ENT

Marrow Edition 8

MARROW

Instructions

- Notes are to be used in conjunction with Marrow videos.

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- The notes have been consciously designed in a way that is concise and revisable. To ensure this, we have intentionally added only the most relevant modules and images that are needed for you.
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// ME821-PPL

Contents

Ear

Nose

Pharynx

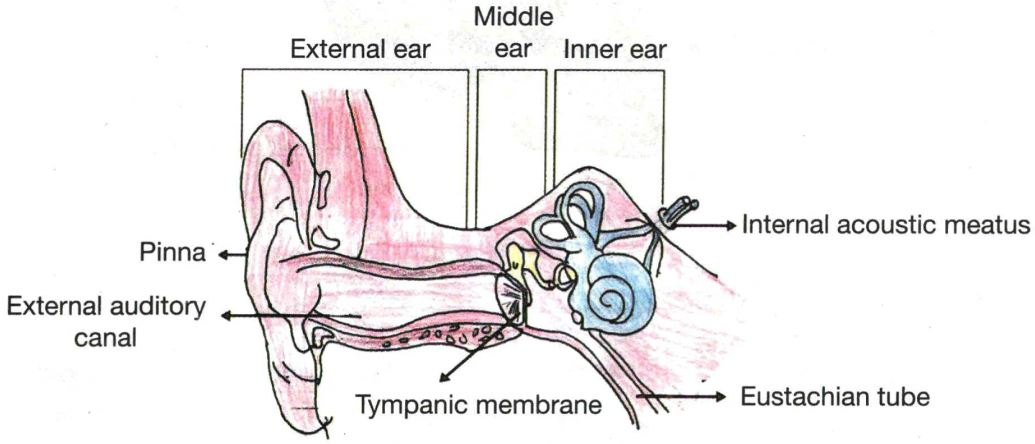
Larynx

BASICS OF EAR

----- Active space -----

Introduction

00:00:40



Parts of the Ear

Parts of the ear

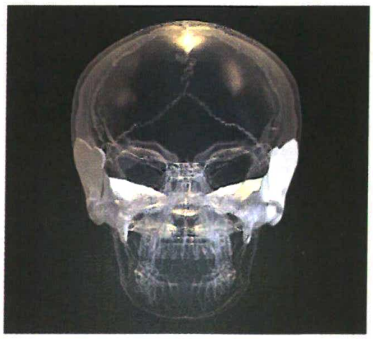
- External Ear
  - Pinna
  - External Auditory Canal
  - Tympanic membrane
- Middle Ear
  - 3 ossicles :
    - Malleus
    - Incus
    - Stapes
  - Eustachian Tube (connection b/w middle ear & pharynx)
    - Air enters while breathing
      - Proper mobility of the ossicles
- Inner Ear (AKA labyrinth)
  - Membranous labyrinth (Inner sac-like structure)
  - Bony labyrinth

Medial to Inner Ear : Brain (Cranium).

Base of Skull : Separates inner ear from the brain.

Internal Acoustic Meatus : Opening which connects inner ear to brain.

Location of ear : Tunnel in the temporal bone.

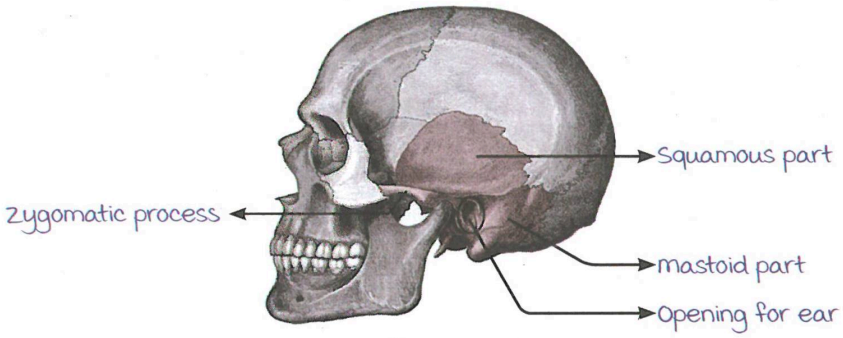


Temporal Bone

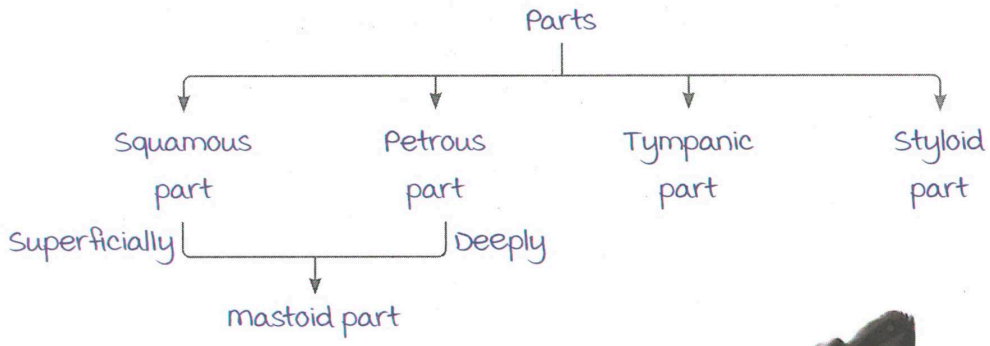
----- Active space -----

Temporal Bone and its Parts

00:05:45



Parts of temporal bone

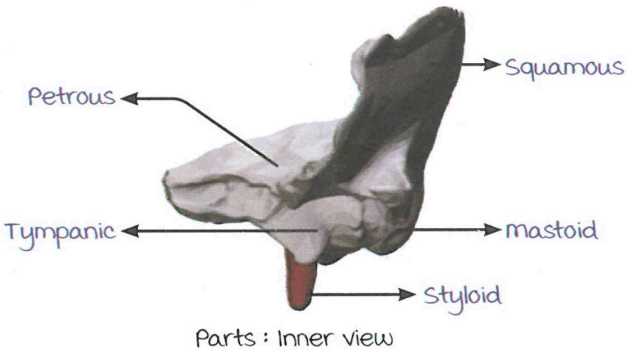


PETROUS PART

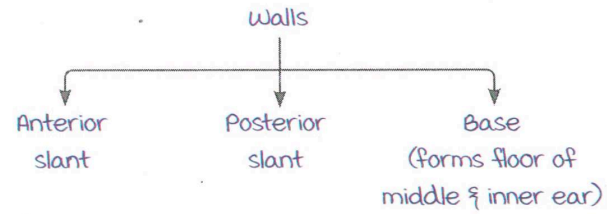
Pyramid-like bone.

'Petrous' : Rocklike.

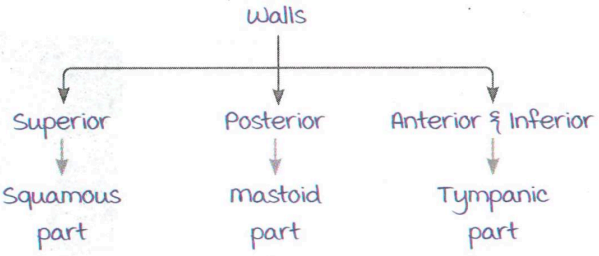
Contents : middle ear and inner ear.

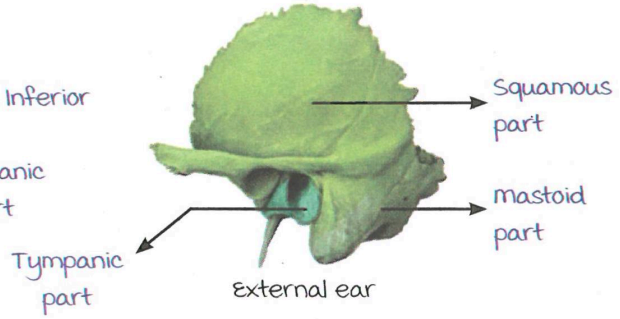


Parts : Inner view



PARTS FORMING EXTERNAL EAR





External ear

Routes of Spread of Infection

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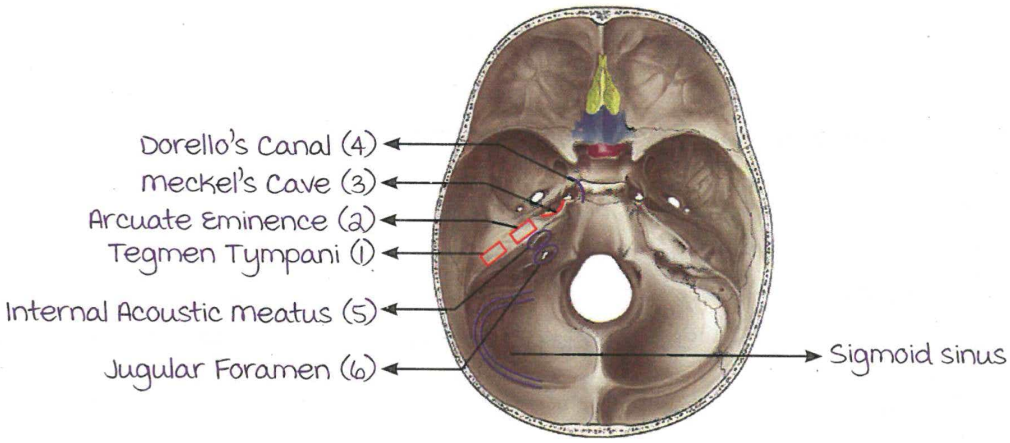


Anterior & posterior slant

SUPERIORLY (ROOF)

Infection reaches base of skull.

Anterior Slant :

1. Tegmen Tympani :
   - Roof of middle ear.
   - Separates middle ear from middle cranial fossa (temporal lobe).
   - Infection reaches temporal lobe → Temporal lobe abscess.

2. Arcuate Eminence :
   - Bulge in roof of internal ear.
   - Produced by Superior Semicircular Canal (SSC).

Note :

SSC dehiscence :

- Bone thin or gaping.
- Significance : Rise in Intra-Cranial Pressure

↓

Stimulates inner ear

↓

Inner ear symptoms

3. Meckel's Cave :
   - Depression containing Gasserian ganglion (ganglion of CN V).
   - Here CN V gives 3 branches.

Ophthalmic Maxillary Mandibular

----- Active space -----

Significance : Infection reaches petrous apex

↓

Involvement of CN V

↓

Retro-orbital pain with ear symptoms

4. Dorello's Canal :

- Present at petrous apex.
- CN VI passes.

Significance : Petrositis → Ear complaints + Diplopia (CN VI supplies lateral rectus).

Posterior slant :

5. Internal Acoustic meatus (IAM) :

- Connects inner ear to posterior cranial fossa.
- Nerves passing : CN VII & CN VIII.

Note : CN VII → Passes through ear → Gives branches in ear → Exits through stylomastoid foramen → Supplies face.

Note : Acoustic neuroma spreads intracranially through IAM.

- Upper pole of tumour → CN V, VI involvement
- Lower pole of tumour → CN IX, X, XI involvement

6. Jugular Foramen :

At the junction of petrous and occipital bone.

Structures passing :

- CN IX
- CN X
- CN XI
- Jugular bulb

} Go to floor of middle ear.

Sigmoid Sinus :

- Forms posterior boundary of mastoid.
- Sigmoid sinus → Jugular bulb → Internal jugular vein (IJV).
- Significance : Infection of mastoid/ear

↓

Sigmoid sinus thrombosis

↓

IJV thrombosis

INFERIORLY (FLOOR)

Infection reaches base of skull.

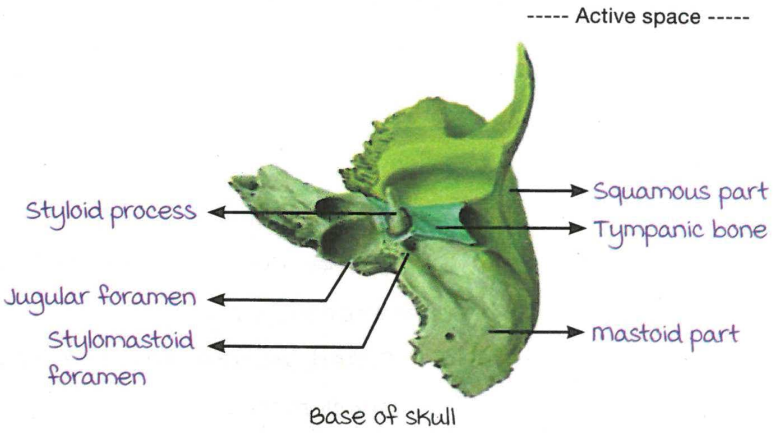
Stylomastoid Foramen :

Present between styloid process & mastoid.

Involvement causes facial nerve palsy.

Significance :

Otitis externa
↓
Spreads via floor
↓
Skull base osteomyelitis



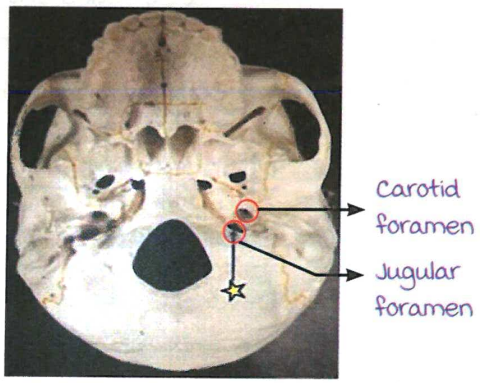
Base of skull

Jugular Bulb :

Lies in the floor of middle ear.

Significance :

Tumors of jugular bulb project through floor of middle ear.



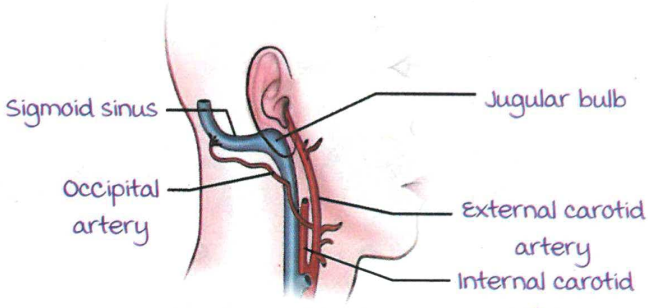
Base of skull

ANTERIORLY

Internal Carotid Artery (ICA) :

Related to anterior wall of middle & inner ear.

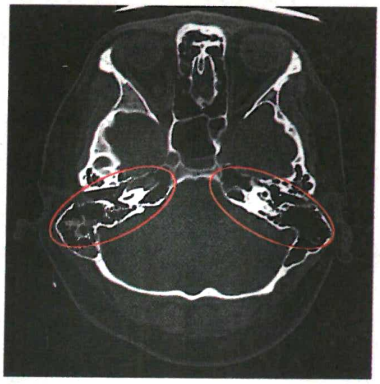
Course : Cervical part of ICA
↓
Enters into foramen of carotid canal
↓
Runs horizontally as petrous part of ICA
↓
Exits through opening in carotid canal
↓
Enters cavernous sinus to become cavernous part



Internal carotid artery

Note :

High Resolution CT scan : Best investigation for conditions of middle ear & temporal bone fractures.

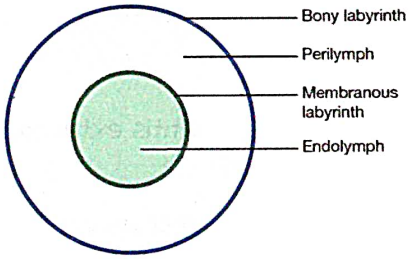

HRCT

----- Active space -----

CLINICAL EMBRYOLOGY AND ANATOMY OF INNER EAR : PART 1

Inner ear (Labyrinth) :

- Parts : Membranous and bony labyrinth.
- Membranous labyrinth :
  1. Closed sac-like structure filled with endolymph.
  2. Contains endolymph and sensory end organs of hearing and balance.
- Bony labyrinth : Has openings to connect inner ear to middle ear and brain.



Basic structure of inner ear

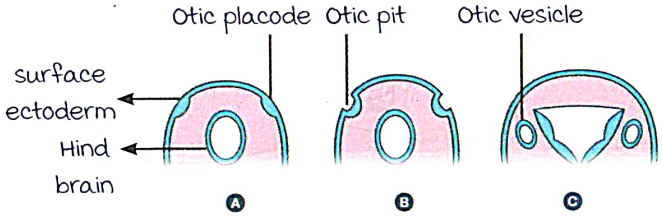
Membranous labyrinth

00:06:08

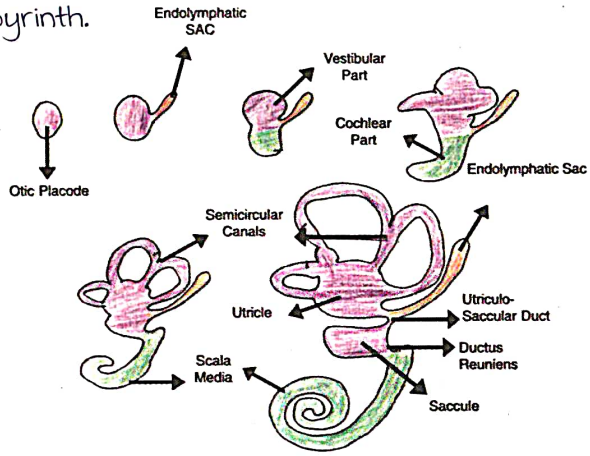
Embryology :

Development :

- Specialized area of surface ectoderm overlying the hind brain.
- Stages : Otic placode → Otic pit → Otic vesicle → Outpouchings from otic vesicle → membranous labyrinth.

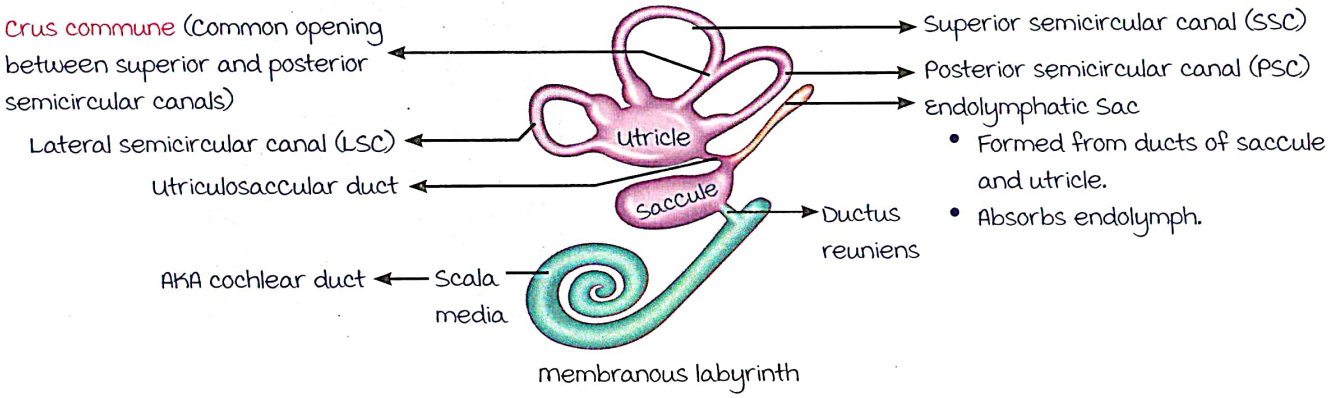


Development of membranous labyrinth



Parts :

The 3 semicircular canals open into utricle through 5 openings.



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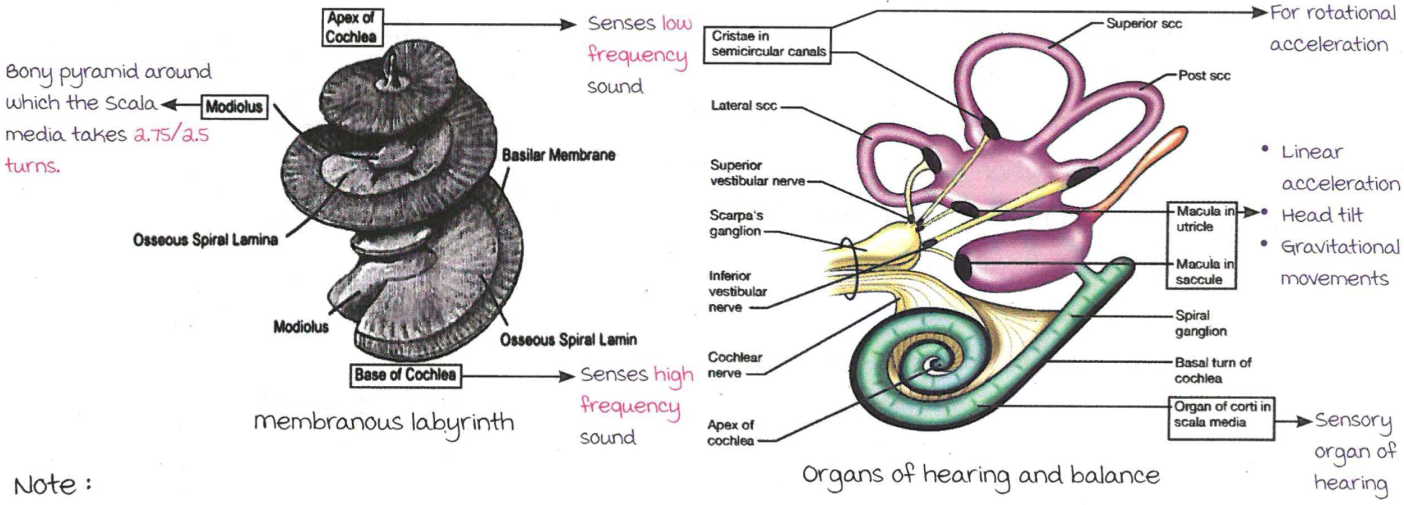


Note :

- All of membranous labyrinth except organ of Corti help with balance.
- Hearing loss + Imbalance → Indicative of inner ear pathology.

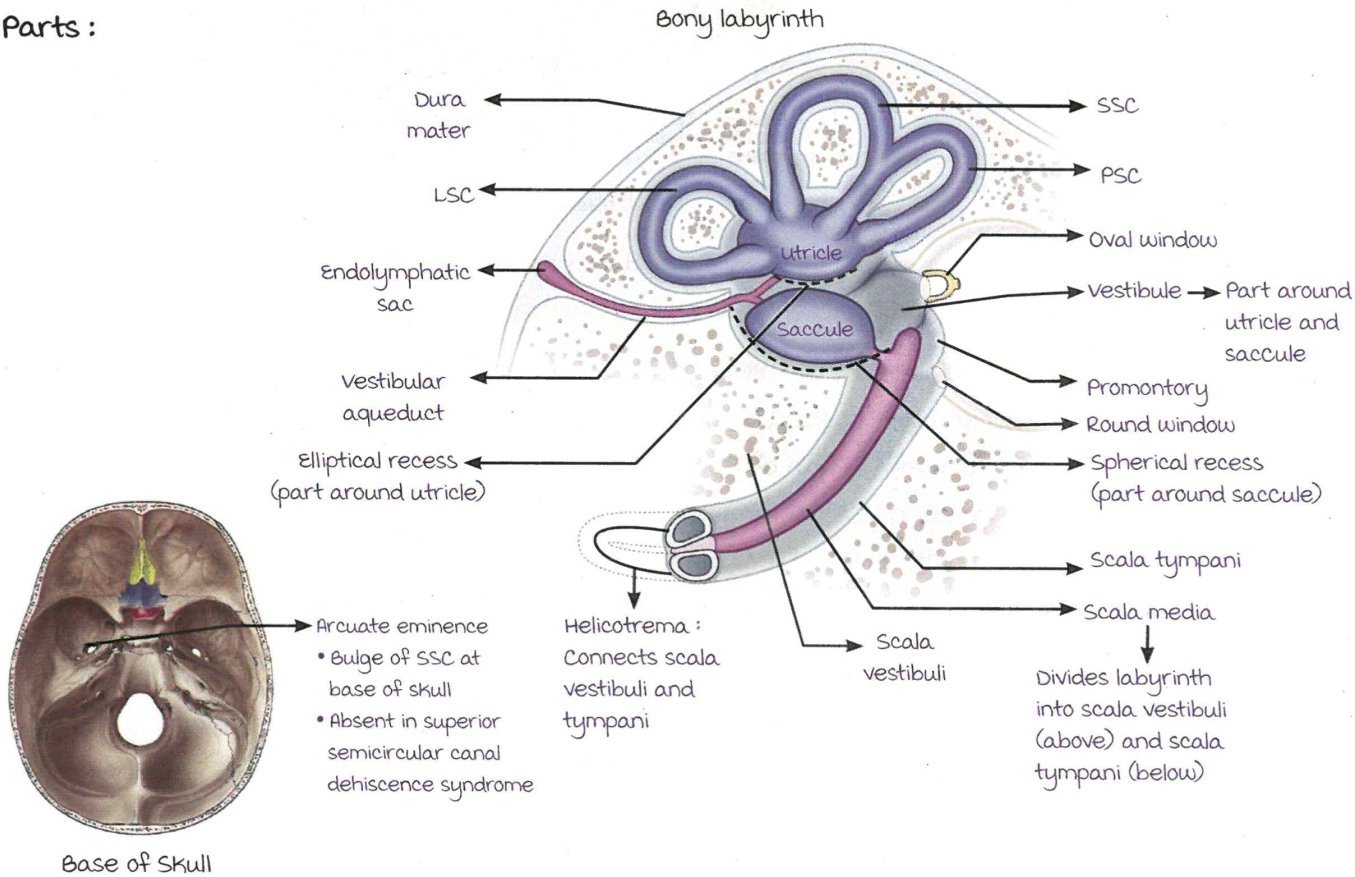
Bony Labyrinth

00:18:18

Embryology :

- Development : From mesoderm by enchondral ossification.
- Enchondral ossification : Cartilage develops into bone.

Parts :



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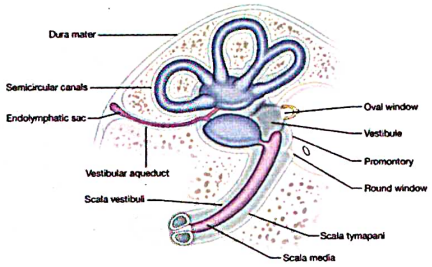
Connections between middle ear and inner ear

00:25:40

Oval Window :

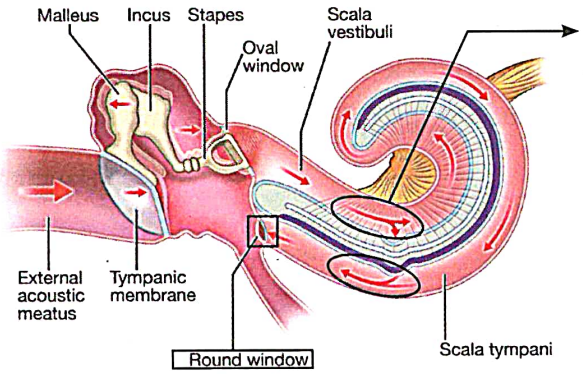
- Covered by footplate of stapes.
- Connects middle ear to the vestibule of inner ear.
- Function : Transmits sound to scala vestibuli (movement of stapes causes vibration in scala vestibuli).
- Abnormalities :
  a. Otosclerosis : D/t fixation of footplate of stapes.
  b. Vertigo : Hypermobility of footplate of stapes → Stimulates maculae in utricle and saccule.
  c. Meniere's disease (Endolymphatic hydrops) : ↑ in endolymph → Dilatation of utricle and saccule → Close proximity with footplate → Stimulated → Imbalance/vertigo.



Oval window and round window

Round Window :

- Covered by secondary tympanic membrane.
- Connects the middle ear to scala tympani.
- Function : Transmission of sound.



Sound transmission : Inner ear

- Clinical Significance :

1. Cochlear Implant (Artificial sense of hearing) :
   - Electrodes passed through : Round window.
   - Replaces : Organ of Corti.
   - Placed in : Scala tympani .
   - Stimulates : Cochlear nerve (8th nerve).
2. Drugs (Gentamicin, steroids) are injected through the round window.

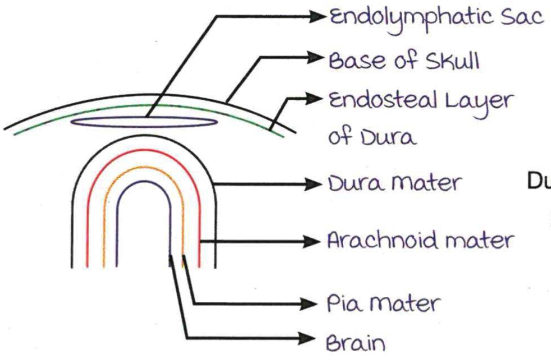
Note :

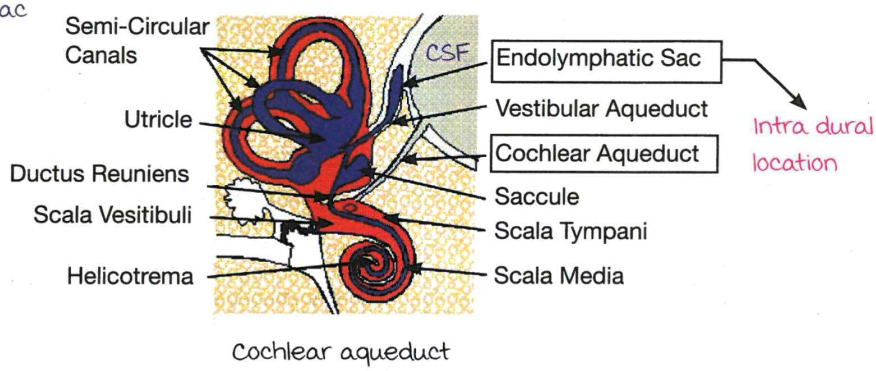
- Oval window is not preferred for passing of electrodes in cochlear implant.
- Electrodes passed through oval window → Stimulate vestibule → Utricle and saccule stimulated → Vertigo.

Connections between inner ear and brain

00:40:05 ----- Active space -----

1. Internal acoustic meatus (passage for 7th, 8th cranial nerves).
2. Cochlear aqueduct (Transfer CSF into inner ear for perilymph production).





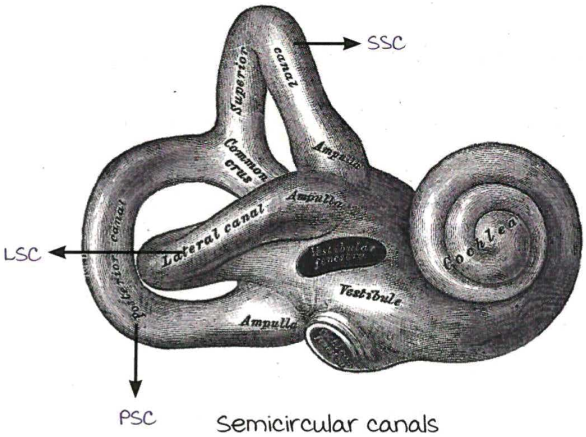
Cochlear aqueduct

Clinical significance :

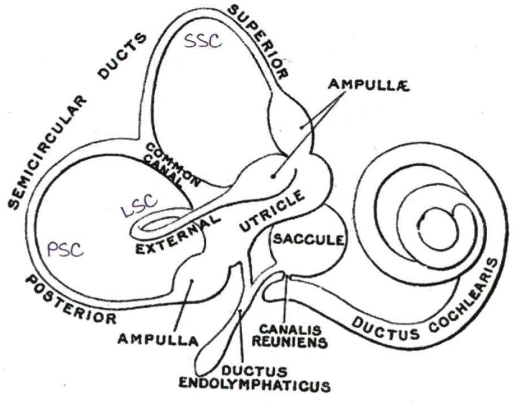
- Spread of infection from brain to inner ear or vice versa (meningitis ↔ Labyrinthitis).
- Patient with meningitis → Recovered → Do BERA before discharge (Brainstem Evoked Response Audiometry).
  (Child > adult since hearing loss in a child needs early intervention and hearing rehabilitation).

Identification of semicircular canals :

- Lateral semicircular canal goes in lateral direction.
- Crus commune: Can be used to identify posterior and superior semicircular canals.
- Posterior semicircular canal can be identified with the lateral semicircular canal bisecting it.



Semicircular canals



Semicircular canals

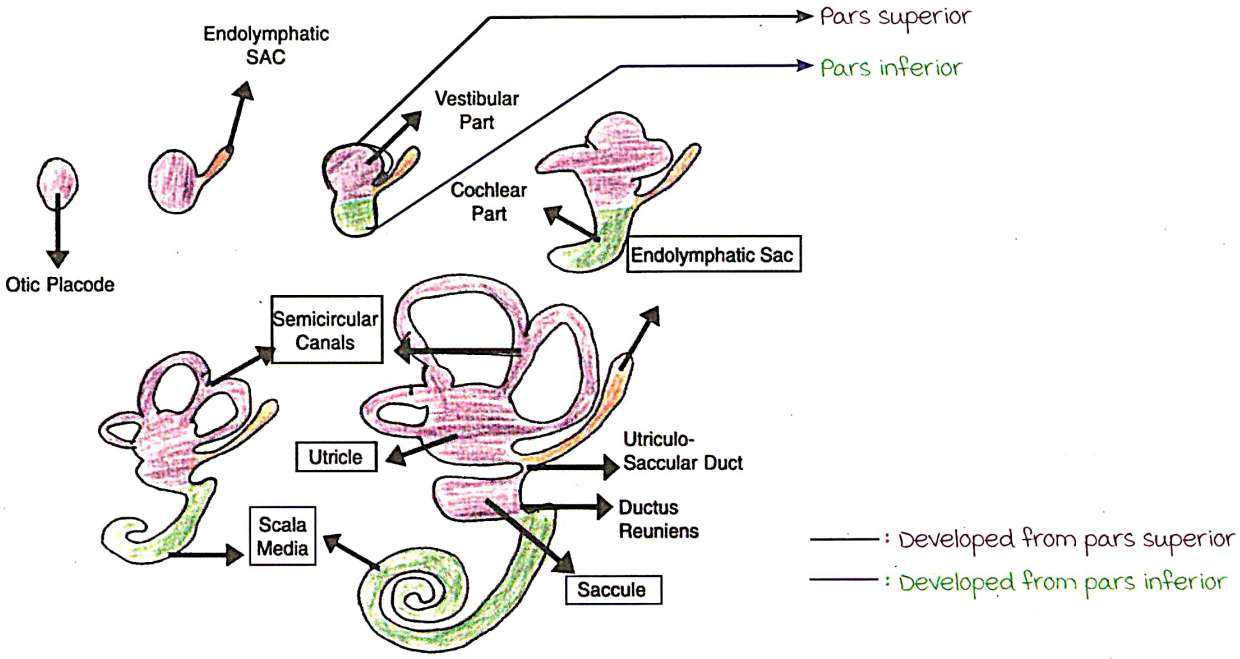
----- Active space -----

Congenital abnormalities

00:48:15

Inner ear development : Fully complete at 20 weeks (5 months) of intrauterine life.

Derivatives of pars superior	Derivatives of pars inferior
Superior semicircular canal	Saccule
Lateral semicircular canal	Scala media
Posterior semicircular canal	-
Utricle	-
Endolymphatic sac	-



Defects :

most congenital anomalies occur due to defect in pars inferior as pars inferior develops later.

Defect	Features
Scheibe aplasia	• m/c congenital abnormality. • Defect : Saccule + Cochlea.
Mondini aplasia	Cochlea has only 1.5 turns.
Alexander aplasia	Defect in basal turn of cochlea.
Michel aplasia	• Complete absence of bony and membranous labyrinth. • Absolute C/I for cochlear transplant.

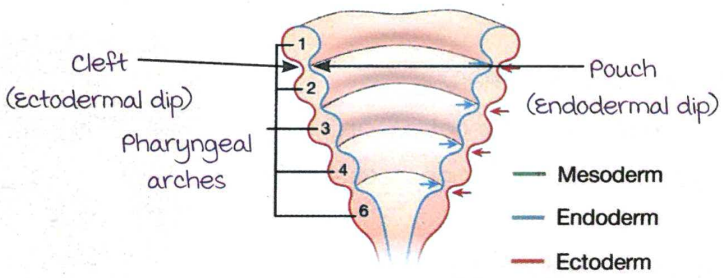
CLINICAL EMBRYOLOGY OF EXTERNAL AND MIDDLE EAR

----- Active space -----

External & Middle Ear development

00:00:30

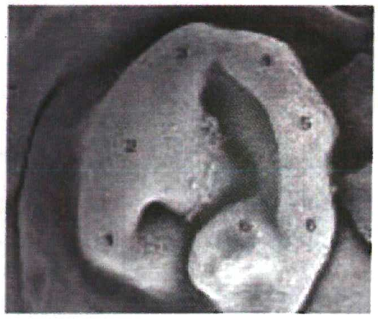
- Developing fetus : Has 6 branchial arches of which 5th arch disappears.
- Each arch : Has ectodermal (Outside) & endodermal (Inside) lining.



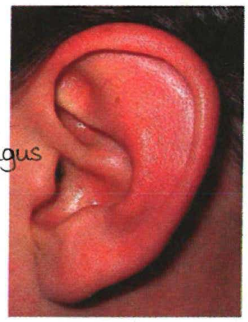
Branchial arches

Hillocks of His :

- 6 mesodermal thickenings : Around 1st cleft.
- Fuse to form : Pinna (Single elastic cartilage).
  - 1st arch → Development of tragus.
  - 2nd arch → Rest of the pinna.

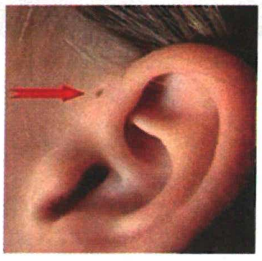
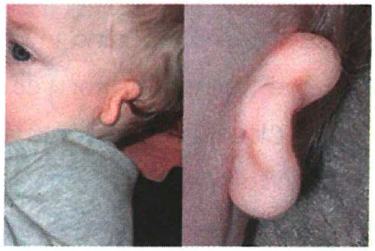


Hillocks of His



Small part of ascending crux of helix (1st arch derivative)

Developmental disorders :

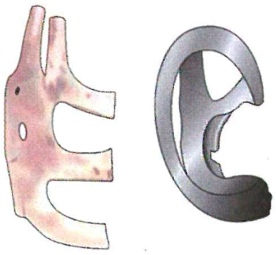
Preauricular sinus	Accessory auricle/tags	Microtia	Anotia
• Fusion defect of the auricular tubercle. • m/C site: Root of helix.		• Malformed/ underdeveloped pinna	Absent pinna
 Preauricular sinus	 Accessory auricle/tags	 Microtia	 Anotia

----- Active space -----

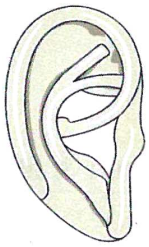
Management of microtia/anotia :

Pinna reconstruction :

- AKA otoplasty/pinnaplasty.
- Graft used : Costal (Rib) cartilage.
- Not done before 6 years.
  - Opposite pinna reach adult size by 6 years → Reference for symmetrical reconstruction.
  - Costal cartilage attain full development, only by 6 yrs.



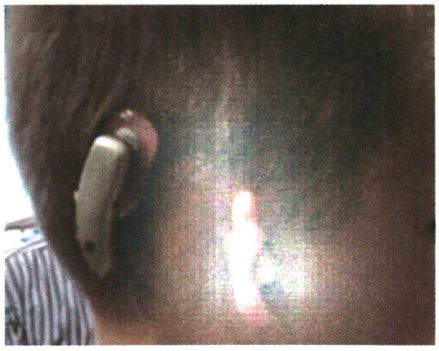
Pinna reconstruction



Pinna cartilage framework

Bone anchored hearing aid (BAHA) :

- Indication : Patients who cannot afford surgery but hearing needs to be saved.
- Use : Congenital or external abnormalities of pinna or external auditory canal (EAC).



BAHA

EXTERNAL AUDITORY CANAL (EAC)

- Medial extension of the 1st pharyngeal cleft.
- At birth : Only cartilaginous part present.
- External acoustic meatus : Develops from 1st arch.

Collaural fistula :

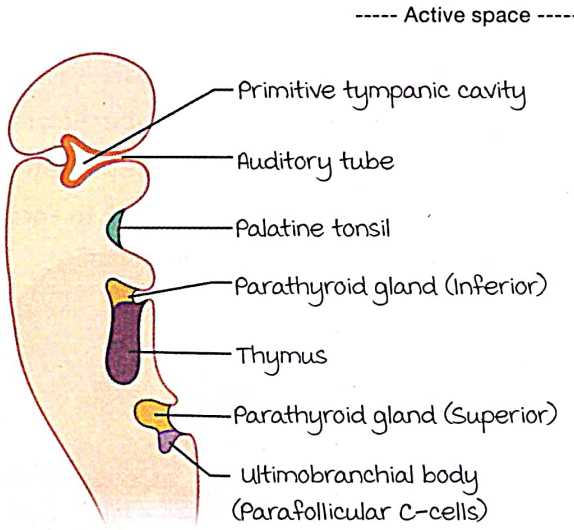
- Connection b/w neck and external auditory canal.
- 1st cleft developmental abnormality.
- Fistula : 2 openings
  - External opening : B/w angle of mandible & sternocleidomastoid.
  - Internal opening : Floor of external auditory canal.
  - Closely related to the facial nerve.
- Management :

Collaural fistula

Repeated infection : Excision of fistula tract (may injure facial nerve).

Tympanic membrane :

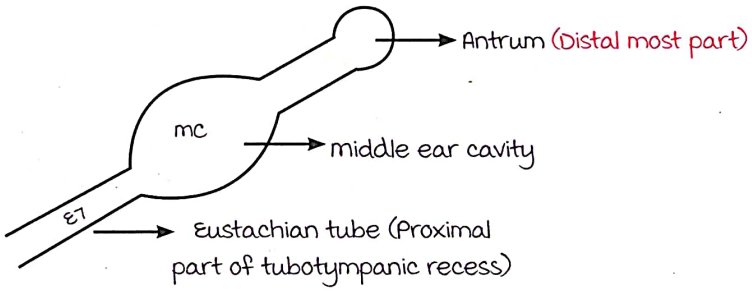
- Develops from all 3 layers : (mesoderm, ectoderm, endoderm).
  - Cleft grows inward and pouch grows outward.
- Middle layer : Fibrous in nature.



Tympanic membrane development

MIDDLE EAR CLEFT

- Eustachian tube + Middle ear cavity + Mastoid antrum.
- Develops from 1st pouch (AKa tubotympanic recess).



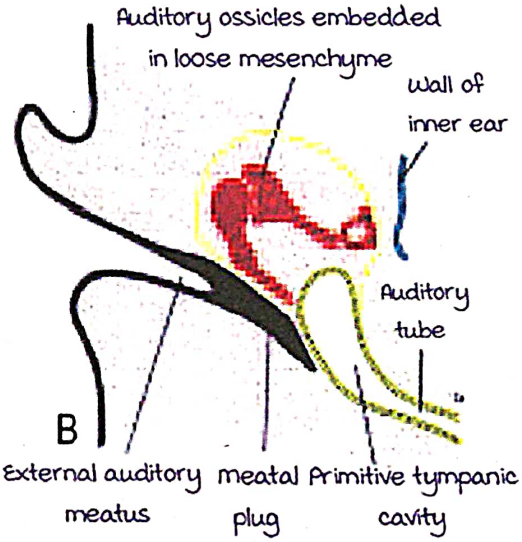
- Mastoid antrum : Largest air cell.

Ear Ossicles

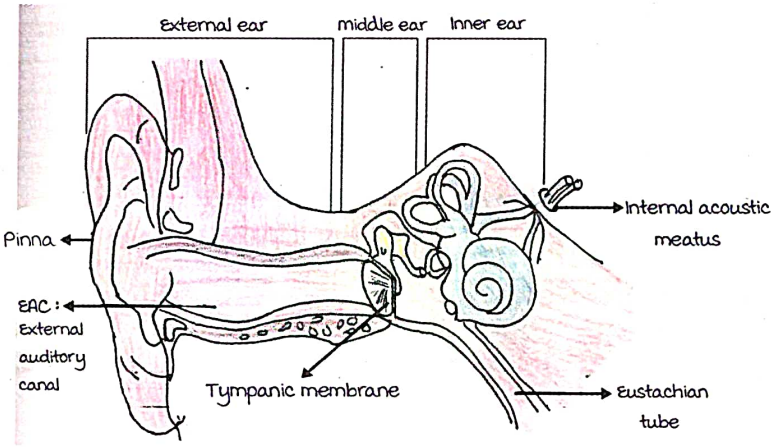
- Development : Lateral extension of 1st pouch ⟶ Entrapment of mesoderm of 1st and 2nd arch.
  - 1st arch ⟶ Malleus & incus.
  - 2nd arch ⟶ Stapes suprastructure.

Note:

- Stapes footplate present at the junction of inner ear & middle ear.
- Develops from otic capsule (AKA bony labyrinth).



Ear Ossicles



Structure of ear

----- Active space -----

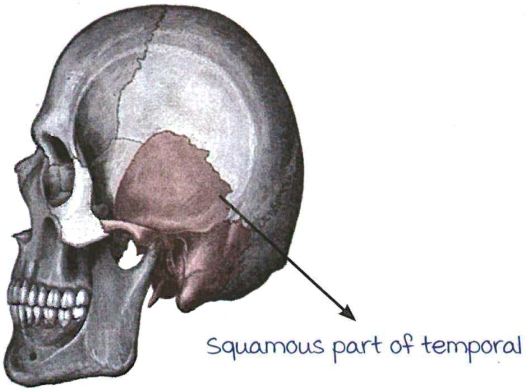
Mastoid

00:15:15

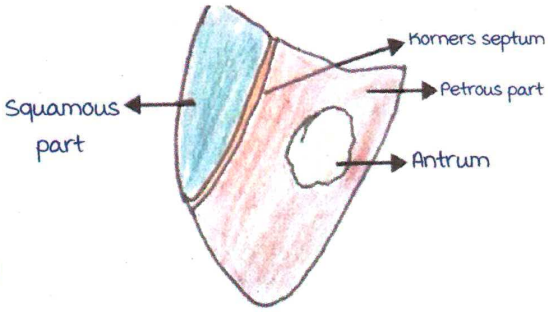
Development :

- Lateral/superficial : Squamous part of temporal.
- Medial/deep : Petrous part of temporal.

Both parts meet to form petrosquamosal suture (usually disappears).



Development of mastoid



Korner's septum

Korner's septum :

- Persistent petrosquamosal suture.
- Clinical significance : Incomplete clearance of disease.

Note :

- Medial most wall of antrum : Around 1.5 cm deep from skin surface.

Mastoid antrum :

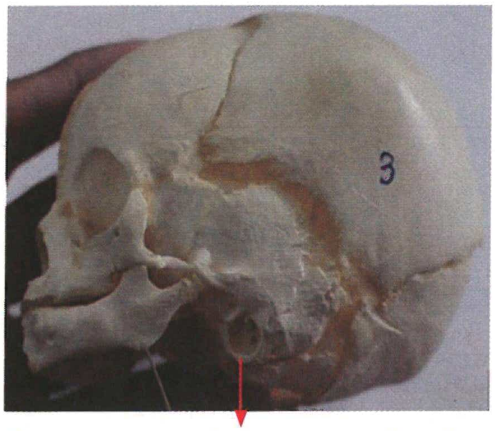
- Largest air cell.
- Present in deep/petrous part of temporal bone.
- Medial to medialmost wall of mastoid antrum : Posterior cranial fossa.
- Indication for stoppage of surgery during clearance.
- Further drilling → Lead to injury of posterior cranial fossa.
- Mastoid tip → Develops around 2 years.

Note :

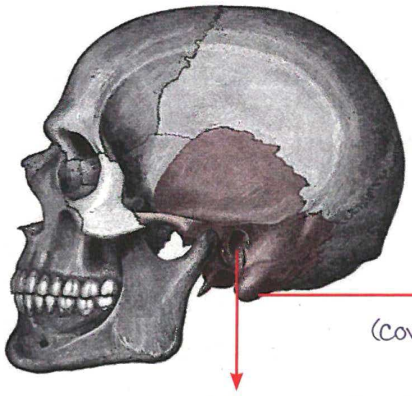
- Organ of corti → Completely developed by 20 weeks/5 months.
- Middle ear and inner ear completely developed by birth.

Comparison between fetal skull and adult skull :

----- Active space -----



Tympanic membrane seen directly (After removal of cartilaginous part of pinna)



Bony external auditory canal is seen

Clinical significance :

Post auricular abscess in child <2 yrs.

- Incision given : Superior and horizontal (To avoid damage to facial nerve exiting via stylomastoid foramen).

Post auricular abscess