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Airway Management

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Disclaimer:

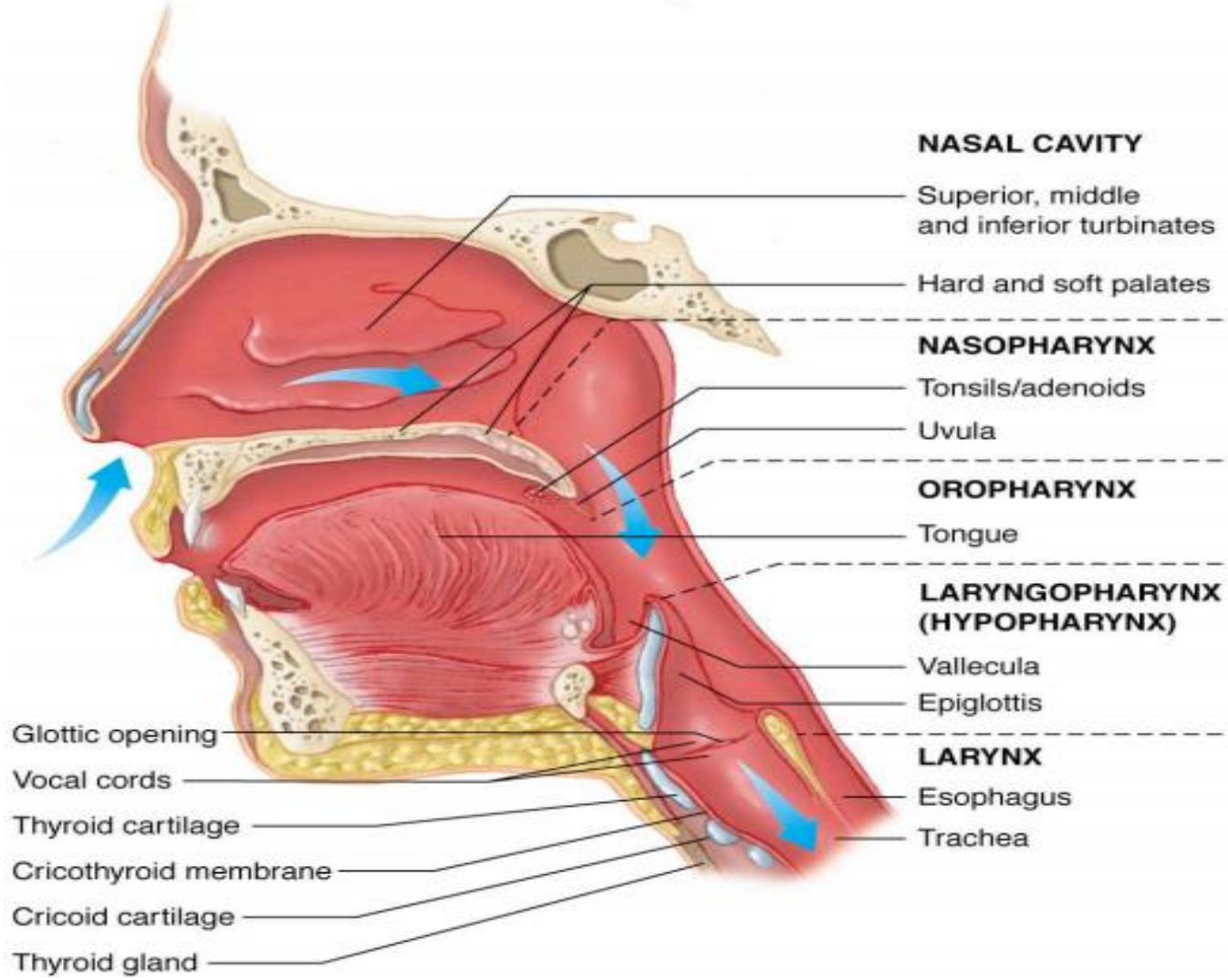
~~Support from Medical Suppliers~~

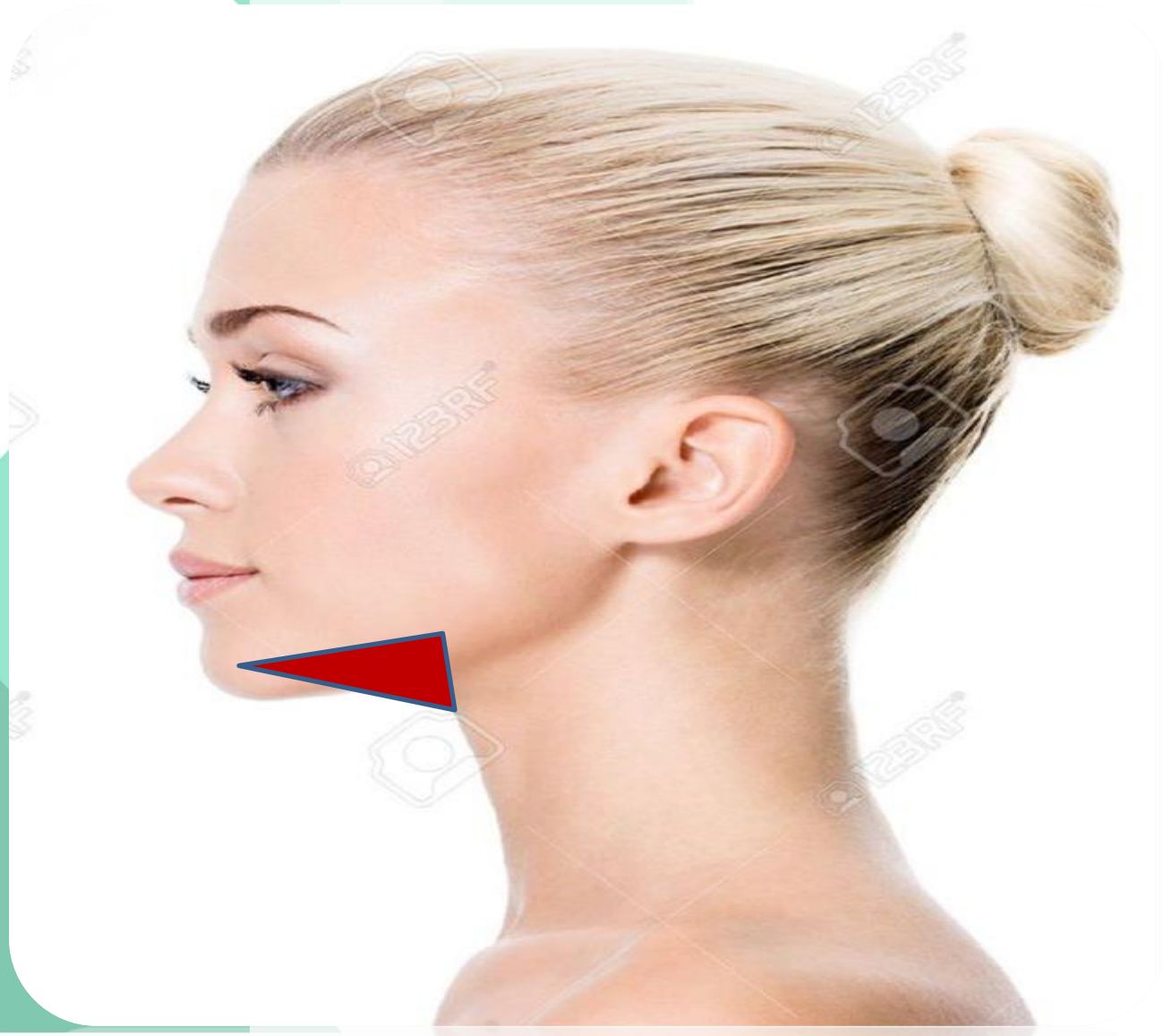
Objectives

- To make a rapid and complete assessment of the airway
- To secure the airway using the most reliable method
- To be familiar with algorithms for difficult airway management

Assessment of the Airway

- Anatomy





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Mallampati Scoring System

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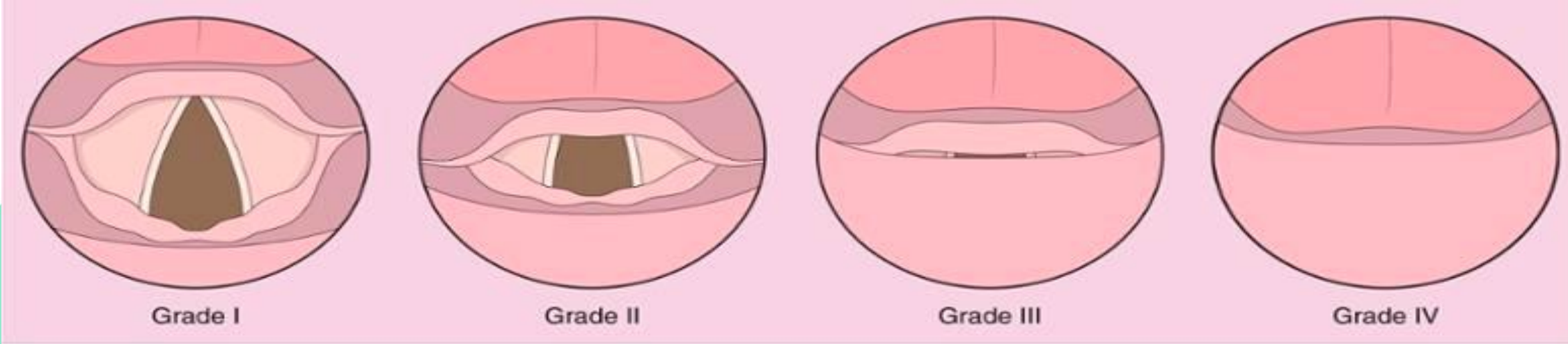
Class 1 Class 2 Class 3 Class 4

Class 1; soft palate, fauces, uvula, pillars
Class 2; soft palate, fauces, portion of uvula
Class 3; soft palate, base of uvula
Class 4; hard palate only

Cormack-Lehane Classification System



Grade 1: Full exposure of glottis

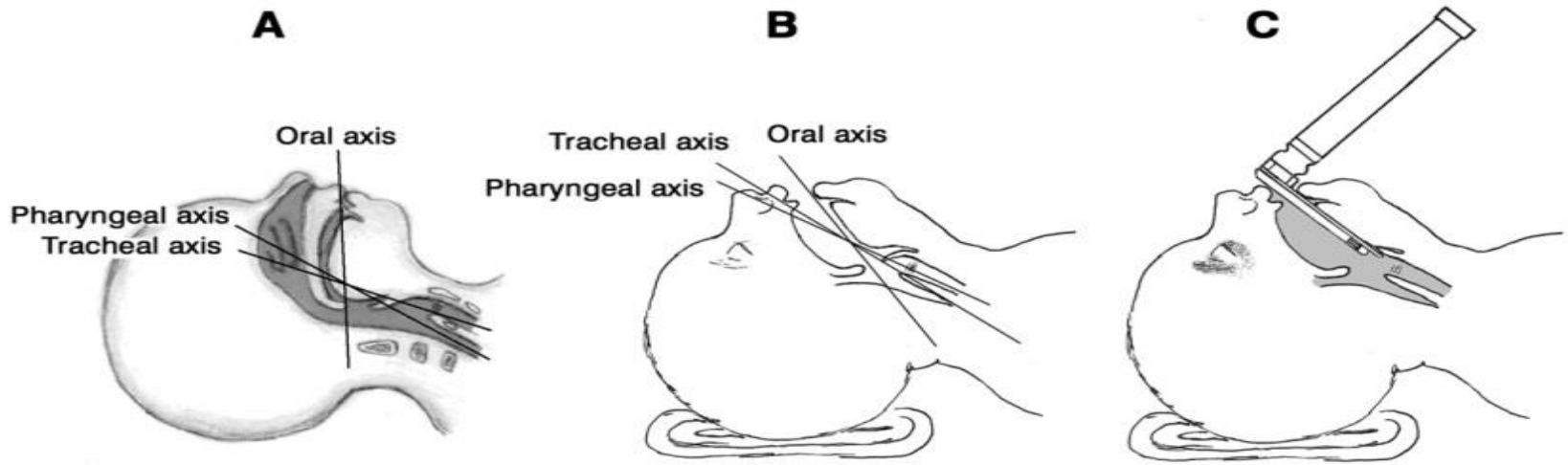
Grade 2: Anterior commissure not visualized

Grade 3: Epiglottis only

Grade 4: No glottic structure visible.

Atlanto-occipital movement

- It assesses feasibility to make sniffing or Magill position for intubation i.e. alignment of oral, pharyngeal and laryngeal axes into an arbitrary straight line.



Predictors of difficult face mask ventilation

- Obese
- Bearded
- Elderly (older than 55 years)
- Snorers
- Edentulous

Mnemonics (M-O-A-N-S)

1. Difficult Bag-Mask Ventilation (MOANS)

Mask seal	Bushy beards, crusted blood on the face, or disruption of lower facial continuity
Obesity / Obstruction	Obesity, pregnancy, angioedema, Ludwig's angina, upper airway abscess, epiglottitis
Age	Age > 55
No teeth	May leave denture in edentulous patients.
Sleep apnea / Stiff lungs	COPD, asthma, ARDS, others

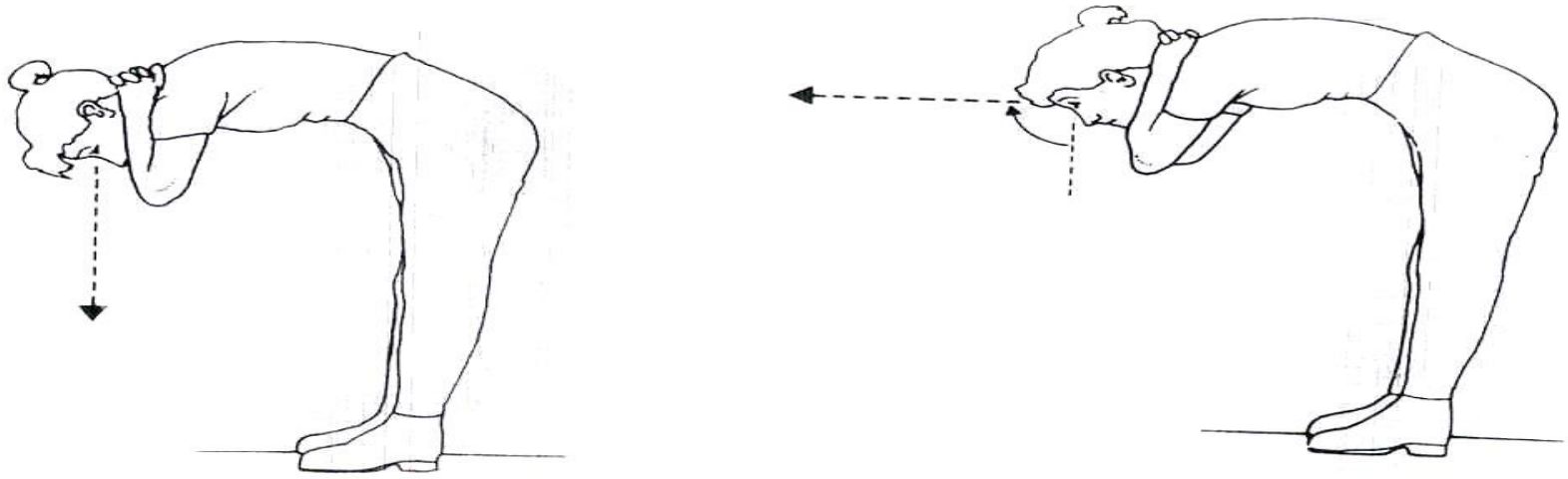
Mnemonics (L-E-M-O-N)

2. Difficult Laryngoscopy and Intubation (LEMON)

Look externally	Use your clinical gestalt, evidence of lower facial disruption, bleeding, small mouth, agitated patient
Evaluate	Use the 3-3-2 rule: mouth open, mandible, glottis
Mallampati score	In order of increasing difficulty Class I-IV
Obstruction / Obesity	Four cardinal signs of upper airway obstruction: stridor, muffled voice, difficulty swallowing secretions, sensation of dyspnea. Obese patients frequently have poor glottic views.
Neck mobility	May not be able to optimally move the head and neck due to trauma, arthritis, ankylosing spondylitis. Immobilize the neck and consider using video laryngoscopy.

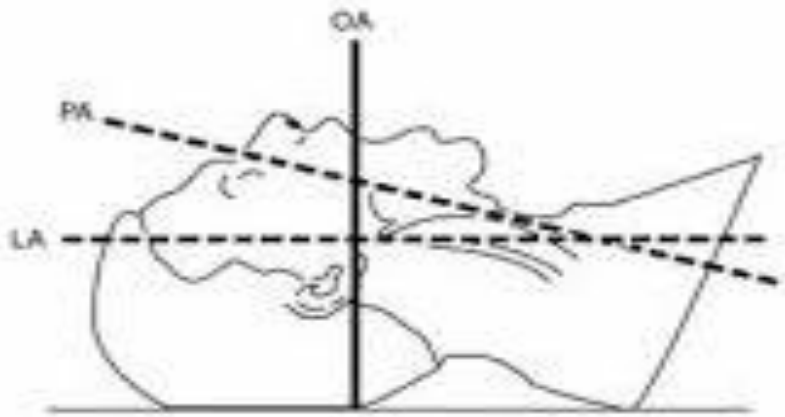
Atlanto-occipital movement

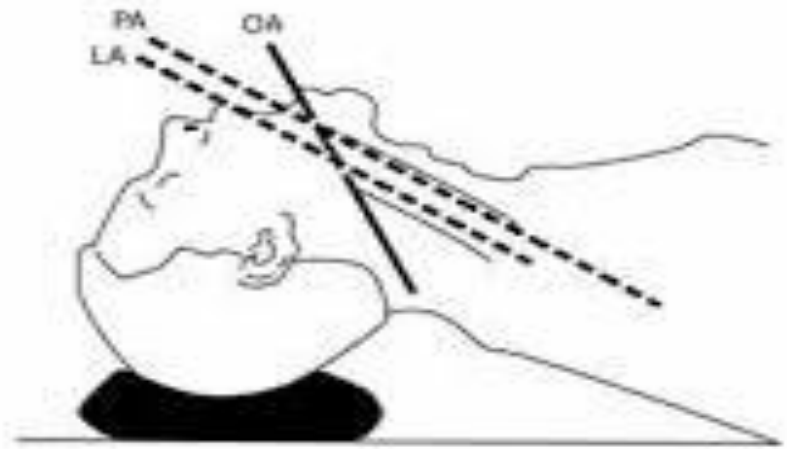
- can also be done by asking the patient to look at the floor and at wall after fully flexing and fixing the neck as shown



Atlanto-occipital movement

- Flexion movement of the cervical spine can be assessed by asking the patient to touch his manubrium sternii with his chin.
- Flexion & extension movement if within the normal range, three axes (oral,pharyngeal & laryngeal axis) can be brought into a straight line.





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Thyromental distan

- Measure from upper edge of thyroid cartilage to chin with the head fully extended. Normal is approximately 7cm.

- If the thyromental distance is short, the laryngeal axis makes a more acute angle with the pharyngeal axis and it will be difficult to achieve alignment.

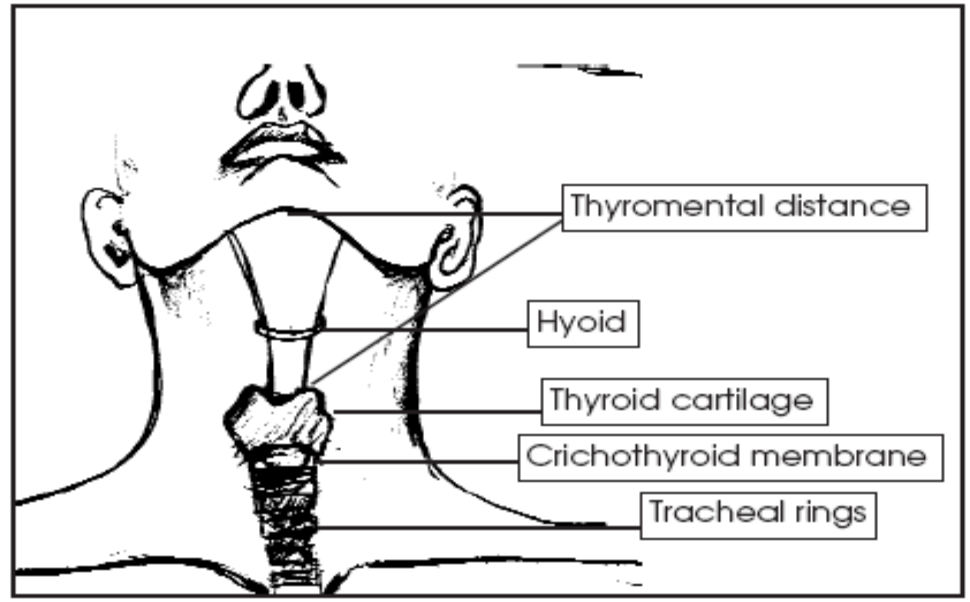


FIGURE 4: Chin to Thyroid notch (thyromental distance)

Thyromental distance

- Limitations
  - Little reliability in prediction
  - Variation according to height, ethnicity
- Modification to improve accuracy
  - Ratio of height to thyromental distance
  - Useful bedside screening test
  - RHTMD > 23.5 – very sensitive predictor of laryngoscopy

- Inter-incisor distance with maximal mouth opening
- Normal value > 5cm / admits 3 fingers.

Inter-incisor gap

Significance:

- Positive results: Easy insertion of a 3 cm deep flange of the laryngoscope blade
- < 3 cm: difficult laryngoscopy
- < 2 cm: difficult LMA insertion
- Affected by TMJ and upper cervical spine mobility

Assessment of the airway can be considered in four parts:

Assessment of the Airway

Airway patency	Respiratory drive
Protective reflexes	Inspired O2 concentration

Patil's Triangle

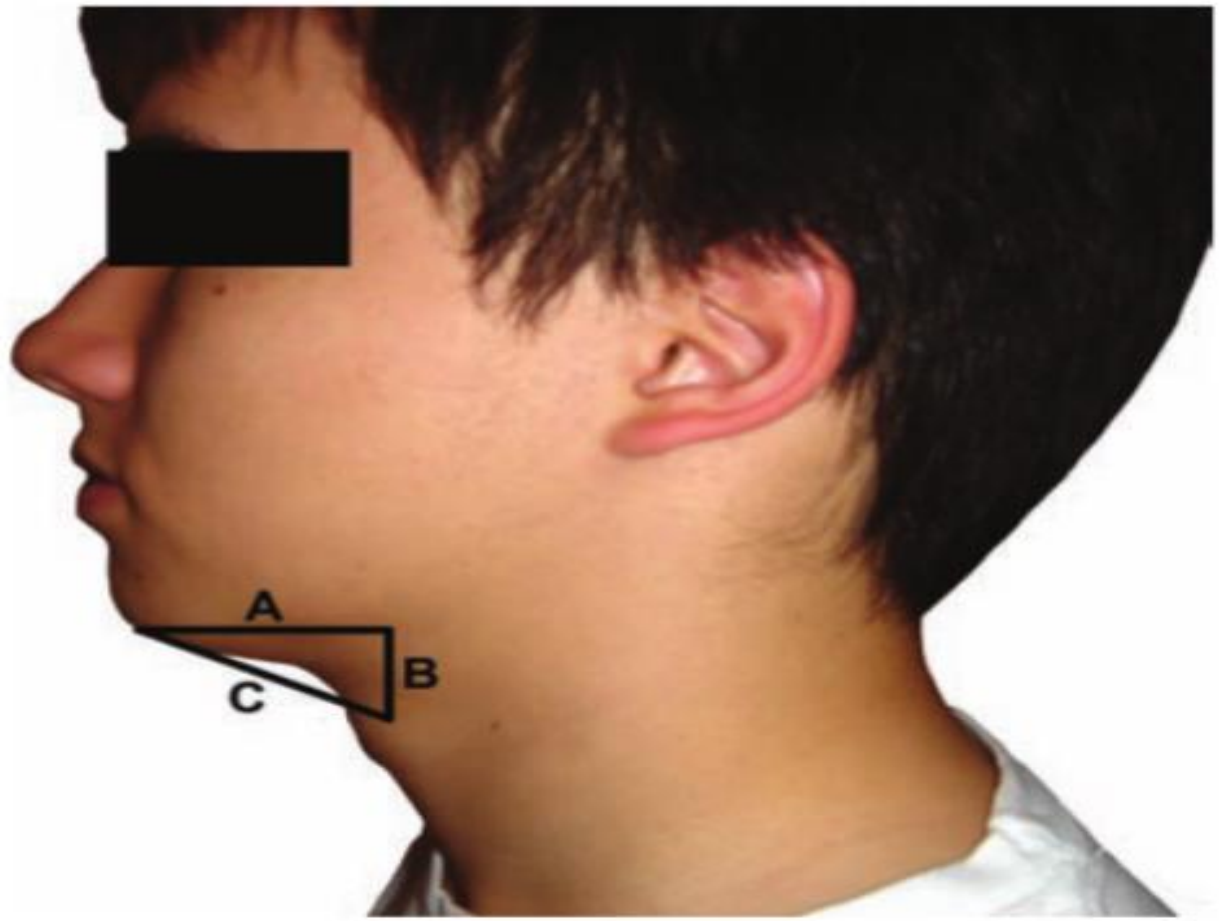
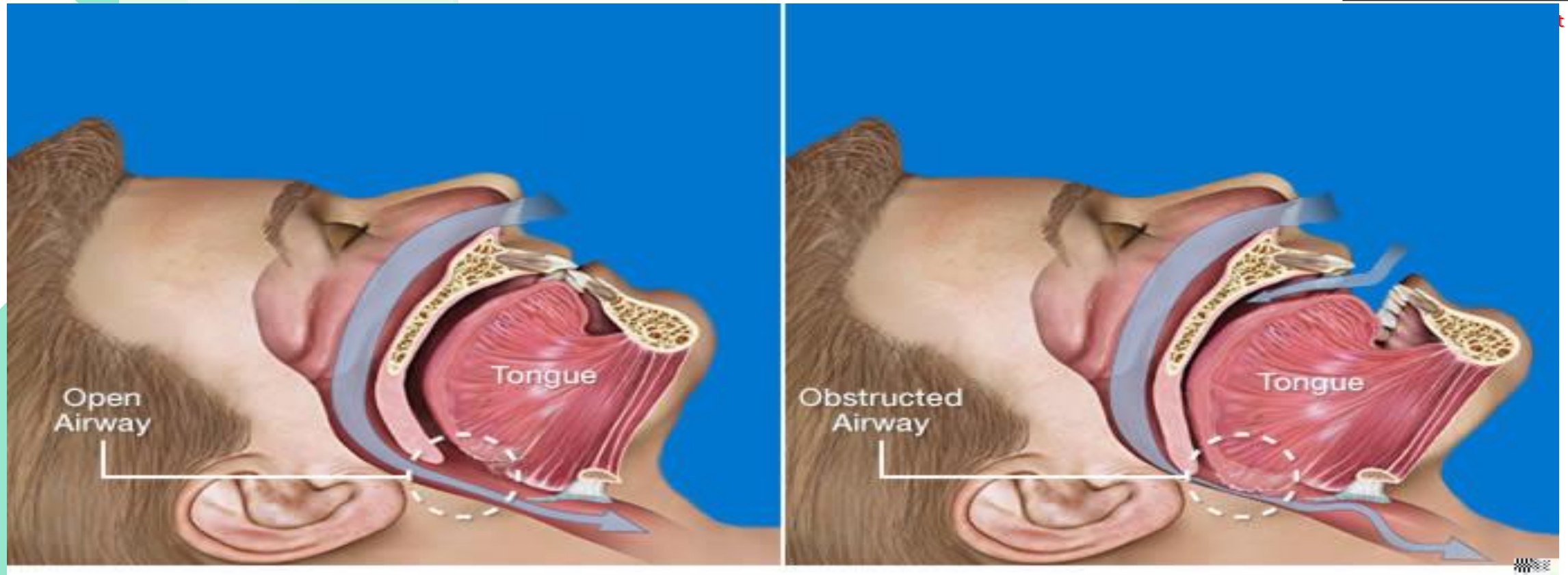


FIGURE 1-3. The Patil's triangle. (A) The second *3* of the evaluate 3-3-2; (B) The *2* of the evaluate 3-3-2; (C) The thyromental distance.

Airway patency

- A depressed level of consciousness is the greatest risk factor for airway obstruction.


Open
Airway
Tongue
Obstructed
Airway
Tongue

Frequent causes of airway obstruction

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Location	Cause
Oropharynx	Presence of blood
	Presence of mucus
	Presence of vomitus
	Presence of foreign bodies
Upper airways	Oedema
	Swelling
	Inflammation of the tissues bordering the airway

Recognition of injuries to airway or other structures

- Trauma to the head and neck
- Fractures or dislocation to the facial skeleton and mandible
- Soft tissue inflammation
- Bleeding
- Pulmonary aspiration of blood or dislodged teeth
- Cervical spine injury

Causes of partial or total loss of reflexes

- Decreased level of consciousness
  - Intoxication
  - Overdose
  - Brain injury
  - Brain-stem dysfunction
  - Stroke
  - Tumor
  - Demyelination
  - polyneuritis

Causes of partial or total loss of reflexes

- Mechanical (motor) impairment of swallowing
  - Pharyngeal tumor
  - Pharyngeal pouch
  - Polyneuritis
- Sensory impairment of pharynx/larynx
  - Local anesthesia
  - Polyneuritis

Respiratory drive

- Controlled by the respiratory centre

Inspired oxygen concentration

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- Maintain oxygen saturation at more than 94%

Delivery of Supplemental Oxygen

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Device	Flow rates (L/min)	Delivered O_2 (%)*
Nasal cannula	1 2 3 4 5 6	21 to 24 25 to 28 29 to 32 33 to 36 37 to 40 41 to 44
Simple oxygen face mask	6 to 10	35 to 60
Venturi mask	4 to 8 10 to 12	24 to 40 40 to 50
Face mask with oxygen reservoir	6 7 8 9 10 to 15	60 70 80 90 95 to 100

Airway Interventions

- Opening the airway

Head tilt – Chin lift

Jaw thrust

Airway Interventions

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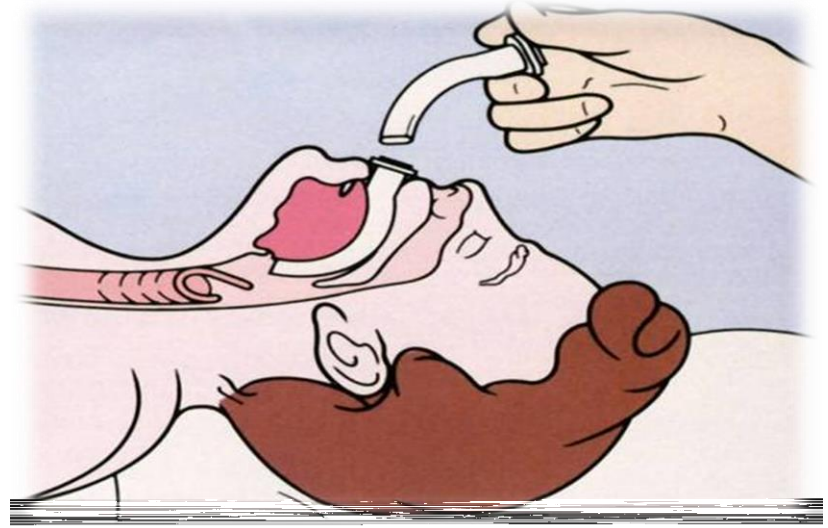
- Bag-Mask ventilation

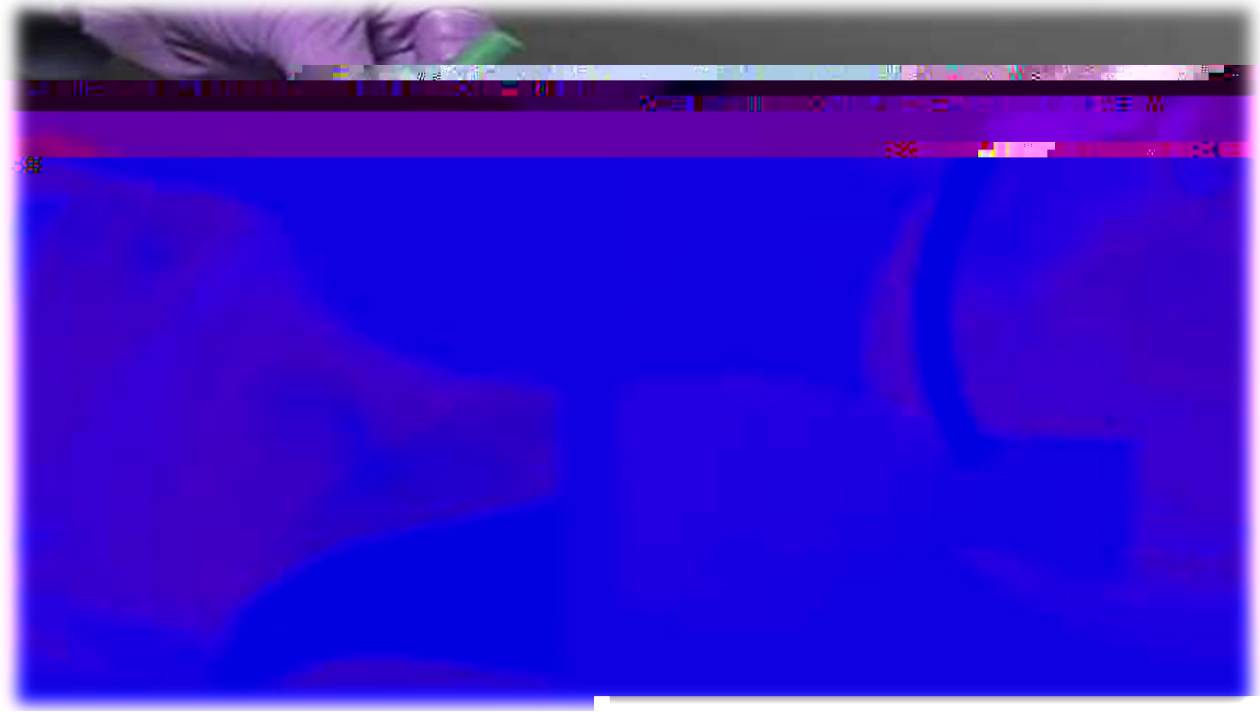
Airway Interventions

- Oropharyngeal airway



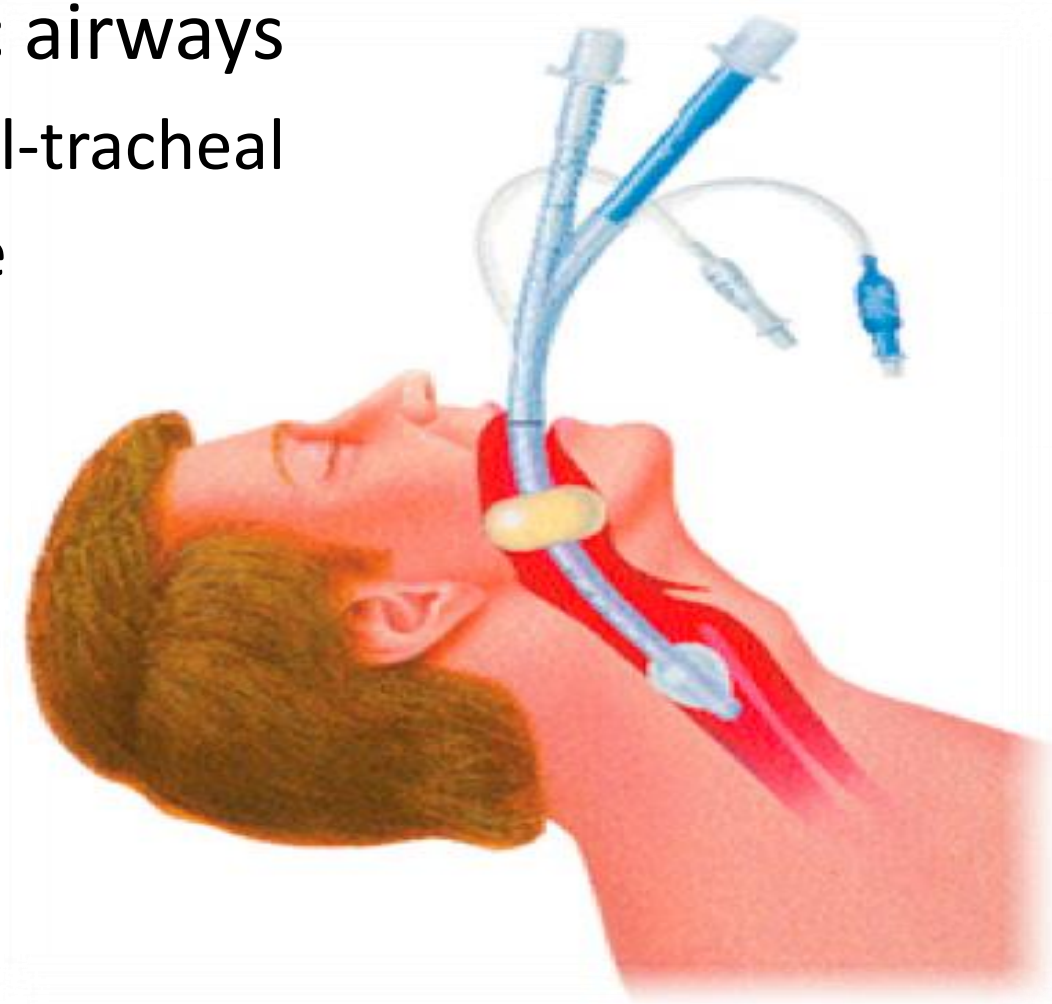
Airway Interventions

- Nasopharyngeal airway



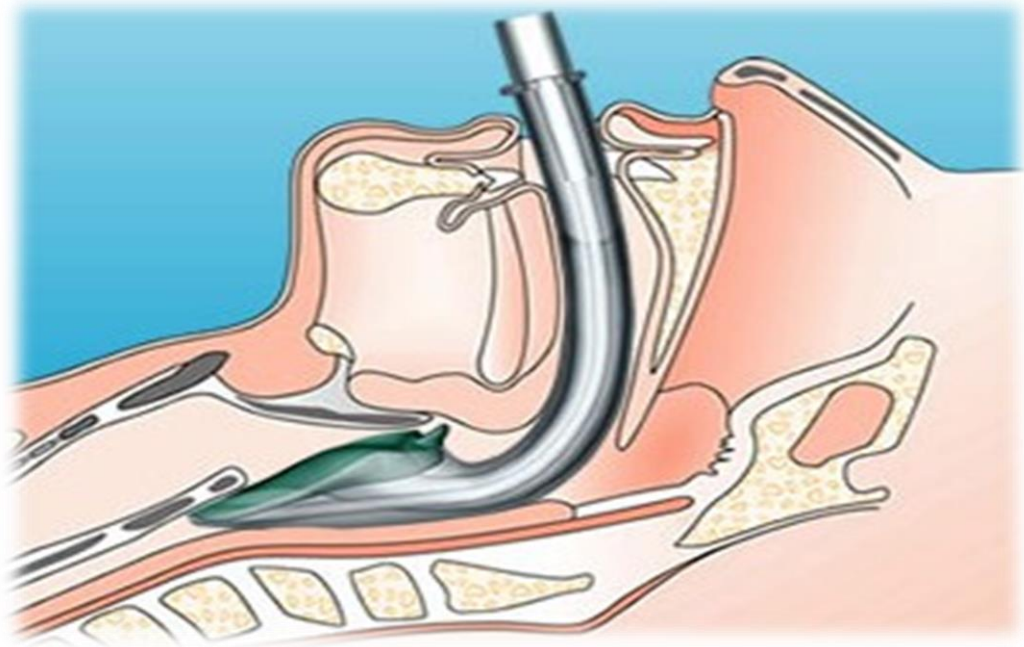
Airway Interventions

- Supraglottic airways
  - Esophageal-tracheal combitube



Airway Interventions

- Supraglottic airways
  - Laryngeal Mask airway

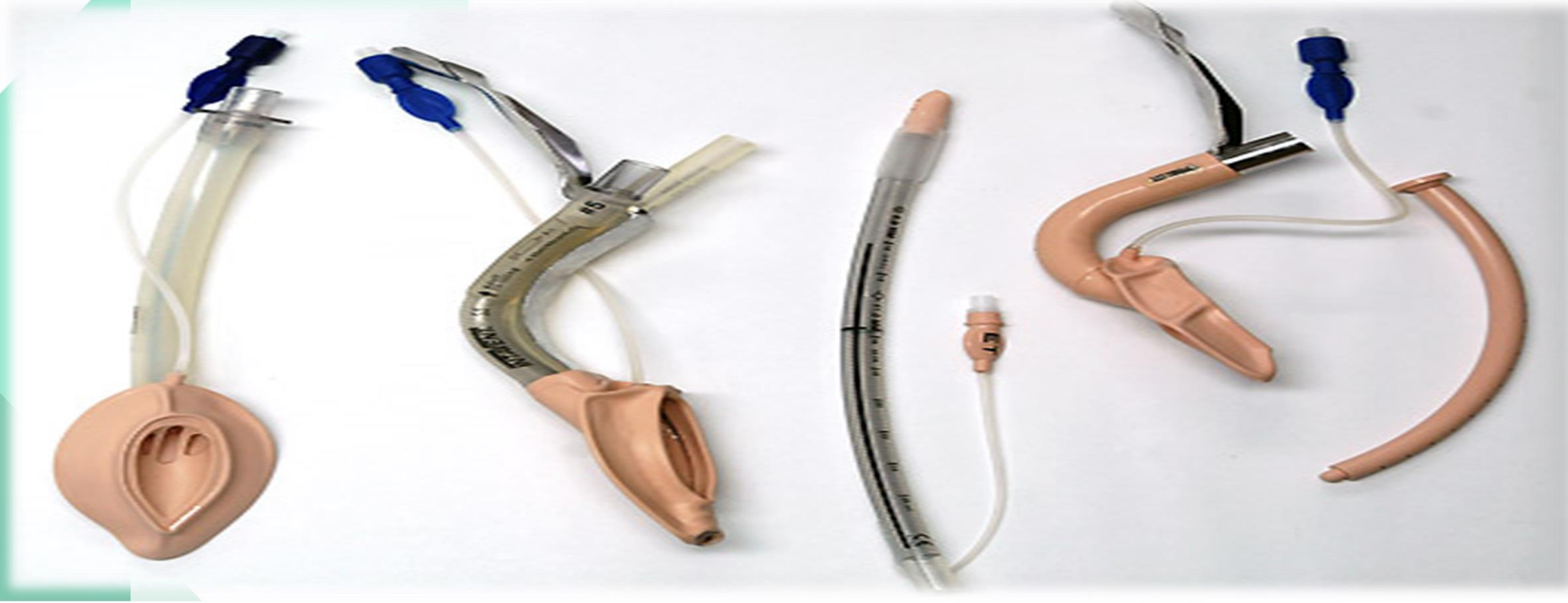


Airway Interventions

- Supraglottic airways
  - LMA Supreme

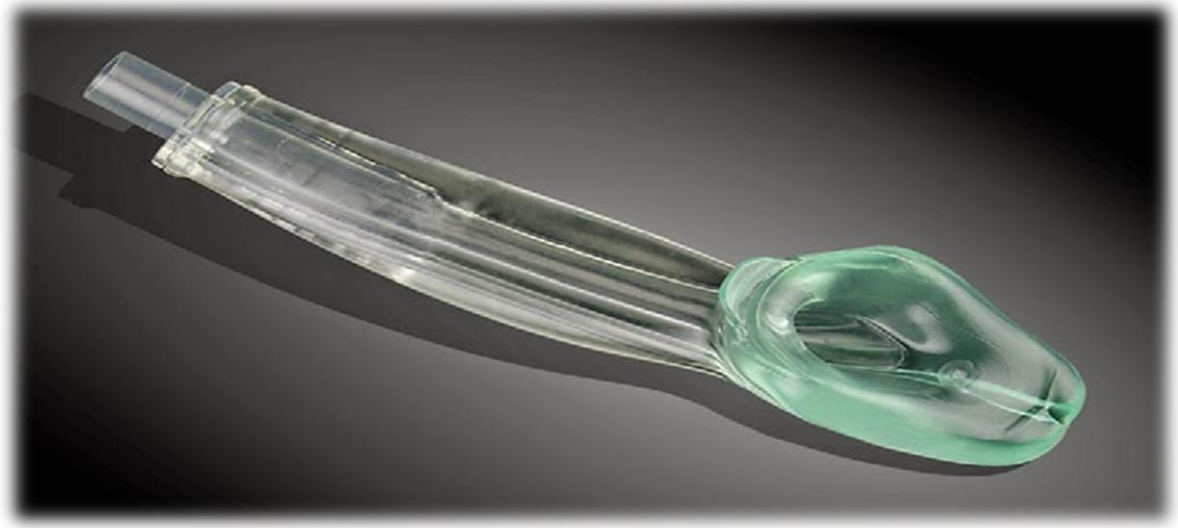
Airway Interventions

- Supraglottic airways
  - Intubating LMA



Airway Interventions

- Supraglottic airways
  - I-gel



Main indications for tracheal intubation

- Inability to obtain/maintain an unobstructed airway by other means
- Long-term prevention of airway obstruction
- Protecting the airway (lack of protective reflexes)
- Inadequate ventilation or oxygenation
- To facilitate positive pressure ventilation
- To facilitate bronchopulmonary toilet
- Life-threatening hemodynamic instability
- Combativeness that prevents emergency diagnostic studies (need for heavy sedation)

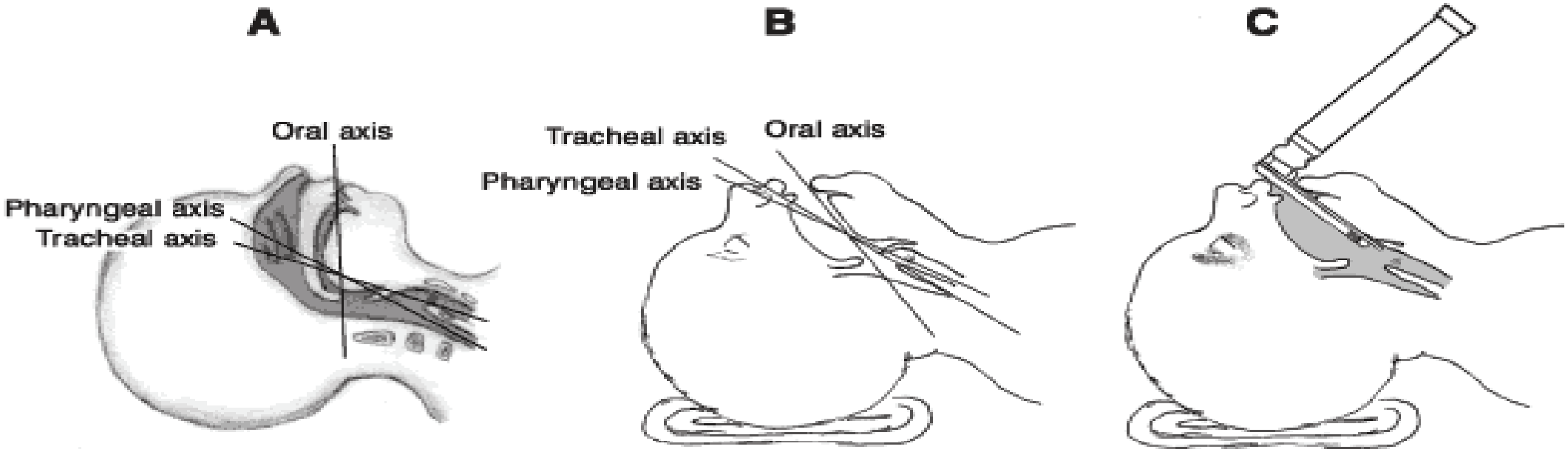


Figure 3 - A) Illustration of the axes (oral, pharyngeal and tracheal); B) alignment of these axes with correct positioning; C) viewing the glottic fold with a straight blade

Intravenous anesthesia induction agents

- Propofol 0.5-2 mg/kg
- Thiopentone 1-5 mg/kg
- Midazolam 0.05-0.01 mg/kg

Neuromuscular blockade may be achieved with:

- Suxamethonium 0.3-0.5 mg/kg
- Atracurium 0.05-0.01 mg/kg
- Rocuronium 0.9-1.2 mg/kg has been advocated as a substitute for suxamethonium

Confirmation of trachaeal tube placement

- Clinical test
  - Look – chest expansion
    condensation of water vapor in the ET
  - Listen – auscultate for breath sounds
  - Feel – for air exchange (for unparalyzed patients)

- Gold Standard – laryngoscopy
  - Visualization of the tracheal tube passing between the vocal chords by laryngoscopy and measuring the end tidal carbon dioxide (6 respiratory cycles)

- Chest x-ray

Airway Interventions

- Endotracheal intubation equipment
  - Laryngoscope with several blades
  - Endotracheal tubes
  - Malleable stylet
  - 10-ml syringe
  - Magill forceps
  - Water soluble lubricant
  - Functional suction unit

Endotracheal intubation

- Endotracheal tubes

Endotracheal intubation

- Laryngoscope

Endotracheal intubation

- Laryngoscope flexi tip

Straight Blade Technique

(video clip)

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Endotracheal intubation

- Bonfils intubation

Endotracheal intubation

- Fiber-optic guided intubation

Endotracheal intubation

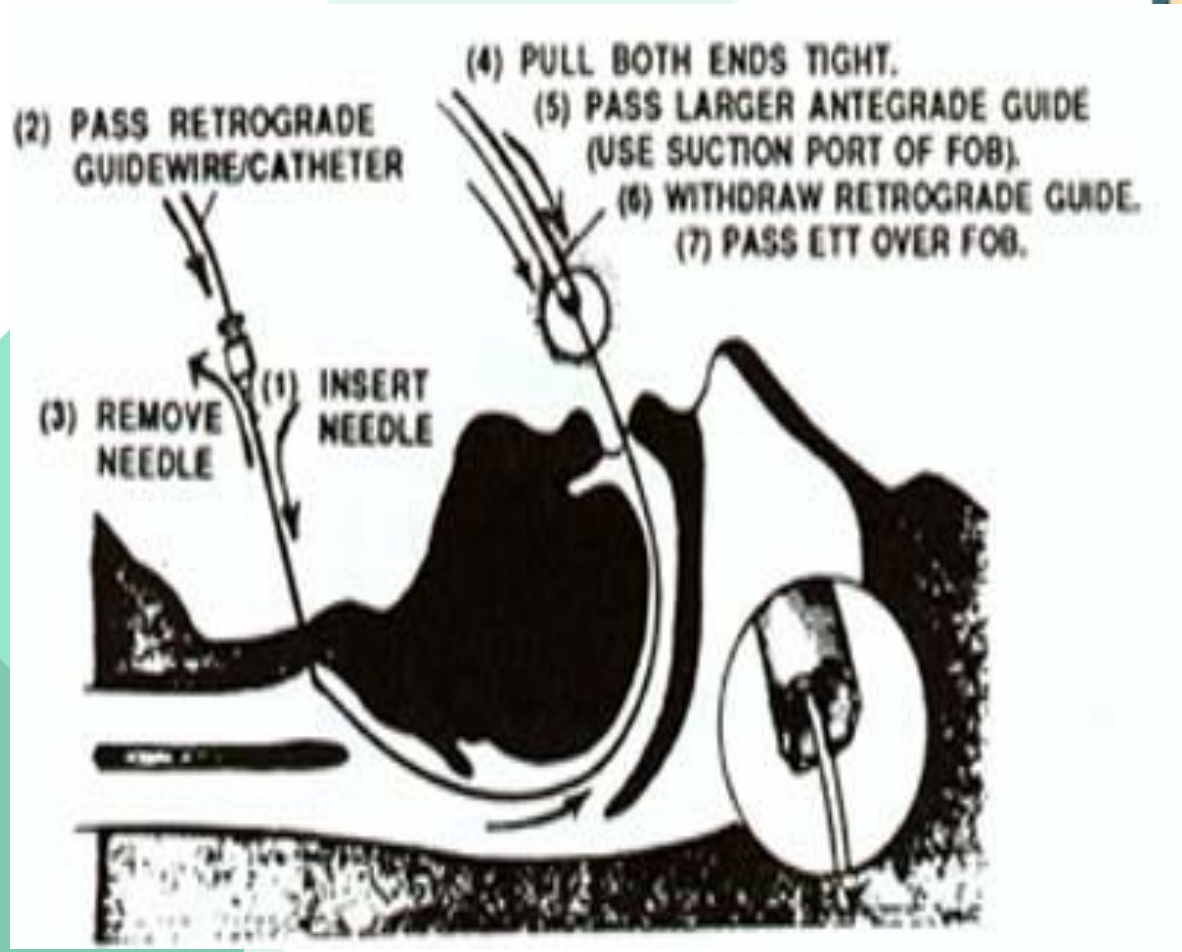
- Video laryngoscope
  - Airtraq

Endotracheal intubation

- Video laryngoscope
  - Mcgrath/Passport
  - Cmac
  - Glidescope

Endotracheal intubation

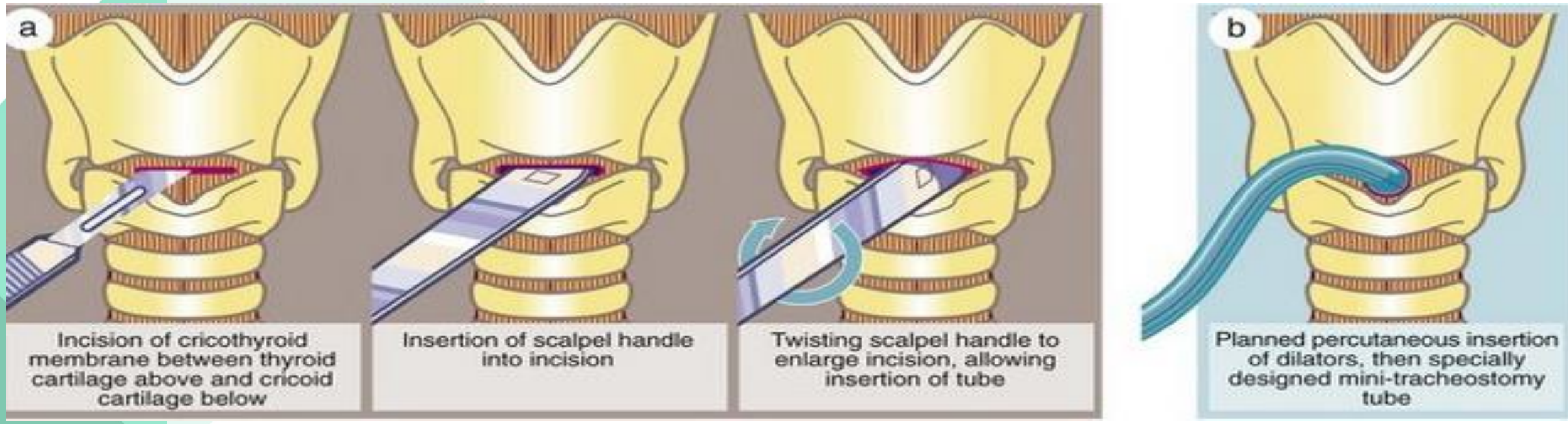
- Retrograde intubation



monoject
mL
5CM
10CM
15CM
20CM
25CM
30CM
35CM
Oral
COOK
FOR AIRWAY USE ONLY

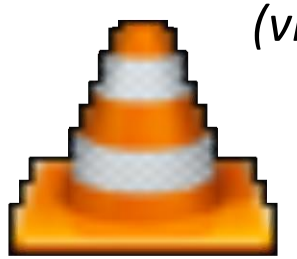
Endotracheal intubation

- Cricothyroidotomy



Cricothyroidotomy

(video clip)



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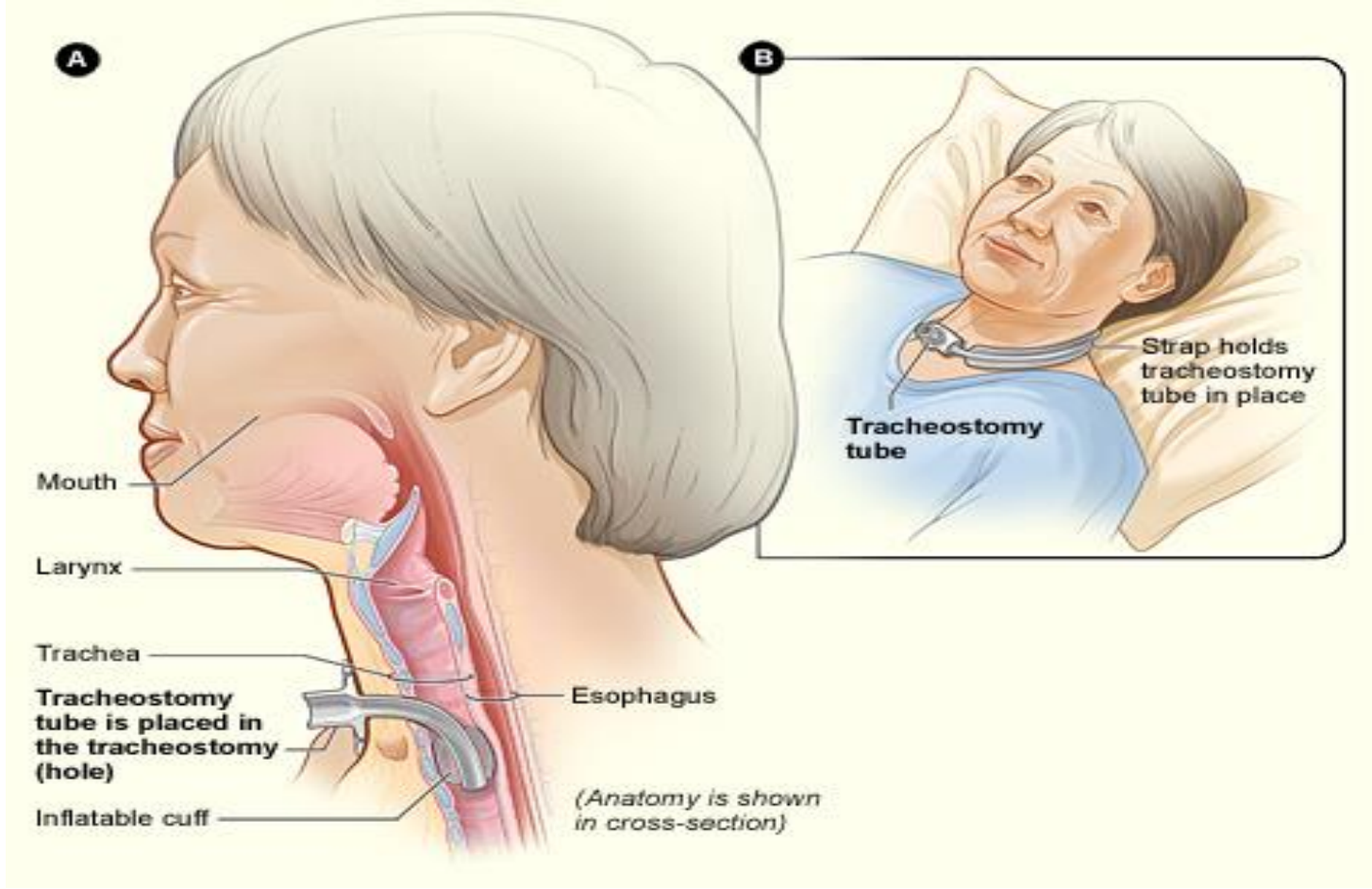
Endotracheal intubation

- Tracheostomy



Difficult Airway Algorithm

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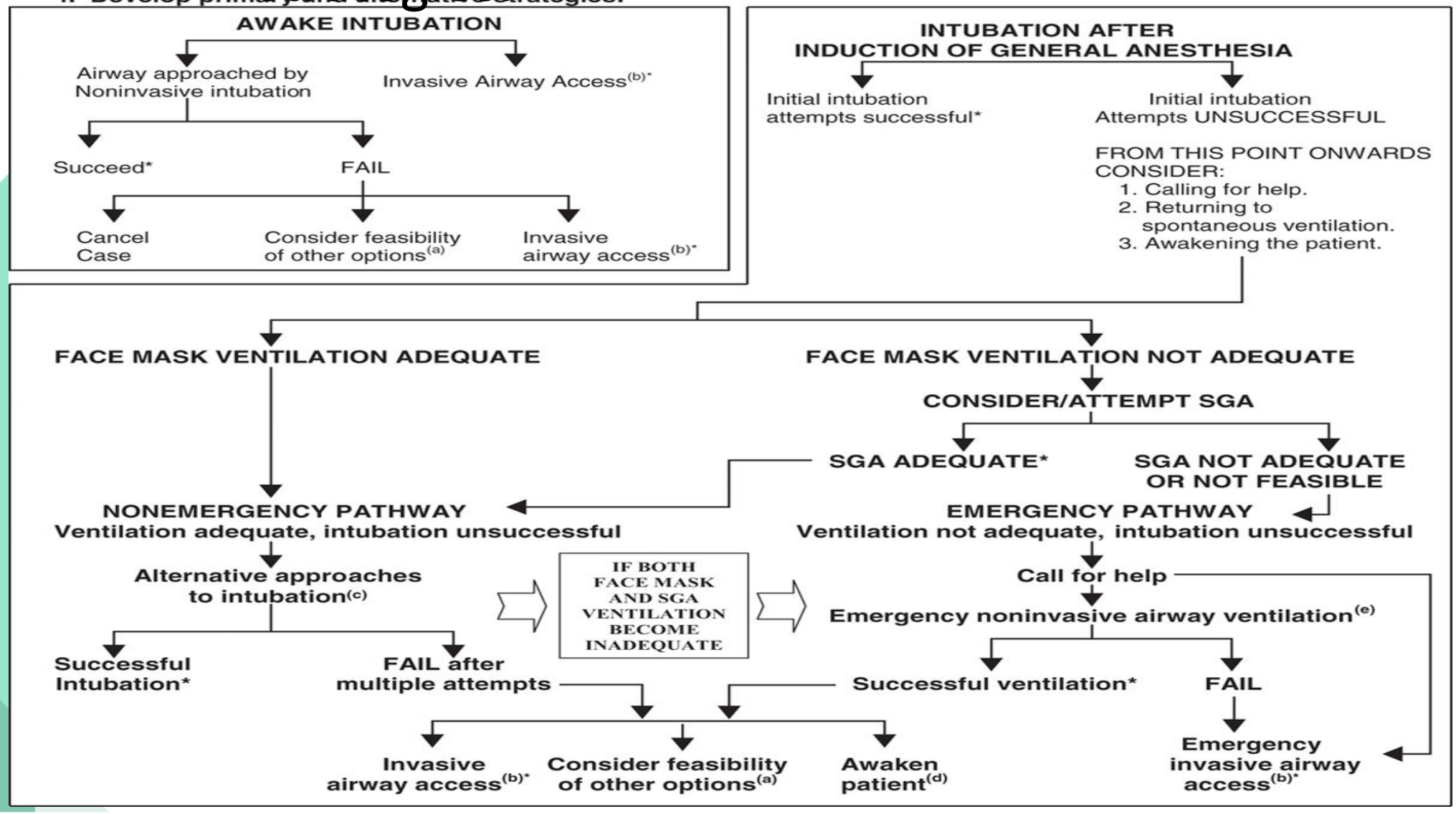
1. Assess the likelihood and clinical impact of basic management problems:
   - Difficulty with patient cooperation or consent
   - Difficult mask ventilation
   - Difficult supraglottic airway placement
   - Difficult laryngoscopy
   - Difficult intubation
   - Difficult surgical airway access

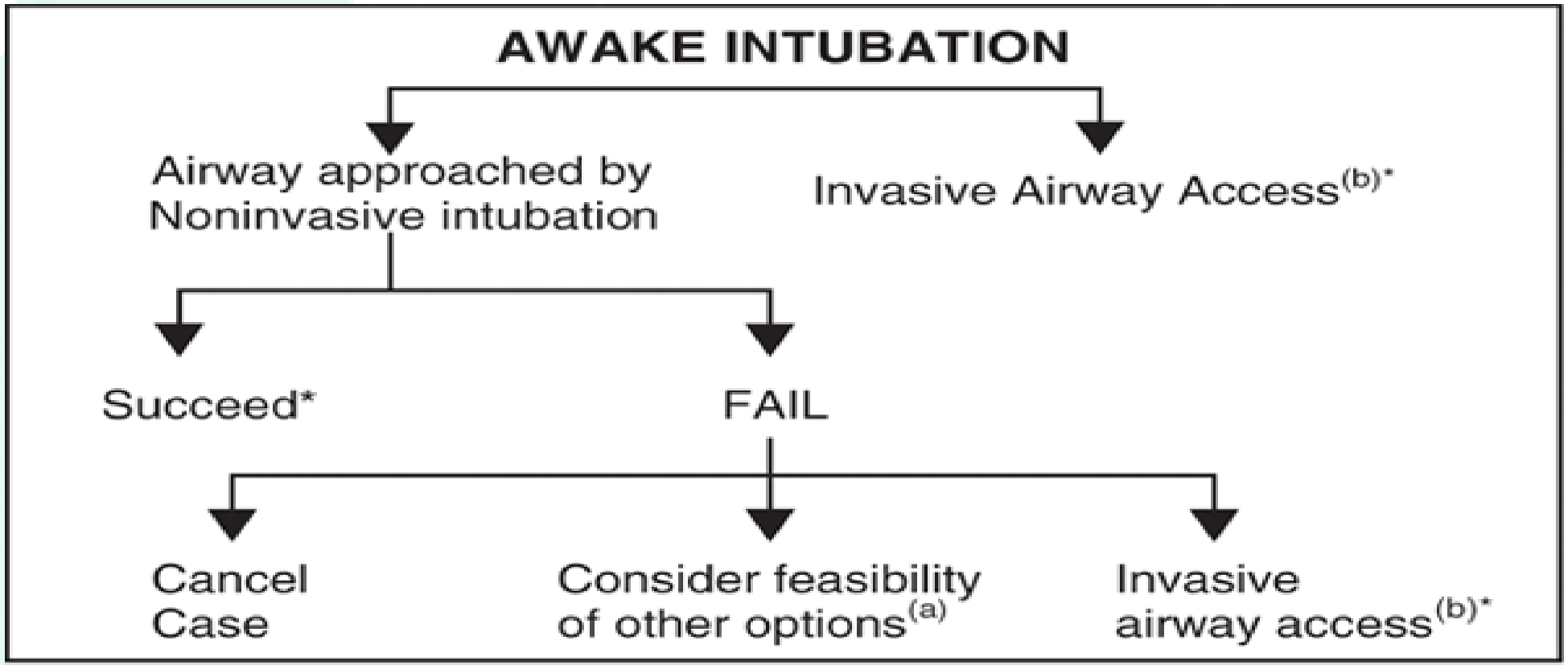
2. Actively pursue opportunities to deliver supplemental oxygen throughout the process of difficult airway management

3. Consider the relative merits and feasibility of basic management choices:
   - Awake intubation vs. intubation after induction of general anesthesia
   - Non-invasive technique vs. invasive techniques for the initial approach to intubation
   - Video assisted laryngoscopy as an initial approach to intubation
   - Preservation vs. ablation of spontaneous ventilation

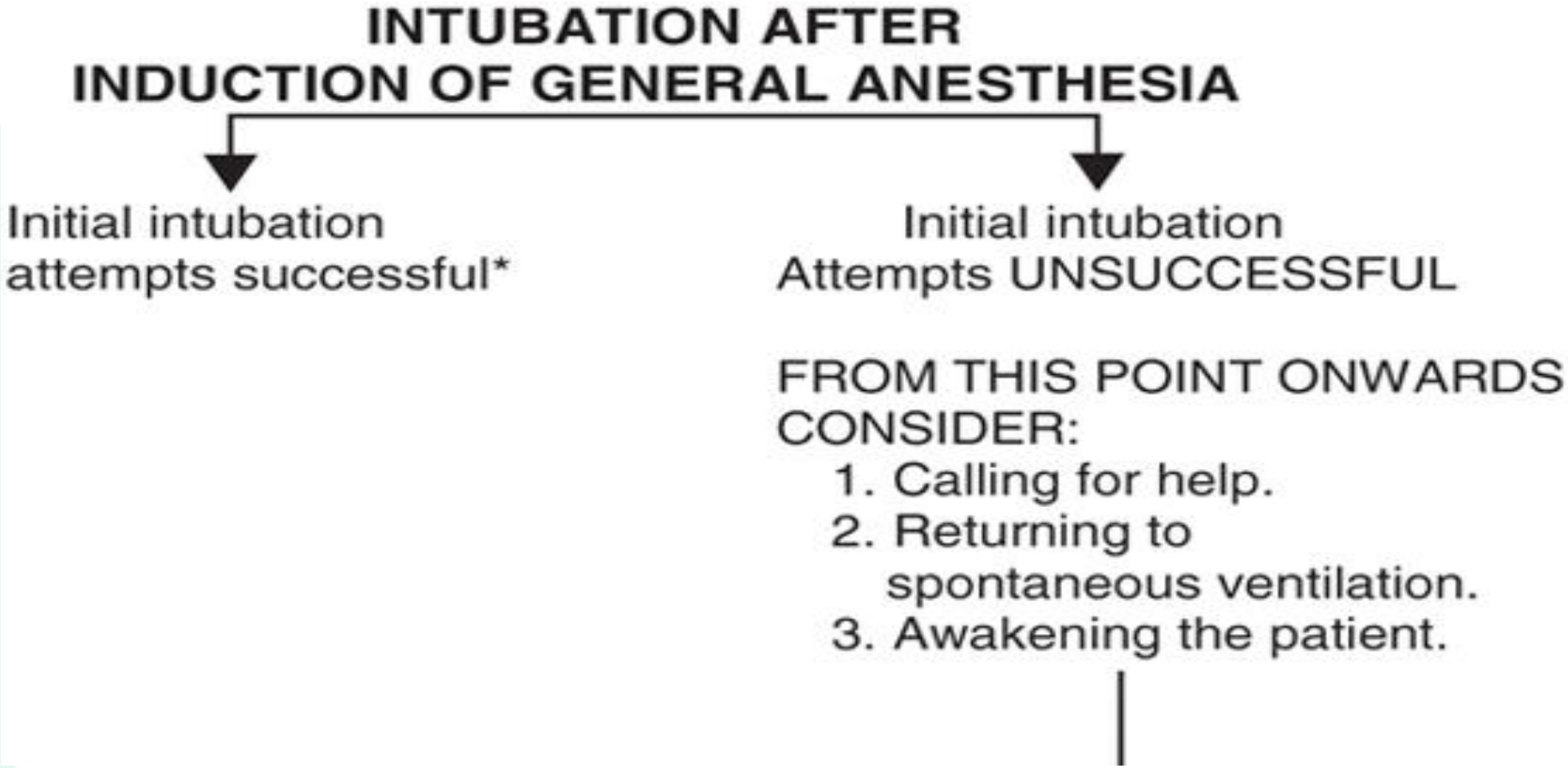
4. Develop primary and alternative strategies:



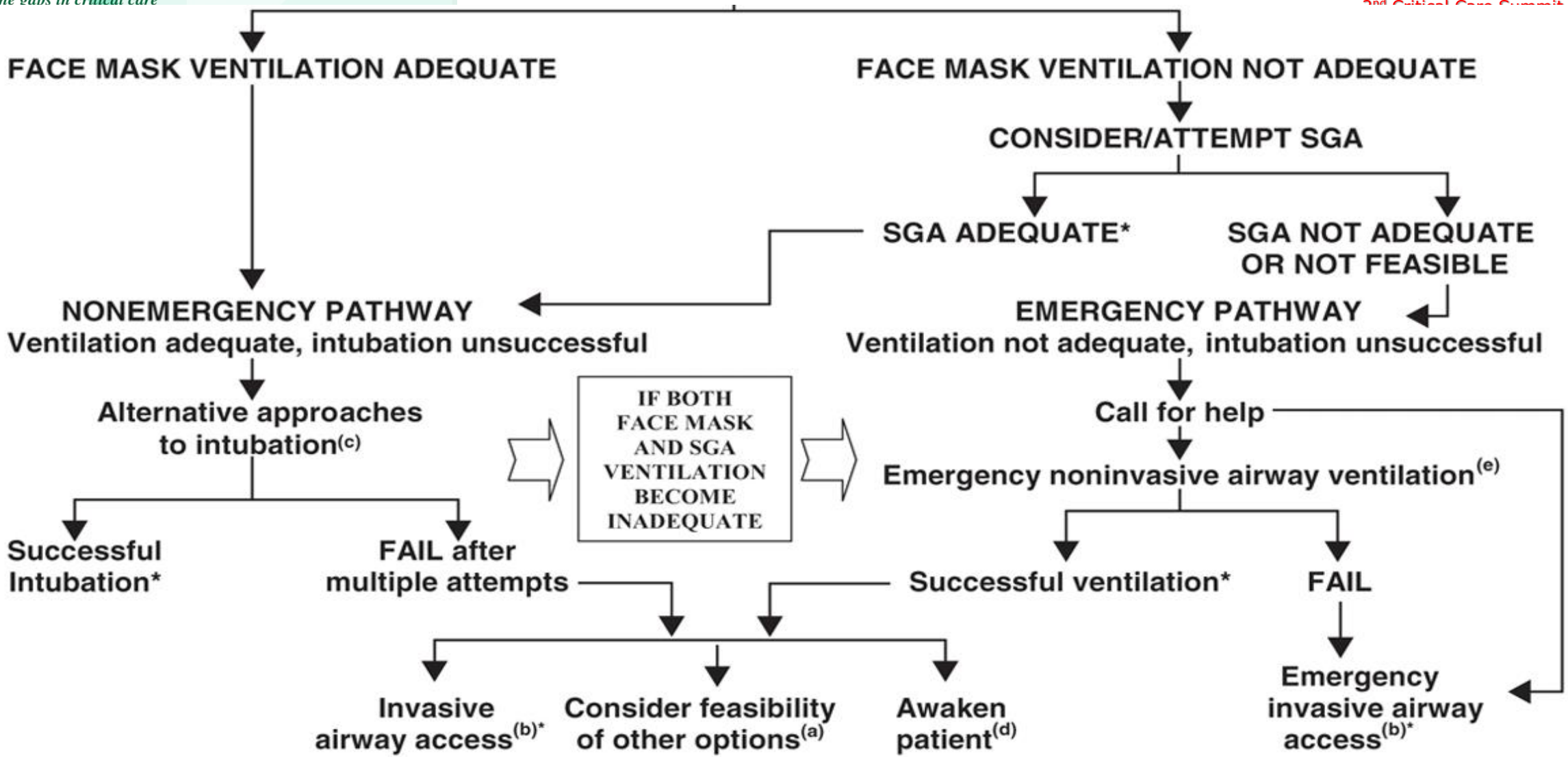
cont. Difficult Airway Algorithm



cont. Difficult Airway Algorithm



cont. Difficult Airway Algorithm



Difficult Airway Success Rate

DAC	C-MAC, % (n=255)	DL, % (n=495)
Airway edema	85.7 (6/7)	46.2 (6/13)
Blood in airway	93.4 (57/61)	82.2 (88/107)
Cervical immobility	98.8 (82/83)	83.1 (103/124)
Facial/neck trauma	95.3 (41/43)	87.8 (43/49)
Large tongue	90.5 (19/21)	75.0 (33/44)
Obesity	93.8 (30/32)	78.1 (57/73)
Short neck	92.9 (26/28)	66.0 (33/50)
Small mandible	100 (5/5)	72.2 (13/18)
Vomit in airway	93.6 (44/47)	73.2 (52/71)

Sakles JC, Mosier J, Chiu S, Cosentino M, Kalin L. Ann Emerg Med. 2012 Dec;60(6):739-48

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Recommendation

- Establish an individual algorithm for your institution.
- Training of all the team according to your algorithm.

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