



EAR III&IV

Objectives:

Ear III

- Chronic otitis media and middle ear operation.
- Classification of chronic otitis media.
- Otitis media effusion.
- Adhesive otitis media.
- Chronic suppurative otitis media – types and management.
- Ear operation in brief (myringotomy, tube, tympanoplasty and mastoidectomy).

Ear IV

- Predisposing factors for complications, and the complications of acute & chronic otitis media.
- The pathways for spreading the infections beyond the ear.
- To know the classifications of complications (extra cranial, cranial {temporal}, & intra cranial).
- To know presentations, clinical findings, investigations and management of each complication.
- In detail (acute mastoidectomy and management).

[Color index: Important | Notes | Extra | 433 Box]

Resources: Slides+433team+Dotor's notes.

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Quick middle ear anatomy:

- **Eustachian** (Pharyngo-tympanic) **Tube**
- **Tympanum** (Middle Ear Cavity):
 - **Ossicles**
 - malleus, incus, and stapes.
 - **Muscles**
 - Stapedius muscle and Tensor tympani
 - **Nerves**
 - Facial nerve
- **Mastoid Antrum and Air Cells**

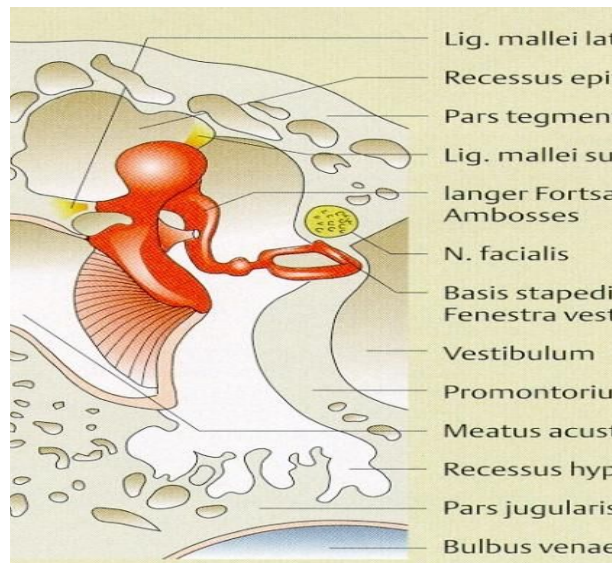
- Stapedius muscle innervation: stapedial nerve, from the facial nerve

What is the tiniest muscle in the body is? Stapedius muscle

- Tensor tympani muscle innervation: mandibular branch, of the trigeminal nerve

ACUTE VS CHRONIC Otitis Media

Type	Acute Otitis Media	Sub-Acute Otitis Media	Chronic Otitis Media
Duration	Less than 3 weeks	From 3 weeks – 3 months	More than 3 months



Acute otitis media (AOM):

Stages:

- I: Tubal occlusion
- II: presuppurative
- III: Suppuration
- IV: Resolution/complications



- **Stage I:** Eustachian tube is blocked that will lead to negative pressure forming in the middle ear cavity, and there will be more fluids and less air, that will result in the retraction of the tympanic membrane towards the middle ear cavity
- **Stage II:** this happens approximately when the middle ear cavity is almost filled with fluids (no air), that will give you bacterial invasion but still no pus and suppuration (pre-suppurative), if treated at this stage it may prevent you from going to the next stage but if you didn't treat it the patient will go to stage three
- **Stage III:** in addition to the complications in stage I&II the patient will have a lot of pus, more pain, fever, and the condition progressed to infection which you should handle it with antibiotics normally. If you didn't treat it at this stage the patient will go to the next stage
- **Stage IV:** if you have a negative pressure in a tight area, most likely the pressure will try to break through the weakest point in that area, as we know the middle ear cavity is all bony EXCEPT the lateral side which has the tympanic membrane, so the TM will rupture to relieve the pressure inside the middle ear cavity.
- When the TM is perforated/ruptured, there will be pus collection (discharge) in the external auditory meatus and there will be resolution of the symptoms (pain will decrease)
- What are the complications of acute OM?

In the above picture, what do you think is the stage of AOM?

Stage III, but if you waited longer the patient might go to stage IV

Chronic Otitis Media (COM):

- ❖ 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**.
- ❖ The tympanic membrane is **intact** (not perforated) in Chronic non- suppurative otitis media, while in chronic suppurative otitis media it is **not intact** (perforated).
- ❖ To have a **discharge** coming through the external canal the membrane has to be **perforated**.
- ❖ **Classification:**

A. Chronic Non suppurative otitis media:

- **Otitis media with effusion (OME)**. If not treated properly or not cured by itself it could lead to adhesion in the tympanic membrane in middle ear (adhesive otitis media).
- **Adhesive otitis media**

B. Chronic suppurative otitis media (CSOM)

- **TuboTympanic**, which is also known as the Safe type, has no risks of serious complications. the perforation is toward the Eustachian tube or in the middle of tympanic membrane.
- **AtticoAntral**, which is also known as the Unsafe type, has a high risk of developing complications.

A. Chronic Non suppurative otitis media:

- ❖ In chronic there are two main types: safe: less dangerous than unsafe, divided to OM with effusion and Adhesive OM, and the other type is unsafe.

➤ Otitis media with effusion:

- Glue ear or secretory otitis media (**SOM**):
 - Glue ear or secretory OM are all synonyms for OM with effusion.
 - Effusion means fluids in the middle ear cavity, you can see in the picture there are air bubbles and the tympanic membrane is red and bulging, this is an image of OM with effusion



- Dysfunction of the Eustachian tube:
 - **Notes:** If the patient had recurrent acute otitis media, and you keep giving him antibiotics and didn't improve you think of the cause that is blocking the eustachian tube, in children the main problem that is causing blockage if the Eustachian tube is adenoids so you need to remove the adenoids in order for the child to benefit from other procedures: like tube or drainage, in adults Eustachian tube dysfunction could happen post radiation.

Management:

- Medical: Decongestants, Nasal corticosteroid sprays, OTOVENT ([click here](#)).
- **Notes:** Medical is the first step before surgical, nasal sprays, nasal drops, or for long term there are steroid sprays (not giving to children less than 2 years, and no longer than 3 months of use), OTOVENT: is a balloon that the patient inflates with one of the nostrils to open the blocked Eustachian tube
- Surgical: myringotomy +/- tube, balloon dilation of the Eustachian tube
- **Notes:** it is named myringotomy because you open the tympanic membrane, the tympanic membrane is rounded in shape.
- Where is the best site in the TM to do an incision for myringotomy? Most likely and it is recommended to do it in the anterior inferior part of the membrane, sometimes you will find adhesions in the anterior inferior site so you do the incision the posterior inferior site.
- Some of the schools will do adenoidectomy, myringotomy, (grommet) tube placement all at the same time, others will do for example only myringotomy ... etc.
- Tube might have some complications like: permanent perforation, foreign body reaction...etc, it will stay in the ear for 6 months.
- Myringotomy will heal after 48 to 72 hours.
- One of the new methods of dealing with OM with effusion is balloon dilation of the Eustachian tube, promising results



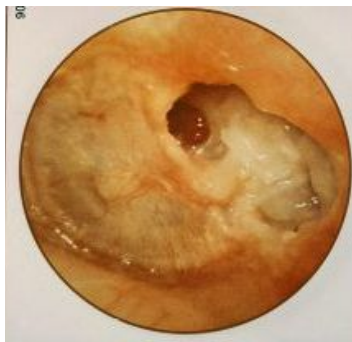
➤ Adhesive Otitis Media:

- **Notes:** Adhesive OM is other way of negative pressure in the middle ear cavity, in this case the negative pressure is without fluids, so it will create a tension pulling the tympanic membrane medially towards the ossicles and promontory (another term for cochlea) and get adherent to them.
- Management is the same for the one with effusion.

B. Chronic suppurative otitis media (CSOM):

➤ Safe Vs. Unsafe (Cholesteatoma)

- **Notes:**
 - **Cholesteatoma:** keratin in the middle ear cavity, it is the unsafe type of CSOM, it has more **complications** and may need major surgeries.
 - What are the causes and why it happens? There are only theories about this subject, not well known.
- Suppurative means you have **discharge**, so if you have discharge and **perforation**, the treatment is **surgery**.
- In the picture (right down) we don't depend on the size of the perforation we depend on the annulus (tympanic membrane rim) if the annulus is intact most likely it is safe COM, also if there is no keratin (the whitish material).
- In the other picture (right up) we have sub total or total perforation, but the annulus is still intact, and no keratin, so it is safe.
- In the other picture (left down) we have middle ear polyp, it is a reaction by the body if there was a long term suppuration(pus), that will lead to bulging of the middle ear mucosa, and that polyp will continue to discharge until it is cleared by an operation, so we can't judge because it is obscuring the TM but it seems within the safe.



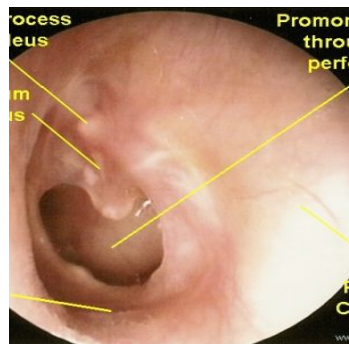
No.1 "Unsafe"



No.2 "safe"



No.3 "safe"



"safe"

Management is Surgery in form of:

a. Tympanoplasty:

- **Notes:**
- Tympanoplasty is closure of the perforation in the TM, with or without ossiculoplasty (reconstruction of the ossicles).

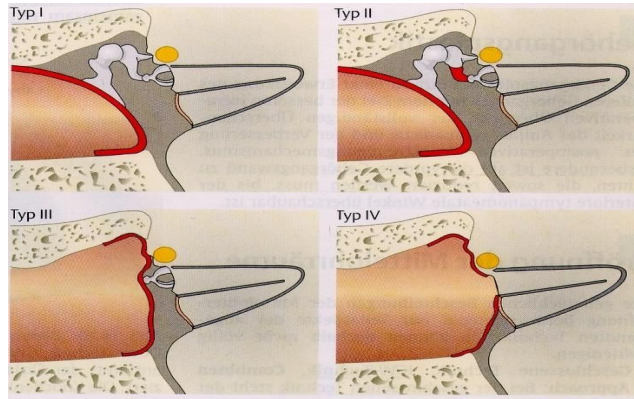
b. Mastoidectomy:

- **Notes:**
- Mastoidectomy: is cleaning of the air cells in the mastoid, we need it in case if the Chronic suppurative OM extended to mastoiditis, every patient should be CT scanned prior to surgery to plan and judge before deciding whether to perform tympanoplasty or mastoidectomy with tympanoplasty.

c. Tympanomastoidectomy:

- **Notes:**
- Different types of tympanoplasty:
- **Wullstien** classification of tympanoplasty
- **Type I:** called simple tympanoplasty or myringoplasty.
 - why? (because you are reconstructing the tympanic membrane without touching any ossicles), you do that if you have a tympanic perforation and you gave it time to heal but it didn't, so you go and reconstruct as a simple myringoplasty.
- **Type II:** TM reconstruction + the Pt will need partial ossicular reconstruction prosthesis (PORP) or total ossicular reconstruction prosthesis (TORP) because of the erosion mainly to the incus.
- **Type III:** the most common, and usually the Pt come at II or III, we are reconstructing the TM but the ossicles are already eroded, and the only intact ossicle is the stapes, so you will attach the TM membrane on the head of the stapes and you may use some prosthesis as will.
 - We have in Stapes a foot plate, and crura (suprastructure)
- **Type IV:** rarely used.
 - In the picture we see the TM membrane, there is Partial Ossicular Replacement Prosthesis (PORP) because the stapes is intact, but if the stapes' supra structure is not there, we do Total Ossicular Replacement Prosthesis (TORP).

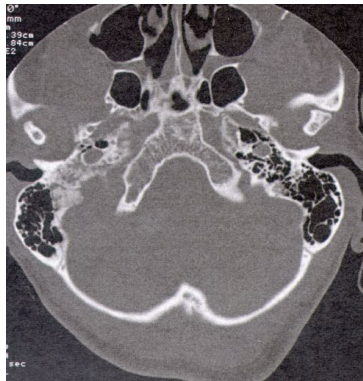




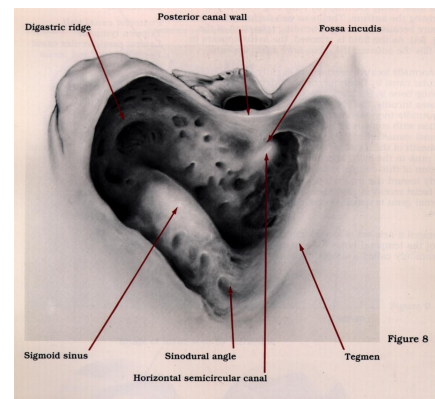
★ **Notes:**

★ **Where is the mastoid?**

- This picture is an Axial cut of CT showing the mastoid. There are a lot of normal variations in mastoid in adults, so you may notice that both sides aren't symmetrical, if the mastoid is filled with air it will appear black, but when it is filled with either edematous mucosa or pus or discharge it will appear like it is totally opacified and you can't see air, in this case you should go forward for mastoidectomy, tympanoplasty alone will not help and won't be successful, because if we did a tympanoplasty and cleaned the pus and/or discharge from the middle ear cavity, the pus and/or discharge will recur again because you didn't treat the cause of the infection.



- ★ In MASTOIDECTOMY, we go to the area of the mastoid if the underlying mucosa in COM and chronic mastoiditis is inflamed and producing pus, we drill and clean all the whole area.
- ★ The doctor mentioned the anatomical structures of the external and middle and inner ear with the mastoid air cells in the CT axial cut



◆ **Investigations in Chronic Otitis Media:**

1. **Audiology:** PTA, tympanogram, acoustic reflex.
2. **Radiology:** CT, MRI.

We care more about CT than MRI in case of COM.

When do we care more about MRI for COM? If you are dealing with or expecting complications.

Complications of Otitis Media (Acute & Chronic):

❖ Predisposing factors:

- **Virulent organisms.**
 - the most common organism causing COM? pseudomonas and the most dangerous one, very resistance to antibiotics.
- **Chronicity** of disease
 - the more chronic the most likely to get complications, less successful the surgery to treat the disease
- Presence of **Cholesteatoma** and **bone erosion.**
 - cholesteatoma: the presence of skin “white keratin material” in abnormal location that secretes enzymes and eat up the bone, causing a pathway for disease to spread specially behind the mastoid going to the brain and meninges. Anatomically there is no skin in the middle ear.
- **Obstruction** of natural drainage e.g. by a polyp. (Natural drainage eustachian tube).
- **Low resistance** of the patient.
 - e.g. immunocompromised pts. Most of the times otitis media is cured without any complications

❖ Pathways of infection:

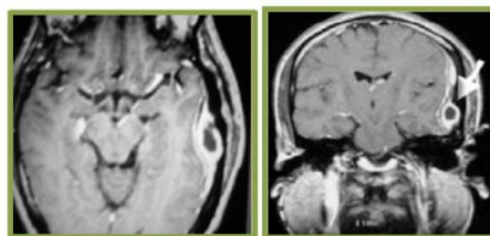
- Extension of infection is by bone erosion due to a cholesteatoma. The most common pathway.
- Vascular extension (retrograde thrombophlebitis) from the mastoid area going most likely to the brain.
- Congenital dehiscence.
- Fracture lines.
- Round or oval window membrane to the labyrinth.
- Dehiscence due to previous surgery.

The complications of acute and chronic otitis media:

Intra-cranial

Extradural abscess:

- b/w the bony part of the mastoid and the dura, there will be abscess
- Collection of pus against the dura.
- Middle or posterior cranial fossa.
Why not the anterior? Because the mastoid is related to middle and posterior cranial fossa, but the anterior one is far away
- Extradural abscess is the commonest Intracranial complication of otitis media.



❖ Clinical picture:

- Persistent headache on the side of otitis media.
- Pulsating discharge.
- Fever
- Asymptomatic (discovered during surgery) especially in immunocompromised

❖ **Diagnosis:** CT scans reveal the abscess as well as the middle ear pathology.

❖ **Treatment:** Mastoidectomy and drainage of the abscess + IV ABx for prevention.

Meningitis: most common

- meningitis and VST, serious complications, very rare, but they could happen
- Inflammation of meninges (pia & arachnoid)

❖ **Pathology:** Occurs during acute exacerbation of chronic unsafe middle ear infection.

❖ Clinical picture:

- General symptoms and signs: High fever, restlessness, irritability, photophobia and delirium.
- Signs of meningeal irritation: Kernig's sign and Brudzinski's sign (click on the sign there is a video).

❖ **Diagnosis:** Lumbar puncture is diagnostic. to detect the organism and to assess the severity of the disease.

❖ **Treatment:** treatment of the complication itself and control of ear infection:

- Specific antibiotics. you start empirically with broad spectrum, and you wait for the results of the sensitivity.
- Antipyretics and supportive measures
- **Mastoidectomy** to control the ear infection. A must.

Subdural abscess:

- **b/w dura and arachnoid space**
- Collection of pus between the dura and the arachnoid. It's a rare pathology.

❖ Clinical picture:

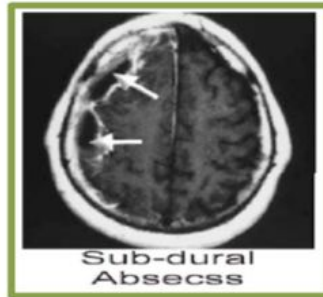
- Headache without signs of meningeal irritation.
- Convulsions.
- Focal neurological deficit (paralysis, loss of sensation, visual field defects)

❖ Investigations:

- CT scan, MRI

❖ Treatment:

- Drainage (neurosurgeons).
- Systemic antibiotics.
- Mastoidectomy.



Axial cut, CT, Bone window
The subdural abscess is within the dura (a white thin line).
It's a landmark to distinguish between extra and subdural abscess

Why we do mastoidectomy if the abscess is subdural?

b/c the source of the disease is there, so if you drained the abscess and didn't treat the source it will happen again and again

Venous Sinus Thrombosis:

- Thrombophlebitis of the venous sinus.

❖ **Etiology:** It usually develops secondary to direct extension.

❖ Clinical picture:

- Headache, vomiting, and **papilledema** (increase intracranial pressure).
- Signs of blood invasion:
 - (**spiking**) fever with rigors and chills.
 - persistent fever (septicemia).
 - **Positive Greissinger's sign** which is edema and tenderness over the area of the mastoid emissary vein.

❖ Diagnosis:

- CT scan with contrast.
- MRI, MRA, MRV
- Angiography, venography.
- Blood cultures is positive during the febrile phase.

❖ Treatment:

- Medical:
- Antibiotics and supportive treatment.
- **Anticoagulants.**

– Surgical:

- Mastoidectomy with exposure of the affected sinus and the intra-sinus abscess is drained.

Brain Abscess:

- inside the brain parenchyma
- Localized suppuration in the brain substance.
- It is the **most lethal** complication of suppurative otitis media.

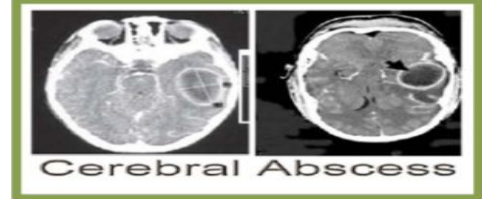
❖ **Incidence:** 50% is Otogenic brain abscess.

❖ **Pathology Site:** Temporal lobe or Less frequently, in the cerebellum. (more dangerous).

❖ **Diagnosis:** – CT scans. – MRI

❖ Treatment:

- Medical:
 - Systemic antibiotics.
 - Measure to decrease intracranial pressure.
do not do LP, contraindicated
- Surgical:
 - Neurosurgical drainage of the abscess
 - mastoidectomy operation after subsidence of the acute stage



Intra-temporal complications:

these complications are more common to happen than extra or intra cranial

Facial nerve paralysis:

- The facial nerve exits through the stylomastoid foramen.
- 70% of the cases are Bell's palsy الخواجة بيل.
- Congenital or acquired(surgery, inflammation, erosion) dehiscence of nerve canal.
- It is possibly a result of the inflammatory response within the fallopian canal to the acute or chronic otitis media.
- Tympanic segment is the most common site to be involved.

❖ Diagnosis:

- Clinically
- May occur in acute or chronic otitis media.
- CT scan.



Which side is paralyzed?
The left side

in otitis media it is peripherally injured so the affected nerve side of the face will be completely paralyzed

LMNL vs UMNL?

Lower: upper and lower parts of the face are affected

Upper: lower part of the face is affected (upper part has bilateral supply from both hemisphere)

❖ Treatment:

- Acute otitis media and acute mastoiditis: (cortical mastoidectomy +ventilation tube).
- Chronic otitis media with cholesteatoma: (mastoidectomy ± facial nerve decompression).

Labyrinthine fistula:

- if the infection spread from the middle ear to the inner ear (cochlea and semicircular canals) and would present with vertigo and sensory neuron loss.
- Communication between middle and inner ear

❖ **Atiology:** It is caused by erosion of boney labyrinth due cholesteatoma.

❖ **Clinical picture:**

- Hearing loss. Sensory neural hearing loss
- Attack of vertigo mostly during straining, sneezing, and lifting heavy object.
- Positive fistula test. ([click Here](#))

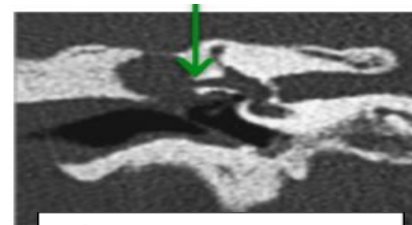
EXTRA→ the idea that you will create more pressure in the EAC and that will reflect on the middle ear and TM, normal people won't be affected, in abnormal Pts with + fistula test the pressure will extend to the inner ear causing vertigo, tinnitus in the same time when you're doing the test, fistula isn't commonly seen, it is seen clearly in CT

❖ **Diagnosis:**

- High index of suspicion.
- Longstanding disease.
- Fistula test.
- CT scan of temporal bone.

❖ **Treatment:** Mastoidectomy.

treatment of fistula: explore the area and see which area is affected by cholesteatoma and close it, you can close it with fascia (most likely from temporalis muscle) or by a rib cartilage, or by using synthetic materials and others.



- CT scan showing labyrinthine fistula
- Most common lateral semicircular canal

Mastoiditis: **Imp**

- It is the inflammation of mucosal lining of antrum and mastoid air cells system.
- Acute Mastoiditis: **really fast progression**

◆ Pathology:

- Production of pus under tension.
- Hyperaemic decalcification.
- Osteoclastic resorption of bony walls. (causes bone fracture pus excrete outside “subperiosteal abscess”).

◆ Symptoms:

- Earache.
- Fever.
- Ear discharge.

◆ Signs:

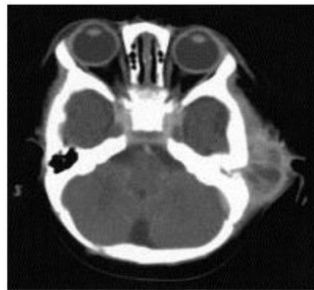
- Mastoid tenderness.
- Sagging of posterosuperior meatal wall.
- TM perforation.
- Swelling over mastoid.
- Hearing loss.

◆ Investigation:

- CT scan temporal bones.
- Ear swab for culture and sensitivity.



abscess
behind
the skin
directly



Axial cut of CT scan
without contrast
(assuming he is a
child) showing very
big collection of pus

Mastoid abscess

Medical treatment:

- Hospitalize
- Antibiotics
- Analgesics

Surgical treatment:

- Myringotomy
- Cortical mastoidectomy


Extracranial complications:

- Extension of infection to the neck.
- Bezold abscess (extension of infection from mastoid to SCM). **management: drain the abscess**

Note: **433 Box** is a nice work by 433 team, containing the information that were mentioned in the previous lectures but not in this years' lectures (because they were different lecturers, and different slides), I added it because I do not want to miss any information, you can read it, or you can skip it, it is up to you.

433 note: The sternocleidomastoid and digastric muscle are attached to the mastoid process and covered by a sheath, the mastoid abscess can drag through and extend down to the neck (rare).

<p>433 Box</p> <ul style="list-style-type: none"> • Middle ear filled with serous or mucoid fluid • No purulence • Often present after acute otitis media is treated appropriately with antibiotics • Most will clear within 3 months • Previously thought sterile • 30-50% grow in culture • over 75% PCR + • Usual organisms 	<p>Etiology :</p> <p>Bacteria</p> <ul style="list-style-type: none"> • Strep pneumonia. • Moraxella cat. • Haemophilus influ. <p>Virus</p> <ul style="list-style-type: none"> • RSV • Rhinovirus • Parainfluenza virus • Influenza virus
<p>Estimates of residual effusion:</p> <ul style="list-style-type: none"> - 70% @ 2 wks - 40% @ 4 wks - 20% @ 8 wks - 10% @ 12 wks 	<p>Diagnosis</p> <ul style="list-style-type: none"> • History • Clinical Examination • Tuning fork tests (Weber and Rinne test) • Audiological assessment – Tympanometry - Pure tone audiogram(PTA). <p>Management of otitis media with effusion:</p> <ul style="list-style-type: none"> • Observation – many European countries wait 6-9 months prior to placement of ear tubes • Antibiotics: Meta-analysis shows beneficial short-term resolution of OME • Audiogram at 3 months with persistent effusion to determine impact on hearing <p>Surgical treatment: Tympanostomy Tubes.</p> <ul style="list-style-type: none"> • chronic OME >3mos with hearing loss and/or speech delay is an indication for tympanostomy tube placement • Bypass Eustachian tube to ventilate middle ear

<p>433 Box</p> <p>Adhesive Otitis Media:</p> <p>Formation of adhesion in the middle ear after reactivation and subsequent healing of either CSOM or OME.</p> <ul style="list-style-type: none"> • Lack of middle ear ventilation results in negative pressure within the tympanic cavity. • The ear drum retracts onto structures within the middle ear. • The result of long standing Eustachian tube dysfunction • The drum loses structural integrity and becomes flaccid • Contact between the drum and the incus or stapes can cause bone erosion at the IS joint • Can sometimes be treated with tympanostomy tubes 	<p>Middle Ear Atelectasis</p> <ul style="list-style-type: none"> • The result of long standing Eustachian tube dysfunction. • The drum loses structural integrity and becomes flaccid. • Contact between the drum and the incus or stapes can cause bone erosion at the IS joint. • Can sometimes be treated with tympanostomy tubes. 
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433 Box

Chronic suppurative otitis media with and without cholesteatoma

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.

3D:

- **Duration** > 3 months despite treatment
- **Discharge** mucopurulent otorrhea
- **Deafness** Perforation /Ossicular chains

Etiology:

- **Pseudomonas aeruginosa**
- **Staphylococcus aureus**
- **Proteus species**

Pathogenesis:

- ET dysfunction
- Poor aeration
- Mucosal edema and ulceration
- Capillary proliferation
- Osteitis;

- **Tubotympanic type (Safe):**

- Simple perforation
- Intermittent non offensive non bloody ear discharge
- On examination (central perforation)

- **Attico-antral (unsafe):**

- Chronic ,Scanty, offensive and bloody ear discharge
- On examination marginal perforation
- You may see cholesteatoma



Cholesteatoma:

- Cholesteatomas are epidermal inclusion cysts of the middle ear and/or mastoid with a squamous epithelial lining
- Contain keratin and desquamated epithelium
- Can be congenital or acquired

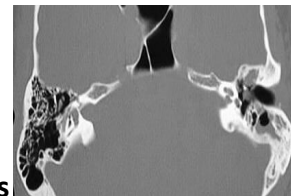


CONGENITAL CHOLESTEATOMA

Pathogenesis of cholesteatoma

Natural history is progressive growth with erosion of surrounding bone due:

- **Pressure effects**
- **Osteoclast activation**



Diagnosis

- History
- Examination
- **Otoscopic - Microscopic -Tuning fork test**
- Investigation
- **Audiological assessment**
- **Radiological assessment**

Treatment:

Chronic suppurative otitis media without cholesteatoma (safe)	Chronic suppurative otitis media with cholesteatoma (Unsafe)
A. Otological Medications <ul style="list-style-type: none">● Antibiotic only otic drops Floxin (<i>ofloxacin</i>)● Antibiotic with steroid otic drops Ciprodex (<i>ciprofloxin and dexamethasone</i>) Cipro HC (<i>ciprofloxin and hydrocortisone</i>) B. Surgical repair of the TM perforation <ul style="list-style-type: none">● Myringoplasty● Tympanoplasty C. Ossicular Chain Reconstruction	A. Cholesteatoma Surgery B. Mastoidectomy

433 team:

What are the vascular structures that pass through temporal bone?

Carotid and internal jugular (vein more common than artery) may get affected from thrombophlebitis (inflammation of the lining wall of the vessels)