EMERGENCY AIRWAY MANAGEMENT AND RSI

Muhammet Gokhan Turtay, M.D.

Assoc.Prof.

Department of Emergency Medicine

Inonu University School of Medicine

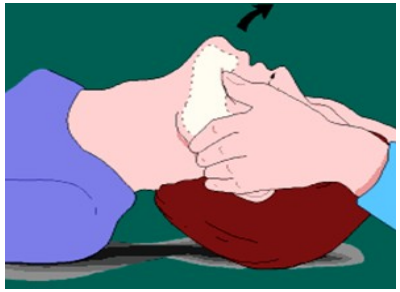
Malatya/Turkey

METHODS USED

- **Basic Methods**
  - Methods without assist devices
  - Methods with assist devices
- **Alternative Methods**
  - Supraglottic airways (Laryngeal mask)
  - Esophageal airways (Combitube)
  - Translumination with lighted guide
  - Fiberoptic laryngoscope [Direct-indirect (fiberoptic stile)]
  - Video assisted laryngoscope
- **Advanced Methods**
  - ETI, Nasotracheal intubation
  - Surgical Methods

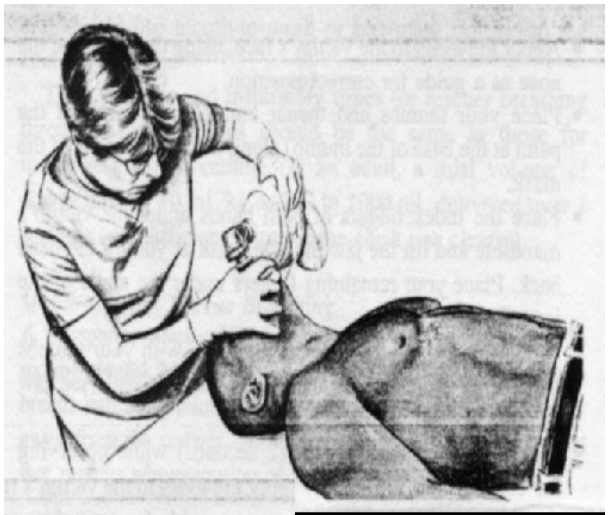
BASIC METHODS

- **Methods without assist devices**
  - Head tilt-Chin lift
  - Jaw thrust
  - Brow / Neck maneuver
- **Methods with assist devices**
  - Orofarengeal airway
  - Nasofarengeal airway
  - Bag-valve-mask (AMBU)



BASIC METHODS
BAG VALVE MASK DEVICE

- In situations where there is no chance for intubation
- In situations where there is no intubation experience
- For oxygen and ventilation before intubation
- For patients having respiratory insufficiency



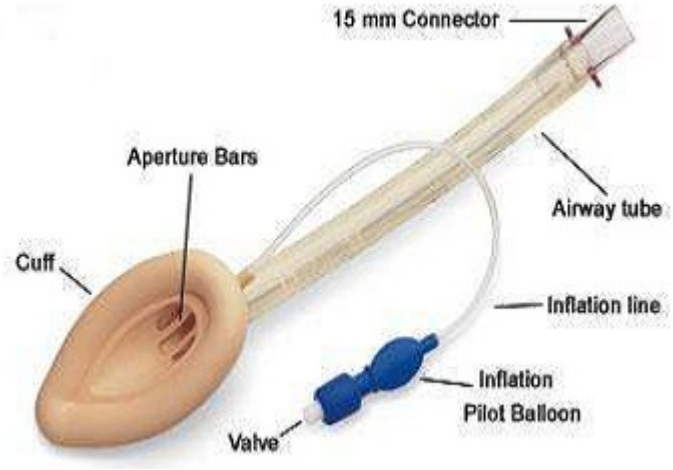
ALTERNATIVE METHODS LARINGEAL MASK, COMBITUBE

- Between bag valve mask and advanced methods
- Two basic characteristics

1. Closure of esophageous
2. The air given passes through pharynx and hypopharynx and reaching to larynx

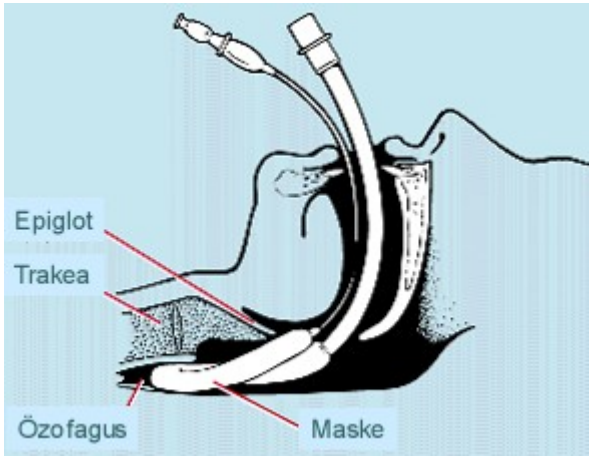
LMA

- Laryngeal Mask
  - Tube + Oval Mask + Oval Balloon



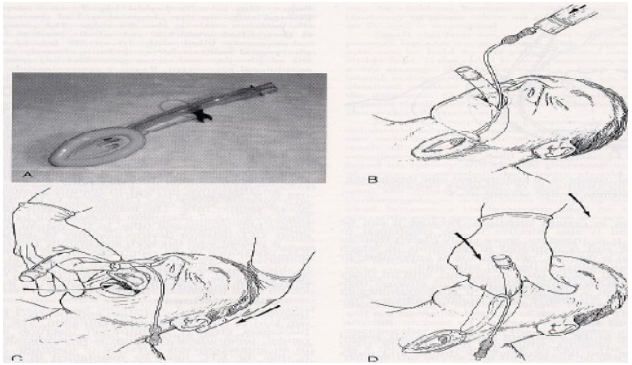
LMA

- When ETI is impossible
- Generally to children
- Do not block aspiration
- May not be effective if laryngospasm exists
- Air leakage in high airway pressure



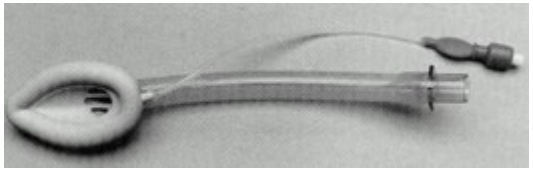
LMA

- After LMA, cuff deaerationed properly
- Lubricant gel to the surface contacting to palate
- Inserted blindly with thumb and index finger
- Cricoid pressure blocks LMA insertation
- Stop when facing resistance
- Inflate the cuff (Number 4 which is used for 60-80kg should be inflated with max 25-30ml)



LMA TYPES

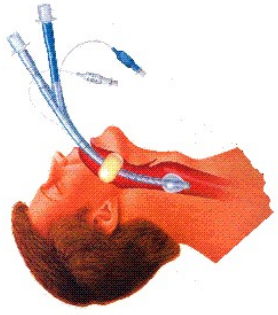
- LMA Classic
- LMA unique (Disposable)
- LMA supreme
- LMA fastrach (Intubation tube can be placed)
- LMA proseal (Nasogastric tube can be placed)
- LMA flexible (supported with wire)
- LMA ctrach (LMA fastrach + fiberoptic tip and screen)

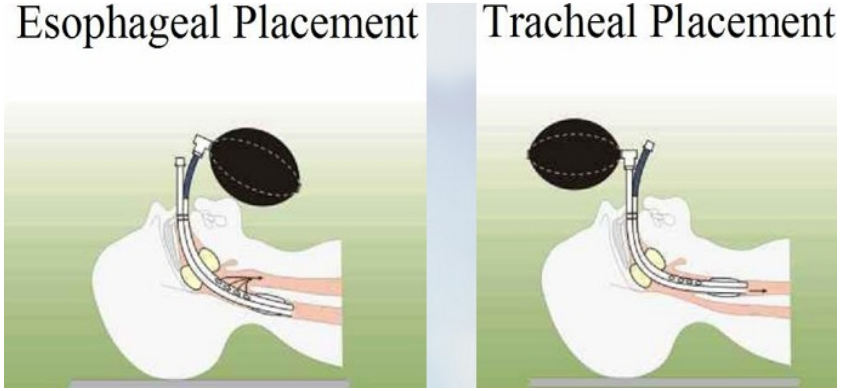


COMBITUBE

- Applied blindly, placed at esophagus or trachea
- A tube with two lumens

1. Short lumen
   - Distal end closed. Holed at the pharynx level
2. Long lumen
   - Distal end open





COMBITUBE

- Indications
  - ETI is not possible, unconscious
  - Situations in which neck movement is not possible
- Contraindications
  - When there is faucial reflex
  - Age<16
  - Caustic intoxication
  - Severe oropharyngeal trauma

King LT

Easy-tube

ALTERNATIVE METHODS

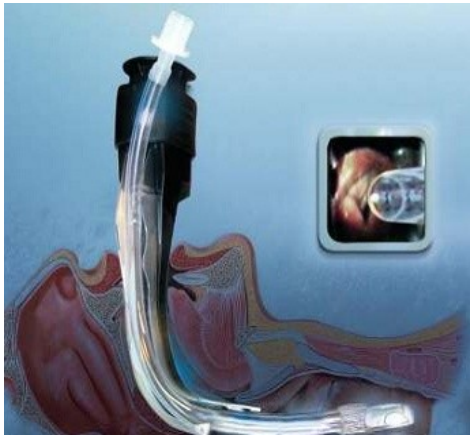
- Transluminaton with lighted guide
- Fiber-optic laryngoscope

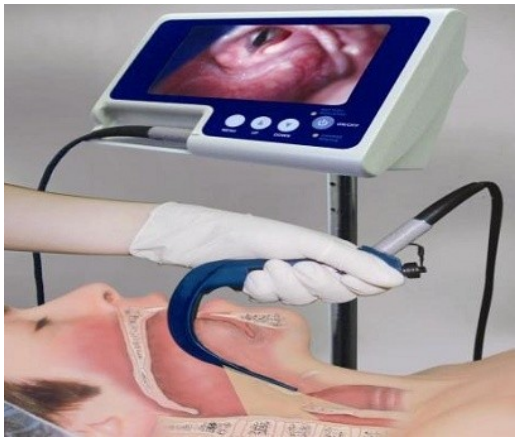
  [Direct-indirect (fiber optic style)]
- Video assisted laryngoscope

  - Enables watching the glottis without moving the neck

  - Trauma, obesity…

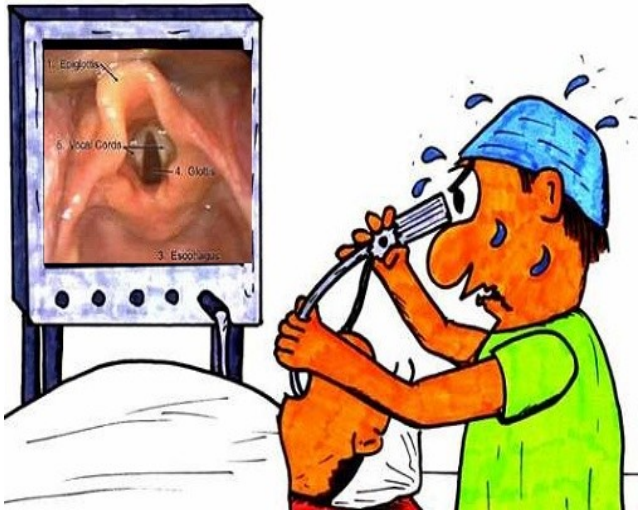
    * Airtraq Laringoskop * Airway Scope





ADVANCED METHODS
ETI

- Continuous airway
- Reliable oxygenation
- Reliable respiration
- Prevention of aspiration
- Easily aspiration of the secretions in the airway
- Drug delivery path in case of emergency (ELVAN)



ETI INDICATIONS

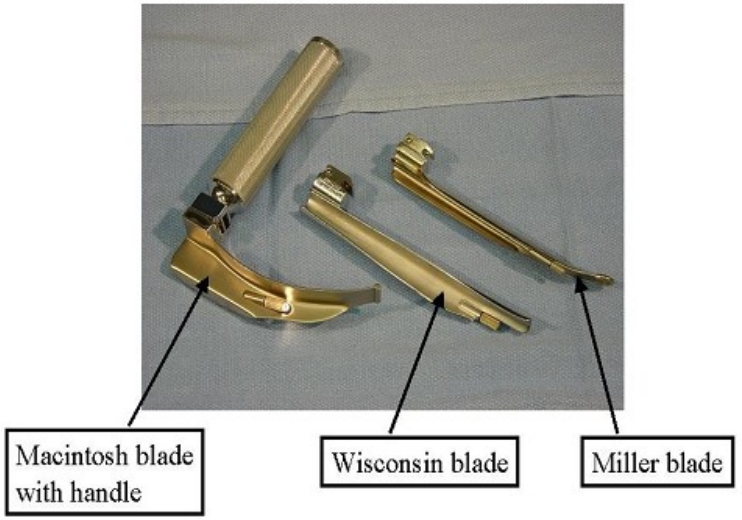
- **Sat O2 can not be increased with simple methods (BVM…)**
- Cardiac arrest
- Apnea
- Shortness of breath
- Respiratory excess of labor force
- General poor health
- Poor hemodynamics (shock …)
- Those having impaired consciousness
- Patients not having gag reflex (SVO…)
- **Status epilepticus**
- **Unable to protect airway against aspiration**
- Intoxications (TCAD…)
- **GKS 8 ≤**
- **With politrauma GKS 10 ≤**
- Politraumatic patients with positive peritoneal lavage
- Pulmonery contusioned politraumas
- **Politrauma with alcohol intoxication**
- **Head trauma and Intracranial hypertension**

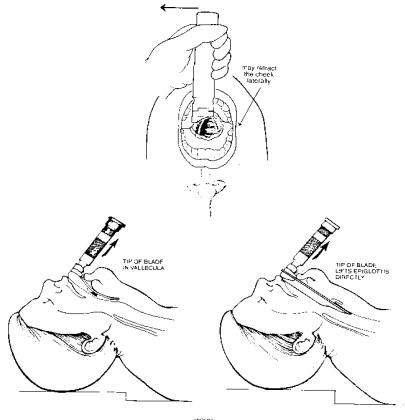
ETI APPLICATION

- First of all, the anatomy should be checked
- If conditions are suitable 100 %O2 (3-5 min, especially children, pregnancy, CHF…)
- If necessary, premedication
- **Laryngoscope**
- **Tube selection**
- **Head position**
- **Cricoid pressure**
- Laryngoscope from right mouth; by pushing tongue to the front, to the left and to up
- **BURP maneuver**
- Seeing arytenoids or vocal cords
- Fixing of the tube after verification of the tube's location

LARYNGOSCOPE

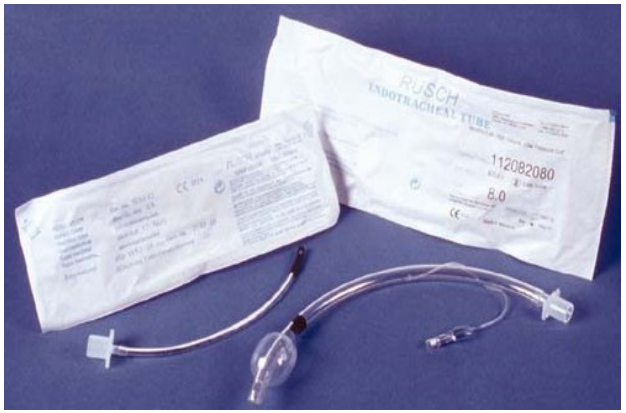
- Laryngoscope light should be checked
- **Premature**
  - Miller 0
- **Newborn**
  - Miller 0-1
- **From 1 month to 2 years of age**
  - Miller 1
- **2-6 years**
  - Macintosh 2
- **6-12 years**
  - Miller 2 or Macintosh 2-3
- **12 years and over**
  - Miller 2-3 or Macintosh 3





ETT

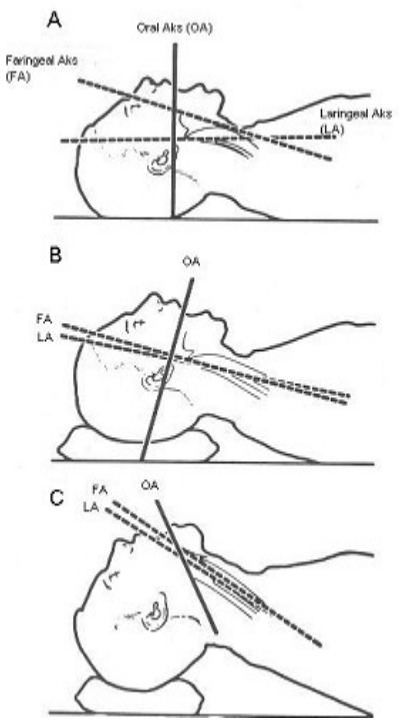
- For men: 8.0-8.5
- For women : 7.5-8.0
- For children (> 2 years)
  - Tube diameter uncuffed: Age / 4 + 4 mm
  - Tube diameter cuffed: Age / 4 +3 mm
  - Practicially little finger



- The cuff should be controlled before intervention
- The cuff pressure should be appropriate ➔ If too much, it causes necrosis and if less it causes risk for aspiration (5 cc)
- Fixing of the tube
  - M=23, F=21, C=Age/2 +14 cm or Tube diameter × 3
  - Tip of the tube should be 2 cm above the carina

HEAD POSITION

- The most common mistake in failed interventions ➔ wrong position or inadequate equipment
- Sniffing position
  - 30˚ flexion of the neck, 20˚ extension of the head
  - Elevate occiput (8-10cm)
- Cervical collar to the traumatic patients
- Children under 2 years have significant occiputs, pillow is not necessary, slight head extention is enough



CRICOID PRESSURE (SELLICK)

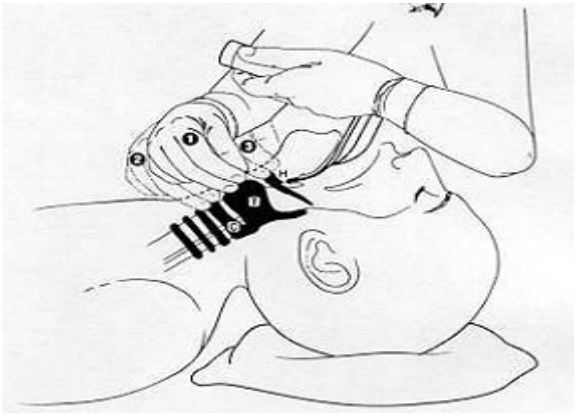
- When the patient is ventilated with ambu
- In order to prevent aspiration
- 2010 AHA – Class III

  - Causes difficulty in intubation and bag valve mask ventilation

BURP MANEUVER

- Backwards
- Upwards
- Right
- Pressure

  - To thyroid cartilage

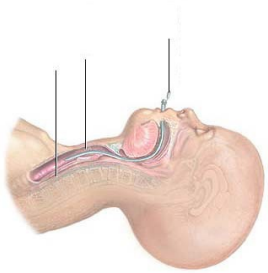


ETI
CAUTION..!

- Monitoring, pulse-oximetre
- Without aspirator successful intubation is risky and difficult
- Bag valve mask; the distinction of children and adult sizes should not be forgotten
- The patient should be sedatised adequately
- For ETI, Do not spend time more than 30 seconds (Bag valve mask)

SUCCESSFUL INTUBATION

- Seeing the ETT passes through vocal cords
- AC sounds can be taken bilaterally
- No sounds from epigastrium
- Symetric elevation of both hemithorax
- Condensation in the tube
- Increase of Sat-O2 and colour turning pink
- Chest X-Ray
- End-tidal CO2 measurement
- Esophageal detectors
- Detection of the location of the tube passed with direct laryngoscopy
- Fiberoptic verification



ETI COMPLICATIONS

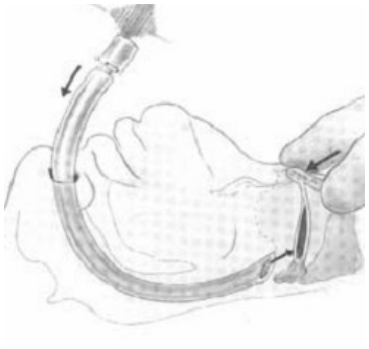
- Early
  - Esophageal intubation
  - Right bronchial intubation
  - Trauma (tongue, lips, teeth, pharynx, trachea)
  - Pharyngeal-esophageal perforation
  - Hypoxia, hypocapnia
  - Dysrhythmia
  - Obstruction (secretions such as blood and mucus, biting ...)
- Late
  - Infection (pneumonia, sinusitis, ...)
  - Hoarseness
  - Vocal cords injury, adhesion
  - Subglottic stenosis (most common)

NASOTRACHEAL INTUBATION

- If laryngoscope is not available
- If cricothyroidotomy can not be carried out
- If neuromuscular blockage is harmful
- If there is serious dyspnea, awaken and can not be put down

  - CHF, COPD, asthma ...
- If trouble combining the oropharyngeal-laryngeal axis

  - Arthritis, masseter spasm, temporomandibular joint dislocation, a new intraoral surgical intervention

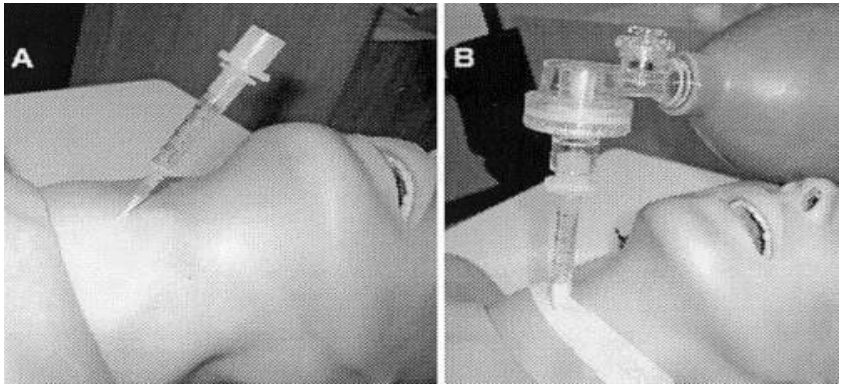


NASOTRACHEAL INTUBATION

- Technique
  - From ETT 0.5-1 mm small tube
  - Topical vasoconstrictor
  - Lubricating gel
  - Sniffing position should be secured
  - While pushing tube with one hand, fix larynx with the other
  - During inspiration, the tube is pushed
  - Distance from the nasal entry
    - Male 28 cm
    - Female 26 cm

SURGICAL METHODS

- The frequency of surgical airway from 0.6 % ↓
  - Needle cricothyroidotomy
  - Surgical cricothyroidotomy
  - Retrograde tracheal intubation
  - Tracheostomy

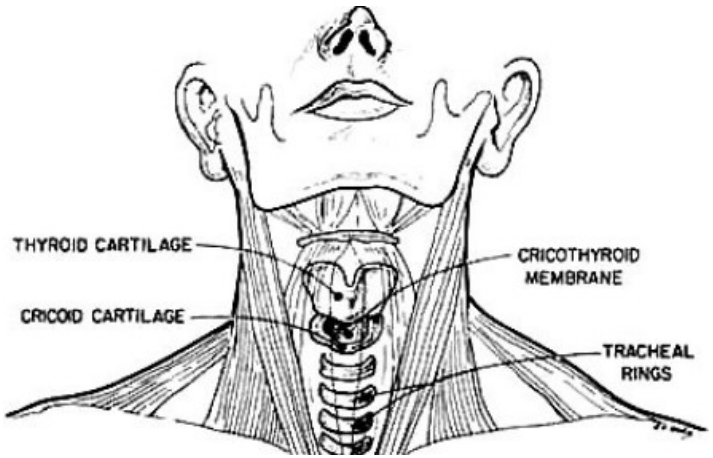


SURGICAL METHODS INDICATIONS

- **Anatomical**
  - Short/obese neck
- **Medical**
  - Retropharyngeal abscess
  - Oropharyngeal edema
  - Laryngeal edema
  - Epiglottitis
  - Mass
  - Vocal cord paralysis
- **Traumatic**
  - Hematoma (cervical fracture, major vascular injuries ...)
  - Severe facial trauma (Mandibular fracture...)
  - Penetrating cervical trauma
  - Foreign body
  - Serious blood aspiration
  - Tracheal/laryngeal rupture

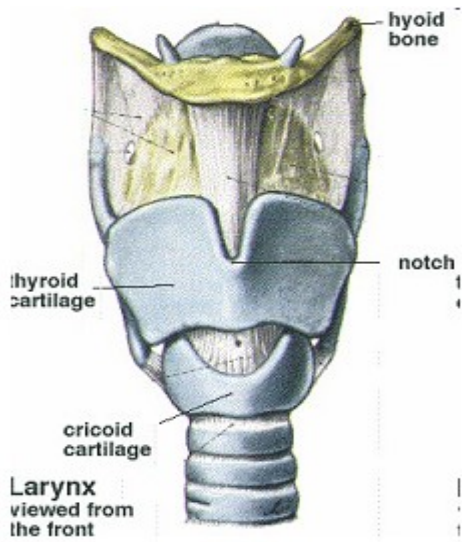
SURGICAL METHODS
CRICOTHYROTOMY

- 10 -12 years ↓ ➔ Needle cricothyroidotomy
- 10 -12 years ↑ ➔ Surgical cricothyroidotomy
- Tracheostomy tube ➔ should be prefered to ETT..!
- 7mm ↓ ETT (Max 6 mm ETT)



SURGICAL CRICOTHYROTOMY

- Protective materials
- Scalpel number 10 or 11
- Tracheal dilatator
- ETT (6 mm) or tracheostomy tube
- Materials for fixing
- Bag valve mask, oxygen



SURGICAL CRICOTHYROTOMY

- Thyroid cartilage is stabilized with thumb and middle finger of the hand which is not dominant
- A vertical incision is made in the midline between the thyroid and cricoid cartilage
- Cricothyroid membrane is perforated horizontally

SURGICAL CRICOTHYROTOMY

- Incision is extended
- Tracheostomy tube is placed
- If ETT has been used, don't push forward more than 2-3 cm
- The tube is stabilized
- Bag valve mask ventilation
- Respiratory sounds are listened

SURGICAL CRICOTHYROTOMY COMPLICATIONS

- Acute
  - Bleeding and hematoma
  - Incorrect placement of the tube
  - Subcutaneous emphysema
  - Trachea, esophagus, recurrent laryngeal nerve injury
  - Pneumothorax (barotrauma)
- Chronic
  - Infection
  - Dysphonia and voice changes
  - Subglottic stenosis
  - Tracheoesophageal fistula

SURGICAL METHODS
NEEDLE CRICOTHYROTOMY

- Protective equipment
- 12-14 G IV catheter
- 3 ml syringe
- 7 mm endotracheal tube adapter
- Bag valve mask, oxygen

NEEDLE CRICOTHYROTOMY

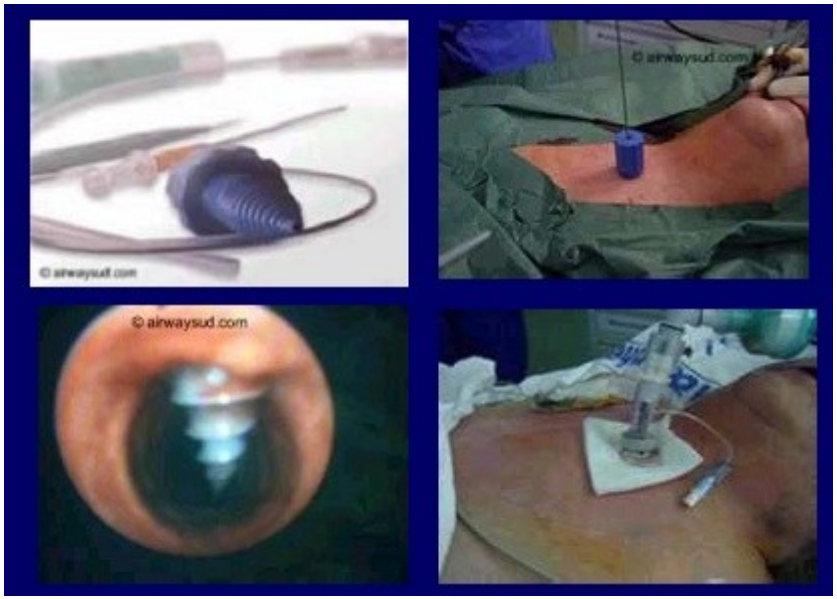
- 12-14 G catheter is connected to 3ml syringe
- Cricothyroid membrane is palpated
- Skin and subcutaneous tissues is passed with 90° angle, When the air comes to the syringe, tilt to larynx with 45° angle
- Needle and the syringe is retracted
- Catheter and pistonless syringe is reconnected
- 7mm ETT or the adapter is connected to the syringe

NEEDLE CRICOTHYROTOMY

- Bag valve mask with100 % oxygen
- Intermittent positive-pressure jet ventilation

  - Connect Y connector to ETT ; Ventilate 1 second by closing the open tip of the connector and then release for 4 seconds
- Ensure the safety of catheter
- Complications are rare
- Do not forget for adults it provides sufficient ventilation for max. 20-30 minutes...!

SURGICAL METHODS
PERCUTANEOUS TRACHEOSTOMY



RAPID SEQUENCE INTUBATION (RSI)

- Additional medicine that will reduce the physiological response against intubation
- With potent sedative or induction agents
- With administration of rapid-acting and short-term neuromuscular blocker

performing proper tracheal intubation

RSI

- Aspiration risk ↓

  - When emergency airway is needed in patients who are not hungry

- Physiological responses to intubation ↓

  - When emergency intubation is needed

- Pain and discomfort of the patient ↓

  - For trauma patients…

- The stress levels of emergency service workers ↓

  - To facilitate emergency interventions (CT, MR…)

RSI-6P

- **P**reparation
- **P**reoxygenation
- **P**retreatment
- **P**aralysis
- **P**lacement
- **P**ost-intubation

RSI-PREPARATION

- AMPLE
  - Allergies
  - Medications
  - Past medical history
  - Last eaten
  - Events leading to intubation
- The patient should be examined in terms of difficult intubation
- Equipment should not be missing

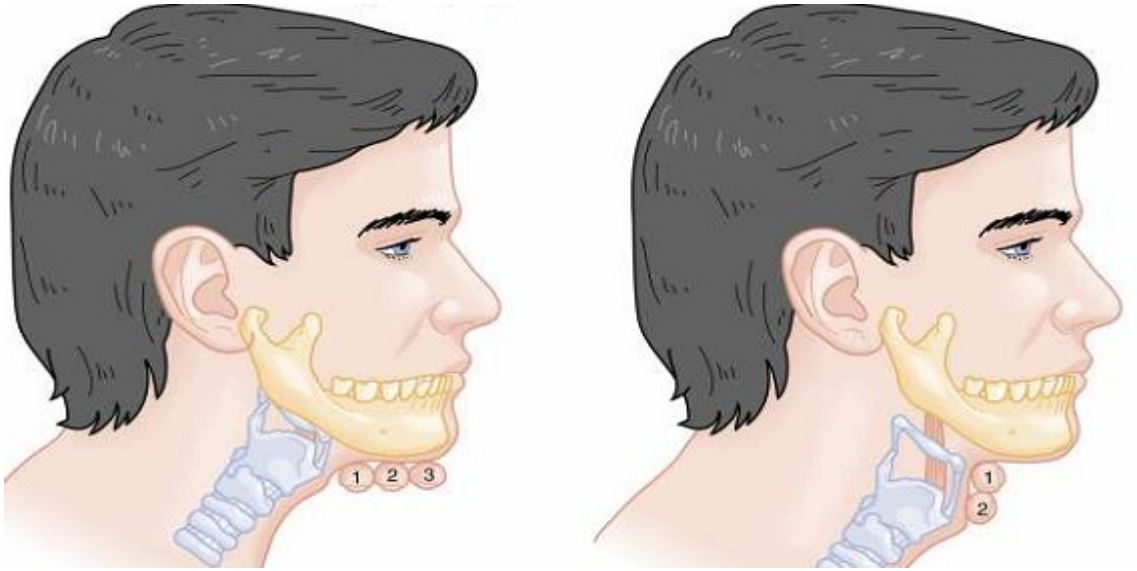
RSI-DIFFICULT INTUBATION

- If more than 3 attempts
- If could not be carried out in 10 min ↑
- Need for laryngoscope blade replacement or stile
- Frequency 1-2 %

- Limitation of neck extension, neck trauma patients
- Patients with dense beard
- Limitation of mouth opening
- Long and forward front teeth
- Mass in the mouth, large tongue
- Small and behind jaw structure
- High arched palate
- Short, thick neck
- Obesity, pregnancy

RSI-DIFFICULT INTUBATION
3-3-2 RULE

- The distance between the front incisors shorter than 3 fingerbreadths
- The distance between mentum and hyoid shorter than 3 fingerbreadths
- The distance between hyoid and thyroid cartilage shorter than 2 fingerbreadths



RSI-DIFFICULT INTUBATION

- **Mallapati**

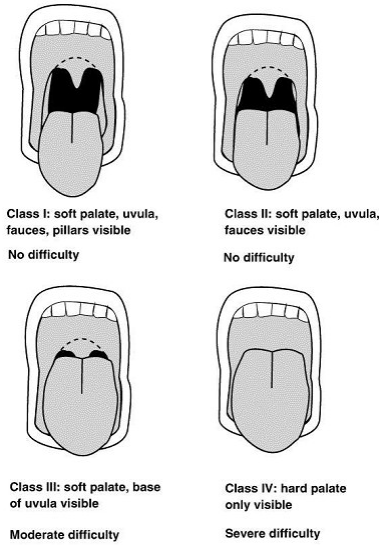
I: Faucial pillars, soft palate and uvula visible

II: Soft palate visible but uvula is masked by the base of the tongue

III: Only the base of the uvula can be visualized

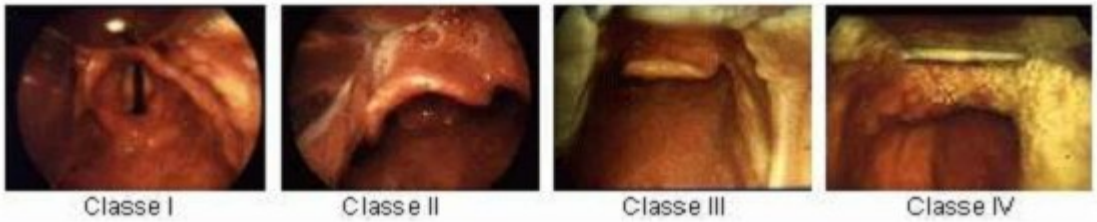
IV: None of the three structures can be visualized

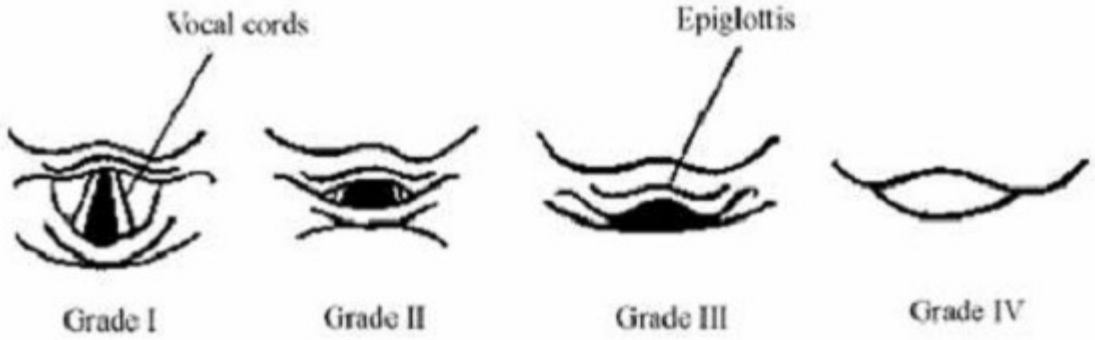
- When used alone the value is limited



RSI-DIFFICULT INTUBATION CORMACK & LEHANE GRADING

Cormack RS, Lehane J: Difficult tracheal intubation in obstetrics.Anaesthesia 39:1105, 1984.





RSI-PREOXYGENATION

- 100% oxygen
  - The patient's respiration +
    * Normal: 1-4 min
    * Fast and deep: 30-60 sec
    * Superficial and / or slow: 4 min ↑
  - If there is no respiration, the patient must be oxygenated via BVM
- After a full oxygenation, the decrease of oxygen saturation under 90 %
  - In non-obese ➔ approximately 6 min
  - In obese ➔ approximately 4 min
  - In morbidly obese ➔ approximately 3 min

RSI-PREMEDICATION

1. The reactions related to laryngoscopy and ETI (Reflex sympathetic response) and side effects of the medication to be administered ↓
2. To prepare the patient to intubation

- Not compulsory, done if time is available
- The findings are unclear regarding to the improvement of the results
- Most commonly used medications are
  - Atropine
  - Lidocaine
  - Fentanyl

RSI-PREMEDICATION

- **Atropin**
  - Bradycardia (for succinylcholine and laryngoscopy on children)
  - Routine administration not recommended
  * Children ➔ 0.02 mg/kg (IV)
  * Adults ➔ 0.01 mg/kg (IV)
- **Lidocaine**
  - To decrease ICP
  - To prevent bronchospasm
  - No evidence regarding positive effecting of the results in RSI
  * 1.5 mg/kg IV (2%)

RSI-PREMEDICATION

- **Fentanyl**

  - Pain

  - Supress sympathetic response of intervention

  (Especially aortic dissection, ischemic heart disease, aneurysm...)

  * 3 min before 3 mcgr/kg IV

- Before intubation administration of nondepoloarizan agents (Vecuronium/pancuronium 0.01 mg/kg IV) not recommended

RSI-PARALYSIS WITH INDUCATION SEDATIVE AND NMB SELECTION

- Hemodynamic stability and risk of hypotension
- Respiratory status and the risk of respiratory depression
- ICP and cerebral perfusion
- The presence of ischemic heart disease
- Action rate of the agent

are decisive ..!

RSI-SEDATIVE AGENTS

Agent	IV Dose	Onset of action	Duration of action
Thiopental	3-5 mg/kg	10-40 sec	10-20 min
Methohexital	1-3 mg/kg	30-60 sec	5-10 min
Etomidate	0,3 mg/kg	30-45 sec	10-20 min
Propofol	0.5-1.5 mg/kg	20-40 sec	8-15 min
Ketamine	1-2 mg/kg	30-60 sec	10-20 min
Midazolam	0.05-0.2 mg/kg	2-3 min	10-30 min

RSI-SEDATIVE AGENTS THIOPENTAL

Advantages	Disadvantages	Contraindications
Rapid acting	Hypotension	Asthma
The short duration of effect	Myocardial/Respiratory depression	Hypotension
ICP ↓	No analgesic effect	Porphyria
Anticonvulsant	Histamine release	Multiple trauma

RSI-SEDATIVE AGENTS METHOHEXITAL

Advantages	Disadvantages	Contraindications
Rapid-acting	Hypotension	Hypotension
The short duration of effect	Myocardial / Respiratory depression	Epileptic patients
ICP ↓	No analgesic effect	Asthma
	Hiccups / hypertonicity	Porphyria
	Trismus	Multiple trauma
	Laryngospasm	

RSI-SEDATIVE AGENTS ETOMIDATE

Advantages	Disadvantages	Contraindications
Effect on blood pressure Ø	Myoclonic jerks	Focal epileptic seizure
Min. respiratory dep.	Seizure	Adrenal insufficiency
Reduces ICP and IOP	Hiccups	
Protective against cerebral and myocardial ischemia	Nausea / vomiting	
Reduced histamine release	No analgesic effect	
	Steroid synthesis inh.	

RSI-SEDATIVE AGENTS PROPOFOL

Advantages	Disadvantages	Contraindications
ICP ↓	Hypotension	Hypotension
Titratable	Myocardial/Respiratory depression	Asthma?
Anticonvulsant	No analgesic effect	
Antiemetic	Rare bronchospasm	
Does not result in the discharge of histamine	Injection pain	
	Trismus and dystonic reactions	

RSI-SEDATIVE AGENTS KETAMINE

Advantages	Disadvantages	Contraindications
Dissociative anesthesia	Emergence phenomenon	Uncontrolled HT
Amnesia	Laryngospasm	Glaucoma
Analgesia	IOP ↑	Penetrating eye injury
Bronchodilation	TA and Heart Rate ↑	Psychosis history
No respiratory dep.	Nausea and vomiting	Thyroid storm
Do not lower TA in hypotensives	Secretions ↑	CAD/CHF?
No effect ICP, cerebroprotective		

RSI-SEDATIVE AGENTS MIDAZOLAM

Advantages	Disadvantages	Contraindications
Amnesia	Hypotension - variable and dose-dependent	Hypotension
Anticonvulsant	Late onset	
	Respiratory depression	
	Variable effect	

RSI-NEUROMUSCULAR BLOCKERS

Agent	Dose	Onset of Action	Duration of action
Depolarizing			
Succinylcholine	1.5 mg/kg	45-60 seconds	5-9 min
Nondepolarizing			
Pancuronium	0.1 mg/kg	2-3 min	45-60 min
Vecuronium	0.1-0.15 mg/kg	2-4 min	25-40 min
Rocuronium	0.6-1 mg/kg	1-3 min	30-45 min

RSI-NMB
SUCCINYLCHOLINE

Advantages	Disadvantages	Contraindications
Rapid-acting	Hyperkalemia	Kidney failure
Reliable	Bradycardia	M. Hyperthermia history
Short-acting	ICP, IOP ↑	Burn
	Masseter spasm	Neuromuscular diseases
	Fasciculations	Crush injury
	Malignant hyperthermia	Serious infections
	Prolonged apnea	Pseudocholinesterase deficiency or MG

RSI-NMB
PANCURONIUM

Advantages	Disadvantages	Contraindications
Fasciculation Ø	Histamine release	Difficult airway
	Tachycardia	
	Long duration of action	

RSI-NMB
VECURONIUM

Advantages	Disadvantages	Contraindications
Cardiac effects Ø	Hypotension possibility	Difficult airway
Histamine release Ø	Action starts later	
Fasciculation Ø	Prolonged duration of action for the elderly, obese and patients with hepatorenal failure	

RSI-NMB
ROCURONIUM

Advantages	Disadvantages	Contraindications
Serum K^+ ineffective	Action starts later	Difficult airway
Bradycardia Ø	Action is long lasting	
Fasciculation Ø	Tachycardia	
In comparison with Vecuronium side effects and contraindications ↓	Allergy	

RSI-CAUTION..!

- When intubation is not successful, do not give muscle relaxants to patients that you can not make inhalation with BVM
- If ETI intervention is prolonged, the patient should be ventilated with BVM in a way that the saturation is not under 90%
- The second attempt should be tried by a person who is more experienced

RSI-POST INTUBATION SEDATION AND NMB

Sedative	Intermittant bolus	Infusion
Diazepam	0.1 - 0.15 mg/kg	
Lorazepam	0.05 - 0.1 mg/kg	
Midazolam	0.05 - 0.1 mg/kg	
Propofol	1 - 1.5 mg/kg	10 - 30 mcg/kg/h

- When significant motor activity is detected in the patient

  - Vecuronium or Pancuronium

    * 1/3 of the dose 0.1 mg/kg, bolus one in every 45-60 min

İNÖNÜ ÜNİVERSİTESİ
TURGUT ÖZAL TIP MERKEZİ
"1996'dan beri"

ATÜDER
International Emergency Medicine
Turkish - Macedonien
Meeting

Thank You..!