AIRWAY ANATOMY AND ASSESSMENT

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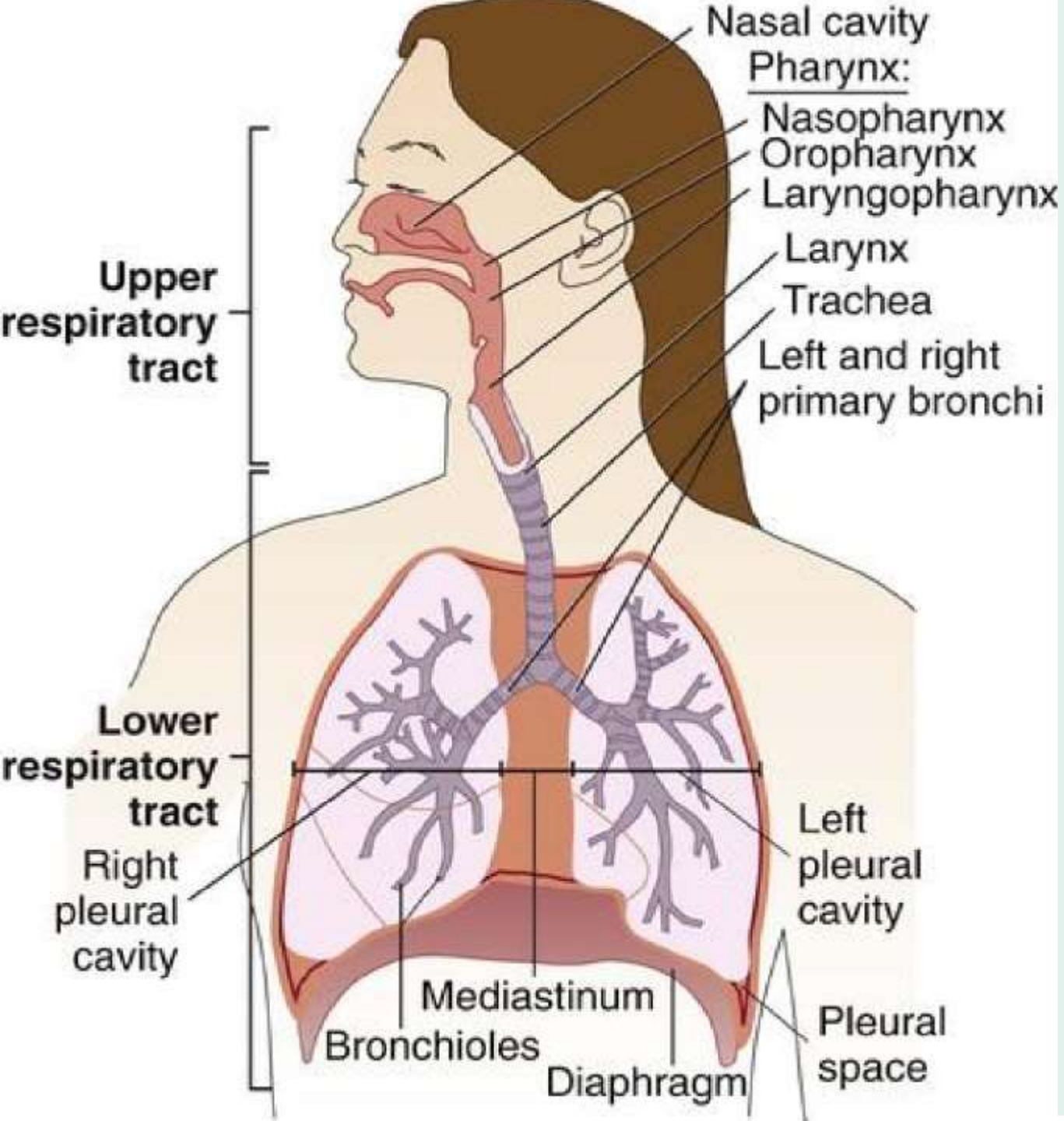
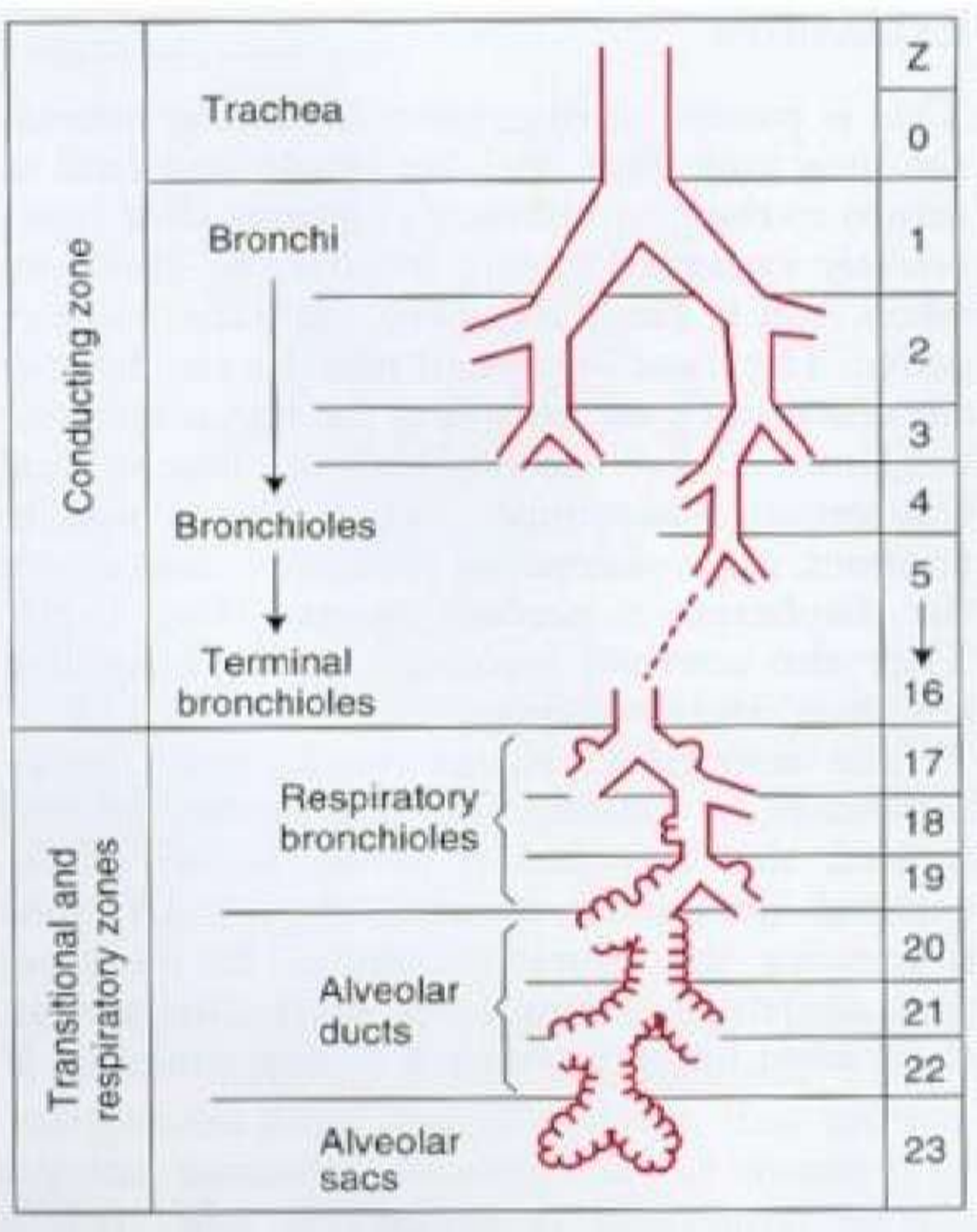
AIR WAY ANATOMY SIGNIFICANCE IN ANESTHESIA AND ICU

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 managment. 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.


Nasal cavity
Pharynx:
Nasopharynx
Oropharynx
Laryngopharynx
Larynx
Trachea
Left and right primary bronchi
Upper respiratory tract
Lower respiratory tract
Right pleural cavity
Left pleural cavity
Mediastinum
Bronchioles
Diaphragm
Pleural space


Conducting zone
Transitional and respiratory zones
Trachea
Bronchi
Bronchioles
Terminal bronchioles
Respiratory bronchioles
Alveolar ducts
Alveolar sacs
Z
0
1
2
3
4
5
16
17
18
19
20
21
22
23

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:

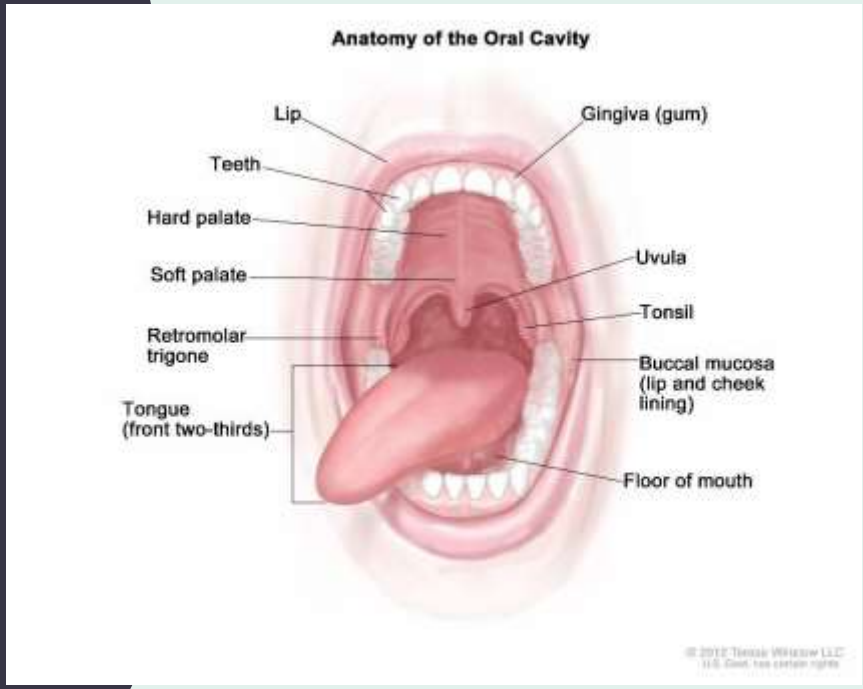
*upper airway (oral and nasal cavities,pharynx,larynx)

More vulnerable to obstruction

*lower air way (trachea,bronchi,bronchioles,alveoli)

ORAL CAVITY

Extending from lips into oropharyngeal isthmus.
During evaluation for airway assessment, mouth openening must at least 3 fingers width (>6cm)

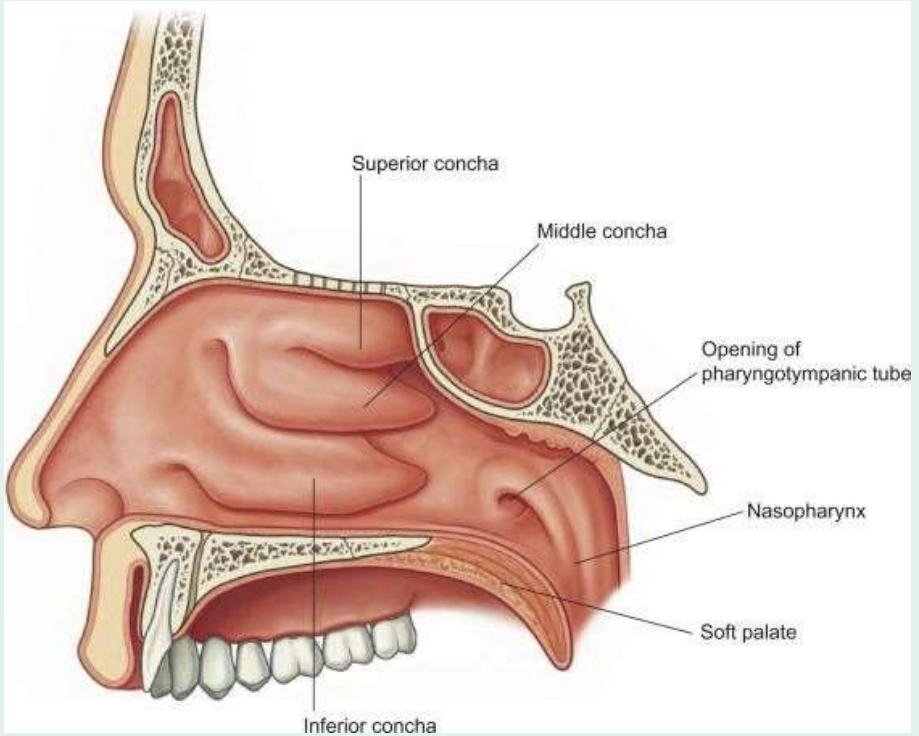


NASAL CAVITY

Extending from nostrils to posterior nasal aperture.

D ivided by nasal septum into 2 halves (right and left)

Aims in humidification, heating and filtering of inspired air.



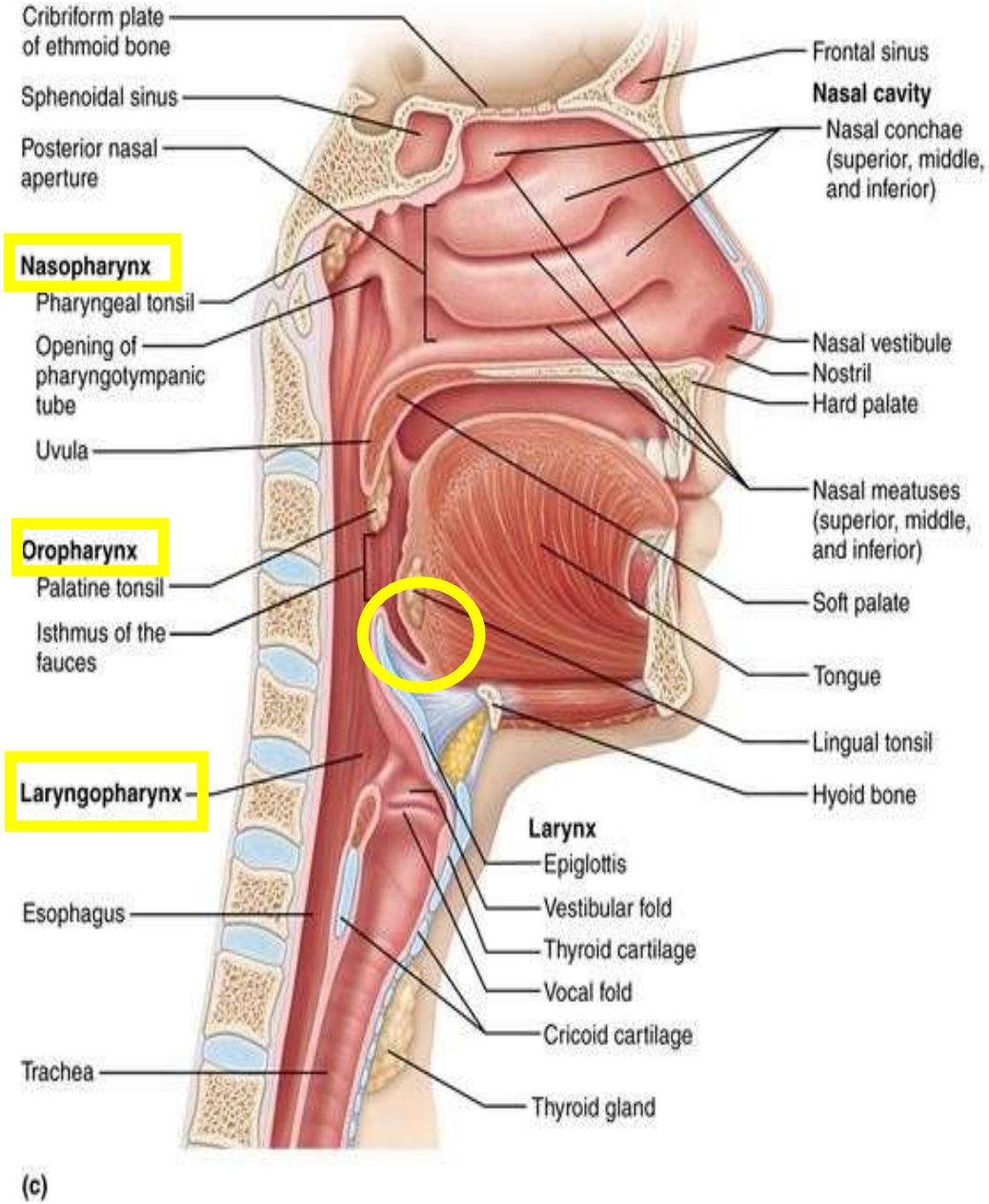
PHARYNX =THROAT

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

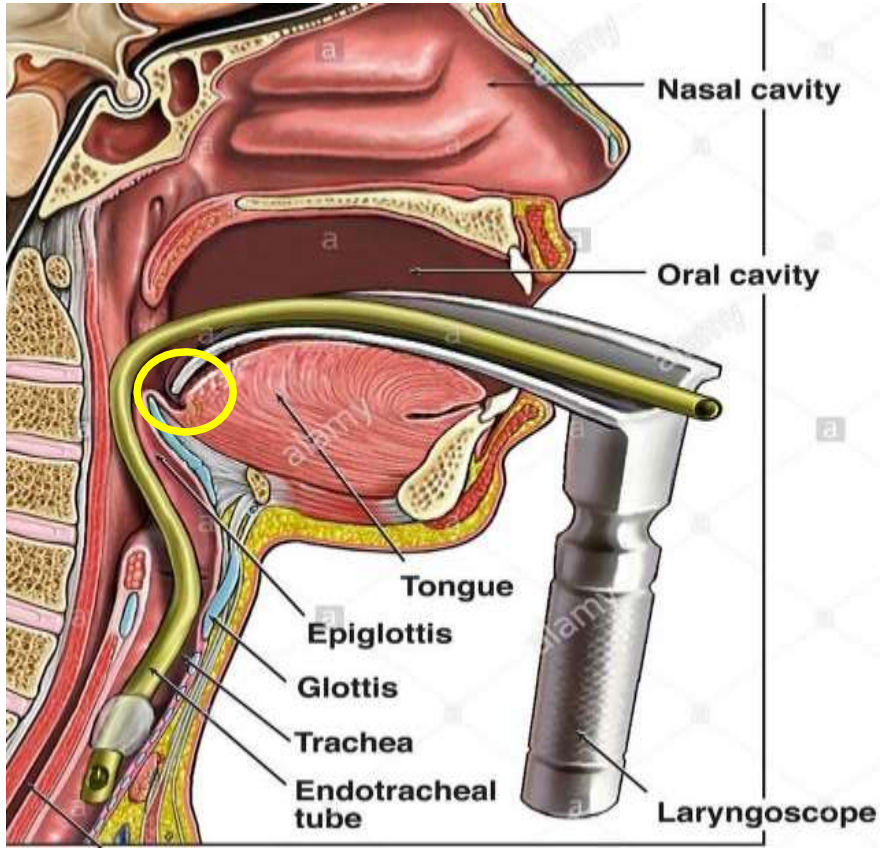
nasopharynx	oropharynx	Laryngopharynx
Behind the nasal cavity and above the soft palate.	Behind the oral cavity, between soft palate and top of hyoid bone.	Behind the larynx and below the epiglottis to the beginning of esophagus.

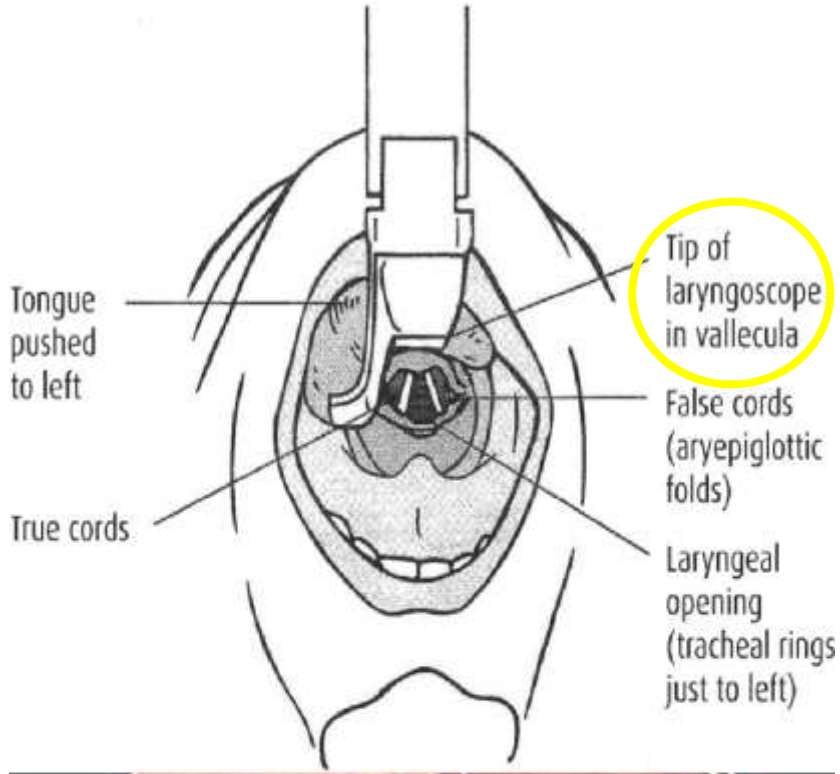
vallecula: a depression between epiglottis and base of the tongue
***where blade of laryngoscope rests.**

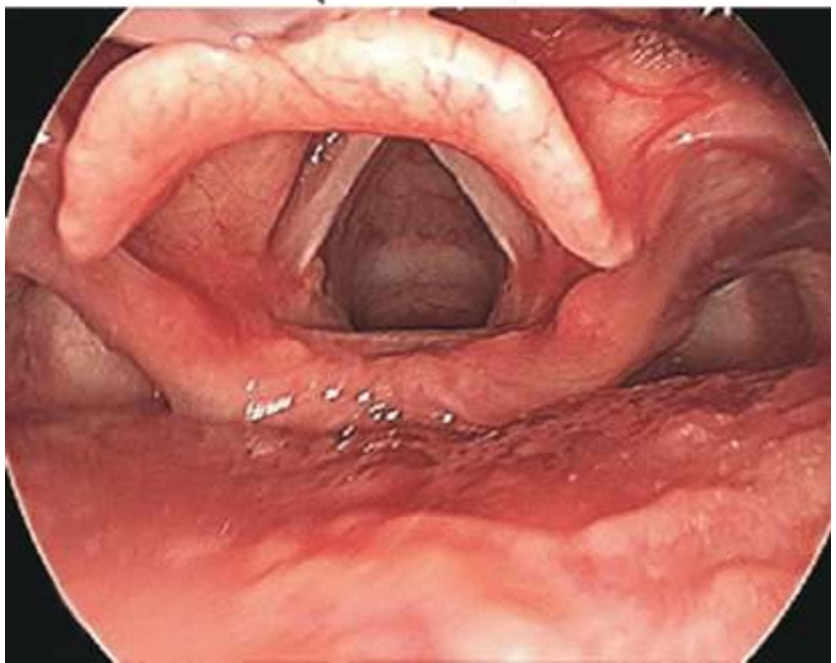


LARYNGOSCOPY FOR TRACHEAL INTUBATION

Endoscopy of the larynx to obtain a good view for vocal cords and glottis.
***Used for placement of the ETT into the trachea.**



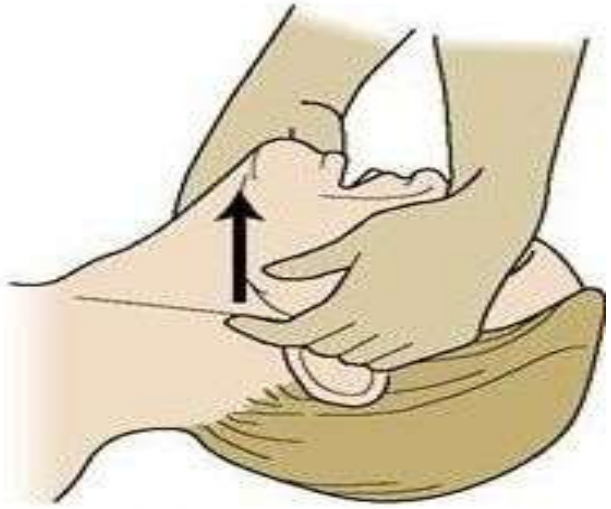




JAW THRUST MANEUVER

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

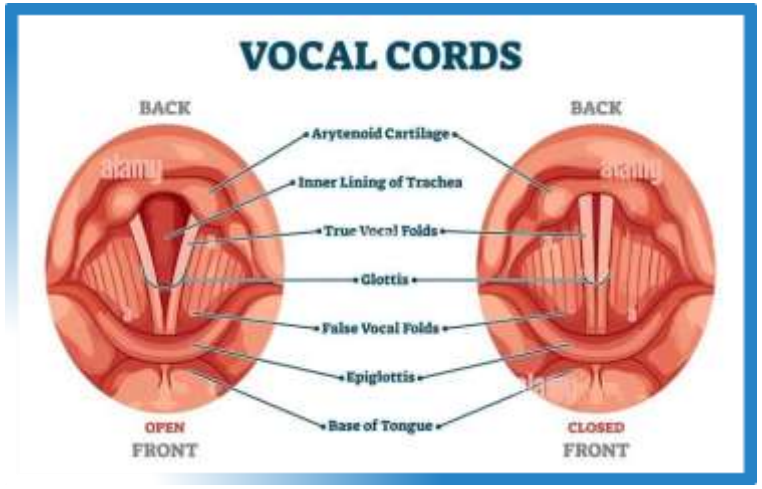
These maneuvers are used to maintain patient's airway.



Jaw-thrust maneuver

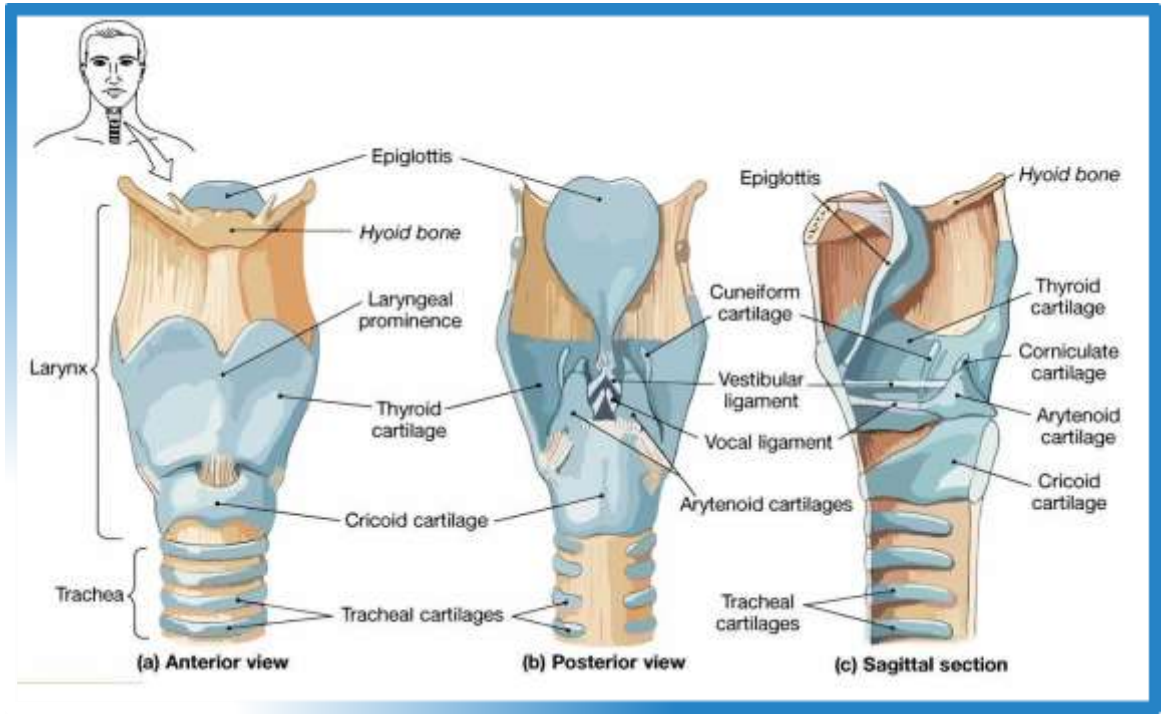
performed by placing the index and middle fingers to physically push the posterior aspects of the lower jaw **upwards and outwards** while their thumbs push down on the chin to open the mouth.

LARYNX = SOUND BOX



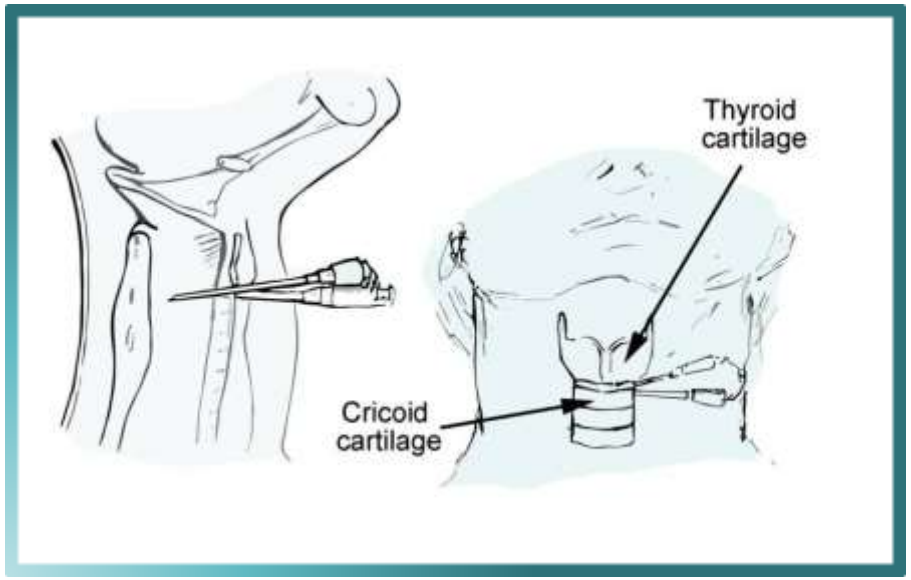
- The passageway for air between the pharynx above and the trachea below.
- Extends from C3-C6 in adults.
- It is formed a number of cartilages which articulates by synovial joints and connected together by ligaments and membranes and moved by number of muscles.

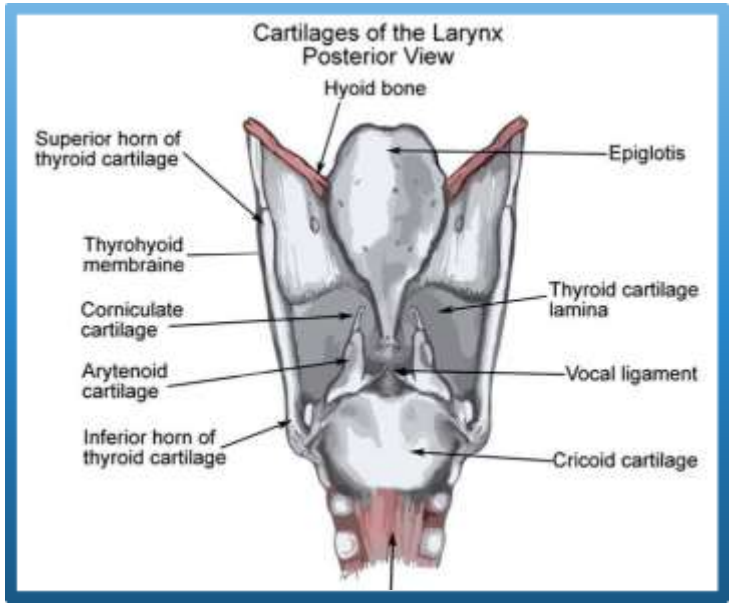
Laryngeal cavity has 2 pairs of mucous membrane folds :
*upper folds=false vocal cords
*lower folds= true vocal cords, which could be injuried during intubation.



CRICOTHYROTOMY

- Cricothyroidotomy, also known as cricothyrotomy, 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.
- Surgical airway made via the cricothyroid membrane in acute emergency when obsruction at or above the larynx not relieved.





INDICATIONS AND CONTRAINDICATIONS

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:

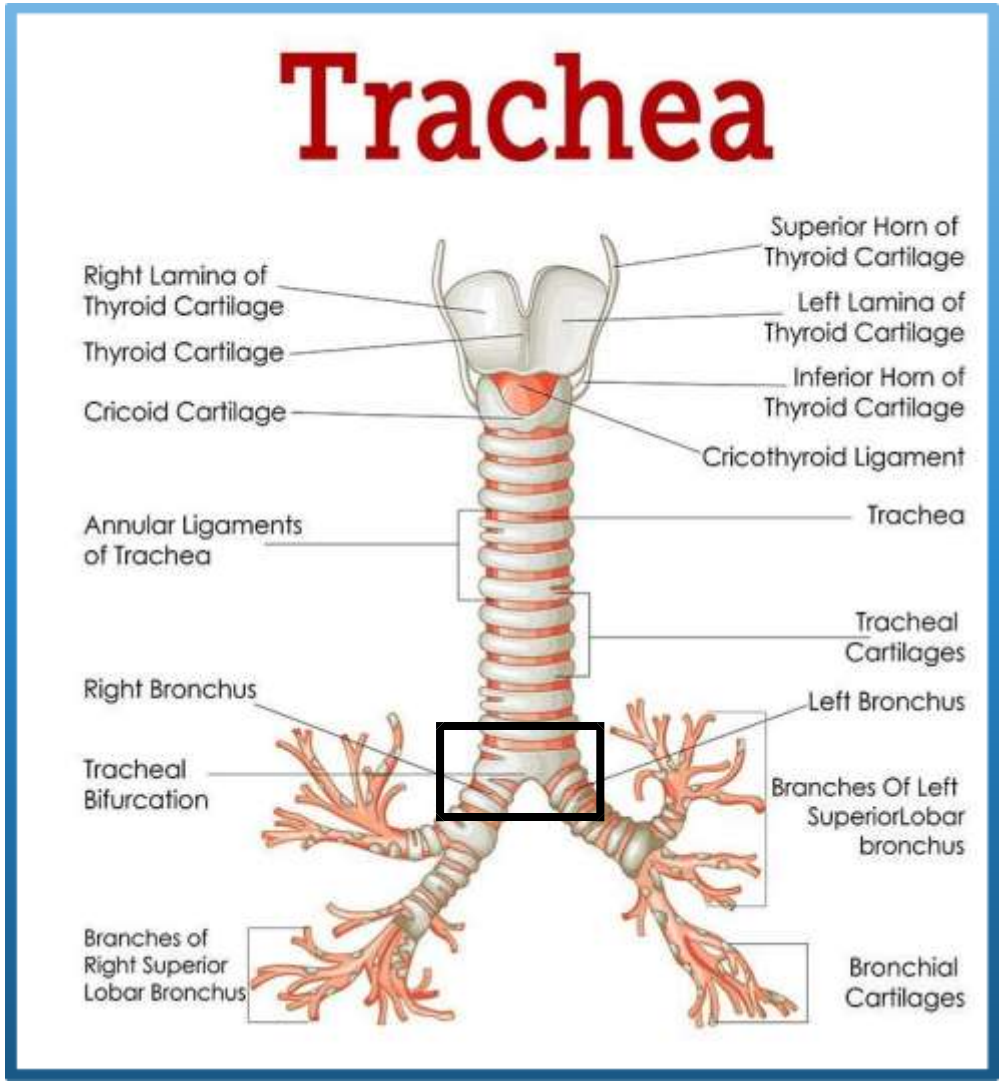
  - Oropharyngeal edema (eg, anaphylaxis

Contraindications

C 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.

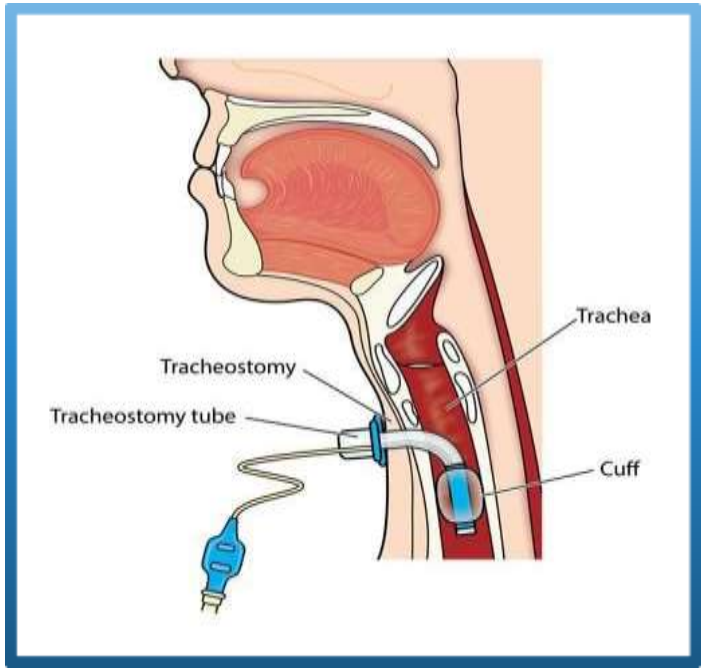
THE TRACHEA

- 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 operative procedure that creates a surgical airway in the cervical trachea.[1, 2] It is most often performed in patients who have had difficulty weaning off a ventilator, followed by those who have suffered trauma or a catastrophic neurologic insult.
- **it y 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.**



LEVELS OF TRACHEOSTOMY

- High level at first tracheal ring
- Mid level at second tracheal ring
- Low level at third tracheal ring

INDICATIONS OF TRACHEOSTOMY

- respiratory obstruction
- Retained secretions
- Respiratory insufficiency

INDICATIONS :

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

Respiratory obstruction

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

Retained secretions

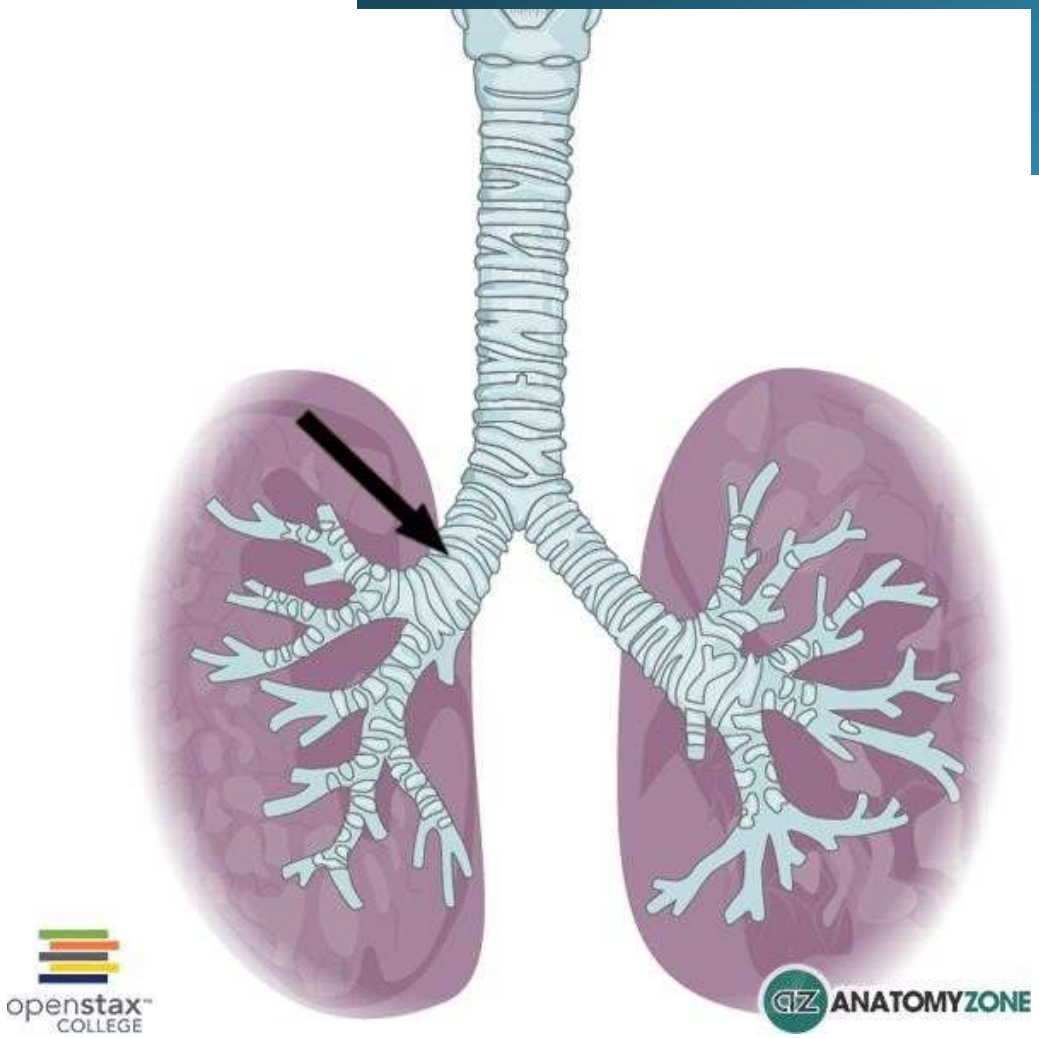
- Chronic lung conditions as

- emphysema , chronic bronchitis,
- Bronchiectasis
- atelectasis
-

Respiratory insuffieciency

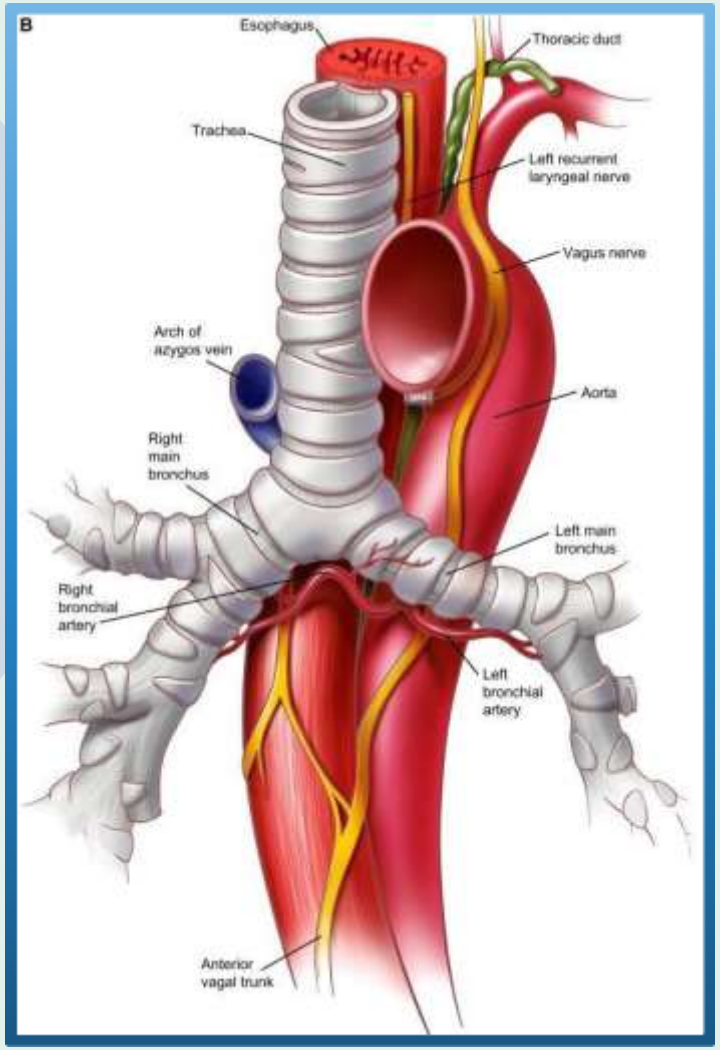
BRONCHI

- Right bronchus is shorter and wider and is more vertical than the left bronchus.
- Foreign bodies usually enter the right bronchus.



Carina clinical signifance

- 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**.



Air way 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 :

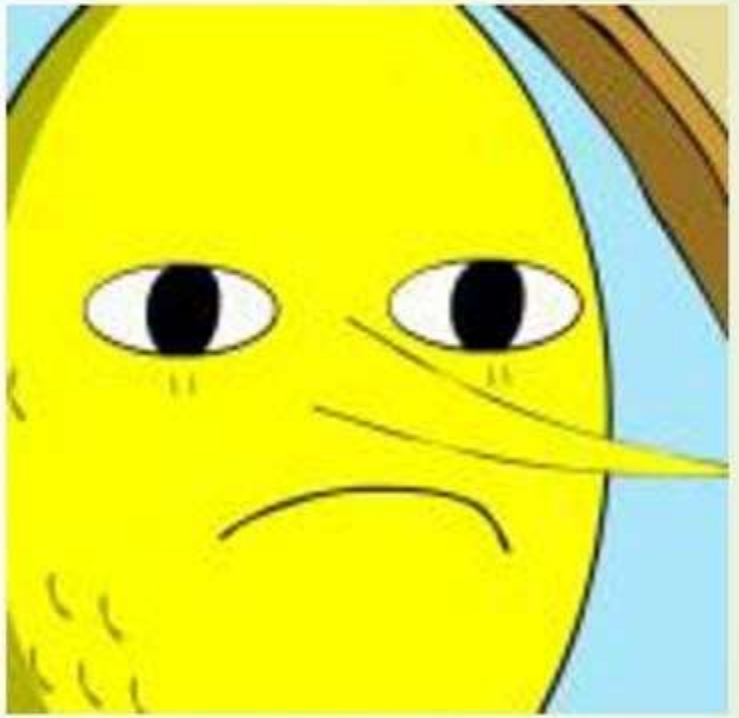
- 1- difficulty of endotracheal intubation; account 17% of respiratory related injury and result in significant morbidity and mortality
- 2- Oesophageal intubation
- 3- Inadequate ventilation
-
- 28%of anaesthesia related death are secondary to the inability to mask ventilate or intubation

- 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

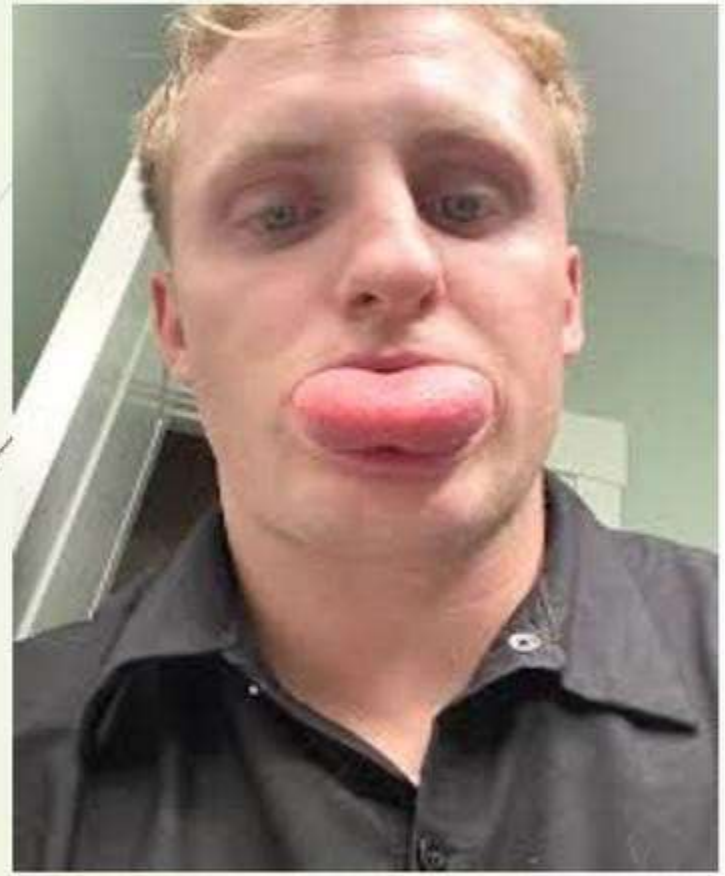
Lemon

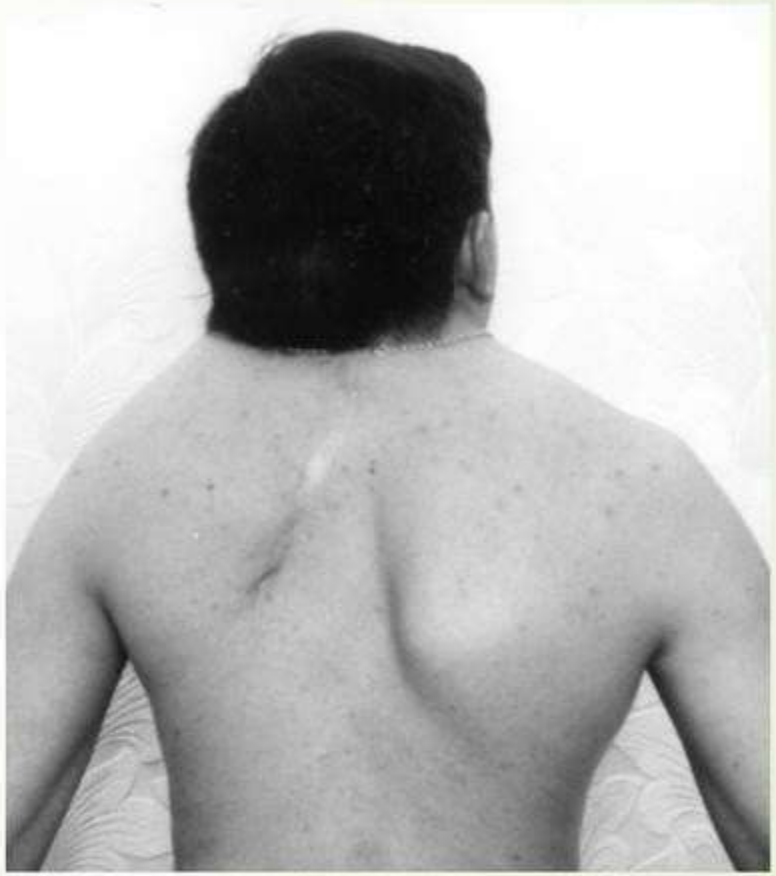
- Look
- **E**valuation
- Mallampati scores
- **O**bstructive
- **N**eck mobility



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



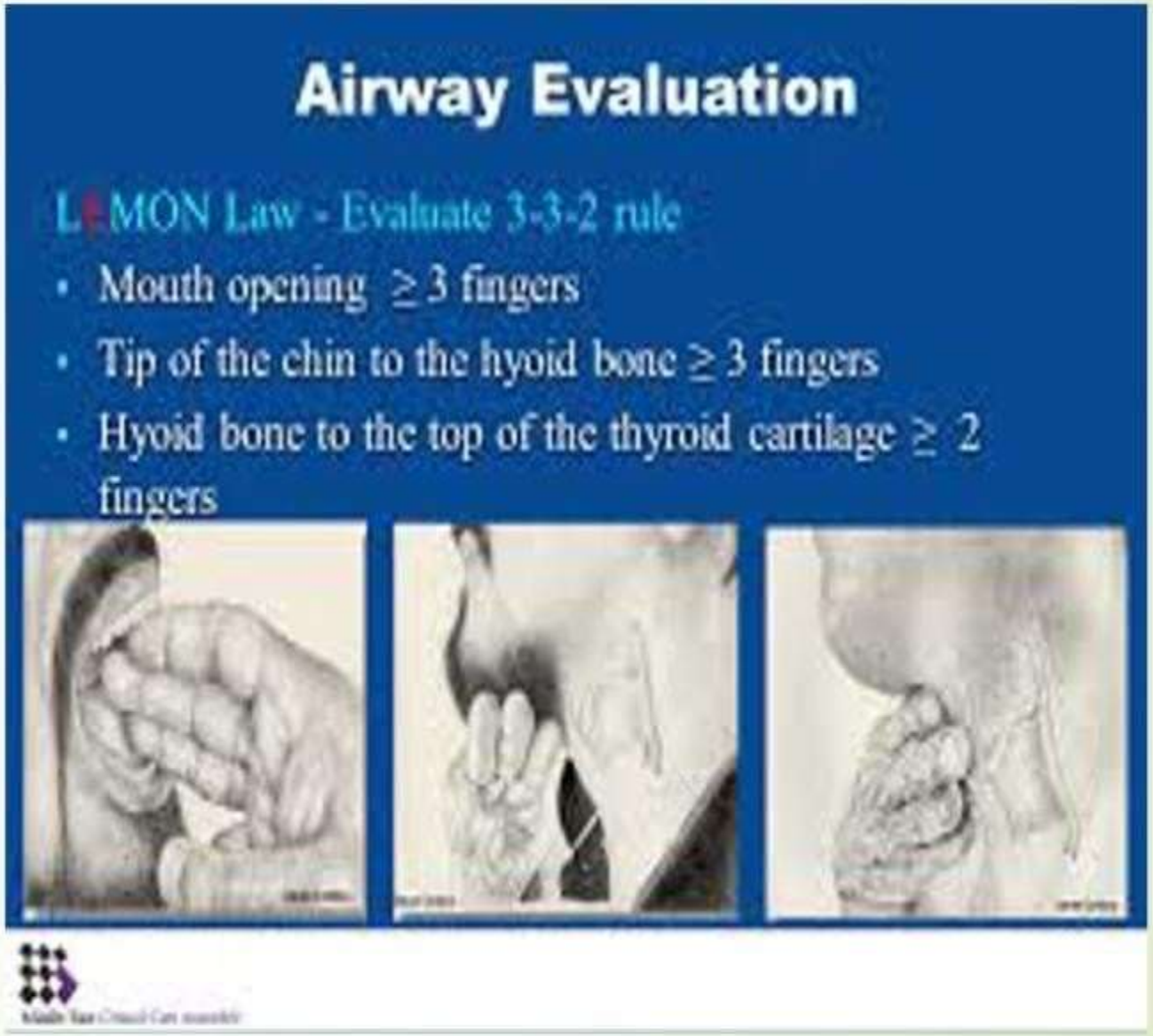


Predictor of difficulty encountering ventilation mask

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

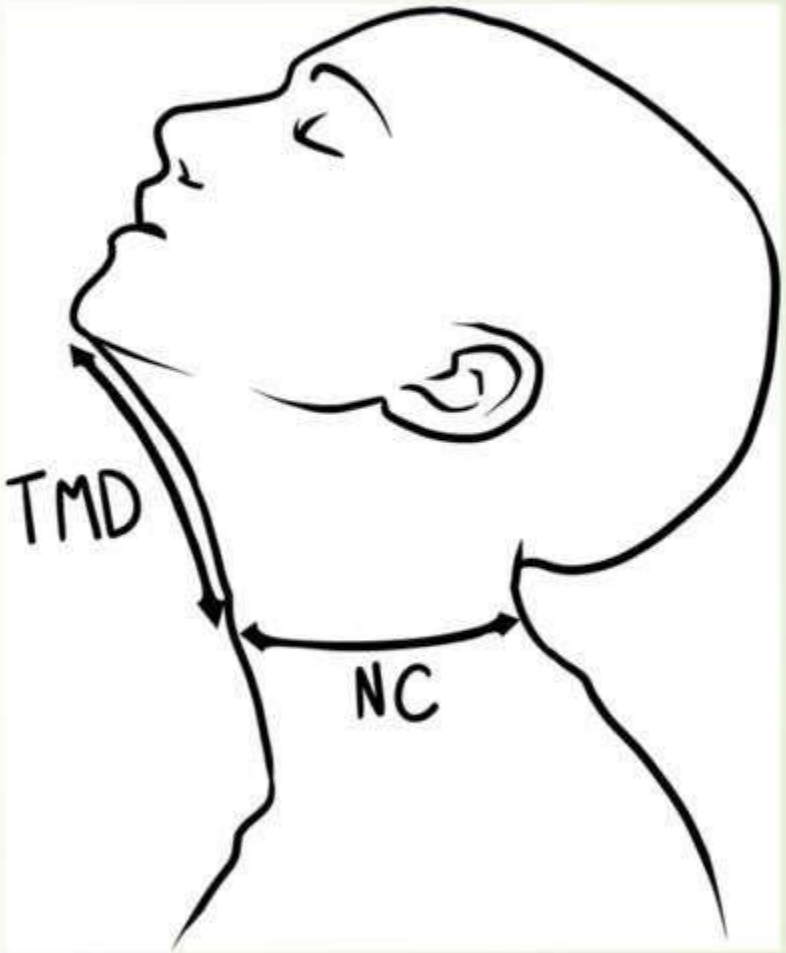
Evaluation

- EVALUATE 3 3 2
- 1)Mouth Opens at least three finger widths (>6cm)
- 2)Thyromental distance Three finger widths(>6cm)
- 3)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

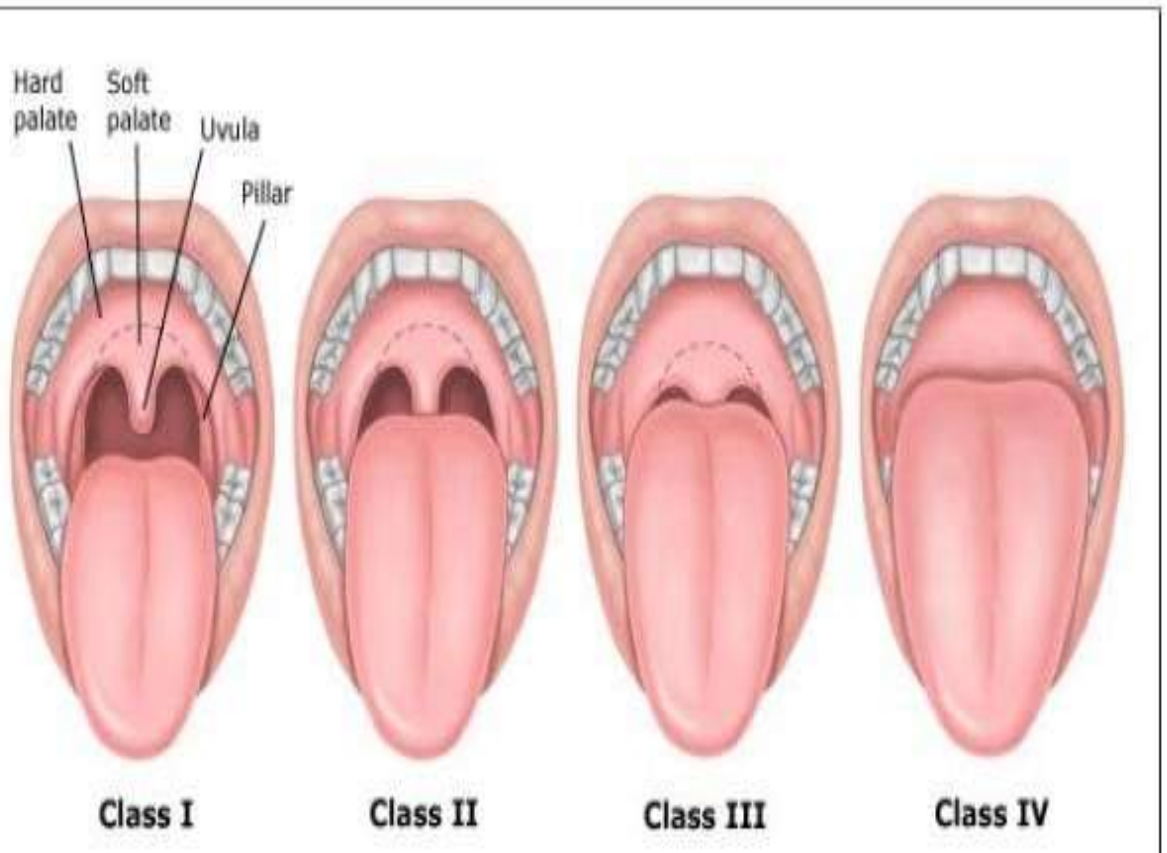
- THYROMENTAL DISTANCE (PAIL'S TEST)
- Distance from the tip of thyroid cartilage to inside of the mentum
- Neck full extended / mouth closed
- >6.5cm _no problem with laryngoscopy & intubation
- 6-6.5 –difficult laryngoscopy but possible
- < 6cm –laryngoscopy is impossible



HYOMENTAL

- 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 = Less space to displace tongue tend to be more difficult to intubate.

FIGURE 1-10. Airway evaluation: The second 3 of 3-3-2 evaluation indicates the length dimension of the mandibular space.



)LEMON(

MALLAMPATI SCORE

The assessment of the size of tongue relative to the size of pharyngeal opening to predict intubation difficulty.

Performed with patient in a sitting position, head neutral, mouth open wide and tongue protruding to the maximum.

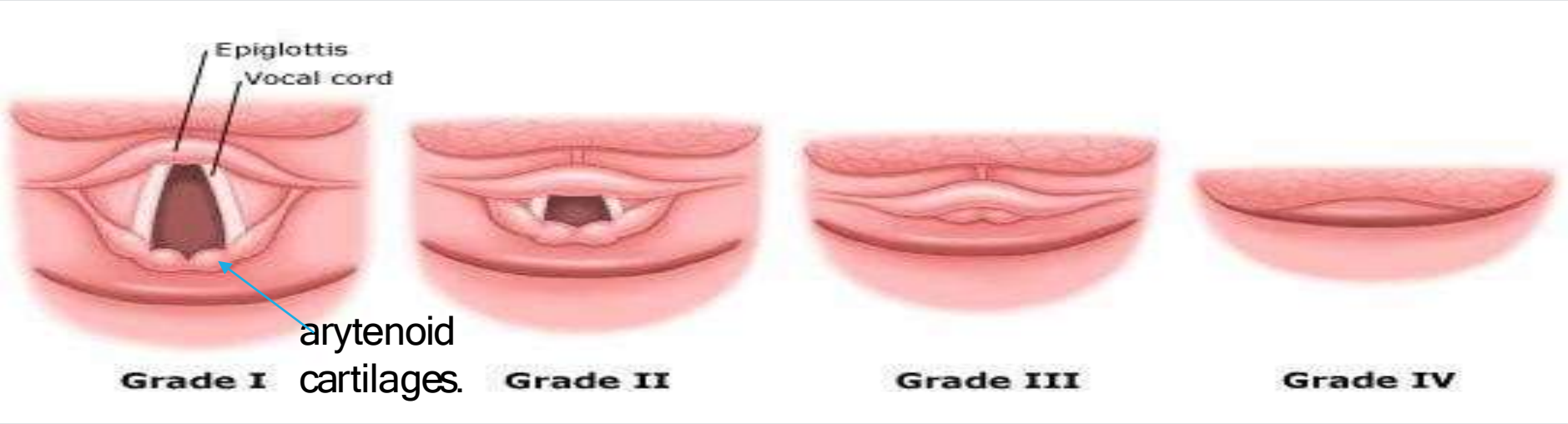
Class I: **46%** prevalence(No Difficult intubation)
Class II:**40%** prevalence(No Difficult intubation)

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

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

CORMACK-LEHANE GRADING

"LARYNGOSCOPIC VIEW GRADES

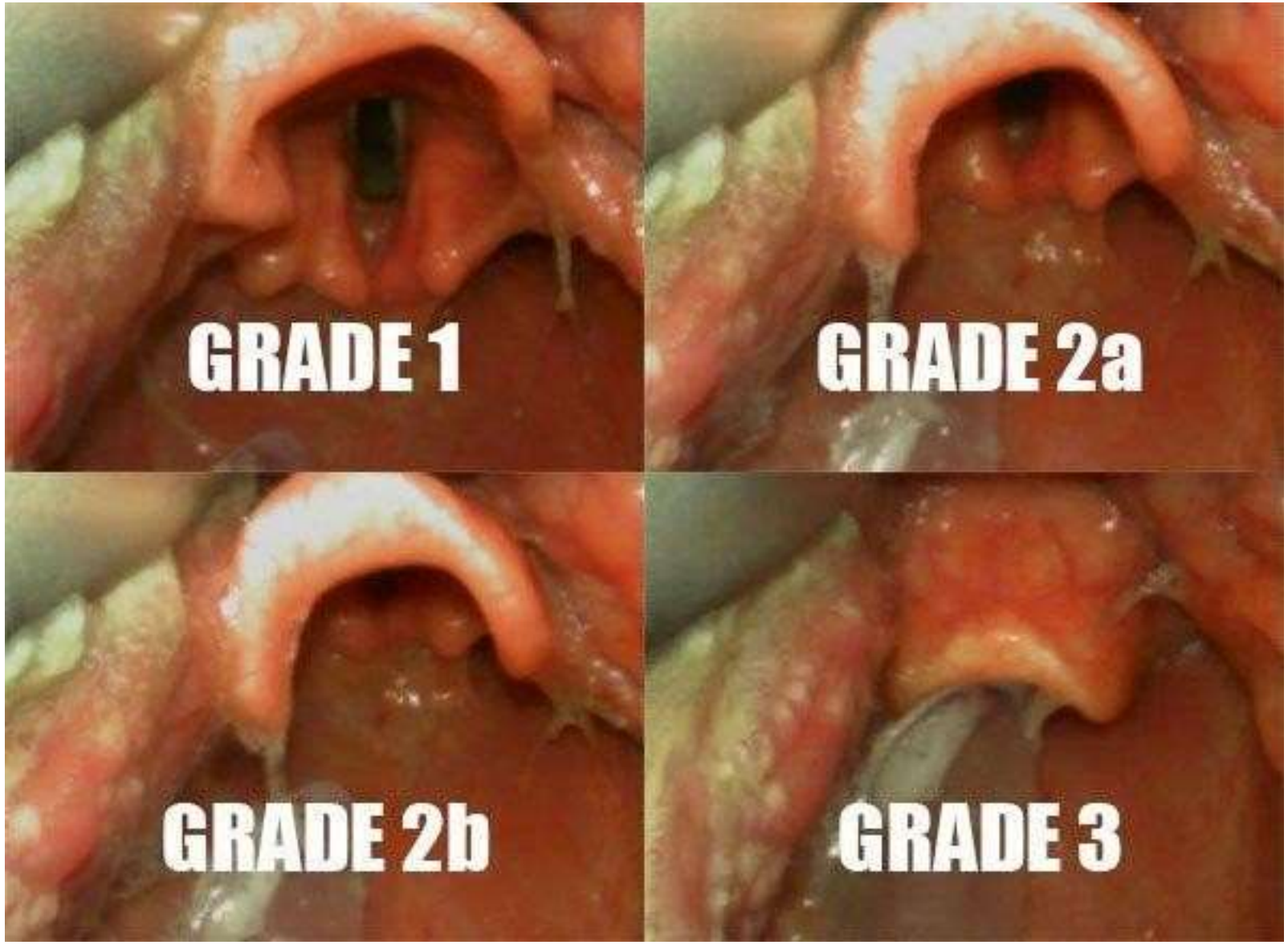


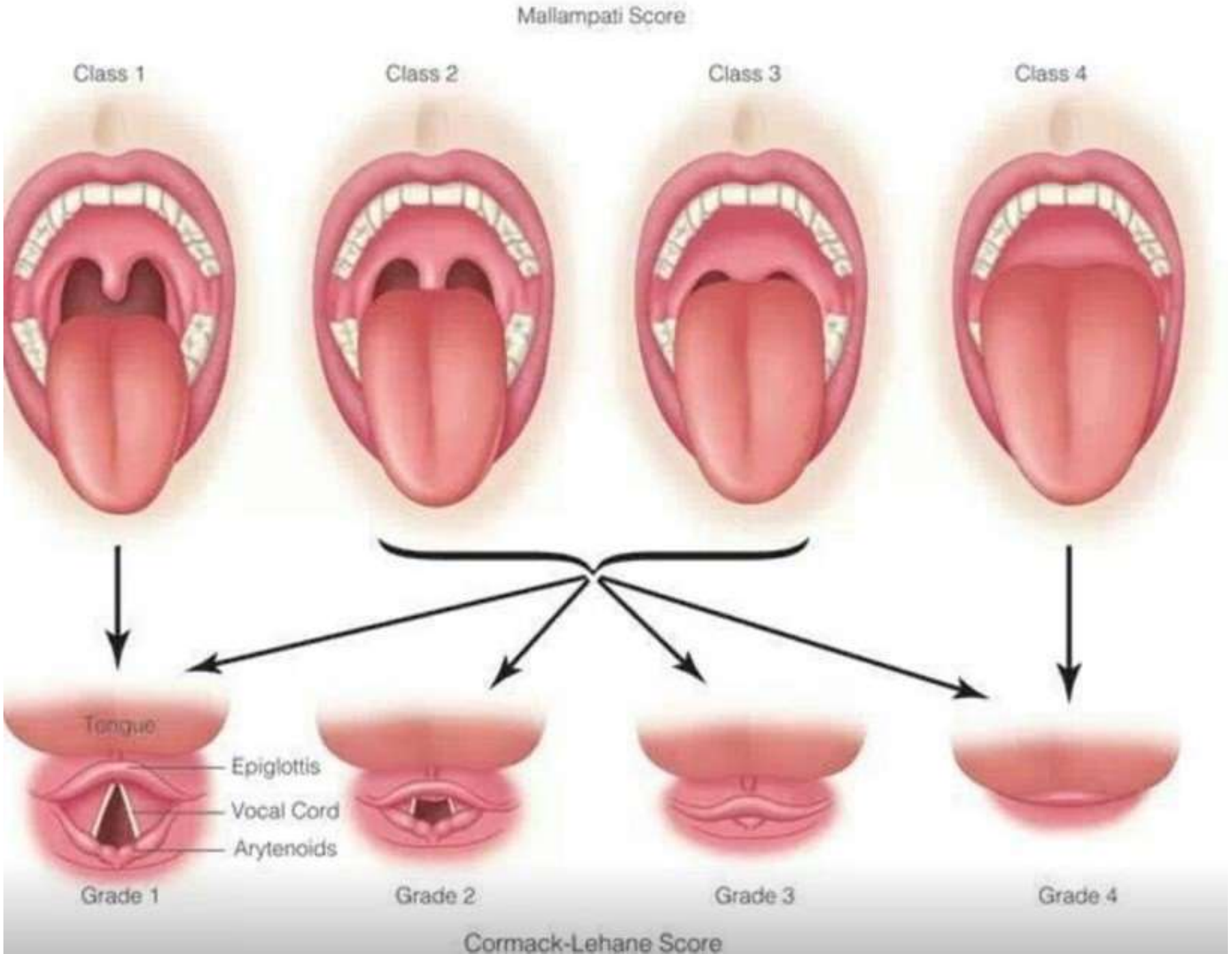
Grade 1: Full view of glottis.

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

Grade 3: Only epiglottis seen.

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


GRADE 1
GRADE 2a
GRADE 2b
GRADE 3


Mallampati Score
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(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 & COMPLETE AIRWAY OBSTRUCTION SYMPTOMS.

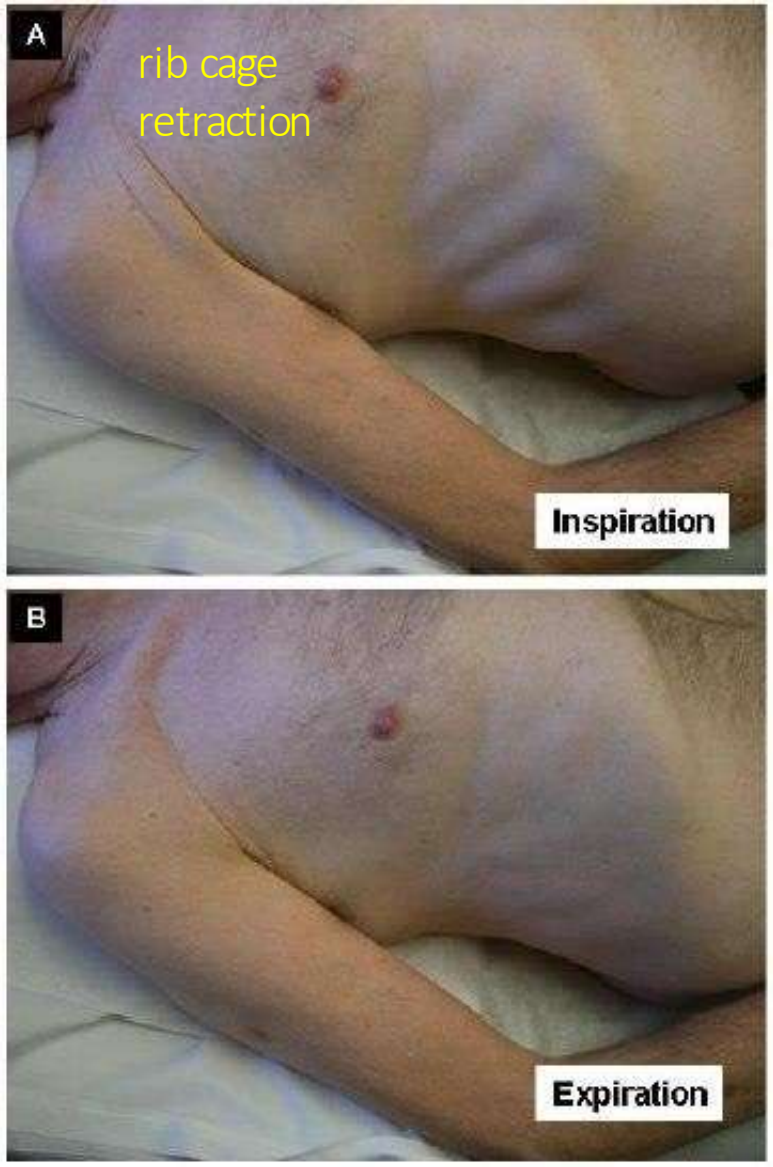
Partial:

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

Complete:

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

Choking sign



AIRWAY OBSTRUCTION MANAGEMENT

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

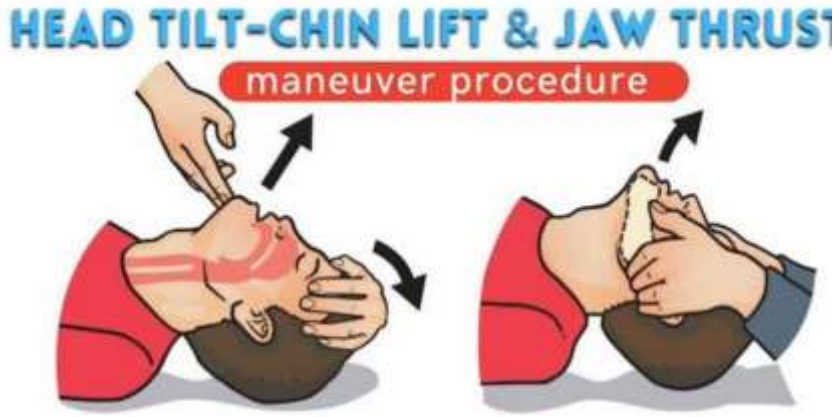
Heimlich manoeuvre : subdiaphragmatic abdominal thrust create an artificial cough and expel a foreign body from airway.

Head-tilt\ chin-lift : contraindication in suspected cervical injury.

Jaw thrust maneuver.

Surgical intervention.

Investigation: X-ray, CT and bronchoscopy.



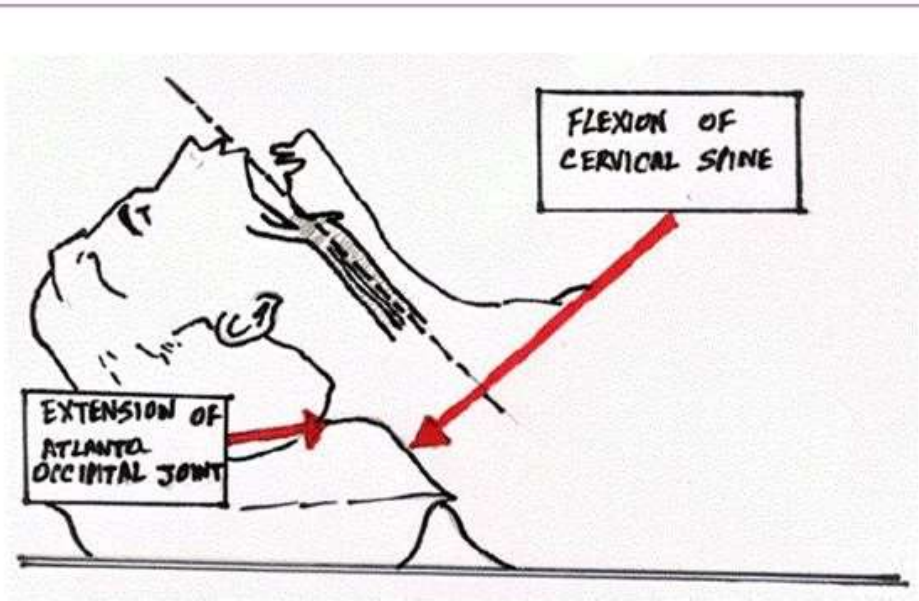


Figure 1: Sniffing position, how a pillow is used to create flexion at the atlanto-axial and extension at the atlanto-occipital joint.

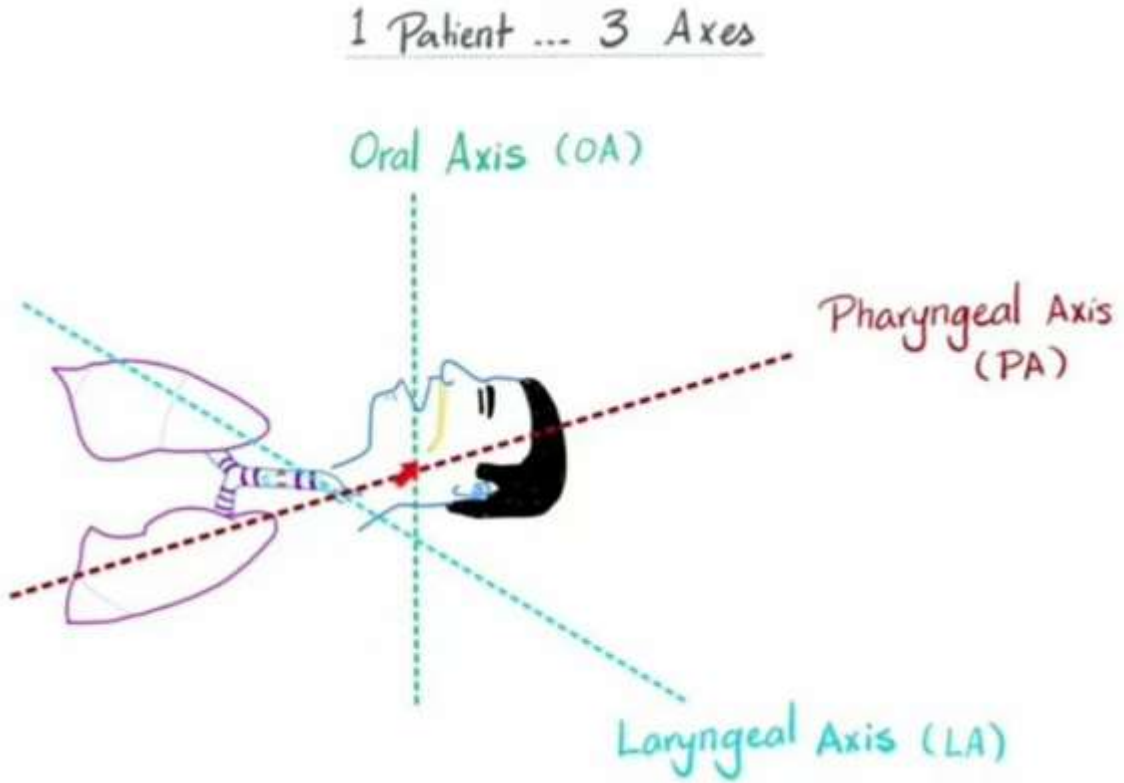
)LEMON(

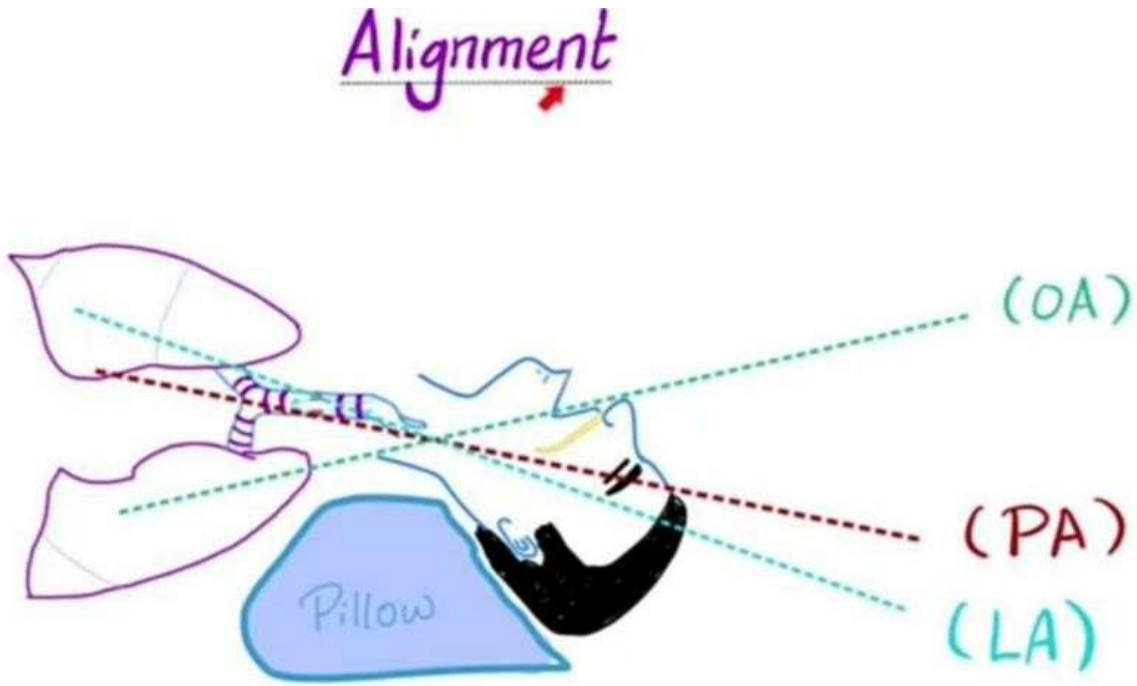
NECK MOBILITY

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

the best position for intubation is the sniffing position.

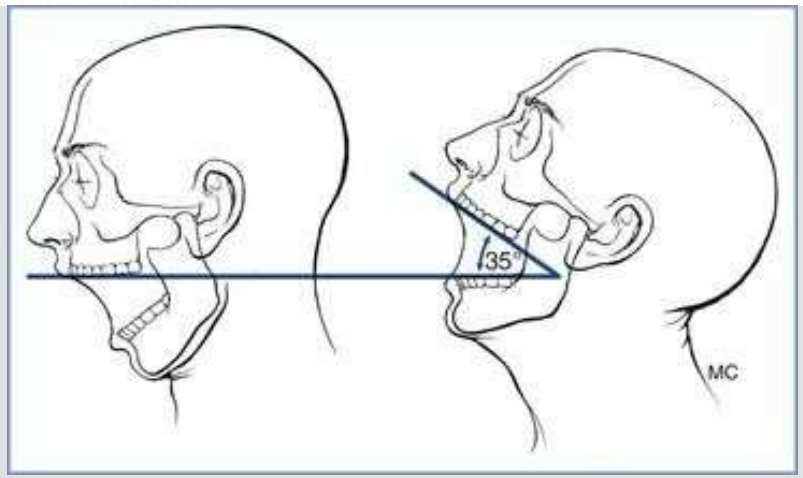
Atlanto-occipital movement assesses neck mobility !!!!


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 Immobilizatic
  - Ankylosing Spondylitis
  - Rheumatoid Arthritis
  -Halo fixation (treatment for cervical spine trauma)

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

"روح الروح هادي روح الروح"

"اسمه يوسف 7 سنين شعره كيرلي وأبيضاني وحلو.. بدي يوسف يابابا"

"كان يصرخ عليّ يا كمال يا كمال!
كان عايش والله.. بدي أبوسه

" الولاد وين؟ الولاد ماتوا بدون مایاكلوا يشهد عليا الله"

"بدي شعرة منه.. شعرة واحدة بس قبل م تد.فنوه "

"يا عمـــاار.. حاسس فيني؟ مش راح أمشي قبل م تطلع من تحت الر.دم بستنى ليوم ليومين لسنة لحتى تطلع"

Be safe ***Stay happy*** ***Study hard***