# Ear III-IV

## Objectives:

**Ear III:**

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

Ear IV: (this objectives are from the guide but not given by the doctor)

- 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).

**Resources:** **435 team work, slides, team 436 group A**

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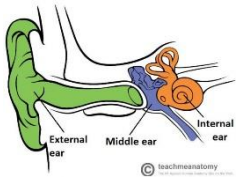
[Color index: Important | Notes | Extra] Editing File

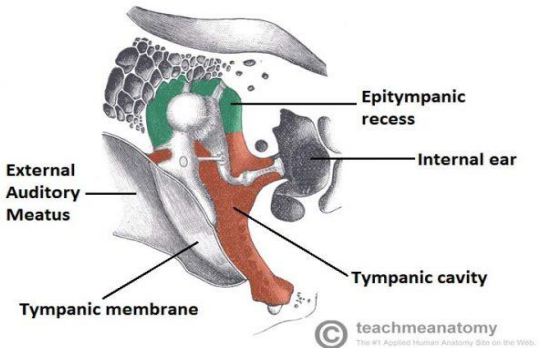
# Overview of the lecture

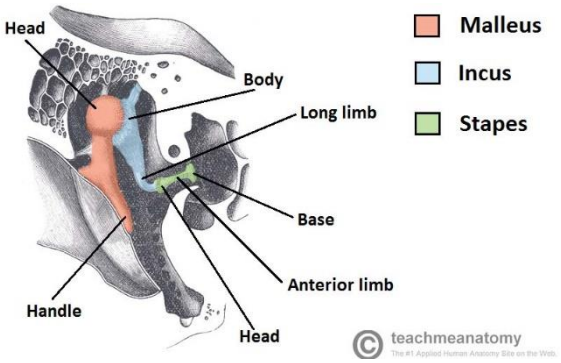
As we know if the infection occur in the external part of the ear we call it otitis externa, if it's in the middle part we call it otitis media and if it's in the inner part we call it otitis interna or labyrinthitis. In the first part of this lectures we will talk about the types of chronic otitis media and in the second pert we will talk about the complications of otitis's media. So since we will talk about chronic **otitis media**, **let's review the anatomy of the middle ear:**




The middle ear lies within the temporal bone, and extends from the tympanic membrane to the lateral wall of the inner ear. The main function of the middle ear is to transmit vibrations from the tympanic membrane to the inner ear via the auditory ossicles. it contains:

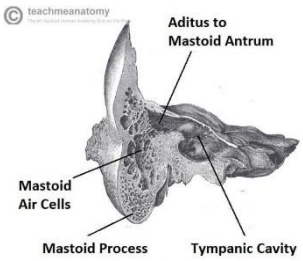
- **Tympanic cavity, Tympanum (Middle Ear Cavity):** located medially to the tympanic membrane. It contains three small bones known as the auditory ossicles: the malleus, incus and stapes. They transmit sound vibrations through the middle ear.
- **Epitympanic recess**: a space superior to the tympanic cavity, which lies next to the mastoid air cells. The malleus and incus partially extend upwards into the epitympanic recess.

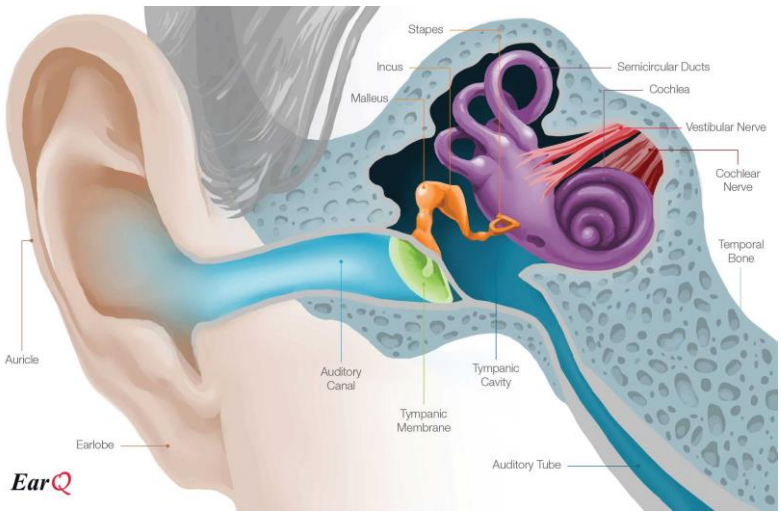


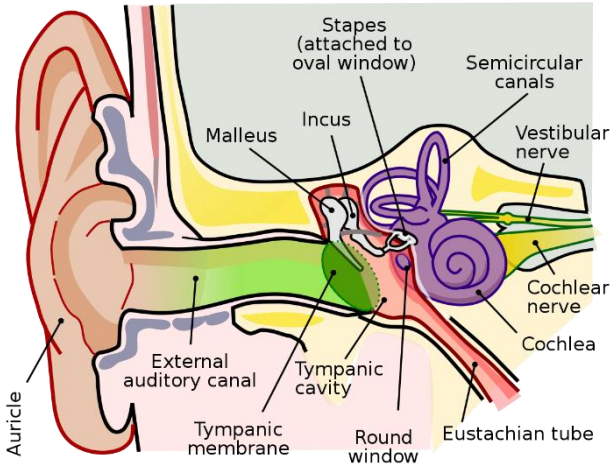




- **Muscles:** There are two muscles which serve a protective function in the middle ear the tensor tympani and stapedius. They contract in response to loud noise, inhibiting the vibrations of the malleus, incus and stapes, and reducing the transmission of sound to the inner ear. This action is known as the acoustic reflex. The tensor tympani originates from the auditory tube and attaches to the handle of malleus, pulling it medially when contracting. It is innervated by the tensor tympani nerve, a branch of the mandibular nerve of the trigeminal nerve. The stapedius muscle is the tiniest muscle in the body, attaches to the stapes, and is innervated by the stapedial nerve from the facial nerve.
- **Nerves**: Facial nerve
- **Eustachian** (Pharyngo-tympanic) **Tube:** The auditory tube, is a cartilaginous and bony tube that connects the middle ear to the nasopharynx. It acts to equalise the pressure of the middle ear to that of the external auditory meatus.

Mastoid Air Cells: The mastoid air cells are located posterior to epitympanic recess. They are a collection of air-filled spaces in the mastoid process of the temporal bone. The air cells are contained within a cavity called the mastoid antrum. The mastoid antrum communicates with the middle ear via the aditus to mastoid antrum. The mastoid air cells act as a 'buffer system' of air – releasing air into the tympanic cavity when the pressure is too low.



# Acute Vs Chronic Otitis Media

| | Acute otitis media | Sub-acute otitis media | Chronic otitis media |
|---|---|---|---|
| Duration | Less than 3 weeks | From3 weeks-3months | More than 3 months |

why it's important to know is it acute or chronic? Because the treatment and complications are different.

## Acute otitis media (AOM):

**Stages:**

I. Tubal occlusion (to early)
II. pre-suppuration (effusion not pus yet)
III. Suppuration
IV. Resolution/complications (to late)

**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 happen 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-suppuration), if treat it at this stage it may prevent you from going to 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)

## Chronic otitis media (COM):

- Inflammation of the middle ear. May also involve inflammation of mastoid.
- 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.
- To have a discharge coming through the external canal the membrane has to be perforated.

**Classification:** the chronic otitis media were divided according to (discharge) if there no discharge or pus صديد it's chronic non suppurative otitis media and if there is any discharge or pusصديد , so it's chronic suppurative otitis media.

**A. Chronic Non suppurative (discharge) otitis media:**

- **Otitis media with effusion (OME)** also called secretory otitis media. It's mean there is fluid in the middle ear, which is related to the Eustachian tube. If not treated properly or not cured by itself, it could lead to adhesion in the tympanic membrane in middle ear (adhesive otitis media).

يعني اذا مثلا طفل جاه acute otitis media عادية، 90% من الأطفال يتعالجون منها تماماً وانتهى الموضوع. بس فيه 10% بعد العلاج ظلت شوي سوائل بالإذن الوسطى وهي تقريبا مثل الصندوق السداسي المغلق فالمويا تظل بالداخل وخاصة لو فيه Eustachian tube dysfunction هذا بيساعد بشكل كبير على تجمّع المويا. فالسيناريو يكون ان طفل جاه التهاب وتعالج بس الحين يشكي من اذنه وانه ما يسمع او لو طفل صغير وما يقدر يتكلم تلاحظه الأم يحك اذنه/ بنفحص الإذن ونشوف وجود مويا فنسأل الأم متى بالضبط جاه الإلتهاب؟ 90 الى 99% من الأطفال تتجمّع عندهم المويا بعد الإلتهاب وتروح من نفسها خلال 3 أشهر وما تحتاج أي تدخّل، لكن نسبة بسيطة جدا 1% منهم يستمر فوق 3 اشهر وفي هذه المرحلة يكون chronic ويتطلب مني أتدخل. ضروري جدا اعرف المدة ولو كانت اقل من 3 اشهر انتظر وما اسوي اي تدخل علاجي. ولو ما تعالجت بعد 3 شهور ممكن تسبب النوع الثاني وهو Adhesive otitis media

- **Adhesive otitis media.** When there is a prolonged problem with the Eustachian tube, there will be retraction of the tympanic membrane, it will be sucked in (adhesive). you can see all the structures of the middle ear.

B. **Chronic suppurative otitis media (CSOM):** discharge, the reason maybe an acute infection not treated well or adequately or because of immunosuppressant patient. So the pus will accumulated and cease perforation of the tympanic membrane.
    - TuboTympanic (As long as the annulus is intact, we consider it TT), 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. Name: Tubo = Eustachian tube \Tympanic= problem in the middle ear.
    - AtticoAntral, which is also known as the Unsafe type, has a high risk of developing complications. Name: related to. Unsafe because it is associated with complications if not treated.

The tympanic membrane is intact (not perforated) in Chronic non- suppurative otitis media, while in chronic suppurative otitis media it is not intact (perforated).

## A. Chronic non suppurative otitis media

1. **Otitis media with effusion:** Also called Glue ear or secretory otitis media (SOM)

**Definition:** persistence of serous or mucoid **fluid** in the middle ear space without evidence of infection. 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




- Often present after acute otitis media is treated appropriately with antibiotics
- Most will clear within 3 months

**Etiology:**

- **Bacterial:** Strep.pneumoniae, Moraxella cat, Haemophilus influ. → cause of the acute infection which lead to choronic effusion. If after a while we did a fluid analysis, we will not find the bacteria because it is an early finding.
- **Viral:** RSV, Rhinovirus , Parainfluenza virus, Influenza virus

**Sign and Symptom's:**

- Non mobile TM
- Air fluid level
- Aural fullness after URTI.
- Hearing loss (not complete)

**Diagnosis:**

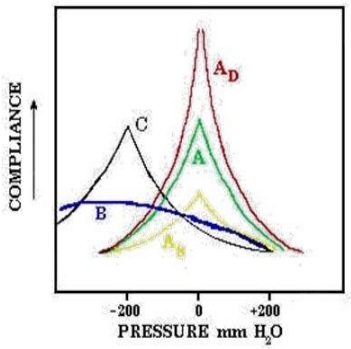
- History. As we sied before there will be a history of previous infections with hearing loss
- Clinical Examination → effusion
- Tuning fork tests (Weber and Rinne test)
- Audiological assessment to confirm the diagnosis

| Tuning fork tests | |
|---|---|
| **Rinne** | Weber |
| The fork first tests the air then the bone.<br>- Air is better(positive): normal<br>- Bone is better(negative): conductive hearing loss<br>- Air is better (positive) or Both lost: Normal or sensorineural hearing loss | Tuning fork in the middle. It will vibrate normally in the center.<br>- If to the diseased ear (e.g. OM with effusion): conductive hearing loss.<br>- If to the non- diseased ear: sensorineural hearing loss |

**Mnemonic**: (Weber and Rinne test) Rinne= rinne under the pinne(pinne=pinna) normal of Air Conduction more than bone conduction. weber=weber it's right or left. tells u sensorineural hearing loss. example; if u hear it better in the left mean right sensorineural.

**Audiological Assessment:**

1. **Tympanometry.**




It's a prob in the ear: We apply pressure and the machine will calculate the pressure with TM movement.

A: Normal. zero pressure, good movement.

AS: sclerotic (restricted). E.g: otosclerosis, tympanosclerosis.

AD: discontinuity. ossicles are disconnected.

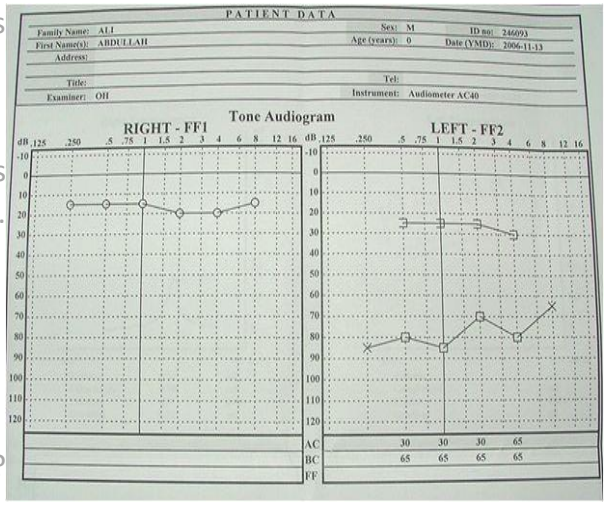
B: flat, no movement: wax, effusion, perforation. To differentiate between them: it will be compared to external canal volume:

- if it is less, then it is something outside.
- If it is the same, then it is effusion
- If it is more, then it is perforation

C: Eustachian tube dysfunction. There is a movement, but negative pressure.

2. **Pure tone audiogram.**

It's based on average population. Up to 25 is normal. 25 to 45 this is mild hearing loss. 45 to 60 this is moderate hearing loss.




- Noise trauma at 4000
- we give tone to patient in isolated room with headphones and specific frequency and he\she says yes I heard it or no. and the audiologist count the value.
- Normal air conduction? Normal
- abnormal air conduction? Test bone conduction
- normal bone conduction? Conductive hearing loss.
- Both are decreased? Sensorineural hearing loss
- Bone is reduced and air is reduced more, with air-bone gab? Mixed hearing loss

**Management:**

- **Medical**
  - Observation: many European countries wait 6-9 months prior to placement of ear tubes.
  - Antibiotics if there is an infection. Meta-analysis shows beneficial short-term resolution of OME.
  - Audiogram at 3 months with persistent effusion to determine impact on hearing
  - Decongestants, Nasal corticosteroid sprays, OTOVENT

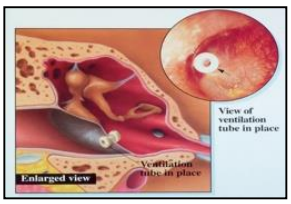
Medical is the first step before surgical, nasal sprays, nasal drops, or for long term there are steroid sprays (not giving to children less than 2 years, and no longer than 3 months of use), OTOVENT: is a balloon that the patient inflate with one of the nostrils to open the blocked Eustachian tube

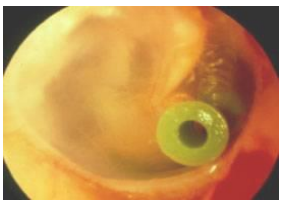
- **Surgery**

الفكرة إيش؟ احنا عندنا سائل بالداخل نبغى نشيله فراح نحط تيوب بحيث نشفط السائل ونعادل الضغط

We will do Myringotomy with pressure equalization tube if persist.

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.



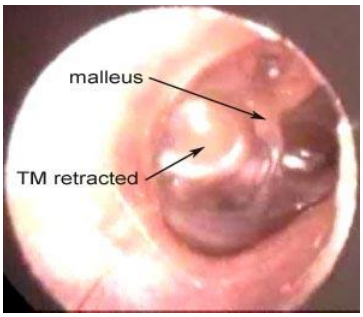
One of the new methods of dealing with OM with effusion is balloon dilation of the Eustachian tube.

**Tympanostomy Tubes:** Bypass Eustachian tube to ventilate middle ear.

**Indications :** chronic OME >3 months with hearing loss and/or speech delay is an indication for tympanostomy tube placement.

2. **Adhesive Otitis Media:**

**Definition:** formation of adhesion in the middle ear after reactivation and subsequent healing of either CSOM or OME





**Clinical features:**

- History of CSOM or OME
- Deafness is usually the inly symptom.
- TM shows various structural changes. There is retracted TM

**Treatment:**

- Observation
- Hearing aid
- Surgical treatment. Should we do a surgery or not? In this case we evaluate the hearing, if the hearing deteriorates, we operate. If hearing is normal, we will observe. Because if we try to elevate the tympanic membrane, we might miss some skin cells inside the middle ear, that will develop into cholesteatoma. cholesteatoma will affect ossicles (conductive hearing loss), facial nerve (weakness), lateral semicircular canal (dizziness), cochlea (sensorineural hearing loss), and skull base (brain herniation). It's very rare to remove the retracted TM and put a new one.

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 (first turn of cochlea) and get adherent to them.

## B. Chronic suppurative otitis media

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. Previously there were many cases due to the lack of development in treatment methods. The reason is acute infection not treated well or adequately or because of immunosuppressant patient. So the pus will accumulated and cease perforation of the tympanic membrane.

### 3D:

⇒ Duration: 3 months despite treatment.
⇒ Discharge: mucopurulent otorrhea.
⇒ Deafness: Perforation /Ossicular chains.

### Etiology:

- Environmental
- Genetic
- Previous otitis media
- URTI

- Eustachian tube dysfunction

## Classification

1. Tubo-tympanic (TT) → safe.
2. Attico-antral (AA) → un safe from middle ear to mastoid through pars flaccida

## Signs and symptoms

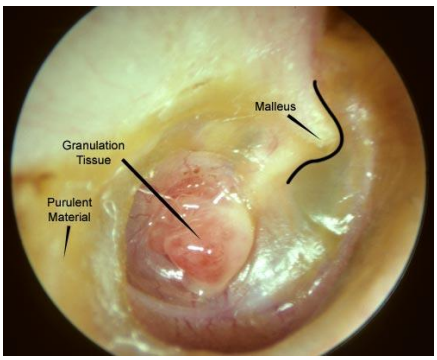
- **Otorrhea:** it's important in the history to ask about the amount, color, odor and viscosity
  - TT type: Intermittent non offensive(odorless) non bloody, Profuse ear discharge.
  - AA type: Chronic(persist), Scanty, offensive (malodorouse) and bloody ear discharge.
- Deafness because the TM was perforated
- Tinnitus
- Sign of healing (granulation tissue and polyps, fibrosis and tympanoscelerosis)
- Cholesteatoma: in AA type

N.B. any othere symptoms means complications

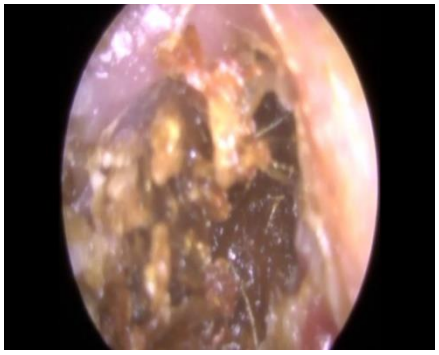
## Orthoscopic examination:

- **Discharge:**
  - TT type: present if active, but may be absent.
  - AA type: usually present. Any wax superiorly, remove it. Because most of the time there is something under it. E.g. cholesteatoma
- **Perforation:**
  - TT type: always central regardless of size. Annulus is intact
  - AA type: marginal or attic perforation, In the area with no annulus. It may present inferiorly, but the annulus has been eroded because annulus acts as a barrier. with cholesteatoma
- There will be polyps, granulation tissue and tympanoscelerosis

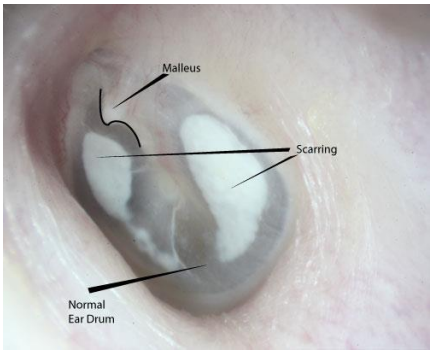
Extra pics:



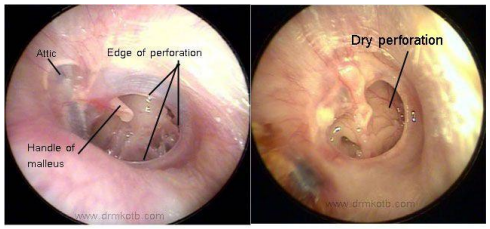

Granulation tissue



Polyps




Tympanoscelerosis




Chronic suppurative otitis media – safe type = tubo-tympanic

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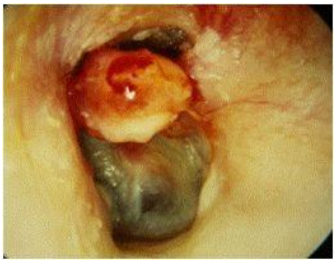
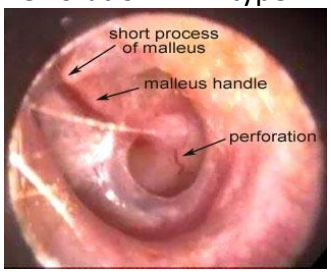
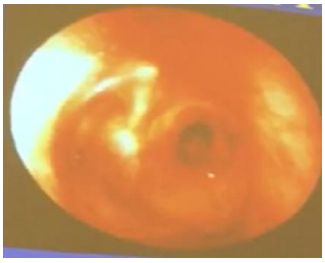
Tubotympanic type

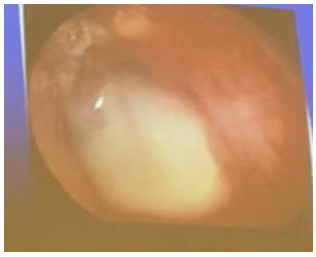


Attico-antral with Cholesteatoma

Perforation in TT type



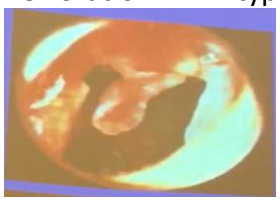



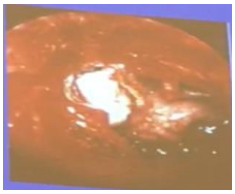


Active type of TT

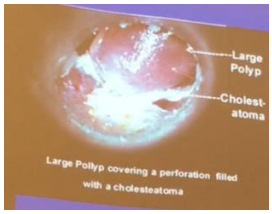
Inactive type of TT

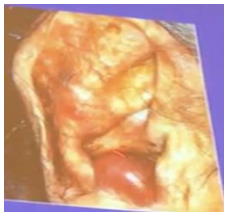
Perforation in AA type





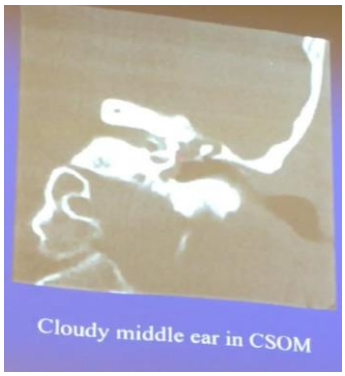
Active type of AA

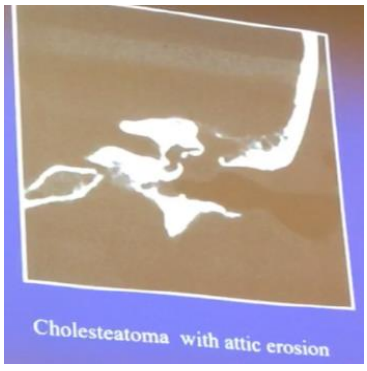


## Investigations:

- **Bacteriology:** just for your information. We need it know the type of bacteria and type of treatment.
  - **Aerobes:** pseudomonas aeruginosa, staphylococcus aureus, protues, klebsiella and Escherchia coli.
  - **Anaerobes:** Bacteroides, peptostreptococcus, peptococcus
- **Audiometry.** To check the type of hearing loss. PTA, tympanogram, acoustic reflex.
- **Imaging**
  - CT scan
  - MRI. If we suspect intracranial extension
    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.

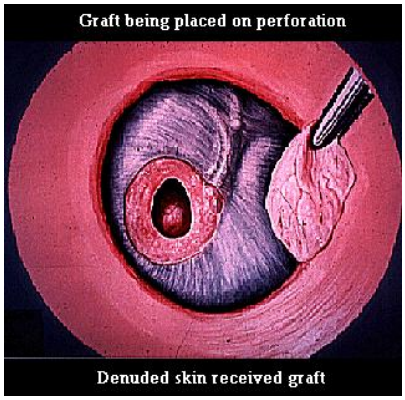


### Treatment

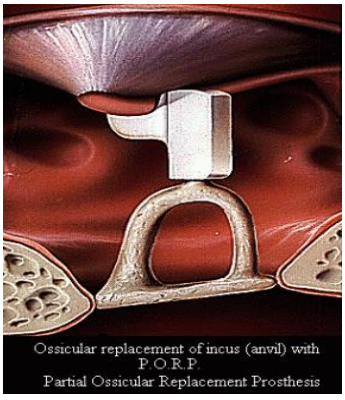
- **TT type:** We start with conservative until the ear is dry then we do surgery.
  - **Conservative:**
    - ⇒ Treat any predisposing factor
    - ⇒ Keep the ear dry
    - ⇒ Ear toilet
    - ⇒ Antibiotic
      - Antibiotic only otic drops: Floxin (ofloxacin), Ciprofloxacin, Neomycin, Polymyxin B, Gentamicin, Tobramycin
      - Antibiotic with steroid otic drops:
        - Ciprodex (ciprofloxin and dexamethasone)
        - Cipro HC (ciprofloxin and hydrocortisone)
    - ⇒ Removal of polyps and granulation tissue

  - **Surgery:** repair of the TM perforation by:
    - ⇒ **Tympanoplasty:** An operation performed to eradicate disease in the middle ear cavity. The aim of it's are:
      1. To close the perforation
      2. To prevent reinfection
      3. To improve hearing
    - ⇒ **Myringoplasty:** an operation performed to repair the tympanic membrane only.
    - ⇒ **Tympanoossiculoplasty:** an operation performed to eradicate disease in the middle ear cavity and to reconstruct the hearing mechanism.




Ossicular replacement of absent stapes and incus with T.O.R.P. (Total ossicular replacement prosthesis) conducting sound from malleus (hammer) to footplate-bony covering of vestibule leading to inner ear

**Incus-Stapes prosthesis - a synthetic bone**




- **AA type:** removal of cholesteatoma by mastoid operation**.** In TT type we start with conservative until the ear is dry then we do surgery. While in AA we do surgery

## Cholesteatoma

Cholesteatomas is presence of desquamating stratified squamous epithelium in the middle ear. It's epidermal inclusion cysts of the middle ear and/or mastoid with a squamous epithelial lining contain keratin and desquamated epithelium. White cheesy material (Normal skin in abnormal place)

### Its effects are:

- Keratin encourages persistence of the infection

- Matrix causes none erosion

## Classifications:

- Congenital (with intact TM) no discharge + white mass
- Acquired (discharge)
  - Primary
  - secondary

## Pathogenesis:

Implantation congenital or acquired.

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

- Pressure effects.
- Osteoclast activation.
- Some protease and collagenase secretion leading to bone and tissue erosion.

**Primary acquired cholesteatomas pocket**

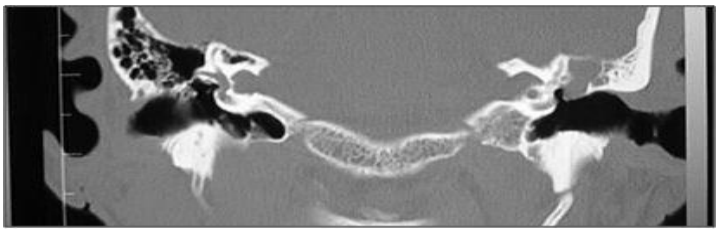
- Invagination
- Basal cell hyperplasia
- Otitis media with effusion
- Epithelial invasion

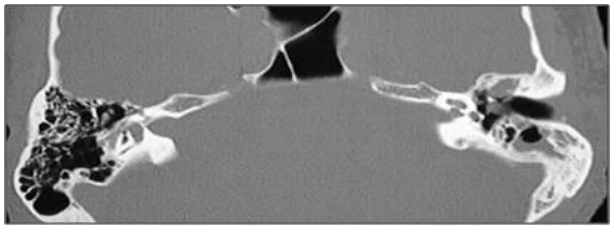
**Secondary acquired cholesteatomas**

- Implantation theory
- Metaplasia theory
- Epithelial invasion theory

## Diagnosis:

- History.
- Examination:
  - Otoscopic
  - Microscopic
  - Tuning fork test.
    - ⇒ If it still affecting only TM and ossicles: conductive hearing loss.
    - ⇒ If it is affecting cochlea: sensorineural hearing loss.
- Investigation:
  - Audiological assessment.
  - Radiological assessment
  - Cholesteatoma image





**Treatment:**

Cholesteatoma Surgery → **mastoidectomy**

**Classified as:** you need to know modified radical & radical only

1. Simple (cortical, complete) mastoidectomy
2. Modified radical mastoidectomy: spares the ossicles, so we only clean the epitympanum.
3. Radical mastoidectomy: remove malleus, incus, mastoid. So we make the middle ear and the attic one cavity.

**Aims of Modified radical & Radical mastoidectomy:**

- Safety
- Dry ear
- Preserve hearing

**Determinants of operative technique for cholesteatoma**

**Local factors:** Presence of a fistula, Extent of disease, Eustachian tube function, Mastoid pneumatization, SNHL.

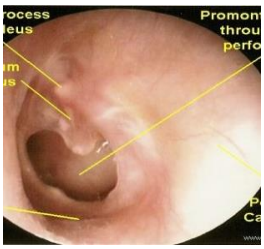
**General factors:** General medical condition, Reliability, Skill of the surgeon

So if you have discharge and perforation, the treatment is surgery.

Unsafe

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.

we have subtotal or total perforation, but the annulus is still intact, and no keratin, so it is safe.



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 summary: the chrinic otitis media is devided into suppurative and non suppurative. The non suppurative devived into efusion and adhesive. And the suppurative devided into TT and AA. in TT type the discharge is usually copious, intermittent and oderless. The perforation is central and the treatment is conservitive if there is active infectio until it's dry. Then followed by tympanoplasty to prevent reinfectio and improve hearing. While in AA type the discharge is usually scanty, persisten and with bad odor. The perforatiom is attac or marginal with cholesteatoma and the treatment is by mastiodectomy to proive safety and dry ear.

At the end of this page, lecture earlll ends

# Complications of Otitis Media (Acute & Chronic):

IMPORTANT

It is associated with acute and chronic unsafe OM.

## Predisposing factors:

- Virulent organisms. What is 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:

- Direct 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.
- Normal anatomic pathway.
- Normal anatomical bony defect
- Congenital dehiscence.
- Fracture lines.
- Round or oval window membrane to the labyrinth.
- Dehiscence due to previous surgery.

## Classification:

1. **Intra-cranial:**
    a. **Intradural:**
        i. Subdural abscess
        ii. Brain abscess (ear is near to temporal lobe\ nose is near to all lobes but especially frontal)
        iii. Otitic hydrocephalus
    b. **Extradural:**
        i. Extradural abscess
        ii. Meningitis
        iii. Lateral sinus thrombosis (ear is near to sigmoid sinus \ nose is near to cavernous sinus)

2. **Intra-temporal complication:**
    i. Mastoiditis
        1. Acute Mastoiditis
        2. Masked Mastoiditis (latent)
    ii. Petrositis
    iii. Facial nerve paralysis

iv. Labyrinthitis & Labyrithine fistula
v. Tympanosclerosis
vi. Ossicular fixation or erosions (conductive hearing loss)

3. **Extra-temporal complication**

## 1. Extradural abscess

- Accumulation pf pus between the bony part of the mastoid and the dura, there will be abscess
- 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.
- Sharply defined dural adherence to bone at suture lines
- Extradural abscess is the commonest Intracranial complication of otitis media.
- Intracranial complication of otitis media.
- Outside the dura of the lateral venous sinus is called perisinus abscess.
- Associated with subdural empyema, management and etiology same as subdural empyema.
- can lead to focal osteomyelitis

### 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 or MRI

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

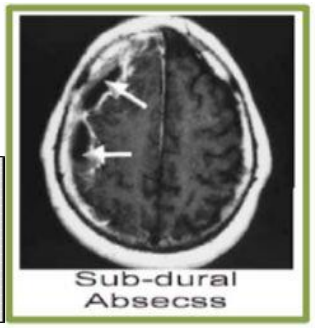
## 2. Subdural abscess

- Also called emphysema
- Collection of pus between the dura and the arachnoid. It's a rare pathology.
- May be localized, multiple or diffuse.
- Potential space
- Lack of anatomical boundaries

### Clinical picture:

- Sever headache without signs of meningeal irritation.
- Convulsions.
- spread rapidly
- Fever & Vomiting
- Focal neurological deficit (paralysis, loss of sensation, visual field defects)
- Ear 14% (paranasal sinusitis 75%)
- Forehead or eye swelling from emissary vein thrombosis
- Nuchal rigidity (doctor mentioned it in the slides but we don't know how is that matching with the previous statement of not having any signs of meningeal irritation)

**Investigations:** CT scan of head both with and without contrast, MRI




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

**Treatment:**

- Antibiotics: initially (systematic)
  - Vancomycin
  - Chloramphemicol
  - Flagyl
  - Modify based on culture results
- Drainage (neurosurgeons).
- Mastoidectomy. Why we do mastoidectomy if the abscess is subdural? Because 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.
- Craniotomy: relatively emergency. Wide craniotomy because of septations-loculations

Lumbar puncture should not be done as it can cause herniation of the cerebellar tonsils. It is a neurological emergency. A series of burr holes or a craniotomy is done to drain subdural empyema. Intravenous antibiotics are administered to control infection. Once infection is under control, attention is paid to causative ear disease which may require mastoidectomy.

## 3. Meningitis

- Meningitis and VST, serious complications, very rare, but they could happen.
- Inflammation of meninges (pia & arachinoid)
- The most common intracranial complications.

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

**Clinical picture:**

- General symptoms and signs: High fever, headache, neck stiffness, restlessness, irritability, photophobia and delirium, and rarely rash.
- Signs of meningeal irritation → Kernig's sign and Brudzinski's sign

**Diagnosis:** Lumbar puncture is diagnostic. to detect the organism and to assess the severity of the disease. But first do CT scan to prevent herniation of cerebellum.

**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.

**CSF Microbiology:**

- Gram stain: Sensitivity 60-90%, specificity nearly 100%. In pts who received an antibiotic: 40-60% (+)
- Culture (+) in 70-85% – <50% (+) in those partially treated.
- False-negatives may occur in patients who are partially treated

## 4. lateral Sinus Thrombosis

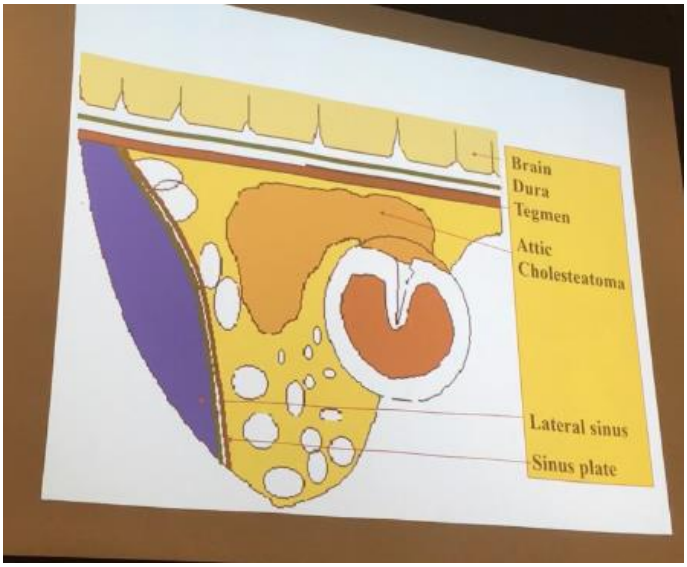
- Thrombophlebitis of the venous sinus (usually lateral sinus venous thrombosis) .

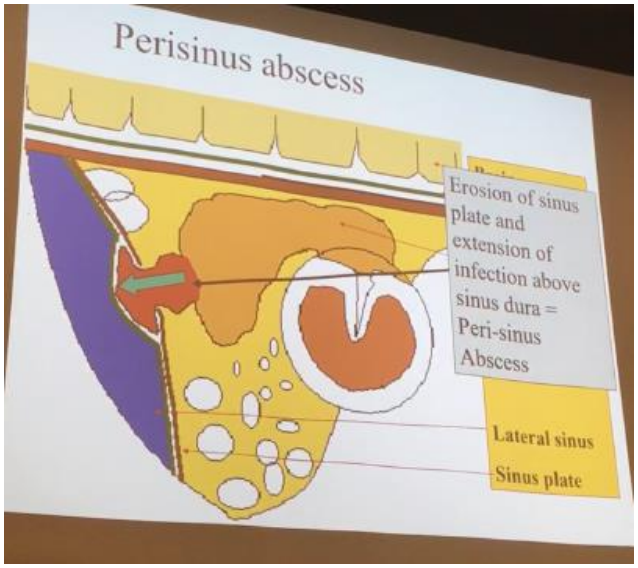
**Etiology:** It usually develops secondary to direct extension.

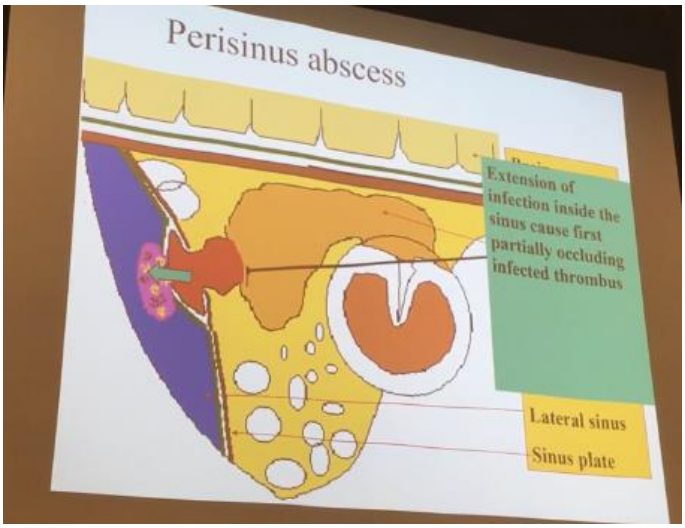
First irritation of the wall then progresses to thrombus then either it will regress or causes symptoms of obstruction (increase ICP, central nerve palsy). Spread of infection by direct extension or via mastoid emissary vein>Pus and granulation adjacent to sigmoid Sinus>Reactive thrombophlebitis>intraluminal thrombus >CSF obstruction

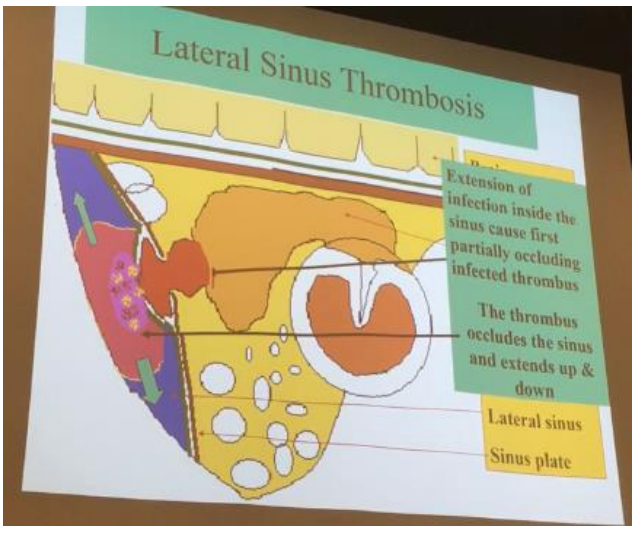
## Pathology:

- Perisinusitis
- Mural thrombus
- Occluding thrombus
- Suppuration
- Embolization




## Clinical picture:

- Headache and neck pain, vomiting, and papilledema (increase intracranial pressure). 6th cranial nerve might be affected because it is the longest cranial nerve passing through the cavernous sinus
- Signs of blood invasion:
  - spiking fever with rigors and chills and sweating
  - persistent fever (septicemia).

- Griesinger sign: edema of the postauricular soft tissues overlying the mastoid process as a result of thrombosis of the mastoid emissary vein. Pressing on the mastoid process will cause tenderness and edema because of small vessel blockage)which is edema and tenderness over the area of the mastoid emissary vein.
- propagation and embolic manifestation
- Jugular Foramen syndrome
- Torticollis

### Diagnosis:

- Clinical (history of AOM)
- CT scan with contrast.
- MRI, MRA, MRV
- Angiography, venography.
- Blood cultures is positive during the febrile phase.

### Treatment:

- **Medical**
  - Antibiotics and supportive treatment.
  - Anticoagulants. in 12 hours window most imp
- **Surgical:** surgery should follow within 48 hours unless there is a dramatic clinical and radiological improvement.
  - Mastoidectomy with exposure of the affected sinus and the intra-sinus abscess is drained.
  - Decompression
  - Thrombus evacuation

## 5. Brain Abscess

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

### Rout of spread:

- Direct extension of infection through meninges
- Indirect vascular extension

**Stages of brain abscess:**

1. Encephalitis (Poorly localized area of discoloration and softening.)
2. Latency (Early Abscess Stage increasing necrosis of center with beginnings of capsule formation
3. Expanding (Late Stage, dense fibro- gliotic capsular wall and purulent center)
4. Rupture

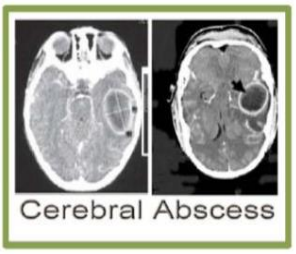
**Incidence:** 50% is Otogenic brain abscess.

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

### Clinical picture:

- Non-specific Symptoms for abscess

- increased intracranial pressure: Headache, Fever, Nausea-Vomiting, Lethargy, Seizures.
- Focal manifestations:
  - Temporal: aphasia, hemianopia, paralysis
  - Cerebellar: ataxia, vertigo, nystagmus, muscle incoordination




**Diagnosis:** CT scans, MRI, lumber puncture, burr hole needling

**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

## 6. Otitic hydrocephalus

- very rare idiopathic benign intracraniaal hypertension assochited with ear diseas. It most often follows laterla sinus thrimophlebitis.
- Many terms used including:
  - pseudotumour cerebri
  - Benign intracranial hypertension
  - idiopathic intracranial hypertension
  - serous meningitis
  - angioneurotic hydrocephalus
  - meningeal hypertension

**Clinical picture:**

- increased intracranial pressure: Headache( Frontal worse on lying down), Tinnitus, Nausea / vomiting

**Treatment:**

- Goals of treatment are: Treat underlying disease, symptom relief and preservation of vision.
- Various treatment modalities including: medication (Oral corticosteroid), diuretics, hyperosmolar dehydration agent, repeated lumbar punctures, Lumboperitoneal shunting

**Prognosis:**

- High variable course
- 10% recur (weeks to years)
- May resolve within months to years
- 10 % serious visual loss

# B. intra-temporal complication

## 1. Facial nerve paralysis

With ear, it is usually lower neuron injury.

### Facial nerve paralysis in AOM

- Mostly due to pressure on a dehiscent nerve by inflammatory products. It is possibly a result of the inflammatory response within the fallopian canal to the acute or chronic otitis media.
- Usually partial and sudden in onset.

### Diagnosis:

Clinically

CT scan. CT localizes involved portion

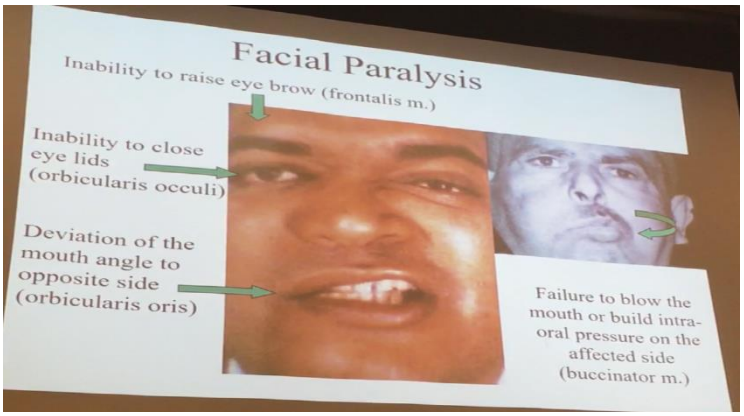
### Treatment:

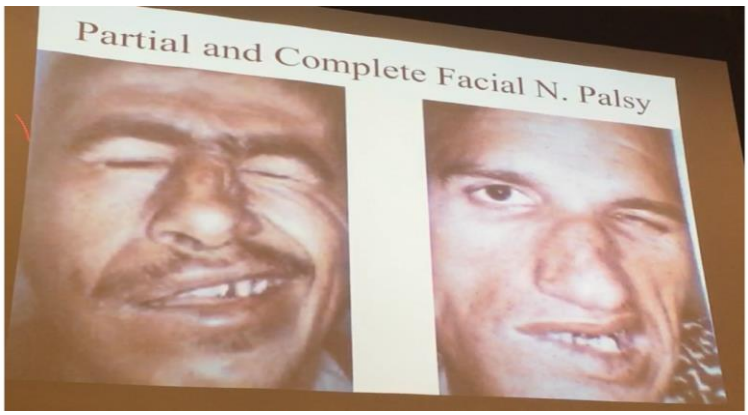
F1: Antibiotic and myrigotomy

F2: cortical mastoidectomy + ventilation tube

### Facial nerve paralysis in CSOM

- Usually due to pressure by cholestetoma or granulation tissue
- Insidious in onset
- May be partial or complete




### Treatment:

F1: Immediate surgical exploration and proceed

F2: mastoidecomy ± facial nerve decompression

If its with cholesteatoma requires immediate surgery to remove cholesteatoma and infected debris

Grades:

1. Normal

2. At rest we can't see the weakness, need more effort to push mean muscle better.
3. At rest we can't see the weakness, less effort needed to push the muscle means muscle weaker.
4. At rest we can see weakness, more effort
5. At rest we can see weakness, less effort needed.
6. Flat.

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)

## 2. Labybrinthitis

A balance disorder involving inflammation of the labyrinths, housing the vestibular system.

### Causes:

May be caused by either viral infection or a bacterial infection. Head trauma, allergies and URTI have also been known to cause Labybrinthitis.

### Symptoms:

Rapid undesired eye movement, nausea, chronic disease, general ill feeling associated with vertigo, patient may not be able to keep balance.

### Progression:

May lead to permanent healing loss and tinnitus

### Treatment

IV Antibiotics and antiemetic's. Even after treatment patient may overcompensate for years to life, cuasing balance issues.

### Pathology of Labybrinthitis:

#### 1. Labybrinthine fistula

Communication between middle and inner ear. Once it's infected it will cause hearing loss and dizziness. There are 2 types: serous (viral) and purulent (bacterial) infections. The difference is that in viral infections hearing loss will improve afterwards but in bacterial infections the hearing loss is permanent.

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

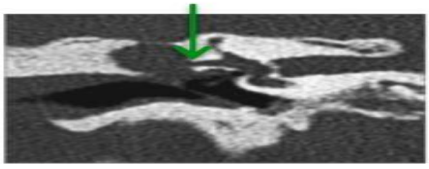
**Clinical picture:**

- Hearing loss (Sensory neural hearing loss) and or vertigo induced by noise or pressure changes.
- Attack of vertigo mostly during straining, sneezing, and lifting heavy object (pressure induce fistula)
- Positive fistula test.

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.



This is a coronal view, so we can not see the posterior canal.

**Treatment:** CWD 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.

2. Circumscribed labyrinthitis

   It's result from erosion of the bony wall of one of the SSC (usually the lateral), or less commonly the promontory by cholestetoma. The inflammatory process is outside the endosteal lining of the labyrinth (intact inner ear function)

3. Acute diffuse serous labyrinthitis

   It's diffuse intra- labyrinthine inflammation without pus formation and is a reversible condition if treated early.

   **Etiology:**

   - Pre-existing circumscribed labyrinthitis associated with chronic middle ear suppuration or cholesteatoma.
   - In acute infection inflammation spreads through round window.

4. Acute diffuse soopurative labyrinthitis

## 3. Mastoiditis

- It is acute suppourative inflammation of mucosal lining of antrum and mastoid air cells system.
- Mastoiditis is the most common infratemporal complication of AOM
- this complication is seen more in children + may give an appearance of a unilateral bat ear.
- Acute Mastoiditis: fast progression (2weeks after OM)

Pathology:

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

Mastoiditis is inflammation of the mastoid air cells in the temporal bone. At birth, the mastoid consists of a single air cell, the antrum, which is connected to the middle ear by a narrow channel, the aditus ad antrum. As the child grows, the mastoid bone becomes pneumatized, resulting in a series of interconnected air cells that are lined by modified respiratory epithelium. When AOM develops as a result of eustachian tube dysfunction, there is an acute inflammatory response of the mucosa lining the middle ear and, in many cases, the mastoid. Most episodes of AOM respond to antibiotic therapy. Eustachian tube dysfunction resolves, and the mucosa of the middle ear and mastoid recovers. In rare cases of newly diagnosed AOM or in cases of inadequate or inappropriate treatment, inflammation of the middle ear and mastoid persists.

Histopathologic specimens from children who undergo mastoidectomy for acute or chronic mastoiditis demonstrate similar subacute or chronic infectious changes. Serous and then purulent material accumulates within the mastoid cavities. As the pressure increases, the thin bony septa between air cells may be destroyed. This may be followed by formation of abscess cavities and ultimately by the dissection of pus into adjacent areas. The direction in which purulent material dissects determines the clinical presentation and complications associated with acute mastoiditis.Pus traversing the aditus ad antrum reaches to the middle ear and empties through the eustachian tube (with resolution of the process) or a perforation of the tympanic membrane. If the pus erodes the lateral cortex of the mastoid, a subperiosteal abscess is produced. The abscess results in swelling or fluctuation above the auricle in infants or behind the lower earlobe over the mastoid process in older children. Rarely, erosion occurs through the medial aspect of the mastoid tip, resulting in a neck abscess beneath the attachment of the sternocleidomastoid and digastric muscles.

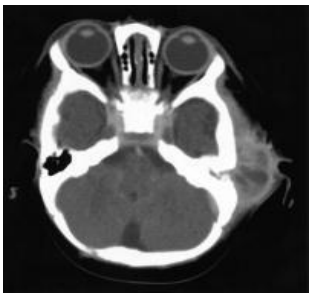
### Symptoms:

- Earache.
- Fever.
- Ear discharge.

### Signs:

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

Common in children with acute otitis media that is not treated well → pus in the mastoid→ eroding cortical mastoid → subperiosteal abscess.

### Diagnosis:

- General constitutional manifestation
- Tympanic membrane changes
- Sagging of posterosuperior meatal wall
- Otorrhea and reservoir sign
- Retroauricular tender red swelling
- Subperiosteal and bezold's abscess
- CT scan temporal bones.
- Ear swab for culture and sensitivity

### Treatment

- **Medical:** if there is no abscess
  - Hospitalize
  - IV antibiotics
  - Analgesics
- **Surgical** if there is an abscess
  - Myringotomy
  - Cortical mastoidectomy. If medical treatment fails or if there are sign of abscess formation

## 4. Petrositis

- Known as apical apicitis. Petrositis is an important complication of infected petrous cells, but it is rarely seen in a non-pneumatized apex (petrous pyramids 30 %normal subjects) The infection is spread from middle ear and mastoid to the petrous part of temporal.
- Poor drainage
- Bony coalescence
- Next to it lies the ganglion of CN5 and the abducent nerve (CN6). So the abducent In many cases are affected

## Symptoms

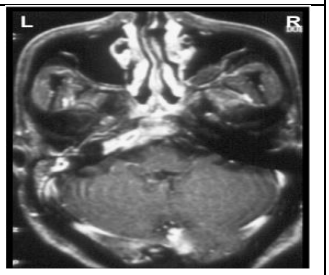
Gradinigo Syndrome: a Triad of

- trigeminal neuralgia (CN5). Retro orbital pain and headache due to irritation of the trigeminal gangion.
- Abducent diplopia due to abducent paralysis
- Ear discharge.

## Treatment:

- Broad spectrum antibiotic which covers staphylococcus aureus
- Myringotomy if TM was not perforated → Evacuating all the discharge
- Surgical drainage if antibiotic failed. Mastiodecotmy must be dine to remove the infection from the petrous.

## Cases

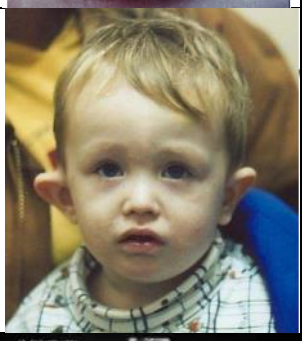
| | |
|---|---|
| **1) COM**<br>**• 45 Y**<br>**• Rt Ear Hearing loss**<br>**• Discharge** |  |
| **2) Cholesteatoma**<br>**35 Y • Left ear • Discharge • Deafness**<br>**• Diagnosis?**<br>**Cholesteatoma**<br><br>**• Treatment?**<br>**See above** |  |
| **3) Petrositis**<br><br>**• 50 Y**<br>**• Headache**<br>**• Persistent ear discharge**<br>**• Diplopia** |  |

### 4) Congenital cholesteatoma

- 3 Y
- Healthy
- Incidental finding

### 5) Mastoiditis

- 3.5 Y
- 2 weeks ago, OM
- Fever
- Earache
- Exam



### 6) Brain abscess

35 Years

- PMHx Rt CSOM
- Fever
- Headache