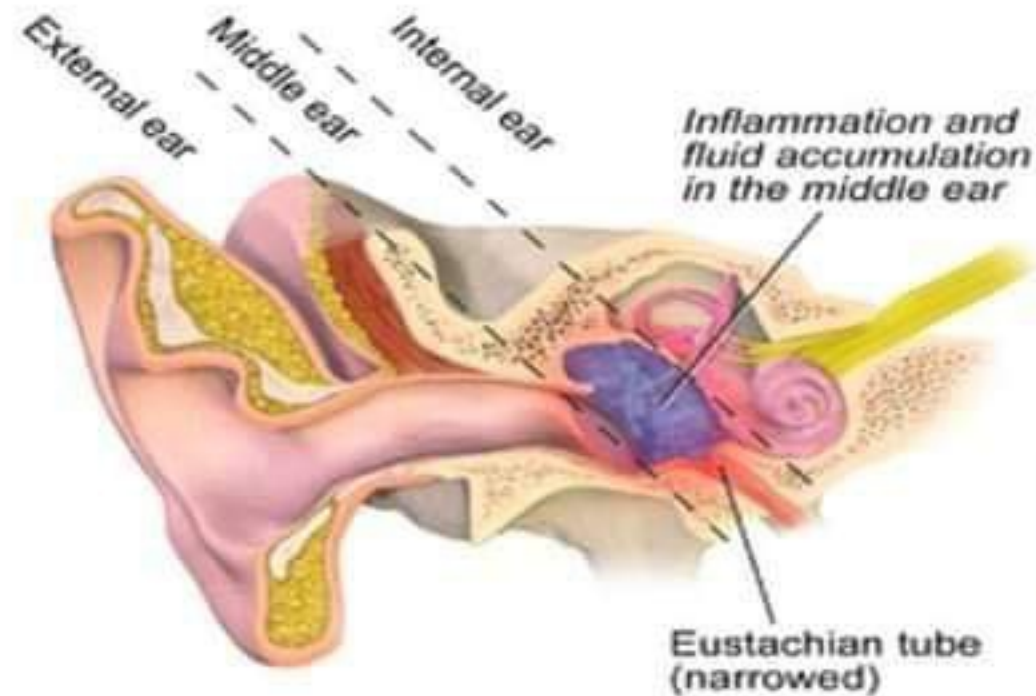


ACUTE OTITIS MEDIA

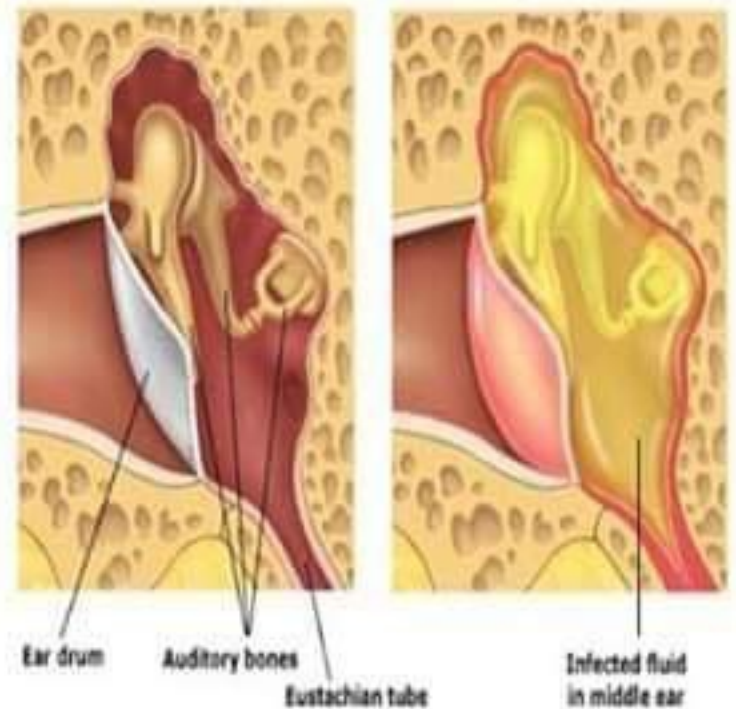
@MD,Sun Bu

Otitis Media



Normal middle ear

Otitis media



Objectives

1. To Review important middle ear anatomy and physiology.
2. To get an idea about the differences in Eustachian Tube between adults and pediatrics, and how that can affect the pathogenesis of otitis media.
3. To define the otitis media and its different subtypes.

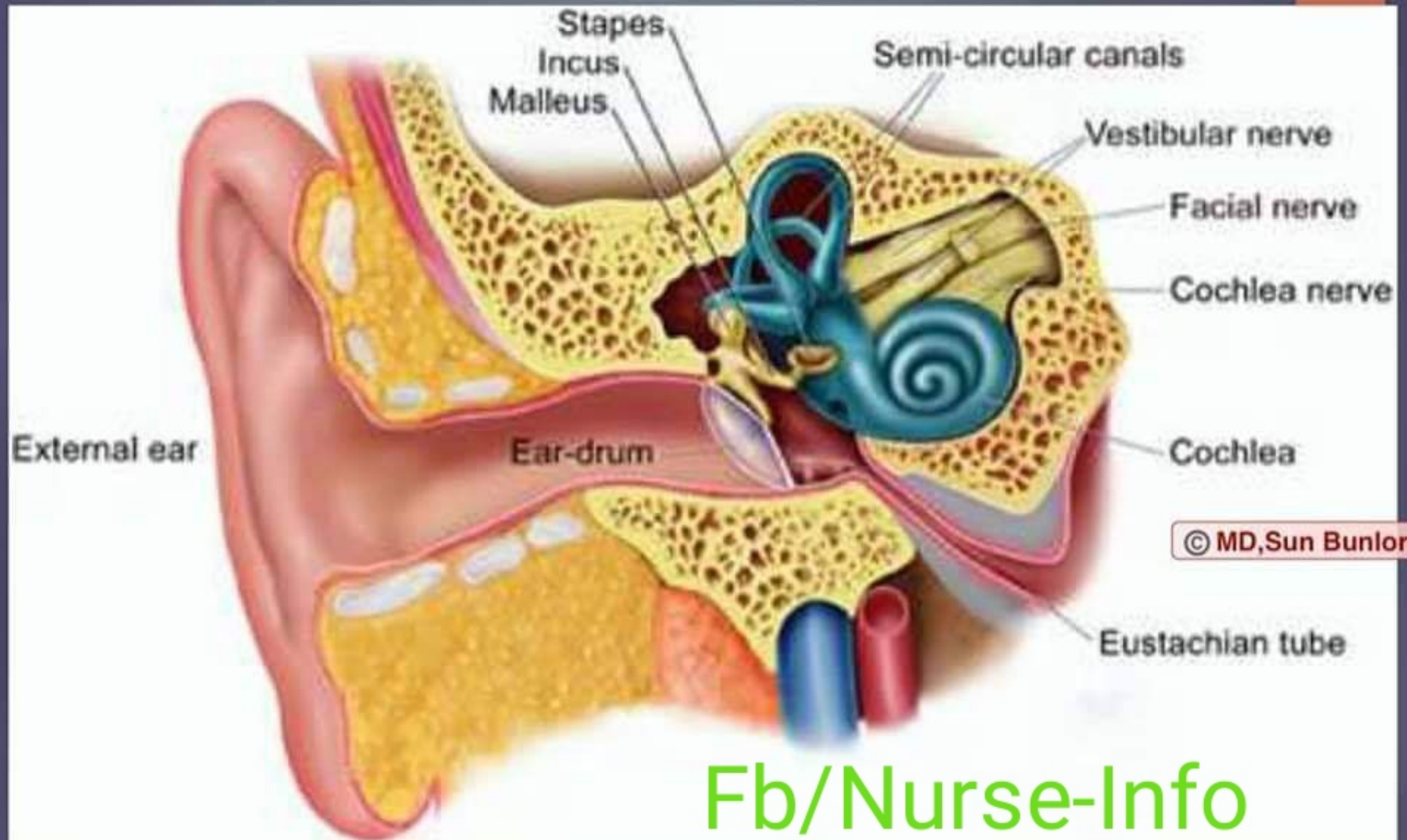
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Anatomy

The middle ear includes:

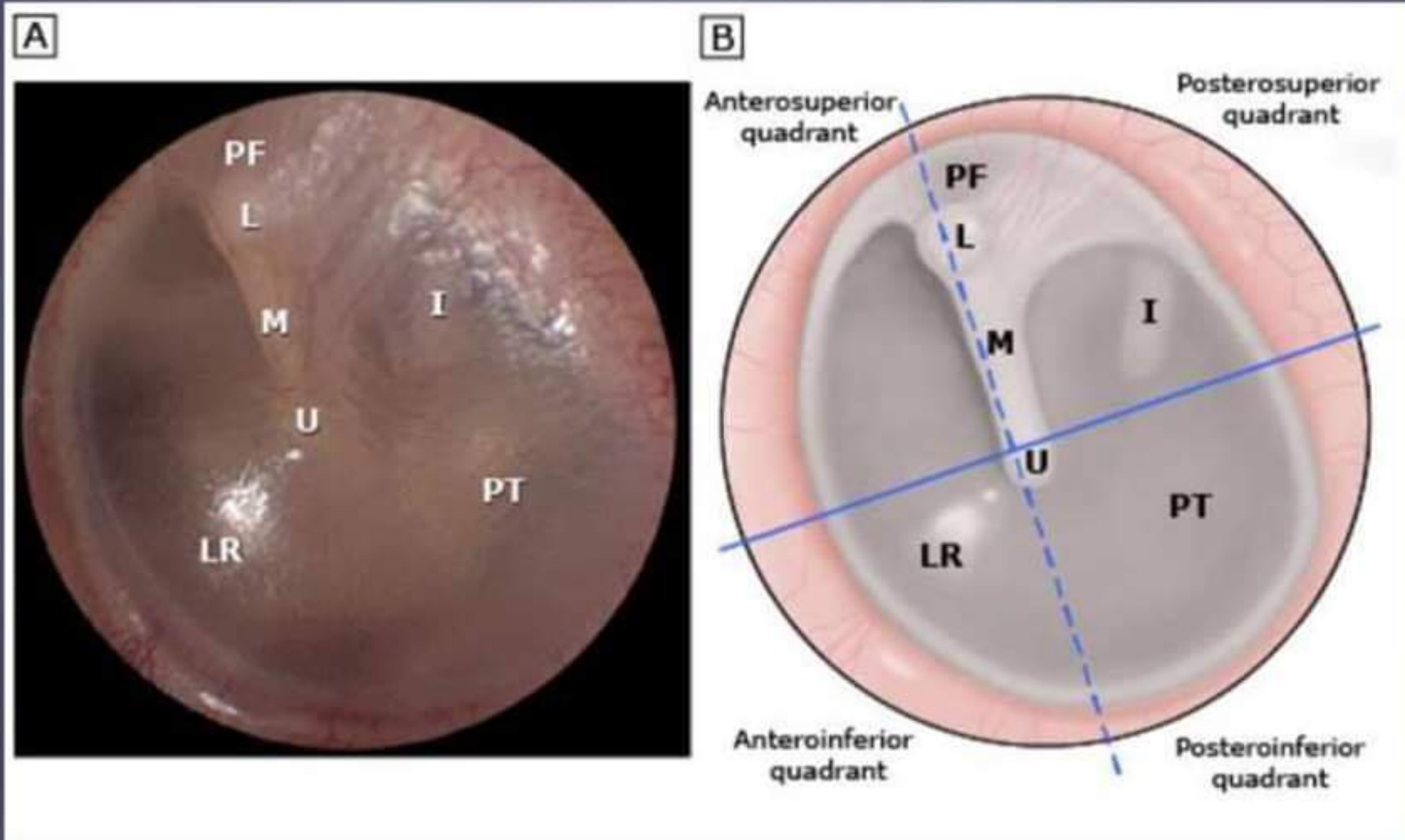
1. Tympanic membrane
2. the tympanic cavity
3. Ossicles

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Tympanic membrane

- ▶ Oval & thin, semi-transparent, divided into 2 parts: the pars flaccida & the pars tensa.
- ▶ The manubrium of the malleus is firmly attached to the medial tympanic membrane; where a concavity is formed. The apex of this concavity is called the umbo.
- ▶ The sensory nerve supply to the tympanic membrane includes the following:
 1. **Auriculotemporal nerve** (mandibular branch of trigeminal nerve)
 2. **Auricular branch** of vagus nerve.
 3. **Tympanic branch** of glossopharyngeal nerve (Jacobson nerve)



- Otoscopic image (panel A) and schematic diagram (panel B) of a left tympanic membrane. A line drawn along the manubrium of the malleus divides the tympanic membrane into anterior and posterior halves (dashed line). A line drawn through the umbo (perpendicular to the first line) divides the tympanic membrane into superior and inferior halves (solid line).

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Anatomy

Tympanic cavity

Divided In To 3 Parts:

1. Epitympanum (Attic)
2. Mesotympanum
3. Hypotympanum

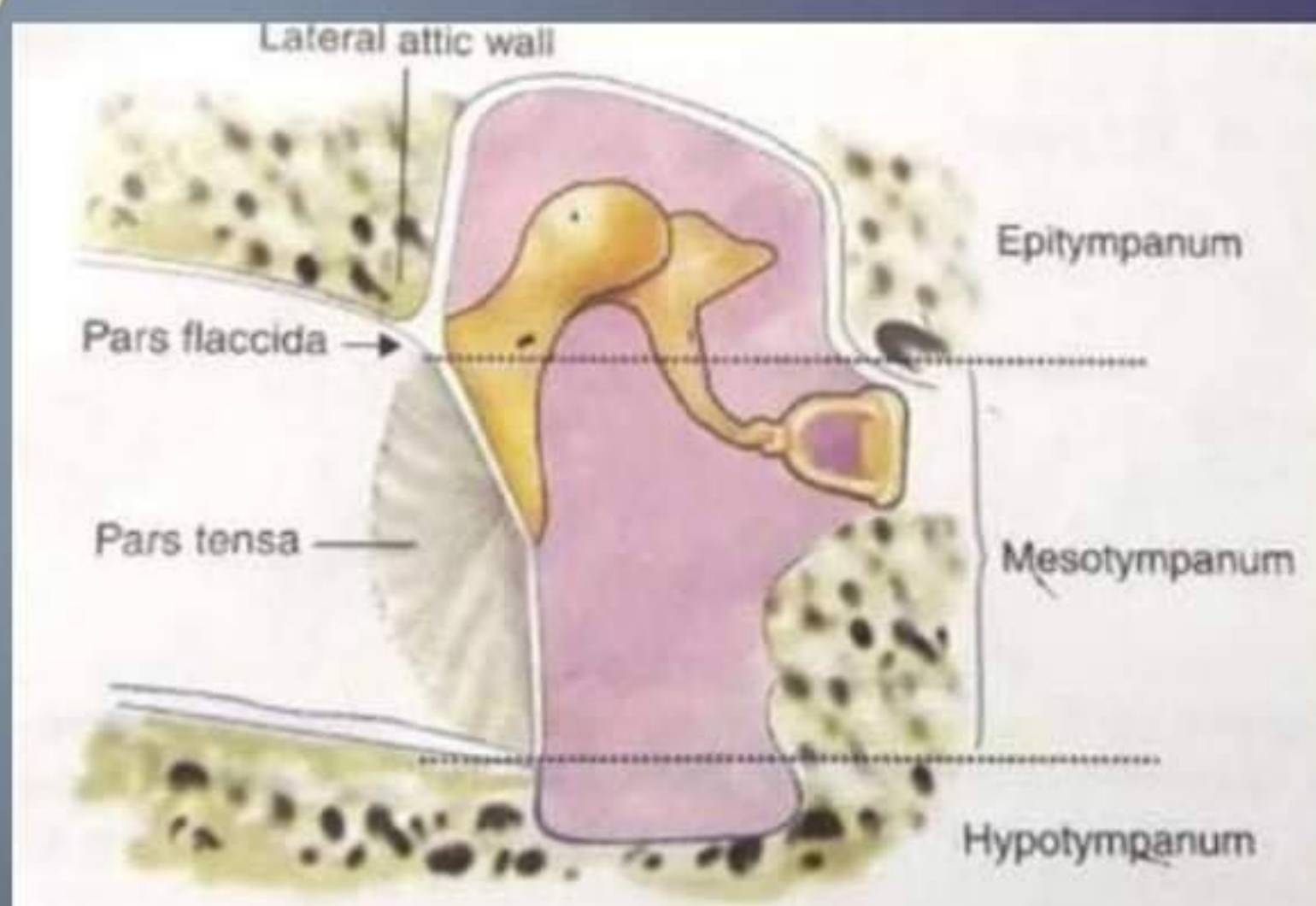


Figure 1.8 Divisions of middle ear into epi-, meso- and hypotympanum.

- ▶ Multiple structures are contained within the confines of the tympanic cavity
- ▶ The cavity is covered in mucoperiosteum.
- ▶ The middle ear inhabits the petrous portion of the temporal bone and is filled with air secondary to communication with the nasopharynx via the auditory (eustachian) tube

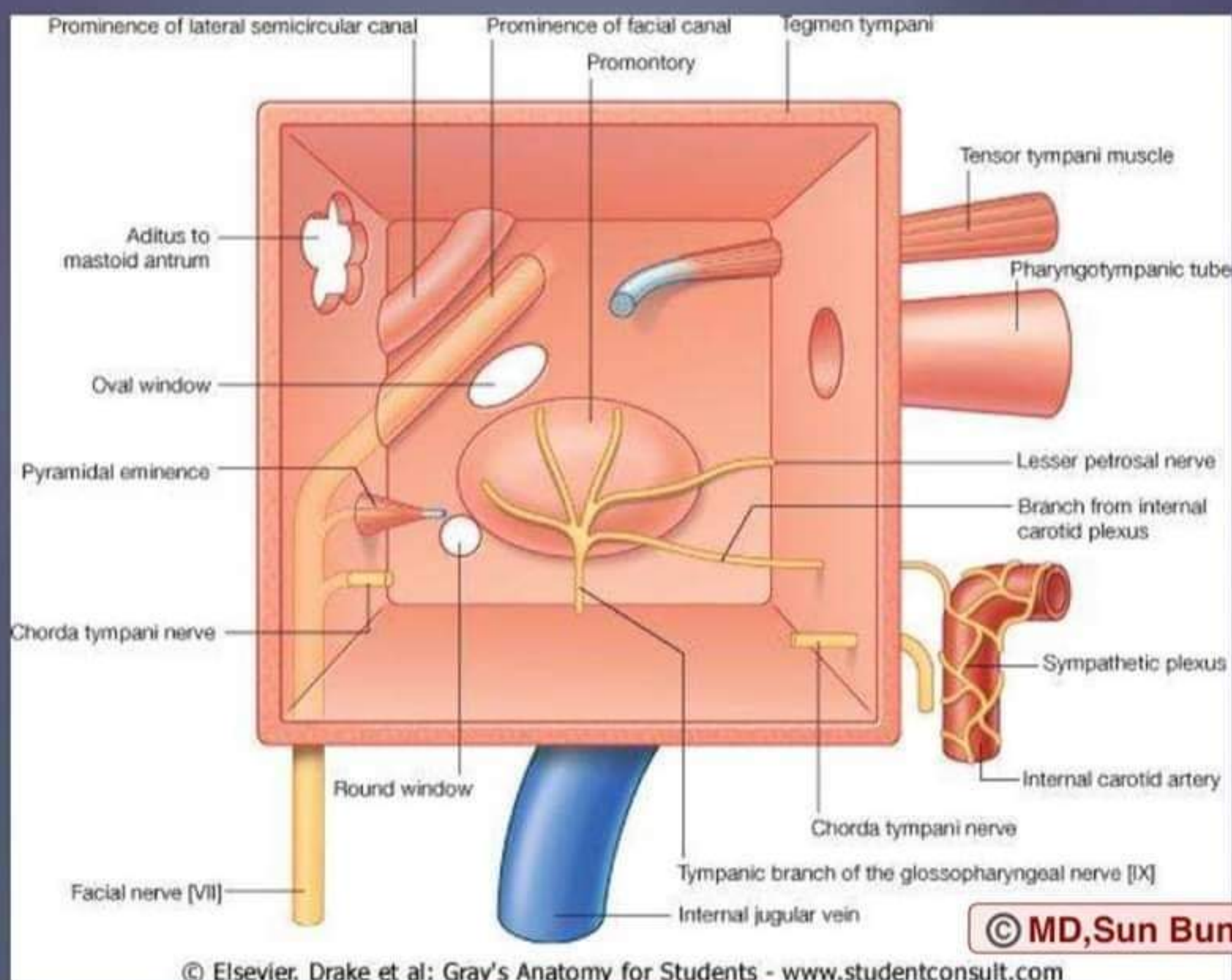
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Anatomy

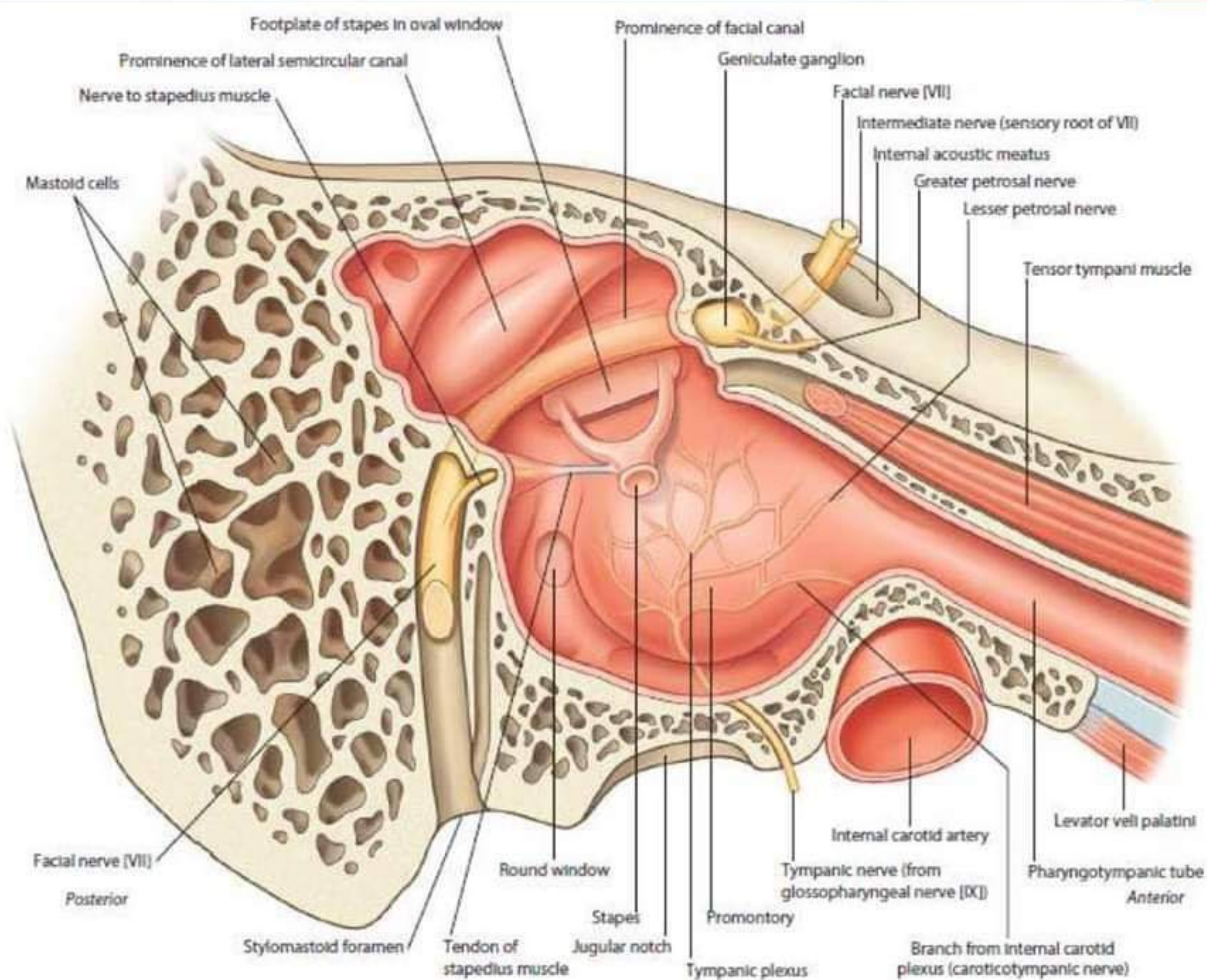
Tympanic cavity

Walls of Tympanic cavity:

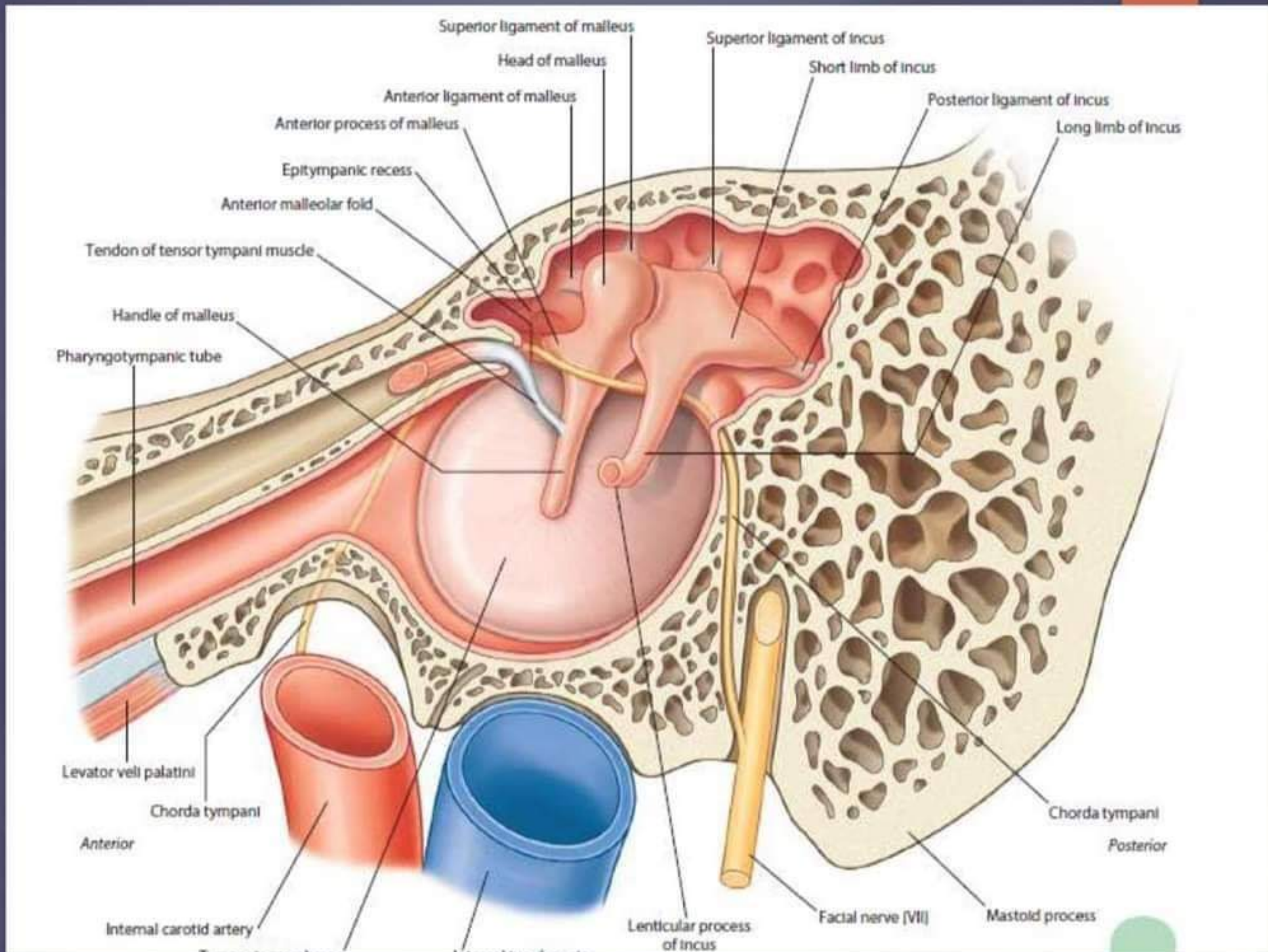
- ▶ **The lateral wall** contains the tympanic membrane, lesser extended by bony outer attic wall (SCUTUM)
- ▶ **The posterior wall** contains the mastoid antrum and communicates with the mastoid air cells
- ▶ **The medial wall** contains promontory, the oval window & the round window; this wall is also called the labyrinthine wall
- ▶ **The anterior wall** is also termed the carotid wall, because a thin plate of bone separates the carotid canal and tympanic cavity and also houses the auditory tube
- ▶ **The roof** of the tympanic cavity is the tegmental wall
- ▶ **The floor** of the middle ear is the jugular wall; it separates the tympanic cavity from the internal jugular vein



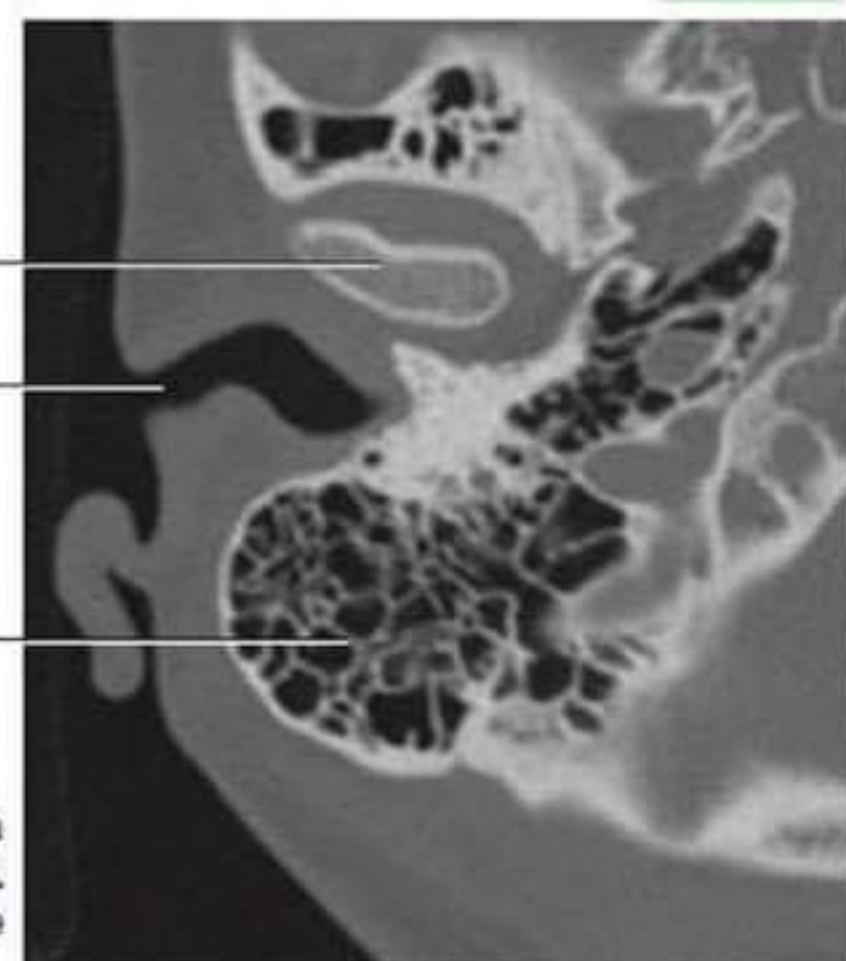
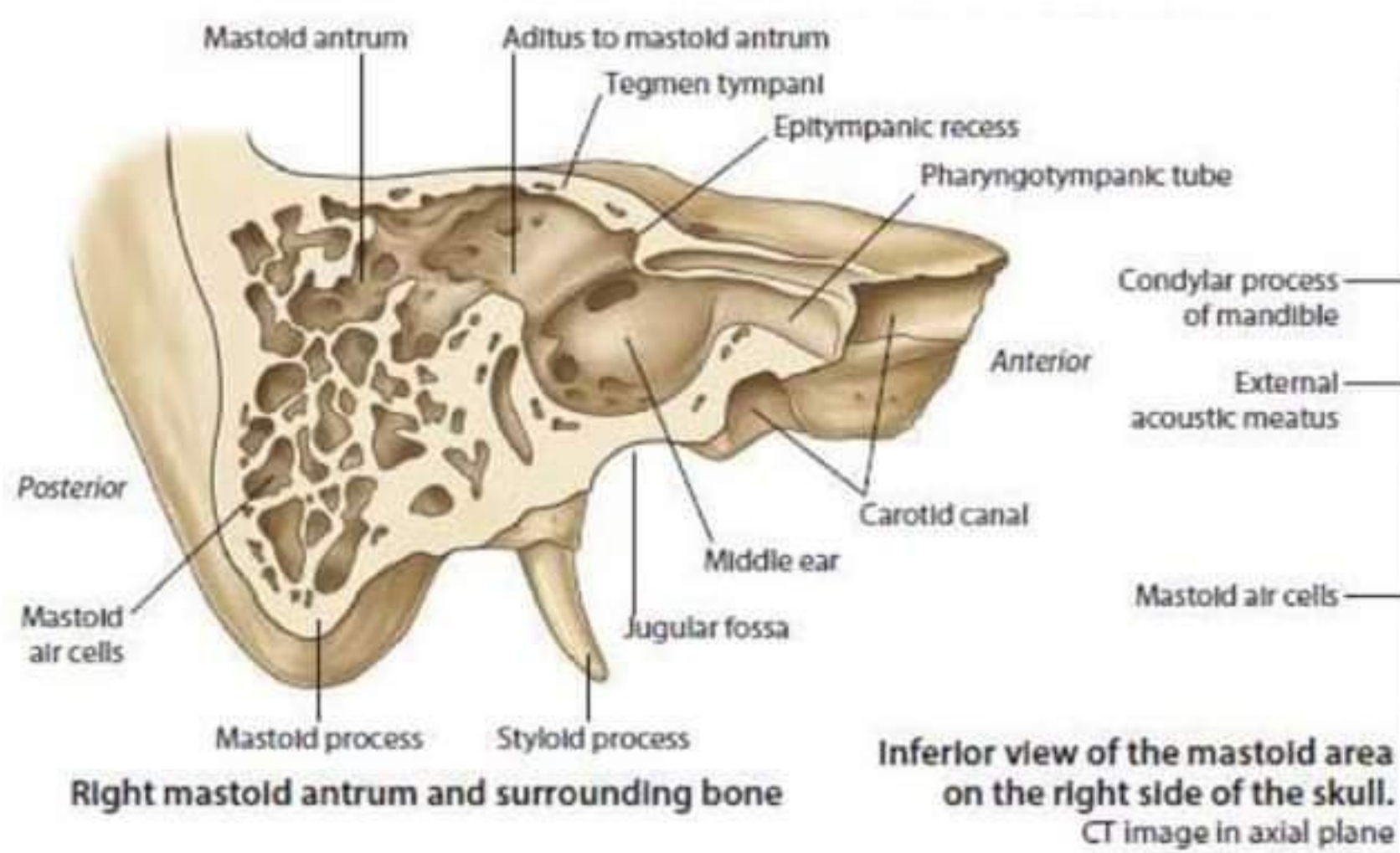
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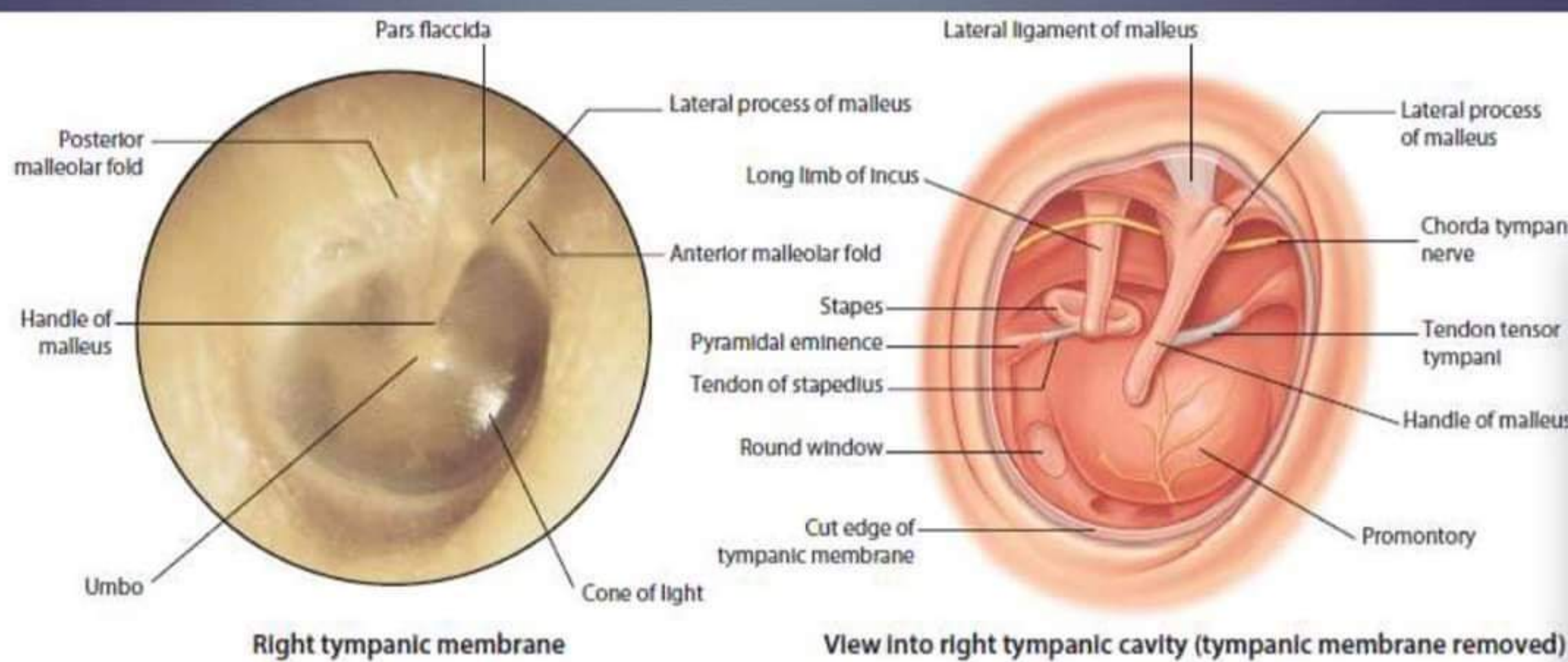


Right medial wall of the middle ear

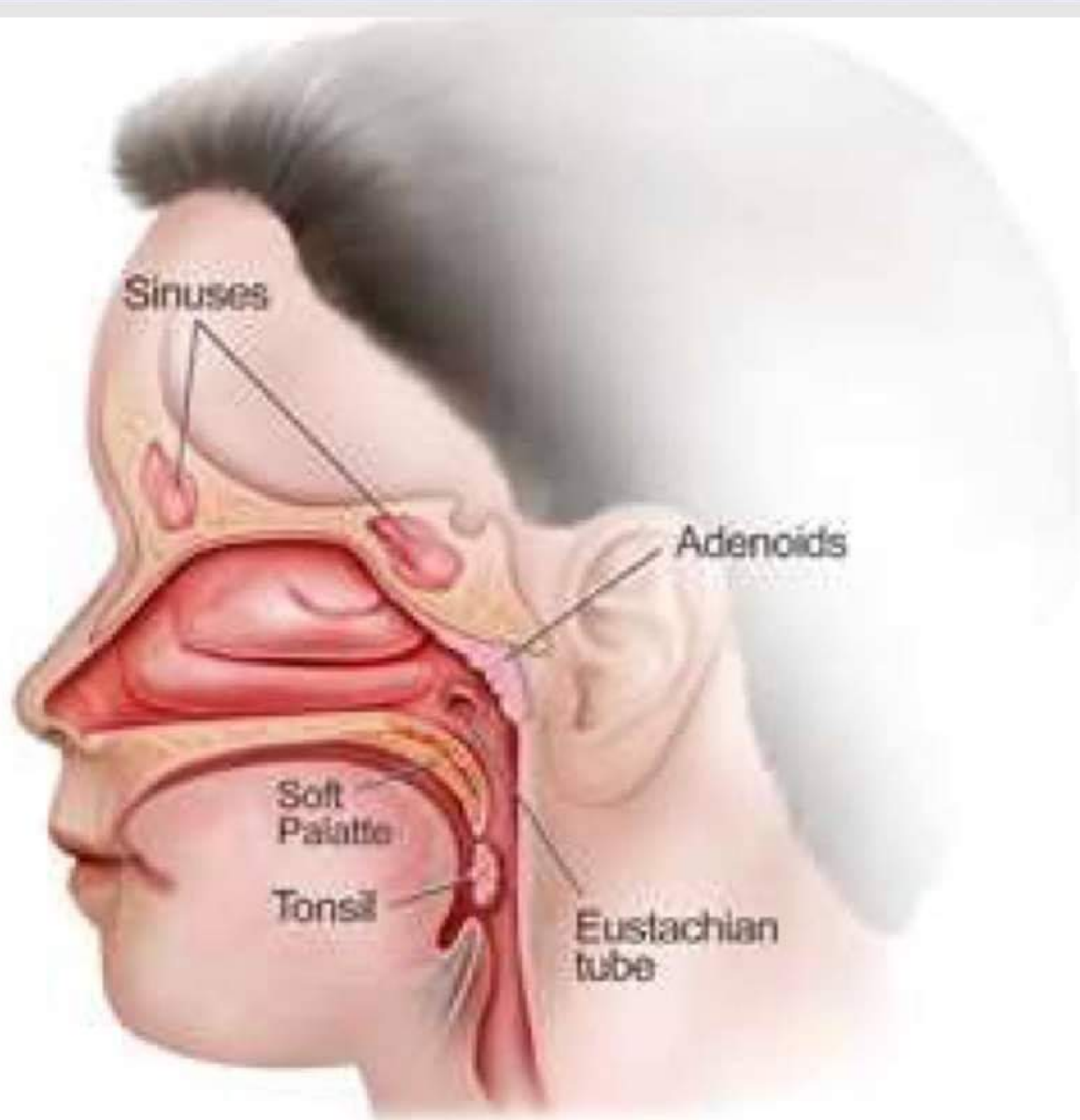


Right lateral wall of the middle ear





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Anatomy

Eustachian tube

- ▶ Eustachian tube is the communication between the middle ear and the nasopharynx.
- ▶ Lumen shaped like two cones with apex directed toward middle
- ▶ Mucosa has mucous producing cells and ciliated cells
- ▶ Usually closed
- ▶ Opens during swallowing, yawning, and sneezing
- ▶ Lumen opens when attachment of tensor veli palatini muscle pulls wall of tube laterally during swallow.
- ▶ Auditory tube close by elastic recoil of cartilage, tissue turgidity and tension of salpingopharyngeus muscle.

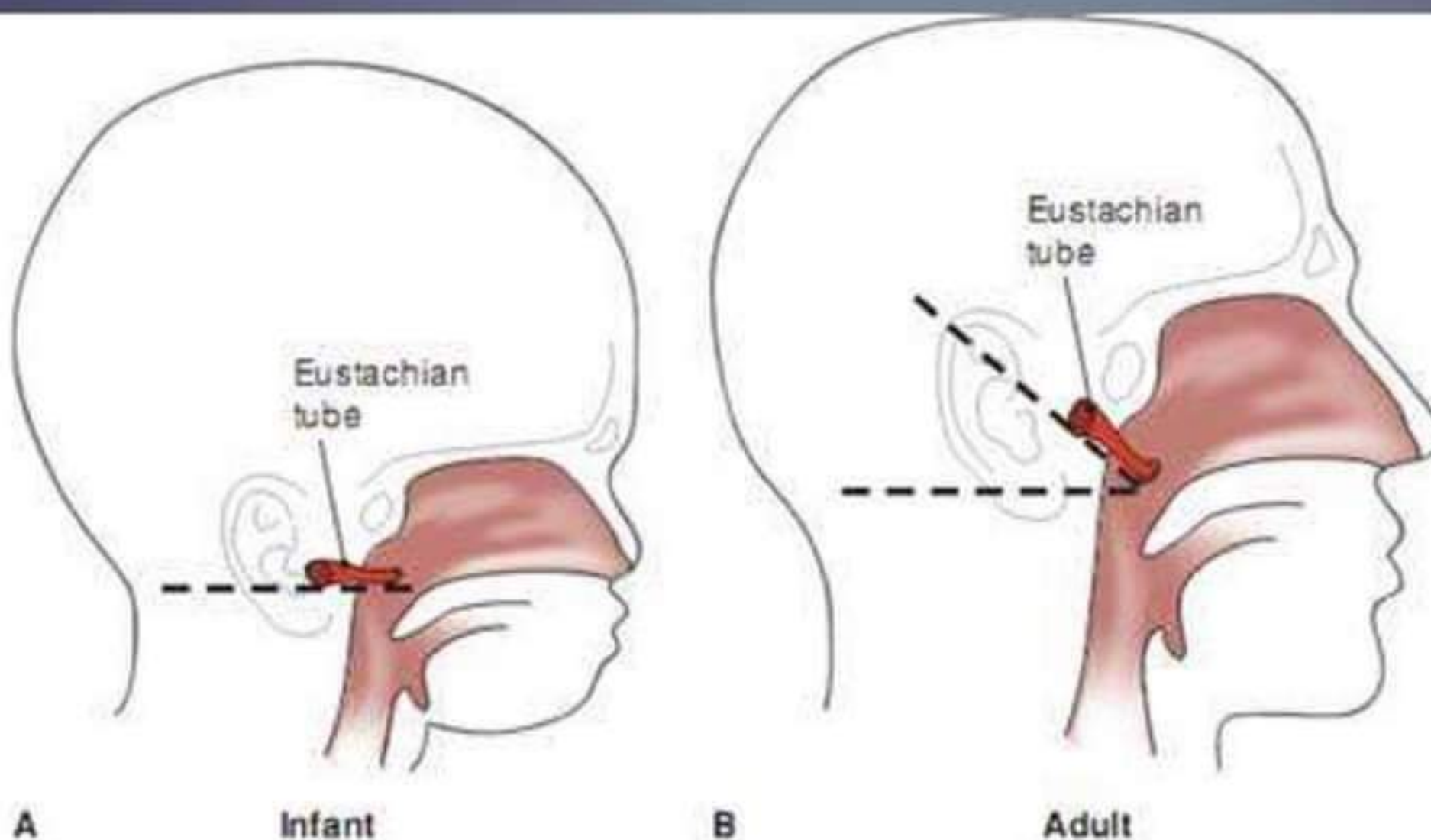
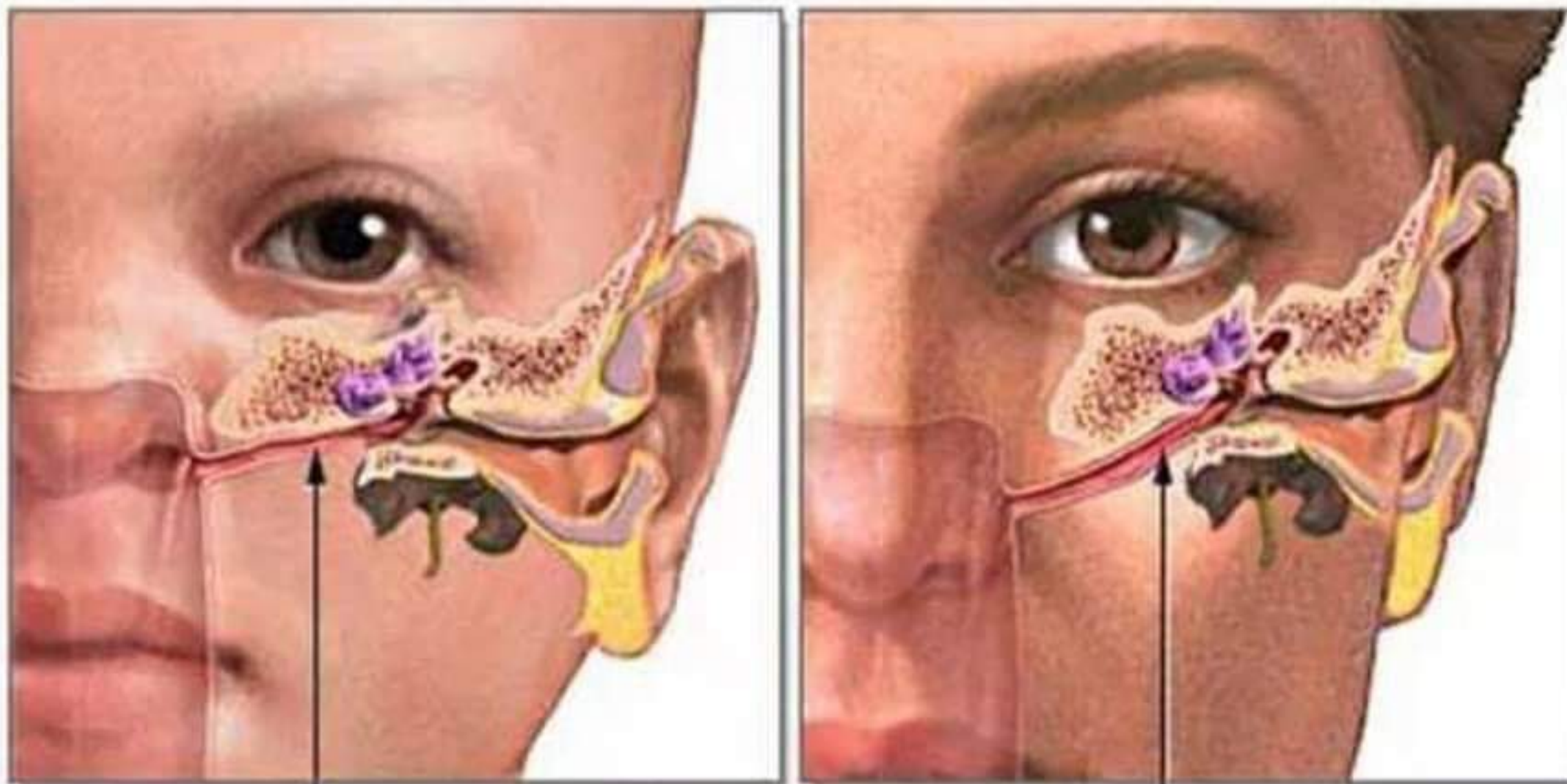


FIGURE 12.17. A. Infant ear canal.
B. Adult ear canal.

Infant

Adult



Eustachian tube

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Anatomy

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ET Differences in infants and adults

	INFANT	ADULT
LENGTH	13-18 mm at birth	36 mm
DIRECTION	More horizontal	Forms an angle of 45° with the horizontal
ANGULATION AT ISTHMUS	No angulation	Angulation present
BONY VERSUS CARTILAGINOUS PART	Bony part > 1/3 of the total length	Bony part 1/3; cartilaginous part 2/3
TUBAL CARTILAGE	flaccid	Comparatively rigid
DENSITY OF ELASTIN AT THE HINGE	Less dense	More dense
OSTMANN'S PAD OF FAT	Less in volume	Large & helps to keep the tube closed

Anatomy

The pharyngeal opening is:

- ▶ **Below** the level of the hard palate in the fetus.
- ▶ **Is level with the palate** at birth.
- ▶ **Is 3 to 4 mm.** above it at the fourth year.
- ▶ **Is 10 mm. Above** it as an adult
- ▶ Lumen of tube in child is more horizontal and wider

Functions :

- ▶ Protection from nasopharyngeal sound and secretions
- ▶ clearance of middle ear secretions
- ▶ ventilation (pressure regulation) of middle ear

Anatomy

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Eustachian tube

▶ Two Parts :

1. Bony part (12mm)
2. Cartilagenous part (24mm)

▶ Muscles attached:

1. Tensor veli tympani:

nerve supply from :mandibular
nerve separate tube from

- otic ganglion
- mandibular nerve
- chorda tympani
- middle meningeal artery

2. Salphingo pharyngeus:

3. Levator veli palati

Nerve supply for these muscles
=pharyngeal plexus

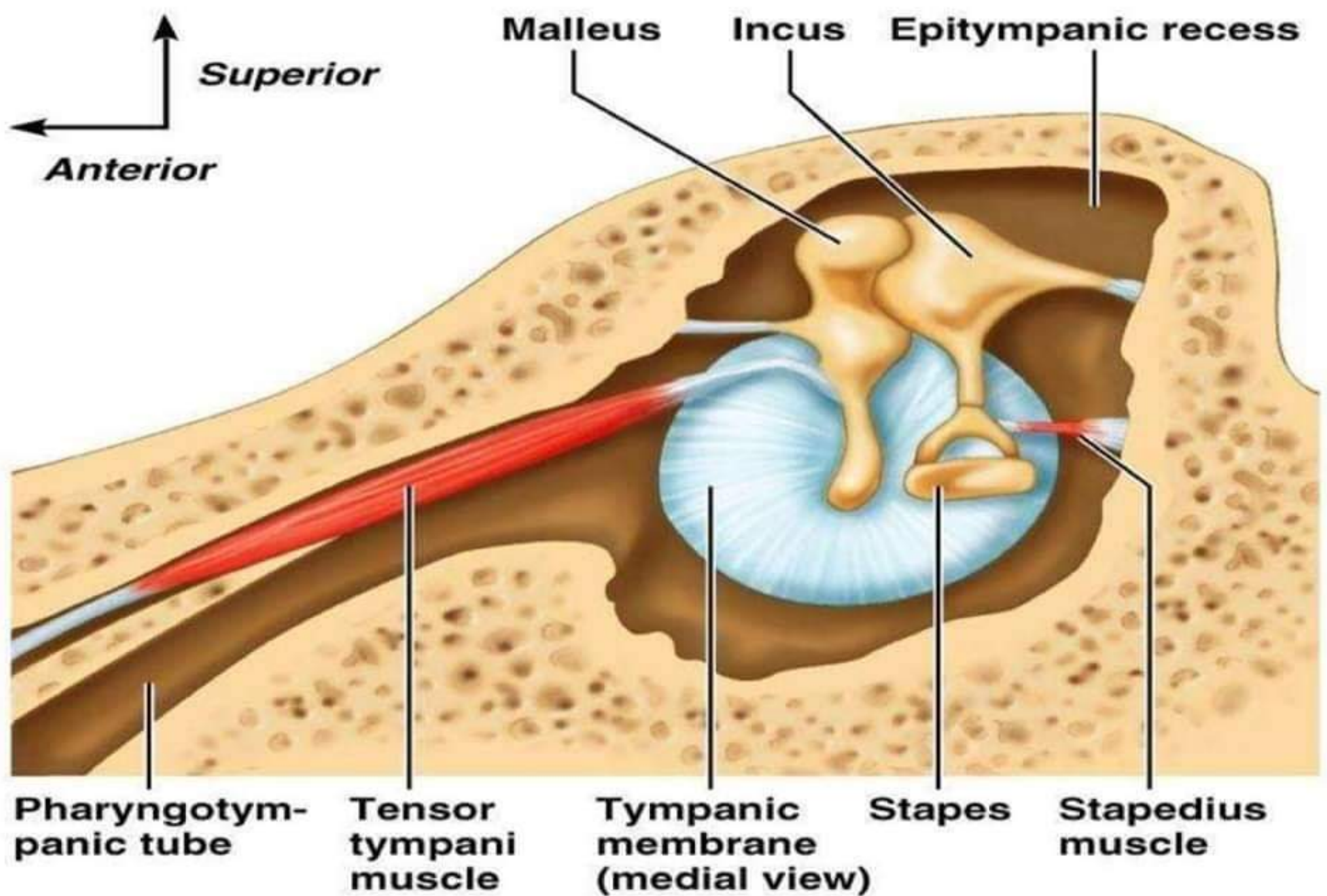
Nerve Supply

- ▶ Sensory & parasympathetic : tympanic branch of glossopharyngeal N
- ▶ Tensor veli palatini: V3
- ▶ Levator veli palatini pharyngeal plexus
- ▶ Salpingopharyngeus (cranial part of XI N via vagus)

Anatomy Muscles

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- ▶ **Stapedius muscle**, which connects the neck of the stapes to the posterior tympanum.
- ▶ Innervation is provided by the nerve to the **stapedius** from the facial nerve
- ▶ Contraction displaces the stapes posteriorly and functions to prevent loud noises from injuring the inner ear.
- ▶ The tendon of the **tensor tympani** attaches to the manubrium of the malleus
- ▶ Innervated by **the mandibular branch** of the trigeminal nerve
- ▶ contraction of the tensor tympani displaces the malleus medially



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Eustachian tube obstruction

- ▶ **Anatomic obstruction** is most commonly caused by inflammation of the eustachian tube mucosa or extrinsic compression by tumor or large adenoids.
- ▶ **Functional obstruction** usually occurs as a result of either the **failure of the normal muscular mechanism of eustachian tube opening**, as seen in cleft palate, or **insufficient stiffness of the cartilaginous portion of the eustachian tube**, often seen in infants and young children.
- ▶ The more acute angle of the eustachian tube seen in children, compared with adults, may also result in the impaired function of the eustachian tube opening.
- ▶ These abnormalities are often seen in patients with Down syndrome, which may account for the high rate of OM.
- ▶ Normal function of the eustachian tube is also dependent on ciliary function

Eustachian tube dysfunction

► Symptoms of tubal occlusion

- Otalgia
- Hearing loss
- Popping sensation
- Tinnitus
- Disturbances of equilibrium

► Signs of tubal occlusion

- Retracted TM
- Congestion along the handle of malleus and pars tensa
- Transudate behind TM

Eustachian tube dysfunction

Clinical causes of ET obstruction:

- Upper respiratory tract infection
- Allergy
- Sinusitis
- Nasal polyps
- Nasal septum deviation
- Hypertrophic adenoids
- Nasopharyngeal tumour/ mass
- Cleft palate
- Submucous cleft palate
- Down's syndrome

Eustachian tube dysfunction

Treatment :

- ▶ **Decongestant nasal sprays or drops**
- ▶ **Antihistamine.**
- ▶ **Steroid nasal spray**

Acute Otitis Media (AOM)

TERMINOLOGY

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- ▶ **Middle ear effusion (MEE)** —refers to fluid in the middle ear cavity. MEE occurs in both otitis media with effusion and AOM.
- ▶ **Acute otitis media (AOM)** —refers to acute infection of middle ear fluid.
- ▶ **Otitis media with effusion** — Otitis media with effusion (OME) refers to middle ear fluid that is not infected.
 - ▶ OME is also called serous, secretory, or nonsuppurative otitis media.
 - OME frequently precedes the development of AOM or follows its resolution.

Classification of AOM

Suppurative

Nonsuppurative

Recurrent

AOM

RISK FACTORS

- ▶ A number of risk factors for AOM have been established, **the most of important of which is age.**
- 1. **Age** – The age-specific attack rate for AOM peaks between 6 and 18 months of age
- 2. **Family history**
- 3. **Day care** – The transmission of bacterial and viral pathogens is common in day care centers.
- 4. **Lack of breastfeeding** – Lack of or limited breastfeeding is associated with an increased risk of AOM
- 5. **Tobacco smoke and air pollution**
- 6. **Low income countries** – Lack of access to medical care and local environmental factors lead to severe suppurative episodes of OM in children living in developing areas

Cont' Risk factors

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- ▶ **Other risk factors** – Other important risk factors in the development of single and recurrent episodes of AOM include [18]:
 - Social and economic conditions (poverty and household crowding increase the risk)
 - Season (increased incidence during the fall and winter months)
 - Altered host defenses and underlying disease (eg, HIV, cleft palate, Down syndrome, allergic rhinitis)

AOM

Pathogenesis

The pathogenesis of AOM in at-risk children generally involves the following sequence of events

1. The patient has an **antecedent event** (usually a viral upper respiratory tract infection) while colonized with an otopathogen(s). Some evidence suggest that co-colonization with bacterial otopathogens only, in the absence of viral respiratory tract infection, may be sufficient to trigger the cascade of events.
2. The event results in **inflammatory edema** of the respiratory mucosa of the nose, nasopharynx, and eustachian tube.
3. Inflammatory edema **obstructs** the narrowest portion of the eustachian tube, the isthmus.

4. Obstruction of the isthmus causes poor ventilation and resultant **negative middle ear pressure**. This leads to the accumulation of secretions produced by the middle ear mucosa.
5. The secretions have no egress and accumulate in the middle ear space.
6. Viruses and bacteria that colonize the upper respiratory tract **enter the middle ear via aspiration, reflux, or insufflation**.
7. Microbial growth in the middle ear secretions often progresses to **suppuration** with clinical signs of AOM (bulging tympanic membrane [TM], middle ear fluid, erythematous TM).
8. The middle ear effusion may persist for weeks to months following sterilization of the middle ear infection.

AOM

MICROBIOLOGY

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- ▶ Bacteria — Three species of bacteria account for most of the bacterial isolates from middle ear fluid:
 1. **S. pneumoniae** app. 50 % of severe cases
 2. **Nontypeable H. influenzae (NTHi)**, app 45% of severe cases
 3. **Moraxella catarrhalis**.

AOM

MICROBIOLOGY

- ▶ Bacterial and/or viral respiratory tract pathogens can be isolated from most middle ear aspirates from children with AOM.
- ▶ The finding of combined bacterial and viral infections in two-thirds of cases has important clinical implications .Mixed viral and bacterial infections may respond differently to antibiotic therapy than purely bacterial infections. The presence of viruses may increase middle ear inflammation ,decrease neutrophil function , and reduce antibiotic penetration into the middle ear .

AOM

CLINICAL

Symptoms.

MANIFESTATIONS

- ▶ Children with AOM, particularly **infants**, may present with **nonspecific** symptoms and signs, including fever, irritability, headache, apathy, disturbed or restless sleep, poor feeding/anorexia, vomiting, and diarrhea .
- ▶ Fever occurs in one- to two-thirds of children with AOM, though temperature $>40^{\circ}\text{C}$ (104°F) is unusual unless accompanied by bacteremia or other focus of infection , **However**, ear pain and other ear-related symptoms (eg, ear rubbing) are not always present
- ▶ **Otalgia is the most common complaint** in children with AOM and the best predictor of AOM

AOM

Diagnosis

- ▶ Pneumatic otoscopy is gold standard.
- ▶ **IMPORTANCE OF ACCURATE DIAGNOSIS** — The importance of accurate diagnosis of AOM cannot be overstated.
- ▶ **Accurate diagnosis** ensures appropriate treatment for children with AOM, who require antibiotic therapy, and avoidance of antibiotics in children with otitis media with effusion, in whom antibiotics are unnecessary.
- ▶ **Accurate diagnosis** also prevents overuse of antibiotics, which leads to the development of resistant organisms

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Pneumatic otoscope



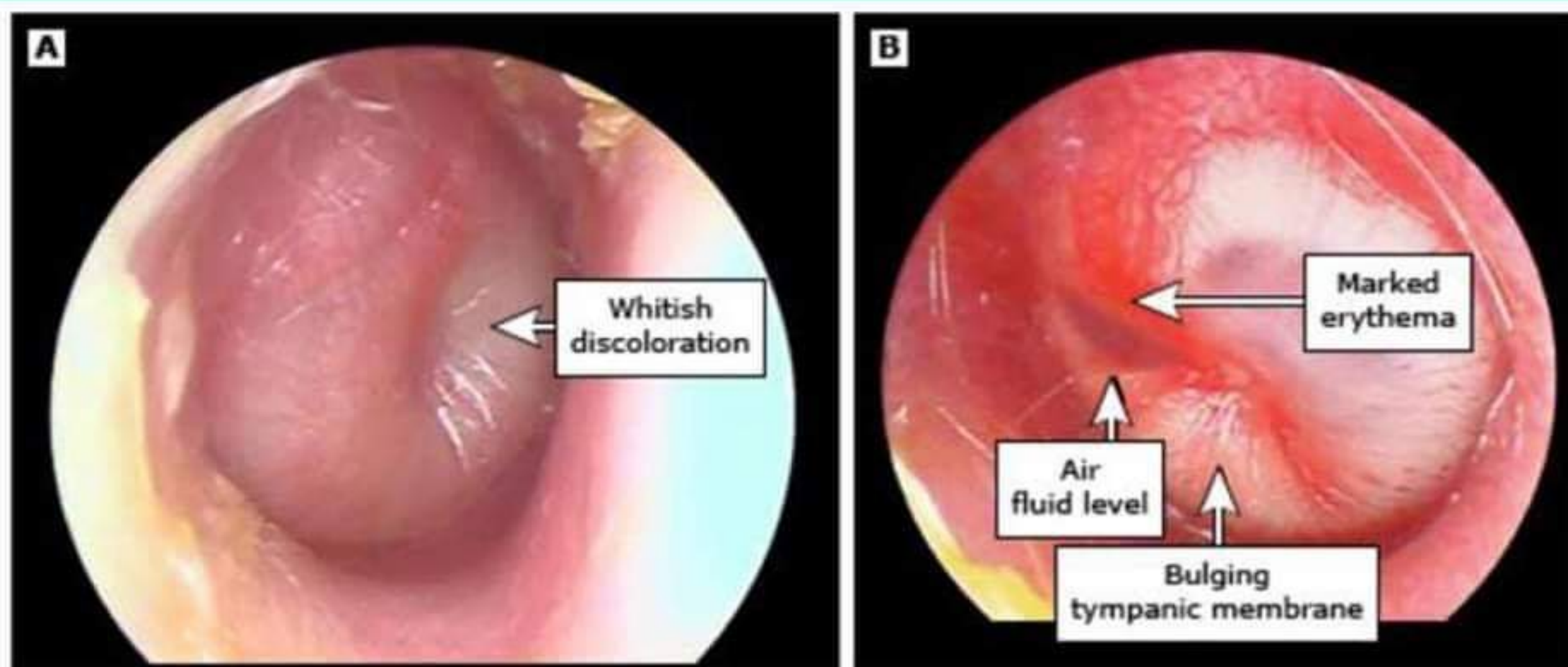
► ***Accurate diagnosis of AOM requires systematic evaluation of the tympanic membrane for:***

1. **Color** (eg, gray, white, pale yellow, amber, pink, red, blue)
2. Other conditions (eg, fluid level, bubbles, perforation, otorrhea, bullae, tympanosclerosis [scars], atrophic areas, retraction pockets, cholesteatoma)
3. **Mobility**
4. **Position** (eg, neutral, retracted, full, or bulging)
5. **Lighting.**
6. **Entire surface** (the four quadrants of the tympanic membrane should be examined) ([figure 1](#))
7. **Translucency**
8. **External auditory canal and auricle** (eg, deformed, displaced, inflamed, foreign body)
9. **Seal** (a good seal requires an airtight pneumatic system and a speculum that is large enough to prevent air leak)

Pneumatic Otoscopy

6

Acute otitis media



Examples of the white, bulging tympanic membrane seen in acute otitis media. Panel B also demonstrates marked erythema along the handle of the malleus and an air-fluid level in the anterosuperior portion of the tympanic membrane.

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Experienced otoscopists at a tertiary care children's hospital developed and validated a classification scheme describing the signs and symptoms that they use to diagnose AOM :

1. Bulging tympanic membrane (with or without opacification or air-fluid level): **AOM**
2. Opacification of the tympanic membrane or air-fluid level: **OME**
3. Absence of bulging, opacification, and air-fluid level: **no MEE**

Cont'

AOM Diagnosis

- ▶ **Position** — A bulging tympanic membrane is the hallmark of AOM. The position of the tympanic membrane is the most critical characteristic in distinguishing AOM from OME.
- ▶ **Translucency** — Translucency of the tympanic membrane is another important aspect of the examination.

AOM Diagnosis

- ▶ The clinical diagnosis of AOM requires :
 1. Bulging of the tympanic membrane, or
 2. Very infrequently, other signs of acute inflammation and middle ear effusion (MEE)
- ▶ A diagnosis of AOM also can be established if there is acute purulent otorrhea and otitis externa has been excluded

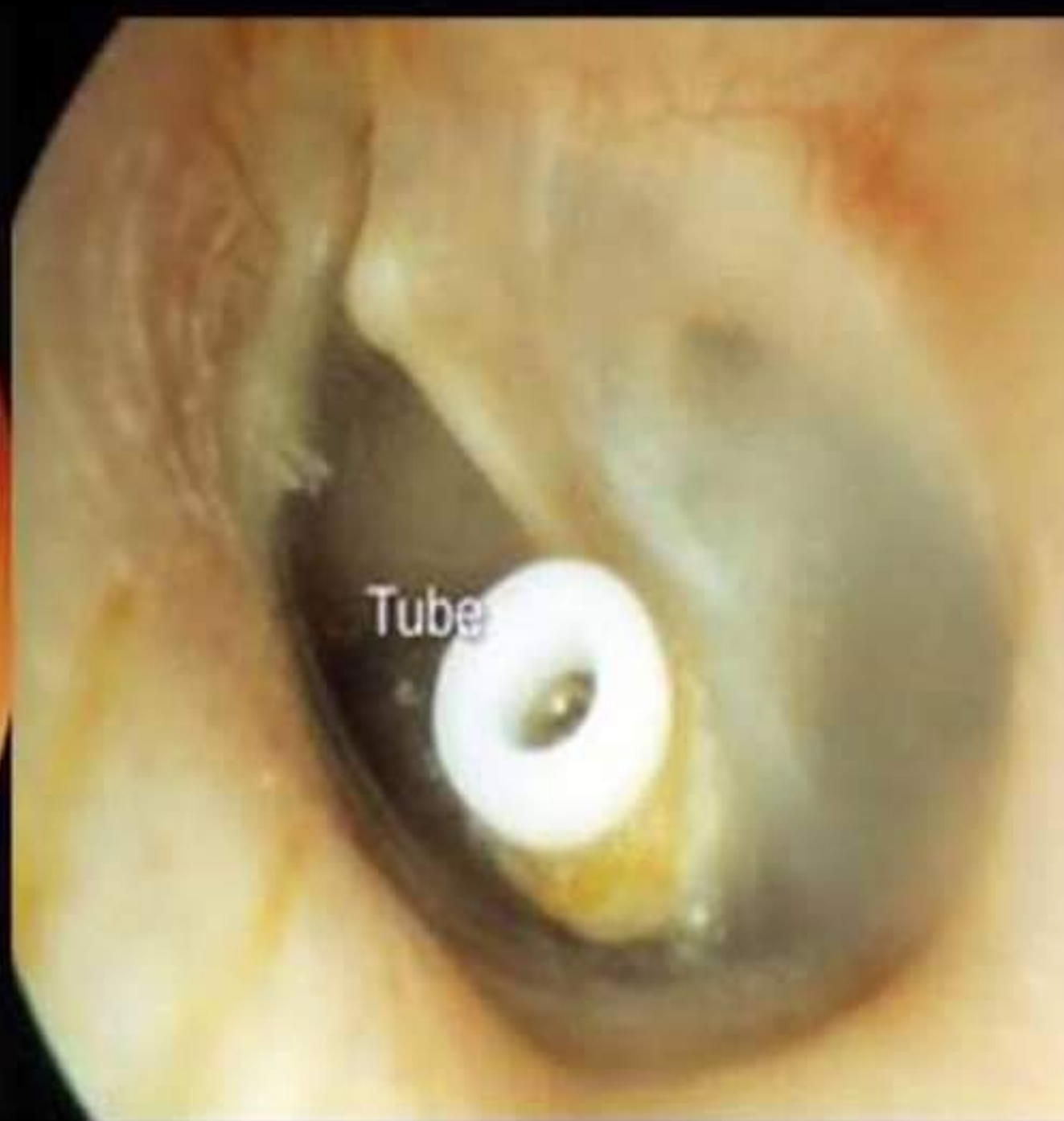
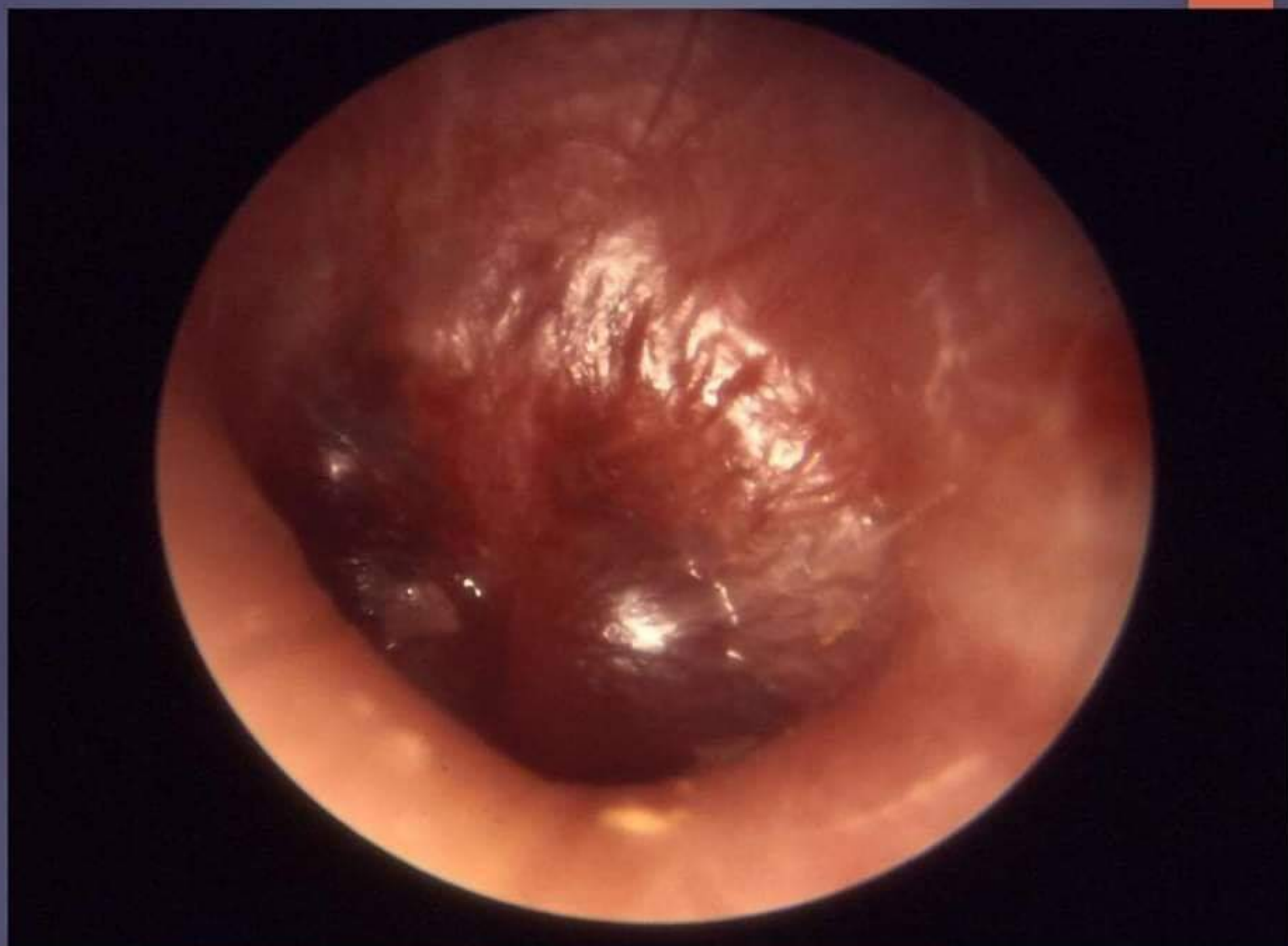
AOM

DIFFERENTIAL DIAGNOSIS

The main consideration in the differential diagnosis of AOM is otitis media with effusion (OME).

- ▶ Middle ear effusion (MEE) with decreased mobility and opacification or cloudiness of the tympanic membrane occurs in both AOM and OME. However, careful evaluation of the position, color, and other findings of the tympanic membrane can help to distinguish AOM from OME .
- ▶ In AOM, the tympanic membrane is usually bulging; in OME, it is usually retracted or in the neutral position.
- ▶ In AOM, the tympanic membrane is typically white or pale yellow; in OME, it is typically amber or blue.
- ▶ In AOM, pus may be visualized behind the tympanic membrane; the tympanic membrane may be perforated with acute purulent otorrhea, or bullae may be present. In OME, a fluid level or bubbles may be seen.





RECURRENT AOM

- ▶ **Recurrent acute otitis media** (AOM) is defined by the development of signs and symptoms of AOM soon after completion of successful treatment.
- ▶ It is particularly important to establish the diagnosis of recurrent AOM with bulging of the tympanic membrane and signs of inflammation. Otherwise, persistent middle ear effusion in a child with a febrile upper respiratory infection may be misinterpreted as a recurrent episode and the child may receive antibiotics unnecessarily.

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When recurrence occurs within 15 days of completion of antimicrobial treatment for the previous episode, we suggest:

- ▶ **Ceftriaxone** 50 mg/kg per day intramuscularly (IM) or intravenously (IV) for three days, or
- ▶ **Ceftriaxone** 50 mg/kg per dose IM or IV every 36 hours for a total of two doses, or
- ▶ **Levofloxacin** 10 mg/kg every 12 hours orally for 10 days for children six months to five years or 10 mg/kg per once daily for 10 days for children ≥ 5 years (maximum 500 to 750 mg/day) [78]

When the recurrence occurs **more than 15 days after completion** of the treatment for the previous episode:

- ▶ it is most often due to a different pathogen than the previous episode. Although the child is at higher risk for a nonsusceptible pathogen, we suggest high dose [amoxicillin-clavulanate](#) as initial therapy, even if the child received amoxicillin-clavulanate for the previous episode.
- ▶ Tympanostomy tube insertion may be warranted for children with ≥ 3 distinct and well-documented episodes of AOM within six months or ≥ 4 episodes within 12 months if middle ear fluid is also present

AOM Treatment

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- ▶ **Watchful waiting** : current practice guidelines advise on an initial watchful waiting without antibiotic therapy for healthy 2-year-olds or older children with nonsevere illness because AOM symptoms improve in most within 1–3 days .
- * *Watchful waiting is not recommended for children < 2 years old.*
- ▶ **Antibiotics**
Penicillin
In children < 5 years, when *H. influenzae* is likely to be present, → amoxycillin is more effective
- ▶ **Analgesics**
- ▶ **Nasal vasoconstrictors**: The role of 0.5% ephedrine nasal drops is traditional but its value is uncertain .
- ▶ **Ear drops** : Ear drops are of no value in acute otitis media with an intact drum.
- ▶ AOM fail to respond to medical therapy or develop a complication. **Myringotomy** is then indicated to allow the drainage of pus

AOM

Treatment

- ▶ Do not consider acute otitis media to be cured **until the hearing and the appearance of the membrane have returned to normal.**
- ▶ uncomplicated episodes of AOM resolves without any adverse outcome

AOM

Treatment

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- ▶ Antibiotic
- ▶ First line
 - ▶ Amoxil - 60-90 mg/kg divided tid
 - ▶ Ceftin - B lactam stable
 - ▶ Augmentin - B lactam stable
 - ▶ Bactrim, Pediazole
- ▶ Second line
 - ▶ Augmentin
 - ▶ Ceftin
 - ▶ Rocephin
 - ▶ Macrolides - Zithromax, Biaxin

AOM

Treatment

If resolution does not occur, suspect:

- ▶ Nose, sinuses or nasopharynx Infection
- ▶ the choice or dose of antibiotic
- ▶ low-grade infection in the mastoid cells.
- ▶ Of patients who develop a perforation of the tympanic membrane with otorrhea, a small proportion go on to develop CSOM because of the failure of the tympanic membrane to heal.