Airway Management and Equipment

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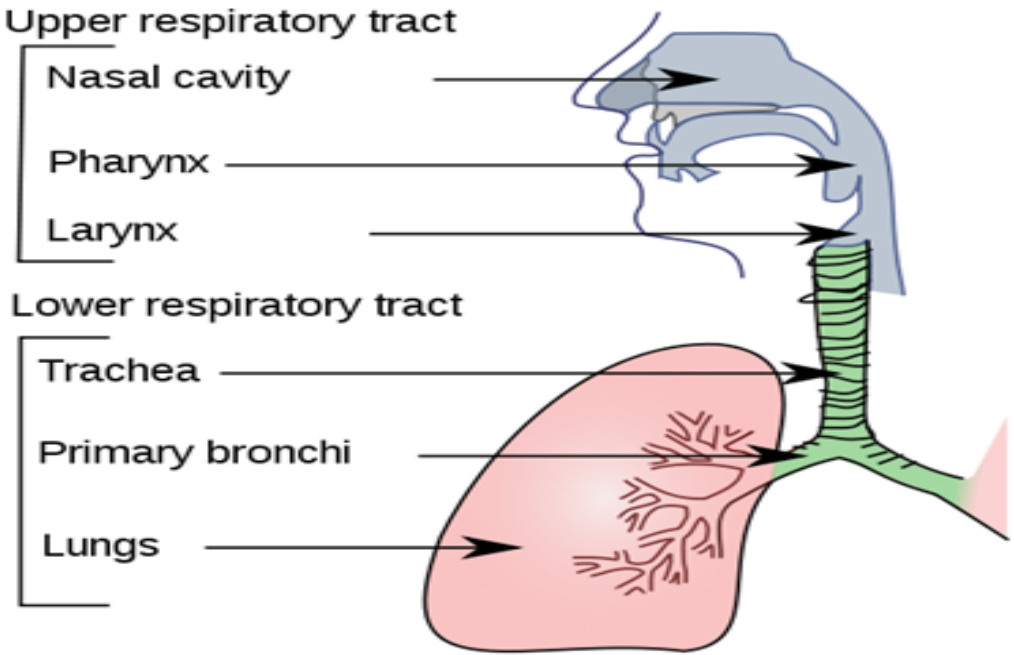

Upper respiratory tract
Nasal cavity
Pharynx
Larynx
Lower respiratory tract
Trachea
Primary bronchi
Lungs

NERVE SUPPLY OF LARYNX

MOTOR

- All the muscles which move the vocal cords (abductors, adductors or tensors) are supplied by the ***Recurrent Laryngeal Nerve*** except the cricothyroid muscle, which is supplied by ***Superior Laryngeal Nerve***.
- Both of these are branches of the **Vagus Nerve**.

SENSORY

- Above the vocal cords, larynx is supplied by ***Internal Laryngeal Nerve*** – a branch of Superior Laryngeal Nerve & below the vocal cords by ***Recurrent Laryngeal Nerve***.

Differences between adult & infant Larynx

- 7 S

1. Size- smaller in infants

2. Shape- funnel shaped in infants , cylindrical in adults

3 . Softness-laryngeal cartilages are softer in infants

4. Superiorly placed in infants

5 . Straighter and less oblique than in adults

6 . Sensitivity is greater in infants more prone to spasm

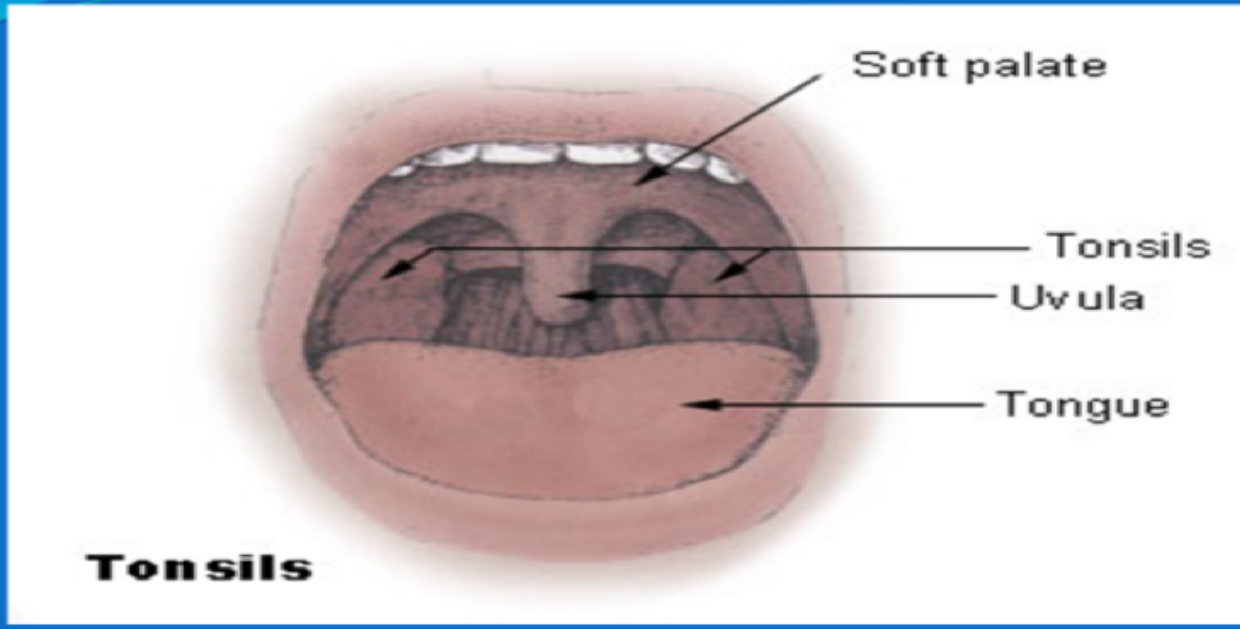
7 . Sub glottis is very narrow ,even a small swelling can lead to airway obstruction in infants

Infant Larynx

- Position: Infant larynx is situated higher in the neck. Vocalcords lie at C3/C4 level and during swallowing go up to C1/ C2 level. In adults vocal cords lie at C5 level.

- Cartilages: Laryngeal cartilages in infants are soft and collapse easily.
  - Epiglottis: It is omega shaped.
  - Arytenoids: They are relatively large and cover significant posterior part of glottis.
  - Thyroid: It is flat.
  - Cricoid: The diameter of cricoid is smaller than glottis.

Airway Evaluation



Airway Evaluation (cont.)

- Take very seriously history of prior difficulty
- Head and neck movement (extension)
  - Alignment of oral, pharyngeal, laryngeal axes
  - Cervical spine arthritis or trauma, burn, radiation, tumor, infection, scleroderma, short and thick neck

Airway Evaluation (cont..)

- Jaw Movement

  Receding mandible

  Inability to sublux lower incisors beyond upper incisors

- Protruding Maxillary Incisors (buck teeth)

Airway Evaluation (cont..)

- Mallampati Score
- Sitting position, protrude tongue, don't say "AHH"

Class 1: Full visibility of tonsils, uvula and soft palate
Class 2: Visibility of hard and soft palate, upper portion of tonsils and uvula
Class 3: Soft and hard palate and base of the uvula are visible
Class 4: Only Hard Palate visible

LEMON

LOOK at the patient's anatomy
- small mandible
- large tongue
- short bull neck
- obese
- abnormal facial/neck anatomy

EVALUATE – 3,3,2 finger widths between
- teeth
- hyoid and mentum
- hyoid and thyroid

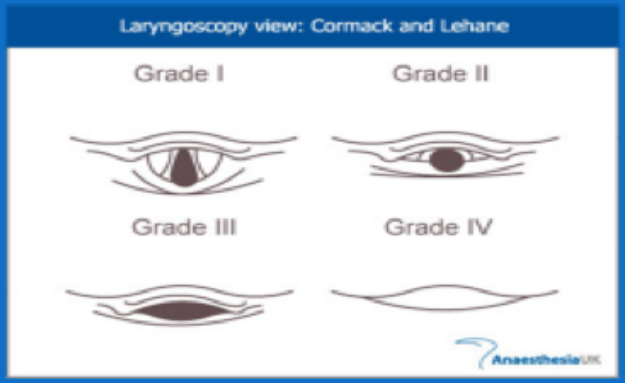
MALLAMPATI

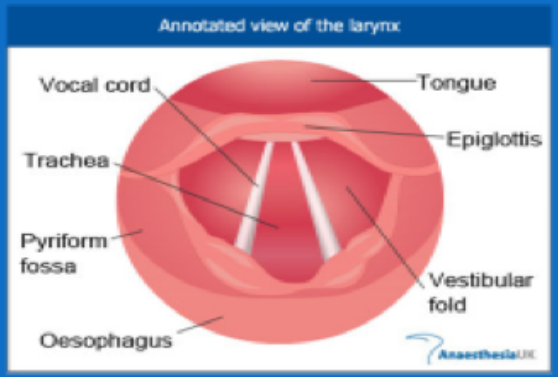
OBSTRUCITION
- secretions, stridor, muffled voice, mass, fb

NECK MOBILITY
- c-spine immobilization, RA, Ankylosing Spond

Airway Evaluation (cont…)

Laryngoscopy view: Cormack and Lehane



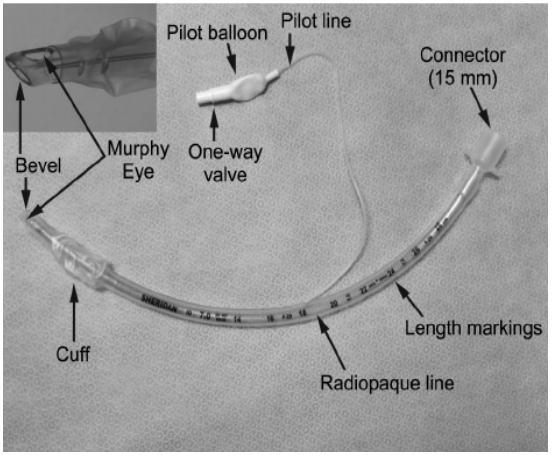


Grade I: complete glottis visible
Grade II: anterior glottis not seen
Grade III: epiglottis seen, but not glottis
Grade IV: epiglottis not seen

OROTRACHEAL INTUBATION

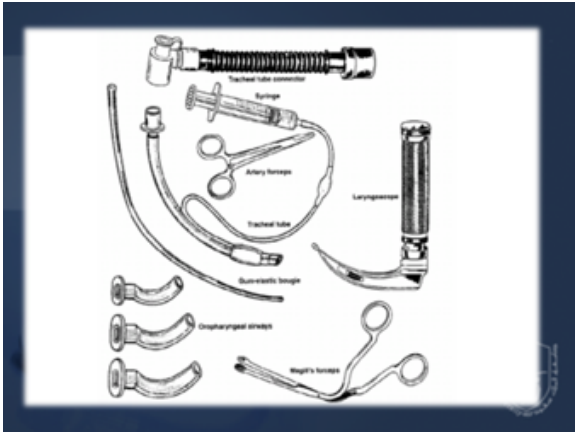
Indications for Intubation - the 5 P's:

- ❑ Patency of airway required
  - Decreased level of consciousness (LOC)
  - Facial injuries
  - Epiglottises'
  - Laryngeal edema, e.g. burns, anaphylaxis
- ❑ Protect the lungs from aspiration
  - Absent protective reflexes, e.g. coma, cardiac arrest
- ❑ Positive pressure ventilation
  - Hypoventilation – many etiologies
  - Apnea, e.g. during general anesthesia
  - During use of muscle relaxants
- ❑ Pulmonary Toilet (suction of tracheobronchial tree)For patients unable to clear secretions
- ❑ Pharmacology also provides route of administration for some drugs



Equipment Required for Intubation

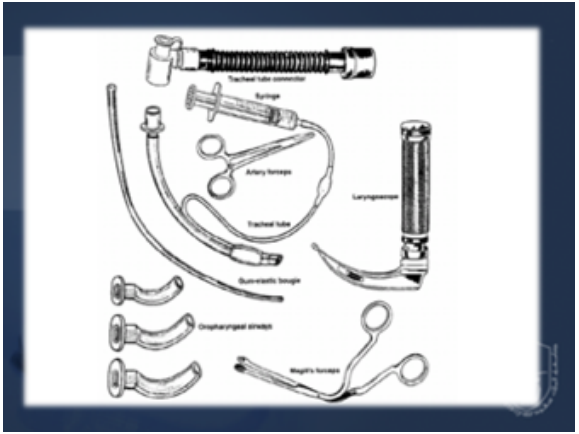
- ❑ Bag and mask apparatus (e.g. Laerdal/Ambu)
- ❑ Pharyngeal airways (nasal and oral types available)
- ❑ Laryngoscope • MacIntosh = curved blade (best for adults)
  - • Magill/Miller = straight blade (best for children)
- ❑ Trachelight - an option for difficult airways
- ❑ Fiberoptic scope - for difficult, complicated intubations
- ❑ Endotracheal tube (ETT): many different types for different indications
  - • Inflatable cuff at tracheal end to provide seal which permits positive pressure ventilation and prevents aspiration
  - • No cuff on pediatric ETT (physiological seal at level of cricoid cartilage)
  - • Sizes marked according to internal diameter; proper size for adult ETT based on assessment of patient
  - • Adult female: 7.0 to 8.0 mm • Adult male: 8.0 to 9.0 mm • Child (age in years/4) + 4 or size of child's little finger = approximate ETT size
  - • If nasotracheal intubation, ETT 1-2 mm smaller and 5-10 cm longer
  - • Should always have ETT smaller than predicted size available in case estimate was inaccurate



- ❑ Malleable stylet should be available; it is inserted in ETT to change angle of tip of ETT, and to facilitate the tip entering the larynx; removed after ETT passes through cords
- ❑ Lubricant and local anaesthetic are optional
- ❑ Magill forceps used to manipulate ETT tip during nasotracheal intubation
- ❑ Suction, with pharyngeal rigid suction tip (Yankauer) and tracheal suction catheter
- ❑ Syringe to inflate cuff (10 ml)
- ❑Stethoscope to verify placement of ETT
- ❑ Detector of expired CO_2 to verify placement
- ❑ Tape to secure ETT and close eyelids

Remember "SOLES"

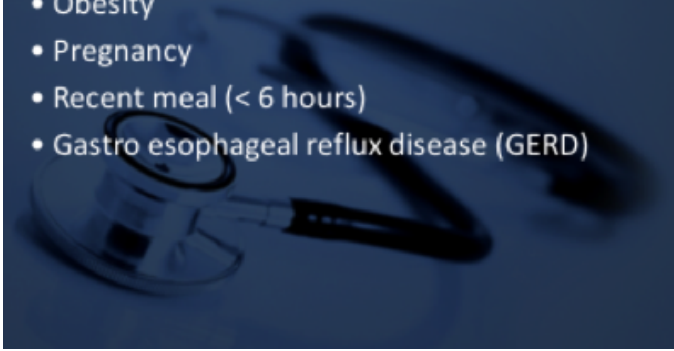
Suction
Oxygen
Laryngoscope
ETT
Stylet, **S**yringe



Rapid Sequence Induction

❑ Indicated in all situations predisposing the patient to regurgitation/aspiration

- Acute abdomen
- Bowel obstruction
- Emergency operations, trauma
- Hiatus hernia with reflux
- Obesity
- Pregnancy
- Recent meal (< 6 hours)
- Gastro esophageal reflux disease (GERD)



Confirmation of Tracheal Placement of ETT

- ❑ Direct visualization of tube placement through cords
- ❑ Indirect (no one indirect method is sufficient)
  - Auscultation axilla for equal breath sounds bilaterally and absence of breath sounds over epigastrium
  - Chest movement and no abdominal distension
  - Feel the normal compliance of lungs when bagging patient
  - Condensation of water vapor in tube during exhalation
  - Refilling of reservoir bag during exhalation
  - AP CXR: ETT tip at midpoint of thoracic inlet and carina
- ❑ Esophageal intubation is suspected when
  - Capnograph shows end tidal CO_2 zero or near zero
  - Abnormal sounds during assisted ventilation
  - Impairment of chest excursion
  - Hypoxia/cyanosis
  - Presence of gastric contents in ETT
  - Distention of stomach/epigastrium with ventilation

Complications during Laryngoscopy and Intubation

❑ Mechanical

- Dental damage (i.e. chipped teeth)
- Laceration (lips, gums, tongue, pharynx, esophagus)
- Laryngeal trauma
- Esophageal or endobronchial intubation

❑ Systemic

- Activation of sympathetic nervous system (hypertension (HTN), tachycardia, dysrhythmias) since tube touching the cords is stressful
- Bronchospasm

EXTUBATION

General guidelines:

- 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.

Complications Discovered at Extubation

- Early
  - Aspiration
  - Laryngospasm
- Late
  - Transient vocal cord incompetence
  - Edema (glottic, subglottic)
  - Pharyngitis, tracheitis
  - Damaged neuromuscular pathway (central and peripheral nervous system and respiratory muscular function), therefore no spontaneous ventilation occurs post extubation

APPROXIMATE CUFFED ENDOTRACHEAL TUBE SIZES FOR FULL-TERM INFANTS AND CHILDREN

AGE	SIZE (INTERNAL DIAMETER mm)
0–4 months	3.0
4 months–12 months	3.5–4.0
10 months–2 years	4.0
2–3 years	4.5
3–5 years	5.0
6–10 years	5.5
10–14 years	6.0
15–18 years	6.5–7.0

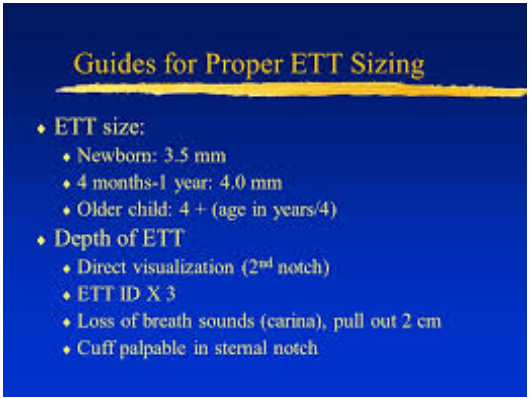
Pediatric Endotracheal Tube Sizes

$$\text{Uncuffed ETT} = \frac{\text{Age}}{4} + 4$$

*Newborns 3 or 3.5

$$\text{Cuffed ETT} = \frac{\text{Age}}{4} + 3.5$$

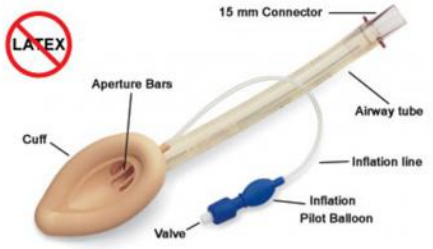
Classically > 8 years, at least >1 year



Intubation Type	Depth of insertion (cm) at lips or nares	
	Neonate	Child
Oral	Weight in kg + 6	Age in years/2 + 12
Nasal	Weight in kg + 7	Age in years/2 + 15

LMAs (Laryngeal Mask Airway)

- Is a reusable airway management device that can be used as an alternative to both mask ventilation and endotracheal intubation in appropriate patients.
- The LMA also plays an important role in management of the difficult airway.
- When inserted appropriately, the LMA lies with its tip resting over the upper esophageal sphincter, cuff sides lying over the pyriform fossae, and cuff upper border resting against the base of the tongue. Such positioning allows for effective ventilation with minimal inflation of the stomach.



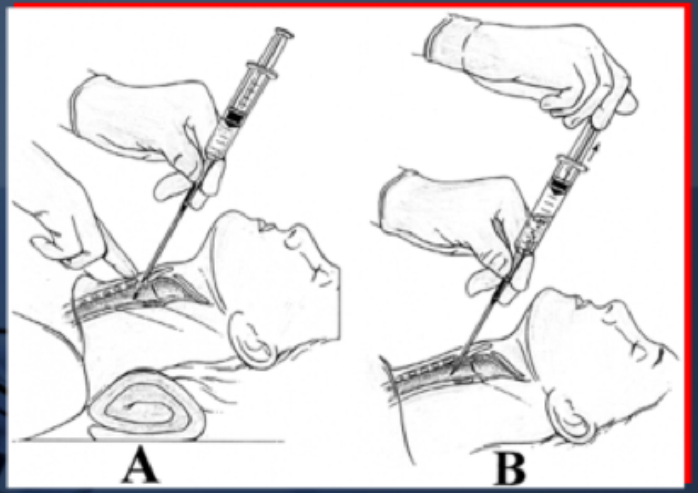
Indications

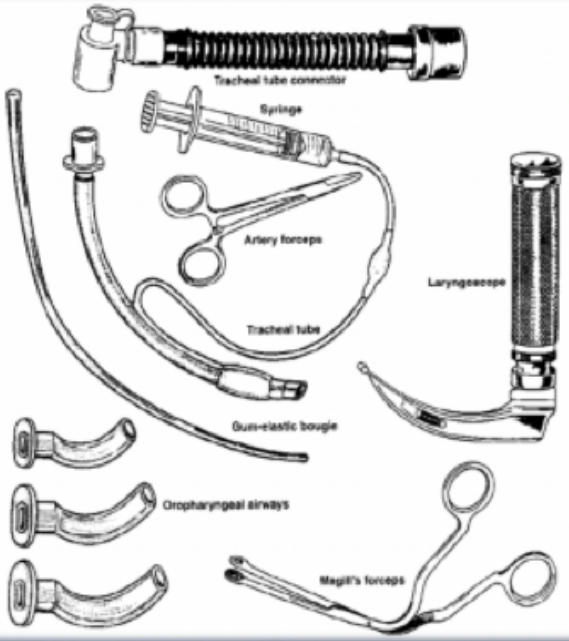
- As an alternative to mask ventilation or endotracheal intubation for airway management. The LMA is not a replacement for endotracheal intubation when endotracheal intubation is indicated.
- In the management of a known or unexpected difficult airway.
- In airway management during the resuscitation of an unconscious patient.

LMA SIZES FOR CHILDREN

LMA SIZE	APPROPRIATE WEIGHT (kg)	CUFF VOLUME (mL)
1	<5	2–5
1.5	5–10	3–8
2	10–20	5–10
2.5	20–30	10–15
3	30–50	15–20
4	50–70	25–30

Needle cricothyroidotomy




Tracheal tube connector
Syringe
Artery forceps
Laryngoscope
Tracheal tube
Gum-elastic bougie
Oropharyngeal airways
Magill's forceps

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