Cerebellum
Get the balance right

Cerebellum ENT

Cerebellum ENT

For the Students
By the Teachers



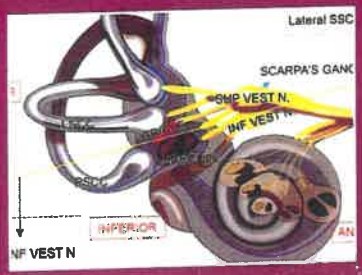


Table of Content

Section 1

Ear

1 Chapter

PINNA OR AURICLE

- Entire pinna and outer cartilaginous external auditory canal - single piece of yellow elastic cartilage
- Area devoid of cartilage in the pinna - **incisura terminalis.**
  Lempert's endaural approach ear surgery done through it.

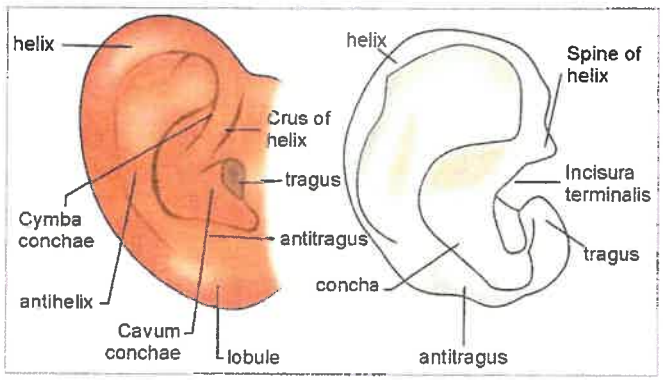


Fig. 1

- The lobule on ear pinna contains fat covered by skin. No cartilage exists in this area. Fat grafts are taken from here.
- This pinna is embryologically developed from **6 'hillocks of his'** which are formed by 1st and 2nd pharyngeal arches.
- Tragus develops from **1st** arch and remaining pinna from **2nd arch.**
- Improper fusion between these 2 arches is responsible for '**pre-auricular sinus** formation.' If it repeatedly gets infected, then surgical excision is the mainstay of treatment. If asymptomatic, no treatment given.

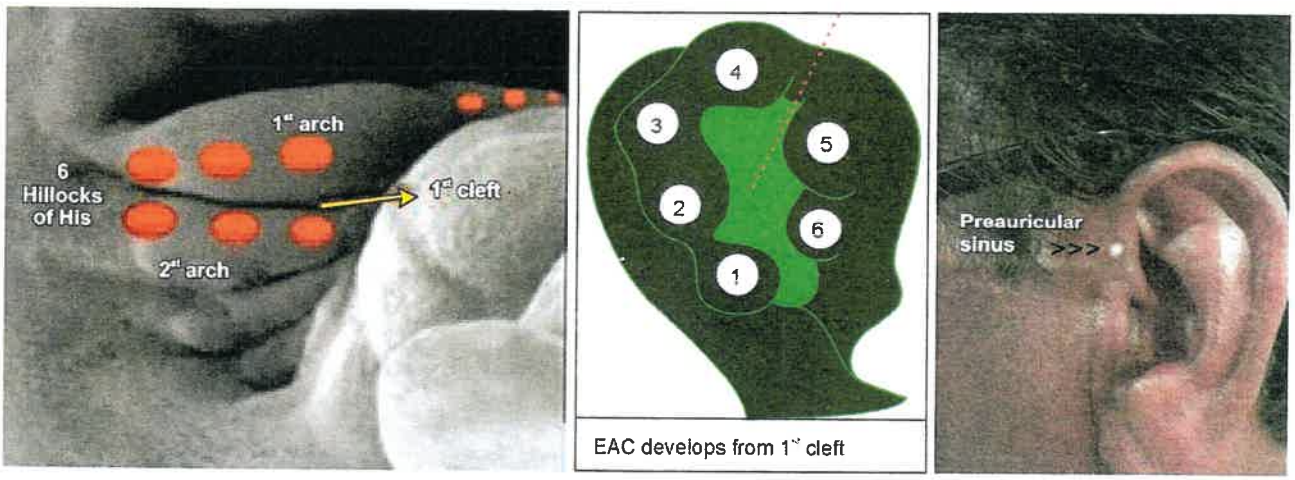


Fig. 2

- Other congenital anomalies of pinna:

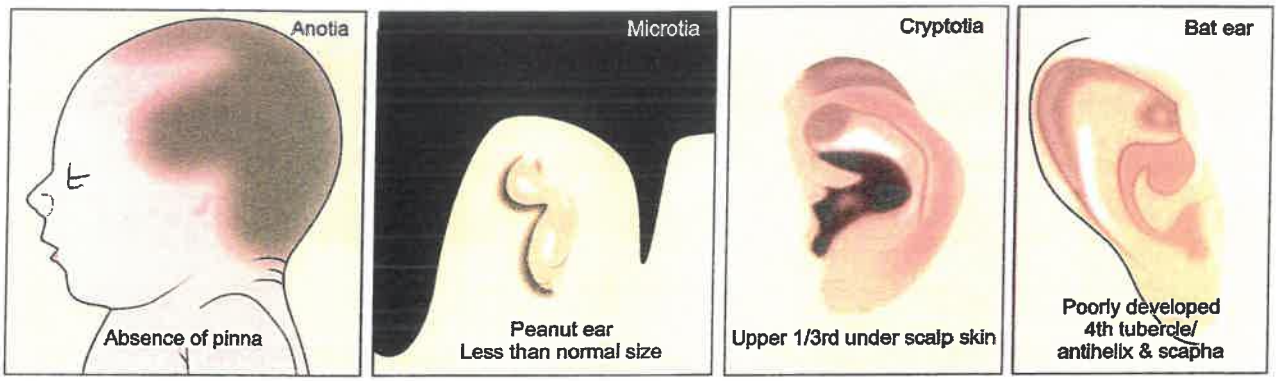


Fig. 3

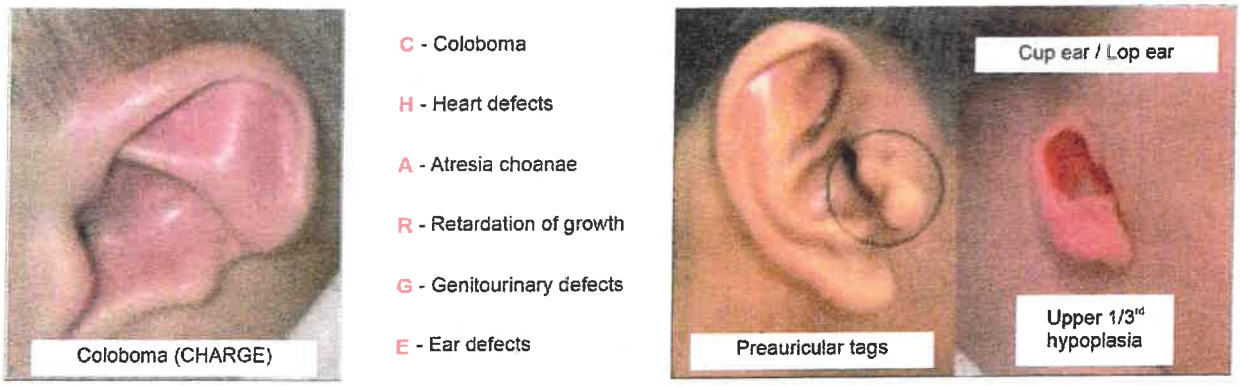


Fig. 4

- Pinna attains adult size by 6 years. **So, any surgical correction of pinna due to congenital anomalies is done after 6 years.**
- Due to ear piercing, **keloid** formation is seen on pinna, most commonly over lobule and helix.

Fig. 5

- ***Cartilage from tragus and concha – used as ossiculoplasty graft.***
- Perichondrium from tragus – **used as myringoplasty / tympanoplasty graft.**
- Collection of blood between this cartilage and its perichondrium occurs in **hematoma of auricle**, most commonly seen in wrestlers, boxers, rugby players.
- Due to pressure by the blood collection, cartilage necrosis can occur and pinna may get deformed, called as **cauliflower ear / boxer's ear / pugilistic ear**. Treatment is either immediate aspiration or 'incision & drainage' followed by pressure dressing.

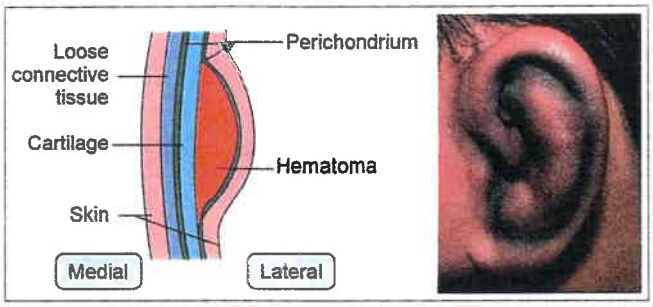


Fig. 6

- **Nerve supply** of pinna and EAC: Greater auricular, lesser occipital, auriculotemporal, Arnold's (auricular branch of Vagus nerve), facial branch

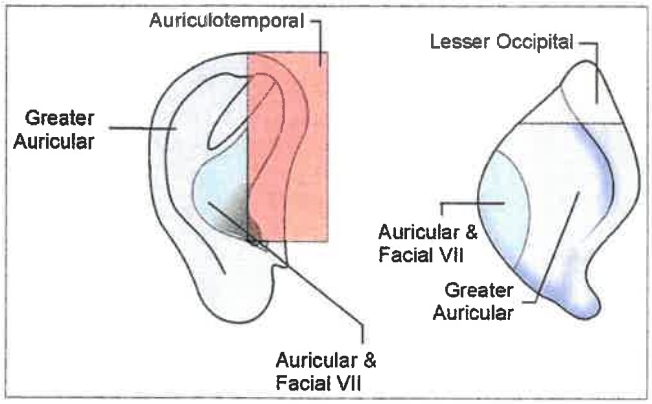


Fig. 7

Nerve	Derivation	Region supplied
Greater auricular	Cervical plexus C2, 3	Medial surface and posterior portion of lateral surface
Lesser occipital	Cervical plexus C2, 3	Superior portion of medial surface
Auricular	Vagus X	Concha and anthelix. also supply medial surface (small area) (eminetia concha)
Auriculotemporal	V_3 (mandibular)	Tragus, crus of helix and adjacent helix
Facial VII		Probably supplies small region in the root of concha

2 Chapter

EXTERNAL AUDITORY CANAL

- 24mm (outer **8mm** cartilage and inner **16mm** bony)
- To visualize **tympanic membrane** – Pinna pulled **upwards, backwards and outwards.**
- **Fissures of Santorini – in cartilaginous part**
- **Foramen of Huschke – in bony part of the canal**
- **Isthmus – narrowest part of EAC, 6mm lateral to tympanic membrane.**

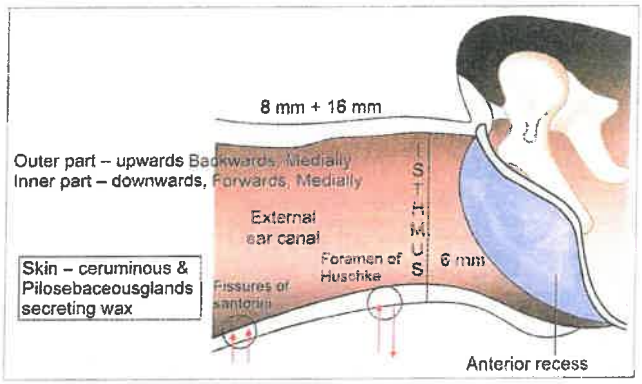


Fig. 1

- **Ceruminous & pilosebaceous glands, hair follicles – cartilaginous part only → wax & furuncle seen here only**
- **Furuncle (localized otitis externa):**
  - Staphylococcal infection of the hair follicle, appears like a swelling from the wall of EAC (differentiate from **osteoma** and **exostosis**-swelling from the wall of EAC – these are bony tumors seen in the deeper bony part of EAC).
  - **Exostoses commonly seen in surfers who constantly get exposed to cold water.**
  - **Treatment of furuncle: Ichthammol glycerine pack**

    (Treatment of osteoma/exostosis – surgical excision & canaloplasty)

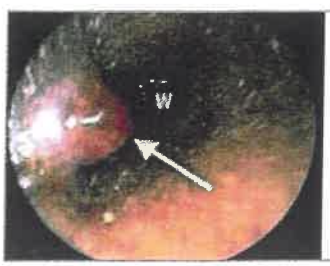


Fig. 2: Furnucle

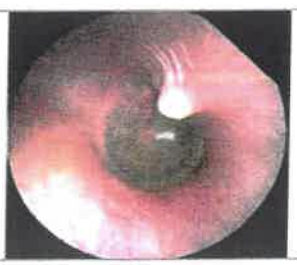
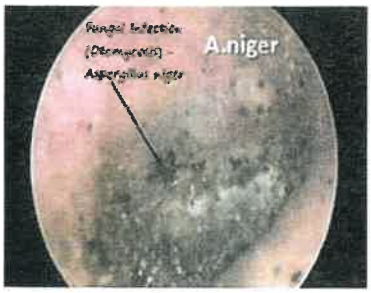


Fig. 3: Osteoma

Fig. 4: Exostoses

- **Diffuse otitis externa (Tropical ear/Singapore ear/Swimmer's ear/Telephone ear) means infection of the whole skin of EAC.**
- **Otomycosis:**
  - It is the **fungal infection** of the external auditory canal.
  - **Aspergillus niger (most common), Aspergillus fumigatus and Candida albicans** are the most common organisms.
  - Most commonly seen in **diabetics and immunocompromised.**
  - Treatment includes **aural toileting, systemic and topical antifungals.**



A.niger – black filamentous heads

A.fumigatus – blue/green

Candida – white/creamy deposit

Fig. 5

- **Herpes zoster oticus (Ramsay hunt syndrome):**
  - It is a viral infection characterized by vesicles on **TM, meatal skin, concha and postauricular groove.**
  - It appears as a **rash of small tense blisters with surrounding erythema**, preceded by pain in the ears for several days.
  - Varicella Zoster virus (VZV) residing dormant in the Gerniculate Ganglion (GG) causes this condition on reactivation
  - Can be associated with ***facial nerve palsy, sensorineural hearing loss and vestibular disturbance.***

Fig. 6: Ramsay-hunt Syndrome

Fig. 7: Malignant Otits externa

Fig. 8: Keratosis obturans

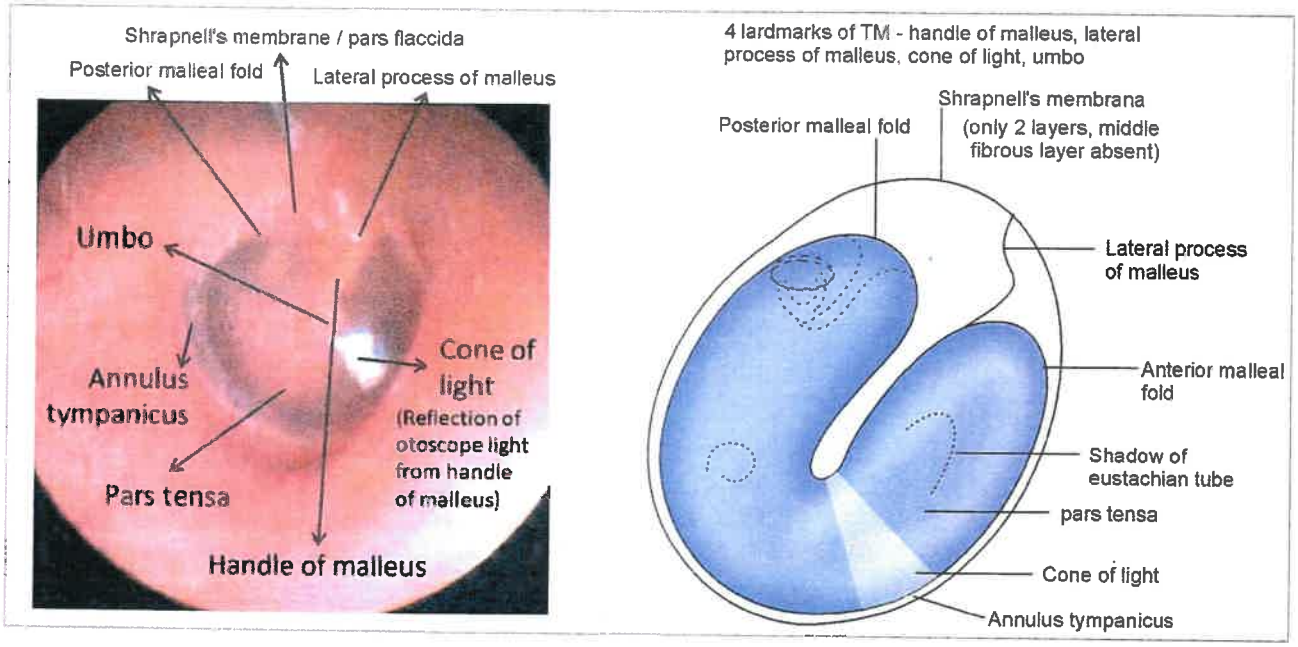
- **Malignant otitis externa (a.k.a. skull base osteomyelitis) (IMPORTANT)**
  (***Causative agent-Pseudomonas aeruginosa,*** infections in diabetics or immunocompromised.)
  - It behaves as a malignancy but not a proper malignancy.
  - C/F- severe ear pain & granulations in ear canal with or without facial paralysis.
  - Antipseudomonal antibiotics like **ceftazidime** should be given systemically & surgical debridement needs to be done later, if required.
  - Ga-67 scan shows soft tissue involvement
  - **Tc-99 scan shows bony damage.**

- **Keratosis obturans**
  - Failure of normal migration of squamous epithelium onto meatus occurs
  - Deep meatus has a collection of a pearly white mass of desquamated epithelial cells.
- **Wax** in the canal is a mixture of secretions of sebaceous glands & ceruminous glands, hair, desquamated epithelial debris, keratin & dirt.
  - It can be removed by **syringing** with water (at body temperature).
  - Cold or hot water used for syringing can cause vertigo by stimulating the **lateral semicircular canal**.
  - Impaction of wax occurs due to narrow & tortuous canal, stiff hair or obstructive lesions. These need to be softened first before syringing.
- **Foreign bodies:**
  - If there is a live insect, instill oil first to kill it and remove with suction/forceps/syringing.

3 Chapter

TYMPANIC MEMBRANE

- Pearly grey/white in color, oval shaped, 9-10mm tall, 8-9mm wide, 0.1mm thick.
- The total surface area is 90mm² but effective vibratory part is only 45mm².
- 3 layers - outer epithelium (ectoderm derivative), middle fibrous (mesoderm) & inner mucosa (endoderm).
- 2 parts - Pars tensa & Pars flaccida.
- Lies at 55° angle with horizontal.



Right TM - Cone of light at 5 o' clock position;
Left TM - Cone of light at 7 o' clock position

Another method:
Right TM - Handle of malleus in continuation with cone of light and form '<' shape → '<' symbol facing towards right. Similarly, for left - '>'.

- Annulus tympanicus (Gerlach ligament): Peripheral thickened part of pars tensa (lost in marginal and total perforations).

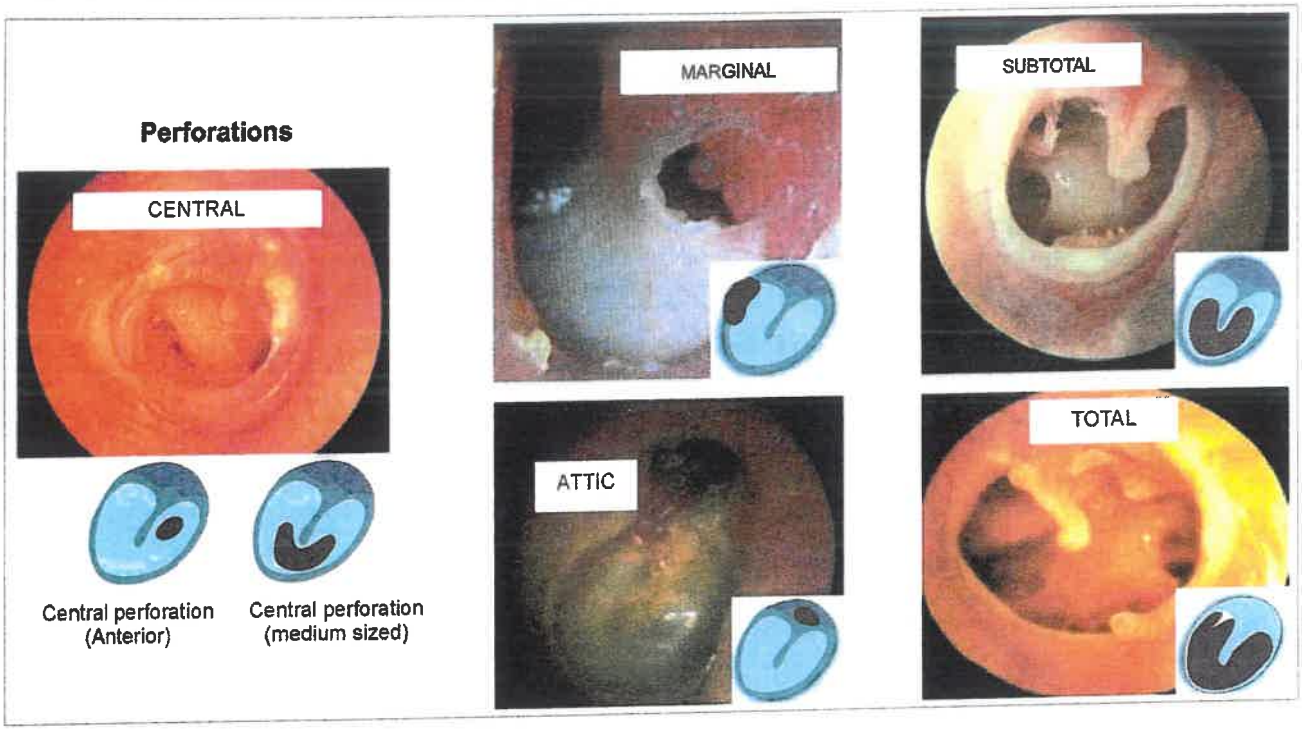


Fig. 3

- Cone of light: Anteroinferior quadrant, absent in retracted or perforated tympanic membrane.

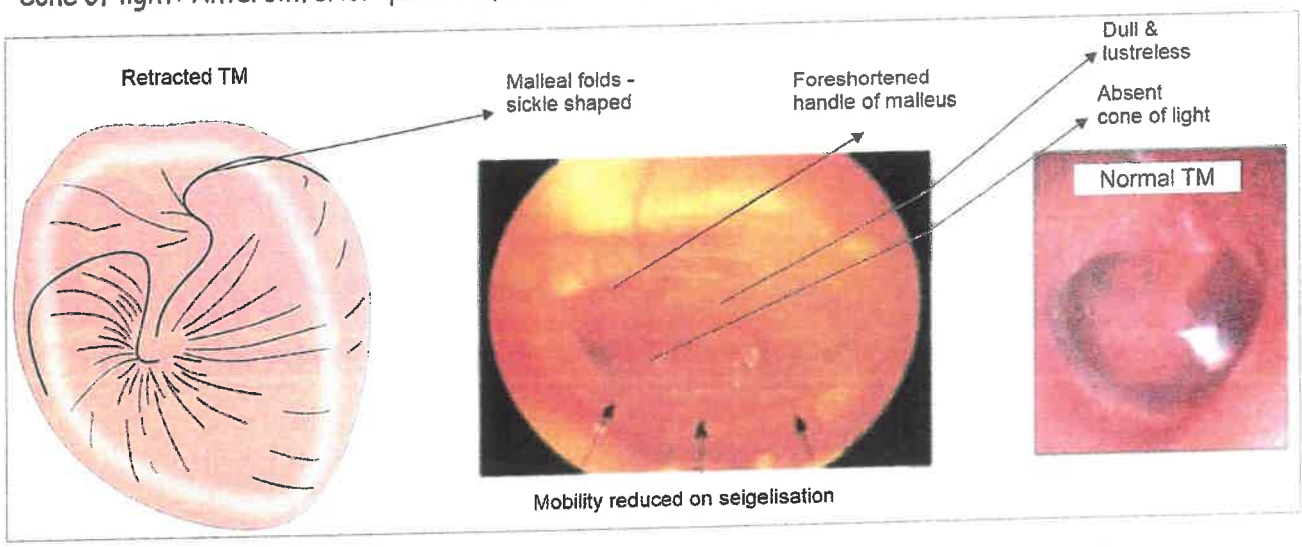


Fig. 4: Retracted Tympanic Membrane

- Malleolar folds: Separating folds between pars tensa and pars flaccida.
- Notch of Rivinus: Superiorly, tympanic bone deficient area where pars flaccida completes its margins.
- Middle fibrous layer of tympanic membrane (in pars tensa only): fibers arranged in radial, circular and parabolic pattern.
- Nerve supply of TM: Auriculotemporal (outer anterior half), Arnold's (outer posterior half), Jacobson's (inner mucosa).
- **Myringitis bullosa:** Viral infection of TM, multiple vesicles on TM, self-limiting.

Tympanic Membrane.

painful

Haemorrhagic blebs on TM

Virus –
Mycoplasma pneumoniae
Bacteria –
S.pneumoniae, H.influenzae, GABHS, M.catarrhalis

Between middle & outer layers of TM

Associated OME – most commonly seen

SNHL may occur, but resolves spontaneously

Treatment - self limiting mostly, Antibiotics & steroids if required

Fig. 5

Squamous layer gone & replaced by granulations
No ME disease

Cause – Trauma, mostly iatrogenic
Pseudomonas, Staphylococcus, Proteus, Corynebacterium are most commonly seen

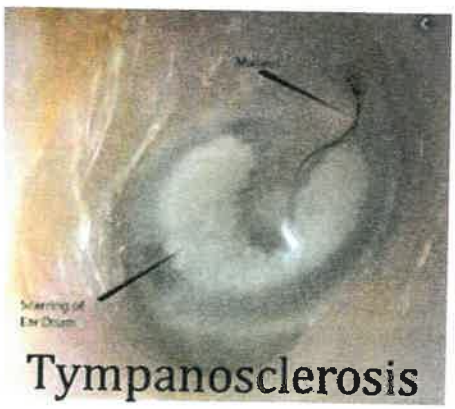
Painless otorrhoea

Focal/segmental type more common than diffuse type

Long standing → fibrosis, scarring, stenosis

Rx –
Topical antibiotic + antifungal + steroid/anti-inflammatory
Topical antiseptic – H_2O_2, Al acetate
Debulking of granulations – cold steel/$AgNO_3$/laser
Surgical excision with grafting

Fig. 6



Hyalinisation in fibrous layer → calcification

Appearance – chalky white plaque

Asymptomatic

Commonly seen in OME, complication of grommet

Also seen in middle ear structures

Conductive hearing loss

Fig. 7

- *Arnold nerve* = auricular branch of vagus (X cranial nerve).
- *Jacobson nerve* = tympanic branch of glossopharyngeal (X cranial nerve) - supplies middle ear mucosa. Referred otalgia from tonsillitis / pharyngitis / Cancers of base of tongue is due to this nerve common innervation (ear & pharynx).
- *Nerve of Wrisberg* (*nervus intermedius*) = sensory branch of facial nerve supplying posterior meatal wall.
- *Hitselberger sign* = compression of nervus intermedius in internal auditory canal by acoustic neuroma causing hypoesthesia of posterior meatal wall in EAC.

4 Chapter

MIDDLE EAR

- **Middle ear cleft = Eustachian tube + middle ear cavity (tympanum) + aditus + antrum + mastoid air cells.**
- **Middle ear cavity areas : epitympanum/attic above (6mm depth), mesotympanum (2mm), hypotympanum below (4mm).**

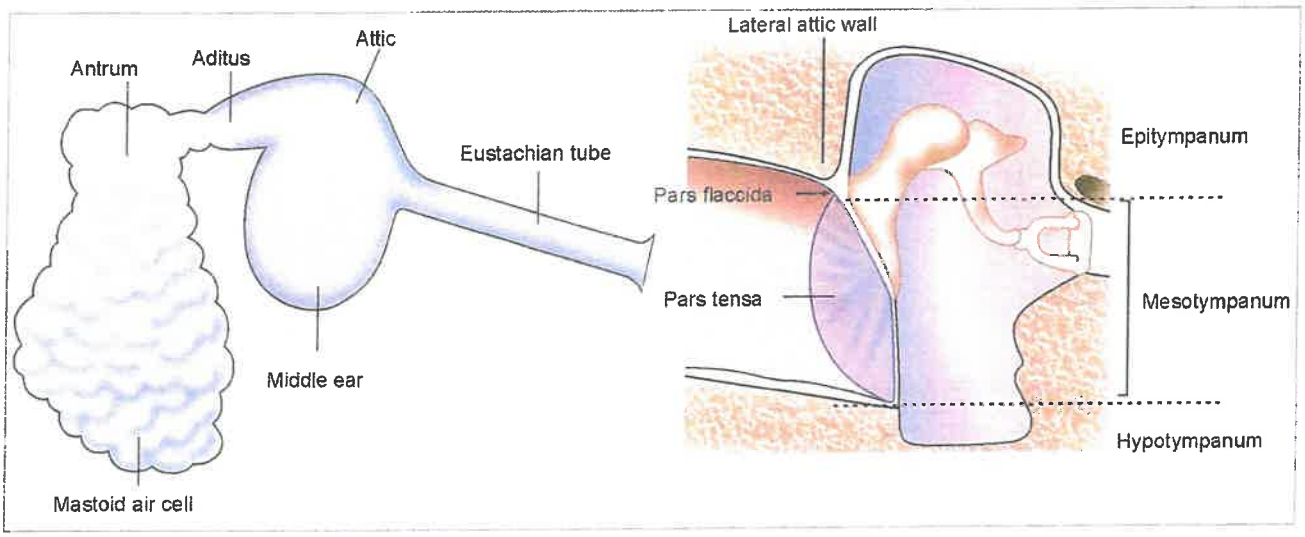


Fig. 1

- **Roof of middle ear:** Tegmen tympani
- **Roof of mastoid antrum:** Tegmen antri (separates ear from middle cranial fossa).
- **Floor of middle ear:** Thin plate of bone, separates from jugular bulb.
- **Anterior wall of middle ear:** Eustachian tube opening, canal of tensor tympani (muscle originates here).
- **Lateral wall of middle ear:** Tympanic membrane (= medial wall of outer ear).
- ***Scutum:*** Lateral bony wall above the tympanic membrane / lateral wall of the attic (cholesteatoma erodes it commonly).
- ***Prussak space:*** Space between the scutum & pars flaccida laterally and neck of malleus medially.
  - **Retraction pockets** most commonly develop into this area forming cholesteatoma, which later erodes the surrounding bony structures.
- Medial wall of middle ear (= lateral wall of inner ear):
  - Promontory **(formed by basal turn of cochlea)**
  - **Processus cochleariformis** anteriorly (landmark for facial nerve which enters middle ear above it),
  - Oval window posterosuperior to promontory (stapes footplate inserts),
  - Round window (also called secondary tympanic membrane) posteroinferior to promontory **(electrode in**

cochlear implant inserted through this)

- Facial nerve runs horizontally above oval window till the junction of medial and posterior walls.

- Posterior wall of middle ear:
  - ***Pyramid* (stapedius muscle arises from it and inserts into posterior crura of stapes),**
  - Facial nerve runs vertically and gives chorda tympani branch below the level of middle ear (chorda tympani travels up and enters middle ear, runs between malleus and incus, exits middle ear through ***canal of Huguier*** in petrotympanic or glaserian fissure lying anteriorly on lateral wall of middle ear, supplies anterior 2/3rd of tongue for taste sensation).
  - **Facial recess (posterior tympanotomy surgical approach)** lies between chorda tympani & facial nerve. Incus short process forms a superior boundary of facial recess.
- Ponticulus: Bony elevation connecting promontory and pyramid **(PPP).**
- Subiculum: Bony elevation inferiorly.
- **Sinus tympani:** Space between ponticulus and subiculum **(cholesteatoma here may be missed on ear examination).**

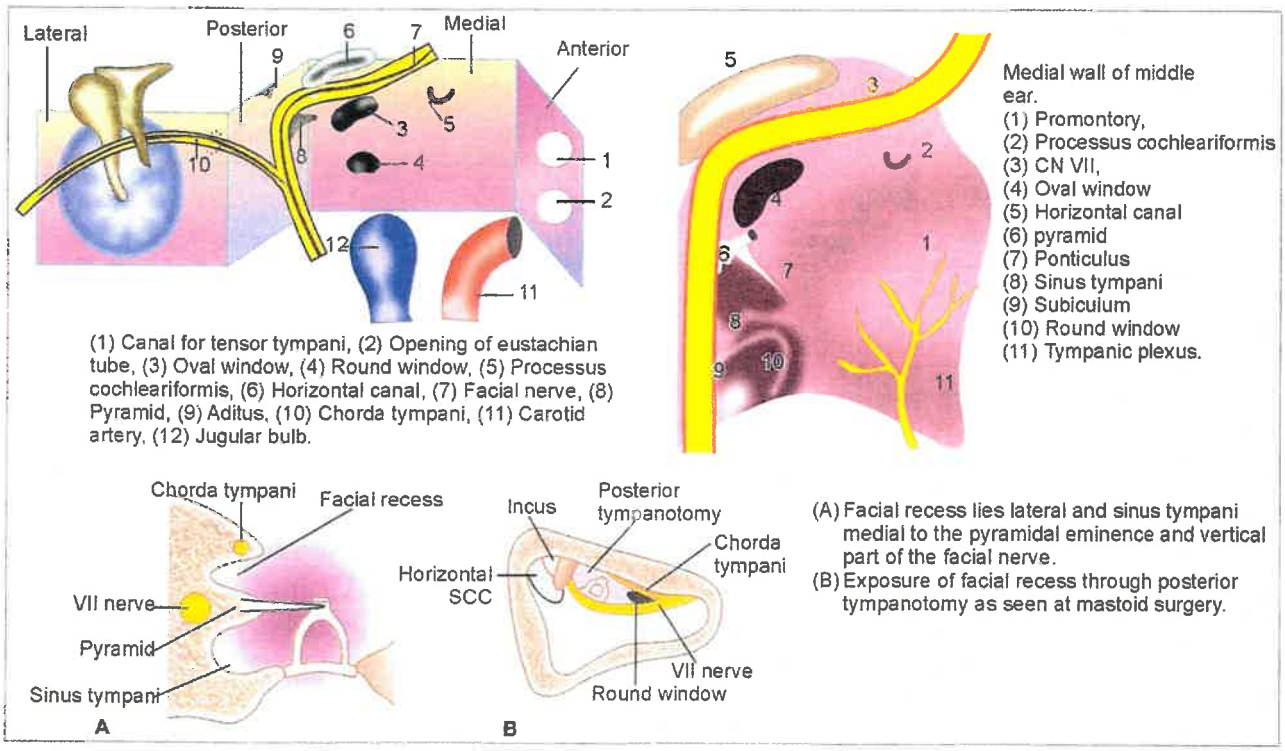


Fig. 2

- ***MacEwen's triangle:*** **(IMPORTANT)**
  - Surgical landmark to identify an antrum which lies **1.5cm** deep inside.
  - Borders:posterosuperior meatal wall anteriorly, temporal line above and a tangent to external canal posteriorly.
- ***Korner's septum:*** **(IMPORTANT)**
  - Thin bony plate (persistent petrosquamous suture) between outer squamous cells of mastoid and inner petrous cells of mastoid.
  - **During mastoidectomy, only outer cells will be removed and on seeing this bony septum, the surgeon may stop drilling thinking it is the inner end of dissection and he may think he has removed all cells of mastoid.**

- **But behind this septum, petrous cells will be left and residual disease inside may be left.**

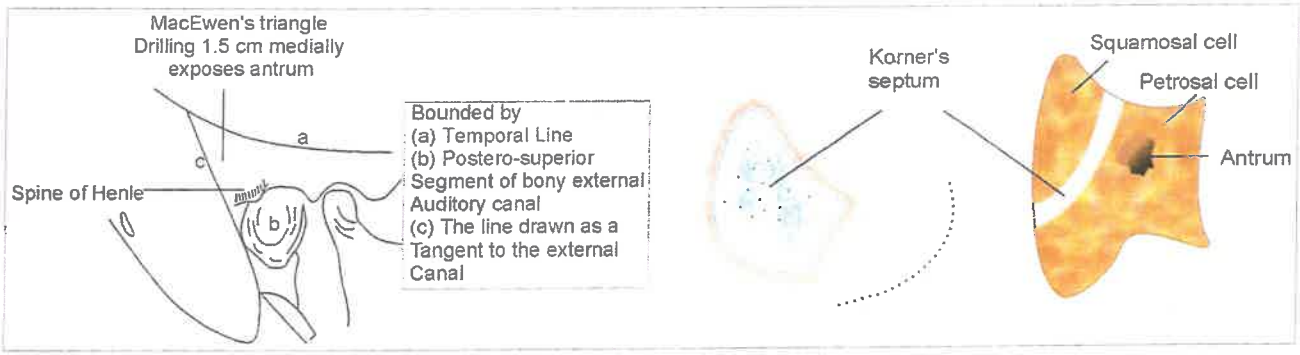


Fig. 3

- Ossicles:
  - 3 – malleus, incus stapes.
  - Malleus is the largest and stapes is smallest (in fact, smallest bone in the whole body).
  - **They attain adult size by birth.**
  - Upper parts of ossicles lying in epitympanum (head and neck of malleus, body and short process of incus) and derived from **1st pharyngeal arch**.
  - Lower parts of them lying in mesotympanum (handle of malleus, long process of incus, stapes supra structure) and derived from **2nd arch**.
  - Stapes footplate develops as a part of **bony otic capsule** (bony labyrinth of inner ear).

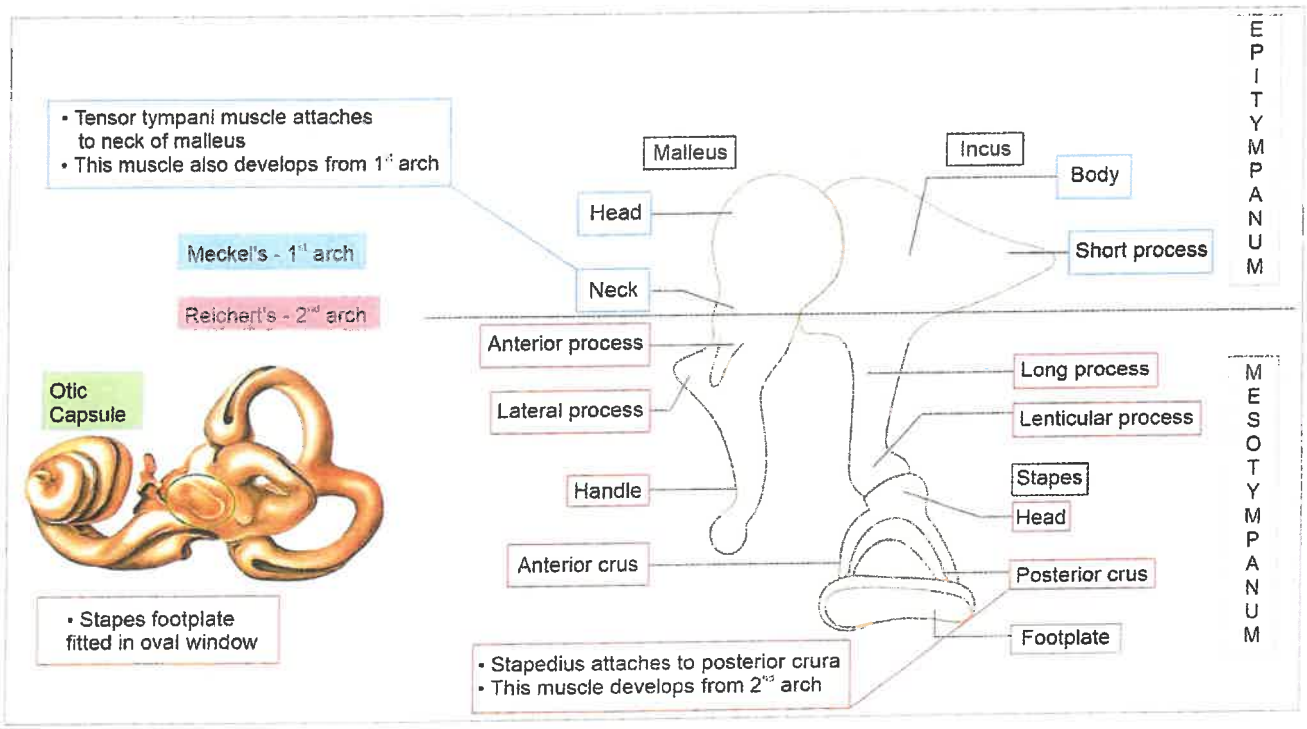


Fig. 4

- *Stapes footplate* attaches to the oval window by ***annular ligament*** all along its periphery in a circumferential manner.
- It is this ligamentous attachment between the footplate and oval window that makes the footplate vibration transfer through the oval window during sound conduction.

- The vibrations caused due to these movements are transmitted to inner ear fluids.

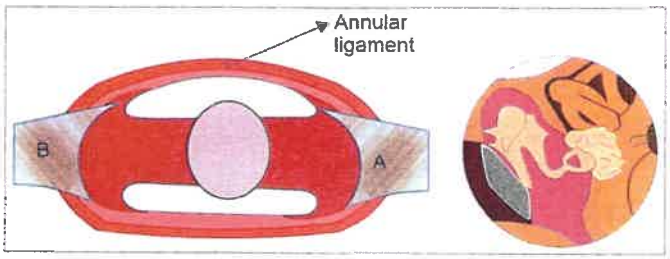


Fig. 5

- **Transformer mechanism of middle ear:**
  - When sound waves travel from middle ear (medium containing air – lesser density medium) to inner ear (medium containing fluid – higher density medium), some part of it is reflected, refracted and absorbed.
  - This *energy* lost should be *gained* somehow such that we can hear the sound with its original energy. Otherwise, we will hear all sounds with less than their original energy. This *compensatory mechanism* present in the middle ear is called transformer mechanism or impedance-matching mechanism.

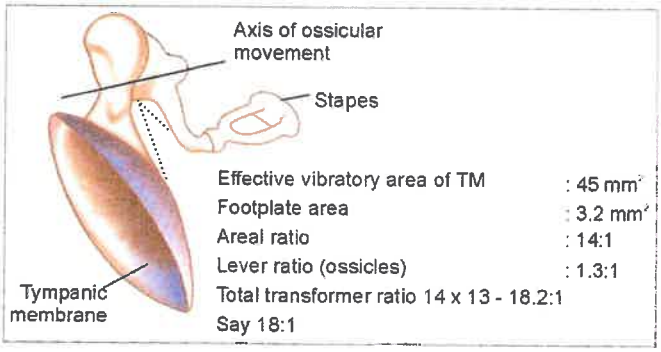


Fig. 6

All the sounds striking on the tympanic membrane should get transferred through the footplate into the inner ear. Hence, the sound waves striking on the 45mm2 area of tympanic membrane are getting concentrated on 3.2mm² area of footplate. So, there is a gain of 45/3.2 = 14:1 → this is called ***areal ratio.***

Similarly, the handle of malleus is 1.3 times longer than the long process of incus. This ratio is called the lever ratio. (1.3:1).

14 x 1.3 = 18. **18:1 is the total transformer ratio.**

- So, a total of ***18 times gain is present with the help of this mechanism.***
- Again, this is lost during transmission into inner ear fluids.
- Therefore, the initial sound which was striking on the tympanic membrane will be the same as that heard by the cochlea.

Otosclerosis

- Irregular ***spongy bone*** deposition in the anterior part of footplate and adjacent oval window (fissula ante fenestram) causes stapedial type of otosclerosis. (IMPORTANT)
  - This impedes the sound conduction and causes conductive hearing loss.
  - It most commonly occurs in ***20-30 years age, whites, females, during pregnancy, blue sclera (Van der Hoeve's syndrome) and positive family history (autosomal dominant).***

    (Triad of VanderHoeve's syndrome – otosclerosis, blue sclera, osteogenesis imperfecta)

Important points to remember on otosclerosis:

Most common site – Fissula ante fenestrum

Most common type– Stapedial

Other 2 type –Cochlear, Histologic

Clinical presentation – Hearing impairment

Paracusis willisii (hears better in noisy surroundngs)

Otoscopy – intract tympanic membrane

Schwarts sign –seen in active lesions only, reddish hue seen on promontory through intact TM

Tunning fork tests – Rinne negative, Weber to poorer ear → conductive loss

Pure tone audiometry –Dip at 2000Hz on BC curve (Carhart's notch)

Treatment of choice – Surgery (Stapedotomy > Stapedectomy)

Other treatments – NaF, Hearing aid for those not fit for surgery.

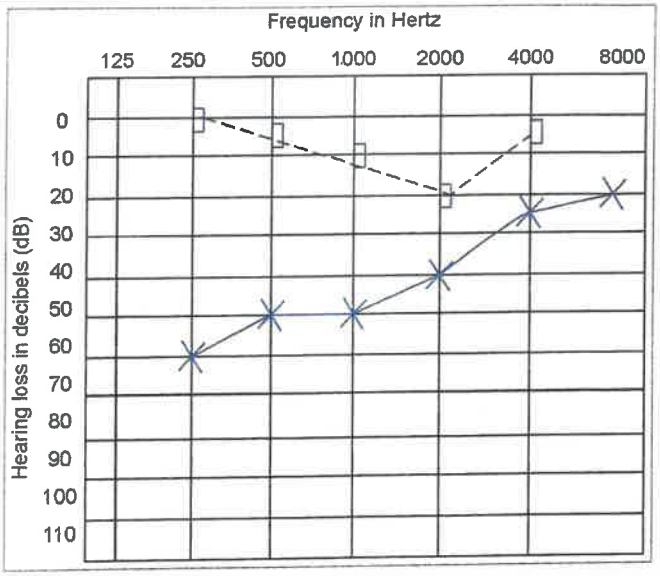


Fig. 7

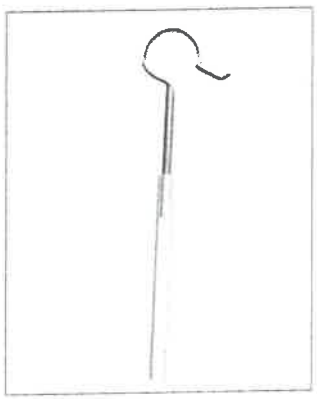


Fig.8: Stapes Piston used in Stapes Surgery

- Stapedius (2nd arch) attaches to posterior crura of stapes (2nd arch), supplied by facial (VII) nerve.
- Tensor tympani (1st arch) attaches to neck of malleus (1st arch), supplied by mandibular branch (V3) of trigeminal nerve.
- Blood supply of middle ear: **anterior tympanic artery of maxillary and stylomastoid artery of posterior auricular**.

Glomus tumour -

Most common benign neoplasm of middle ear. Locally invasive, highly vascular.

Glomus jugulare - arise from glomus cells lying around jugular bulb, compress IX-XII cranial nerves. Mostly seen in females.

Glomus tympanicum - arise from promontory, aural symptoms present.

Symptoms - hearing loss & *tinnitus (pulsatile*, swishing, synchronous with pulse)

Rising sun sign - red reflex through intact TM, seen in glomus jugulare

Pulsation sign / Brown sign - tumour pulsates vigorously and blanches when ear canal pressure raised (by seigel's)

Aquino sign - Blanching of the mass with manual compression of ipsilateral carotid artery.

Rule of 10 - 10% familial, 10% multicentric, 10% functional

Never do biopsy (Vascular lesions bleed when punctured and controlling the bleed is difficult).

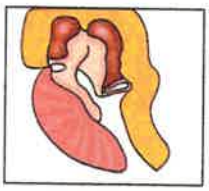
CT / MRI - CT shows *Phelps sign* (obliteration of caroticojugular spine which is a bony spine between carotid artery and jugular bulb). MRI shows 'salt & pepper' appearance.

Angiography can be done to know feeding vessel. (most common - inferior tympanic branch of ascending pharyngeal artery)

Treatment options - surgery, radiation, embolization.

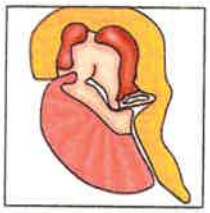
EXTRA POINTS -

Sade retraction staging of pars tensa

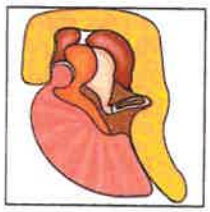


Grade 1: Mild retraction in tympanic membrane, the lateral process of the malleus has become more significant.

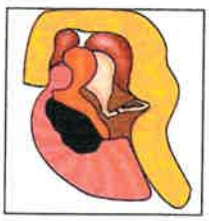
Grade 2: Tympanic membrane contacts the incus or stapes



Grade 3: Tympanic membrane contacts the promontory



Grade 4: Adhesive otitis media



Grade 5: spontaneous perforation of the atelectatic tympanic membrane