



## ANATOMY & HISTOLOGY

### - The ear is divided into 3 parts:

- **External ear:** consisting of auricle which collects sound waves and conduct them through the external auditory canal to the tympanic membrane (a thin membrane which is separating the external ear from middle ear cavity).
- **Middle ear:** it is a space which is communicating with nasopharynx through the auditory tube and contains 3 small bones known as auditory ossicles (these are: malleus, incus and stapes).

### - Histology of the ear:

- **External ear:**
  - ✓ Auricle: keratinized stratified squamous epithelium with fibroelastic cartilage.
  - ✓ External auditory canal: keratinized stratified squamous epithelium. The outer 1/3 contains ceruminous glands (producing ear wax when mixing with secretions of sebaceous glands). The inner 2/3 lacks ceruminous glands and contains bone (not cartilage).
  - ✓ Tympanic membrane: the part which is facing the outer ear is also lined by keratinized stratified squamous epithelium while the part which is facing the middle ear is lined by non-keratinized stratified squamous epithelium.
- **Middle ear:**
  - ✓ Eustachian tube: respiratory epithelium that becomes pseudostratified as it approaches nasopharynx.
  - ✓ Mastoid: flat, single, cuboidal epithelium.
  - ✓ Ossicles: typical synovial joints.

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## PATHOLOGY

### - Causes of ear discharge:

- Otitis externa.
- Otitis media.
- Otomycosis (fungal otitis externa).
- Trauma.

### - Types of ear discharge:

- Wax (normal).
- Pus.
- Mucus and mucopus.
- Blood stained (in otitis media).
- Fresh blood (trauma).
- CSF (trauma).

### - Otitis externa:

#### • **It can be classified as:**

- ✓ Acute otitis externa: which can be further classified to:

- ❖ *Diffuse:* the causes include:

- ✚ **Excessive removal of wax (especially seen in swimmers)** → this increases pH of external auditory canal enhancing bacterial growth.
- ✚ **Obstruction of external auditory canal:** by excessive cerumen, debris or a narrow canal → all leading to moisture retention.
- ✚ **Trauma:** caused by scratching or vigorous cleaning.
- ✚ **The most common causative organisms are:** S.aureus and Pseudomonas species.

- ❖ *Localized:* associated with infection of a hair follicle (furunculosis).

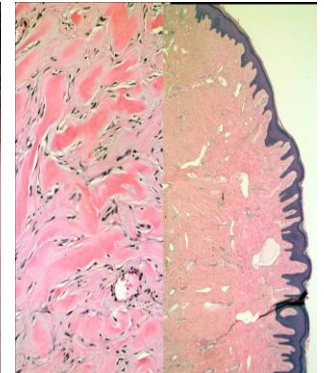


- ✓ **Chronic otitis externa:** in which the disease stays for a longer duration (more than 6 weeks). Rarely the skin may become hypertrophic leading to stenosis of external auditory canal (chronic stenotic otitis externa).
- ✓ **Otitis externa maligna:** invasive, potentially life-threatening infection of the external ear and skull base (caused mostly by pseudomonas). The term “maligna” is due to its propensity to cause complications (cellulitis or osteomyelitis).
- **Causative organisms:**
  - ✓ **Bacterial:** localized otitis externa – diffuse otitis externa – malignant otitis externa.
  - ✓ **Fungal:** otomycosis (fungal otitis externa).
  - ✓ **Viral:** herpes zoster oticus – otitis externa hemorrhagica.
- **Complications:**
  - ✓ **Abscess:** accumulation of pus from the infection.
  - ✓ **Fibrosis:** which can lead to stenosis.
  - ✓ **Myringitis:** inflammation of the tympanic membrane.
  - ✓ **Otitis externa maligna.**

- **Other disease of the external ear:**

- ✓ **Keloids (benign scar that doesn't know when stop):** cutaneous lesion that results from excessive collagen synthesis and deposition. Earlobe keloids are especially seen as a complication of plastic surgery or ear-piercing.

- ❖ **Histology:** randomly arranged hyalinized collagen with scattered fibroblasts and myofibroblasts. The overlying epidermis is atrophic.



- ✓ **Chondrodermatitis nodularis helices:** idiopathic degenerative process involving upper dermis of auricular rim. Risk factors for this condition are trauma and sun exposure.

- ❖ **Gross features:** lesions are discrete, grey to red in color, oval-shaped, with raised rolled edges and a central ulcer or depression.

- ❖ **Histology:** epithelial hyperplasia, collagen degeneration, focal fibrinoid necrosis and inflammatory components.

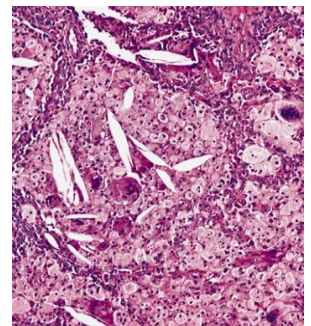


- **Otitis media:**

- Notice that the mucosa of middle ear is lined by low cuboidal epithelium and Eustachian tube is lined by ciliated columnar epithelium (respiratory epithelium).
- **Definition of otitis media:** acute or chronic infection of the middle ear. This infection reaches the middle ear through:
  - ✓ Eustachian tube.
  - ✓ Blood.
  - ✓ Direct extension if there is perforation of the tympanic membrane.
- Severe cases of otitis media are associated with destruction of auditory ossicles (malleus, incus and stapes).
- Acute mastoiditis (inflammation of the mastoid) is a serious complication of acute otitis media.
- **Otitis media results from obstruction of Eustachian tube which can be due to:**
  - ✓ Respiratory infection (cold)
  - ✓ Allergies.
  - ✓ Exposure to cigarette smoke.
  - ✓ Infected or overgrown adenoids (tonsils).



- ✓ In infants, being fed lying down.
- **Otitis media can be subdivided into:**
  - ✓ Acute otitis media:
    - ❖ *Caused by:* S.pneumoniae and H.influenzae.
    - ❖ *Characterized by:* edema, hyperemia, polymorphonuclear leukocyte infiltration in the subepithelial space (SES).
    - ❖ If untreated, it may lead to formation of granulation tissue and scar.
  - ✓ Serous (otitis media with effusion/fluid without signs of infection):
    - ❖ It is more common than acute otitis media.
    - ❖ *Caused by:*
      - ✚ Swelling of Eustachian tube.
      - ✚ Air in the middle ear cavity is absorbed.
      - ✚ Negative pressure.
      - ✚ Transudate from plasma.
    - ❖ Notice that signs and symptoms occur when fluid in the middle ear becomes infected.
    - ❖ *Seromucinous otitis media (glue ear): causes include:*
      - ✚ Recurrent otitis media because of poor Eustachian tube function (common in children with cleft palate).
      - ✚ Inadequate antibiotics for acute infections.
      - ✚ Allergy.
      - ✚ Nasopharynx carcinoma in adults.
      - ✚ Barotraumas (sudden change in atmospheric pressure produced by flying or diving).
  - ✓ Chronic otitis media:
    - ❖ Characterized by chronic inflammatory cells and glandular metaplasia (unevenly distributed glands lined by cuboidal to columnar epithelium with or without cilia and may or may not contain secretions).
    - ❖ *Complications of chronic otitis media (intratemporal):*
      - ✚ Fibrosis and granulation tissue.
      - ✚ Destruction of auditory ossicles.
      - ✚ Reactive bone formation.
      - ✚ Tympanosclerosis (see the image) : representing dystrophic calcification/ossification in middle ear following recurrent episodes of otitis media. It is seen in children and elderly.
        - Gross features: white nodules/plaques.
        - Histology: clumps of calcification material in connective tissue of tympanic membrane. This may cause scarring and ossicular fixation.
      - ✚ Cholesterol granuloma (see the image)
      - ✚ Perforation of tympanic membrane (with resulting ingrowth of squamous epithelium forming cholesteatoma).
      - ✚ Mastoiditis.
      - ✚ Petrositis.
      - ✚ Labyrinthitis.
      - ✚ Facial paralysis.
    - ❖ *Intracranial complications of chronic otitis media:*
      - ✚ Meningitis.
      - ✚ Extradural abscess.
      - ✚ Subdural empyema.
      - ✚ Focal encephalitis.

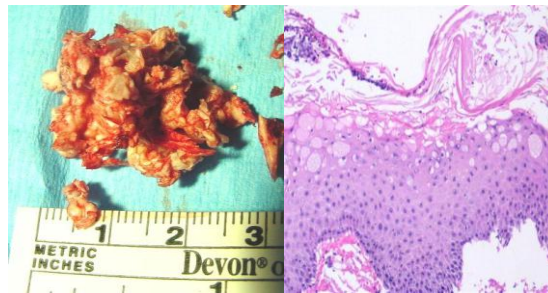
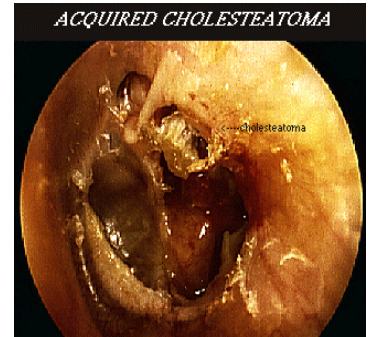


- ✚ Brain abscess.
- ✚ Lateral sinus thrombosis.
- ✚ Otitis hydrocephalus.



- **Cholesteatoma:**

- **Definition:** it is a mass of desquamated keratin collecting in a sac in the middle ear cavity and/or mastoid, caused by cystic loculation of squamous epithelium.
- Presents over a wide age range and located in upper posterior part of middle ear cleft.
- It enlarges by erosion of underlying bone.
- If it is not completely excised, it leads to widespread bone destruction, hearing loss, facial paralysis, meningitis, brain abscess or labyrinthitis.
- **This disease can be:**
  - ✓ Congenital.
  - ✓ Acquired: this is explained basically by 3 theories:
    - ❖ Invagination of tympanic membrane: caused by negative pressure in middle ear cavity generated by non-functional Eustachian tube.
    - ❖ Epithelial in-growth through a perforation that results from chronic infection or direct trauma.
    - ❖ Squamous metaplasia of middle ear epithelium.
- **Gross features:** cystic white lesions of varying size with creamy or waxy granular material.
- **Histology:** lined by keratinized squamous epithelium and filled with granulation tissue and keratin debris.



**In cholesteatoma, cholesterol comes from degenerated keratin and hemorrhage**

- **Aural polyp:**

- Non-cancerous fleshy growths in the outer ear canal or on the ear drum.
- It is an infrequent complication of chronic otitis media and originated from middle ear mucosa.
- **Histology:**
  - ✓ Polypoid lesion lined by cuboidal or ciliated columnar epithelium.
  - ✓ Focus of squamous or glandular metaplasia may be seen.
  - ✓ Lymphocytes, histiocyte, granulation tissue, variable neutrophils, mast cells, eosinophils and some plasma cells.
  - ✓ Some multinucleated giant cells and cholesterol granulomas may be present.

