomerulonephritis and SNHL ▪ Abnormal type IV collagen in GBM; gene COL4A5 ▪ Bilateral degeneration of organ of Corti and stria vascularis ▪ Ocular disorders (myopia, cataracts)
Otopalatal-digital	▪ Ossicular malformation (CHL) ▪ Palate defects

	▪ Digital abnormalities: broad fingers and toes ▪ Hypertelorism, short stature, mental retardation
Norrie Syndrome	▪ Blindness ▪ Progressive mental retardation ▪ Hearing loss

NOSE

OPENINGS IN LATERAL WALL OF NOSE

OPENING OF	OPENS IN/ MEATUS OF NOSE
• Sphenoidal sinus →	• Spheno-ethmoidal recess
• Posterior ethmoidal sinus →	• Superior meatus
• Anterior ethmoidal sinus → • Frontal sinus → • Maxillary sinus →	• Ethmoidal infundibulum • (Hiatus semilunaris) of • Middle meatus
• Middle ethmoidal sinus →	• Middle meatus
• Fronto-nasal duct (FND) →	• Middle meatus
• Nasolacriraal duct (NLD) →	• **Inferior** meatus

- *Chronic dacryocystitis & mucocele of lacrimal sac are treated by **dacryocystorhinostomy**. In dacryocystorhinostomy lacrimal sac is drained in — middle meatus (viafrontonasal duct)*
- *In Proof puncture / anlral puncture maxillary antrum is punctured & drained through — inf. meatus*
- *In infra nasal antrostomy (for chronic suppurative maxillary sinusitis) opening is made in — inf. meatus*
- *Osteomeatal complex is an important landmark during FESS. It includes middle meatus-^ uncinate process + ethtnoidal bulla*
- *Chonca bullosa —pneumatized middle turbinate*
- *Drainage of nasal mucosa is caused by — cilliary movements*

Nasal septum is formed by

Bony part

V	E	S	P	NF
↓	↓	↓	↓	↓
Vomer	Ethmoid's Perpendicular plate	Sphenoid Rostrum	Palatine	nasal spine of Frontal bone

Cartilaginous part:

V	E	S
↓	↓	↓
Maxillary	Alar Cartilage	Septal Cartilage

- **Nasal valve** is narrowest part of nose, produces most turbulant flow. *Formed bv* — Lower edge of upper lateral cartilage, anterior end of inferior turbinate, adjacent NS with surrounding tissues.
- **M/c** site of cpistaxis — **Little's area** . (Situated in antero-interior quadrant of nasal septum) **Sphenopalatine artery** is k/as artery of epistaxis

  [Note, that posterior ethmoidal artery does **not** take part in formation **of *Klesscilbach's plexus* around Little's area]**
- ***Woodroff plesus*** .— Venous plexus situated at posterior end of inferior turbinate on the lateral wall of nose. There is anastomosis b/w Sphenopalatine & pharyngeal vein.

Nasal mucosal membrane in

- Chronic hypertrophic rhinitis — Mulberry appearance
- Atrophic rhinitis (Ozaena) —Mucosa is lined by stratified squamous epithelium. Roomy nose filled with crusts
- Rhinosporidiosis — Pink/ purple polypoidal mass protruding through nose (mulberry appearance)
- Mucormycosis — **Black necrotic mass** filling nose

- Coryza — Congested
- Maxillary sinusitis — Red and swollen
- Allergic rhinitis — Pale and swollen

Rhino lal ia Clausa
- A/w hyponasality.
- Seen in angiofibroma

Rhinolalia Aperta
- A/w hypernasality.
- Seen in — Cleft palate, palatal palsy

Granulomatous/Chronic disease of nose:

	Nose	Nasal septum
Syphilis	Snuffles, Saddle nose	Perforation(bony part)[Q]
Leprosy	Nasal bleed, Saddle nose	Perfora" (cartilage destruction)
Lupus vulgaris	Begins in vestibule, Apple jelly nodules	Perforation (cartilaginous part)
SLE	Ala of nose involved	Perforation (cartilaginous part)
Sarcoidosis	Nasal bridge collapse	Perforation of anterior portion of NS
WG	Nasal block/crust/ bleed	Total destruction of NS
TB		Septal perforation

- *Wegner's granuloma is a midline destructive lesion of nose which causes total destruction of nasal septum.*
- *Trauma is the m/c cause of perforation of nasal septum.*
- *All granutomatous diseases involve cartilaginous part.*
- *Nasal septal perforation has been reported as a side effect of anti-angiogenesis drugs like bevacizumab*

Chronic Granulomatous Diseases of Nose :
Rhinoscleroma

- Chronic disease progressing on to atrophic nodular and cicatrizing stages involving the nasopharynx, oropharynx, larynx, and tracheobronchial tree in addition to nose.
- Chronic granulomatous d/s of URT caused by Gram -ve coccobaciltus, Klebsiella Rhinosclerema **(Frisch Bacillus)**
- Common in **north India,** in HIV^+ patients
- Because of cicatrization, nose attains a hard feel (**woody nose/Hebra nose).**
- **Investigation :**Biopsy. Characteristic histological features include foam cells with vacuolated cytoplasm and eccentric nucleus (**Mikulicz cell**) **(foamy histiocytes**) and transformed **plasma cells** (**Russell bodies**)
- **Treatment :Systemic anti**biotics for 4-6 weeks (ciprofloxacin, rifampicin, tetracycline, co-trimoxazole, streptomycin) till 2 cultures-ve from biopsy sample.
  Application of 2% acriflavine dye or rifampicin locally and local irradiation have been tried.

SYPHILIS

- All stages of syphilis affect nose.
- Primary chancre in primary syphilis, mucous patches, and snail track ulcers (secondary syphilis), gummatous ulcers leading to bony septal perforation, nasal bridge tenderness and dorsal saddling (tertiary syphilis).
- Commonest stage encountered is tertiary.
- Congenital syphilis may manifest as snuffles (catarrhal rhinitis in new 3 weeks to 3 months) and gummatous lesions (toward puberty).
- There may be other stigmata including peg shaped incisors, interstitial keratitis, and sensorineural deafness (Hutchinson's triad).

TUBERCULOSIS

- May present as ulceration and perforation of cartilaginous septum or isolated sinus granuloma.
- **Lupus vulgaris** is the indolent mucocutaneous form of tuberculosis characterized by reddish firm nodules in the skin and mucosa that doesn't blanch on pressure or application of adrenaline known as apple jelly nodules.

Glanders :
Caused by Pseudomonas mallei, T/t:- Sulfadiazine

ATROPHIC RHINITIS

- Progressive atrophy of nasal mucosa and turbinates.
- Commoner in **females**.
- Causative organisms-**Klebsiella ozaenae** /Perez Abel bacilli, Coccobacillus (foetidus) ozaenae, and diptheroids.
- Hereditary, endocrine, nutritional, and autoimmune factors also predispose.
- Mucosa is atrophied and foul smelling crusts present (blessful anosmia)
- D/s is usually b/L; familial ; seen in females of **pubertal age.**
- A/w—**Vitamin A** deficiency, TB, syphilis, reflex sympathetic dystrophy , sex hormones, bld group O & B
- **Middle furbinate** is involved earliest.

Rhinitis Sicca:

- Mild anterior atrophic rhinitis, without progression to the full clinical picture. Seen in dry arid conditions; predisposed by nutritional deficiency, anemia, and alcoholism.

Laryngitis Sicca:

- Atrophic laryngitis that may occur along with atrophic rhinitis; caused by Klebsiella ozaenae. Characterized by hoarseness and cough, laryngeal examination revealing atrophic changes of he mucosa with foul smelling crusts.

Treatment of Atrophic Rhinitis:

Medical —

- 25% glucose in glycerin nasal drops (inhibits proteolytic organisms).
- **Alkaline douche** (sodium chloride:sodium bicarbonate:sodium diborate-2:1:1+280mL of water)
- Local spray of **estrogen** & placental extract, Kemistine solution

Surgical Rx:

- **Young's (Nostril closure**) operation was done earlier, but now partial nostril closure (modified young's) of cais the preferred method.
- Other surgeries include narrowing the nose (insertion of cartilage**, Teflon strips**, cancellous bone, fat under mucoperiosteum) injection of placental extract submucosally, stellate ganglion block, medial displacement of lateral nasal wall **(Lautenslager's operation).**

RHINOSPORDIUM

- **Causative Organism:**Caused by **Rhinosporidium seeberi.** The most accepted theory is that it is a fungus. However, recent studies tend to classify it as an aquatic parasite belonging to the class mesomycetozoa
- Endemic in India and Sri Lanka. In India, predominantly seen **in southern states**, Kerala and Tamilnadu, especially toward the coastal belt.
- **Presentation:Reddish granular bleeding** masses in the nasal mucosa, but can involve any mucosal surface including respiratory, GIT, and genitourinary. Has high predilection for recurrence. Commonest site in the nose **is inferior meatus followed by septum**.
- **Diagnosis** is by histopathological examination.
- **Treatment of choice** is **Endoscopic excision followed** by **cauterization** of base. Use of Laser may be an added benefit.
- **Dapsone** has been prescribed after surgery; found to bring down **reurrrence (**acts by competitive inhibition of dihydrofolate reductase enzyme on PABA, depriving the organism of DNA synthesis). Dapsone further is thought to reduce vascularity in recurrent lesions.

VASOMOTOR RHINITIS

- Also known as intrinsic rhinitis, idiopathic rhinitis, non-allergic non-infectious perennial rhinitis.
- Due to unstable **autonomic nervous system** (sympathetic-parasympathetic imbalance).
- Symptoms are similar to allergic rhinitis, but no demonstrable allergen.
- May or may not be associated with eosinophilia.
- When associated with eosinophilia, it is known as **NARES** (non- allergic rhinitis with eosinophilia syndrome).
- May lead to polyposis
- Nasal examination-congested hypertrophic turbinates.

Treatment:

- Medical –similar to allergic rhinitis
  Surgical:
- If predominant symptom is obstruction-surgeries for turbinate reduction (submucous diathermy, linear cautery, SMR of turbinate, turbinectomy, cryo, LASER).
- If rhinorrhea is the predominant symptom-Vidian neurectomy.

MYIASIS:

- Maggots in the nose.
- Flies (commonly of the genus Chrysomya) get attracted by the foul smelling discharge in these conditions and lay eggs in the nose which hatch out to form larvae.
- Treatment includes flushing out the maggots by instillation of irritants like chloroform water/ether, followed by manual removal and treatment of the predisposing condition

RHINITIS MEDICAMENTOSA:

- Rhinitis caused by long-term use of **topical decongestant** nasal drops because of tachyphylaxis and rebound congestion.

RHINOLITH:

Calculus formation in the nose, due to deposition of crystals of calcium and magnesium salts around a nidus like inspissated mucus, blood clot, or foreign body.

PARANASAL SINUSES

PNS	Developed at	Radio logically visible at	M/c involved in	Best X-ray view
Maxillary	Birth	4-5 mo	Bacterial/ fungal sinusitis, Carcinoma	Water's
Frontal	2 yrs	6 yr	Ivory osteoma, **mucocoele**, osteomyelitis of frontal **(Pott's puffy tumour)**	Caldwell's (OF)
Ethmoidal	1 yr	1 yr, but fully devp by 8-10 yr	Acute sinusitis in children, adenocarcinoma in wood worker, SqCC in workers of **nickel** industry, Orbital cellulitis	Oblique
Sphenoidal	5 yrs	3 yrs	Cavernous sinus thrombophlebitis	Basal/lateral (SMV)

- *Maxillary sinus is also k/as antrum of Highmore.*
- *Both the maxillary and ethmoidal sinuses are present at birth but **only the ethmoidal sinuses are pneumatized.***
- *Order of development of sinuses (MESF) = Maxillary → Ethmoid→ Sphenoid → Frontal.*
- *Radiologically , maxillary sinus c/b identified at 4-5 months, ethmoids at 1 year, sphenoid at 4 years, andfrontals at the age of 6*
- ***M/c** sinusitis in children is — Ethmoidal sinusitis.*
- ***M/c** sinusitis in adults is — Maxillary sinusitis.*
- *For posterior ethmoidal sinus — X-ray lateral oblique view from opp. side required*
- *All the sinuses are seen in lateral view.*
- ***M/c** sinus to develop :*
- *Mucocoele → Frontal*
- *Carcinoma → Maxillary*
- *Osteoma → Frontal*
- *Orbital cellulitis involve → Ethmoid sinus.*

PARANASAL SINUSES

Paranasal sinuses are made up of 4 bones (frontal, maxilla, ethmoid, and sphenoid) of which only the maxilla is paired, while others are unpaired.

MAXILLARY SINUS

- Also known as antrum of Highmore.
- Volume 15-30mL-Largest of the sinuses
- Opens into the middle meatus of nose
- Posterior most ostium in the middle meatus is maxillary ostium

Surgical Importance of Accessory Ostium:

- Usually maxillary ostium is not seen on diagnostic nasal endoscopy, since it is hidden under the uncinate process. Hence, if an ostium is visualized, it should be accessory ostium. During FESS for recurrent maxillary sinusitis when an accessory ostium is visualized, it should be widened anteriorly to join it with the natural ostium.
- Nerve in relation to the roof of maxillary sinus is the infraorbital nerve.

Importance :

- In malignancies of maxilla with erosion of roof one of the early signs is infra-orbital numbness due to involvement of the nerve.
- Commonest complication of Caldwell-Luc's surgery is infra-orbital neuralgias due to stretching of the nerve.
- Floor is related to the alveolus with the mola and premolar teeth.

FRONTAL SINUS

- Usually asymmetric.
- Anterior wall is diploic and posterior wall is cancellous
- Drains into the middle meatus of nose.

Importance:

- Since only the anterior wall contains marrow osteomyelitis of frontal bone, affects only the anterior wall.
- Normal pattern of pneumatization of frontal sinus is known as scalloping. There is loss of scalloping in mucocele of frontal sinus.

ETHMOIDAL AIR CELLS

- 3-18 ethmoidal air cells on either sides.
- Divided as anterior and posterior group separated by the basal lamella. Anterior ethmoids open into the middle meatus while posterior ethmoids open into the superior meatus.
- Roof of the ethmoids is known as fovea ethmoidalis, separates if from the anterior cranial fossa.
- Lateral wall of ethmoids is very thin and related to the orbit-lamina papyracea. (This is the thinnest wall of the orbit).

Ethmoidal Air Cells Important in Pathophysiology of Sinusitis:

- Haller cells are ethmoidal air cells toward the floor of the orbit intimately related to the maxillary sinus ostium-infection of these cells lead to obstruction to the ostium of maxillary sinus leading to recurrent maxillary sinusitis.
- Similarly, **alaer nasi** and **frontal recess cells** surround the frontonasal duct and the lacrimal bone-implicated in frontal sinusitis.
- **Onodi cells** are posterior ethmoidal air cells in intimate contact with the optic nerve, and in some cases the nerve may lie within the air cell. These cells should be recognized prior to endoscopic sinus surgery by CT scan to avoid injury to optic nerve during posterior dissection of ethmoids.

SPHENOID SINUS

Volume 7.5mL, very rarely symmetrical.

Opens into the sphenoethmoidal recess of the nose behind the superior meatus.

Function of the Paranasla Sinuses:

- Various theories like providing vocal resonance, lightening the skull bones.
- But now there is adequate evidence to believe that the paranasal sinuses are the richest source of nitric oxide which is present in very high concentrations inside healthy sinuses. Sinus epithelium has been found to express the enzyme inducible nitric oxide synthase, which generates large quantities of nitric oxide, having vasodilating and antimicrobial action.

X-RAY EVALUATION

- Waters' view (30 degree occipitiomental view) is the commonest view used for the sinuses, but ideal only for maxillary sinus.
- Lateral oblique view is ideal for ethmoids.
- Though visualized by open mouth projection, sphenoid sinus is better visualized via submentovertical (skull base) view.

Indications for Lateral View X-Ray:

- Lateral view skull is utilized effectively to visualize the posterior wall of frontal and sphenoid sinus also is the best view for sella turcica.
- X-ray soft tissue lateral view nasopharynx is used to grade adenoid hypertrophy.

Clacification in X-Ray PNS: Seen in inverted papilloma, meningioma, chordoma, and chondrosarcoma.

OPG: Orthopantomogram or panoramic radiography achieves complete demonstration of bony structures in the upper and lower jaw in a single film without any overlap from the opposite side. Ideal investigation for imaging of mandible. It is also useful in dental surveys.

Radiological Imaging of Choice in Nose and PNS:

- CT scan (preferably multislice CT evaluation, which allows high-resolution images in all planes (coronal, sagittal, and axial).
- The disadvantage of CT is that it cannot differentiate between exudates, mucosal thickening, polyps, or neoplasm, which is better done by MRI.

SINUSITIS

- To classify as A/C sinusitis, the duration of symptoms should last **for 7 days to <4 weeks**. Sub A/C sinusitis lasts for 4-12 weeks.
- When lasting for **more than 12 weeks**, it is **termed Chr. sinusitis.**
- Commonest sinus involved **in adults is maxillary** followed by anterior ethmoidal cells. Commonest sinusitis in children is ethmoidal.
- Commonest organism involved **in A/C sinusitis is Streptococcus pneumoniae**. Other organisms include Haemophilus influenza, Moraxella catarrhalis, and Staphylococcus aureus.
- In Chr sinusitis, mixed gram-positive and negative flora (Staphylococcus aureus, Pseudomonas, Proteus, and Klebsiella) are involved, while in sinusitis of dental origin there is added anaerobic involvement.
- **Symptomatology:**
  As per Rhinosinusitis Task Force definition major symptoms include facial pain, pressure, congestion, nasal obstruction, nasal/postnasal discharge, hyposmia, and fever.
  Minor symptoms are headaches, halitosis, and dental pain.
  Diagnosis requires two major criteria or one major and two minor criteria.

Diagnosis: The diagnostic sign is mucopus in the middle meatus, which signifies involvement of either frontal, maxillary, or anterior ethmoids since they open into middle meatus.

Diagnostic Investigation of Choice:

- In Chr sinusitis, it is nasal endoscopy along with endoscopy guided cultures from the middle meatus. This may be supplemented with CT scan and PNS.
- The diagnosis of A/C sinusitis is best made on clinical grounds with little role for imaging.

Medical Treatment is Offered in A/C Bacterial sinusitis:

- Cornerstone is antibiotics; a 10-14 day course is recommended. Antibiotics recommended are amoxicillin+ clavulanic acid, high-dose amoxicillin (1.5-4 g/day), cefuroxime or cepodoxime. Supportive therapy with intranasal sterioids, topical decongestants, mucolytics and nasal saline irrigation should be initiated along with antibiotics.

Surgical Management:

- For most forms of sinusitis, the surgery of choice is functional Endoscopic Sinus surgery (FESS).

FUNGAL SINUSITIS

- Aspergillus species is the commonest etiological agent.
- Commonest organism involved in non-invasive from is Aspergillus fumigates followed by Dematiceous species (Bipolaris, Curuvularia, Alternaria).
- Non-invasive form may either present as a fungal ball or allergic fungal rhinosinusitis (AFRS) and usually affect immunocompetent individuals.

FUNGAL BALL

- Presence of a tangled mass of fungal hyphae in one or more sinus cavities, commonest site being maxillary followed by sphenoid.
- Most reliable diagnosis is CT scan
- Treatment is FESS

AFRS (ALLERGIC FUNGAL RHINOSINUSITIS)

Type I and Type III hypersensitivity are involved in AFRS.

MUCORMYCOSIS

- Caused by Rhizopus species, and Absidia species.
- Initially runs a subtle course with only fever and rhinorrhea. Later on it invades the orbit and intracranial cavity with rapid loss of vision, meningitis, cavernous sinus thrombosis and multiple cranial nerve palsies.
- Characteristic nasal finding is a dark necrotic turbinate surrounded by pale mucosa blackish discharge and crusts.
- Commonest site is middle turbinate followed by middle meatus and septum.
- Radiological investigation of choice is MRI, while biopsy is confirmatory.

Treatment:

- For mucormycosis includes amphotericin-B, heparinization, hyperbaric oxygen, and debridement.

Drug of Choice in Invasive Aspergillosis

- Drug of choice was itraconazole; recently, voriconazole has replaced it.

Intracranial Complications of Sinusitis:

- Meningitis and encephalitis, extradural, subdural, and brain abscess and cavernous sinus thrombosis.
- Commonest intracranial complication is meningitis.

- **Commonest site of** brain abscess following sinusitis is frontal lobe. Presents as fever, headache, seizures, and altered behavioral pattern.

Different Orbital complications and features of Each:

- Pre-septal cellulitis-Lid edema
- Orbital cellulitis-Proptosis, chemosis, and ophthalmoplegia
- **Superior orbital fissure syndrome**-IIIrd IVth, VIth cranial and ophthalmic division of Vth cranial nerve involvement.
- **Orbital Apex syndrome**-Along with involvement of structures of superior orbital fissure syndrome there is added optic nerve and maxillary division of Vth cranial nerve.

MUCOCOELE

Presents as swelling at inner canthus below eyebrow, **frontal sinus** is **m/c** involved f/b ethmoid sinus. Mucocoeie of PNS are treated by **Lynch-Howarth operation.**

POTT'S PUFFY TUMORS:

- Subperiosteal abscess following **osteomyelitis of frontal** bone secondary to frontal empyema giving rise to a doughy swelling on the forehead.

GLOSSOPHARYNGEAL NEURALGIA:

Presents as pain in the throat, neck, and lower jaw brought about by swallowing often radiating to the ear. Causes include an elongated styloid process causing compression (**Eagle's syndrome**), aberrant vessels, and unsuspected neurofibroma. Treatment is in similar lines to that of trigeminal neuralgia.

TEMPOROMANDIBULAR JOINT DYSFUNCTION (COSTEN'S SYNDROME)

Produces auriculotemporal neuralgia with pain in and around TM joint radiating up along the temple or down along the jaw with deep otalgia. Commonly attributed to bruxism, malocclusion, missing teeth, or ill-fitting dentures. Treatment includes rest to the joint, correction of aggravating factors, local heat, and

CALDWELL-LUC'S SURGERY :

- Also known as radical sublabial antrostomy. Maxillary antrum is entered through the sublabial route to clear the disease inside. Antrum is connected to the nose through a naso-antral window made via the inferior meatus.

Indications:

- Dental origin maxillary sinusitis
- Recurrent antrochoanal polyp in an adult (contraindicated in children for the fear of altering mid-facial growth)
- Oroantral fistula
- Foreign bodies in the antrum
- Dental cyst
- Fractures of maxilla
- As an approach to pterygopalatine fossa (maxillary artery ligation/Vidian neurectomy) and ethmoids (trans-antral ethmoidectomy-Jansen Horgan procedure).

CSF RHINORRHEA

- Leakage of CSF through **a defect in dura, bone and mucosa** from the subarachnoid space into the nasal cavity.
- It can occur from the **Anterior cranial fossa (**cribriform plate, roof ethmoids, posterior wall of frontal sinus).
- Middle cranial fossa (roof of sphenoid sinus, mastoid and middle ear through Eustachian tube)
- Posterior cranial fossa (posterior wall of sphenoid sinus, mastoid air cells).
- **Commonest site of leak** is **Lateral lamella of cribriform plate** at the junction with the fovea (roof of ethmoids)
- **Paradoxical rhinorrhea** from the opposite side of CSF leak; due to shift of midline structures like crista galli and vomer following trauma.
- Reservoir sign is collection of CSF inside the sinuses and later producing intermittent rhinorrhea.
- **commonest cause of CSF Rhinorrhea:**

Historically the most common condition to cause leak CSF was head injury. But in all recent series iatrogenic trauma has replaced head injury as the commonest cause. Common surgeries causing CSF leak are trans-sphenoidal hypophysectomy, intranasal naked eye surgeries, FESS and Skull base surgeries.

- **Spontaneous CSF rhinorrhea:**

Idiopathic or acquired intracranial hypertension (pseudotumor cerebri) results in hydrostatic pressure at anatomically weakened sites of the skull. The dura then herniated into the sella turcica and fills it with CSF which compresses the pituitary giving the appearance of an 'Empty sella'. (Empty sella is also seen following necrosis of pituitary tumor). Spontaneous CSF leak (spontaneous intracranial hypotension) ensues.

- **Risk of CSF rhinorrhea:**CSF rhinorrhea can lead to recurrent meningitis due to ascending infection. The risk of developing one or more episodes of meningitis following CSF leak is quoted to vary from 5.6% to 60%. However, the most comprehensive study to date indicates the relative risk to be 9.8%.

Investigations:

- **Handkerchief test-** In Traumatic leaks, collect blood from the nose on a white hadkerchief-blood stays in the center while CSF gravitates to the periphery. This is Halo sign, Ring sign, Double ring sign or Target sign.
- **Sugar estimation**- Normal CSF sugar is 30 mg/dL while in nasal secretions, it is <10mg/dL ($1/3^{rd}$ of blood sugar). However this is only suggestive evidences as false+ve results are obtained in presence of blood, mucous and tears.
- **Beta 2 transferrin estimation** is the pathognomonic investigation since it has almost 100% sensitivity and 95% specificity. Other than CSF, Beta 2 transferrin is seen only in perilymph and vitreous humor. However, false+ve results are possible in liver disease, Ca Rectum, Glycogen storage disease and neuropsychiatric disease.
- Other than this **Beta Trace Protein** is also used in detection of CSF.
- **Nasal endoscopy Intrathecal dyes (Fluorescein) are used as an adjunct for loc**alization of the leak intranasally. A brilliant yellow fluid leaking in the nose is visualized in the vicinity of the defect and use of a blue filter on the endoscopic light (blue light endoscopy) makes it more sensitive.
- **High Resolution CT scan** is the investigation of choice for detection of site of leak in bone defect.
- **MRI (T_2-weighted)** is the preferred modality in suspected encephalocele/tumors.

Treatment:

Conservative treatment should be tried for 10-14 days. This includes rest, avoidance of straining, head up position, acetazolamide, lumbar drain, etc.

- Surgical treatment of choice in most of the cases is endoscopic repair. Graft materials include nasal mucosa, composite graft of nasal mucosa with turbinate bone or septal cartilage.

Imp. facts about nose

- **Sluder's** neuralgia — Referred pain to area below eyes. Seen in high DNS pressing middle turbinates. (Anterior ethmoidal nerve syndrome)
- **Potato nose (Rhinophyma)** — D/to hypertrophy of sebaceous glands. **Glandular form of acne rosacea.**
- **Inverted papilloma of nose** (Ringertz tumour) — Benign tumour of nose with malignant potential. Present in young adults in *lateral* wall of nose.
- **Frog face deformity of nose /face — Seen in** nasopharyngeal angiofibroma.
- **M/c** cause of oroantral fistula — dental extraction (1st & 2nd molar)
- Septoplasty is preferred surgery for DNS in all age group A child with u/L foul smelling discharge from nose is likely to have — FB nose.
- During maxillary (antral) washout sudden death occurs d/to air embolism.

Nasal alkaline douche

- Contains $NaHCO_3$, (30 gm). Na-Biborate (30 gm) and NaCI (60 gm) [**triple sodium**] dissolved in ½ pint of water
- Used in atrophic rhinitis (ozena) and crusting rhinitis (rhinitis sicca) to dislodge crusts

  - *Proelz displacement therapy*
    -Contains alcohol + glycerine + saline
    -Used in chronic atrophic rhinitis
  - *Mandl's paint contain iodine + KI + glycerine + peppermint nil. Used for chronic pharyngitis*
  - *In nasal anaesthesia lignocaine 4% is used as spray and surface anaesthesia*

Surgeries for various sinuses

- Maxillary sinus → **Caldwell Luc operation**. Indicated in Chronic infection of the maxillary anirum which fails to respond to non-operative treatment., exploration.and to obtain a biopsy, and reduce the bulk of the tumour, in suspected carcinoma of the maxillary antrum.
- Mucocoele of frontal /ethmoid sinus → Lynch-Howarth operation.
- Maxillary antral washout: Death c/b due to air embolism.

NASAL POLYPS

Feature	Antrochoanal	Ethmoidal
• Incidence	Less common	M/c
• Etiology	Infection	Allergy, **aspirin hypersensitivity**
• Arose from,	Maxillary sinus/antrum	Ethmoidal air cells
• Age group	**Children**	**Old age**
• Numbers	**Single, u/L project backward in post, choana**	**Multiple, always b/L project forward**
• Recurrence	–	+
• T/t	**FESS** or simple polypectomy (avulsion) ↓ If recurrence ↓ Caldwell Luc operation	Topical nasal spray (Fluticasone/mometasone) T/t is usually **conservative** [histamine, steroids] Surgery is indicated if If 1 or 2 pedunculated polyps present → Polypectomy If multiple & sessile → Intranasal ethmoidectomy [Through middle meatus] If recurrence occur ↓ Extra nasal/external ethmoidectomy

- An antrochoanal polyp is easily removed by avulsion.
- FESS has superseded other modes of polyp removal now a days.
- Caldwell luc operation is done for recurrent polyp (avoided now-a-days).
- Nasal polyps are more common in males (2:1). Incidence increases with age. they are rare <2 year of age, if present think for other d/g like meningocele.
- Samter's triad is association of asthma + nasal/ethmoidal pofyposis + aspirin hypersensitivity d/to leukotrienes excess.

JUVENILE NASOPHARYNGEAL ANGIOFIBROMA

- Benign tumour of nasopharynx but locally invasive
- Arises from **posterior part of nasal cavity near sphenopalatine foramen**
- It occurs mainly in **young males** in second decade (12-20 years is m/c age group)
- Role of sex hormones (testosterone) in etiology,
- **Patho:** high vascular tumour (with no m/s coat in vascular channels, so heavy bleeding possible during surgery).
- Biopsy is contraindicated
- **M/c** presentation - recurrent epistaxis and progressive nasal obstruction may be present – *frog face deformity*, proptosis may be present
- *On posterior rhinoscopy* – it appears as a pink fleshy mass
- There is involvement of CN **2, 3, 4 & 6**

INVESTIGATIONS

- Special investigation
- Lateral tomography : Antral sign
- Antral sign (Holman miller sign) : anterior bowing of the posterior wall of the maxillary sinus.
    - Antral sign may not be present in 20% of the cases.

- C.E.C.T. – Most constant feature : Deformity of the base of the medial pterygoid plate (seen in the coronal cut sections).

- **MRI** (gadolinium enhanced)

- **STAGING SYSTEMS FOR JUVENILE NASOPHARYNGEAL ANGIOFIBROMA**

Chandler		Sessions		Radkowski	
I	Tumor confined to nasopharyngeal vault	IA	Limited to nose and/or nasopharyngeal vault		Same
		IB	Extension to one or more sinuses		Same
II	Tumor extending to nasal cavity or sphenoid sinus	IIA	Minimal extension to PMF		Same
		IIB	Full occupation of PMF with or without erosion of orbital bones		Same
		IIC	Infratemporal fossa with/without cheek	IIC	Or posterior to pterygoid plates
III	Tumor extending into antrum, ethmoid sinus, PMF, ITF, orbit, and/or cheek	III	Intracranial extension	IIIA	Erosion of skull base; minimal intracranial
				IIIB	Erosion of skull base; extensive intracranial with/without cavernous sinus
IV	Intracranial tumor				

- **T/t**
  - **Surgical excision is TOC**
  - Commonly trans-palatine approach (Wilson's)
  - Extended lat. rhinotomy approach for complete clearance of extra-pharyngeal extensions.
  - RT if intracrania! extension found
  - Methods of reducing blood loos in angifibroma
  - Pre-operative: Embolization/ estrogen Rx/ RT/Flutamide Rx.
  - Hypotensive anaesthesia.

Nasopharyngeal Carcinoma

- Sqamous cell variety is commonest.
- **M/c** it arise from lateral wall of nasopharynx (mostly in supratonsillarfossa of Rosenmiller)
- Bimodal age peak (common in 5th-7th decades but can occur in 2/3rd decade).M>F
- A/w early antigens of EBV, HLA2 &8, chminey smokers, wood and leather worker. Common in China.
- Chemicals like **nickel,** dust from chromium, isopropyl oil, formaldehyde, asbestos can irritate the lining of the nose & predispose to nasal cancer.
- By the time diagnosis is established 70% of patient have enlargej cervical nodes. M/c presentation is cervical lymphadenopathy. Rhinolalia clausa is seen.
- **M/c** nerve involved is abducent 6 > 5th & 3rd nv . Can involve any CN except 7th & 8th.
- **Trotter's triad** / *Sinus of Morgagni syndrome :*
  Conductive deafness + facial pain + ipsi/L palatal paralysis
- Cervical metastasis to jugulodigastric LN or post digastric nodes.
- CT is diagnostic
- **Radiotherapy** is TOC. RND is reserved for persisting nodes when primary has been controlled.

MAXILLARY SINUS CARCINOMA

- Age – 40-60 years
- Sex – M/F
- Symptoms- silent for long –time

- Early features
  Nasal stuffiness
- Blood stained nasal discharges facial paraesthesisa, pain, epiphora

Staging Criteria of Primary Malignant Maxillary and Ethmoid Sinus Tumors.		
Stage	**Maxillary Sinus**	**Ethmoid Sinus**
T_X	Primary tumor cannot be assessed	
T_0	No evidence of primary tumor	
T_{IS}	Carcinoma in situ	
T_1	Tumor confined to antral mucosa with no bony destruction	Tumor confined to ethmoid sinuses with no bony destruction
T_2	Tumor causing bony destruction (except for posterior wall of maxillary sinus), including extension into the hard palate or middle meatus	Tumor extends into the nasal cavity
T_3	Tumor invades any of the following: bone of the posterior wall of maxillary sinus, subcutaneous tissue, skin of cheek, floor of medial wall of orbit, infratemporal fossa, pterygoid plates, ethmoid sinuses	Tumor extends to the anterior orbit or the maxillary sinus
T_4	Tumor invades orbital contents beyond the floor or medial wall, including any of the following: the orbital apex, cribriform plate, base of skull, nasopharynx, sphenoid, frontal sinus	Tumor with intracranial extension; orbital extension including the apex or the sphenoid, the frontal external nose, or the skin of the external nose

Early maxillary disease is stage 1-2 where as adavanced maxiallry disease is stage 3-4.

Spread

Medial – nasal cavity ethmoids

- Anterior – cheek
- Inferior – alveolus
- Superior – orbit
- Posterior – pterygoid plates
- Intracranial spread

Lymphatic spread

- Nodal metastases uncommon
- Submandibular & UDC LN enlarged
- Retropharyngeal notes not accessible to palpation

Diagnosis :

- Biopsy
- CECT nose & PNS

Classification :

- Ohngren's classification

An imaginary plane drawn extending between medial canthus of eye & angle of mandible.
Growths above this plane have poorer prognosis than those below it.

2. AJCC classficition
3. Lederman's classification -2 horizontal lines of sebileau
One – passing through floors of orbit
Other – through floor of antrum
Thus dividing this area into:
a. Suprastrcuture – ethmoid, sphenoid, frontal sinus
b. Mesostructure – maxillary sinus & respiratory area of nose
c. Infrastructure – alveolar process
Treatment
Surgery – partial or total maxillectomy

Incision used – weber – Fergusson
Radiotherapy (usually post operative)
Prognosis
5 year cure rate of 30%
Ethmoid sinus malignancy
Often involved from extension of maxillary carcinoma
Primary growth in this region not common

EPISTAXIS

EPISTAXIS

Areas of nasal bleed

a**. Little's area** : - Location – antero – inferior part of the nasal septum
- Arteries contributing – sphenopalatine artery
- Anterior ethmoidal
- Septal branch of greater palatine
- Septal branch f superior labial

b. **Retrocolumellar area** : - Location
- Just behind the columella
- Occurs at the anterior edge of the Little's area
- The retrocolumellar vein of this area then runs along the floor of the nose to anastomose with the various plexus of the lateral wall of the nose
- Vein of the area : retrocolumellar vein
- Feature : occurs in young people (<35 yrs)

c. **Woodruff's plexus**:
Location: is found in the lateral nasal wall posterior to the inferior meatus
Contributing vessel : from the posterior pharyngeal wall
Features: venous bleed

d. Septal turbinate :
Location: nasal septal area

e. Hemorrhagic nodules
Location: can occur anywhere
Features: these are aneurismal dilatations of an unusually sited muscular artery

CAUSES OF EPISTAXIS

Local	General
Nose : trauma Infections – acute stenosis, chronic (T.B. syhpills granulomatous lesion of the nose) Liver disease Foreign boides Neoplasms of nose and paranasal sinuses (benign / malignant) Atmospheric changes (high altitudes) Nasal septum Nasopharaynx adenoitis Juvenile angiofibroma Malignant tumours (Influenza, measles) With age : The medium and smaller nasal arteries undergo change. The muscle layer of media is replaced by fibrous tissue. Treatment In young person : nasal pinching : for 5-10' If bleeder seen – cauterize If diffuse bleeding – anterior nasal packing	Cardiovascular causes (mitral, stenosis, hypertension) Blood & blood vessels (anemia, thrombocytopenia) Kidney disease Drugs (analgesics, anti deviated coagulant therapy) Mediastinal tumours Acute general infection

Epistaxis : post-nasal packing if bleeding does not stop with anterior nasal pack
Adult patient with recurrent bleeding : ask for history of hypertension, alcohol, any current medication

Treatment :
- Control blood pressure
- Cauterize the bleeder with AgNO3
- Resistant cases

- Submucosal Resection Or mucoperiosteal Flap septoplasty simple elevation of the mucoperichondrium

TROTTER'S METHOD
- Old fashioned method of controlling epistaxis
- Make the patient sit up with a cork between his teeth – allow him to bleed

Till he becomes hypotensive. Absurd and not practiced in modern medicine.

Vessel ligation in uncontrollable bleeds

a. External carotid artery ligations - Operation of choice : elderly and debilitated
- Indication – bleeding from the external carotid artery system And all conservative methods have failed

Site for ligation : above the origin of superior thyroid artery

b. Maxillary artery ligation : Performed in the pterygo palatine fossa. Is performed in posterior bleeds

c. Ethmoidal arteries : in anterosuperior bleed above the middle turbinate not controllable by packing

FRACTURES OF THE FACIAL SKELECTON

NOSE

Fracture of the nose

Classified

Class 1 fracture (chevallet)	Class 2 fracture (Jarjavay)	Class 3 fracture
Depressed nasal fracture Force required 25-75 ib/in2 Fracture line runs parallel to the dorsum & the nasomaxillary suture line Nasal septum is not involved in this injury In a severe variant it is involved Features : Do not cause gross lateral displacement Rx *** Fracture reduction done either immediately or after 5-7 days once edema settles	Involve the nasal bone, the frontal process of the maxilla and the septal structures Ethmoidal labyrinth and the orbit are spared Here the quadrilateral cartilage gets dislocated from the maxillary crest Rx: closed reduction of the nasal bone fracture with open reduction of the septum	Caused by high velocity trauma Naso orbito ethmoid fracture Present with multiple fracture of the roof of ethmoid, orbit & sometimes extend as far back as the sphenoid and parasellar regions (C.S.F leak, pneumo-cranium) Px: open reduction & internal fixation

PS – distal part of the nasal bone is half the thickness of the proximal part. Therefore more susceptible to injury.

Untreated nasal bone fractures lasting for more than 21 days require open reduction

Caudal dislocation is a type of class 2 fracture or at times class 1 fracture.

Any C.S.F. leak persisting for more than 2 weeks have to be considered for repair

Mandible :

- Most common site of fracture: stibcondylar region
- Fracture sites: subcondylar area>angle>body>symphysis

** subcondylar fracture is caused by indirect force delivered either to the chin or the contralateral mandibular body

TREATMENT

1. Closed reduction technique

Dental wiring / intermaxillary fixation (# in the tooth bearing area)

External pin fixation : for combined fracture of the mandible & maxilla

2.Open reduction technique

Condylar neck fracture

Px: intermaxillary fixation for 10 days followed by jaw exercises

Le fort Type fracture :

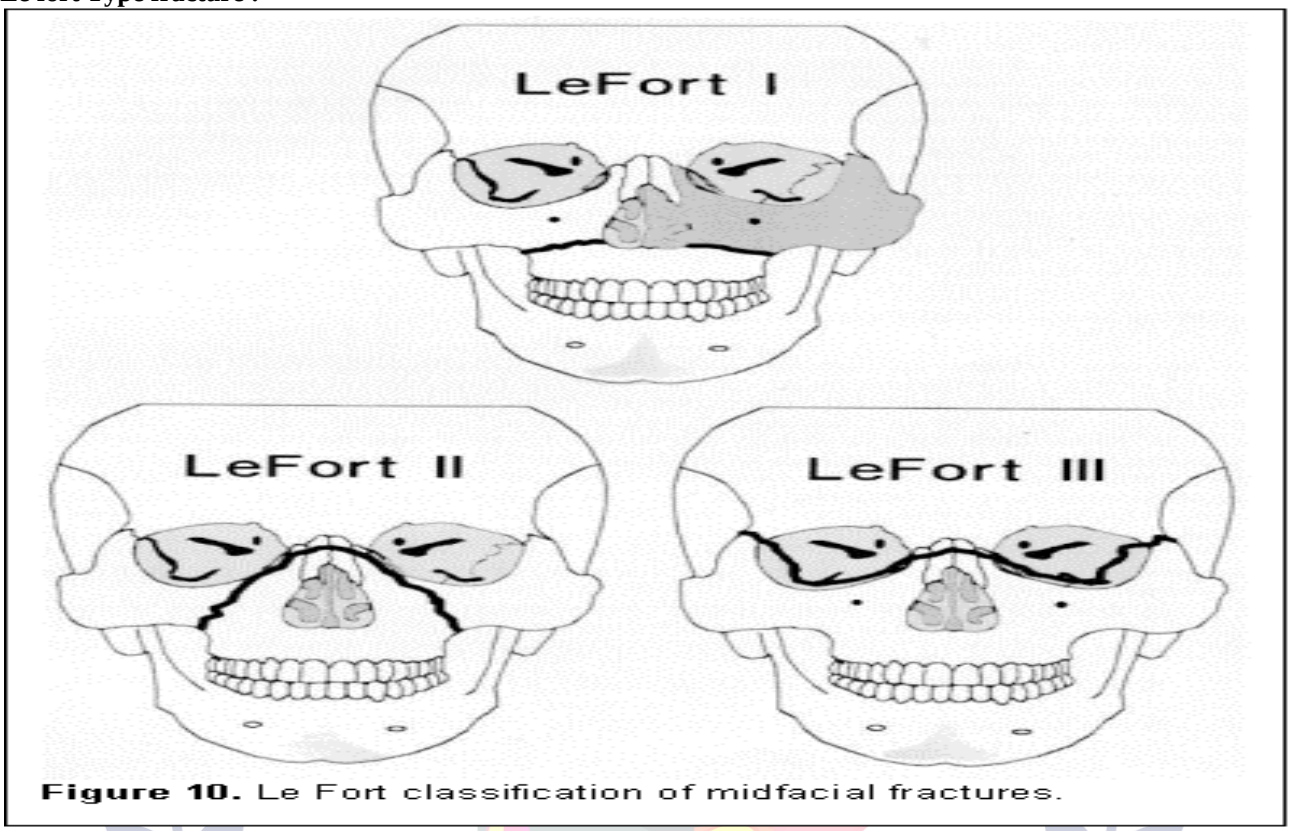


Figure 10. Le Fort classification of midfacial fractures.

Type 1 (transverse) (infra orbital nerve damage) Facial skeleton is separate fracture line Through the floor of the maxilla of both sides Above the nasal cavity floor And through the nasal septum Infer. Parts of the Medial & lateral pterygoids	Type 2 (pyramidal) Dysjunction Floor of the maxilla Through zygomatico maxillary suture line Floor of the orbit Lacrimal bone nasion	Type 3 (cranio-facial) From the cranial base) Root of nose Ethmofrontal junction Superior orbital tissue Lateral wall of orbit Zygomaticotemppra; suture Temperozygomatic suture Upper part of pterygoid

Zygomatic fracture : (tripod fracture)
Commonly called tripod fracture since the bone breaks at three places

Frontozygomatic suture — infraorbital rim — zygomatico-temporal suture

(Posterior to it)

Feature :

a. Step – deformity at the infra – orbital margin
b. Flattening of the malar prominence
c. Anesthesia in the distribution of the infra – orbital nerve
d. Trismus
e. Restricted ocular movement
f. Periorbital emphysema

**Diagnosis: Water's view
C.T. scan (orbit)

Treatment

- Only displaced fracture are to be trated
- Open reduction and internal wire fixation is to be carried out
- Orbital fracture:
- Orbital fracture predominantly involve the floor\
- It is commonly found in association with Le fort type 2 and zygomatcio fractures

Blow out fractures of the orbit – isolated fracture of the orbital floor following injury with large blunt object

Symptoms

- Restriction of extra ocular mobility (esp. upward gaze)
- Infra orbital anaesthesia
- Exophthalmos
- Ecchymosis
- Diplopia
- Radiology

PNS x-rays ; 70% if them demonstrate orbital fracutes
CT scan : tear – drop sign in the antrum roof (due to herniation of the orbital fat)
Treatment
Surgery required only when Enopthalmos and
Diplopia is present
It is performed 7-10 days later or immediately if visual acuity is affected

DEVELOPMENT OF NOSE

- Starts by 4th week of IUL.
- Paired thickenings known as olfactory placodes arise from cranial ectoderm – deepen to form nasal pits and nasal sacs.

This is closed posteriorly by bucconasal membrance

Importance of Bucconasal Membrane

- ✓ Persistence of bucconasal membrane leads to choanal atresia.
- ✓ Defective fusion between the medial nasal processes leads to nasal dermoid and bifid nasal tip.
  Defective fusion between frononasal process and maxillary processs leads to cleft lip deformity.
- ✓ Defective fusion between palatal processes with each other leads to cleft palate.

Vomeronasal Organ of Jacobson :

- It is an accessory olfactory organ with a chemreceptor function found in primates and lower mammals analogous to the flicking tongue in reptiles and snakes.

➢ The frontonasal prominence surrounds the ventrolateral part of the forebrain, which gives rise to the optic vesicles. These vesicles project from the sides of the forebrain into the mesenchyme and form the eyes. The frontal portion of the frontonasal prominence forms the forehead, whereas the nasal part of the frontonasal prominence forms the rostral boundary of the stomodeum and nose.

A summary of the derivatives of the prominences is as follows:

- Frontonasal prominence - Forehead and the dorsum apex of the nose
- Lateral nasal prominences - Sides (alae) of the nose
- Medial nasal prominences - Nasal septum
- Maxillary prominences - Upper cheek region and most of the upper lip
- Mandibular prominences - Chin, lower lip, and lower cheek regions
- Mesenchyme in the facial prominences - Fleshy derivatives and various bones

DEVELOPMETN ANOMALIES

Choanal atresia:

- Most common congenital anomaly of nose
  Due to persistence of bucconasal membrane.
- Incidence – 1/8000 live births
  M:F – 1:2
  90 % bony 10% membranous
  May be unilateral or bilateral
- Presentation :
  B/L choanal atresia presents as acute respiratory at birth, since newborns are obligate nose breathers. The classical cyclical cyanosis (blue spells relieved by crying) is seen.
  U/L atresia presentation is more vague; as feeding difficulty and U/L nasal discharge.

- **Management:**

✓ Emergency management of respiratory obstruction requires only an oral airway

✓ Definitive management – surgical approach of choice is transnasal endoscopic repair. Other approaches are transseptal and transpalatal approaches.

NASAL DERMOID

- Swelling root of nose.
- Infectionof nasal dermoid can predispose to meningitis and brain abscess.
- D/D:Meningoencephalocele and glioma – protrusion of meningitis and brain matter through a defect in the skull base. In meningoencephalocele there is a patent communication with the intracranial cavity, white in flioma there is no patent communication but only a cord-like thickening.
- Presentation of Meningoencephalocele:
  Pulsatile/ compressible swelling root of nose with an impulse on straining or crying (Furstenberg sign) due to the intracranial communication.
- CT scan can demonstrate the defect in the skull base.
- However, MRI clearly differentiates between cyst, meninges, and brain matter, and hence the investigation of choice.

CLEFT LIP AND CLEFT PALATE

- Orofacial clefting is te commonest congenital malformation of craniofacial skeleton.
- Maximum incidence in North American IndiansandJapanese.
- Lowest incidence in Negroes.
- U/L clefting is commoner than B/L (U/L:B/L- 2:1)
  U/L clefts are more seen on Lt. side.
- Commonest Type:
  Cleft lip with or without cleft palate.
- Sex Incidence:
  In cleft lip with or without cleft palate males predominate (M:F-2:1), while females outnumber males in isolated cleft palate (M:F-1:2)
- There are more than 300 syndromes associated with orofacial clefting, which is more with cleft palate alone. These include, Pierre Robin sequence, Aperts, Treacher Collin's, Goldenha, DiGeorge comples, Down's syndrome, and Klippel Feil syndrome.
- Management:

At Birth – Cosmetic
Parental counseling
Presurgical orthopedics (orthodontic manipulation of cleft alveolar segments to facilitate later repair)

- CLEFT LIP REPAIR:

Indcation – Cosmetic
At 3 months
Rule of 10 (Age > 10 weeks , weight > 10 pounds, Hb> gm%, TC<10,000)
Type - U/L – Millard repair
B/L – Veau III repair

- CLEFT PALATE REPAIR:
  Indications – velopharyngeal insufficiency, recurrent middle ear infections, speech abnormality, and dental.
  At 9-12 months
- Type – Veau – Wardill – Kilner (V-Y) repair

Speech Abnormality in Cleft Palate:

- Speech abnormality in cleft palate is hypernasal speech known as Rhinolalia Aperta.
- Also seen in palatal palsy and immediately after surgery for bilateral nasal obstruction.

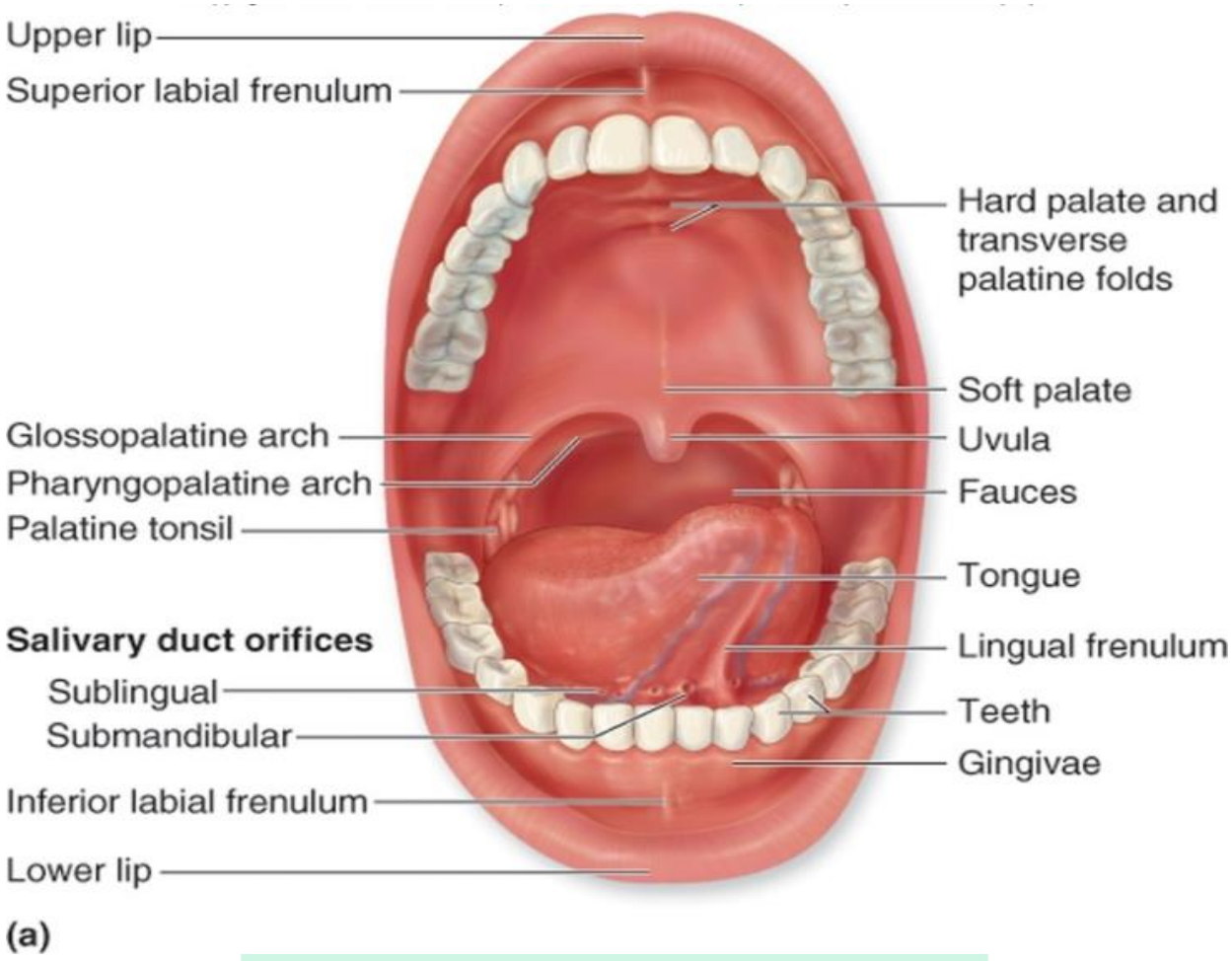
KARTAGENER'S SYNDROME (IMMOTILE CILIA SYNDROME/PRIMARY CILIARY DYSKINESIA)

- Autosomal recessive
- Partial or complete dynein arm deficiency of respiratory tract cilia along with structural abnormality of radial spokes and microtubules resulting in ciliary dyskinesia and defective mucociliary clearance.
- Leads to stasis and bacterial overgrowth.
- Characterized by bronchiectasis, sinusitis

ORAL CAVITY AND TONSILLS

ANATOMY OF ORAL CAVITY

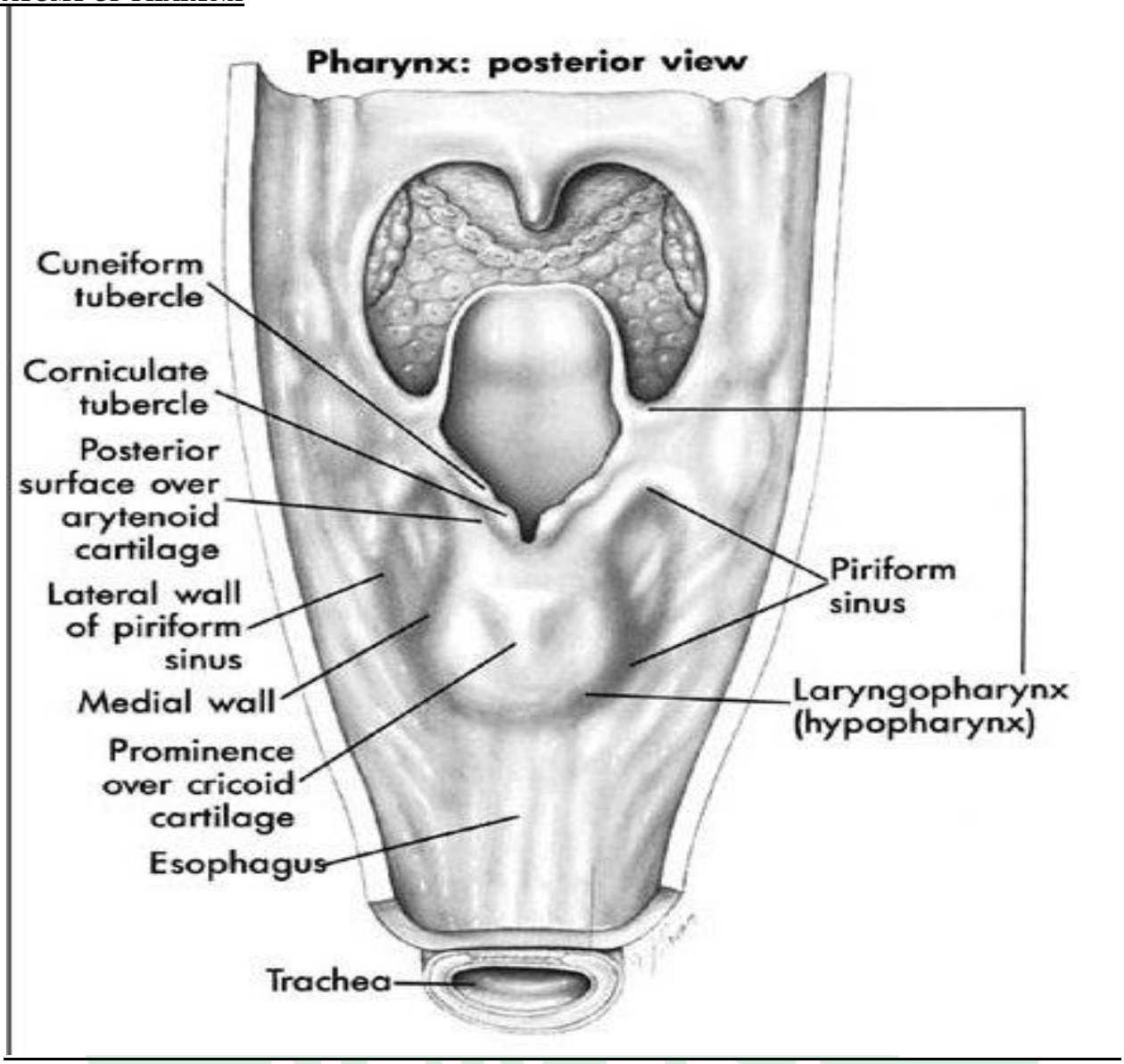
- Oral cavity extends from lips to oropharyngeal isthmus i.e. posterior margin of hard palate and junction of palatoglossal arch with the tongue.



Contents:

- ✓ Lips
- ✓ Buccal mucosa
- ✓ Gingival
- ✓ Retro molar trigone
- ✓ Hard palate
- ✓ Oral tongue – anterior 2/3
- ✓ Floor of mouth

ANATOMY OF PHARYNX



- Pharynx extends from base of skull to lower bordere of criocid cartilage
- 12 – 14 cm
- Width – 3.5cm at base to 1.5cm at cricoesophageal junction which is the narrowest part of digestive tract.

DIVISION OF PHARYNX:

1.NASOPHRAYNX:→ Extends from base of skull to plane passing through hard palate.

- Roof → basisphenoid & basiocciput
- Posterior wall → C1 vertebral
- Floor → Soft palate anteriorly
  Nasopharyngeal isthmus posteriorly
- Anterior wall → Choanae
- Lateral wall → Pharyngeal opening of Eustachian tube situated 1.25cm behind the posterior end of inferior turbinate.
- It is bounded above & behind by torus tubaris behind which is a recess called fossa of rosenmuller.

- **Adenoids:**Sub epithelial collection of lymphoid tissue at the junction of roof and posterior wall of nasopharynx.
- **Nasopharyngeal bursa:**

Epithelial lined median recess extending from pharyngeal mucosa to the periosteum of basiocciput. Represents attachment of notochord to pharyngeal endoderm during embryonic life. Abscess of this bursa is k/a **Thornwald's disease**.

- **Sinus of morgagni:**

Space between base of skull and upper free border of superior constrictor muscle. Through this pass auditory tube, levator palate muscle and ascending palatine artery.

- **Passavant's ridge :**

Mucosal ridge raised by fibers of palatopharyngeus and superior constriction. Soft palate makes firm contact with this ridge to cut off nasopharynx from oropharynx during deglutition and speech.

2.OROPHARYNX:

- Extends from hard palate above to hyoid below.
- **Boundaries:**
  - ✓ Posterior wall – posterior pharyngeal wall lying opposite C2 & C3-
  - ✓ Anterior wall

  a. Base of tongue – posterior to civallate papillae
  b. Lingual tonsils
  c. Vallecular – between base of tongue and anterior surface of epiglottis.
- **Lateral wall**

  a. Palatine (faucial) tonsil
  b. Anterior pillar (palatoglossal arch)
  c. Posterior pillar (palatophryngeal arch)
- **Inferior boundary**
  - Upper border of epiglottis
  - Pharngoepiglottic folder

3.HYPOPHARYNX (laryngopharynx)

- Lies b/w body of hyoid to lower border of cricoid cartilage. Lies opposite C3,4,5,6 cervical vertebrae.
- Subdivided into three regions

A. Pyriform sinus (fossa):

Bounded by
- ✓ Superiorly – pharngoepiglottic fords
- ✓ Inferiorly – lower border of cricoid
- ✓ Laterally – thyrohyoid membrane & thyroid cartilage
- ✓ Medially – aryepiglottic fold,
- ✓ Posterolateral surface of arytenoids and cricoid cartilages

Importance:

1. Forms lateral channel for food
2. Foreign bodies may lodge here
3. Internal laryngeal nerve runs submucosally here thus

- Easily accessible to anesthesia
- Pain referred to ear in carcinoma pyriform sinus

B. Post cricoid region:

- Lies between upper & lower borders of cricoid lamina.
- Commonest site of carcinoma in females suffering from plummer Vinson syndrome.

C. Posterior pharyngeal wall:

- Extends from hyoid bone to cricoarytenoid joint.

VINCENT'S ANGINA Vs. LUDWIG'S ANGINA

Vincent's angina	Ludwig's angina
• Also k/as acute necrotizing ulcerative gingivitis/Trench Mouth	• Usually starts in infected Lower Molar 2nd & 3rd. (Cellulitis of floor of mouth)
• Halitosis and ulceration of the interdental papillae.	• Rapidly spreading, Life-threatening cellulitis of sublingual/submand spaces.
• Cause – *Oral anaerobes* (P. intermedia) - Gm- fusiform bacilli (Fusobacterium nucleatum) - Spirochete denticola	• Cause: Anaerobes, strepto
• Patch (grayish-white pseudomembrane) in mouth Tracheostomy in case of glottis edema penicillin (high doses) + metro IV therapy.	• T/t: Intubation/emergency

SUBMUCOUS FIBROSIS

- Chronic insidious process characterized by fibrosis in sub mucosal layers of oral cavity. Described in India by Joshi in 1953.
- **Etiology :**

a. Prolonged local irritation: Due to mechanical and chemical irritation caused by chewing betel nut.
b. Dietary deficiency : VitA; VitB complex
c. Localized collagen disese
d. Racial : mainly affects Indians

- **Pathology:**

Epithelial atrophy & sub mucosal fibro elastic transformation.

↓

Progressive trismus and difficulty to protrude the tongue.

- **Clinical features**

- Age → 20-40 years
- Sex → F > M
- Is premalignant
- Difficulty to open mouth fully
- Difficulty to protrude the tongue
- Soreness of mouth with constant burning sensation

Treatment :

- **Medical –**Steroids – - Topical injection of steroids combined with hyalase.
  - Avoid irritant factors
  - Treat anemia and vitamin deficiencies
- Surgery: Mucosal Flaps and stripping of affected sub mucosal tissue is done

Carcinoma Lip : most common cancer of oral cavity

- Sex : M>F
- Age: 40-70 years
- Site: Lower lip, between commissure and midline of lip
- LN inv: Submental & submandibular involved 1st followed by deep cervical nodes.
- Pathology : 98% are squamous cell carcinoma which can be endophytic, verrucous and ulcerative.
- Treatment : - < 2cm diameter
  Interstitial radiotherapy
  Or
  Surgery
  - Larger lesions – resection with reconstruction

Carcinoma buccal mucosa

- Squamous cell carcinoma is most common
- Commonest site of origin is buccal sulcus
- Submandibular and upper deep cervical nodes involved
- Treatment: -
  - < 2 cm – surgical removal with safe margin
  - Larger lesions with no encroachment on bone – intersititial radiotherapy
    OR
  - Surgery

  Involvement of bone also: wide resection with neck dissection with postoperative radiotherapy.

Carcinoma oral tongue

- Age : 50 – 70 years
- Sex : M>F
- Site : Lateral border most common
- LN : Lateral border – submandibular and upper deep cervical
  Tip – Submandibular and submental & lower deep jugular
- Treatment : < 2 cm – surgical excision
  Or
  Interstitial radiotherapy
  >2cm – hemiglossectomy with or without neck dissection

NEOPLASMS OF SALIVARY GLANDS

- 75% salivary gland tumor arise in parotid
- 805 of these are benign & 80% of benign tumors in parotid are pleomorphic adenoma
- Adenolymphoma (bengin tumor) seen in 5^{th} – 7^{th} decase with M>F; also known as Warthin's tumor. Hot spot is seen with Tc99 scan.
- MC malignant tumor of parotid is muco-epidermoid carcinoma
- MC malignant tumor of minor salivary gland is Adenoid cystic carcinoma shows perineural spread.
- MC benign tumor of parotid in children is hemangioma

PALATINE TONSIL

- **Definitions:** Palatine tonsil is an oval mass of specialized subepitbelial lymphoid tissue situated between the palatopharyngeal and palatoglossal folds.

PLICA TRIANGULARIS

~ Shape: Triangle fold of mucosu membrane
~ Site: covers the antero-inferior part of the tonsil

PLICA SEMILUNARIS

~ Is a semilunar fold of mucous membrane
~ Covers the upper pole of the tonsil.

- **Feature:**

a. Lining mucosa: Non-keratinizing stratified squamous epithelium
b. Each tonsil has 15-20 crypts
c. Intratonsillar cleft – represent persistence of the ventral portion of the second pharyngeal pouch.
d. Tonsillar sinus: is a triangular recess between the palatopharyngeus and palatoglossal muscle.

- **Nerve supply:**By the tonsillar branch of the 9^{th} nerve.Upper part of the tonsil : lesser palatine nerve
- **Blood supply:**
  - ✓ Tonsillar branch: Facial artery
  - ✓ Ascending palatine: facial artery
  - ✓ Dorsal linguae : lingual artery
  - ✓ Descending palatine: maxillary artery
  - ✓ Tonsillar branch: ascending pharyngeal artery
- **Venous drainage:**Paratonsillar vein – pharyngeal plexus or facial vein pterygoid plexus common
- Lymphatic drainage:Upper deep jugulodigastric lymph nodes

Tonsillectomy

Absolute indications	Relative Indication	Contraindications
• Recurrent attacks of tonsillitis • Quinsy • Tonsillitis causing upper airway obstruction (sleep apnoea) • Suspected 1 malignancy	• Diphtheria carriers who do not respond to antibiotics • Streptococcal carriers • Chronic tonsillitis with halitosis • Recurrent streptococcal tonsillitis in a patient with valvular heart diseases	• Hb<10gm% • Acute UR1 (even acute tonsillitis) • Cleft palate • Bleeding disorder • Children <3 yr • DM.HTN, asthma (uncontrolled, systemic disorder) • Epidemic of polio, Menstruation

Newer Methods of tonsillectomy:

1. Harmonic scalpel
2. Microdebrider
3. Coblation tonsillectomy
4. Radiofrequency tonsillectomy
5. Tonsillotomy

Tonsillotomy :

- Recent studies have demonstrated that removal of tonsil tissue with preservation of the tonsillar capsule may decrease postoperative pain by protecting the underlying pharyngeal musculature. Proponents argue that patients with obstructive symptoms can be treated just as effectively with significantly less morbidity. Opponents express concern regarding potential tonsillar regrowth, possible infection of the tonsillar remnant, and the potential need for repeat tonsillectomy

INTERVAL TONSILLECTOMY:

- Patient to undergo tonsillectomy: at 6 weeks if recurrent quinsy
- Tonsillectomy performed in the acute stage

OTHER DISORDERS WHERE TONSILLECTOMY MAY BE USEFULL

1. PFAPR (PERIODIC FEVER ADENITIS AND PAHRYNGITIS SYNDROME)
2. PANDAS (Pediatric Autoimmune Neuropsychiatric Disorders Associated with Streptococcal infections)
3. IG A NEPHROPATHY

Complications of tonsillectomy :

Immediate		**Delayed**
Primary hge	**Reactionary hge**	**Secondary hge**: ***between 5th and 10th post op days*** due ***to infection*** Qand premature separation of membranes
Occurs *at time of surgery*Q*due to injury to paratonsilar vein*	Occurs within *24 hrs of surgery due to slipping of the ligature or rise of B.P.*	

[

Acute tonsillitis:

- **Organism:**Most common β hemolytic streptococcus

Others - staphylococcus
- Hemophilus
- Pneumococcus

Viral causes: adenovirus > Ebstein Barr > influenza

- Symptoms:

✓ Fever, headache, malasise, general body ache
✓ Soar throat
✓ Dysphagia
✓ Earache

- **Signs** :

✓ Inflarned tonsils, pillars, soft palate, uvula
✓ B/I jugulodigastric lymph nodes are enlarged and tender.

Treatment:

- Antibiotics – pencillin group 7-10 days
- Analgesics

Complications of untreated tonsillar infection:

- Chronic tonsillitis
- Peritonsillar abscess
- Para pharyngeal abscess
- Cervical abscess
- Acute otitis media
- Rheumatic fever
- Acute glomerulonephritis
- Sub acute bacterial endocarditis

MEMBRANE OVER THE TONSILS:

- Membranous tonsillitis
- Diphtheria : membrane is dirty grey
  - Removal causes bleeding
- Vincent's angina
- Infectious mononucleosis
- Agranulocytosis
- Leukemia
- Apthous ulcer
- Malignancy tonsil
- Traumatic ulcer

PERITONSILLAR ABSCESS (QUINSY)

- Definition: is a collection of **pus between the fibrous capsule and the superior constrictor**.
- Commonest site: **Tonsillar upper pole.**
- Etiology: occurs as **a complication of acute tonsillitis**
- May arise de novo without a preceding history of tonsillitis
- Age group – **adults commonly**
- Organisms: **mixed flora (anaerobes and aerobes)**
- Clinical feature: fever (104° F) with chills and rigors
    - General body ache
    - Earache
    - Trismus (spasm of pterygoid muscles)
- Treatment – hospitalization. Intra oral USG is useful to localize pus.

i.v. fluids, antibiotics, analgesics
I & D : if soft palate bulge
No adequate response
Within 24 hrs of the antibiotic therapy

Latest theory supports that Quinsy is due to infection of Minor Salivary Glands in tonsillar bed.

RETROPHARYNGEAL ABSCESS

- Extent: From the skull base to the bifurcation of trachea
- Boundaries:
    - ✓ antrly buccopharyngeal fascia covering the constrictors.
    - ✓ Posteriorly prevertebral fascia
    - ✓ Laterally carotid sheath
- Features: it is a potential space.It is divided in to 2 lateral compartments space of Gillete.
  The space is filled with loose areolar tissue and retropharyngeal lymph nodes which disappear by 3-4 years of age
- **NODES OF ROUVIERE**: forms the main and constant lateral group of retropharyngeal lymph node.
- Position: lies anterior to the lateral mass of the atlas at the lateral border of longus capitis muscle.

Retropharyngeal abscess

Acute:

- Children:Cause: suppuration of retropharyngeal lymph nodes due to infection at its draining sites: adenoids, nasopharynx, posterior nasal sinuses or nasal cavity.
- Adults:Cause: Penetrating injuries to the posterior. Pharyngeal wall or the cervical esophagus. i.e fish bone.
- Ludwiga angina may have extension into retropharyngeal space.
- Features:

✓ Dysphagia
✓ Fever
✓ Difficulty breathing – stridor or croupy cough
✓ Torticollis
✓ Bulge in posterior pharyngeal wall

- Treatment:I & D without general anesthesia

- Antibiotics
- Tracheostomy: if large abscess causing mechanical obstruction to the airway

CHRONIC:

- Cause: T B of the cervical spine.TB of the retropharyngeal lymph nodes secondary to tuberculosis of the deep cervical lymph nodes
- **Feature:**

- Discomfort in the throat
- Pain
- Fever
- Progressive neurolocial signs and symptoms due to spinal cord compression.
- Neck may show tubercular lymph nodes

- **Treatment :**Enternal drainage – Drainage through cervical incision

-High abscess: vertical incision along the posterior border of sternocleidomastoid
-Low abscess: Vertical incision along the anterior border of sternocleidomastoid muscle

PARAPHARYNGEAL ABSCESS

- Extent: Skull base to the hyoid bone
- Boundaries: shape: inverted 5 sided pyramid

✓ Base: Greater wing of sphenoid
✓ Infrly. By the fascia surrounding the submandibular gland
✓ Latr.lly : Ramus of the mandible and deep lobe of the parotid
✓ Medially: Eustachian tube
  - Pharynx
  - Palatine tonsil

✓ Postrly: vertebral and prevvertbral muscles
✓ Antrly : Pterygoid muscles and interptergoid fascia

Content:

Perestyloid compartment
- Pterygoids

✓ Tensor villi palatine

Post-styloid
-Neurovascular bundle
-Internal carotid artery
- Interal jugular vein
- IX, X. XI, XII cranial nerves
- Sympathetic chain

Others contents: Loose areolar tissue and lymph nodes

- Features: The para pharyngeal space communivates with the retropharyngeal, Parotid: submandibular, carotid and visceral spaces.
- Etiology:
  - ✓ Pharynx: Tonsil,Adenoids,Peritonsillar abscess
  - ✓ Teeth – Dental infections
  - ✓ Ear – Petrositis & Bezold's
  - ✓ Infection from the communicating spaces
  - ✓ External trauma: Penetrating injuires of the neck

CLINICAL SYMPTOMS & SIGNS

Anterior compartment
~Prolapse of the tonsil and tonsillar fossa
~Trismus
~External swelling behind the angle of the jaw
~Marked odynophagia

Posterior compartment
~Bulge in pharyngeal wall posterior to the posterior pillar
~IX, X, XI, XII palsy
~Sympathetic chain involvement
~Parotid bulge
~Minimal trismus

TREATMENT

Abscess drainage: Through a collar incision in the neck at the level of hyoid –bone
I.V. antibiotics

COMPLICATION

- Laryngeal edema
- Spread to retropharyngeal space
- Jugular vein thrombophlebitis
- Spread to mediastinum along the carotid space
- Erosion of the carotid artery

INFECTIOUS MONONUCLEOSIS

- ✓ [**Glandular disease**]
- ✓ Etiology: Ebstein Barr virus organism can be isolated from -Blood
  - Lymph node
  - Saliva
- ✓ AGE GROUP: young adults
- ✓ CLINICAL FEATURES: - Incubation period : 5-7 weeks
  - Prodromal phase : 4-5 days

- Most common manifestation] : tender enlargement of cervical lymph nodes
- Soar throat
- Fever (in severe form)
- Splenomegaly (50%)
- Hepatomegaly [10%] – abnormal liver function test : 10%
- Rubelliform rashes : Sometimes if ampicillin given
- Ampicillin is contraindicated in Infectious Mononucleosis.

Other rare manifestations

Facial Palsy | Gullian Barre syndrome | Meningo encephalitis | Myelitis | Myocarditis | Nephritis | Pericarditis | Pneumonia

- **Blood picture:** WBC remain normal in the 1st week and rises in the second week

(50% mononuclear)
(1% atypical)

More than 10% of Atypical cells is diagnostic IM

- Paul Bunnel & Monospot test:

Positive in 90% of the test in the 1st week
Occasionally the patient may have hemolytic anemia, Aplastic anemia or Thrombocytopenia.

- ➢ Diagnostic Test remains IgM antibodies against VCA .
- ➢ To avoid contact sports like football , rugby for couple of years for the fear spleenic rupture.
- ➢ Steroids are given if airway oedema and impending air obstruction is present.

KERATOSIS PHARYNGES

- Features : benign condition

- Horny excrescences on the tonsillar surfaces, pharyngeal wall or lingual Tonsils: appear as white / yellow dots & cannot be wiped off.
- No constitutional symptoms
- Reassurance: Treatment modality

ADENOIDS – [nasopharyngeal tonsil]

- Definition : Adenoids are lymphoid tissue located at the junction of nasopharyngeal roof and the posterior pharyngeal wall
- Features : are lined by ciliated columnar epithelium
  - Have no capsule / crypts
  - Are present at birth
  - Not visible on X-ray in children under 1 month of age
  - Clinically seen by the 4th month
  - Visible radio graphically in children more than 6 month of age
  - Hypertrophy 3-5 years
  - Involution after puberty
- nasopharyngeal mass in neonates suspect ENCEPHALOCOELE

ADENOID HYPERTROPHY

Etiology

- Rhinitis
- Sinusitis
- Allergy

Clinical symptoms:

Nasal symptoms	Aural symptoms	General symptoms
- Nasal obstruction	- Conductive hearing - loss	Elongated dull face
- Wet bubbly nose	- Recurrent attacks of acute Otitis media	- Dull expression
- Sinusitis	- C.S.O.M	- Open mouth
- Epistaxis		- Crowded upper teeth
		- Hitched up upper lip

Treatment: Adenoidectomy

Grading of adenoids:

Grade 1 hypertrophy - About 3-6mm of minimum airway on lat xray (Borderline for surgery)
Grade 2 Hypertrophy- 1-3 mm of minimum airway on lat xray (Needs surgery)
Grade 3 Hypertrophy- complete obstruction (definite surgery)

Adenoidectomy contraindicated in :

1. Cleft palate
2. Velopharyngeal insufficiency
3. Meningeocele

THORNWALDT'S CYST

- Site : in the posterior nasopharyngeal wall

Just above the upper fibres of superior constrictor

- **Features :**
  - ✓ is a cystic notochordal remnant
  - ✓ Persistent post – nasal discharge
  - ✓ Nasal obstruction
  - ✓ Obstruction of the Eustachian tube openings : B/L
  - ✓ Occiptial headache

Treatment : antibiotics – infection
Marsupilization

PHARYNGEAL POUCHES

- ✓ Types are : Congenital diverticula : Is covered by all the muscle layers of the viscus. Eg. Meckel's diverticulum's
  - Acquired diverticula : is a circumscribed pouch caused by protrusion of the mucosa through the muscle layers of the wall of an organ.
- ✓ Pharyngo – oesophageal diverticula arise above the criopharynx: most commonly arise above the cricopharynx.

- The weak areas of the pharynx through which the diverticula may form:

Posterior	Lateral
Killian's dehiscence (b/w thyropharyngeus & cricopharyngeus)	- Above the superior constrictor - B/W the superior and the middle
Laimer – hackerman's area (in the upper posterior part of the esophagus, just below the cricopharynx where the longitudinal fibers do not cover the circular fibers)	- B/W the middle and the inferior constrictor - Below the cricopharyngeus (Killian – Jamieson's area)

- ✓ Zenker's diverticula : (Posterior pharyngeal pulsion diverticulum)
- ✓ Site of origin: Killian's dehiscence area
- ✓ Etiology: Theories
    a. Tonic spasm of the cricopharyngeus
    b. Lack of inhibitory stimuli to the cricopharynx.
    c. Premature contraction during the act of deglutition
    d. Neuromuscular inco-ordination and congenital weakness.
- ✓ Feature : seen after 60 years of age
- ✓ Male : female = 2:1

- Dysphagia
~ Feeling of food sticking in the throat
~↑ing difficulty to swallow solids – followed by semisolids – then liquids
- Regurgitation of food (undigesterd food – in the mouth)
- Weight loss
- Hoarsensess: (Sac contents spill in the larynx – laryngitis)
- Pulmonary complications (Pneumonitis, bronchiectasis, lung, abscess

- Feature : **Signs L Boyce's sign** : soft swelling on the left side, in the lower part of the anterior triangle which gurgles on palpation

TREATMENT

No treatment : if the general condition of patient is poor

Endoscopic treatment

Dilatation Of the sphincter (Temproary relief) | Septum (Dolman's operation) | Endoscopic diathermy of the diverticulo-esophageal

External surgical approach: Pouch excision & cricopharyngeal myotomy through lateral pharyngotomy approach.

LARYNX

Anatomy of the larynx and tracheobronchial tree

- Larynx lies opp. **3rd - 6th** cervical vertebrae
- Infant larynx is smaller, funnel shaped, narrow lumen, higher up & contains more of submucosal tissue
- 3 unpaired (Epiglottis, thyroid, cricoid) & 3 paired (Arytenoid, Corniculate & Cuneiform) cartilages
- Epiglottis - leaf like yellow elastic cartilage
- Thyroid - Largest of all the cartilages
- Its two alae meet anteriorly forming an angle of 90° in males & 120° in females
- VC are attached to the middle of thyroid angle
- Most of laryngeal foreign bodies are arrested above the vocal cords
- Cricoid - Only cartilage forming a complete ring
- Its post part is expanded to form a lamina while anteriorly it is narrow
- Laryngeal joints (cricoarytenoid, cricothyroid) - Synovial joints
- Thyrohyoid menus - is pierced by superior laryngeal vessels & internal laryngeal N.
- Cricovocal menus - forms the vocal ligament
- Intrinsic muscles of larynx acting on VC:
    - Abductor - Post. cricoarytenoid
    - Adductor - Lat. cricoarytenoid
        - Interarytenoid (Transverse arytenoid)
        - Thyro arytenoid (External part)
    - Tensors - Cricothyroid
      Vocalis (Internal part of Thyroarytenoid)
- Depressors of larynx - Stenohyoid, Sternothyroid, Ornohyoid
- Vestibular & vocal folds divide the laryngeal cavity into 3 parts - vestibule, ventricle & subglottic space
- Glottis (Rima glottidis) - is the elongated space between vocal cords anteriorly & arytenoids posteriorly
- Antero - posteriorly it is about 24mm in men & 16mm in women
- It is the narrowest part of laryngeal cavity
- Anterior 2/3rd of VC are membranous & post. 1/3rd cartilagenous

- Epithelium is ciliated columnar type except over the VC & upper part of the vestibule where it is stratified squamous type
- There are no mucous glands in the vocal folds

Summary of Innervation of the Vocal Cord.	
Muscle	**Nerve**
Adductors (lateral cricoarytenoid, thyroarytenoid, interarytenoids)	Recurrent laryngeal (adductor branch)
Posterior cricoarytenoid	Recurrent laryngeal (abductor branch)
Cricothyroid	External laryngeal

- ***Lymphatic drainage*** - Supraglottic larynx is drained by lymphatics which pierce the Thyroihyoid membrane & go to upper deep cervical.

Infraglottic larynx is drained by lymphatics which pierce the cricothyroid membrane & go to prelaryngeal & pretracheal nodes & then to lower deep cervical & mediastinal nodes

There are NO lymphatics in VC hence carcinoma of this site rarely shows lymphatic metastases

- ***Pre - epiglottic Space*** (Space of Boyer) - filled with fat, areolar tissue & some lymphatics
- ***Reinke's Space*** - Under the epithelium of VC is a potential space with scanty subepithelial connective tissue
- **Functions of the Larynx** :1. Protection of lower airway (Phylogenetically this is the earliest function to develop ; voice production is secondary)Respiration temporarily ceases through a reflex generated by ninth nerve when food comes in contact with post. Pharyngeal wall or base of tongue

2. Voice production (Phonation)

3. Respiration - VC abduct during Inspiration adduct during expiration

4. Fixation of chest : Increases Intra abdominal pressure

It is important in digging, pulling, climbing, coughing, vomiting, defaecation, micturition & childbirth

Common facts : Larynx

- Narrowest part of larynx in adult is — glottis (cricoio/sub-glottis in child)
- [Mnemonic: **C**ricoid in **c**hild & **G**lottis in **G**entleman].
- Lymphatic spread is not seen in carcinoma glottis because there is no lymphatic drainage of the glottis
- Main function of larynx— protection of airway
- Posterior crico-arytenoid is the only abductor of Lx (s/by RLN).
- Pyriform fossa is present in laryngo-pharynx.

Laryngomalacia

- **M/c** cause **of stridor in newborn child**.
- **M/c congenital** condition of larynx.
- Stridor **is present but cry is normal** . Stridor is d/to partial or complete collapse of supraglottic structures on inspiration
- Stridor is intermittent i.e. **↑ed ed on crying and relieved in prone position.**
- ***'Omega shaped'*** *epiglottis* seen.

- T/t: Wait and watch. Rarely aryepiglottoplasty or supraglottoplasty may be required

  - *Cry is normal in → Laryngomalacia, subglottic stenosis, & congenital subglottic hemangioma.*
  - *Cry is abnormal in → Laryngeal web, laryngeal paralysis, congenital laryngeal cyst. (VC are abnormal)*

Laryngocoele

- It is air filled cystic swelling due to abnormal dilatation of the **saccule of the ventricle**.
- Laryngocoel *arise from* raised transglottic pressure as in trumphet player, glass blowers.
- *Presents as* hoarseness, cough, airway obstruction.
- External laryngocoel pierces thyrohyoid membrane.
- *D/g* can be made by laryngoscopy. Soft tissue X-ray.
- *T/t* is surgical excision through an external neck incision.
- Marsupialization of an internal laryngocele.

Laryngeal **Pseudo-sulcus**

- Infraglottic edema extending from the anterior commissure to the posterior larynx.
- Seen on ventral surface of vocal fold, in laryngo-pharyngeal reflux
- Also called pseudosulcus-vocalis

Zenker's Diverticuium

- Also k/ as **pharyngo-esophageal diverticulum**
- Outpouching *of anterior* pharyngeaf mucosa d/to detect *in chcopharyngens,* lies just above this m/s
- Occlusive mechanism is most important factor. ZD is **a pulsion diverticulum** caused by high pressure proximal to LES & UES (Recall that mid **esophageal diverticulum is a traction** diverticulum).
- Symptoms are oropharyngeal dysphagia & regurgitation of undigested food → foul smelling odor from mouth.
- Simple barium swallow is sufficient to diagnose.
- Endoscopy is contraindicated (risk of perforation).
- T/t: No t/t for asymptomatic/ small Z~, for large symptomatic cases incise cricopharyngeus.

Killian's dehiscence

- Herniation or outpouching of *posterior* pharyngeal mucosa, through Killian's Laimcr triangle, just above esophagus.
- Inferior constrictor m/s has 2 parts – *thyropharyngeus* (oblique fibres) and *cricophuryngeus* (transverse fibres) the potential space b/n fibres is known as k-~. It is vulnerable for perforation during esophagoscopy.

Passavant's ridge ---

Is formed by contraction of palatopharyngeus & **superior** canstrictors. Soft palate makes firm contact with it during deglutition or speech & cut off nasopharynx from oropharynx

Androphomia is male voice (low pitch) in females. Corrected by type IV thyroplasty (lengthening of VC)

Puberphonia (Adolescent/mutatiunal falsetto) is persistence of high pitch voice usually in males beyond the age at which the pitch of ones voice is expected to lower. T/t is type III thyroplasty (shortening/loosening of VC) for extreme cases.

- *Puberty dysphonia is due to — Over tensed vocal cords*
- *Functional aphonia or hysterical aphonia — A functional disorder seen in emotionally labile females*
- *Dysphonia plica ventrictilaris — voice is produced by* ***ventricular bands*** */false vocal cords.*
- *Spasmodic dysphonia(LaryngeaI dystonia) is d/ to — Psychological or neurological cause.*
- *After total laryngectomy esophageal spcech is utilized in voice production.*
- *Topical mitomycin -C, antibiotic isolated from streptomyces is used for t/t of laryngeal stenosis.*

Spasmodic dysphonia (Laryngeal dystonia)

- Spasmodic dysphonia is used to describe a neurological condition that results in involuntary movements of the vocal folds. There are two types:
- Adductor type – Voice sounding strained /strangled
- Abductor type – Voice having uncontrolled bursts of breathness or involuntary voice breaks.
- The exact cause is still debated. Most people believe it has either a psychological (following a traumatic event) or neurological (due to abnormalities in the brain) origin
- **M/c** t/t is intra-laryngeal injection of botulinum toxin. May require monthly injections.

Croup

(Acute Laryngotracheobronchitis, ALTB)

- Affects children 3 months to 3 year esp males.
- Mainly d/to parainftuenza virus (type 1 & 2); also d/to RSV, influenza virus, mycoplasma.
- M/c symptom : **Cough**
- Cl/f: Fever, hoarseness of voice, seal bark cough, inspiratory or biphasic stridor
- X-ray (AP-view) :- Sub- glottic edema (Hourglass sign) & steeple sign I pencil tip sign on PA view

Acute Epiglottitis

- Caused **by Hib (Haemophilus influenzcie type b)**
- M/c symptom : **Dysphonia & stridor** (cough is not seen).
- **Cl/f:** 2-7 yrs children (male > female) present with high fever, inspiratory stridor. Baby sit in tripod position.
- Onset is abrupt & progression is rapid, child may die in a day.
- Lateral X-ray neck :- **Enlarged epiglottis (Thumb sign)**
- T/t :- Emergency hospitalization and airway management.

Recurrent Laryngeal Papilomatosis

- Benign lesion of larynx and trachea usually seen in children.
- Lesions are multiple & known for recurrence.
- Caused by HPV 6 and 11
- Warts are formed on larynx
- Cl/f : Stridor is inspiratory initially but later it becomes biphasic. Airway obstruction worsens as the papilloma grow
- All children with stable obstruction should undergo flexible fibreoptic nasopharyngoscopy by specialist.
- **IFN**α (Interferron alpha) c/b used in t/t of juvenile laryngeal papillomatosis.
- T/t to prevent recuirence. : Endoscopic removal with cup forceps, cryo,micro-electro-cautery and CO2 laser are preferred.

Vocal nodules:

Also k/ as **singer's or screamer's nodes**

Small, solid, benign, *non-neoplastic* lesions of larynx

They appear *bilaterally* symmetrically on the free edge of VC**, at the junction of anterior l/3rd with post 2/3rd of VC** as this is the area of maximum vibration of VC and thus subjected to maximum trauma

Vocal abuse / vocal trauma is the cause, when person speaks in low tones for prolonged period or at high intensity

Cl/f- hoarseness is chief complaint

T/t: Speech therapy is TOC

- Conservatively by voice rest (in early stages)
- Microlaryngoscopic excision (for larger /prolonged nodes)

D/d of solid non-neopiastic lesions of larynx

Lesion	M/c cause	Site	T/t
1. Vocal nodules (singer's /	Vocal abuse	M/c site is junction of anterior 1/3rd + post. 2/3rd VC (B/L)	- Voice rest - Microlaryngoscopic excision for large nodules
2. Vocalpolyps (u/L)	Vocal abuse	Junction of anterior l/3rd + posteroir 2/3rd of VC (B/L) *but +/- U/L*	- Surgery (microlaryngoscopic removal)
3. Reinke's edema (B/L diffuse polyposis)	Vocal abuse, smoking	Subepithelial space of Reinke	- VC stripping

- Vocal polyps can also result from vocal abuse and treated in same way as'nodules, but they are usually unilateral at the same position
- Reinke's edema (bilateral diffuse polyposis) is aV to vocal abuse (hoarseness) and smoking. Submucosal loose CT layer of vocal cords. Treated by VC stripping/decortication.
- In indirect laryngoscopv anterior commisure is difficult to
- Direct bronchoscopy can visualize — Trachea, VC, but can **not** visualise subcarinal LN

Contact ulcer / Kiss ulcer

- Change in voice d/to voice abuse.
- M/c site is posterior arytenoid
- T/t: speech therapy

Intubation granuloma

- M/c site is junction of anterior 2/3rd + posterior l/3rd.
- TOC is laser surgery + voice rest.

- *Vocal polyps (or vocal nodules) are seen at the junction of anterior I/3rd + posterior 2/3rd of VC.*
- *Intubation granulomas are seen at the junction of anterior 2/3rd + posterior I/3rd of VC.*
- *Pachydermia laryngis is seen at posterior portion of VC. There is thickening of epithelium in the region of arytenoid*

Laryngo-pharyngeal Reflux (LPR) can cause:

- Pachydermia laryngis
- Pseudosulcus vocalis
- Acquired sub-glottic stenosis

CARCINOMA LARYNX/ GLOTTIS

Type	**Supra/G**	**Glottic**	**Sub/G**	**Trans/G**
Confined to	Ant 2/3rd of VC			Involves paraglottic space
VC	Mobile	Usually mobile		Usually fixed
Earliest symptom	Pain/ feeling of mass	Hoarseness	Resp. difficulty	Hoarseness
Metastasis	To cervical LN-	very rare & late		Lymphatic spread
T/t	RT	RT/Sx	Sx	Sx/RT

- SqCC is the m/c type of laryngeal cancer
- ↑ incidence in males, smokers, and alcoholics.
- **M/c** symptom of laryngeal cancer — hoarseness
- **M/c** site for laryngeal cancer —- supra glottic area above false vocal cords.
- *Ca in situ of vocal cords (CIS-VC)*
  Often discovered following multiple stoppings of VC for leukoplakia, atypia, dysplasia-TOC is stripping +full course of radiation.
  Infraglottic Ca. :
- Commonly spreads to mediastinal LN.
- **Stages**

T_1: Tumour in only one part of the larynx
T_2: Tumour in >1 part of the larynx +/- VC involvement
T_3: If tumour made vocal cords fixed.
T_4: If tumour invades thyroid cartilage

- **T/t** for Ca larynx early lesion <2 mm-radiation & >2 mm radiation + surgery
- *T/t of Ca Larynx*
  T_1 andT_2 with N_Q → Radiotherapy (RT) is TOC
  T_3 and T_4 with N_0 → Surgery f/b RT
  Any T with
  +ve neck nodes (N_+) → Surgery f/b RT
  T_1 glottic cancer → Best treated by Endoscopic laser cordectomy
- T_1 N_0 M_0 with stndor → Tracheostomy
  For surface lesion → R_T
  Small lesion fixed VC → R_T
  Large lesion fixed VC → Total Laryngectomy.
- Horizontal partial laryngectomy is done in T_2 supraglottic cancer while vertical partial laryngectomy is done in T_2 glottic cancer.
- There is no role of chemotherapy.

Site of Larynx affected in

D/s	**Part of larynx most affected**	**Other/f**
1. TB	Post > ant (posterior commissure)	• Mouse nibbled VC • Turban epiglottis • Tongue is m/c site in oral cavity • TB larynx is painful
2. Lupus vulgaris	Anterior	• Apple jelly nodules on nose • Painless
3. Syphilis	Any part of Lx Ant. 1/2 of glottis	• Serpignous ulcer on epiglottis
4. Leprosy	Stenosis oflarynx	
5. Cancer Lx	Anteriorly	

[Remember that in TB posterior part of scrotum affected more while in syphilis anterior part of scrotum is affected more]

Keratosis of Larynx

- VC are normally lined by straitified squamous epithelium
- ↑Rate of keratinisation is seen in smokers and it leads to keratosis of larynx,
- T/t: Quit smoking, cordectomy, decortication of VCs.

Laryngeal Nerve Lesions

- *Superior LN (Ext LN + Internal LN)*
- ELN supplies cricothyroid m/s (which is adductor & tensor . Tensors including vocalis gives quality to voice. So in SLN lesion voice is weak & husky, loss of timber (poor quality voice not suitable in singing).
- ILN is sensory to larynx above VC. So a lesion of ILN causes I aspiration pneumonia and death.

- *RLN: U/L complete section*
  Speech is not affected much.VC in half abducted position L. or sometimes called cadaveric positipn).

- *RLN: U/L partial section*
  VC is in *adducted (midline) position* of affected side.

- *RLN: B/L complete section*
  Both VC are in midway b/n abduc" & adduc" *breathing is impaired* since rima glottidis is partially closed.

- *RLN : B/L partial section*
  Acute breathlessness - dyspnoea & stridor. Both VC are adducted *(B/L abductor palsy). Emergency* cricothyroidotomy or tracheostomy is necessary.
- **Abductor paralysis** — VC midline , normal voice but respiratory difficulty; tracheostomy required in b/L cases
- **Adductor paralysis** — **VC** lateral, change in voice but no respiratory difficulty, prone for aspiration.
- **B/L Abductor paralysis** — Treated by tracheostomy, arytenoidectomy, or cordectomy. TOC is VC lateralization (type II thyroplasty)
- **B/L Adductor paralysis** — TOC is VC medialisation (type I thyroplasty). Injection of teflon in VC is also effective.
- **Adductor spasm** — Strained and croacky voice with spasmodic dysfunction

  - *Bronchial carcinoma m/c involves — RLN*
  - *M/c nerve injured during thyroid surgery — RLN (right sided)*
  - *Overall left RLN injury is more common*
  - *BOTOX injection in PCA (posterior crico-arytenoid) should be reserved for abductor spasmodic dysphonia*

Vocal cords(VC)

- Cadeveric position of VC is seen in — u/L or b/L complete paralysis of RLN + Sup LN
- Most dangerous position of vocal cords — B/L abductor palsy.
- **M/c** cause of vocal cord paralysis — injury to the recurrent LN during thyroidectomy
- **M/c** sign of unilateral vocal cord paralysis — hoarseness
- **M/c** sign of bilateral vocal cord paralysis—stridor
- **Mc** benign tumour of vocal cords — squamous papillomas (a/w HPV6&11)

Thyroplasty (Ishhiki Classification)
Type 1: It is medial displacement of VC (achieved by teflon paste injection)
Type 2: It is lateralization of VC to improve airway
Type 3 : It is used to shorten (relax) the VC Type
4: To lengthen/ tighten or to make VC tense and ↑ es pitch. If converts male character of voice to female
(Mnemonic to remember MLSL from 1 to 4)

Rehabilitation after total Laryngectomy.
Requires developing new voice using **Esophageal** speech (Using pharyngo-esophageal junction during inspiration) & by creating tracheo-esophageal fistula (expiratory voice).
Blom Singer Pmsthexix
Is a variety of TEP (tracheo-esophageal puncture) device. It is used for vocal rehabilitation of laryngectomised patient. (Electrolarynx).

Phonesthenia
Laryngeal m/s tired or fatigued . T/t is voice rest Normally two m/s — interarytenoid or thyroarytenoid are involved
- If thyroarytenoid is involved — spindle shape
- If both m/s are involved **— 'key hole'** appearance

SOME IMP INDICATIONS

- **Cortical mastoidectomy** (Schwartze operation)
- Acute mastoiditis (with coalescence of air cells)
- Masked mastoiditis (mastoid reservoir phenomena)
  - **Radical mastoidectomy**
  - Indication: Unsafe CSOM with extensive d/s, cholesteatoma, glomus tumour & Ca middle ear All of the middle ear structures are removed except stapes. In end eustachian tube is plugged with cartilage.
  - Not indicated in children < 12 yr.
- **Modified Radical Mastoidectomy (MRM)**
  - Indication : Unsafe CSOM + atticoantral d/s or hearing loss or facial nerve palsy or vertigo or labyrinthine fistula (+ve fistula sign),
  - Only diseased ossicles are removed.
- **Tympanoplasty**
  - Cholesteatomas mastoiditis without complication
- **Stapedectomy**
  -Otosclerosis with good A-B gap and good cochlear reserve
- **Myringotomy**
  - ASOM with bulged TM on the point of rupture
  - Unresolved AOM
- **Myringoptasty**
- Dry central perforation without mastoid pathology and intact ossicular chain
- **Laryngopharyngectomy**
  Uusually accompanied with block dissection of the neck in
  -Pyriform fossa cancer(Inferior hypopharyngeal cancer)
  -Post-cricoid cancer
  -Failed radiotherapy in hypopharyngeal cancer

POINTS OF SPECIAL MENTION

- *Otoioxic Dntgx*

1. Aminogly cos ides (Amika/ Genta)
2. Anticancer (Cisplatin)
3. p-blockers (Propranolol)
4. Chelating agents(Desferroxamine)
5. Diuretics (Furosemide)
6. NSAIDs (Salicylates/aspirin, ibuprofen, indomethacin)
7. Quinine/Chloroquine

Ototoxicity is classically reversible with aspirin.

- ***Radiological Signs in ENT***

	Imaging method ,	Seen In /Condition
• Thumb sign	X-ray soft tissue neck (lateral)	Acute epigloltitis
• Steeple sign/ (Hourglass/ pencil tip sign) ‘	X-ray soft tissue neck (lateral)	Acute LTB
• Phelp’s sign	CT	Glomus jugulare
• Delta sign	CT	Sigmoid sinus thrombosis
• Antral sign (Holman Miller sign)	CECT	Nasopharyngeal angiofibroma
• Dodd’s sign	X-ray	Nasopharyngeal angiofibroma
• Lyre’s sign	MRI	Carotid body tumour
• Tear drop opacity	X-ray	Blow out # of orbital floor

Site of Origin

Pathology	Seen in/Location
• Acoustic neuroma	Superior vestibular division of 8th CN
• Nasopharyngeal Ca	Fossa of Rosenmuller
• Angiofibroma of nose	Sphenopalatme foramen
• Inverted papilloma	Lateral wall of nose
• Esthesio-neuroblastoina (Olfactory neuroblastoma)	Olfactory neuroepithelium

Epiglottis

Finding	Seen In
Thumb sign	Acute epigjottitig
Serpigeoout ulcer	In Syphilis
Omega shaped epiglottis	In laryngomalacia
Turbon epiglottia	TB Larynx

- ***Trailer s triad***
  Is seen in carcinoma nasopharynx.
  1. Pain on the ipsi/Lsideof faceduetoSthnv. Involvement (trigeminal neuralgia)
  2. Conductive deafness
  3. Palatal palsy / fixation.

- *Gradenigos .syndrome –*
  Triad of
  - Apex of petrous/ petrositis
  - Vth CN involvement (retro-orbital pain)
  - Vlth CN involvement (Lat rectus with diplopia)

Gradenigo's syndrome (GS) was first described by Giuseppe Gradenigo in 1904 when he reported a triad of symptoms consisting of periorbital unilateral pain related to trigeminal nerve involvement, diplopia due to sixth nerve palsy and persistent otorrhea, a/w bacterial otitis media with apex involvement of the petrous part of the temporal bone (petrositis).

- *Melkersson s syndrome* -Triad of
  - Recurrent facial palsy
  - Swelling of lips
  - Fissured tongue

- *Vander Hoeve's syndrome* -
  Blue sclera + Otosclerosis + Osteogenesis imperfecta.

- *Blue- eardrum is seen in*
  Hemotympanum (as in temporal bone fracture), glue ear, glomus tumour & hemangioma of middle ear.
- *Prussak's pouch :*
  - The inferior pouch of outer attic of middle ear.
  - The inflammatory exudates in P~ often leads to perforation of the pars flaccida.

- *Lever ratio*
  Between the handle of malleus and the long process of incus is 1.3:1.

- *Henmebert's sign*
  Is a positive fistula sign in absence of fistula. (it is seen in congenital Syphilis due to excessively mobile stapes). +ve in 30% of Meniere's d/s patients

- *Krause's nodes*
  Are LN situated in jugular foramen. Enlargement of these nodes causes *jugular foramen syndrome* by compression effecton CN9,10,& 11

- *Montgomery's T tube* Silicon tracheal tube used forsurgical m/m of tracheal stenosis.

- *Node of Roviere'*
  Is the most superficial LN of the lateral gp of retropharyngeal space.

- *Reinke x space*
  Often affected by edema k/as Reinke's edema & causes polypoid degeneration of vocal cords.

- *Turban epiglottis*
  Edema & infiltration of the epiglottis caused by TB larynx
- *Omegu shaped epigh Xlis*
  Is seen in laryngomalacia
- Mouse -nibbled VC are seen in TB

- *Structure fully **developed** at btrih*
  Middle ear, malleus, incus, stapes, labyrinth & cochlea [MIS MLC]
- *Fluctuating hearing loss is seen in —*
  Serous OM (otitis media with effusion) Meniere's ds,
- Perilymph fistula,
- Malingering
- Commonest site of involvement in stapedial otosclerosis is located at the anterior edge of oval window in the area of fistula ante fenestrum
- Carhart's notch is b/c of loss of bone conduction & dip at F 2000 Hz (in Otosclerosis)
- Noise induced hearing loss shows a dip at 4000 Hz or above in air conduction curve of audiogram.
- Acceptable level of noise in industries in India 90 dB for 8 hrs a day for 5 days a week.
- **Silverstein Microwick microcatheter** sustained release preparation are used to deliver medications (steroids and gentamycin) to round window membrane

- *Nayolabial cyxt*
  Soft-tissue lesion developing from **odontoid epithelium** within the labial vestibule just below the attachment of the nasal ala in the maxilla. The clinical presentation is one of upper-lip swelling or of swelling within the floor of the nose. It should be excised from an intraoral approach.
- M/c site of oral TB —Tongue
- Meningitis leads to vestibulitis through cochlear aqueduct.
- *Hyrtle's fissure* is an embryonic hole that connects hypotympanum to sub-arachnoid space (tympano-meningeal hiatus),
- Stapes and related structures develop from 2nd arch while stapes foot plate (.otic capsule) develops from neuroectoderm.
- Otoacoustic emissions arise from outer hair cells.
- Middle superior alveolar nerve is a branch of— Palatine branch of maxillary nerve.
- Infection from meninges can transfer to labyrinth through cochlear aqueduct,
- Endolymph is secreted by stria vascularis.
- Distance b/w pharyngeal opening of auditory tube and posterior end of inferior turbinate is 31 cm.

- *Lower CN (9, 10, 11, 12) palsies in ENT*
  1. Glomus jugulare
  2. Malignant otitis externa
  3. Nasopharyngeal carcinoma

- *ENT conditions common in females*

1. Glomus jugulare
2. Atrophic rhinitis
3. Functional aphonia
4. Post cricoid carcinoma
5. Otosclerosis

- *Potentially disfiguring conditions of nose*

1. Leprosy (saddle nose)
1. 2.TB
2. Rhinoscleroma