

EAR - CLINICAL PROBLEMS

OUTER EAR

- Wax
- Foreign body
- Otitis externa

INNER EAR

- Otitis media - Acute (\pm blocked auditory tube)
- Chronic (cholesteatoma, glue ear)
- Perforation of eardrum
 - Infective
 - Traumatic
 - Direct injury
 - Barotrauma
- CSF leak with fractured skull

DEAFNESS - Conductive and Neural

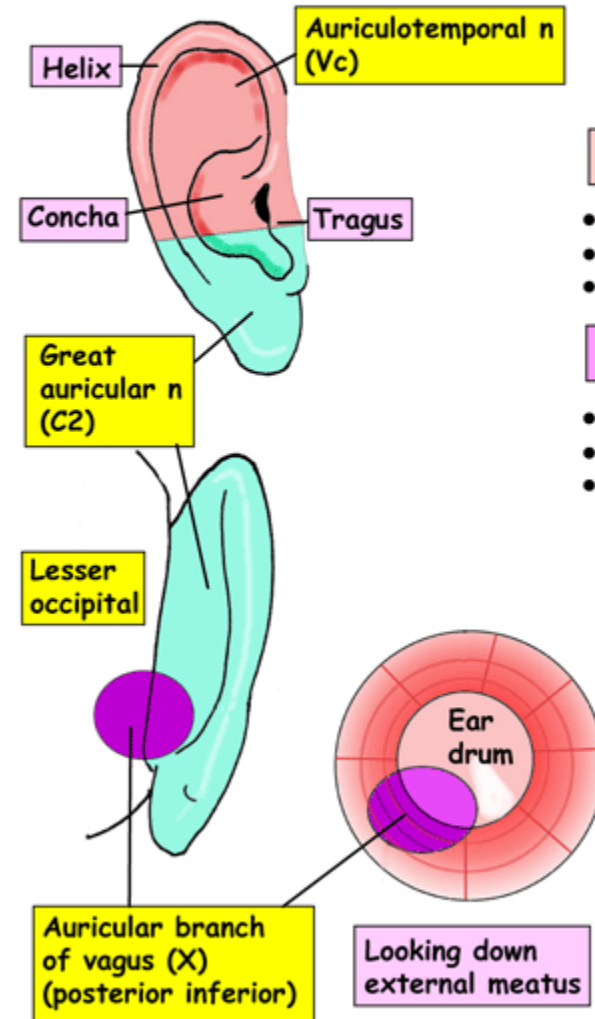
- Post infection
- Traumatic dislocation of ossicles
- Otosclerosis
- Noise injury
- Genetic & senile
- Rubella in pregnancy
- Viruses & drugs
- Tumours of nerves (acoustic neuroma)

VERTIGO (Dizziness)

- Acute labyrinthitis
- Meniere's disease (attacks with deafness & tinnitus)

EAR - RIGHT PINNA & EXTERNAL MEATUS

NERVE SUPPLY



Blood supply:

- Posterior auricular
- Superficial temporal
- Deep auricular (maxillary)

Lymph nodes:

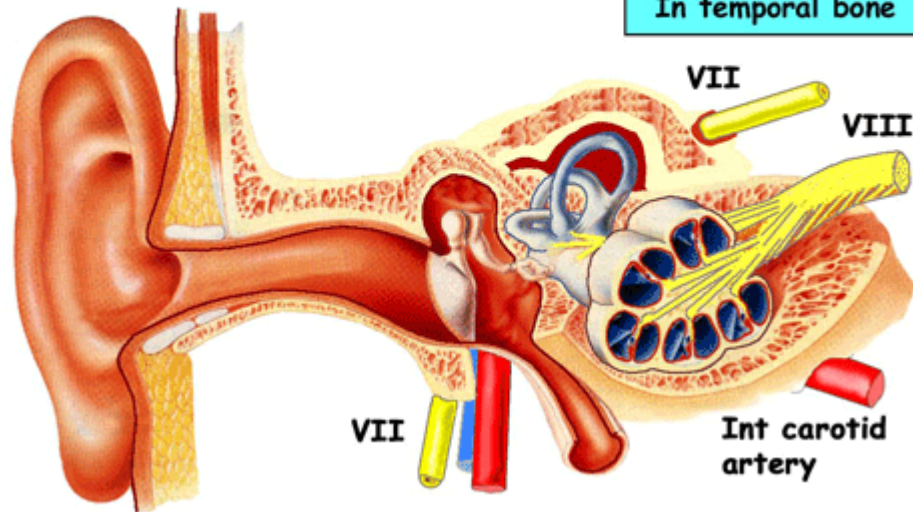
- Pre-auricular
- Mastoid
- Superficial cervical

External meatus and outer surface of drum are supplied by:

- Auriculotemporal
- Auricular br of vagus
- Facial (VII) (as small contribution from tympanic plexus)

EAR - OVERVIEW

Hearing & balance
In temporal bone



EXTERNAL

- Pinna**
 - Amplification
 - Localisation
 - Elastic cartilage
 - Vascular
- Ext meatus**
 - 3cm long
 - 2/3 bone
 - 1/3 cartilage
 - Curves forwards
 - Hairs
 - Glands
 - Sebaceous
 - Ceruminous
- Outer eardrum**

MIDDLE

- Ossicles**
- Facial n**
- Chorda tympani**
- Inner eardrum**
- Auditory tube**
 - Opens on swallowing to equalise pressure
 - 3.5cm long
 - 1/3 bone
 - 2/3 cartilage
 - 30 degrees down
 - 45 degrees ant/med
 - Tubal tonsil at exit in nasopharynx
- Mucosa valvelike**
- Sensory Ns - Vb & IX (referred pain)**

INTERNAL

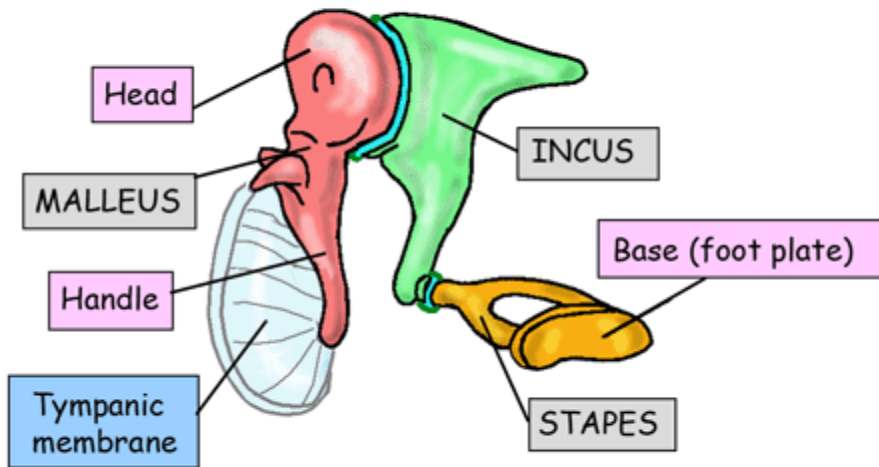
- Labyrinth**
 - Cochlea
 - Semicircular canals

MIDDLE EAR - NOTES

The middle ear:

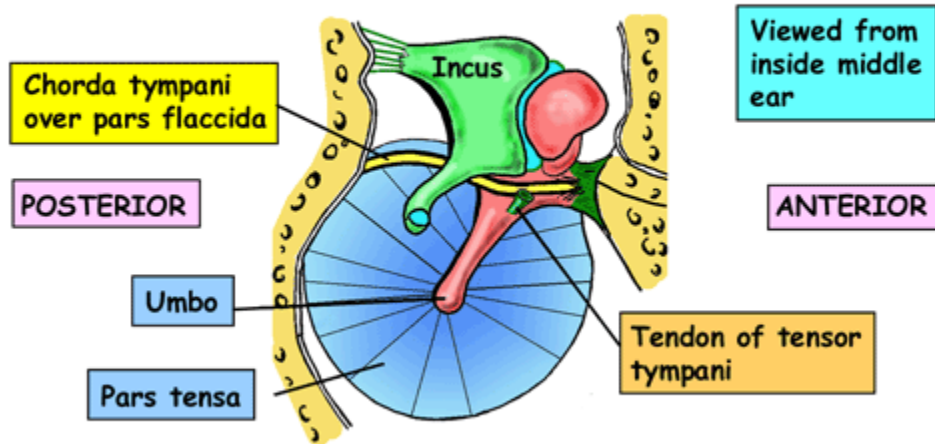
- Transfers and enhances vibrations of the tympanic membrane by means of the ossicles - malleus, incus and stapes. The signal is then passed via the foot plate of the stapes in the oval window to the labyrinth of the inner ear.
- Is a small air filled cavity in the petrous part of the temporal bone
- Connects via an aditus posteriorly to the mastoid air sinus which contains air cells
- Connects to the nasopharynx via the auditory tube for access of air & to keep the air pressure equilibrated by opening with each swallow
- Contains two small muscles - tensor tympani (Vc) & stapedius (VII) which attach to malleus & stapes respectively, which dampen down movements of these ossicles to avoid over-vibration during low pitched sounds.
- Has the facial (VII) nerve passing through it from the internal acoustic meatus to the stylomastoid foramen. It is joined by nervus intermedius, carrying general sensory, taste & parasympathetic fibres, at the geniculate ganglion. Greater petrosal nerve leaves at this ganglion to pass eventually to the pterygopalatine ganglion. Facial nerve also gives a small motor branch to stapedius and then the chorda tympani leaves it just before it exits the middle ear. The chorda tympani passes back into the middle ear, crosses the pars flaccida of the tympanic membrane then exits forwards from the middle ear finally to join the lingual nerve.
- Has a tympanic branch of the glossopharyngeal nerve (IX) supplying sensation to it & it also supplies parasympathetic to the parotid gland via the lesser petrosal nerve & otic ganglion.
- Has mucous membrane covering all its contents.
- Has a sensory supply largely from glossopharyngeal (IX) with a small contribution from facial (VII)
- Has blood supply from a tympanic branch of maxillary & a stylomastoid branch of posterior auricular artery.
- May fill with fluid or pus when infected & transmission of sound via the ossicles is less efficient than sound passing directly through the bone. This is tested with a tuning fork.

MIDDLE EAR - OSSICLES



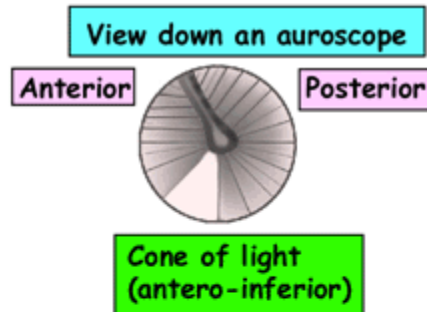
- They increase the amplitude of the vibrations 15-20 times because of:
 - a. leverage
 - b. eardrum to oval window ratio
- Synovial joints between them
- Almost adult size at birth

MIDDLE EAR - LEFT TYMPANIC MEMBRANE

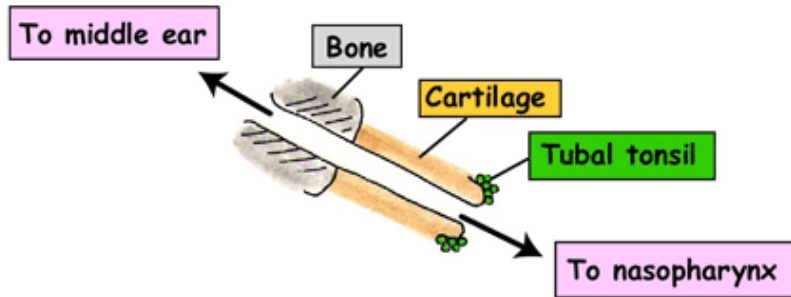


TYMPANIC MEMBRANE

- 3 layers
 - Inner - low columnar
 - Middle - fibrous
 - Outer - stratified squamous
- 1cm diameter
- Pearly grey & shiny
- 55 degrees to horizontal
- Concave outwards
- Faces downwards, forwards & laterally
- Pulled inwards by tensor tympani
- Sensory supply
 - Inner - glossopharyngeal (IX)
 - Outer - auriculotemporal (Vc)
- Vibrates with incoming sound
- Needs equal air pressure on each side of it (see auditory tube)



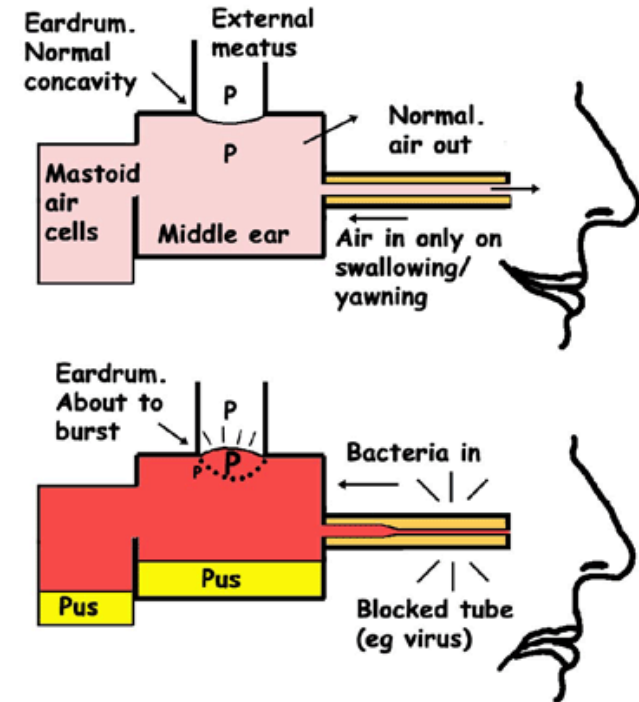
MIDDLE EAR - AUDITORY (EUSTACHIAN) TUBE - TOPOGRAPHY



NOTES

- Develops from 1st pharyngeal pouch
- 3-3.5cm long
- Blood supply from ascending pharyngeal & middle meningeal
- 30 degrees downwards, 45 degrees anteromedially
- Tubal tonsil at exit in nasopharynx
- 1/3 bone
- 2/3 cartilage
- Opens on swallowing to equalise pressure
- Mucosa is valvelike
- Sensation via pharyngeal branch of maxillary nerve (Vb) in lower part and glossopharyngeal (IX) in upper part (hence referred pain to middle ear from tonsils and oropharynx)
- Bony part in petrous temporal bone has columnar epithelium
- Cartilaginous part in squamotympanic fissure has ciliated columnar epithelium
- Muscles opening it are:
 - Salpingopharyngeus
 - Levator palati
 - Tensor palati

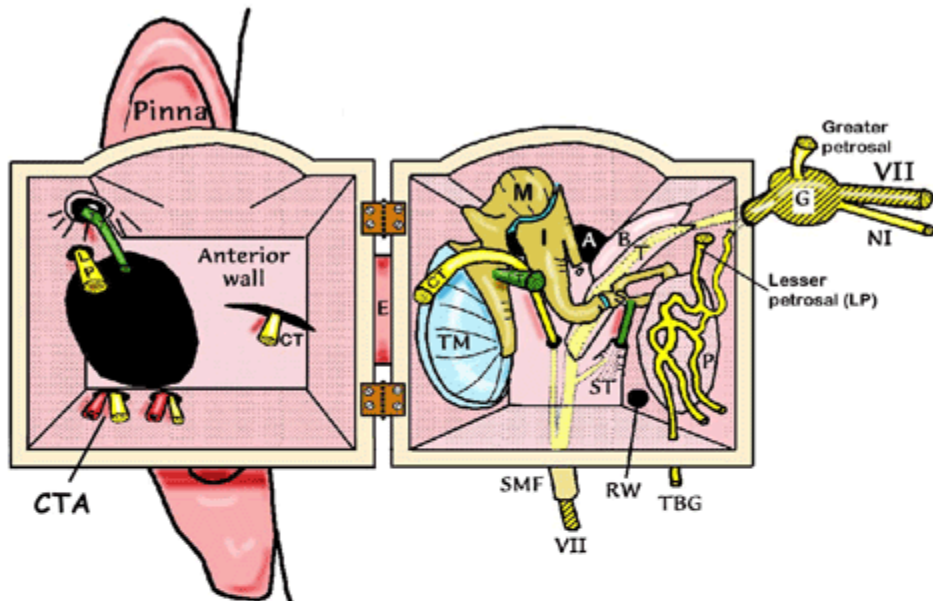
MIDDLE EAR - AUDITORY (EUSTACHIAN) TUBE - EFFECT OF BLOCKAGE



Effects of blocked auditory tube:

1. At first air is still absorbed - drum sucked in more
2. Giving poor ossicle/drum movement - deafness
3. Then viral/bacterial exudate gets infected
4. Middle ear +/- mastoid air cells fill with pus (otitis media)
5. Then pressure rises - drum bulges outwards +/- bursts
6. Infection may spread to - inner ear, venous sinuses, extradural, subdural, meninges, brain abscess
7. THEN EITHER:
 - Drains and heals
 - Becomes chronic, +/- glue ear or cholesteatoma
 - Persistent perforation of drum, +/- necrosis of ossicles

**MIDDLE EAR
- RIGHT SIDE LOOKING POSTERIORLY**

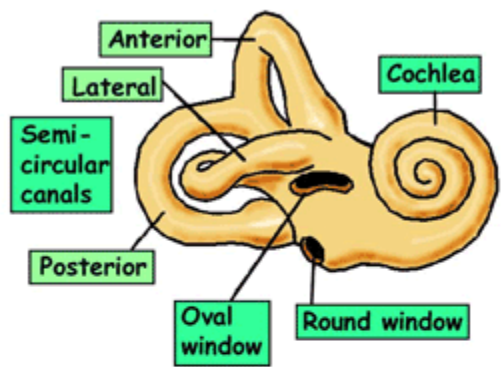


Right hand box is a view of the right middle ear looking posteriorly. The left hand box is the anterior wall of the right box. Hinges are to illustrate how it would close to become the anterior wall

- A = Aditus to mastoid air sinus
- B = Bony bulge of lateral semicircular canal
- CT = Chorda tympani
- E = External auditory meatus
- G = Geniculate ganglion
- I = Incus
- LP = lesser petrosal n
- M = Malleus
- P = Promontory (last turn of cochlea)
- RW = Round window
- S = Stapes
- ST = Stapedius
- SMF = Stylomastoid foramen (VII emerging)
- T = Bony tunnel for facial n
- TBG = Tympanic branch of glossopharyngeal

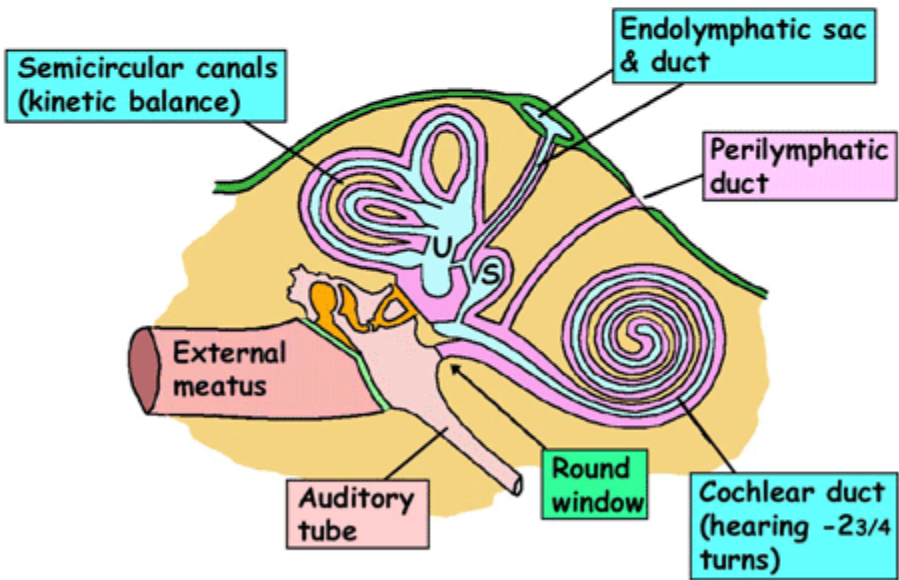
Mucosa covers all contents & is supplied by IX & a little VII. The carotico-tympanic arteries (CTA) bring in blood supply & sympathetics for the tympanic plexus on the promontory

INNER EAR - BONY & MEMBRANOUS LABYRINTHS



Full size at birth
In petrous temporal bone
One continuous cavity
For hearing & balance
Vestibulocochlear nerve

Membranous labyrinth
lies within osseous labyrinth

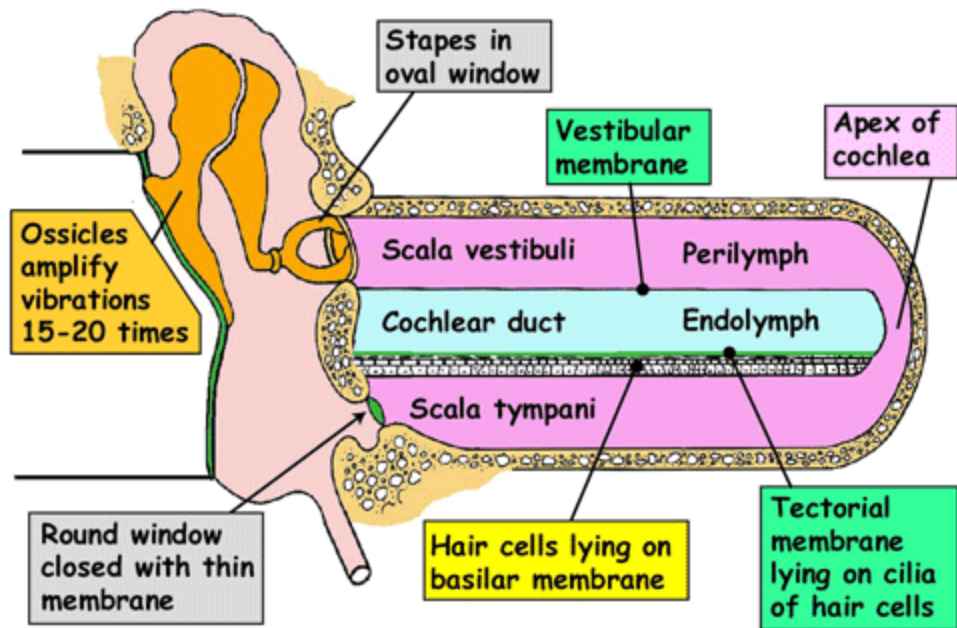


Endolymph
Perilymph

U= Utricle
S= Saccule
(both for static balance)

Blood supply via
labyrinthine artery

INNER EAR - STRAIGHTENED OUT COCHLEA TO AID UNDERSTANDING



HEARING MECHANISM

