



Unlocking airway management skills

...the key to patient survival.

Wendy Porteous

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- ◆ Airway management must come first in an emergency situation and must not be attempted until the airway is patent.
- ◆ Many airway problems can be dealt with effectively with the use of simple techniques.



- ◆ Before attempting to secure a patient's airway, it is first necessary to perform a respiratory assessment, even if this is brief, because any airway management strategy used will need to be appropriate and patient-specific



Airway assessment

- ◆ Airway assessment should ascertain whether there is any airway obstruction such as foreign bodies, vomit or tongue. Facial, mandible and laryngeal fractures should also be assessed for.



- ◆ In the event that a patient's airway is closed, the most effective method to open it is the head tilt, chin lift approach. Place one hand on the patient's forehead, and apply firm, backward pressure with the palm of your hand. This will cause the patient's head to tilt back. Place the fingertips of your other hand under the bony part of the chin; lift the chin with your fingertips and lift the mandible upward and outward. However, it must be noted that this procedure is not to be performed if a neck injury is suspected.



- ◆ A compromised airway can be maintained by using an artificial airway, such as a Guedel (OPA) airway. A severely compromised airway can be treated by intubation and, in certain circumstances, cricothyroidotomy and emergency tracheostomy.



- ◆ The quick assessment of whether an airway is clear or not is to ask the patient a question.
- ◆ A normal verbal response from the patient immediately informs the assessor that the patient has a patent airway, is breathing and is perfusing his/her brain. If the patient can only speak in short sentences or with one or two words, then he/she is in respiratory distress and requires a further in-depth assessment of respiratory function.



Breathing assessment

- ◆ Breathing assessment is required to ascertain the patient's ability to adequately ventilate.
- ◆ The first step is to observe the patient and simply watch how they breathe. In medical terms this aspect of assessment is termed 'inspection', with medical colleagues adopting a logical progression of inspection, palpation, percussion and auscultation. What this means for nurses is observe (look), feel and listen.



Observations

- ◆ When assessing a patient's respiratory system, it is important that the nurse makes a number of important observations.
- ◆ The nurse should look for effective, equal and bilateral chest wall expansion without any paradoxical movements.



- ◆ Paradoxical movements might include:
 - Observing only one side of the chest moving up and down
 - Greater movement of one side of the chest when compared with the other
 - One side of the chest moving up and the other side moving down.



- ◆ Any asymmetrical chest expansion is abnormal and any form of unilateral lung or pleural disease can cause this asymmetry of the chest.
- ◆ Furthermore, any of these observations might indicate respiratory disease/pathology.





- ◆ When undertaking a respiratory assessment it is not only important to consider the above, but also to perform checks for and record any vital signs.



Respiratory observations

Colour	The colour of the patient's skin and mucus membranes is a useful indicator of haemoglobin saturation
Pursed lips	A sign of respiratory compromise. The patient appears to pucker or purse his/her lips, as if he/she is going to whistle
Flared nostrils	Flaring of nostrils is another sign of respiratory distress
Ability to speak	Increased effort to speak and/or inability to speak, as well as only being able to speak in monosyllables
Use of accessory muscles	A patient who is in respiratory distress uses additional muscles to breathe. These include sterno-mastoid, scalene and abdominal muscles.
Rate, rhythm and depth of breathing	Nurses should assess whether the patients' respiratory rate is above or below normal level. In an emergency situation, it is difficult to assess lung volumes, so observing the depth of breathing is an important indicator
Shape and expansion of chest	When performing a respiratory assessment it is important to consider both the shape and expansion of the chest. For example, the anteroposterior (AP) diameter may change for a number of reasons and not just because of an underlying respiratory problem



Vital signs

- ◆ An assessment of the vital signs provides essential physiological information about patients. Impending critical illness and respiratory compromise can alter these signs. For example:
 - Increased temperature (indications for pneumonia, increase in the work of breathing)
 - Increased pulse (cardiovascular to respiratory disease)
 - Decrease in blood pressure (sepsis, etc)
 - Decreases in O₂ saturations.



Oxygen saturation monitoring

- ◆ An effective way to monitor for hypoxaemia is to use a pulse oximeter. This is a good monitor, but its limitations should be recognized. A pulse oximeter is a continuous and non-invasive monitor. Its principal limitation is that, in patients who are receiving supplemental oxygen, it will not reliably detect hypoventilation.



- ◆ In most circumstances, the trend in oxygen saturation is more important than the value per se, as this can indicate whether the patient is responding to therapy or deteriorating.
- ◆ Normally, a person's O_2 saturation will range between 98% and 100%. However, saturations will fall in many respiratory conditions. It is therefore necessary to maintain oxygen saturation as near to normal as possible.



- ◆ In order to obtain O₂ saturations successfully, the probe should be placed in the best possible position to gauge the best possible reading. There are a number of places where the probe can be attached; these include the fingers, toes, ears, nose and forehead.
- ◆ Bear in mind that pulse oximeters can provide false information if the probe is inappropriately placed, or if the patient is cardiovascularly compromised (low blood pressure) and/or unduly sweaty or cold. In addition, it must be acknowledged that certain patient groups (e.g. patients with chronic obstructive pulmonary disease (COPD) and emphysema) may have normally low oxygen saturations, and so the nurse will need to consider this when interpreting pulse oximeter data.




Respiratory management skills

- ◆ Any deviations discovered during the basic respiratory assessment will need to be acted on. One of the very first and most basic respiratory management skills essential for good patient care is that of oxygen therapy.
- ◆ Nurses need to know when to initiate oxygen therapy, how to deliver oxygen safely and appropriately, and base oxygen delivery on patient needs.
- ◆ In combination with respiratory assessment and oxygen saturation monitoring, if a patient requires oxygen, then this needs to be administered safely and effectively.



Administering oxygen

- ◆ If a patient's condition necessitates the administration of oxygen, then this should be carried out as quickly and as efficiently as possible. Although technically and legally oxygen is a drug that must be prescribed by a qualified practitioner, in the emergency situation the absence of a prescription should not delay the administration of this essential intervention. Once the decision to administer oxygen has been made, an appropriate oxygen delivery device will need to be used.
- ◆ There are two types of oxygen delivery system—variable performance and fixed performance.



Variable performance oxygen delivery systems

- ◆ These oxygen delivery systems are classed as variable because it is impossible to predict the true inspired oxygen concentration (FiO_2) that they deliver. Although the system delivers oxygen at a given rate, the concentration delivered is dependent on the patient's pattern of breathing.



i) Simple face mask—Hudson mask

- ◆ This mask will deliver between 35% and 45% oxygen and is commonly used as an initial oxygen delivery device in a respiratory emergency. However, owing to its inability to deliver high concentrations of oxygen above 45%, it is of limited use in severe respiratory distress where high oxygen flow is needed.

i) Simple face mask—Hudson mask





ii) Non-rebreathing mask with reservoir bag

- ◆ The reservoir bag improves the maximum FiO_2 to up to 70%. The reservoir fills up with oxygen during expiration and is breathed in during inspiration. This is used in severe respiratory distress where high-flow oxygen is needed.

ii) Non-rebreathing mask with reservoir bag

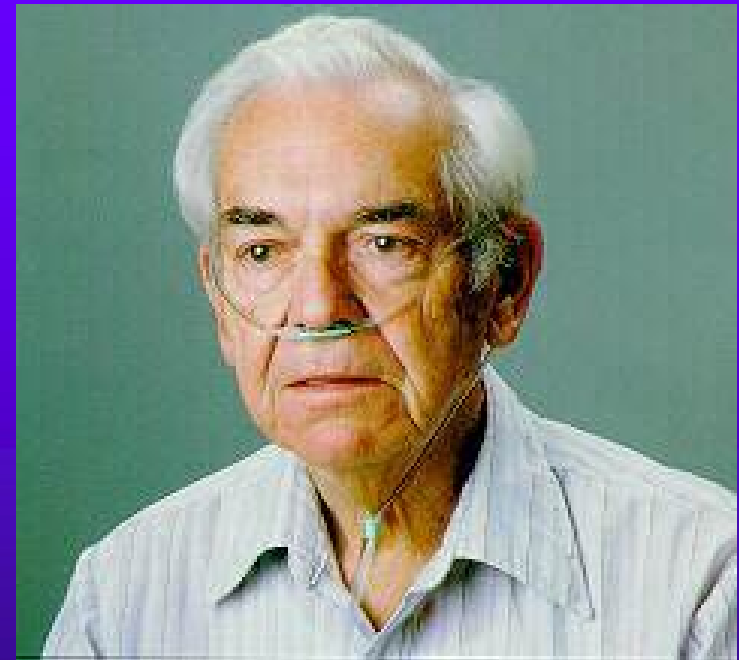
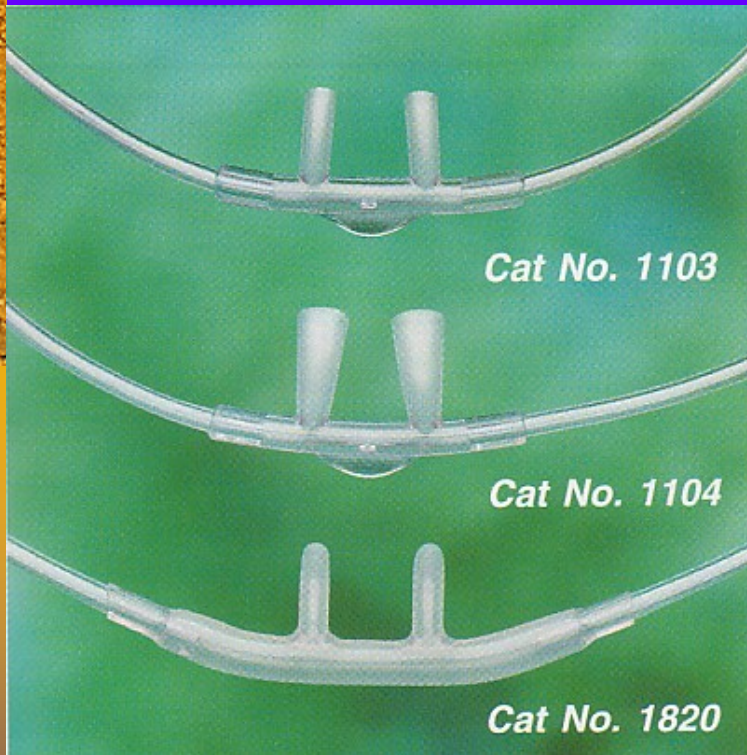




iii) Nasal cannula

- ◆ A nasal cannula is used for delivering supplementary oxygen, but has limited use in an emergency situation. This system delivers 28–30% oxygen.

iii) Nasal cannula





Fixed performance oxygen delivery systems

- ◆ These systems deliver a precise concentration of inspired oxygen (FiO_2), which is unaffected by the patient's breathing pattern.



i) High airflow enrichment masks— Venturi masks

- ◆ When used correctly they will deliver a known FiO_2 .
- ◆ Precise FiO_2 of 24%, 28%, 35%, 40% and 60% can be achieved. These masks are used for treating patients requiring controlled oxygen therapy.

i) High airflow enrichment masks— Venturi masks





Maintenance of oxygen delivery

- ◆ Whichever oxygen delivery system is used, it is important that the nurse continuously monitors the effectiveness of oxygen delivery. If the patient does not respond to initial oxygen therapy and/or if the patient's condition deteriorates, then the nurse will need to take appropriate action. For example, oxygen delivery might have to be increased and adjusted.

Oxygen in an emergency

Table 1 – High levels of supplemental oxygen for adults with critical illnesses

Target Saturation 94-98%	Administer the initial oxygen dose until the vital signs are normal, then , reduce oxygen dose and aim for target saturation within the range of 94-98%	
Condition	Initial dose	Method of administration
<ul style="list-style-type: none"> • Cardiac arrest or resuscitation: <ul style="list-style-type: none"> o basic life support o advanced life support o foreign body airway obstruction o traumatic cardiac arrest o maternal resuscitation • Carbon monoxide poisoning 	Maximum dose until the vital signs are normal <div> <p>Note – some oxygen saturation monitors cannot differentiate between carboxyhaemoglobin and oxyhaemoglobin</p> </div>	Bag-valve-mask
<ul style="list-style-type: none"> • Major Trauma <ul style="list-style-type: none"> o Abdominal trauma o Burns and scalds o Electrocution o Head trauma o Major limb trauma o Neck and back trauma(spinal) o Pelvic trauma o The immersion incident o Thoracic trauma o Trauma in pregnancy • Anaphylaxis • Major haemorrhage • Sepsis e.g. meningococcal septicaemia • shock 	15 litres per minute	Reservoir mask (non-rebreather mask)
<ul style="list-style-type: none"> • Active seizure • Hypothermia 	Administer 15 litres per minute until a reliable SpO ₂ measurement can be obtained and then adjust oxygen flow to aim for target saturation within the range of 94-98%	Reservoir mask (non-rebreather mask)



Table 2 – Moderate levels of supplemental oxygen for adults with serious illnesses if the patient is hypoxaemic.

Target saturation 94-98%	Administer the initial oxygen dose until a reliable SpO ₂ measurement is available then adjust oxygen flow to aim for target saturation within the range of 94-98% as per table below.	
Conditions	Initial Dose	Method of administration
<ul style="list-style-type: none">• Acute hypoxaemia or clinically centrally cyanosed (cause not yet diagnosed)• Deterioration of lung disease	SpO₂ < 85% 10-15 litres per minute	Reservoir mask (non-rebreather mask)
<ul style="list-style-type: none">• Acute hypoxaemia (cause not yet diagnosed)• Deterioration of lung disease• Acute asthma• Acute heart failure• Pneumonia• Lung cancer• Pulmonary embolism• Pleural effusions• Pneumothorax• Severe anaemia• Postoperative breathlessness	SpO₂ ≥ 85-93% 2-6 litres per minute	Nasal cannulae
	SpO₂ ≥ 85-93% 5-10 litres per minute	Simple face mask



Table 3 – Controlled or low-dose supplemental oxygen for adults with COPD and other conditions requiring controlled or low-dose oxygen therapy

Target saturation 88-92%	Administer the initial oxygen dose until a reliable SpO ₂ measurement is available then adjust oxygen flow to aim for target saturation within the range of 88-92% or prespecified range detailed on patient's care plan, as per the table below.	
Condition	Initial Dose	Method of administration
<ul style="list-style-type: none">• Chronic obstructive pulmonary disease (COPD)• Exacerbation of cystic fibrosis• Chronic neuromuscular disorders• Chest wall disorders• Morbid obesity (high BMI)	28% via Venturi system	Venturi mask (F&P)
NOTE – If the oxygen saturation remains below 88% change to a simple face mask or consider alternative oxygen delivery modes	6-10 litres per minute	Simple face mask
NOTE – Critical illness AND COPD / or other risk factors for hypercapnia	If a patient with COPD or other risk factors for hypercapnia sustain or develop critical illness/injury ensure the same target saturations as indicated in Table 1 – Critical Illness	



Table 4 – No supplemental oxygen required for adults with these conditions unless the patient is hypoxaemic but patients should be monitored closely

Target saturation 94-98%	If hypoxaemic ($\text{SpO}_2 < 94\%$) administer the initial oxygen dose then adjust oxygen flow to aim for target saturation within the range of 94-98% , as per the table below.		
Condition	Initial dose	Method of administration	
<ul style="list-style-type: none"> • Myocardial infarction and acute coronary syndromes • Stroke • Cardiac rhythm disturbances • Non-traumatic chest pain/discomfort • Implantable defibrillator firing • Pregnancy and Obstetric Emergencies <ul style="list-style-type: none"> ◦ Birth imminent ◦ Haemorrhage during pregnancy ◦ Pregnancy induced hypertension ◦ Vaginal bleeding • Abdominal pain • Headache • Hyperventilation syndrome or dysfunctional breathing • Most poisonings and overdoses • Metabolic and renal disorders • Acute and subacute neurological and muscular conditions producing muscle weakness (assess the need for assisted ventilation is $\text{SpO}_2 < 94\%$) • Post seizure • Gastrointestinal bleeds • Glycaemic emergencies • Heat exhaustion/heat stroke 	$\text{SpO}_2 < 85\%$ 15 litres per minute	Reservoir Mask (non-rebreather mask)	
	$\text{SpO}_2 \geq 85-93\%$ 2-6 litres per minute	Nasal cannulae	
	$\text{SpO}_2 \geq 85-93\%$ 6-10 litres per	Simple Face Mask	



- ◆ All of the above oxygen delivery systems can only be used in patients who are spontaneously breathing and who can maintain their own airway.



Oropharyngeal Airway

- ◆ Should the patient develop severe respiratory distress and become unable to maintain their own airway, it may become necessary for the patient to have an oropharyngeal airway (OPA) inserted



Oropharyngeal Airway - OPA

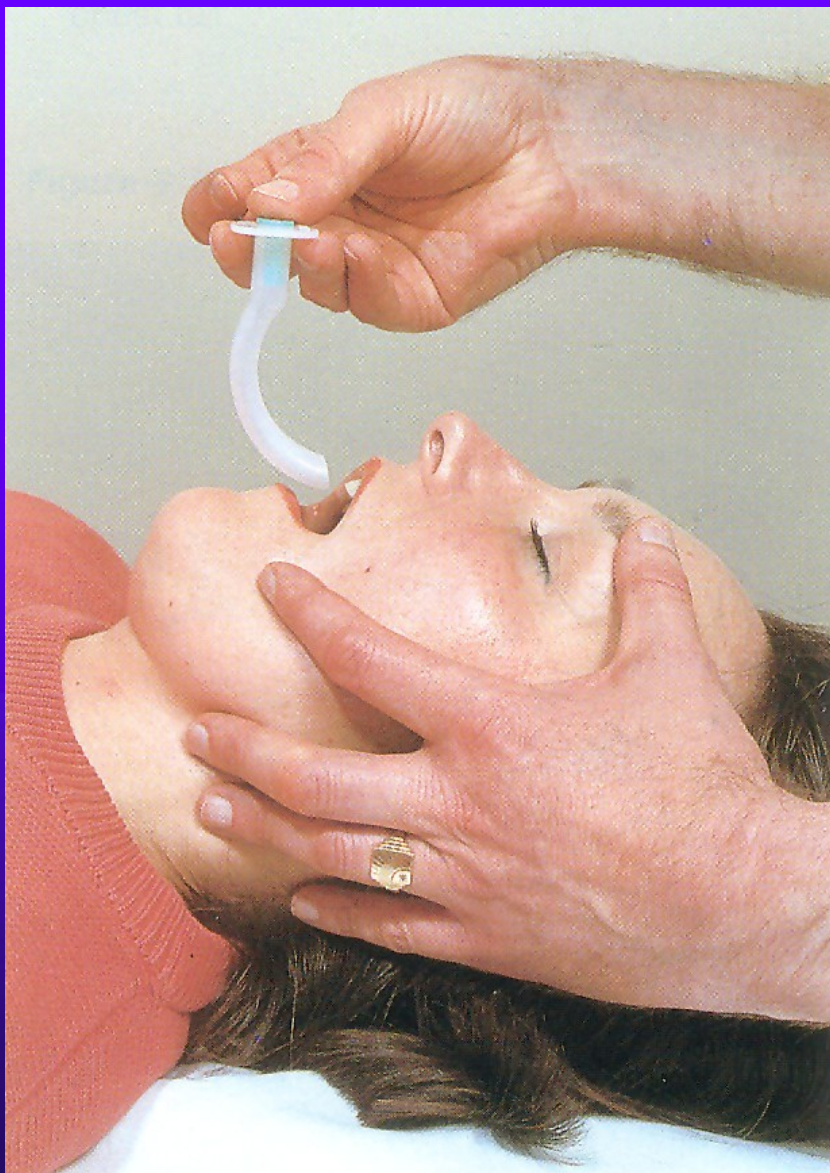
- ◆ Used to **assist** in keeping the tongue from occluding the airway.
- ◆ Should be used only in the fully obtunded patient as it can cause laryngospasm, and stimulate the gag reflex.
- ◆ Proper insertion is done most often by placing the airway into the patient's mouth upside down until reaching the soft palate where it is then rotated into position.

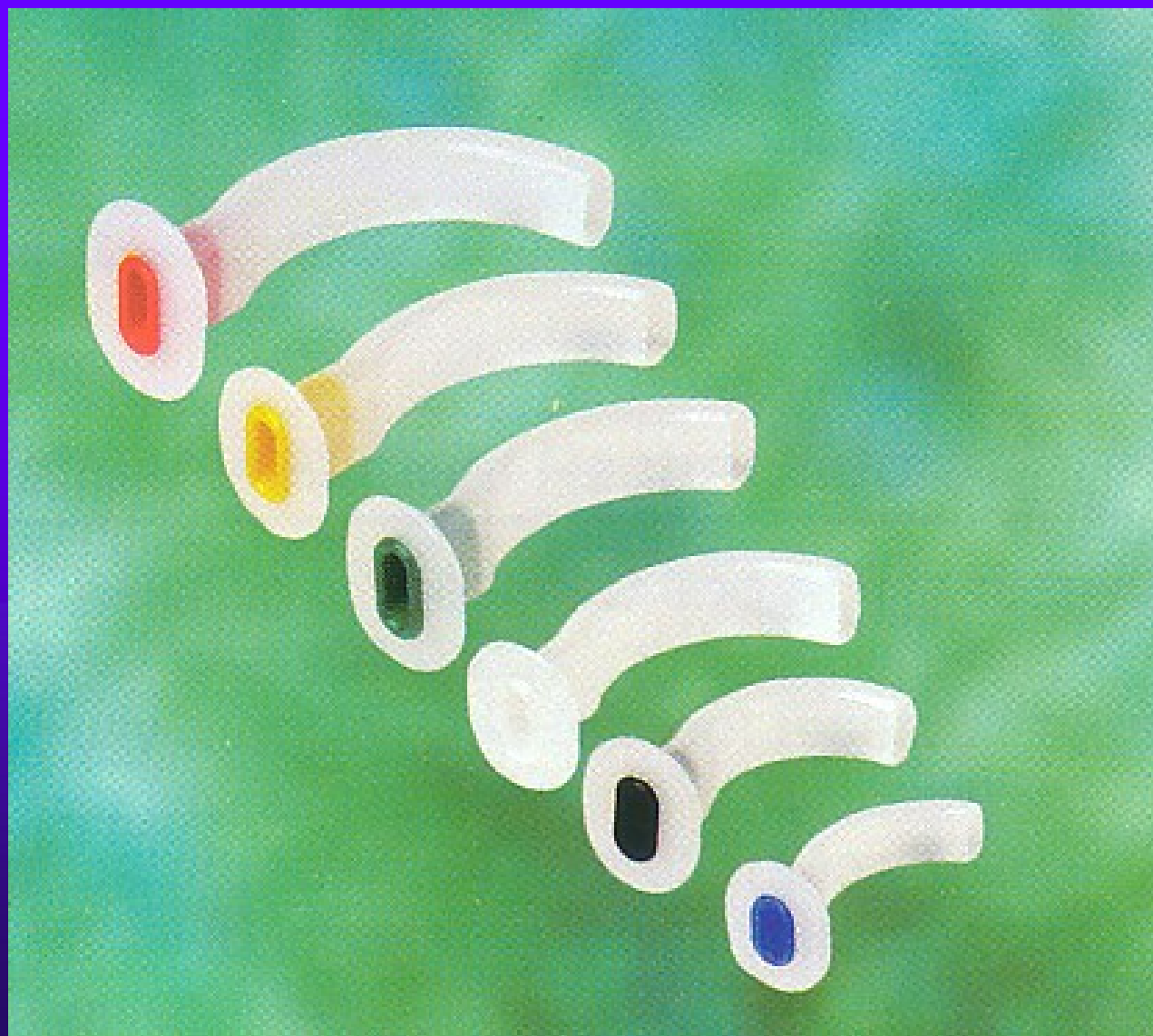


Oropharyngeal Airway - OPA

- ◆ The flange rests against the teeth.
- ◆ Sizing is done by selecting a size that reaches from the corner of the patient's mouth to the angle of the jaw.
- ◆ Proper insertion helps keep the tongue from falling against the posterior pharynx in the unconscious patient and blocking their airway.
- ◆ An airway that is too short forces the patient's tongue back into the pharynx; too long and it may be occluded by the vallecula











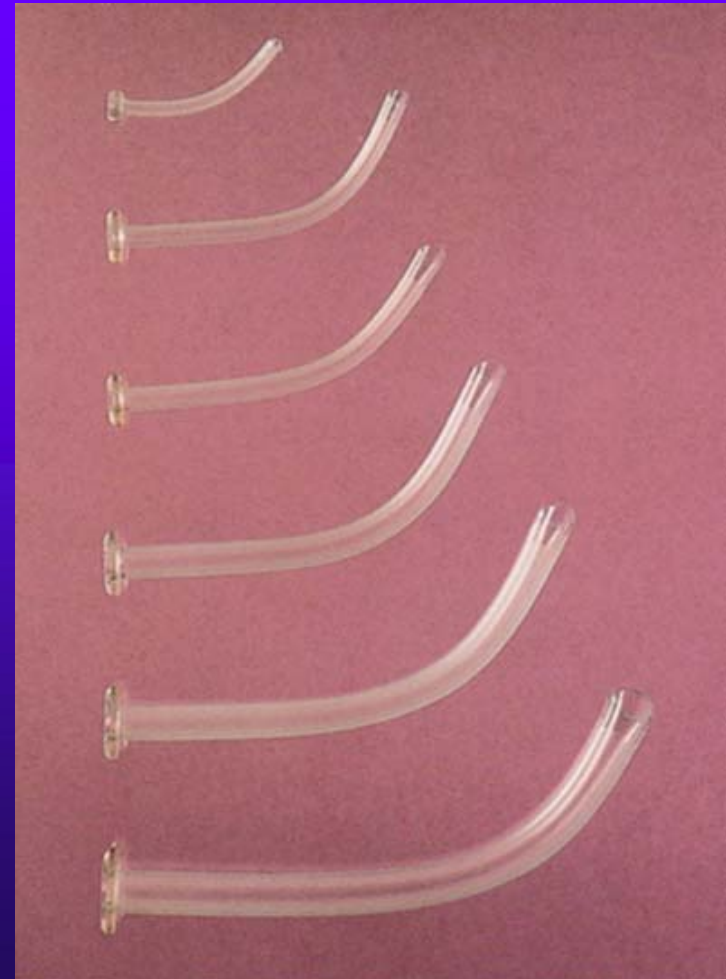
Oropharyngeal Airway

- ◆ These are colour-coded to aid in the selection of the correct size, and size is determined by the size of the patient
- ◆ The shape of the airway is designed to hold the tongue in the right anatomical position, but insertion of the airway requires that it is initially inserted upside down and rotated 180°.

Oropharyngeal Airway



Nasopharyngeal Airway - NPA





Nasopharyngeal Airway - NPA

- ◆ Indicated when the patient has a depressed level of consciousness resulting in loss of muscle tone and airway obstruction and when an OPA is contraindicated or technically difficult
- ◆ Also used to facilitate the passage of suction catheters
- ◆ Contraindicated in patients with suspected BOS# and in the presence of coagulopathy because severe epistaxis may result

Nasopharyngeal Airway - NPA





- ◆ Size – measure from the tip of the nose/nostril to the earlobe or angle of the jaw
- ◆ Too long it may enter the oesophagus and cause gastric distension
- ◆ If a tube is too short to enter the posterior portion of the pharynx, a patent airway cannot be established

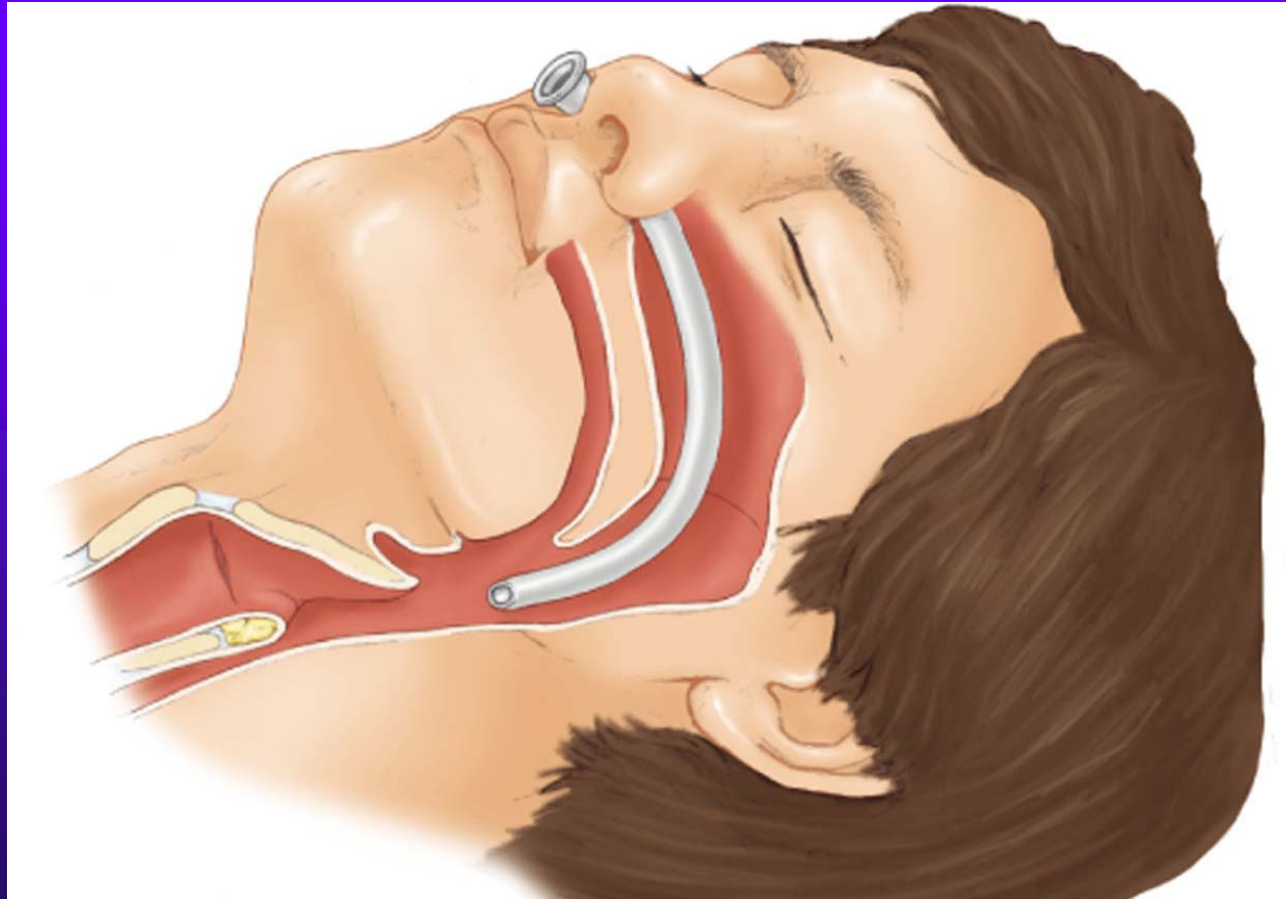
Nasopharyngeal Airway - NPA





- ◆ To insert, lubricate well with a water soluble lubricant
- ◆ Choose the nostril, position the bevelled tip to the patients midline
- ◆ Insert the airway along the floor of the nose, with gentle steady pressure
- ◆ If resistance is met, use the other nostril, or a smaller tube
- ◆ When properly positioned, the flanged portion will rest against the nostril

Nasopharyngeal airway, inserted





- ◆ Although supplementary oxygen can improve oxygenation and an OPA airway can help maintain a patent airway, both require that the patient spontaneously breathes. However, when cessation of breathing occurs or when respiratory rate and effort is insufficient to maintain normal respiratory function, more advanced airway management may be required. This will involve the insertion of a laryngeal mask airway (LMA) or an endotracheal (ET) tube



Laryngeal mask airway

- ◆ The LMA is usually indicated as an alternative to the face mask for achieving and maintaining control of an airway, and has proved to be a valuable tool in the emergency management of a failed intubation, as it helps establish and maintain an airway
- ◆ The LMA is a supra-glottic airway device and can be inserted by less experienced practitioners.

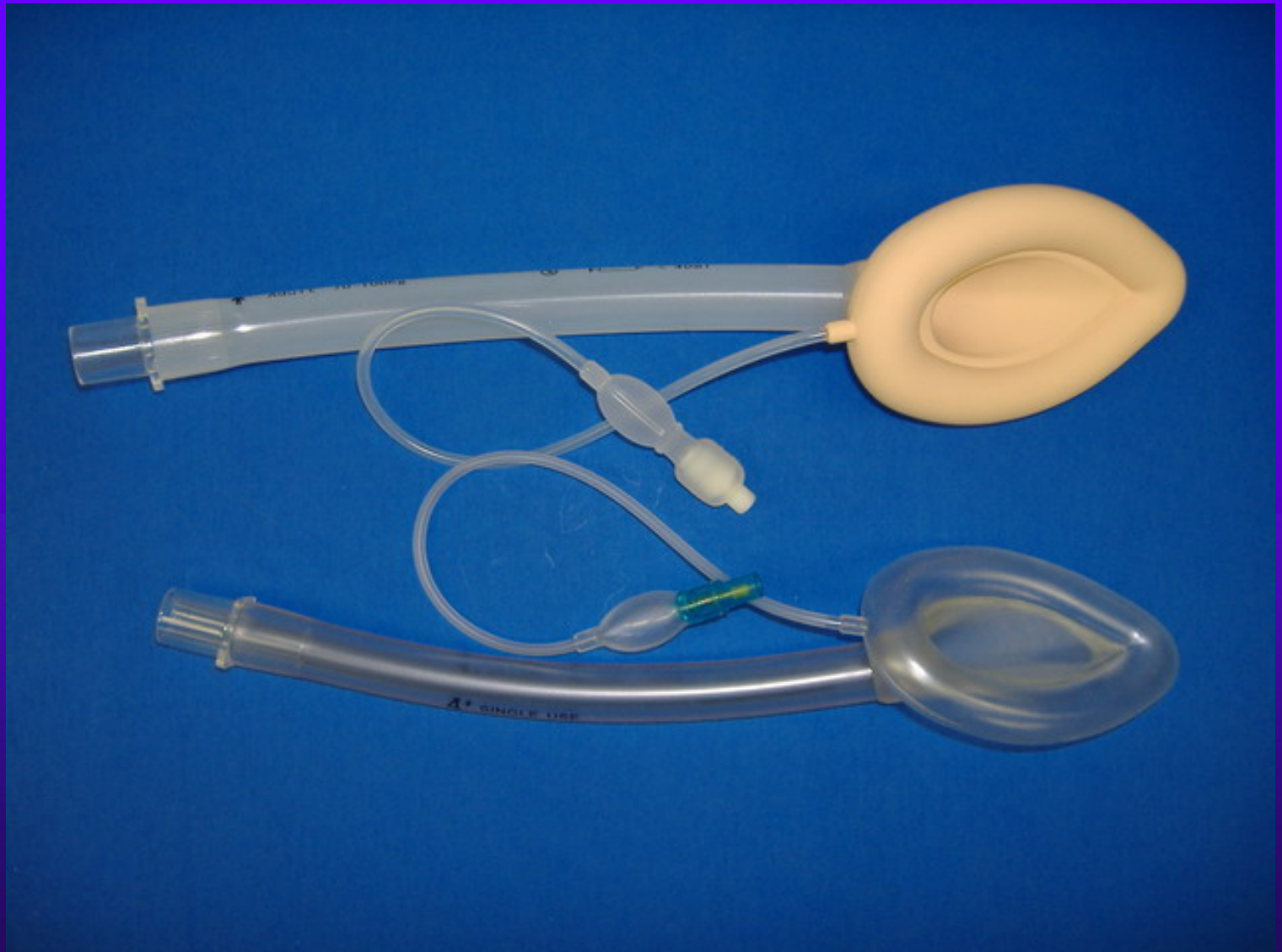


- ◆ The LMA is a wide bore tube with an elliptical inflated cuff, which opposes the laryngeal opening.
- ◆ The LMA does not guarantee protection of the airway, but pulmonary aspiration is uncommon. Provided tidal volumes do not generate high inflation pressures during intermittent positive pressure ventilation (>20 cmH₂O), gastric inflation is unlikely.
- ◆ Inserting an LMA does not require such vigorous movements to align the head and neck, so could be the best adjunct if cervical spine injury is suspected.

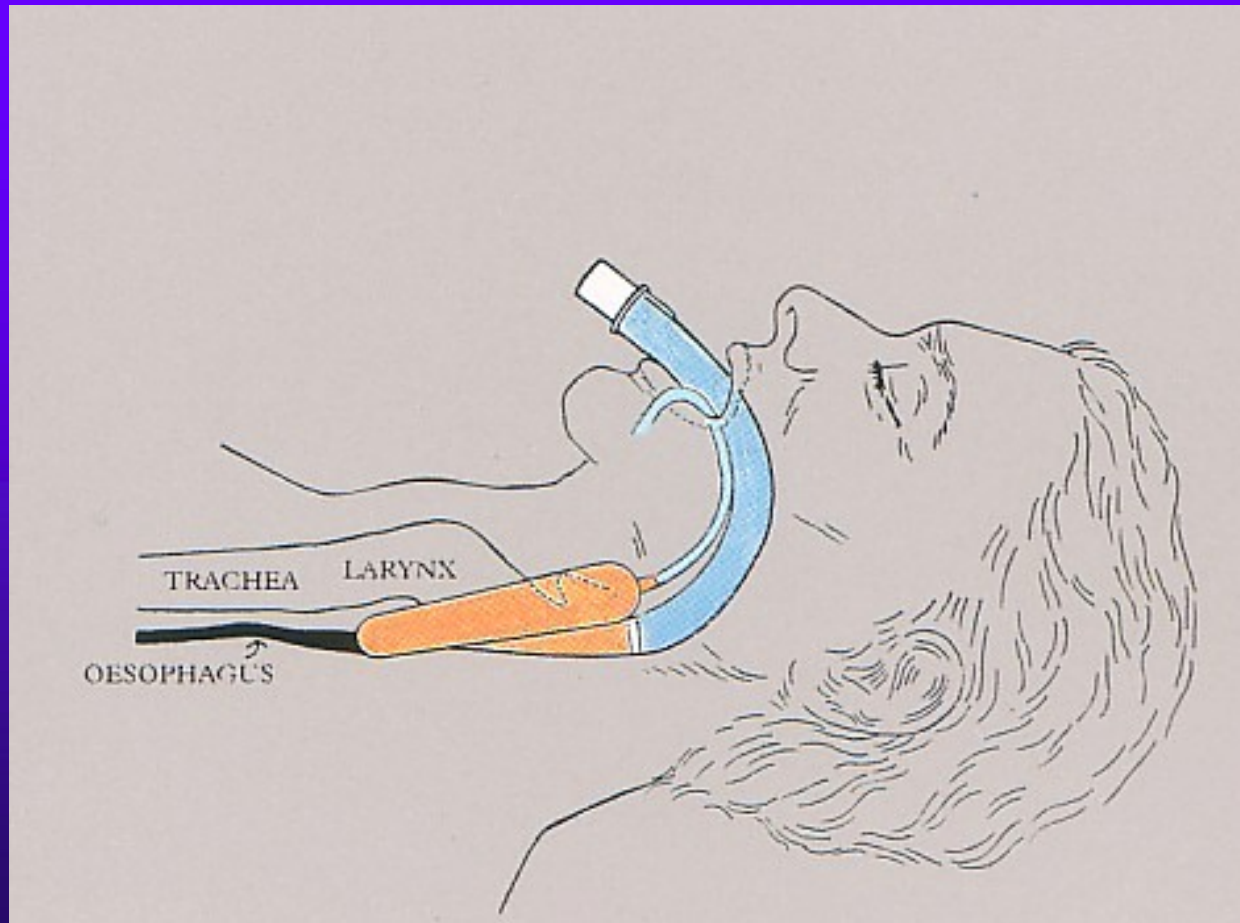
Laryngeal Mask Airway



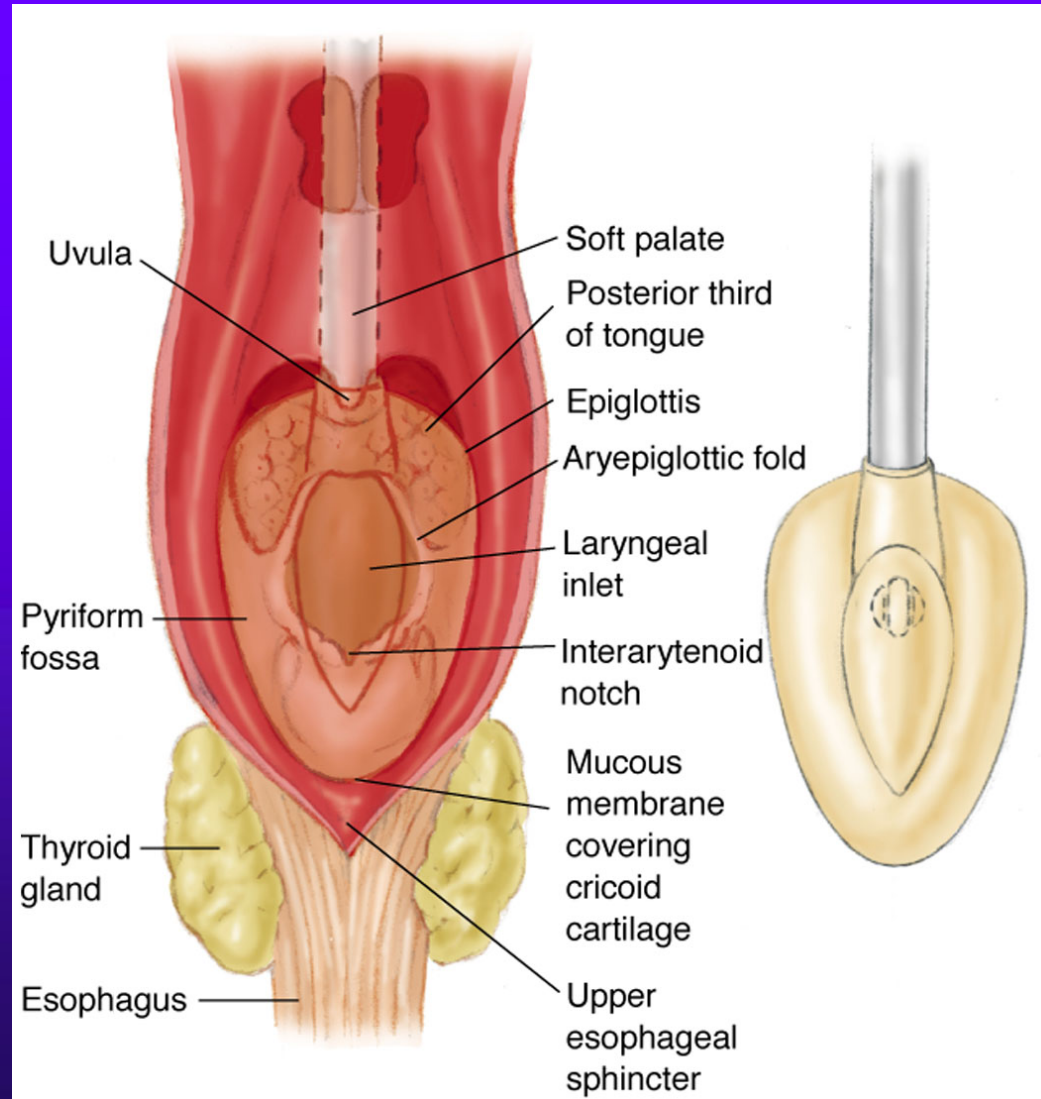
Laryngeal Mask Airway



Laryngeal Mask Airway



Laryngeal Mask Airway



Introduction

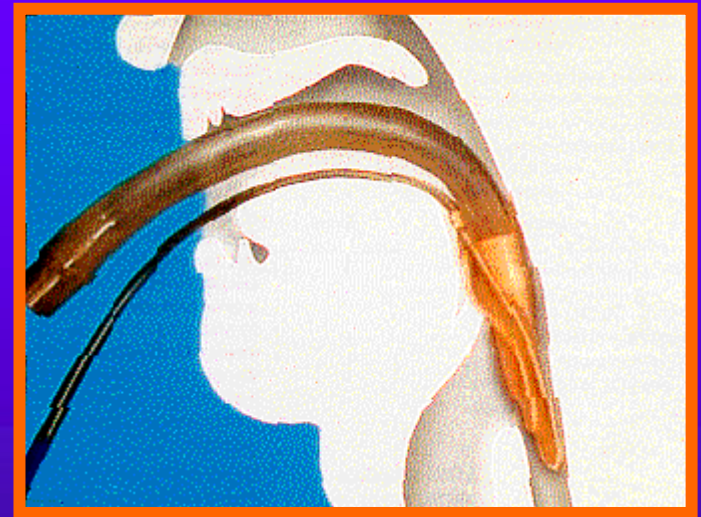
The LMA consists of two parts:

- The mask
 - The tube
- ♦ The LMA has proven to be very effective in the management of airway crisis



Introduction continued

- ◆ The LMA design:
 - Provides an “oval seal around the laryngeal inlet” once the LMA is inserted and the cuff inflated.
 - Once inserted, it lies at the crossroads of the digestive and respiratory tracts.



Indications for the use of the LMA

- ◆ Situations involving a difficult mask (BVM) fit.
- ◆ May be used as a back-up device where endotracheal intubation is not successful.
- ◆ May be used as a “second-last-ditch” airway where a surgical airway is the only remaining option.



Contraindications of the LMA

- ◆ Greater than 14 to 16 weeks pregnant
- ◆ Patients with multiple or massive injury
- ◆ Massive thoracic injury
- ◆ Massive maxillofacial trauma
- ◆ Patients at risk of aspiration
- ◆ **NOTE:** Not all contraindications are absolute





Side-Effects of the LMA

- ◆ Throat soreness
- ◆ Dryness of the throat and/or mucosa
- ◆ Side effects due to improper placement vary based on the nature of the placement



Equipment for LMA Insertion

- ◆ P.P.E.
- ◆ Appropriate size LMA
- ◆ Syringe with appropriate volume for LMA cuff inflation
- ◆ Water soluble lubricant
- ◆ Ventilation equipment
- ◆ Stethoscope
- ◆ Tape or other device(s) to secure LMA



Preparation of the LMA for Insertion

- ◆ Step 1: Size selection
- ◆ Step 2: Examination of the LMA
- ◆ Step 3: Check deflation and inflation of the cuff
- ◆ Step 4: Lubrication of the LMA
- ◆ Step 5: Position the Airway

Step 1: Size Selection

- ♦ Verify that the size of the LMA is correct for the patient

- ♦ Recommended Size guidelines:

- Size 1: under 5 kg
- Size 1.5: 5 to 10 kg
- Size 2: 10 to 20 kg
- Size 2.5: 20 to 30 kg
- Size 3: 30 kg to small adult
- Size 4: adult
- Size 5: Large adult/poor seal with size 4



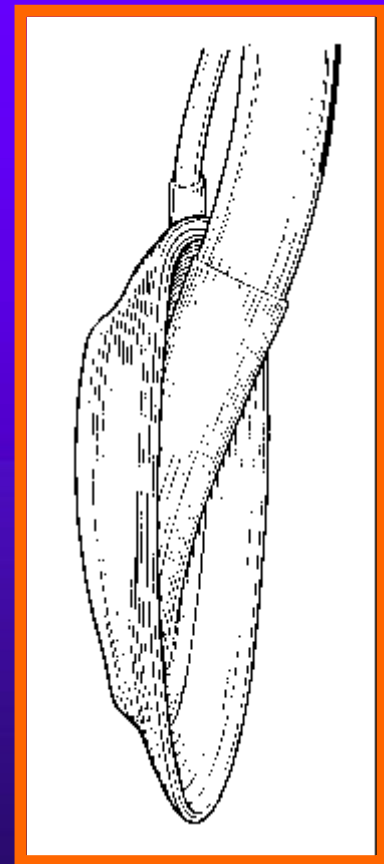
Step 2: Examination of the LMA

- ◆ Visually inspect the LMA cuff for tears or other abnormalities
- ◆ Inspect the tube to ensure that it is free of blockage or loose particles
- ◆ Deflate the cuff to ensure that it will maintain a vacuum
- ◆ Inflate the cuff to ensure that it does not leak




Step 3: Deflation and Inflation of the LMA

- ◆ Slowly deflate the cuff to form a smooth flat wedge shape which will pass easily around the back of the tongue and behind the epiglottis.
- ◆ During inflation the maximum air in cuff should not exceed:
 - Size 1: 4 ml
 - Size 1.5: 7 ml
 - Size 2: 10 ml
 - Size 2.5: 14 ml
 - Size 3: 20 ml
 - Size 4: 30 ml
 - Size 5: 40 ml



Step 4: Lubrication of the LMA

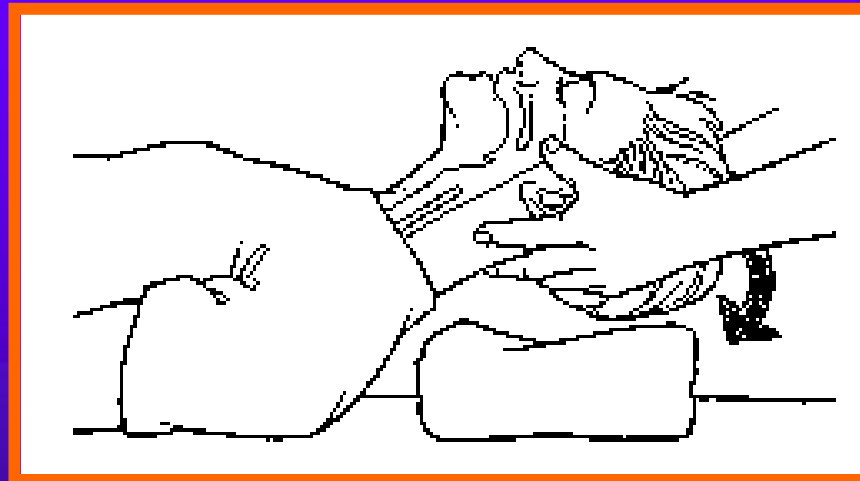
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- ◆ Use a water soluble lubricant to lubricate the LMA
 - ◆ Only lubricate the LMA just prior to insertion
 - ◆ Lubricate the back of the mask thoroughly

Important Notice:

- ◆ Avoid excessive amounts of lubricant
 - on the anterior surface of the cuff or
 - in the bowl of the mask.
- ◆ Inhalation of the lubricant following placement may result in coughing or obstruction.

Step 5: Positioning of the Airway

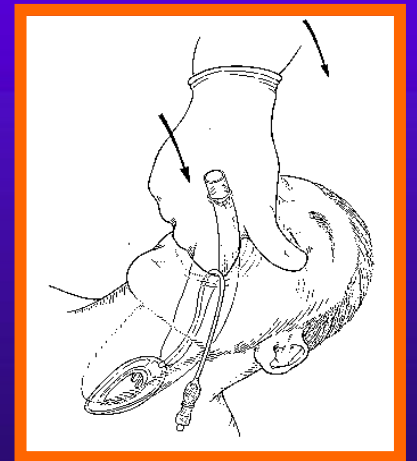
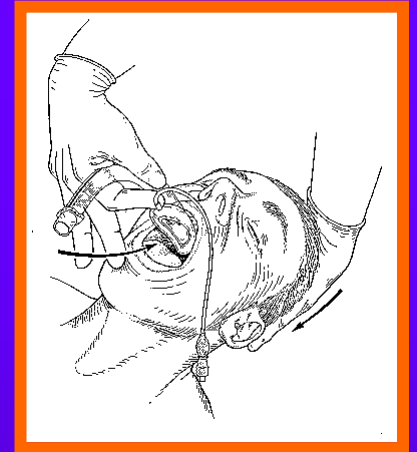
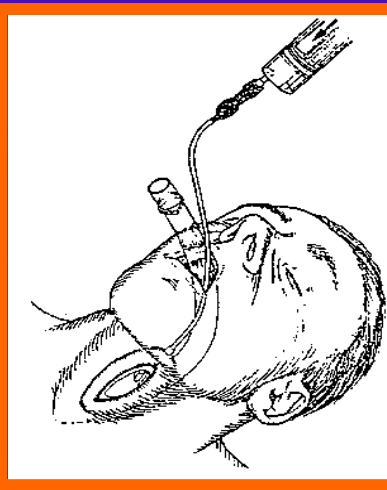
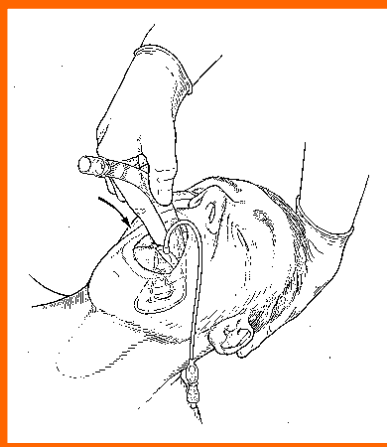
- ◆ Extend the head and flex the neck
- ◆ Avoid LMA fold over:
 - Assistant pulls the lower jaw downwards.
 - Visualize the posterior oral airway.
 - Ensure that the LMA is not folding over in the oral cavity as it is inserted.





LMA

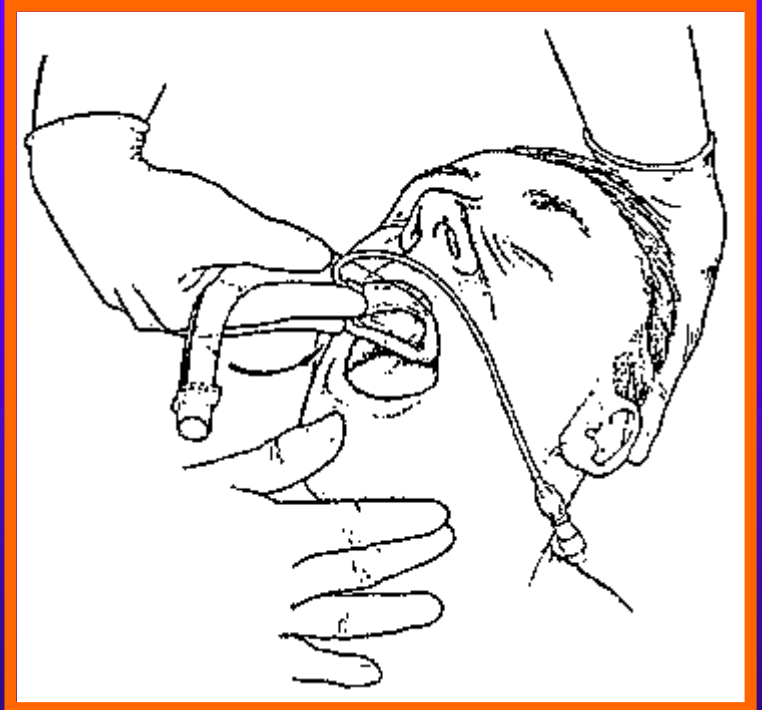
Insertion Technique



LMA Insertion

Step 1

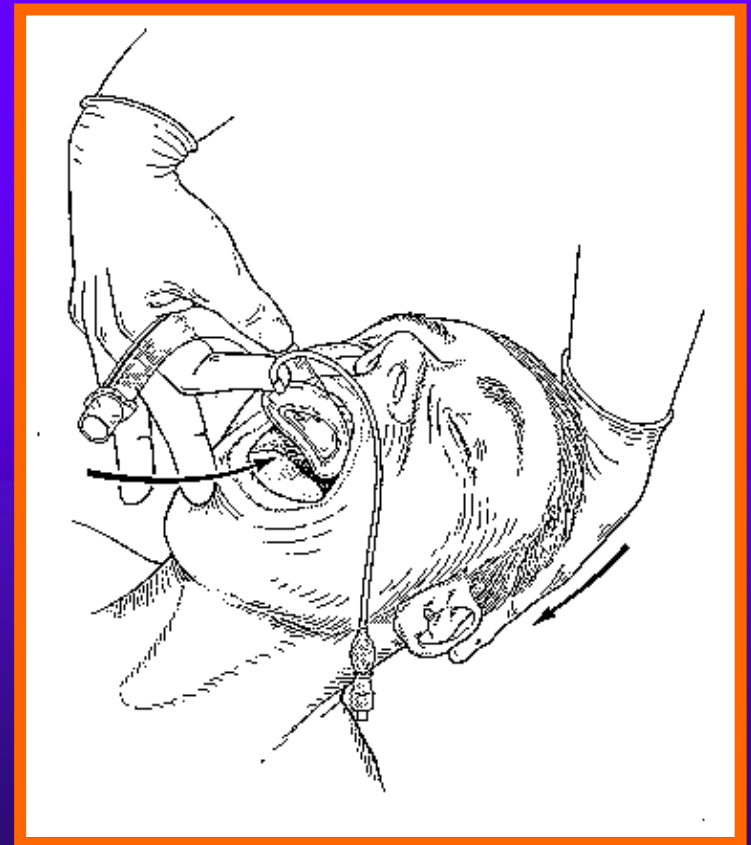
- ◆ Grasp the LMA by the tube, holding it like a pen as near as possible to the mask end.
- ◆ Place the tip of the LMA against the inner surface of the patient's upper teeth



LMA Insertion

Step 2

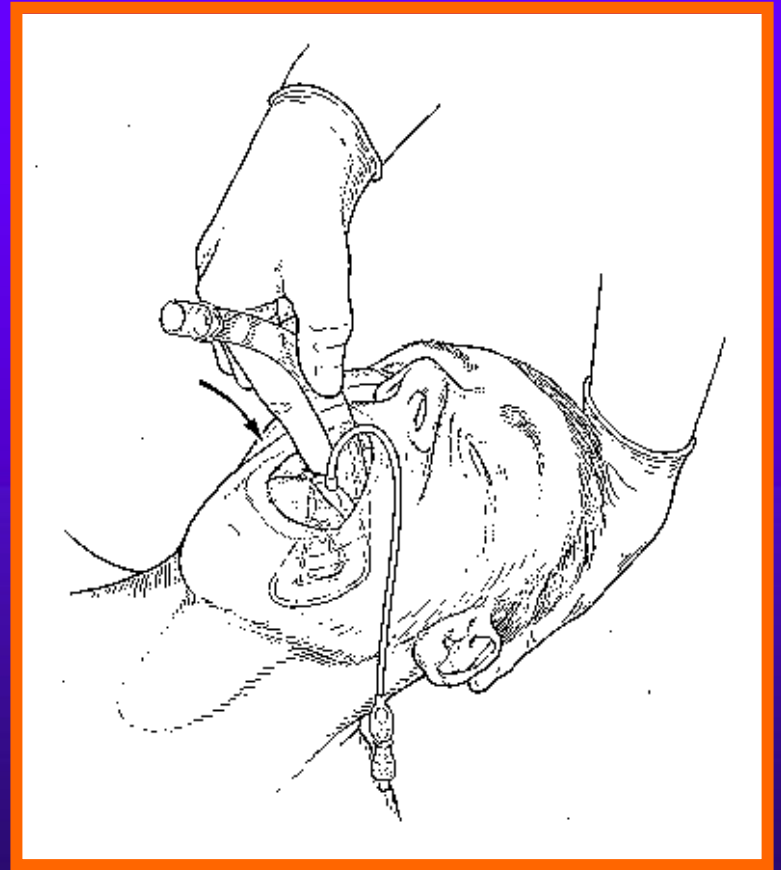
- ◆ Under direct vision:
 - Press the mask tip upwards against the hard palate to flatten it out.
 - Using the index finger, keep pressing upwards as you advance the mask into the pharynx to ensure the tip remains flattened and avoids the tongue.



LMA Insertion

Step 3

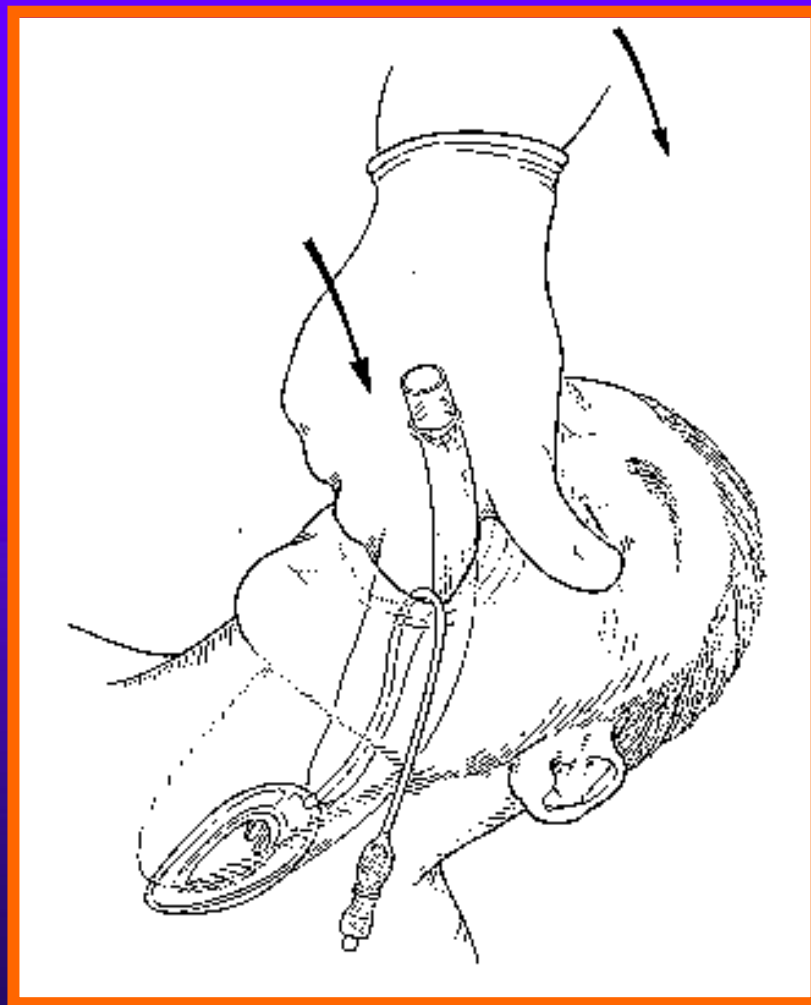
- ◆ Keep the neck flexed and head extended:
 - Press the mask into the posterior pharyngeal wall using the index finger.



LMA Insertion

Step 4

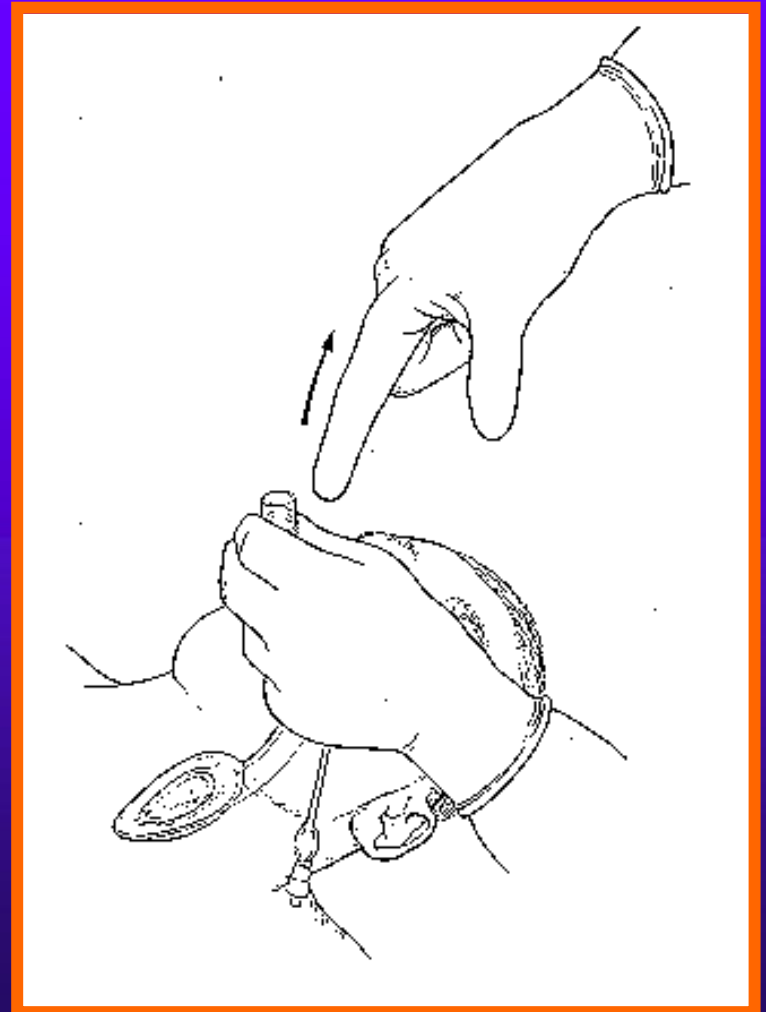
- ◆ Continue pushing with your index finger.
 - Guide the mask downward into position



LMA Insertion

Step 5

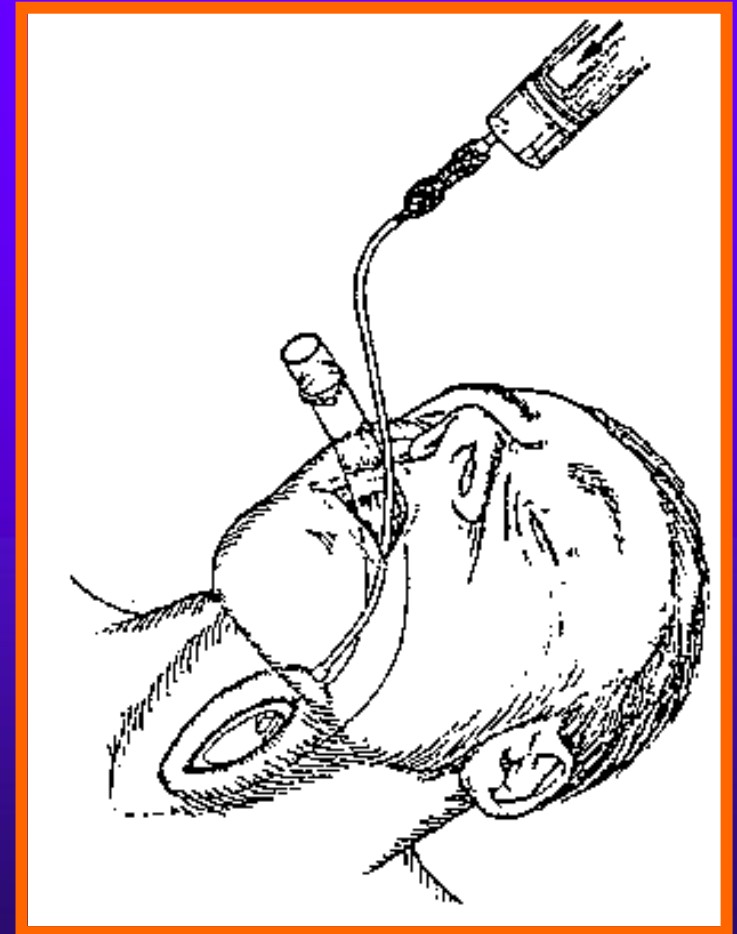
- ◆ Grasp the tube firmly with the other hand
 - then withdraw your index finger from the pharynx.
 - Press gently downward with your other hand to ensure the mask is fully inserted.



LMA Insertion

Step 6

- ◆ Inflate the mask with the recommended volume of air.
- ◆ Do not over-inflate the LMA.
- ◆ Do not touch the LMA tube while it is being inflated unless the position is obviously unstable.
 - Normally the mask should be allowed to rise up slightly out of the hypopharynx as it is inflated to find its correct position.



Verify Placement of the LMA

- ◆ Connect the LMA to a Bag-Valve Mask device
- ◆ Confirm placement with end-tidal CO₂
- ◆ Ventilate the patient while confirming equal breath sounds over both lungs in all fields and the absence of ventilatory sounds over the epigastrium observing chest rise with ventilation.



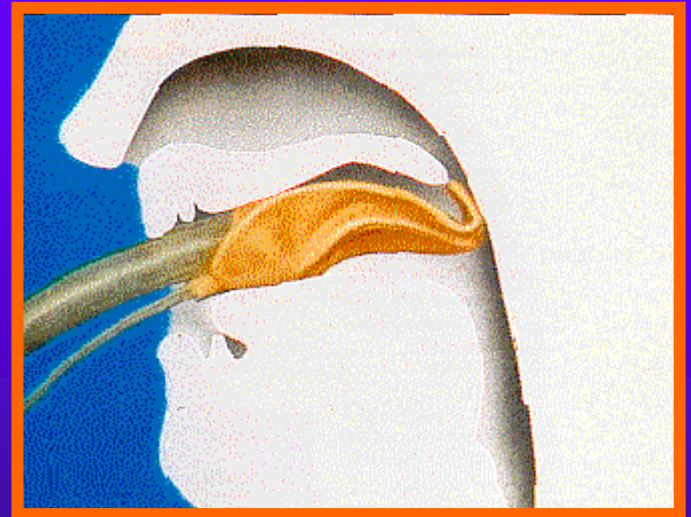
Securing the LMA

- ◆ Insert a bite-block or roll of gauze to prevent occlusion of the tube should the patient bite down.
- ◆ Now the LMA can be secured utilizing the same techniques as those employed in the securing of an endotracheal tube.



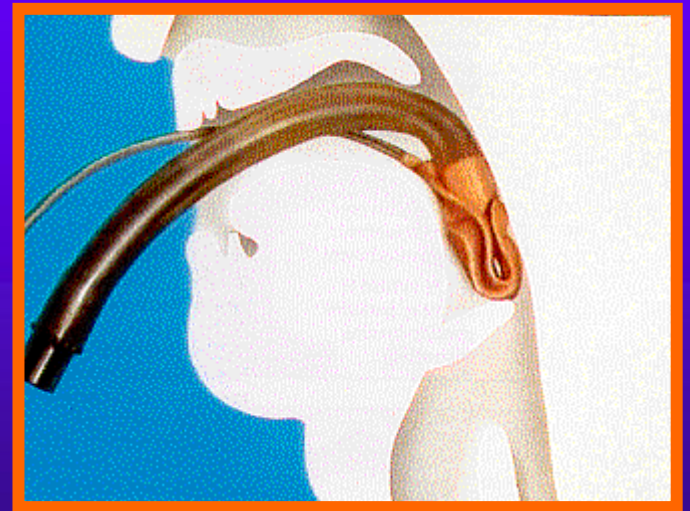
Problems with LMA Insertion

- ◆ Failure to press the deflated mask up against the hard palate or inadequate lubrication or deflation can cause the mask tip to fold back on itself.



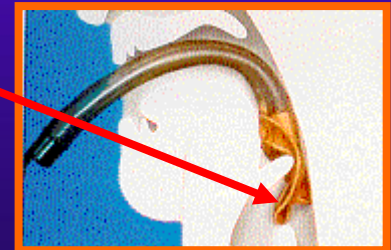
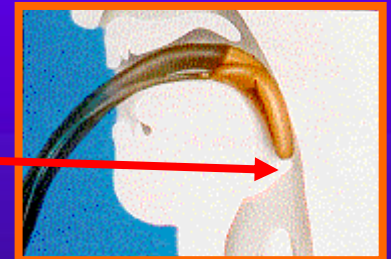
Problems with LMA Insertion

- ◆ Once the mask tip has started to fold over, this may progress, pushing the epiglottis into its down-folded position causing mechanical obstruction



Problems with LMA Insertion

- ◆ If the mask tip is deflated forward it can push down the epiglottis causing obstruction
- ◆ If the mask is inadequately deflated it may either
 - push down the epiglottis
 - penetrate the glottis.



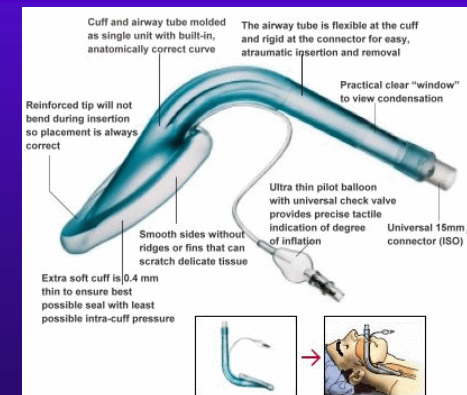
Proseal & LMA Supreme

- ◆ Has two separate tubes
- ◆ Three dimensional inflation of cuff
- ◆ Holds a better cuff seal pressure



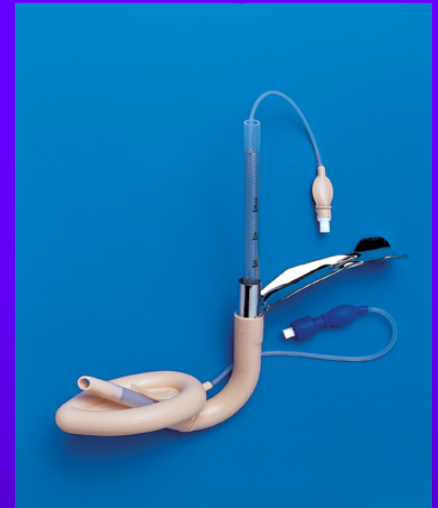
Flexible & Ambu LMA

- ◆ Flexometallic tube
- ◆ Preformed angle
- ◆ Better placement
- ◆ Less incidence of dislodgement once placed
- ◆ More useful in head and neck surgery



ILMA & LMA C Trach

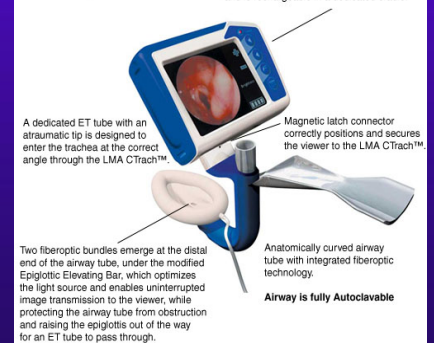
- ◆ Allows intubation with minimal head and neck manipulation
- ◆ Recommended in both difficult airway and Resuscitation algorithm
- ◆ C Trach allows intubation under direct vision



Key Features of the

LMA CTrach™

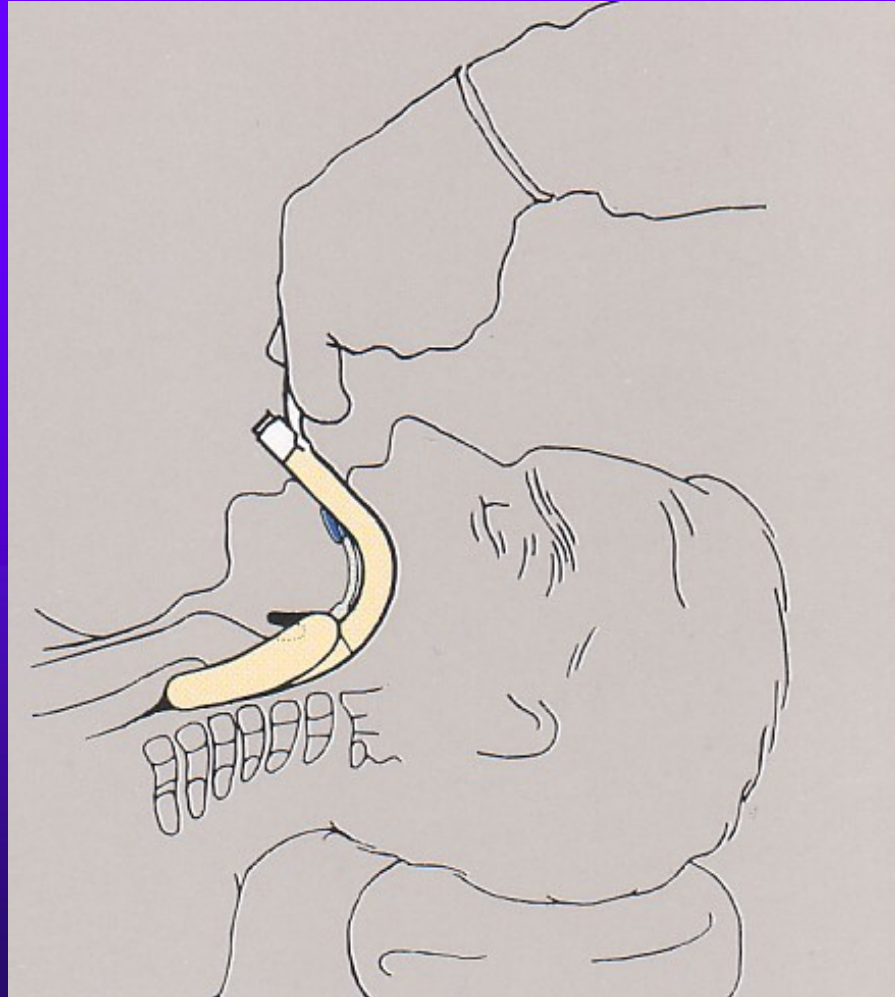
The LMA CTrach™ Viewer weighs less than eight ounces, and is totally wireless and portable. The Viewer provides controls for focusing and image adjustment. The battery provides 30 minutes of uninterrupted viewing and is rechargeable in a dedicated cradle.



LMA Fastrach – Intubating LMA - ILMA



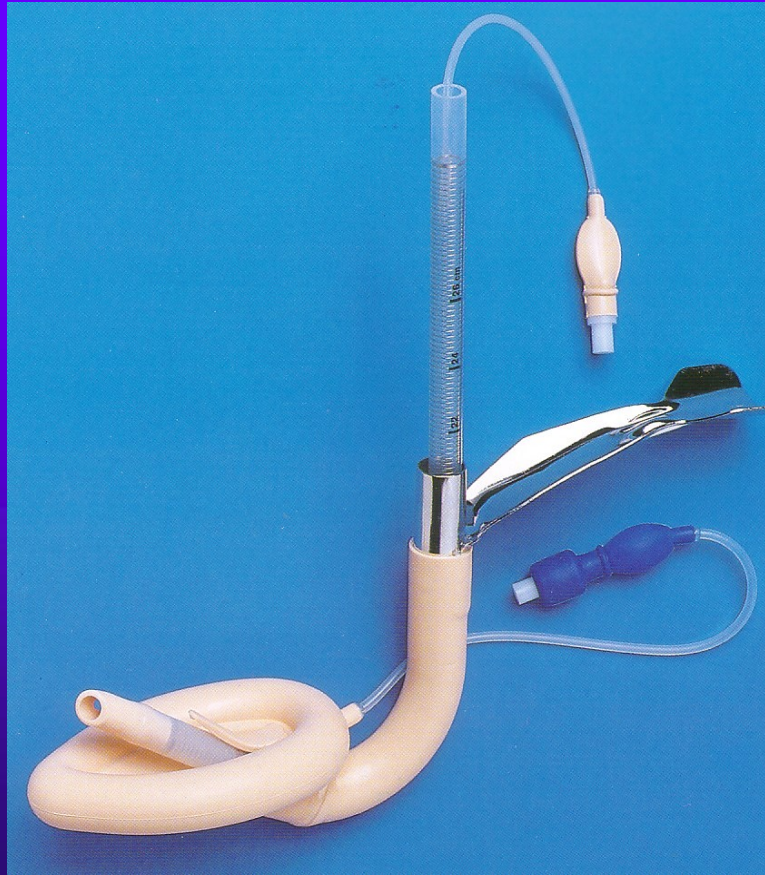
LMA Fastrach in Position



LMA Fastrach



Intubation via LMA Fastrach

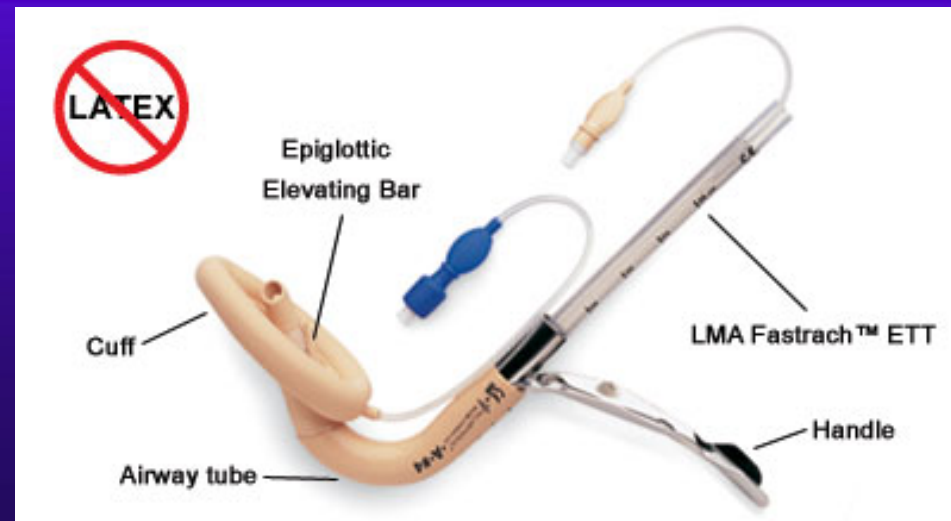


Intubation via LMA Fastrach



Intubating LMA

- ◆ Allows special ETT through LMA and out aperture into trachea
- ◆ 3,4 LMA = 6.0 ETT
- ◆ 5 LMA = 7.0 ETT





 **INTERSURGICAL**
COMPLETE RESPIRATORY SYSTEMS

i-gel

Natural airway management



Airway management has evolved.



- ◆ Single use, cuffless
- ◆ Integral gastric channel
- ◆ Epiglottic blocking ridge
- ◆ Moulding feature





Endotracheal intubation

- ◆ The most common method of securing a patient's airway in an emergency situation is via the ET tube. Again, the size of the ET tube is usually determined by the size of the patient in question. However, usually a size 7.5-8 tube will suffice for a female and a size 8-8.5 tube for a male.



Why Intubate ??

- ◆ protects the airway from aspiration
- ◆ maximizes inspired oxygen
- ◆ allows long-term ventilation if required
- ◆ reduces accidental gastric dilation during manual ventilation with BVM
- ◆ safer for transport
- ◆ frees attendants for other tasks



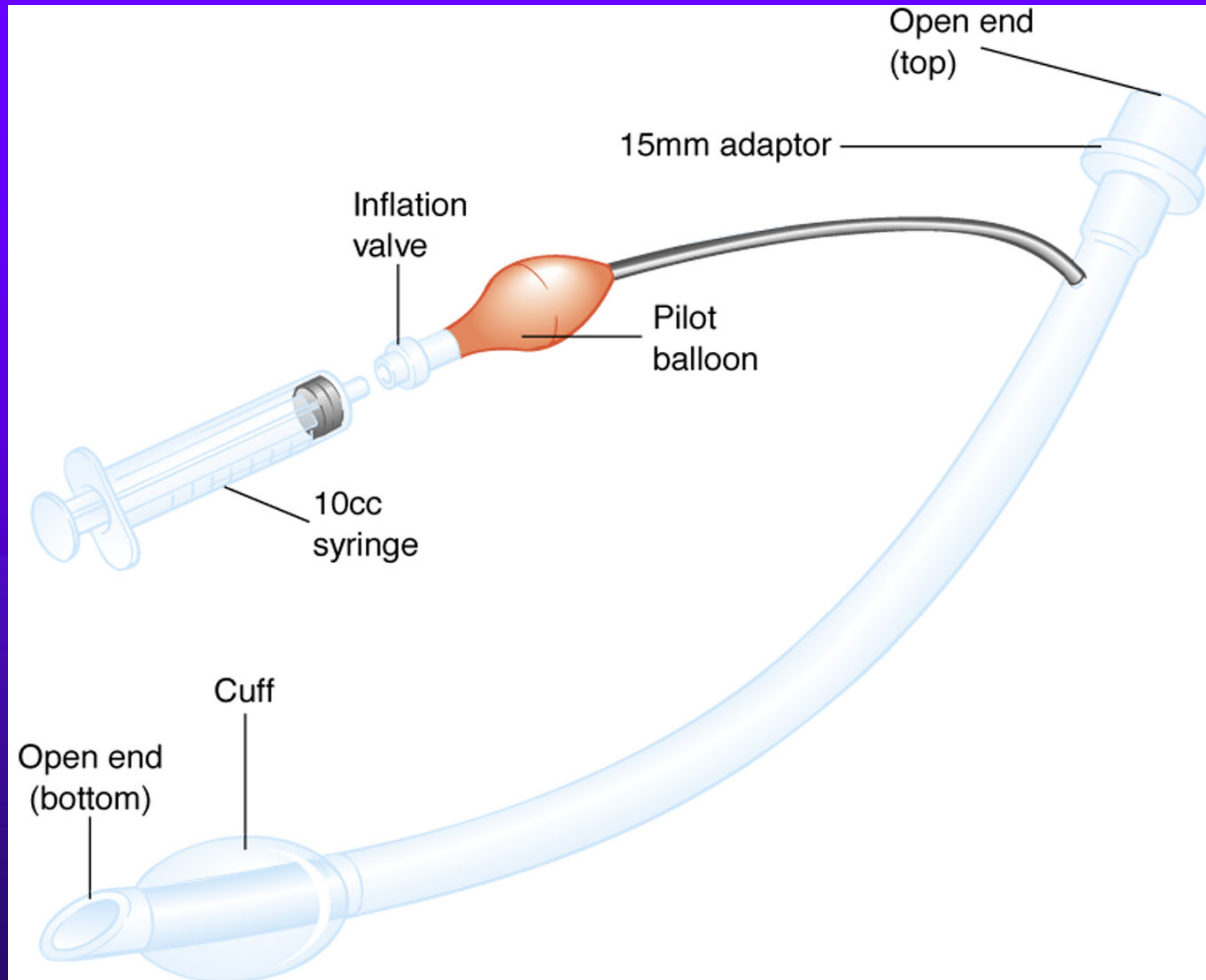
Endotracheal Intubation

- ◆ Accomplished by placing a tube , either nasally or orally through the larynx and into the trachea
- ◆ **Indications**
 - Airway compromise/obstruction that persists despite the use of the previously described adjuncts
 - Secretion management – as a conduit for suctioning
 - Airway protection from regurgitation or aspiration in patients with dec. level of consciousness or ineffective upper airway reflexes
 - The need for high concentrations of oxygen, mechanical ventilation or general anaesthesia

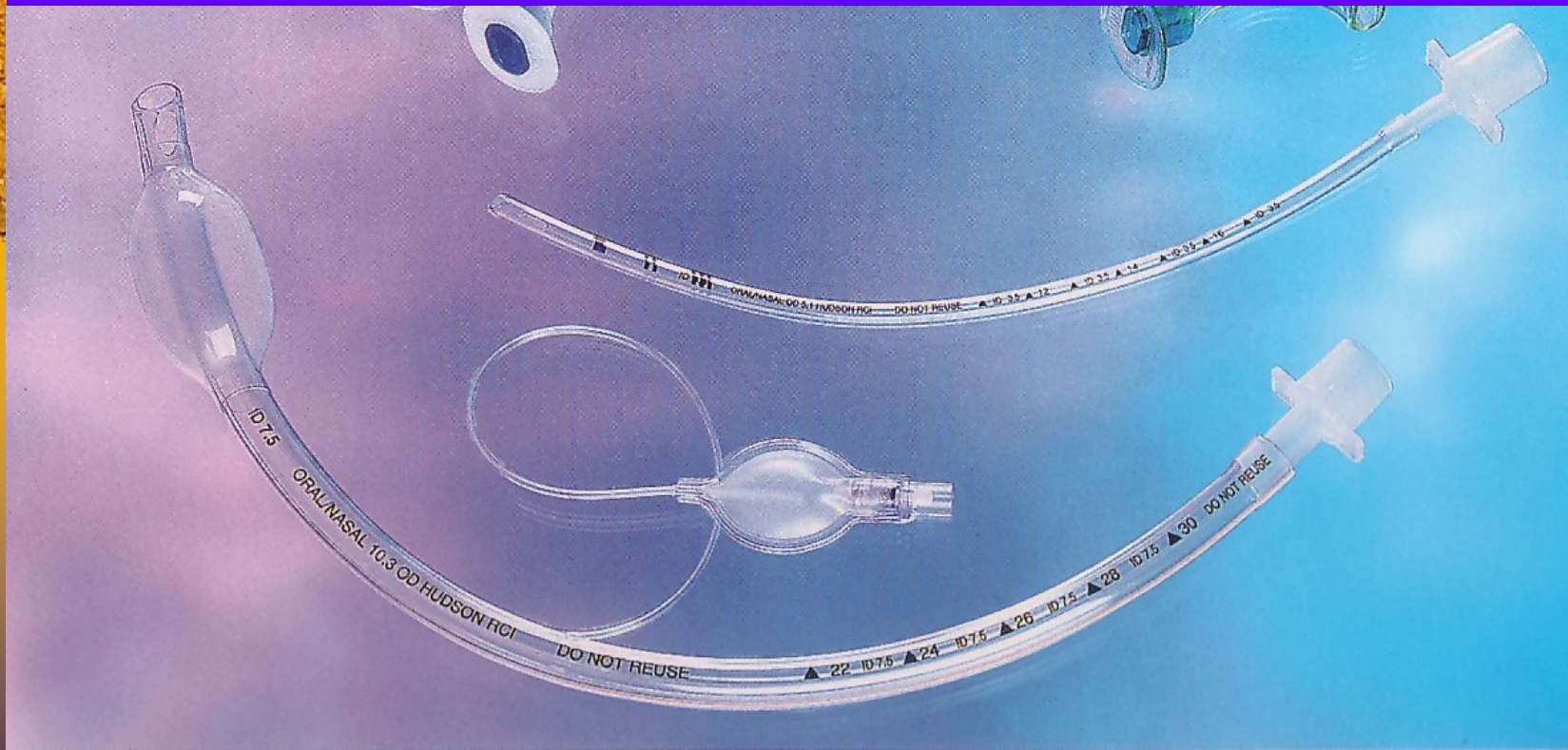
ETT Tube Design

- ◆ Basic standardised design
- ◆ Connector at the proximal end – standard 15mm outside diameter
- ◆ The tube body has a standard curvature, centimetre markings to allow depth determination
- ◆ Radiopaque markings running the length of the tube or at the distal end to allow for location on the chest x-ray
- ◆ The distal tip has a bevelled edge, allows for easier passage through the glottic slit
- ◆ Murphy type tubes has a second smaller opening opposite to the bevelled edge
- ◆ Adult ETTs are equipped with a cuff, when inflated seals the trachea
- ◆ The inflating system is a small-bore tube fused within the wall of the ETT which allows for inflation of the cuff, proximal end has a spring loaded valve
- ◆ Adjacent to the valve is the pilot balloon, indicates general inflation state of the cuff

ETT and Syringe



Endotracheal Tubes



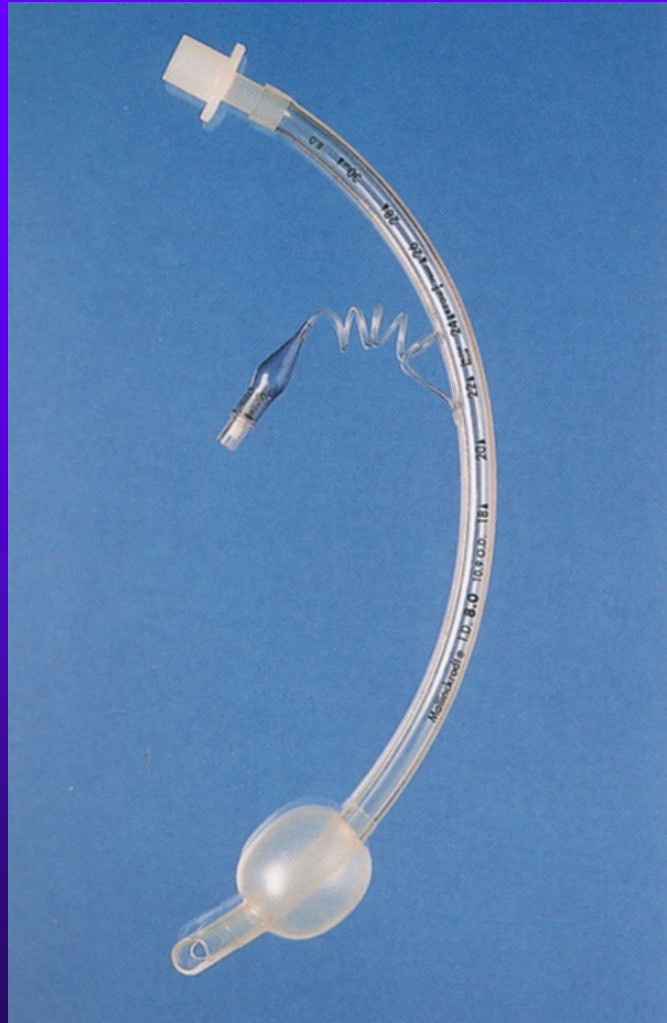
Selecting Appropriate ETT Size

♦ Adults

- ETT Diameter
 - Females- 7.0 – 8.0 mm
 - Males – 8.0 – 9.0 mm
- ETT Depth: 21-23 cm



Cuffed Endotracheal Tube



Uncuffed Endotracheal Tube





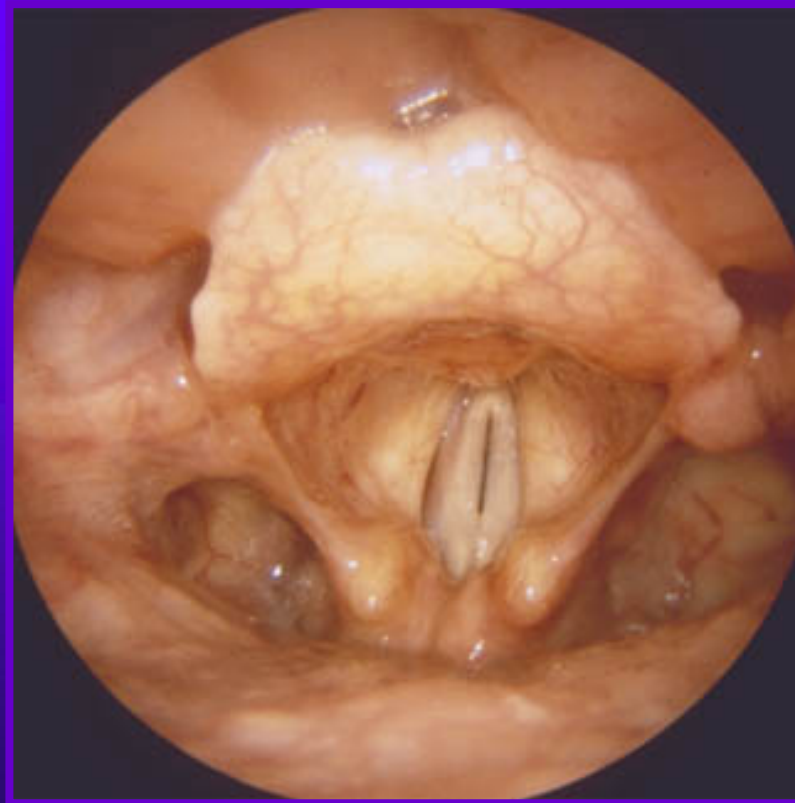
Technique – Intubation equipment

- ◆ Most often facilitated by direct laryngoscopy
- ◆ Visualisation of the vocal cords or glottic slit
- ◆ Performed with the use of a laryngoscope

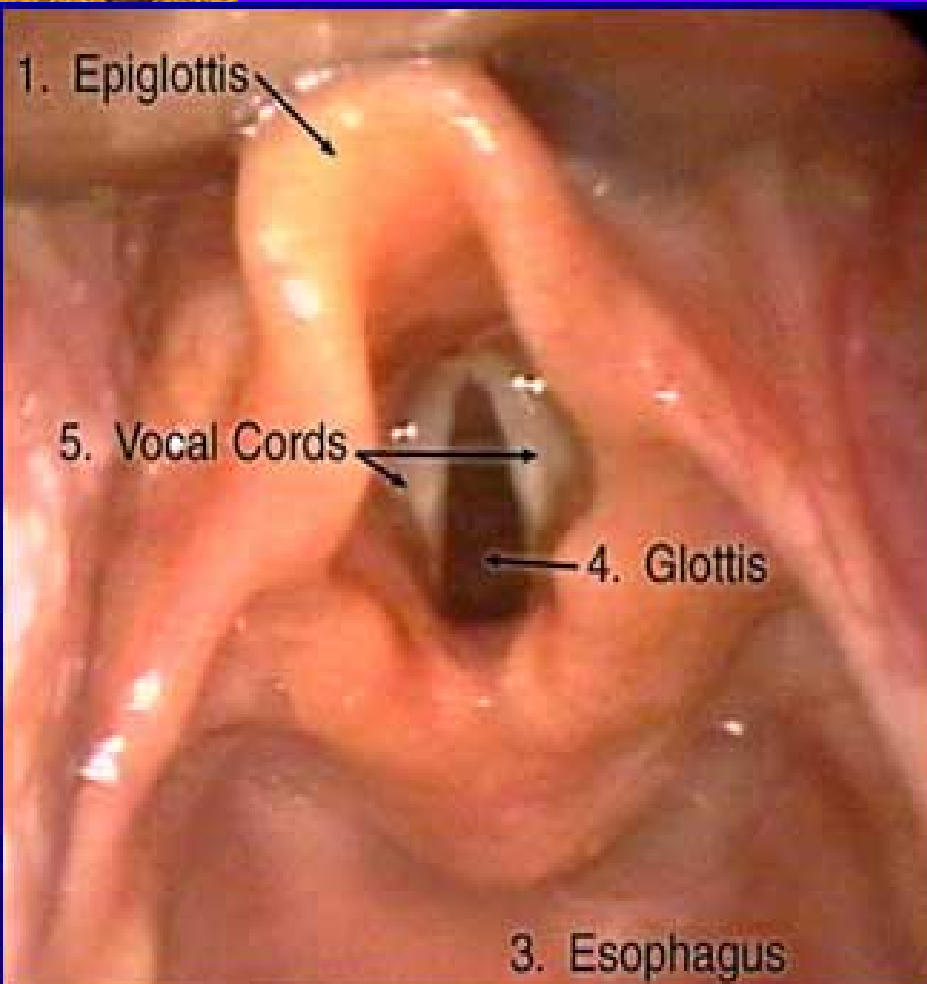
Vocal Cords



Glottis visualized through laryngoscopy



Glottis





The Laryngoscope

- ◆ Two basic parts – handle and blade
- ◆ Blades can be either curved (MacIntosh) or straight (Miller)
- ◆ Come in a variety of sizes

Laryngoscopes



Laryngoscope Blades MacIntosh



Smooth shape for easy cleaning and sterilizing

Large fiber optics bundle
4.4 mm dia.

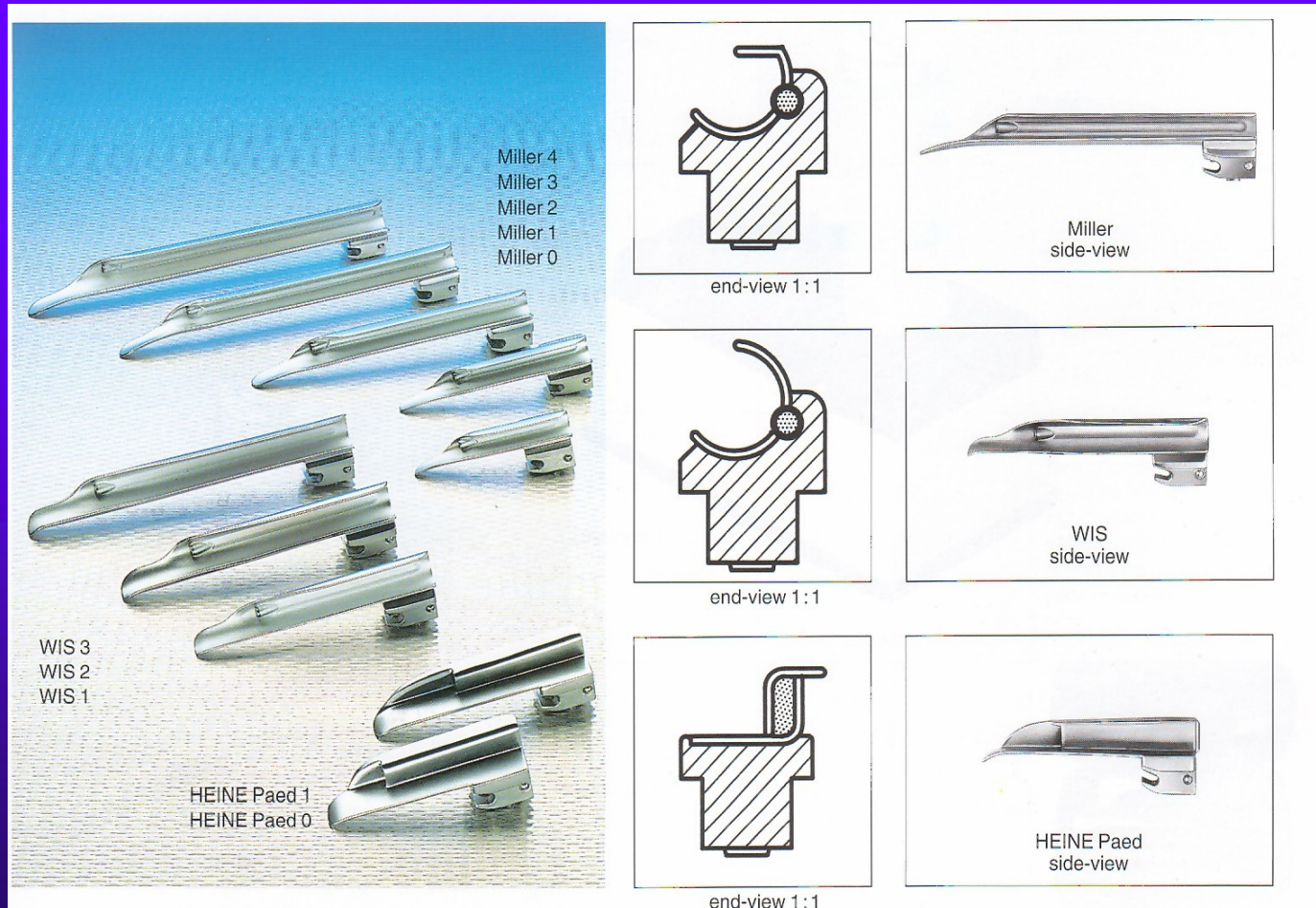
Bright, white halogen light
from protected fiber bundle

Length

Mac 3
side-view

Mac 3
end-view 1:1

Laryngoscope Blades Miller



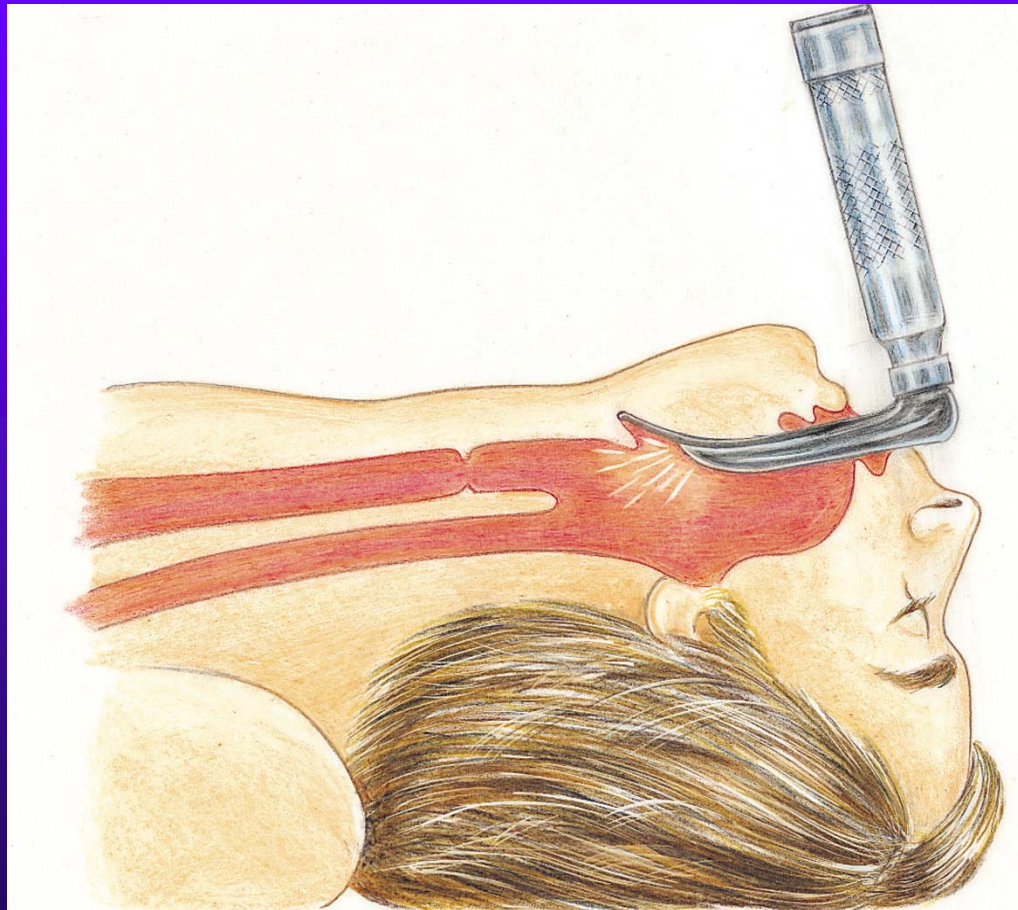
Fibreoptic Laryngoscope

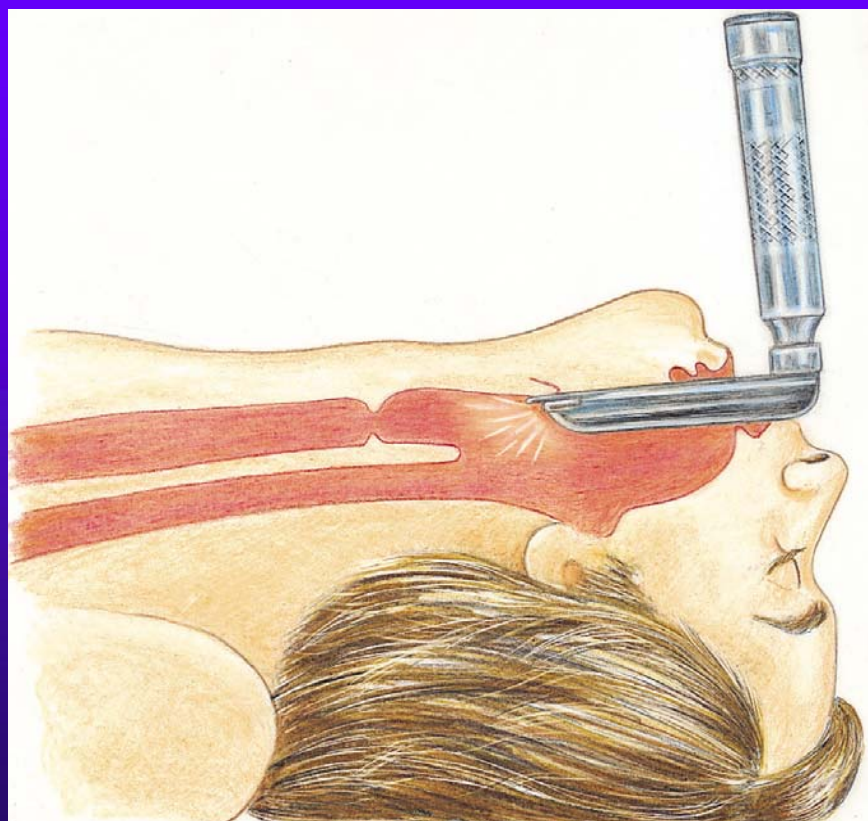


Traditional Laryngoscope



Placement of Macintosh blade into vallecula







Equipment Required

- ◆ The ETT
- ◆ Suction equipment in good working order – 2 separate sources
- ◆ Rigid tip suction (Yankauer) and a suction catheter
- ◆ Oxygen source, BVM device and mask
- ◆ Water soluble lubricant
- ◆ A 10 ml syringe for cuff inflation
- ◆ Tape or other device for stabilization of the tube
- ◆ Magill's forceps
- ◆ Malleable stylet
- ◆ Bougie
- ◆ ETCO₂ detection device
- ◆ Stethoscope
- ◆ Oximetry
- ◆ monitoring



Basic Airway Equipment

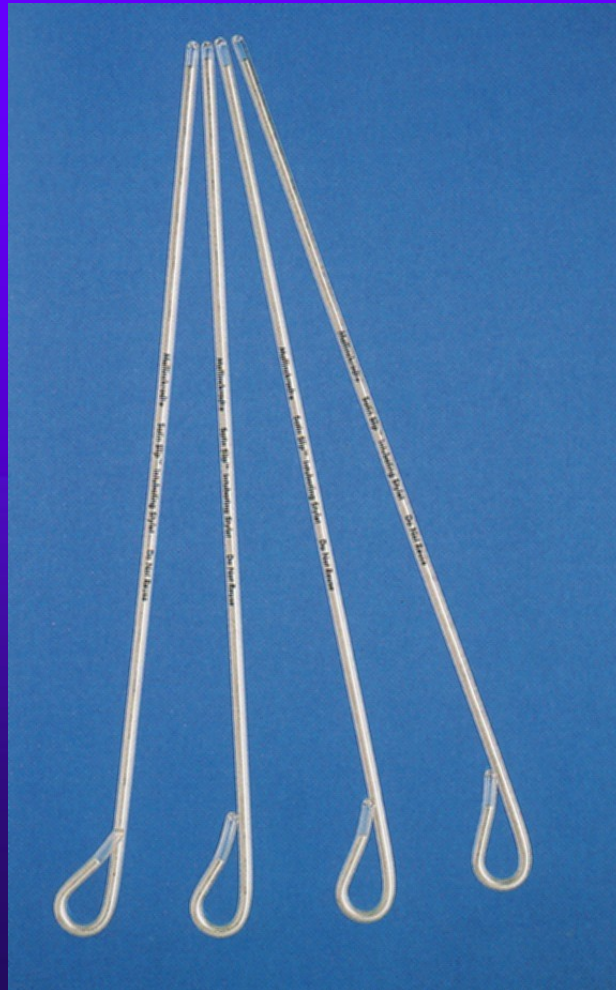
Stylet

- Semi rigid, malleable, blunt-tipped wire
- Inserted into ETT to change curvature

Magills Forceps

- For nasal ETT
- Used to grasp & direct tip of ETT

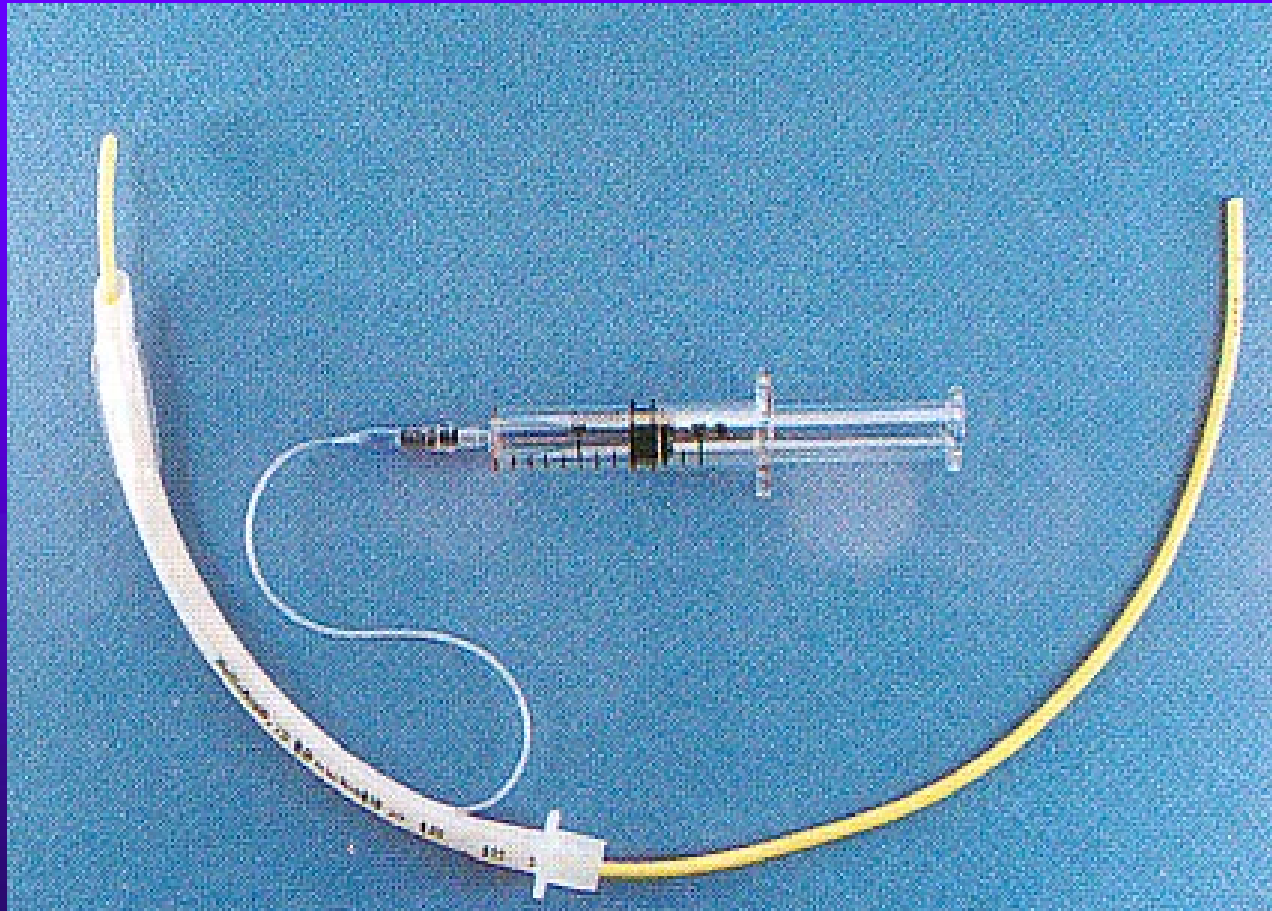
Malleable ETT Introducer



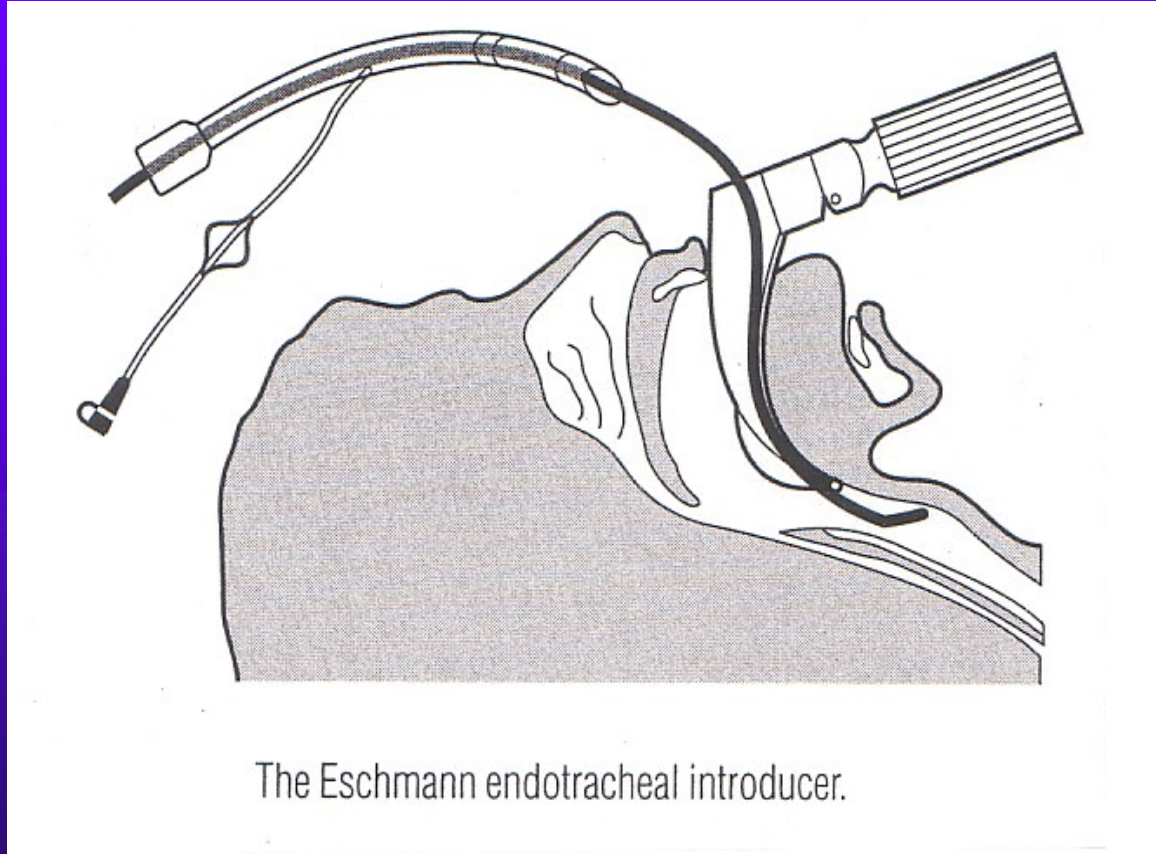
Magills Forceps



Gum Elastic Bougie



Intubation using a Bougie



Technique of Intubation

- ◆ Planning & preparation Vital
- ◆ Typically involves 6 steps:
 - Equipment check
 - Patient positioning
 - Opening patient's mouth
 - Laryngoscopy
 - ETT insertion
 - Confirmation ETT placement & securing ETT



Prepare equipment.



Laryngoscopy – Position Patient

- ◆ Supine
- ◆ Towel or blanket under head to achieve sniffing position – if no trauma
- ◆ Preoxygenate
- ◆ Medications – See RSI later



Laryngoscopy

Left hand !





Technique of Intubation

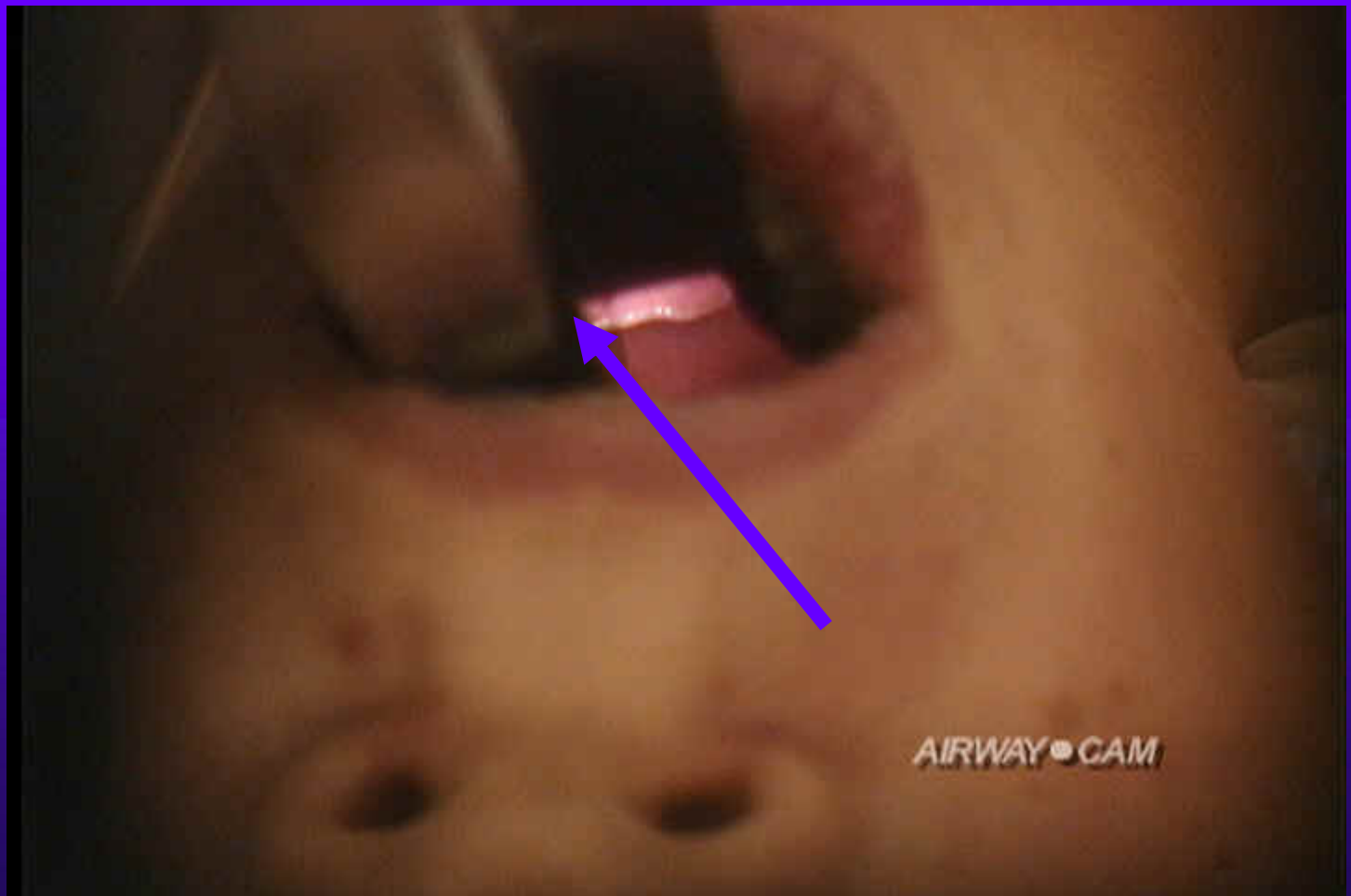
◆ Laryngoscopy

- Hold laryngoscope in LEFT hand
- Insert blade into RIGHT side of patients mouth & displace tongue to left
- Upward traction is exerted to expose the glottic opening. Do not LEVER on upper incisors

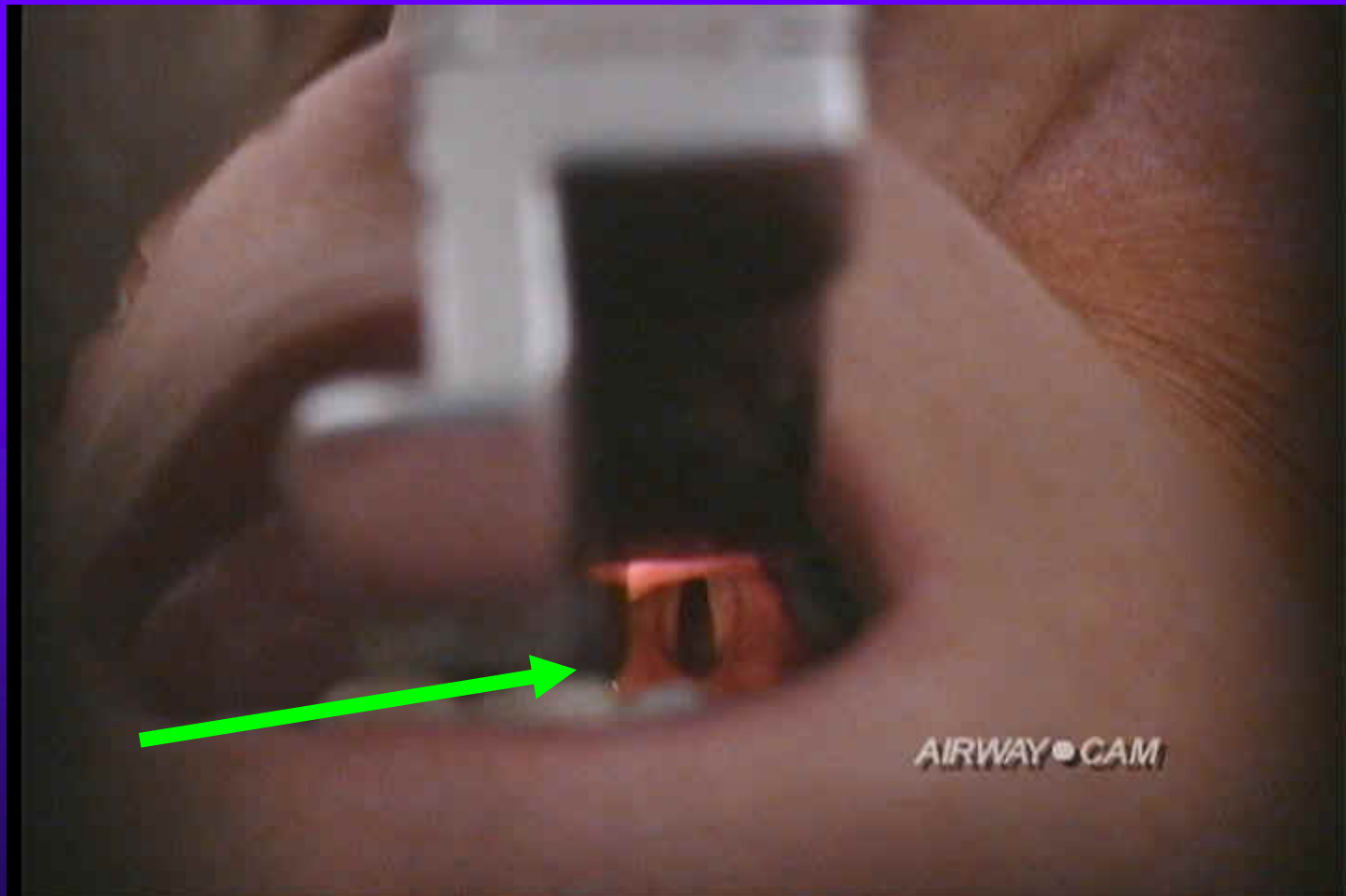
◆ ETT Insertion

- The tube is inserted through the vocal cords and slightly beyond (5-6cm), and into the trachea.

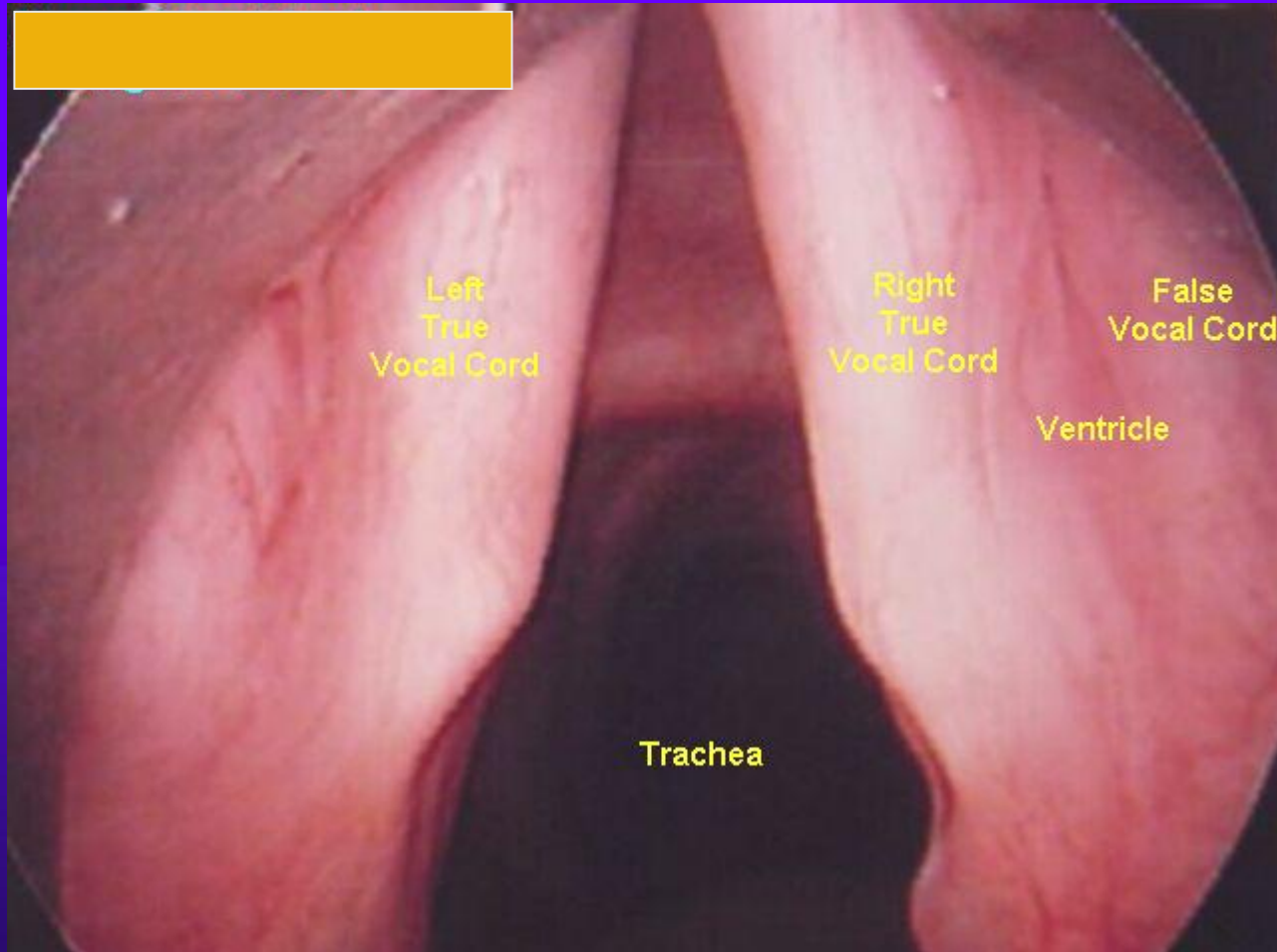
Laryngoscopy views: Tip of Epiglottis



Laryngoscopy views: Vocal Cords



Laryngoscopy views: Vocal Cords





- ◆ After passage of the tube, the laryngoscope is removed
- ◆ And the cuff inflated.
- ◆ Connected to a BVM device
- ◆ Assess tube placement



Ensuring optimal tracheal position

- ◆ Sighting the passage of the ETT through the vocal cords
- ◆ Misting/fogging of the ETT during exhalation
- ◆ Auscultation of breath sounds in the lung fields.
- ◆ The characteristic waveform of capnography is regarded as the gold standard for confirmation of tracheal placement in patients with a palpable



Performing Intubation



Intubation (sequence)

- oxygenation
- position head
- insert laryngoscope – visualise cords
- insert ETT
- confirm position
- secure ETT
- ventilate

Oxygenation

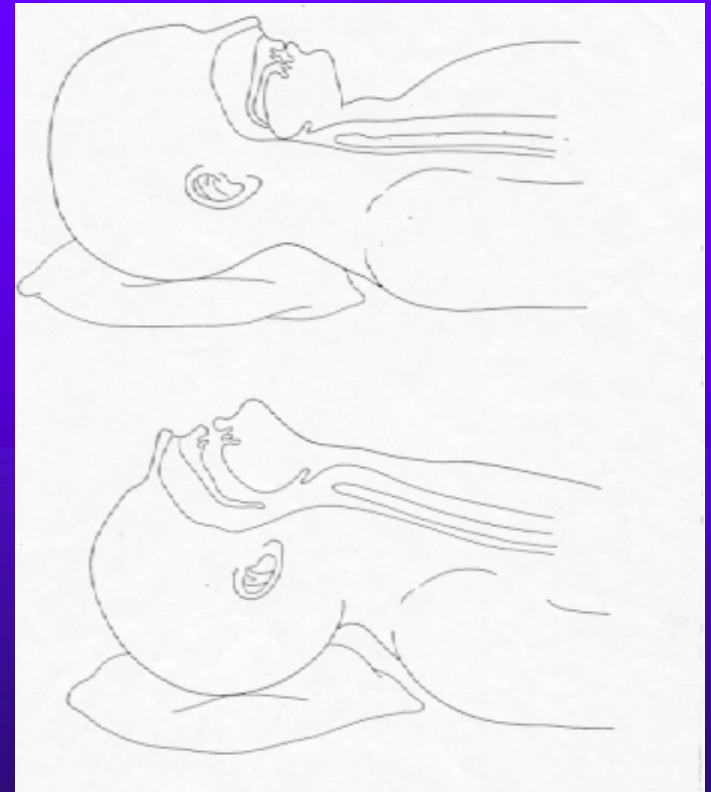
Aim:

- reduces potential for hypoxia during intubation by replacing (most) of the nitrogen in the lungs with oxygen
- during a cardiac arrest this oxygenation will be already underway



Position head

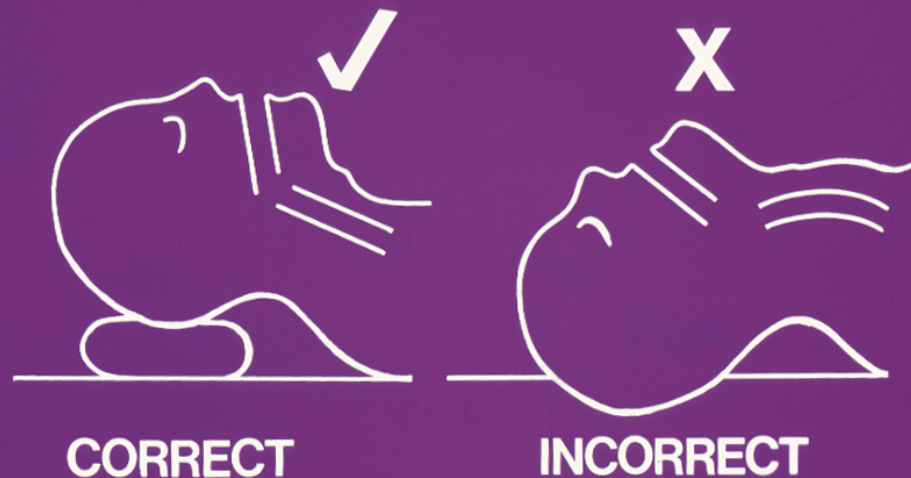
- ♦ pillow under crown of head
- ♦ right hand holds crown of head and tilts it back so that ...
- ♦ neck is
 - extended at atlanto-occipital joint
 - flexed cervical spine



Position head

Pillow under crown of head is necessary to create the correct neck position:

- extended at atlanto-occipital joint
- flexed cervical spine





Insertion of laryngoscope

- ◆ laryngoscope is held in *LEFT* hand
- ◆ crown of head is held in *RIGHT* hand
- ◆ push back (down) on crown of head and slight mouth opening will occur (assistant may aid by pulling down lower jaw)

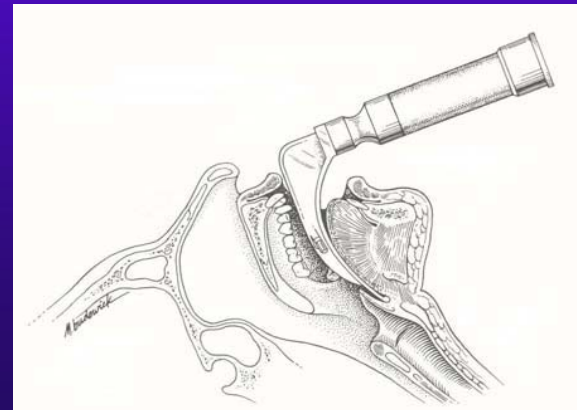
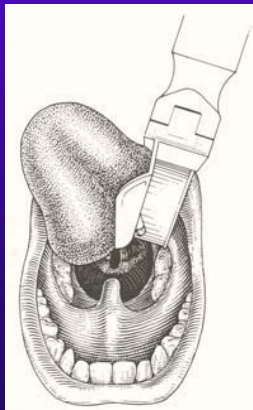
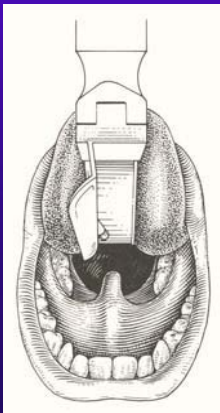
Insertion of laryngoscope



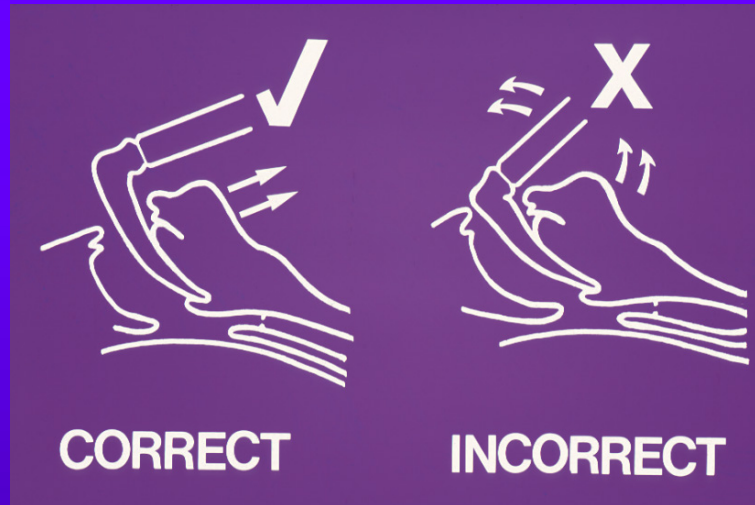
- ◆ insert laryngoscope into mouth and follow the curve of the tongue
- ◆ place tip of laryngoscope between epiglottis and tongue
- ◆ lift perpendicular to line of trachea to expose the vocal cords

Inserting the Blade

- Advance blade over tongue until uvula and tonsillar folds are seen.
- Then move it to right side of mouth so it lies between aryepiglottic folds and tongue. This manoeuvre displaces tongue to left.
- Advance blade further until its tip lies in vallecula



Insertion of laryngoscope



If laryngoscope is rotated against upper teeth rather than lifted:

- view worsens
- dental damage can occur

Insertion ETT

- ♦ assistant hands the endotracheal tube to the intubator in the position of insertion (a)
- ♦ if handed incorrectly (b) or (c) time is wasted to realign and risk of aspiration or hypoxia increases because of the delay



(a) correct

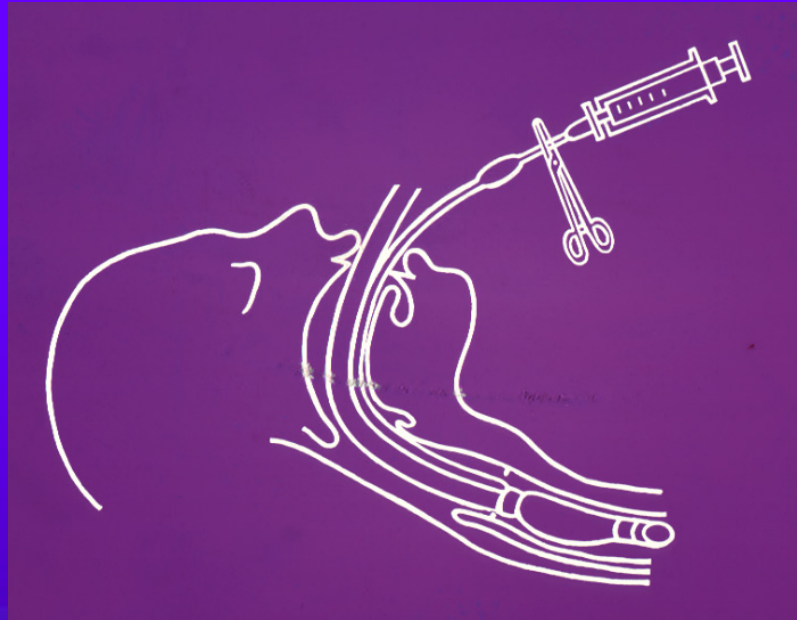


(b) reversed



(c) holding cuff

Insertion ETT



- ◆ insert ETT so that cuff is just through vocal cords
- ◆ secure tube so that it neither falls out or advances down the right main bronchus



Insertion ETT (secure, confirm, ventilate)

- ◆ insert ETT so that cuff is just through vocal cords
- ◆ secure tube so that it neither falls out or advances down the right main bronchus
- ◆ inflate cuff
- ◆ use capnograph if possible to confirm ETT is not in oesophagus
- ◆ connect BVM
- ◆ ventilate lungs & auscultate lungs to confirm both lungs are being ventilated



Capnography

- ◆ Capnography is the measurement of carbon dioxide in exhaled air
- ◆ Capnography is made possible by end-tidal carbon dioxide detectors
- ◆ Purpose:
 - Help confirm proper ET tube placement
 - Reveal inadvertent Oesophageal placement
 - Can also be used in non-intubated patients
 - Used to help monitor breathing patterns of patients with respiratory illness/problems

Types of Carbon Dioxide Detectors

- ◆ Chemical based
 - Colourimetric
- ◆ Electronic
 - Capnometry
 - Capnography
- ◆ Electronic sensors are similar to pulse oximetry
 - Uses infrared light and sensors to measure CO₂



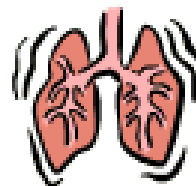
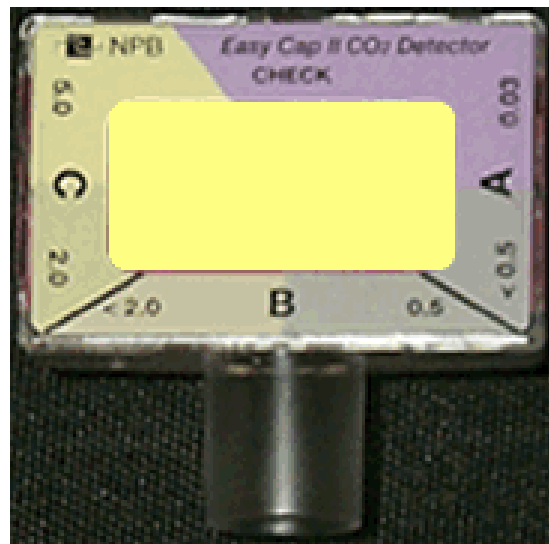


Colourimetric

- ◆ Placed between ET tube and BVM
- ◆ Disposable device
- ◆ Contains chemical indicator that is sensitive to carbon dioxide
 - Changes colours to indicate success
 - Yellow/Gold (Yes it's in the trachea)
 - Tan (Think about it, it may not be properly placed)
 - Purple (Problem, ET tube is not placed properly)
- ◆ Colourimetric is only used for short periods of time
- ◆ Colourimetric will give false readings in vomitus or if tube is in oesophagus and they just had carbonation

Colourmetric ETCO₂

O₂



Colorimetric Devices



Capnometry

- ◆ Simple electric device
- ◆ Probe is placed between ET tube and BVM
- ◆ Displays numeric value of exhaled CO_2
 - Changes are observed over time
- ◆ Goal is to maintain readings between 35-45 mm Hg

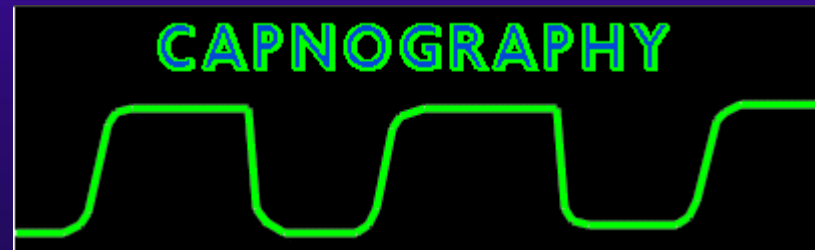




Capnography

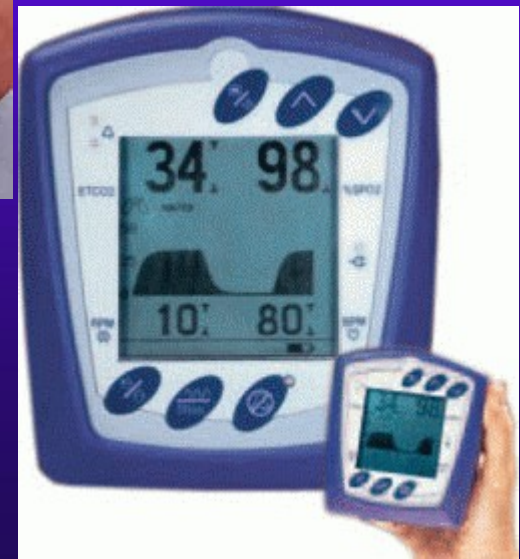
- ◆ More advanced electronic device
- ◆ Measures end-tidal CO_2 and records a wave form
 - Provides visual display of rate, depth, and effectiveness of patient's ventilations
 - Similar to pulse oximetry wave forms
 - Also gives numeric reading (35-45)
- ◆ Can be used on non-intubated patients

Capnography wave forms should be constant and show a steady inspiratory and expiratory phase, as shown here.



Capnography Monitors

- ◆ Usually included in defibrillator monitors such as Lifepak, Zoll, or Phillips



Capnography Sensors

- ♦ Intubated sensors typically go between ET tube and BVM, then to monitor
- ♦ Sensors for non-intubated patients are usually a nasal cannula device





Summary

- ◆ Capnography is the measurement of carbon dioxide in exhaled air and is made possible by end-tidal CO₂ detectors
- ◆ Capnography's purpose is to help confirm ET tube placement, it can also be used on non-intubated patients for monitoring respirations
- ◆ Colourimetric, capnometry, and capnography are all types of end-tidal CO₂ detection
- ◆ Colourimetric is a chemical based sensor that changes different colours from CO₂ levels
 - Yellow (yes), Tan (think), Purple (problem)



Summary cont.

- ◆ Capnometry comes from a simple electric device that provides a numerical reading
 - Remember between 35-45 mm Hg
- ◆ Capnography devices are more complex and provide a wave form that shows depth, rate, and effectiveness of patient ventilations; also provides numerical reading (35-45 mm Hg)
- ◆ Capnography can be used during resuscitation to see perfusion; to help confirm ET placement; and in non-intubated patients with respiratory illness/problem



Rapid Sequence Intubation



- ◆ Unless the patient is deeply comatose or in cardiac arrest, upper airway reflexes will be present and ETI will require the use of sedative and neuromuscular blocking drugs to facilitate laryngoscopy and placement of the tube



RSI - Definition

- ◆ The virtually simultaneous administration of a potent sedative agent and a neuromuscular blocking agent to induce unconsciousness and motor paralysis for tracheal intubation
- ◆ It refers to pre-oxygenation of the patient followed by delivery of an induction agent and a muscle relaxant in association with cricoid pressure to reduce regurgitation



Precautions and relative contraindications

- ◆ Patients with an upper airway obstruction
- ◆ Distorted facial anatomy
- ◆ Likely difficult or impossible intubation, e.g. micronathia or ankylosed neck
- ◆ Lack of operator skill or experience



The Seven Ps of RSI

Ppreparation

Ppreoxygenation

Ppre-treatment

Pparalysis with induction

Pprotection

Pplacement

Ppost-Intubation Management



RSI: The Timeline

- ◆ Zero minus 10 minutes **Prepare**
- ◆ Zero minus 5 minutes **Preoxygenate**
- ◆ Zero minus 3 minutes **Pretreat**
- ◆ ***Time ZERO*** **Paralysis with induction**
- ◆ Zero plus 30 seconds **Protection**
- ◆ Zero plus 45 seconds **Placement**
- ◆ Zero plus 90 seconds **Post-intubation management**



The Sequence

Zero:

The time of administration of
succinylcholine



The Sequence

Zero – 10 minutes

PREPARATION

- ◆ **Difficult airway: last chance**
- ◆ **Plan approach**
- ◆ **Assemble drugs and equipment**
- ◆ **Establish access, monitoring**



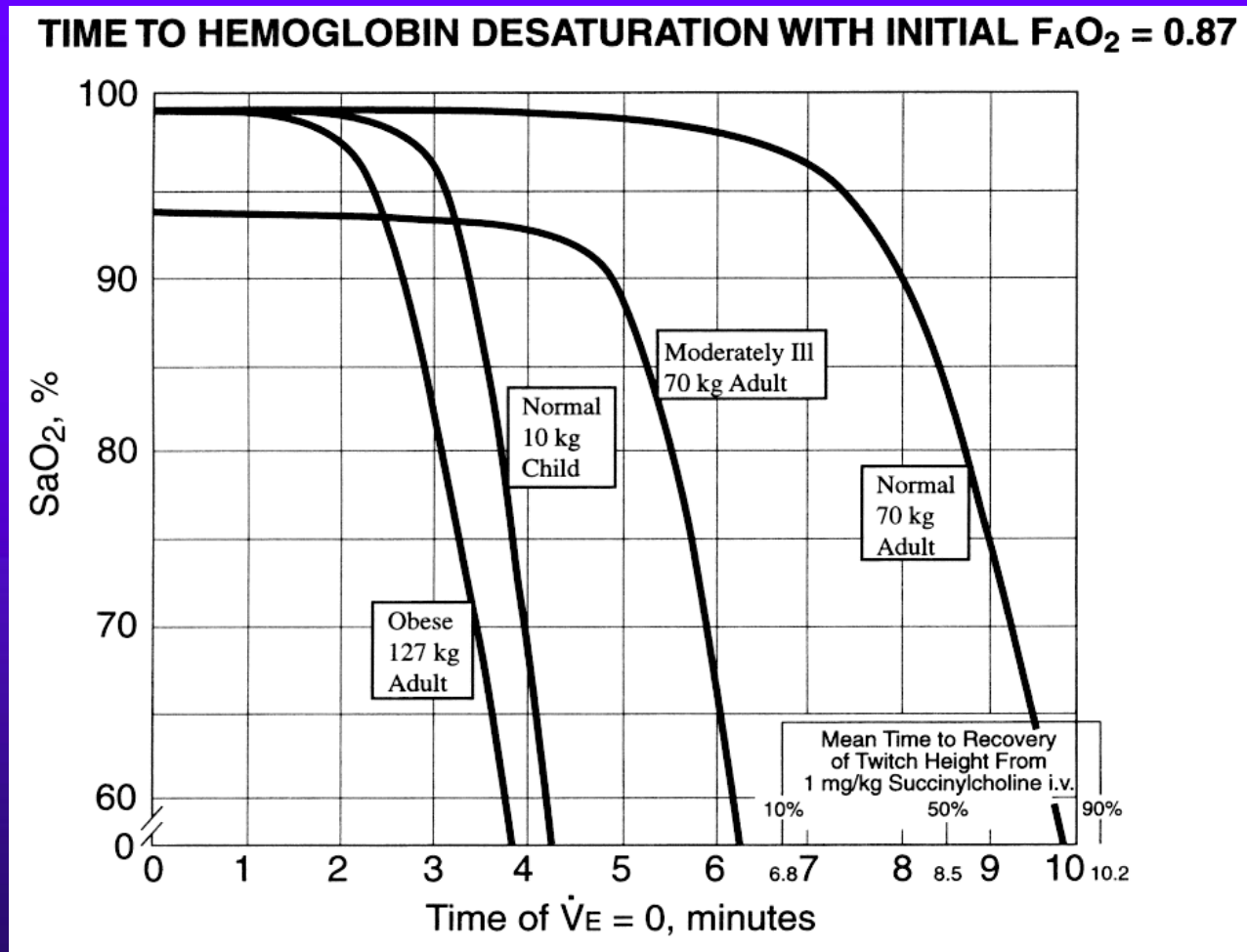
The Sequence

Zero – 5 minutes

PREOXYGENATION

- ◆ 100% oxygen for 5 minutes
- ◆ 8 vital capacity breaths
- ◆ Provides essential apnoea time
- ◆ Apnoea time varies

Time to Desaturation



From: Benumoff



The Sequence

Zero – 3 minutes

Pre-treatment

- ◆ Opioid
- ◆ Benzodiazepine
- ◆ Defasciculation



The Sequence

Zero !!!

Paralysis with induction

- ◆ Induction agent IV
- ◆ Succinylcholine 1.0 mg/kg

ENTERING THE RED ZONE!!



The Sequence

Zero + 30 seconds

Protection

- ◆ Sellick's Manoeuvre – Cricoid Pressure
- ◆ Position patient
- ◆ Do not bag unless $\text{SpO}_2 < 90\%$



The Sequence

Zero + 45 seconds

Placement

- ◆ Check mandible for flaccidity
- ◆ Intubate, remove stylet
- ◆ Confirm tube placement – ET
CO₂
- ◆ Release Sellick's manoeuvre



The Sequence

Zero + 90 seconds

Post – Intubation Management

- ◆ Secure tube
- ◆ Chest x-ray
- ◆ Long acting sedation/paralysis
- ◆ Establish ventilator parameters



Summary

The Seven Ps of RSI

P Preparation

P Preoxygenation

P Pre-treatment

P Paralysis with induction

P Protection

P Placement

P Post-Intubation Management

Cricoid pressure (Sellick's manoeuvre)

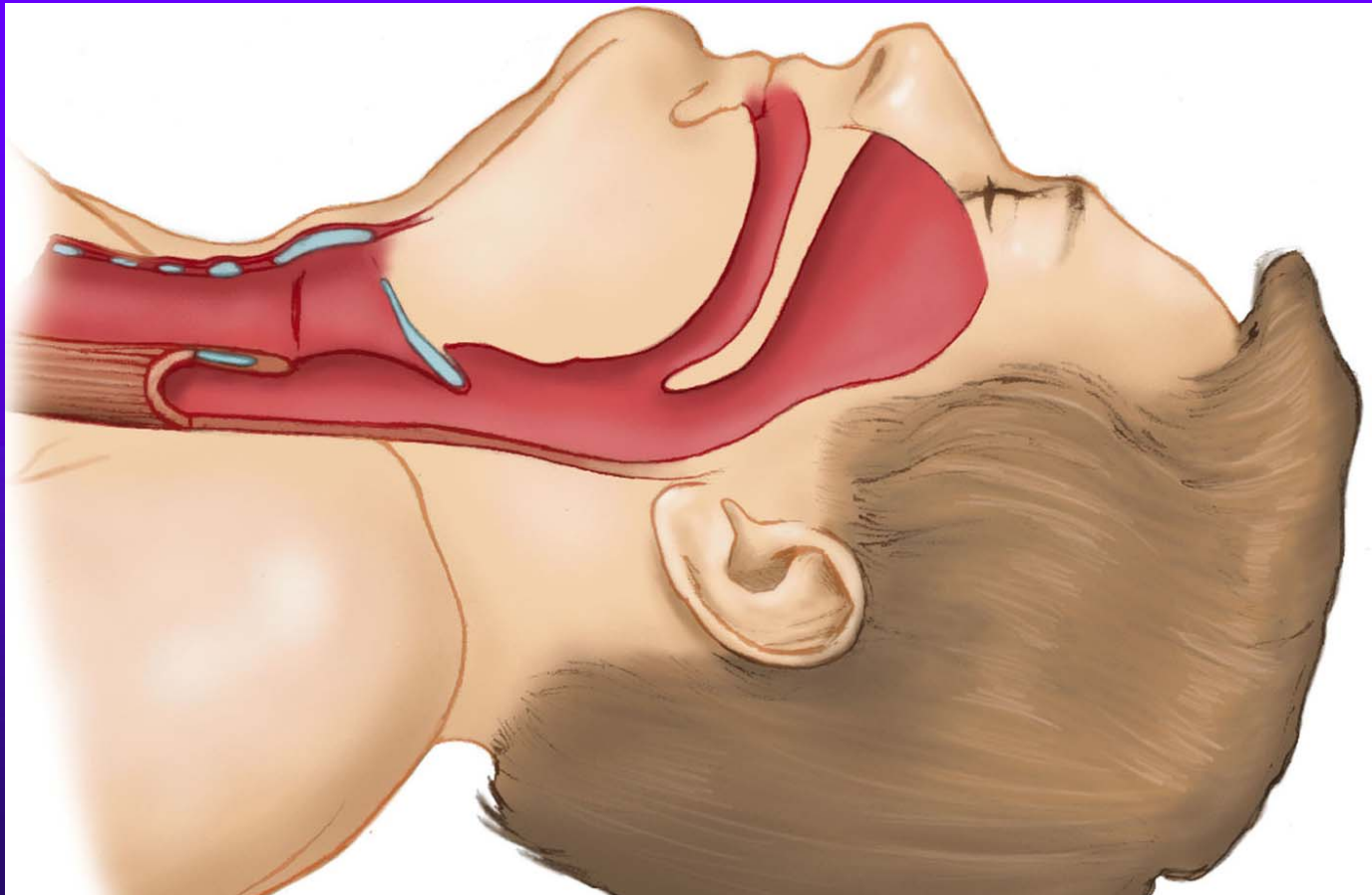
- ◆ Applying firm backward pressure over cricoid cartilage, to compress the oesophagus, to prevent gastric distension.



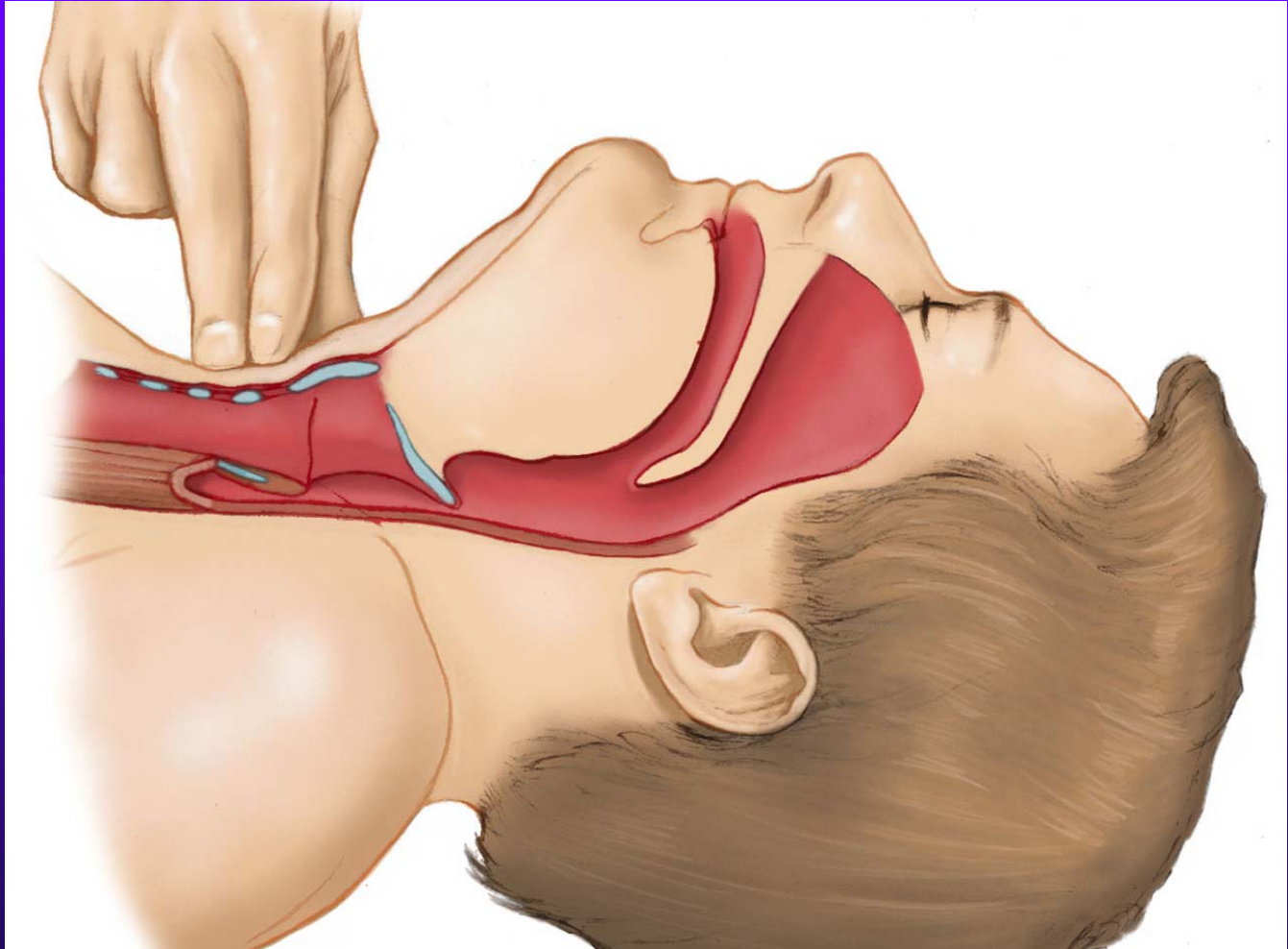
Sellick's Manoeuvre (Cricoid Pressure)



Airway before applying Sellick's manoeuvre



Airway with Sellick's applied (note compression on the oesophagus)





Drugs – Pre-induction

◆ Midazolam

- Sedative
- Hypnotic often used as induction drug as relatively haemodynamically stable compared with Propofol

◆ Fentanyl or Morphine

- Sedative analgesic
- Limits hypertensive response to intubation, but may induce hypotension and hypoventilation



Drugs - Induction

◆ Propofol

- Rapid acting hypnotic with short half-life
- Anticonvulsant and antiemetic
- At higher doses produces apnoea and muscle relaxation
- Principal side effect is hypotension, due to reduced systemic vascular resistance
- Dose : 0.5-2mg per kg body weight
- For unstable patients use a lower dose



Drugs - Induction

◆ Thiopentone

- Rapid acting hypnotic with a short duration of action
- Associated with reduction in sympathetic activity and therefore hypotension
- Hypotension may be profound in the hypovolaemic/septic patient
- The doses needed in critically ill patients are much smaller than traditional anaesthetic use (1-15mg per kg body weight)



Drugs – Relaxant – NMB – Paralytic

◆ Suxamethonium/ Succinylcholine

- Depolarising muscle relaxant with rapid onset 30-60 seconds and a short duration of approx. 5 minutes
- Major complication is hyperkalaemia
- Contraindicated in history of malignant hyperthermia, uncontrolled hyperkalaemia, myopathy, severe burns after 24 hours
- Dose 1 – 1.5mg per kg of body weight



Rocuronium

- ◆ Alternative to suxamethonium when it is contraindicated
- ◆ Non-depolarising muscle relaxant
- ◆ Usually combined with propofol induction, gives intubating conditions after 60 seconds
- ◆ Has a prolonged action of 30 to 60 minutes
- ◆ Dose 1 mg per kg body weight



Drugs - Vasopressors

♦ Metaraminol

- Potent sympathomimetic agent that increases blood pressure, principally by its vasoconstrictor action
- Useful in the setting of intubation if induction agents cause hypotension unresponsive to volume
- Give in aliquots of 0.5-1mg every 1-2 minutes until a response is seen
- Metaraminol comes as 10mg in 1 ml
- It must be diluted for IV injection
- One mL of metaraminol (10mg) diluted in 19mL of diluent to make a 0.5 mg/mL solution is safest



Inducing agent

◆ Sedation – Institutional choice

- Midazolam 0.1 mg/kg
- Thiopental 3 mg - 5 mg/kg
- Ketamine 1mg - 2mg/kg
- Propofol 0.5 to 1mg/kg



Paralyzing agent

- ◆ Immediately after the induction dose
 - Succinylcholine 1 mg to 1.5 mg/kg
 - Vecuronium 0.08mg to 0.15mg/kg
 - Rocuronium 0.6 - 1 mg/kg