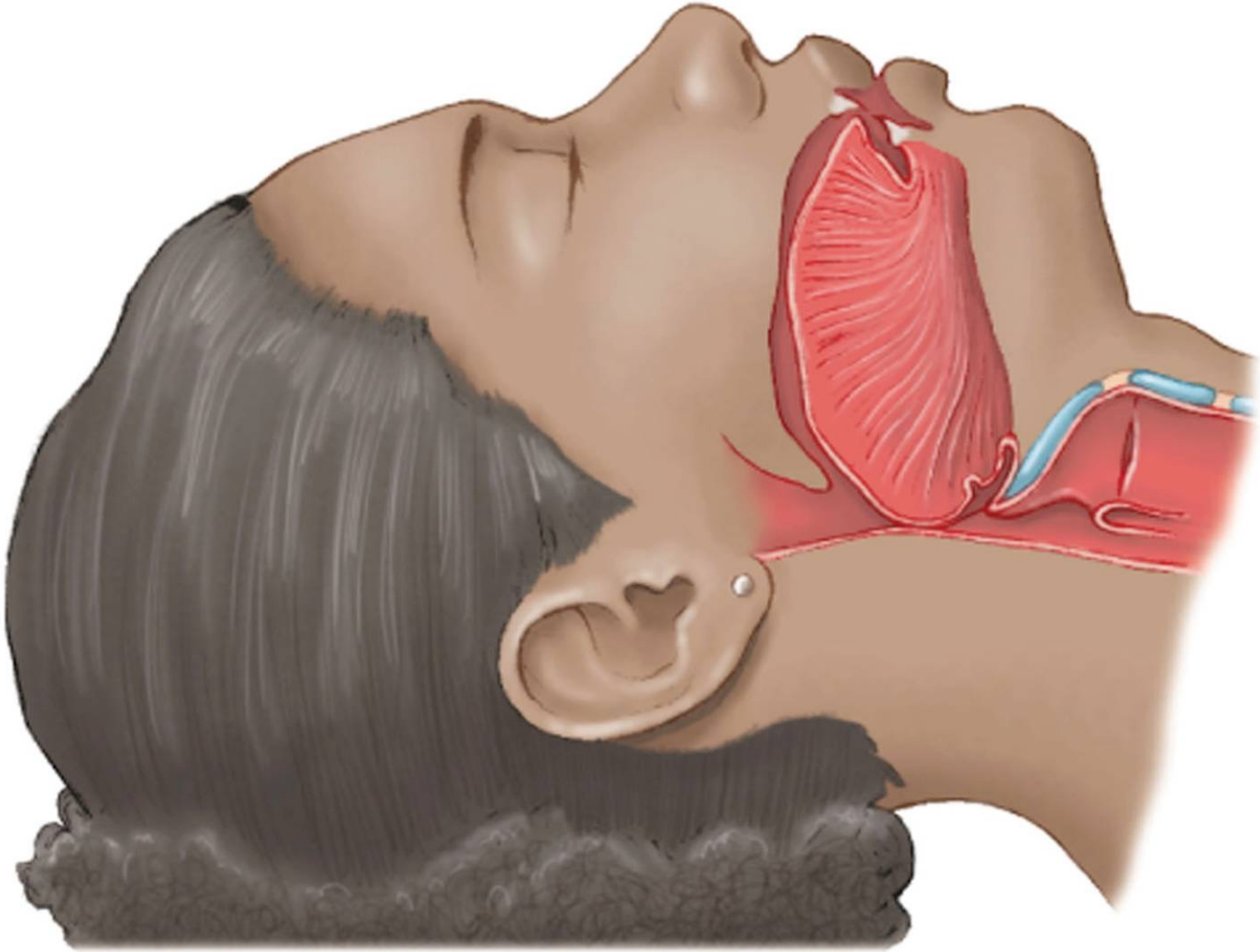
Airway Evaluation & Management

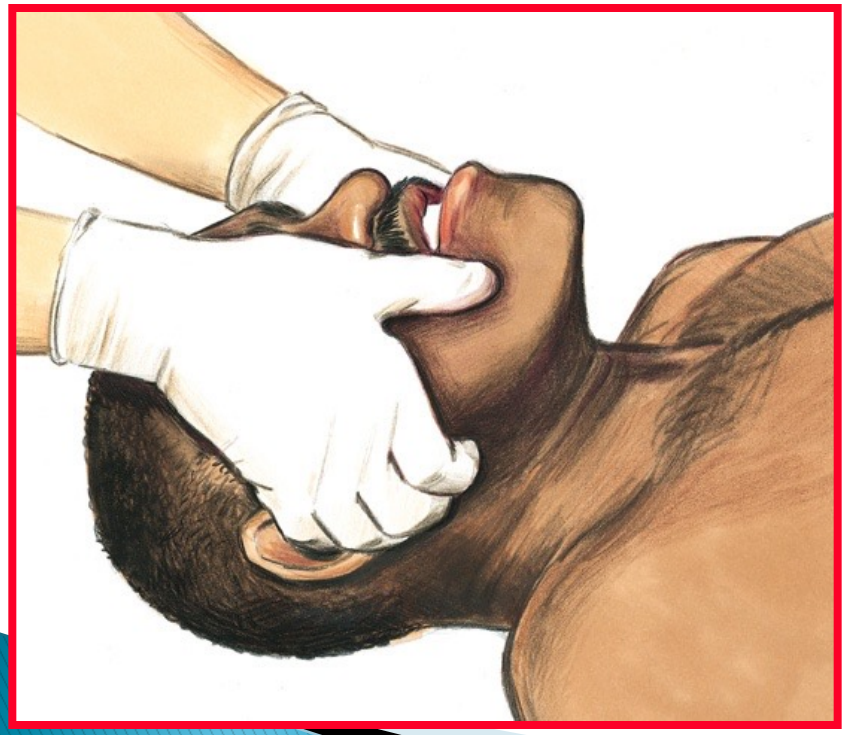
Dr. Abdulaziz Alfadhel
Assistant Professor of Anesthesiology
Consultant Cardiothoracic Anesthesia & Critical care

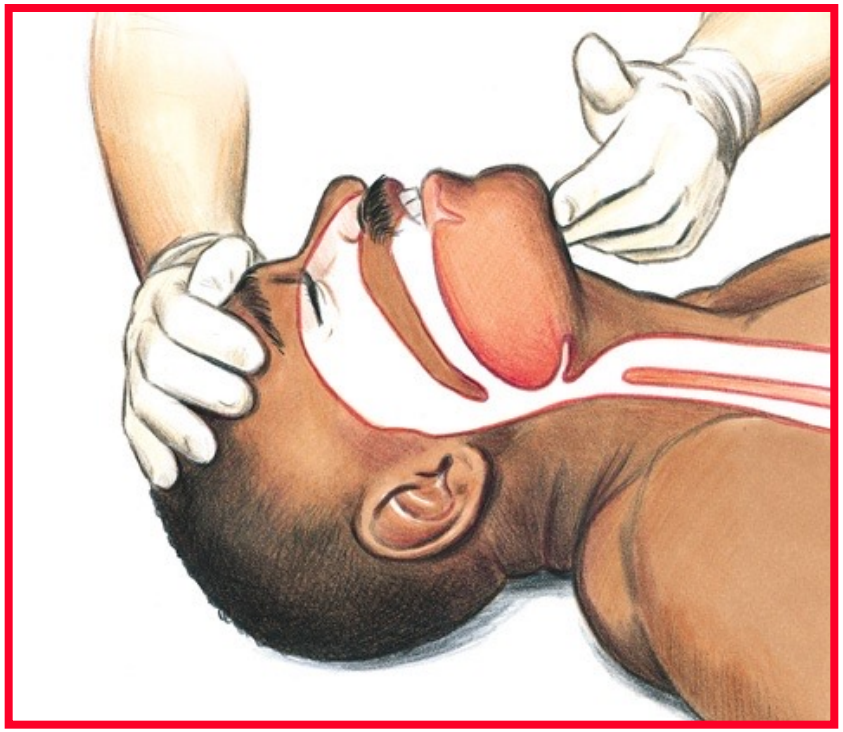
Lecture Objectives

- Describe the applied anatomy of the airway.
- Conduct a preoperative airway assessment .
- Identify a potentially difficult airway.
- Learn about management of airway .
- Become familiar with airway equipment.
- Understand issues around aspiration prophylaxis.

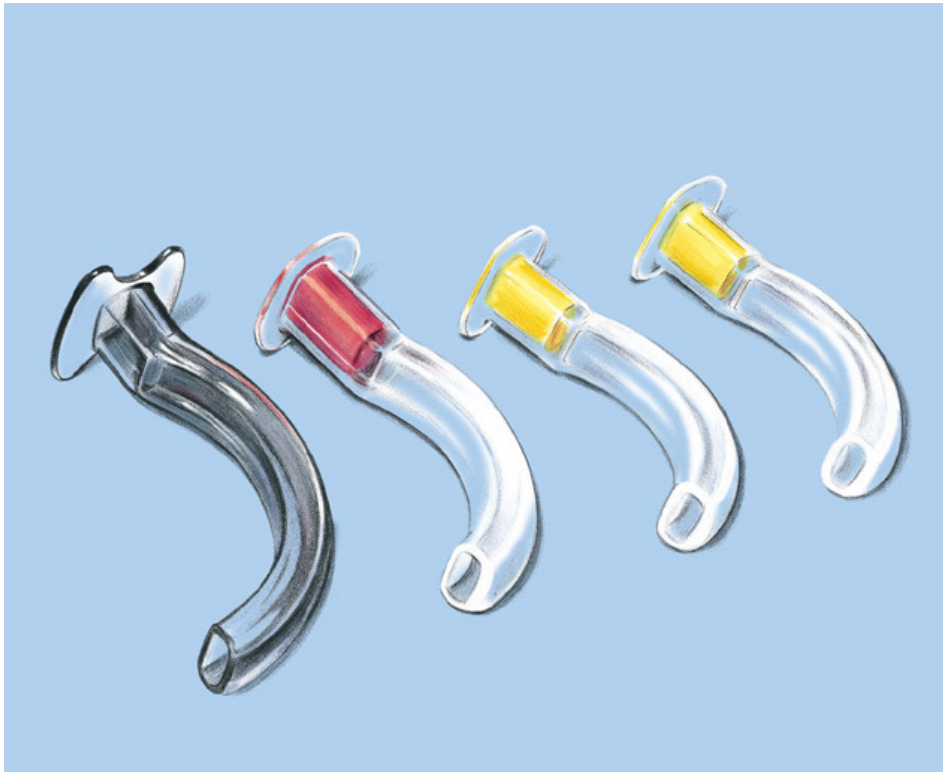


AIRWAY CONTROL



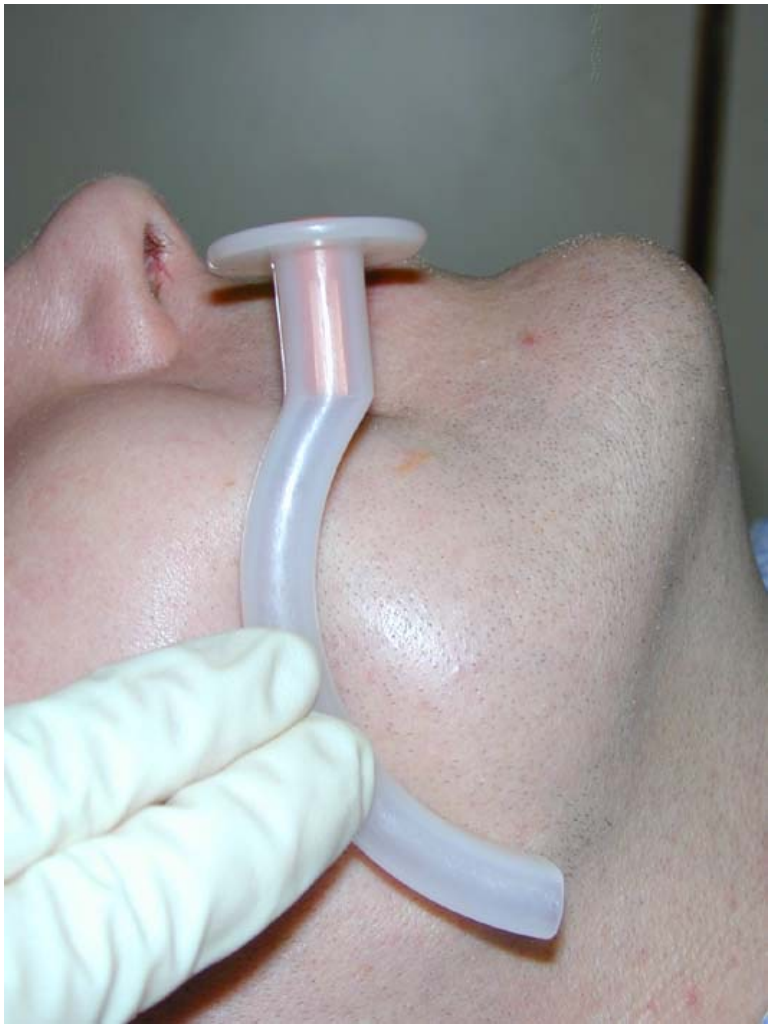


AIRWAY CONTROL

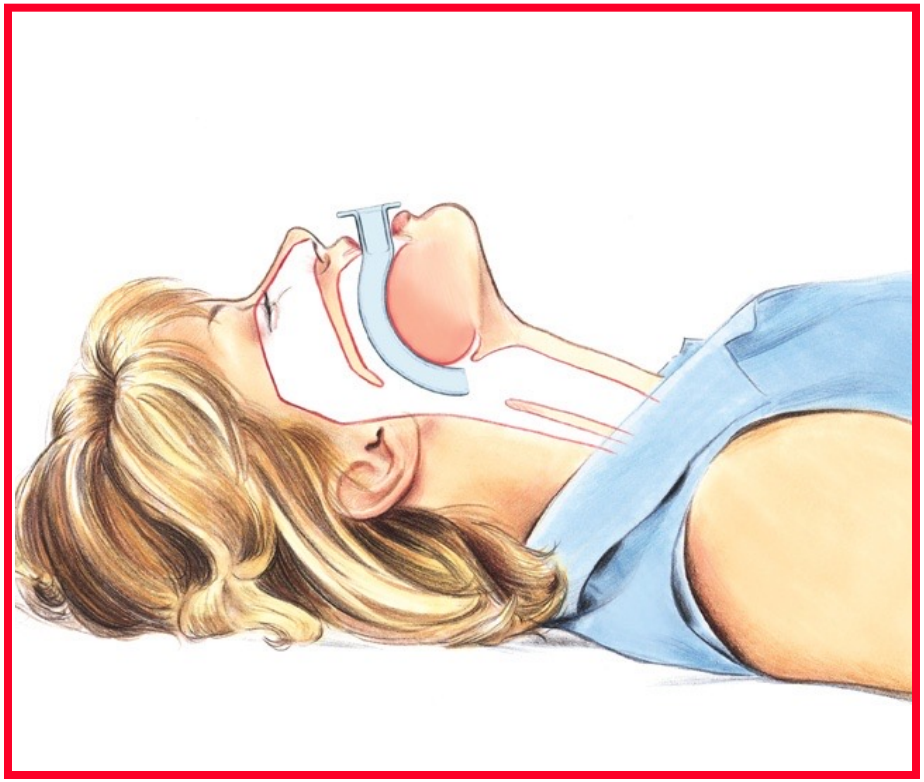


Oral Airway

- Proper size



AIRWAY CONTROL

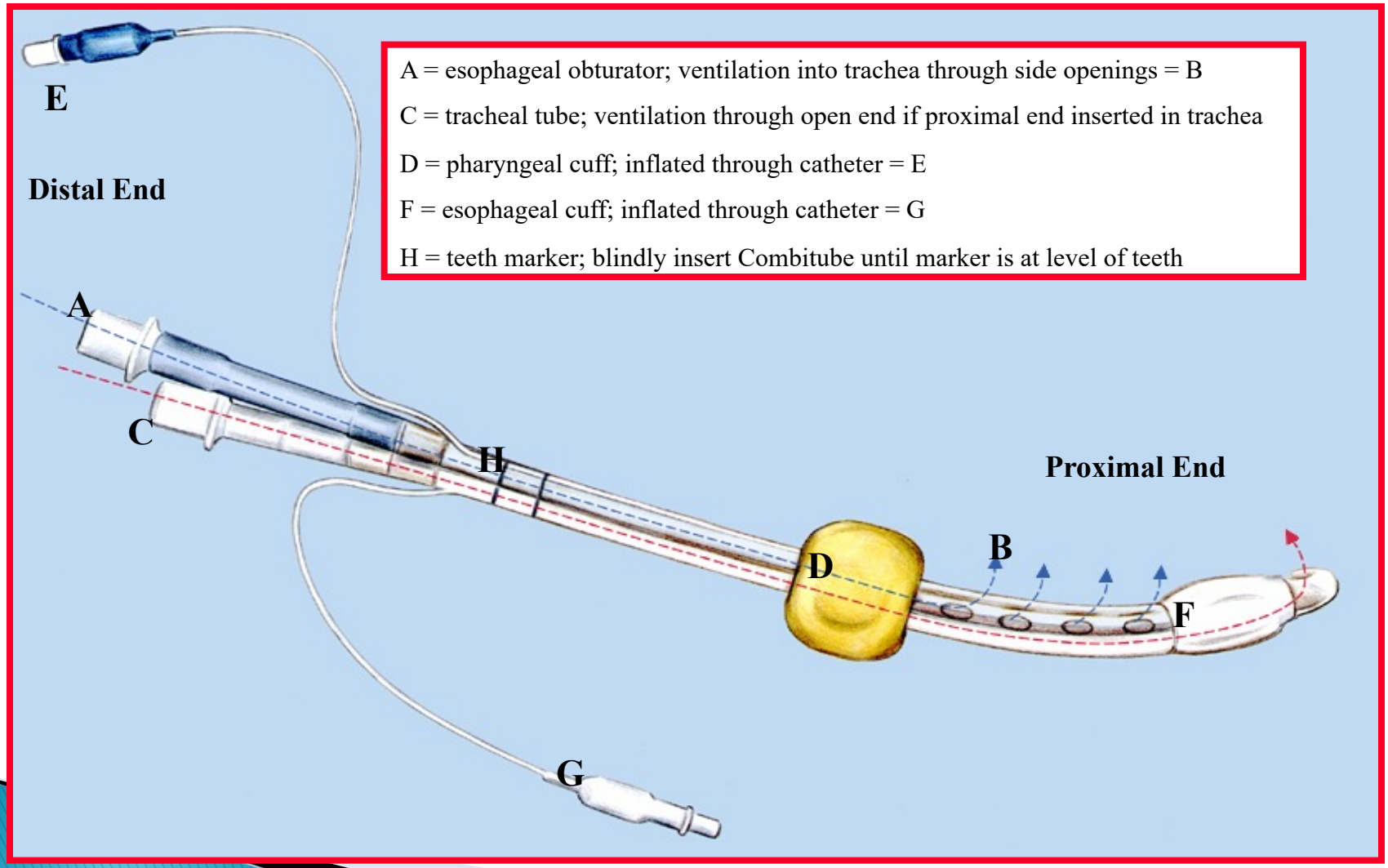


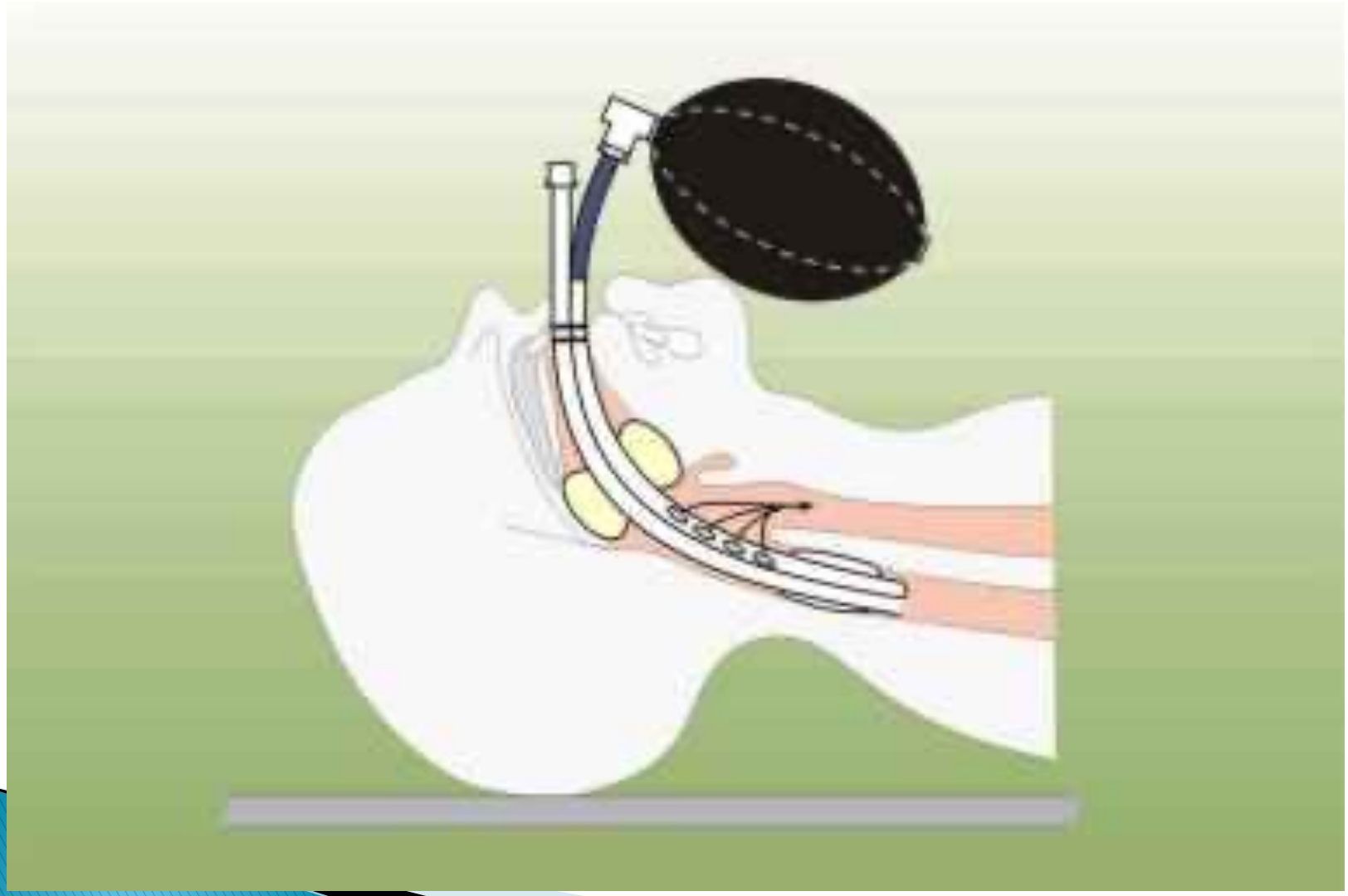
NASAL AIRWAY

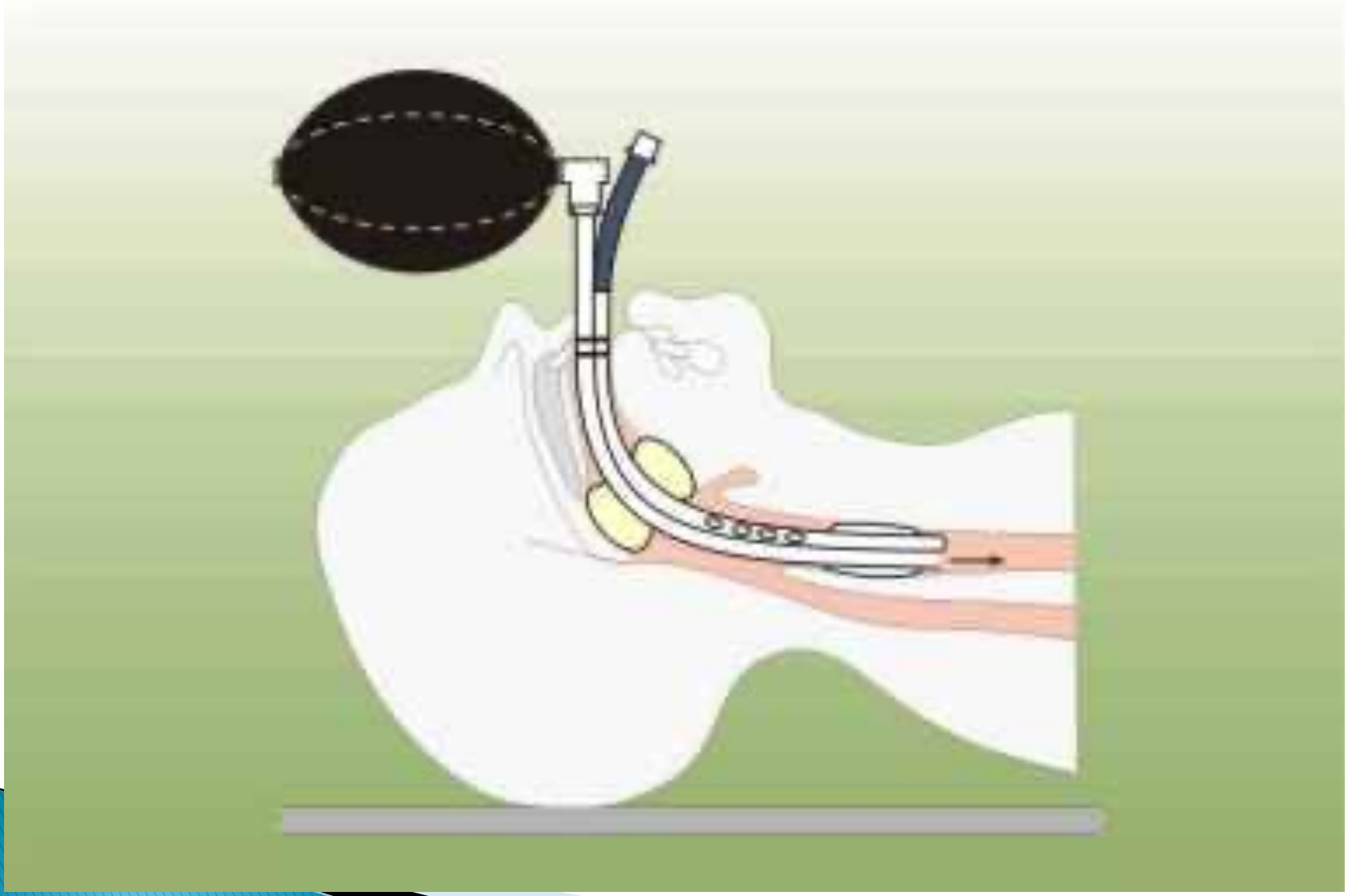
Ambu bag

C-E maneuver

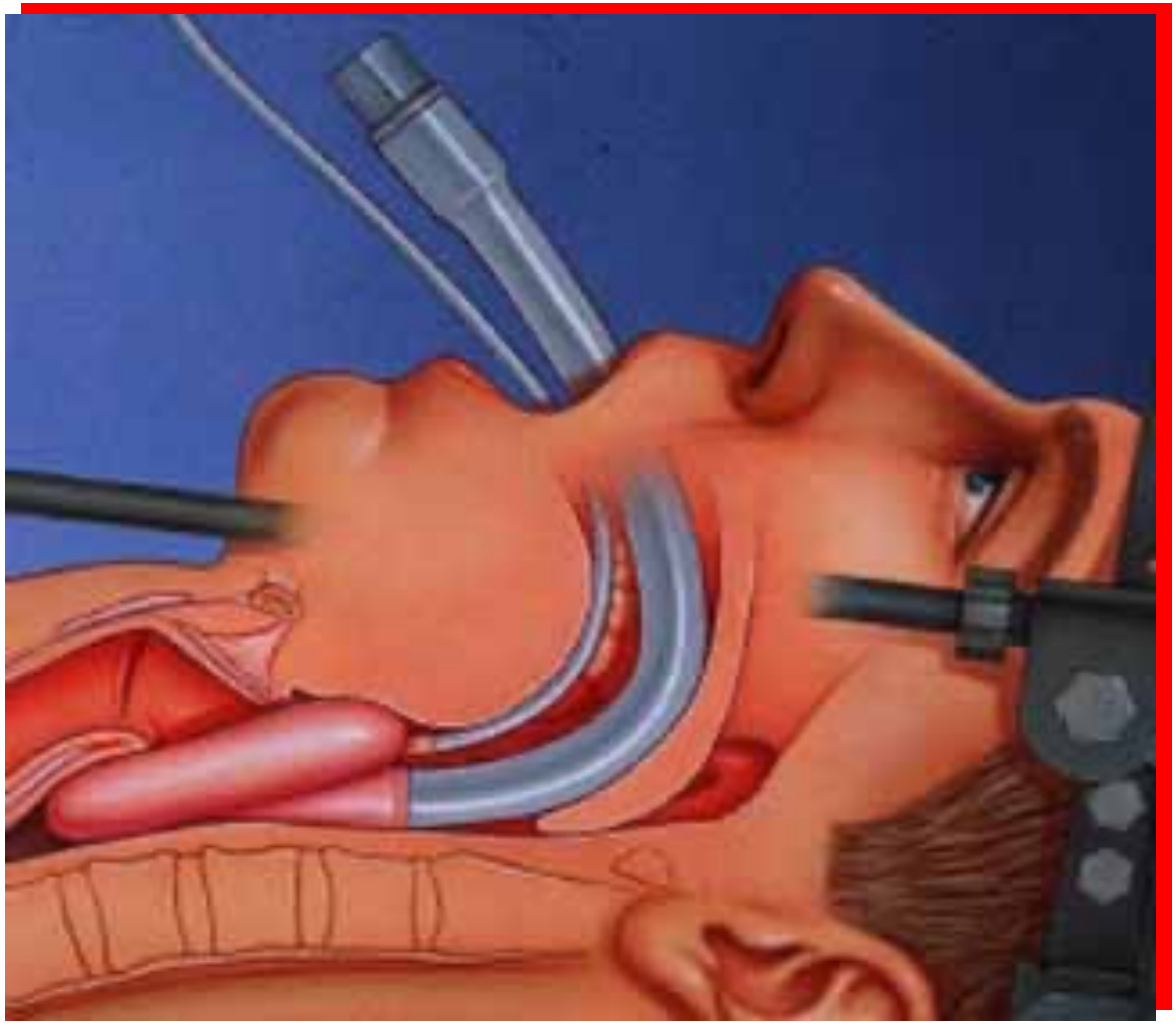
Combitube


A = esophageal obturator; ventilation into trachea through side openings = B
C = tracheal tube; ventilation through open end if proximal end inserted in trachea
D = pharyngeal cuff; inflated through catheter = E
F = esophageal cuff; inflated through catheter = G
H = teeth marker; blindly insert Combitube until marker is at level of teeth
E
Distal End
A
C
H
Proximal End
B
D
F
G



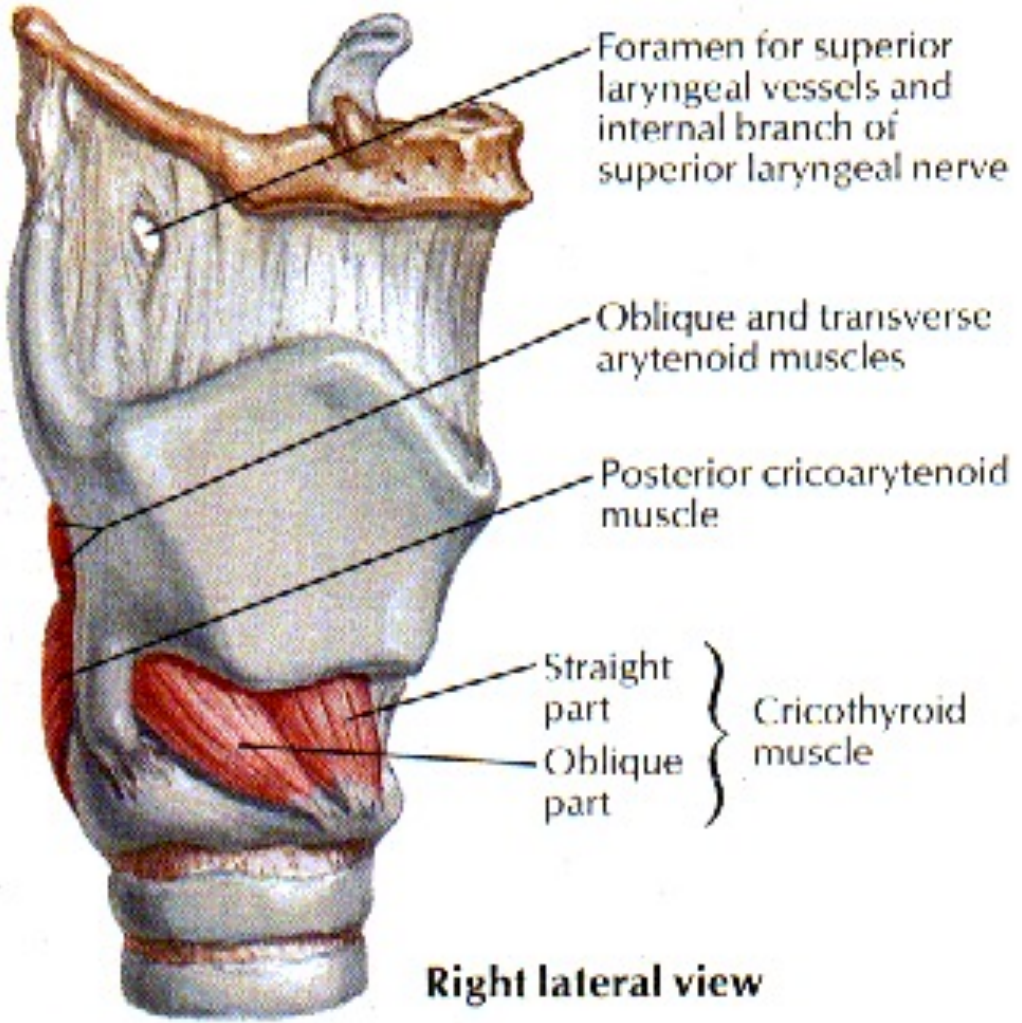


Laryngeal Mask Airway



Airway Anatomy

- Innervation
- Vagus n.
  - Superior laryngeal n.
    - External branch – motor to cricothyroid m.
    - Internal branch – sensory larynx above TVC's
  - Recurrent laryngeal n.
    - Right – subclavian
    - Left – Aortic arch
    - Motor to all other muscles, Sensory to TVC's and trachea



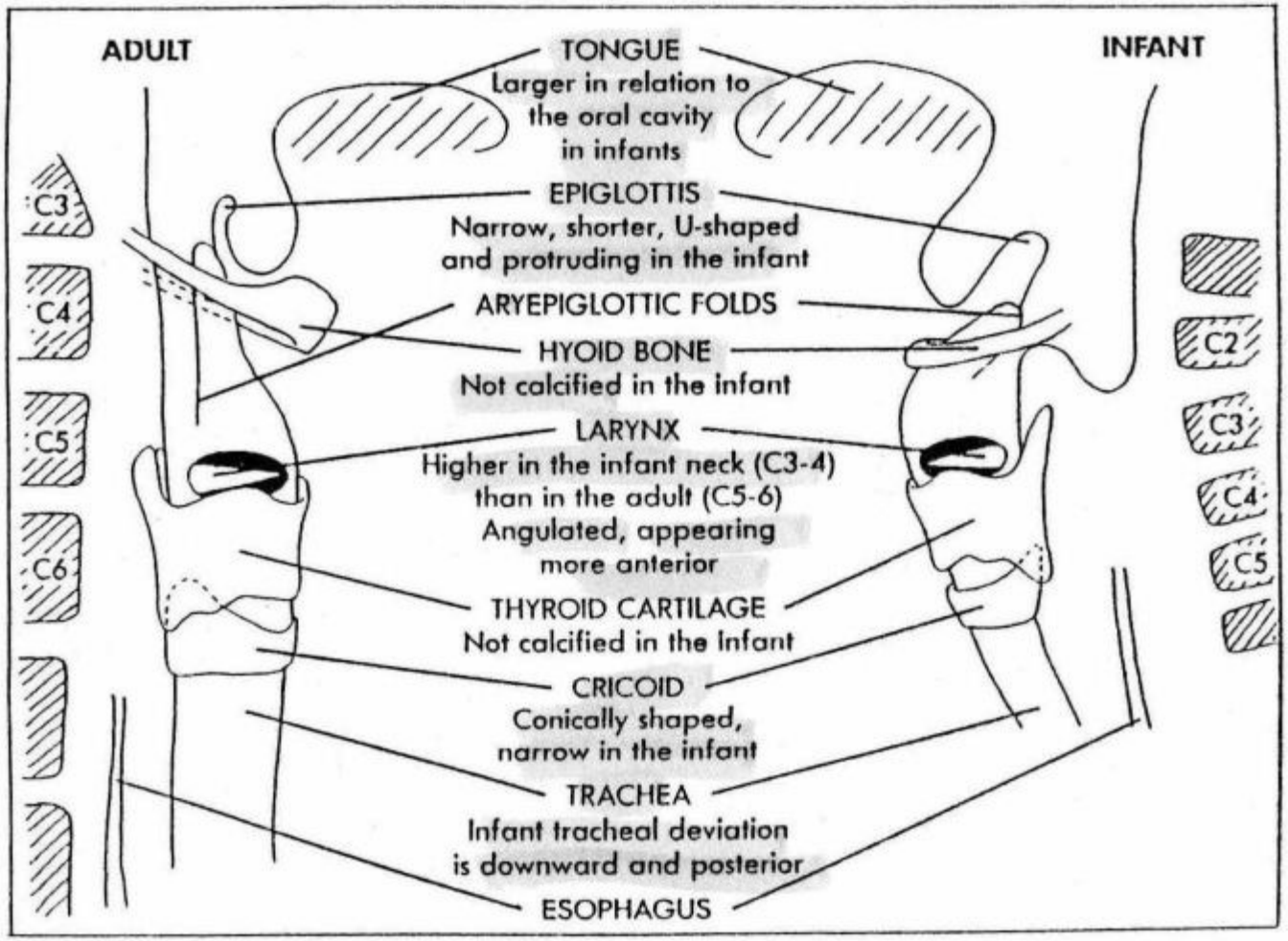
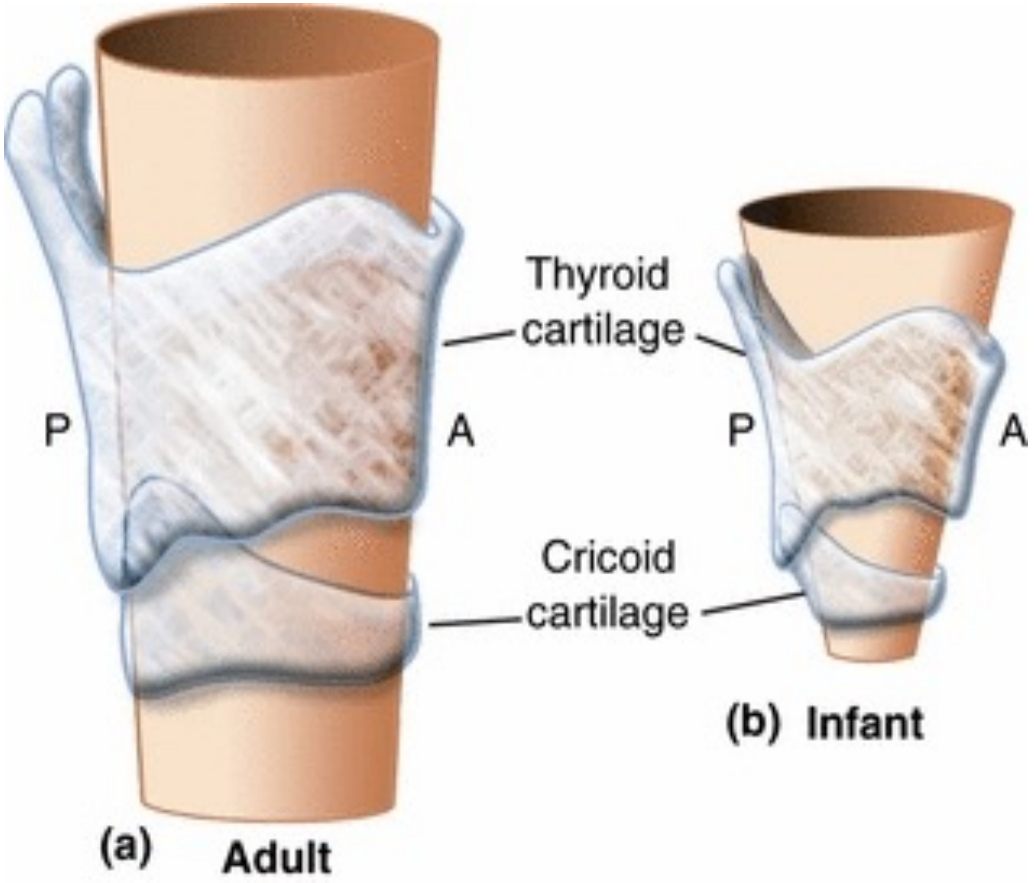


Figure 1. Comparison of adult and infant airway anatomic differences. (*From* Ho M: The Pediatric Airway. *In* Bell C, Hughes C, Oh T (eds): The Pediatric Anesthesia Handbook. St. Louis, Mosby Year Book, 1991, p 130. *Adapted from* Cote CJ, Todres ID: The Pediatric Airway. *In* Ryan JF, et al (eds): A Practice of Anesthesia for Infants and Children. Orlando, Grune & Stratton, 1986; with permission.)

Airway



Indications for intubation

- Airway Protection
- Need for mechanical ventilation
- Lung isolation
- Anticipated decline in clinical status

Management

I-History:

previous history of difficulty is the best predictor

- Nature of difficulty
- Number of trials
- Ability to ventilate
- Maneuver & equipment used
- Complications

II-Obstructive sleep apnea .

III-Predictors of DMV (obese) .

TABLE 14.3 LEMON: airway assessment method

L = Look externally for anatomic feature that may make intubation difficult.

E = Evaluate the 3-3-2 rule.

- — Mouth opening (3 fingerbreadths)
- — Hyoid–chin distance (3 fingerbreadths)
- — Thyroid catilage–floor of mouth distance (2 fingerbreadths)

M = Mallampati score

- — Class I: soft palate, uvula, pillars visible
- — Class II: soft palate, uvula visible
- — Class III: soft palate, base of uvula visible
- — Class IV: hard palate visible

O = Obstruction: examine for partial or complete upper airway obstruction

N = Neck mobility

Reed MJ, Dunn MJ, McKeown DW. Can an airway assessment score predict difficulty at intubation in the emergency department? *Emerg Med J.* 2005;22:99–102.

LEMON

- Look for any obvious anomaly
  - Morbid obesity(BMI)
  - Skull
  - Face
  - Jaw
  - Mouth,teeth
  - Neck

Examination

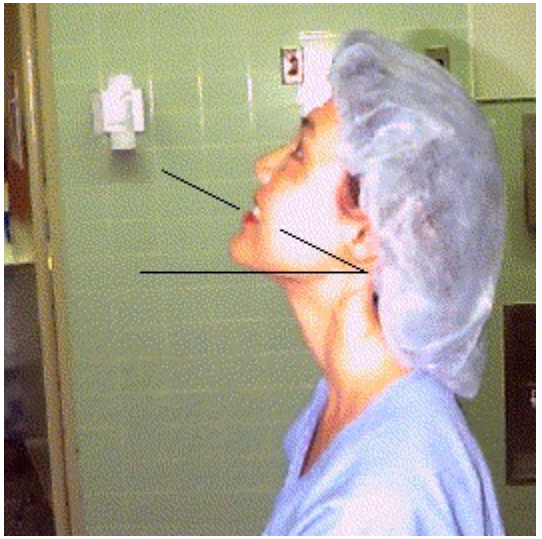
I-The 3 joints movements

- Atlantooccipital joint

(15-20 degrees)

- The cervical spine(range>90)
- T.M joint:

Subluxation (1 finger)

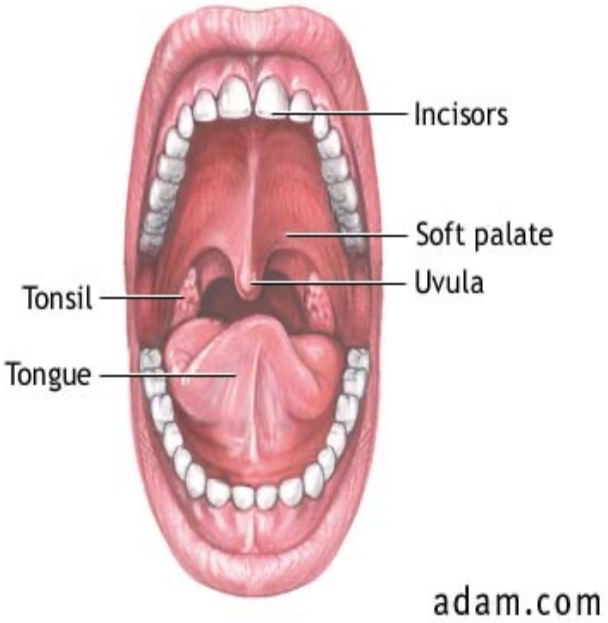


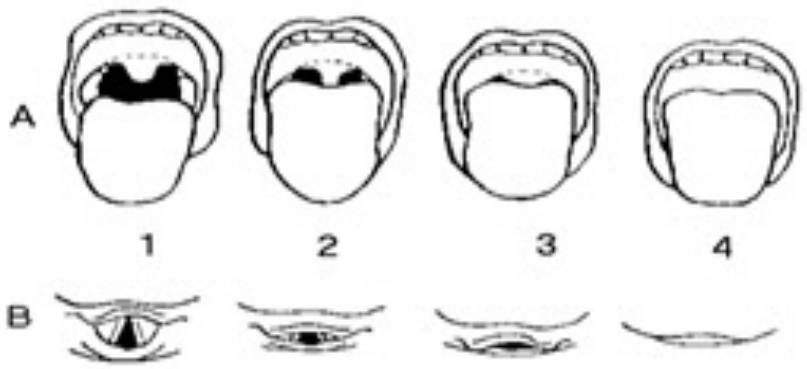
Examination

- Mouth opening: 3 fingers
- Thyromental distance: >6.5cm
- Sternomental distance >12.5cm .

Mallampatti

Based on the hypothesis
That when the base of the
Tongue is disproportionally
Large it will overshadow the
larynx





-Simple easy test,correlates with what is seen during laryngoscopy or Cormack-Lehene grades ,but

1-moderate sensitivity and specificity(12% false +ve)

2-Inter observer variation

3-Phonation increases false negative view

Obstruction

- Apparent cause e.g. goitre
- OSA
- Noisy breathing or stridor
- Signs of upper airway obstruction
- Other causes

Neck Mobility

Prior condition

- Surgery
- Rheumatoid arthritis
- Osteoarthritis
- Short muscular neck .

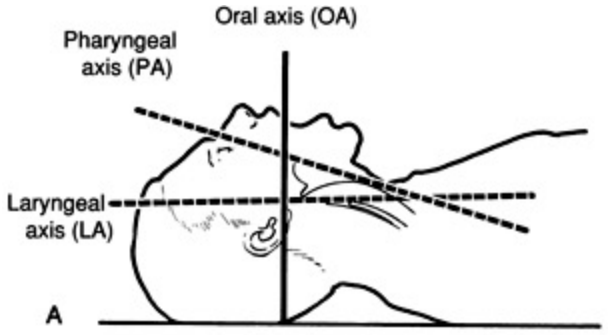
Proper Equipment

-Bag and mask, oxygen source
-Airways adjuncts, and LMA
-Laryngosopes different blades
-ETT proper size
-suction

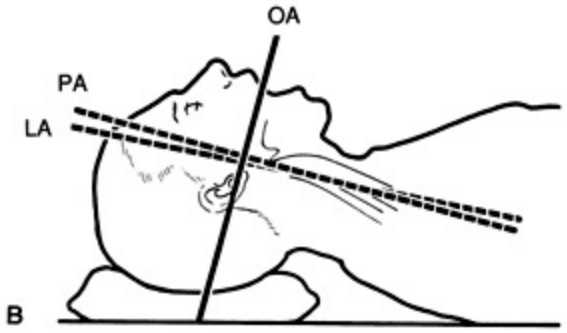
Airway gadgets

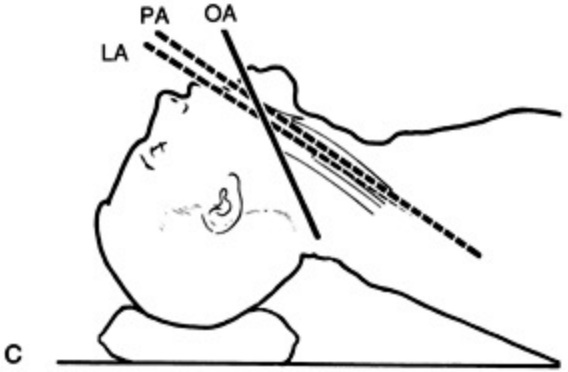
Positioning for successful intubation

Alignment of 3 axes or
Assuming sniffing position



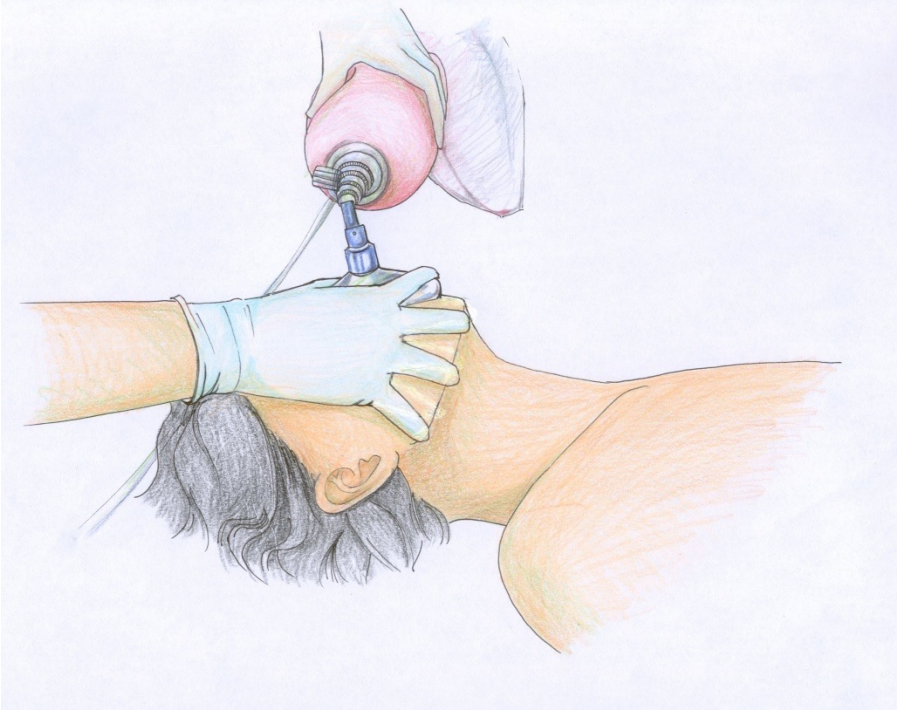
-Any anomaly in these 3 joints
A-O, T-M or C-spine can resu
In difficult intubation





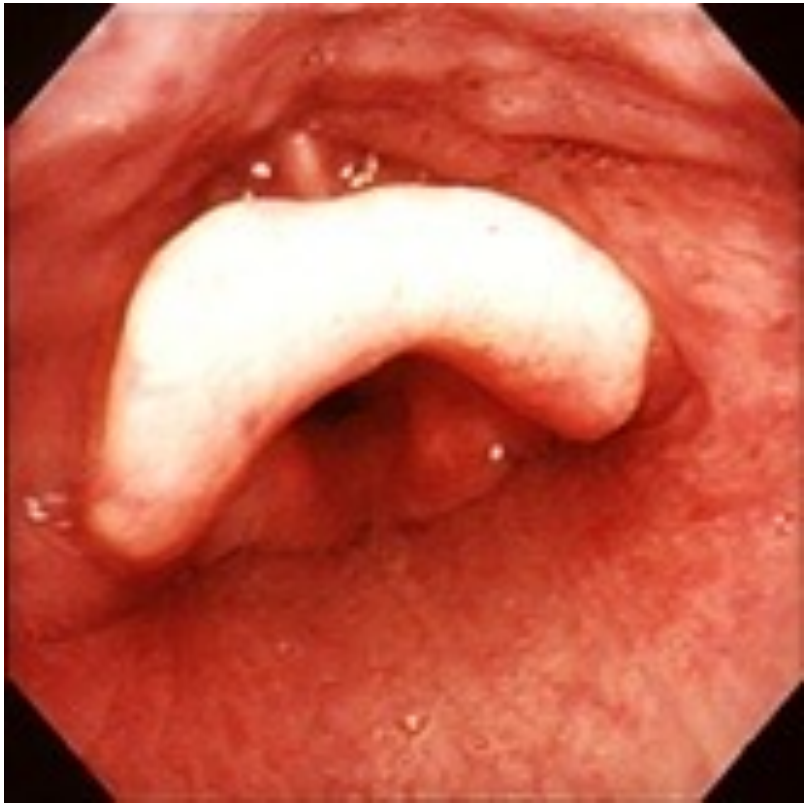
Mask Ventilation

- Induction of anesthesia produces upper airway relaxation and possible collapse



Endotracheal Intubation

- https://youtu.be/8AOB2PtHfVM



Confirm tube position

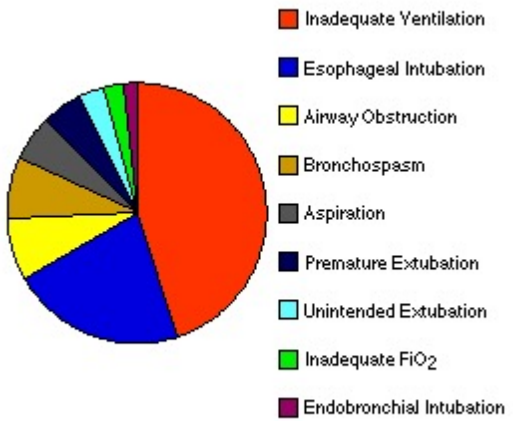
- Direct visualization of ETT between cords
- Continuous trace of capnography
- 3 point auscultation
- Bronchoscopy
- Esophageal detector device
- bilateral chest movement, mist in the tube, and CXR

Rapid sequence induction

- Indications
- Technique:
  - -Preoxygenation
  - -IV induction
  - -Cricoid pressure ?
  - -Intubate, inflate the cuff ,confirm position
  - -Release cricoid and fix the tube

Complications of intubation

1-Inadequate ventilation
2-Esophageal intubation
3-Airway obstruction
4-Bronchospasm
5-Aspiration
6- Trauma
7- Sympathatic response



Problems with ETT and Cuff

- ❑ Too long – endobronchial intubation
- ❑ Too short – accidental extubation
- ❑ Too large – trauma to surrounding tissues
- ❑ Too narrow – increased airway resistance
- ❑Too soft – kinks
- ❑ Too hard – tissue damage
- ❑ Prolonged placement – vocal cord granulomas, tracheal stenosis
- ❑ Poor curvature – difficult to intubate
- ❑ Cuff insufficiently inflated – allows leaking and aspiration
- ❑ Cuff excessively inflated – pressure necrosis

Difficult airway

- Causes

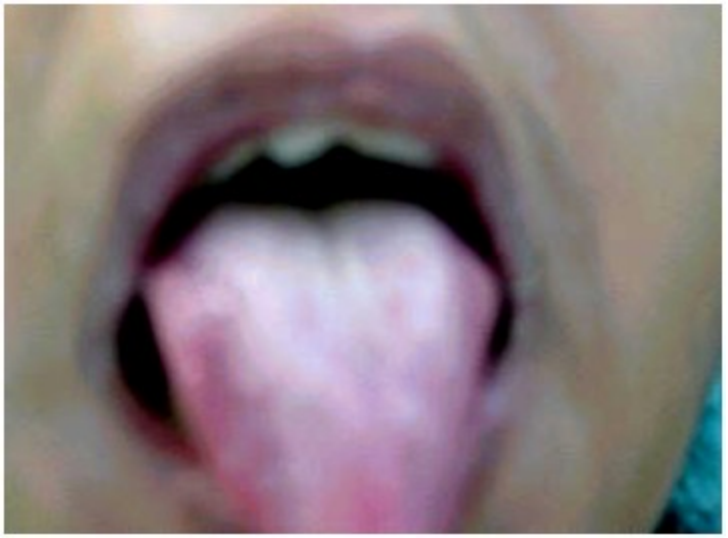
-Congenital

-Acquired

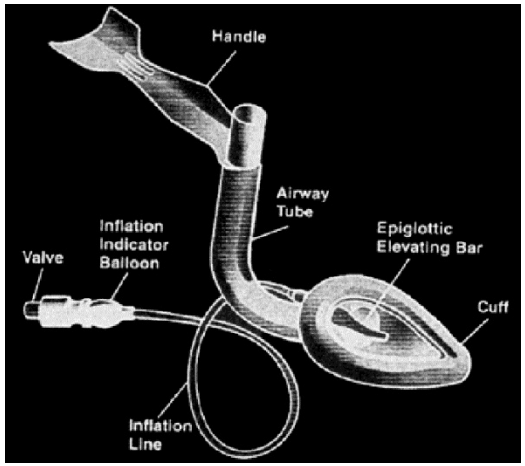
Difficult intubation

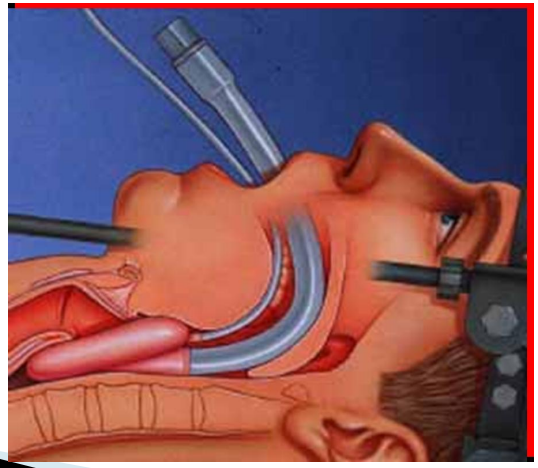
- Malampatti grade 4

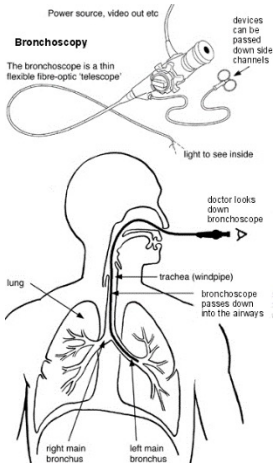
Treacher-Collins syndrome



Difficult Airway gadgets







Rigid Fiberoptic Scope

Bullard

Wu Scope

Rigid Fiberoptic Scope

Upsher

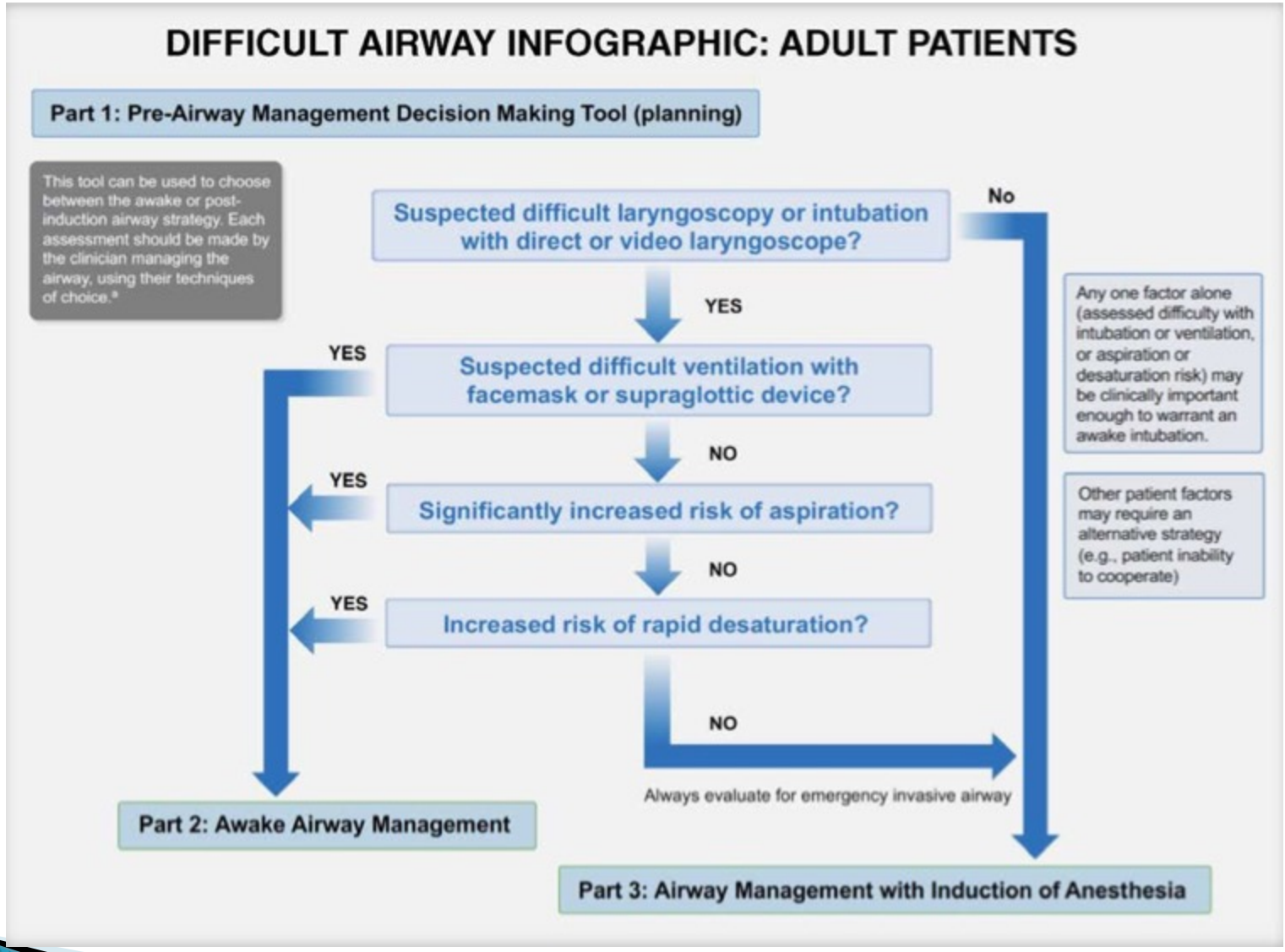
GlideScope

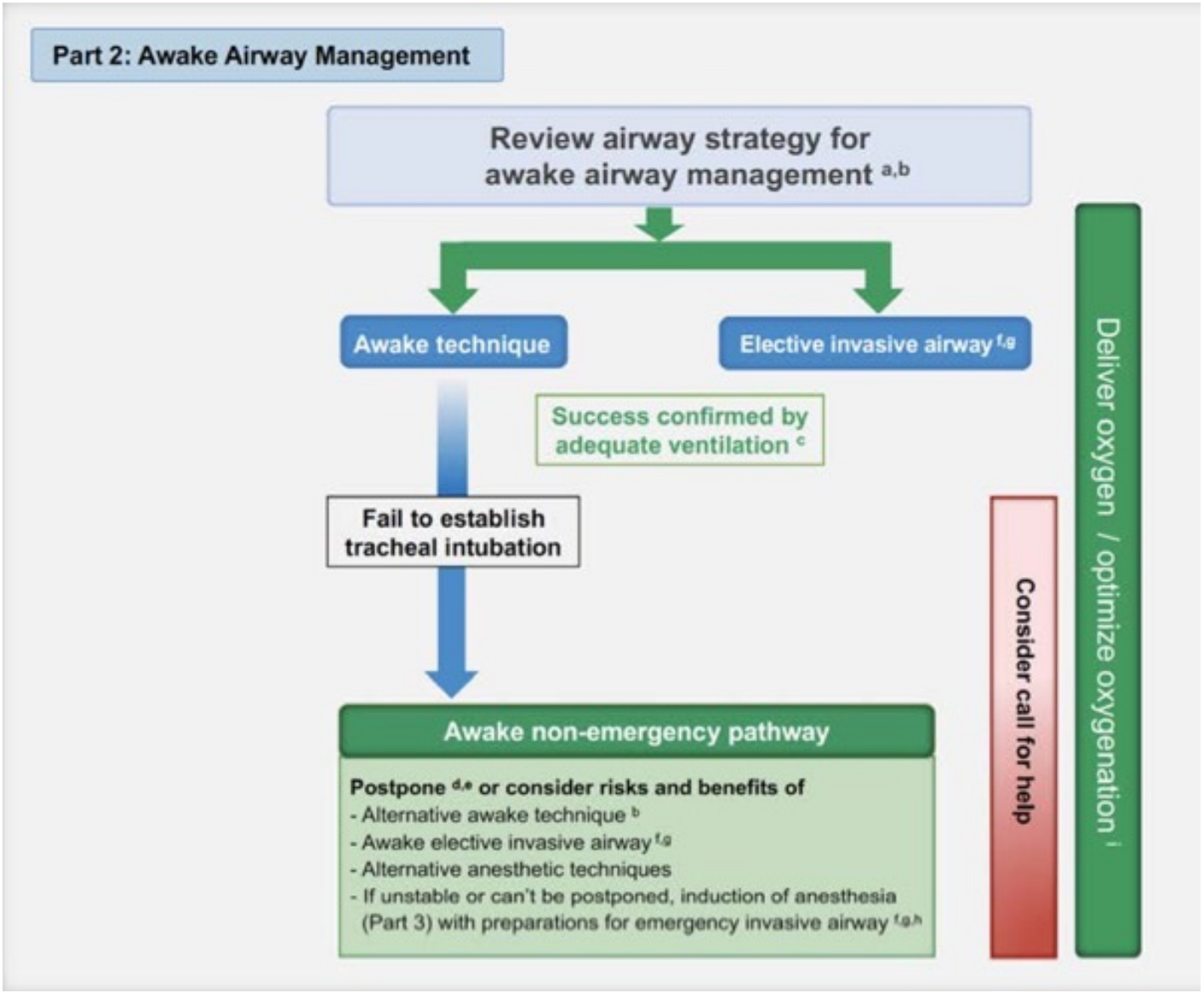
Management of Difficult airway

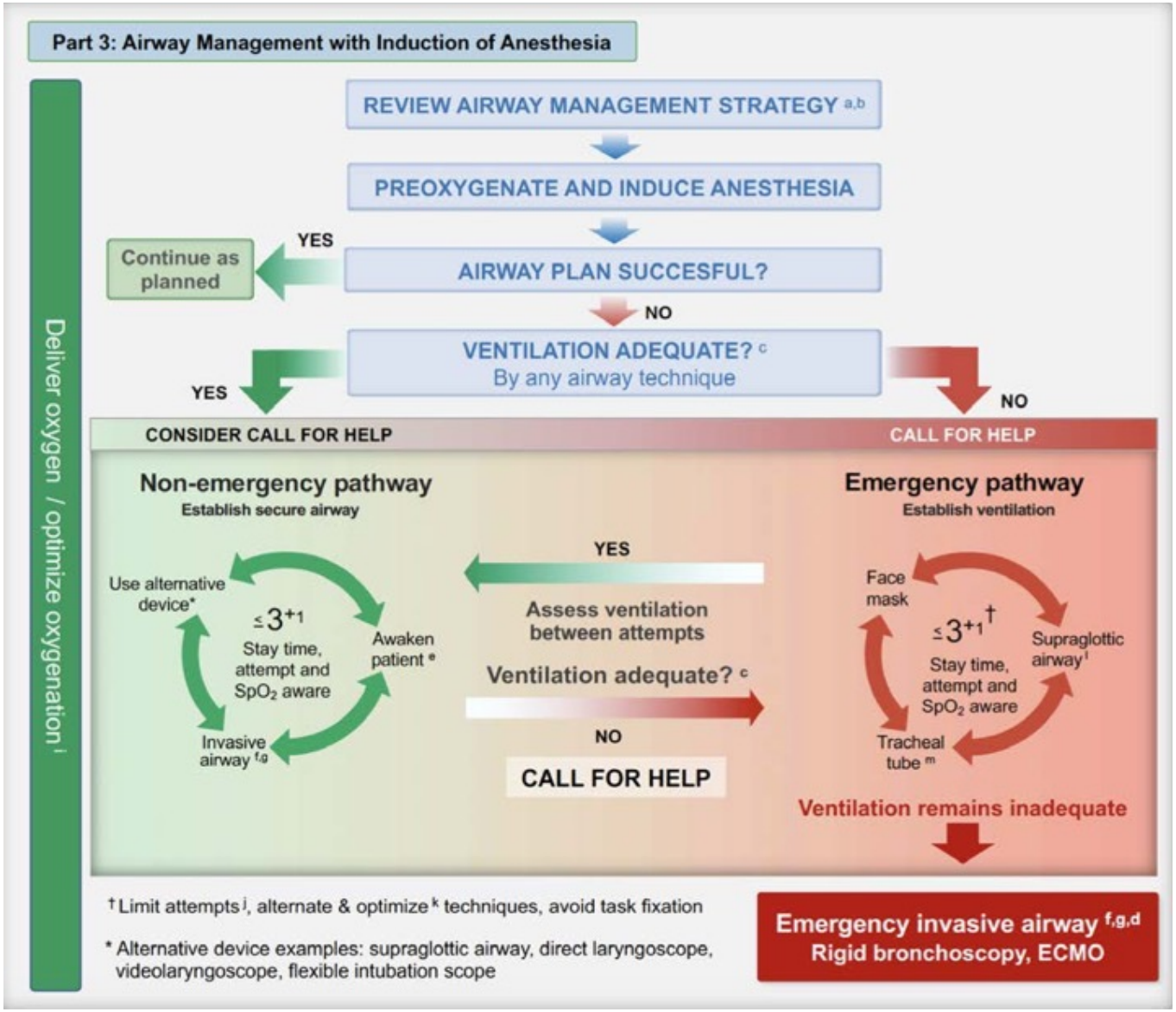
- Anticipated from history, examination

- Unexpected

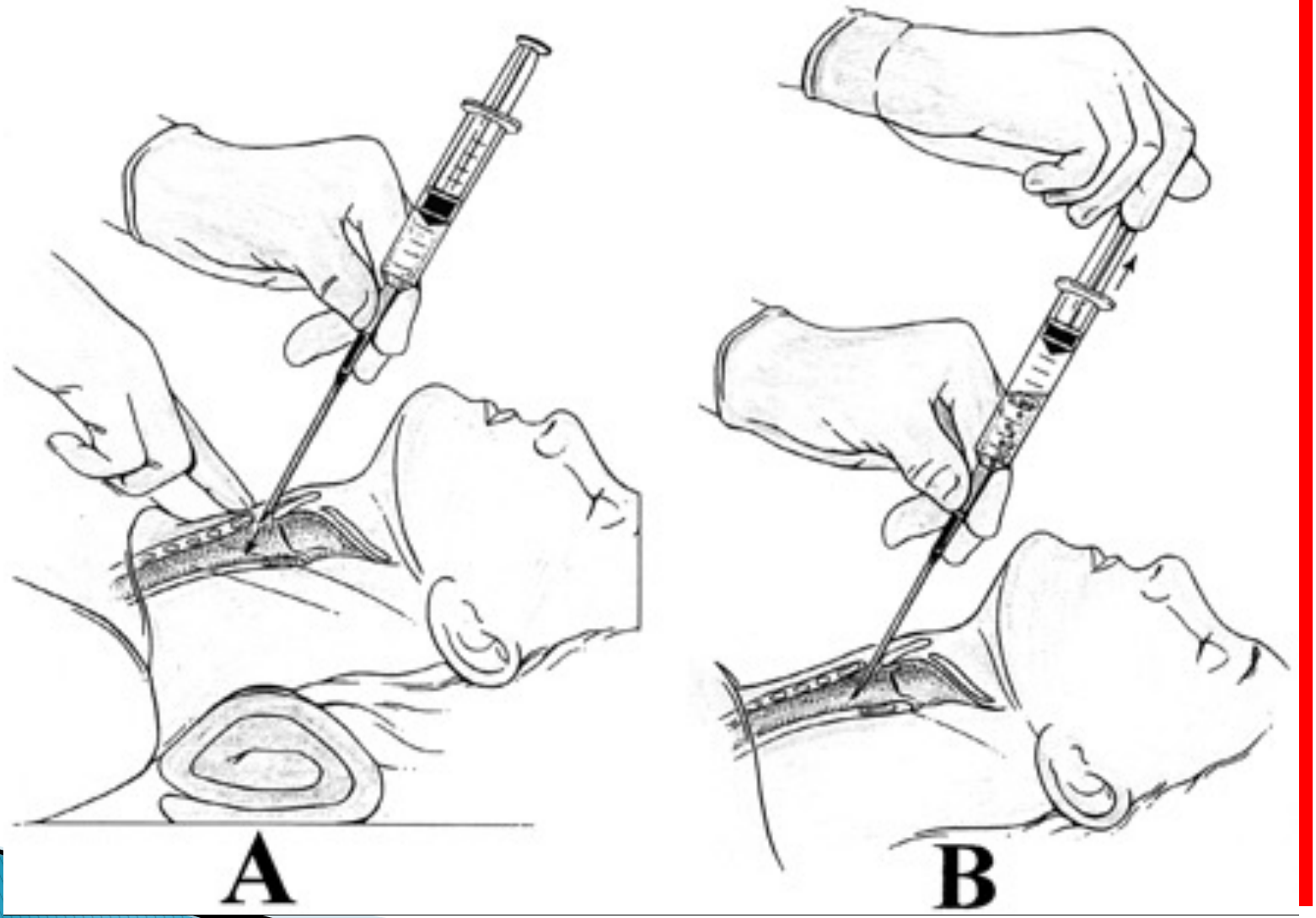
  Priority to maintain patent airway and ventilate the patient safely


DIFFICULT AIRWAY INFOGRAPHIC: ADULT PATIENTS
Part 1: Pre-Airway Management Decision Making Tool (planning)
This tool can be used to choose between the awake or post-induction airway strategy. Each assessment should be made by the clinician managing the airway, using their techniques of choice.a
Suspected difficult laryngoscopy or intubation with direct or video laryngoscope?
No
YES
Suspected difficult ventilation with facemask or supraglottic device?
YES
NO
Significantly increased risk of aspiration?
YES
NO
Increased risk of rapid desaturation?
YES
NO
Any one factor alone (assessed difficulty with intubation or ventilation, or aspiration or desaturation risk) may be clinically important enough to warrant an awake intubation.
Other patient factors may require an alternative strategy (e.g., patient inability to cooperate)
Always evaluate for emergency invasive airway
Part 2: Awake Airway Management
Part 3: Airway Management with Induction of Anesthesia


Part 2: Awake Airway Management
Review airway strategy for awake airway management a,b
Awake technique
Elective invasive airway f,g
Success confirmed by adequate ventilation c
Fail to establish tracheal intubation
Awake non-emergency pathway
Postpone d,e or consider risks and benefits of
- Alternative awake technique b
- Awake elective invasive airway f,g
- Alternative anesthetic techniques
- If unstable or can't be postponed, induction of anesthesia (Part 3) with preparations for emergency invasive airway f,g,h
Consider call for help
Deliver oxygen / optimize oxygenation i


Part 3: Airway Management with Induction of Anesthesia
Deliver oxygen / optimize oxygenation [i]
REVIEW AIRWAY MANAGEMENT STRATEGY [a,b]
PREOXYGENATE AND INDUCE ANESTHESIA
AIRWAY PLAN SUCCESFUL?
YES
Continue as planned
NO
VENTILATION ADEQUATE? [c]
By any airway technique
YES
NO
CONSIDER CALL FOR HELP
CALL FOR HELP
Non-emergency pathway
Establish secure airway
Use alternative device*
≤3+1
Stay time, attempt and SpO2 aware
Awaken patient [e]
Invasive airway [f,g]
YES
Assess ventilation between attempts
Ventilation adequate? [c]
NO
CALL FOR HELP
Emergency pathway
Establish ventilation
Face mask
≤3+1 †
Stay time, attempt and SpO2 aware
Supraglottic airway [l]
Tracheal tube [m]
Ventilation remains inadequate
† Limit attempts [j], alternate & optimize [k] techniques, avoid task fixation
* Alternative device examples: supraglottic airway, direct laryngoscope, videolaryngoscope, flexible intubation scope
Emergency invasive airway [f,g,d]
Rigid bronchoscopy, ECMO

Transtracheal Jet Ventilation



Ventilation

- Spontaneous ventilation
- Controlled ventilation

Pressure or volume cycled ventilation

- Tidal volume 4-6 ml/kg
- Respiratory rate
- I:E ratio
- PEEP
- Oxygen concentration

Recommendations

- Adequate airway assessment to pick up expected D.A to be secured awake
- Difficult intubation cart always ready
- Pre oxygenation as a routine

- Maintenance of oxygenation not the intubation should be your aim
- Use the technique you are familiar with
- Always have plan B,C,D in unexpected D.A

EXTUBATION

- check that neuromuscular function and hemodynamic status is normal
- check that patient is breathing spontaneously with adequate rate and tidal volume
- allow patient to breathe 100% O2 for 3-5 minutes
- suction secretions from pharynx
- deflate cuff, remove ETT on inspiration (vocal cords abducted)
- ensure patient breathing adequately after extubation
- ensure face mask for O2 delivery available
- proper positioning of patient during transfer to recovery room, e.g. sniffing position, side lying.

Oxygen delivery systems:

- ***Nasal cannulae***
  - inspired oxygen concentration is dependent on the oxygen flow rate, the nasopharyngeal volume and the patient's inspiratory flow rate.
  - Increases inspired oxygen concentration by 3-4%
  .
  - Oxygen flow rates greater than 3 liters are poorly tolerated by patients due to drying and crusting of the nasal mucosa.

Nasal cannulae

I L/min:	21%to24%
2 L/min:	25% to 28%
3L/min:	29%to32%
4L/min:	33%to36%
5 L/min:	37% to 40%
6L/min:	41%to44%

- ***Face masks :***
  - Three types of facemask are available; open, Venturi, non-rebreathing.

- ***Open facemasks :***
  - Are the most simple of the designs available.
  - They do not provide good control over the oxygen concentration being delivered to the patient causing variability in oxygen treatment.
  - A 6l/min flow rate *is the minimum* necessary to prevent the possibility of rebreathing.
  - Maximum inspired oxygen concentration ~ 50-60%.

Venturi facemasks

- They should be used in patients with COPD/emphysema where accurate oxygen therapy is needed.

- Masks are available for delivering 24%, 28%, 35%, 40%, 50%.

- Non-rebreathing facemasks
  - have an attached reservoir bag and one-way valves on the sides of the facemask.
  - With flow rates of 10 liters an oxygen concentration of 95% can be achieved.
  - These masks provide the highest inspired oxygen concentration for non-intubated patients.

Reference book and the relevant page numbers..

American Society of Anesthesiologists (http://www.asahq.org/publicationsServices.htm), accessed January 30, 2006.

Anesthesia Patient Safety Foundation (http://www.apsf.org) accessed January 30, 2006.

Cooper JB, Gaba DM. A strategy for preventing anesthesia accidents. Int Anesthesiol Clin 1989;27:148â€“152.

Cooper JB, Newbower RS, Kitz RJ. An analysis of major errors and equipment failures in anesthesia management: considerations for prevention and detection. Anesthesiology 1984;60:34â€“42.

Gaba DM. Anaesthesiology as a model for patient safety in health care. BMJ 2000;320:785-–788. Available at: http://www.bmj.com/cgi/content/full/320/7237/785.