The Outer Ear

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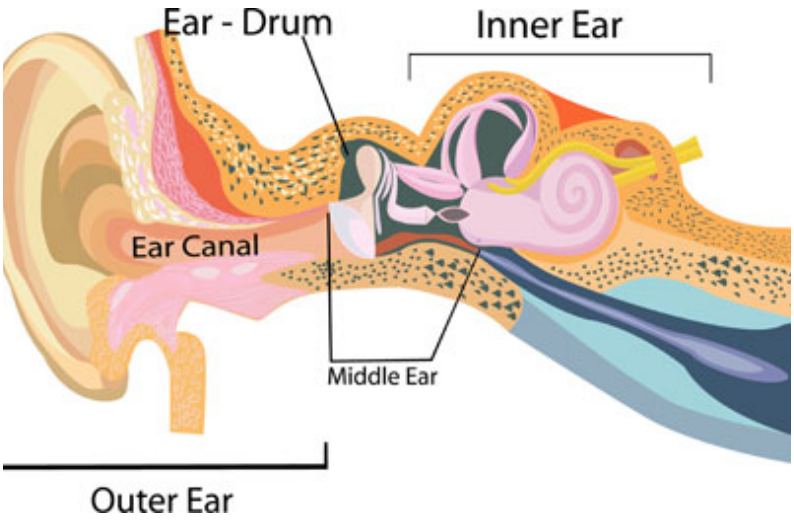
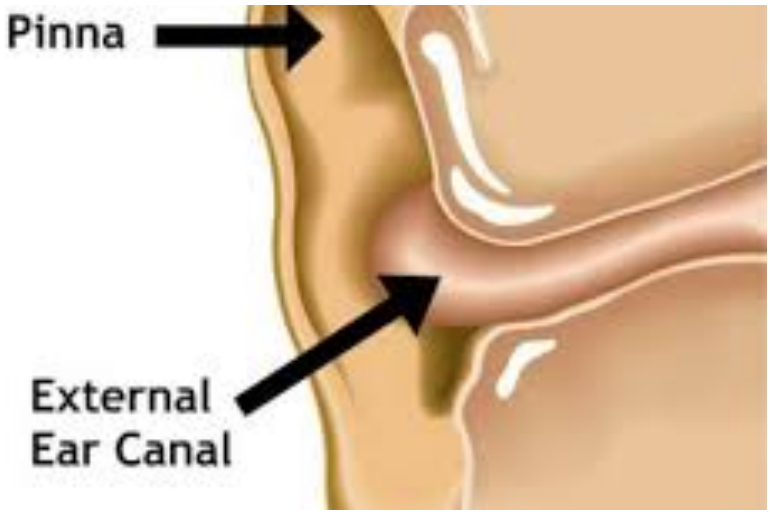
Learning outcomes

- Describe the basic structures of the outer-ear and its purposes.
- Basic knowledge of common disorders that may affect the outer ear.
- Describe how these disorders are caused and treated and how they may manifest on a variety of audiometric tests.

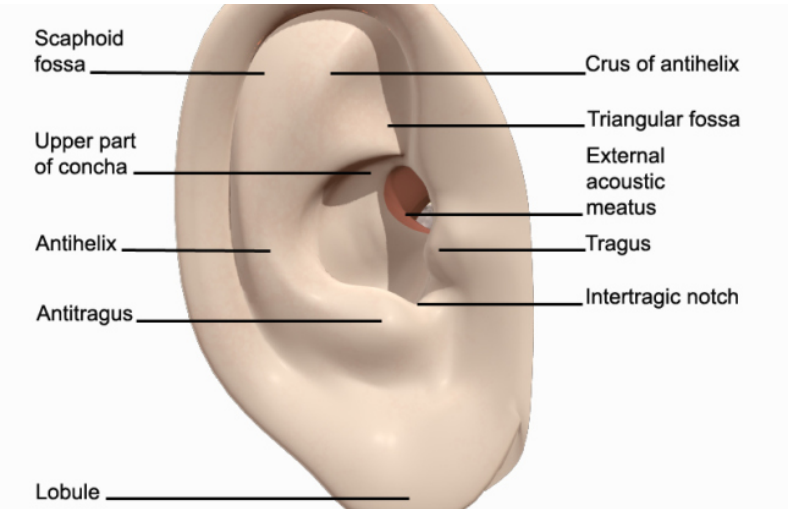
Peripheral auditory system



Outer ear



The Auricle



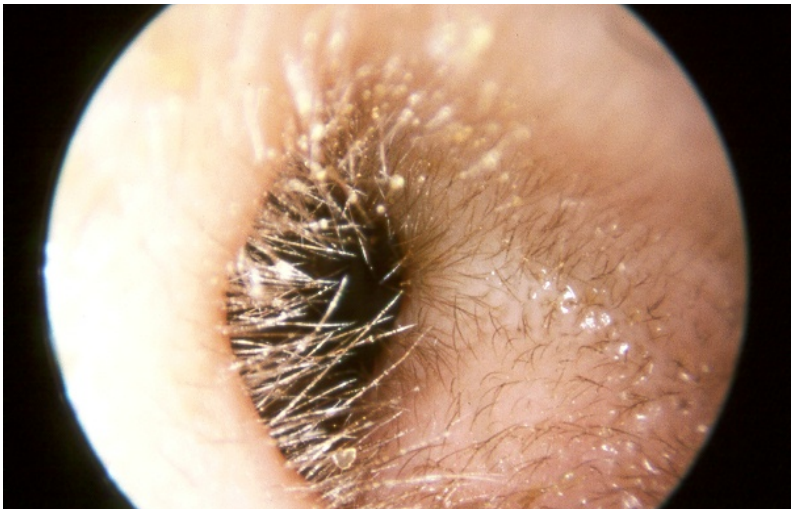
The Auricle

- The most noticeable part of the outer-ear is the auricle or pinna.
- Made entirely of cartilage.
- It's function

1. Funnels sound into the external auditory meatus.
2. Helps in sound localization.

If we obstruct the pinna, our ability to localize sounds worsens; we cannot tell whether a sound comes from in front or behind, or above or below.

The external auditory canal EAC



The external auditory canal EAC

- The external auditory canal is a tube begins at the concha and extends inward for approximately 2.5 cm in adults.
- Two portions:

1. The outer portion (cartilaginous) of the EAC is surrounded by cartilage, thick skin, hair and earwax glands.
2. The inner portion (bony) of the EAC is surrounded by bone, extremely thin skin, hairless and very sensitive.

In small children, the angel of the EAC is different than that in adults. Therefore, when one wants to examine the ear, the adult pinna is pulled up and back , whereas in children the pinna is pulled down and back.

The external auditory canal EAC

- EAC function:

1. Channels sound to the tympanic membrane TM
2. Protects the tympanic membrane TM;
   a. Wax and hairs trap dirt and foreign objects.
   b. Keeps constant temperature and humidity.
3. Ear-canal resonance for frequencies between 2-7 kHz. Amplifies incoming sound, thereby creating an efficient transfer of energy to the TM.

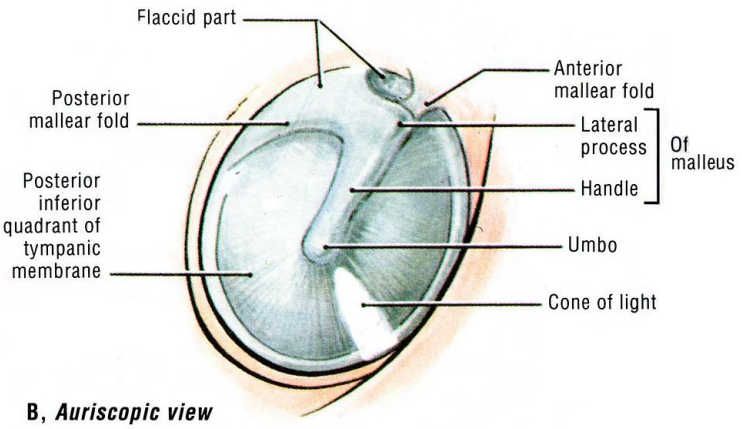
Tympanic Membrane TM

Tympanic Membrane TM

- The tympanic membrane has three layers:

1. An outer layer of very thin skin, continuous with that of the external ear canal.
2. A middle layer arranged of connective tissue fibers.
3. An inner layer, a single layer of cells, continuous with the lining of the middle ear cavity.

Tympanic Membrane TM



B, *Auriscopic view*

Video Otoscope

Development of the Outer Ear

- The pharyngeal arches begin to appear after 28 days after conception of the human embryo. These arches are known to have three layers, the ectoderm, the entoderm and the mesoderm.
- Development of the auricle begins before the second fetal month.
- A primitive meatus forms in the 4th gestational week, but the external auditory canal is not complete until puberty.
- The tympanic membrane begins to format by the beginning of the second embryonic month.

Disorders of the Outer Ear and their Treatments

- Disorders of the pinna

1. Usually part of genetic syndromes.
2. They do not reveal any effects on hearing sensitivity, word recognition, and localization.
3. Indicate maldevelopment or absent development and mirrors middle and external auditory canal development.
4. Patterns:

a. Complete/partial absence of auricle
b. Abnormal position/shape of auricle
c. Preauricular sinus/cyst
d. Associate with EAC abnormalities

4. Treated by reconstruction or prosthesis

Disorders of the pinna

Atresia of the EAC

- Condition occurred when the cartilaginous, the bony, or the entirety of the EAC has never formed at all.
- Could be unilateral or bilateral.

a. Treacher Collins Syndrome which is an inherited condition involves anomalies of the facial bones, especially the cheek and lower jaw; the auricle; and congenital atresia of the EAC. Collins syndrome present with preauricle tags which represent incomplete embryological development and appear in front of the auricle.

- Surgical correction may be quite difficult with Treacher Collins syndrome because of the presence of a number of abnormalities of the middle ear and temporal bone.

Atresia of the EAC

Treacher Collins Syndrome

Atresia of the EAC

b. CHARGE syndrome is a genetic disorder that occurs in one out of 10,000 to 15,000 births (Thelin & Swanson, 2006).

- Often obvious in childhood because of the anomalies of the pinna and EAC. However, any part of the auditory system can be affected.
- CHARGE stands for Coloboma (a keyhole slot in the retina, iris, or optic nerve), Heart disorders, Atresia choanae (blockage of the respiratory passages), Retarded growth and development, genitourinary abnormalities, and Ear anomalies.
- Habilitation for this syndrome is very difficult to audiologists, speech-language pathologies and physicians because of the multiple disorders.

Atresia of the EAC

- The condition may also be acquired, as a result of trauma or burns.
- Hematoma is an unsightly blood blister occurred in response to trauma to the outer ear.
- Frostbite which is the loss of pinna after being damaged by sunlight or extreme cold.
- Surgical procedures for correction of atresia of the EAC have improved in recent years. Imaging techniques have been assisted greatly and chances of success are better when only the cartilaginous canal is involved, and when the middle ear and the TM are normal. However, the ultimate decision for a surgical treatment or hearing aid for the bony canal is always left to the family in consultation with a physician.

Atresia of the EAC

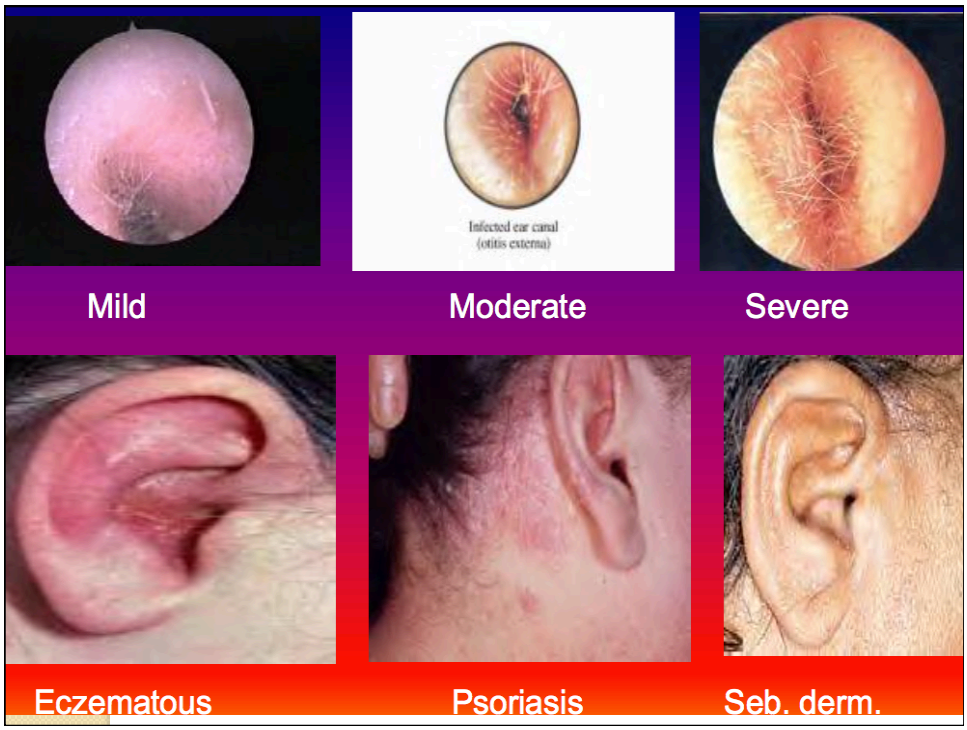
Collapsing External Auditory Canals

- Condition when a false conductive hearing loss appears during examination because the pressure of a supra-aural earphone causes the auricle to move forward, blocking the opening of the canal, and attenuating sound entering it.
- Incidence for the condition is 4% of a typical audiology caseload.
- Most incidences occurring among children before 7 years of age as the outer portion of the ear canal is less rigid, and among the elderly because of the greater elliptical shape of the canal and being more flaccid.
- The otoscopic examination should include inspection for canal collapse.
- Insert earphones are completely eliminated the ear collapsing.

Foreign Bodies in the External Ear Canal

External Otitis

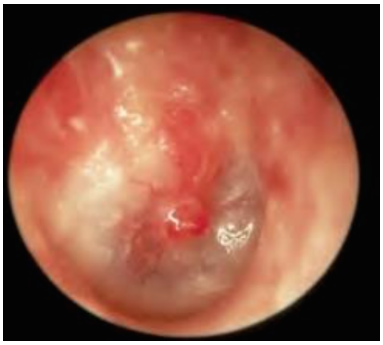
- An infection that occurs in the skin of the external auditory canal.
- Also referred to as "swimmer's ear".
- More common condition in tropical areas.
- Bacterial infections are more common cause.
- Otomycosis (fungal external-ear infection) is rare.
- May originates from allergic reactions to earplugs, hearing-aid earmolds, soap, or other allergens.
- Furunculosis: infection of hair follicles.
- Predisposed by scratching
- May be due to impacted wax & increased ep. turnover
- Starts with itching – pain- crusting – discharge – CHL
- Often body temperature elevates.
- Constitutional upsets
- May be accompanied with AOM or CSOM
- 3 clinical types – mild (canal open); moderate (canal partly occluded, TM partly seen); severe (canal fully occluded)
- Treatment:
- Systematic antibiotics are frequently unsuccessful
- Irrigating the canal with warm saltwater-dry it-apply topical antibiotics and or topical steroids for the inflammation.



External Otitis

Myringitis

- Inflammatory condition of TM
- Blood blisters on the surface of the TM
- May be a part of otitis externa
- Topical treatment
- May hide otitis media



External Otitis

Otitis externa malignans

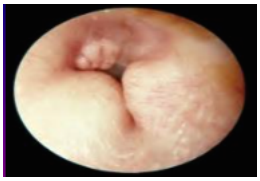
- Usually in diabetics/immune compromised patients (elderly patients).
- Caused by Pseudomonas – rapidly destroys bone and affects multiple cranial nerves (osteitis and osteomyelitis of the temporal bone).
- Pain/discharge and nerve palsies
- Systematic Antibiotics and surgery; *may be fatal*

Growths in the External Auditory Canal

Swellings

- Osteomas
- Usually single
- Bony tumors, both benign and malignant
- Usually in outer canal
- May cause CHL if the size is big enough to occlude the canal
- May interfere with skin migration

- Exostosis
- Common in swimmers, usually multiple
- Usually in deep canal regions
- May cause CHL
- May interfere with skin migration
- Both treated by excision if necessary



Earwax in the External Auditory Canal

- *Remember the commonest cause of hearing aid malfunction is ear wax !*
- Anatomy

Secreted by modified sweat glands (ceruminous glands) in the dermis of skin of outer 1/3 rd of EAC

- Physiology
- Normal phenomenon but in some cases the wax glands are extremely active
- Types
- Wet – autosomal dominant inheritance (Caucasian & African)
- Dry – autosomal recessive inheritance (Mongoloid)
- Functions
- Repels moisture and traps dust
- Lubricates EAC for smooth extrusion of dead skin cells
- Bactericidal – hence protective function
- Management (only when accumulates)
- Diagnosis by otoscopy and clearance (microsuction or syringing)
- Wax softeners (olive oil or Sodium bicarbonate)

Earwax in the External Auditory Canal

- Morbidity associated with wax
- 2.3 milllion in U.K have problems with wax; 2-6% get impacted wax
- Impacted wax may give rise to otitis externa by interfering with migration of dead skin
- Impacted wax may give rise to pain
- Impacted wax may give rise to CHL
- Impacted wax may give rise to psychological problems including social isolation and withdrawal
- Wax may hide a condition of the middle ear
- Wax may prevent impression taking
- Wax accumulation interferes with & may damage hearing aid mechanism
- Treatment in children may necessitate clearance under GA
- Self cleaning may induce trauma

Earwax in the External Auditory Canal

Perforations of the Tympanic Membrane

- Causes:
- Excessive pressure buildup during a middle-ear disorder.
- In response to infection.
- A frequent cause is direct trauma from a pointed object such as a cotton swab (such accidents are extremely painful, and embarrassing).
- Sudden pressure in the external ear canal, as created by a hand clapped over the ear or an explosion.
- The amount of hearing loss produced by a perforated TM depends on the size and place of the perforation.
- Treatment:
- Traumatic perforations tend to show spontaneous closure than that perforations from a disease.
- Perforations in the inferior portion of the TM heal more rapidly than those in the superior portion, because the normal epithelium migration is more active inferiorly.
- Surgical repair is called myringoplasty

Perforations of the Tympanic Membrane

Thickening of the Tympanic Membrane

- Also called tympanosclerosis
- The TM membrane becomes thickened and scarred, often in response to infection.
- Calcium plaques appear, adding to the mass of the TM and interfering with its vibration but sometimes causing no hearing loss.
- Do not respond well to medical or surgical treatment.

Tympanosclerosis

Thank you