Airway management

Dr FL Chow

Incidence

Unanticipated difficult tracheal intubation	3% - 5%
Failed intubation	0.5% - 1.2%

Gap in care

1	Poor identification of at risk patients
2	Incomplete planning / preparation
3	Inadequate staff and equipment
4	Delayed recognition of events
5	Failed rescue

Difficult airway

Difficult airway	Difficult bag-mask ventilation	Anatomic factors
	Difficult endotracheal intubation	Physiologic factors
Failed airway	Failure to achieve endotracheal intubation on 3 attempts	
	Cannot intubate / cannot oxygenate (SpO_2 <90%)	

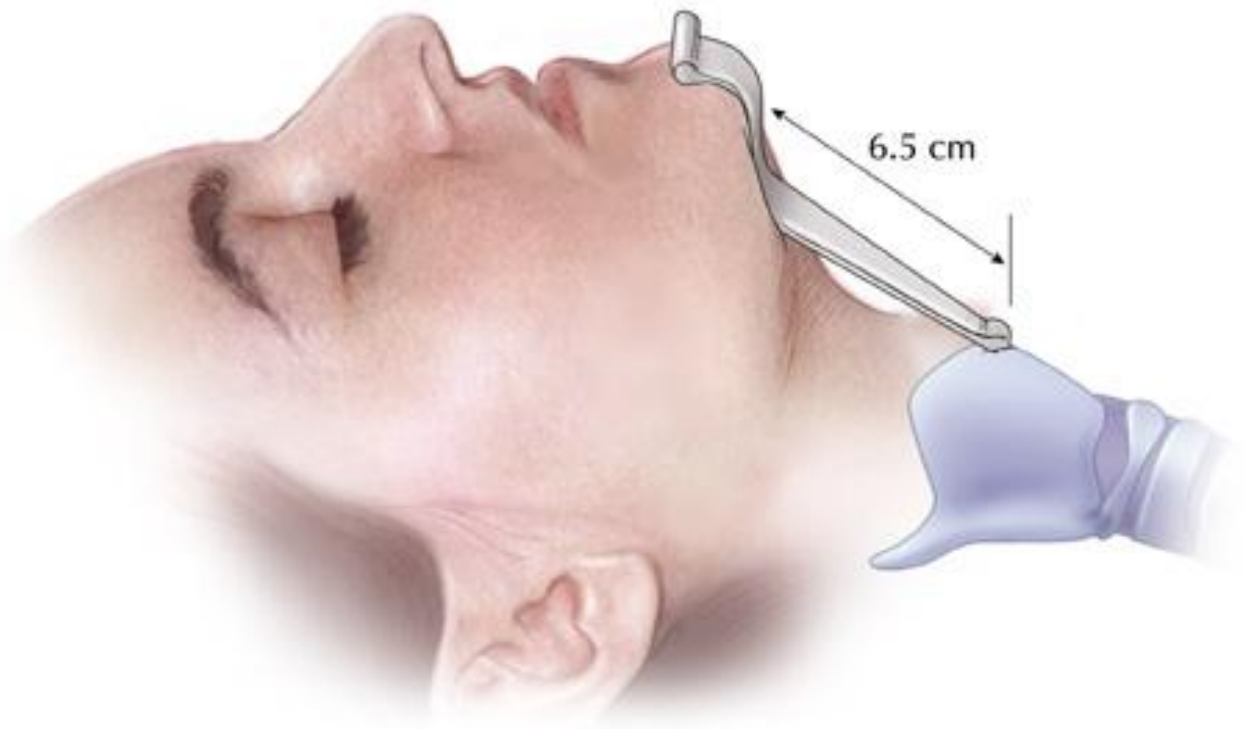
Principles

Anticipation	Airway obstruction / protection
	Respiratory failure
Preparation	Personnel (skill, PPE) and patient (anatomic, physiologic)
	Equipment and medication

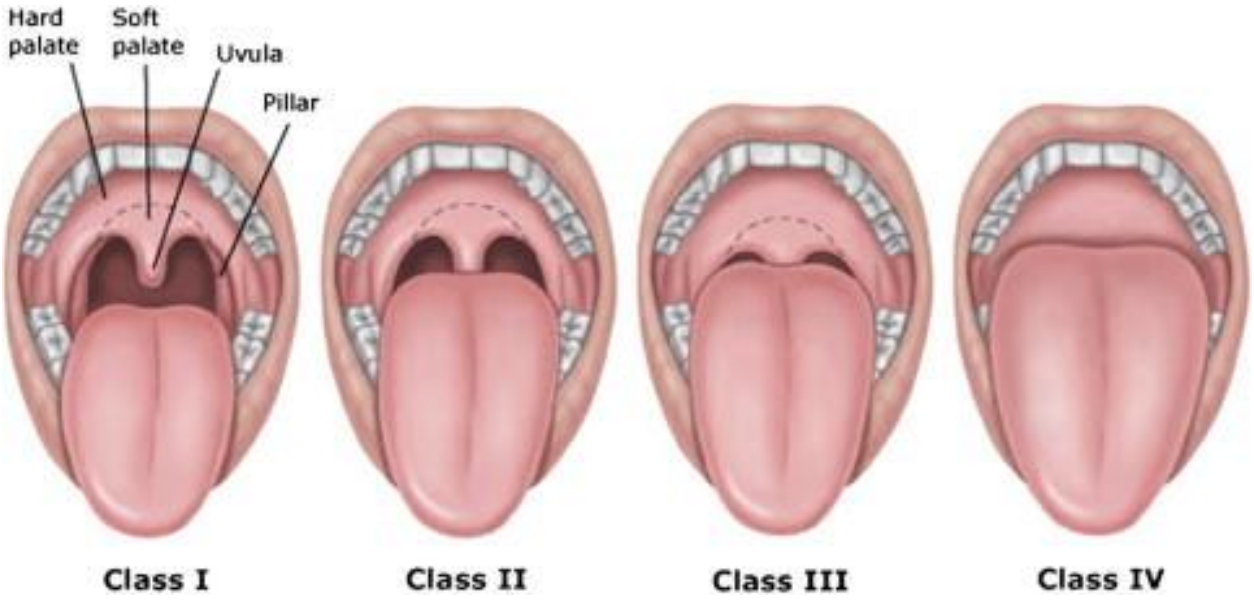
Assessment

Illness	Past / current	Trauma, bleeding tendency
	Urgency	Mental status, oxygenation
Anatomical challenge	Ventilation	Facial hair, edentulous
	Direct laryngoscopy	Thyromental distance, Mallampati class

Thyromental distance



Mallampati classification

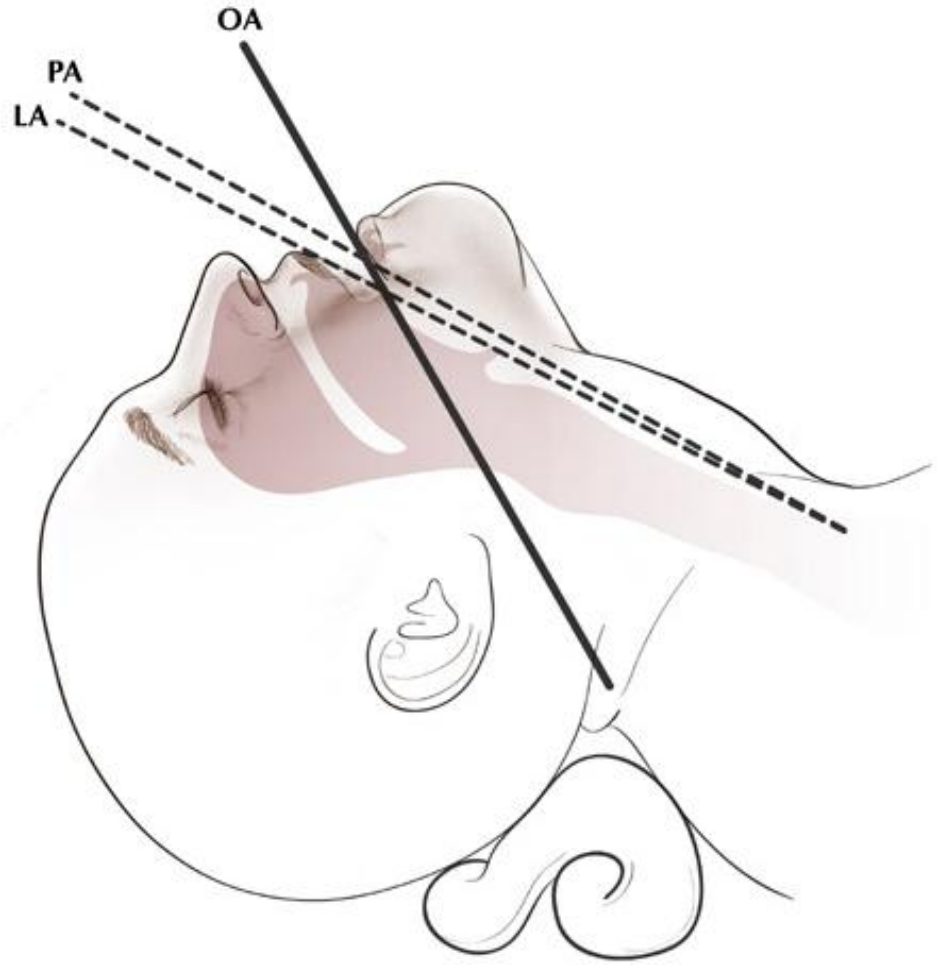


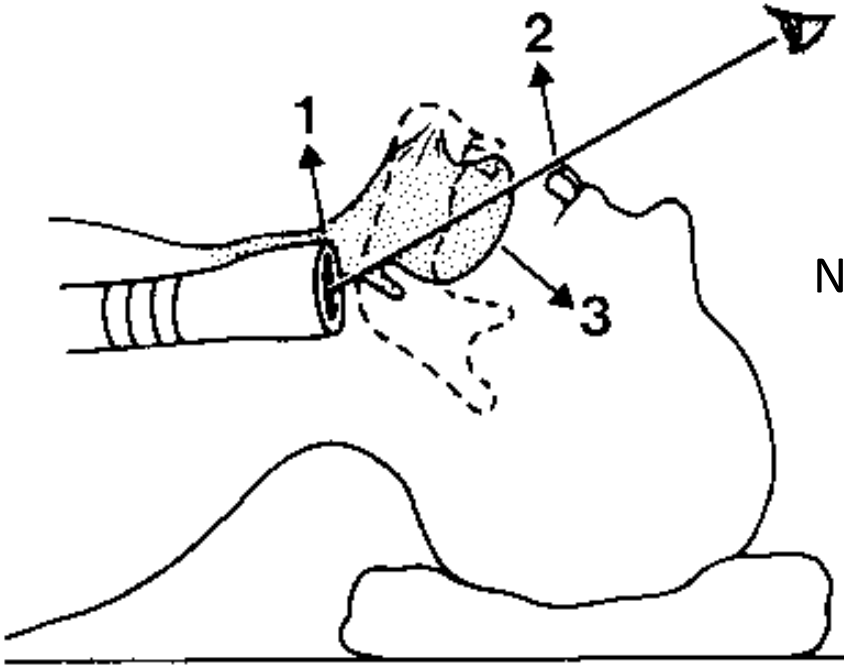
Class I allows full view of tonsils, uvula, and soft palate
Class II allows view of hard, soft palate, upper portion of tonsils, uvula
Class III allows view of soft and hard palate, base of the uvula
Class IV allows view of hard palate only

Patient preparation

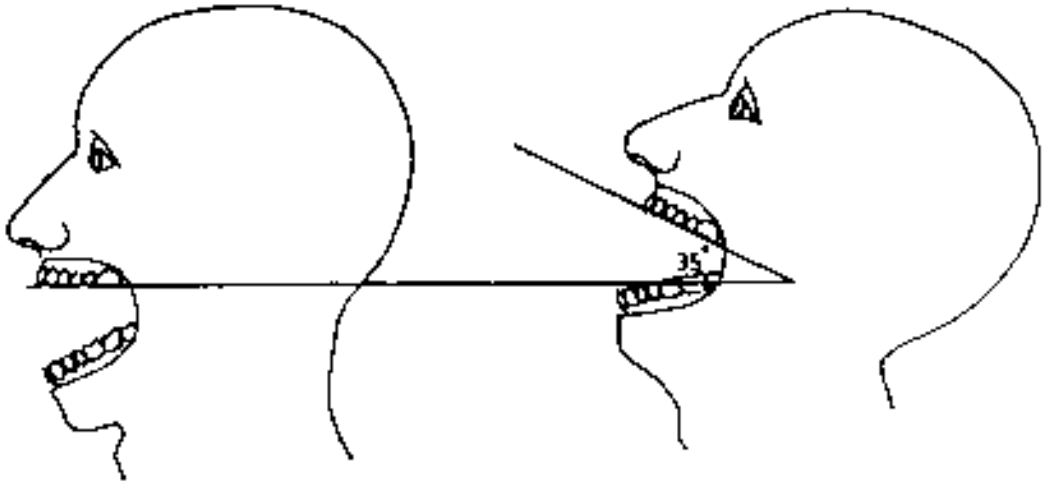
Condition	Hemodynamic
Position	Sniff position
	Simple head extension
	Ramp position: Align sternal notch --- ear
	Manual in-line cervical spine stabilization
Pre-oxygenation	100% O_2 for 3 to 5 min; non-invasive positive pressure ventilation
	Apneic oxygenation: O_2 15L/min nasal cannula + mask ventilation
	Delayed sequence intubation: Sedative → pre-oxygenation
	Rapid sequence intubation

Sniff position – Neck flexion and atlanto-occipital joint extension

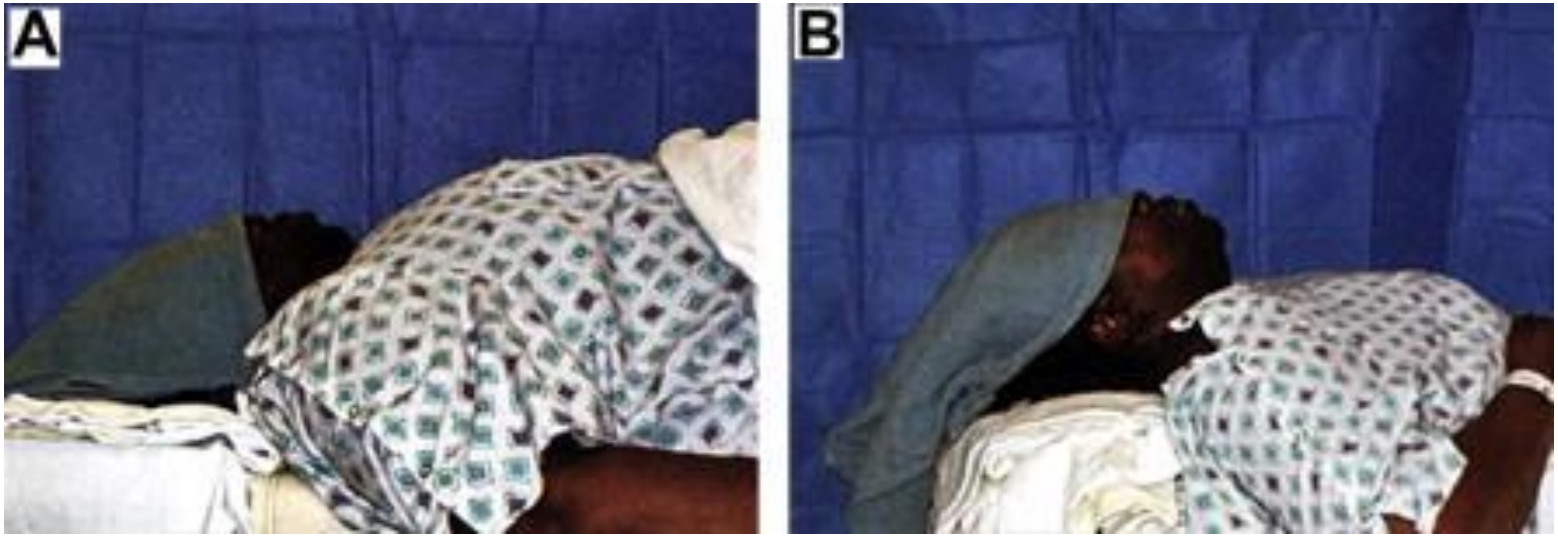




Neck extension and mandibular space

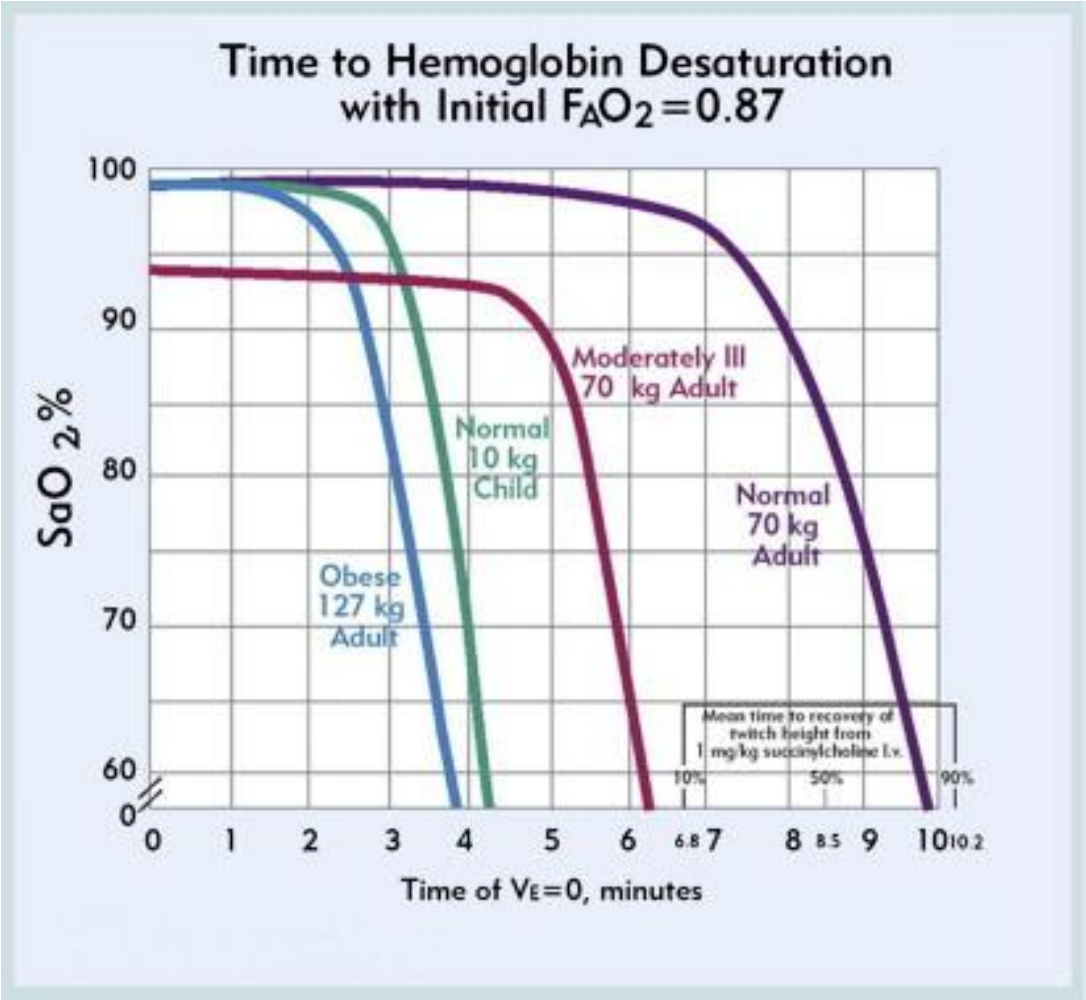


Ramp position



(*A*) In the supine patient, access to the airway is obstructed. (*B*) The patient propped on linens in the ramp position, access to the airway is improved, an imaginary horizontal line can be drawn from the external auditory meatus to the sternal notch.

Time to desaturation



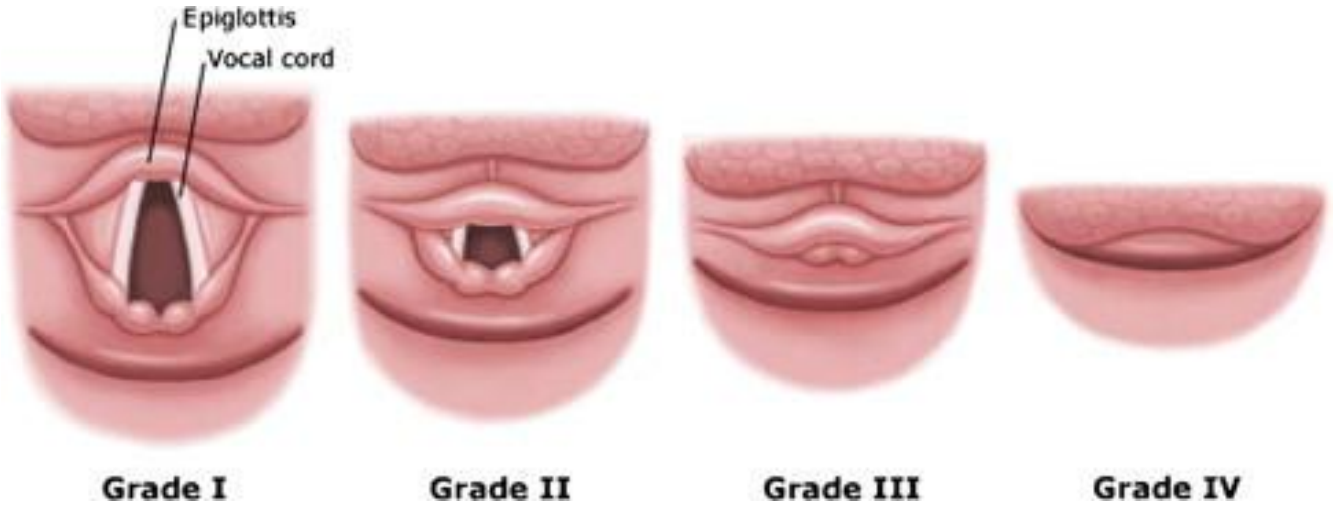
Medication

Pretreatment	Lignocaine (1.5mg/kg)	Blunt sympathetic, ↓ICP, ↓BP; outcome?	
	Fentanyl (1-3ug/kg)	Blunt sympathetic, proof?, rigid chest	
	Atropine	For child age <8	
	Defasciculating agent	Fasciculation ↑ ICP & IOP; ≥3 min NMBA	
Induction	Ketamine (1-2mg/kg)	CI: Head trauma, coronary artery disease	
	Etomidate (0.15-0.3mg/kg)	Transient adrenal suppression	
	Midazolam (0.1-0.4mg/kg)	Onset of induction (min)	
	Propofol (0.5-2mg/kg)	Onset (sec), relax pharynx & larynx muscle	
Paralyzing agent	Depolarizing NMBA	Succinycholine (0.3-2mg/kg)	Onset 1 min → 4 – 6 min CI: K^+, T^0, M dystrophy
	Non-depolarizing NMBA	Rocuronium (0.6-1mg/kg)	Onset 1 min → 30 min Prolonged in liver failure

Non-surgical technique & devices

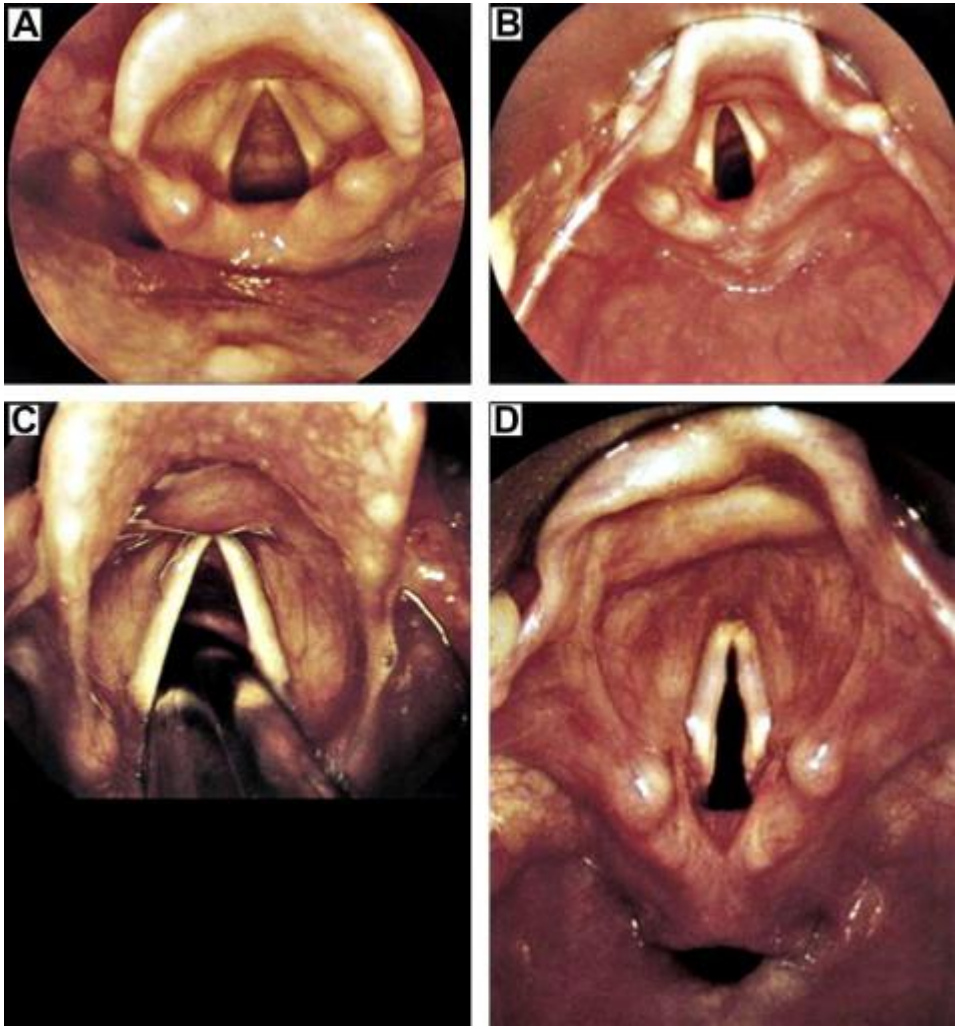
Direct laryngoscopy	Laryngeal view by Cormack-Lehane classification
	Cricoid pressure: Increase risk of aspiration
	Laryngeal lift
	Bimanual: BURP (backward, upward, → Right, pressure)
Bougie assisted endotracheal intubation	When vocal cords cannot be visualized
	60cm semi-rigid 2.5cm anterior hook, feel clicks, 90^0 turn
Supraglottic airway	Cannot intubate / cannot oxygenate scenario
	Laryngeal mask airway; lighted stylet (bright red glow)
Fibreoptic guided / video assisted devices	Awake assessment, anatomical abnormality
	Blood and secretions, prepare alternative device

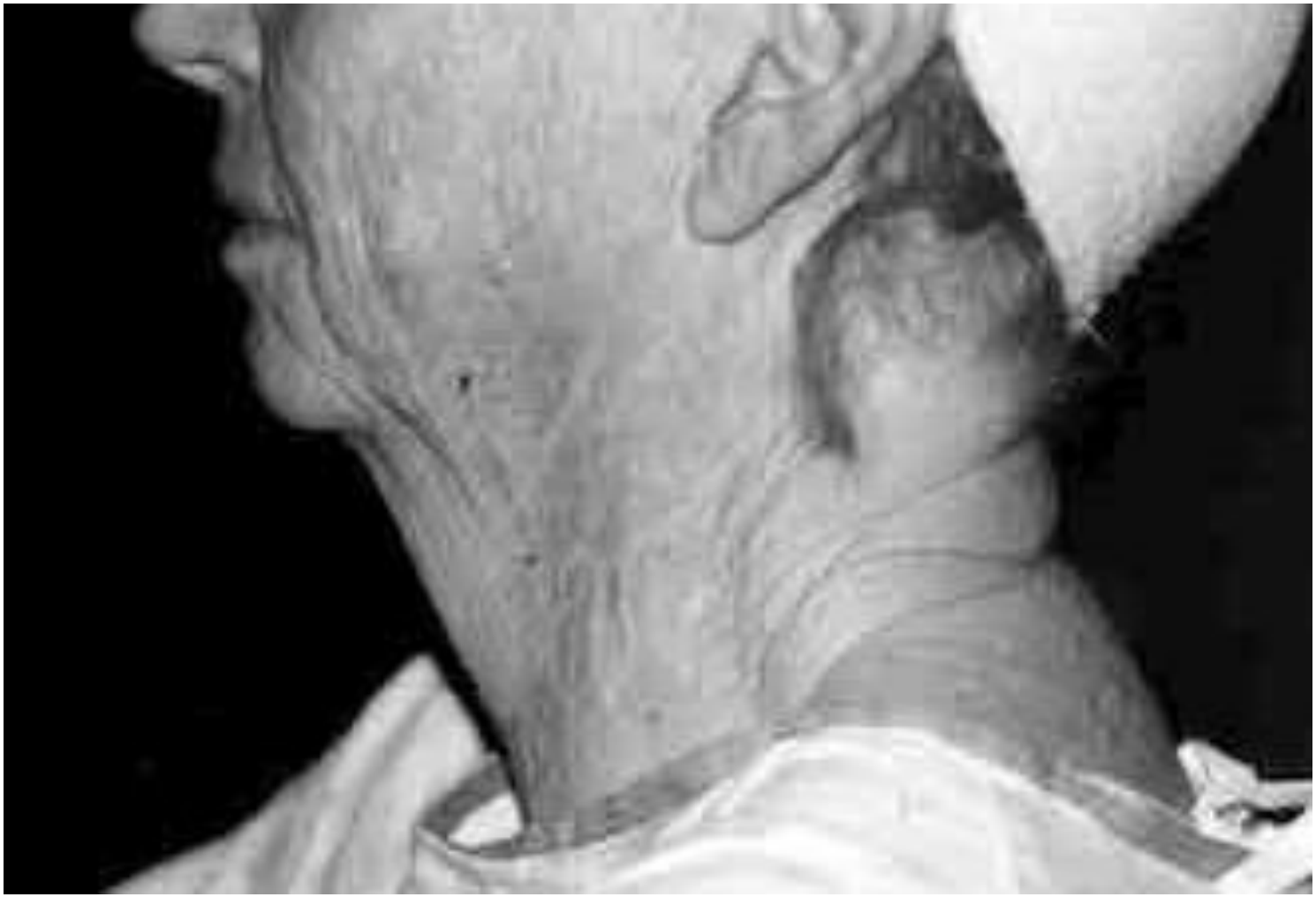
Cormack-Lehane scale for laryngoscopic view



Grade I view allows a full view of the entire glottic aperture
Grade II allows a partial glottic view
Grade III allows visualization of the epiglottis only
Grade IV does not even allow view of the epiglottis

Laryngeal appearance





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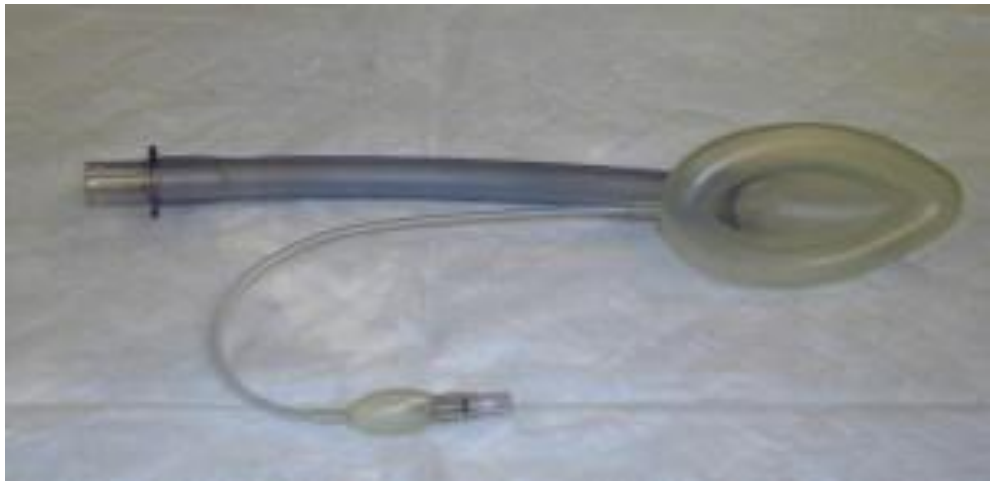
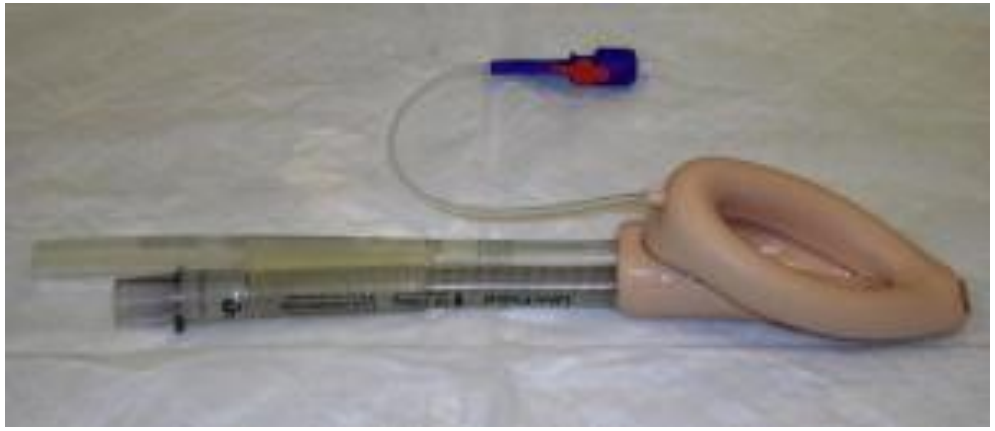


Laryngeal mask airway



Intubating LMA

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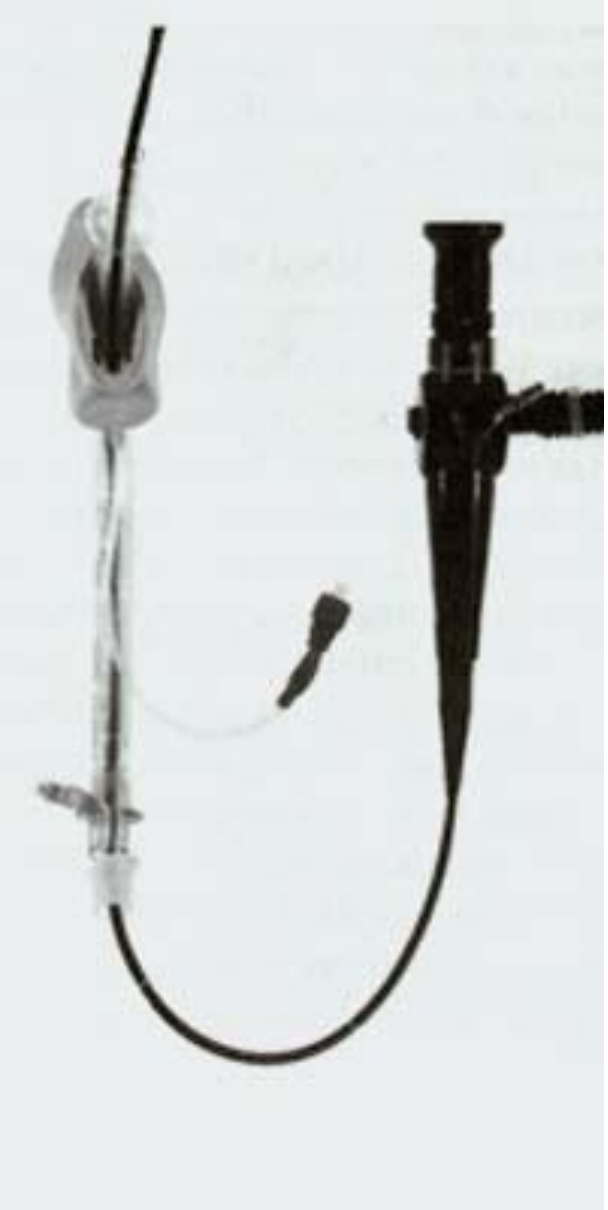
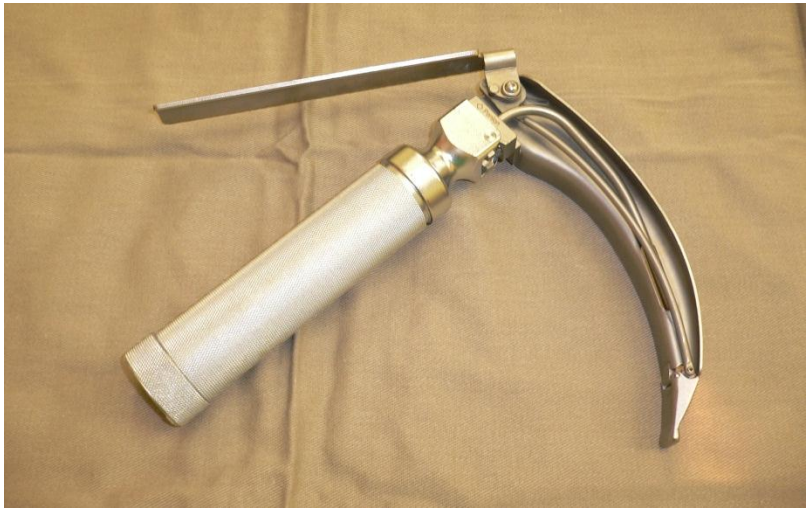
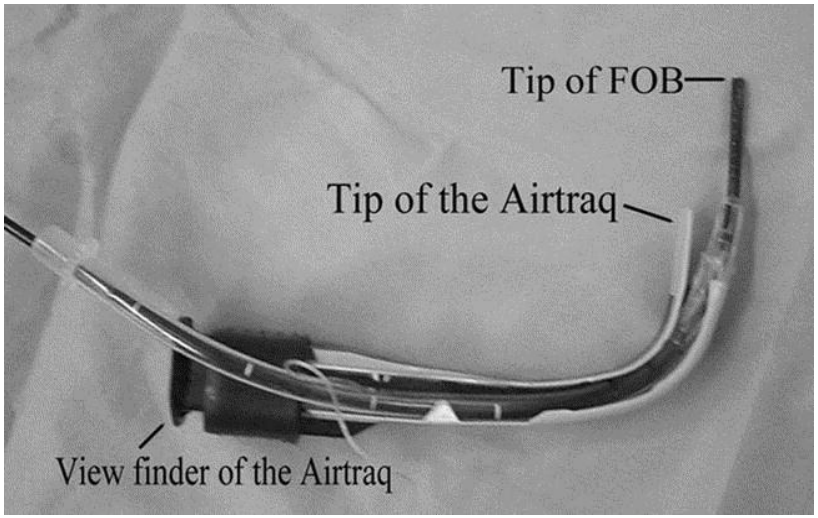


Other devices

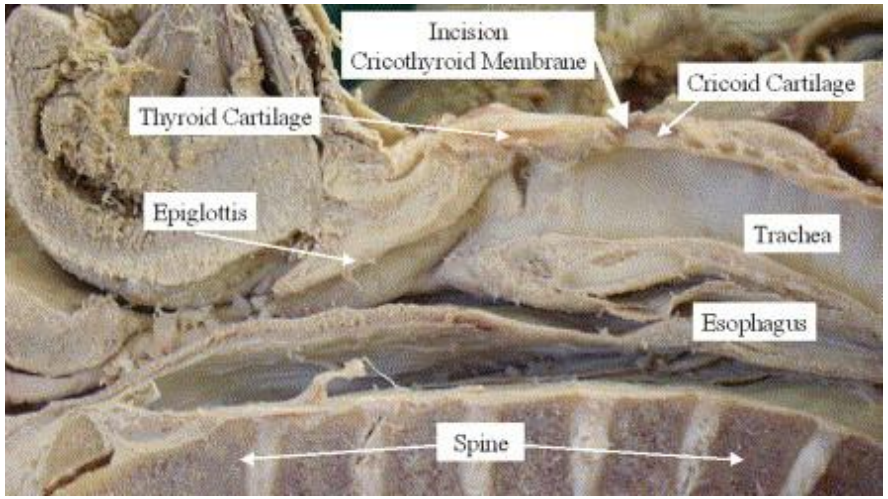


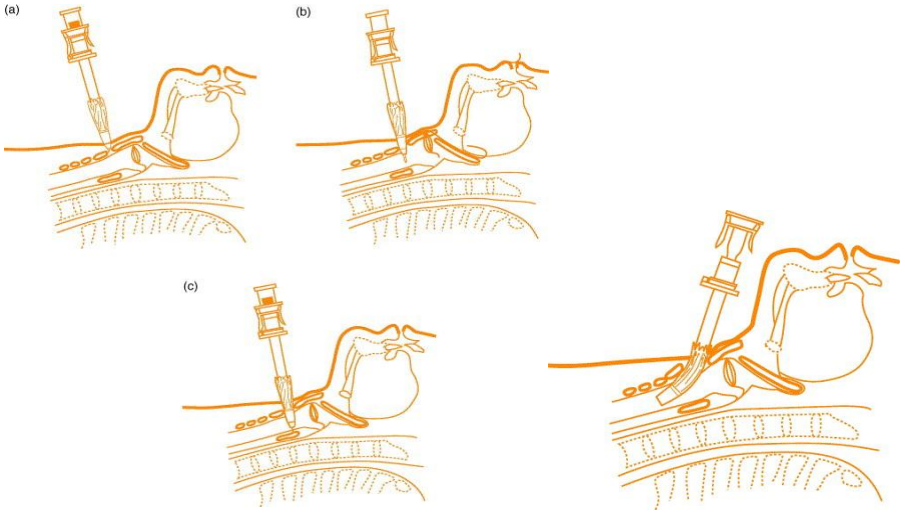


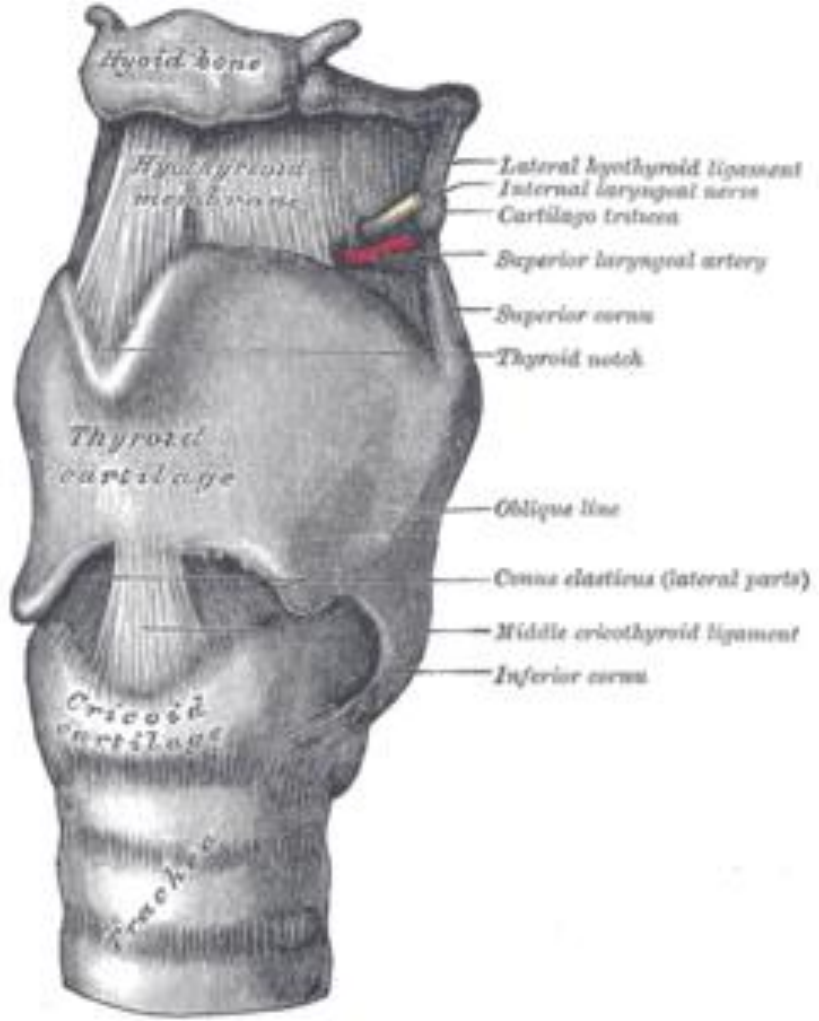
Surgical techniques

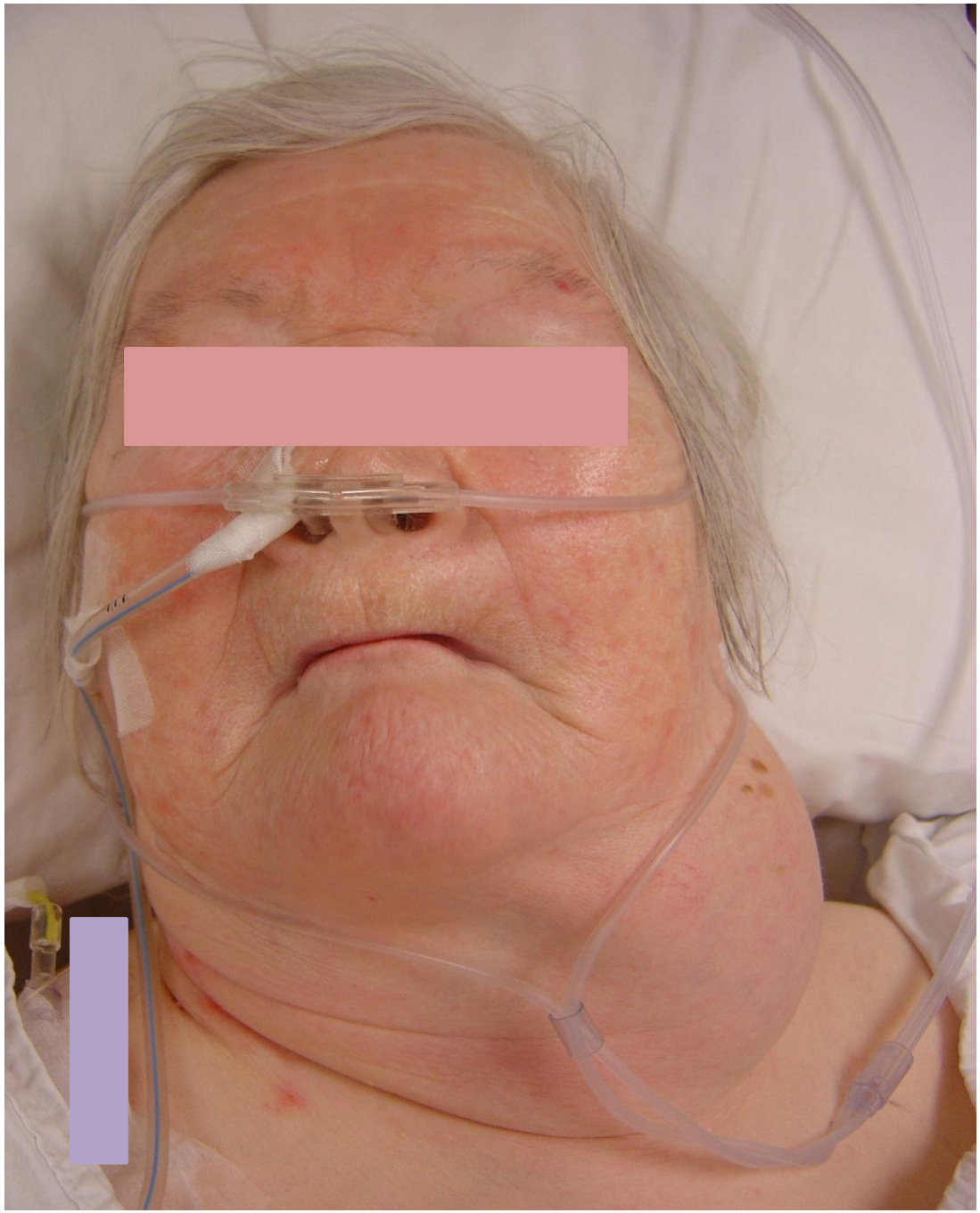
Cricothyroidotomy	Last resort, Seldinger technique
	Temporizing measure → definitive airway
	Cricothyroid membrane (bleeding, tube diameter >4mm)
	Contraindication for age <10
Percutaneous tracheotomy	Surgical technique of choice for age <12
	Cannot ventilate / cannot intubate scenario

Cricothyroidotomy

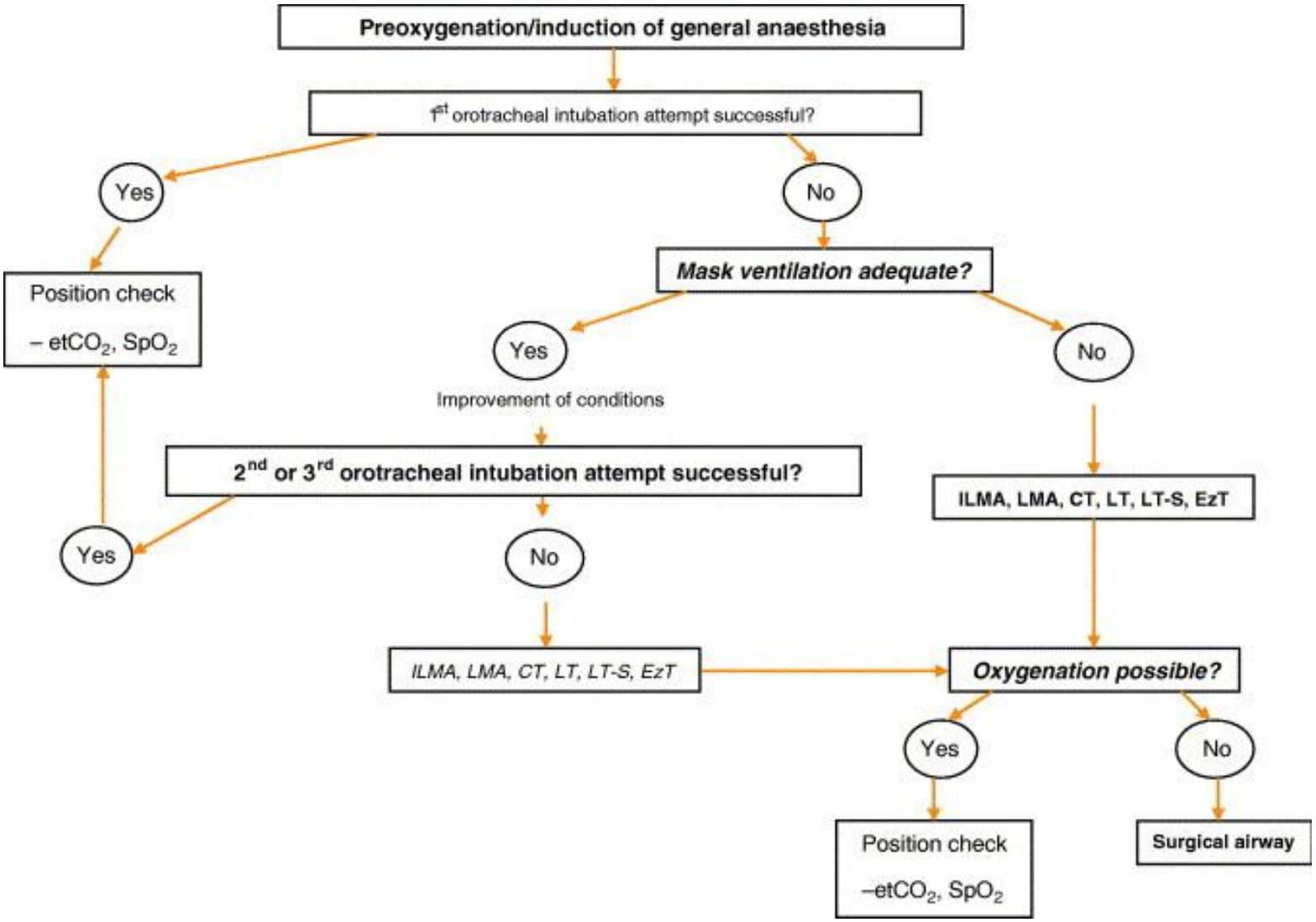








Airway algorithm



Injury during intubation

- Cervical spine injury
- Laryngeal / pharyngeal trauma
- Tracheal or bronchial rupture
- Nose bleed
- Tooth injury
- Eye and facial injury
- Tube displacement

Post extubation complications

- Glottic oedema
- Laryngeal dysfunction
- Sore throat and hoarseness
- Vocal cord paralysis
- Delayed: Laryngeal / tracheal stenosis

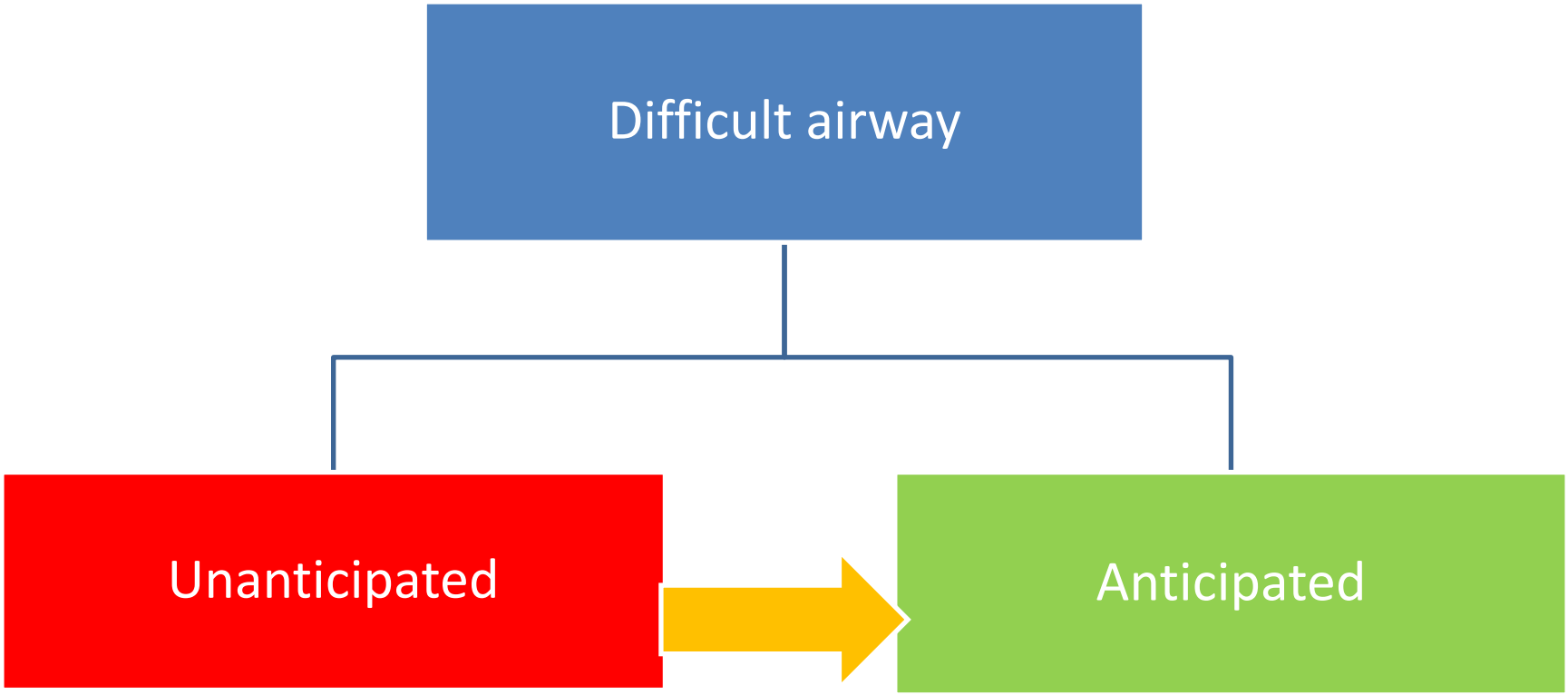
Extubation

- Planning in patient of difficult intubation

- Criteria by cuff leak test
- Reduced leak volume predict risk for stridor, e.g. 130ml or 12% of tidal volume

- Via airway exchange catheter

Strategy



Failed intubation will not kill but failed ventilation does

Main reference

- Emergency Airway Management: The Difficult Airway. J Nemeth, N Maghraby, S Kazim. Emergency Medicine Clinics of North America 2012; 401 – 420