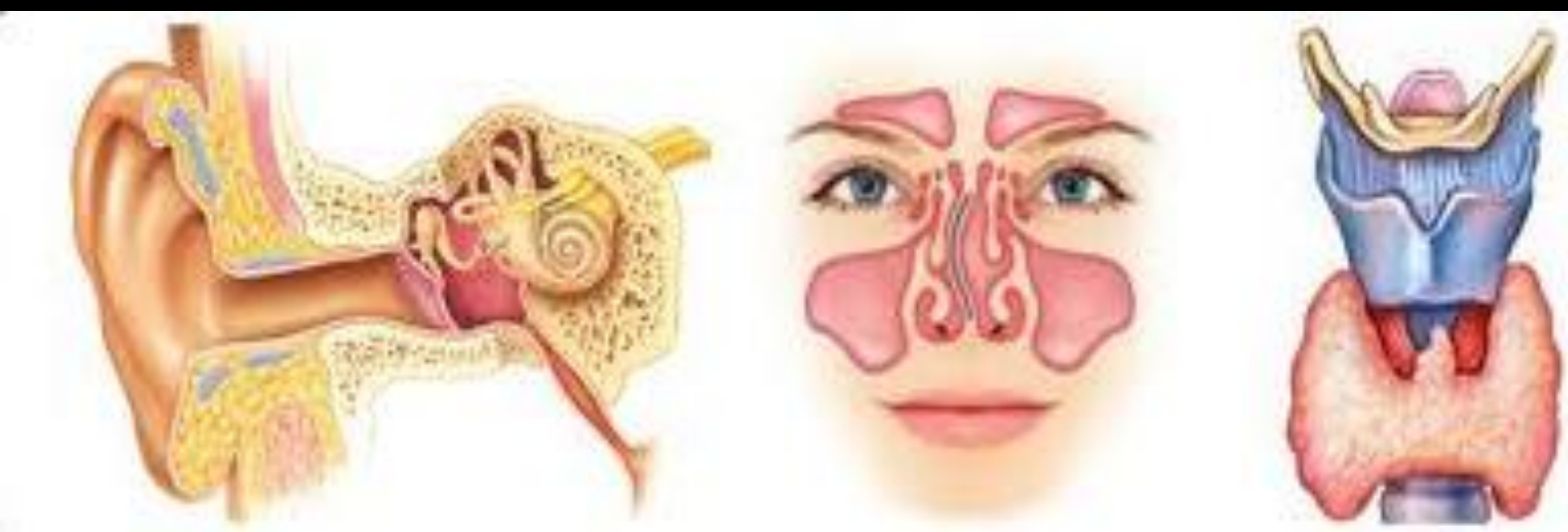


Diseases of the Ear, Nose and Throat



Lecture:

CHRONIC OTITIS MEDIA and MIDDLE EAR EFFUSION Done by: Layan Akkielah

The slides were provided by Doctor Al- Essa

Source: recording, the slides , Toronto notes, ENT lecture notes, CURRENT diagnosis and treatment LANGE, Diseases of EAR, NOSE & THROAT PL Dhingra, Team 429

Important Notes in **red**

Slides and doctor notes are in **black**

Our notes in **green**

GROSS ANATOMY OF THE EAR

The ear is divided into three parts:

- **The External ear**

It is formed by the Auricle or the Pinna, the external acoustic meatus and the tympanic membrane which acts as a partition between the external and the middle ear.

- **The Middle ear cleft**

It is composed of:

➔ The Eustachian Tube:

It's a tube that connects the middle ear cavity to the nasopharynx.

The normal physiologic functions of the tube include:

- 1- Equalization of the middle ear pressure and the atmospheric pressure.
 - 2- Prevent reflux of contents of the nasopharynx into the middle ear.
 - 3- Clear secretions of the middle ear by both mucociliary transport and a "pump action" of the Eustachian tube.
- Failure of any of these functions can result in Otitis Media.

➔ The middle ear cavity:

- The main content of the middle ear is **air**.
- Three little bones known as the auditory ossicles: Malleus, Incus and Stapes.
- **Muscles: tensor tympani muscle which is attached to the malleus, and the stapedius muscle which is attached to the stapes.**
- **Nerves**

➔ The mastoid antrum and air cells.

- **The Inner ear**

It is composed of the Cochlea, which transforms sound into nerve impulses that travel to the brain, and fluid-filled semicircular canals (labyrinth), which send information on balance and head position to the brain.

The normal tympanic membrane is a pale gray semitransparent ovoid cone shaped disc located at the end of external canal. Cone-shaped reflection of light appears in the anterior inferior quadrant of the membrane

The tympanic membrane has three layers:

- 1- Outer epithelial layer which is continuous with the skin lining the meatus.
- 2- Middle fibrous layer which encloses the handles of malleus.
- 3- Inner mucosal layer which is continuous with the mucosa of the middle ear.

MECHANISM OF HEARING

- The auditory ossicles conduct sound from the tympanic membrane to the inner ear. Sound waves picked up by the external ear vibrate the tympanic membrane, which in turn mobilizes the ossicular chain of the middle ear. The footplate of the stapes applies a mechanical pressure on the oval window and the vibration reaches the perilymphatic fluid of the cochlea. Inside the inner ear these vibrations are converted to nerve signals that are carried by the auditory nerve to the brain.

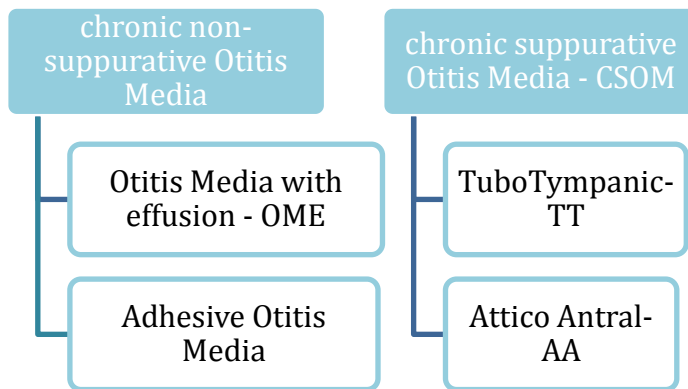
CHRONIC OTITIS MEDIA

Definition:

- **Chronic Otitis Media** is an infection involving a part of the **middle ear cleft** or all its components *that is persistent for more than 3 months*.

Route of infection:

- 1- Local: From one part to another.
- 2- Via the Eustachian Tube: An Upper respiratory tract infection can spread to the ear through the Eustachian tube.
- 3- Blood – bone.
- 4- Lymphatic spread

Classification of chronic otitis media:**Note:**

There are many different classifications. This classification is classified according to the cause as the doctor said.

Suppurative = Puss formation.

- The tympanic membrane is **intact (not perforated)** in **Chronic non-suppurative otitis media**, while in **chronic suppurative otitis media** it is **not intact (perforated)**.
- Chronic suppurative otitis media is divided **clinically** into two types:
 - 1- TuboTympanic, which is also known as the **Safe** type, has no risks of serious complications.
 - 2- AtticoAntral, which is also known as the **Unsafe** type, has a high risk of developing complications.
- To have a discharge coming through the external canal the membrane has to be perforated.

1. CHRONIC NON-SUPPURATIVE OTITIS MEDIA**1.1 OTITIS MEDIA WITH EFFUSION****Other terms:**

- Secretary middle ear, Syn. Serous Otitis media, Mucoid otitis media , Glue ear, Catarhal otitis media, Sero-mucinous otitis media.

Definition

- It is a condition characterized by the presence of non-purulent fluid (sterile) within the middle ear cleft that persists for more than 3 months with an intact tympanic membrane.

Prevalence:

- It is a very common disease especially in children at age of 5 years and below.
- Almost everyone during one time or another will have one attack of OME, even though it's self limiting and can't be recognized.
- Between 20% and 50% of children do have OME at some time between 3 and 10 years of age.
- Two peaks at 2 and 5 years of age.

Pathogenesis :

- Normally, the middle ear is aerated all the time by the eustachian tube. If the eustachian tube was obstructed for any reason, the normal mucosa of the middle ear will start absorbing the air, which is one of its normal functions, and will create negative pressure in the middle ear. Due to that, the tympanic membrane is retracted and therefore its movement is hindered causing conductive hearing loss. Also, it becomes unable to drain the fluid that started to accumulate due to the increased secretory activity of the middle ear mucosa

Histopathology:

- Changes in the mucosa:
 - Vasodilatation and mono nuclear cell infiltration.
 - Metaplasia of the epithelium to ciliated columnar epithelium
 - Mucus secreting gland formation.
- Formation of fluid in the middle ear:
 - Transudate.
 - Exudates.
 - Secretions.

Risk factors:**Environmental factors:**

- It is more common in **winter** months.
- It's more common in **developing countries** with low socio-economic status.
- **Exposure to cigarette smoke increases** the risk of developing the infection. **Passive smoking results in inflammation of the mucosa of the middle ear cleft as well as impaired mucociliary clearance, which will potentially facilitate bacterial colonization and congestion.**

Genetic factors:

- Both females and males are at **the same risk** of getting OME.
- It's more common in people with **fair skin**.
- Considering the variations in anatomy of the Eustachian tube between adults and children, Otitis media with effusion is **more common in children** where the Eustachian tube is shorter, wider and more horizontal. This will make it easier for organisms from URTI to access the middle ear.
- Otitis media is almost universally seen in children with **Cleft palate**. Because the tensor veli palatine muscle lacks its normal insertion into the soft palate, it is unable to open the Eustachian tube properly on swallowing or chewing.

Normally, the Eustachian tube is closed at rest. It opens either actively by contraction of muscles as in swallowing or by Valsalva maneuver, which is increase in the pressure of the Eustachian tube and middle ear by forcible exhalation effort against occluded nostrils and closed mouth, or passively.

- **Nasopharyngeal anatomical abnormalities:** Eustachian tube obstructions.
- Allergy. **Seasonal or perennial allergy to inhalants or foodstuff is common in children. This not only obstructs Eustachian tube by oedema but may lead to increase secretory activity as middle ear mucosa acts as a shock organ in such cases.**

Important note:

- Case:
A healthy adult came to your clinic complaining of sudden gradual **unilateral** hearing loss. He has no history of previous infections (whether URTI, tonsillitis, adenoiditis..etc).
On examination you find fluid in the middle ear cleft.
Diagnosis: otitis media with effusion due to an obstruction in the Eustachian tube caused by **Nasopharyngeal carcinoma**.
- Always think of nasopharyngeal carcinoma in adults with an explained otitis media with effusion.
- Glue ears and unilateral cervical lymphadenopathy can be the first clinical presentation of that carcinoma in some patients.
(the first sign will be streaks of blood in the throat, but no one would see that)
- Patients with nasopharyngeal carcinoma will present with conductive hearing loss and a lump on the neck.

Etiology

- Unresolved AOM acute otitis media: Inadequate Antibiotic therapy will not resolve the infection completely. There will be fluid remained and remnants of bacteria.
- Mainly Eustachian tube dysfunction:
Causes that will result in an obstruction in the Eustachian tube and accumulation of fluid:
 - The chronic inflammation itself can cause obstruction of the tube by formation of oedema around the esustachian tube.
 - Nasopharyngeal carcinoma in adults but it is rare.
 - In children:
URTIs including sinusitis
Tonsillitis: **enlarged tonsils will obstruct the movement of the cleft palate.**
Adenoiditis: either by inflammation by hypertrophy of Lymphoid tissue or enlarged adenoids which can cause obstruction of the tube.
- Cleft palate
- Poor muscular function: Diseases that causes hypotonia such as Down syndrome.
- Baro-trauma: It means air pressure changes, such in rapid descent during flights or during diving. If the atmospheric pressure reaching is **higher than 90 mm of Hg** (Doctor mentioned if around 80 mm of Hg but he said he wasn't sure), Eustachian tube gets blocked. It will be associated with severe pain and retracted tympanic membrane due to the negative pressure.

Symptoms:**- Hearing impairment:**

- It is the most common symptom in children with OME.
- How will the parent notice their child's hearing loss?
The child will not respond to calls and will only listen to high volumes.
- It happens due to the restriction of movement of the tympanic membrane and ossicles because of the retraction of the membrane and fluid accumulation.
- In OME the patient suffers of *conductive hearing loss*.
- *It might cause speech impairment after a long time, but this is rare.*

There are three types of hearing loss, depending on the area affected in the ear:

- 1- Conductive hearing loss: It is caused by any disease affecting the external ear or the middle ear cleft.
- 2- Sensorineural hearing loss: results from lesions of the cochlea (sensory type) or VIIIth nerve (neural type). It is associated with speech impairment.
- 3- Mixed hearing loss: elements of both conductive and sensorineural are present in the same ear.

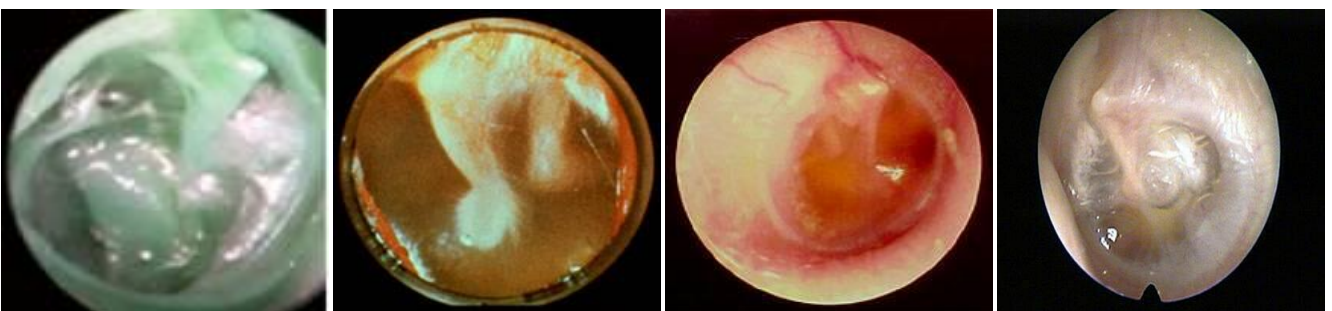
- **Otalgia** is sometimes present. Such as OME caused by Baro-trauma.
- **Fluid sensation** with the movement of the head.

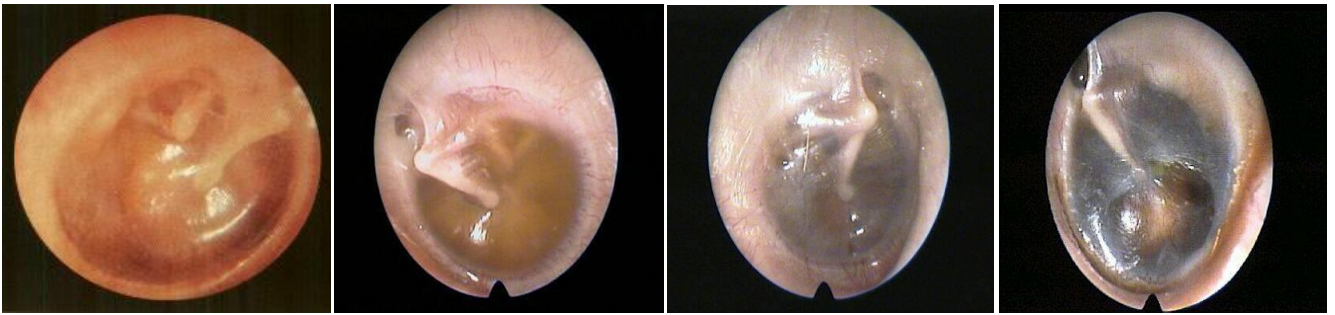
Diagnosis:**→ Otoscopic findings:**

The tympanic membrane is often dull, opaque, might vary in the degree retraction, and appears yellow in early stages, grey or bluish in late stages. There will be loss of light reflex. The handle of malleus will seem horizontal.

Causes of blue tympanic membrane:

- Long standing OME.
- Blood in the middle ear - hemotympanum





→ **Tuning fork tests:** shows conductive hearing loss.

• **Weber's test:**

The base of a vibrating tuning fork is held on the middle of the skull and the patient is asked whether the sound is heard centrally or is referred to one or other ear.

Interpretation:

In conductive hearing loss the sound is heard in the deafer ear but in sensorineural

deafness the sound is heard in the better hearing ear.

If it is heard in both ears equally, this is normal.

In webber's test the most sensitive areas are the upper incisors, lower incisors or the mandible.

- **Rinne's test:**

This test compares the relative effectiveness of sound transmission through the middle ear by air conduction, AC, and bypassing the middle ear by bone conduction, BC. A tuning fork of 512 Hz is struck and held close to the patient's ear (AC), the base is then placed firmly on the mastoid process behind the ear (BC), the patient is then asked whether it is heard better by BC or AC.

Ideally, in the exam while student is performing Rinne's test he/she must say:

I will put the vibrating fork next to the patient's ear and wait until he stops hearing anything, then place it on the bone.

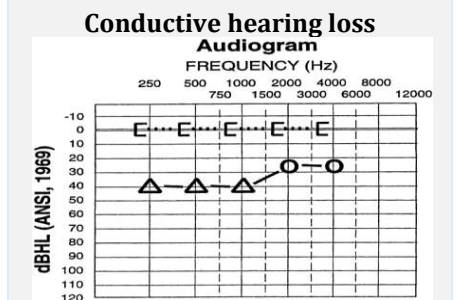
Interpretation of Rinne's test:

If $AC > BC$ it is considered a positive test, means that middle and outer ear are functioning normally.

If $BC > AC$ it is considered a negative test, means that there is a defective function of the outer or the middle ear (conductive hearing loss).

→ **Pure tone audiogram:**

- Can be done for children older than 4-5 years.
- -10 – 25 dB HL = Normal range
- If there is an air- bone gap it's a conductive hearing loss.

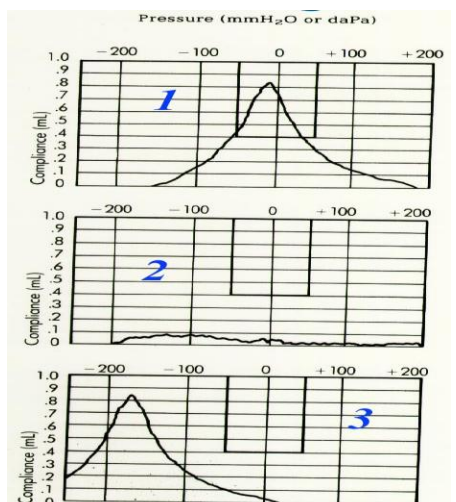


→ **Myringotomy**

→ **Tympanometry:**

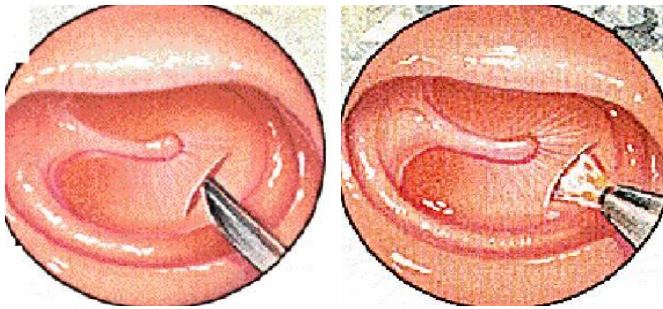
The picture aside describes the different types of curves seen in a tympanometry:

- The first curve -1-: Type A, it defines a normal curve which will be at zero level.
- The second curve -2-: Type B, a flat or dome-shaped graph Seen in middle ear fluid or thick tympanic membrane.
- The third curve -3-: Type C, is in the negative side. Seen in the eustachian tube dysfunction, retracted tympanic membrane and may show some fluid in the ear.

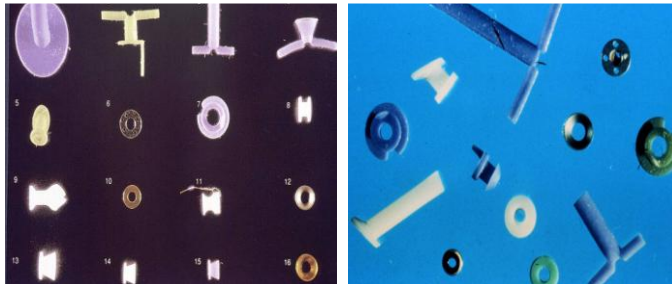


Treatment

- Treatment of the cause if feasible
- *Observation*: OME can be a self-limiting disease.
Spontaneous resolution occurs in some cases. Observing the patient for three months from the beginning of the onset or the diagnosis is advisable before interfering.
- *Medical treatment*
 - Antibiotics: useful in cases of unresolved acute suppurative otitis media (fever, discharge)
 - Decongestants (local or systemic): it is given to help relieve the oedema of the eustachian tube.
 - Antihistamine for allergy.
 - Steroids, it is controversial, nobody will give steroid.
- *Surgical interference* is done when there is no improvement by medications:
 - **Surgical treatment of causative factors (adenoidectomy, tonsillectomy)**
 - Myringotomy and aspiration are done to repair the tympanic membrane and equalize the pressure.
 - Ventilation tubes/ myringotomy tubes/grommets:
 - ➔ When the tube is inserted, it is left in place until it comes out by itself. It might take from six months up to two/three years until it falls off by the shedding process of the tympanic skin leaving the tympanic membrane intact.

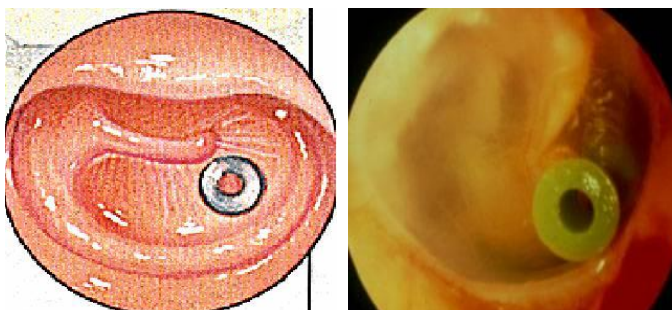


This is not the right incision, the incision should be anterior inferior and it should be radial not transitional like showed in the pictures. Suction should be done, if suction is not done and it is clear you put the ventilation tube.



There are different types of tubes depending on the case. We have two main types:

1. Short-term tubes (eg, grommets), which remain in the tympanic membrane for an average of 12 months.
 2. Long-term tubes (eg, T-tubes), which can remain for several years, and in cases such as cleft palate.
- Complications of T-tubes: It may cause perforation after removing it. So we should consider using the simple grommets tubes before jumping into the decision of using the T-tubes.



➔ complications of ventilation tube insertion:

- Infection: the ventilation tube will act as a foreign body. If there was no improvement with the Antibiotics given, removal of the tube is required.
- Blockage: It could be blocked by blood, mucus or wax. It has to be cleared because if it got obstructed it won't function.
- Extrusion: Bulging out.
- Scarring of the tympanic membrane in late stage and formation of tympano scarring patch.
- Tympanosclerosis: hyalinization of the fibrous tissue followed by calcium deposits in the tympanic membrane and around the ossicles and their joints, which causes their fixation.
- Persistent perforation in a late stage.

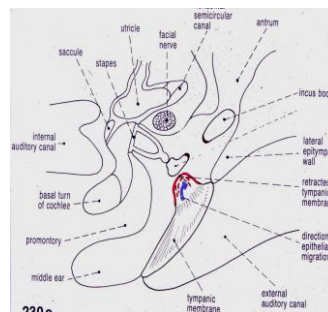


Factors affecting treatment:

- Age: In young children, observation is required before intervention because the disease might resolve by itself.
- Duration: In a long standing disease, intervention is required. Also, if the child is in a preschool age or if it is causing speech impairment intervention is required.
- Unilateral or bilateral.
- Degree of hearing impairment
- Previous treatment: Having a history of previous tube surgery. Surgery is then required.
- Associated conditions such as cleft palate and myotonia in Down syndrome.
- Intervention is required when there are severe changes in the tympanic membrane such as severe retraction of tympanic membrane.

SEQUELAE

- Spontaneous resolution:
50% of the cases resolve within 3 months.
Only 5% persists for more than 12 months.
- Tympanosclerosis.
- Scarring, retraction, atelectasis of the middle ear and **ossicular necrosis**.
- Cholesteatoma and **cholesterol granuloma**.



1.2 CHRONIC ADHESIVE OTITIS MEDIA

Definition:

Formation of adhesions in the middle ear (between the medial wall of the middle ear and tympanic membrane): 1. After reactivation and subsequent healing of either CSOM or OME. 2. Due to severe negative pressure due to OME or CSOM with a perforated drum which is healed by a thin membrane, and eustachian dysfunction that will cause severe retraction of the membrane.



Clinical features:

- 1- Previous history of CSOM or OME.
- 2- Deafness/Conductive hearing loss is usually the main symptom.

- 3- Tympanic membrane shows various structural changes such as severe retraction and very prominent ossicles.

Treatment

- Observation, every 6 months if there were any complications.
- Surgical treatment: Ventilation tube insertion.
- Hearing aid will help a lot

2. CHRONIC SUPPURATIVE OTITIS MEDIA (CSOM)

Definition:

Chronic suppurative otitis media is a long standing infection of a part or whole of the middle ear cleft characterized by **ear discharge (Otorrhea)** and **permanent perforation** of tympanic membrane.

Etiology

- Environmental: It is common in humid and hot areas.
- Genetic, It may be related.
- Previous history of persistent AOM
- Upper respiratory tract infections.
- Eustachian tube dysfunction

Clinical- pathological types of CSOM:

Chronic suppurative otitis media is divided **clinically** into two types:

- 1- TuboTympanic (TT):
 - Also known as the **Safe** type.
 - It involves the anterior inferior part of middle ear cleft.
 - Perforation is central.
 - It has no risks of serious complications.
- 2- AtticoAntral(AA):
 - Also known as the **Unsafe** type.
 - It involves the posterosuperior part of the cleft such as the attic, antrum and mastoid.
 - Perforation could be attic or marginal.
 - It has a high risk of developing complications.
 - It is associated with Cholesteatoma.

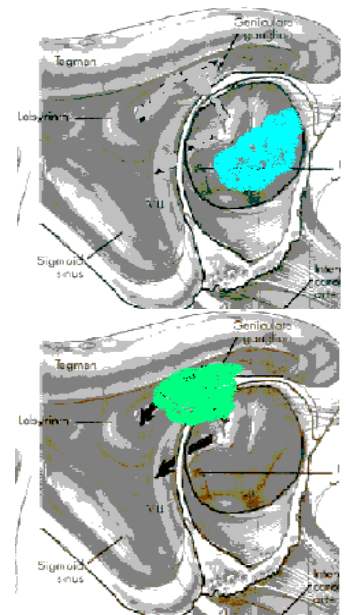
Pathology:

- Signs of suppurative infection
 - Discharge & perforation
 - Chronic inflammatory reaction in the mucosa and the bone (ostietis)
- Signs of healing attempts:
 - Granulation tissue & polyps
 - Fibrosis & tympanosclerosis
- Cholesteatoma (attico-antral type)

Clinical Features::

Common presentation of **uncomplicated** chronic otitis media:

- **Otorrhea:** 📌 - Intermittent, profuse, mucoid & odorless in TT type
Persistent, scanty, purulent & foul smelling in AA type.




- *Deafness*: conductive hearing loss.
- Tinnitus
- Any other symptom other than these three is considered a sign of complication.

Ex: Headaches (could indicate intracranial complications), Vertigo (indicates involvement of the inner ear), Facial movement abnormalities (indicates involvement of facial nerve), Vomiting and fever (indicates involvement of the balance system and increased intracranial pressure).

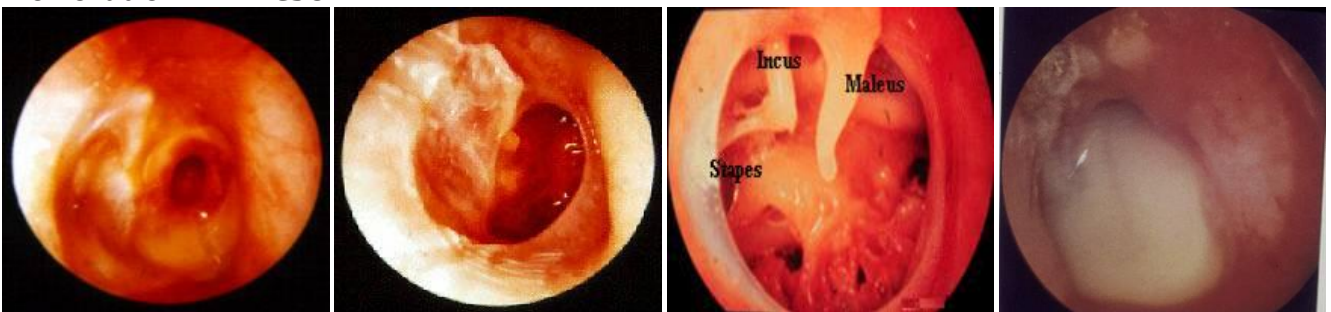
Otoscopic examination

- Discharge:
 - Present in TT type if active but may be absent
 - Usually it persists in AA type.
- Perforation:
 - Central perforation : in TT type.
 - Marginal or attic in AA type with cholesteatoma.
- Polyps, granulation tissue, tympanosclerosis

 Otorrhea is the medical term for ear discharge.

- It could be blood, ear wax or fluid coming through the external canal.
- Characteristics of the discharge according to the cause:
 - 1- Purulent discharge seen in acute/chronic otitis externa.
 - 2- Mucopurulent discharge is seen in middle ear diseases.
 - 3- Clear fluid (CSF leakage) is seen with skull traumas (especially in RTA).
 - 4- Bloody discharge is seen with base of skull traumas, acute otitis media, or malignancy in middle ear.

Perforation in TT CSOM:



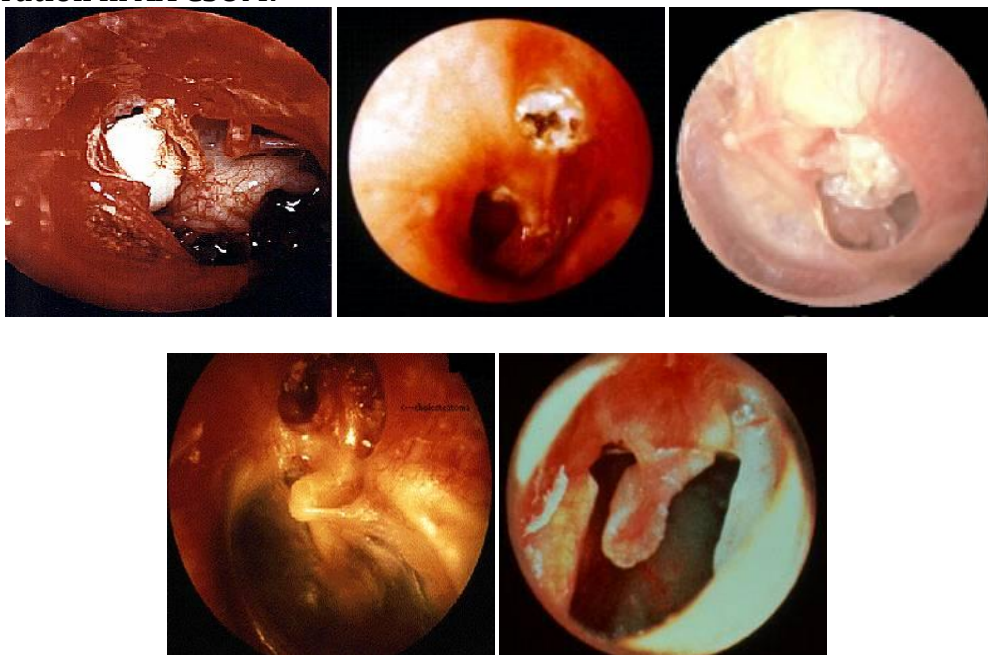
Central perforation

Subtotal perforation

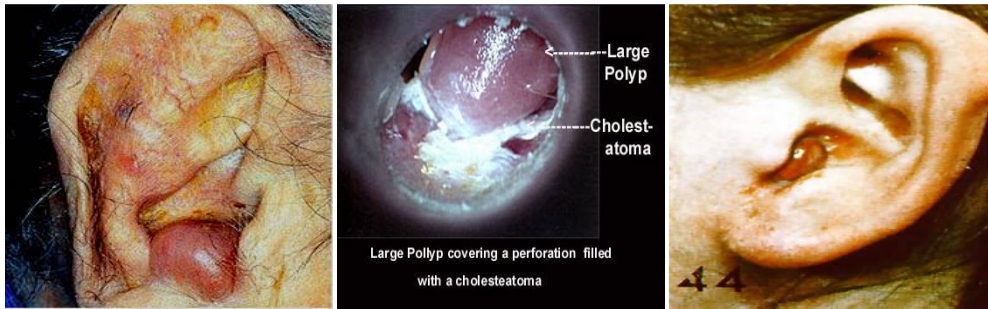
Almost total perforation

Active CSOM with pure purulent discharge

Perforation in AA CSOM:



Polyps protruding from the auricle (it's extreme)



Bacteriology

- Aerobes:
 - Pseudomonas aeruginosa (it is the most common organism causing the infection)
 - Staphylococcus (gram positive)
 - Proteus (gram negative)
 - Escheria coli (gram negative)
 - Klebsiella (gram negative)
- Anaerobes:
 - Bacteroides fragilis
 - Peptostreptococcus

Infections from bacteroids and anaerobes with osteitis are usually associated with a bad odor in case of the unsafe type.

Investigations.

- Audiometry and tuning fork test (it is done to measure the level of hearing loss and type of hearing loss)
- Bacteriology
- Imaging Ex: mastoid x-ray, CT done usually in the Atticoantral type to check for complications such as cholesteatoma.

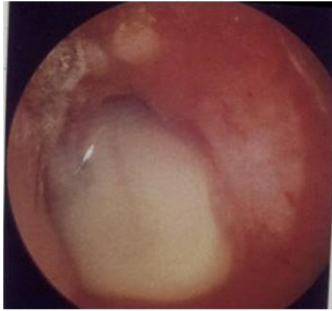
Congenital cholesteatoma Cloudy middle ear in CSOM Cholesteatoma with attic erosion



Treatment:

- Depends on the type and presentation.
- 1- **Management of Tubotympanic CSOM:**
 - The aim of treatment is to control infection and eliminate ear discharge, and at later stage, to correct hearing loss by surgical means:
- Conservative management (in active infection until it becomes inactive - the ear dries out):
 - The mainstay of treatment is regular ear toilet. It is removal of ear discharge and debris from the ear.
- Ear drops

- Precautions: patients are instructed to keep water out of the ear during bathing and swimming. Rubbers inserts can be used. Hard nose blowing should be avoided.
- Treatment of contributory causes.
- Surgical treatment: removal of aural polyp or granulation, if present. **It will facilitate ear toilet and permit ear drops to be used effectively.**
- Antibiotics should be given according to culture results (e.g. clindamycin or second generation cephalosporins).



Active TT type

Conservative treatment



Inactive TT type

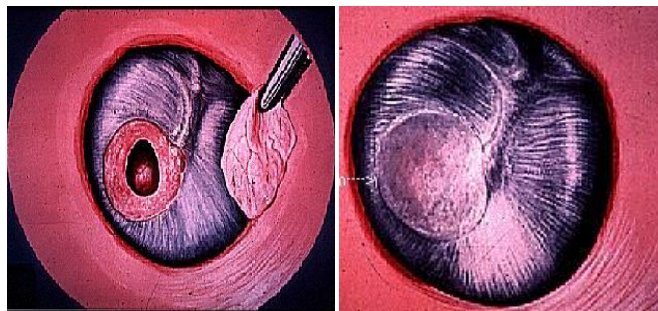
- Reconstructive surgery:
Myringoplasty: - it's an operation performed to repair the tympanic membrane.
Once ear is dry, myringoplasty with or without ossicular reconstruction can be done to restore hearing loss. Closure of perforation will also prevent repeated infection from the external ear.

Tympanoplasty

It is an operation performed to eradicate disease in the middle ear cavity and to reconstruct the hearing mechanism. It is done by closing the perforation with a graft (most commonly from temporalis fascia) and repairing the ossicles.

Aims of tympanoplasty

- To close the perforation,
- To prevent re-infection.
- To improve hearing.



2- Treatment of attico antral CSOM:

Surgery in this type is the mainstay of management.

Removal of cholesteatoma by mastoid operation

Mastoidectomy:

It is the removal of the mastoid contents

- Cortical mastoidectomy → converting the mastoid antrum and air cells into one cavity without disturbing the existing middle ear contents.
- Radical mastoidectomy → An operation in which the mastoid antrum and air cells, attic and middle ear are converted into common cavity, exteriorized to the external canal.

The tympanic membrane, malleus and incus are removed leaving only the stapes in situ (keep stapes in situ to avoid causing sensorineural hearing loss)

- **Modified radical mastoidectomy:**

An operation in which the mastoid antrum and air cells, attic and middle ear are converted into common cavity, exteriorized to the external canal. The tympanic membrane and ossicles remnants are retained.

Types of mastoidectomy:

- Canal wall up: they leave the mastoid cavity open into the external canal so that the diseased area is fully exteriorized.
- Canal wall down: here disease is removed by combined approach through the meatus and mastoid but retaining the posterior meatal wall intact, thereby avoiding an open mastoid cavity.

Aims of radical & modified radical mastoidectomy:

- Safety
- Dry ear
- Preserve hearing

Types of incisions:

- 1- Behind the auricle
- 2- Endo- oral
- 3- Transcanal (not used anymore)

Complications of mastoidectomy:

- Facial paralysis (facial nerve injury during surgery)
- Hearing impairment.

CHOLESTEATOMA

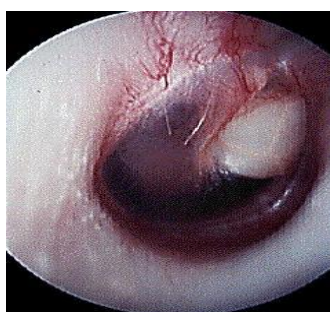
Definition:

- It's the presence of a desquamating stratified squamous epithelium (skin) in the middle ear.
- It has tendency of multiplying, forming granulation tissue underneath and producing letic enzymes which causes local destruction.

Pathogenesis:

It could be congenital or acquired

- Congenital cell rests: skin trapped in the middle ear cleft since birth.
- Pocket formation: Invagination of the tympanic membrane from the attic or posterosuperior part of pars tensa in the form of retraction pockets. The outer surface of the tympanic membrane is lined by stratified squamous epithelium which after invagination forms the matrix of cholesteatoma and lays down keratin in the pocket.
- Metaplasia of the middle ear mucosa due to repeated infections and transforms into squamous epithelium.
- Epithelial invasion: the epithelium from the meatus or outer drum surface grows into the middle ear through a pre existing perforation. Ex: Iotrogenic External canal cholesteatoma (injury of the external canal in myringotomy then skin gets trapped behind the tympanic membrane).
- Basal cell hyperplasia. The basal cell of germinal layer of skin proliferate under influence of infection, and lay down keratinising squamous epithelium.

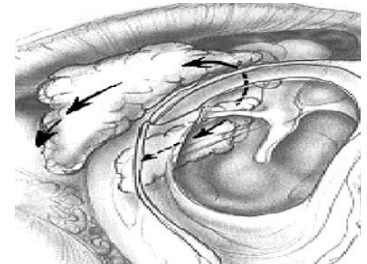


Classification of cholesteatoma:

- Congenital cholesteatoma arises from the embryonic epidermal cell and rests in the middle ear cleft or temporal bone.
- Acquired:
 - Primary called primary as there is no history of previous otitis media or perforation.
 - Secondary in these cases there is a pre existing perforation and it's often associated with posterosuperior marginal perforation or sometimes large central perforation.

Effect of Cholesteatoma

- Keratin encourages persistence of the infection because the cholestatoma is there all the time and could cause discharge most
- Matrix causes bone erosion and otitis associated



conclusion

Otitis media with Effusion:

- OME is very common in children.
- Etiology is associated with Eustachian tube dysfunction and/or chronic infections (URTI).
- In adults: Nasopharyngeal pathology should be considered.
- Most cases resolve spontaneously.
- Conservative treatment is of doubtful value.
- Ventilation tube insertion restore hearing in selected cases. It is the main stay of treatment in chronic cases of OME.

Chronic Suppurative otitis media

- In Tubotympanic type (safe type) the discharge is usually copious, intermittent and odorless. The perforation is central. Treatment is conservative (if there is an active infection) followed by tympanoplasty to prevent re-infection and improve hearing.
- In the AtticoAntral type (the unsafe type) the discharge is usually scanty, persistent and of bad odor. The perforation is attic or marginal with cholesteatoma. Treatment is by mastoidectomy to provide safety and dry ear.
- Middle ear effusion → myringotomy and ventilation tube insertion.
- Safe type CSOM → tympanoplasty
- Unsafe type with cholestetoma → mastoidectomy