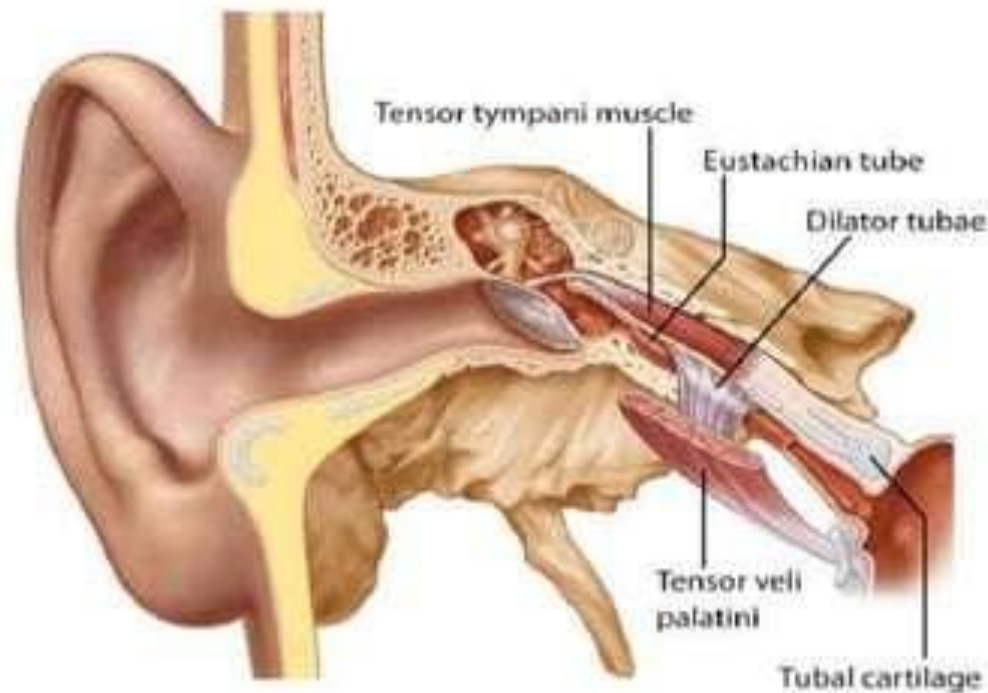
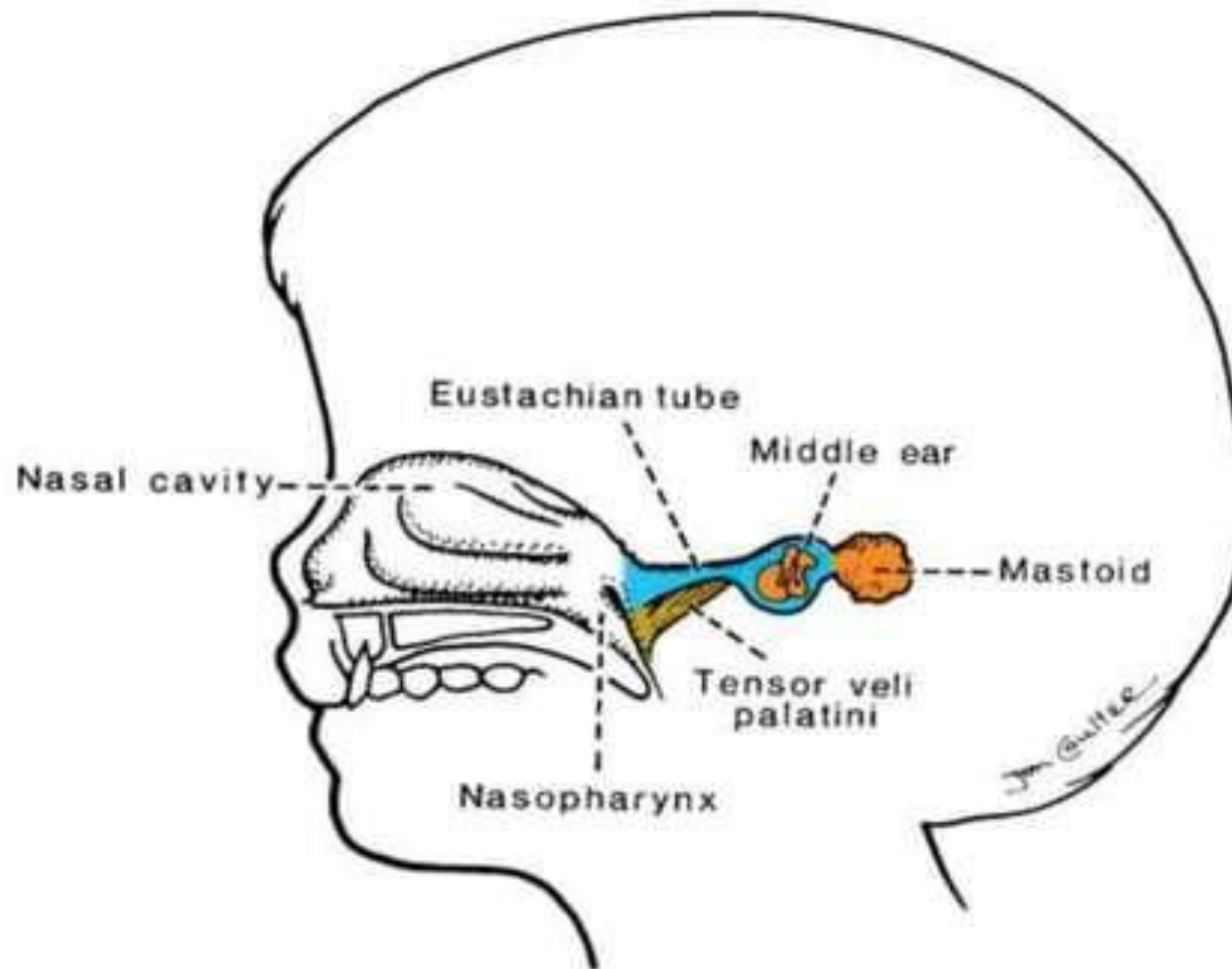


EUSTACHIAN TUBE AND ITS DYSFUNCTION

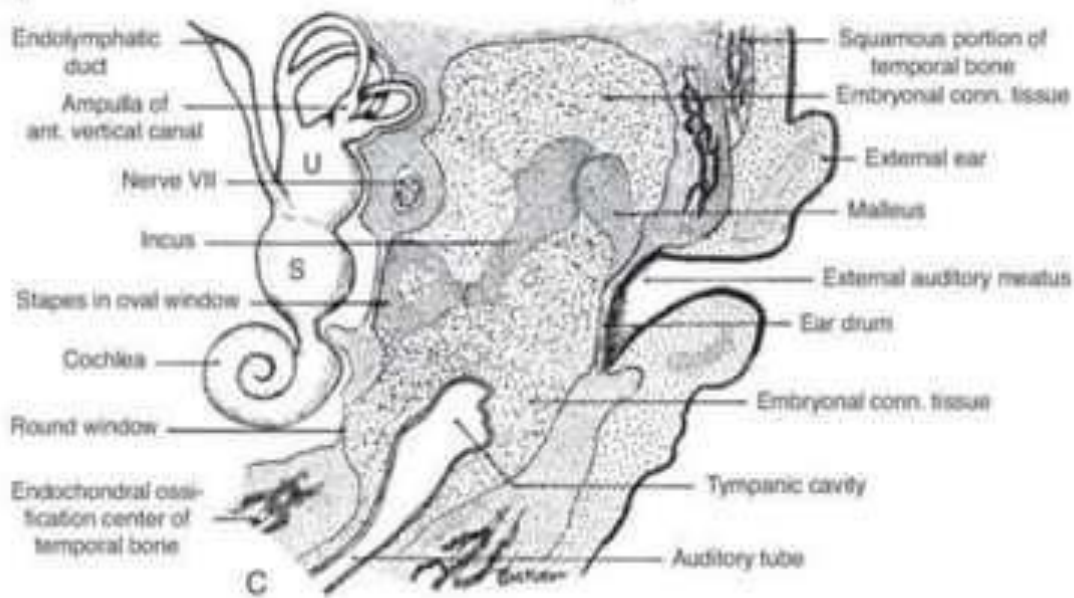
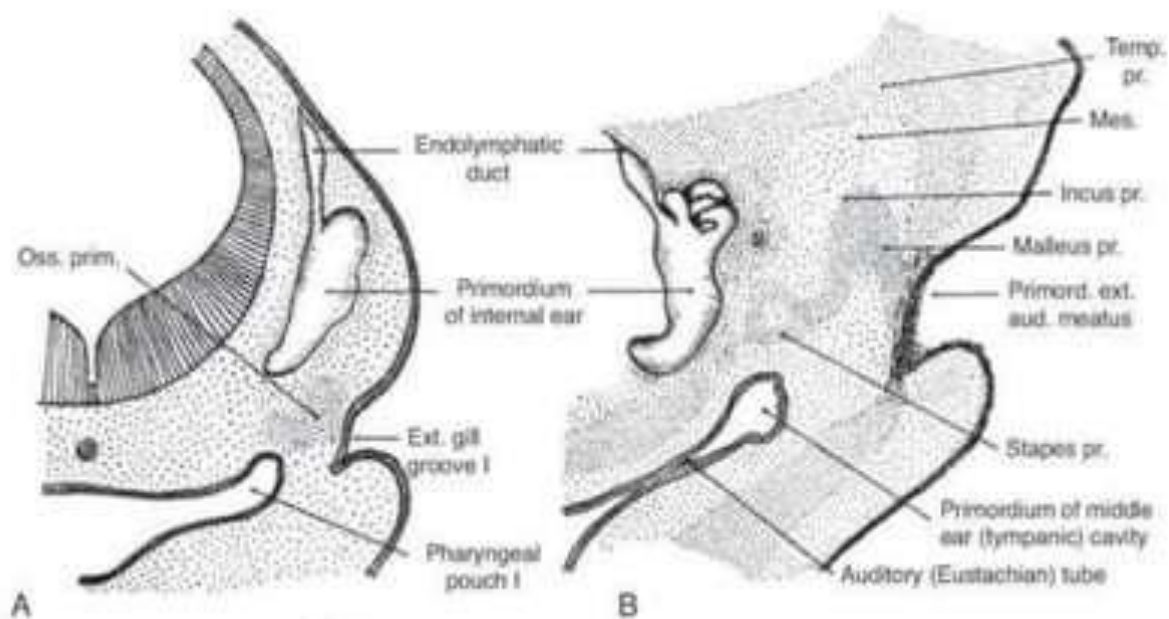


- Dr. Alka Kapil

Eustachian tube is a part of system including the nose ,
palate, rhinopharynx, and middle ear spaces



Embryology



- *Tubo-tympanic recess*, derived from endoderm of 1st pharyngeal pouch
- Distal portion - middle ear cavity
- Proximal portion - Eustachian tube
- cartilage and muscles - surrounding mesoderm

Components of ET

Lumen mucosa

Ossaceous portion

Lateral membranous wall

Extraluminal soft tissue

Cartilaginous portion

Ostmann's fat pad

Muscles

Tensor veli palatini (and tensor tympani)

Levator veli palatini

Salpingopharyngeus

Innervation

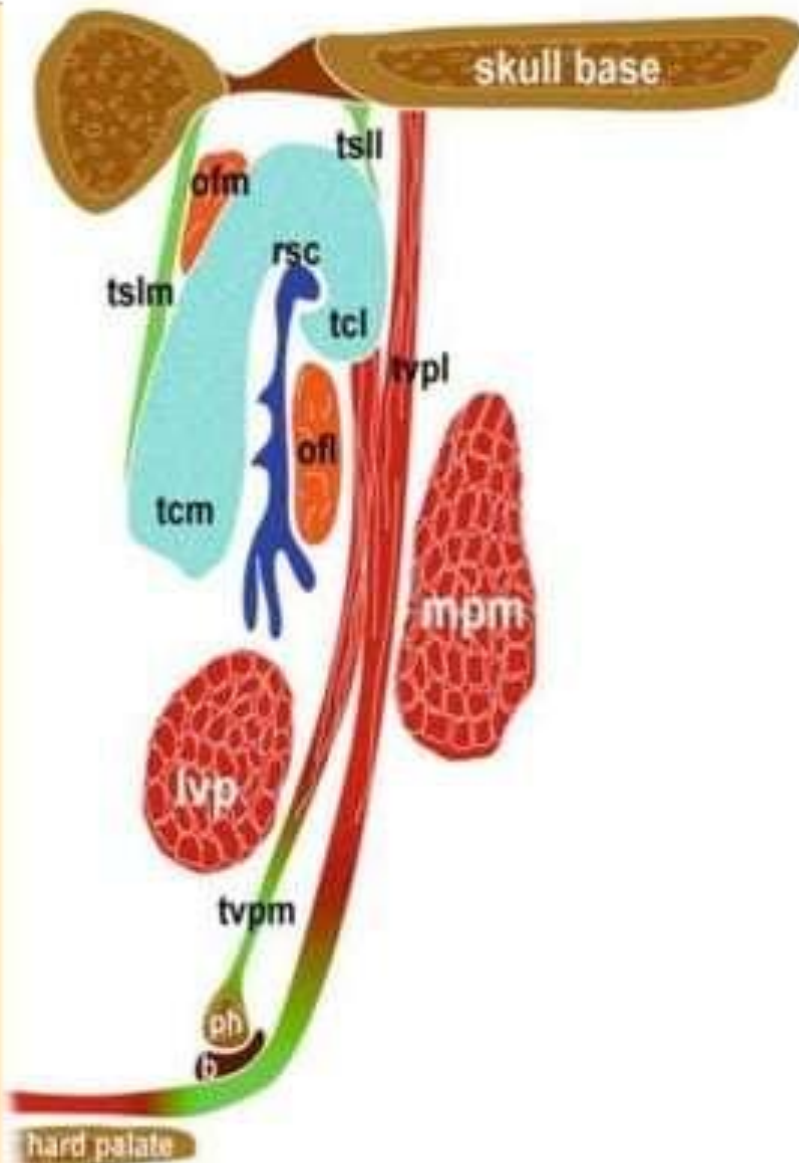
Blood supply

Lymphatics

Ossaceous support

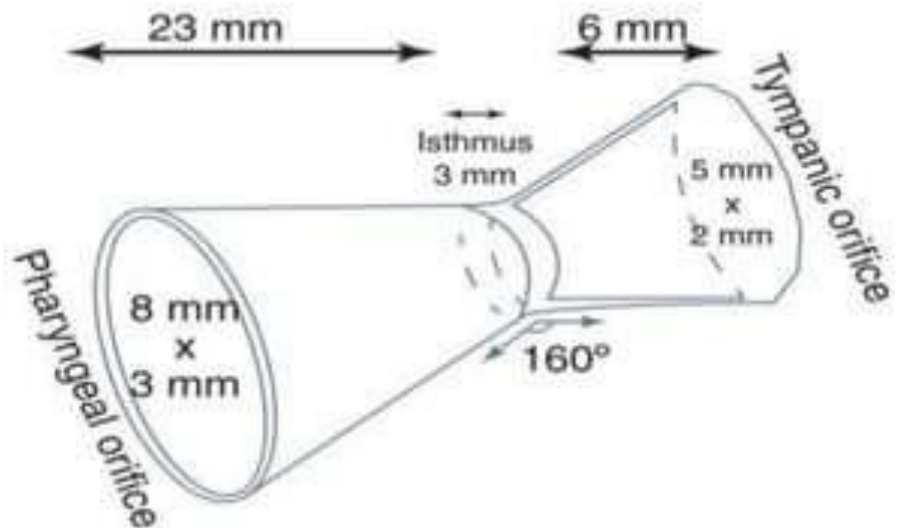
Sphenoid sulcus

Medial pterygoid plate



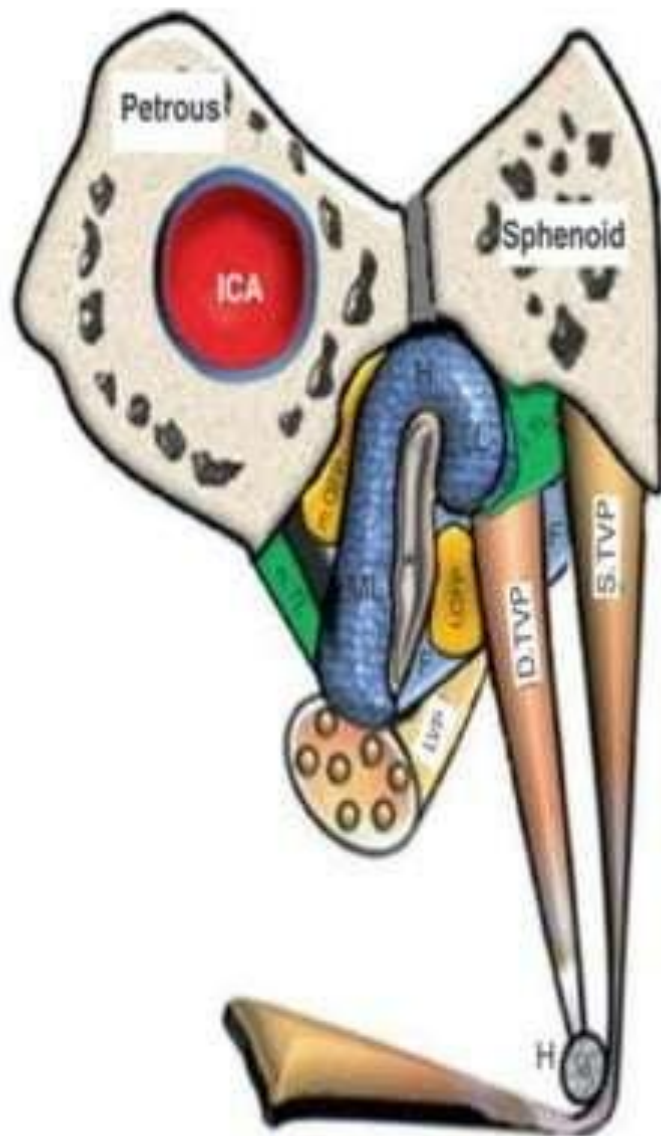
Eustachian tube anatomy

- Narrow osteocartilaginous channel connecting the tympanic cavity to the nasopharynx
- Allows passage of : air and fluid
- Begins at tympanic orifice at protympanum & ends at pharyngeal orifice on the lateral wall of nasopharynx
- Hourglass shaped of two unequal cones



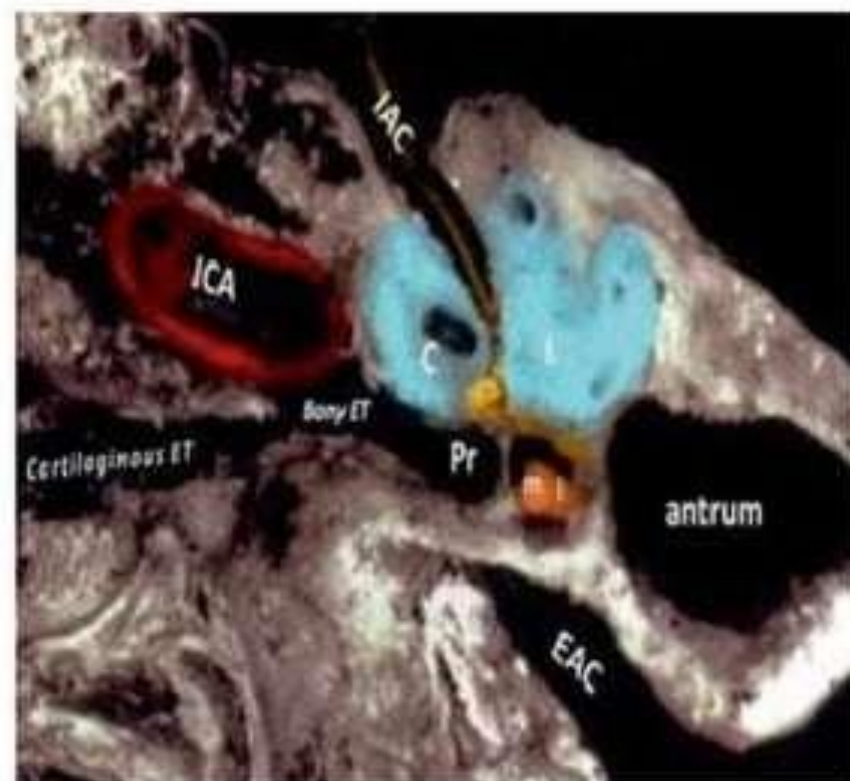
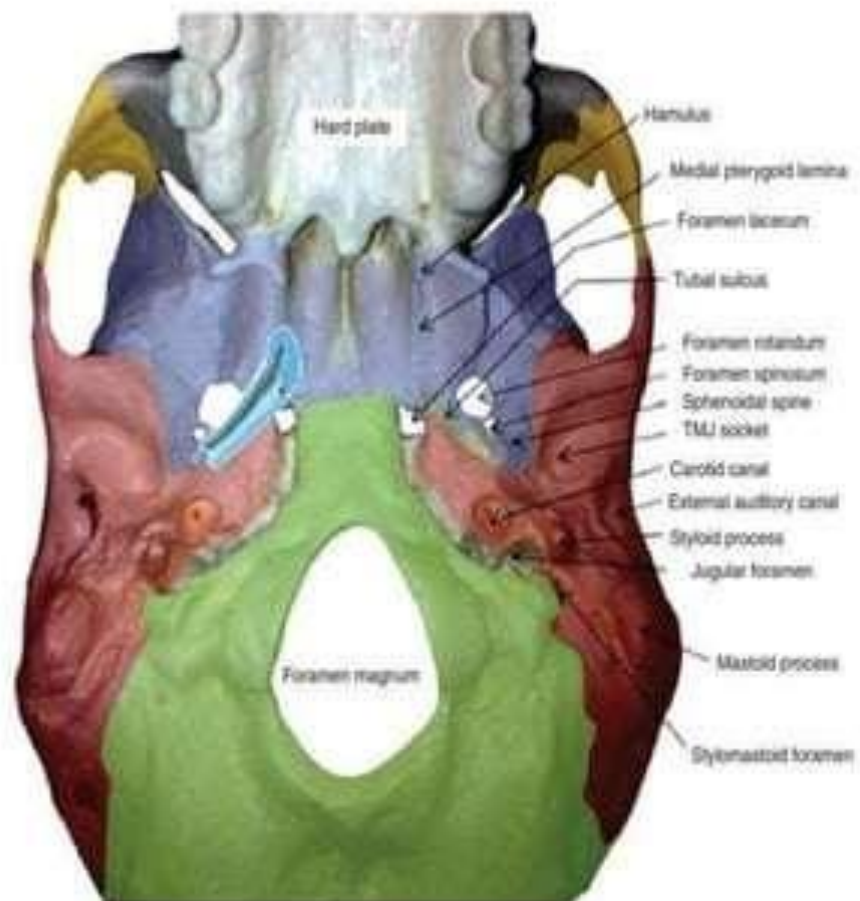
- Total length of ET is 33 mm :
 - bony part 6.5mm
 - junctional part 3mm
 - cartilaginous part 23.5mm
- *Bony portion patent all times*
- Fibrocartilaginous portion that is
 - closed at rest
 - opens during swallowing or when forced to open, such as during the Valsalva maneuver
- Lining epithelium: pseudo stratified ciliated columnar

Mid cartilaginous portion of the Eustachian tube



The cross-sectional view through the lumen shows two different compartments:

1. **Rüdinger's safety canal** – filled with air or with mucus; likely always open
2. **Auxiliary gap** – has longitudinal mucosal folds. contributes to the clearance and protection function



Tubal cartilage (*) insertion in the sulcus tubae

Saggital cadeveric cut through left Middle ear



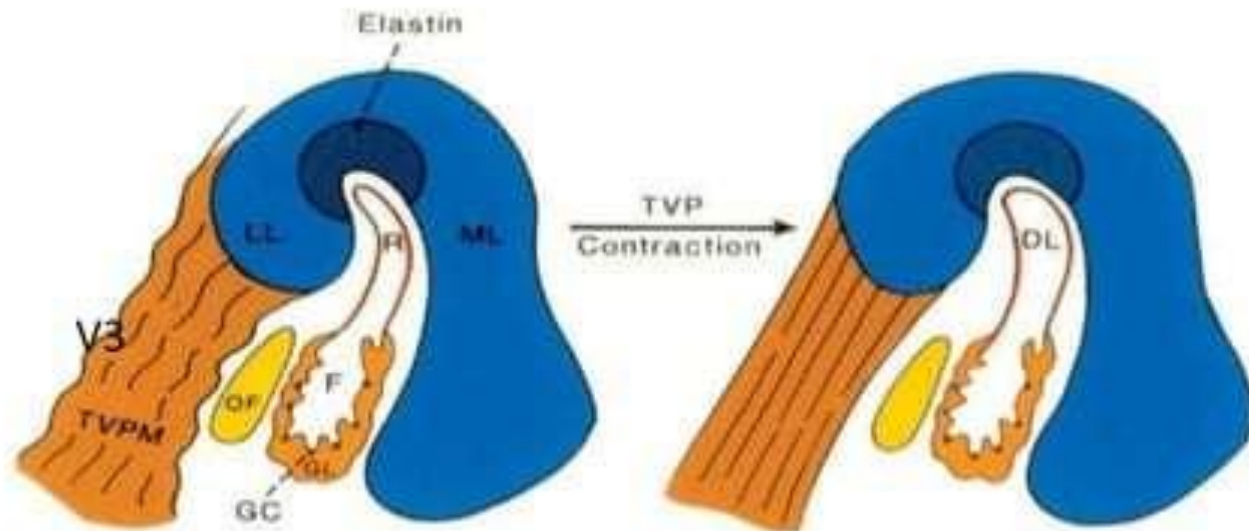
bony Eustachian tube (Pr) and the canal of tensor tympani muscle (asterisk), the isthmus (I), the cartilaginous Eustachian tube (ET), and its inferiorly related levator veli palatini muscle (LVP). The superior wall of the bony Eustachian tube is formed by the tegmen tubari

Tensor veli palatini :

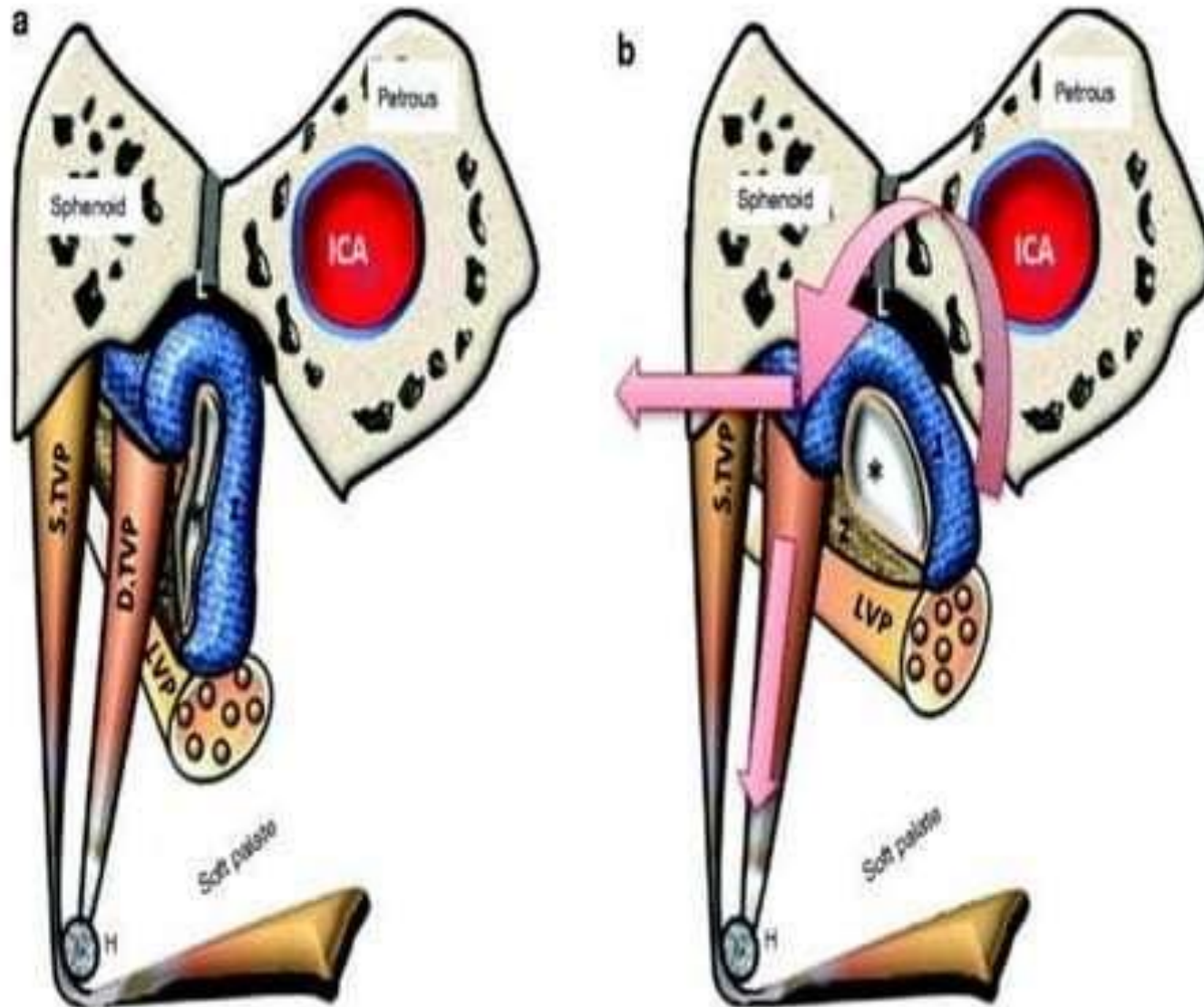
bony wall of the scaphoid fossa and from the entire length of the short lateral lamina of the cartilage tube

around the pterygoid hamulus

then fans out within the soft palate and mingles with the fibers from the opposite side in the midline raphe



Attachment of Tensor veli palatini

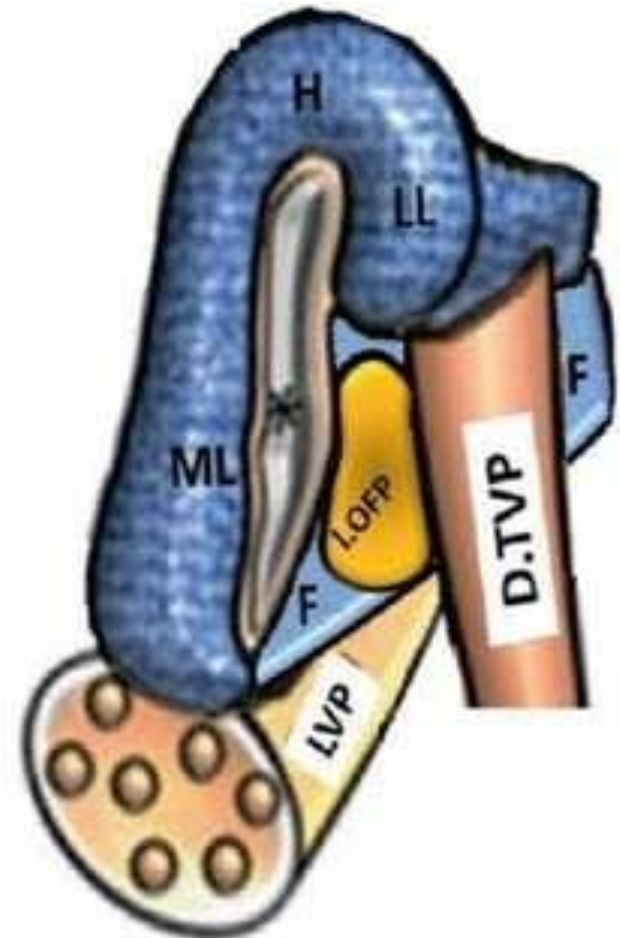


Levator Veli Palatini

inferior aspect of the petrous apex of the
temporal bone

Fanning out and blending with
dorsal surface of the soft
Palate

related to the pumping clearance
(drainage)
function of the tube &
Competence of the soft palate



Salpingopharyngeus muscle

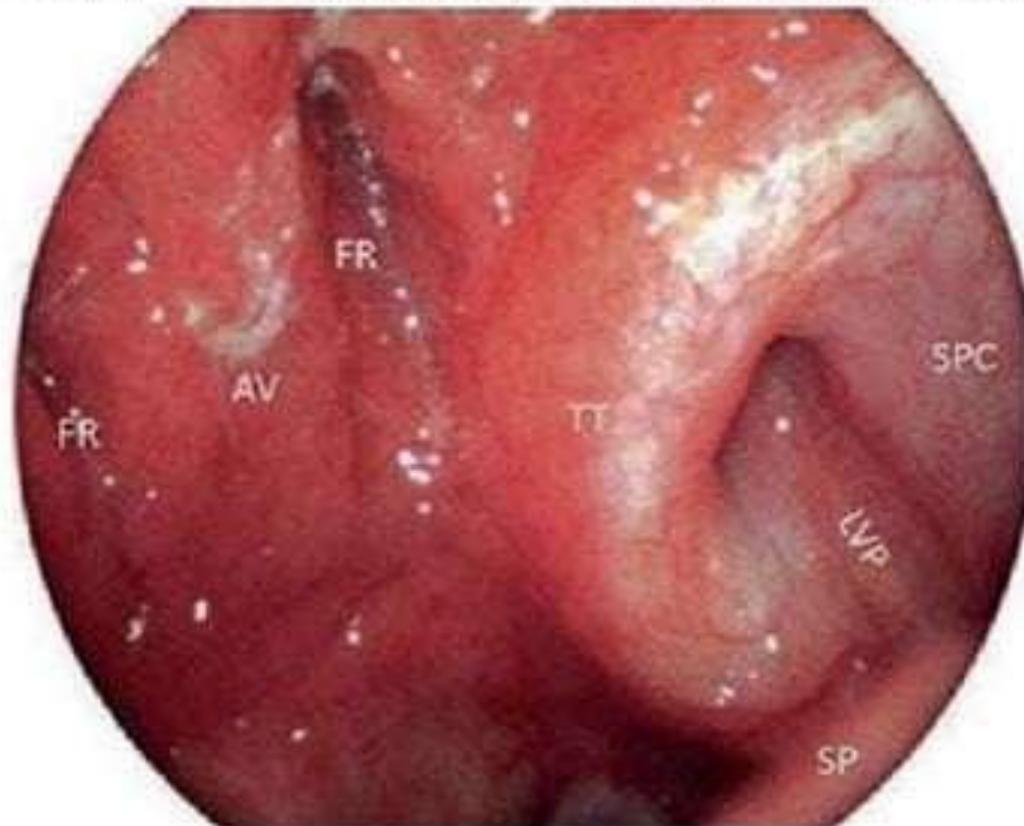
medial and inferior borders of the tubal cartilage via slips of muscular and tendinous fibers

↓
keep in position the pharyngeal orifice of the
ET

- The Eustachian tube (ET) is closed at rest.
- The opening of the ET is limited to Rüdinger's safety canal.
- The lateral Ostmann's fat pad transfers the pressure of the tensor veli palatini muscle to the ET.
- The function of the levator veli palatini muscle is restricted to the soft palate.
- The tensor veli palatini muscle has a dual function: opening the cranial portion and compression of the lower portion of the ET.
- The salpingopharyngeal muscle is an anchor chain of the cartilaginous part of the ET.


Endoscopic Anatomy

- Medial end forms tubal elevation / *torus tubarius*
- Lymphoid collection over torus is called *Gerlach's tonsil*
- Postero-superior to torus is *fossa of Rosenmüller*

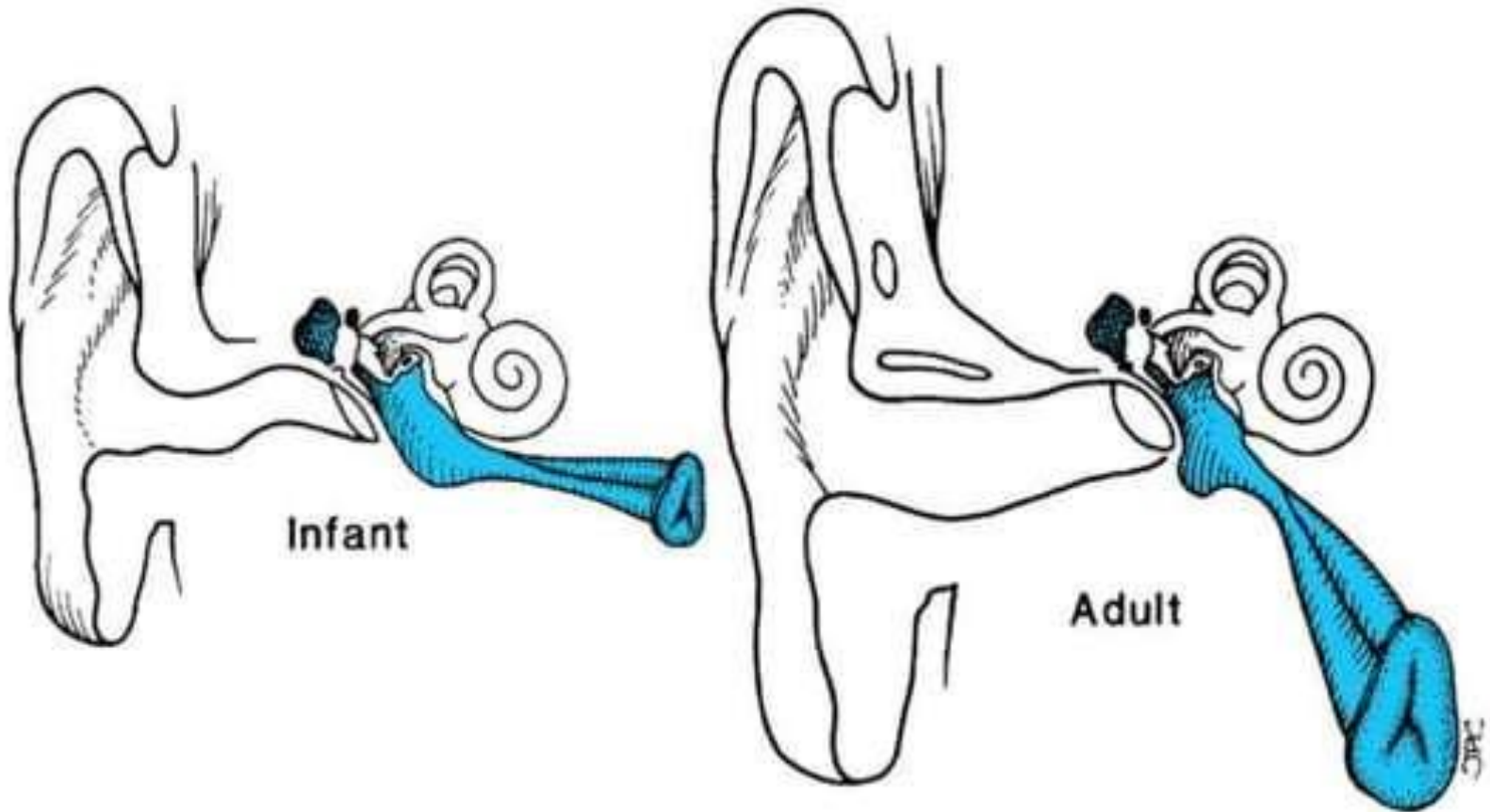


- Arterial supply: ascending pharyngeal &
middle meningeal arteries
- Venous drainage: pharyngeal & pterygoid
venous plexus
- Lymphatic drainage: retropharyngeal node

Nerve supply

- Tubal mucosa – tympanic branch of cranial nerve IX
 - Tensor veli palatini - Mandibular branch of trigeminal
 - Levator veli palatini
 - Salpingo pharygeus
- Pharyngeal plexus
- 
- A diagram consisting of two thin lines that originate from the right side of the text 'Levator veli palatini' and 'Salpingo pharygeus' and converge to point towards the text 'Pharyngeal plexus' on the right.

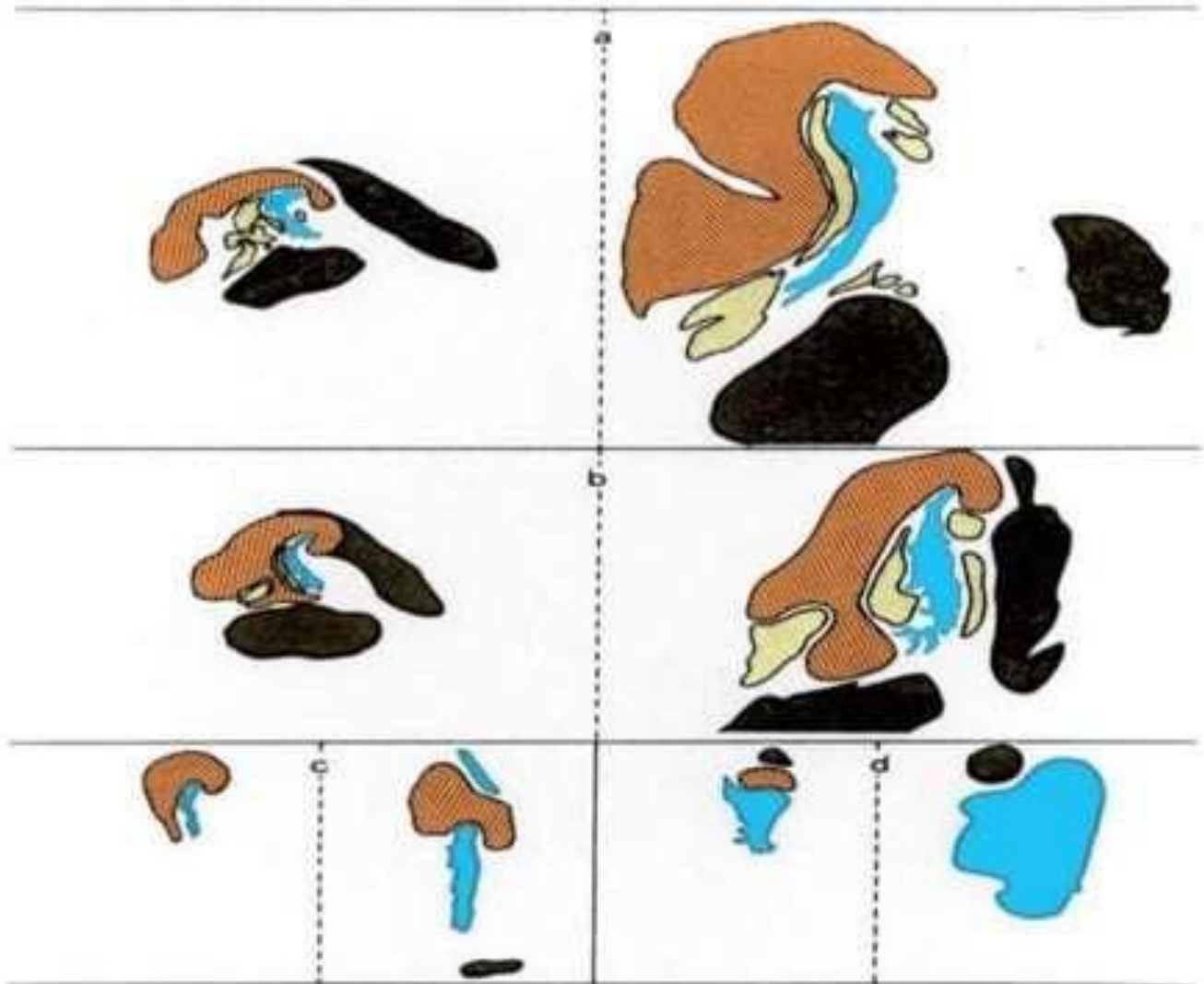
Adult and infant ET







	Infant	Adult
Length (mm)	Approximately 15–18 mm	Approximately 30–36 mm
Cartilaginous portion	Less than 2/3 of the tube	longer = 24 mm (2/3)
Bony portion	Longer (more than 1/3) and wider than in adult	shorter, narrower, = 12 mm (1/3)
Pharyngeal orifice	Height 4 mm, width 2 mm	Height 8 mm, width 2 mm
Angulation with respect to base of skull (°)	10 degrees	45 degrees
Tensor veli palatini muscle action	Less efficient	More efficient
Ostmann fat pad	Less prominent	Prominent

Infant ET

Adult ET

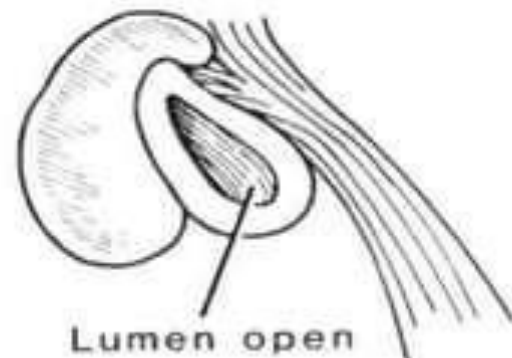
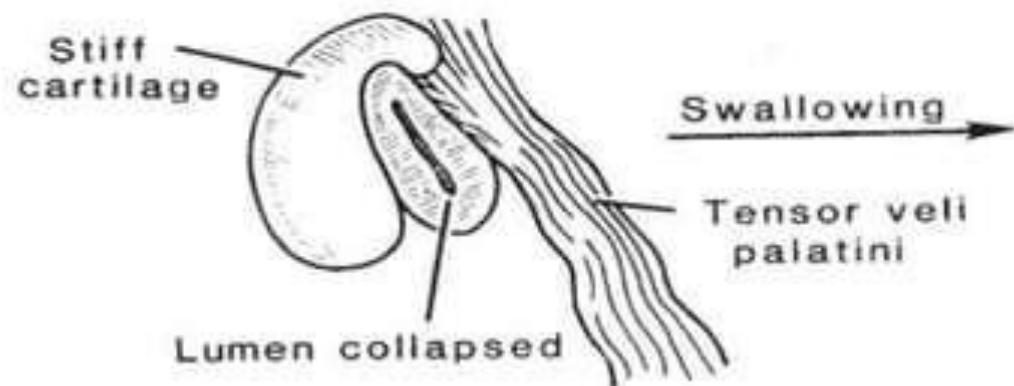


 Eustachian tube lumen  Cartilage  Gland  Muscles

ADULT

At Rest

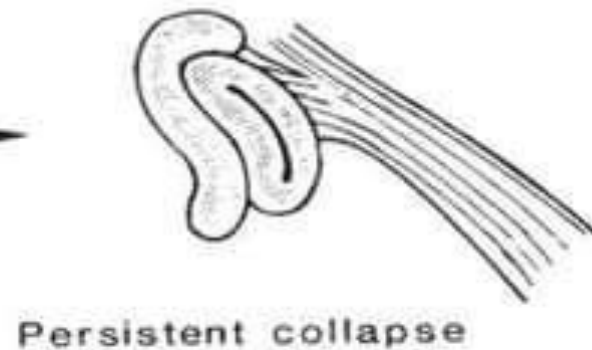
Active Function



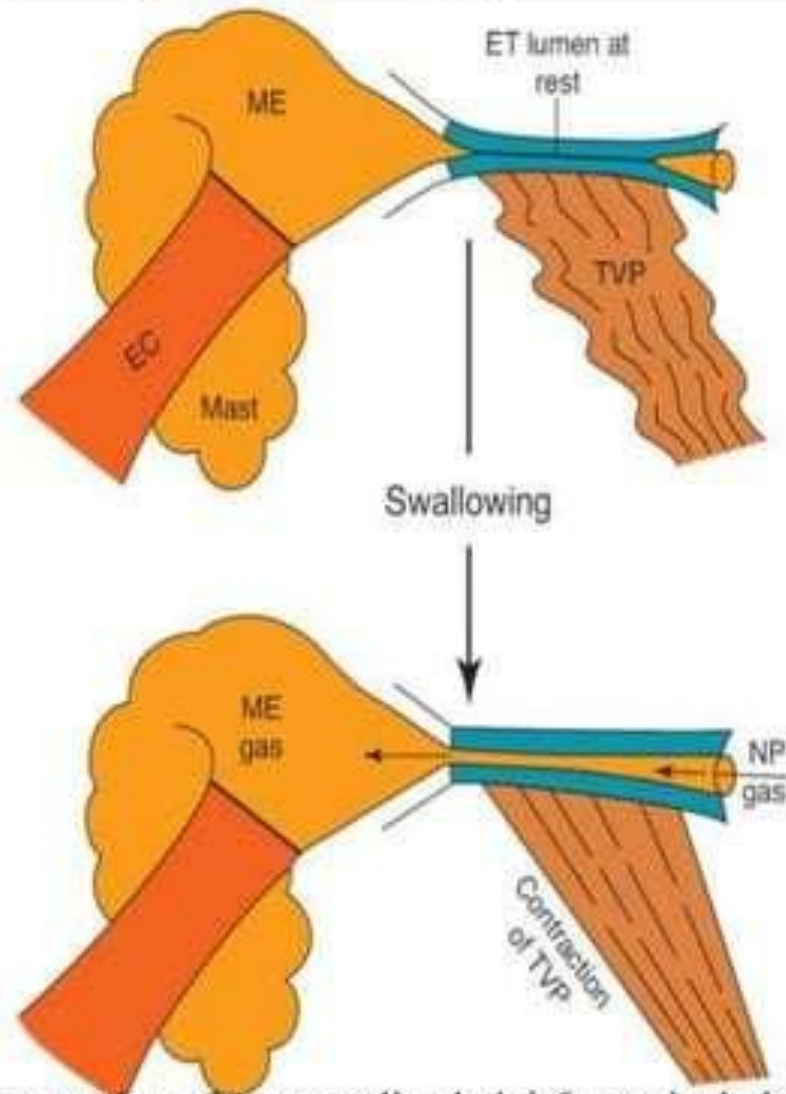
INFANT



Swallowing

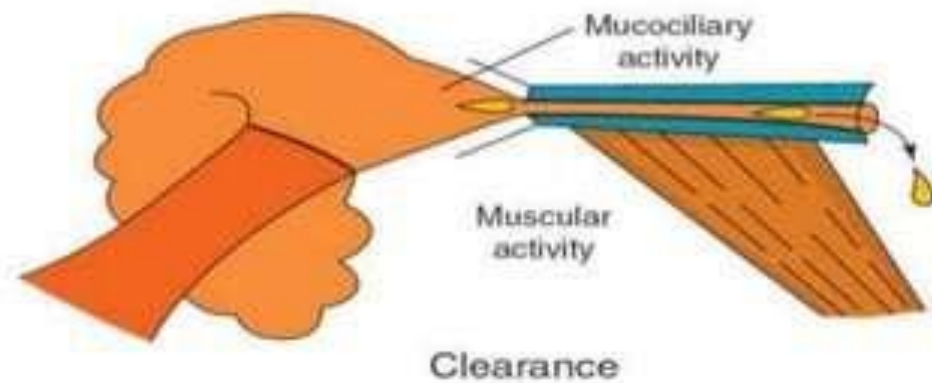
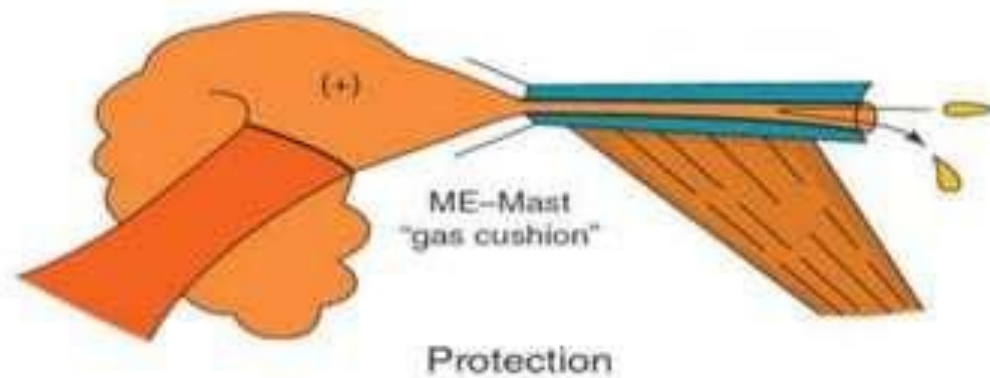
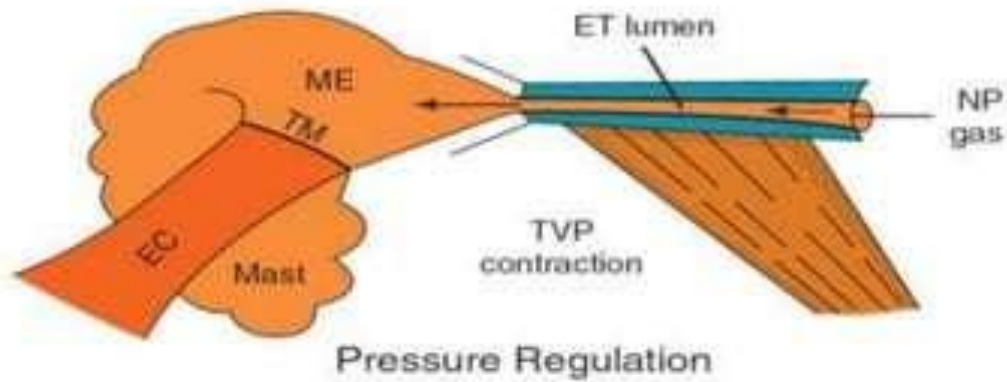


Physiology of ET



- Opens actively by contraction of tensor veli palatini & passively by contraction of levator veli palatini (it releases the tension on tubal cartilage)
- Closes by elastic recoil of elastin hinge & deforming force of Ostmann's fat pad

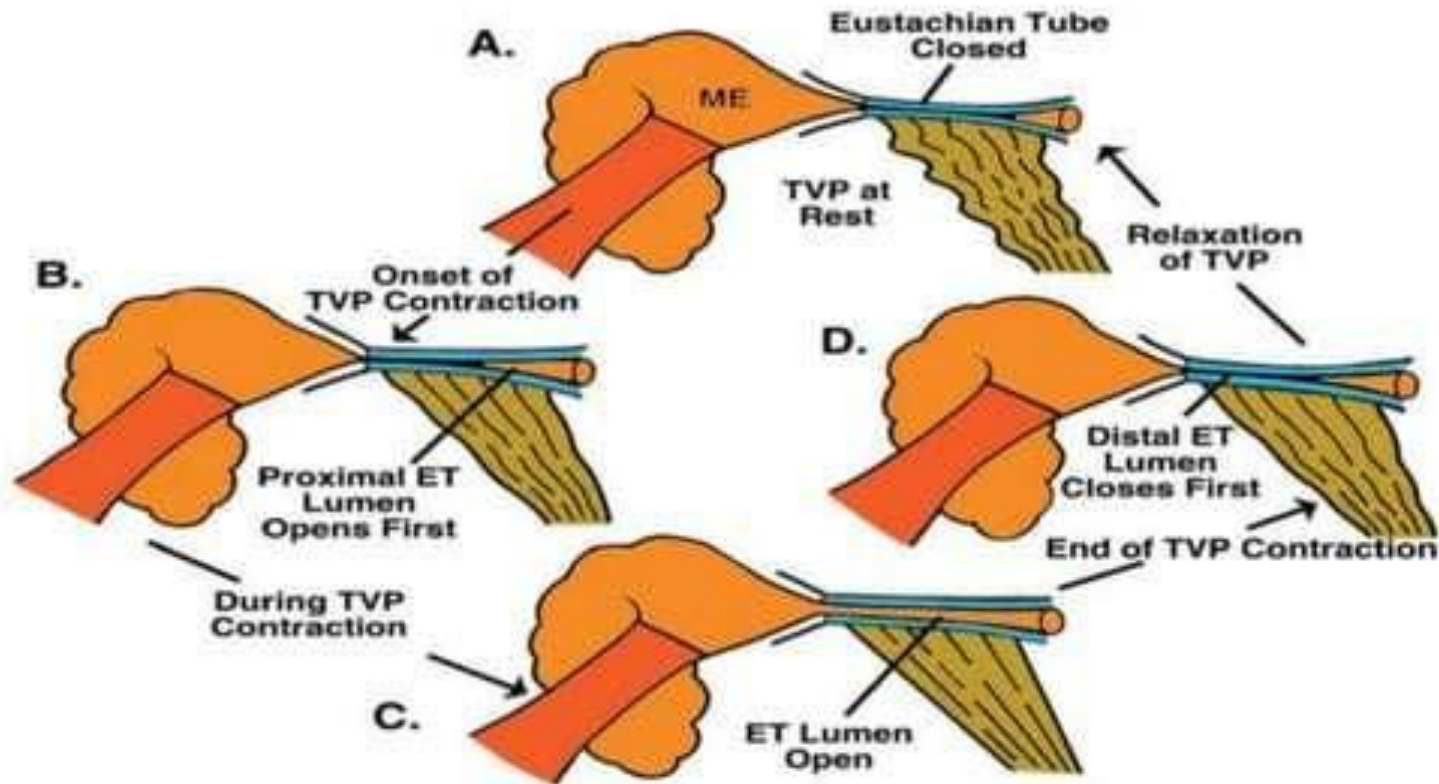
Functions of ET



Functions of ET

1. Ventilation & maintenance of atmospheric pressure in middle ear for normal hearing.
2. Drainage of middle ear secretions into nasopharynx by muco-ciliary clearance, pumping action of Eustachian tube & presence of intra-luminal surface tension.
3. Protection of middle ear from :-
 - Ascending nasopharyngeal secretions due to narrow isthmus & angulation between 2 parts of E.T. at isthmus
 - Pressure fluctuations
 - Loud sound coming through pharynx

Sequence of events during ET dilation



A - ET at rest is closed.

B - Proximal end of the cartilaginous lumen dilates first and is then followed by (C).

C - dilation of the distal end and is open to the middle ear (ME).

D - ET passively closes from the distal end to the proximal end to its resting, closed position

ET is short and floppy in the infant

crying insufflates nasopharyngeal gas into the middle ear

compensate for their inefficient tubal opening mechanism



But during periods of upper respiratory tract infection, nasopharyngeal secretions

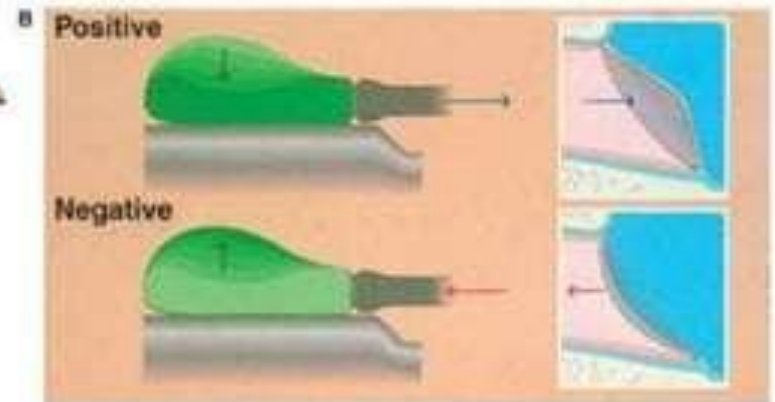
and viruses and bacteria—may also be insufflated into the middle ear

Evaluation of eustachian tube function

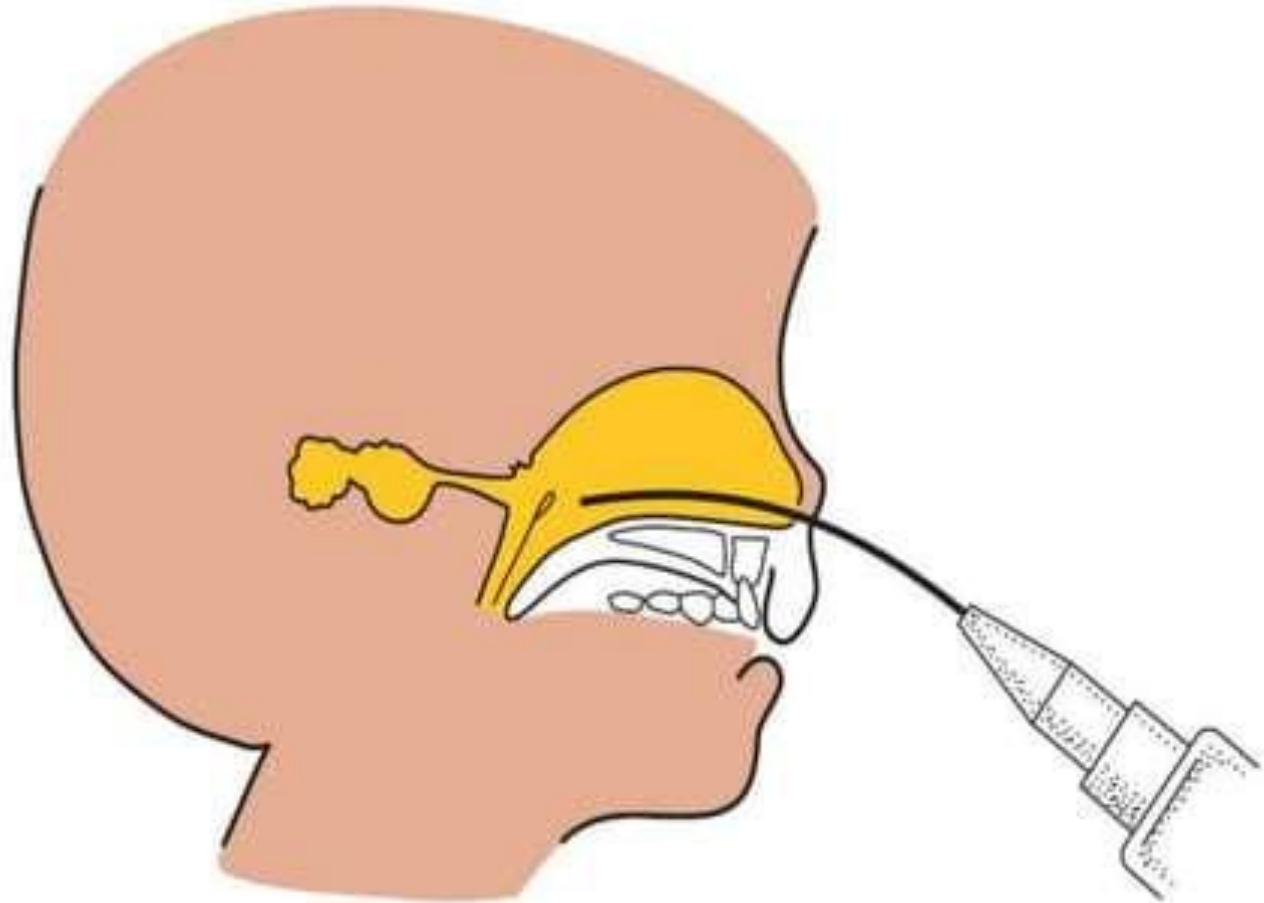


Pneumatic otoscopic examination

- Positive pressure to the eardrum :
TM move slightly inward
(medially);
- on releasing pressure on the
pneumatic bulb TM will return to
its original position ^A



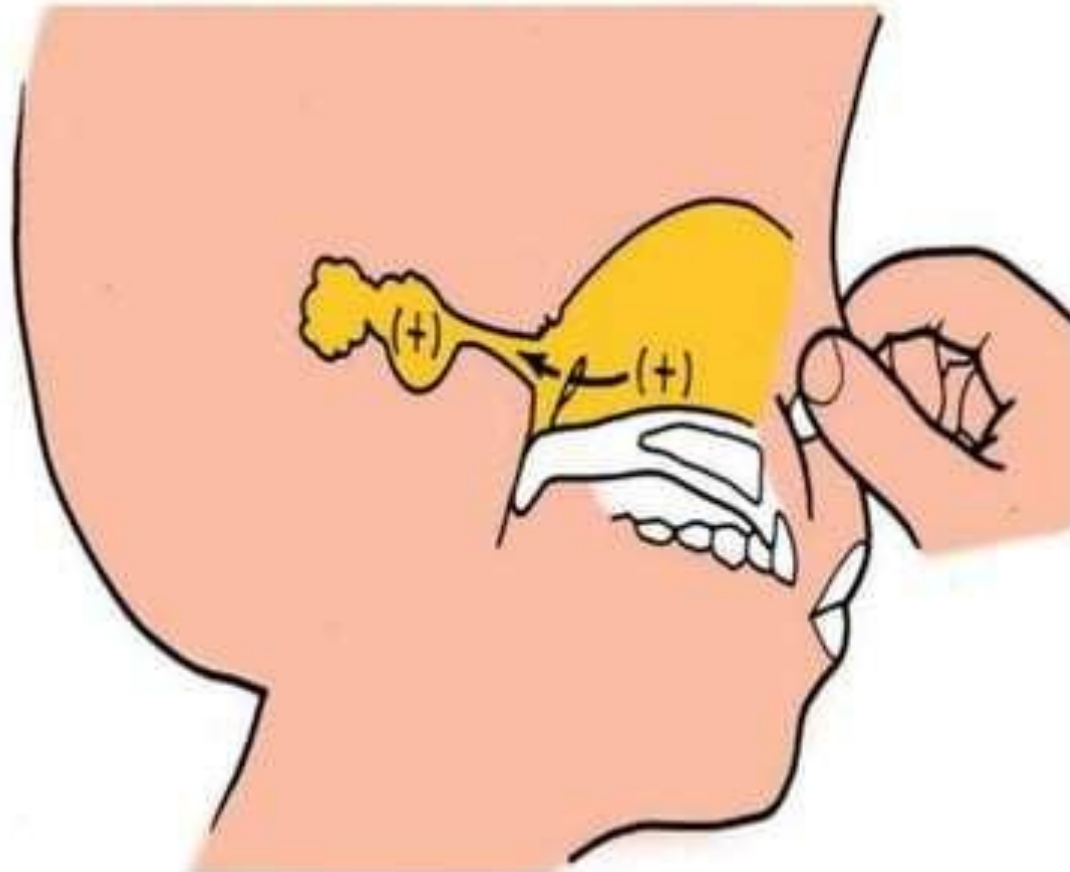
Endoscopic examination



flexible fiberoptic nasopharyngoscope inserted intranasally to examine the nasal cavities, nasopharynx, fossae of Rosenmüller, and pharyngeal orifices of the tubes.

- VALSALVA TEST

Principle : to build positive pressure in the nasopharynx so that air enter the Eustachian tube



Procedure of Valsalva :

Patient pinches his nose with thumb and index finger



Takes deep breath



Closes his mouth



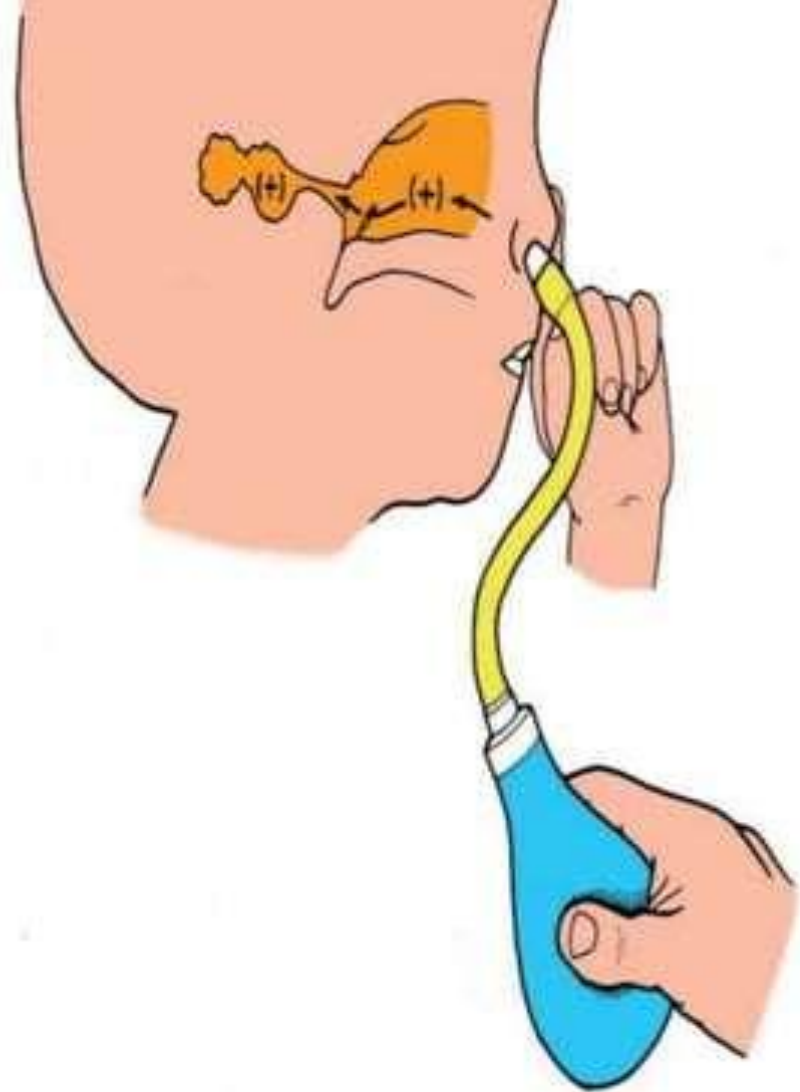
Tries to blow air into the ears

If air enters the middle ear the tympanic membrane will move outwards that can be visualized by otoscope

- Inference :
 - Tympanic membrane perforation- a hissing sound
 - Discharge in the middle ear- cracking sound
- Only 65% of persons can do this test
- Contraindications :
 - atrophic scar of tympanic membrane which can rupture
 - infection of nose & nasopharynx

Politzer test

- Done in *children* who are unable to perform valsalva test.
- Olive shaped tip of the politzer's bag is introduced into the patient's nostril on the side of which the tubal function is desired to be tested.
- Other nostril closed & the bag compressed while at the same time the patient swallows or says "ik,ik,ik"



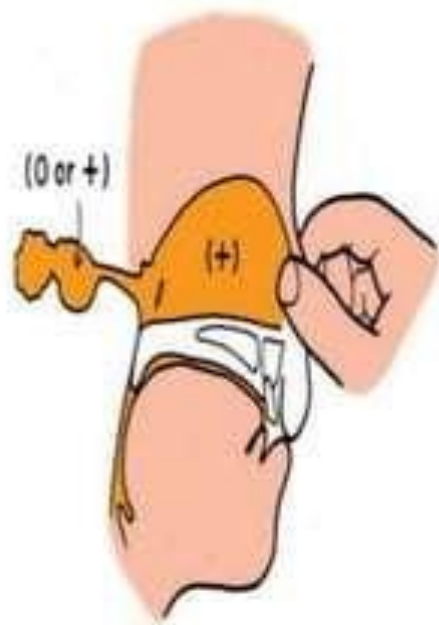
- By means of an auscultation tube a hissing sound is heard.
- Compressed air can also be used instead of politzer's bag
- Test is also therapeutically used to *ventilate the middle ear*.



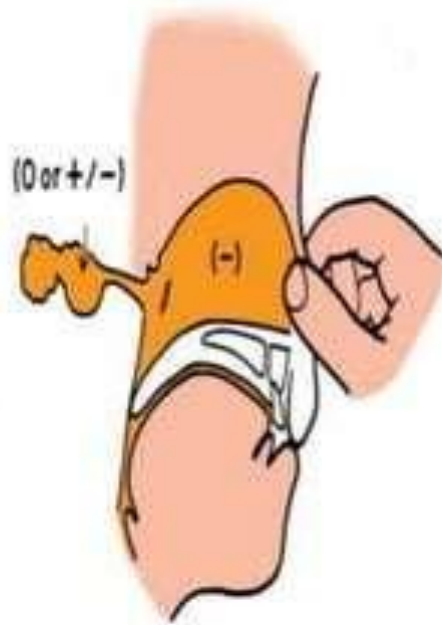
Toynbee's test

- Uses **negative pressure**
- Ask the patient to swallow while nose is pinched
- Draws air from middle ear to nasopharynx – inward movement of tympanic membrane visible otoscopically.

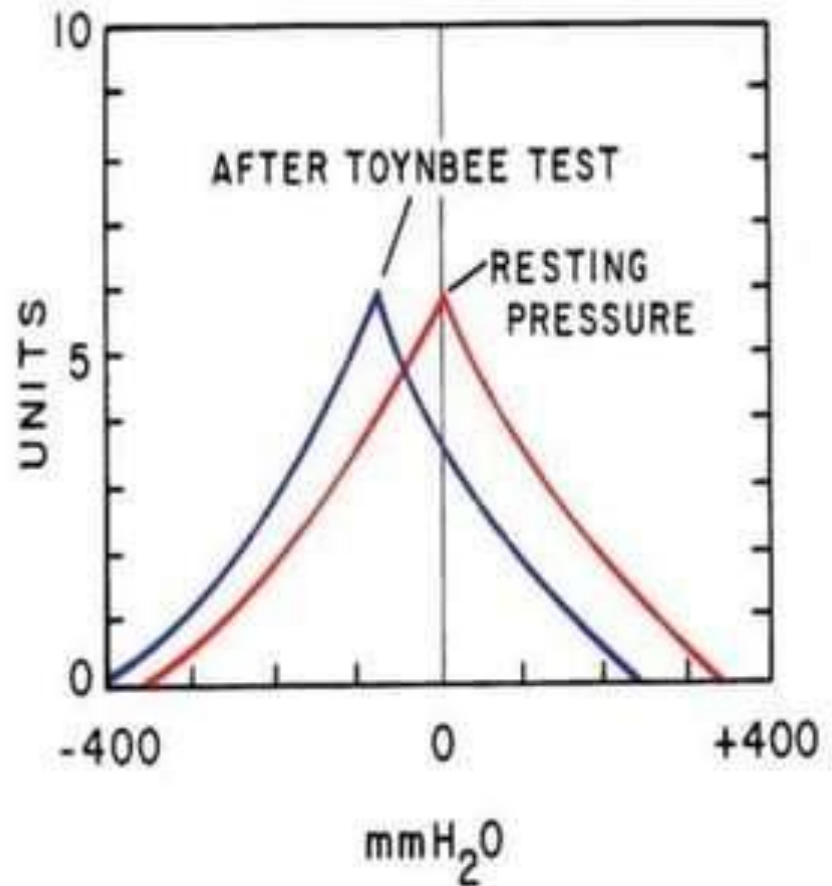




POSITIVE PHASE



NEGATIVE PHASE



Negative middle-ear pressure after the Toynbee test or only momentary negative middle-ear pressure followed by normal middle-ear gas pressure usually indicates good tubal function because it shows that the tube can open actively (the tensor veli palatini muscle contracts) and that the tubal structure is sufficiently stiff to withstand nasopharyngeal negative pressure.

Eustachian tube Catheterisation

Procedure

Nose is anaesthetised

ET catheter passed along the floor of nose till it reaches naso pharynx

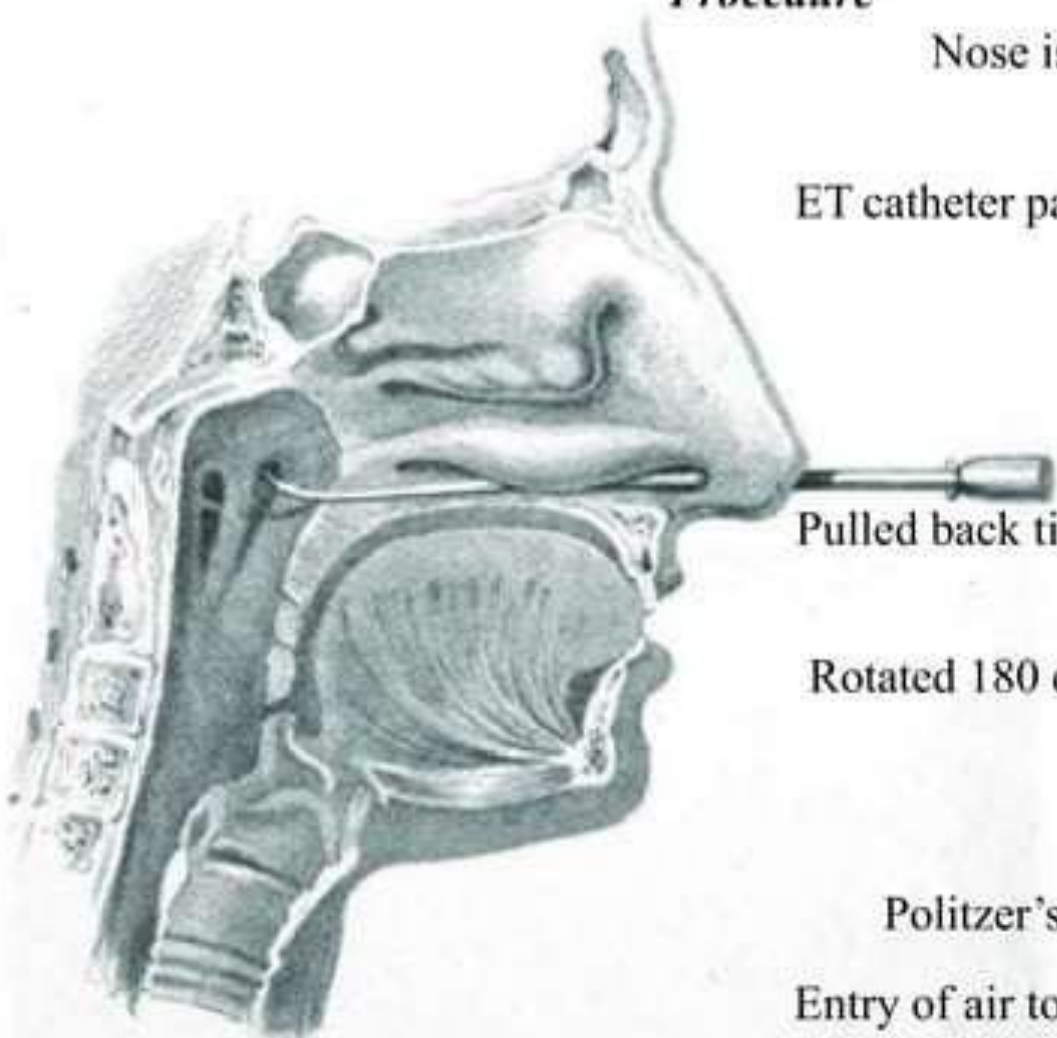
Rotated 90deg medially

Pulled back till posterior border of nasal septum engaged

Rotated 180 deg laterally – tip lies against tubular opening

Politzer's bag connected & Air insufflated

Entry of air to middle ear verified (*lateral bulging of t.m*)



Air pushed into E.T. catheter by squeezing Politzer bag.

Examiner hears by Toynbee auscultation tube put in pt's ear

Inference :-

- ✓ Blowing sound = normal E.T. patency
- ✓ Bubbling sound = middle ear fluid
- ✓ Whistling sound = partial E.T. obstruction
- ✓ No sound = complete obstruction of E.T.

Complications:

- Injury to Eustachian tube opening
- Bleeding from nose
- Transmission of nasal & nasopharyngeal infection into middle ear
- Rupture of atrophic area of tympanic membrane

- Tympanometry (inflation-deflation test)

- +Ve & -ve pressures are created in the external ear and the patient swallows repeatedly
- in patients with perforated or intact tympanic membrane



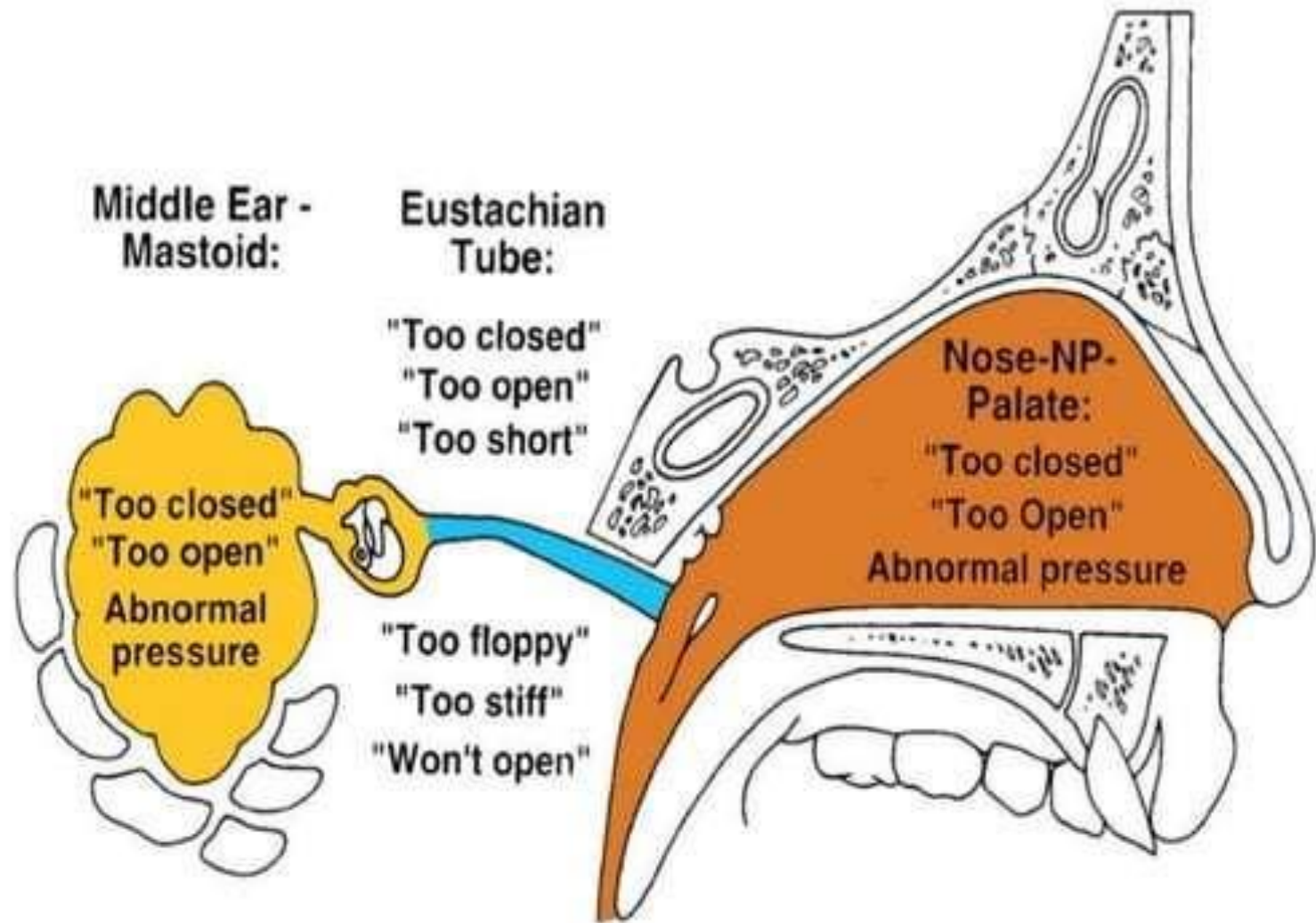
- Radiological Test

- Saccharine/ Methylene blue Test

- Saccharine solution
- Methylene blue dye
- Ear drops into ear with TM perforation

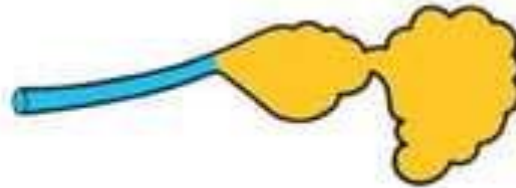
- Sonotubometry

DYSFUNCTION OF EUSTACHIAN TUBE SYSTEM



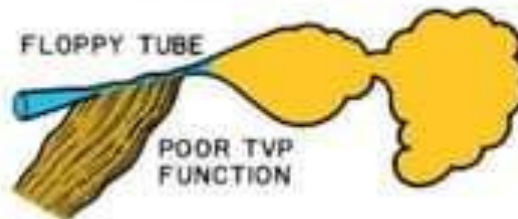
Pathophysiology

ABNORMAL PATENCY



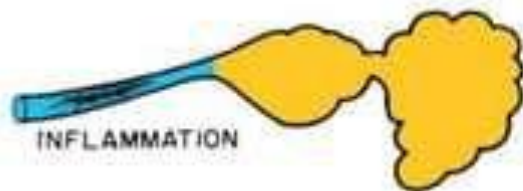
OBSTRUCTION:

FUNCTIONAL OBSTRUCTION:

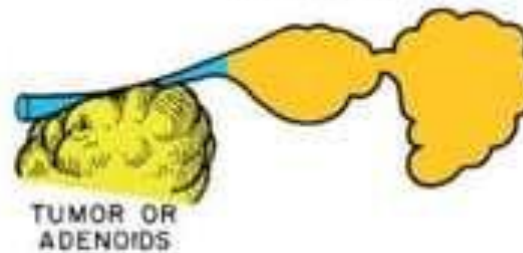


MECHANICAL OBSTRUCTION:

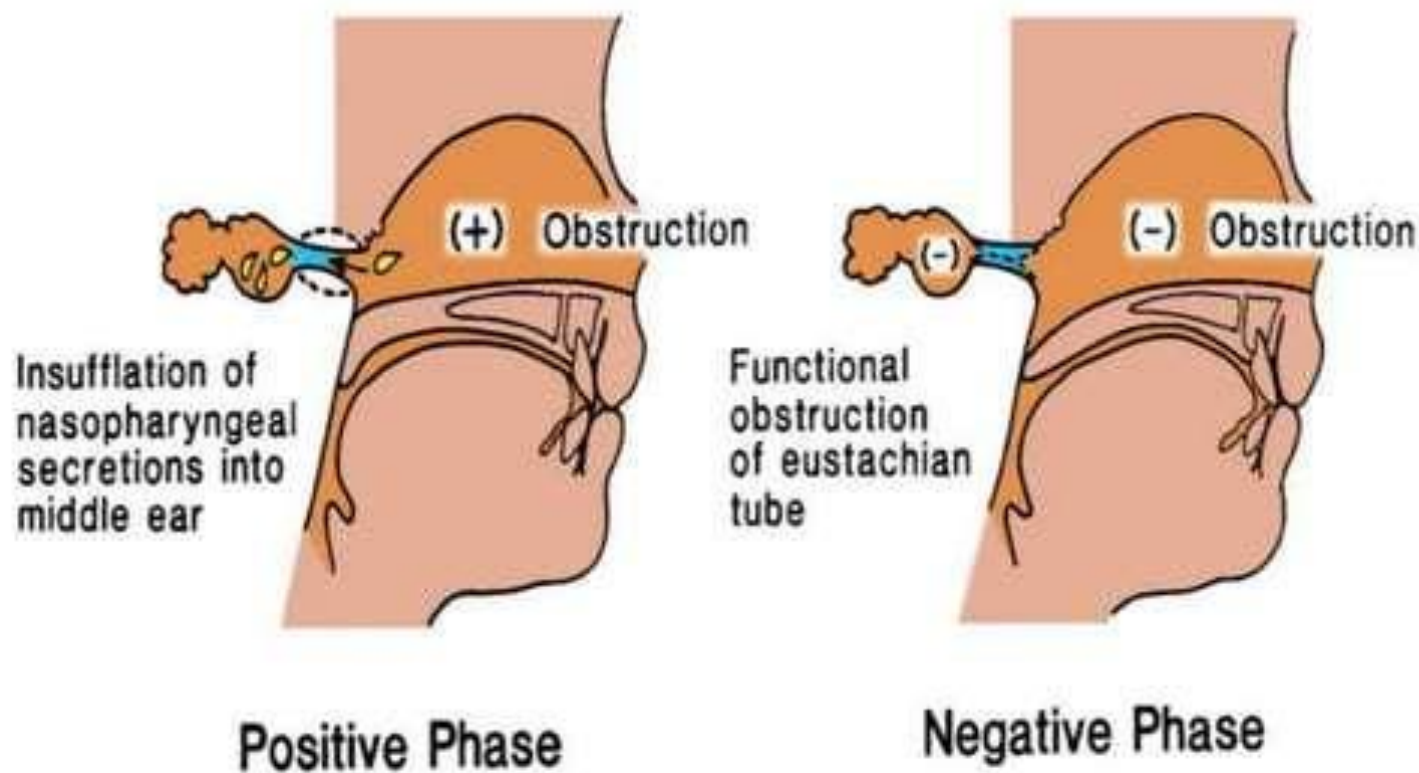
INTRINSIC



EXTRINSIC

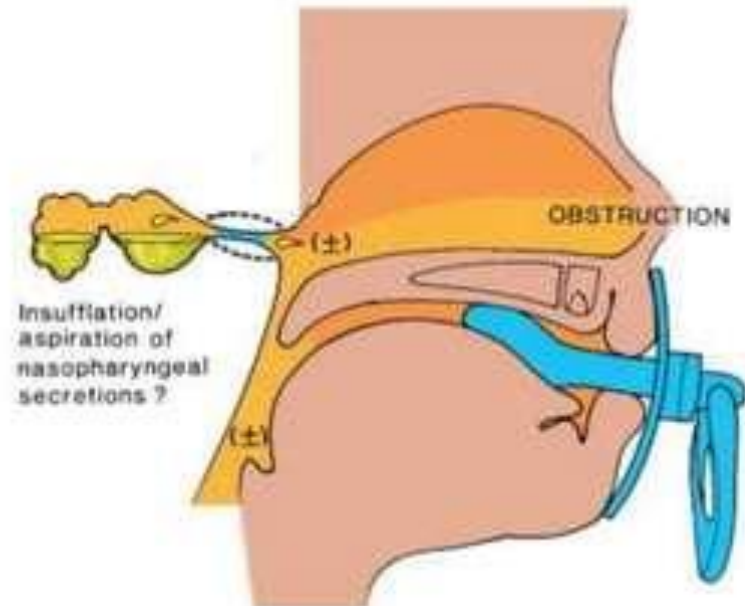


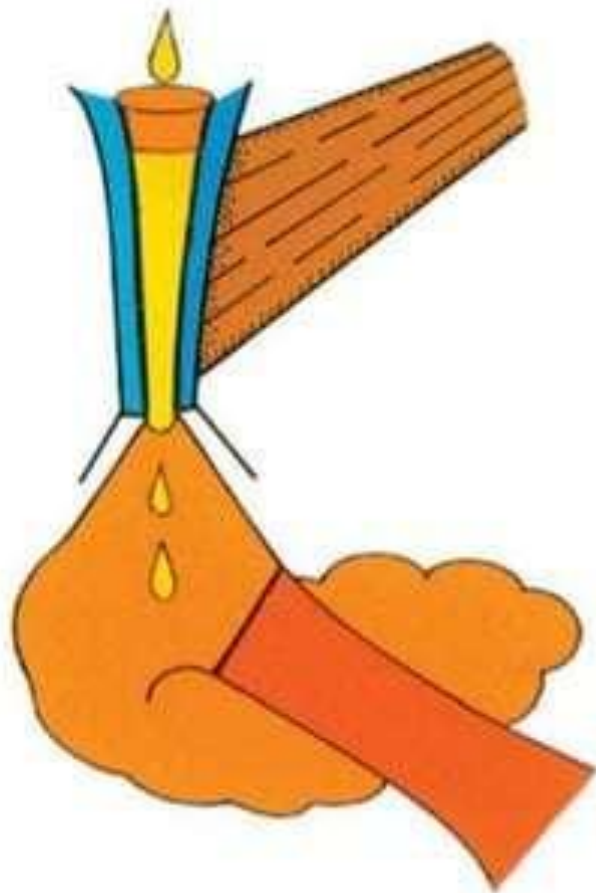
When the nose or nasopharynx is obstructed, unphysiologic pressures can develop in the nasopharynx and adversely affect the ET and middle ear, which is termed the *Toynbee phenomenon*.



Epidemiology / Causes of ET Dysfunction

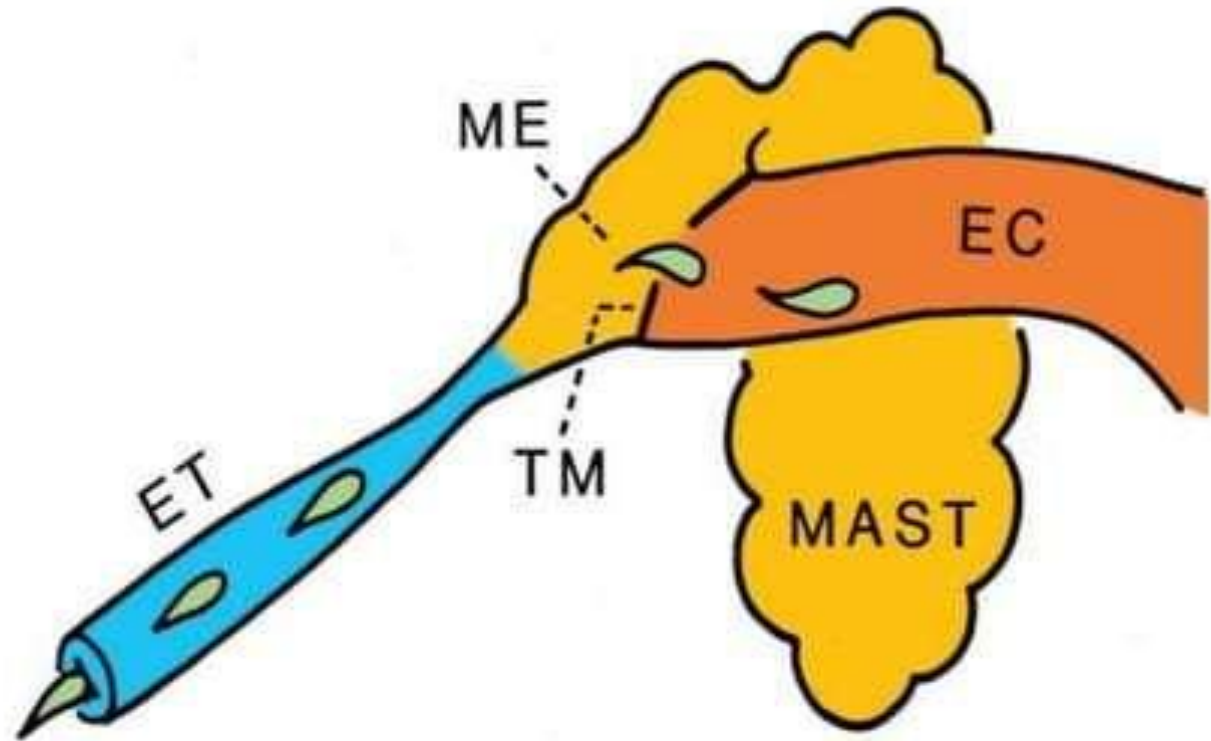
- Infants – short ET; immature immunity
- Genetic & ethnicity
- Craniofacial abnormalities – Downs; Cleft palate
- Risk factors for inflammation- Passive smoking; air pollution; pacifiers; sleeping position; gastroesophageal reflux; cystic fibrosis; adenoiditis
- Trauma – ET catheterisation; #maxilla
- Neoplasm in nose and nasopharynx
- Palatal paralysis



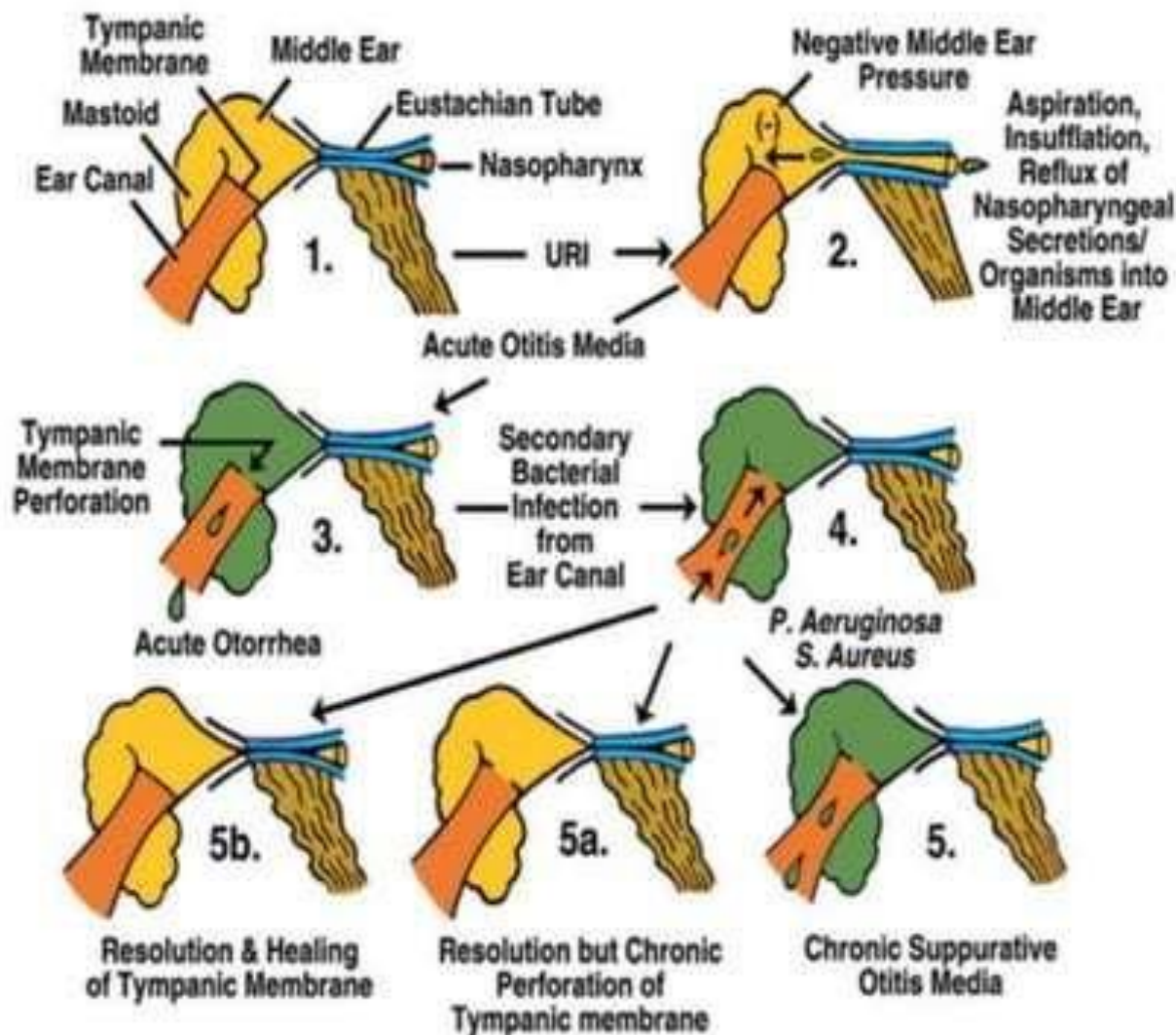


Reflux into middle ear (flask) when tubal lumen too wide.

Reflux of nasopharyngeal secretions through the ET into the middle ear (ME) and draining out into the external auditory canal (EC)

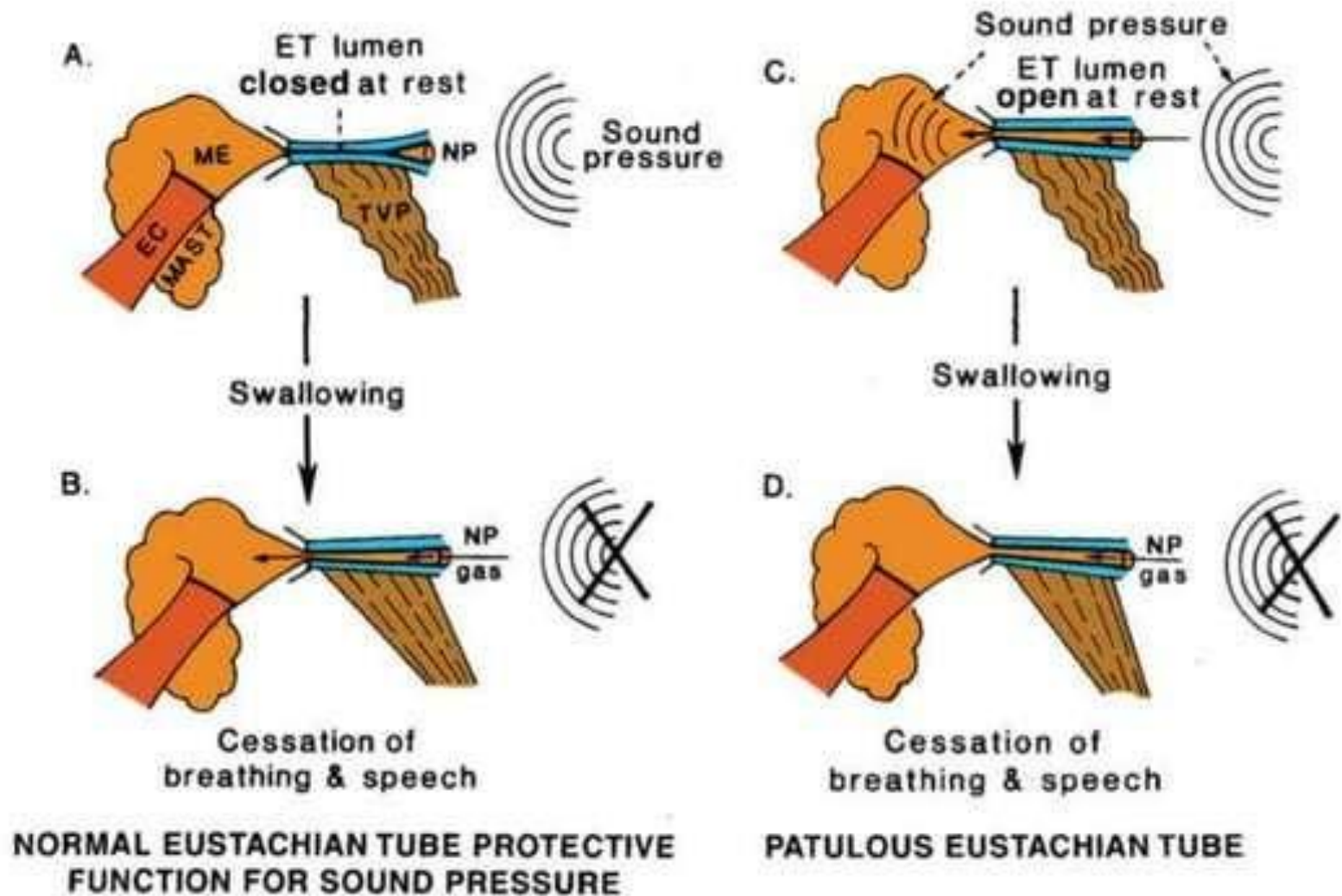


Sequelae of ET dysfunction



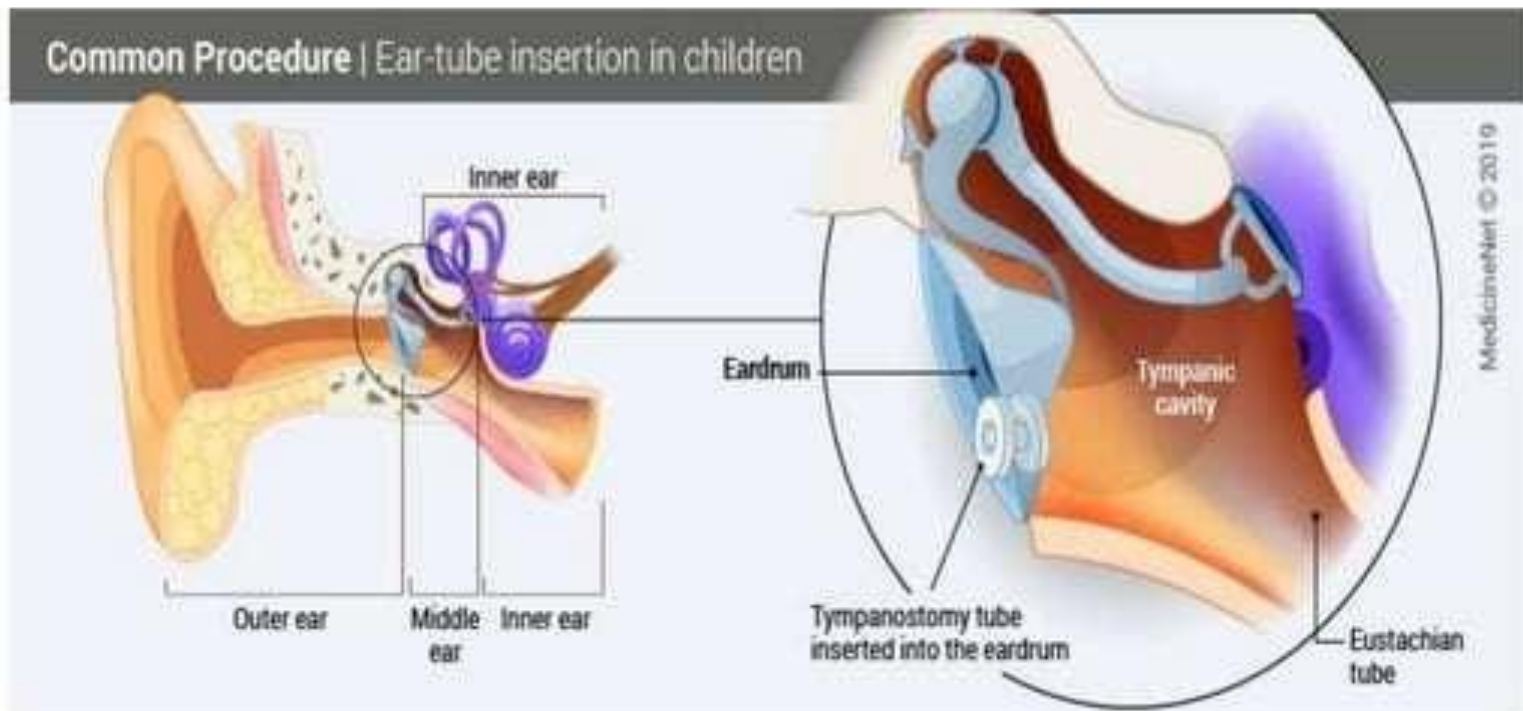
Patulous Eustachian Tube

- ET is abnormally patent
- Causes:
 - Idiopathic, rapid weight loss, pregnancy (esp 3rd trim) & multiple sclerosis
- Chief complaints
 - Autophony, hearing his own breath sounds
- Pressure changes in the nasopharynx are easily transmitted to the ME
- Movements of the TM can be seen with inspiration & expiration



The patulous tube is open even at rest, which allows pressure regulation of middle-ear pressure, but sound pressures are transmitted to the middle ear, causing autophony

- Management
 - Acute cases: Usually self-limiting
 - Weight gain & oral administration of KI
 - Topical decongestants
 - Long standing cases: insertion of grommet; PET reconstruction ; injection of Vox implants.



Thank you