AIRWAY ANATOMY ASSESSMENT

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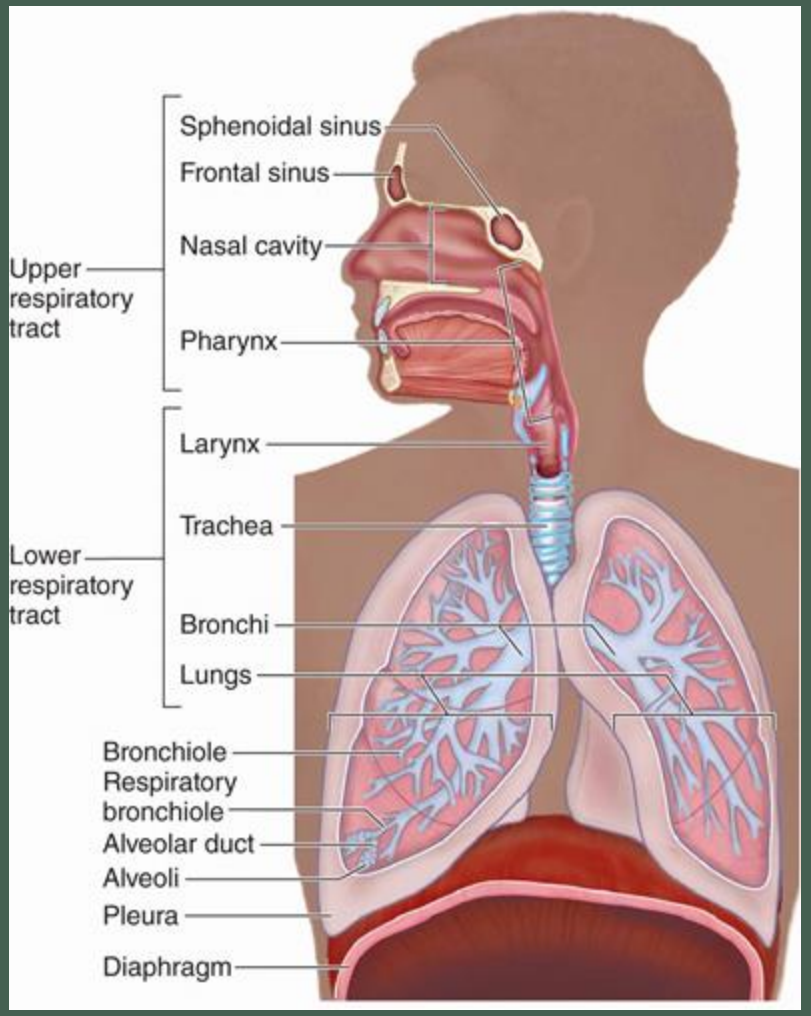
AIRWAY ANATOMY SIGNIFICANCE IN ANESTHESIA AND ICU

Accurate knowledge of anatomy and physiology of the respiratory tract is important in anaesthesiology and critical care

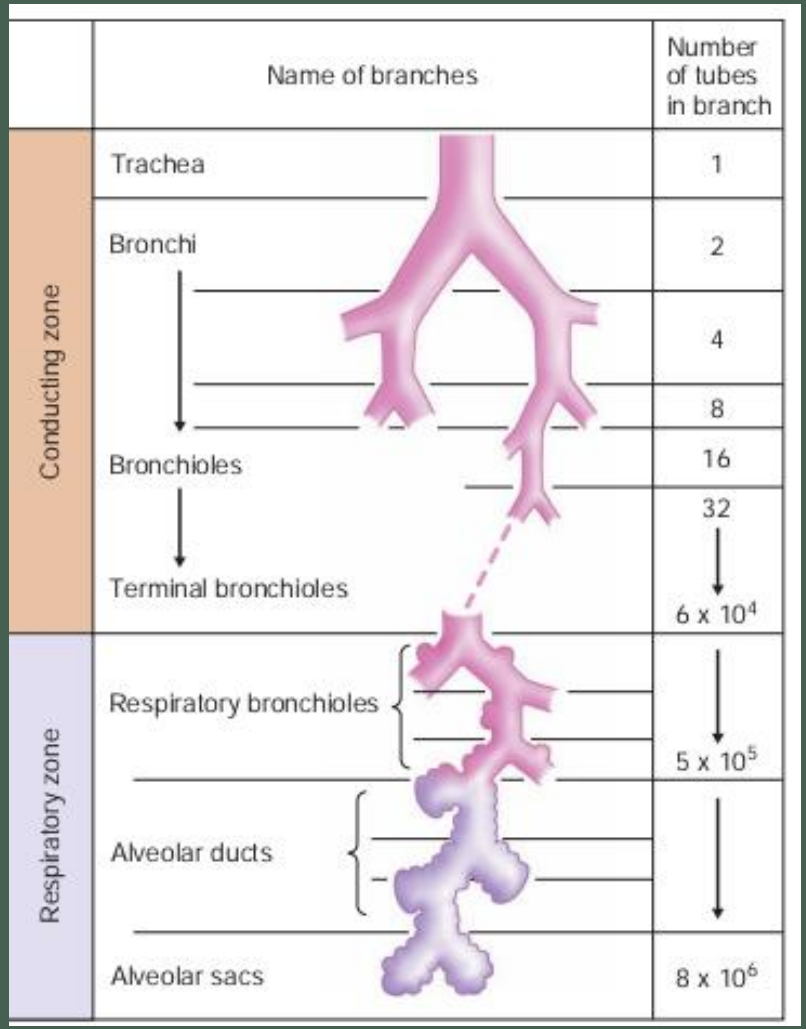
for safe and smooth conduction of anaesthesia and ICU management. as General anaesthesia sedation and muscle relaxation are associated with alterations in the respiratory function and carry with them at least a small risk of airway obstruction and apnea.

Airway is divided

Anatomically



Functionally



Air way is defined as a passage through which the air/ gas passes during respiration.

Functionally divided into:

*conductive zone – till terminal bronchioles

*respiratory zone – includes respiratory bronchioles,alveolar ducts,alveoli

And **anatomically** divided into:

*upper airway (oral and nasal cavities,pharynx,larynx)

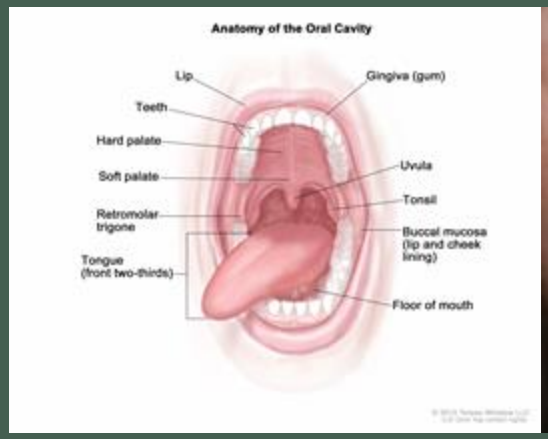
More vulnerable to obstruction

*lower airway (trachea,bronchi,bronchioles,alveoli)

ORAL CAVITY

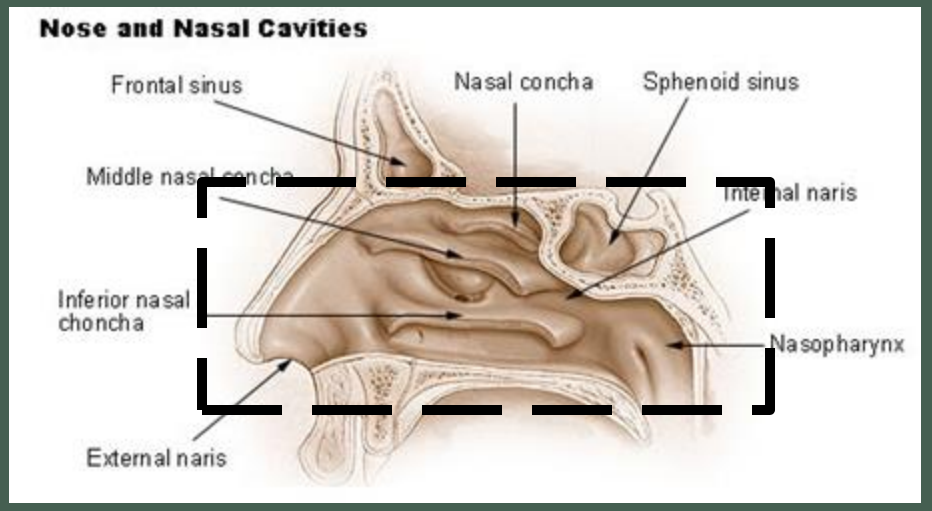
Extending from lips into oropharyngeal isthmus.

During evaluation for airway assessment, mouth opening must at least 3 fingers width (>6cm)



NASAL CAVITY

Extending from nostrils to posterior nasal aperture.
Divided by nasal septum into 2 halves (right and left)
Aims in humidification, heating and filtering of inspired air.

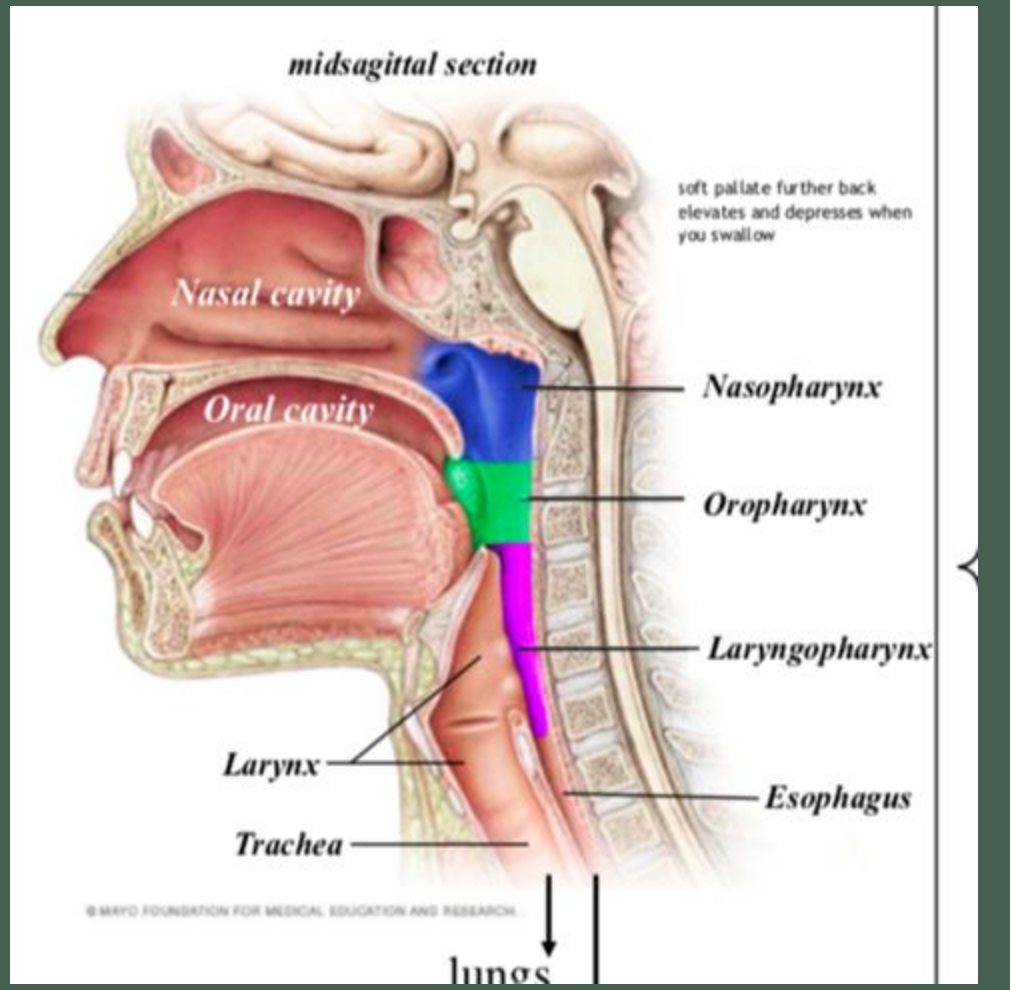


PHARYNX =THROAT

A hollow muscular tube inside the neck that connects the posterior nasal and oral cavities to the larynx and esophagus.

*12-14 cm in length

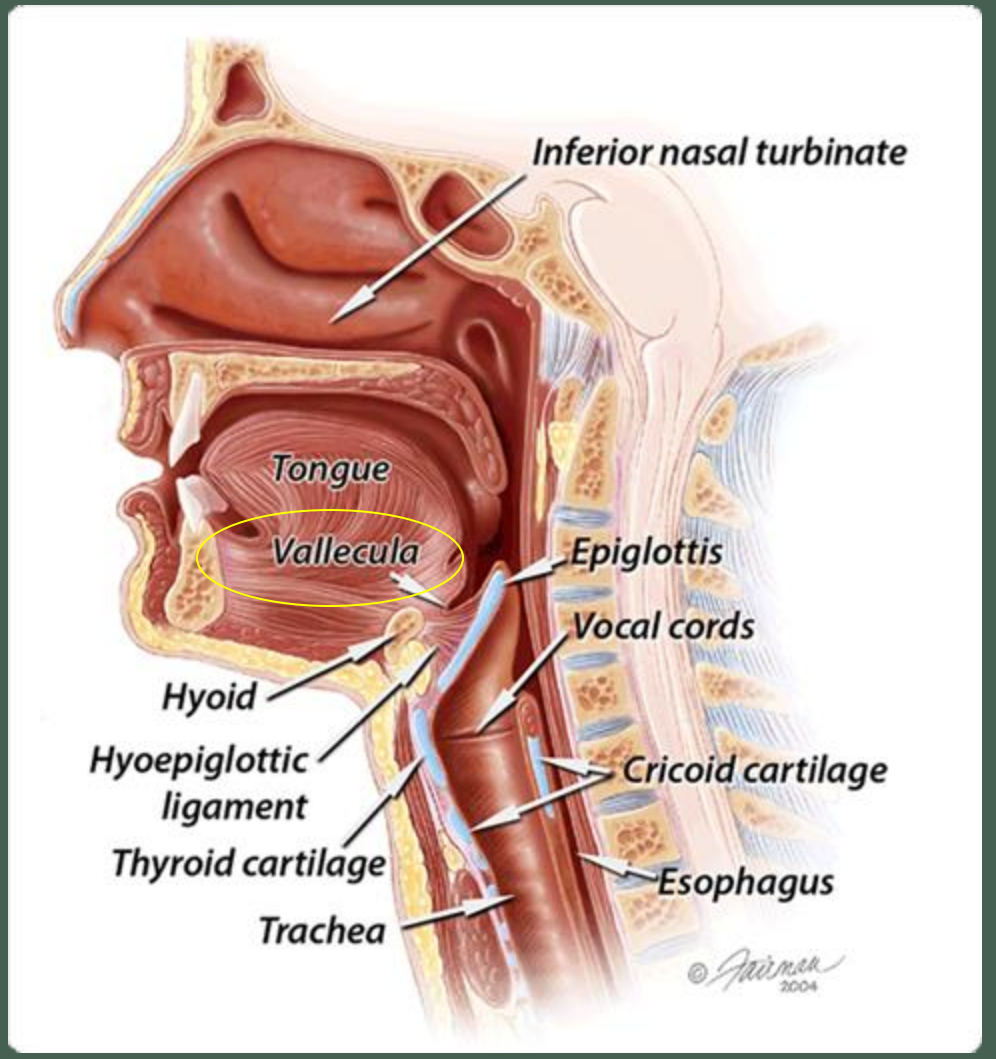
Nasopharynx	Oropharynx	Laryngopharynx
Behind the nasal cavity and above the soft palate.	Behind the oral cavity, between soft palate and top of hyoid bone.	Behind the larynx and below the epiglottis to the beginning of esophagus.



Vallecula

- **Vallecula:** a depression between epiglottis and base of the tongue

*where blade of laryngoscope rests.

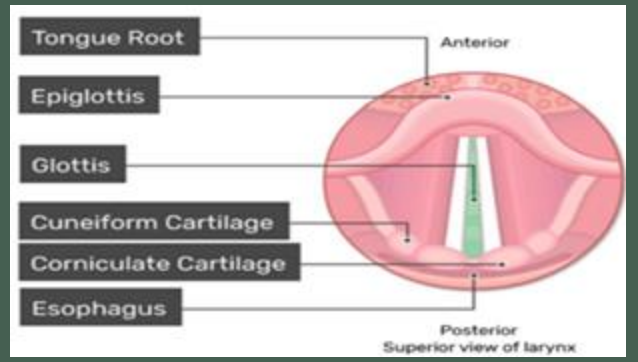


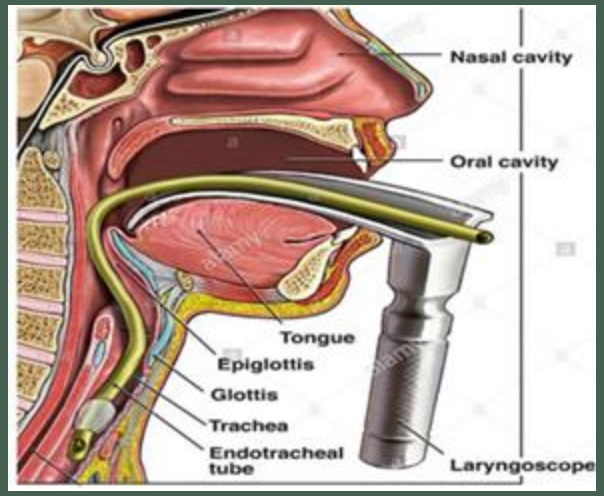
Laryngoscopy

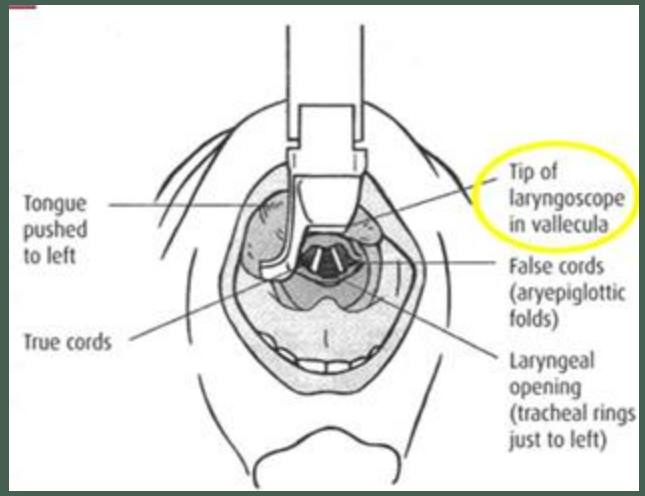
- Laryngoscopy for tracheal intubation:

– Endoscopy of the larynx to obtain a good view for vocal cords and glottis.

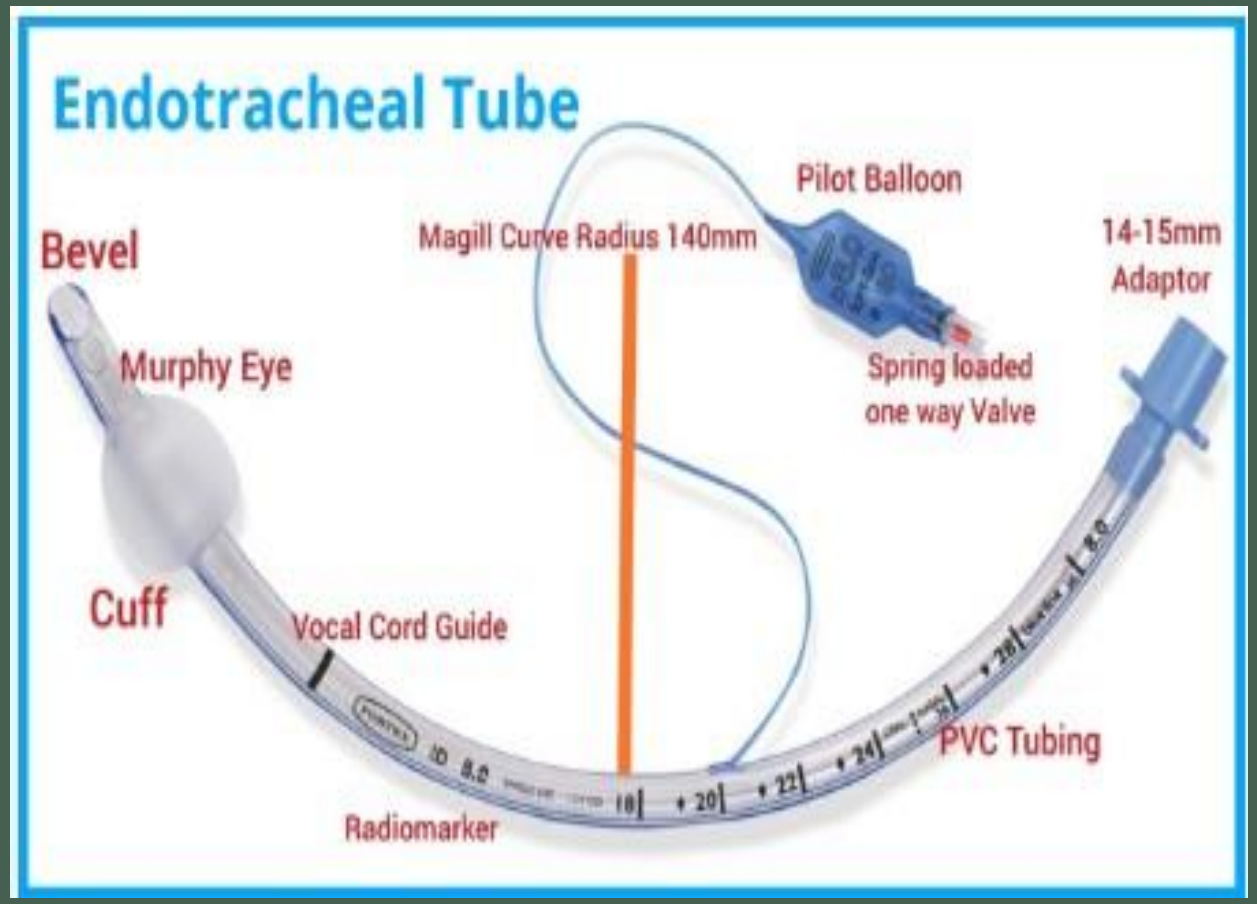
– Used for placement of the **Endotracheal Tube (ETT) into the trachea**







Endotracheal Tube (ETT)



➔ ETT is a tube constructed of polyvinyl chloride .

➔ placed into the windpipe through the mouth or nose .

• Jaw thrust maneuver

– In cases of decreased consciousness as in General Anesthesia and due to decreased muscle tone,tongue may be posteriorly displaced into oropharynx obstructing the airway.

– **These maneuvers are used to maintain patient's airway.**

– performed by placing the index and middle fingers

to physically push the posterior aspects of the lower jaw upwards and outwards

while their thumbs push down on the chin to open the mouth.

https://youtu.be/PdkgnRCoci4?si=qy21zF7KV7PUjNni

Head Tilt Chin Lift

The head tilt-chin lift maneuver consists of two separate maneuvers. First, one hand is placed on the forehead and is used to rotate the head into a "sniffing" position (i.e., neck fully extended and head tilted backwards). Second, the other hand is used to lift the chin forward and up.

• Larynx (sound box)

- The passageway for air between the pharynx above and the trachea below.

- Extends from C3-C6 in adults.

- It is formed a number of cartilages which articulates by synovial joints

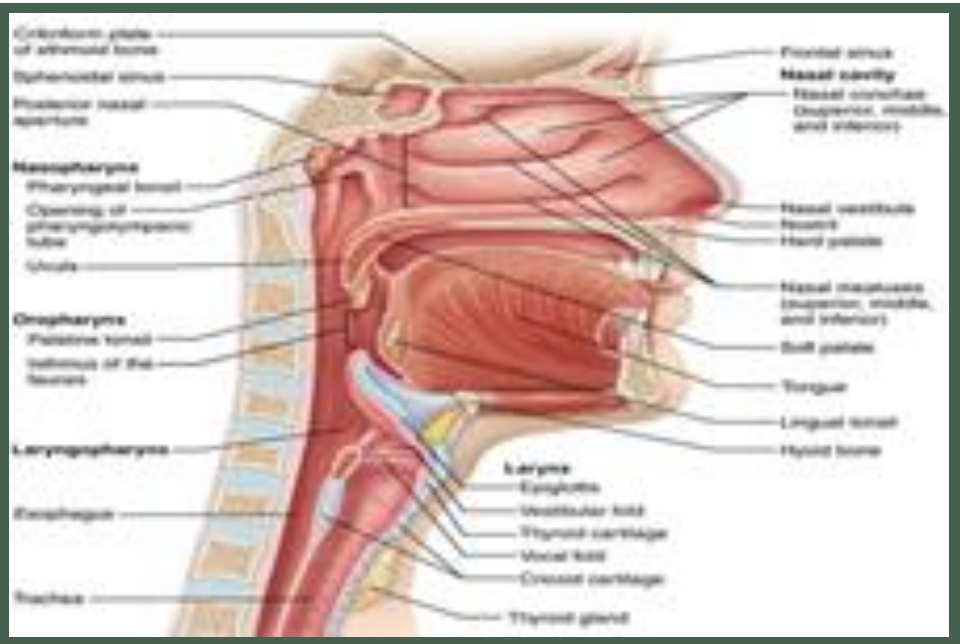
and connected together by ligaments and membranes and moved by number of muscles.

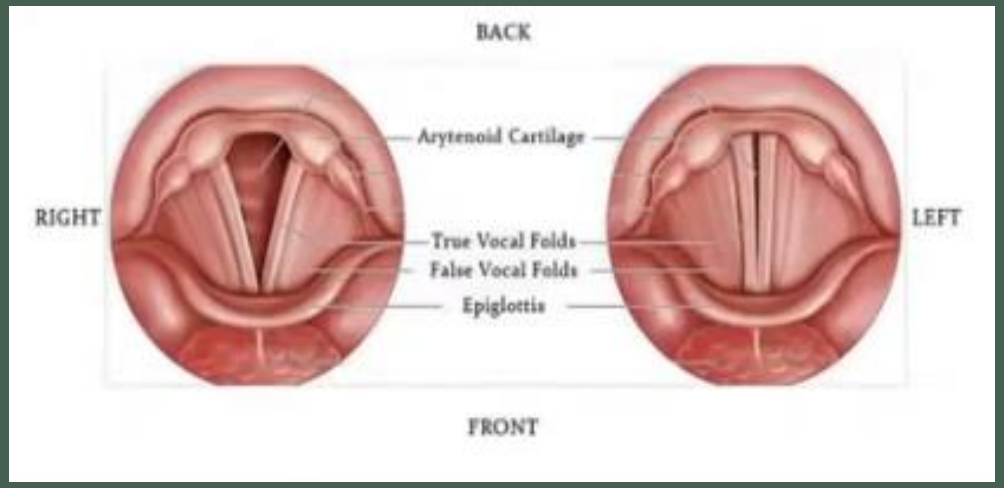
- Laryngeal cavity has 2 pairs of mucous membrane folds:

*upper folds = false vocal cords

*lower folds = **true vocal** cords,

which could be injured during intubation

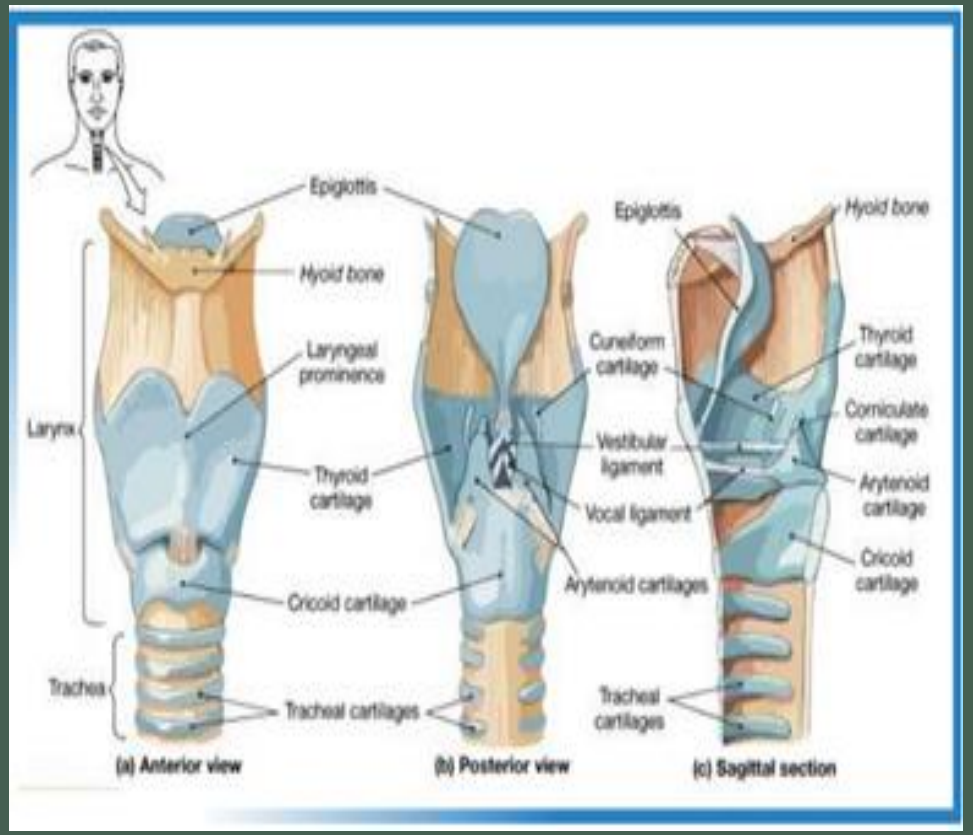


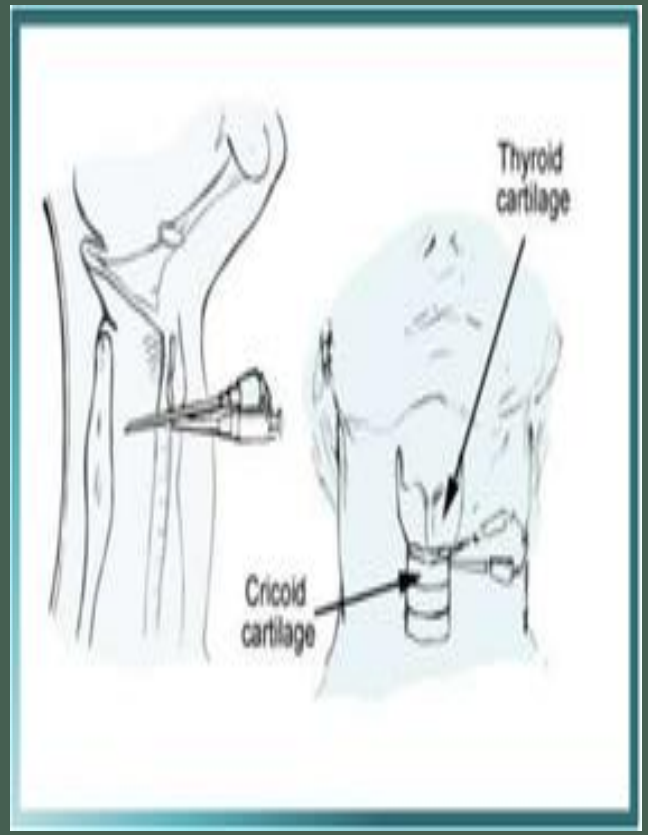


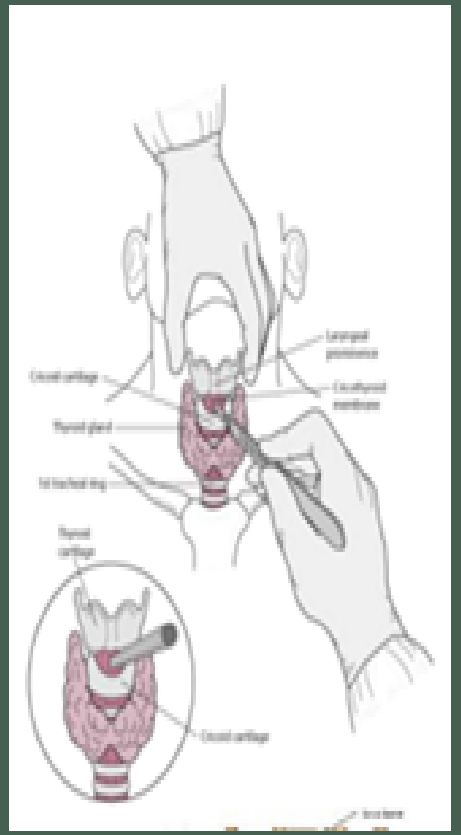
Cricothyrotomy:

Surgical airway made via the cricothyroid membrane in acute emergency

when obstruction at or above the larynx not relieved.







INDICATIONS AND CONTRAINDICATIONS

Cricothyrotomy , also known as Cricothyroidotomy, is an important emergency procedure that is used to obtain an airway when other,more routine methods (eg, laryngeal mask airway [LMA] and endotracheal intubation) are ineffective or contraindicated.

Indications

Cricothyroidotomy is indicated upon failure to obtain an airway with traditional methods in the following situations:

- Trauma causing oral ,pharyngeal, or nasal hemorrhage .
- Facial muscle spasms or laryngospasm.
- Uncontrollable emesis.
- Upper airway stenosis or congenital deformities.
- Clenched teeth.
- Tumor,cancer,or another disease process or trauma causing mass effect. Airway obstruction indications include the following:
- Oropharyngeal edema (eg,anaphylaxis.

Contraindications

The only absolute contraindication to surgical cricothyroidotomy is **age**,although the exact age at which a surgical cricothyrotomy can be safely performed is controversial and has not been well defined.Various sources list lower age limits ranging from 5 years[15]to 12 years[16] ,and Pediatric Advanced Life Support (PALS) defines the pediatric airway as age 1-8 years.

• The Trachea

- The trachea is a mobile cartilaginous and membranous tube.

- It begins as a continuation of the larynx at the lower border of the cricoid cartilage

at the level of the 6th cervical vertebra

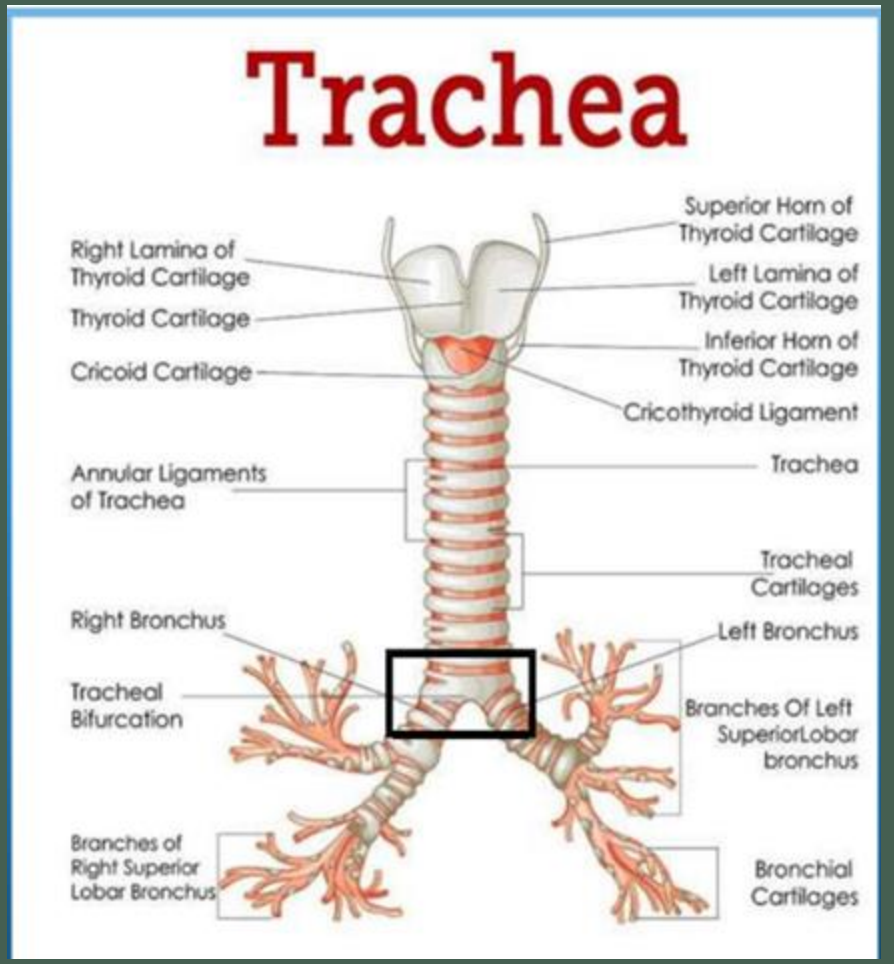
- Trachea ends at the carina by dividing into right and left principal (main) bronchi

at the level of the sternal angle

(opposite the disc between the fourth and fifth thoracic vertebrae

- The carina is a cartilaginous ridge within the trachea at the site of the tracheal bifurcation

- In adults the trachea is about 4½ in. (11.25 cm) long and 1 in. (2.5 cm) in diameter



• Tracheostomy

– tracheostomy is an opening (made by an incision) through the neck into the trachea (windpipe).

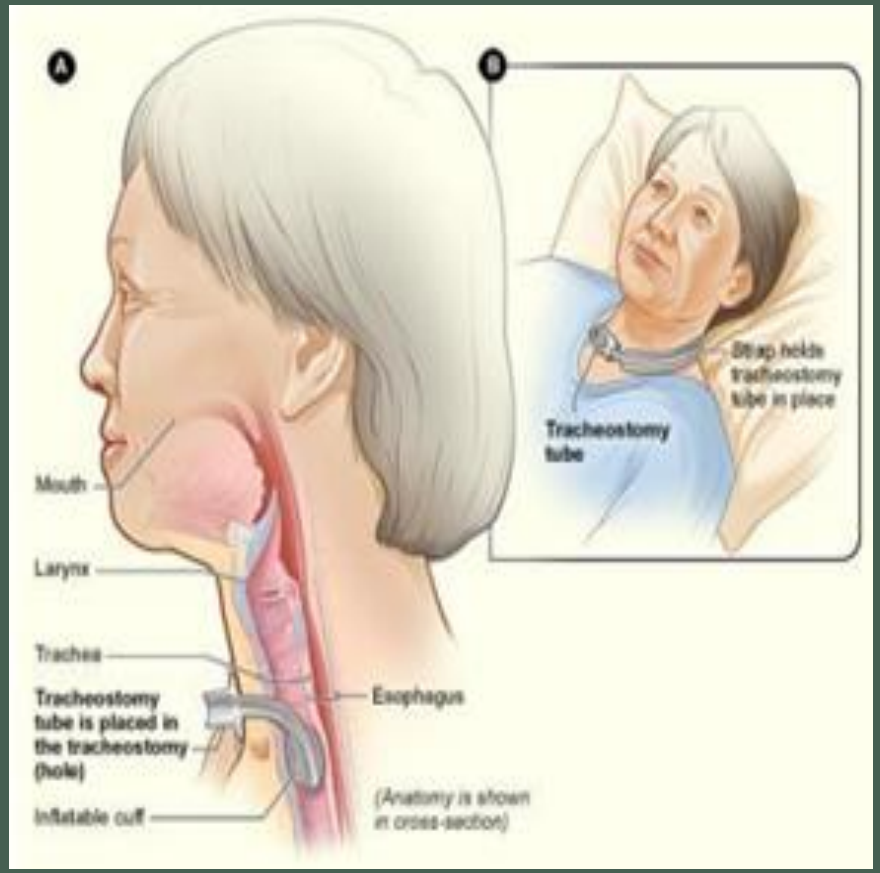
A tracheostomy opens the airway and aids breathing.

– A tracheostomy may be done in an emergency, at the patient's bedside or in an operating room.

– Anesthesia (pain relief medication) may be used before the procedure

o Levels of tracheostomy :

1. High level at first tracheal ring
2. Mid-level at second tracheal ring
3. Low level at third tracheal ring



INDICATIONS OF TRACHEOSTOMY

Respiratory obstruction:

-Infection -Trauma -Laryngeal oedema -Neoplasm -Foreign body -Bilateral abductor paralysis

Retained secretion :

-Inability to cough -Respiratory muscles spasm -Respiratory muscles paralysis -Coma of any cause : head injury -Painful cough -Chest injuries , multiple rib fractures, pneumonia -Aspiration of secretion

Respiratory insufficiency :

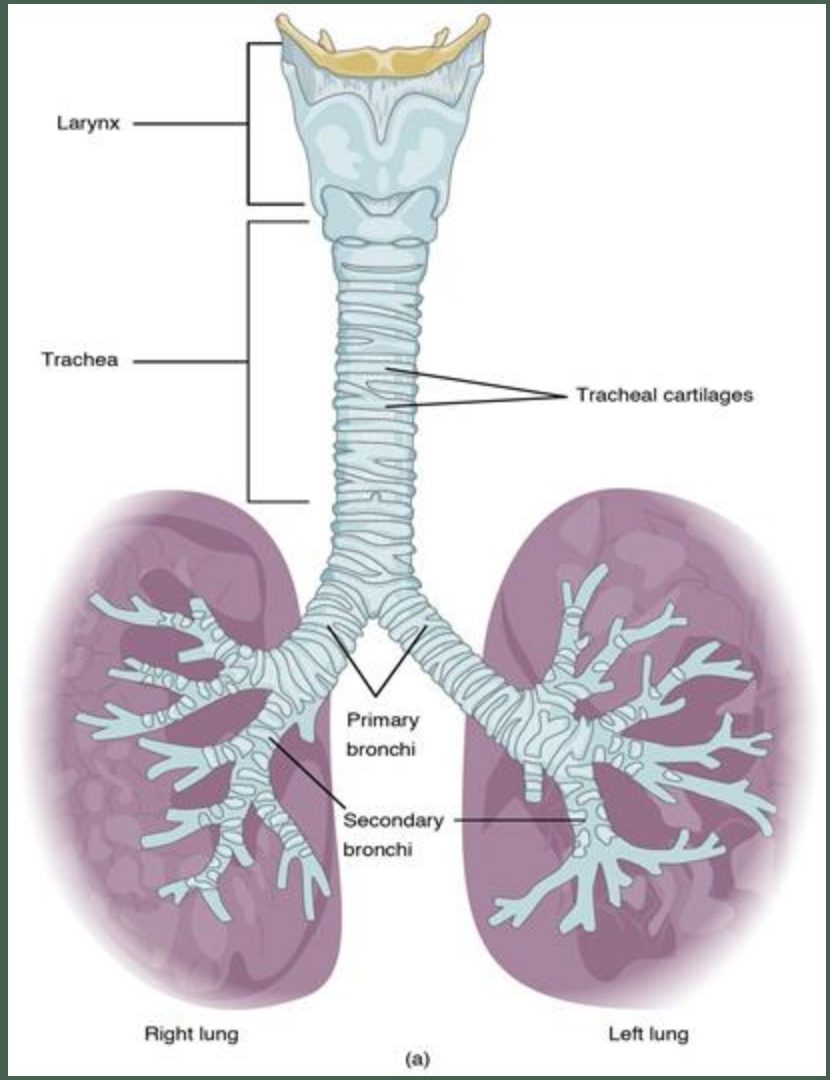
-Chronic lung conditions as :

*Emphysema
*Chronic bronchitis
*Bronchiectasis
*Atelectasis

BRONCHI

- Right bronchus is shorter and wider and is more vertical than the left bronchus.

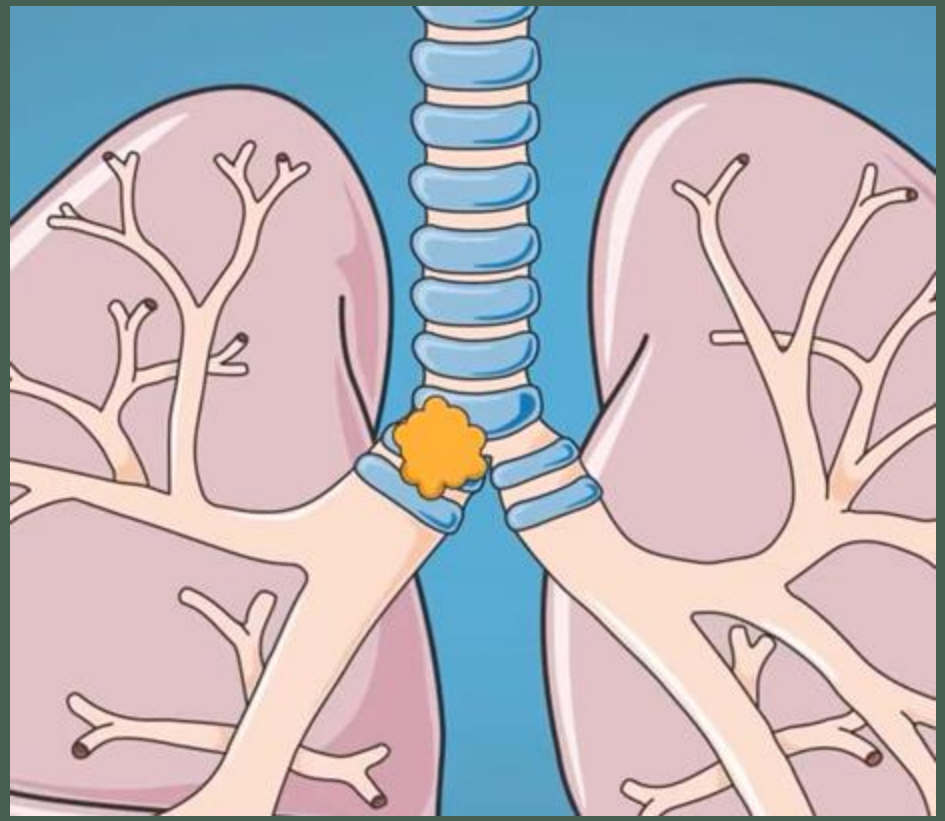
- Foreign bodies usually enter the right bronchus .



Carina clinical significance

- **Foreign bodies that fall down the trachea are more likely to enter the right bronchus.**

- **The mucous membrane of the carina is the most sensitive area of the trachea and larynx for triggering a cough reflex.**



Airway assessment

- History
- Local examination
- Specific tests
- Radiological presentation

Airway assessment is the first step in successful airway management. Several anatomical and functional manoeuvres can be performed to estimate :

1 - difficulty of endotracheal intubation; account 17% of respiratory related injury and result in significant morbidity and mortality

2- Oesophageal intubation

3- Inadequate ventilation

*28%of anaesthesia related death are secondary to the inability to mask ventilate or intubation

Predictor of difficulty encountering ventilation mask :

- Bearded man
- mask sealing difficult due to receding mandible syndromes with facial abnormality burn stricture and treacher Collins syndrome .etc
- Obesity, upper airway obstruction
- Advanced age
- no teeth
- Snorer

WHY IT IS NECESSARY ?

TO DIAGNOSE THE POTENTIAL FOR DIFFICULT AIRWAY FOR :

1- Optimal patient preparation

2- Proper selection of equipment and technique

3- Participation of personnel experienced in difficult airway management

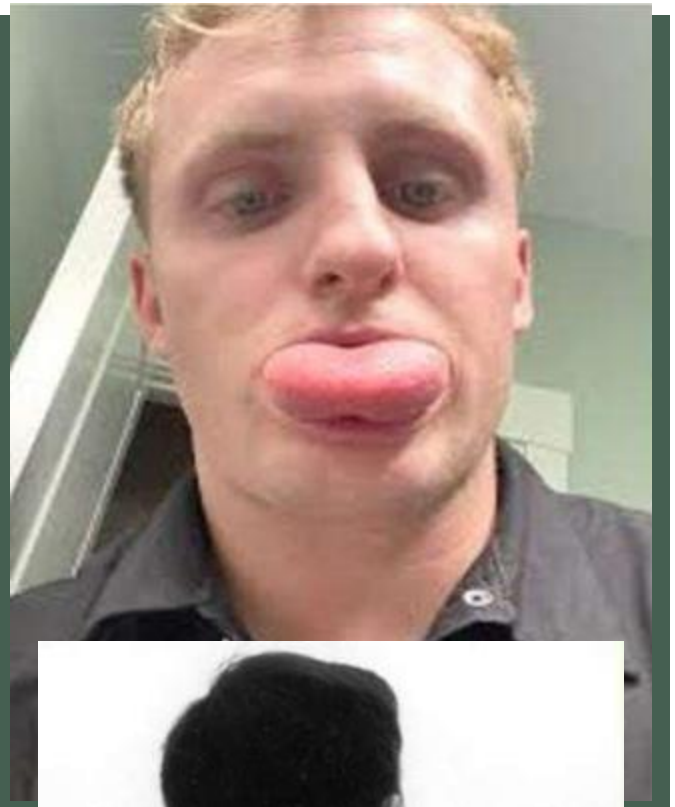
LEMON

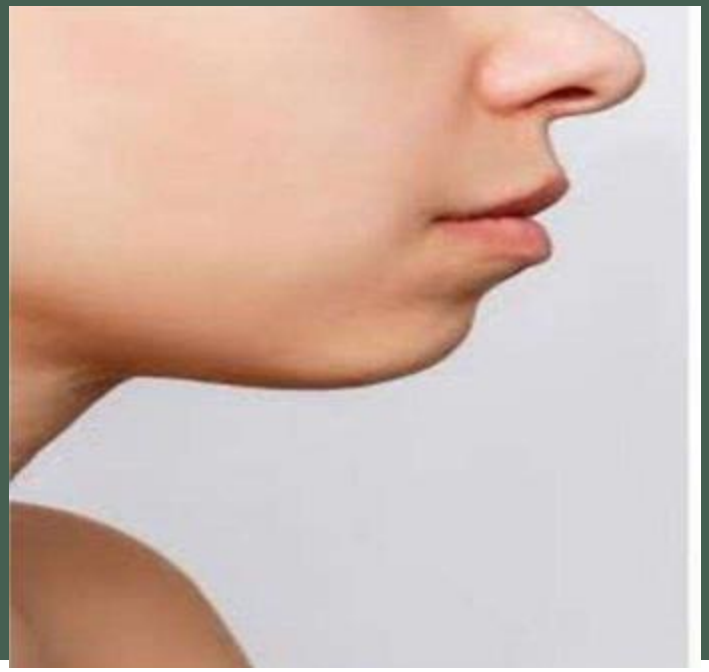
- LOOK
- Evaluation
- Mallampati scores
- Obstructive
- Neck mobility

Look

Examination of the airway look for:

- Short immobile muscular neck
- Receding mandible
- Protruding maxillary incisors
- Long high-arched palate
- Loose or capped Missing teeth
- Enlarged tonsils &tongue
- tumor that could obstruct air flow
- Limited temporomandibular joint mobility

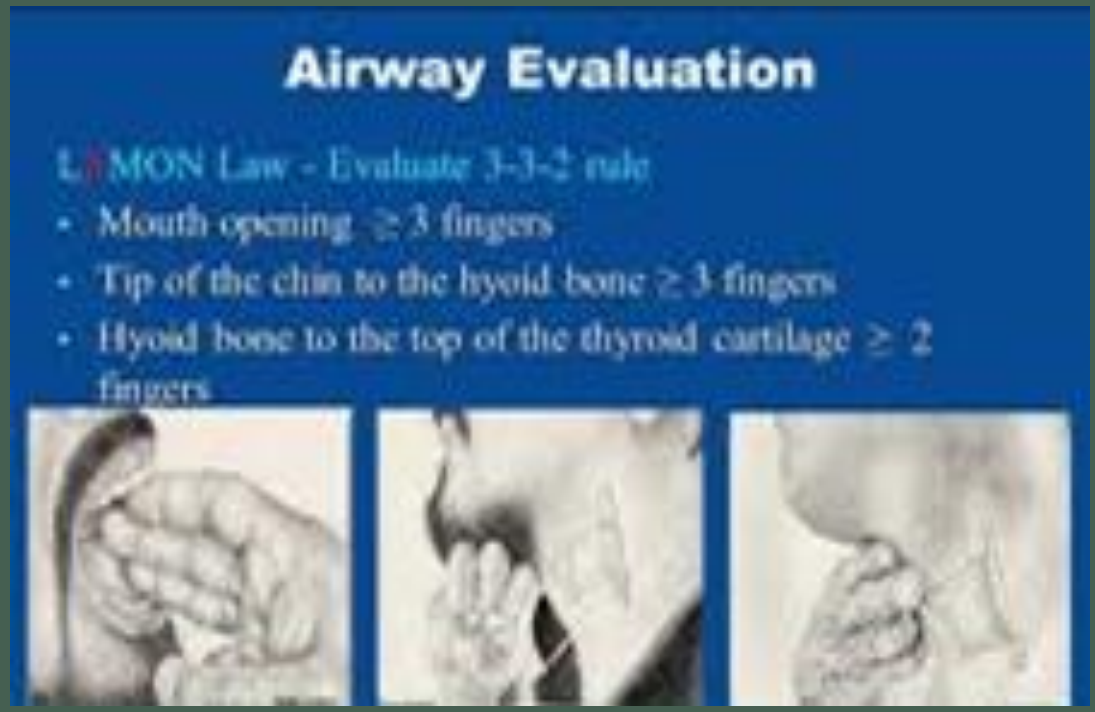




Evaluation

EVALUATE 3 32

- Mouth Opens at least three finger widths (>6cm)
- Thyromental distance Three finger widths(> 6cm)
- hyomental distance Two finger widths

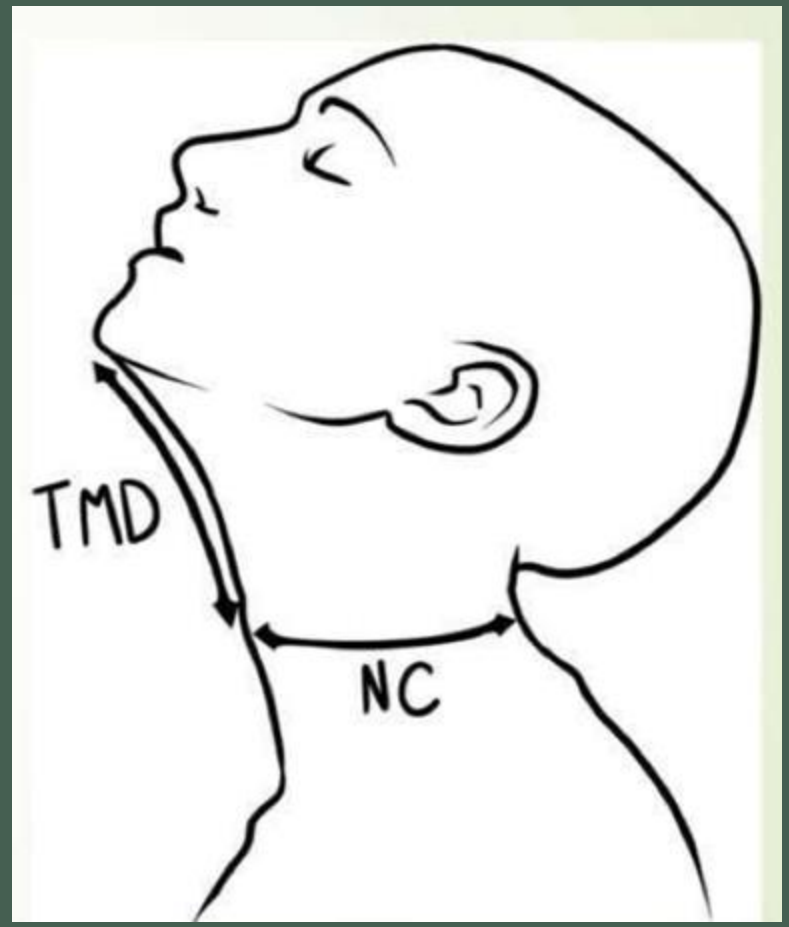


- Inter-incisor distance with maximal mouth opening

- Minimum acceptable value: > 5 cm
- Significance:
  < 3 cm: Difficult laryngoscopy
  < 2 cm: Difficult LMA insertion

Thyromental Distance (Pail's Test):

- Distance from the tip of the thyroid cartilage to inside of the mentum
- Neck fully extended / mouth closed
- **>6.5 cm:** No problem with laryngoscopy and intubation
- **6-6.5 cm:** Difficult laryngoscopy but possible
- **<6 cm:** Laryngoscopy is impossible



Hyomental distance

- Measured from the mentum to the top of the hyoid bone >2 fingers

- The position of the hyoid bone marks the entrance to the larynx.

- <2 fingers: less space to displace tongue tends to be more difficult to intubate.

IGURE 1-10. Airway evaluation: The second 3 of 3-3-2 evaluation indi-
ates the length dimension of the mandibular space.

LEMON:

3-Mallampati score :

- The assessment of the size of the tongue relative to the size of the pharyngeal opening to predict intubation difficulty.
- Performed with the patient in

a sitting position,

head neutral,

mouth open wide,

and tongue protruding to the maximum.

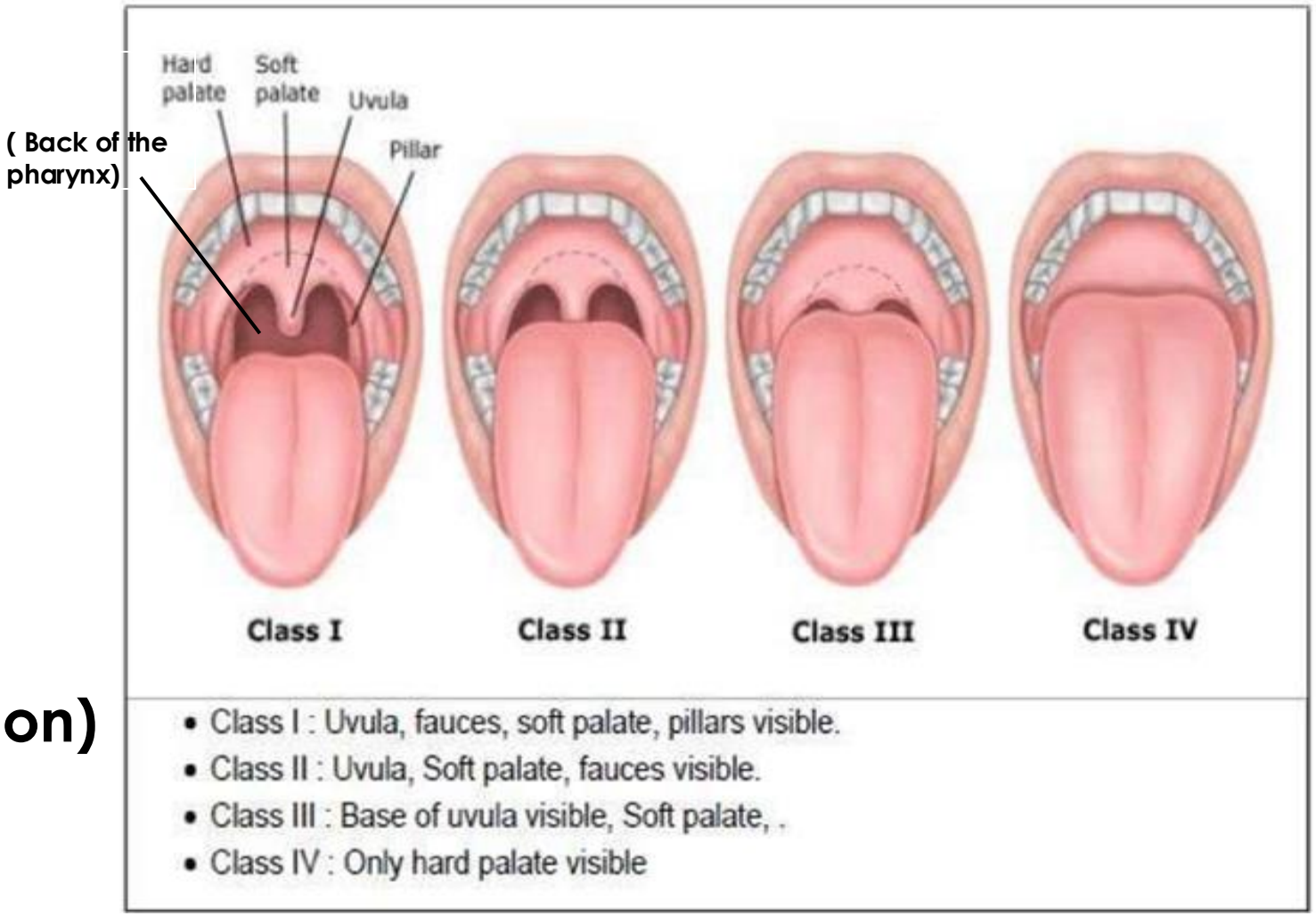
- Mallampati score :

Class I: 46% prevalence
(No Difficult intubation)

Class II:40% prevalence
(No Difficult intubation)

Class III:<13% prevalence
(Moderate Difficult intubation)

Class IV:<1% prevalence
(Severe Difficult intubation)



- Class I : Uvula, fauces, soft palate, pillars visible.
- Class II : Uvula, Soft palate, fauces visible.
- Class III : Base of uvula visible, Soft palate, .
- Class IV : Only hard palate visible

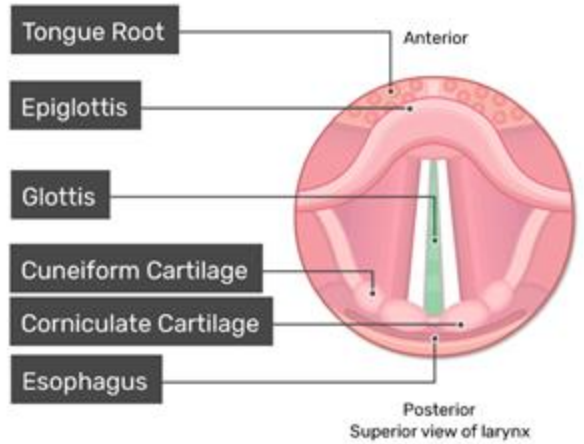
•Cormack-Lehane Grading (Laryngoscopic view Grades)

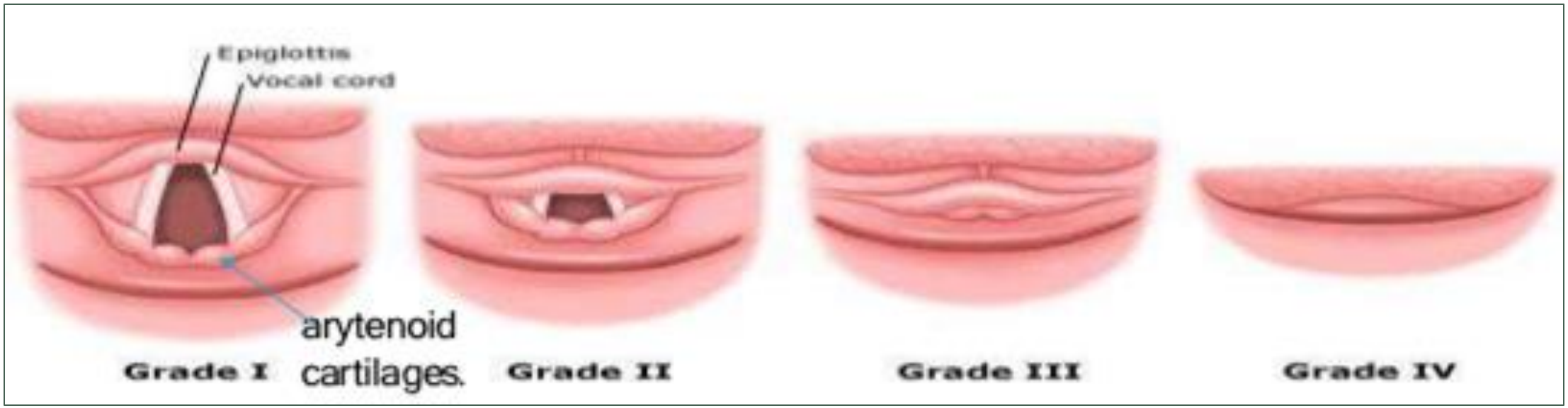
Grade 1: Full view of the glottis.

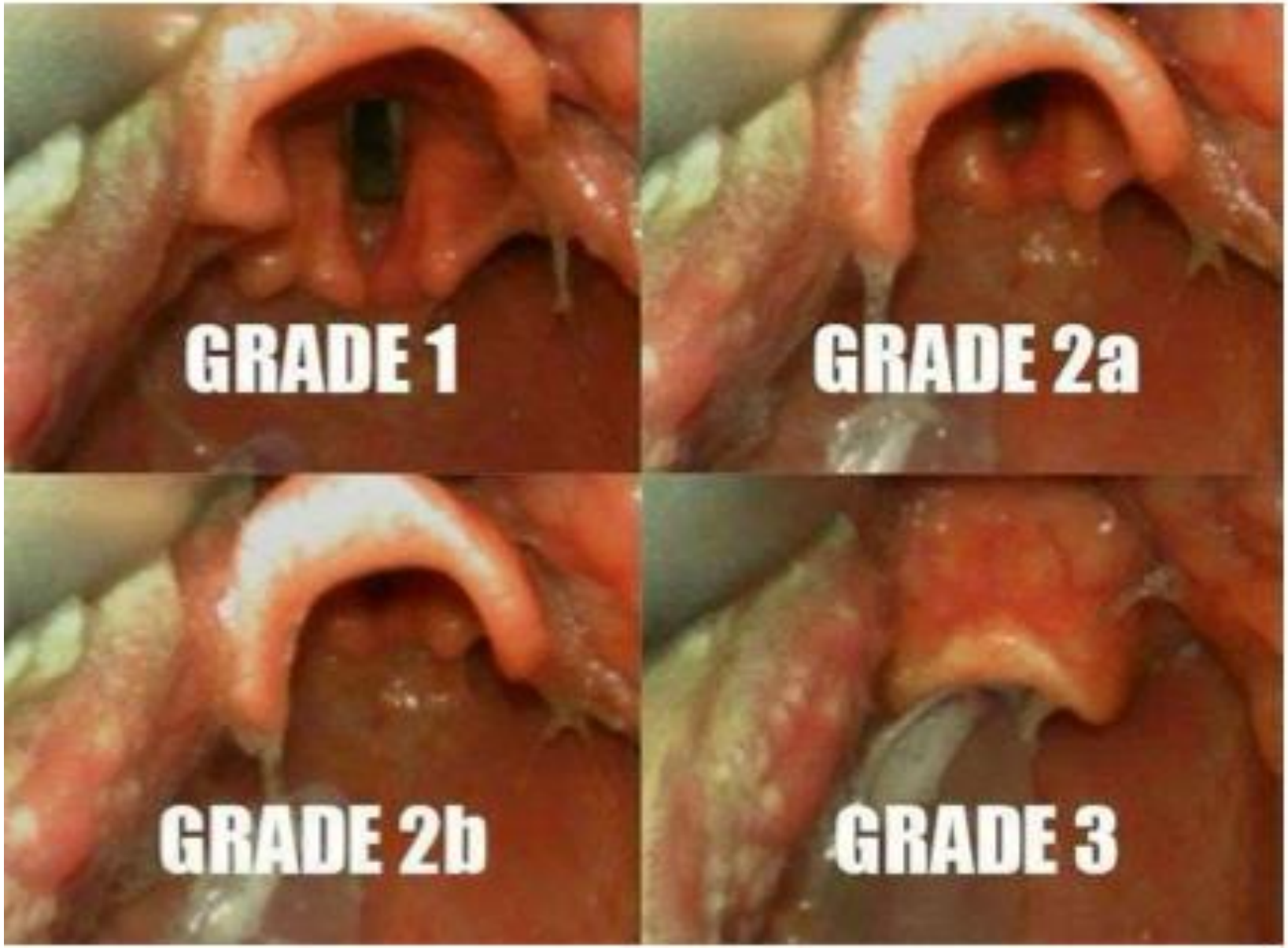
Grade 2: Only the posterior extremity of the glottis seen or only arytenoid cartilages.

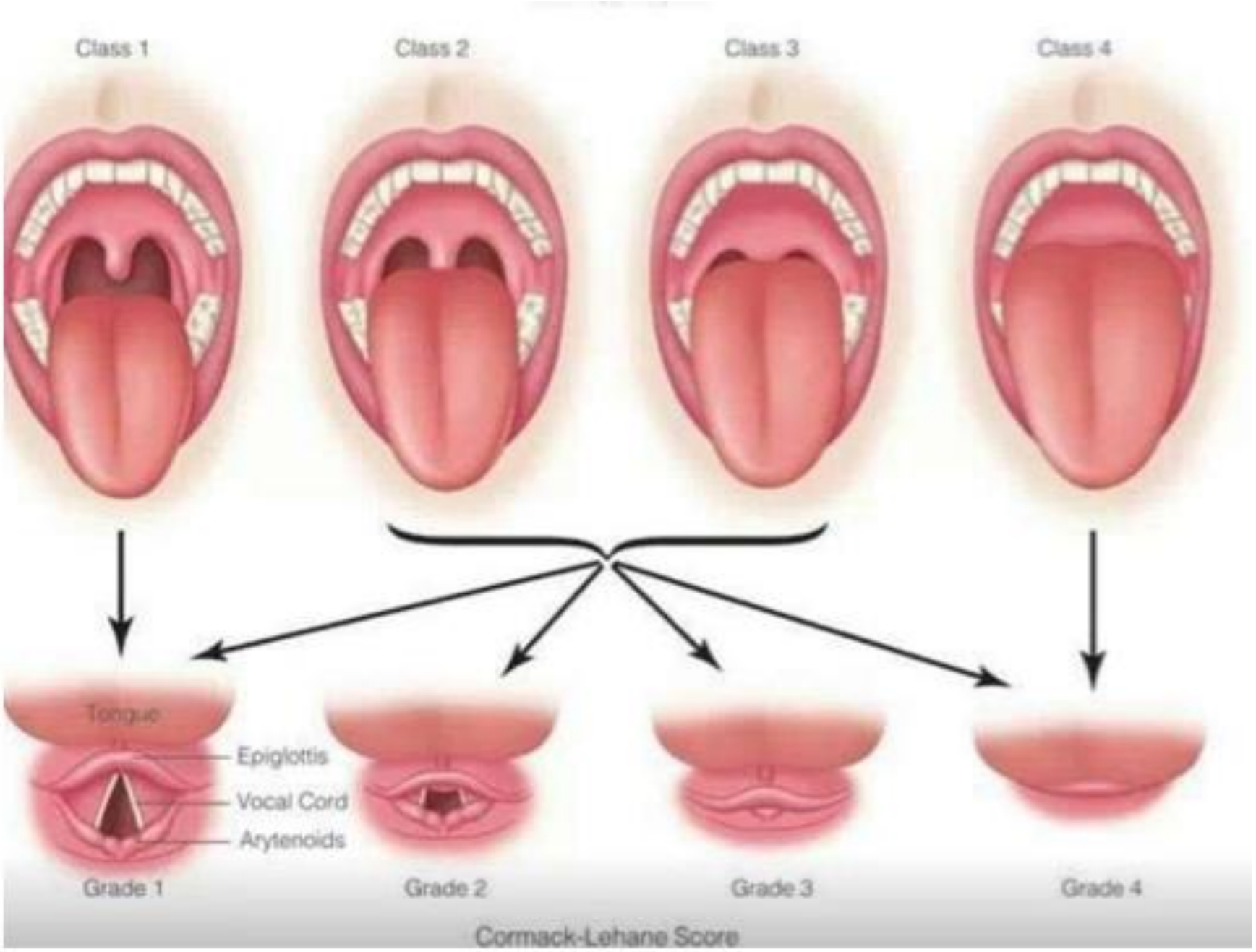
Grade 3: Only the epiglottis seen.

Grade 4: Neither glottis nor epiglottis seen (very rare).






GRADE 1
GRADE 2a
GRADE 2b
GRADE 3


Class 1
Class 2
Class 3
Class 4
Tongue
Epiglottis
Vocal Cord
Arytenoids
Grade 1
Grade 2
Grade 3
Grade 4
Cormack-Lehane Score

LEMON:

4-Airway obstruction

Partial or complete blockage in any part of the airway resulting in a decreasing the ability to ventilate.

Airway obstruction can be either acute or chronic. EX:

Tongue.

foreign body.

trauma (burn, bleeding).

Infections (epiglottitis).

allergic reactions.

tumors.

abscess(Peritonsillar abscess, Retropharyngeal abscess).

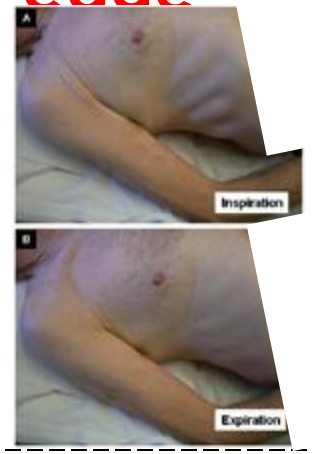
Partial and Complete Airway Obstruction Symptoms:

Partial:

- Noisy breathing (stridor, snoring).
- Coughing.
- Retraction of the sternum.
- Hypoxemia.
- Hypercarbia.

Complete:

- Lack of any air movement
- Lack of breath sounds with a stethoscope
- Choking sign (hands clenched throat).
- Cyanosis.
- Retraction of the sternum and rib cage
- Hypoxemia
- Hypercarbia



Airway Obstruction Management

- Quick history and clinical examination can help in determining the site of obstruction.

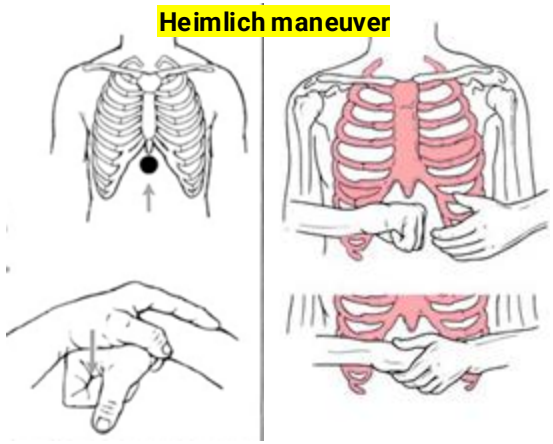
- Heimlich maneuver: Subdiaphragmatic abdominal thrust creates an artificial cough and expels a foreign body from the airway.

- Head-tilt/chin-lift: Contraindicated in suspected cervical injury.

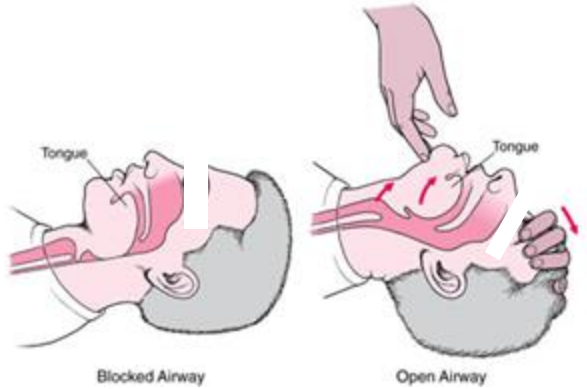
- Jaw thrust maneuver

- Surgical intervention

- Investigation: X-ray, CT, and bronchoscopy



Head Tilt - Chin Lift



Jaw thrust

LEMON :

5-Neck mobility

- Ideally, the neck should be able to extend back approximately 35°.

- The best position for intubation is the sniffing position.

- Atlanto-occipital movement assesses neck mobility.

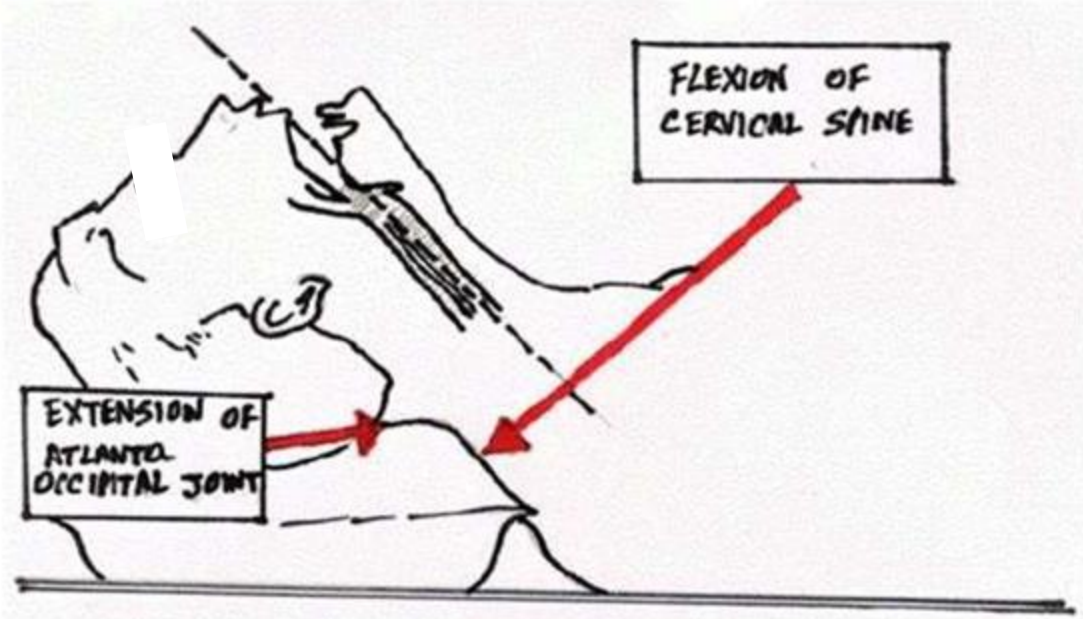
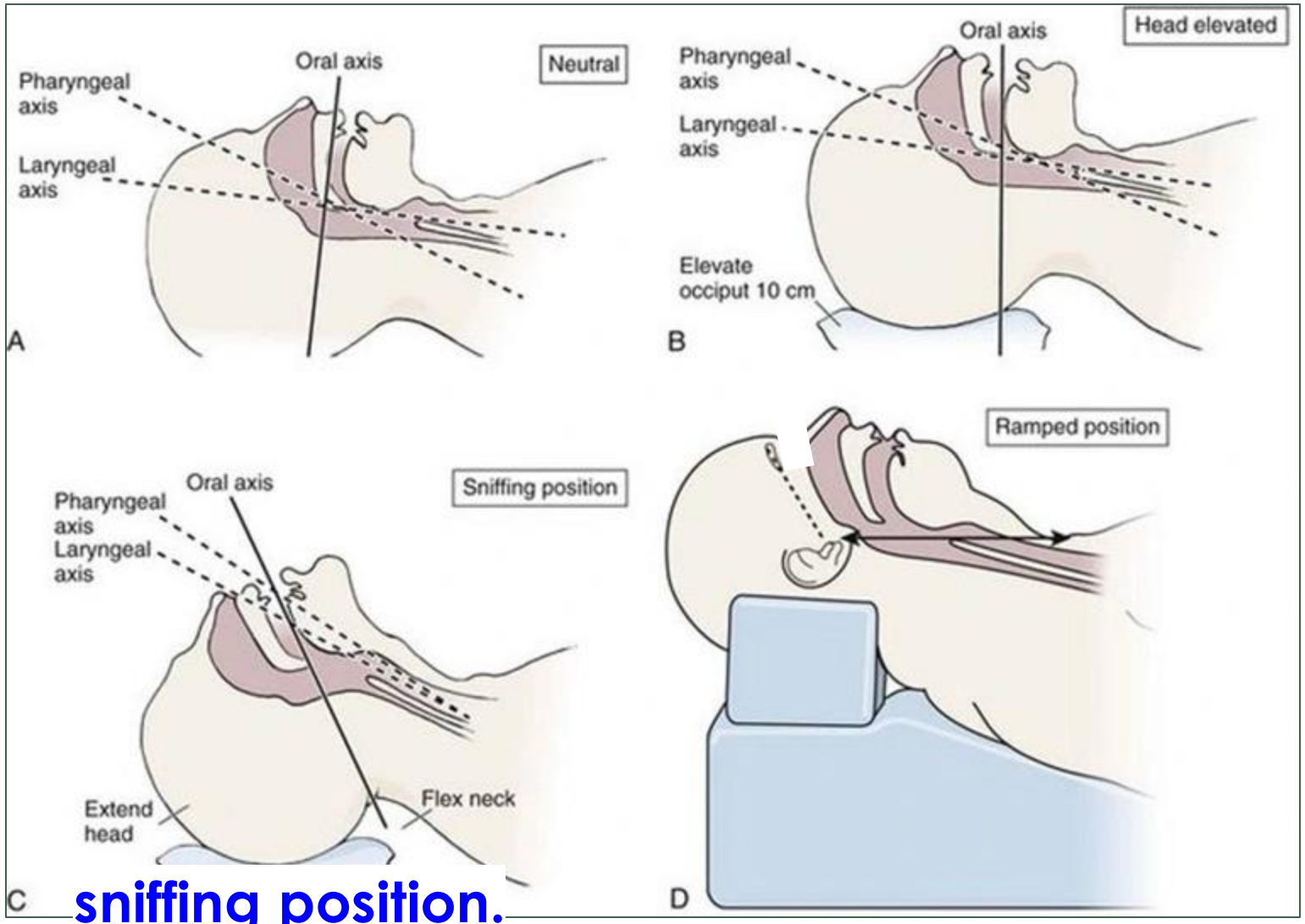
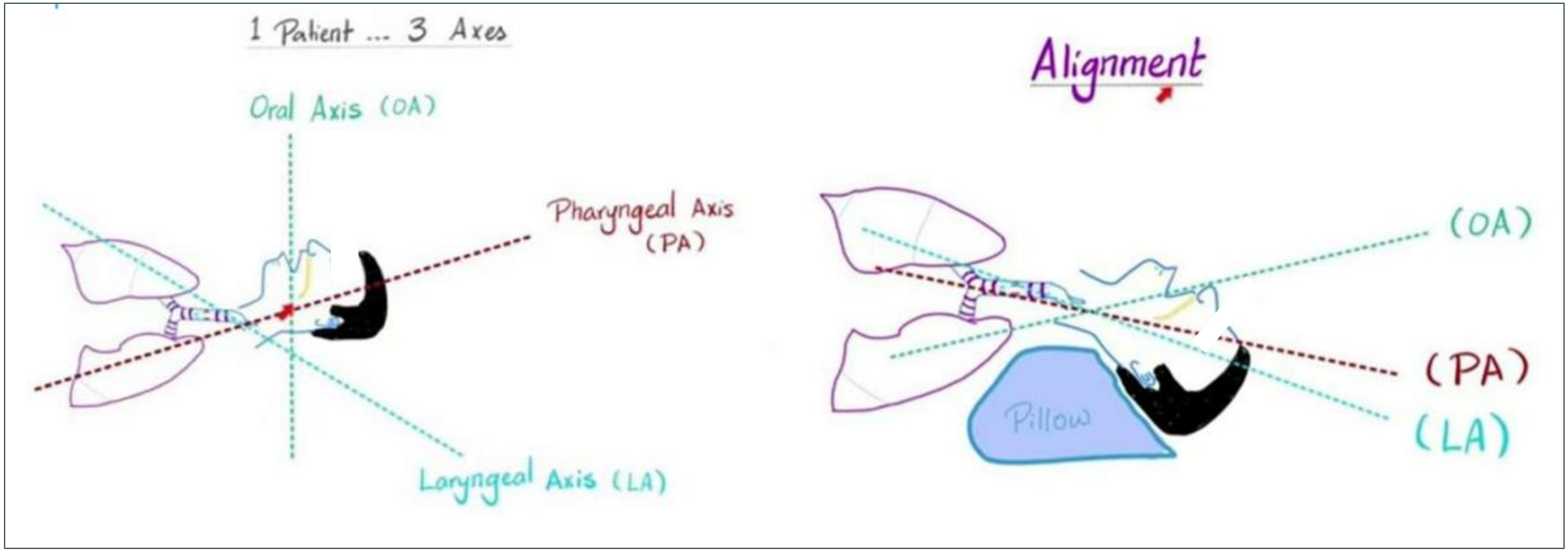


Figure 1: Sniffing position, how a pillow is used to create flexion at the atlanto-axial and extension at the atlanto-occipital joint.



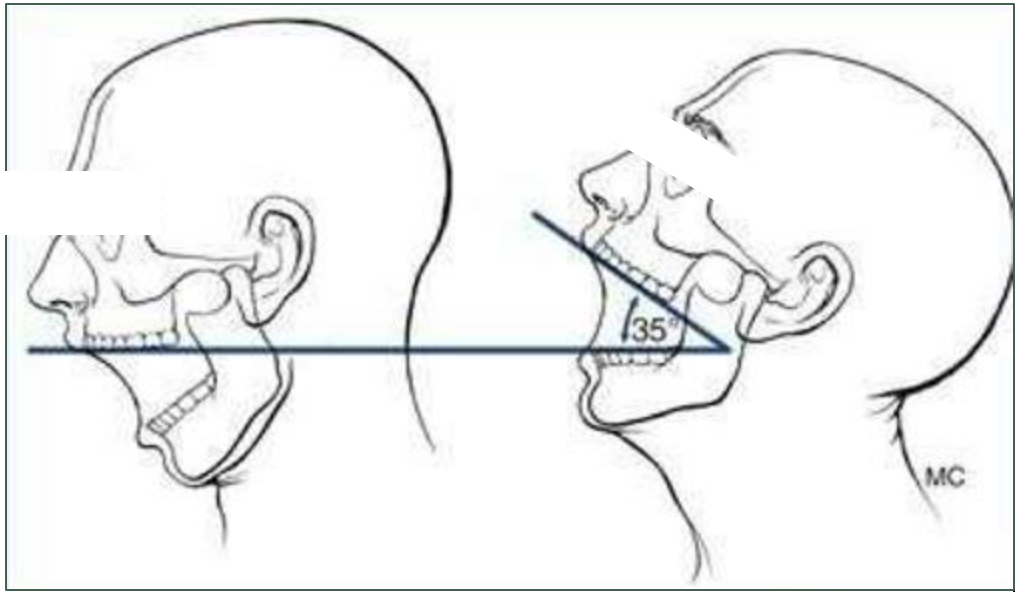
sniffing position.


1 Patient ... 3 Axes
Oral Axis (OA)
Pharyngeal Axis (PA)
Laryngeal Axis (LA)
Alignment
(OA)
(PA)
(LA)
Pillow

Atlanto-occipital Movement:

- The patient is asked to hold head erect, facing directly to the front, then he is asked to extend the head maximally and the examiner estimates the angle traversed by the occlusal surface of upper teeth.

- Visual assessment or using a goniometer.
  - Grade I >35 degrees
  - Grade II 22-34 degrees
  - Grade III 12-21 degrees
  - Grade IV <12 degrees



Assesses feasibility to make the optimal intubation position with alignment of oral,pharyngeal, and laryngeal axes into a straight line.

Problems:

- Cervical Spine Immobilization
- Ankylosing Spondylitis
- Rheumatoid Arthritis
- Halo Fixation (treatment for cervical spine trauma)

Used to hold the head and neck in place so that the bones of the spine (vertebrae) can heal from an injury or surgery.

"تعلّم العِلم فَلا تَدري متى تحتاجُ الأمّةُ إليك "

لا تغفل عن اخوتك من دعائك
اللهمَّ إنّا لا نملكُ لِغزة إلا الدعاء ..فيا رب لا تردَّ لنا دعاءً و لا تُخيّب لنا رجاءً..
اللهم غزّة والسودان وسوريا ولبنان وسائر بلاد المسلمين

Thank you!