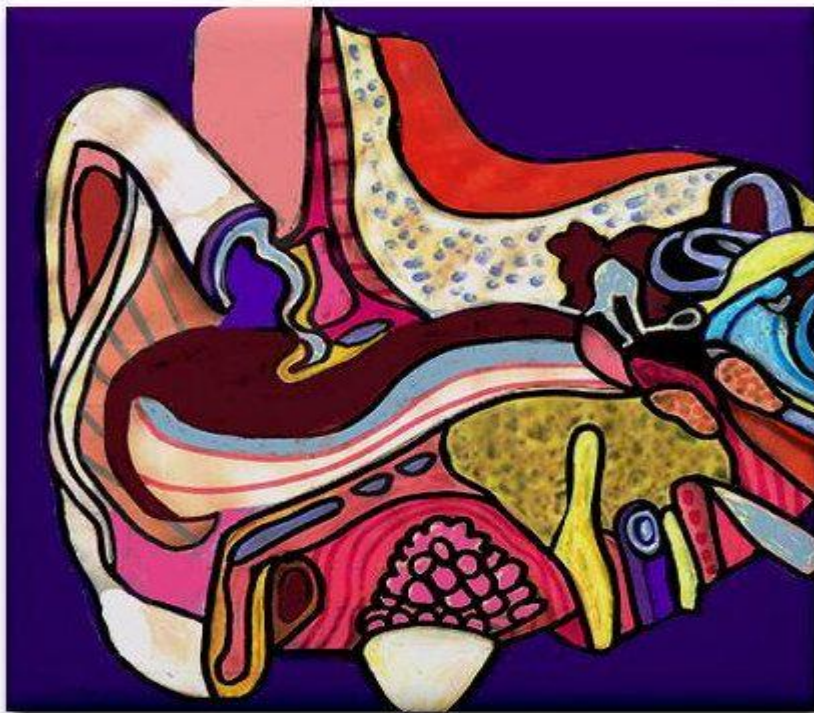




EAR I-II- III & IV



Done by : Hanan Omar Khushaim & Yara Alzamil

Reviewed by : Hadeel B. Alsulami

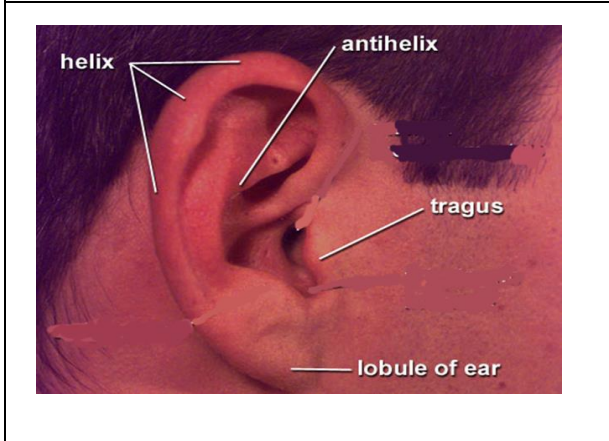
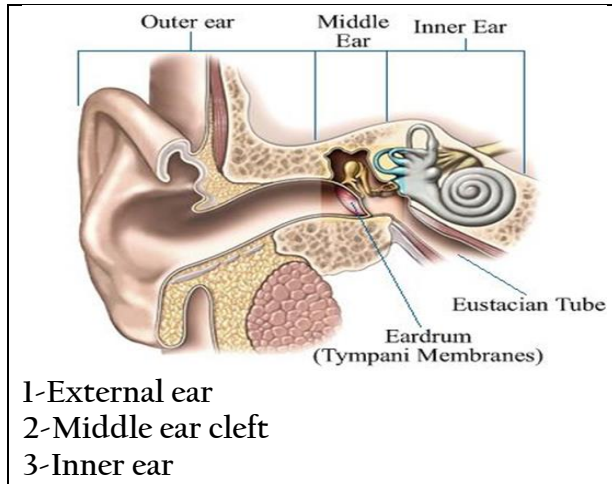
Correction File

Color Index :

Slides - Team 433 - Important Notes - Doctors' Notes - Lecture notes book -Toronto notes

Anatomy of the ear

The ear consists of:





External ear:

Is Formed of **Auricles** and **External auditory meatus** (auditory canal). Both of them are lined by skin

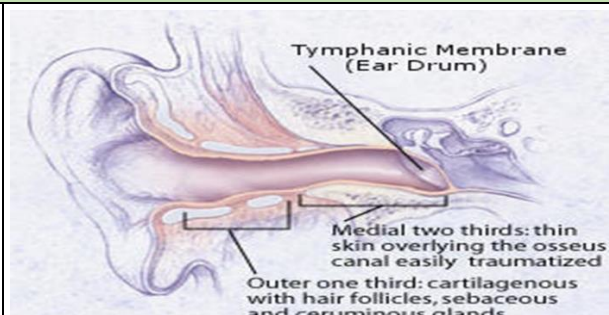
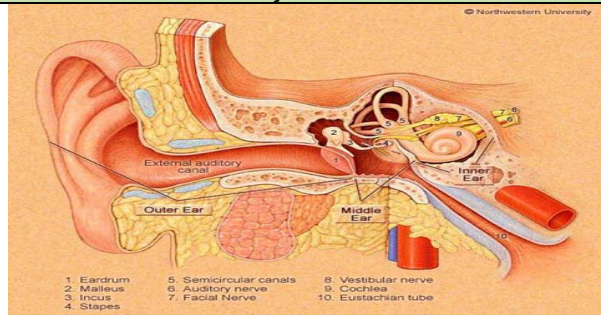
Auricles:

Is Formed of **fibrous cartilage** and lined by skin ,except the lobule (formed of fatty tissue)

The five most important structures of Auricles are: Helix ,Antihelix, tragus, concha and lobule

A		B	
	<p>So in case of Perichondritis in pic(A) (inflammation of connective tissue that surrounds the cartilage) the lobule is not affected</p>		<p>.but in case of any skin problem like Erysipelas (B), all of auricle is affected.</p>

External auditory canal:



The external auditory meatus (2.5 cm) is an S shaped canal (to protect the eardrum and middle ear).

During examination you should pull the auricle posteriorly and superiorly to straighten the canal).

The auditory meatus consists of

A. Cartilaginous part (lateral 1/3):

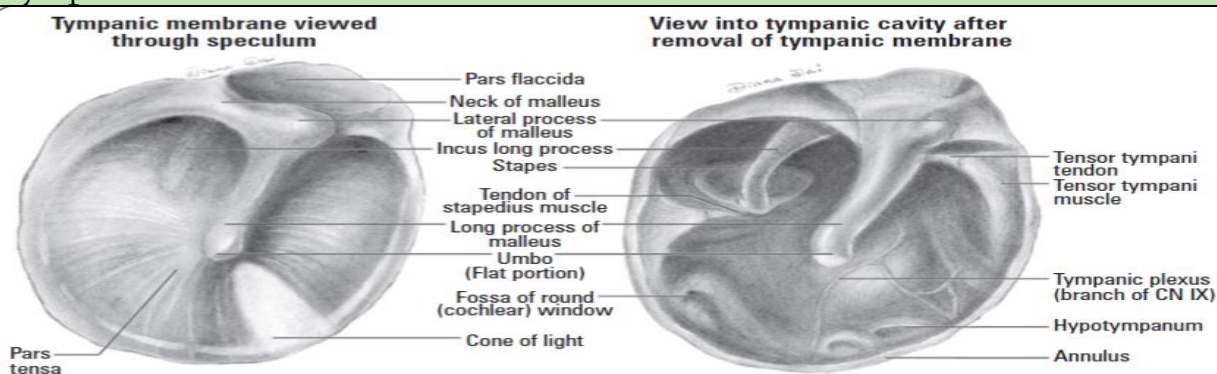
- it develops at birth and formed by elastic cartilage and covered by skin which means it can get any skin disorders and contains
- hair follicles ceruminous glands (which secrete wax); prevent particles from entering the ear
- sebaceous glands : to keep the skin wet

B. Bony part (medial 2/3):

it develops after birth (for conduction of sound)

- The narrowest portion is at the bony-cartilaginous junction. (The skin is thin and easy to be injured during examination. (Another area of constriction is at the tympanic membrane.

Tympanic membrane:



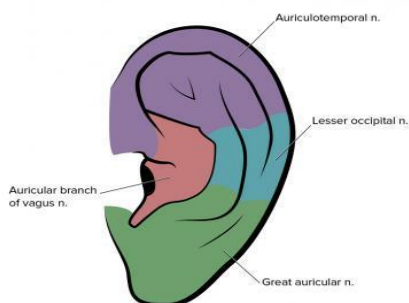
It forms the partition between the external auditory canal and the middle ear.

Parts:

A. Pars Tensa, taut. (greater part) B. Pars Flaccida, thin and lax (triangular).

The Tympanic membrane consists of three layers:

- Outer layer: stratified squamous epithelium (skin) continuous with skin of auditory canal, ectodermal origin. (epithelial)
- The middle layer: or lamina propria fibrous layer, mesodermal in origin. (present only in pars tensa. which makes pars flaccida more prone to perforation) (fibrous)
- The inner layer, endodermal in origin, comprising the middle ear mucosa. (mucosal)
 - normally, it is gray or transparent in color. Red means it's inflamed. It is normally tense which is essential for normal hearing.
 - Since the tympanic membrane is translucent, it possible on examination to see the underlying malleus and part of the incus.



Nerve Supply of External Ear:

- Cervical II & III (greater auricular and lesser occipital).
- V cranial nerve (auriculotemporal).
- X cranial nerve (auricular or Arnold's).
- Fibers from VII cranial nerve.

Blood supply:

Richly supplied by branches from the external carotid

2-Middle ear cleft

Formed of:

- A. Eustachian tube (pharyngotympanic tube).
- B. Tympanum (Middle ear cavity).
- C. Mastoid antrum and hair cells.

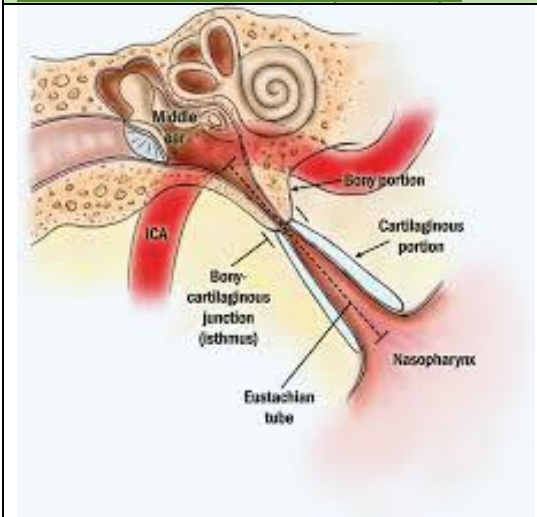
-it is a narrow slit-like cavity in the petrous part of temporal bone.

Lining of middle ear:

Mucous membrane consists of stratified cuboidal epithelium, which changes to pseudostratified ciliated epithelium around the mouth of the Eustachian tube.

(ciliated columnar epithelium anteriorly and cuboidal or flat elsewhere)

A-Eustachian tube (3.7 cm):



Connect the middle ear cavity with nasopharynx. Lies adjacent to the ICA (internal carotid artery).

Yawning, Swallowing, eating; open up the

Parts of Eustachian Tube:

- Lateral $\frac{1}{3}$ is bone.
- Medial $\frac{2}{3}$ is fibro-cartilaginous.

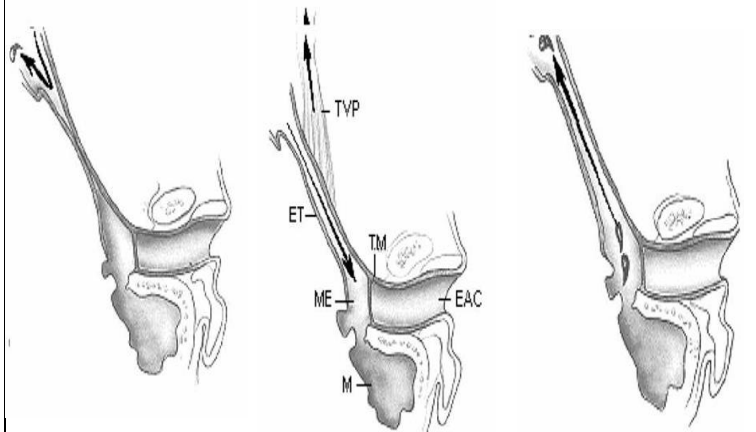
* Junction between 2 parts is isthmus, narrowest part of the tube.

ET reaches downward, forward and medially from anterior part of tympanic cavity to lateral wall of nasopharynx. It is lined by ciliated columnar epithelium

Physiology of Eustachian tube:

• It opens actively by contraction of tensor veli palatini and passively by contraction of levator veli palatini (it releases the tension in tubal cartilage).

• Closed by elastic recoil of elastin hinge + deforming force of Ostmann fat.



Protection

Ventilation

Drainage

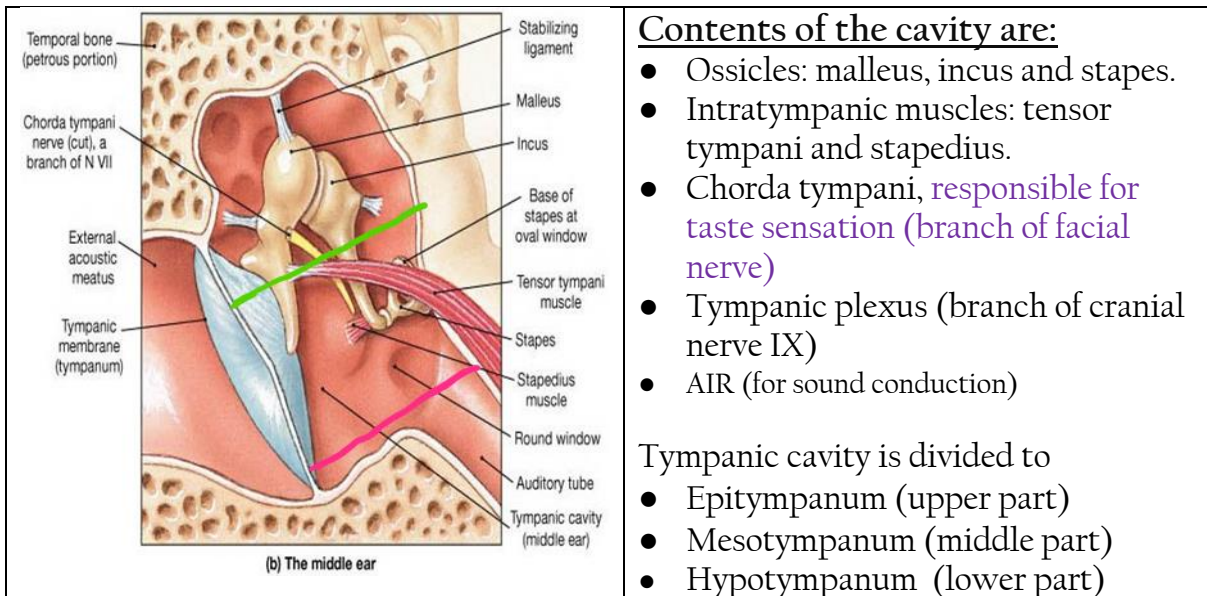
Adult vs INFANT ★

	ADULT	INFANT
Length	36 mm	18 mm
Angle with horizontal	45 °	10 °
Lumen	Narrower	Wider
Angulation at isthmus	Present	Absent
Cartilage	Rigid	Flaccid
Elastic recoil	Effective	Ineffective
Ostmann's fat	More	Less

The 45 angle is protective form infections

Difference between ET of infant and adult.

B-Tympanic cavity (middle ear cavity):



Contents of the cavity are:

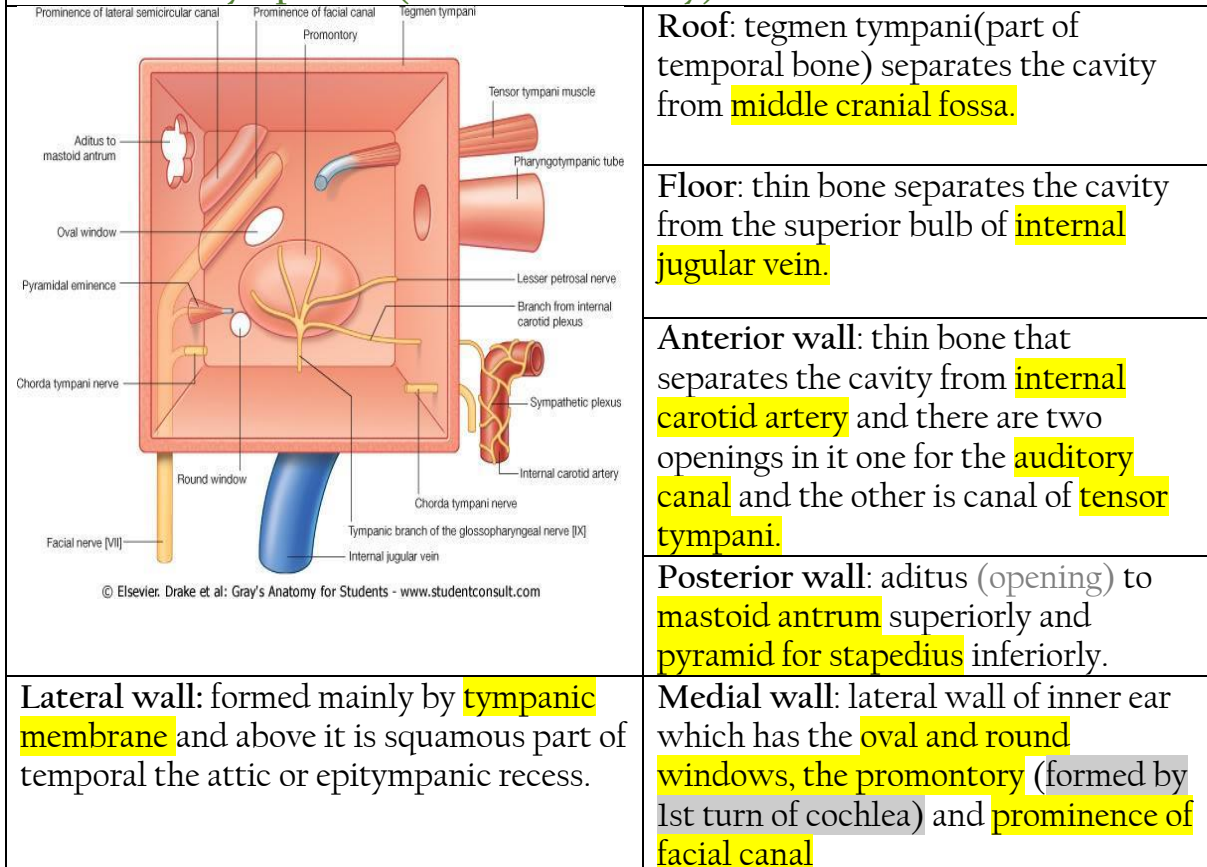
- Ossicles: malleus, incus and stapes.
- Intratympanic muscles: tensor tympani and stapedius.
- Chorda tympani, responsible for taste sensation (branch of facial nerve)
- Tympanic plexus (branch of cranial nerve IX)
- AIR (for sound conduction)

Tympanic cavity is divided to

- Epitympanum (upper part)
- Mesotympanum (middle part)
- Hypotympanum (lower part)

The Stapes receives the insertion of stapedius muscle. Handle of Malleus receives the insertion of Tensor tympani muscle. Contraction of the stapedius muscle restricts the movement of the stapes (this is considered as a physiologic reflex that protects the inner ear from very loud sounds (Attenuation reflex).

Content of Tympanum (Middle Ear Cavity)



Roof: tegmen tympani (part of temporal bone) separates the cavity from middle cranial fossa.

Floor: thin bone separates the cavity from the superior bulb of internal jugular vein.

Anterior wall: thin bone that separates the cavity from internal carotid artery and there are two openings in it one for the auditory canal and the other is canal of tensor tympani.

Posterior wall: aditus (opening) to mastoid antrum superiorly and pyramid for stapedius inferiorly.

Lateral wall: formed mainly by tympanic membrane and above it is squamous part of temporal the attic or epitympanic recess.

Medial wall: lateral wall of inner ear which has the oval and round windows, the promontory (formed by 1st turn of cochlea) and prominence of facial canal



Clinical importance of walls of middle ear:

- Fracture of temporal bone (roof of middle ear cavity) will be presented by either CSF otorrhea or rhinorrhea .
- Lateral sinus thrombosis secondary to otitis media (posterior wall).

Nerve supply of middle ear:

Sensory nerve supply of mucosa of middle ear:

- Tympanic branch of the glossopharyngeal nerve.
- Auriculotemporal branch of the trigeminal nerve.

Motor nerve supply of middle ear muscles:

- Stapedius muscle supplied by the stapedial branch of the facial nerve.
- Tensor tympani muscle supplied by the mandibular division of the trigeminal nerve.

Referred earache:

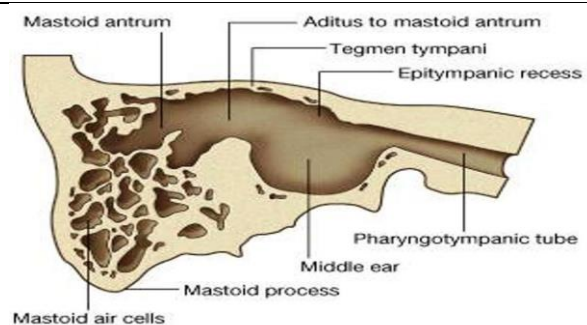
(Pain in the ear due to a disease in an area supplied by a nerve that also supply the ear)

- CII, CIII :Neck injury, cervical spondylosis
- CN5: dental infection, sinonasal disease.
- C9: tonsillectomy or tonsillar carcinoma or tonsillitis
- CN10 :Tumors of the hypopharynx, larynx, or esophagus.



C-Mastoid antrum and air cells:

Situated in the posterior portion of petrous temporal bone
Anterior: opening of the aditus (means entrance)
Medial :post and horizontal semicircular canals
Roof (tegmen antri)
Lateral :squama and macewen's triangle

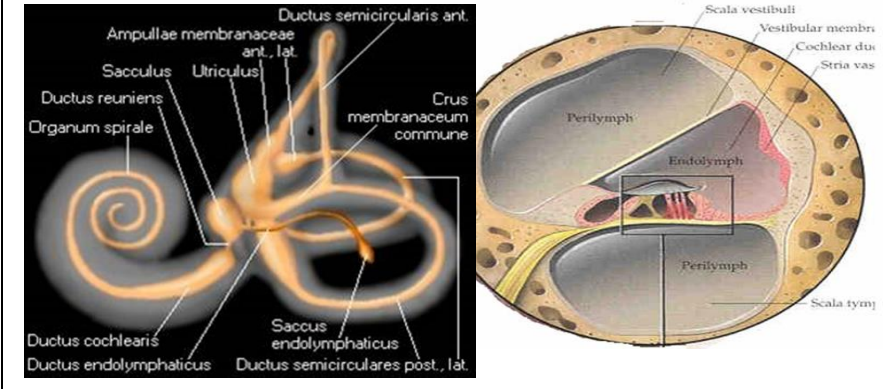
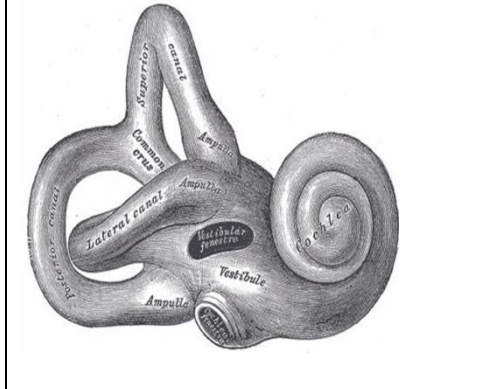


-Air-containing cells of the mastoid process are continuous with the air in the middle ear.

- Pneumatization is complete between the sixth and twelfth years of life.
- Normal tubal function is a prerequisite for biologically active, healthy Middle ear mucosa, and thus for the normal process of pneumatization.

3-Inner ear Consists of:

- A-Osseus labyrinth bony labyrinth
- B-Perilymph
- C-Membranous labyrinth



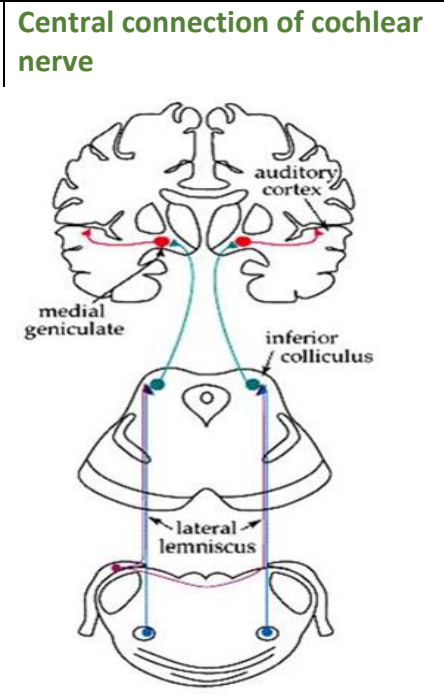
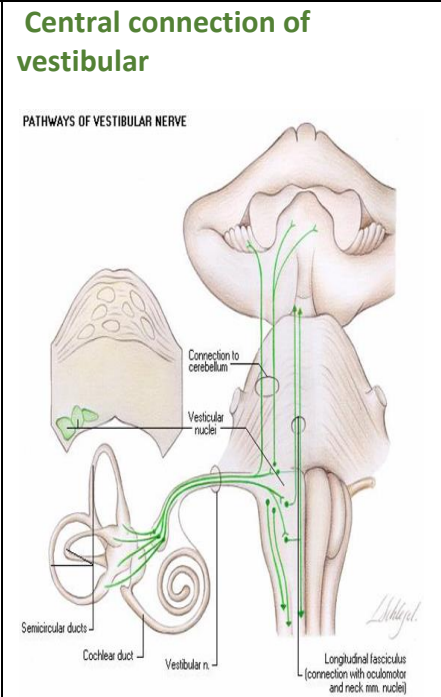
- A.Bony (Osseous) Labyrinth, its parts:**
- Bony Cochlea
 - Vestibule
 - Bony semicircular canals

- C.Membranous Labyrinth, its parts:**
- Cochlear duct
 - Saccule and utricle
 - Membranous semicircular ducts

- Its contents:**
- Perilymph fluid (Like ECF)
 - Membranous labyrinth

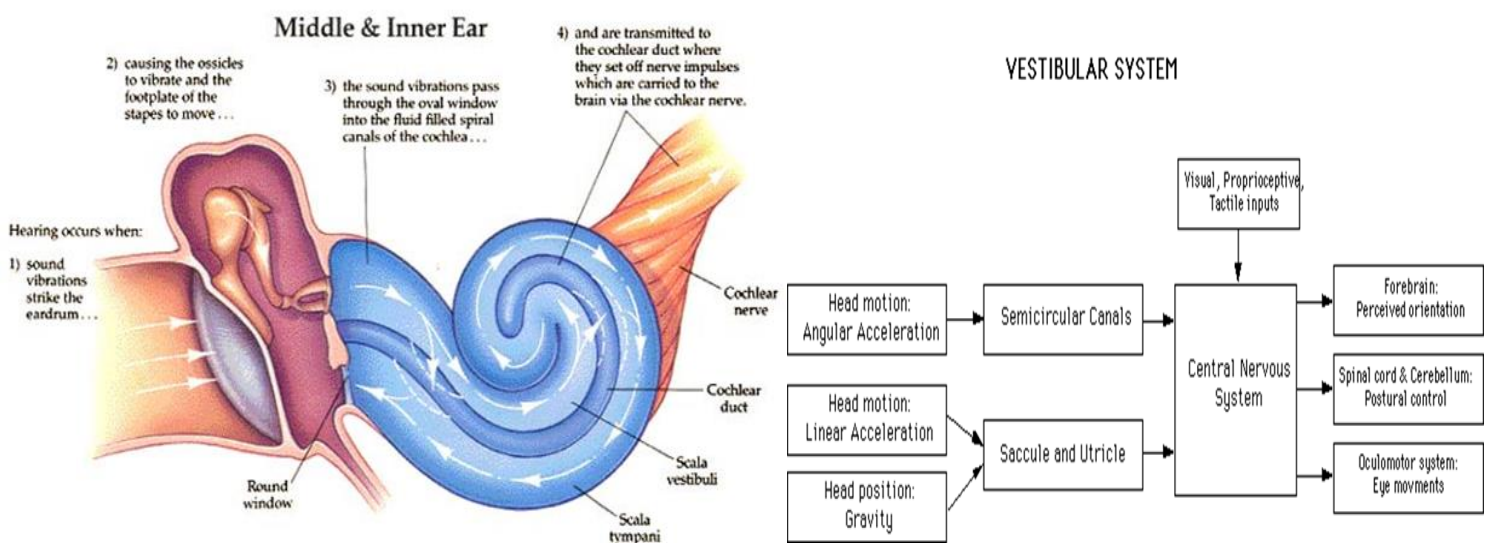
- Its contents:**
- Endolymph (Like ICF)
 - Sensory epithelium:
 - Cochlea: organ of Corti (has inner and outer hair cells, responsible For hearing) – (each part of the cochlea responds to specific kHz to conduct to the nerve)
 - Utricle and saccule: maculae (The saccule tells you when you stop moving and the utricle is responsible for head tilting)
 - Semicircular canals: cristae

- D-Internal Auditory Canal, Contains:**
- Vestibulocochlear nerve
 - Facial nerve
-
- © Mayfield Clinic



Physiology of the ear








<p><u>Functions of the external ear</u></p>	<p>-Auditory functions: Sound conduction Increase sound pressure by the resonance function.</p> <p>-Protection of the middle ear:</p> <ul style="list-style-type: none"> ● Curvature ● Cerumen(acidic and sticky kills bacteria)
<p><u>Functions of Eustachian tube</u></p>	<ul style="list-style-type: none"> ● Protection ● Ventilation ● Drainage (of mucosal secretion) <p>Tube is straight in children which increases their risk of otitis media, also Secretions or food may enter the tympanic cavity more easily when the baby is supine particularly during feeding causing otitis media.</p>
<p><u>Functions of middle ear</u></p>	<ul style="list-style-type: none"> ● Conduction of sound ● Transformer mechanism <ul style="list-style-type: none"> ○ Hydraulic action ○ Ossicular leverage ● Protection to the inner ear <ul style="list-style-type: none"> ○ stapedial reflex
<p><u>Functions of inner ear</u></p>	<p><u>Hearing Function:</u> Transduction of sound to action potentials.</p> <p><u>Vestibular Function:</u> Participate in maintaining body balance</p> <p>The mechanisms of maintaining body balance: Brain stem: is the center of balance. It's connected to : Cerebellum to coordinate muscle tone and Cerebral cortex for the feeling of space. Input: Proprioceptive (sensation) Visual Vestibular. Output: gives information to: Postural muscles and Ocular muscle. (Team 431)</p>



Disease of external ear and acute otitis media ear

Conditions of the pinna

- Conditions of the external auditory meatus: Congenital , wax**

1-Congenital anomalies of external ear:		
Protruding ear (bat ear) (A)	<p>Condition is due to absence of anti-helix.</p> <p>Treatment :</p> <p>Pinnaplasty</p> <p>Otoplasty (they construct anti-helix)</p> <p>(Do it after school age)</p>	
Preauricular sinus: (B)	<p>The sinus can get infected, it needs to be excised surgically.</p> <p>It's a common congenital malformation characterized by a nodule, dent or dimple located anywhere adjacent to the External ear.</p> <p>Management:</p> <p>Systemic antibiotics. If an abscess is present, it must be incised and drained.</p>	 <p style="text-align: center; font-size: small;">Preauricular Sinus</p>
Microtia (C)	<p>It's a condition in which the external portion of the ear (the auricle) is malformed. There is also Narrowing or absence of the external auditory canal.</p> <p>Absence or severe malformation of the external ear, as in Treacher Collins syndrome</p> <p style="text-align: center;">Spectrum of Microtia Severity</p> <p style="text-align: center; color: blue;">Least Severe → Most Severe</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p style="font-size: x-small;">The ear is smaller but still looks like an ear because most normal features are present</p> </div> <div style="text-align: center;">  <p style="font-size: x-small;">Some normal features are present but the upper ear is severely deficient. The canal may be present or absent.</p> </div> <div style="text-align: center;">  <p style="font-size: x-small;">A small piece of cartilage is present just above the ear lobe which is displaced upward and forward. The canal is almost always absent.</p> </div> <div style="text-align: center;">  <p style="font-size: x-small;">Anotia is when there is a complete absence of the ear and canal.</p> </div> </div>	
Atresia (D)	<p>It's the total absence of the Auricle most often with narrowing or Absence of the external auditory meatus.</p>	
Accessory auricle (E)	<p>It's a type of ear anomaly in the tragus area.</p> <p>Treatment :</p> <ul style="list-style-type: none"> • Plastic reconstruction • Bone anchored hearing aid (BAHA) 	

Wax

Earwax blockade can lead to 20-30% reduction in hearing.

-Cerumen Impaction:

Etiology

ear wax: a mixture of secretions from ceruminous and pilosebaceous glands, squames of epithelium, dust, and debris

Risk Factors

- hairy or narrow ear canals
- in-the-ear hearing aids
- cotton swab usage,
- osteomata

Clinical Features

- hearing loss (conductive)
- ± tinnitus, vertigo, otalgia, aural fullness

Treatment

- ceruminolytic drops (bicarbonate solution, olive oil, glycerine, , Cerumenex®)
- syringing (used in the past)
- manual debridement (by MD)



2-Trauma to the auricle

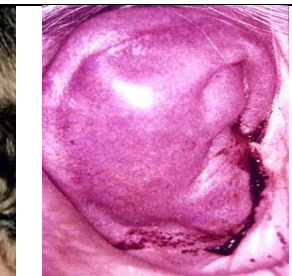
- Lacerations

- Hematoma auris

Treatment: Excise fibrous tissue

. Apply pressure dressing

- drain.



3-Perichondritis of pinna:

Infection of the auricular cartilage that leads to necrosis and deformity.
(cauliflower deformity from untreated infection)

it may follow:

- Haematoma,
- Surgery or otitis externa & piercing
- Commonly caused by Pseudomonas



Signs & Symptoms :

Fever, pain, redness, and swelling (team 433)

MANAGEMENT

ABX ,Incision & drainage ,Removal of necrotic tissue

*(Any cartilaginous organ that forms a hematoma must be drained as early as possible, to prevent necrosis as the cartilage is avascular



4-Otitis externa

1-Acute otitis externa: (infective) :

Bacterial infection involving the skin of the external canal

Pathophysiology: Causes

aggressive washing the wax or retention water

risk factors:

- Microtrauma (cotton swabs, fingernails),
- associated with swimming (“swimmer’s ear”)
- mechanical cleaning (Q-tips®), skin dermatitis, aggressive scratching
- devices that occlude the ear canal: hearing aids, headphones, etc.
- allergic contact dermatitis, dermatologic conditions (psoriasis, atopic dermatitis)

Pathogens;

pseudomonas aeruginosa, staphylococcus (furuncle) (in 90% it is bacterial)

fungus: Candida albicans, Aspergillus niger can also cause it.

Symptoms :

- Pain (otalgia) increased by jaw movement
- Irritation & pruritus (itchiness)
- Discharge (scanty)
- tragal tenderness
- edematous erythematous EAC,
- conductive hearing loss Deafness (mild)



Signs

- Meatal tenderness, especially on movement of the pinna or compression of the tragus In acute otitis externa, pain is aggravated by movement of auricle (traction of pinna or pressure over tragus) *Pulling on the pinna is extremely painful in otitis externa, but is usually well tolerated in otitis media
- Moist debris, often smelly and keratotic Patient may also have otorrhea (sticky yellow purulent discharge)
- Red desquamated skin and oedema of the meatal walls
- posterior auricular lymphadenopathy

MANAGEMENT

Suction cleaning, Ear drop, Analgesia and antibiotic.

(antipseudomonal otic drops (e.g. ciprofloxacin) or a combination of antibiotic and steroid)

*systemic antibiotics if either cervical lymphadenopathy or cellulitis is present.

Treatment of otitis externa/dermatitis ;

1. Clean the ear canal thoroughly (q..).
2. If there is any suspicion of a sensitivity reaction, stop topical treatment with antibiotics.
3. The ear may be treated by a glycerine and ichthammol wick, or an emollient ointment.
4. Apply steroid ointment sparingly.
5. Severe cases may require admission to hospital.

Herpetic lesions:

Ramsay hunt syndrome= herpes simplex type 1 virus causing otitis externa

Signs & Symptoms :

Severe pain, Vesication, Cranial nerve lesion deafness SNHL, Vertigo, Facial nerve palsies,

RX:

oral and topical acyclovir early, if infection is involving facial nerve give steroid

Herpes simplex (acyclovir in severe cases),herpes zoster oticus



Otomycosis :

Aspergillus ,candida

Risk factors : moist ear (swimmers) , Diabetes mellitus

signs & symptoms :

moist tissue –paper dotted gray membrane, pruritic, (NEWSPAPER APPEARANCE)

RX:: suction cleaning Fungicides :nystatin ,econazole



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2-Reactive otitis externa:

A Eczematous otitis externa: Allergic dermatitis

Signs & Symptoms :

pruritis - redness oedema - mild pain- dry scaly skin

Management :

- recognize the allergen
- Hydrocortisone cream
- Antihistamin
- Coal tar ointment ,silver nitrate ,canalplasty (chronic stage)



B- Seborrhoeic otitis externa :

Greasy, scaling and crusting condition

Causes: abn sebum and wax

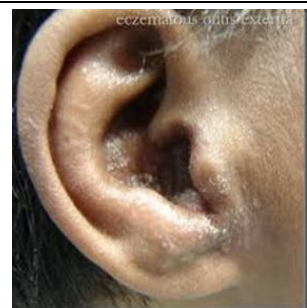
Signs & Symptoms :

Greasy yellow scales, itching

Management :

Shampoo selenium sulphide and ketoconazole

Ointment; salicylic acid and sulphur 2%



Malignant otitis externa (osteomyelitis of skull base):

Pseudomonas infection occurring in elderly diabetic patients .

Definition

- osteomyelitis of the temporal bone

Epidemiology

- occurs in elderly diabetics and immunocompromised patients



SIGNS & SYMPTOMS :

- Granulation tissue in EAC at the bony cartilaginous junction
- Persist otalgia, otorrhea
- Cranial nerve involvement VII, IX ,X XI ,XII,V,VI
e.g.



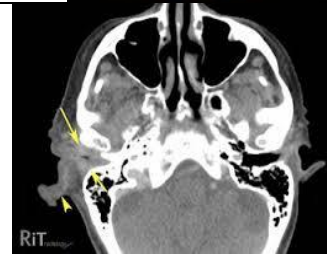
Diagnosis:

CT scan, bone scan ,culture

Management: (admit patient)

diabetic control,

Prolonged parenteral anti- pseudomonas antibiotics , ear drop,
debridement and hyperbaric oxygen.



inflammation of the middle ear

5-Acute otitis media

Inflammation of the middle ear cavity (<3 weeks)

*most frequent diagnosis in sick children visiting clinicians' offices and most common reason for antibiotic administration peaks in winter

Pathophysiology :

ET dysfunction ,spread of the infection via submucosal lymphatic or direct spread,
primary defect causing AOM: Eustachian tube dysfunction/obstruction
stasis/colonization by Pathogens

Predisposing Factors (

1. Eustachian tube dysfunction/obstruction/abnormality

- swelling of tubal mucosa
 - upper respiratory tract infection (URTI)
 - allergic rhinitis
 - chronic rhinosinusitis
- obstruction/infiltration of Eustachian tube ostium
 - tumour: nasopharyngeal carcinoma (adults)
 - adenoid hypertrophy (not due to obstruction but by maintaining a source of infection)
 - barotrauma (sudden changes in air pressure)
- inadequate tensor palati function: cleft palate (even after repair)
- Abnormal Eustachian tube
 - Down syndrome (horizontal position of Eustachian tube)
 - Crouzon syndrome
 - Cleft palate
 - Apert syndrome

2. Disruption of action of

- cilia of Eustachian tube: Kartagener's syndrome

- mucus secreting cells
- capillary network that provides humoral factors, PMNs, phagocytic cell

3. immunosuppression/deficiency due to chemotherapy, steroids, DM, hypogammaglobulinemia, cystic fibrosis

Pathogens;

S,pneumonia, H, influenza.Moraxella

- commonly due to bacterial/viral co-infection, in 90% cause is viral

Risks:

Craniofacial abnormality ,Recurrent URTI(recurrent upper respiratory tract infection) , Day care, Bottle feeding, smoking, immunological disorders IgA ,IgG deficiencies, Ciliary dysfunction, Adenoid hypertrophy GERD, NGT(nasogastric tube)

Signs & Symptoms :

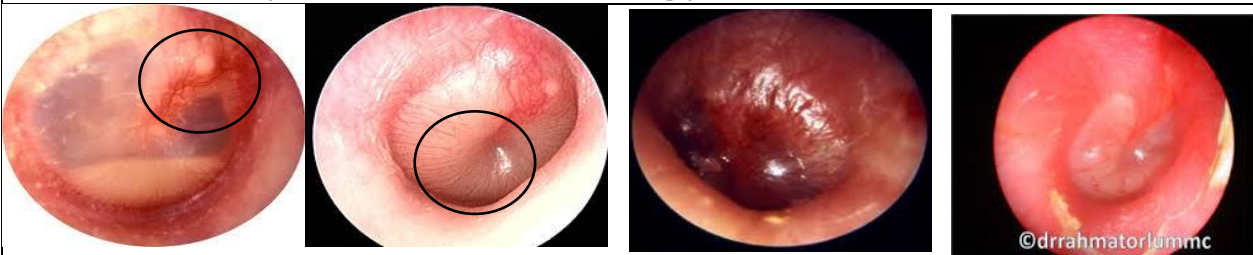
Triad of otalgia, fever (especially in younger children), and conductive hearing loss
other:

acute otorrhea ,aural fullness, tinnitus ,fever, unexplained irritability, upper respiratory symptoms, poor sleeping, anorexia

Hyperemic TM ,non mobile bulging TM ,air fluid level opacification of TM

Otoscopy of TM

- hyperemia
- marked discolouration (hemorrhagic, red, grey, or yellow)
- bulging, pus may be seen behind TM
- loss of bony landmarks: handle and long process of malleus not visible



Hyperemia

Bulging (fluid behind TM)

Management :

oral Antibiotics for 10 days, 1st line treatment (no penicillin allergy):amoxicillin: 2nd line treatment: cefprozil

Antipyretics , analgesia oral and nasal decongestants

Myringotomy (draining the pus through poking a hole into tympanic membrane)

► severe otalgia

COMPLICATIONS:

- Extracranial
 - hearing loss and speech delay (secondary to persistent MEE)
 - TM perforation
 - extension of suppurative process to adjacent structures (mastoiditis, petrositis, labyrinthitis)
 - cholesteatoma
 - facial nerve palsy
 - middle ear atelectasis,
 - ossicular necrosis
 - vestibular dysfunction

- intracranial
 - meningitis
 - epidural and brain abscess
 - subdural empyema
 - lateral and cavernous sinus thrombosis
 - carotid artery thrombosis
 - facial nerve paralysis
- other
 - mastoiditis
 - labyrinthitis
 - sigmoid sinus thrombophlebitis

Acute mastoiditis:

Definition

- infection (usually subperiosteal) of mastoid air cells, most commonly seen approximately two weeks after onset of untreated or inadequately treated acute suppurative otitis media
- more common in children than adults

Etiology

- acute mastoiditis caused by the same organisms as AOM: *S. pneumoniae*, *H. influenzae*

Features: recent URTI, ear discharge, fluctuant tender swelling and fever.

It has a Classic Triad of

- Otorrhea
- Tenderness to pressure over the Mastoid and
- Retroauricular swelling with protruding ear

Management

- Systemic Antibiotics
- analgesia
- URGENT REFERRAL.

(early infection to mastoid=>admit+ Antibiotics but if infect reaches subcutaneous tissue urgent evacuation is needed.)

- the white (hyperdense areas in CT is pus in mastoid)



Recurrent acute otitis media:

Three or more attacks over a 6-months period or (five or six attacks in a year).

Management of recurrent acute otitis media :

Myringotomy with pressure equalization tube and Long-term low dose antimicrobials.

Secretory otitis media, otitis media with effusion:

Definition :

Persistence of fluid in the middle ear space without evidence of infection.

- most common cause of pediatric hearing loss

SIGNS & SYMPTOMS

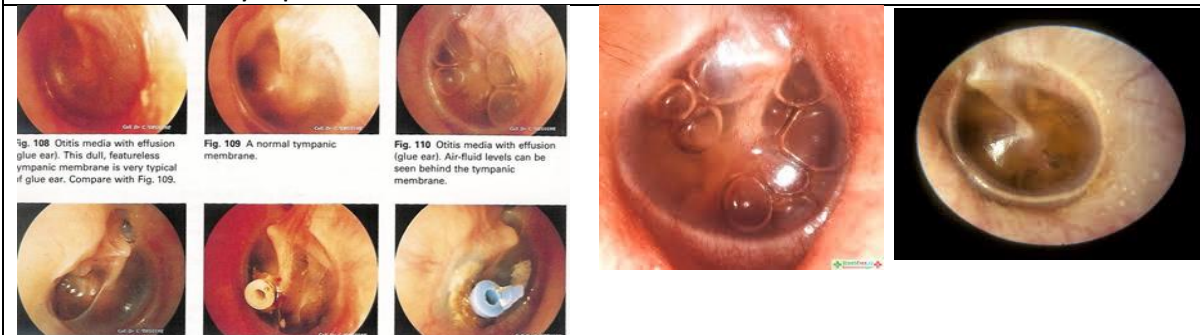
- nonmobile TM, air fluid levels, aural fullness, hearing loss,
 - conductive hearing loss ± tinnitus (confirm with audiogram and tympanogram (flat))
- fullness – blocked ear
- ± pain, low grade fever
- otoscopy of tympanic membrane
 - discolouration – amber or dull grey with “glue” ear
 - meniscus fluid level behind TM
 - air bubbles
 - retraction pockets/TM atelectasis
 - most reliable finding with pneumotoscopy is immobility

Diagnosis tympanometry

Treatment :Antibiotics , Myringotomy (drains pus, rarely done) with pressure equalization tube.(as the TM is covered by skin the tube will fall by itself with time with the skin superficial layer)

Complications of Otitis Media with Effusion

- hearing loss, speech delay, learning problems in young children
- chronic mastoiditis
- ossicular erosion
- cholesteatoma especially when retraction pockets involve pars flaccida
- retraction of tympanic membrane, atelectasis, ossicular fixation



Chronic otitis media

- Chronic Otitis Media is an infection involving a part of the middle ear cleft or all its components that is 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 (perforate)
- To have a discharge coming through the external canal the membrane has to be perforated.

Classification of chronic otitis media

A-CHRONIC **NONSUPPURATIVE** OTITIS MEDIA (no pus coming through external canal)

B-CHRONIC **SUPPURATIVE** OTITIS MEDIA(CSOM) (pus + perforation of drum)

<p><u>Otitis media with effusion (OME)</u></p> <p>Example : child has URTI → viral→ spread to middle ear through eustachian tube lead to inflammation which release fluid , 90 % will recover within 3 months and some will not as a result of damage to the mucosa (irreversible) or obstruction of eustachian tube→ collection of fluid in the middle ear → hearing loss .</p> <p>-If not treated properly or not cured by itself it could lead to adhesion in the tympanic membrane in middle ear (adhesive otitis media).</p> <ul style="list-style-type: none"> ● <u>Adhesive otitis media</u> Middle ear is like a box if the tympanic membrane adherence to the promontory of middle ear leading to inability to elevate it from the promontory .It could be complete or partial. 	<ul style="list-style-type: none"> ● <u>Tubo-tympanic (TT) (safe)</u> <ul style="list-style-type: none"> ○ No risk of serious complications ○ The perforation at the middle (central) of tympanic membrane . ● <u>Attico-antral (AA) (unsafe)</u> <ul style="list-style-type: none"> ○ high risk of developing complications.
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A-CHRONIC NONSUPPURATIVE OTITIS MEDIA:

<p>1 - <u>Otitis media with effusion =secretory OM = Glue ear =Catarrhal otitis media.</u></p>			
<p>Middle ear filled with serous or mucoid fluid , No purulence , Often present after otitis media is treated with antibiotics, Most will clear within 3 months . Previously thought sterile , 30-50% grow in culture , Over 75 % PCR+ , Usual organisms .</p>			
<p>Etiology :</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <p><u>BACTERIA</u></p> <ul style="list-style-type: none"> ● Strep pneumonia. ● Moraxella cat. ● Haemophilus influ. </td> <td style="width: 50%; vertical-align: top;"> <p><u>VIRUS</u></p> <ul style="list-style-type: none"> ● RSV ● Rhinovirus ● Parainfluenza virus ● Influenza virus </td> </tr> </table>		<p><u>BACTERIA</u></p> <ul style="list-style-type: none"> ● Strep pneumonia. ● Moraxella cat. ● Haemophilus influ. 	<p><u>VIRUS</u></p> <ul style="list-style-type: none"> ● RSV ● Rhinovirus ● Parainfluenza virus ● Influenza virus
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<p><u>Management of otitis media with effusion:</u></p> <p>Observation – many European countries wait 6-9 months prior to placement of ear tubes.</p> <p>Antibiotics: Meta-analysis shows beneficial short-term resolution of OME.</p> <ul style="list-style-type: none"> ● Audiogram at 3 months with persistent effusion to determine impact on hearing <p><u>Surgical treatment: Tympanostomy Tubes.</u></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 			

2- Adhesive otitis media

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 only symptoms
- TM shows various structural changes
- **Lack of middle ear ventilation results in negative pressure within the tympanic cavity.**
- **The ear drum retracts medially onto structures within the middle ear.(manly ossicles).**
- **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 Incudostapedial joint (IS) joint**

Can sometimes be treated with tympanostomy tubes .

Middle ear Atelectasis (TM retraction):

- 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

Treatment:

Observation every 6 months

Surgical treatment : Ventilation Tube is the treatment of choice in children

Hearing aid will help a lot

B-CHRONIC SUPPURATIVE OTITIS MEDIA(CSOM) with and without cholesteatoma

ETIOLOGY:

- Environmental
- Genetic
- Previous OM
- Upper respiratory tract infection

3D of CSOM :

Duration > 3 months despite treatment
Discharge **mucopurulent** otorrhea
Deafness Perforation/Ossicular chain dysfunction

PATHOLOGY :



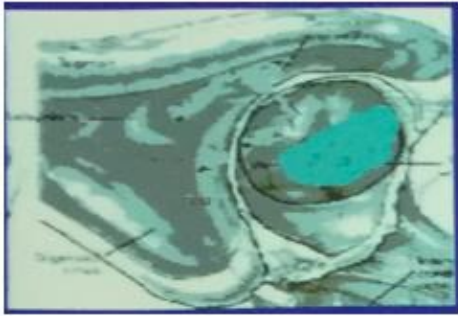
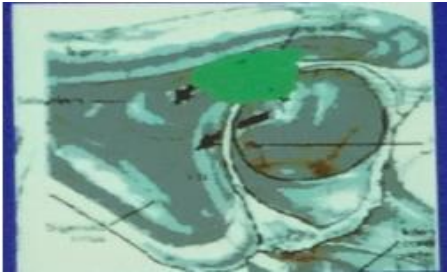
- Signs of supportive infection
 - Discharge (**Otorrhea**)& perforation (**permanent**)
 - Chronic inflammatory reaction in the mucosa and the bone (osteitis)
- Signs of healing attempts:
 - a. granulation tissue & polyps
 - b. Fibrosis & Tympanosclerosis

Symptoms of CSOM:

- Otorrhea
 - Intermittent, profuse & odorless in TT type
 - Persistent, scanty & malodorous in AA type
- Deafness
- Tinnitus .

N.B. any other symptoms means complication

Clinical features of CSOM (Clinico-pathological types)

TUBO-TYMPANIC (SAFE)	ATTICO-ANTRAL (UNSAFE)
<ul style="list-style-type: none">• Simple perforation• Intermittent non offensive (odorless) non bloody ear profuse discharge• On examination (central perforation)	<ul style="list-style-type: none">• Chronic (persistent), scanty, offensive, and bloody ear discharge• On examination marginal perforation• You may see cholesteatoma
	
<p>Tubo-tympanic Safe: The squamous Epithelium will find its way out</p> 	<p>Attico-antral (Cholesteatoma) The Perforation is marginal, so it goes to the bone.</p> 

OTOSCOPIC EXAMINATION:

- DISCHARGE
 - Present in TT type if active but may be absent
 - Usually is present in AA type
- PERFORATION
 - Central in TT type
 - Marginal or attic in AA type with cholesteatoma
- Polyps (if you see a polype in the ear you should suspect cholesteatoma to confirm it do CT), granulation tissue, tympanosclerosis
- ✓ polyps means there's a chronic non-healing process is going and most likely there's cholestatoma

Treatment of Tubotympanic CSOM:

Conservative treatment:

(Until we move the patient from active to inactive)

- Treatment of any predisposing factors
- Keep the ear dry
- Ear toilet
- Antibiotics
- Removal of polyps and granulations

Tympanoplasty :

An operation performed to eradicate disease in the middle ear cavity and to reconstruct the hearing mechanism. If there's ossicles problem we do ossiculoplasty (We replace the missing ossicle with prosthesis)

Aims of tympanoplasty:

- To close the perforation
- To prevent reinfection
- To improve hearing
- **Myringoplasty:** An operation performed to repair the tympanic membrane.

Treatment of attico antral CSOM

Removal of cholesteatoma by mastoid operation

There is no conservative therapy for cholesteatoma

Surgical: **mastoidectomy** ± Tympanoplasty± ossicular reconstruction

Conc treatment AA CSOM:

- **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.

- **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 the ossicles remnants are retained.**

Aims of radical & modified radical mastoidectomy:

- Safety
- Dry ear
- Preserve hearing

What is Cholesteatoma :

A cyst composed of keratinized desquamated epithelial cells occurring in the middle ear ,mastoid ,and temporal bone .

- Skin in the wrong place. The superficial layer of TM is squamous epithelium—usually there's shedding of the lining epithelium.

PATHOGENESIS :

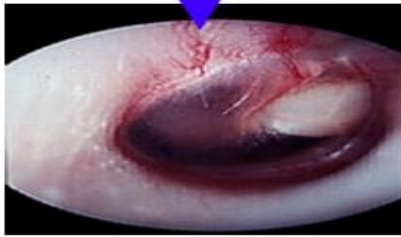
- Implantation
 - congenital : presents as a “small white pearl” behind an intact tympanic membrane (anterior and medial to the malleus) or as a conductive hearing loss

Table 8. Complications of Cholesteatoma

Local	Intracranial
Ossicular erosion: conductive hearing loss	Meningitis
Inner ear erosion: SNHL, dizziness, and/or labyrinthitis	Sigmoid sinus thrombosis
Temporal bone infection: mastoiditis, petrositis	Intracranial abscess (subdural, epidural, cerebellar)
Facial paralysis	

- acquired (Primary & Secondary)
- Metaplasia
- Epithelial migration

Congenital (with intact TM)



Acquired (as a result of infection)



Effect of cholesteatoma :

- Keratin encourages
- persistence of the infection
- Matrix causes bone erosion

INVESTIGATION :

- Audiometry
- Bacteriology (swab)
- Imaging : We do CT scan to see its extension

The complication of acute and chronic otitis media

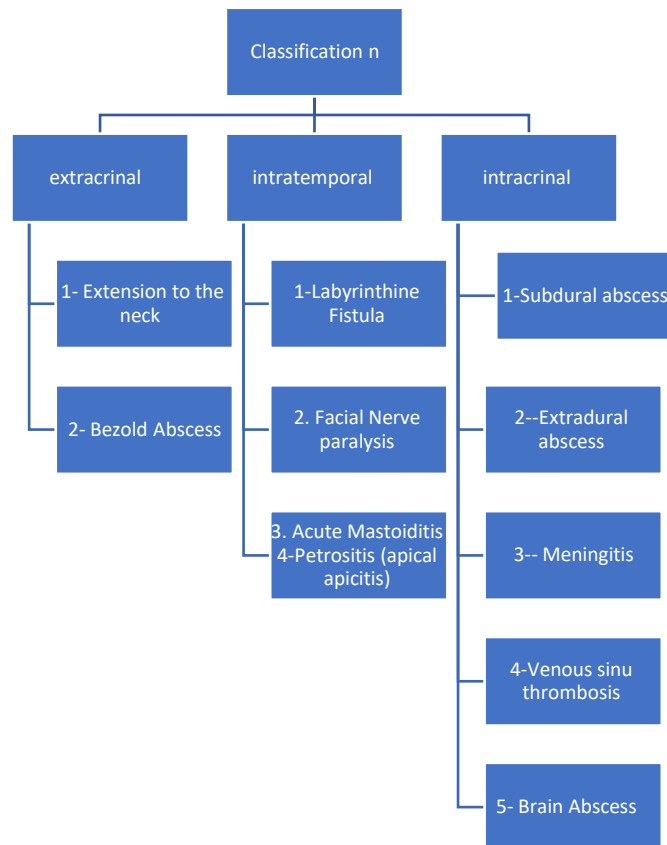
Predisposing factors:

Most of the times otitis media is cured without any complications

- Virulent organisms
- Chronicity of disease
- Presence of Cholesteatoma and bone erosion. (cholesteatoma: the presence of skin “white keratin material” in abnormal location that will secrete enzymes and eat up the bone, causing a pathway for disease to spread. 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 (patient’s immune status)

Pathways of infection:

- Extension of infection is by bone erosion due to a cholesteatoma.
- Vascular extension (retrograde thrombophlebitis)
- Congenital dehiscence
- Fracture lines
- Round or oval window membrane to the labyrinth Dehiscence due to previous surgery



Intracranial complication

1-Extradural abscess

(Collection of pus against the dura in the middle or posterior cranial fossa)

Outside the dura of the lateral venous sinus is called perisinus abscess.

- ★ What are the natural barriers between brain and temporal bone?
Bone and meninges

Clinical picture :

- 1.Persistent headache on the site of OM.
- 2.**Pulsating** discharge.
- 3.Fever
- 4-Asymptomatic (discovered during surgery)

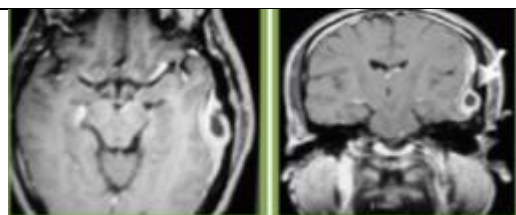
Diagnosis:

CT scans reveal the abscess as well as the middle ear pathology.

Treatment:

- 1- Mastoidectomy.
 - 2- Drainage of the abscess
- +IV ABx to prevent

Axial and coronal MRI showing extradural abscess



2-Subdural abscess

(Collection of pus between the dura and the arachnoid. It's a rare pathology)

Clinical picture:

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

Investigation: CT scan & MRI

Treatment:

- 1– Drainage (neurosurgeons)
- 2– Systemic antibiotics
- 3 – Mastoidectomy.

The subdural abscess is within the dura (a white thin line). It's a landmark to distinguish between extra and subdural abscess

lumbar puncture should not be done as it can cause hernation 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



Meningitis:

(Inflammation of meninges (pia & arachinoid)

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

Meningitis is the most common intracranial complication of Otitis Media

Clinical picture:

General symptoms and signs: High fever, restlessness, irritability, photophobia and delirium.

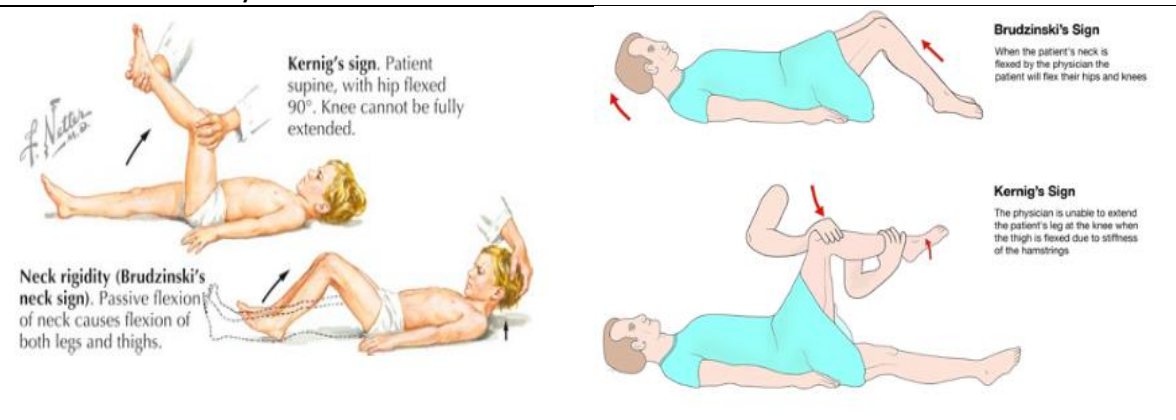
Signs of meningeal irritation: **Kernig's and Brudzinski's sign**

Diagnosis: Lumbar puncture.

Treatment:

Aims: Treatment of the complication itself and control of ear infection:

- Specific antibiotics.
- Antipyretics and supportive measures
- Mastoidectomy to control the ear infection

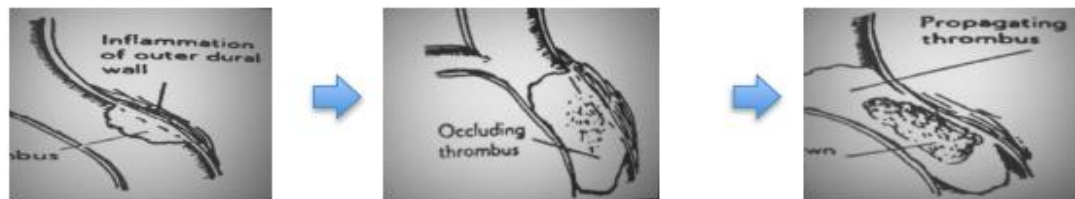


4: Venous Sinus Thrombosis:

(Thrombophlebitis of the venous sinus)

Etiology→ It usually develops secondary to direct extension.

- ★ First irritation of the wall then progress to thrombus then either it will regress or causes symptoms of obstruction (increase ICP, central nerve palsy).



Clinical picture:

-Signs of blood invasion: (spiking) fever with rigors, chills and persistent fever (septicemia).

- Positive Greissinger's sign which is edema and tenderness over the area of the mastoid emissary Vein. (Pressing on the mastoid process will cause tenderness and edema because of small vessel blockage)

- Headache, vomiting, and papilledema (increase intracranial pressure) The 6th cranial nerve might be affected because it is the longest cranial nerve passing through the cavernous sinus.

Diagnosis:

- Clinical
- CT scan with contrast
- MRI, MRA, MRV
- Angiography, venography
- Blood cultures is positive during the febrile phase. Start clinical, blood culture then imaging.

Treatment

– Medical:

- Antibiotics and supportive treatment.
- Anticoagulants

– Surgical:

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

5-Brain abscess:

(Localized suppuration in the brain substance.)

- It is 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).

Clinical manifestations:

general manifestations:

fever, lethargy, headache sever generalization worse in the morning

manifestations of raised ICP (headache , nausea & vomiting)

the latter ususally projectile seen more often in cerebellar lesions.

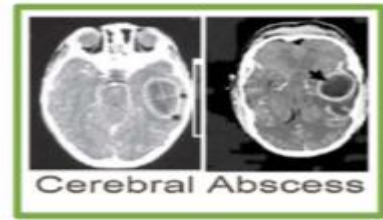
focal manifestations

temporal: Aphasia , hemianopia , paralysis

Cerebellar: ataxia, vertigo , nystagmus , muscle incoordination

Diagnosis:

CT scans / MRI.



Treatment:

Medical:

- Systemic antibiotics.
- Measure to decrease intracranial pressure.

Surgical:

- Neurosurgical drainage of the abscess .
- mastoidectomy operation after
- subsidence of the acute stage

Intratemporal complication

1- Labyrinthitis : if the infection spread from the middle ear to the inner ear and would present with vertigo and sensory neuron loss.

2- Ossicular fixation or erosions

3- Labyrinthine fistula

4- Facial nerve paralysis

6 -Mastoiditis /mastoid abscess

6 -Petrositis (apical apicitis)

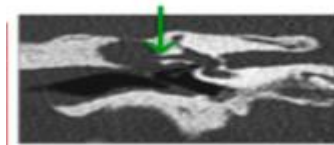
What are the vascular structures that pass through temporal bone? Carotid and internal jugular (vein more common than artery) may get affected from thrombophlebitis (inflammation of the lining wall of the vessels)

1- Labyrinthine fistula (most common)

Definition: Communication between middle and inner ear.

Etiology: It is caused by erosion of bony labyrinth due to cholesteatoma (iatrogenic caused by surgeries)

Most common in the: **lateral semicircular canal**



Clinical picture:

- Hearing loss (may show a sensorineural hearing loss)
- Attack of vertigo mostly during straining, sneezing and lifting heavy object. (Pressure induced maneuver)
- **Positive fistula test.** Pressing on the tragus will cause pressure on the inner ear, the pressure difference will cause imbalance and nystagmus (positive in 70%)

Diagnosis:

- High index of suspicion

- Longstanding disease
- Fistula test (clinical)
- CT scan of temporal bone

Treatment: Mastoidectomy

2. Facial nerve paralysis:

- Congenital or acquired (inflammation and 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:

- Clinical
- May occur in acute or chronic otitis media
- Ct scan



How to differentiate between upper and lower Facial nerve palsy?

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 (mastoidecomy ± facial nerve decompression)

3- Mastoiditis:

(Dr. Fatma said it was the most common) + this complication is seen more in children + may give an appearance of a **unilateral bat ear**.

Definition: It is the inflammation of mucosal lining of antrum and mastoid air cells system.

infection (usually subperiosteal) of mastoid air cells, most commonly seen approximately two weeks after onset of untreated or inadequately treated acute suppurative otitis media

Pathology:

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

There will be + **Reservoir Sign** in acute mastoiditis

Symptoms:

- Earache
- Fever

Signs:

- Mastoid tenderness
- Sagging of posterosuperior meatal wall

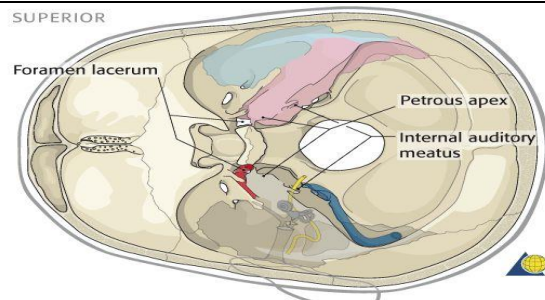
<ul style="list-style-type: none"> • Ear discharge 	<ul style="list-style-type: none"> • TM perforation • Swelling over mastoid • Hearing loss
<p>Diagnosis: (clinical + imaging)</p> <p><u>Investigation:</u></p> <ul style="list-style-type: none"> • CT scan temporal bones • Ear swab for culture and sensitivity 	
<p>Treatment:</p> <p><u>Medical treatment:</u></p> <ul style="list-style-type: none"> • Hospitalize (Admission) • IV Antibiotics • Analgesics <p><u>Surgical treatment:</u></p> <ul style="list-style-type: none"> • Myringotomy (surgical incision into the eardrum). • Cortical mastoidectomy 	

4-Petrositis (apical apicitis):

An extension of infection from the middle ear into a pneumatized petrous apex
It's an important complication, but it is rarely seen in a non-pneumatized apex.

Petrous temporal bone :

- Strongest bone in the skull.
- Bone harboring the middle ear.
- Petrous apex is the most anterior part of the petrous



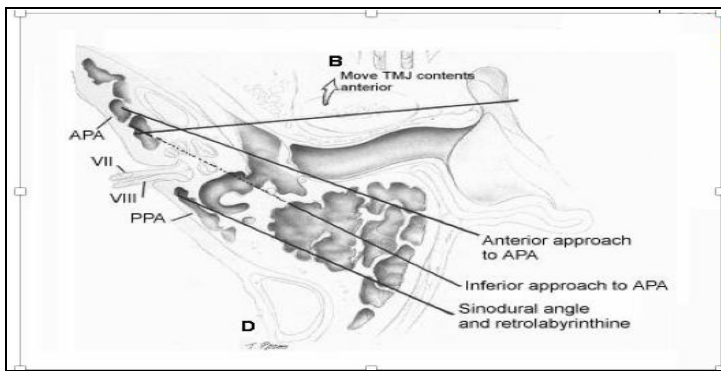
Next to it lies the ganglion of CN5 and the abducent nerve (CN6)

DIAGNOSIS OF PETROSITIS

- **Gradenigo's syndrome**
 - Retro-orbital pain, due to trigeminal nerve involvement.
 - Lateral rectus palsy (squint), due to Abducens nerve palsy.
 - Discharge. Otitis media (persistent otorrhea).
- ✓ **Gradinigo Syndrome** is a **Triad of:**
 - **trigeminal neuralgia (CN5),**
 - **diplopia OR retroorbital pain OR squint (CN6),**
 - **increased ear discharge.**
- Imaging

Treatment of petrositis

- Broad spectrum antibiotics which covers staphelococcus areasus.
- Myringotomy if tympanic membrane was not perforated, t evacuate all the discharge.



- Surgical drainage if antibiotics failed, mastoidectomy must be done to remove the infection from the ME and petrous temporal bone.

Other complications

Labyrinthitis is another important complication. It's seen more with CSOM with cholesteatoma. It involves ALL the inner ear. We treat it with IV Antibiotics and antiemetics. Complications include: permanent imbalance, SNHL, chronic labyrinthitis.

Extracranial complication

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