UNIVERSITATEA
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„VICTOR BABEȘ" DIN TIMIȘOARA

PRACTICAL GUIDE
to
ENT CLINICAL EXAMINATION AND PROCEDURES

A Handbook for Medical Students and ENT Residents

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GHIDURI ȘI ÎNDRUMĂTOARE DE LABORATOR

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CONTENT

1. INSPECTION AND PALPATION

Before the Physical Exam, ask the patient about the following:

- The classic ear disease symptoms include hearing loss, tinnitus, otorrhea, otalgia and vertigo
- Previous ear or head surgeries or trauma
- Family history of hearing loss
- Ask about systemic diseases (stroke, multiple sclerosis, cardiovascular disease)
- Ototoxic medications (gentamicin, cytotoxic drugs, diuretics)
- Age, sex, general condition, mental status, and gait
- Rhinorrhea, sneezing, loss of smell (anosmia), facial pain/pressure (sinusitis), snoring (possible airway obstruction)

Ears:

Inspection of External Ear:

- Observe the auricle and the external auditory canal (without the otoscope). Swab any discharge and remove any cerumen if present
- Size and shape of the pinna
- Accessory cartilage tags, preauricular sinuses, or pits
- Signs of trauma to the pinna
- Suspicious skin lesions on the pinna, including neoplasms
- Skin conditions of the pinna and the external canal
- Infection or inflammation of the external ear canal, with or without discharge
- Signs/scars of previous surgery

Nose:

History:

The following aspects should be addressed:

- Allergies/atopic disease
- Smoking
- Pets at home
- Occupation/exposures (dust, chemicals)
- Previous surgical scars or trauma marks
- General medical history
- Seasonal or daily variation in symptoms

Inspection of the nose:

First, inspect the external nose. Ask the patient to remove glasses. Inspect from the front, side, and ideally from above:

- Assess the size, shape and symmetry
- Deviation/deformity
- Swelling
- Scars, bruising, skin changes
- Redness (dermatological condition/rosacea, infection)
- Nasal discharge or crusting
- Foul smell

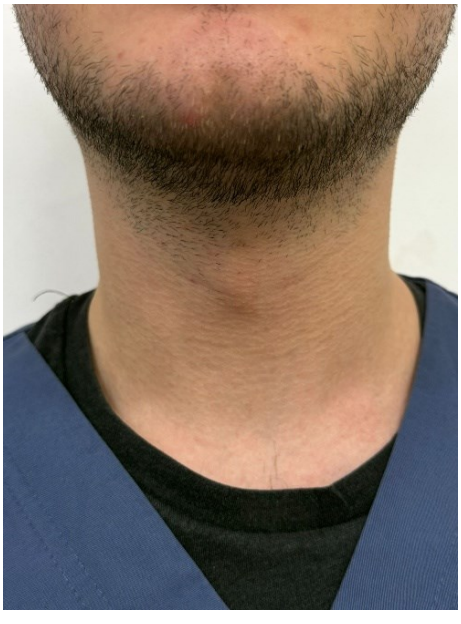
Palpation (external nose and sinuses)

- Palpate the nasal bones and cartilaginous framework for any tenderness, crepitus (suggestive of trauma)
- Examine the external nose and test the patient's ability to breathe through each nostril by occluding one nostril at a time

- Apply pressure to the patient's sinuses to assess for pain→ tenderness can indicate infection:
    - Frontal Sinus
    - The ethmoidal sinuses are not directly palpable. Pain is often assessed by pressure near the medial canthus, but this is less specific
    - Maxillary Sinus

Neck:

Inspection:



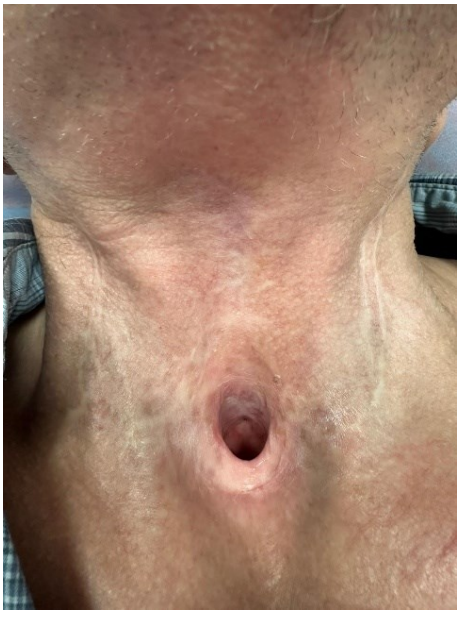


Fig. 1. Normal Neck vs Fig. 2. Neck with tracheostomy

Inspect for any obvious deformities, asymmetries, masses, tracheal deviation.

- Palpation of the lymph nodes of the head and neck
- Palpation of the parotid gland
- Assessment of range of motion of the cervical spine

- Ask the patient to flex the neck so that the chin rests on the chest
- Assessment of spinal accessory nerve function
- Ask the patient to turn the head to the left and right and to elevate the shoulders against resistance
- Evaluate for jugular venous distention
- Evaluate nerve palsies

Lymphatic regions of head and neck:

Palpation:

- Begin with visual inspection, followed by systematic palpation of any abnormal findings detected.
- All lymph node regions should be palpated, even in the absence of visible enlargement, to assess for increased size, consistency, fixation, tenderness, or irregular surface

Fig. 3. Palpation of the submandibular and submental lymph nodes

- Preauricular
- Postauricular
- Parotid
- Occipital
- Tonsillar
- Submandibular
- Submental
- Anterior Cervical
- Posterior Cervical
- Supraclavicular

Thyroid Gland:

- stand behind the patient
- palpate the thyroid cartilage (laryngeal prominence)
- move your fingers inferiorly to identify the cricoid cartilage
- move your fingers to the level of the cricoid cartilage. Just below this level lies the isthmus of the thyroid gland
- place your fingers slightly to either side (over the thyroid lobes) and ask the patient to swallow while applying gentle pressure
- assess the size, consistency, presence of nodules, and tenderness
- ultrasound examination is recommended for more accurate evaluation

Larynx:

- Palpation of the larynx: laryngeal crackle
- Size, consistency, nodules, pain

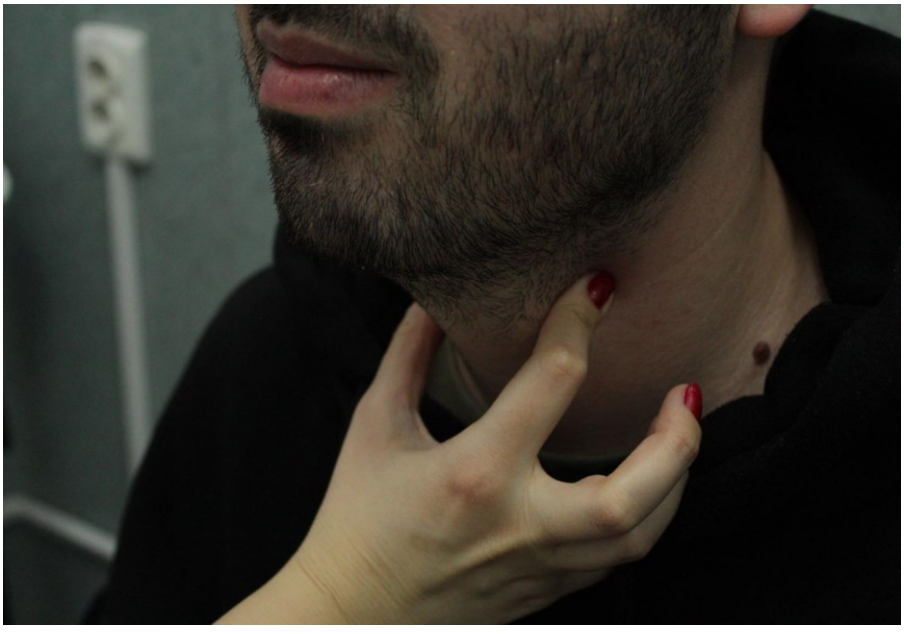


Fig. 4. Palpation of the laryngeal crackle

2. RHINOSCOPY

2.1. Anterior Rhinoscopy

- The instruments needed for anterior rhinoscopy are a nasal speculum and a light source
- Use the largest available speculum that will comfortably fit inside the patient's nostril
- Direct the speculum posteriorly and superiorly while inspecting the nasal cavity
- Examine the nasal mucosa, septum, and turbinates using a nasal speculum and a light source
- The nasal cavity warms and humidifies inspired air before it enters the lungs and serves as the first-line immunological defense barrier by filtering out the particles from inspired air
- It is involved in respiration, olfaction, speech, and taste
- The nostrils, located inferiorly at the apex of the nose, are openings to the nasal cavity and are separated by the nasal septum
- The nasal cavities open anteriorly through the two nostrils and communicate posteriorly with the nasopharynx via the choanae

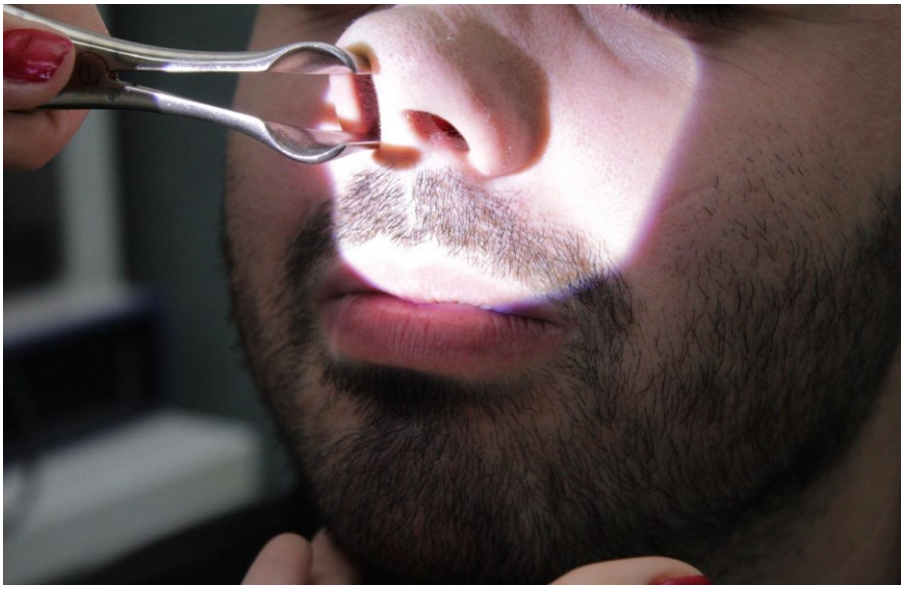


Fig. 5 and Fig. 6. Anterior Rhinoscopy

2.2. Posterior Rhinoscopy

Anatomy of the nasopharynx

- The nasopharynx is an air-filled space located behind the nasal cavity and forms the uppermost part of the aerodigestive tract
- It has a box-like shape, measuring approximately 2-3 cm from front to back and about 3-4 cm in height and width
- Its lining transitions from pseudostratified ciliated columnar epithelium near the nasal side to non-keratinized stratified squamous epithelium toward the pharyngeal surface

Boundaries and communications

Anatomical boundaries:

- Anterior: the posterior end of the nasal septum and the posterior nasal openings (choanae)
- Superior and posterior (roof and posterior wall): these areas blend and are related to the sphenoid sinus, the clivus, and the anterior aspects of the first two cervical vertebrae
- Inferior (floor): formed by the soft palate (velum), which separates the nasopharynx from the oropharynx
- Lateral: formed by the lateral wall of the nasopharynx, including the Eustachian tube opening, torus tubarius, and the pharyngeal recess (Fossa of Rosenmüller)

Communications:

- Anteriorly, it continues with the nasal cavity through the choanae
- Laterally, it connects with the middle ear through the Eustachian tubes
- Inferiorly, it opens into the oropharynx along the posterior border of the soft palate

Key structures related to the nasopharynx:

- Choanae: paired posterior openings of the nasal cavity into the nasopharynx, separated by the nasal septum
- Adenoids: subepithelial lymphoid tissue located at the junction of the roof and posterior wall of the nasopharynx; they enlarge in early childhood (up to 6 years of age) and then gradually regress
- Eustachian (auditory) tubes: paired tubes linking the nasopharynx to the middle ear, helping equalize pressure and allowing mucus drainage from the middle ear
- Torus tubaris: a bulge on the lateral wall created by the cartilaginous part of the auditory tube, situated at the superior-posterior margin of the tubal opening
- Tubal tonsil: lymphoid tissue near the tubal elevation, continuous with adenoidal tissue and part of Waldeyer's ring; enlargement or infection may obstruct the auditory tube and contribute to hearing impairment
- Fossa of Rosenmüller (pharyngeal recess): a recess just posterior to the torus tubarius, formed where the lateral and posterior walls meet; the fossa can measure up to 1.5 cm in adults; it is difficult to visualize on routine examination and is a common site for nasopharyngeal carcinoma. It opens into the nasopharynx at a point below the foramen lacerum and is considered a landmark for carotid artery in endoscopic skull base surgery
- Base of skull: The nasopharynx is located right below and in front of the base of the skull
- Retropharyngeal space: This is a space behind the pharynx, in front of the spine
- Nearby muscles: the pharyngeal constrictors and the levator palatini muscle are closely related to the nasopharyngeal walls

- Sinus of Morgagni: a space between the upper border of the superior pharyngeal constrictor, the skull base, and the pharyngeal aponeurosis; structures passing through include:

1. The cartilaginous part of the Eustachian tube
2. Levator veli palatini
3. Ascending palatine artery
4. Palatine branch of the Ascending pharyngeal artery

Blood supply and innervation:

- Arterial supply: mainly from the branches of the external carotid artery, including the ascending pharyngeal artery, ascending palatine branch of the facial artery, ascending cervical artery, branches of the maxillary artery
- Venous drainage: the superior region drains to the pterygoid venous plexus, while the inferior region drains via the pharyngeal venous plexus; these ultimately empty into the internal jugular vein
- Sensory innervation: provided by the trigeminal (cranial nerve V) and glossopharyngeal nerve (cranial nerve IX). Anterior to the Eustachian tube, sensory supply is by the second division of the trigeminal nerve (maxillary division, V2) nerve while posterior to the tube it is by the glossopharyngeal nerve
- Motor innervation is provided mainly by the vagus nerve (CN X) via the pharyngeal plexus, with the exception of the stylopharyngeus muscle, which is innervated by the glossopharyngeal nerve (CN IX)

Physiological functions:

- Air passage: serves as an airway channel directing air toward the larynx and trachea
- Middle ear ventilation: Eustachian tubes ventilate the middle ear and equalize air pressure on both sides of the tympanic membrane.

Dysfunctions of the Eustachian tube can affect the middle ear and cause hearing problems

- Voice resonance: contributes as a resonating chamber for voice production. Nasopharyngeal obstruction and velopharyngeal incompetence produce changes in voice
- Drainage pathway: helps channel nasal and nasopharyngeal mucus secretions
- Nasopharyngeal isthmus function: during swallowing, vomiting, gagging, and speech it helps separate the nasopharynx from the oropharynx

Posterior rhinoscopy technique:

Definition: It is a procedure performed to examine the posterior part of the nasal cavity and the nasopharynx.

Indications:

- Chronic intermittent to paroxysmal sneezing
- Nasal congestion
- Epistaxis and stertor
- Nasal airflow obstruction
- Nasopharyngeal tumors

Procedure:

1. Rhinoscopic mirror is warmed up first - to avoid fogging inside the oral cavity

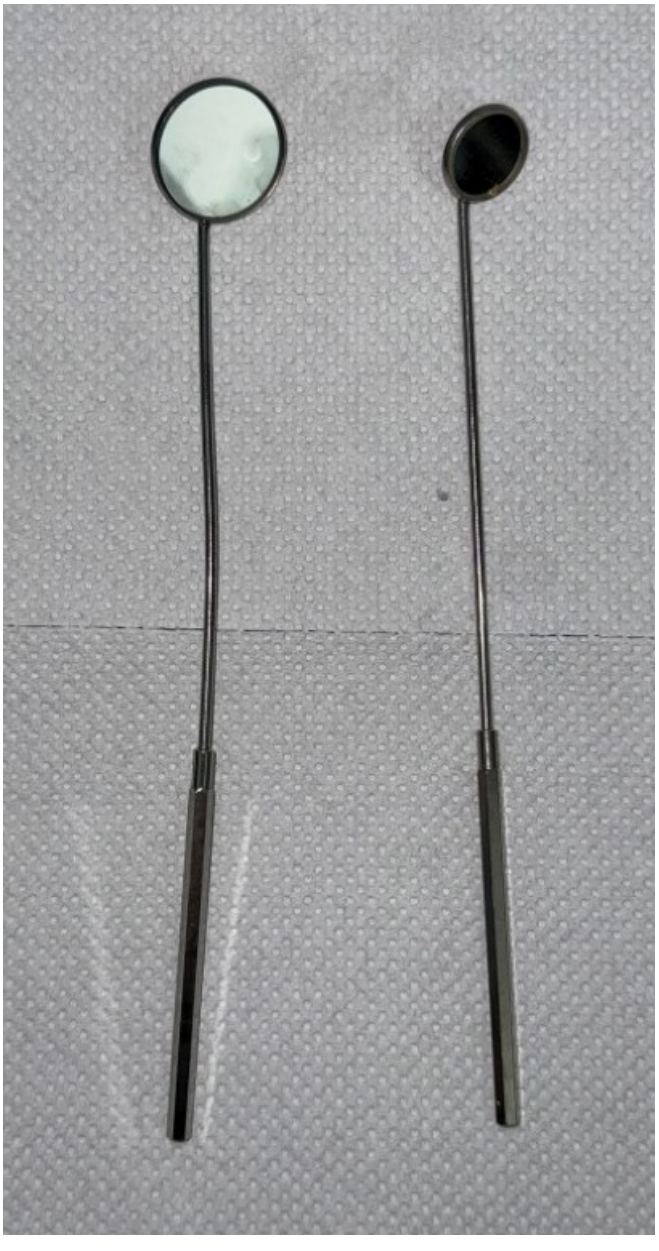


Fig. 7. Laryngoscopy and Posterior rhinoscopy mirrors

2. Depression of the tongue with a tongue depressor
3. Insertion of a rhinoscopic mirror - BEHIND the soft palate
4. Examine the structures seen in the mirror - using a headlamp

Fig. 8. Posterior rhinoscopy procedure

Structures viewed:

- Posterior margin of the nasal septum
- Posterior end of inferior, middle and superior turbinates
- Posterior nares/choanae
- Fossa of Rosenmüller
- Adenoids
- Roof of nasopharynx
- Nasal surface of soft palate and uvula
- In about 20% of patients, it is not possible to examine the postnasal space using a posterior rhinoscopy mirror
- Therefore, fibreoptic nasopharyngoscopy is preferred in these cases

3. BUCOPHARYNGOSCOPY

Inspection of the Oral Cavity and Bucopharyngoscopy:

- External inspection of the mouth
- Inspection of the oral cavity: Examine the labial and sublingual areas for pathological changes such as lesions, ulcers, discoloration, or swelling. Questioning the patient regarding associated symptoms (e.g. pain, duration, appearance, and location)
- General medical history, tobacco or alcohol use, and dental history

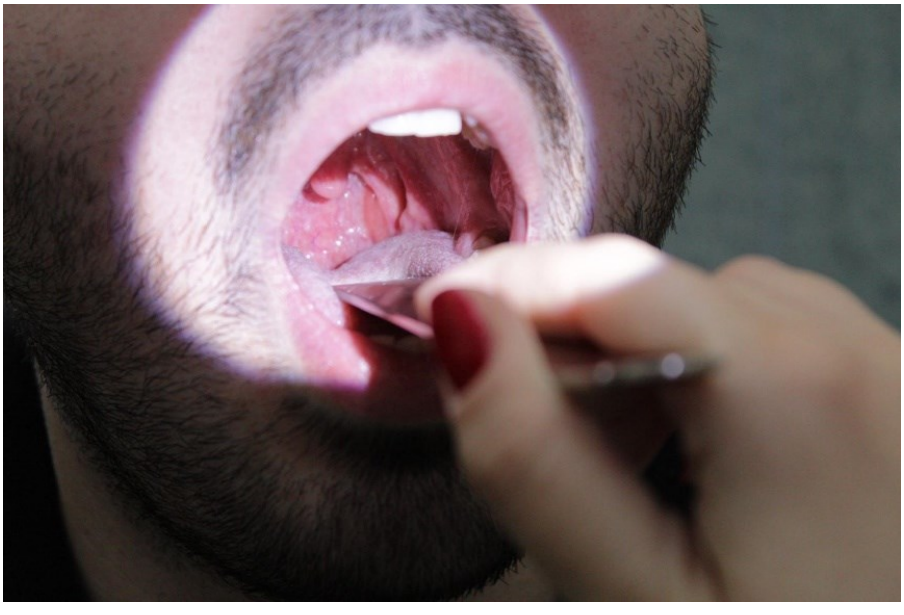


Fig. 9. Bucopharyngoscopy

Ask the patient to remove dentures and examine the mouth systematically (using a light source): the tongue, hard and soft palate, and tonsils.

- Examine the mouth and note the condition of the tongue
- Examine base of the tongue and tonsils (pressing down on the tongue with a tongue depressor)

Fig. 10. “S” shaped tongue depressor

Fig 11. “L” shaped tongue depressor

- Palpate the base of the tongue to detect tumors that may not be easily visible
- Inspect the uvula and soft palate
- Inspect the hard palate (ask the patient to extend the head posteriorly so that the hard palate is visible)

- Examine the buccal area and the gingivobuccal sulcus (the space between cheek and gums)
- Examine the floor of the mouth, evaluating sialolithiasis of the submandibular duct or the presence masses (the patient is asked to protrude the tongue)

Pharynx (overview):

- A muscular, mucosa-lined tube approximately 12–14 cm long
- Extends from the base of the skull to the inferior border of the cricoid cartilage (C6)
- Serves as a shared pathway for air (toward the larynx) and food or liquids (toward the esophagus)

Communicates with:

-Nasal cavity (via choanae)

-Oral cavity (via oropharyngeal isthmus)

-Larynx (via laryngeal inlet)

-Esophagus (inferior continuation)

Divisions of the Pharynx:

1. Nasopharynx

– From base of skull to the soft palate

2. Oropharynx

– Between soft palate to the superior border of epiglottis

3. Laryngopharynx (hypopharynx)

– From the upper border of epiglottis to the lower border of cricoid cartilage, where it continues as the esophagus

Muscles and innervation:

- Circular muscles (constrictors):
  - Superior pharyngeal constrictor
  - Middle pharyngeal constrictor
  - Inferior pharyngeal constrictor
  - Motor supply is provided by the vagus nerve (CN X) via the pharyngeal plexus with the exception noted below
- Longitudinal muscles (elevators):
  - Stylopharyngeus – Glosopharyngeal nerve (CN IX)- this is the key exception
  - Palatopharyngeus – Vagus nerve (CN X) via pharyngeal plexus
  - Salpingopharyngeus – Vagus nerve (CN X) via pharyngeal plexus

Important exception (often tested):

- Cricopharyngeus muscle (part of the inferior constrictor and upper esophageal sphincter)

- Innervation: mainly by vagus nerve (CN X), with contributions from the pharyngeal plexus and branches of the laryngeal nerves (recurrent and superior laryngeal nerves)

Blood supply and venous drainage:

- Arterial supply- mainly branches of the external carotid artery:
- Ascending pharyngeal artery
- Facial artery branches- tonsillar, ascending palatine
- Lingual artery branches
- Maxillary artery branches- pharyngeal branch

- Venous drainage:

- Pharyngeal venous plexus- drains mainly into the internal jugular vein- directly or via facial/pharyngeal veins

Videopharyngoscopy:

- An examination that allows visualization of the pharynx (and often adjacent regions such as the larynx, depending on scope and technique)
- Can be performed using:

- Flexible fibreoptic endoscope (transnasal)

- Rigid endoscope (oral approach)
- Usually performed with topical local anaesthetic (+/- decongestant for nasal approach)

Indications:

- Suspected foreign body
- Suspicious lesions/tumors (or symptoms suggesting them)
- Structural abnormalities (malformations, masses, obstruction)
- Evaluation of symptoms related to reflux
- Persistent pharyngitis, odynophagia, dysphagia, globus, unexplained symptoms
- Post-treatment or follow-up

Procedure - flexible transnasal endoscopy:

- The endoscope tip is sprayed with antifog solution
- A topical decongestant and topical anesthetic may be used to the nasal mucosa
- The endoscope is introduced along the floor of the nose into the nasopharynx

- The nasopharynx is located above the soft palate; the endoscope is then advanced to visualize the oropharynx and hypopharynx by passing beyond the level of the soft palate and behind the base of tongue
- Examine systematically:

- Nasopharynx (choanae, adenoids, torus tubarius, Rosenmüller fossa)
- Oropharynx (posterior pharyngeal wall, tonsillar pillars, base of tongue)
- Hypopharynx (piriform fossae, posterior pharyngeal wall, postcricoid region)

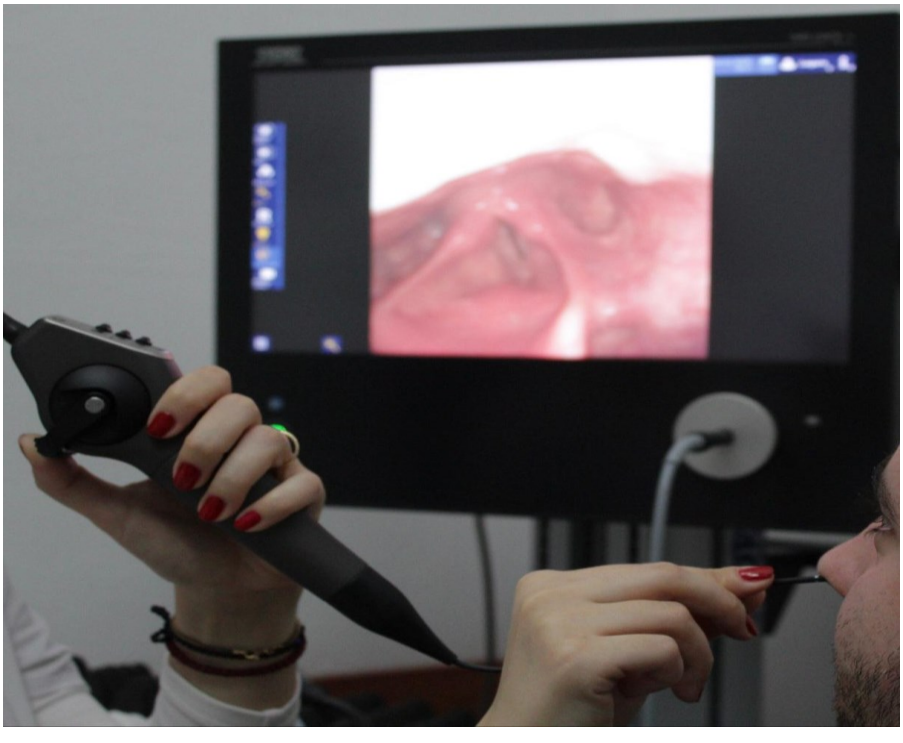


Fig. 12. Flexible endoscopy

4. LARYNGOSCOPY

Indirect Laryngoscopy

Short History:

- It is the first and most basic technique for viewing the larynx
- Remains the most common diagnostic method
- 1806: Bozzini – invented the archetypal laryngoscope
- 1829: Babington – glottiscope
- 1854: Manuel Garcia – "autolaryngoscopy"
- Early 1900s: Chevalier Jackson – sniffing position

Indications:

- Visualization of vocal cords and glottis
- Examination of oropharynx, hypopharynx and larynx
- Most adults and older children
- Suspicion of carcinoma
- Foreign body sensation
- Dyspnea
- Hoarseness
- Voice changes
- Chronic cough
- Choking episodes
- Odynophagia/dysphagia
- Chronic throat pain
- Globus sensation

- Haemoptysis
- Referred otalgia
- Shortness of breath
- Dysarthria
- Stridor

Necessary Equipment:

- Laryngeal mirror size 4 or 5

Fig. 13 Laryngeal mirror

- Adequate lighting
- Gauze sponges
- Local anaesthetic
- Protective eyewear
- Alcohol lamp or warm water

Setup:

- Well-lit room
- Head light or mirror light aligned to the examiner's visual axis
- Heat the mirror to prevent fogging
- Patient sitting in a "sniffing position"
- Examiner sitting higher than the patient
- Apply anaesthetic to the pharynx

Procedure:

- The patient protrudes the tongue
- Cover the tongue with gauze
- Gently pull the tongue using the thumb and middle finger of the non-dominant hand
- Patient breathes normally (inhalation and exhalation)
- Direct the mirror toward the posterior oropharyngeal wall, with the reflective surface facing downward
- Gently elevate the mirror toward against the uvula and soft palate
- Avoid triggering the gag reflex
- Try various angles to visualize the desired structures
- Observe the vocal cords at rest
- Ask the patient to phonate a sustained "EEE" sound
- Reheat the mirror if fogging occurs and repeat the examination

Fig. 14 Indirect laryngoscopy procedure

Diagnosis:

- Epiglottis slightly curved, with a regular superior margin
- Vocal cords: color, mobility, surface and margins
- Apply gentle pressure over the thyroid cartilage externally to visualize the anterior commissure
- Abnormal findings or high-risk patients to be referred for videolaryngoscopy

Advantages:

- Easily available
- Affordable
- No complications
- Easy to learn

Limitations:

- Uncontrolled gag reflex
- Anatomic variations
- The entire piriform sinus and postcricoid region cannot be visualized
- Perceptual error

Common mistakes:

- Insufficient explanation of the procedure
- Incorrect patient positioning
- Incorrect light alignment
- Lifting the uvula
- Visualizing the larynx without looking at adjacent structures
- Inaccurate recording of lesions

5. OTOSCOPY

Definition:

- Otoscopy is a clinical procedure used to examine structures of the ear, particularly the external auditory canal (EAC), tympanic membrane, and middle ear. Clinicians use this procedure during routine clinical examination and for the evaluation of ear-related symptoms

Fig. 15. Ear specula

Procedure:

- The patient is seated; the head is tilted at a 45-degree angle away from the examiner
- The examiner holds the handle of the otoscope and inserts the cone into the patient's external auditory canal, while simultaneously pulling the auricle posteriorly and superiorly (in adults)/posteriorly and inferiorly (in children)
- The otoscope contains a light source, a cone, and a magnifying lens, to illuminate and magnify ear structures, allowing accurate visualization and assessment of the visible anatomical structures

- Otoscopes require regular cleaning. Cleaning and maintenance of the equipment used during otoscopic examination is an important responsibility of the medical team
- Specula may be disinfected using wipes soaked in aldehydes, surfactants, or alcohol-based solutions

Fig. 16. Otoscopy

Indications:

- Infection
- Otalgia
- Hearing difficulty
- Fever
- Otorrhea
- Dizziness
- Stuffy nose

Inspection of the tympanic membrane may reveal:

- Normal tympanic membrane and structures
- Perforation
- Acute otitis media
- Suppurative otitis media
- Otitis media with effusion

There is significant variation in normal appearance, which should be noted, including:

1- colour

2- shape

3- perforation

4- scars

5- ossicles (ossicular chain)

6- light reflex

Anatomy of the Ear:

The ear is a complex and delicate organ responsible for hearing and balance.

The ear can be divided into three main parts:

- The external/outer ear
- The middle ear
- The inner ear

The external ear consists of:

- Auricle (pinna)
- External Auditory Canal
- Tympanic Membrane (eardrum)

The Auricle

- It is a structure made of elastic cartilage covered by skin, the rim of the auricle is called the helix and inferior portion the lobule

The External Auditory Canal

- A curved tube approximately 2.5cm long; ending at the tympanic membrane, which forms a thin, semitransparent barrier between the EAC and the middle ear
- It is located within the temporal bone and connects the auricle to the tympanic membrane
- Near the external opening of this canal, there are hairs and ceruminous glands, which produce cerumen
- The combination of hairs and cerumen helps prevent dust and foreign bodies from entering the ear

5.1 Aural Irrigation

Definition: the process of washing/irrigating the external auditory canal.

- **Cerumen** is a substance naturally produced in the lateral third of the EAC. Anatomically, this region houses a collection of pilosebaceous glands that includes ceruminous glands, hair follicles, and sebaceous glands
- The modified sweat produced by the ceruminous glands has antiseptic and antifungal properties and functions to lubricate and clean the EAC
- As dead skin cells shed and migrate out of the ear canal, they combine with the oily secretions of sebaceous glands and the modified sweat of the ceruminous glands
- The mixture forms cerumen, which consists primarily of dead keratin cells. Cerumen serves as a protective barrier to trap foreign particles

- Several pathologies may affect the EAC including sebaceous cysts, furuncles, and glandular tumors; however, the most common condition is accumulation and impaction of cerumen
- Cerumen impaction may cause symptoms such as hearing loss, dizziness, imbalance, earache, a sensation of ear fullness, itching and tinnitus
- Although cerumen is typically expelled spontaneously from the EAC with the aid of jaw movement, this mechanism may fail in some patients leading to impaction
- Irrigation of the EAC is one of the many options in treating cerumen impaction and a method that is readily available in a doctor's office or in an emergency room

Indications:

- To alleviate symptoms caused by impacted cerumen
- To remove cerumen or foreign bodies
- To cleanse the ear in case of purulent discharge associated with infection
- For its antiseptic effects
- To evaluate vestibular functions

Solutions:

- Boric acid 2-4%
- Sodium bicarbonate solution 1%
- Normal Saline
- Hydrogen Peroxide 2%
- Sterile water

Instruments used:

- Container for irrigation solution
- Syringes
- Ear basin or emesis basin for outflow (kidney tray)
- Towel to cover the patient
- Otoscope & specula
- Gloves
- Cotton swabs or gauze
- Ear medication

Procedure:

- Wash hands thoroughly
- Prepare equipment and supplies
- Explain the procedure to the patient
- Position the patient
- Using an otoscope, visualize the ear canal and tympanic membrane
- Cover the patient with a towel
- Clean the auricle and EAC with a cotton applicator dipped in cleaning solution
- Draw the irrigating solution into the syringe and expel the air by holding it vertically
- Straighten the ear canal by pulling the pinna of the ear upward and backward
- Insert the tip of the syringe at the entrance of the ear canal
- Direct the water jet toward the lateral canal wall, allowing a steady and continuous flow of fluid into the canal

- Plug the ear afterwards loosely with a piece of gauze to collect any drainage
- Dry the skin in and around the ear and instill any medication if indicated

Fig. 17 Ear irrigation procedure

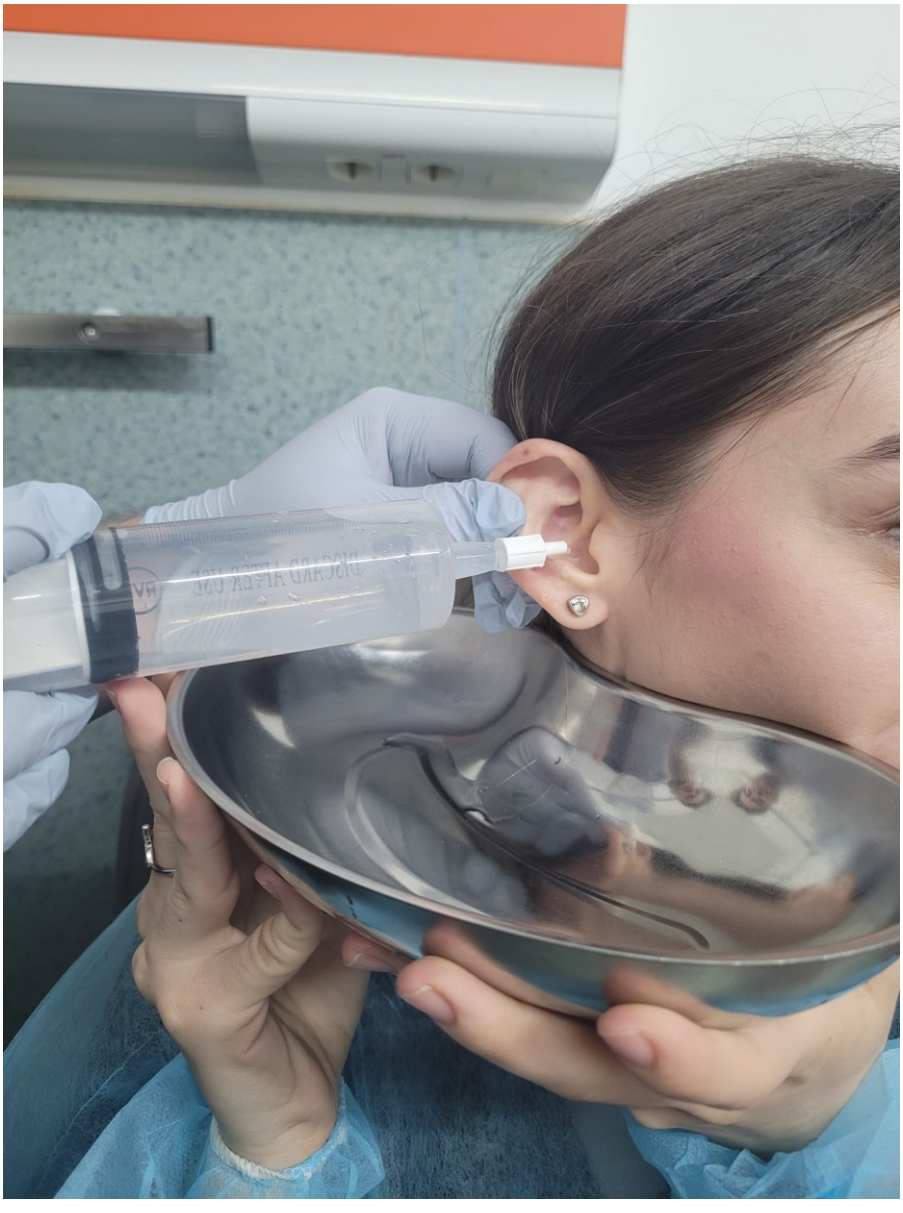


Fig. 18 Ear irrigation procedure

Complications:

Irrigation of the ear can lead to:

- Otitis externa
- Vertigo
- Perforation of the tympanic membrane, which may lead to middle ear damage

Symptoms of complications may include:

- Sudden pain
- Tinnitus
- Hearing loss
- Nausea and dizziness

If the patient experiences any of these symptoms, the examiner should immediately stop the procedure and examine the ear canal and tympanic membrane using an otoscope.

THE MIDDLE EAR

The middle ear is a small air-filled cavity in the temporal bone, that is separated from the external ear by the ear drum and from the inner ear by the oval window, and it consists of:

- Tympanic Membrane
- Ossicles (Malleus, Incus, Stapes)
- Oval window
- Eustachian tube

THE INNER EAR

Mainly responsible for sound detection and balance. It consists of:

- The bony labyrinth, a hollow cavity in the temporal bone of the skull, with a series of bony cavities. It is composed of the *cochlea, vestibule and three semi-circular canals*. All these structures are lined internally with periosteum and contain a fluid called perilymph
- The membranous labyrinth, which lies within the bony labyrinth. It consists of the cochlear duct, semi-circular ducts, utricle and the saccule. The membranous labyrinth is filled with fluid called endolymph

6. FUNCTIONAL ENT TESTS

Functional tests in ENT are essential for evaluating hearing, balance, nasal airflow, and Eustachian tube function. They can be divided into several categories:

I. Hearing (auditory) functional tests:

- Clinical bedside tests using tuning forks: Rinne, Weber, Schwabach
- Audiological (instrumental) tests: Pure-tone Audiometry, Speech Audiometry, Impedance Audiometry (tympanometry and acoustic reflexes), Otoacoustic emissions (OAE), Auditory brainstem response (ABR/BERA)

A tuning Fork is a two-pronged metallic device, usually made of steel, that produces a constant tone at a particular pitch when set into vibration.

Fig. 19. Tuning fork

Fig. 20. Tuning fork

Larger forks vibrate at lower frequencies. Commonly used frequencies in routine examination are *256 Hz, 512 Hz and 1024 Hz* **for Weber, Rinne, and Schwabach tests.**

Indications:

- Evaluation of the type of hearing loss (conductive or sensorineural)
- Screening for hearing impairment

Advantages:

- non-invasive method
- can be performed at bedside
- quick estimation of hearing

Air Conduction:

Hearing occurs through air near the ear

- the tuning fork is placed vertically approximately 2 cm away from the EAC opening
- sound transmission:

  Tympanic Membrane – ossicles – inner ear – auditory nerve – auditory cortex
- both conductive and sensorineural pathways are tested

Fig .21. Tympanometric system

Fig. 22. Audiometer headphones – Air transmition

Fig. 23. Audiometry system

Fig. 24. Audiometer headphones – Bone conduction

Table 1. Comparison between CHL and SNHL

Conductive Hearing Loss (CHL)	Sensorineural Hearing Loss (SNHL) *most common*
- damage to the **outer ear** or **middle ear** - sound conduction to inner ear blocked *e.g. otitis media in children*	- damage to **inner ear (hair cells)** or **auditory nerve** *e.g. prolonged noise exposure*
• AC: less sounds delivered • BC: sounds normally delivered • **BC > AC**	• AC: sound normally delivered • BC: less sounds delivered • **AC > BC**

Bone Conduction:

- hearing occurs through vibrations picked up by the ear's nervous system (bypassing outer + middle ear)
- vibrating tuning fork placed on mastoid bone
- the cochlea is stimulated by vibrations conducted through the skull
- only the sensorineural pathway is tested

Principles of Tuning Fork Test:

Weber Test (bilateral bone conduction comparison)

Place the vibrating tuning fork on the midline of the forehead and ask the patient from which ear the sound is louder

A. **No lateralization:** Normal hearing **or** bilateral hearing loss

B. **Lateralization:** Asymmetric hearing loss

Conductive Hearing Loss - lateralization to the affected side

Sensorineural Hearing Loss - lateralization to the unaffected side

Schwabach test (Test of Hearing Sensitivity)

- fork placed against mastoid process of patient
- note the time in seconds until the patient no longer hears the tone
- **Normal Schwabach: 20 s**
- **Diminished Schwabach <20 s** → *Sensorineural HL*
- **Prolonged Schwabach >20 s** → *Conductive HL*

Rinne Test (Unilateral comparison of AC to BC)

Place the vibrating fork on mastoid process

1. if patient no longer hears tone, hold fork‘s U part over outer ear
2. can patient still hear it?

YES Rinne test positive

- no conductive hearing loss AC (40 s) > BC (20 s)
- Ratio AC/BC 2/1

NO Rinne test negative

- conductive hearing loss present: BC > AC, Ratio < 2
- sensorineural hearing loss present: Ratio AC/BC 2/1, duration of AC and BC equally diminished

Differentiation CHL + SNHL:

Table 2. Differentiation CHL + SNHL

			Weber test				
			lateralizes to left		no lateralization	lateralizes to right	
Condition of ears:			*left*	*right*	*both*	*left*	*right*
Rinne test	⊕	⊕	Normal	**Sensorineural** loss	Normal **Sensorineural** loss	**Sensorineural** loss	Normal
	⊖	⊕	**Conductive** loss	Normal		**Combined** loss	Normal
	⊕	⊖	Normal	**Combined** loss		Normal	**Conductive** loss
	⊖	⊖	**Conductive** loss	**Combined** loss	**Conductive** loss	**Combined** loss	**Conductive** loss
	left ear	**right ear**	**Combined** loss = **conductive** and **sensorineural** loss				

II. VESTIBULAR (balance) functional tests:

Romberg, Unterberger (Fukuda) stepping test, Dix-Hallpike maneuver, Head Impulse Test (HIT), Caloric test, Videonystagmography (VNG), Electronystagmography.

- Romberg:

- The patient stands upright with the feet together and the arms at the sides
- First, balance is observed with the eyes open, then with the eyes closed
- Increased body sway or falling when the eyes are closed may indicate vestibular or proprioceptive impairment

- Unterberger Stepping test:

- The patient is asked to march in place for about 30-50 steps with the arms extended forward and the eyes closed
- A significant rotation or forward displacement suggests a possible unilateral vestibular weakness

- Dix-Hallpike Maneuver

- The patient starts in a sitting position
- The examiner quickly brings the patient backward into a supine position with the head turned 45° to one side and extended slightly over the edge of the table
- The test is repeated on both sides
- Vertigo and nystagmus indicate benign paroxysmal positional vertigo (BPPV)

- Head Impulse Test

- The patient fixes the gaze on a target (usually the examiner's nose)
- The examiner then rapidly turns the patient's head a small distance to one side
- A corrective eye movement (saccade) suggests vestibular hypofunction on the side of the head turn

- Caloric test

- The patient lies supine with the head elevated about 30 °
- Warm or cold water (or air) is introduced into the external ear canal
- This stimulates the vestibular system and produces nystagmus
- Reduced or absent response suggests vestibular dysfunction

- Videonystagmography:

- This is a diagnostic test used to evaluate the vestibular system by recording involuntary eye movements (nystagmus)
- The patient wears special goggles equipped with infrared video cameras

- These cameras track and record eye movements while the patient performs different tasks, such as following visual targets, changing head positions, or undergoing caloric stimulation
- VNG helps identify peripheral or central causes of dizziness and balance disorders by analyzing abnormal eye movement patterns

Fig.2 5; 26; 27; 28. Frenzel Nystagmus Goggles

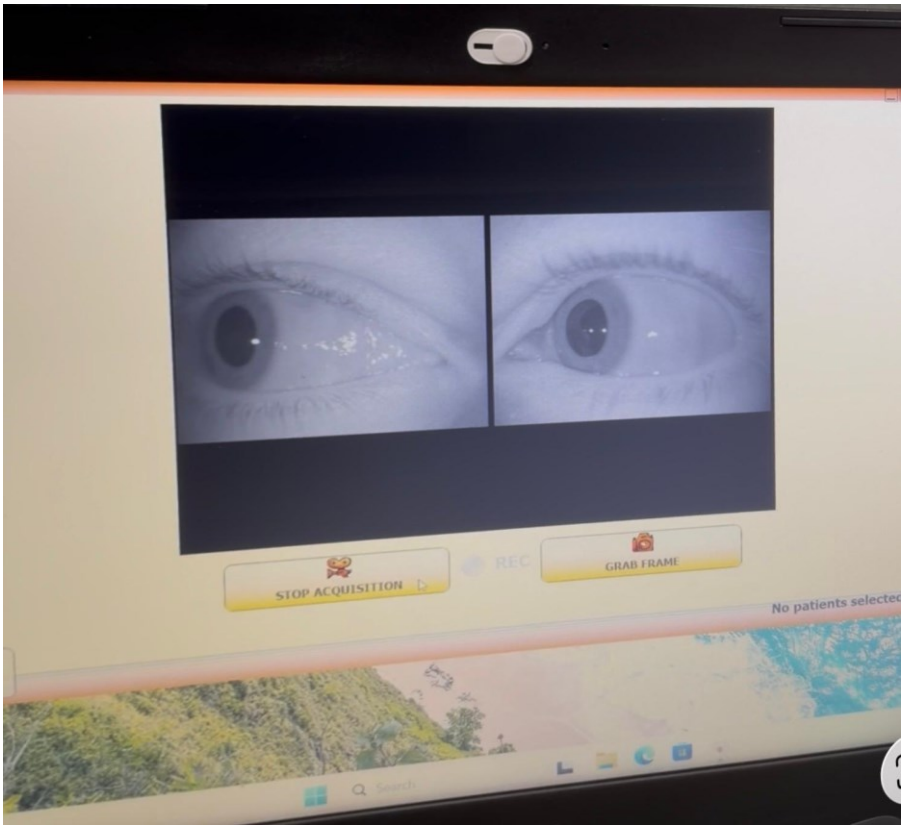


Fig. 29. VNG

- Electronystagmography:

- This is another method for assessing vestibular function by measuring eye movements, but instead of cameras, it uses surface electrodes placed around the eyes
- The electrodes detect changes in the electrical potential generated by eye movements
- The patient is asked to perform similar tests to VNG, including gaze tracking, positional maneuvers and caloric testing
- ENG is useful in diagnosing vestibular dysfunction, although it is considered less precise than VNG because it cannot directly visualize eye motion and is more affected by artifacts

III. NASAL functional tests:

Rhinomanometry, Acoustic rhinometry, Mirror fogging test, Olfactory tests (smell identification tests)

- Rhinomanometry:

- The patient breathes normally through the nose while one nostril is partially sealed with a sensor
- The device measures nasal airflow and pressure during inspiration and expiration
- This allows calculation of nasal resistance and helps assess nasal obstruction

- Acoustic Rhinometry:

- A probe is placed at the entrance of the nostril and sound waves are emitted into the nasal cavity
- Reflected sound signals are analyzed to determine the cross-sectional area and volume of the nasal passages
- It is useful for evaluating structural narrowing

- Mirror fogging test:

- A small mirror is held under the patient's nostrils while they breathe out
- The pattern and symmetry of condensation on the mirror indicate the presence and degree of nasal airflow from each side
- It is a simple bedside screening test

- Olfactory tests:

- The patient is presented with standardized odors (such as coffee, mint, or specific test kits) and is asked to identify or discriminate between smells
- These tests evaluate olfactory function in cases of hyposmia or anosmia

IV. PHARYNX-VOICE-LARYNX:

Laryngeal stroboscopy, Acoustic voice analysis, Maximum phonation time (MPT), Spirometry (in phoniatric assessment)

- Laryngeal Stroboscopy

- A rigid or flexible endoscope is inserted through the mouth or nose to visualize the vocal folds
- A strobe light flashes in synchronization with vocal vibration while the patient phonates (says "eee")
- This creates a slow-motion effect, allowing assessment of vocal fold movement and lesions

- Acoustic Voice Analysis

- The patient is asked to sustain vowels (e.g. "aaa") or speak normally into a microphone
- Computer software analyzes voice parameters such as pitch, intensity, jitter, shimmer and noise
- This provides an objective evaluation of voice quality

- Maximum Phonation Time

- The patient takes a deep breath and sustains a vowel sound (usually "aaa") for as long as possible at a comfortable pitch and loudness

- The duration is measured in seconds and reflects respiratory support and vocal efficiency

- Spirometry

- The patient breathes into a spirometer through a mouthpiece
- Measurements of lung volumes and airflow are recorded
- In voice evaluation, spirometry helps determine whether reduced respiratory capacity contributes to voice disorders

V. EUSTACHIAN TUBE function tests:

Valsalva Maneuver, Toynbee Maneuver, Politzer test

- Valsalva Maneuver

- The patient closes the mouth, pinches the nostrils shut, and forcefully exhales against the closed airway
- This increases nasopharyngeal pressure and may open the Eustachian tube, equalizing middle ear pressure

- Toynbee maneuver

- The patient pinches the nose closed and swallows
- Swallowing activates the muscles that open the Eustachian tube, helping assess pressure regulation in the middle ear

- Politzer test

- A soft rubber bulb is placed at the nostril, and the patient is asked to swallow while air is gently insufflated into the nasal cavity
- If the Eustachian tube is patent, air reaches the middle ear, producing a pressure change

7. ENT EMERGENCIES AND EMERGENCY PROCEDURES

7.1. MYRINGOTOMY

Definition:

- It is an incision of the tympanic membrane performed to drain suppurative or non-suppurative effusion from the middle ear or to provide aeration in case of Eustachian tube dysfunction
- A ventilation tube (grommet) may also be required in the latter case

Indications:

- Acute suppurative otitis media
- Severe earache with a bulging tympanic membrane
- Incomplete resolution with an opaque tympanic membrane and persistent conductive hearing loss
- Complications of acute otitis media (e.g. facial paralysis, labyrinthitis or meningitis) with bulging tympanic membrane
- Recurrent acute otitis media
- Otitis media with effusion
- Aero-otitis media (to drain fluid and restore Eustachian tube function)
- Atelectatic ear (grommet is often inserted for long-term aeration)

Anesthesia:

- Infants and children: general anesthesia is always used
- Adults: general anesthesia is used only when the tympanic membrane is acutely inflamed

- Adults: local anesthesia or no anesthesia may be used if there is no inflammation

Fig. 30. Ear Microscopy

Procedure:

- Ear canal is cleaned of wax and debris
- The procedure is ideally performed under an operating microscope using a sharp myringotome and a good suction apparatus
- In acute suppurative otitis media, a circumferential incision is made in the posteroinferior quadrant of the tympanic membrane, midway between the handle of the malleus and the tympanic annulus, avoiding injury to the incudostapedial joint
- In otitis media with effusion, a small radial incision is made in the posteroinferior or anteroinferior quadrant, and all the effusion is aspirated
- When the ventilation tube is to be inserted, the incision should be just large enough to admit the tube and is preferably placed in the anteroinferior quadrant for longer retention
- No stitches will be used to close the incision
- The incision heals spontaneously. The procedure is often done on both ears
- Some doctors may use a laser beam to make the opening in the eardrum
- The procedure usually lasts about 15–20 minutes

Fig. 31. Myringotome

Risks:

- When the tympanic membrane is thickened, the incision may involve only the superficial layers of the membrane without cutting through its entire thickness
- Incision in the posterior meatal wall. This may happen when the distinction between drum head and posterior meatal wall is lost, when both are inflamed
- Beware of vascular anomalies of the middle ear such as a high jugular bulb, aberrant carotid artery or glomus tympanicum

Postoperative care:

- Daily cleaning of ear discharge will be required in cases of acute suppurative otitis media
- In serous otitis media, a wad of cotton wool may be left in place for 24–48 hours
- Drum incisions usually heal rapidly
- Water should not be allowed to enter the ear canal for at least 1 week, and if a grommet has been inserted, entry of water is prevented for as long as the grommet is in position
- Complete healing without complications should occur within 4 weeks
- If ear tubes were inserted, they should fall out within 6-12 months

Complications:

- Injury to the incudostapedial joint or stapes
- Injury to the jugular bulb with profuse bleeding
- Middle ear infection

Grommet tube insertion:

- It is a ventilation tube placed in the tympanic membrane for drainage or ventilation of the middle ear
- It has also been called a pressure-equalizing or tympanostomy tube and is made of Teflon or medical-grade silicone which are biocompatible
- Some grommets are made of gold or titanium
- For long-term ventilation or when grommets are repeatedly extruded, a T-tube can be used

Complications of ventilation tube:

1. Blockages due to blood or secretions
2. Middle ear infection
3. Extrusion
4. Persistent perforation after extrusion or removal
5. Granuloma formation
6. Tympanosclerosis

7.2. EPISTAXIS:

Introduction:

- ▶ Epistaxis (nosebleed): bleeding from the nasal cavity and /or nasopharynx
- ▶ It can occur easily because of the rich vascular supply of the nasal mucosa
- ▶ Approximately 60% of individuals will experience at least one episode of epistaxis in their lifetime
- ▶ The majority of epistaxis occurs most frequently between the ages of 2-10 and 50-80 years old

Nasal vascular anatomy:

Vascular supply of the nasal cavity:

1. Greater palatine artery
2. Anterior ethmoidal artery
3. Sphenopalatine artery
4. Superior labial artery
5. Posterior ethmoidal artery

Classification:

a. Anterior Epistaxis:

- Bleeding from the nostrils
- ~ 90% of cases
- Children < 10 years of age
- Kiesselbach's plexus
- Most commonly due to trauma

b. Posterior Epistaxis:

- Bleeding through the posterior nasal aperture
- ~ 10% of cases
- Older individuals
- Originates from Woodruff's plexus
- Often associated with hypertension and arteriosclerosis

Etiology:

- LOCAL: trauma, deviated nasal septum, inflammatory diseases
- SYSTEMIC: Alcoholism, Hypertension, Vascular malformations, Coagulopathies

- ENVIRONMENTAL FACTORS**:** Allergies, Environmental dryness (more common in winter months)
- MEDICATIONS: NSAIDs (ibuprofen, naproxen, aspirin), Topical nasal steroid sprays, Illicit drugs (cocaine)

Patient evaluation:

Patient history:

- duration
- symptoms
- amount of blood loss
- side of the nose from which bleeding is occurring
- family history
- drug intake

Laboratory investigation:

Physical examination: examine the nasal cavity using a nasal speculum and headlight to locate the site of bleeding.

Management:

- Initial Treatment
- First Aid- Anterior Epistaxis-Trotter's Method
- Ice Packs

Treatment

- **Cauterization**: useful in anterior epistaxis, performed under topical anesthesia, cauterization may be performed using a bead of silver nitrate or coagulation with electrocautery.
- **Adrenaline-soaked cottton pledget**
- **Anterior nasal packing**

- Performed if localized bleeding is profuse or the bleeding point cannot be identified
- Use of a ribbon gauze soaked with liquid paraffin (1 m long and 2.5 cm wide in adults, and 12 mm wide in children)
- Can be done with a vertical layer and a horizontal layer
- It can be removed after 24 hours, or it can be kept up to 2-3 days
- Systemic antibiotics should be administered to prevent sinus infection and toxic shock syndrome

Fig. 32. Nasal forceps

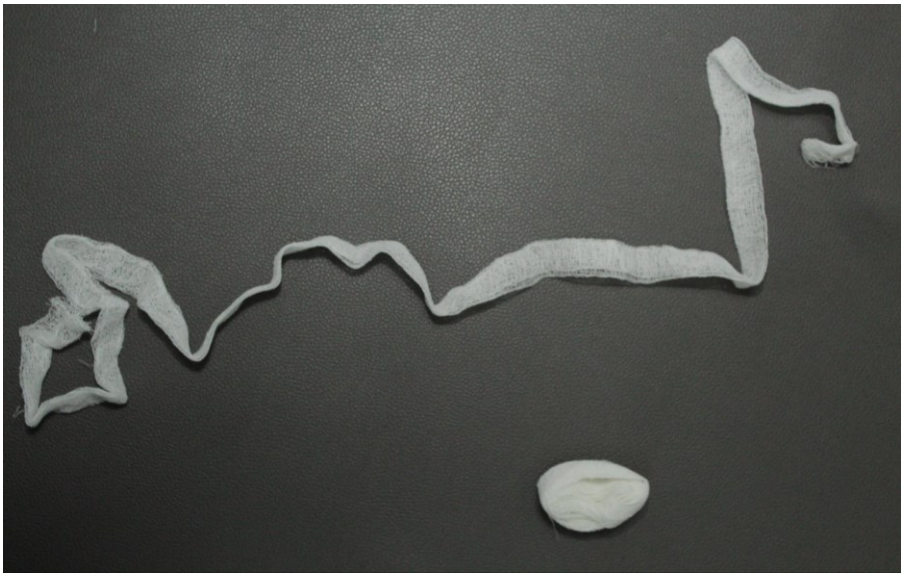


Fig. 33. Anterior epistaxis - nasal packing

- **Posterior nasal packing**

Fig. 34. Posterior epistaxis - nasal packing

Complications of nasal packing:

- septal hematoma
- abscess
- sinusitis
- pressure necrosis
- toxic shock syndrome
- alar necrosis

Surgical intervention

- indicated if bleeding continues despite adequate packing and resuscitation
- nasal anomaly- deviated septum

Patient refusal or intolerance to packing

Arterial ligation

- External carotid artery
- Ethmoidal arteries
- Most commonly ligated vessel is the sphenopalatine artery

7.3. MAXILLARY SINUS PUNCTURE

Anatomy of the paranasal sinuses

Overview:

• The nose contains the human olfactory system and is responsible for the sense of smell

• The paranasal sinuses are a group of air-filled structures within the skull (frontal, ethmoid, sphenoid) and facial bones (maxilla)

• The sinuses help to provide resonance to the voice, warm and humid the air that is inhaled and are part of the mucociliary system

• The maxillary sinus (sinus maxillaris) is the largest of the paranasal sinuses and pyramidal in shape, its size varies in different skulls, and most of the time even on the two sides of the same skull; an average-sized sinus has a vertical height opposite the first molar tooth about 3.75 cm, a transverse breadth about 2.5 cm and an antero-posterior depth of approximately 3 cm

• The anterior wall of the maxillary sinus is formed by the facial surface of the maxilla and is internally grooved by the canalis sinuosus; three major landmarks: (1) the thin canine fossa; (2) the infraorbital foramen located in the midsuperior region; and (3) the infraorbital groove

• The posterior wall is formed by the infratemporal surface of the maxilla and forms the anterior border of the pterygopalatine fossa.

• Laterally the apex of the MS extends into the zygomatic process reaching the zygomatic bone and therefore forming the zygomatic recess

• Medially the base is formed by the lateral wall of the nasal cavity. It is rectangular in shape and slightly deficient at the maxillary hiatus. This opening is partially closed in an articulated skull by sections of the inferior turbinate, the uncinate process of the ethmoid bone, the perpendicular plate of the palatine bone, the lacrimal bone, and the overlying mucosa that forms the ostium as well as anterior and posterior fontanelles

• The roof is formed by the fragile, triangular orbit floor, with the infraorbital groove running through it, while its floor is formed by the alveolar process and is usually 0.5 to 10 mm below the level of the floor of the nose. The maxillary posterior teeth root tips are in close relation to the floor of the sinus, with the root tips of the molars being very close to the floor of the sinus (oroantral fistulae after extraction or possible sinusitis after dental infection)

Blood supply:

• primarily from branches of the maxillary artery:

1. the posterior superior alveolar artery (PSAA): courses along the wall of the maxillary sinus

2. the infraorbital artery: passes along the infraorbital groove and canal, under the orbit, and finally through the infraorbital foramen on the facial surface of the maxilla

3. The posterior lateral nasal artery: anastomoses together with PSAA along the anterolateral wall of the sinus, supplying the mucous membrane of the nasal chambers; additionally, it branches from the sphenopalatine artery and passes through the sphenopalatine foramen to enter the nasal cavity and can be found within the medial wall of the sinus. As it continues anteriorly, the posterior lateral nasal artery begins to branch, supplying blood to the posterior and medial wall of the sinus

Innervation:

• general sensation innervation is given by the infraorbital and anterior, middle, and posterior superior alveolar branches of the maxillary nerve (V2)

• Most innervation is given by the posterior superior alveolar branch

• The anterior superior alveolar branch innervates the anterior portion of the maxillary sinus, whereas the middle superior alveolar branch contributes secondary mucosal innervation

• The ostium of the maxilla is innervated by the greater palatine nerve while the infundibulum is innervated by the anterior ethmoidal branch of the ophthalmic nerve (V1)

Physiology and Function:

1. Ventilation and Mucus Drainage

2. Lightening the weight of the head

3. Supporting immune defense of the nasal cavity

4. Humidifying inspired air

5. Increasing resonance of the voice

Maxillary sinus puncture:

• Also called Antral lavage (Probe puncture)

• Surgical procedure in which a cannula is inserted into the maxillary sinus via the inferior meatus to allow irrigation and drainage

• Indication: infective rhinosinusitis or bacterial maxillary sinusitis => Diagnostic or Therapeutic tool (no response to conservative treatment)

Fig. 35. Maxillary sinus puncture instruments

Procedure: it involves making a small puncture on the wall of the maxillary sinus that separates it from the nose. Through this puncture a small cannula is inserted into the maxillary sinus. Through the cannula the sinus cavity is irrigated. The returning fluid comes through the natural maxillary sinus opening.

1. Nasal preparation is done by placing co-phenylcaine patties in the nose for about 10 minutes; lateral wall of the nasal cavity injected with 2% lidocaine and 1:80000 epinephrine.

2. The maxillary wall is then punctured with a trocar and cannula.

3. Once the cavity is irrigated, the drainage can be started.

7.4. TRACHEOSTOMY:

Fig. 36; 37. Tracheotomy

Definition:

- Tracheostomy / tracheotomy

→ Artificial opening of the trachea through the anterior neck

→ New airway

- Cricothyrotomy = Emergency airway

Key structures for tracheostomy:

- → Laryngeal notch and thyroid cartilage

- → Area below the cricoid cartilage, usually between the second and third tracheal rings
- → Cricoid cartilage
- → Tracheal rings

Indications:

Bypassing airway blockage:

- Can be an emergency
- Facial trauma
- Acute angioedema in anaphylaxis
- Tumors → Laryngeal cancer

Long term ventilation:

→ Less sedation needed

→ Less vasopressors needed

→ Endotracheal tube can cause damage

→ Speech valves

→ Can be early or late (10 days)

Example: Covid-19 pneumonia with needed ETI → Early tracheostomy

Cannot intubate, cannot ventilate → in case of failed advanced airway and impossible bag-valve-mask ventilation → Emergency cricothyrotomy

Contraindications:

- Not in case of emergency
- Active infection at the site of tracheostomy
- Abnormal tracheolaryngeal structures
- Bleeding disorder
- **C**irculatory shock

Technique:

1. Check equipment
    - Team: 2 Surgeons and a nurse
    - Tracheostomy set
    - Bronchoscope
    - Patient monitored, sedated, intubated
2. Preoxygenate 100% O2 for 3 min
3. Hyperextend the neck, clean the skin and prepare
4. Identify landmarks, local anesthesia
5. Horizontal 3-4 cm cut between 1st and 2nd or 2nd and 3rd tracheal rings
6. Dissect and push away tissue
7. Insert retractors
8. Dissect anterior neck muscles
9. Dissect under the thyroid gland
10. Visualize the first two tracheal rings
11. Inject Lidocaine solution in the trachea between the first and second tracheal rings
12. Cut first and second tracheal rings
13. Insert tracheal dilator forceps
14. Remove the endotracheal tube
15. Check the tracheostomy tube, lubricate it, advance into the trachea
16. Hold it in place and retract the tracheal dilator forceps
17. Connect ventilator tubing
18. Check for bleeding

Complications of tracheostomy

1. Acute
    - Hemorrhage
    - Tracheal or laryngeal fractures
    - Failure; loss of airway
    - Aspiration
    - Hypoxemia, hypercapnia
    - Posterior wall perforation
    - Thyroid perforation
    - Pneumothorax
    - Death
2. Chronic
    - Tracheal stenosis
    - Fistulas
    - Dysphonia
    - Granulomas
    - Stoma infection

Tracheostomy – Care

- Clean inner cannula
- Replace spoiled gauze dressing around the neck
- Inspect skin around the stoma → Red, hard, tender, foul smell?
- Clean and dry the skin and outer cannula
- Change the trach tube ties

7.5. RIGID BRONCHOSCOPY:

The Respiratory System:

The respiratory tract is divided into:

1- The upper respiratory tract:

- Nose
- Nasal cavity and nasal sinuses
- Pharynx
- Larynx above the vocal cords

2- The lower respiratory tract:

- The lower part of the larynx
- Trachea
- Bronchi
- Bronchioles
- Alveoli

- Trachea is formed by cartilages (15-20), joined together by annular ligaments and it bifurcates at the level of T4 into the left and the right main bronchus (Tracheal Carina)
- Neighboring structures:

1. Posterior: esophagus, descending aorta
2. Anterior: thyroid, ascending aorta, brachiocephalic trunk,
3. Superior: larynx
4. Lateral: superior vena cava (right)

- Bronchi: - The right main (primary) bronchus divides into 3 lobar bronchi (secondary bronchi)

  - The left main (primary) bronchus divides into 2 lobar bronchi (secondary bronchi)

  - The lobar bronchi divide further into segmental bronchi (tertiary bronchi)

Physiology of the Tracheobronchial Tree:

- Conduction of air in and out of the respiratory tree
- Anatomic dead space
- Warms and humidifies the air
- Mucociliary clearance

Rigid Bronchoscopy:

- **Definition: RB** is an invasive procedure that is utilized to visualize the oropharynx, larynx, vocal cords, and tracheobronchial tree
- It is performed for both the diagnosis and treatment of lung disorders. The procedure may be performed in an endoscopy suite with available anesthesia, but more appropriately in the operating room, and rarely in the ICU
- It is frequently combined with flexible bronchoscopy to acquire and maintain better distal airway visualization and suctioning

Indications:

- Foreign body retrieval
- Bleeding
- Deeper tissue biopsy specimens
- Dilation of airway strictures
- Relief of airway obstruction
- Insertion of stents
- Laser therapy or other mechanical tumor ablation

Contraindications:

- Uncontrolled coagulopathy
- Extreme ventilatory or oxygenation demands
- Tracheal obstruction with an inexperiencced operator

Rigid Bronchoscopy instruments:

Fig. 38. Rigid bronchoscope and rigid endoscope

- There should be at least 3 different sizes of rigid bronchoscope—usually 7, 8, 9 mm scopes. Having paediatric Jackson scopes available of various sizes, such as 3.5, 4, 5, and 6 mm (2.5-3 mm may be necessary for children less than 10 kg)
- Large-bore suction catheters
- Video telescopes
- A halogen light provides illumination
- Flexible bronchoscopes
- Graspers and biopsy forceps
- Metal centimetre ruler
- Rubber tooth guard or
- Saline-soaked gauze to protect the teeth
- Other materials that should be available include normal saline solution, lubricant jelly, syringes, and suction tubing

Rigid Bronchoscopy – The Procedure:

- The patient is placed in the supine position. The head should be on a small pillow or foam rest and positioned on the portion of the table that can be flexed or extended as needed
- After introducing the instrument, the epiglottis is gently lifted with the end of the bronchoscope, after which the larynx and vocal cords can be seen
- Once the vocal cords have been visualized, the bronchoscope is turned 90° vertically to pass through the vocal cords
- After entering the upper trachea, the bronchoscope is turned back to its original neutral position
- Ventilation is initiated via the side port

- The bronchoscope is gently advanced toward the carina and systematically inserted into each mainstem bronchus
- Telescopes may be inserted into the rigid bronchoscope to visualize the distal segments, requiring the angled 30° and 90° scopes to see particularly the right upper lobe orifice. The head is usually turned to the left to enter into the right mainstem bronchus and turned to the right to enter into the left mainstream bronchus
- Once the preliminary examination is completed, the purpose for which the procedure was performed should be addressed (*e.g.*, dilation, stent insertion, laser ablation, extraction of foreign bodies)
- Cautery, forceps, and suction should be readily available
- If a more detailed examination, washings, laser/photodynamic ablation, or stent insertion is required, a flexible bronchoscope can be inserted through the rigid bronchoscope

Rigid Bronchoscopy – Possible Complications:

- Injury to the teeth and gums
- Tracheal or bronchial tears
- Severe bleeding

7.6. PERITONSILAR ABSCESS (PERITONSILAR PHLEGMON)

Definition:

- Peritonsillar abscess, also known as a peritonsillar phlegmon, is the most common deep neck space infection
- It represents a collection of pus located between the capsule of the palatine tonsil and the superior pharyngeal constrictor muscle, usually as a complication of acute tonsillitis

- It is considered an ENT emergency due to the risk of airway compromise and extension to deep neck spaces

Etiology and Pathophysiology

Peritonsillar abscess most commonly arises from bacterial tonsillitis, especially when infection spreads beyond the tonsillar capsule. Common causative organisms include:

- Streptococcus pyogenes (Group A β-hemolytic streptococcus)
- Staphylococcus aureus
- Anaerobic bacteria (e.g. Fusobacterium, Prevotella)

The infection leads to inflammation, tissue edema, and eventual abscess formation in the peritonsillar space.

Clinical Features

Patients typically present with:

- Severe unilateral sore throat
- Fever and general malaise
- Trismus (due to involvement of the pterygoid muscles)
- Muffled “hot potato” voice
- Dysphagia and odynophagia
- Referred otalgia
- Drooling
- Cervical lymphadenopathy

Physical examination reveals:

- Bulging of the peritonsillar region
- Medial displacement of the affected tonsil
- Deviation of the uvula to the contralateral side
- Hyperemia and edema of the soft palate

Diagnosis

Diagnosis is mainly clinical

- Complete blood count (leukocytosis)
- Ultrasound (to differentiate abscess from cellulitis)
- Contrast-enhanced CT scan (if deep neck space extension is suspected)

Management Overview

Peritonsillar abscess requires prompt intervention, which includes:

- Airway assessment
- Antibiotic therapy
- Surgical drainage (needle aspiration/incision and drainage)

EMERGENCY PROCEDURE- NEEDLE ASPIRATION AND DRAINAGE OF PERITONSILLAR ABSCESS

Indications

- Confirmed peritonsillar abscess
- Severe pain or trismus
- Failure of conservative treatment
- Airway compromise risk

Contraindications

- Uncooperative patient
- Bleeding disorders
- Suspected vascular anomalies
- Inability to secure the airway if needed

Instruments required

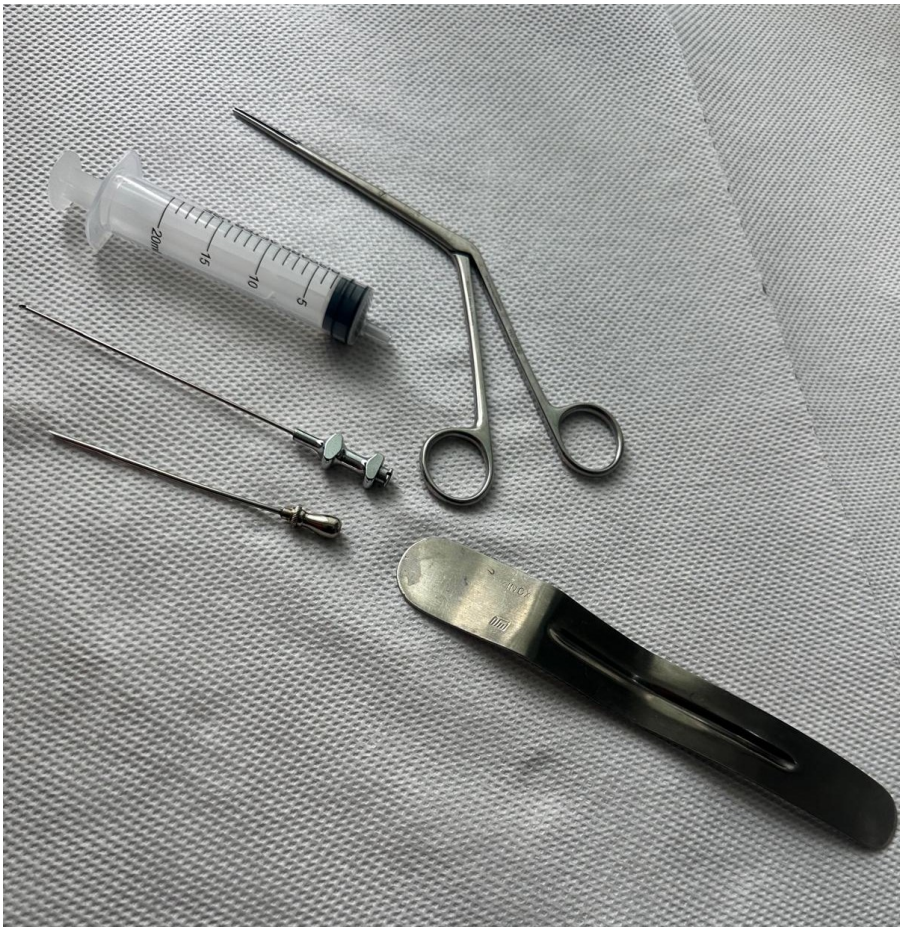


Fig. 39. Instruments for peritonsillar abcess drainage

Fig. 40. Headlight

- Headlight or adequate light source
- Tongue depressor
- 10-20ml syringe
- 18–21-gauge needle
- Local anesthetic
- Suction apparatus
- Sterile gloves
- Antiseptic solution

Anesthesia

- Topical anesthesia using lidocaine spray to the oropharynx
- Optional local infiltration at puncture site
- General anesthesia may be required in children or uncooperative patients

Procedure

- Position the patient seated upright with adequate head support
- Apply topical local anesthetic to the oropharynx
- Identify the point of maximum fluctuation→ usually at the junction of the anterior tonsillar pillar and the soft palate, superior to the tonsil
- Insert the needle no more than 1 cm deep to avoid injury to the internal carotid artery
- Aspirate pus slowly using the syringe
- If pus is obtained, complete drainage until no further material can be aspirated
- Send aspirated material for microbiological culture if indicated
- Apply suction to clear secretions and blood

Incision and Drainage (Alternative method)

If needle aspiration fails or abscess recurs:

- A small incision is made at the point of maximal bulging
- Blunt dissection allows complete drainage
- Care is taken to avoid deep penetration

Post-procedure care

- Start broad-spectrum intravenous or oral antibiotics
- Analgesics and antipyretics
- Adequate hydration
- Monitor airway status
- Soft diet recommended

Complications

- Hemorrhage
- Aspiration
- Spread to the parapharyngeal or retropharyngeal space
- Septicemia
- Recurrence

Definitive treatment

- Interval tonsillectomy is recommended in recurrent cases
- Immediate tonsillectomy (quinsy tonsillectomy) may be considered in selected patients

7.7. FOREIGN BODIES IN ENT PRACTICE

Definition

- Foreign bodies in ENT practice refer to objects accidentally lodged in the ear, nose, pharynx, larynx, or esophagus, causing acute symptoms and requiring prompt evaluation and removal
- A fish bone is one of the most common foreign bodies encountered in ENT emergencies, particularly in adults

Etiology and risk factors

- Rapid eating
- Poor mastication
- Use of dentures (reduced palatal sensation)
- Alcohol consumption
- Elderly patients

Common locations of fish bone impaction

- Palatine tonsils
- Base of the tongue
- Vallecula
- Pyriform sinuses
- Upper esophagus

Clinical features

- Sudden onset of throat pain during or after eating
- Foreign body sensation in the throat
- Odynophagia
- Dysphagia
- Referred otalgia
- Hypersalivation

In some cases, symptoms may persist even after spontaneous passage of the foreign body due to mucosal abrasion or local inflammation.

Diagnosis

- Detailed patient history (recent fish consumption)
- Careful inspection of the oral cavity and oropharynx
- Flexible or rigid endoscopy
- Plain radiography- with minimal sensitivity
- CT scans are indicated if complications are suspected or if endoscopy is inconclusive

Emergency management

- Assess airway patency
- Evaluate the severity of symptoms
- Exclude signs of airway compromise or perforation

Removal techniques

- Visible fish bone in the oropharynx: removal using Magill forceps or bayonet forceps
- Fish bone lodged deeper (hypopharynx/esophagus): removal under flexible/rigid endoscopy or esophagoscopy (under general anesthesia)

Post-removal care

- Re-examination of the mucosa
- Analgesics if needed
- Soft diet for 24-48 hours
- Antibiotics only if mucosal injury or infection is present

Complications- if not promptly treated, fish bone may lead to:

- Mucosal ulceration
- Local abscess formation
- Retropharyngeal or parapharyngeal infection
- Esophageal perforation
- Mediastinitis (rare but life-threatening)

Differential diagnosis

- Acute pharyngitis
- Tonsillitis
- Globus pharyngeus
- Esophageal spasm

8. ELECTIVE PROCEDURES IN ENT

8.1. ADENOIDECTOMY

Anatomy and Physiology:

- ✦ Lymphoid tissue (vertical ridges separated by deep clefts)
- ✦ Situated at the junction of the roof and posterior wall of nasopharynx
- ✦ Covered by pseudostratified ciliated columnar epithelium
- ✦ Part of Waldeyer's ring➔ part of the immune system
- ✦ Physiological enlargement up to age 6-7, then tends to atrophy at puberty and almost completely disappears at the age of 20

Vascular supply:

- ✦ Arterial:
  - Ascending pharyngeal artery
  - Ascending palatine artery
  - Tonsillar branch of the facial artery
  - Pharyngeal branch of the maxillary artery
  - Artery of the pterygoid canal
  - Basisphenoidal artery
- ✦ Venous:
  - Drainage to the pharyngeal plexus and then into the internal jugular and facial veins

Nerve supply:

- ✦ From the pharyngeal plexus

Adenoid hypertrophy:

Etiology:

- ✦ Recurrent attacks of rhinitis
- ✦ Sinusitis
- ✦ Chronic tonsillitis
- ✦ Substances triggering allergic reactions in the superior respiratory tract

Symptoms:

Nasal:

- ✦ Nasal obstruction
- ✦ Nasal discharge
- ✦ Sinusitis
- ✦ Epistaxis
- ✦ Voice changes

Auricular:

- Tubal obstruction
- Recurrent attacks of acute otitis media
- Chronic suppurative otitis media
- Serous otitis media

General:

- Adenoid face (open mouth, hypoplastic maxilla, undeveloped thin nostrils, short upper lip, prominent upper teeth)
- Pulmonary hypertension

Diagnostic:

- ✦ Posterior rhinoscopy
- ✦ Rigid or flexible nasopharyngoscopy
- ✦ Soft tissue lateral x-ray

Treatment:

- ✦ Without marked symptoms:
  - Breathing exercises
  - Decongestant nasal drops
  - Antihistamines
- ✦ With marked symptoms:
  - Adenoidectomy

Indications:

- ✦ Adenoid hypertrophy leading to:
  - Obstruction of breathing
  - Snoring with difficulty sleeping
  - Sleep apnea syndrome
  - Mouth breathing ➔ dry mouth
  - Voice/ speech abnormalities
- ✦ Recurrent rhinosinusitis with chronic stuffy nose
- ✦ Chronic otitis media with effusion associated with adenoid hyperplasia

- ✦ Recurrent ear discharge in benign chronic suppurative otitis media associated with adenoiditis / adenoid hyperplasia
- ✦ Dental malocclusion
- ✦ Failure of conservative therapy (topical steroids)

Contraindications:

- ✦ Bleeding disorders
- ✦ Acute upper respiratory tract infection
- ✦ Children < 1 year
- ✦ Cleft palate
- ✦ Neuromuscular disorders

Procedure:

➔ can be removed alone or in combination with tonsillectomy

➔ most often performed in pediatric patients

➔ takes about 20 minutes

➔ different techniques possible

- ✦ Supine position on the back
- ✦ General anesthesia with oral endotracheal intubation
- ✦ Use a retractor to hold the mouth open
- ✦ Insert a catheter through the nose and out the mouth to retract the soft palate

Use a laryngeal mirror to see adenoids (because they are behind the nasal cavity)

1. Adenoid Curette:

Fig. 41. Adenoid Curettes

- ✦ Standard and conventional successful method
- ✦ The curette has a sharp edge in a perpendicular position to its long handle
- ✦ Insertion through the mouth and placing it into position
- ✦ Cutting out and suctioning adenoid tissue
- ✦ Control hemostasis with packing or electrocautery

Control area using mirror

Fig. 42. Adenoidectomy procedure

2. Electrocautery with suction bovie:

- ✦ Using electrocautery with suction bovie to remove adenoid tissue
- ✦ Suction bovie has a hollow center to suction blood and secretions and a rim of metal contact for coagulation and suction
- ✦ Can be used for pure coagulation or coagulation and cutting

- ✦ Insertion and placing of the device
- ✦ Ablation and suction of adenoid tissue
- ✦ Control the area with a mirror

3. Alternatives:

- ✦ Adenoid punch
  - Curved instrument that is placed over adenoid tissue
  - Chamber is closed and a knife blade surgically removes adenoids which are then disposed in that chamber and removed with the instrument
  - Control hemostasis with packing and electrocautery

- ✦ Coblation
  - Use of coblation to ablate adenoids
  - Effective but increases time to remove

- ✦ Excision through the nose
  - Removing adenoids through the nasal cavity with a suction microdebrider
  - Bleeding can occur and must be controlled with either packing or suction cautery

Postoperative & Recovery:

- ✦ Outpatient surgery ➔ patients are able to go home on the same day as the procedure once fully recovered from anesthesia (usually several hours after)

- ✦ Only minor problems/ symptoms postoperative:
    - Mild pain
    - Sore throat
    - Bad breath
    - Nasal discharge
    - Earache
    - Nausea

Complications:

➔ generally rare, a very safe operation

- ✦ Bleeding
- ✦ Infection
- ✦ Velopharyngeal insufficiency
- ✦ Damage to teeth, lips, mucosa, tongue, nerves
- ✦ Reaction to anesthesia
- ✦ Wound healing disturbance
- ✦ Very rare: adenoid tissue may grow back (usually does not cause any problems)

Fig. 43. Bipolar electrocautery

8.2. TONSILLECTOMY:

Fig. 44. Tonsillectomy instruments

Anatomy & Physiology:

Tonsils:

- Lymphoid tissue masses covered by stratified squamous non-keratinized epithelium
- 3 types: pharyngeal, adenoid and lingual
- IR and Ig secretion

Blood Supply:

Ext. Carotid branches (sup: ascend. Pharyngeal + lesser pallatine; inf: facial, dorsal lingual + ascend. Palatine)

Drainage:

Peritonsillar, lingual and pharyngeal Plexuses

Nerve Supply:

Glossopharyngeal and lesser palatine nerves

Tonsil Pathologies:

Peritonsilar abscess:

- most common due to

Strept. Pyogenes

- Forms between the palatine tonsil capsule and the superior pharyngeal constrictor muscle

Tonsillitis:

- Streptococcal angina
- Red, swollen, cryptic with pus

Tonsil Cancer:

- Squamous cell carcinoma
- Metastasizes to cervical LN
- RF: smoking, alcohol abuse

Indication:

Absolute:

1. Enlarged tonsils with upper respiratory tract obstruction, dysphagia
2. Peritonsillar abscess (unresponsive)
3. Tonsillitis complicated with febrile seizures
4. Tonsil malignancy + biopsy

Relative:

1. Frequent tonsillitis > 7/year
2. Persistent foul taste/smell due to chronic tonsillitis (unresponsive)
3. Chronic recurrent tonsillitis in Streptococcal infection
4. Unilateral hypertrophy (neoplastic growth)

Contraindication:

- Coagulopathies
- Anemia
- Acute infection → sepsis risk!
- Poor status for general anesthesia

Preoperative care:

- **Complete physical exam of the patient**
    - Tonsillar exam
    - Vital functions
- **Laboratory & Further investigations**
    - CBC, aPPT, PT, Quick, Biochemistry, Electrolytes, Inflammatory markers
    - ABGs in case of general anesthesia
    - Pathogen: tonsil swab or ASLO
- **In case of malignancy** → X-ray, CT, MRI, MRA (arteriography for pulsatile masses)

Intraoperative care:

For subtotal (tonsillotomy) or total tonsillectomy:

Prepare your patient before dissection:

Fig. 45. Tonsils and Tonsillectomy instruments

- Place patient in rose position (with shoulder roll)
- Insert a mouth prop, open and suspend it
- Apply an „Aliss clamp" to the tonsil to allow for traction during dissection Procedures

Dissection methods:

1. Use of cold steel (scissors, curette)
2. Monopolar cautery
3. Bipolar cautery with/without microscope
4. Radiofrequency ablation or coblation (→ shrink the tonsil)
5. Harmonic scalpel with vibrating titanium blades
6. Powered instruments (microdebrider) for intracapsular technique

Hemostasis:

- Usually enough to press with a sponge, if not: bismuth subgallate or cautery

Postoperative care:

- Important to give adequate analgesics to the patient (ex. Nurofen)
- If parents refuse → child won‘t eat → sequelae (dehydration, AMS)
- GOOD HYDRATION!!
- Bed rest
- Nonspecific diet, recommended: soft food, avoid high milk consumption
- Recommended: Antibiotics for 1 week post-op

Follow Up:

1. 5-8 days post-op – highest pain
2. 4-6 weeks post-op – to see healing and resolution of symptoms

Complications:

1. Bleeding (most common, 2-3%)
    - can be stopped with adrenaline or thrombin soaked cotton
    - if persistent: electrocautery or local hemostatics (QuikClot)
2. Respiratory compromise
    - Uvula edema, hematoma, local trauma, hoarseness, dysphonia
3. Pain, fever, dehydration, weight loss
4. Temporomandibular dysfunction due to wide opening of the mouth
5. Anesthesia-related (allergies, hypotension, long recovery)

8.3. NASAL SEPTUM DEVIATION SURGERY (SEPTOPLASTY):

Deviated Nasal Septum:

- **Definition:**
    - surgery to correct deformity in the nasal septum
    - significant deviation of the nasal septum from the midline → unilateral/bilateral nasal airway obstruction
    - The septum is a cartilaginous + bony structure in the midline of the nasal cavity
- **Etiology:**
    - Prenatal: growth disturbances or intrauterine conditions → pressure on facial bones
    - Birth trauma (forceps)
    - Trauma (fall onto facial bones)

- **Clinical findings:**
    - Difficulty breathing = nasal obstruction (unilateral/bilateral – depending on type of septal deformity)
    - Sinusitis (blocking of sinus ostia → poor ventilation → sinusitis)
    - Anosmia (failure of air reaching the olfactory epithelium)
    - Snoring, noisy breathing
    - Headaches or facial pain (due to pressure on the lateral wall of the nose → pressure headache)
    - Epistaxis (the convex side of septum may dry out → crust formation → manual removal = epistaxis)
- **Diagnostics:**
    - Anterior rhinoscopy: a nasal speculum and an external light source used to visualize the septum
    - Nasal endoscopy
    - CT scan

Fig. 46. Septoplasty instruments

Treatment:

Septoplasty:

General facts:

- Performed to correct nasal obstruction caused by septal deformity
- General anesthesia
- Supine position with the head elevated 30%
- Local vasoconstrictive anesthesia: lidocaine + adrenaline
- ↓ postoperative pain
- Vasoconstriction of the mucosa → ↓ intraoperative bleeding
- Limited usage before the growth period of the nose is finished → possible external changes of the shape of the nose

Procedure:

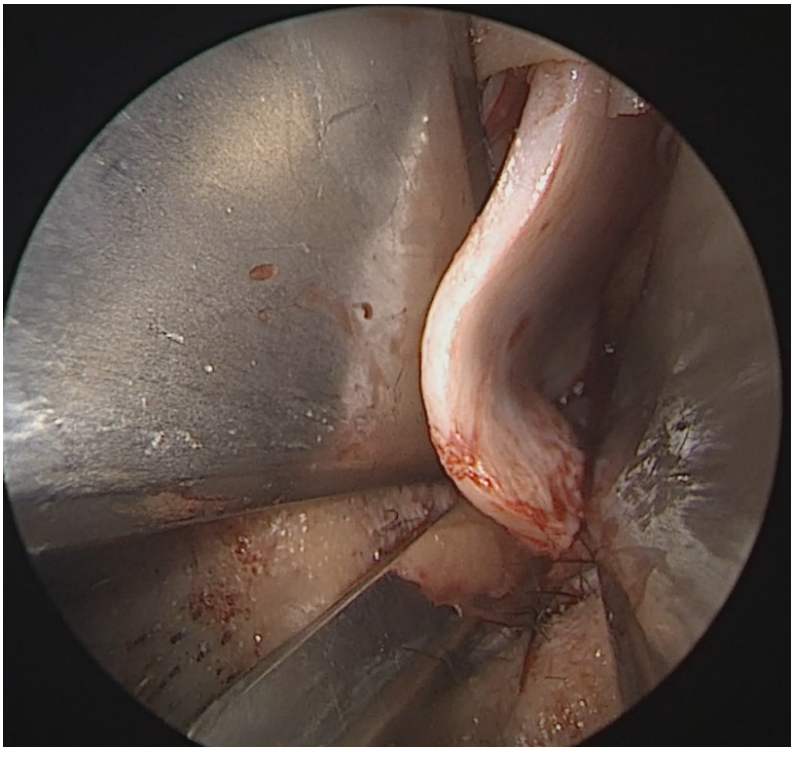


Fig. 47. Septoplasty

1. Incision of septal mucosa
    - Mostly by: hemitransfixion (incision at the caudal end of the septum)
2. Columella retractor placed over the columella → pulled laterally → exposure of the caudal border of the septum
3. Vertical incision (no. 15 blade) over the caudal end of the septum → until reaching the plane of the septal cartilage
    - Essential: identifying the perichondrium
4. Using the cottle elevator → dissect and lift the perichondrium → creating a flap
5. Dissecting the mucoperiostium from the nasal floor along the maxillary crest → creating a second „tunnel" → afterwards connected with the „tunnel/pocket"previously prepared over the septum
6. Deviated parts of the septum identified and removed → trimmed, shaped, straightened → sutured back to the periosteum
    - Essential: care not to break the cribriform plate → CSF fistula → CSF leakage
    - Flaps and hemitransifixion incision sutured back together with absorbable sutures

Summary

1. Performed only if:
    - symptoms are significant (headaches, facial pain; frequent epistaxis; difficulty breathing; recurrent purulent sinusitis with failure of conservative management [nasal sprays, decongestants, antihistamines, topical steroids])
2. Anesthesia: general/local
3. Incision: within the nasal cavity

4. Mucosal lining separation: the mucosal membrane lifted away from the septum

   →possible complication: septal perforation

5. Actual septum correction: deviated septum (= bone/cartilage) removed → mucosal lining spared
6. Closure of incision: septum in desired position + straightened → mucosal lining repositioned around it → sutured back together
7. Post-surgery care: care for septal perforation, hemorrhage, septal hematoma

Complications:

- Hematoma
- Infection
- CSF leak (= avulsion or damage to the cribriform plate when handling the perpendicular plate of the ethmoid)
- Epistaxis
- Septal perforation
- Numbness of facial structures
- Alteration of the sense of smell/taste
- Return of deviation

8.4. NASAL POLYPOSIS AND ENDOSCOPIC SINUS SURGERY

Anatomy of the nose

- The nose presents 2 parts: **external** and **internal**
- The **external nose** is very important; besides its aesthetics it protects the inner nose and allows the air to enter the cavities
- The **internal nose** (nasal cavity) brings warm humidified air into the lungs, the first line immunological defense barrier by filtering out the particles in inspired air, it is also involved in respiration, olfaction, speech and taste
- The nares (nostrils) located inferiorly at the apex of the nose are openings to the nasal cavity and are separated by the nasal septum
- The nasal cavities are opene anteriorly through the two nares and communicate posteriorly with the nasopharynx by the choanae

Anatomy of the nose and nasal cavities

- There are 12 bones in total that contribute to the nasal cavity structure

Paired bones: nasal, maxilla, palatine and lacrimal bones

Unpaired bones: ethmoid, sphenoid, frontal and vomer

- The three nasal turbinates divide deeply the nasal cavities into four air channels: inf, sup, middle nasal meatus and spheno-ethmoidal recess
- The nasal cavities are divided into three regions: the vestibule, respiratory and olfactory regions. They communicate with four bony recesses called paranasal sinuses (sphenoid, maxillary, frontal sinuses and ethmoid cells)
- All four sinuses are covered by respiratory mucosa and innervated by the trigeminal nerve

Nasal polyps:

- It is a pathology of the nasal cavity
- Are soft, painless, noncancerous lesions on the lining of the nasal passages or sinuses
- Result from chronic inflammation causeing hyperplasia of the intranasal mucosal membrane
- Appear at any age, most commonly in young and middle-aged adults

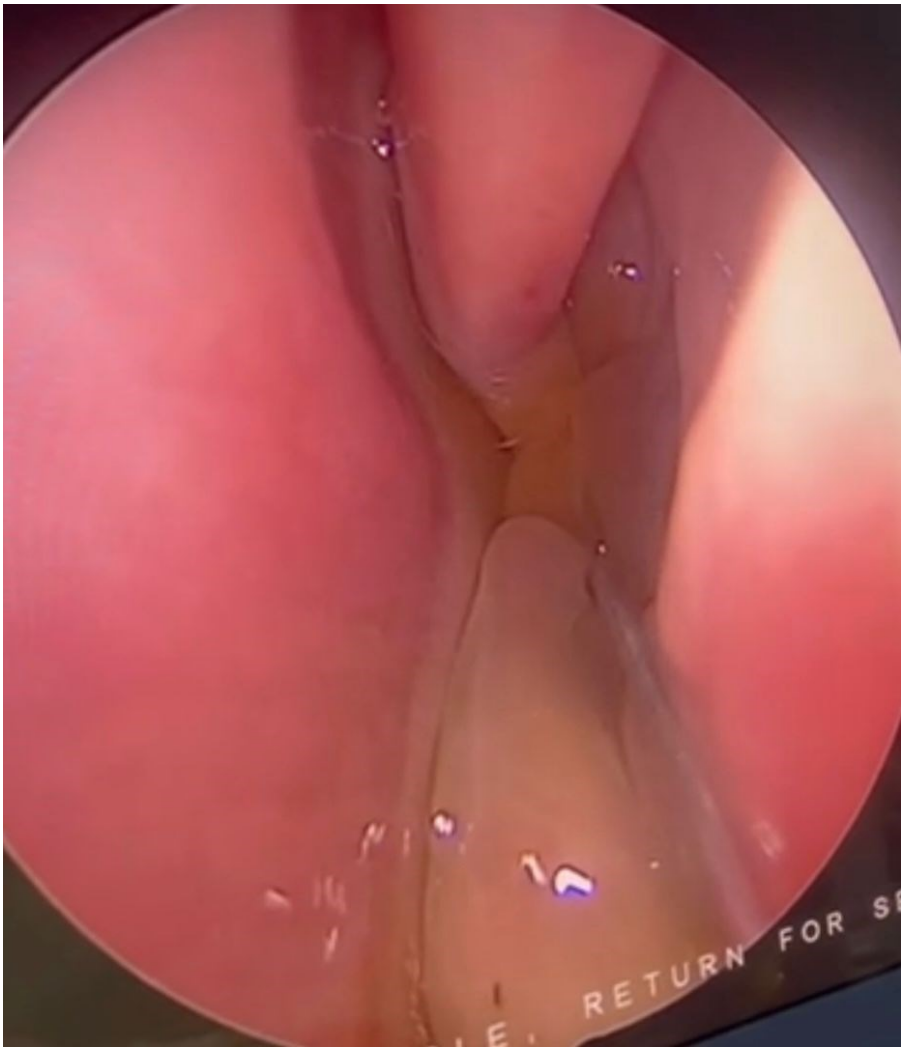


Fig. 48. Nasal polyps

Fig. 49. Nasal polyps

Signs and symptoms:

- Runny nose
- Persistent nasal obstruction
- Postnasal drip

- Decreased/absent sense of smell
- Loss of sense of taste
- Facial pain/ headache
- Pain in the upper teeth
- Snoring
- Frequent nosebleeds

Risk factors:

- Asthma
- Aspirin sensitivity
- Allergic fungal sinusitis
- Cystic fibrosis
- Churg-Strauss syndrome (eosinophilic granulomatosis with polyangiitis).
- Vit. D deficiency
- Complications
- Obstructive sleep apnea
- Asthma flare-ups
- Sinus infection

Work up:

Physical examination of the nose: with an anterior rhinoscopy

Lab studies:

-Allergy testing in patients with environmental allergies or strong family history of allergies

-Sweat chloride test or genetic testing

Imaging studies:

- Coronal (frontal plane) sinus CT scanning: is the imaging study of choice in the evaluation of patients with nasal polyposis

- Magnetic resonance imaging (MRI): is not an appropriate imaging modality for nasal polyposis unless intracranial extension is suspected

- Radiography: views may show opacification of the sinuses

Management:

- The management of nasal polyposis is based on causative factors, the etiology is unclear, hence management of the underlying pathology is essential, which in most cases is inflammatory
- Medication: non-specific treatment for inflammatory disorder

- Oral corticosteroids: are the most effective medical treatment for nasal polyps

- Intranasal steroid sprays: may reduce or retard the growth of small nasal polyps

- Intra-polyp steroid injections: reduce polyp growth and nasal symptoms, (safe alternative to surgery in select patients)

- Antihistaminic drugs

- Leukotrienes receptor antagonists

- Interleukin inhibitors

Surgical procedure: Nasal Polypectomy

- A nasal polypectomy is an operation to remove polyps from within the nose. It is done through the nose, so there is no incisions on the outside
- There are 2 main techniques:

- Intranasal polypectomy: polyps are removed with a wire loop or forceps

- Endoscopic nasal polypectomy (functional endoscopic sinus surgery): is a minimally invasive technique. The patient is under local or general anesthesia

Fig. 50. FESS instruments

- The procedure lasts: 45 min – 1 hour
- Outcomes after surgery:

Relieves a blocked nose, and improves sinus infection, frontal headache, nasal discharge, postnasal drip and reduced sense of smell.

- Post-operative complications:

Nasal obstruction for the first few weeks and bleeding (are common), loss of smell, aesthetic problems and occasionally infection and recurrent symptoms may develop.

- Post-operative recommendations:

Patient requires at least 2 days of rest after surgery, must use nasal saline (salt water) and a corticosteroid nasal spray (if needed).

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