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EAR : PART 1

----- Active space -----

Embryology & Anomalies

00:00:52

EMBRYOLOGY

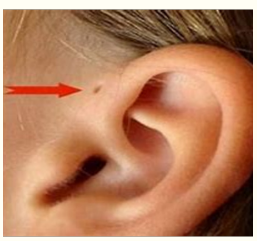
Structure	Origin	
Tragus, anterior helix	1st pharyngeal arch	Via Hillocks of HIS
Rest of the pinna	2nd pharyngeal arch	
External Auditory Canal (EAC)	1st pharyngeal cleft	
External Auditory Meatus (EAM)	1st pharyngeal arch	
Middle ear cleft : Middle ear cavity, mastoid antrum, eustachian tube	1st pharyngeal pouch/Tubotympanic recess	
Malleus, incus	1st pharyngeal arch	
Stapes suprastructure	2nd pharyngeal arch	
Stapes footplate	Otic capsule (Bony labyrinth)	
Tympanic membrane : 1. Outer layer (Epithelial) 2. Middle layer (Fibrous) 3. Inner layer (Mucosal)	All 3 germ layers : 1. Ectoderm 2. Mesoderm 3. Endoderm	
Mastoid : • Superficial • Deep	Temporal bone : • Squamous part • Petrous part	
Semicircular canals, utricle, utriculosaccular duct, endolymphatic sac	Pars superior	Otic capsule
Saccule & cochlea	Pars inferior	

Note : M/c congenital anomaly of middle ear → Fixation of stapes footplate.

ANOMALIES

Pinna :

1. Preauricular sinus :
   - Fusion defect of the auricular tubercle.
   - M/c site : Root of helix.
2. Microtia : Malformed/underdeveloped pinna.
3. Anotia : Absent pinna.



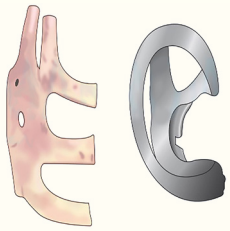
Preauricular sinus

Microtia

----- Active space -----

Management of Microtia/Anotia :

1. Pinna reconstruction :
   - AKA Otoplasty/Pinnaplasty.
   - Graft : Autologous costal (Rib) cartilage.
   - Age : >6 yrs (Costal cartilage is developed).


Pinna reconstruction


Pinna cartilage framework

2. Bone Anchored Hearing Aids (BAHA) :
   Indication : External ear deformities + Unable to afford Sx.

EAC :

1. Meatal atresia : Incomplete development of EAC.
   - Rx : Meatoplasty (Widening of cartilaginous part of EAC).
2. Collaural fistula : Persistent ventral part of 1st pharyngeal cleft.
   - Internal opening : Floor of EAC.
   - External opening : B/w angle of mandible & sternocleidomastoid.
   - Significance : Relation to facial nerve.
   - Mx in repeated infection : Excision of tract.


Collaural fistula

Mastoid & Inner Ear

00:08:14

Mastoid :

Structure	Significance
Korner's septum	• Persistent petrosquamosal suture. • Incomplete clearance of disease.
Mastoid antrum	• Largest air cell • Present at deep-petrous part. • Fully developed at birth.(Other mastoid air cells grow until 18 years).
Tip of mastoid	• Develops at 2 yrs of age. • Exposed facial nerve. • Postauricular incision <2 yrs : Superior & horizontal to prevent facial nerve injury.

Comparison of fetal and adult skull :

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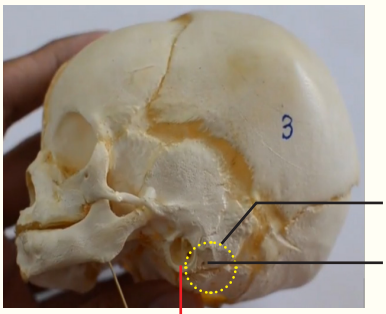
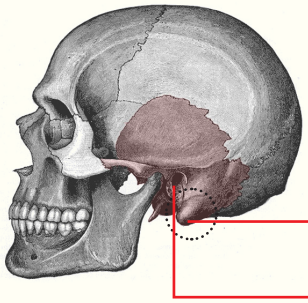




Inner Ear :

Parts : Membranous, bony labyrinth.

Anomalies :

Defect	Features
Scheibe aplasia	• Cochleosaccular dysplasia. • m/c congenital abnormality of inner ear.
Mondini aplasia	Cochlea has only 1.5 turns.
Alexander aplasia	• Defect in basal turn of cochlea. • High frequency hearing loss.
Michel aplasia	• Complete absence of bony and membranous labyrinth. • Absolute C/I for cochlear transplant.

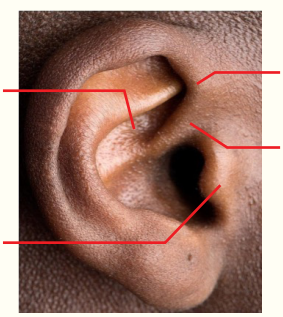
Note : Development of parts of ear

Parts completely developed at birth	Parts not developed at birth
• Middle ear • Inner ear : Organ of corti developed by 20–25 wks of gestation. • Mastoid antrum • Outer cartilagenous part of EAC	• Mastoid tip : 2 yrs • Bony EAC

Pinna

00:17:54

Anatomical Landmark :



----- Active space -----

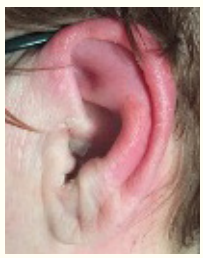
Diseases :

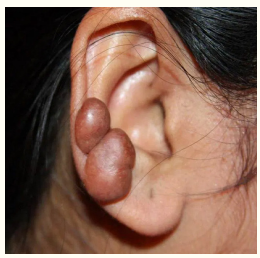
Cause : Skin (Lateral side of pinna) tightly adherent to perichondrium.

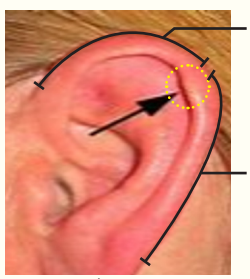
	Presentation	Mx
Hematoma (Organised hematoma AKA cauliflower ear)	Swelling lateral side of ear, h/o trauma ⊕	• Aspiration/drainage. • Contour dressing. • For cauliflower/boxer's/wrestler's/ pugilist's ear : Plastic Sx.
Perichondritis (m/c d/t Pseudomonas)	Red hot painful pinna, sparing lobule.	• Does not resolve spontaneously. • Antibiotics : Ciprofloxacin.
Keloid (Fibrous tissue formation)	H/o trauma, firm rubbery nodule on pinna.	• Intralesional steroids : 1st line of Mx. • Excision f/b post-op intralesional steroids/radiation to prevent recurrence.


Hematoma


Cauliflower ear


Perichondritis


Keloid



Darwin's tubercle
(Atavistic feature)

Anatomy of External Auditory Canal (EAC) 00:24:05

Total length of EAC : 24 mm.

Parts :

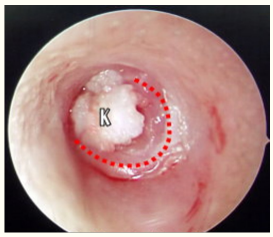
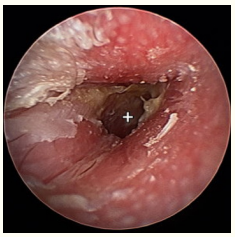
	Cartilaginous (Outer 1/3rd : 8 mm)	Bony (Inner 2/3rd : 16 mm)
Direction	Upwards, backwards, medially (Pulled to visualize TM)	Downwards, forwards, medially
Lining epithelium	Stratified squamous epithelium	
Skin	Thick skin	Thin skin
Skin appendages	Contains sweat, sebaceous, ceruminous (modified apocrine) gland.	Absent
Deficiency	Fissures of Santorini (Present throughout birth) : Spread to parotid gland	Fissures of Huschke (Close by 4 yrs of age) : Spread to base of skull

Isthmus
5-6 mm lateral to TM; Narrowest part of EAC → Foreign body impacted medial to isthmus → Difficult to remove

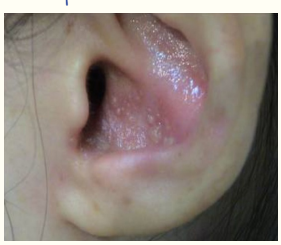
----- Active space -----

Condition of EAC

00:27:49

Conditions of EAC	Features		Mx
Impacted wax 	• Feeling of ear block • Pain ⊕		Aural syringing : • Temperature of water → Body temperature • Direction : Postero superiorly • C/I : TM perforation, removal of battery from ear
Keratosis obturans 	• Keratin collection (Laminar onion skin arrangement) • C/f : Severe otalgia; H/o chronic sinusitis, bronchiectasis • O/E : White mass + wax in deep meatus; Ulceration/granulation; EAC widening → Facial palsy.		Removal by instrumentation under anaesthesia
Furuncle 	• Etiology : m/c : Bacterial (Pseudomonas) > Fungal > Viral. • C/f : Pain ± Purulent discharge ± Blocked ear	• O/E : Localized swelling in cartilaginous part of EAC • m/c cause : Staphylococcus	Antibiotics : Amoxiclav
Diffuse otitis externa 		• O/E : Diffuse swelling • Itching → Abrasion • AKA Swimmer's/ tropical ear • Cause : Pseudomonas	Antibiotics : Ciprofloxacin

----- Active space -----

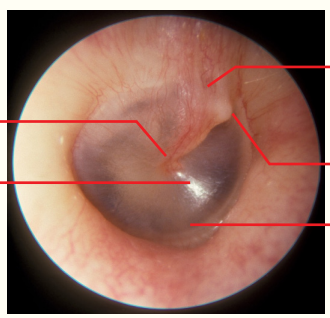
Conditions of EAC	Features	Mx
Malignant otitis externa  AKA Skull base osteomyelitis (D/t infection spread via fissure of Santorini)	• Seen in immunocompromised • m/c : Pseudomonas • C/f : Severe otalgia • O/E : Necrosis, granulations Complications : • 7th nerve palsy (m/c) • 9, 10, 11 CN : Affected late • Ix : Tc^{99} bone scan → ↑uptake	1. Antibiotics: • Oral : Ciprofloxacin • IV : Ceftazidime, cefoperazone, newer penicillins 2. Correct immunosuppression 3. Gallium-67, Indium-111, serial ESR to check resolution
Otomycosis 	• Aspergillus niger (m/c cause) > Candida ↓ ↓ • O/E : Wet newspaper appearance — Cotton ball appearance • C/f : Pain ± Discharge ± Blocked ear	Antifungal ear drops
Herpes zoster oticus 	• C/f : Pain ± Discharge ± Blocked ear • O/E : Vesicles in EAC • A/w facial nerve palsy → Called Ramsay Hunt syndrome (D/t herpes zoster reactivation in geniculate ganglion) • Other CN involved : 5th, 8th, 9th, 10th • Poor prognosis	Antivirals + steroids

Note :

Mucopurulent discharge : Disorder of middle ear.

Anatomy of Tympanic Membrane (TM)

00:38:43



Umbo

Cone of light (Anteroinferior quadrant)

Pars flaccida/Shrapnell's membrane
- Most mobile

Lateral process (Handle of malleus)

Pars tensa :
- Fixed to umbo & annulus
- Mobile part : Paramedian/periphery

Right TM

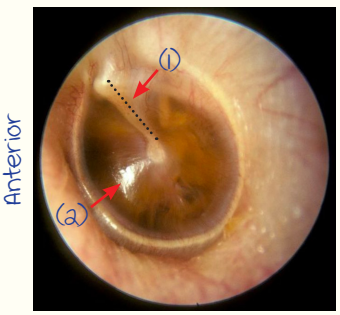
----- Active space -----

Characteristics :

- Colour : Pearly grey & translucent.
- Angle : 55° with horizontal.
- Effective vibratory area : 55 mm^2.
- Middle ear structures seen through tympanic membrane :
  - Incus.
  - Incudostapedial joint.
  - Shadow of round window.
  - Eustachian tube area (Anteriorly) : Very rarely.

Side Identification :

1. Upper end of malleus (If point to right, indicates right sided TM).
2. Cone of light : Antero-inferior quadrant.



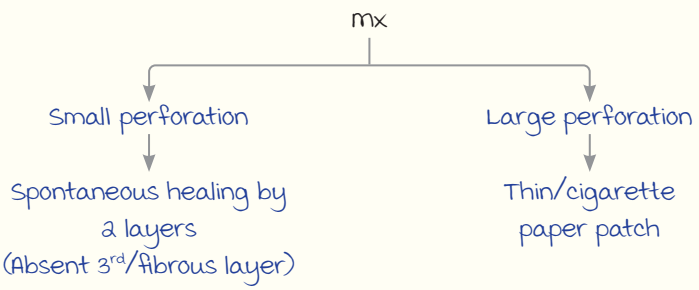
Left TM

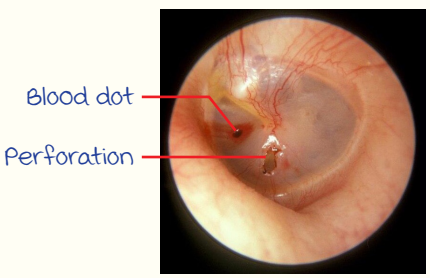
TM Perforation

00:43:00

Traumatic Perforation :

C/f : Pain, ↓hearing, ear bleed.

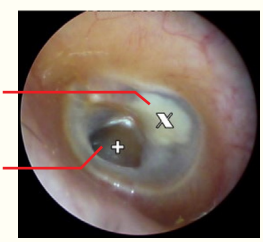




Tympanosclerosis :

- Chronic inflammation of ME (CSOM, SOM).
- TM perforation.

→ Calcification, Hyalinization


Tympanosclerosis

----- Active space -----

Anatomy of Middle Ear

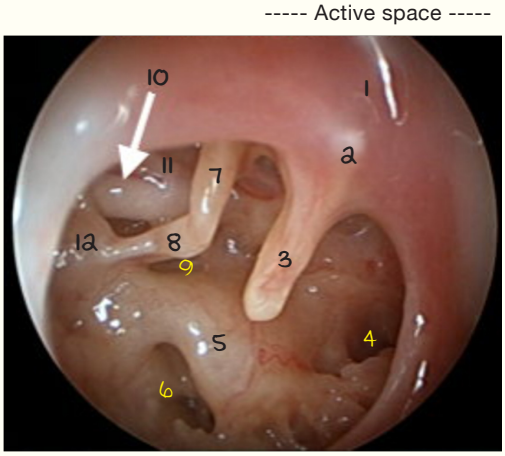
00:44:50

Walls :

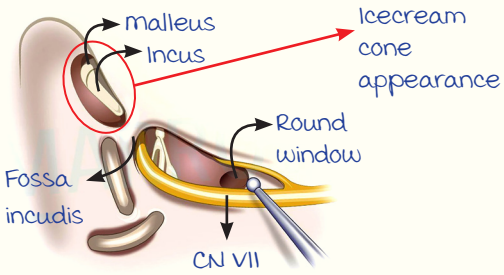
	Structures	Significance
Lateral	• Tympanic membrane : – Pars tensa – Pars flaccida • Scutum	-
Medial	Tympanic/Horizontal segment of facial nerve	m/c dehiscent segment of facial nerve
	Processus cochleariformis	• Landmark for 1st genu of facial nerve • Tensor tympani takes lateral turn to attach to upper end of malleus handle
	Oval window	Foot process of stapes present here
	Lateral semicircular canal bulge	• m/c semicircular canal eroded d/t infection/by cholesteatoma • Stimulated by caloric test
	Round window	Electrodes of cochlear implant & drug delivery
	Promontory	• Formed by basal turn of cochlea • Tympanic plexus lie over promontory : Formed by Jacobson's nerve (Branch of 9th CN) & sympathetic plexus around ICA
Posterior	Aditus	Superior most (Connecting middle ear to mastoid)
	Chorda tympani	Enters posterior wall → Exits from anterior wall
	Vertical/Mastoid segment of facial nerve	m/c site of facial nerve injury during mastoid Sx
	Fossa Incudis	Short process of incus present on fossa
	Facial recess/Supra-pyramidal recess	• Boundaries : Laterally → Chorda tympani; Medially → Vertical part of facial nerve; Superiorly → Fossa Incudis • Intact canal wall mastoid Sx & cochlear implant
	Sinus tympani/Infra-pyramidal recess	• Hidden area (B/w ponticulus superiorly & subiculum inferiorly) • m/c site for residual/recurrent cholesteatoma
	Pyramid	Stapedius arises (Attaches to neck of stapes)
Anterior/Carotid	Tensor tympani	Originates here —Attaches→ Upper end of malleus handle
	Chorda tympani	Exits through this wall → Called canal of Huguier
	Eustachian tube	Opening ⊕
	Close relation to internal carotid artery (Separated from anterior wall by thin bony plate → If ICA aneurysm/Anterior wall sx → ↑Risk of injury)	

Identification of structures :

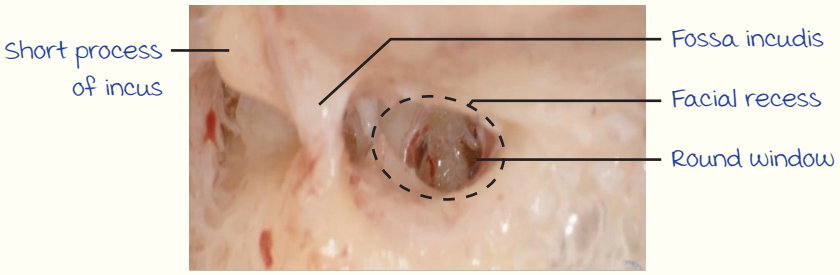
1. Pars flaccida.
2. Lateral process of malleus.
3. Handle of malleus.
4. Eustachian tube.
5. Promontory.
6. Round window.
7. Incus.
8. Incudostapedial joint.
9. Oval window.
10. Tympanic/Horizontal segment of facial nerve (m/c dehiscent).
11. Lateral SCC.
12. Pyramid.



Right TM



Facial recess



Facial recess

Floor & Roof :

	Structures related	Significance
Floor	Jugular bulb	Glomus jugulare (Project as red mass from floor)
	From floor : 9th Nerve branch → Jacobson's nerve	Forms tympanic plexus → Sensory supply to whole middle ear
	Cranial nerves : 9, 10, 11	-
Roof/ Tegmen tympani	Tegmen tympani : Separates middle ear from middle cranial fossa (Temporal lobe)	Chronic middle ear infections → Temporal lobe abscess
	Cog (Bone hanging anteriorly)	• Present above processus cochleariformis • Landmark for 1st genu of facial nerve

Eustachian Tube (ET) :

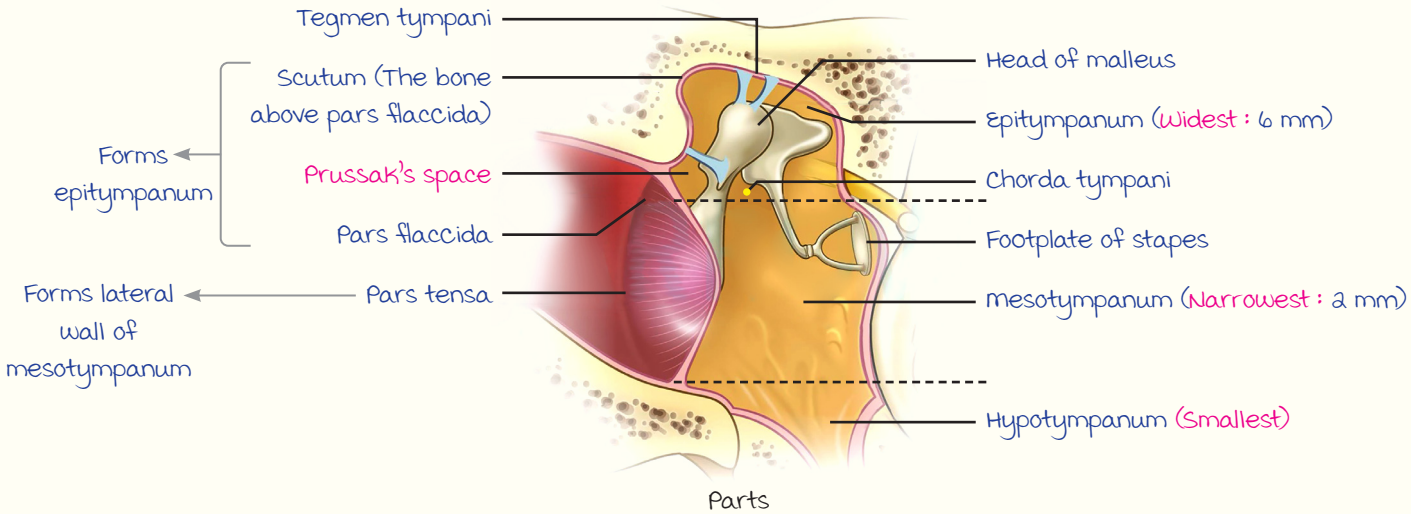
- Opens at nasopharyngeal opening (1 cm behind & below inferior turbinate).
- Surrounded by Ostmann pad of fat (Loss of fat → Autophony d/t patulous ET).
- Parts → Bone : Lateral 1/3rd (12 mm); Cartilage : Medial 2/3rd (24 mm) } At junction : Isthmus (Narrowest)
- Length → Adult : 36 mm (At 45° angle with horizontal); Children : 13–18 mm (Shorter, wider, horizontal, flaccid → ↑Infection)
- Tensor palati (Opens ET) : Cleft palate/palatoplasty → Improper ET function → Recurrent infections.

----- Active space -----

Middle Ear Cavity

01:06:51

Parts :



Parts

Sinus tympani is a part of retrotympanum.

Prussak's Sac :

Boundaries :

Laterally : Pars flaccida (Shrapnell's membrane).

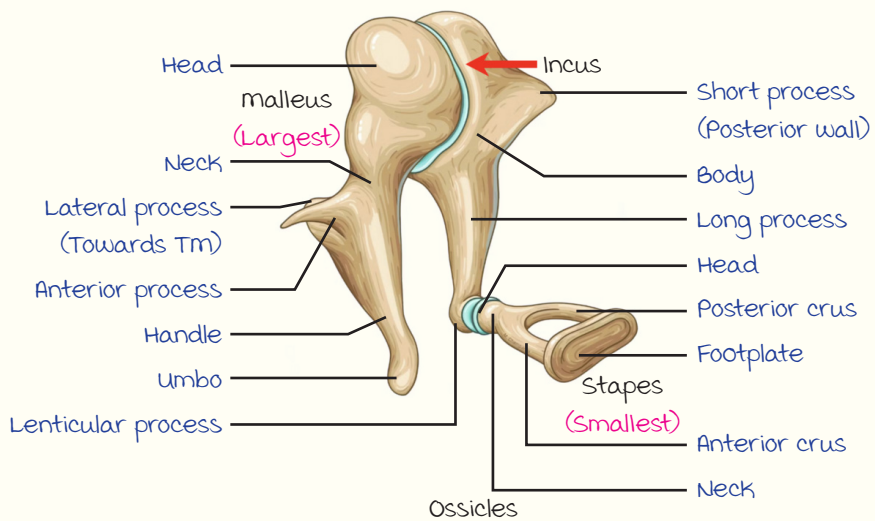
Medially : Neck of malleus.

Inferiorly : Lateral process of malleus.

Significance : m/c site for retraction pocket → 1° cholesteatoma.

Ear Ossicles

01:10:32



Joint	Type of synovial joint
Incudo malleolar	Saddle
Incudo stapedial	Ball & socket

Clinical significance :
Lenticular process > Long process of incus : m/c site of necrosis d/t otitis media.

EAR : PART 2

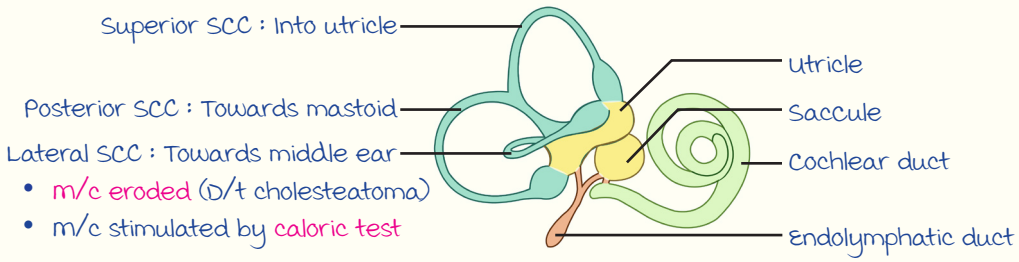
----- Active space -----

Anatomy of Inner Ear

00:01:05

Membranous Labyrinth :

- 3 semicircular canals —(5 openings)→ Utricle (Crus commune : Common opening for SSCC & PSCC).



- m/c eroded (D/t cholesteatoma)
- m/c stimulated by caloric test

- Utriculosaccular duct —(Endolymph absorption)→ Endolymphatic duct → Endolymphatic sac.

- Scala media/Cochlear duct : 2 1/2 around modiolus (Coiled).

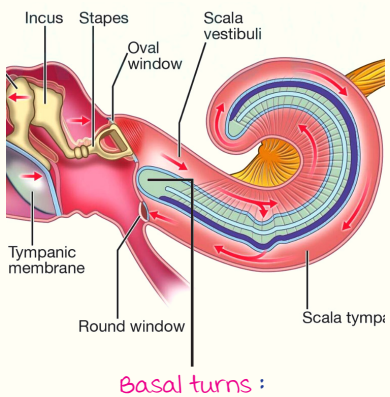
Location	Organ	Function	
SCC	Cristae	Rotational acceleration	
U & S	Maculae	Linear & gravitational acceleration & head tilt	
Scala media	Organ of Corti	Hearing	Basal : High frequency
			Apical : Low frequency

} Travelling wave theory

Bony Labyrinth :

- Bony semicircular canals (Around SCC).
- Vestibule :
  - Around utricle : Elliptical recess.
  - Around saccule : Spherical recess.
- Cochlea (Around scala media) :
  - Above : Oval window ↔ Scala vestibuli
  - Below : Round window ↔ Scala tympani

} Helicotrema (Apex)



Basal turns : Forms promontory (Near oval window)

Connections from inner ear :

- Round window : Covered by secondary tympanic membrane.
- Oval window : Related to footplate of stapes.

} To middle ear.

- Vestibular aqueduct : Around endolymphatic sac (Intradural).

----- Active space -----

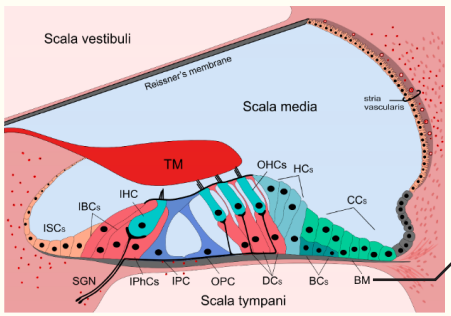
- Cochlear aqueduct :
  - Connect CSF & S. tympani.
  - Forms perilymph.
- Internal acoustic meatus (IAM) :
  Facial nerve, vestibulocochlear nerve

} To brain (Infections transmitted via these routes).

Organ of Corti

00:11:14

Features	Endolymph	Perilymph
Present in	Scala media	Scala vestibuli, scala tympani
Electrolyte concentration	High K^+ (Similar to ICF)	High Na^+ (Similar to ECF)
Secretion	Stria vascularis	From CSF



Basilar membrane

Organ of Corti

Hair Cells :

Inner hair cells :

- Single row, less number.
- Flask shape.
- Less prone to damage.
- Afferent (90–95%).
- Releases glutamate (Excitatory : Auditory stimulus).

Outer hair cells :

- 3–4 rows, more in number.
- Cylindrical.
- more prone to damage.
- Efferent (80%).
- Lips are in touch with tectorial membrane.

Supporting Cells :

Dieters, Claudius, Hensens.

Auditory Pathway

00:20:54

Mnemonic : SLIM.

Cochlear nerve (Spiral ganglion) → Cochlear nuclei → Superior olivary complex → Lateral lemniscus → Inferior colliculus → medial geniculate body → Auditory cortex (Area 41) (Superior temporal gyrus)

Cochlear nuclei → IAM

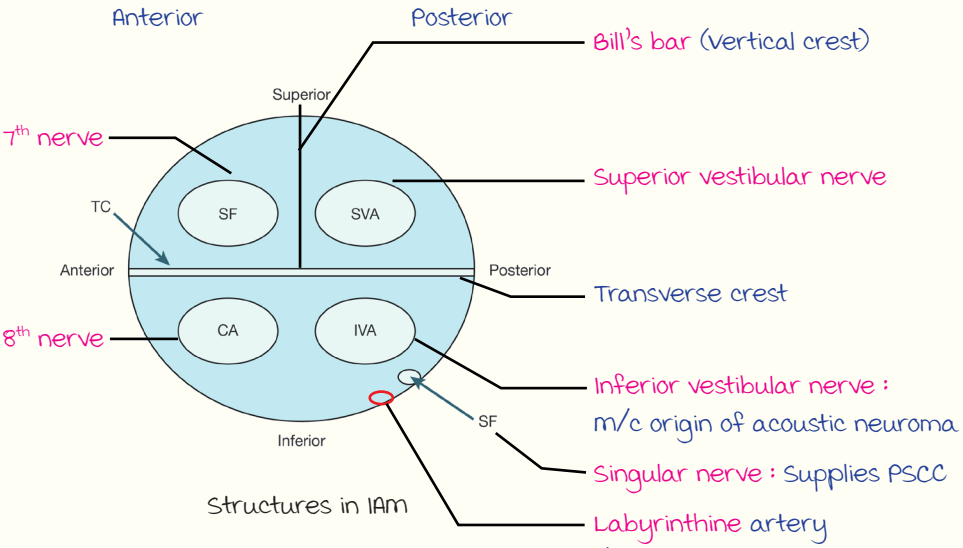
- Cross over : Through trapezoid body.
- Stapedial reflex (Facial nerve connection).
- 1st area of localization.

Internal Acoustic Meatus

00:23:45 ----- Active space -----

Location : Posterior slant of petrous temporal bone.

Structures passing through :



Structures in IAM

Structures in upper part
Structures in lower part

Note :

- m/c beingn tumor of CP angle : Acoustic neuroma.
- Posterior SCC : m/c cause of BPPV.

Mastoid Anatomy

00:27:14

Mastoid antrum : Deep part. (Largest mastoid air cell)

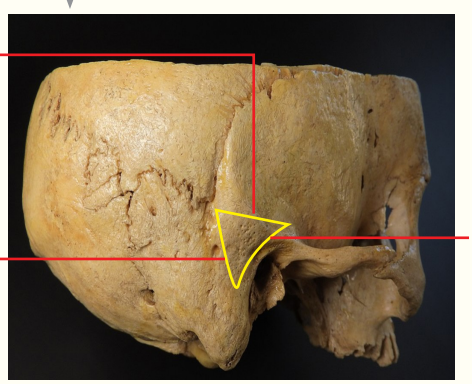
Bony landmark : Macewen's triangle, spine of Henle.
Cartliaginous landmark : Cymba concha.

Macewen's Triangle/Suprameatal Triangle :

- Drilled to reach mastoid antrum (Around 1.5cm).
- Beyond this can cause injuries.

Superiorly : Temporal line. (middle cranial fossa)

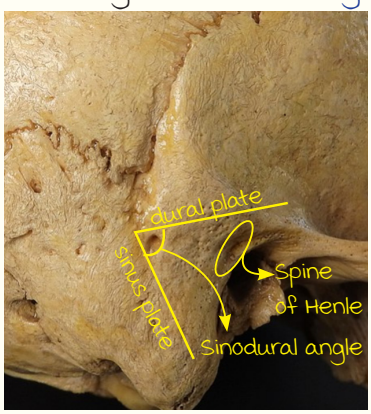
Inferiorly : Tangent b/w other 2 lines. (Sigmoid sinus)



Anteriorly : Posterosuperior border of bony EAC. (Facial nerve)

Macewens triangle

Citelli's angle : Sinodural angle.



Sinodural angle spine of Henle

----- Active space -----

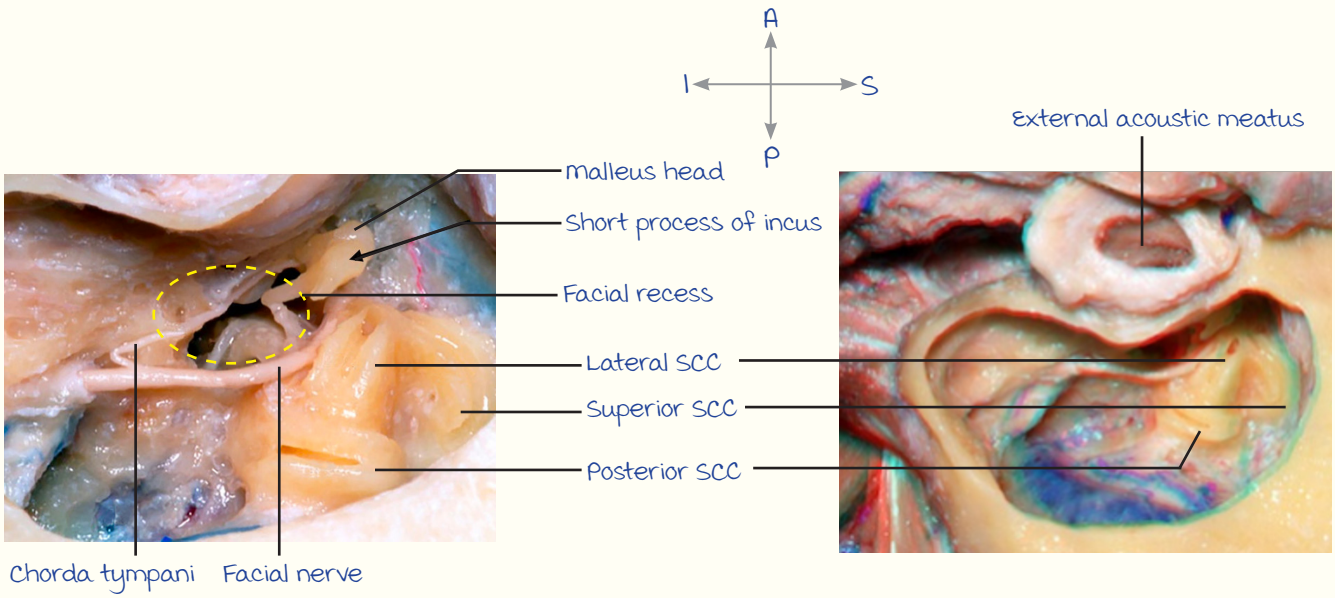
Note :

Komers's septum : Persistent petrosquamous suture (Inadequate drilling : 0.5 cm)

Posterior Cranial Fossa

00:30:06

Identification of structures :



Note :

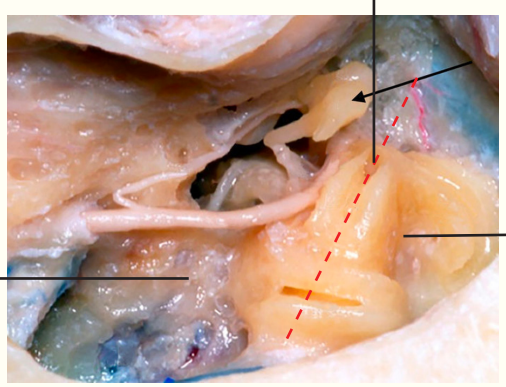
Posterior tympanotomy : Approach middle ear through facial recess.

Donaldson's line :

Through lateral SCC, bisecting posterior SCC

Inferior to it :

Approach to Endolymphatic sac



Superior to it :

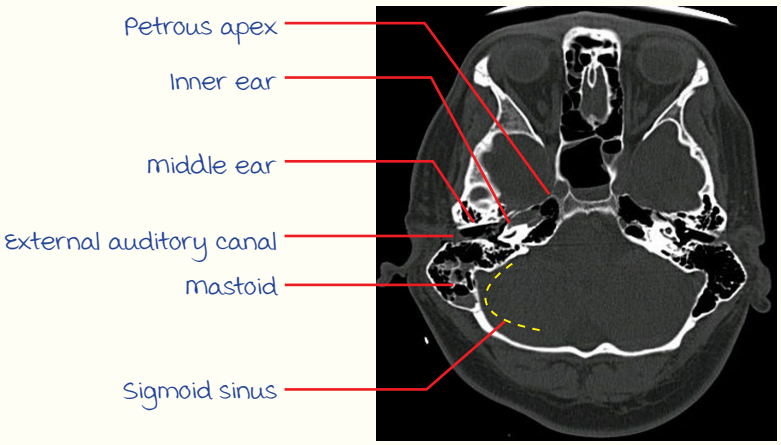
Trautmann's triangle : Approach to posterior cranial fossa.

- Superior : Superior petrosal sinus
- Posterior : Sigmoid sinus
- Anterior : Bony labyrinth

HRCT : Temporal Bone

00:35:34 ----- Active space -----

IOC for ear conditions.

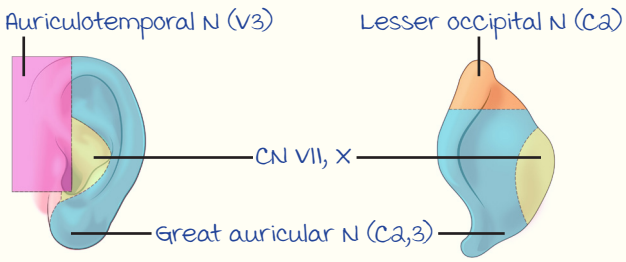


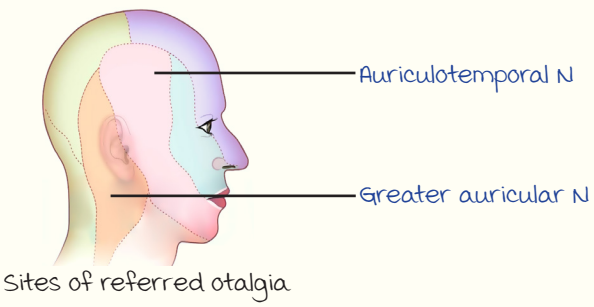
Nerve Supply of Ear

00:36:50

Nerve Supply of Pinna :

Mnemonic : GOAA-F.





Sites of referred otalgia

Referred Otalgia :

Nerve	Areas supplied		Referred otalgia
	Auricular	Extra auricular	
Auriculotemporal	• Anterior & superior EAC • Anterior & superior TM • Pinna, tragus	Anterior 2/3rd of the tongue	• Costen's syndrome : TMJ dysfunction • Dental, parotid infections & tumors
Greater Auricular (C2-C3)	• Pinna • Lobule	Angle of mandible, Temporomandibular joint	• Cervical degenerative conditions • Shaving area numbness • Parotid infections/tumors (Investing layer of deep cervical fascia stretch)
Facial	Parts of EAC	-	Hitzelberger sign : Hyperesthesia/anesthesia in posterior EAC, seen in acoustic neuroma
Arnold/Alderman's nerve (Auricular branch of X)	• Concha • Floor & posterior wall of EAC • Lateral wall of TM	• Larynx • Thyroid • Hypopharynx	• Larynx, hypopharynx, thyroid Ca • Cough while cleaning ear
Jacobson's nerve/ Tympanic plexus	Medial wall of TM	• Oropharynx • Soft palate • Tonsillar fossa • Base of tongue	• Acute tonsillitis • Peritonsillar abscess • Ca base of tongue/tonsils

----- Active space -----

EAR : PART 3

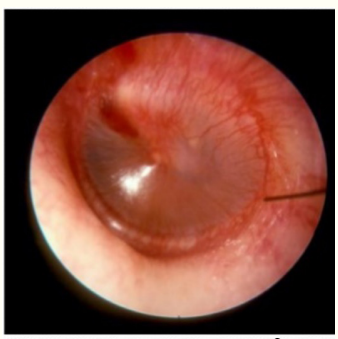
Acute Otitis Media vs. Bullous Myringitis

00:00:57

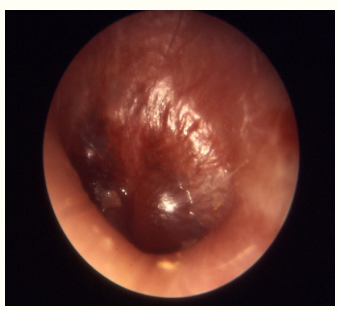
	Acute Otitis media (AOM)	Bullous myringitis
AKA	Acute serous otitis media	Myringitis bullosa/Otitis Externa Hemorrhagica
Etiology	• m/c organism : Pneumococcus • m/c route : Eustachian tube (ET)	• m/c : Pneumococcus • Others : Influenza virus, Mycoplasma pneumoniae
Features	• C/f : Acute otalgia, H/o URTI • Stages : – Tubal obstruction – Hyperemia/pre-suppuration ↓ Cartwheel appearance of TM – Suppuration → Light house sign (Pulsatile otorrhea) ; Maximum pain.	• C/f : Acute otalgia, H/o URTI • O/E : TM red, congested with bullae ↓ If Rupture ↓ Serosanguinous/hemorrhagic discharge
Mx	• Medical Mx : Antibiotics (1st line) • Sx : Myringotomy	Medical mx : Antibiotics

Myringotomy :

- J-shaped curvilinear incision :
  - Made in posteroinferior quadrant of TM.
  - C/I in posterosuperior quadrant of TM (↑Risk of injury to 7th CN + related structures).
- Indications :
  - Bulging TM.
  - Facial palsy, labyrinthitis.



Cartwheel appearance of TM



Bullous myringitis

Chronic Otitis Media

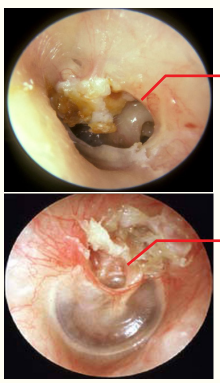
00:17:16 ----- Active space -----

AKA Chronic Suppurative Otitis media (CSOM).

TYPES

	Mucosal CSOM	Squamous CSOM
AKA	Tubotympanic/Safe CSOM	Atticoantral/Unsafe CSOM
TM abnormality (Permanent)	• Central perforation • Pars tensa involved, annulus spared • Non-healing in nature	• Marginal perforation/ Retraction pocket • Annulus eroded ↓ Cholesteatoma formation
Etiology	Trauma, ASOM >3 months : Repeated infections	-
Clinical features	• Profuse, mucoid/ mucopurulent, painless, non-foul smelling ear discharge (Active) • Hearing loss (Inactive)	• Scanty, purulent, foul-smelling, blood-tinged ear discharge + bony erosion • O/E : Granulations appearing as red, fleshy polyp (Never to be avulsed)
Mx	• Active disease : Medical mx • Inactive disease : Sx (mainstay)	Only surgical

Mucosal CSOM



Cholesteatoma : Squamous CSOM

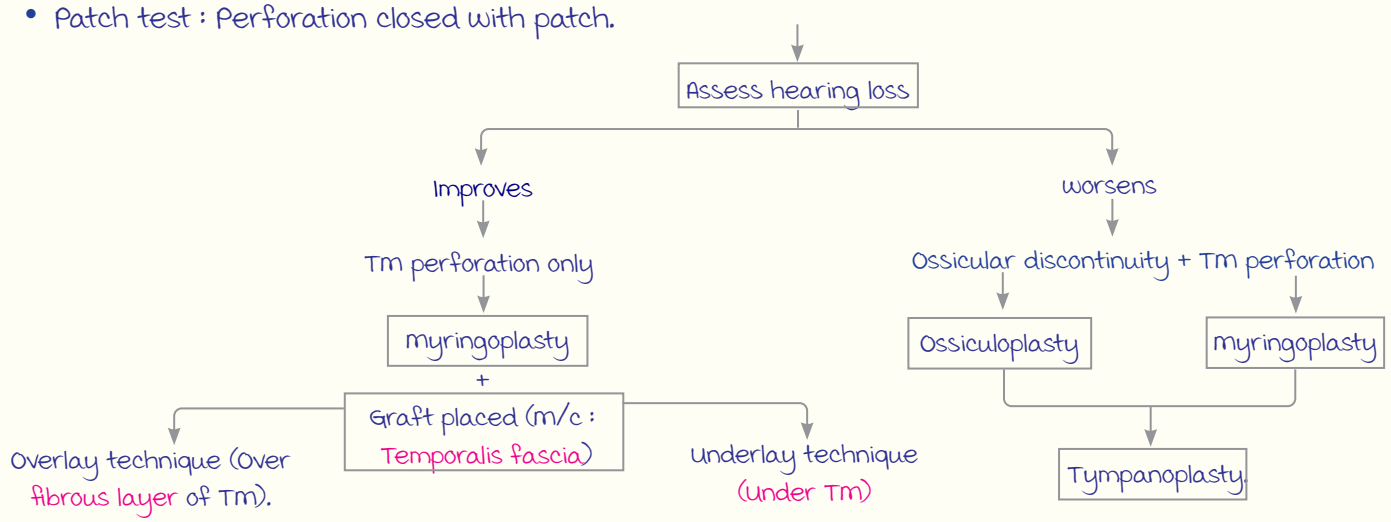
MANAGEMENT OF MUCOSAL CSOM

Treatment Protocol :

Medical Mx : Antibiotics (To make the ear dry) → Dry ear >6 weeks → Surgical Mx → Myringoplasty. / Tympanoplasty.

Pre-operative Assessment of Ossicular Status & Further Mx :

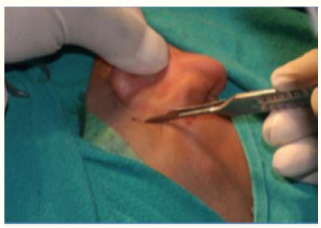
- Pure tone audiometry.
- Patch test : Perforation closed with patch.



----- Active space -----

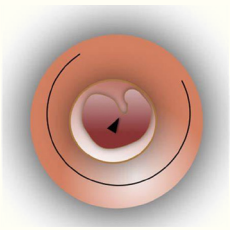
Note : m/c ossicle to undergo necrosis → Long/lenticular process of incus.

Tympanoplasty : Incisions & instruments used in tympanoplasty.

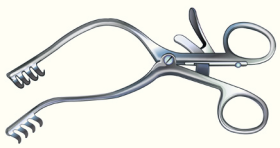


Wilde's postaural incision : (m/c)

Lempert's endaural incision



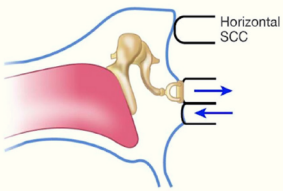
Rosen transcanal incision



Self retaining haemostatic mastoid retractor

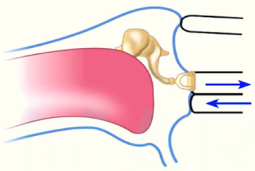
Wullstein Classification of tympanoplasty :

Type I



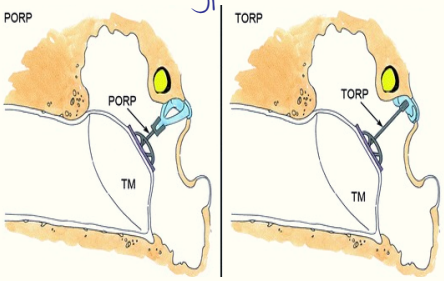
Myringoplasty : Malleus

Type II



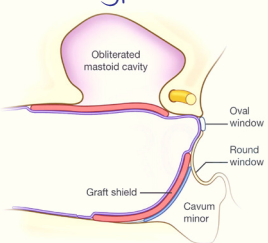
Myringoincudopexy : Incus

Type III



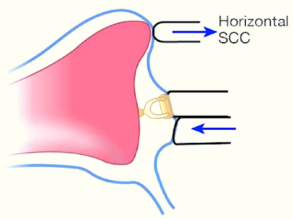
Columella tympanoplasty/myringostapedopexy : Stapes

Type IV



Cavum minor/round window shielding : Round window

Type V



Fenestration (Obsolete) : Fenestra over LSC (Fistula test ⊕)

Key :
- ● : Graft placement.
- PORP : Partial Ossicular Replacement Prosthesis.
- TORP : Total Ossicular Replacement Prosthesis.

In Type IV : Oval window exposed to maintain phase difference.

Austin's classification of ossicular abnormality :

Based on the presence of malleus handle (m) and stapes suprastructure (s) :

Type	Ossicular status
A	m ⊕, S ⊕
B	m ⊕, S ⊖
C	m ⊖, S ⊕
D	m ⊖, S ⊖

Kartush modification :

O : Intact ossicular chain, E : Ossicular head fixation, F : Stapes fixation.

Cholesteatoma

00:26:44 ----- Active space -----

TYPES

	Theory/criteria	Migration	m/c site
Congenital	Levenson's criteria	Congenital cell rests	Anterosuperior quadrant of middle ear
1° acquired	Wittmaack's invagination theory (m/c route)	Through retraction pocket	Pars flaccida/Prussak's space
2° acquired	Habermann's theory (m/c route)	• Through marginal perforation • m/c cause : Acute necrotizing otitis media (β-hemolytic streptococci)	Posterosuperior marginal of Pars tensa

MANAGEMENT

Surgical Mx (Mastoid Sx)
- Aims : Safe, dry & hearing ear.
- Pre-op Ix : PTA, HRCT temporal bone (Assess bone erosion).

Types of Mastoid Sx :

- Intact Canal Wall (ICW) Sx/Posterior tympanotomy/Combined approach tympanoplasty.
- Canal Wall Down (CWD) Sx
  - Radical mastoidectomy.
  - Modified Radical Mastoidectomy.

	Intact canal wall Sx	Canal wall down Sx
Disease in mastoid	Limited	Extensive
Procedure	Opening through facial recess	Complete common wall removed
Visualization during Sx	Limited	Good
Chorda tympani	Preserved	Sacrificed
Healing	Fast	Slow
Tolerance of water entry	Better	Worse (Avoid water entry)
Cavity problems	⊖	Collection of wax, debris ↓ Requires periodic cleaning
Hearing aid	Well tolerated	Problematic
Recurrence	↑↑ (Site : Sinus tympani)	↓

----- Active space -----

Types of canal wall down Sx :

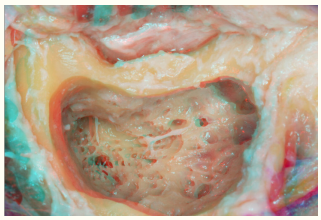
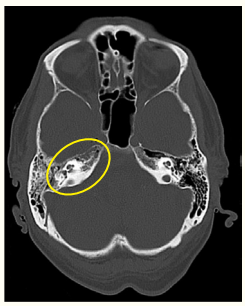
	Radical mastoidectomy	Modified radical mastoidectomy
Mastoid air cells	Removed	
Posterior bony EAC wall	Removed	
Extent of removal of middle ear (ME) structures	Only stapes footplate preserved	Healthy mucosa, TM, ossicles preserved
Eustachian tube	Closed	Not closed
Reconstruction of ME (Tympanoplasty)	Not done	Done
Indication	When disease left behind	Squamous OM with/without complications
Meatoplasty (EAC widening)	Done	

Complications of Otitis Media

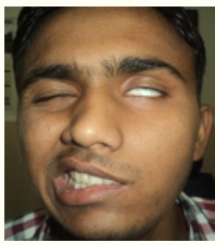
00:37:22

m/c following squamous CSOM > ASOM, mucosal CSOM.

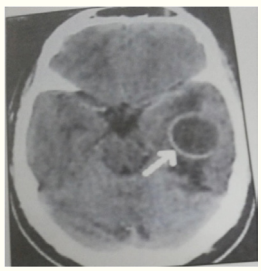
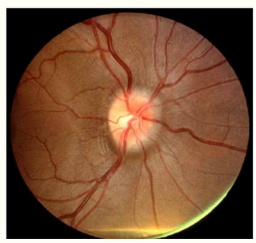
Intratemporal/Extracranial Complications :

Complication	Presentation	Mx	Images
Mastoiditis	• C/f : Fever, ear discharge, post-auricular oedema + tender. • O/E : – Post auricular : Ironed out mastoid. – EAC : Reservoir sign, sagging of posterosuperior meatal wall. • Abscess following mastoiditis : – Postauricular (m/c) – Bezold abscess (Relation to sternocleidomastoid) – Citelli abscess (Relation to posterior belly of digastric/ occipital region) – Luc's abscess (Relation to posterior wall of EAC)	Medical Mx (IV Antibiotics) ↓ No response in 48 hours Surgical Mx (Simple/ Cortical/Schwartze Mastoidectomy)	 Mastoiditis  Mastoidectomy
Petrositis	Gradenigo triad : Retro-orbital pain (5th CN) + Diplopia (6th CN) + Ear discharge	IV Antibiotics + Modified Radical Mastoidectomy (MRM)	 HRCT : Petrositis

----- Active space -----

Complication	Presentation	Mx	Images
Facial nerve palsy	• Features of otitis media + facial deviation to normal side • Route in : – ASOM : Dehiscence – CSOM : Erosion of fallopian canal	• In ASOM : myringotomy + IV antibiotics • In CSOM : MRM + facial decompression	
Others : Labyrinthitis (Presents as vertigo)			

Intracranial Complications :

Complication	Presentation	Mx	Images
Temporal lobe abscess (m/c brain abscess following otitis media)	Features of OM + headache, nominal aphasia/homonymous supra quadrantanopia/seizures/ C/L hemiparesis	• CT/MRI : Ring enhancing lesion • IV antibiotics • Abscess drainage ↓ Patient stabilizes MRM.	
Sigmoid sinus/ lateral sinus thrombosis	• Features of OM + picket fence/hectic fever • Griesinger's sign (Tenderness + edema over mastoid) : Mastoid emissary vein thrombosis • Internal jugular vein (IJV) thrombosis : On compressing Ⓝ IJV → ↑ICT → – Tobey Ayer/Queckenstedt's test ⊕ – Crow beck sign ⊕	• CT/MRI ↓ Delta/empty triangle sign • IV antibiotics + MRM	 Papilledema (Crowbeck sign)
Other complications : Meningitis (m/c intracranial complication), extradural abscess, subdural abscess, cerebellar abscess			

Tubercular Otitis Media

00:49:20

Clinical features	Mx
• Symptoms : – Painless, foul-smelling ear discharge. – Hearing loss (Out of proportion to symptoms) • O/E : – Multiple TM perforations. – Pale granulation tissue. • Complication : Facial nerve palsy.	• Biopsy. • Antitubercular Rx. • Sx debridement (If needed) : Removal of sequestrum. • Middle ear reconstruction. (Only once TB free)

Tubercular otitis media

----- Active space -----

EAR : PART 4

Auditory Localisation & Functions Of Middle Ear

00:01:50

Localisation :

Pathway	Structures	Defect
Conductive pathway	Pinna → Footplate of stapes	Conductive Hearing Loss
Sensorineural/ Cochlear pathway	Organ of Corti → Auditory cortex (Superior temporal gyrus)	Sensory (Cochlea) hearing loss or Neural/Retrocochlear hearing loss

Functions Of middle Ear :

1. Transformer action/Impedance matching :

   a. Areal/Hydraulic ratio : $\frac{\text{Vibratory area of TM (55 mm}^2\text{)}}{\text{Area of foot plate}} = 17 : 1$

   b. Lever ratio : 1.3 : 1

   } Total transformer ratio : 17 × 1.3 = 22

2. Curved membrane effect/Catenary lever :
   - Peripheral TM : more mobile
   - Central TM : Less mobile

   } 2x amplification of sound.

3. Phase difference :
   - Function : Prevents sound cancellation & hearing loss.
   - Significance :
     Exposure of both windows → Loss of phase difference → Maximum CHL.

Tuning Fork Tests

00:07:16

Frequencies used : 512 Hz > 256 Hz, 1024 Hz

Note :
- Hearing range : 20–20,000 Hz.
- Speech frequencies : 500, 1000, 2000 Hz.

----- Active space -----

Rinne's Test :

Inference	Interpretation	Conditions
Rinne's true ⊕	AC > BC	• Normal • SNHL
Rinne's true ⊖	BC > AC	CHL
Rinne's false ⊖	BC > AC	Severe SNHL (>70 dB loss)

Significance : Helps determine degree of CHL.

Rinne's test at different frequencies			Degree of CHL
256 Hz	512 Hz	1024 Hz	
–	+	+	20–30 dB
–	–	+	30–45 dB
–	–	–	45–60 dB

Minimum CHL for negative Rinne's : 15–20 dB.

Maximum CHL : 60 dB.

Weber's Test :

Significance : Differentiate b/w CHL & severe SNHL.

Lateralization : Weber lateralizes when minimum 5 dB difference b/w both ears ⊕.

Mnemonic : SOCS

- SNHL → Lateralizes to better ear (Opposite side of disease).
- CHL → Lateralizes to diseased ear (Same side of disease).

Absolute Bone Conduction Test (ABC) :

Assesses only bone conduction (Sensorineural pathway) by occluding tragus.

Inference :

- Same as examiner :
  - Normal
  - CHL
- ↓/Shortened :
  - SNHL

Schwabach Test :

Assesses both conductive & sensorineural pathway (Tragus not occluded).

Inference
- ↑/Lengthened → CHL
- ↓/Shortened → SNHL

----- Active space -----

Gelle's Test :

Significance : Assesses change in hearing with change in EAC pressure.

Inference
- Gelle's +ve : Normal/SNHL.
- Gelle's -ve (No change) : Otosclerosis.

Bing's Test :

Significance : Assesses change in hearing on pressing & releasing tragus.

Inference
- Bing's +ve : Normal/SNHL.
- Bing's -ve : CHL.

Pure Tone Audiometry

00:31:45

Subjective test.

Uses :

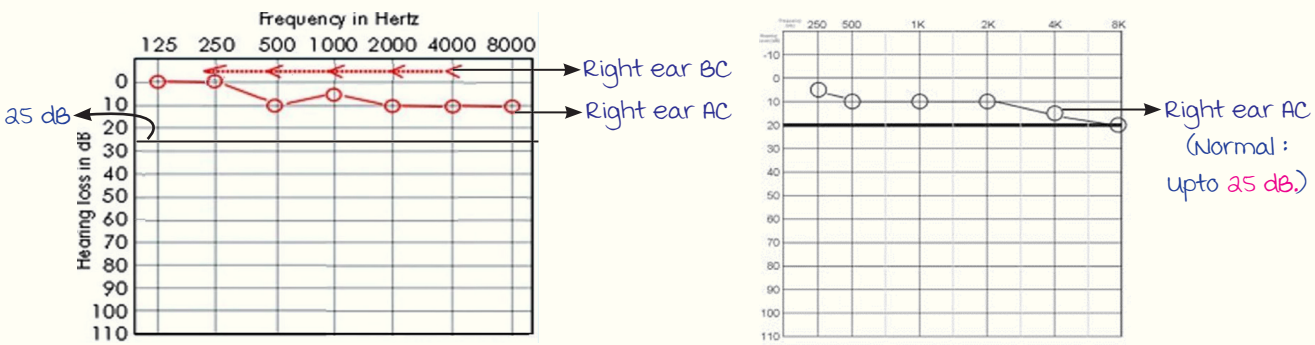
- Confirmatory test of CHL/SNHL.
- Determines degree of hearing loss.

AUDIOGRAM

Symbols :

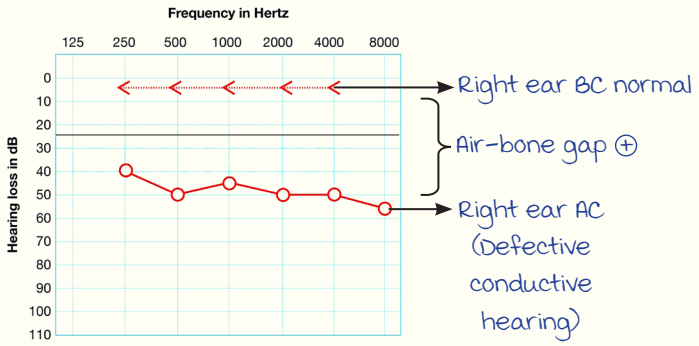
	Right ear	Left ear
Colour	Red	Blue
AC unmasked	○	×
AC masked	Δ	□
BC unmasked	<	>
BC masked	[	]
No response	↙○	×↘

Interpretation :

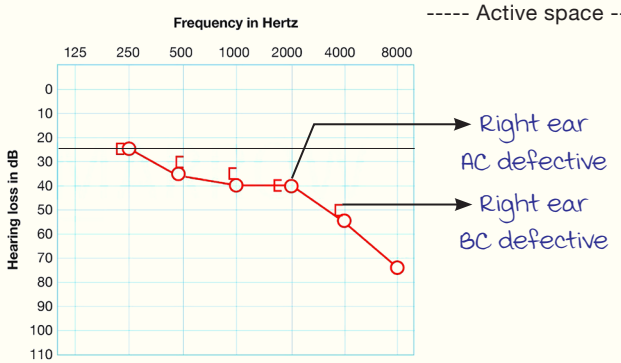


1. Normal PTA : Right ear

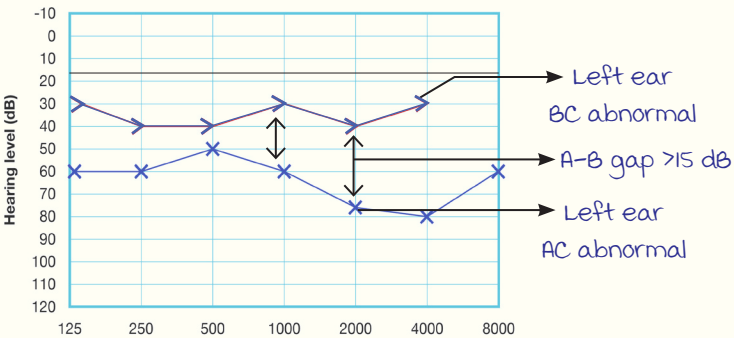
----- Active space -----



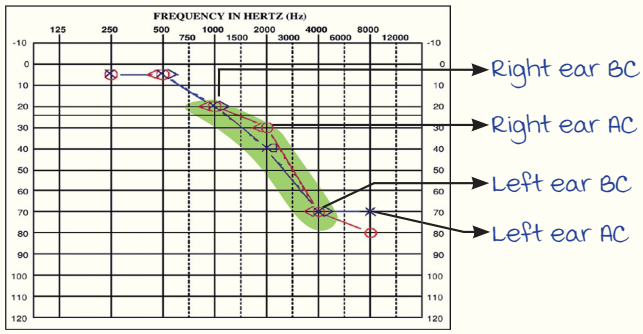
2. Right CHL



3. Right SNHL (No AB gap)



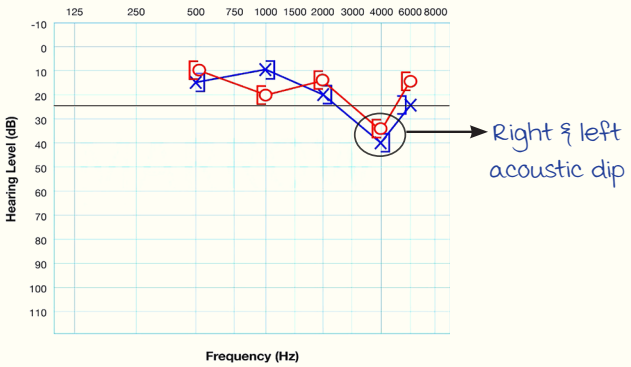
4. Mixed hearing loss



5. High frequency SNHL

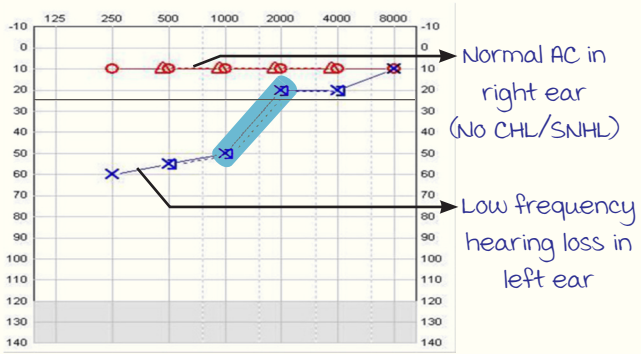
→ Downsloping audiogram :

1. Noise induced hearing loss.
2. Ototoxicity
3. Presbycusis



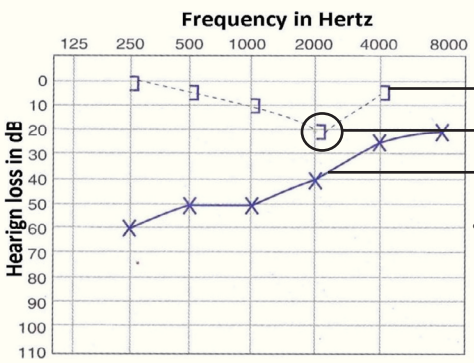
6. Noise induced HL

Acoustic dip : Dip in AC & BC at 4000Hz (Earliest feature)



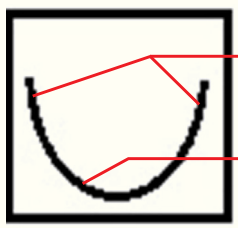
7. Left low frequency SNHL

→ Upsloping audiogram :
Seen in Meniere's disease.



8. Left CHL with Carhart's notch :

- Carhart's notch : Dip in BC curve at 2000 Hz.
- Seen in Otosclerosis.



9. Mid frequency HL

----- Active space -----

Classification Of Hearing Loss

00:48:37

a. WHO Classification :

	Degree of hearing loss	Pure tone average (dB)
0	None	≤25
1	Slight	26–40
2	Moderate	41–60
3	Severe	61–80
4	Profound, including deafness	≥81

b. ASHA Classification :

Pure tone average range in dB	Degree of hearing loss	
-10 to 25	Normal hearing sensitivity	
26 to 40	Mild	
41 to 55	Moderate	
56 to 70	Moderately severe	
71 to 90	Severe	Indication for cochlear implant
>91	Profound	

WHO Grading Of Disability :

Grade of impairment	Audiometric iso value	Disability
0 : None	25 dB or better	Able to hear whispers
1 : Slight	26–40 dB	Able to hear words spoken in normal voice at 1 metre
2 : Moderate	41–60 dB	Able to hear words using raised voice at 1 metre
3 : Severe	61–80 dB	Able to hear words when shouted
4 : Profound	≥81 dB	Unable to hear words even when shouted

Note : Threshold frequencies

- 30 dB : Whisper.
- 60 dB : Normal conversation.
- 90 dB : Shout.

Degree Of HL In Different Conditions :

Condition	Degree of HL
Complete obstruction of EAC	40 dB
Protection provided by earplug/headphones	
TM perforation	10–40 dB
TM perforation with ossicular discontinuity	40 dB
Ossicular discontinuity with intact TM	55 dB
Complete fixation of stapes footplate	60 dB

Impedance Audiometry

00:51:38

Objective test of hearing done using 226, 220 Hz frequencies.

Indication : Defect is middle ear (CHL + Intact TM).

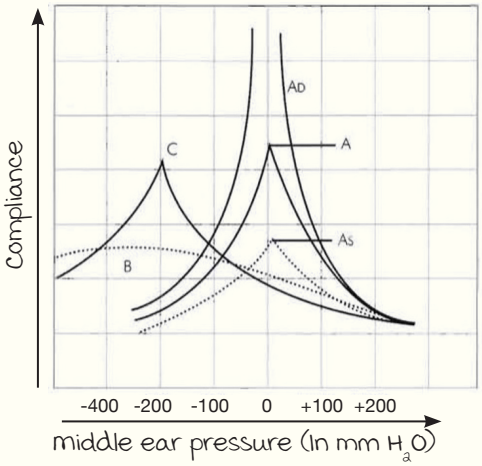
Component → Tympanometry
Component → Stapedial reflex

Impedance audiometry devices

TYMPANOMETRY

Best investigation to assess ET function.

Compliance ∝ Ease of mobility of TM



----- Active space -----

Types Of Tympanogram Curves :

Type of curve	middle ear pressure	Compliance	Diagnosis
A	Normal	Normal	Normal middle ear
A_S (Sclerosis)	Normal	↓	Otosclerosis, tympanosclerosis
A_D (Discontinuity)	Normal	↑	Ossicular discontinuity
B (Dome curve)	↓	↓	SOM
C	↓	Normal	Early eustachion tube obstruction
Flat	-	-	Perforation of TM, later stages of SOM

STAPEDIAL REFLEX

Protective mechanism of inner ear against noise trauma.

Pathway :

- Afferent : I/L 8th nerve.
- Centre : Superior olivary complex.
- Efferent : B/L 7th nerve (B/L reflex).

Significance :

Stapedial reflex	Significance
Normal	Completely normal hearing pathway Hence, can be used to detect malingering.
Absent B/L	• Conductive hearing loss (Otosclerosis, SOM). • Ipsilateral VIIIth nerve palsy.
Absent U/L	Ipsilateral VIIth nerve palsy.
↓Threshold (Present at <70 dB)	Sensory/Cochlear hearing loss (↓Threshold d/t loss of fine tuning of loudness → Abnormal ↑ of loud sounds : Recruitment).
Decay (Present only briefly)	Neural/neurocochlear hearing loss.

Note : Best test for malingering → BERA.

----- Active space -----

EAR : PART 5

Brainstem Evoked Response Audiometry (BERA) 00:00:55

AKA Auditory brainstem response.

Objective test.

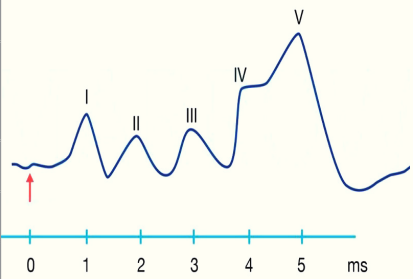
BERA

Latency Response :

Duration	Response	Assessed by
Sound stimulus ⟶ 10 ms	Short latency	BERA
12 ms ⟶ 50 ms	middle latency	-
50 ms ⟶ 500 ms	Late latency	CERA

Interpretation :

Waveform	Corresponding part of auditory pathway being tested
Wave I	Distal part of VIII nerve (Towards inner ear)
wave II	Proximal part of VIII nerve (Towards brainstem)
Wave III	Cochlear nuclei
Wave IV	Superior olivary complex
Wave V	Lateral lemniscus (Largest wave/most prominent/most consistent wave)



Waves in BERA

Significance :

Adults : Best audiometric test for

1. Retrocochlear hearing loss (Eg : Acoustic neuroma).
2. Differentiating b/w cochlear & retrocochlear hearing loss.
3. Detecting malingering.

Note : Best Ix for acoustic neuroma ⟶ Gadolinium enhanced MRI.

Neonates : Best audiometric test to

1. Confirm hearing loss in neonates & infants.
2. Screen hearing loss in neonates in ICU.
3. Determine hearing threshold.

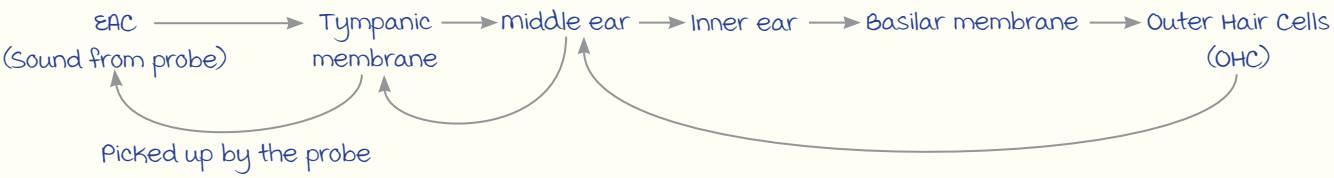
Otoacoustic Emissions (OAE)/Kemp Echoes

00:10:20

----- Active space -----

Objective test.

Pathway :



Types :

- OAE
  - Spontaneous
  - Evoked
    - Transient evoked : Screening.
    - Distortion product evoked : Frequency specific test.

Inference :

- OAE present : OHC, cochlea, middle ear are all normal.
- OAE absent (>30 dB hearing loss) : Referred for tympanometry & BERA.

Significance :

Adults :

- Differentiates b/w cochlear & retrocochlear pathology.
- Distortion product evoked OAE : Detects NIHL & ototoxicity.

Neonates :

Transient evoked OAE : Best to screen for hearing loss in neonates (Except in ICU).

Electrocochleography & Recruitment

00:21:20

ELECTROCOCHLEOGRAPHY

- Objective test to measure electrical activity of cochlea.
- Best test for meniere's disease.

Waves :

1. Cochlear microphonic : Movement of outer hair cells.
2. Summating Potential (SP) : Sum of activity of inner & outer hair cells.
3. Action Potential (AP) : Activity in the nerve (Secondary to neurotransmitter release).

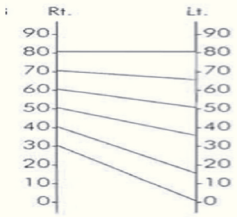
Inference : $\frac{SP}{AP}$ >45% ⟶ Indicative of cochlear lesion (meniere's disease).

----- Active space -----

RECRUITMENT

Feature of cochlear pathology (meniere's disease).

Tests :

Alternate Binaural Loudness Balance (ABLB)	Short Increment Sensitivity Index (SISI)	Stapedial reflex
 • Compare loudness perception b/w both ears • Hearing in defective ear imporves with intensity of sound.	Increments of dB ↓ Not able to identify → Normal Able to identify → Recruitment (+) → SISI score : 70–100% → Cochlear pathology (meniere's disease)	Stapedial reflex threshold ↓ → Recruitment (+)

Decoy Tests & Speech Audiometry

00:26:16

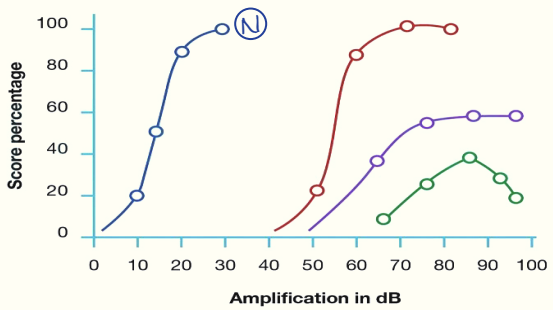
Tone Decay :

- Subjective test.
- Test for retrocochlear/neural hearing loss.

Speech Audiometry :

Discrimination Score (DS) :

- Ability to discriminate between words.
- Indicative of nerve function.



Condition	Change in DS with loudness
CHL	Improves with loudness
Cochlear deafness	Improves & plateaus (Never 100 %)
Retrocochlear deafness	Improves & then falls : Roll over phenomenon

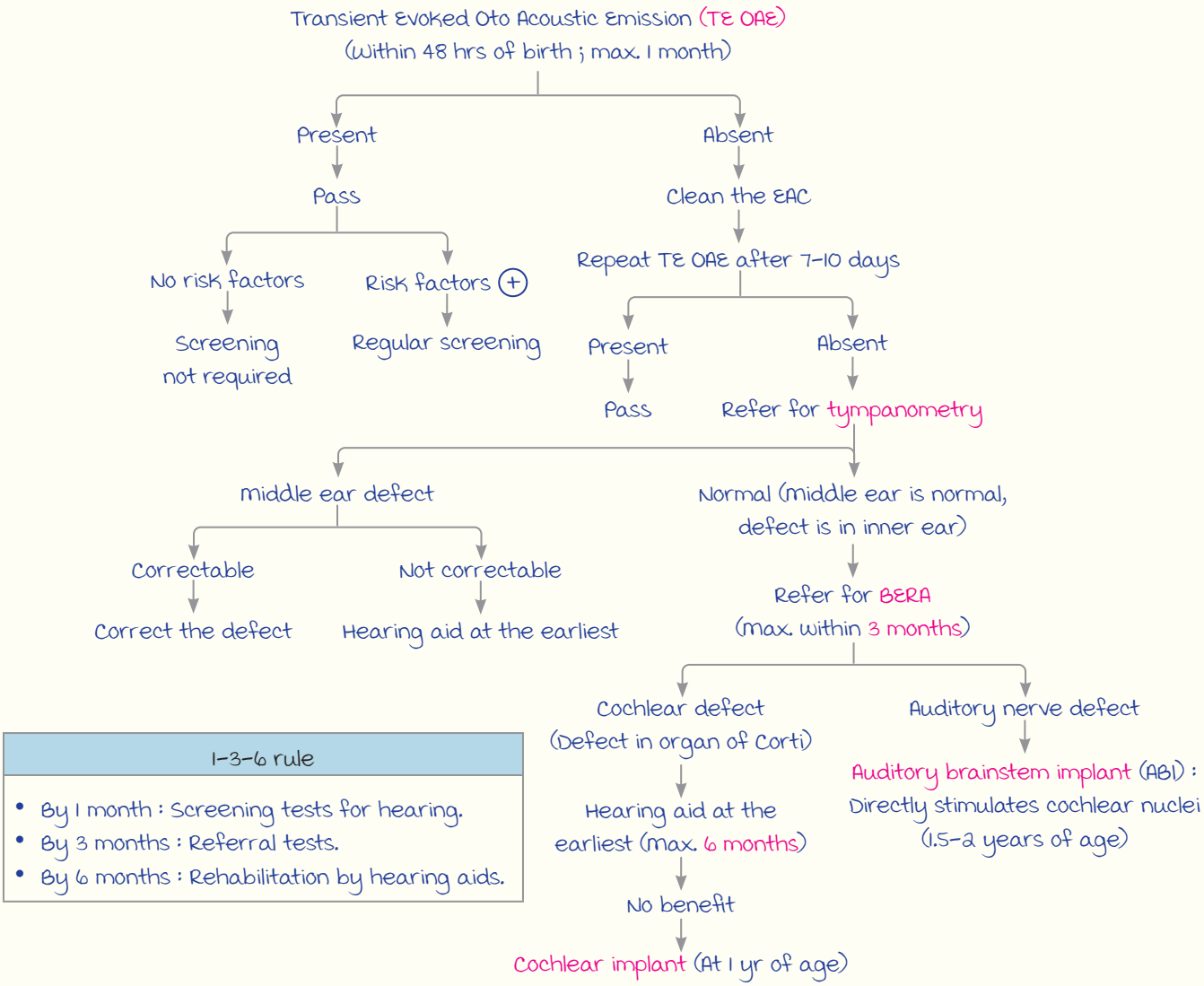
Speech Reception Threshold (SRT) :

- Assess hearing threshold by manipulating speech intensities.
- Usually matches PTA threshold.

Protocol for Neonatal Hearing Screening

00:31:00

----- Active space -----



1-3-6 rule

- By 1 month : Screening tests for hearing.
- By 3 months : Referral tests.
- By 6 months : Rehabilitation by hearing aids.

Auditory Neuropathy Spectrum Disorder

00:36:26

Pathophysiology :

- Damaged inner hair cells.
- Demyelination of nerves.
- Loss of axon.

→ Dyssynchrony →

- Hearing : Normal.
- Speech intelligibility : Absent. (Late presentation : School going age).

----- Active space -----

Investigations :

Test	Result
PTA	Normal/mild to moderate SNHL
Speech audiometry	Disproportionately poorer than degree of HL
OAE	Normal (OHC : Normal)
BERA	Abnormal
Middle latency response	
Cortical response	

Management : Hearing aids, cochlear implantation.

Behavioural Observation Audiometry (BOA) & ASSR 00:40:00

BOA

- Done for children b/w 6 months – 5 yrs.
- Similar to PTA.
- Behavioural change in response to sound is observed.

Tests :

5–24 months :

Free field audiometry

Visual reinforcement audiometry

2–5 years :

Play audiometry

Note :
>5 yrs : PTA.

ASSR (AUDITORY STEADY STATE RESPONSE)

Estimates threshold at different frequencies.

Uses : Helps assess

- >80 dB hearing loss.
- Frequency specific hearing loss.

EAR : PART 6

----- Active space -----

Serous Otitis Media (SOM)

00:00:49

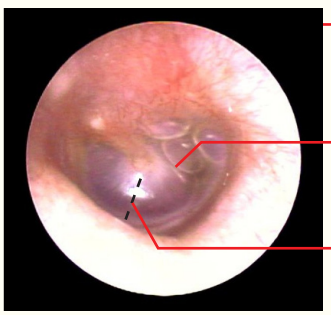
AKA otitis media with effusion/glue ear : Collection of serous or sterile fluid in middle ear.

Causes of clinical features :

	Children	Adults
m/c cause	Adenoid hypertrophy	Nasopharyngeal Ca
C/F	B/L fluctuating painless hearing loss (HL), speech delay, h/o snoring ⊕ ; A/w high arched palate, open mouth (Adenoid facies)	U/L progressive HL

O/E :

Tympanic membrane (Tm) : Bluish, Intact but retracted + air bubbles/fluid level.



TM in som

Investigations :

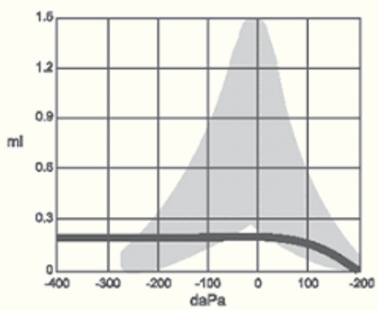
Tuning fork test :

- Rinne's test : ⊖.
- Weber's test : Lateralized to affected ear → CHL.

Pure Tone Audiometry (PTA) : A-B gap ⊕

Confirmatory Ix : Tympanometry

- Type B curve.
- 1st Ix in children.



Tympanogram : Type B curve

Management :

1st line mx : Medical Mx (3 months).

↓ Not recovering/chronic (monthly tympanometry : Type B curve)

Sx : Myringotomy + grommet/ventilation tube + adenoidectomy.

Myringotome

Myringotomy :

- Radial incision → Grommet insertion (Antero-inferior quadrant of TM).
- Short term grommet : Self extruded in <6 months (Preferred).

----- Active space -----

Sequelae :

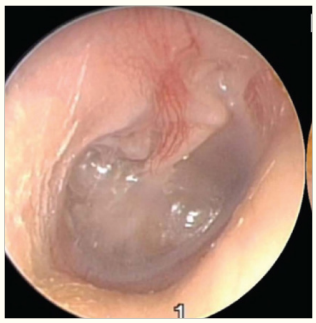
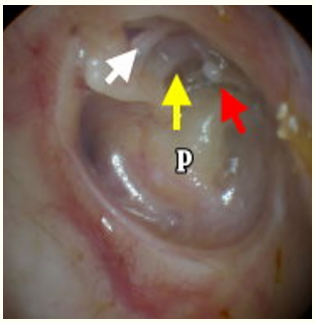
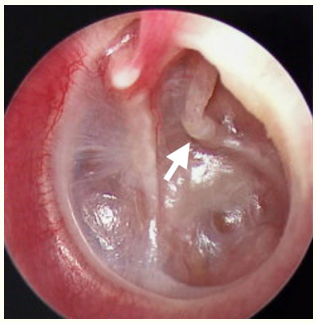
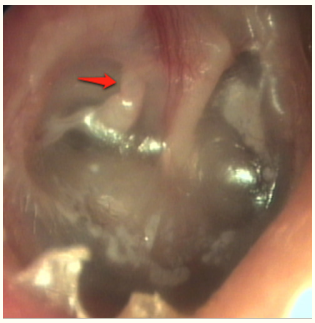
No Rx → Retraction pocket → 1° cholesteatoma.

Tympanic Membrane Retractions

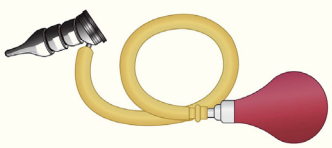
00:10:38

TM retractions → Pars flaccida (PF) : Tos classification.
→ Pars tensa (PT) : Sade classification.

SADE CLASSIFICATION

			
Stage 1 : Retracted Tm, not touching incus	Stage 2 : Touches incus, incudostapedial joint	Stage 3 : Atelectasis (Touches promontory)	Stage 4 : Adhesive otitis media (Adherent to promontory mucosa)

Note : Stage 3 & 4 can be differentiated by siegalisation/ pneumatic otoscopy.



Siegel's pneumatic speculum

Features :

- Cone of light : Distorted/⊖.
- Tm appearance : Dull.
- Handle of malleus : Foreshortened.
- Lateral process of malleus : Prominent.
- Anterior + Posterior malleolar folds : Sickled.

As stage progresses → Features : more prominent.

TOS CLASSIFICATION :

Stage 1	PF retracted, not touching malleus
Stage 2	Retraction touching neck of malleus.
Stage 3	Part of retraction pocket may be hidden, may be a/w erosion of scutum
Stage 4	Part of retraction hidden and definitive erosion of scutum

Otosclerosis

00:23:08 ----- Active space -----

Bone remodelling disease, AKA otospongiosis.

Site of origin :

Fissula ante fenestram ⟶ Overgrowth on oval window
(Enchondral layer of otic capsule) (Fixes stapes foot plate).

Presentation :

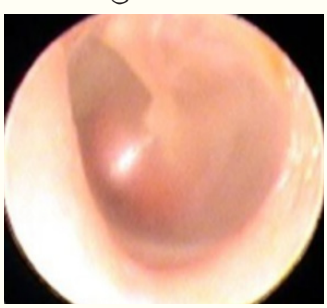
- B/L progressive CHL.
- Age group : 20–30 yrs.
- F >> M.
- Paracusis willisii : Hearing better in noisy surroundings.
- Aggravating factors : measles, pregnancy.
- Family H/o ⊕ (Autosomal dominant inheritence).

Tests
• Rinne's : B/L ⊖
• Weber's : Lateralized to worst ear/centralised
• Gelle's test : ⊖ (No change)
• PTA : AB gap, Carhart's notch
• Impedance audiometry (Best Ix)
• Tympanometry : 'As' curve
• Stapedial reflex : Absent

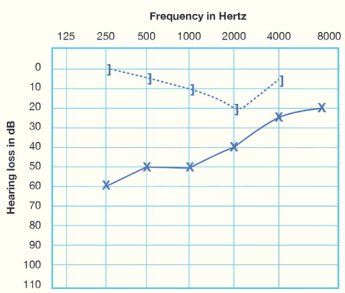
O/E :

TM appears : Pearly white >> Flamingo pink (Active d/t ↑vascularization).

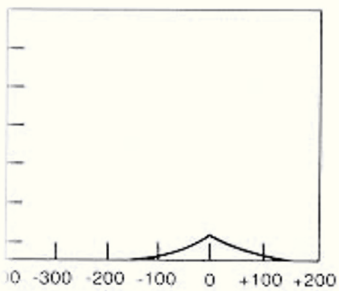
HPE findings : Blue mantle of manasse in enchondral layer.



Flamingo pink TM
(Schwartz sign)



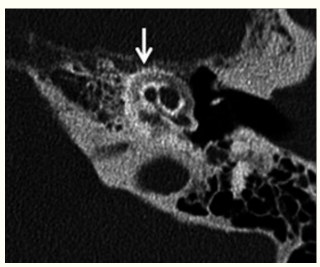
Carhart's notch : Dip at 2000 Hz in bone conduction curve



As curve

Cochlear otosclerosis :

- Overgrowth towards inner ear : Cochlea involved.
- Present as : Mixed hearing loss (CHL + sensorineural HL).
- Ix : HRCT ⟶ Halo/double ring sign (Ring of lucency around cochlea).



Halo/double ring sign

----- Active space -----

Management :

Active cases (Schwartz sign ⊕) : NaF (Sodium fluoride).

Mature/non-active cases :

Stapedectomy + teflon piston (worse ear treated first).

C/I for Sx :

Only one hearing ear → Mx with hearing aid/ cochlear implant.

Piston

Note :

Van der Hoeve disease : Osteogenesis imperfecta + blue sclera + otosclerosis.

NIHL, Ototoxicity & Presbycusis

00:39:14

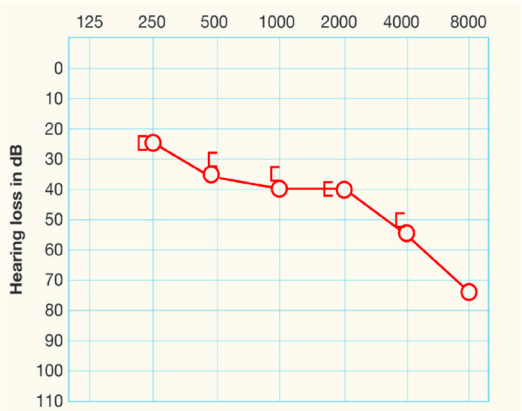
Conditions of Adult B/L Sensorineural HL :

	Features	Ix	Prevention/Mx
Noise induced hearing loss (NIHL)	• Safe limit : 85 dB, 8 hr/day • H/o noise exposure above safe limit • BL high frequency hearing loss, tinnitus • Early damage : Outer hair cells affected	• Early diagnosis : Distortion product Otoacoustic Emission (OAE) • PTA : – Early : Acoustic dip at 4000 Hz – Late : Down sloping curve	• Prevention : • Ear muffs (40 dB) > Ear plugs (30 dB) • Rx in Permanent HL : – Hearing aid – Cochlear implant
Ototoxicity	• H/o exposure to drugs : Mnemonic A3 VCD – Aminoglycosides – Antimalarials – Analgesics – Vancomycin – Cytotoxic drugs : Cisplatin – Diuretics (Na K 2CL channels of stria vascularis) – Erythro/azithromycin 🟡 : Irreversible HL	• Early diagnosis : Distortion product OAE (Outer hair cells affected) • PTA : Down sloping curve (High frequency HL)	• Early identification of hearing loss : ↓/stop/ change ototoxic drugs • Permanent HL : Hearing aid, cochlear implant
Presbycusis	• Age >50 years/elderly • Slowly progressive + B/L symmetrical HL • m/c : Neural type	PTA : Down slopping curve (High frequency HL)	• Hearing aid • Cochlear implant

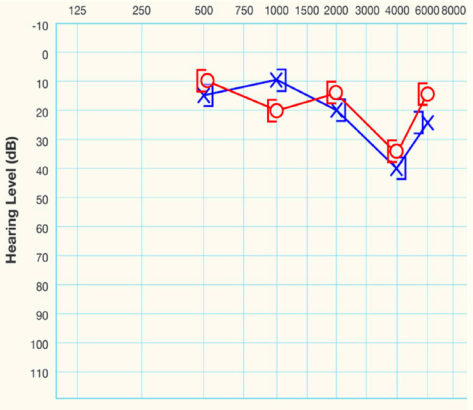
----- Active space -----

Aminoglycosides :

- Cochleotoxic :
  Neomycin > Kanamycin, Amikacin
- Vestibulotoxic :
  Streptomycin, Gentamycin



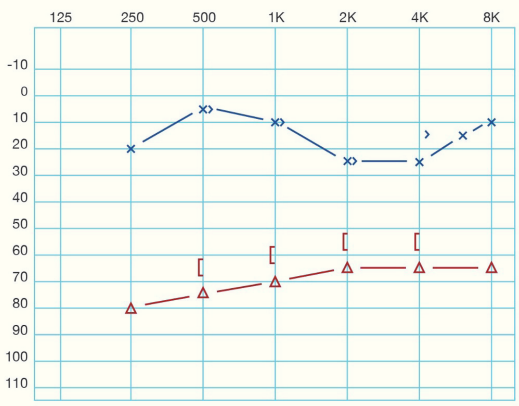
Down sloping audiogram



Acoustic dip at 4000 Hz

Idiopathic sudden SNHL :

- Otologic emergency (Sudden U/L HL).
- >30 dB SNHL, 3 continuous frequencies, over 3 days.
- Severe SNHL (>70 dB) → (−) Rinne's test.
  → Weber's test lateralize to opposite ear.
- MRI : To rule out acoustic neuroma (In elderly SNHL).
- Mx :
  - Steroids → Oral.
    → Transtympanic (Microwick → Round window).
  - Carbogen (5% CO_2 + 95% oxygen).
  - Hyperbaric O_2.
  - Hearing loss (Not recovering) → C/L routing of signal (CROS) hearing aid.
    → Bone anchored hearing aid (BAHA).



PTA : Severe SNHL

----- Active space -----

EAR : PART 7

- Only vertigo :
  - BPPV.
  - Vestibular neuritis.
- Vertigo + hearing loss
  - Vertigo + SNHL :
    - Meniere's disease.
    - Labyrinthitis.
    - Perilymphatic fistula.
  - Vertigo + CHL :
    - SCC dehiscence.

BPPV, Nystagmus & Vestibular Neuritis

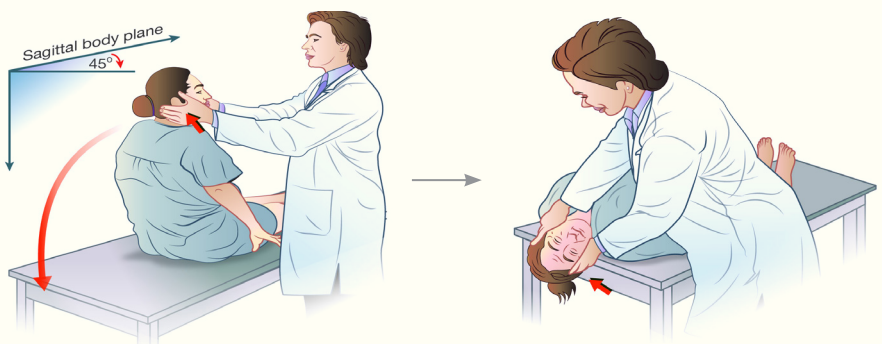
00:01:18

BENIGN PAROXYSMAL POSITIONAL VERTIGO (BPPV)

m/c canal involved : Posterior SCC > Horizontal SCC > Anterior SCC.

Examination & Management :

Maneuver	SCC tested	Positive result	Management
Dix-Hallpike maneuver	Posterior	• Vertigo (Episodic & positional) • Nystagmus : – Vertical – Towards hyperactive side (I/L)	• Epley's maneuver • Semont maneuver • Brandt-Daroff exercise
Supine roll	Horizontal	• Vertigo (Episodic & positional) • Nystagmus : – Horizontal – Towards hyperactive side (I/L)	• Gufoni maneuver • Barbecue roll maneuver



Dix-Hallpike maneuver

NYSTAGMUS

----- Active space -----

	Peripheral nystagmus	Central nystagmus
Latency	⊕	⊖
Duration	Limited	Not limited
Fatigability	⊕	⊖
Direction of fast component	Fixed	Changing
Optic fixation	Nystagmus disappears	Nystagmus persists
Torsional component	Vertical/horizontal nystagmus with torsion	Pure horizontal/pure vertical /pure torsional

Direction & Types of Peripheral Nystagmus :

Structure involved	Type of nystagmus	Conditions
Vertical canal (Posterior & superior SCC)	Vertical nystagmus with torsion	• BPPV → Hyperactive labyrinth → I/L nystagmus • Superior SCC dehiscence
Horizontal SCC	Horizontal nystagmus	Horizontal SCC BPPV
Complete involvement of labyrinth	Horizontal nystagmus with torsion	• Vestibular neuritis • Purulent labyrinthitis • Meniere's disease → Hypoactive labyrinth → C/L nystagmus

VESTIBULAR NEURITIS

C/f :

- Vertigo : Sudden onset, continuous, lasts 5–7 days.
- Spontaneous nystagmus.

Management :

- Labyrinthine sedatives.
- Vestibular rehabilitation exercises.

Head Impulse & Caloric Test

00:16:00

Head Impulse Test :

- Test for vestibulo ocular reflex (VOR).
- Abnormality of labyrinth → Lag + saccades ⊕.

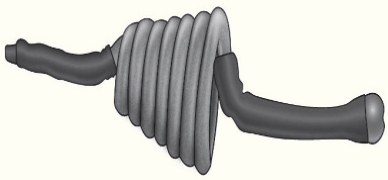
Significance :

- Office procedure.
- Normal physiological stimuli (Head movements).
- Each SCC can be tested separately.

----- Active space -----

Caloric Test :

- Test for lateral SCC.
- Position : Supine with 30° head elevation.



Dundas grant tube
(use : Cold air caloric test)

Inference : Mnemonic : COWS.

Temperature	Labyrinth	Direction of nystagmus
Cold : 30°C	Hypoactive	Opposite
Warm : 44°C	Hyperactive	Same

Meniere's Disease

00:24:27

Unilateral.

M = F.

Age : 20 – 50 years.

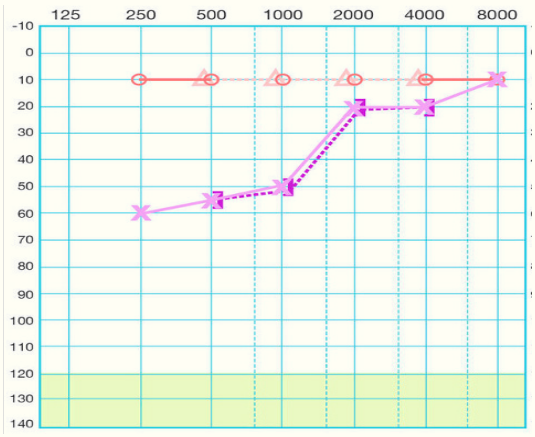
Note :
Lermoyez/reverse meniere's syndrome :
Hearing loss → Vertigo → Normal hearing.

Clinical Features :

- Vertigo :
  - Episodic (20 mins – 24 hours).
  - A/w aura & vagal symptoms.
  - Tullio's phenomenon & Hennebert sign.
- Hearing loss :
  - Fluctuating.
  - Low frequency affected first.
  - Diplacusis (U/L).
  - Recruitment (Intolerence to loud sound).
- Fullness in the ears, tinnitus.
- Tumarkin crisis (Drop attacks).

Tests :

Investigations	Result
Tuning fork tests	SNHL
Pure tone audiometry	Low frequency SNHL (U/L)
SISI	70–100 % (D/t recruitment)
Electrocochleography	SP/AP = >0.45
Glycerol test	Vertigo improves



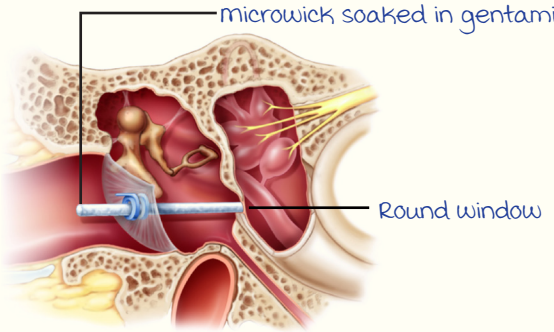
PTA : Upsloping audiogram

Management :

Medical Mx :
- Salt & caffeine restriction
- Labyrinthine sedatives
- Diuretics
- Vasodilators : Betahistine (m/c)

↓ No improvement

Intractable vertigo



Transtympanic administration of steroids

----- Active space -----

Hearing intact	Hearing lost
• Transtympanic steroids. • Chemical labyrinthectomy : Gentamicin (Vestibulotoxic). • Endolymphatic sac decompression (Below Donaldson's line). • Vestibular neurectomy (Salvage precedure).	Total labyrinthectomy.

Perilymphatic Fistula, SCCD, VEMP

00:36:56

PERILYMPHATIC FISTULA

Causes :
- Cholesteatoma.
- Barotrauma.
- Surgeries (Stapedotomy, cholesteatoma sx).

C/f :
- Vertigo : On coughing/straining, Tullio's phenomenon ⊕.
- Hearing loss : SNHL/Mixed HL.

Fistula test : Positive.

Management :
- Conservative : Avoid straining/lifting weights.
- Definitive : Surgical repair.

Note : Fistula test.

False +ve/Hennebert sign	False negative
• Meniere's disease • Congenital syphilis (Hypermobile footplate)	• Cholesteatoma covering fistula • Dead labyrinth

----- Active space -----

SUPERIOR SEMICIRCULAR CANAL DEHISCENCE SYNDROME (SCCD)

AKA third window.

C/F :

- Vertigo :
  - Tullio's phenomenon ⊕.
  - Hennebert sign ⊕.
- Conductive hearing loss.
- ↑ BC sounds :
  - Autophony.
  - Pulsatile tinnitus.

Tests :

Investigations	Findings
Tuning fork tests	BC > AC (Rinne's ⊖)
PTA	AB gap ⊕
Tympanometry	Normal middle ear
VEMP	Reduced threshold

IOC : HRCT.

Management : Conservative/Surgical repair.

VESTIBULAR EVOKED MYOGENIC POTENTIAL (VEMP)

Normal response :

- Cervical VEMP : Loud sound → Saccule → Inferior vestibular nerve → I/L SCM relaxation ⊕
- Ocular VEMP → Superior vestibular nerve → Vestibular nuclei → VOR → C/L eye movement

Abnormal response :

Response	D/d
Hyperactive	• Fistula • Hypermobile footplate (Congenital syphilis) • SSCD • Meniere's disease
Hypoactive	• Vestibular neuritis • Acoustic neuroma

EAR : PART 8

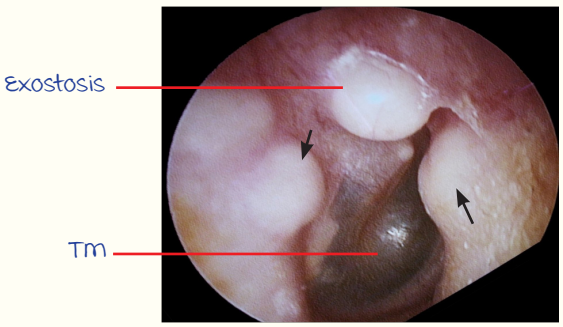
----- Active space -----

Tumours of EAC

00:00:50

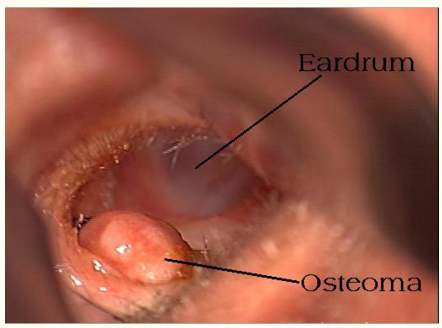
Exostosis (Surfer's Ear) :

- D/t entry of cold water in the ear.
- m/c benign tumour of EAC.
- Multiple, sessile.
- B/L bony outgrowth in deep EAC.



Osteoma :

- Single.
- Bony outgrowth in lateral bony EAC.



Glomus Tumours/Paraganglioma

00:02:00

- m/c benign tumour of middle ear, locally invasive.
- Non-chromaffin tumour, 10% multicentric.
- Capsulated.

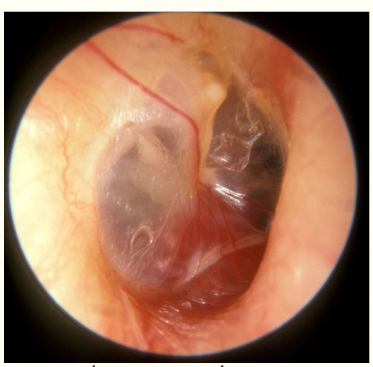
Origin :

Paraganglionic cells (Neural crest cells)
- → Jugular bulb (CN 9, 10) : Glomus jugulare.
- → Tympanic plexus (CN 9) : Glomus tympanicum (m/c).

Clinical Features :

- Pulsatile tinnitus + conductive hearing loss.
- Aquino sign (Glomus jugulare) : Tinnitus disappears on carotid compression.
- Brown's sign/pulsation sign : On siegalisation.
- Multiple cranial nerve palsies (CN 9, 10, 11, 12).

O/E : Red polypoidal mass in EAC.



Rising sun/red reflex/setting sun sign

----- Active space -----

Investigations :

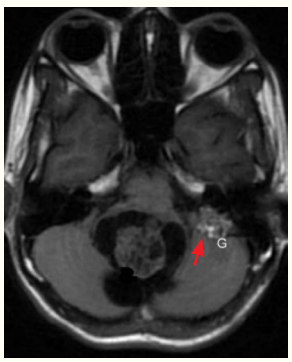
CECT : Best.

- Glomus tympanicum : Vascular area in middle ear cavity adhering to promontory.
- Glomus jugulare : Phleps sign (Crest of bone separating carotid canal & jugular foramen is absent).

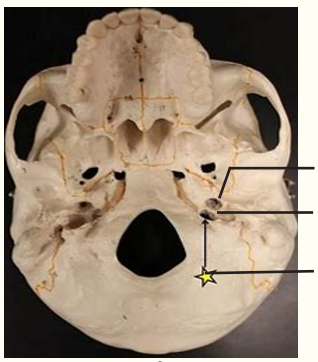
Note :

Ear polyp : Avulsion is C/I.

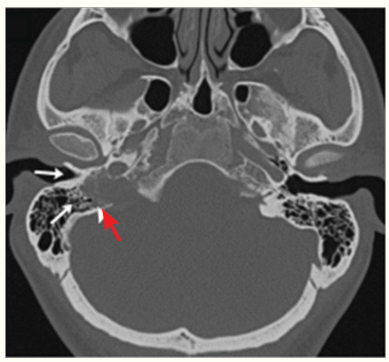
MRI :



MRI : Salt & pepper appearance



Base of skull



CT : Glomus jugulare

Staging :

Fisch classification : CECT based.

Type		Involvement	
A		Middle ear	
B		Mastoid	
C (Labyrinthine & Infralabyrinthine)	C_1	Vertical carotid canal	Limited
	C_2		Extensive
	C_3	Horizontal carotid canal	
D (Intracranial)	D_1	<2 cm intracranial	
	D_2	>2 cm intracranial	

Management :

Preoperative Ix : Urinary Vanillyl mandelic acid (VMA).

Slow growing tumour/in elderly : Wait & watch (Close follow up).

Fit for Sx :

<3 cm : Stereotactic radio Sx/gamma Knife Sx.

>3 cm : Surgical excision with pre-op embolisation.

Acoustic Neuroma

00:13:48

Tumour features :

- M/c benign CP angle tumour.
- Origin : Vestibular nerve at Internal Acoustic Meatus (IAM).
- Locally invasive, slow growing.
- No capsule.

----- Active space -----

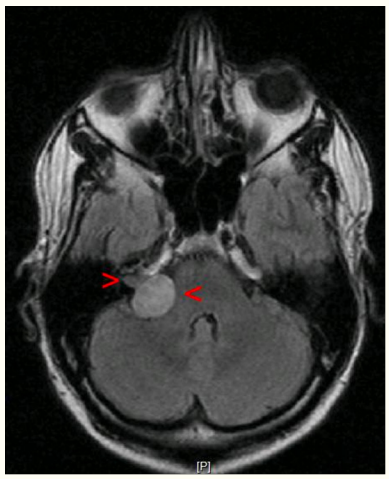
Clinical Features :

Younger patients : NF-2 to be ruled out.

Nerves involved	Features
Cochlear nerve (8th) : Earliest	Tinnitus + U/L SNHL (in elderly)
Vestibular nerve (8th)	Vertigo absent : Slow growing
Facial nerve	Hitzelberger's sign
D/t upper pole of tumor :	
5th nerve	• Earliest nerve involved intracranially • Loss of corneal reflex
6th nerve	Diplopia
D/t lower pole of tumor :	
9th, 10th, 11th nerve	-
Cerebellar compression	Imbalance, nystagmus, coma

Note :

D/d → Presbycusis : B/L SNHL.



Ice cream cone appearance

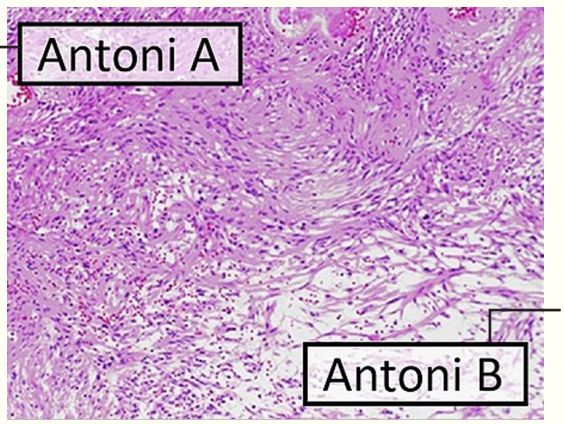
Investigation :

Tuning fork test : SNHL.

Audiometry findings :

- Puretone audiometry : U/L or asymmetric SNHL.
- Speech audiometry : Poor discrimination score.
- Roll over phenomenon (Retrocochlear disease).
- BERA : Best audiometric test.
  - ↑Distance b/w wave I and wave II.
  - Difference of >0.2 ms b/w both ears (If only wave V present).

Gadolinium enhanced MRI : Best investigation.



- Loosely placed
- Cystic spaces
- Bad prognosis
- Mx : Excision

----- Active space -----

Treatment :

< 1.5 cm/slow growing/elderly : Wait and watch.

1.5–3 cm : Stereotactic radiosurgery/gamma knife.

>3 cm/cystic tumor : Sx excision.

Post-op Mx :

- Auditory brainstem implant.
- Rehabilitation of hearing in NF-2.
- Placed in lateral recess of 4th ventricle.

Facial Nerve : Branches & Investigations

00:26:17

Mixed nerve → Motor (major).
Mixed nerve → Sensory : Nervus intermedius/Nerve of Wrisberg.

Temporal Part :

Meatal segment : Internal acoustic meatus.
↓
Labyrinthine segment : Shortest + narrowest part.
↓
Horizontal/tympanic segment : m/c part dehiscent (m/c congenital anomaly of temporal bone).
↓
Vertical/mastoid segment : m/c injured in mastoid Sx.

Branches :

	Nerve supply	Injury	Topodiagnostic test
Greater superficial petrosal nerve	Lacrimation, nasal & palatine secretion	Dry eye	Schirmer's test
Nerve to stapedius	Stapedius muscle	Hyperacusis: Abnormally high perception of normal sounds	Stapedial reflex (Impedance audiometry)
Chorda tympani	• Taste sensation over ant. 2/3rd of tongue • Salivation from sublingual & submandibular glands	Loss of taste, loss of salivary flow	Electrogustometry
Posterior auricular nerve	Sensory supply to posterosuperior part of EAM & adjacent part of canal	Hitzelberger sign : Hypoaesthesia in this region d/t facial nerve compression by acoustic neuroma	-

----- Active space -----

Investigation :

Electrophysiological test (Determines prognosis)

- Electroneuronography : Not done before 3 days → False +ve results d/t Wallerian degeneration.
- Electromyography (EMG) : Useful >3 weeks of injury.
  - Action potential : Good prognosis.
  - Fibrillation potentials : Bad prognosis.

Facial Nerve Palsy

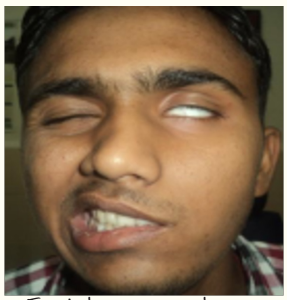
00:33:30

CAUSES

Idiopathic :

Bell's palsy :

m/c cause of acute idiopathic LMN facial nerve palsy.



Facial nerve palsy

Features	Presentation	Management
• Idiopathic > Viral (HSV-1 in 60 %) • m/c site of involvement : Labyrinthine segment • Can recur • ↑Susceptibility in DM, Pregnancy, AIDS	• U/L Complete facial deviation • U/L sweating • Hyperacusis • Loss of taste • Dry eye	• High dose steroids immediately : 1 mg/kg body weight • Acyclovir : If presented within 3 days • Supportive care : Physiotherapy, nerve stimulation, eye care, Vitamin B12 nerve nourishers

Non-iatrogenic :

Temporal bone fracture : m/c cause.

Types :

	Longitudinal fracture	Transverse fracture
Relation to long axis of petrous part of temporal bone	Parallel	Perpendicular
Incidence	More common	Less common
Direction of blow	Lateral	Posterior (Occipital)
TM perforation	Yes	No
Hearing loss	CHL	SNHL
CSF otorrhoea	Present (Leak of CSF through perforation)	Absent
CSF rhinorrhoea	Absent	Present (Leak of CSF through ET)
Vertigo	Absent	Present
Facial nerve injury	Less common	More common
Severity	Less	More

----- Active space -----

Clinical findings :

Battle sign


Hemotympanum

Iatrogenic :

Cause : Parotid Sx > Mastoid (Vertical segment) Sx.

Facial nerve palsy post Sx :

	Sudden onset	Late onset
Cause	Nerve transection	Edema
Mx	Re-exploration and repair	Steroid

Grafts for facial nerve repair :

- Greater auricular nerve (m/c).
- Sural nerve.
- Lateral cutaneous nerve of thigh.

COMPLICATIONS

D/t aberrant regeneration of facial nerve.

1. Synkinesis : Contraction of two separate groups of muscles.
   - Eg : Movement of lips on closing the eyes & vice versa.
2. Crocodile tears : Tearing of eyes during salivation.
   - D/t aberrant connections b/w chorda tympani fibers & greater superficial petrosal nerve.
3. Frey syndrome : Gustatory sweating over parotid region.
   - Aberrant regeneration of auriculotemporal nerve after parotid Sx.

- Management
  - Temporary : Botox.
  - Permanent :
    - Sternocleidomastoid flap implantation.
    - Tympanic neurectomy.

Note :

Parotid gland nerve supply :

- Sensory : Auriculotemporal nerve (ATN).
- Parasympathetic :

9^{th} nerve → Tympanic plexus → Lesser superficial petrosal nerve $\xrightarrow[\text{Foramen ovale}]{\text{Otic ganglion}}$ ATN.

- Stretching of parotid fascia $\xrightarrow{\text{via Greater auricular nerve}}$ Pain.

Bone Anchored Hearing Aid (BAHA)

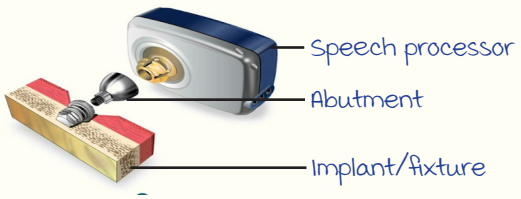
00:48:52 ----- Active space -----

Prerequisite :

Age >5 years : 3 mm skull thickness required for osseo-integration.

Indications :

- Cannot use normal hearing aid.
  - Congenital deformities of external ear (Eg : Atresia).
  - Discharging ears.
  - Following MRM → Big mastoid cavity.
- U/L deaf ear.



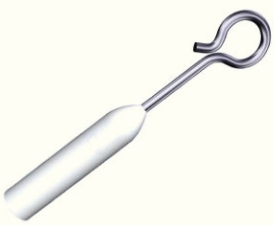
Components of BAHA

Mechanism :

Sound → Speech processor implanted on the bone → Fixture vibrates → Stimulates inner ear.

Other Prosthesis/Aids :

Partial ossicular replacement prosthesis



Stapes piston

Cochlear implant (External component)

Cochlear Implant

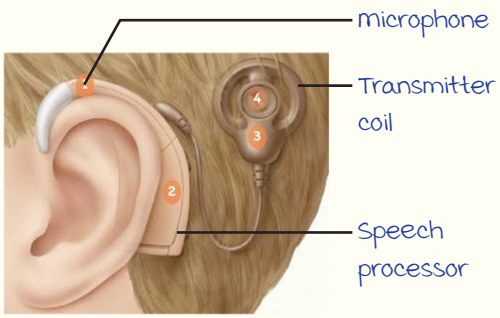
00:52:20

Invented by : William F. House (Father of neuro-otology).

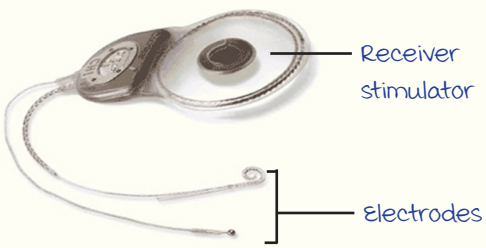
Indication : B/L severe to profound HL → Not benefitting with hearing aids.

Done : Earliest at 14 years of age.

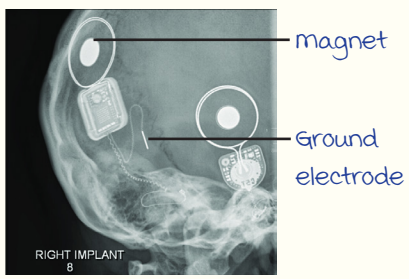
Components :



External component



Internal component



Cochlear implant

----- Active space -----

Electrodes :

- Insertion : Mastoid → Facial recess → Middle ear → Round window → Scala tympani (Inner ear).
- Replaces : Organ of Corti → Stimulation of cochlear nerve.
- Reference/ground electrode (Placed in temporalis muscle) : Regulates power consumption + stimulation intensity.

C/I : Michel aplasia, cochlear nerve lesions, central auditory lesions.

Age of implant placement :

- Earliest : Pre-lingual deafness (Deaf at birth).
- Any age : Post-lingual deafness (Acquired).

NOSE : PART 1

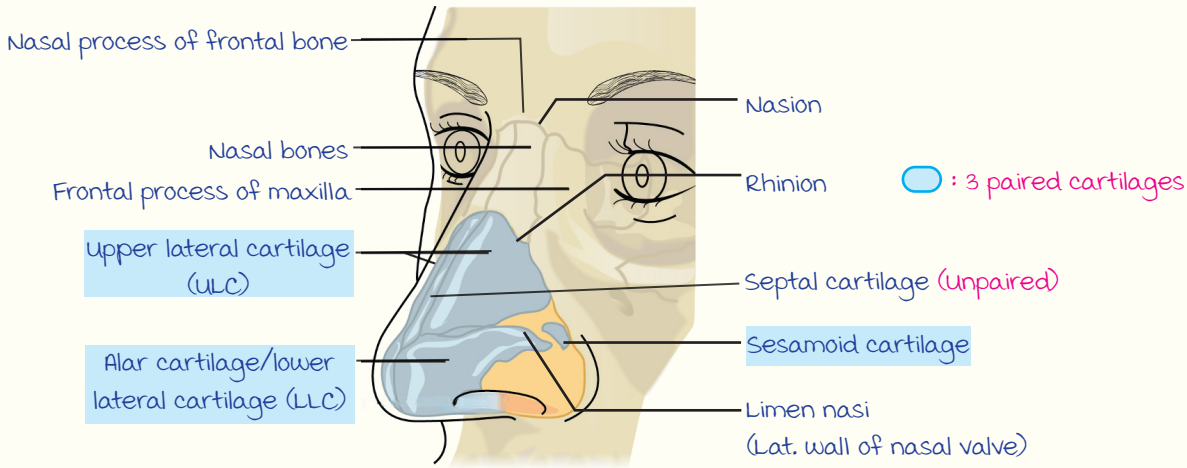
----- Active space -----

Anatomy of Nose

00:00:46

Anatomy of External Nose :

External nose → Upper 1/3rd : Bony.
→ Lower 2/3rd : Cartilaginous.



Lining Epithelium :

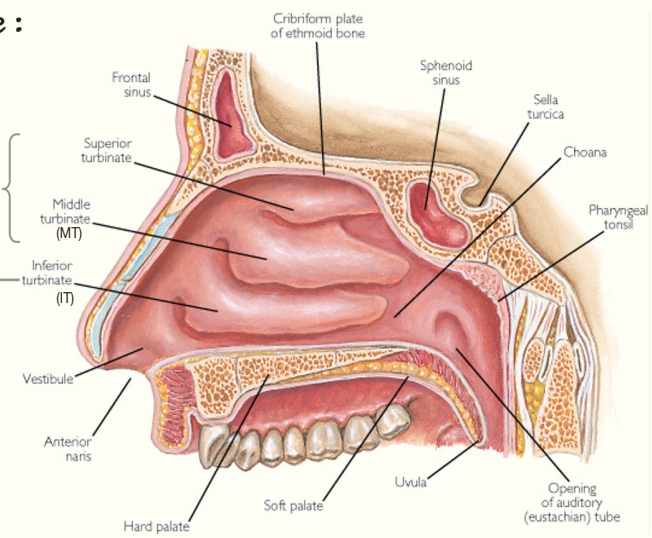
Sinus, Nose } Ciliated columnar pseudostratified epithelium.

Vestibule : Stratified squamous keratinized epithelium.

Upper 1/3rd : Olfactory epithelium.

- Dangerous area of nose.
- Receives only 10–15% of inhaled air, ↑ by sniffing.

Anatomy of Lateral Wall of Nose :

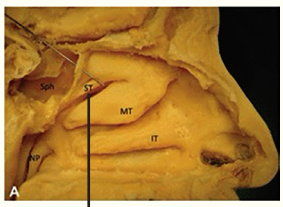


Part of Ethmoid bone

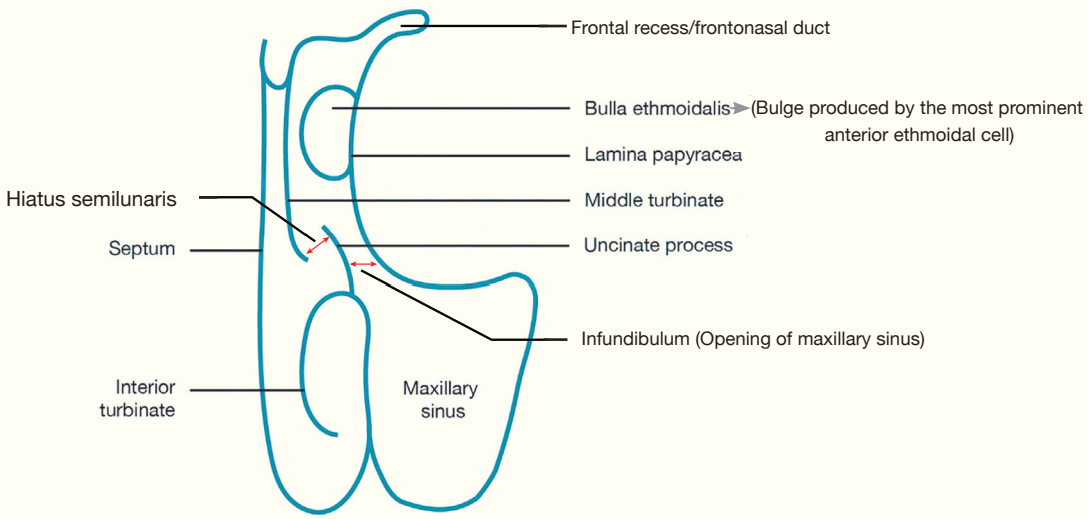
- Largest.
- Anterior & inferior most.
- Independent bone, articulates with :
  - Ethmoid (Superiorly)
  - Maxillary (Laterally)

----- Active space -----

Meatuses & SER :

	Inferior meatus	Middle meatus	Superior meatus	Sphenoethmoidal recess (SER)
Significance	Largest	• Most congested meatus • M/c meatus approached for FESS	-	-
Openings	Nasolacrimal duct : • Site : Junction of anterior 1/3rd & posterior 2/3rd of IT (Highest point) • Valve : Valve of Hasner • Orientation (Direction of massage if blocked) : Downwards → Backwards → Lateral	Anterior group of sinuses : • Frontal • Anterior ethmoid • Maxillary drains into Osteomeatal complex (middle meatus)	Posterior ethmoid sinus	Sphenoid sinus  SER

Osteomeatal Complex :

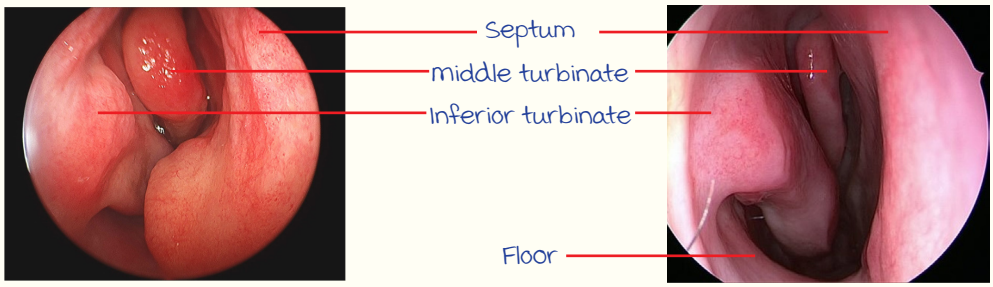


Note :

- M/c sinusitis : Maxillary > Ethmoid.
- First step for FESS/Infundibulotomy : Uncinectomy.

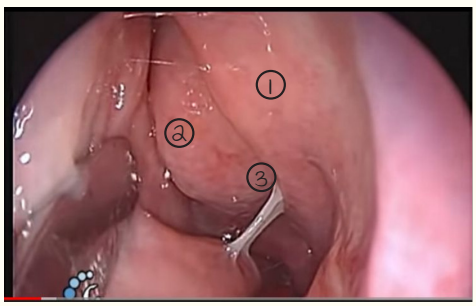
Nasal Endoscopy :

	Parts examined
First pass	Inferior meatus, nasopharynx
Second pass	Superior turbinate, superior meatus, sphenoethmoidal recess
Third pass	Middle meatus



----- Active space -----

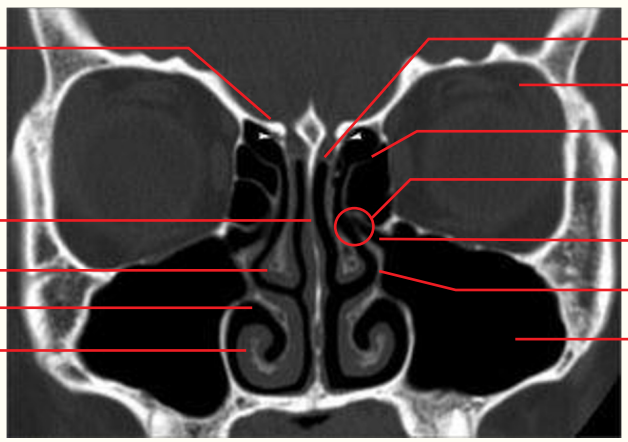
Rt. Nostril



① Uncinate process
② Bulla ethmoidalis
③ Hiatus semilunaris

Lt. Nostril

Identification of Structures :

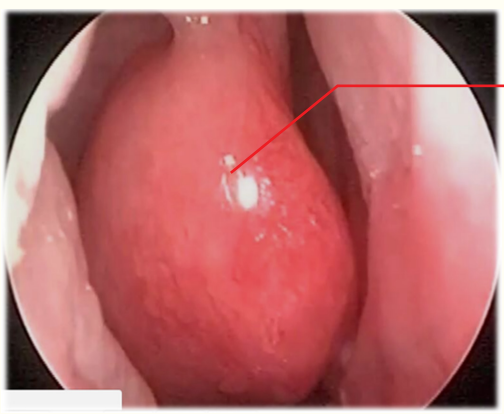


Fovea ethmoidalis :
- Orbital plate extension of frontal bone
- Forms roof of ethmoid sinus

Septum
Middle turbinate (MT)
Inferior meatus
Inferior turbinate (IT)

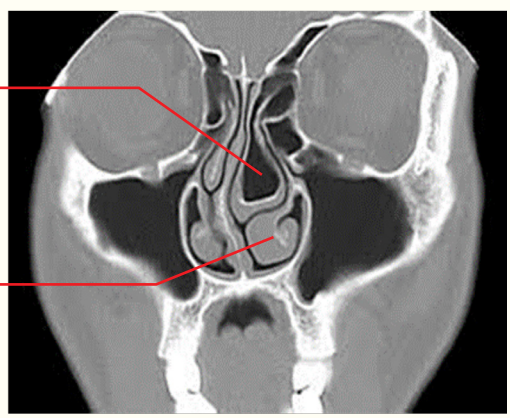
Cribriform plate
Orbit
Bulla ethmoidalis
Hiatus semilunaris
Infundibulum
Uncinate process
Maxillary sinus

CT



Concha bullosa :
- Pneumatized turbinate
- m/c site : MT
- On endoscopy : Resembles polyp

Hypertrophic turbinate :
- m/c site : IT



Rhinoscopy

CT

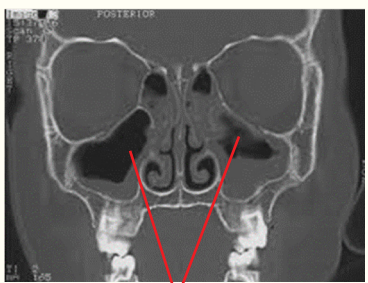
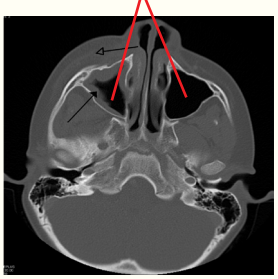
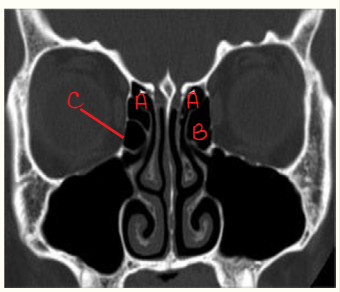
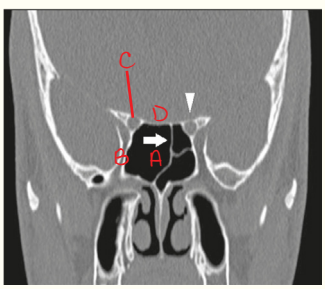
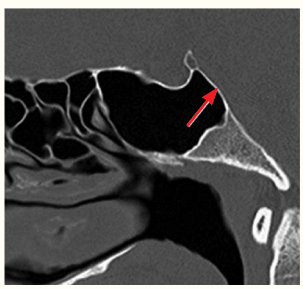
----- Active space -----

Sinuses

00:20:40

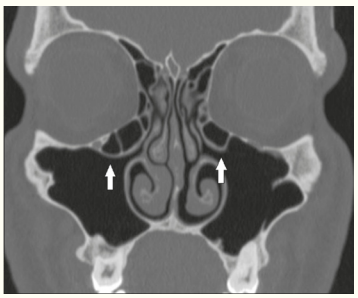
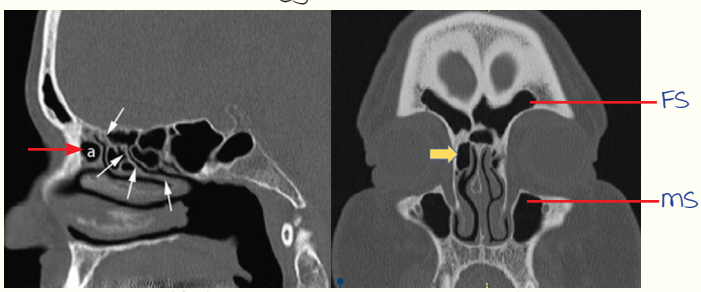
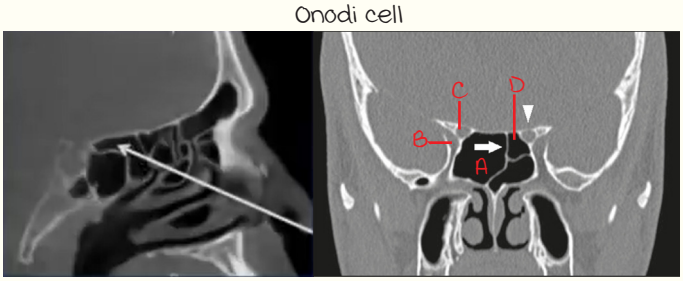
Ventilation of sinuses :

Expiration → Resistance at nasal valve area → Eddy currents → Ventilation.
formed

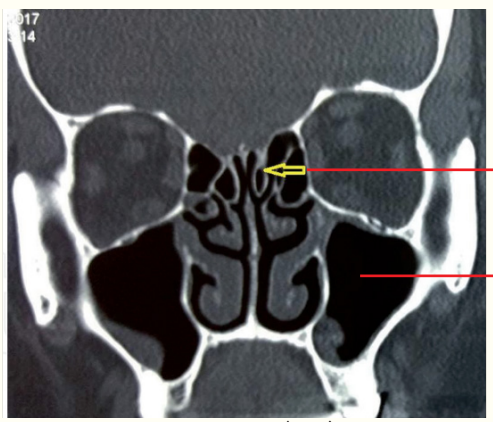
Maxillary sinus (MS)/ Antrum of Highmore	Ethmoid sinus	Sphenoid sinus	Frontal sinus (FS)
• Largest (Capacity : 15 ml). • Earliest to develop. • Present at birth. • M/c sinusitis in adults. • Sinusitis risk factors : – Extraction of 2nd premolar/1st molar → Risk of oroantral fistula. – Dental infection.	• Max. pneumatized at birth. • M/c sinusitis in children. • M/c sinusitis leading to Orbital complications (D/t common venous drainage & lamina papyracea).	• L/c sinusitis. • M/c pneumatization. type/best for transsphenoidal hypophysectomy : Sellar. • Relations : – Optic nerve. – Internal carotid artery (ICA). – Pituitary gland.	• Superior most. • Last to develop. • Absent at birth. • Last to be seen on X-ray : At 6 yrs. • Drainage : Via frontal recess.
 Maxillary sinus  Transverse view	 A : Ethmoid sinuses B : Bulla ethmoidalis C : Lamina papyracea	 A : Sphenoid sinus B : ICA + Cavernous sinus C : Optic nerve D : Pituitary	

Named Ethmoidal Cells :

----- Active space -----

Anterior group	
Bulla ethmoidalis	Most prominent
Haller cell 	Location : Near floor of orbit/Roof of maxillary sinus ↓ Narrows opening of maxillary sinus ↓ Recurrent maxillary sinusitis
Supraorbital cell	-
Agger nasi (a)  CT : Sagittal view CT : Coronal view	• Present in 90% of population • Anterior most • May block frontal recess ↓ Recurrent frontal sinusitis • Visualized in coronal cut with small maxillary sinuses
Posterior group	
Onodi cell  A : Sphenoid Sinus C : Optic Nerve B : ICA + Cavernous Sinus D : Onodi Cell	• Location : Near sphenoid sinus • Relations : - Internal carotid artery (ICA) - Optic nerve ↓ Risk of injury during FESS (Most dreaded complication of FESS)

Note :



Pneumatized superior turbinate

Large maxillary sinus
(Agger nasi not visualized)

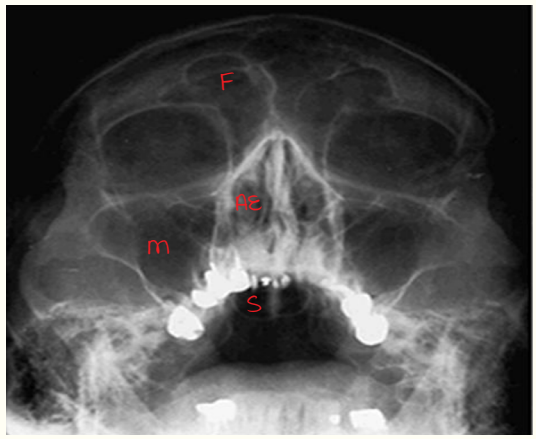
CT : Coronal cut

----- Active space -----

X-ray Views :

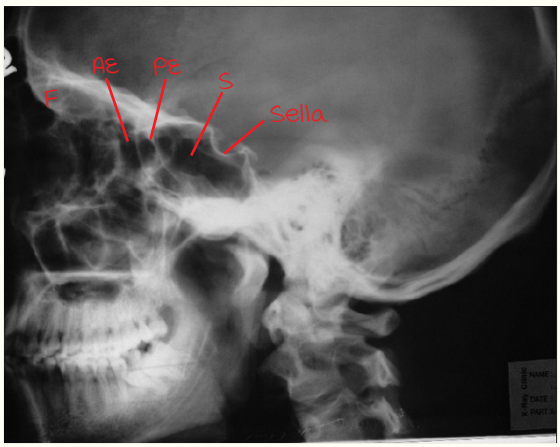
Waters'/Occipitomental View :

- Position : Nose-chin
- Mandible : Appears inverted 'U' shape



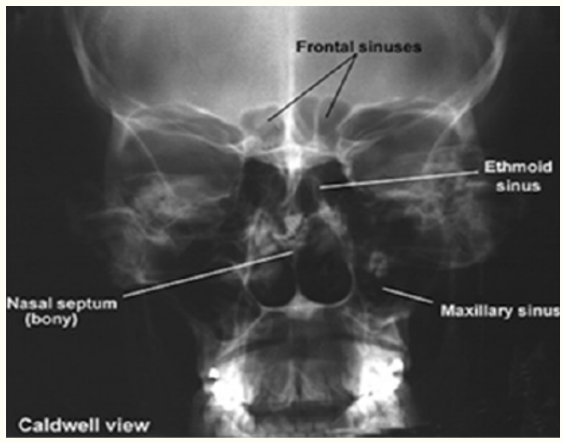
Pierre's View/Waters View with Open Mouth :

Sinuses seen : Frontal (F), Anterior Ethmoidal (AE), Maxillary (M), Sphenoid (S)



Lateral View :

- All sinuses seen, including posterior ethmoid (PE)
- Superiormost sinus : Frontal



Caldwell View/Occipitofrontal :

- Position : Nose-forehead
- Mandible : Appears straight
- Sinus best seen : Frontal

Rhinosinusitis

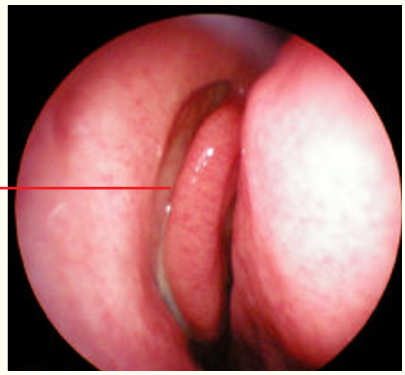
00:42:17

Clinical Features :

Nasal obstruction + nasal discharge + facial pain + hyposmia.

Facial pain characteristics	Seen in
Pain/tenderness over root of nose, medial and deep to eye	Ethmoid sinusitis
Pain increases with eye movements	
Pain/tenderness over frontal area	Frontal sinusitis
Early morning pain/periodic/office headache	
Pain/tenderness over cheek and upper jaw	Maxillary sinusitis
Occipital headache	Sphenoid sinusitis

----- Active space -----

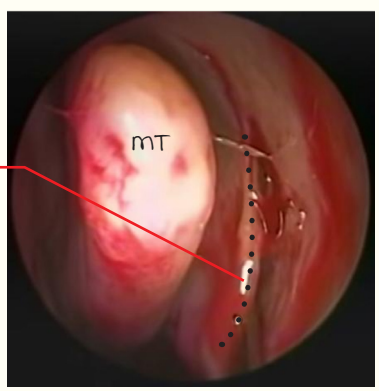


Endoscopy

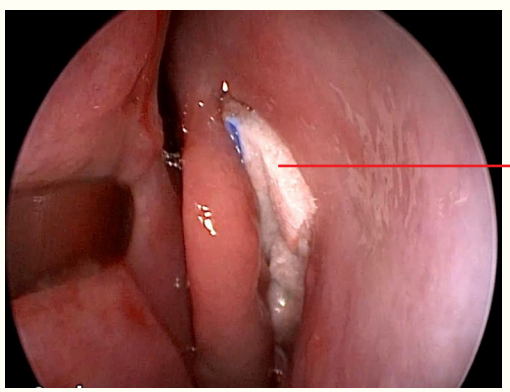
CHARACTERISTICS

	Acute Rhinosinusitis	Chronic Rhinosinusitis
Duration	< 12 weeks	> 12 weeks
Investigation	• Anterior rhinoscopy • Nasal endoscopy	NCCT (IOC)
Etiology/ Pathophysiology	• Viral • Bacterial : – Strep pneumoniae – H. influenzae – M. catarrhalis	Disordered interaction b/w immune system & local microbes ↓ Chronic inflammation & obstruction of osteomeatal complex
Management	• Symptomatic : – Nasal decongestants – Pain killers • Antibiotics	1. Medical (1 month) – Steroid nasal spray (TOC) – Saline irrigation – Antibiotics in acute exacerbation 2. Surgical (FESS) : If refractory to medical management

Functional endoscopic sinus surgery (FESS)



Uncinectomy : First step of FESS


Pack infused with mitomycin C inserted
↓
Reduces synechiae formation

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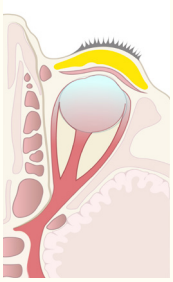
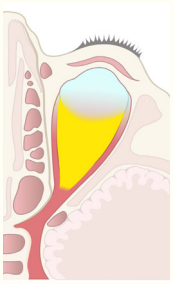
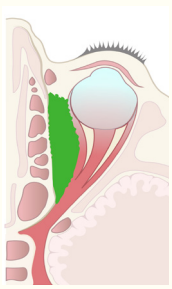
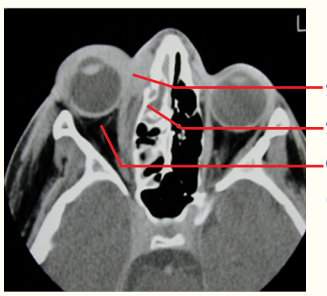
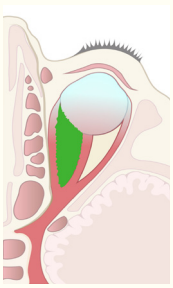
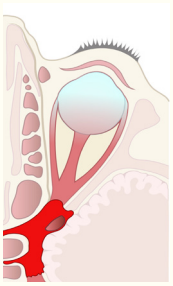
COMPLICATIONS

Acute Complications :

1) Orbital :

Chandler's staging		Clinical features
A) Preseptal cellulitis		 • Involves only eyelid • Globe : normal • Edema of eyelid
B) Orbital cellulitis		 • Chemosis • Proptosis • Restricted ocular movements • Decreased vision
C) Subperiosteal abscess		 Subperiosteal abscess Sinusitis Orbit pushed out (Non axial proptosis)
D) Orbital abscess		-
E) Cavernous sinus thrombosis		 • B/L involvement • Spread : – Direct : nose & PNS – U/L → B/L (Cavernous sinus communication)

Note : Orbital cellulitis vs. cavernous sinus thrombosis

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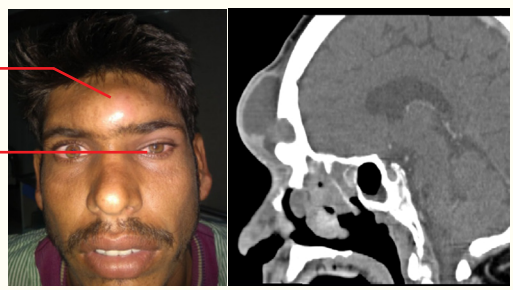
	Orbital cellulitis	Cavernous sinus thrombosis
Onset	Gradual	Abrupt
Nerve involvement	3, 4 & 6 concurrently	$6^{th} \rightarrow 3^{rd} \rightarrow 4^{th}$ sequentially
Trigeminal paresthesia	Absent	Present
U/L or B/L	U/L	U/L $\xrightarrow{\text{Progresses}}$ B/L

Other orbital complications	
Superior orbital fissure syndrome	Ophthalmic branch of CN III, IV, V, VI
Orbital apex syndrome	Superior orbital fissure syndrome + CN II involvement

2) Osteomyelitis of frontal bone :

- m/c bone affected : Frontal (Adults), maxillary (Children).
- Clinical features :



Potts puffy tumor

3) Intracranial complications :

- Subdural abscess (m/c) > Brain abscess > Extradural abscess, meningitis, cavernous sinus thrombosis.
- Brain abscess :
  m/c frontal lobe abscess (Follows frontal sinusitis) → Personality changes.

Note : m/c brain abscess following otitis media → Temporal lobe abscess.

Chronic Complications :

1) Mucocele :

- Collection of secretions in sinus (D/t blocked drainage)
  ↓
  Cystic swelling.
- Causes :
  - Frontal sinusitis (m/c).
  - Trauma (RTA, post FESS).

2) Pyocele : Infection of mucocele.


Non axial proptosis


Mucocele

----- Active space -----

NOSE : PART 2

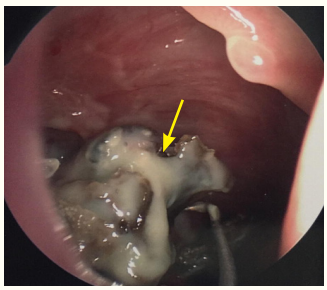
Fungal Sinusitis

00:00:39

	Non-invasive		Acute invasive fungal sinusitis
	Fungal ball	Allergic Fungal Sinusitis (AFS)	
Causative Organism	m/c : Aspergillus	Dematiaceous fungi : Bipolaris, Curvularia, Alternaria	• Mucormycosis : Rhizopus and Mucor • Invasive Aspergillosis : Aspergillus fumigatus
Immune Status	Immunocompetent	Immunocompetent + Atopic (Type I Hypersensitivity)	Immunocompromised (DM, steroid use)
Sinus Involved	m/c : Maxillary sinus	m/c : Ethmoid sinus	-
Presentation	Chronic sinusitis	Chronic rhinosinusitis + Nasal polyps	• Angioinvasive + neural spread : Rapidly to orbit, palate, brain • Acute sinusitis
Endoscopy Findings	Cheesy/clay-like debris in middle meatus	• Nasal discharge : Mucinous, peanut butter/ axle-grease • Nasal polyps	Black necrotic areas/ anaesthetic areas
CT Findings	Double density sign : Heterogeneous appearance	Double density sign + sinus expansion → Bone erosion	-
Diagnosis	-	Bent and Kuhn criteria	Nasal smear/biopsy (IOC) : Infarcts, angioinvasion, perineural invasion
Mx	Functional Endoscopic Sinus Surgery (FESS)	• FESS $\xrightarrow{F/b}$ Steroids (Local/short course : ↓Edema) • Refractory cases : Post-op antifungal Rx (Itraconazole)	Local debridement + Rx of immunosuppression + IV antifungal : • Liposomal amphotericin B (mucormycosis) • Voriconazole (Aspergillosis)

----- Active space -----

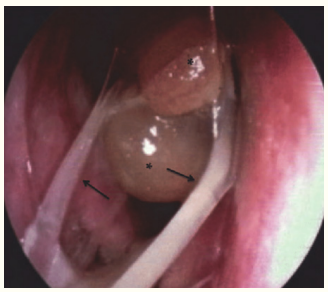
Fungal ball



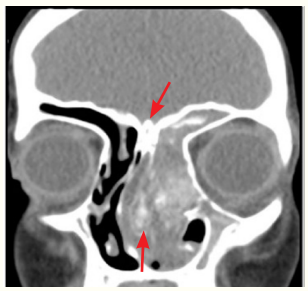
Cheesy debris

CT : Double density sign
(Entrapment of metals)

Allergic fungal sinusitis

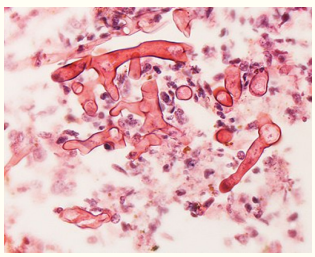


Nasal polyps

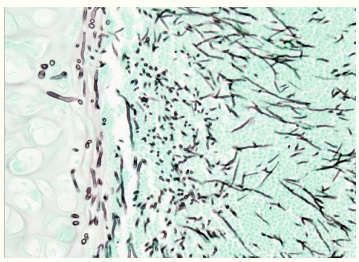


Double density sign

Invasive fungal sinusitis



Mucormycosis :
- Septate hyphae.
- Branching at acute angles.



Aspergillosis :
- Ribbon-like aseptate hyphae.
- Branching at right angles.

Black necrotic areas

Bent and Kuhn Diagnostic Criteria :

For allergic fungal rhinosinusitis.

Major criteria	Minor criteria
• Nasal polyps • Eosinophilic mucin • Type I hypersensitivity (↑IgE levels) • CT : Hazy sinuses + Heterogenous opacities • Fungal smear : ⊕	• U/L predominance • Asthma • Serum eosinophilia • Charcot leyden crystals • Bony erosion • Fungal culture : ⊕

Types of mucormycosis (Phycomycosis) :

- Rhino-ocular or Rhino-oculo-cerebral (m/c)
- Pulmonary
- Cutaneous
  - Occurs in immunocompetent.
  - Percutaneous implantation : Injury with vegetative matter.
- Gastrointestinal
- Disseminated

Nasal Polyps

00:20:21

----- Active space -----

mechanism of formation : Bernoulli's principle.

C/f : Chronic sinusitis → Nasal obstruction, nasal discharge.

Best Ix : NCCT.

B/L Nasal Polyps :

Conditions	Features
B/L nasal polyps in adults	
Allergy (m/c)	• Watery nasal discharge • H/o sneezing/itching, family h/o allergy • ↑IgE levels
Aspirin Exacerbated Respiratory Disease (AERD, AKA Samter's triad)	• Non-allergic, non-IgE mediated hypersensitivity reaction • Abnormal arachidonic acid metabolism : COX 1 > COX 2 inhibitors • C/f : Nasal polyposis, asthma, aspirin hypersensitivity • Mx : Desensitization with aspirin, symptomatic Rx with Montelukast
Eosinophilic Granulomatosis with Polyangiitis (EGPA)/ Churg-Strauss Syndrome	• Chronic rhinosinusitis + Adult onset asthma • Eosinophilia >10%
Young's syndrome (Rare)	Triad : Chronic sinusitis + Bronchiectasis + Infertility (Obstructive azoospermia)
B/L nasal polyps in children	
Cystic Fibrosis/ Mucoviscidosis	• Recurrent pulmonary airway infections, bronchiectasis, intestinal obstruction, pancreatic insufficiency, and malabsorption • Multiple polyps
Kartagener's Syndrome/ Primary Ciliary Dyskinesia (PCD)	Triad :  Situs inversus/ Dextrocardia  Chronic sinusitis  Bronchiectasis

Tests for Mucociliary Function :

Normal : Mucus blanket movement (Ciliary action) —5–10 mm/min→ Cleared into pharynx every 10–20 mins.

- Used in diagnosis of PCD & cystic fibrosis.

1. In vivo testing :

Saccharine test	Nuclear testing/scintigraphy
• Saccharine placed on inferior turbinate → Time taken for sweet taste assessed. • Saccharine mixed with color (methylene blue, indigo blue, charcoal) : Objective test.	Radiolabelled Tc^{99} albumin colloid particles placed on inferior turbinate ↓ Migration checked by gamma camera.
Ⓝ Mucociliary Clearance Time (MCT) : < 30 mins	Ⓝ : Radioactivity disappears from nasal cavity in 30 mins.

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2. In-vitro testing :

Electron microscopy : Ciliary ultrastructure abnormal in PCD.

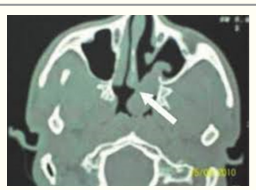
Management of Nasal Polyps :

Medical Mx :
- Nasal steroid spray : ↓Size of polyp.
- Saline nasal spray.
- Mx of underlying condition.

→ If not effective → Surgical Mx : FESS + Nasal polyp excision.

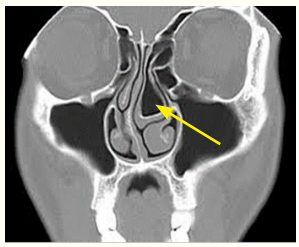
Mx remains the same if recurrent (medical → Sx).

U/L Nasal Polyps :

Conditions	Management
Adults	
Allergic fungal sinusitis	FESS → F/b → Local Steroids (Post-operatively)
Bacterial rhino sinusitis	Medical Mx (1 month) → No benefit → FESS
Children/Young	
Antrochoanal polyp (Growth : Maxillary antrum → Choana)  CT : Transverse view	FESS

----- Active space -----

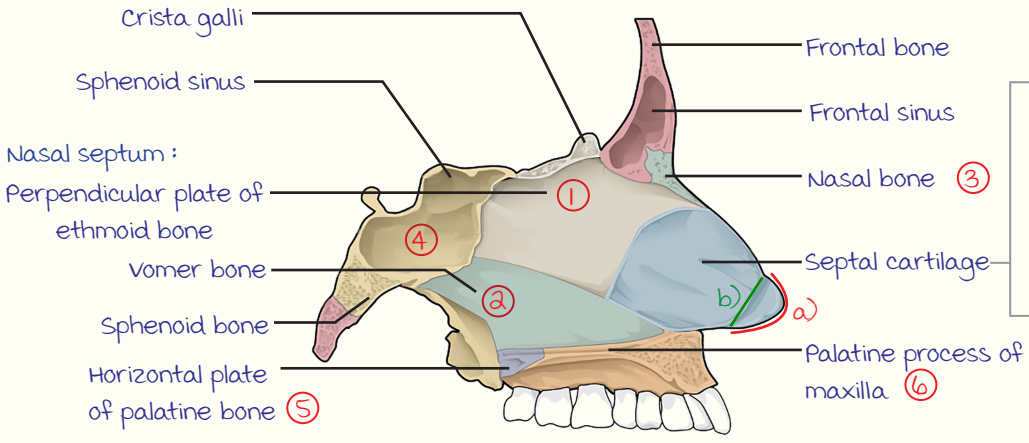
Differential Diagnosis :

	Features	Imaging
Concha bullosa (Pneumatized turbinate) 	Probe test (On probing) : • Polyp : Bleeding & pain ⊖, able to pass probe around • Concha : Bleeding & pain ⊕, unable to pass probe around	 Middle turbinate
Meningocele or Meningoencephalocele (Polypoidal mass in infants)	• Compressible • Transillumination ⊕ • Furstenberg test ⊕ (Cry/cough → ↑Mass size)	 Meningoencephalocele
Malignancy (Polypoidal mass in elderly)	IOC : Biopsy	-

Nasal Septum and DNS

00:38:38

Anatomy of Nasal Septum :



Sagittal section

- Quadrangular/ quadrate shaped.
- Supports lower 2/3rd of nose.
- Removal → Saddling of nose

Nasal septum : 3 parts

a) Columellar septum

b) Membranous septum

c) Septum proper :

- Bony : ①,②,③,④,⑤,⑥
- Cartilaginous

DEVIATED NASAL SEPTUM (DNS)

----- Active space -----

m/c nasal septal abnormality.

Causes → External trauma.
→ Birth trauma/Developmental abnormalities (m/c).

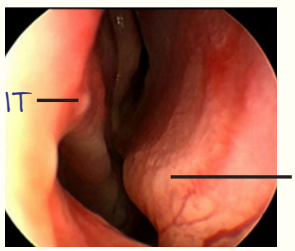
Clinical Features :

- C/o paradoxical nasal obstruction (D/t turbinate hypertrophy).
- Recurrent sinusitis.
- Recurrent otitis media.
- Epistaxis, hyposmia.

O/E :

- Septal deviation.
- Compensatory turbinate hypertrophy of opposite side
  - m/c : Inferior turbinate (IT).

DNS



Nasal endoscopy

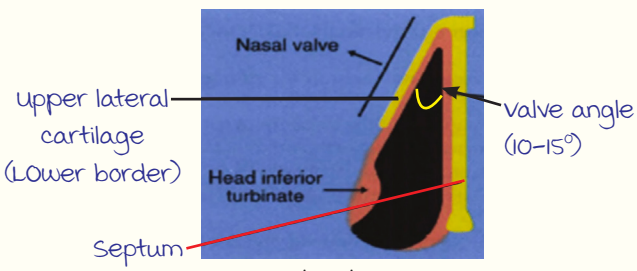
Investigations :

1. Nasal endoscopy : Confirmatory Ix.

2. Cottle's test : To check nasal valve patency.

Cottle's test

Cheek pulled upward + laterally
↓
If obstruction ↓
↓
DNS at nasal valve area.

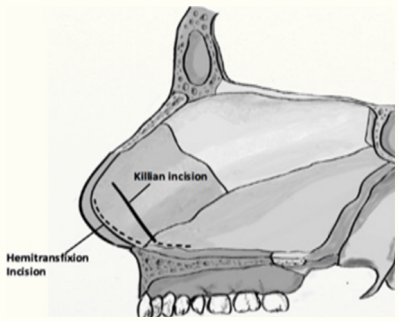


Nasal valve area

Surgical Mx :

Only if symptomatic.

Septal surgery	
Septoplasty (TOC)	Submucosal resection (SMR)
Freer's/Hemitransfixion incision : Over lower/caudal septal border	Killian's incision : 1 cm above lower/ caudal septal border
Mucoperichondral flaps raised on one side	Mucoperichondrial flaps raised on both sides
Only deviated part removed.	Most of cartilage removed.
↓Complication rate (Surgery of choice).	↑Complication rate : ↑Chances of septal perforation, saddling of nose



Sx incisions

Septal perforation

Septoplasty not done in <17 years of age.

----- Active space -----

Fractures of Face

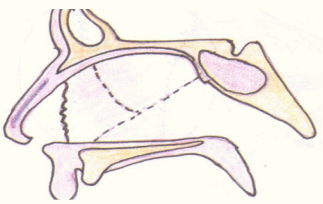
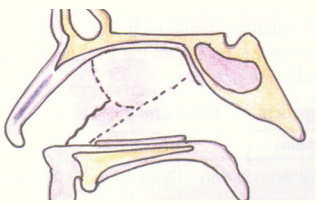
00:47:28

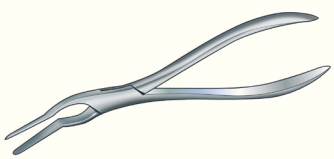
NASAL BONE FRACTURE

m/c facial #, h/o trauma ⊕.

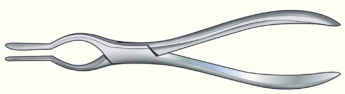
C/f : C/o nasal obstruction, edema over external nose & crepitus ⊕

Nasal bone #

Types of nasal bone #		
Class 1/Chevallet	Class 2/Jarjaway	Class 3/Naso-orbito ethmoid #
Vertical septum fracture (No or mild deformity)	Horizontal/C-shaped # septum (Gross deformity + Septal deviation)	• Pig nose deformity : # nasal dorsum + Perpendicular plate of ethmoid + Cribriform plate + Lamina papyracea • CSF rhinorrhea ⊕
		
Management of class 1/2 # : 1. Early presentation (<3 weeks) : Wait for edema to ↓ (5–7 days) ↓ ⊖ ← Deformity → ⊕ ↓ ↓ Symptomatic Rx — Closed reduction (using forceps + Splint) 2. Late presentation (>3 weeks) + Deformity : Open rhinoplasty or septo-rhinoplasty (Not done in <17 yrs of age)		Management : Follow ABCD of trauma ↓ Immediate Sx (open reduction and internal fixation)

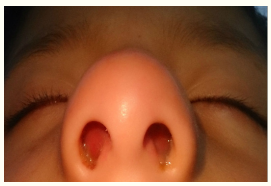


Asch's forceps
(For septal reduction)



Walsham forceps
(For nasal bone reduction)

V-shaped incision
(Rhinoplasty)



Septal hematoma

----- Active space -----

Septal Hematoma :

H/o trauma.

C/f : B/L boggy swelling on both sides of septum.

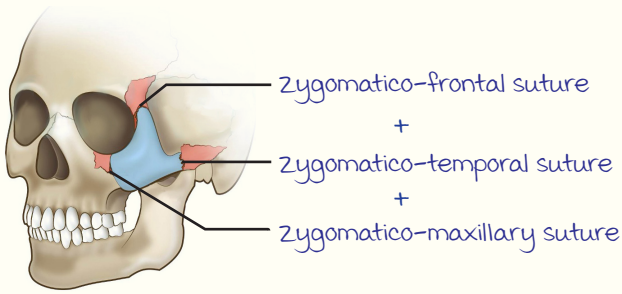
Rx : I & D within 72 hours —Not done→ Septal necrosis, perforation, saddling, or abscess formation.

FRACTURE OF ZYGOMATIC BONE

AKA Tripod # (# at 3 suture sites).

Clinical Features :

- Flattening of malar eminence.
- Anaesthesia over cheek (Infraorbital nerve injury).



Tripod # of zygomatic bone

Orbital/eye findings :

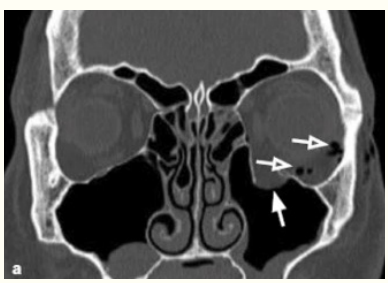
- Periorbital emphysema.
- Step deformity of infra-orbital margin.
- Restricted ocular movements (Inferior oblique, inferior rectus entrapment).
- Enophthalmos.

Zygomatico-frontal suture involved : Step deformity of lateral orbital margin.

Zygomatico-temporal suture involved : Trismus (TM joint involved).

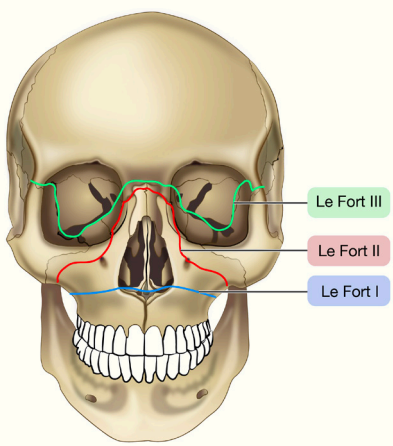
Blow out # :

- # of inferior wall of orbit (D/t severe blow on orbit).
- Infra-orbital nerve injured : Anaesthesia over cheek.
- CT finding : Tear drop sign (Orbital fat protrusion into maxillary sinus)


Blow out #

FRACTURES OF MAXILLA

AKA Le Fort #.



----- Active space -----

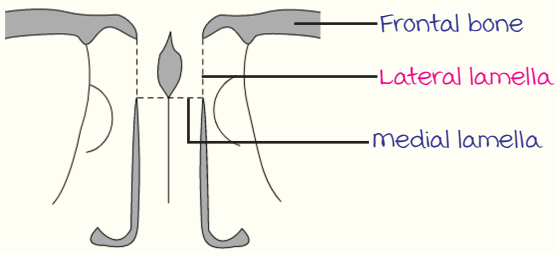
	Le Fort I/Guerin's	Le Fort II	Le Fort III
# line	Runs parallel to palate (Floor of nose + maxillary sinuses)	Runs through maxillary sinus, infra-orbital margin, lacrimal bone up till root of nose (Pyramidal #)	Craniofacial dysjunction
X-ray/CT	Floating palate/ Floating teeth	Hanging maxilla	-
CSF rhinorrhea	⊖	⊕	⊕
Infraorbital nerve injury	⊖	⊕	-

CSF Rhinorrhea

01:01:18

m/c cause : Trauma.

Site of # →
- Anterior cranial fossa (Cribriform plate : Lateral lamella)
- Middle cranial fossa (Sphenoid, transverse temporal bone)



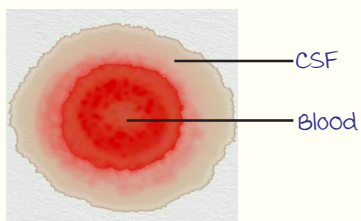
Cribriform plate

C/f :

- H/o trauma.
- U/L watery nasal discharge (↑es on leaning forward).
- Not able to sniff back.

Handkerchief test : No stiffening seen.

Reservoir sign : ⊕.



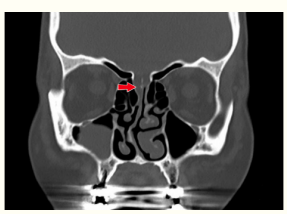
Halo sign/double ring sign/target sign

Investigations :

Biochemical IOC : β2 transferrin, β trace protein ⊕.

Radiological IOC : HRCT (Look for exact site of #).

Active leak assessment →
- MRI/CT cisternography.
- Intrathecal fluorescein (Locate site of leak).


HRCT

Management :

Conservative Mx :
- Propped up position.
- Avoid straining.
- Stool softeners.
- Prophylactic antibiotics

→ No resolution in 2 weeks → Surgical Mx : Endoscopic > Open repair

NOSE : PART 3

----- Active space -----

Nerve Supply of Nose

00:00:55

OLFACTORY SUPPLY

Olfactory Pathway :

Olfactory mucosa (Lines upper 1/3rd of nasal cavity) → Olfactory nerves (12-20 in number) → Olfactory bulb → 1° & 2° olfactory cortex.

Disorders of Smell :

Disorders	Meaning	Causes
Hyposmia	↓ sensation of smell	Partial nasal obstruction
Anosmia	Complete loss of smell	• Viral infections • Fractures of cribriform plate (Transects nerve) • Olfactory bulb tumors (E.g. Frontal lobe meningiomas) • Atrophic rhinitis
Parosmia/Cacosmia/ Dysosmia	Perversion of smell (Patients c/o rotten eggs/ burnt rubber smell)	Aberrant regeneration of nerves
Phantosmia	Delusion of smell	Temporal lobe seizures
Presbyosmia	Age related loss of smell	Neurodegenerative diseases : • Alzheimer's • Parkinson • Multiple sclerosis
Congenital anosmia	Inability to smell from birth	Hypogonadotrophic hypogonadism : Kallman syndrome

Tests :

1. Smell Identification test (SIT) :
   a) University of Pennsylvania smell identification test (UPSIT) : 40 scratch & sniff questions.
   b) Cross-cultural/brief smell identification test : Uses odors well known in most cultures.

----- Active space -----

2. Smell Diskettes

3. Sniffin sticks :

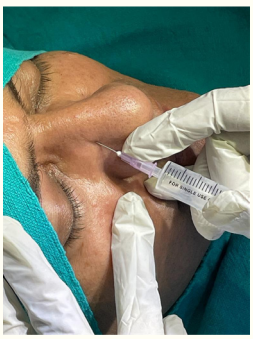
Tells degree of loss of smell.

SENSORY SUPPLY

Trigeminal nerve

- Ophthalmic branch
  - Nasociliary
    - Anterior ethmoidal
    - Posterior ethmoidal
    - Infratrochlear : Sensation to upper part of external nose
  - Anterior ethmoidal + Posterior ethmoidal → Pierces lamina papyracea & enters external nose
    - External nasal : Supplies lower part of external nose (Tip).
    - Internal nasal : Supplies lateral wall of nose.
- Maxillary nerve (Exits via foramen rotundum)
  - Via infra-orbital foramen → Infra-orbital nerve : Supplies cheek & ala of nose.
  - Via sphenopalatine foramen → Sphenopalatine/ nasopalatine nerves : Major supply of nasal cavity.

Nerve Blocks :



External nasal nerve

Infratrochlear nerve
Medial to medial end of eyebrow

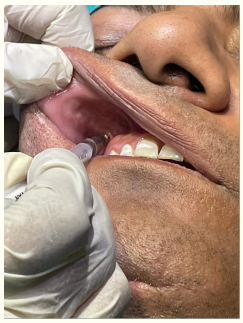
Nasociliary nerve

- 1 cm above medial canthus
- 1.5 cm deep → Anterior ethmoidal
- 2.5 cm deep → Posterior ethmoidal

Infraorbital nerve block :

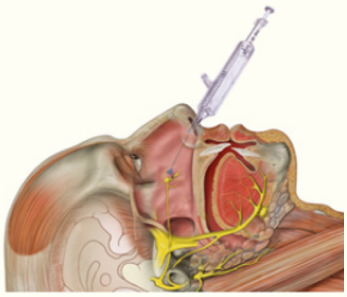
----- Active space -----

External approach



Sublabial approach

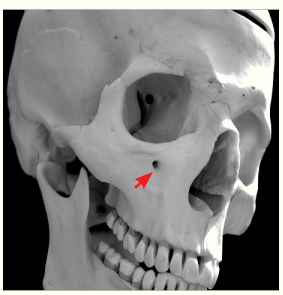
Sphenopalatine ganglion block : Anaesthesia of internal nose.



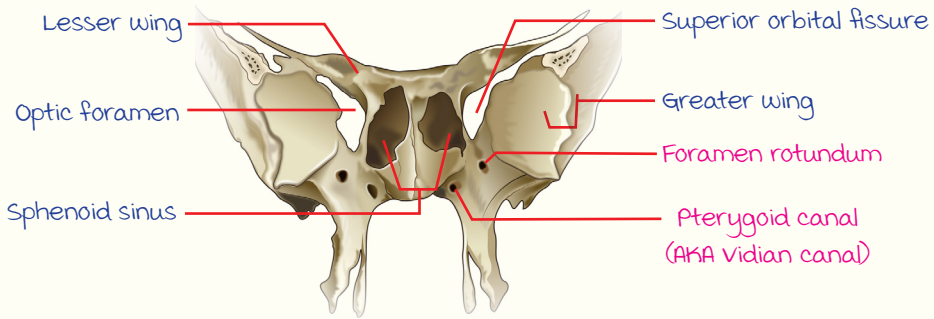
Via nose

Via greater palatine foramen (medial to 3rd molar)

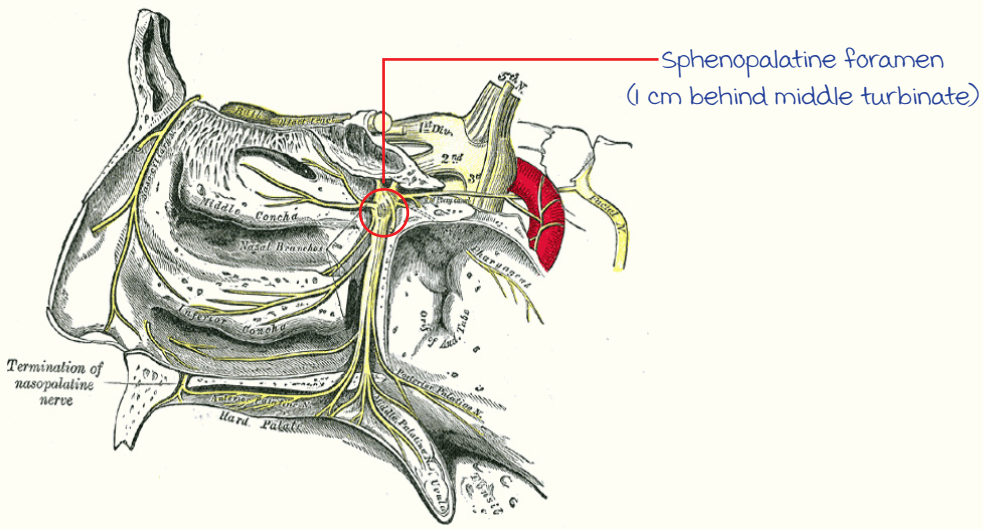
Note : Foramina



Infra-orbital foramen



Foramen rotundum



Sphenopalatine foramen

----- Active space -----

AUTONOMIC SUPPLY

Vidian Nerve :

Branch of facial nerve → GSPN
Sympathetic plexus around ICA → DPN
GSPN + DPN → Fusion → Vidian nerve

- Parasympathetic fibres → Via Pterygoid canal → Relays in SPCT → Functions :
  - Lacrimation.
  - Vasodilatation.
  - Nasal secretions.
  - Palatine secretions.
- Sympathetic fibres → No relay in SPCT → Function : Vasoconstriction.

GSPN : Greater superficial petrosal nerve.
DPN : Deep petrosal nerve.
SPG : Sphenopalatine ganglion.

Note :

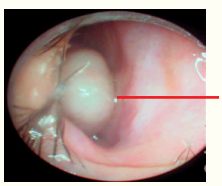
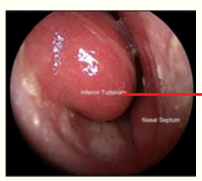
Nasal cycle :

- Simultaneous vasodilatation of one nostril & vasoconstriction of other.
- Duration of one cycle : 2.5–4 hrs.

Rhinitis : Allergic, Vasomotor, Medicamentosa

00:20:37

Allergic vs. Vasomotor Rhinitis :

	Allergic rhinitis		Vasomotor rhinitis
Etiology	Allergen		Idiopathic
C/F	Nasal obstruction, nasal discharge/PND, itching, sneezing.		
	Facial signs	• Allergic salute • Allergic shiners • Dennie morgan lines	⊖
	Family h/o allergy	⊕	⊖
Anterior rhinoscopy	 Pale/boggy		 Congested mucosa
IgE levels (RAST)	↑↑		Normal
Skin prick test	⊕		⊖
Rx	• Anti-allergics • Nasal steroid spray • Leukotriene inhibitors (montelukast) • Nasal decongestants (<7 days) ↓ No improvement Immunotherapy		• Intranasal steroids ↓ No improvement Vidian neurectomy • Partial/total turbinectomy : If hypertrophy of inferior turninate (mulberry appearance) present.

RAST : Radioallergosorbent test. PND : Post nasal drip.

Note : Otto Veraguth folds are seen in depression.

----- Active space -----

Allergic salute

Dennie Morgan lines (Crease in lower lid)

Allergic shiners (Dark discoloration & puffiness below eyes)

Rhinitis Medicamentosa :

Pathophysiology :

Prolonged use of nasal decongestants → Prolonged vasoconstriction → Ischemic changes in nose.

Prevention : Avoid nasal decongestant use for >7 days

Rx :

- Stop decongestant use.
- Short course of steroids : Local (Nasal spray) > Systemic.

Atrophic Rhinitis

00:28:45

F > M (Starts during puberty).

Types :

Primary :

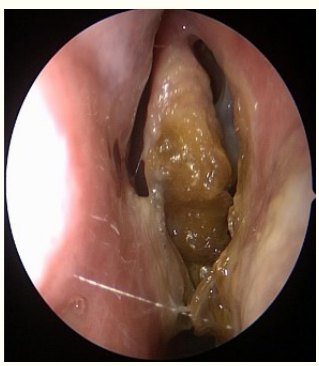
Causes :

- Unknown (M/C).
- Klebsiella ozaenae.

Secondary :

Causes :

- Granulomatous conditions.
- Tissue destructive Sx → Empty nose syndrome.



Atrophic rhinitis

Clinical Features :

- B/L excessive nasal crusts → Nasal obstruction & infection.
- B/L roomy nasal cavity.
- Foul smelling nasal discharge (merciful anosmia : Patient is unaware).

Treatment :

1. Removal of crusts : Alkaline nasal douche.
   Contents : Sodium chloride, Sodium bicarbonate, Sodium biborate (2 : 1 : 1 in distilled water)
2. Treat infection :
   - 25% glucose in glycerine spray.
   - Kemicetine solution contents : Chloramphenicol, Oestradiol, Propylene glycol & Vitamin D (Mnemonic : COPD).

----- Active space -----

3. Surgery :
   - Young's operation : Complete closure of nasal cavity.
   - Modified Young's operation : Nasal cavity closure with 3mm opening in center.

Granulomatous Conditions of Nose

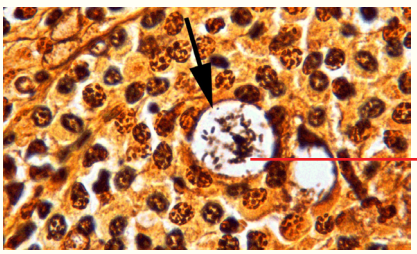
00:34:05

Rhinoscleroma :

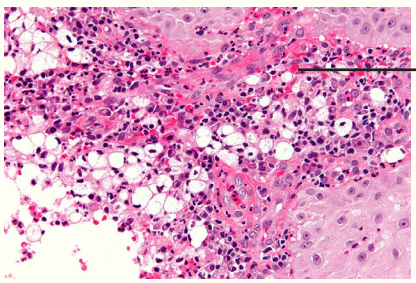
Etiology : Klebsiella rhinoscleromatis (Frisch bacillus) → Endemic to Asia & Africa.

Stages	1. Atrophic stage	2. Granulomatous stage	3. Cicatricial stage
C/f	Crusting, nasal obstruction	Hard, woody nose	Nasal deformities ⊕ (Eg : Hebra/Tapir nose)

Biopsy :



Mikulicz cells : Macrophages containing phagocytosed bacilli.



Russel bodies : Plasma cells with eosinophilic inclusion bodies.

Treatment :

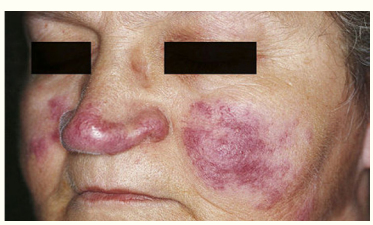
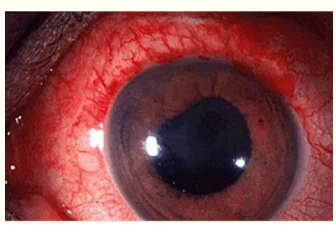
- Antibiotics : Ciprofloxacin (DOC), Streptomycin, Rifampicin, Tetracycline.
- Steroids : ↓fibrosis.

Common Clinical Features :

- Nasal obstruction.
- ↑Crusting $\xrightarrow{\text{Removal}}$ Blood tinged nasal discharge.
- Septal perforation :
  - Cartilaginous part : All granulomatous conditions.
  - Bony part : Syphilis, granulomatosis with polyangiitis (Wegener's granulomatosis).
- Saddling (Later stages).

----- Active space -----

Specific Characteristics :

Condition	Clinical features	Investigations
Granulomatosis with polyangiitis	 Serous otitis media  Strawberry gingiva	• c-ANCA ⊕ • Biopsy : Necrotizing granulomatous vasculitis
Syphilis	• Septal perforation (Bony > Cartilaginous) • Congenital : Snuffles (Rhinitis)	-
TB	Saddling + perforation in cartilaginous septum	Biopsy : Caseating granulomas + acid fast bacilli
Lupus vulgaris	Non-blanching brownish nodules (Apple jelly nodules)  	-
Leprosy	Skin patches, sensory loss, paresthesia/numbness in extremities	-
Sarcoidosis	• Strawberry nasal mucosa • Heerfordt's syndrome/Uveoparotid fever (Triad) : - B/L parotid enlargement - Facial nerve paralysis - Anterior uveitis  Lupus pernio : Violaceous affection of nose  Anterior uveitis	Biopsy : Non-caseating granulomas

T-cell Lymphoma

00:45:36

AKA Midline lethal granuloma/Stewart's lymphoma/NK lymphoma.

A/w EBV.

Clinical features : Destruction of midline structures (Septum, palate).

Investigations : Biopsy.

Treatment : Radiotherapy ± Chemotherapy $\xrightarrow{F/b}$ Reconstruction of defect.

----- Active space -----

NOSE : PART 4

ARTERIAL SUPPLY

Internal carotid artery → Ophthalmic A. → Post. ethmoidal A. / Ant. ethmoidal A.

External carotid artery → Maxillary A. → 1. Sphenopalatine A. (main arterial supply). 2. Greater palatine A. (Supplies palate & nose).

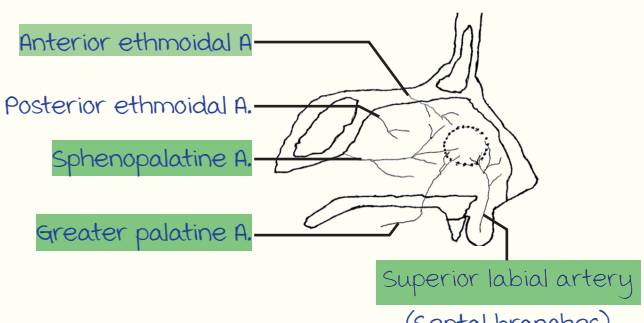
External carotid artery → Facial A. → Septal branch of superior labial A.

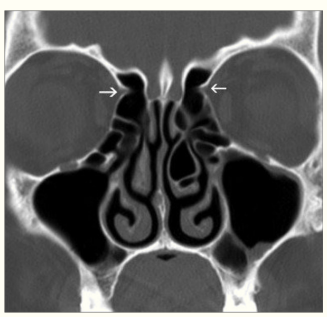
: Supplies lateral wall & septum.

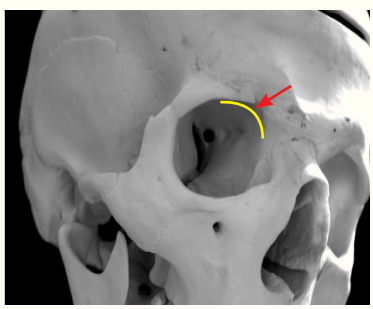
	Anterior ethmoidal artery	Sphenopalatine artery
Features	Pierces lamina papyracea → Enters → Nose : Anterior ethmoidal notch/Nipple sign.	Runs through sphenopalatine foramen.
Significance	Injury during FESS → Orbital hematoma. (Emergency) Mx : Lynch Howarth incision → Ligation of anterior ethmoidal artery.	• main artery of epistaxis + Little's area/ Kiesselbach's plexus. • Ligated in sphenopalatine foramen (1 cm behind posterior end of middle turbinate.)

Kiesselbach's Plexus :

- Anastomoses in Little's area (Antero-inferior part of the septum).




Nipple sign on CT


Lynch Howarth incision

: Arteries forming Kiesselbach's plexus

- Posterior ethmoidal A. : Not a part of Kiesselback's plexus.

EPISTAXIS

----- Active space -----

m/c site :

- Children & young : Little's area.
- Adults : Posterior epistaxis.

Woodruff's plexus :
Venous plexus behind inferior turbinate.

m/c cause :

- Children : Trauma (Nose picking).
- Adults/elderly : Idiopathic.

m/c artery involved : Sphenopalatine artery (Anterior + posterior epistaxis).

Recurrent epistaxis : In young male → Rule out angiofibroma.

Note : Foreign body in children → U/L foul smelling nasal discharge > Epistaxis.

Management :

Small volume bleeds

1. Hippocratic/Trotter's method : Pinch nose tightly + sit leaning forwards

Bleeding ↓ continues

2. Endoscopic cauterization :
   - Silver nitrate used.
   - Bipolar cautery.

Bleeding ↓ continues

3. Anterior nasal packing :
   - Ribbon gauze.
   - merocel packs/sponge.

Bleeding ↓ continues

4. Posterior nasal packing : using foley's catheter

Bleeding ↓ continues

Admit the patient + prophylactic antibiotic coverage

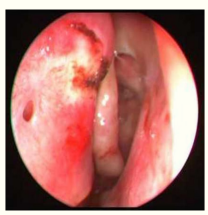
Bleeding ↓ continues

5. Ligation (Order & site) :
   - TESPAL (Sphenopalatine foramen)
     Bleeding ↓ continues
   - Maxillary artery ligation
     Bleeding ↓ continues
   - ECA ligation (Neck)
     Bleeding ↓ continues
   - Anterior ethmoidal artery ligation (Anterior ethmoidal canal)

TESPAL : Transnasal Endoscopic Sphenopalatine Artery Ligation.

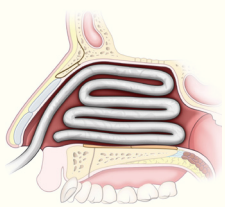
Large volume bleeds :
- Airway, breathing, circulation.
- IV access :
  - Blood parameters, grouping.
  - Fluid resuscitation.
- History + Rx underlying cause.

Trotter's method

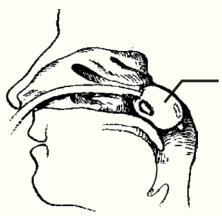


Cauterization

Merocel sponge



Anterior nasal packing



Posterior nasal packing

maxillary artery ligation
Site : Sphenopalatine/pterygopalatine fossa.
Approach : 1. Endoscopic. 2. Caldwell Luc procedure :

----- Active space -----

Rhinosporiodiosis

00:15:14

Etiopathogenesis :

- Causative organism : Rhinosporidium seeberi (Aquatic protozoa).
- Cattle breeders, farmers (Commonly).
- Endemic to South India (m/c : Tamil Nadu)

Features :

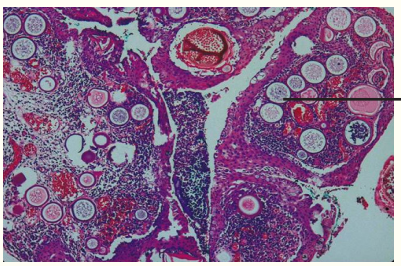
H/o bathing in ponds frequented by animals.

Symptoms : Epistaxis, nasal obstruction, blood tinged nasal discharge.

O/E : Subcutaneous nodules on skin ⊕, Strawberry/mulberry mass (Polypoidal, vascular)

Management :

Ix : Biopsy (IOC).



Sporangium filled with sporangiospores

HPE of Rhinosporidiosis

Mass with white dots (Sporangia of protozoa)

Strawberry mass

Rx : Wide excision of base + cauterization $\xrightarrow{F/b}$ Dapsone (Post operatively, ↓recurrence rate)

Tumours Of Nose

00:19:08

Inverted Papilloma :

- AKA Ringertz tumour/Schneiderian papilloma/Transitional cell papilloma.
- m/c benign tumour of nasal cavity.

Features
• Locally invasive.
• Premalignant
• Recurrent

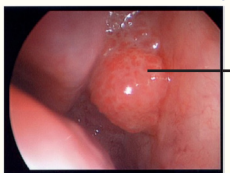
Cause : Human Papilloma Virus (HPV).

C/f :

- m > F (40–70 years).
- U/L nasal obstruction + blood tinged nasal discharge.

Investigations :

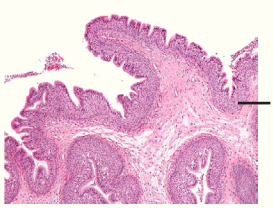
a. Endoscopy :



Papillary appearance

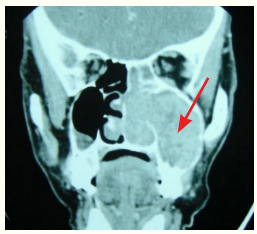
U/L polypoidal mass (Arises : middle meatal area)

b. Biopsy :



Epithelium growing towards stroma

c. CT scan :



Cerebriform appearance

Mx : Wide excision (Endoscopic > External approach).

Carcinoma Of Nose :

Basal Cell Carcinoma (BCC)	Squamous Cell Carcinoma (SCC)
AKA Rodent ulcer	AKA Nose picker's carcinoma
m/c carcinoma of external nose	m/c carcinoma inside nasal cavity

BCC : Basophilic cell bundles + palisading nuclei (HPE).


BCC/ Rodent ulcer

----- Active space -----

Tumours Of Paranasal Sinuses

00:22:19

	Sinus affected (m/c → l/c)
Benign tumours	Frontal > Ethmoid > Maxillary > Sphenoid
Carcinoma	Maxillary > Ethmoid > Frontal > Sphenoid

BENIGN

Osteoma : m/c benign tumour of PNS (m/c : Frontal sinus).

Fibrous dysplasia :

- Normal bone replaced by fibrous tissue.
- Seen in young; m/c : maxillary sinus.
- X-ray/CT : Ill-defined ground glass appearance.

MALIGNANT

SCC : m/c carcinoma PNS (m/c sinus : Maxillary).

Adenocarcinoma : m/c in hard wood furniture industries/ Carpenter (m/c : Ethmoid sinus).

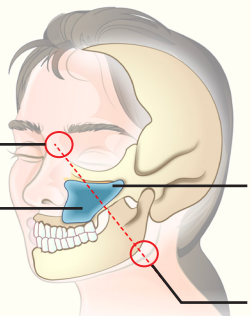
Esthesioneuroblastoma/Olfactory neuroblastoma :

- Neuroendocrine hormone secreting tumour from olfactory mucosa.
- Highly vascular, cherry-red, polypoidal mass.


CT : Esthesioneuroblastoma

Maxillary Sinus Carcinoma :

Ohngren's classification :



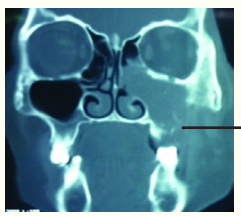
- Better prognosis.
- Early stage tumours.

- Bad prognosis.
- Late stage tumours.

Ohngren's line

Investigations :

a. CT scan :



Maxillary sinus carcinoma

b. Biopsy : Carcinoma features. (Mitotic figures)

----- Active space -----

TNM classification :

T1	Antral mucosa involved.	T4	Involvement of : • Pterygoid plate. • Infratemporal fossa. • Orbital contents. • Cribriform plate. • Frontal Sinus. • Sphenoid sinus.
T2	Bony erosion : • Medial maxillary wall. • Floor of maxilla (Hard palate).		
T3	Bony erosion of : • Floor of medial wall of orbit. • Posterior wall of maxillary sinus. • Pterygopalatine fossa invasion.		

Management :

- T1, T2 : Sx (Partial/Total maxillectomy).
- T3, T4 : Sx + Radiotherapy.

Sx approach

Lateral Rhinotomy (Moure's incision)

Weber Ferguson incision

Midfacial degloving (Sublabial incision; Cosmetically better.)

Denker's operation :

- Endoscopic approach.
- Anteromedial maxillectomy.

Note :

Juvenile nasopharyngeal angiofibroma

- Arises from sphenopalatine foramen.
- Holman miller sign :
  Pushing posterior wall of antrum anteriorly (On CT).

Rhinophyma/Nasal Elephantiasis

- Seen in middle aged males.
- H/o long standing acne rosacea. (Sebaceous gland hypertrophy).
- Sx : Wide skin excision. (For large deformity).

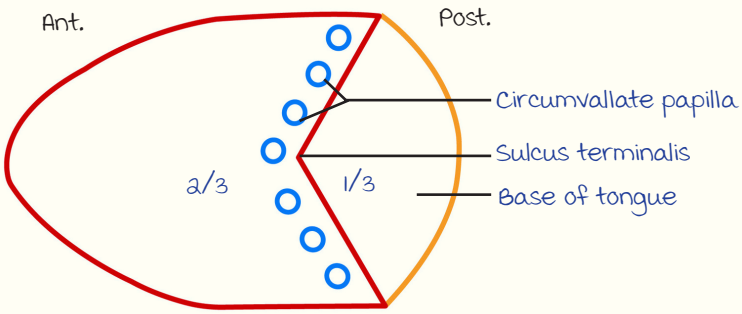
Potato nose

PHARYNX : PART 1

----- Active space -----

Nerve Supply of Tongue

00:00:49



Sensory Supply :

	Sensory	Taste	Referred pain to ear
Anterior 2/3rd	Lingual nerve (Branch of mandibular)	Chorda tympani (Branch of facial)	Lingual nerve (Branch of mandibular)
Posterior 1/3rd (Base of tongue)	Glossopharyngeal nerve		Jacobson's branch of glossopharyngeal nerve
Circumvallate papillae (In ant. 2/3rd)			-
Posterior most	Vagus nerve		Arnold's branch of vagus nerve

Motor Supply :

- Muscles : derived from occipital myotomes.
- Hypoglossal nerve. → Exception : Palatoglossus by pharyngeal plexus.

Clinical significance :

U/L hypoglossal nerve palsy → Deviation of tongue to weaker side
D/t genioglossus of normal side.

Action of genioglossus :

- Protrusion
- Deviation to opposite side.

Deviation of tongue

Note : Nerves passing through jugular foramen → CN IX, X, XI.

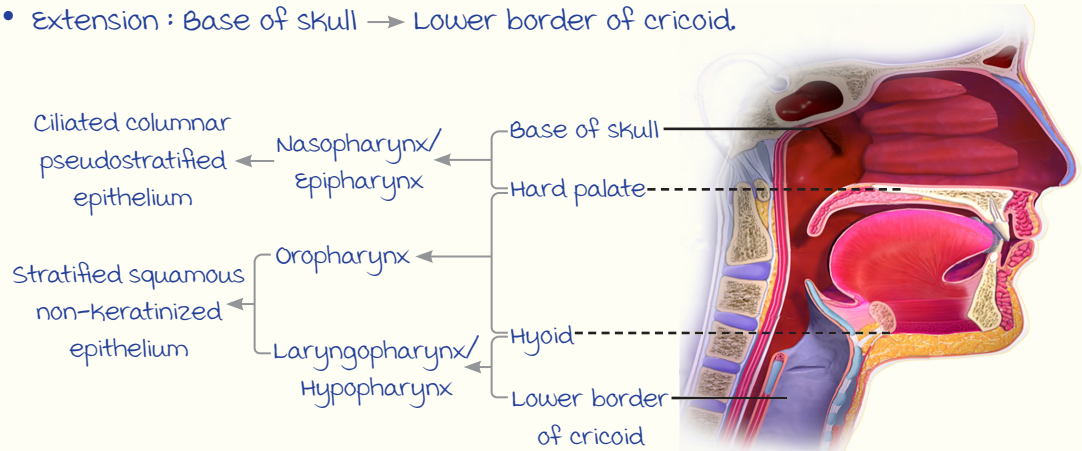
----- Active space -----

Anatomy of Pharynx

00:05:03

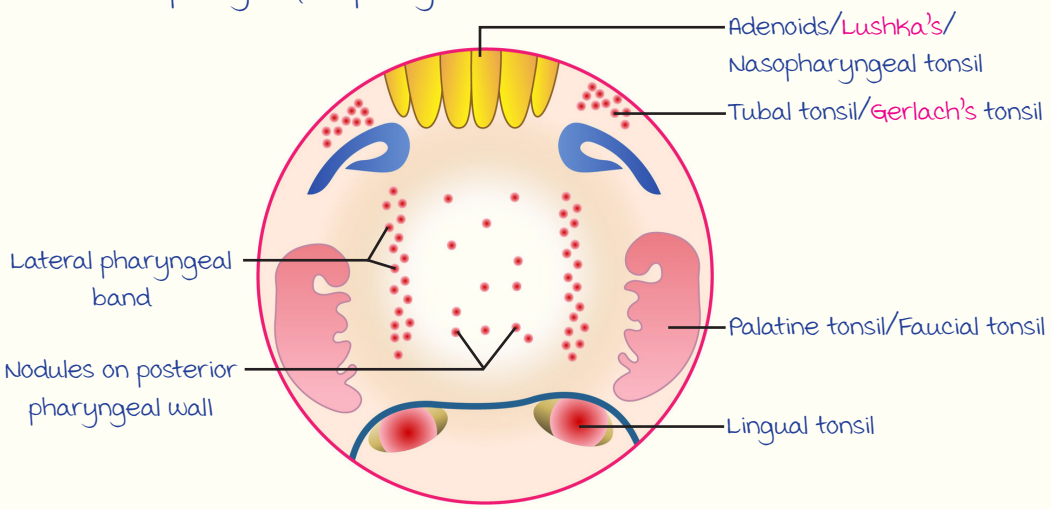
Parts of Pharynx :

- Fibromuscular tube.
- Extension : Base of skull → Lower border of cricoid.



Waldeyer's Ring/Mucosal Associated Lymphoid Tissue (MALT) :

Present in nasopharynx & oropharynx.



Muscles :

Muscles of pharynx : Pushes food into esophagus

Longitudinal : Dilators
- Stylopharyngeus
- Salpingopharyngeus
- Palatopharyngeus

Circular : Constrictors
- Superior constrictor (SC) → At level of nasopharynx, bed of tonsil.
- Middle constrictor (MC)
- Inferior constrictor (IC)

Fascia :

Pharyngobasilar fascia : Anterior fascia

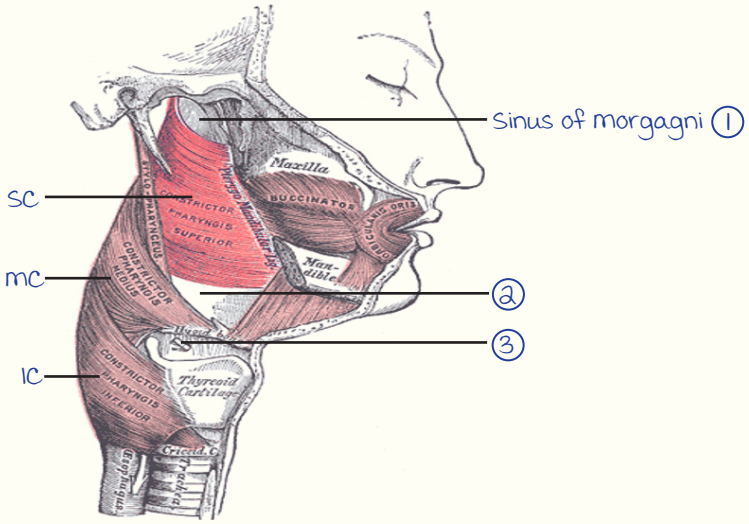
↓

Thickened part lateral to palatine tonsil → Capsule.

Buccopharyngeal fascia : Posterior fascia outside circular muscles.

Constrictors & Relevant Anatomy

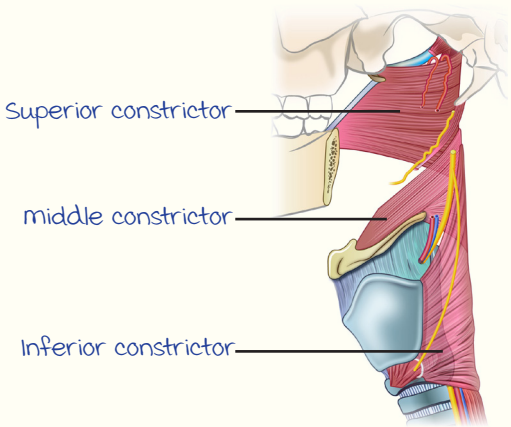
00:11:42 ----- Active space -----



Lateral view

Structures Passing Between Each Constrictor :

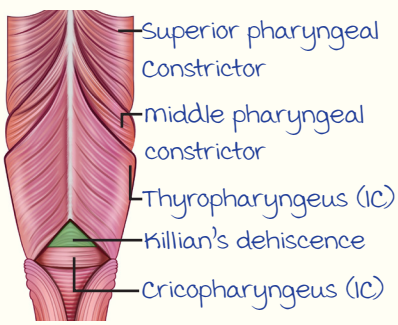
Landmark	Structures
1. Sinus of Morgagni : B/w base of skull & superior constrictor	• Tensor veli palatini • Ascending palatine artery • Ascending pharyngeal artery • Levator veli palatini • Auditory tube (Eustachian tube) Mnemonic : TAALA
2. B/w superior & middle constrictor	• Glossopharyngeal (IX) nerve • Stylopharyngeus muscle
3. B/w middle & inferior constrictor	Internal branch of superior laryngeal nerve (Branch of CN X)
4. B/w inferior constrictor & esophagus	Recurrent laryngeal nerve (Branch of CN X)



Circular muscles

Killian's Dehiscence/Zenker's Diverticulum/Gateway of Tears :

- Outpouching of mucosa in pharyngobasilar fascia.
- Most common in elderly, left side.
- Posterolateral extension.
- Pulsion diverticulum.
- False diverticulum.

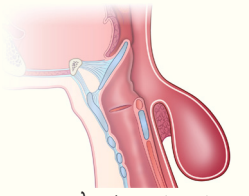


Posterior View

----- Active space -----

C/f :

- Dysphagia, regurgitation (D/t food collection) → Cough, hoarseness, halitosis. / Recurrent laryngitis. / Lung complications.
- O/E : Boyce sign → Gurgling sound on neck palpation.



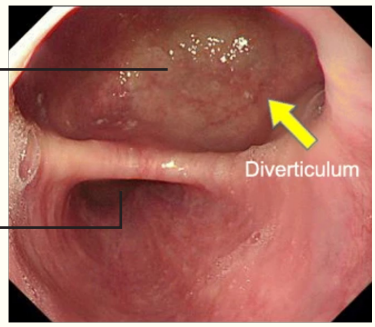
Zenker's diverticulum

Investigation :

1. Barium Swallow (Lateral view) : Best Ix.

Rising tide appearance : Rising of pouch filled with food, fluids.

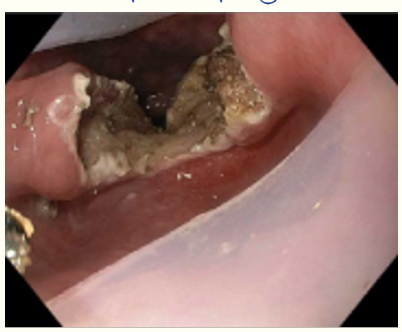
Esophageal lumen



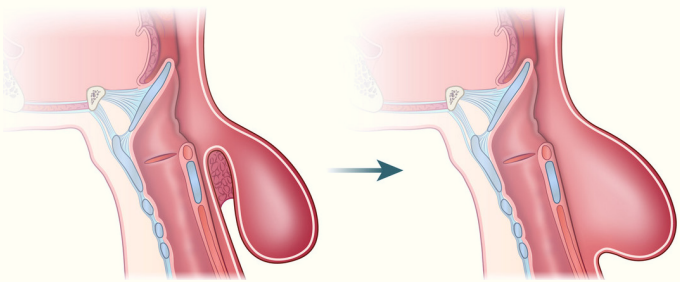
2. Endoscopy

Management :

- Dohlman's procedure : Laser-based procedure.
- Endoscopic stapling diverticulectomy.
- Open excision : For large diverticula.



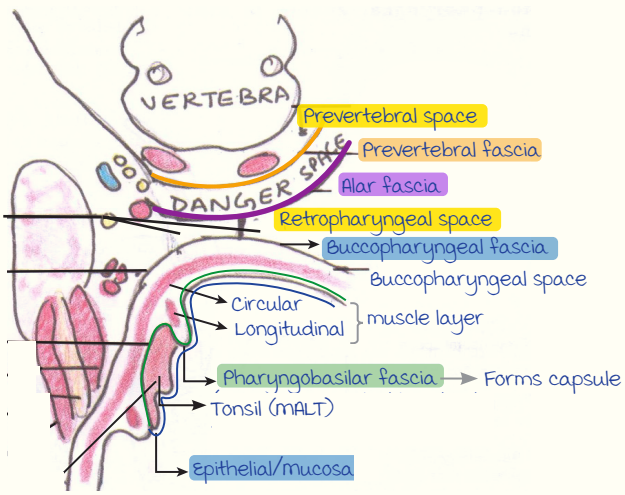
Endoscopic diverticulectomy



Removal of common wall

Spaces of Pharynx

00:21:02



Transverse Section of pharyngeal wall

Fascia behind pharyngeal wall
Mnemonic : BAP • Buccopharyngeal fascia • Alar fascia • Prevertebral fascia

Extension :

----- Active space -----

	Lower limit	Upper limit
Retropharyngeal space	T4	Base of skull
Danger space	Diaphragm	
Prevertebral Space	T4	

On Examination :

	Retropharyngeal space/Space of Gillette	Prevertebral space
Posterior wall bulge	U/L swelling (D/t fibrous septa)	Diffuse midline swelling

Applied Anatomy :

Danger space : Infection —Spreads→ Mediastinum → Mediastinitis, pericarditis, pleuritis.

Acute Retropharyngeal Abscess

00:25:00

Content : Nodes of Rouviere (Lymph nodes).

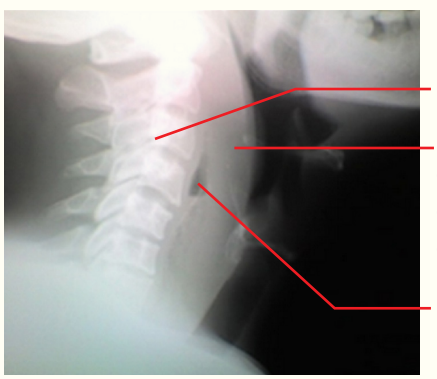
Etiology :

- Children (m/c) : Acute suppurative lymphadenitis (D/t nasopharyngeal/oropharyngeal infection).
- Adults : Penetrating injury (Eg : Fish bone).

Clinical Features :

- Fever.
- Dysphagia, odynophagia.
- Stridor.
- Torticollis (D/t spasm of prevertebral muscles).

Investigation :



X-ray

Note : CT → To differentiate between retropharyngeal & prevertebral abscess.

Management :

- Airway, fluid management.
- Intra-oral incision & drainage of abscess.
- IV antibiotics.

----- Active space -----

Peritonsillar Abscess/Quinsy

00:28:20

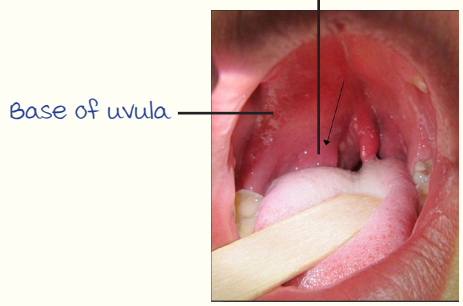
Peritonsillar space location : B/w capsule of palatine tonsil & superior constrictor.

Spread :

Crypta magna (Largest tonsillar crypt) : m/c in adults d/t tonsillar atrophy.

Clinical Features :

- Fever.
- Sore throat.
- Odynophagia, dysphagia.
- O/E : Medially pushed tonsil.
- Hot potato voice.



Site of Incision : Lateral to point of intersection b/w line drawn along anterior pillar & base of uvula

Management:

- IV antibiotics.
- Aspiration of abscess —Not treated→ Incision & drainage.
- Interval tonsillectomy : 6 weeks after → 1st episode : Children
  → 2 episode : Adults

Parapharyngeal Space

00:31:35

AKA Lateral pharyngeal/Pharyngomaxillary space.

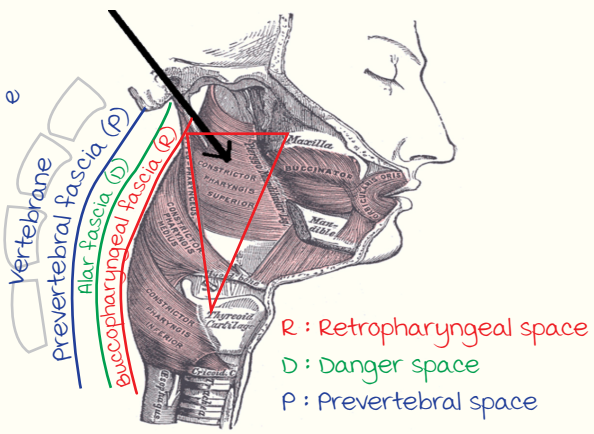
Boundaries :

Medial : Lateral pharyngeal wall, buccopharyngeal fascia.

Lateral : Mandible, medial pterygoid, masseter.

Base : Base of skull.

Apex : Hyoid bone.

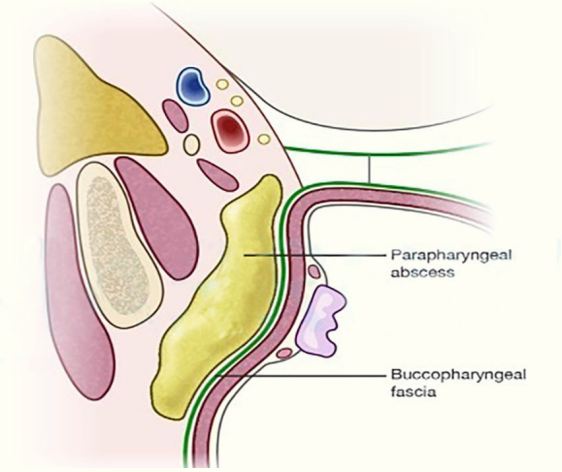


Parapharyngeal Space

Compartments :

----- Active space -----

Divided by styloid process.



	Anterior/Pre-styloid compartment	Posterior/Post-styloid compartment
Compartments	• Loose areolar tissue • Maxillary artery branches • Mandibular nerve branches	• Internal carotid artery • Internal jugular vein • CN : IX, X, XI, XII • Cervical sympathetic trunk
O/E	Tonsil pushed medially	Bulge behind posterior pillar of tonsil
Clinical significance	• Abscess • Trismus (D/t mastication muscles involvement)	• Neurogenic tumor • Horner's syndrome
Parotid bulge (Bulge at angle of mandible)	 Note : Absent in peritonsillar abscess	

Management :

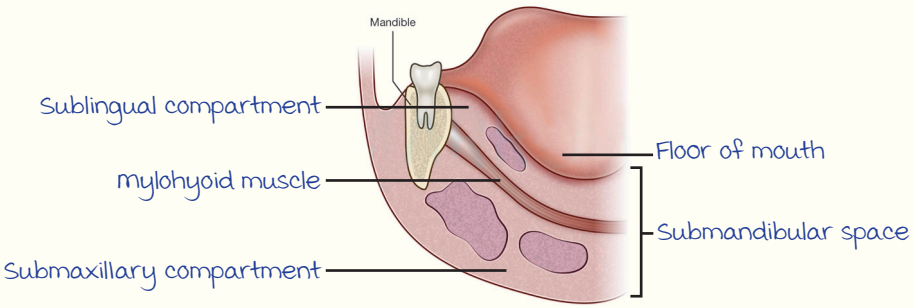
- Incision & drainage : 2-3 cm below angle of mandible. → To prevent marginal mandibular nerve injury.
- IV antibiotics.

----- Active space -----

Submandibular Space

00:40:31

Anatomy :



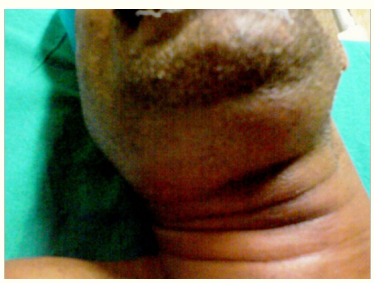
Ludwig's Angina :

Cellulitis of submandibular space.

Spread : Dental caries	C/f
Premolar → Sublingual	Raised floor of mouth, difficulty in speaking, breathing & swallowing
Molar → Submaxillary	Brawny edema (B/L woody feel)

Management :

- Airway management : Tracheostomy.
- Fluid management.
- IV antibiotics.
- Incision & drainage : Incision b/w both angles of mandible.
- Caries Mx.



Brawny Edema

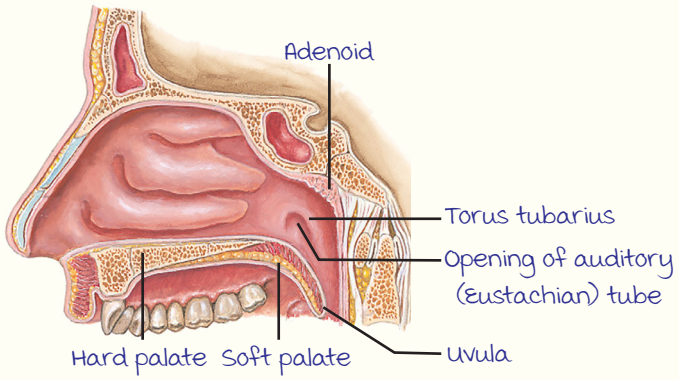
PHARYNX : PART 2

----- Active space -----

Nasopharynx

00:00:26

- Located behind nasal cavity.
- Extension : Base of skull
  ↓
  Hard palate.



Structures in Nasopharynx :

Structures	Features
Posterior wall :	
Adenoids	• At the junction of roof & posterior wall.
Lateral wall :	
1. Eustachian tube	• 1.25 cm behind inferior turbinate. • Bounded postero-superiorly by torus tubarius.
2. Fossa of Rosenmuller	• Behind torus tubarius. • M/c site of nasopharyngeal carcinoma.

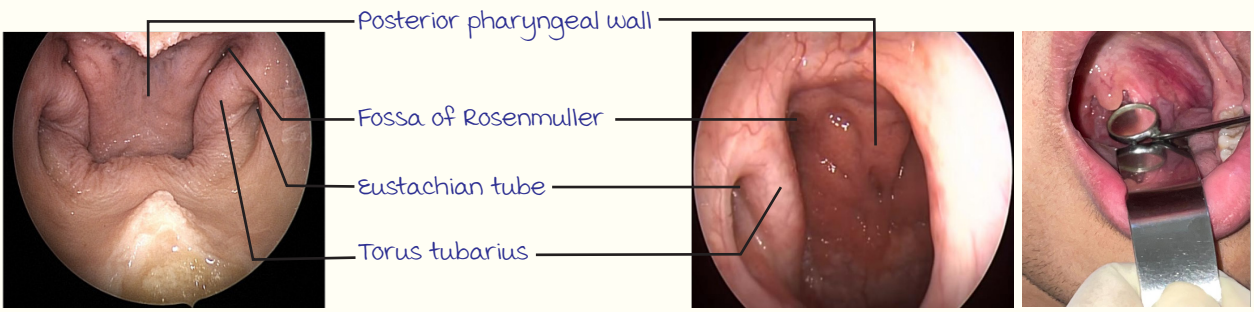
Note : Sphenopalatine foramen.

- 1 cm behind posterior end of middle turbinate (Nasal cavity).
- Contents : Branches of maxillary artery & nerves.

Sensory supply (main) : Maxillary nerve.

Arterial supply (main) : Maxillary artery branches.

Visualization :



Nasal endoscopy : 1st pass

Posterior rhinoscopy

----- Active space -----

Clinical features of mass in nasopharynx :

- Nasal obstruction.
- ET obstruction → Serous Otitis media (SOM).
- Voice change : Rhinolalia clausa (Hyponasality).

Passavant Ridge :

Formed by : Superior constrictor & palatopharyngeus.

Action : Closure of nasopharyngeal isthmus by joining soft palate.

Clinical significance :

Incomplete closure (D/t paralysis of palate, cleft palate) → Rhinolalia aperta. (Hypernasality)

Adenoid Hypertrophy

00:07:22

- Component of Waldeyer's ring.
- Present at birth → Provides immunity.

Growth : ↑till 6–7 years, plateaus – 7–12 years, Atrophies – >12 years.

Features : No capsule, vertical ridges → makes it appear multiple.

Adenoid facies

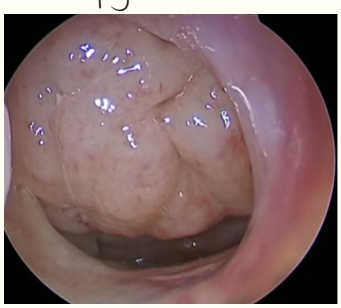
Clinical Features :

- Nasal obstruction :
  Chronic nasal obstruction → Pinched nose (D/t nasal atrophy), absent nasolabial folds.
- Rhinolalia clausa.
- ET obstruction → Serous otitis media.
- Adenoid facies : mouth breathing → Open mouth, high arched palate, crowding of teeth.
- Recurrent infection : D/t failure of passage of secretions.
- Sleep apnea (In large adenoids).

} Failure to thrive.

Investigation :

Endoscopy :



X-ray lateral view : Done in young children.

----- Active space -----

Management :

- **Medical :**
  - Steroid nasal sprays.
  - Antibiotics : If infection ⊕.
- **Surgical :**
  - Adenoidectomy + grommet insertion (If SOM ⊕).

Adenoidectomy :

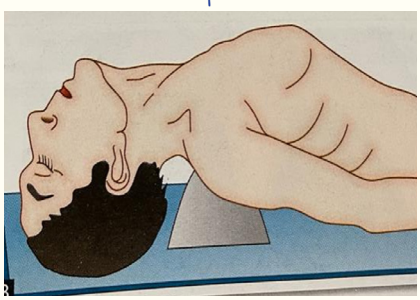
Indications	C/I
• Sleep apnea • Chronic serous otitis media • Recurrent infections (Sinusitis, AOM)	• Bleeding diathesis • Acute infection • Velopharyngeal insufficiency (Cleft palate) ↓ Post sx Rhinolalia aperta, nasal regurgitation of food

Instruments :

- Cold methods : Curettage
- Hot methods : Coblation

Blind curettage

Position : Rose position



Extension at atlanto occipital & cervicothoracic joints..

Complication :

- Hemorrhage (m/c).
- Unmasking of velopharyngeal insufficiency.
- Grisel syndrome : Non- traumatic inflammatory atlanto-axial subluxation.
  - Neck stiffness.
  - Torticollis.
  - Severe neck pain.

  } Paraspinal spasm d/t inflammation.

Torticollis

----- Active space -----

Angiofibroma

00:14:40

- m/c benign tumour of nasopharynx.
- Locally invasive.

Site of origin : Sphenopalatine foramen (Posterior nasal cavity).

Etiology :

D/t incomplete regression of 1st arch artery $\xrightarrow[\text{Pubertal male}]{\text{Androgen stimulation}}$ Proliferation.

Characteristics :

- No muscular coat.
- Well circumscribed.
- No capsule.

Clinical Features :

- U/L nasal obstruction.
- Recurrent epistaxis.
- Rhinolalia clausa.
- SOM d/t ET obstruction.
- Frog facies : Broadening of nose, swelling of cheek, proptosis.

Frog facies

Spread :

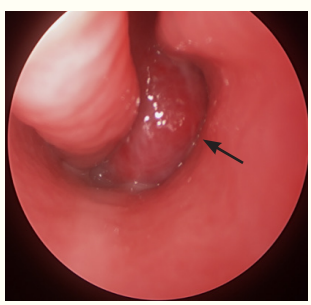
- Sphenopalatine fossa.
- Infratemporal fossa.

} Laterally → Swelling of cheek.

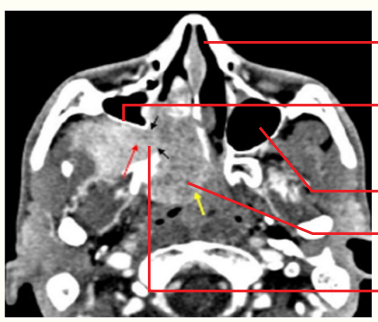
- Proptosis : Superior spread.

Investigation :

- Endoscopy : Red fleshy mass.
- CECT : IOC.
- Biopsy & digital examination : C/I.



Nasal endoscopy



CECT

----- Active space -----

Staging :

a. Radkowski staging :

- I : Medial spread
  - Ia : Limited to nose & nasopharynx.
  - Ib : Extension into one or more sinuses.
- II : Lateral spread
  - IIa : Minimal extension to sphenopalatine fossa (SPF).
  - IIb : Complete filling of SPF & spread to orbit.
  - IIc : Extension to infratemporal fossa (ITF).
- III : Intracranial spread
  - IIIa : Minimal.
  - IIIb : Extensive.

b. Fisch classification.

Management :

- Surgical excision.
- Pre-op : Embolisation of maxillary artery (main supply of angiofibroma).
- Radiotherapy : Unresectable (3b) tumour.

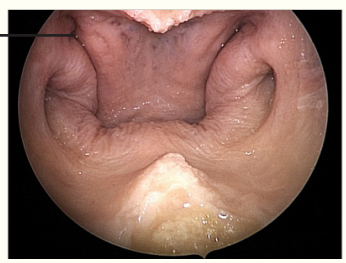
Recurrence : ↑↑

Nasopharyngeal Carcinoma

00:22:48

- m/c carcinoma of nasopharynx.
- Type : Squamous cell.
- Radiosensitive tumour.

Site of origin : Fossa of Rosenmuller



Etiology :

- Genetic : Southern China (AKA Guandong/Mongolians Ca).
- Virus : EBV.
- Exposure to :
  - Nitrosamines : Preservatives in salted fish.
  - Hydrocarbons : Wood & incense burning.

Clinical features :

- Painless cervical lymphadenopathy (70% cases).
  - Retropharyngeal LN → Upper deep cervical LN (Level II) → Posterior group LN (Level V).
- Nasal obstruction.
- U/L ET obstruction → U/L SOM.
- Rhinolalia clausa.

Cervical lymphadenopathy

----- Active space -----

Spread :

- Base of skull
- Sinus of morgagni → Trotter's triad :
  1. Mandibular neuralgia.
  2. Palatal palsy.
  3. Conductive hearing loss d/t SOM.
- Parapharyngeal space (Posterior compartment) → Cervical sympathetic chain → Horner's syndrome.

Investigation :

Screening : EBV IgA viral capsid antigen (VCA), Early Antigen (EA).

Confirmatory : Nasal endoscopy + biopsy.

Treatment :

- Early stages : Radiotherapy.
- Late stages : Concurrent chemoradiation.

WHO Classification :

- Type I : Keratinizing SCC.
- Type II : Non Keratinizing SCC.
  - IIa : Differentiated.
  - IIb : Undifferentiated (m/c in endemic areas, most aggressive, most radiosensitive).
- Basaloid.

Oropharynx

00:28:10

Structures comprising oropharynx :

- Superiorly : Soft palate.
- Laterally : Tonsils.
- Inferiorly : Base of tongue, vallecula.
- Posteriorly : Posterior pharyngeal wall.

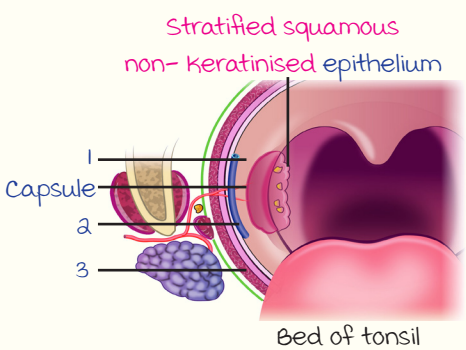
Sensory nerve supply : Glossopharyngeal nerve.

Oropharynx

TONSILS :

Embryology :

- Development : 2nd pharyngeal pouch.
  - Crypta magna (Largest) : Remnant of 2nd pouch.
- Present at birth.
- Max size by 12 yrs.



Bed of tonsil

Bed of Tonsil :

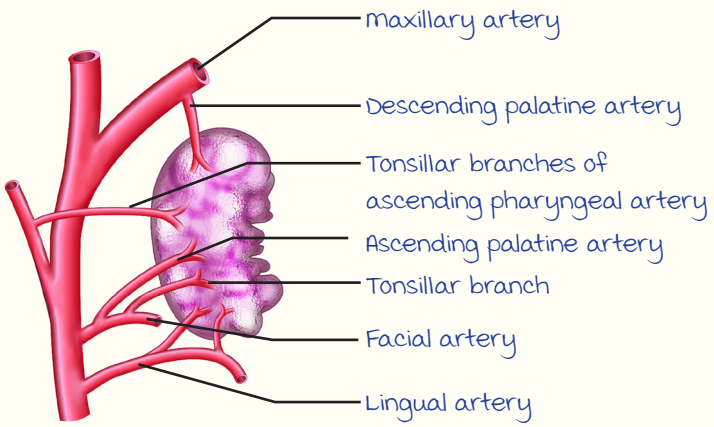
----- Active space -----

1. Peritonsillar space : Abscess → Quinsy.
2. External palatine/paratonsillar vein : m/c site of hemorrhage following tonsillectomy.
3. Superior constrictor muscle.
4. Parapharyngeal space : Divided by styloid process into 2 compartments.
   - Styloglossus muscle.

Arterial Supply :

Branches of external carotid artery (ECA).

- ECA
  - Lingual → Dorsal lingual branches.
  - Facial → Tonsillar branch (main).
    - Ascending palatine.
  - Ascending pharyngeal → Tonsillar branch.
  - Maxillary → Descending palatine.



Clinical significance :

Lower pole (main supply) —Ligation→ ↓hemorrhage risk.

Lymphatic drainage :

Upper deep cervical (Tonsillar node).

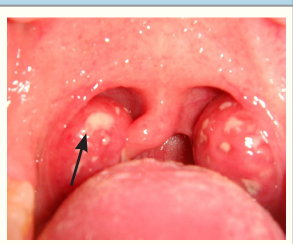
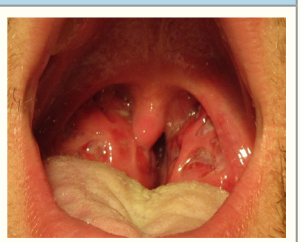
Acute Tonsillitis

00:32:11

Etiology :

- Bacterial : Group A β- hemolytic streptococcus (m/c).
- Viral.

Types :

	Acute catarrhal	Follicular	Pseudomembranous/ membranous	Parenchymatous
Appearance				
Features	Diffuse involvement of tonsils & pharynx.	Pus/exudates in crypts.	Formed by fusion of exudates.	• Invade parenchymal spaces. • C/F : Sleep apnea.

----- Active space -----

Management :

Tonsillectomy.

Membrane over Tonsils : D/D

Mnemonic : AL VITAMIN D.

- Agranulocytosis.
- Leukemia.
- Vincent's angina/trench mouth.
  - Acute necrotizing gingivitis.
  - Causative organism : B. vincenti/F. fusiformis (Anaerobe).
- Infectious mononucleosis :
  - Causative organism : EBV.
  - C/F : Multiple B/L lymphadenopathy.
  - Dx : Heterophile antibodies in Paul Bunnel/Monospot test, atypical lymphocytosis.
- Trauma.
- Aphthous ulcer.
- Moniliasis (Candidiasis).
- Infection of throat.
- Neoplasia.
- Diphtheria.

Diphtheria

00:34:59

No h/o immunization.

C/F of membrane :

- Dirty grey membrane.
- Extends beyond tonsil.
- Tightly adherent → Bleeds on removal.

Ix : Throat-swab microscopy → Club shaped gram positive rods.

membrane over tonsil

Rx :

- Antitoxin against diphtheria exotoxin (After sensitivity).
- Antibiotics : Beta-lactam, macrolides.

Complication :

- Respiratory obstruction, d/t membrane dislodgment.
- Myocarditis, arrhythmia.
- Peripheral neuritis → Palatal palsy.

Bull neck

Tonsillectomy

00:36:15 ----- Active space -----

Position : Rose position.

Indication :

Indication	Criteria
Recurrent infections	• >3/year for 3 consecutive years • >5/year for 2 consecutive years • >7 in a single year
Non-infectious	Obstructive symptoms (Sleep apnea)

Methods :

Cold method :

- Dissection & snare (m/c).
- Microdebrider.

Microdebrider

Hot method :

- Coblation.
- Laser.
- Cautery.

Coblation wand

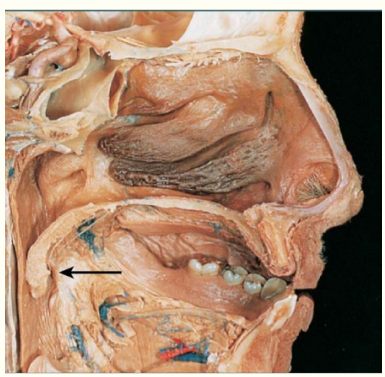
Type of Tonsillectomy :

- Extracapsular (Tonsil & capsule removed) → Infectious.
- Intracapsular (Part of tonsil removed) → Obstructive. (Indication)

Complication :

Hemorrhage (m/c) : Paratonsillar vein/external palatine vein.

Hemorrhage	Characteristics	Mx
1°	During Sx	1. Removal of clots 2. Pressure with gauze/cotton/pack 3. Cauterize bleeders 4. Ligate the vessel
Reactionary	• After Sx upto 24 hours • Due to slippage of ligature/ dislodgement of clots	
2°	• 24 hrs – 10 days • D/t infection (m/c : 5–6 days)	IV antibiotics

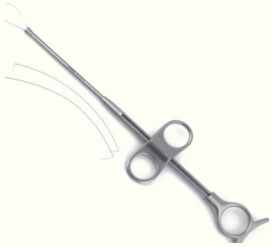


Paratonsillar vein

----- Active space -----

Instruments :

Boyle Davis mouth gag



Eves tonsillar snare : To crush & cut the lower tonsillar pole

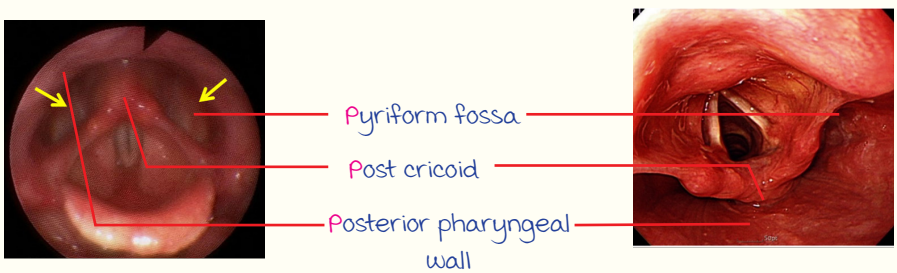
Tonsillar dissector

Anterior pillar retractor

Hypopharynx/Laryngopharynx

00:43:04

Components :



Pyriform fossa	• m/c site of foreign body lodgement. • m/c site of carcinoma of hypopharynx. – Presents with cervical lymphadenopathy.
Post cricoid	m/c site of carcinoma in Plummer-Vinson syndrome.

Nerve Supply :

Upper part : Internal laryngeal nerve.

- Runs in pyriform fossa.
- Referred pain to the ear.

Lower part : Recurrent laryngeal nerve.

Lymphatics :

- Pyriform fossa : Upper (II), middle deep cervical (III) LN.
- Hypopharynx : Level II, III, IV (Lower deep cervical LN).

Visualisation :

1. Indirect laryngoscopy.
2. Endoscopy.

Indirect laryngoscopy

LARYNX : PART 1

----- Active space -----

Anatomy of Larynx

00:00:40

DEVELOPMENT

	Upper larynx	Lower larynx
Develops from	4th arch : Hypobranchial eminence	6th arch
Nerve supply	Superior Laryngeal Nerve (SLN)	Recurrent Laryngeal Nerve (RLN)
Same arch derivatives	Thyroid, epiglottis	Cricoid

CARTILAGES

Paired (3) :
- Arytenoid (Pyramidal)
- Corniculate (Santorini)
- Cuneiform (Wrisberg)

Unpaired (3) :

Epiglottis :
- Do not calcify
- Leaf shaped

Thyroid :
- Largest
- Ala angle :
  - Females : 120°
  - Males : 90°

  (Laryngeal prominence/ Adam's apple)

Cricoid :
- m/c site of stenosis
- Signet ring shape

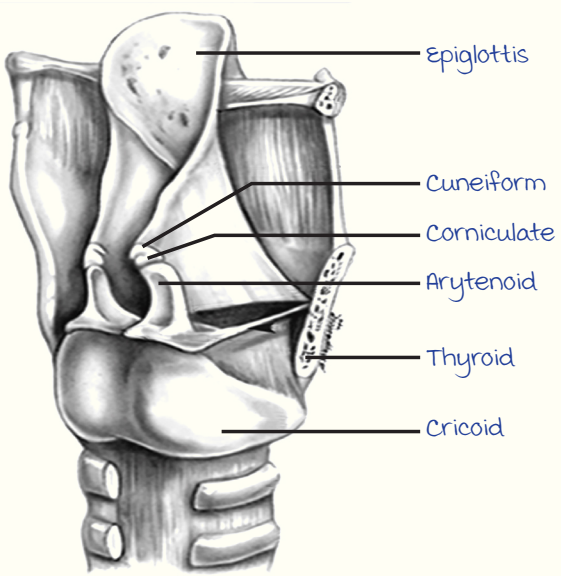
  (Only complete ring cartilage)

Key :

: Elastic cartilages.

: Hyaline cartilages (Mnemonic ACTh)
- Calcify later in life.
  - Visible on X-ray.
  - Can fracture on trauma.

Arytenoid cartilage :
- Pyramidal : Apex and base.
- 2 processes :
  - Anterior process (Vocal process) : Attached to true vocal cords.
  - Muscular process : D/t muscle attachments.



Note : Nerve of Wrisberg → Sensory part of facial nerve.

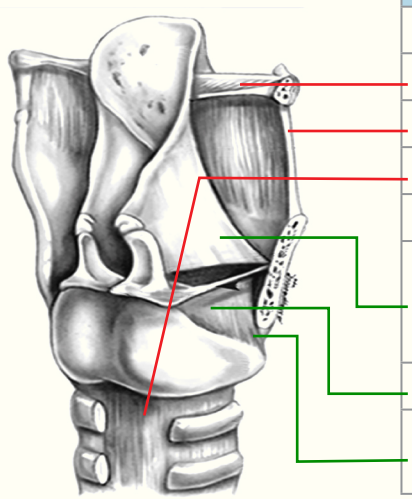
----- Active space -----

Membranes

00:04:36

Intrinsic : Connect laryngeal cartilages with each other.

Extrinsic : Connect laryngeal cartilages to other structures.

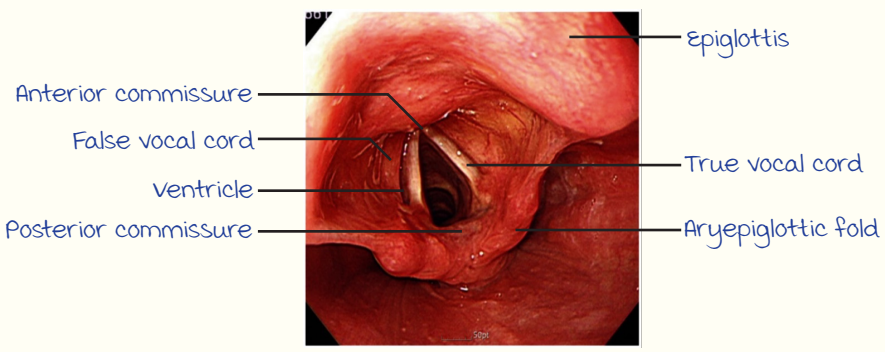


Cartilage	Structures Connected
Extrinsic	
Hyoepiglottic	Hyoid & epiglottis
Thyrohyoid	Thyroid & hyoid
Cricotracheal	Cricoid & trachea
Intrinsic	
Quadrangular	• Upper border : Aryepiglottic fold (Arytenoid → Epiglottis) • Lower border : False vocal cords
Conus elasticus/Cricovocal	• Cricoid & true vocal cords (Conical)
Cricothyroid membrane	• Cricoid & thyroid (Anterior thickening of conus elasticus)

Parts of Larynx

00:07:00

	Supraglottis	Glottis	Subglottis
Level	Above true vocal cords	True vocal cords	Below true vocal cords
Structures	• Epiglottis, arytenoids • Aryepiglottic folds • False vocal cords • Ventricle	Anterior and posterior commissure	
Lymphatic drainage	• Upper deep cervical LN (II) • middle deep cervical LN (III)	No lymphatics (No lymphatic metastasis)	Lower deep cervical LN (IV)
Lining epithelium	Ciliated columnar	Stratified squamous non-keratinized	Ciliated columnar
Features		Narrowest part in adult	Narrowest part in children



Endoscopy : Larynx

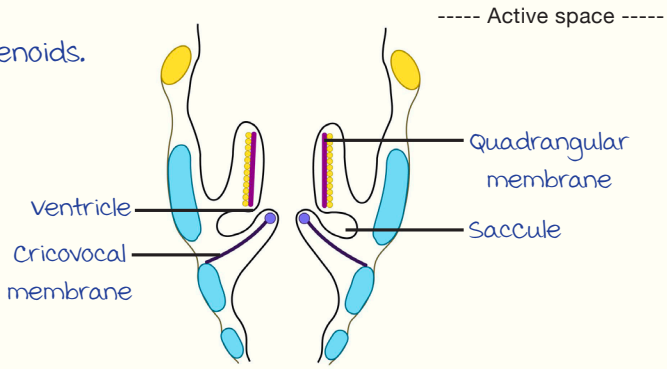
Cavity :

Inlet/Epilarynx : Epiglottis, aryepiglottic fold and arytenoids.

Ventricle : Space b/w true and false vocal cords (VC)

↓

Goes laterally to form saccule.



Clinical significance :

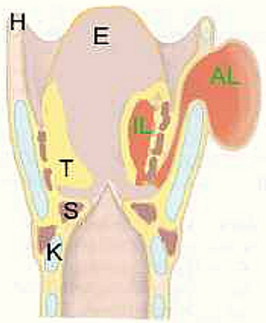
Laryngocele (Enlargement of saccule)

↓ Pierces thyrohyoid membrane

Extrinsic laryngocele

(External neck swelling)

- ↑Size on valsalva manoeuvre.
- Hissing sound on compression : Bryce sign.



External laryngocele

Spaces :

Pre-Epiglottic space/Space of Boyer : Space in front of epiglottis.

- Superior : Hyoepiglottic ligament.
- Anterior : Thyroid, thyrohyoid membrane.
- Posterior : Laryngeal surface of epiglottis.

Paraglottic space : Lateral glottis.

- Lateral : Thyroid alae.
- Medial : Quadrangular membrane, ventricle & conus elasticus.
- Posterior : Pyriform fossa mucosa (Separates from hypopharynx).

Reinke's space : Submucosal space of true VC.

Pathologies :

- Edema : Reinke edema.
- Polyp
- Nodules

Note :

Epiglottis
- Above hyoepiglottic ligament → Lingual surface.
- Below hyoepiglottic ligament → Laryngeal surface.

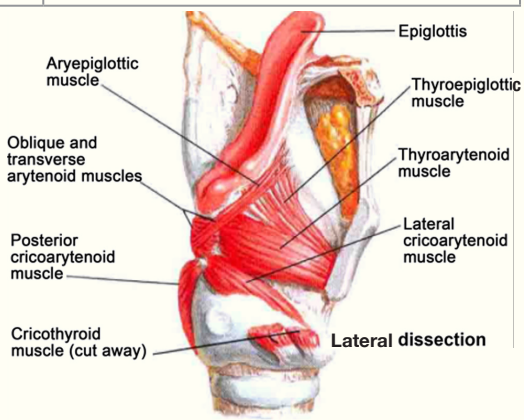
----- Active space -----

Muscles

00:15:17

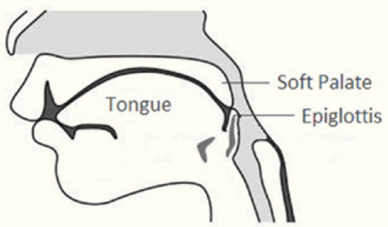
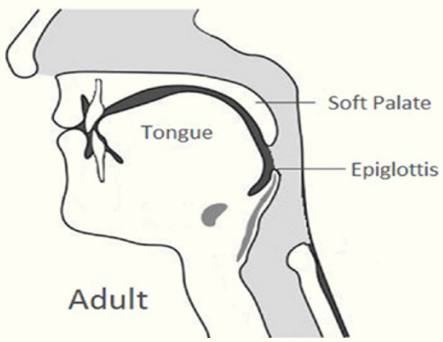
Acting on inlet	Act on true VC	Tensors
• To open : Thyroepiglottis • To close : Aryepiglottis	Adduct : All except ↓ Abduct : Posterior cricoarytenoid (Safety muscle)	• ↑Tension/pitch/length : Cricothyroid • ↓Tension/pitch/length : Vocalis (Innermost part of thyroarytenoid)

- Only unpaired muscle : Interarytenoid.
- Only intrinsic muscle lying outside : Cricothyroid.



Muscles of larynx

Note : Larynx in child vs. adults

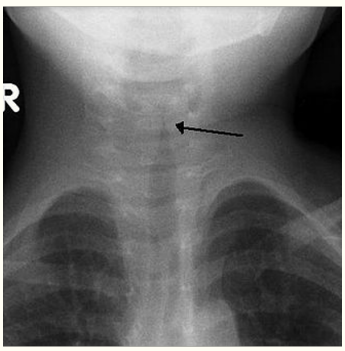
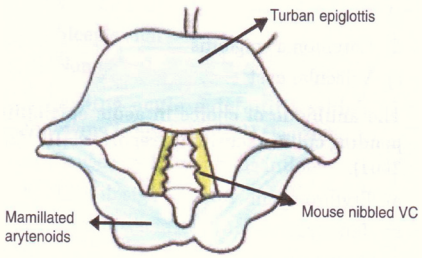
Child	Adult
• Children, higher up C2–C3. • Epiglottis can meet soft palate when swallowing. ↓ Milk goes into pyriform fossa / Air from nasopharynx goes to larynx • They can suckle & breathe at same time.  Infant	• Lies opposite to C3–C6 in adults. • Epiglottis moves down → Closes inlet. • Can either swallow/breathe. 

Infections

00:22:04

Symptom	Structure affected
Stridor : 1. Inspiratory 2. Inspiratory/biphasic. 3. Biphasic 4. Expiratory	 1. Supraglottis 2. Glottis 3. Subglottis (Till cervical trachea) 4. Intrathoracic trachea till secondary bronchi
Wheeze	Trachea below secondary bronchi
Speech affected	Glottis (True VC)
Odynophagia/Drooling of saliva	Epiglottis

----- Active space -----

	Epiglottis/Supraglottic laryngitis	Laryngotracheobronchitis/ Croup	TB Larynx
Etiology	Streptococcus : m/c	Parainfluenza virus (mainly involves subglottis)	Note : Starts in posterior part
Symptoms	• Acute onset • Fever, toxic look • Inspiratory stridor – ↑ : Supine – ↓ : Leaning forward/Tripod • Odynophagia, drooling of saliva • Normal cry	• Gradual onset • Prodromal symptoms ⊕ • Hoarseness • Barking cough • Inspiratory/biphasic stridor	• Low grade fever • Cough • Weight loss • Severe odynophagia
Ix	Thumb sign  X-Ray lateral view C/I investigation : Indirect laryngoscopy (Laryngeal spasm)	Steeple sign  X-ray AP view	• Hyperemia & edema of VC & posterior commissure • Mammilated arytenoids • Mouse nibbled VC (multiple ulcers) • Turban epiglottis (Pseudoedema) 
Mx	• Secure airway : Intubation (1st choice) • IV antibiotics • IV fluids • Steroids • Adrenaline nebulisation	• Steroids • Adrenaline nebulisation • IV fluids	ATT

Congenital Conditions 00:31:44

m/c : Laryngomalacia > Vocal cord palsy > Subglottic stenosis.

Laryngomalacia/Congenital Laryngeal Stridor :

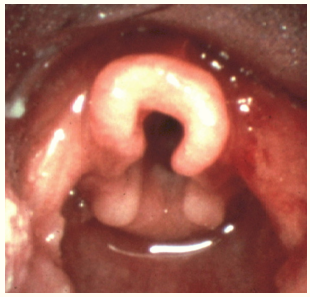
Symptoms :

- Inspiratory stridor at/shortly after birth → Supine : ↑; Prone : Disappears.
- No signs of distress or cyanosis.
- Cry : Normal.

----- Active space -----

Examination :

- Elongated, large omega shaped epiglottis.
- Short, floppy aryepiglottic folds.
- Prominent arytenoids.
- Excessive redundant tissue in supraglottis.


Omega shaped epiglottis

Management :

Reassurance (Disappears by 2 years).

Subglottic Stenosis :

Types :

1. Congenital : Subglottic diameter
   - Full term : <4 mm.
   - Preterm : <3 mm.
2. Acquired : Prolonged intubation.
   (Cuff → Pressure necrosis of glottis)

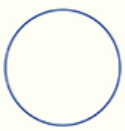
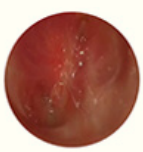
Examination :

Rigid endoscopy : Stenosis ⊕

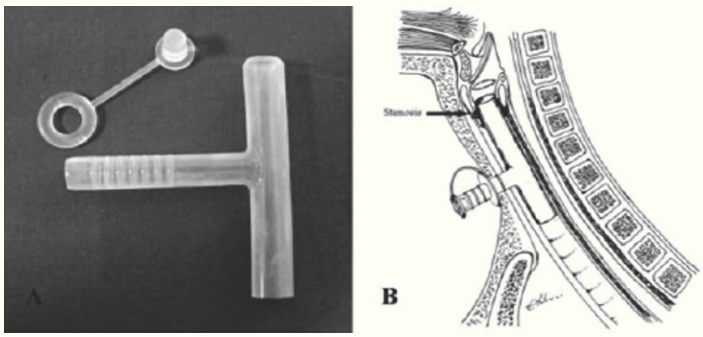
Symptoms :

Biphasic stridor.

Myer-Cotton grading of subglottic stenosis :

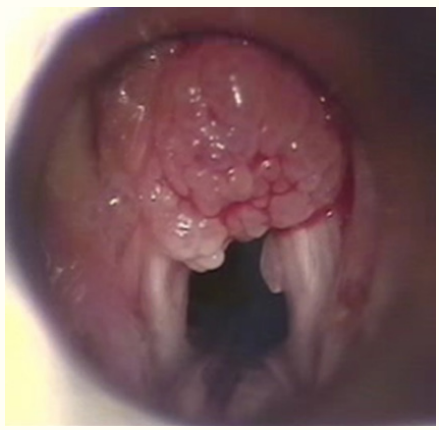
Classification	From	To	Endoscopic appearance	Mx	
Grade I	 No obstruction	 50% Obstruction		None required	
Grade II	 51%	 70%		Early : Balloon dilatation	Late : Cricoid splitting + Graft placement (Anterior & posterior) f/b stenting.
Grade III	 71%	 99%		• Early : Same as for grade II • Late : Same as for grade II • Severe : Same as for grade IV	
Grade IV	No detectable lumen			• Cricotracheal resection + End to end anastomosis. • Adjuvant : Mitomycin C (↓Fibrosis). • Montgomery T-tube insertion (Stenting).	

----- Active space -----



Montgomery T-tube

Juvenile Laryngeal/Recurrent Respiratory Papillomatosis :



Laryngeal Papillomatosis

Etiology :

- Low malignant potential HPV : 6 and 11 (more virulent).
- Via birth canal (H/o vaginal delivery)
- Starts at squamo-columnar junction (True vocal cords).

Symptoms : Hoarseness $\xrightarrow[\text{(months later)}]{\uparrow \text{Papilloma size}}$ Stridor.

Management :

- Microlaryngeal excision : Microdebrider (TOC) > CO_2 laser.
- To ↓ recurrence :
  - α interferon (Immunomodulator)
  - Cidofovir (Intralesional)
  - Bevacizumab
- Tracheotomy is C/I (Intubation preferred).

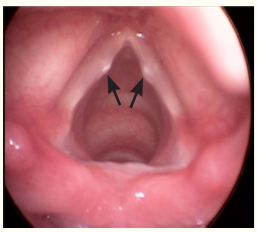
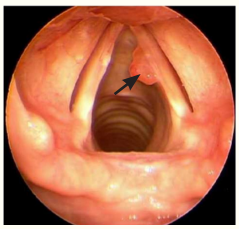
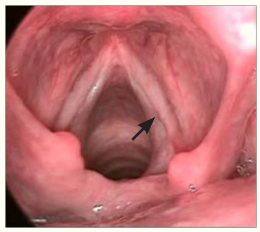
Structural Disorders of Glottis

00:42:30

Note : Disorders of glottis → Muscle tension disorder, Psychogenic

	Vocal cord nodules (Teacher's/Singer's nodules)	Vocal cord polyp	Reinke's edema/ Smoker's larynx	Pseudosulcus
Features	Lesion : • Bilateral • <3 mm • Sessile • Symmetrical	Lesion : • Solitary • Pedunculated • Large size	• Bilateral • Symmetrical edema	• H/o laryngopharyngeal efflux • Infraglottic edema
Site	Junction of anterior 1/3rd & posterior 2/3rd		Whole length of VC	Vocal cords
Mx	• Voice rest • Speech therapy	Excised by MLS (microlaryngeal surgery)	• Smoking cessation • Voice therapy • Reduction glottoplasty	-

----- Active space -----

	Vocal cord nodules (Teacher's/ Singer's nodules)	Vocal cord polyp	Reinke's edema/ Smoker's larynx	Pseudosulcus
Imaging				

Procedures in Larynx : Instruments & Position

00:45:20

Instruments :

Indirect laryngoscope

Flexible endoscope

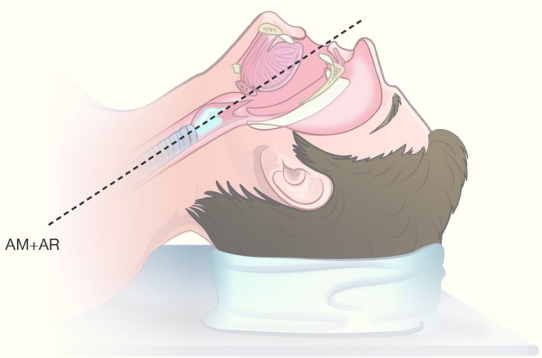
Rigid endoscope

Stroboscope

- Visualization of mucosal wave of VC in slow motion.
- Detects small lesions of VC.

Boyce Position :

- AKA Chevalier Jackson/Barking dog/Sniffing morning air position.
- Flexion at cervical spine & extension at atlanto-occipital joint.
- Used in MLS & direct laryngoscopy (Intubation).



Note :

Boyce position —(Pillow placed below shoulders)→ Rose position (Extension at cervico-thoracic joint).

Functional Disorders of Glottis

00:48:20 ----- Active space -----

	Hysterical/ Functional aphonia	Puberphonia/ Mutational falsetto	Dysphonia plica ventricularis
Presentation	• Female • Following stressful episode • Only whispers	• Adult male • High pitch voice	• Low pitch • Rough voice
O/E	• Speech : No adduction of VC • Cough : Normal adduction of VC	Gutzmann's pressure test : Press larynx ↓ ↓VC function ↓ Low pitch voice	Voice produced by false VC
Mx	Psychotherapy & reassurance	Type III thyroplasty	

Note :

Spasmodic dysphonia :

- Neuromuscular disorder.
- Spasm of vocal muscles during speech with focal dysphonia.
- Mx : Botulinum toxin injection.

	Voice	Mx : Botulinum toxin injection to
Adductor spasm (m/c)	Strained	Thyroarytenoid
Abductor spasm	Breathy, whispery	Posterior cricoarytenoid

----- Active space -----

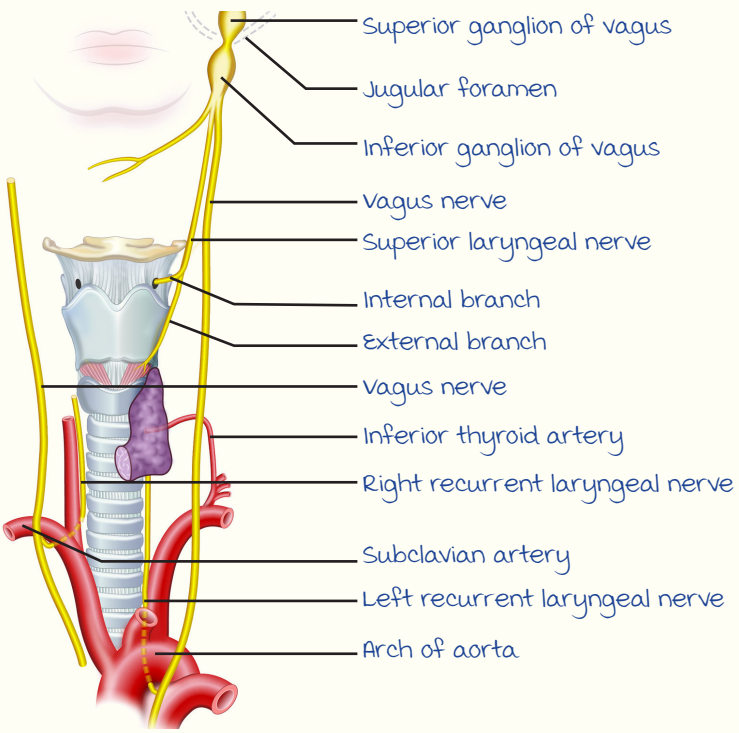
LARYNX : PART 2

Nerve Supply of Larynx

00:00:19

Vagus

- At base of skull
  - 1. Superior laryngeal nerve (SLN)
    - At greater cornu of hyoid
      - Internal branch (ILN)
        - Pierces thyrohyoid membrane
        - Enters larynx
        - Sensory supply above vocal cord (VC) (Supraglottis)
      - External branch (ELN)
        - Motor supply : Cricothyroid
          - Tensor & adductor
          - Intrinsic muscle
  - 2. Recurrent laryngeal nerve (RLN)
    - Right (Winds around Rt. subclavian A.)
    - Left (Winds around arch of aorta)
    - Enters tracheoesophageal groove
    - Enters larynx behind cricothyroid joints
      - Sensory supply : Below true VC (Glottis, subglottis)
      - Motor supply : All muscles except cricothyroid.



Nerve supply to larynx

Applied aspect :
Biopsy above VC :
Anesthetize at
thyrohyoid membrane.

ILN anesthesia

----- Active space -----

NERVE INJURY :

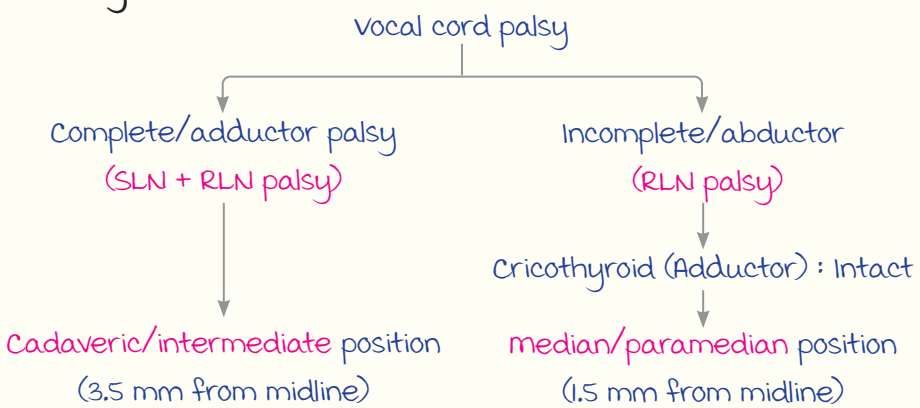
m/c RLN affected : Left RLN (Longer course).

m/c cause of b/L RLN palsy : Surgical trauma (m/c : Total thyroidectomy).

SLN Injury :

	Symptoms
ILN	Aspiration
ELN	Inability to ↑pitch

Vocal Cord Palsy :



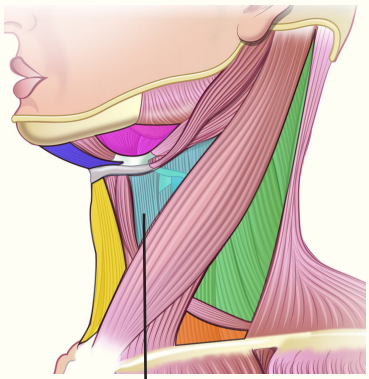
C/F :

	U/L incomplete palsy	B/L incomplete palsy	U/L complete palsy	B/L complete palsy
Speech	Normal/hoarseness	Normal	Aphonia	
Respiration	Normal	Stridor	Normal	
Aspiration	–	–	Occasional	Chronic
Cough	Normal		Ineffective	–
Overall presentation	Asymptomatic	Stridor	Aphonia + Occasional aspiration	Aphonia + chronic aspiration ↓ Recurrent chest infections
Management	–	• Tracheostomy : Immediate • Lateralisation of VC – Woodman's : cordectomy + arytenoidectomy – Kashima : Posterior cordectomy Type II thyroplasty	• Type I thyroplasty • Medialization of VC : Injection of teflon, fat, hydroxyapatite	–

----- Active space -----

Surgical Trauma :

Site of injury	Nerve injured
Base of skull	Complete vagus/SLN
Carotid triangle	ILN/ELN/SLN
Upper pole of thyroid	ELN (m/c injuried in thyroid Sx)
Lower pole of thyroid	RLN (2nd m/c injured in thyroid Sx, Rt > Lt)
Mediastinal	Left RLN (Note : Also involved in Ortner's/cardiovocal syndrome)

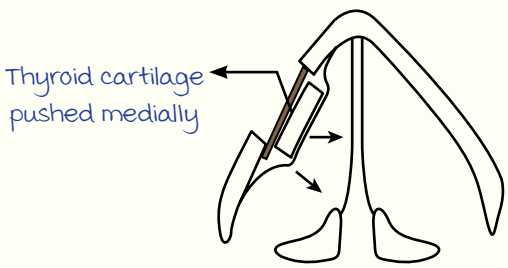


: Carotid triangle

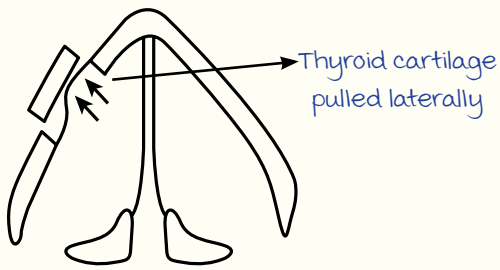
Treatment of VC Palsy :

Mnemonic : Plasty.

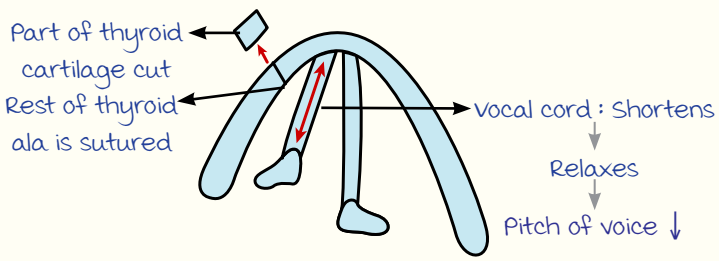
Isshiki's thyroplasty



Type I : Medialisation (Proximalisation)
Indication : U/L complete/adductor palsy



Type II : Lateralisation
Indication : B/L RLN palsy



Type III : Shortening
Indications : Puberphonia

Type IV : Tightening (Tensing)
Indication : Androphonia

Note :

Laryngeal inlet : Epiglottis + arytenoid.

- Component : ILN (Injury → Absence of cough reflex).

Carcinoma Larynx

00:23:15 ----- Active space -----

Squamous cell Ca.

m/c in males, smokers.

Clinical Features :

	Glottic Ca : m/c Site	Supraglottic Ca
Presentation	Referred pain to the ear (via vagus nerve).	
	Hoarseness : Earliest	Dysphagia
Lymphatic metastasis	Least	• Maximum (upper, middle deep cervical) • B/L : Epiglottic Ca
Prognosis	Best	-

Investigation :

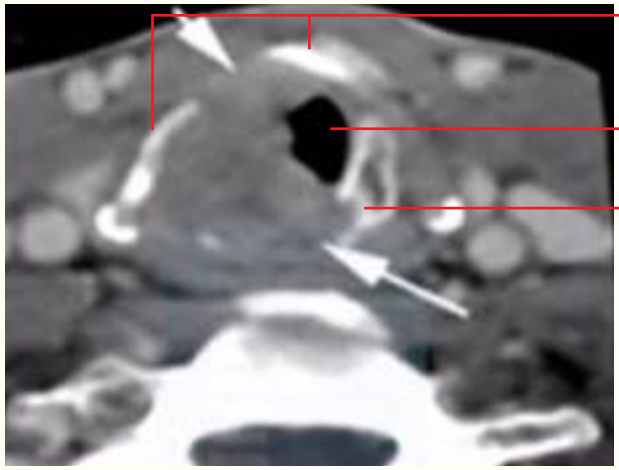
- MRI : IOC for cartilage erosion.
- CT.

TNM Staging :

Stage	Extent		Management
T_1		• Limited to one site (Glottis/subglottis) or one subsite of supraglottis • VC : Ⓝ	
	T_1a	One VC involved	TLM
	T_1b	Both VC involved	TLM/RT
T_2		2 adjacent sites/Subsites involved	TLM/RT
	T_2a	Both VC mobile	
	T_2b	Impaired mobility of VC	
T_3		• Fixed VC • Involvement of pre epiglottic space/para glottic space/post cricoid/inner cortex of thyroid.	Concurrent chemoradiation
T_4	T_4a	Local invasion : → Anteriorly : Thyroid cartilage/thyroid gland/strap muscles → Superiorly : Tongue muscle → Inferiorly : Trachea → Posteriorly : Esophagus	Total laryngectomy + adjuvant RT
	T_4b	Unresectable (Pre vertebral space/carotid sheath/mediastinum)	Palliative management

RT : Radiotherapy, TLM : Transoral laser microsurgery

----- Active space -----



CT : T_4a stage

Rehabilitation Following Laryngectomy :

1. Permanent tracheostome :
   - Trachea is pulled to an external opening.
   - Done following total laryngectomy.

Permanent tracheostome

2. Speech Rehabilitation :
   a. Oesophageal speech :
   Regurgitation of swallowed air → Vibration of pharyngoesophageal segment.

   b. Tracheo-oesophageal speech : Best.
   Blomsinger valve placed on trachea b/w trachea & pharynx.
   ↓
   Closure of trachestome opening → Produces sound.

Electrolarynx

   c. Electrolarynx : External vibration → Speech.

3. Heat & moisture exchanger :
   Temperature regulation
   Humidification of air
   } Placed at the opening.

Heat & moisture exchanger

4.Olfactory rehabilitation : Polite yawning.

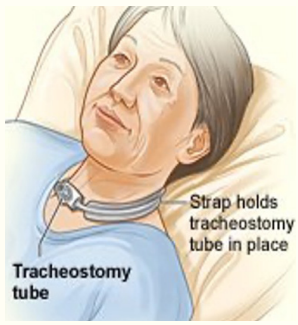
- Nasal airflow-inducing manoeuvre.

Note :

Super-supraglottic swallowing :

- Method for swallowing.
- Indication : Dysphagia + aspiration.

----- Active space -----



Standard tracheostomy

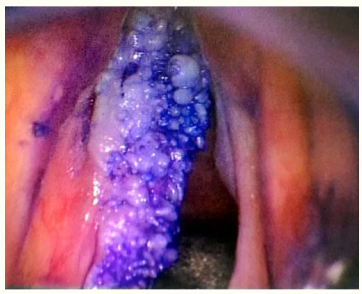
Newer Techniques in Laryngeal Endoscopy

00:33:56

Contact Endoscopy :

- Lesion stained with Lugol's iodine/methylene blue (Supravital stain)
  ↓
  Visualized with Hopkin's endoscope (magnification : 60-120 times).
- First 3 layers of epithelium visualized :
  - Cytological features.
  - Microvasculature.

  } Determines benign/malignant.


Contact endoscopy

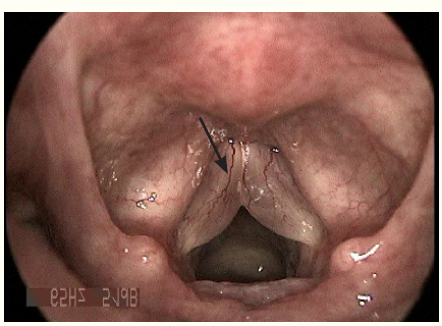
Autofluorescence :

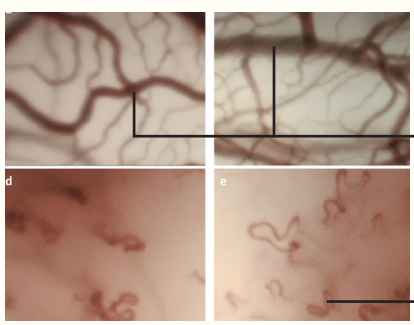
- Helps to identify benign/malignant :

Light → Normal mucosa : Green fluorescence (Specific wavelength absorbed).
Light → Neoplastic mucosa : Red-violet fluorescence.

Narrow Band Imaging :

Filtered light → Visualization of neo-angiogenic features.


Longitudinal vessels
Reinke edema



----- Active space -----

Tracheostomy

00:40:20

Indications :

Mnemonic : Occupy Most Seats in Medical Association.

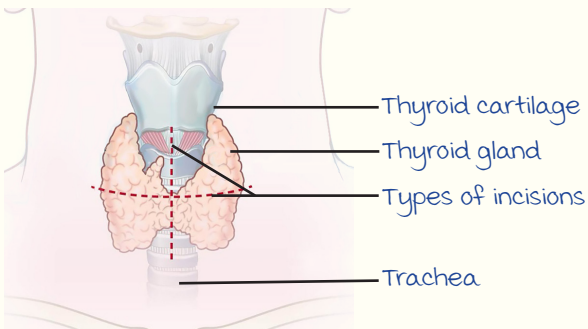
- Obstruction : Above T_2-T_4.
- Mechanical Ventilation : M/C indication for elective tracheostomy.
- Secretion removal/pulmonary toilet (In coma, or chest injury).
- Maxillofacial, head and neck surgeries.
- Prevent aspiration (B/L complete VC palsy).

Position :

Rose's position : Extension at cervico-thoracic and atlanto-occipital joint.

Incision :

- Emergency → Vertical incision : From lower border of cricoid to suprasternal notch
- Elective → Horizontal incision/Skin crease incision : 2.5 cm above suprasternal notch

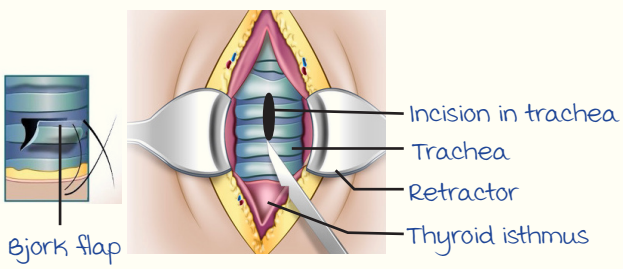


Types of skin incisions

Tracheal incision : 2, 3, 4 tracheal rings.

High tracheostomy : Incision at T_1.

- Complication : Laryngeal stenosis.
- Indication : Ca larynx.



Tracheostomy Tube :

- High volume, low pressure.
- For air tight seal.

Tube block :

- C/f of complete block : Stridor.
- Prevention : Saline/sodium bicarbonate suction.
- Management : Change tracheostomy tube.


Portex cuffed tube

Foreign Body

00:45:14 ----- Active space -----

Age : 1–4 (m/c).

m/c foreign body : Nuts & peanuts.

Symptoms :

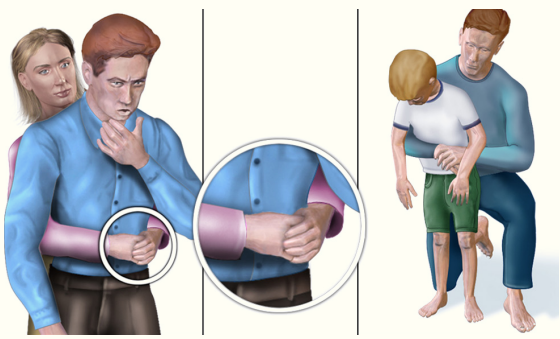
- Sudden onset paroxysmal coughing/choking/gagging : Earliest.
- Hoarseness, stridor.
- Hemoptysis.

Management :

First aid :

1. No respiratory distress, speaks
   - Encourage coughing
   - Back blows
2. Conscious + universal choking sign : Inability to speak, breathe, cough
   → Heimlich manoeuvre : Sudden thrust just below sternum
   → ↑intrathoracic pressure

Back blows



Heimlich manoeuvre

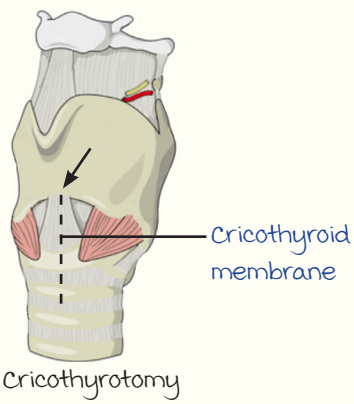
Contraindication of Heimlich maneuver :

- Age <1 yr.
- Unconscious.
- Pregnancy & obese → Chest thrust.

3. Visible foreign body : Finger sweep method.

Definitive :

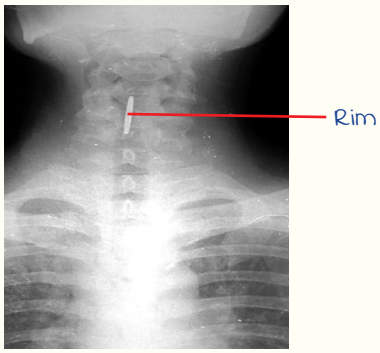
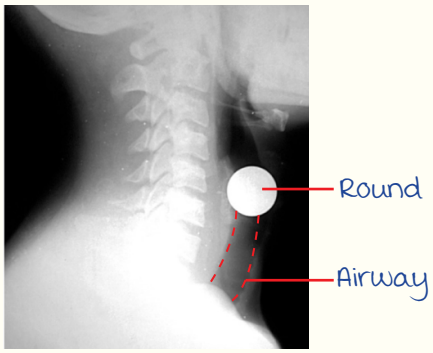
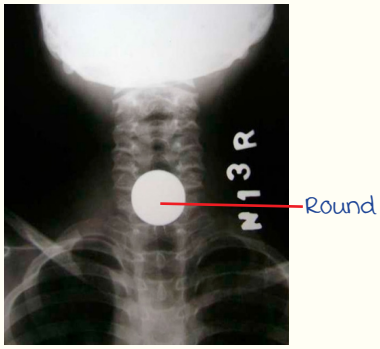
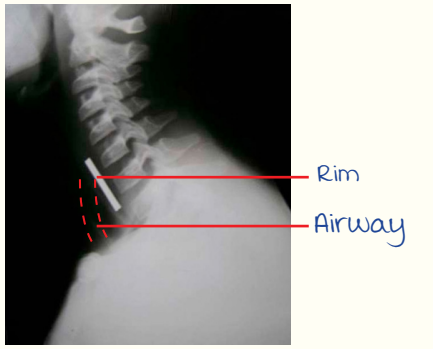
First aid fails → Cricothyrotomy (Cricothyroid membrane)/coniotomy/Inferior laryngotomy/minitracheostomy → Rigid bronchoscopy (Foreign body removal).



Cricothyrotomy

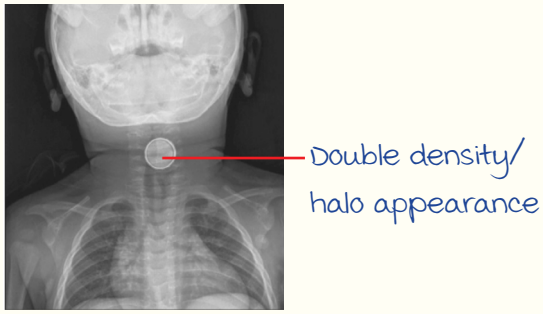
----- Active space -----

Investigation :

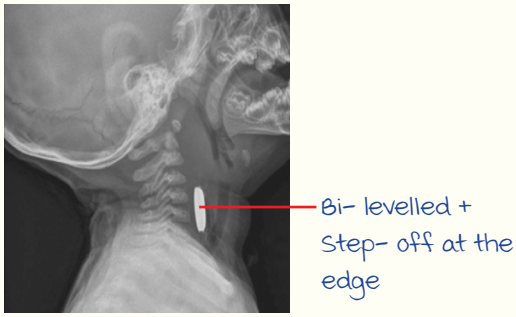
	AP view	Lateral view
Laryngeal foreign body		
Esophageal foreign body		

m/c site of foreign body in esophagus : At or just below cricopharyngeal sphincter.

Button battery :



AP view



Lateral view