Intubation with the GlideScope Cobalt AVL

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Choose baton and stat size per manual

- Cobalt AVL Baton 1-2 (neonates and infants)
  - GVL 0 Stat: <1.5 kg
  - GVL 1 Stat: 1.5-3.6 kg
  - GVL 2 Stat: 3.6-10 kg
- Cobalt AVL Baton 3-4 (children and adolescents)
  - GVL 3 Stat: 10 kg- adults
  - GVL 4 Stat: 40 kg- morbidly obese

Get GlideScope Cobalt ready by

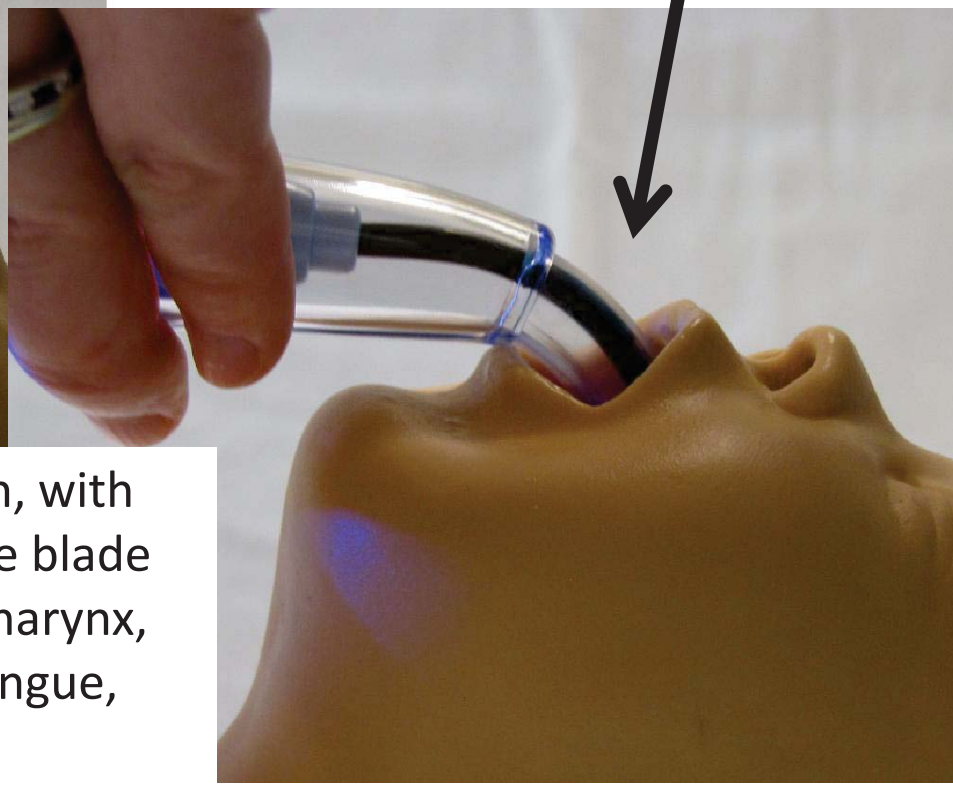
Connecting video baton to monitor

Inserting baton into stat

Turning the device on

GlideScope intubation 4-step technique 1.

1.
MOUTH

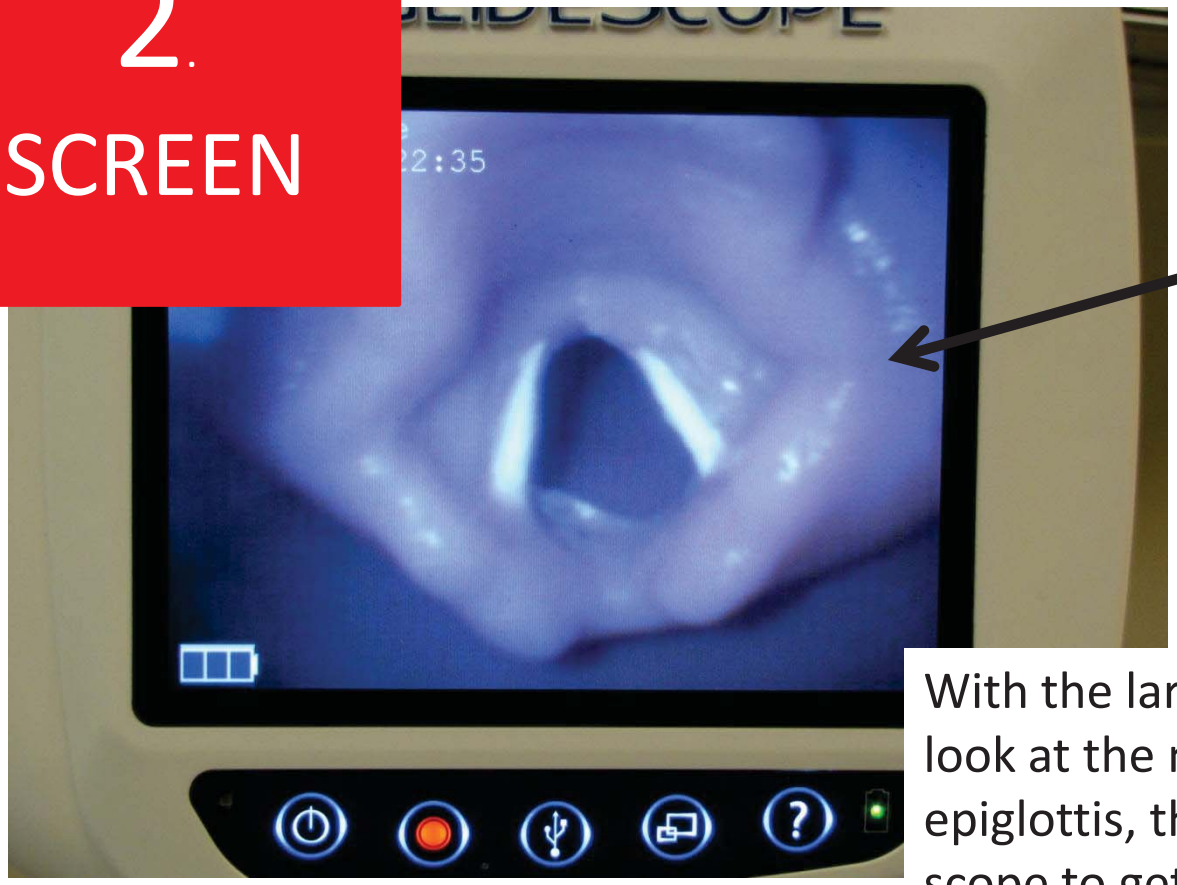


Looking directly into the patient's mouth, with the device in the left hand, introduce the blade of the video laryngoscope into the oropharynx, gliding down along the midline of the tongue, without displacing it.

GlideScope intubation 4-step technique 2.

2.

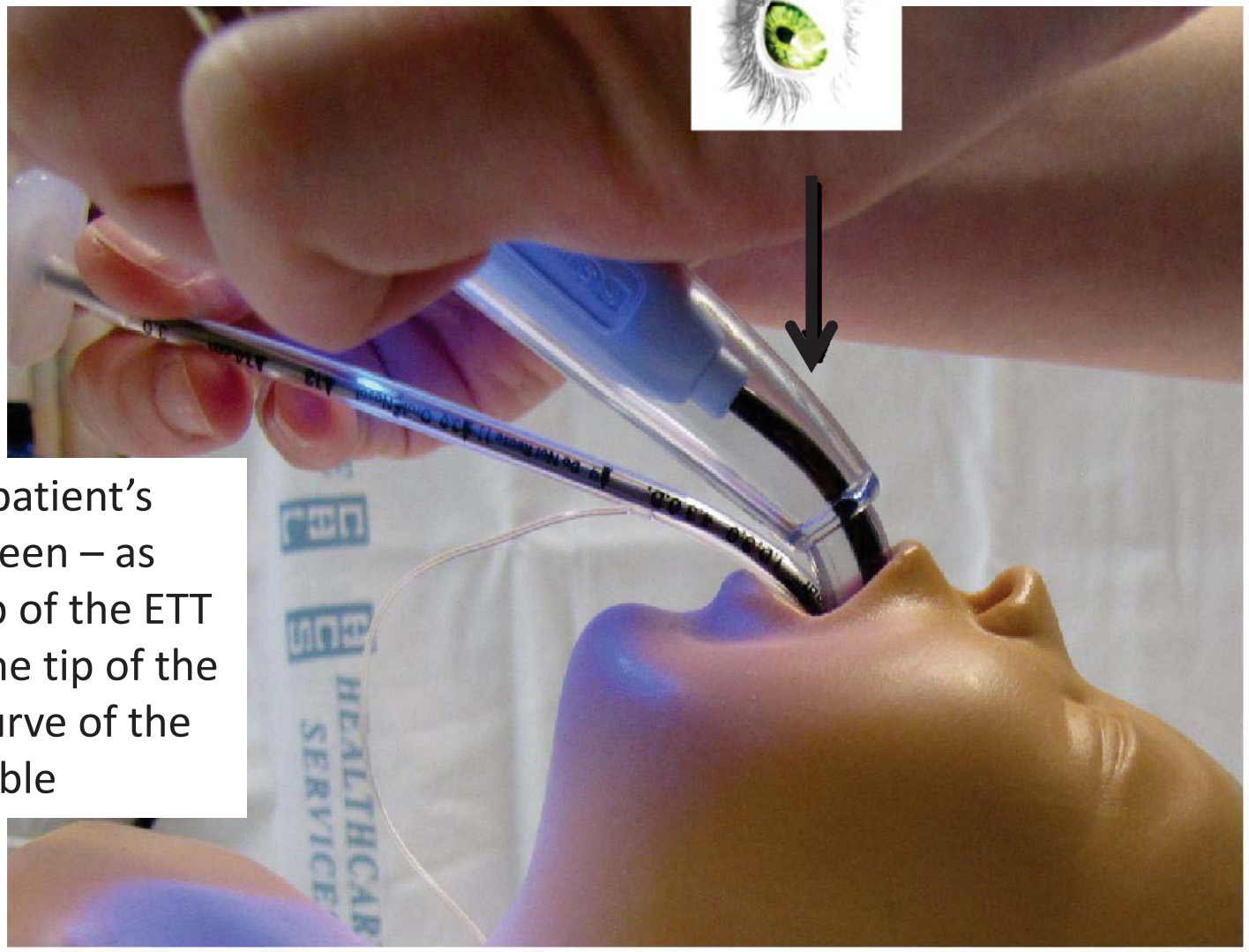
SCREEN



With the laryngoscope inserted, look at the monitor to identify the epiglottis, then manipulate the scope to get the best view of the glottis.

GlideScope intubation 4-step technique 3.

3. MOUTH



Look directly into the patient's mouth – not at the screen – as you guide the distal tip of the ETT into position next to the tip of the blade, following the curve of the blade as close as possible

GlideScope intubation 4-step technique 4.

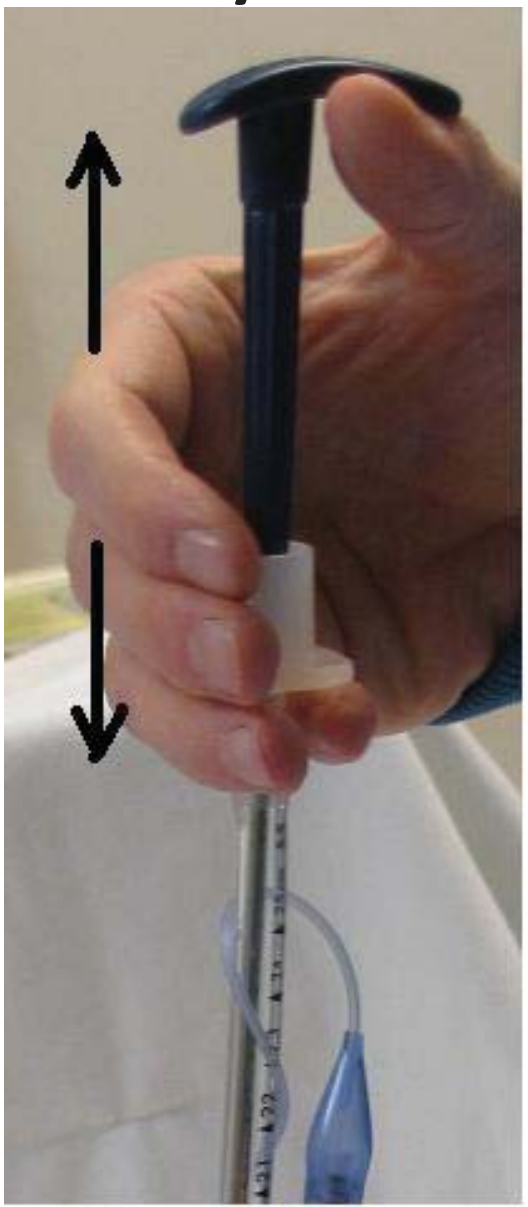
4.

SCREEN

Look at the monitor to complete the intubation.

Advance ETT and remove stylet

- To aid the passage of the ETT, withdraw the stylet carefully while gently advancing the ETT. Slight withdrawal of the laryngoscope may be beneficial to allow a glottis to drop and reduce the viewing angle.



Complications of videolaryngoscopy

Complications of videolaryngoscopy

- Most data from the use of GlideScope
- Incidence was 1% (21/2004) in a large series of GS intubations[1]
- Case reports[2,3,4]

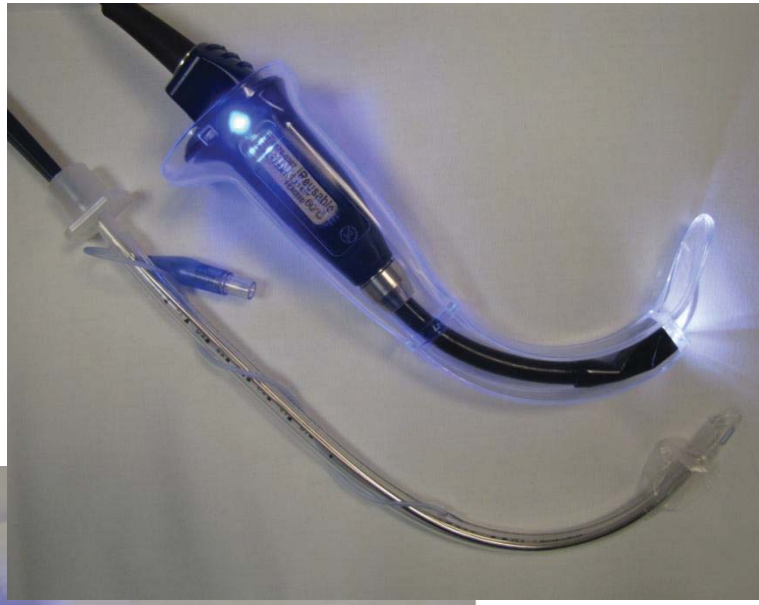
1. Aziz et al. Anesthesiology 2011
2. Hsu et al ActaAnesthesiol Taiwan 2008
3. Cooper Can J Anaesth 2007
4. Leong et al Anaesth Intensive Care 2008

Complications of videolaryngoscopy

- Minor lip and gum laceration
- Vocal cord trauma
- Tracheal injury
- Hypopharyngeal injury
- Dental trauma
- Tonsillar perforation
- Palatoglossal arch injury
- Palatopharyngeal wall perforation
- Possible lingual nerve injury

Maneuvers to avoid injury

- Stylet (and ETT) should reproduce blade's course
- Keep ETT parallel and as close as possible to the blade
- Visual control of ETT advancement



1. MOUTH → 2. SCREEN → 3. MOUTH → 4. SCREEN

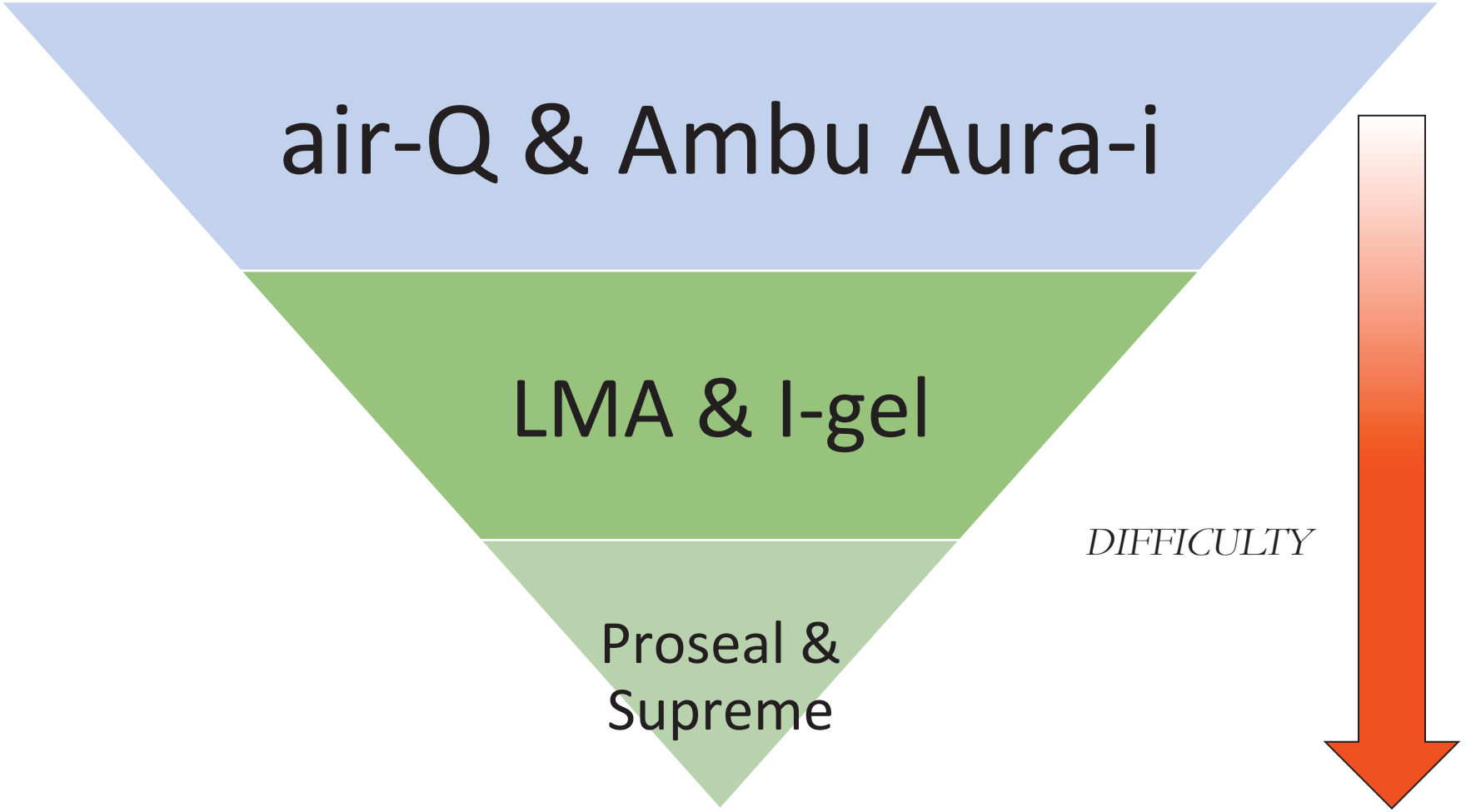
Intubation through supraglottic airway devices

Lisa Sohn & Narasimhan Jagannathan

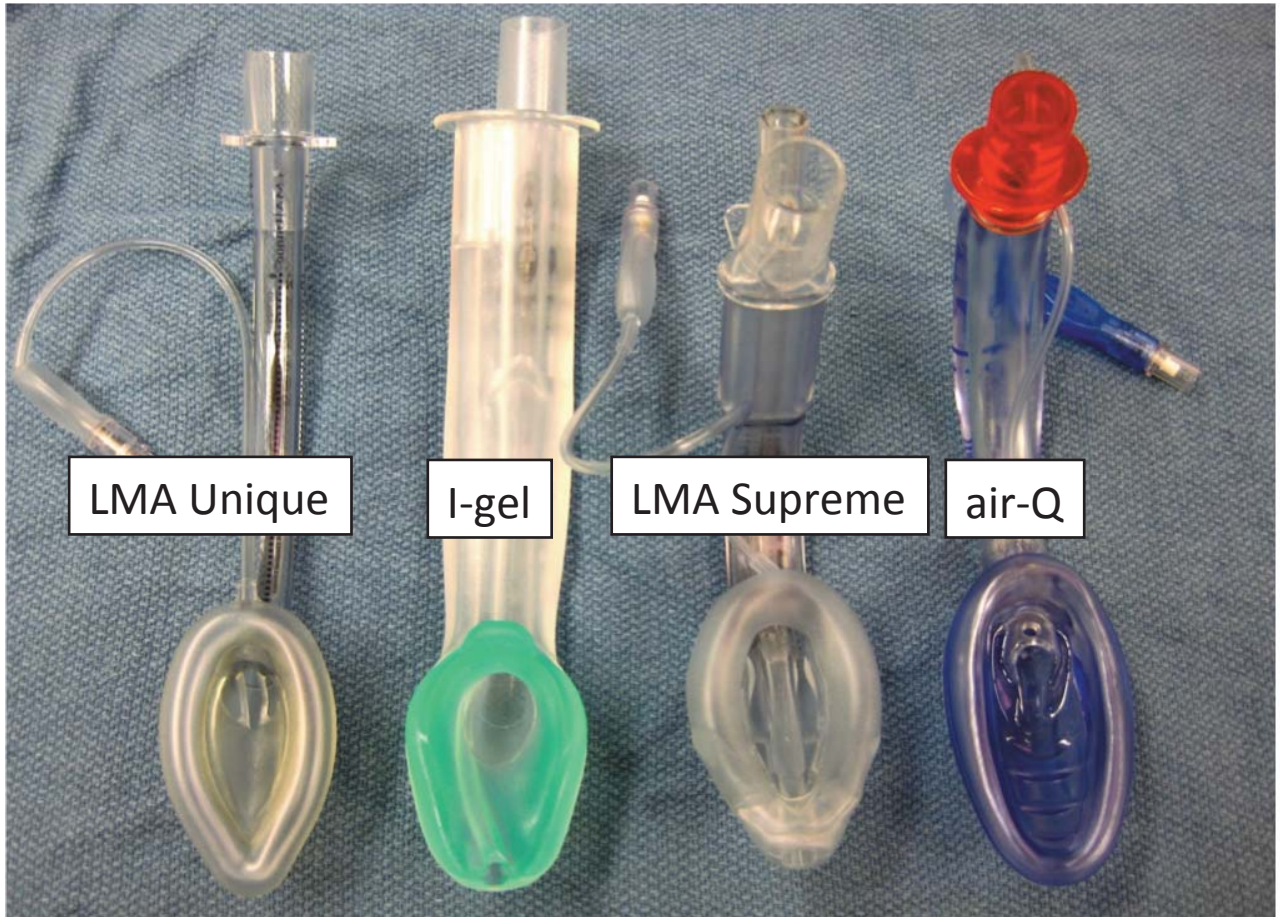
Ann & Robert H. Lurie Children's Hospital of Chicago

March 7, 2014

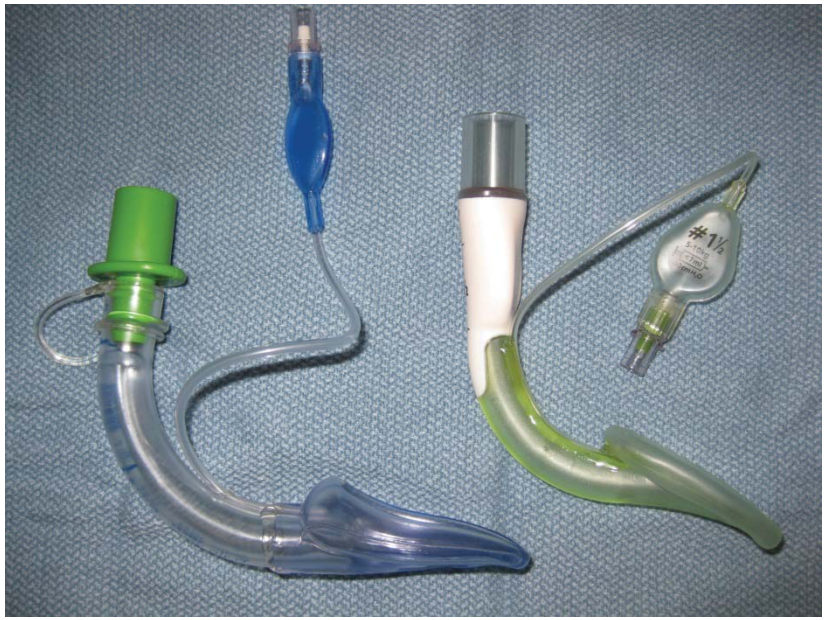
If using a *cuffed* ETT and planning on removal of the supraglottic device:



Supraglottic airway devices (SAD)



air-Q and Ambu Aura-i



- Both airways designed to be a conduit for tracheal intubation

LMA ProSeal and Supreme

- Not ideal for intubation in pediatric population
- Most difficult for tracheal intubation (narrowest airway tube)
- Can use an airway exchange catheter or Aintree intubating catheter for size 3 and larger only

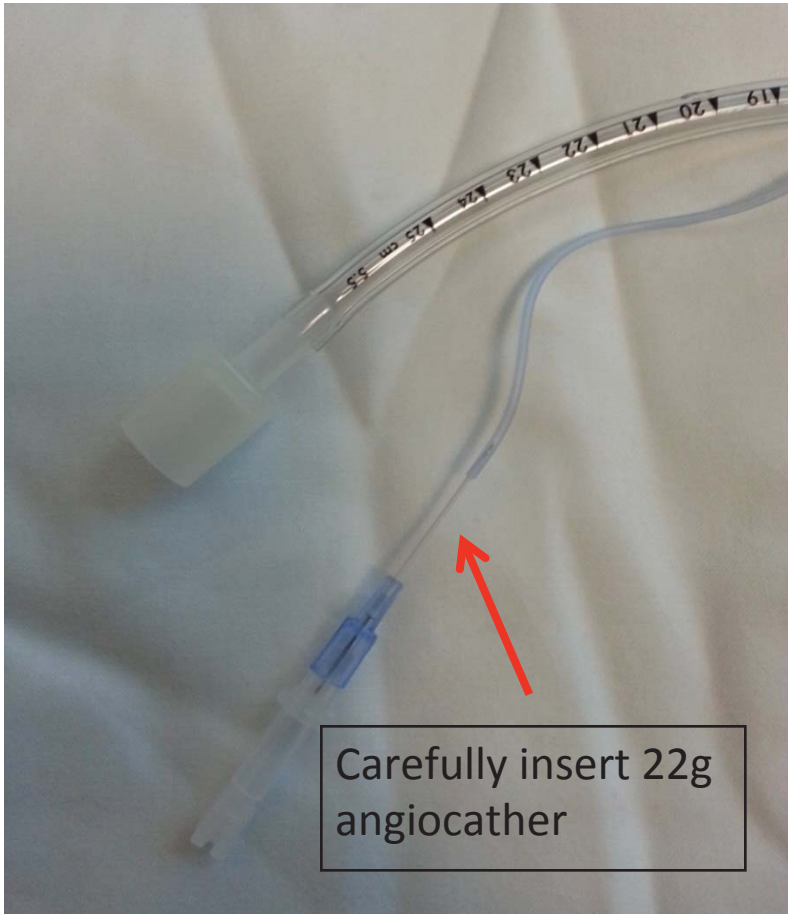
LMA specifications

Mask Size	Patient Size	*Maximum Cuff Volume (Air)	Largest ETT ID (mm)
1	Neonates/infants up to 5 kg	up to 4 ml	3.5
1½	Infants 5-10 kg	up to 7 ml	4.0
2	Infants/children 10-20 kg	up to 10 ml	4.5
2½	Children 20-30 kg	up to 14 ml	5.0
3	Children 30-50 kg	up to 20 ml	6.0**
4	Adults 50-70 kg	up to 30 ml	6.0**
5	Adults 70-100 kg	up to 40 ml	7.0**

Considerations for LMA intubation

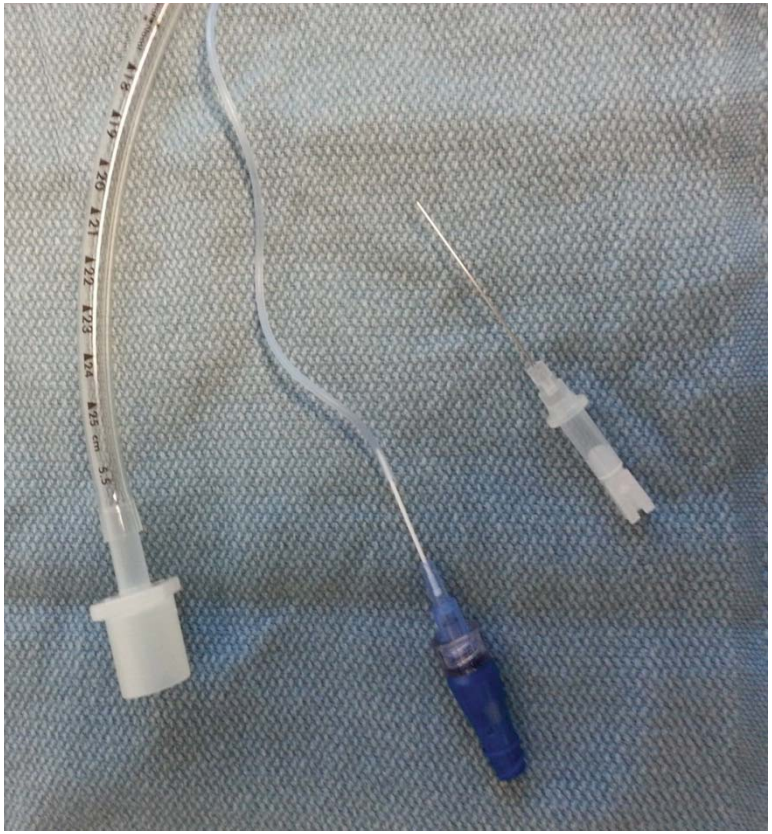
- LMA may be longer than the ETT
  - ➢ Difficult to control ETT
- If LMA size <3
  - ➢ Pilot balloon will not pass due to narrower airway tube
  - ➢ Will need to remove pilot balloon to allow passage

Pilot balloon repair option



Final result

1. Remove needle
2. Attach a needleless IV connector (or stopcock) to the angiocatheter hub
3. Inflate cuff as needed



LMA Unique vs. air-Q intubating laryngeal mask

Features to better isolate the epiglottis

Size 2 LMA Unique **Size 1.5 air-Q**

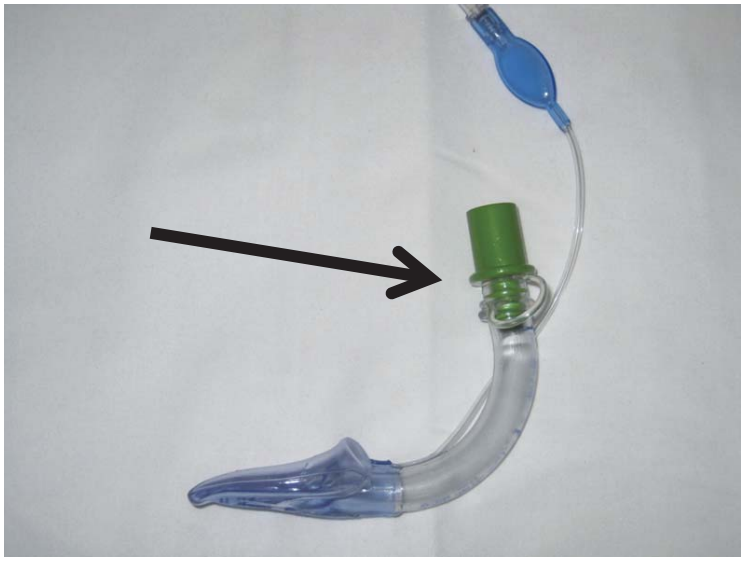
- Bevel of ETT may encounter resistance against LMA grill
- Grill may be cut ahead of time if intubation is planned

air-Q Intubating Laryngeal Airway

Size 1.5 air-Q

- Can be used for airway maintenance and tracheal intubation
- Can accommodate a cuffed tracheal tube
- Does not require equipment modification during the intubation process or subsequent device removal

Useful features

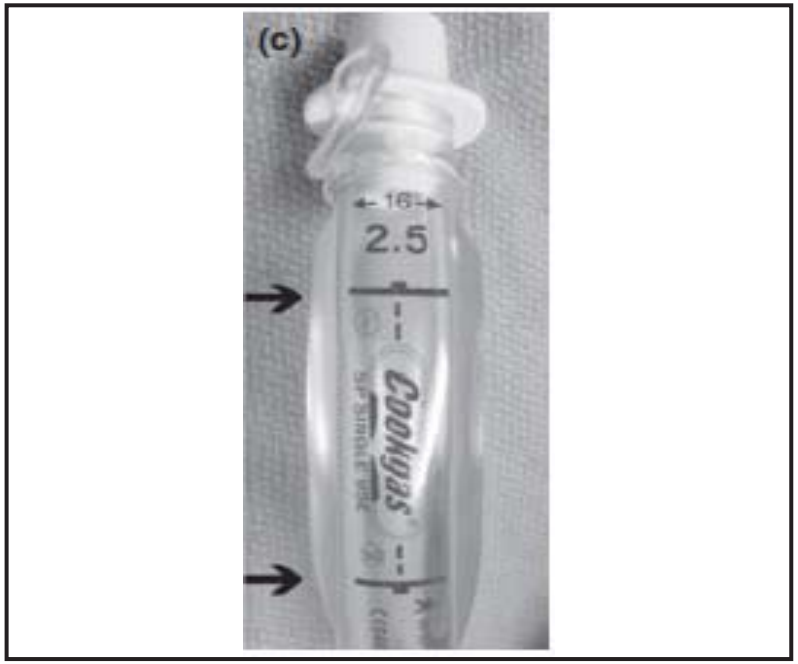


Detachable 15 mm adaptor → makes the airway tube wider and shorter

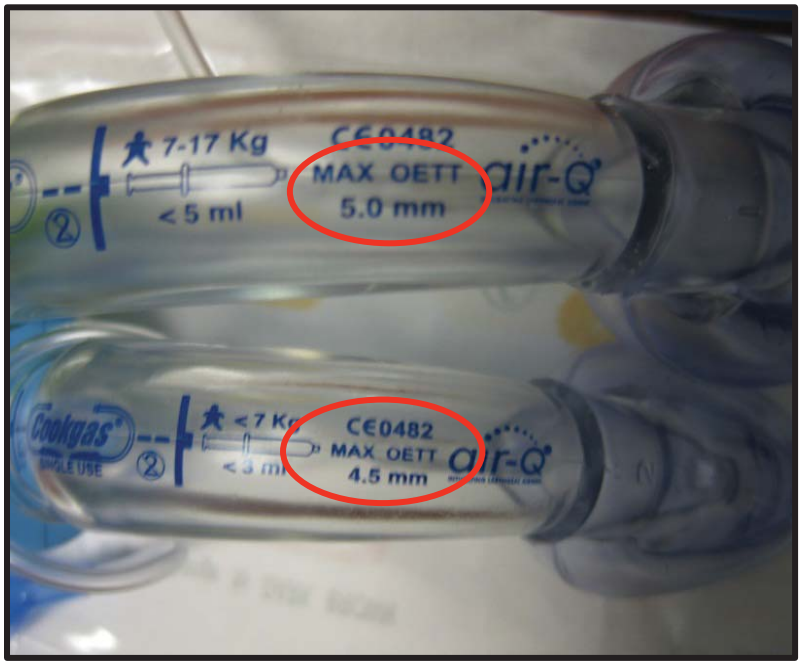
- allows easy passage of the pilot balloon

Useful features

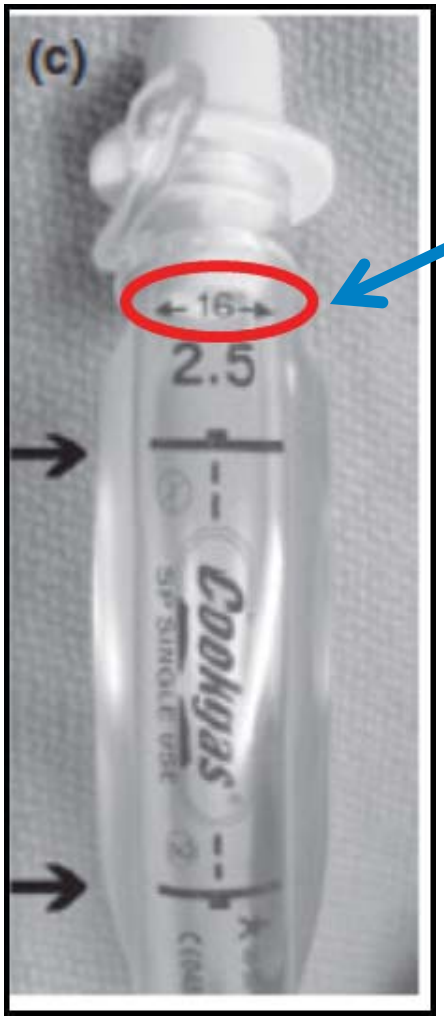
Incisors/gums should rest between the two horizontal lines



The *maximum <u>cuffed</u>* ETT that will fit



Useful features

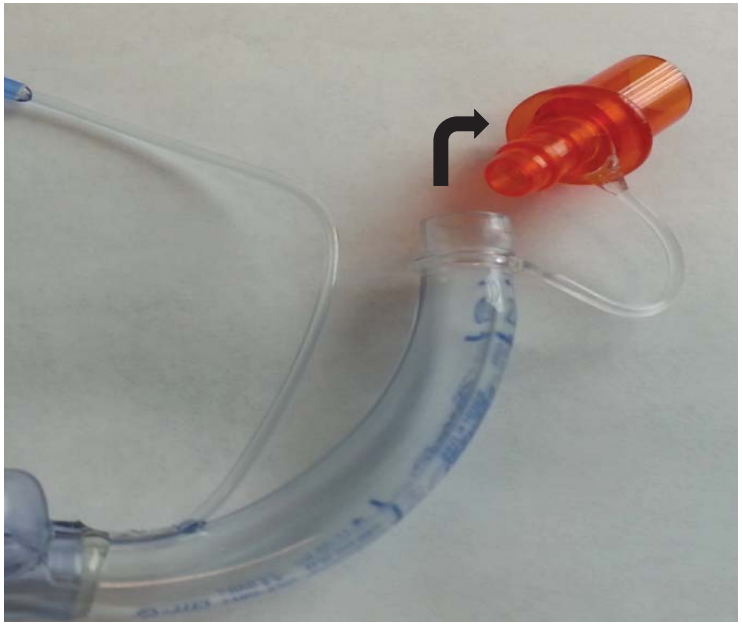


Distance of the airway tube to the ventilation orifice (without the adaptor)

Size	IBW	Max. OETT	Mouth Opening[1]	↔[2]	Volume[3]	Inf. Vol.[4]
4.5	70-100 kg	8.5mm	25 mm	20 cm	25 ml	4-5 ml
3.5	50-70 kg	7.5mm	23 mm	18 cm	18 ml	3-4 ml
2.5	30-50 kg	6.5mm	20 mm	16 cm	12 ml	2-3 ml
2.0	17-30 kg	5.5mm	17 mm	13 cm	8 ml	1-2 ml
1.5	7-17 kg	5.0mm	14 mm	10 cm	5 ml	1 ml
1.0	4-7 kg	4.5mm	11 mm	8 cm	3 ml	.5-1 ml
0.5	< 4 kg	4.0mm	8 mm	6 cm	2.5 ml	0-.5 ml

Steps for intubation through air-Q

1. Load ETT onto the fiberoptic (FO)scope
2. Place air-Q and confirm placement/ventilation
3. **<u>15 mm connector</u> *must be* ***<u>removed</u>*** prior to tracheal intubation
4. Guide FO scope into trachea
5. Offload ETT, remove FO scope
6. Reconnect circuit and ventilate



Options after intubation

1. Leave the air-Q in place after intubation
2. Remove air-Q using a removal stylet or laryngeal forceps
3. Remove it using a second ETT (uncuffed, cut above murphy eye): monitoring ETCO2 & oxygenation
4. Extubate the trachea and wake the patient up with the air-Q left in place

Removal process with stylet

1. Remove ETT connector
2. Use stylet (or second ETT) to stabilize ETT while pulling air-Q out
3. **Secure distal end** *and* **remove stylet** before proceeding
4. Now remove air-Q
5. Reconnect ETT connector and circuit, and ventilate

Example of two cases: Case #1

A 2-day old with Pierre Robin syndrome has small bowel obstruction with severe upper airway obstruction for laparotomy

Main concerns:

1. **Difficult mask ventilation**
2. **Difficult laryngoscopy**
3. **'Full' Stomach**

Case: Pierre Robin baby

Case #2

2 week old neonate with a fixed neck deformity, full stomach, and upper airway obstruction for exploratory laparotomy

Main concerns:

1. **Difficult mask ventilation**
2. **Difficult laryngoscopy**
3. **'Full' Stomach**

‘Awake’ Supraglottic device placement

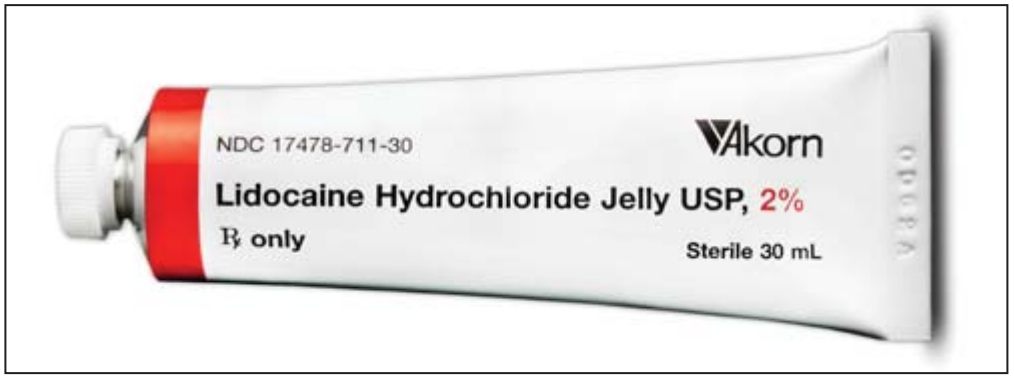
<u>WHY?</u>

- Well tolerated
- Preserves spontaneous ventilation
- Overcomes upper airway obstruction in syndromic infants
- Low risk of aspiration

Pierre Robin syndrome

Topicalization

- Reduces gag reflex during ‘awake’ device placement
- Use a finger to swab posterior pharynx with 2% lidocaine jelly, or inject into pacifier nipple, and allow infant to suckle



Topicalization with pacifier

Remove plunger from syringe and fill with lidocaine jelly

Inject lidocaine jelly, and make several perforations

Awake insertion and rapid sequence via air-Q: ‘full’ stomach

STEP 1

- Administer an anti-sialagogue agent
- Topicalize with 2% lidocaine jelly: by finger or pacifier technique

Lidocaine jelly applied to posterior pharnyx

Awake supraglottic device placement

STEP 2

- Insert the air-Q *without* administering any intravenous anesthetic agents
- Consider prone insertion of the air-Q if severe obstruction
- Pre-Oxygenate

Adjust device position to optimize ventilation

Induction after placement of the air-Q

STEP 3: OPTIONS

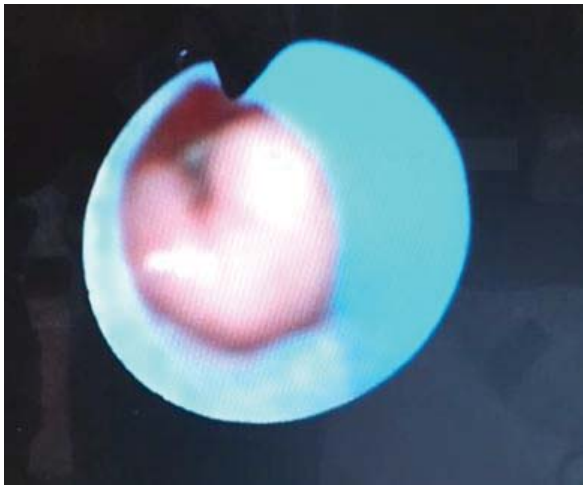
FIRST *confirm fiberoptic visualization of the GLOTTIS through the air-Q!*

A. If the obstruction is relieved, and there is no risk of aspiration, consider sevoflurane induction

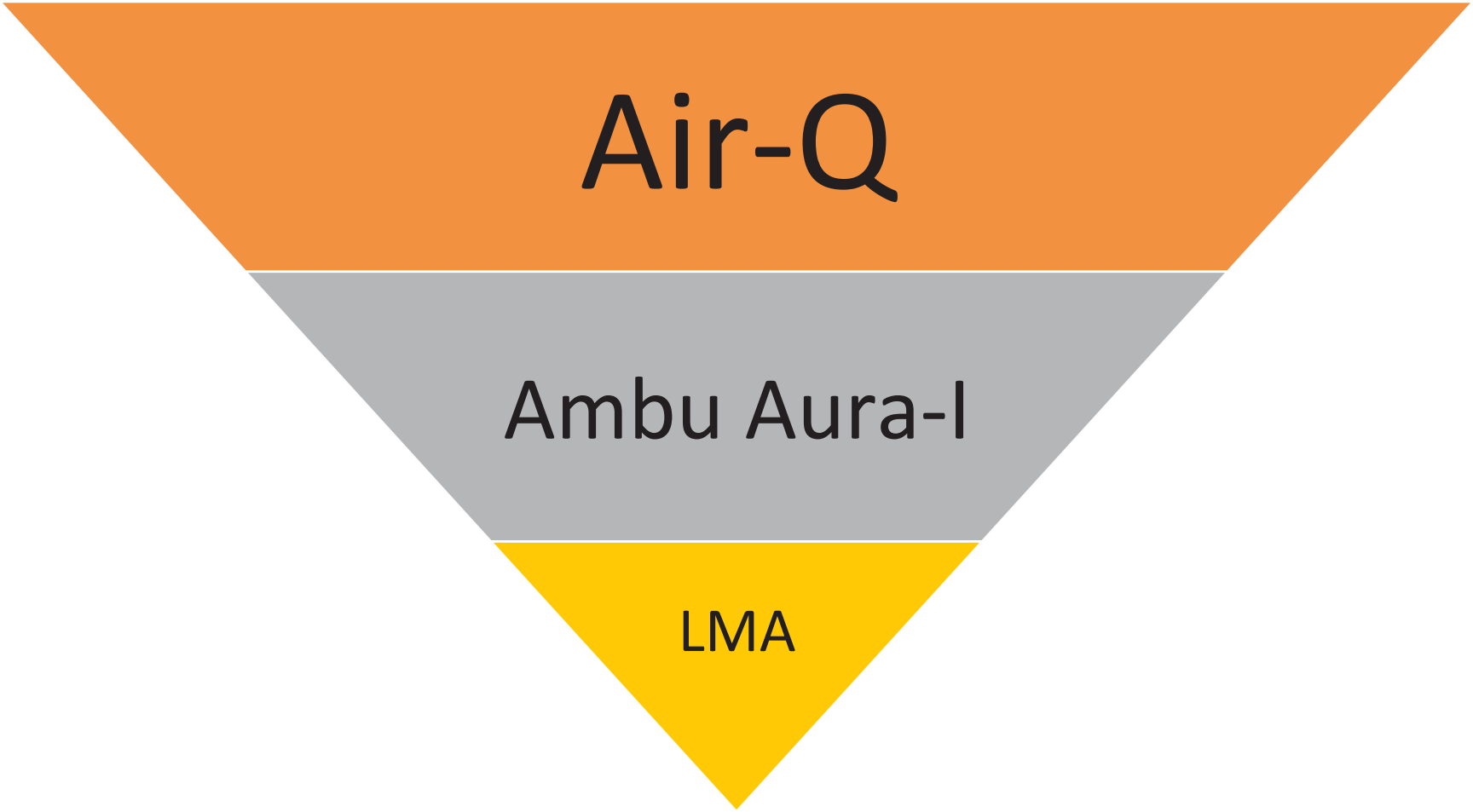
   → air-Q as primary airway vs. paralysis & intubation?

B. If 'full' stomach, consider RSI with induction agent and muscle relaxant →Proceed with fiberoptic-assisted intubation

Fiberoptic view through size 0.5 air-Q



Ease of tracheal intubation



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Jagannathan N, Kozlowski R, Sohn L, Langen K, Kho M, Roth AG, Mukherji I, Suresh S. Clinical evaluation of the Intubating Laryngeal Airway as a conduit for tracheal intubation in children. *Anesthesia & Analgesia*-Jan;112(1):176-82

Fiadjoe JE, Stricker PA.. The air-Q intubating laryngeal airway in neonates with difficult airways. Paediatr Anaesth. 2011 Jun;21(6):702-3

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Jagannathan N, Sohn L, Mankoo, R, Langen K, Roth AG, Hall SC. Prospective evaluation of the self-pressurized air-Q Intubating Laryngeal Airway in children. *Pediatr Anesth*: 2011 Jun;21(6): 673-80

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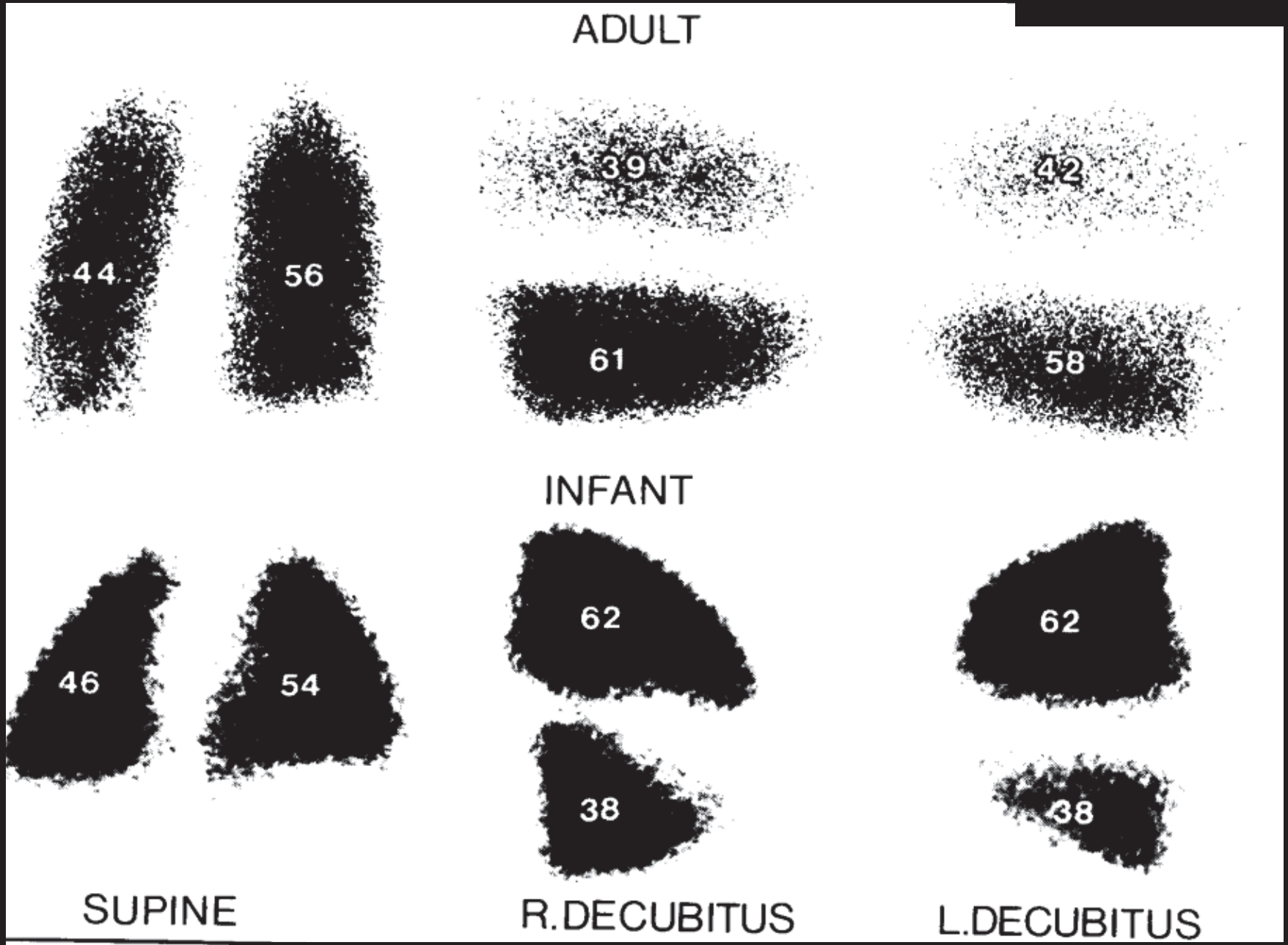
Jagannathan N, Sohn L, Sawardekar A, Gordon J, Shah R, Roth AG, Mukherji I, Suresh S. A randomized comparison between the Ambu aura-i and the air-Q Intubating Laryngeal Airway for tracheal intubation in children. *Paediatr Anaesth*. 2012 Dec;22(12):1197-204.

Kovatsis PG, Fiadjoe JE, Stricker PA. Simple, reliable replacement of pilot balloons for a variety of clinical situations. Paediatr Anaesth. 2010 Jun;20(6):490-4. Epub 2010 Mar 11.

Single Lung Ventilation in Infants and Children

Samuel Wald, MD, MBA



From: Heaf, D.P., Helms, P, Gordon, I., Turner, M.,
Postural Effects of Gas Exchange In Infants, NEJM; 1983

Age, Trachea, ETT Sizes

Years	ETT	DLT	Trachea
<1	3.5-4.0	-----	>5 mm
1-4	4.0-5.0	-----	5-7.5 mm
4-6	5.0-5.5	-----	8 mm
6-8	5.5-6.0	-----	9 mm
8-10	6.0 cuffed	26	9-10.5 mm
10-12	6.5 cuffed	26-28	10-12 mm

Adapted From:

Hammer, G.B., Fitzmaurice, B.G., Brodsky, J.B., Methods for Single Lung Ventilation in Pediatric Patients, Anesth Analg, 1999;89:1426-9

Hammer, G.B., Peditaric Thoracic Anesthesia, Anesthesia and Analgesia, 2001;92:6, 1449

Airway Options

- Surgical Compression
- Endobronchial Intubation
- Double Lumen Endobronchial Tube
- Univent Tube
- Bronchial Blockade

Surgical Compression/CO_2 Insufflation

- **Pros**

- Requires no additional equipment or time for placement
- No age limitation

- **Cons**

- Potential trauma to lung by retraction
- Sub-optimal surgical exposure

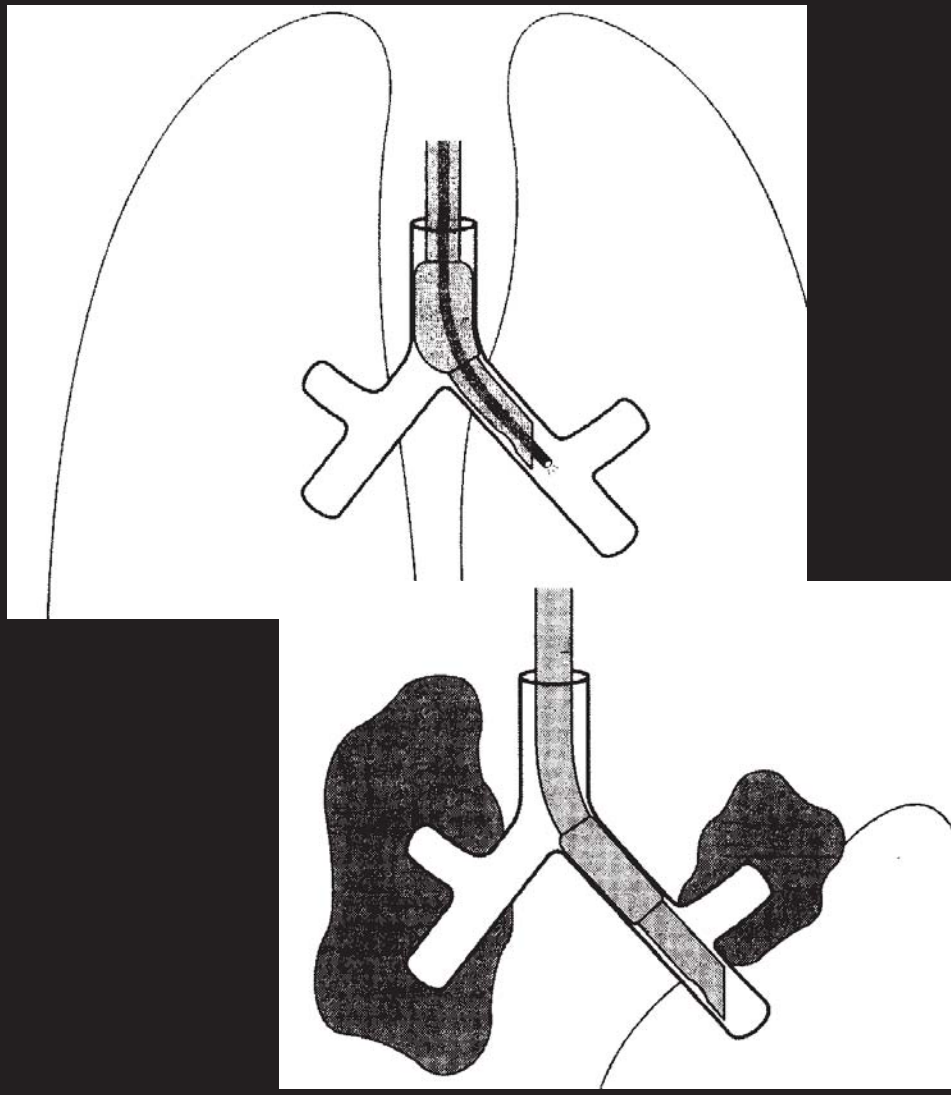
Endobronchial Intubation

- **Pros**
- No extra equipment beyond fiberoptic bronchoscope needed
- No age limitation

- **Cons**
- May be difficult to ventilate right upper lobe
- Uncuffed tubes may have inadequate seal
- Requires manipulation for bilateral ventilation

Endobronchial Intubation

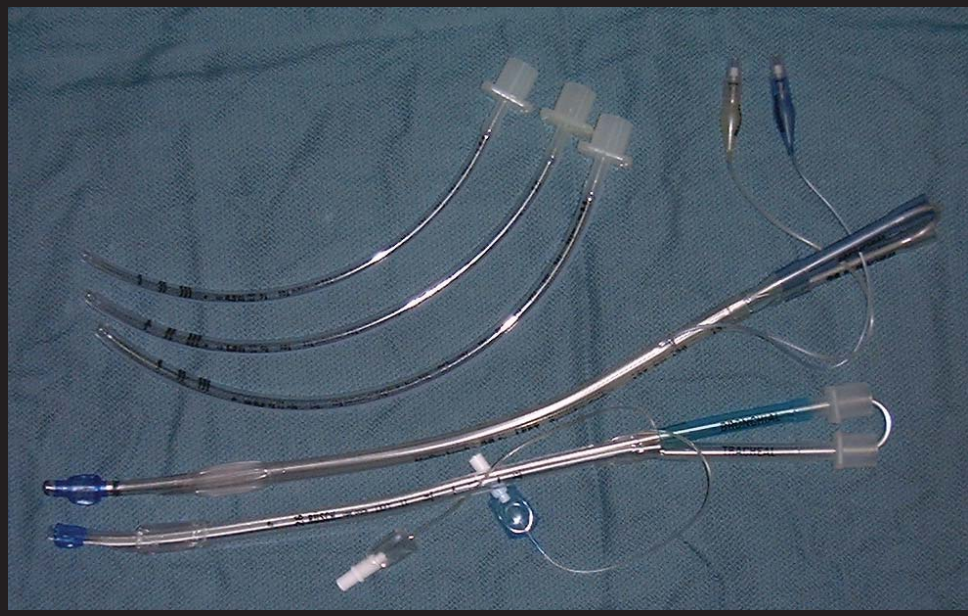
- Case report of patient for thoracotomy for lung abscess
- Left endobronchial intubation failed despite bronchoscopic confirmation



From: Lammers, C.R., Hammer, G.B., Brodsky, J.B., Cannon, W.B., Anesthesia and Analgesia, 1997;85:944-9

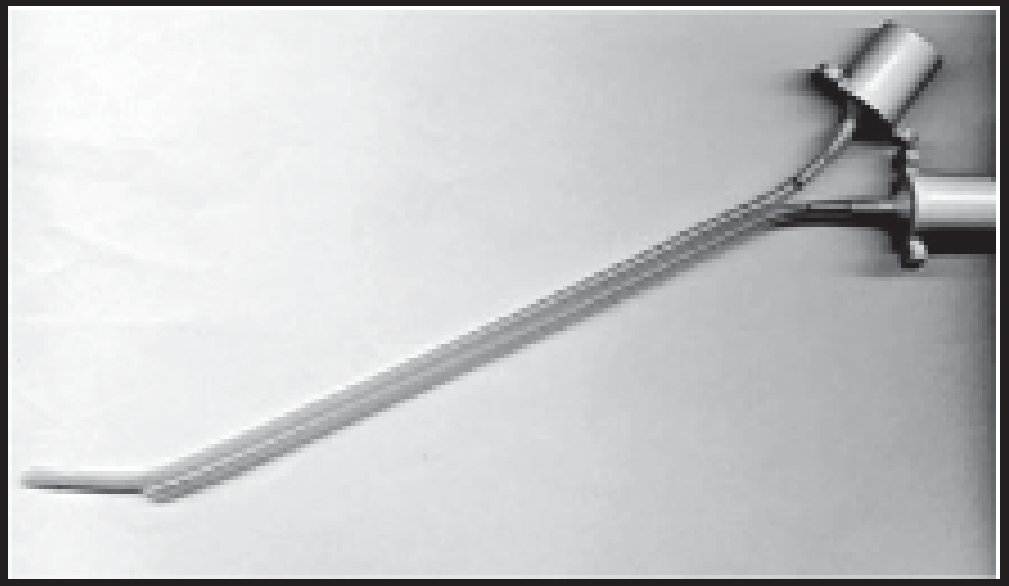
Double Lumen Endobronchial Tube

- **Pros**
  - Reliable lung isolation
  - Ability to suction both lungs
- **Cons**
  - Small sizes are difficult to place
  - Size limitation



Marraro Tube

Pediatric
Anesthesia 2005
15: 204–208



17 patients

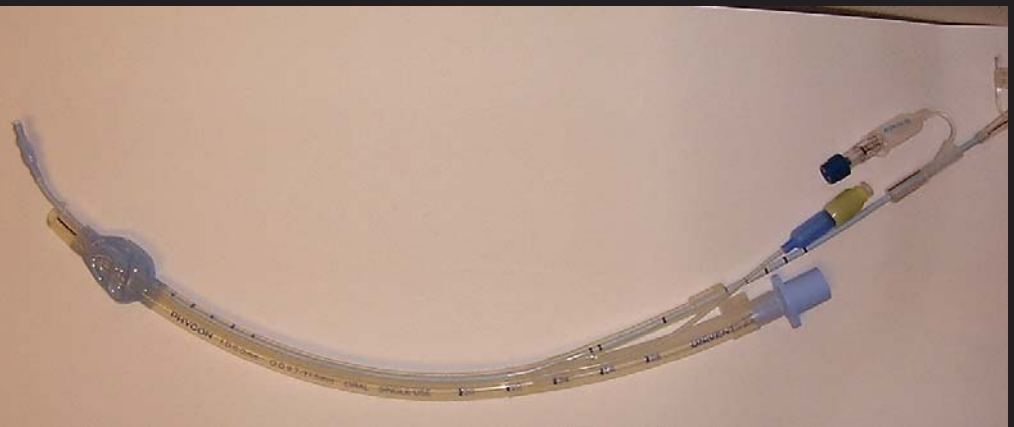
2.5/2.5, 2.5/3.0, 3.0/3.5 tubes

2.5-10 KG

1 day-3 years of age

Univent Tube

- **Pros**
  - Conventional ETT with attached balloon tipped catheter
  - Displacement less likely because of firm attachment



- **Cons**
  - Outer diameter increased by blocker channel
  - Disproportionately high resistance to gas flow
  - Low volume/high pressure balloon
  - Age limitation

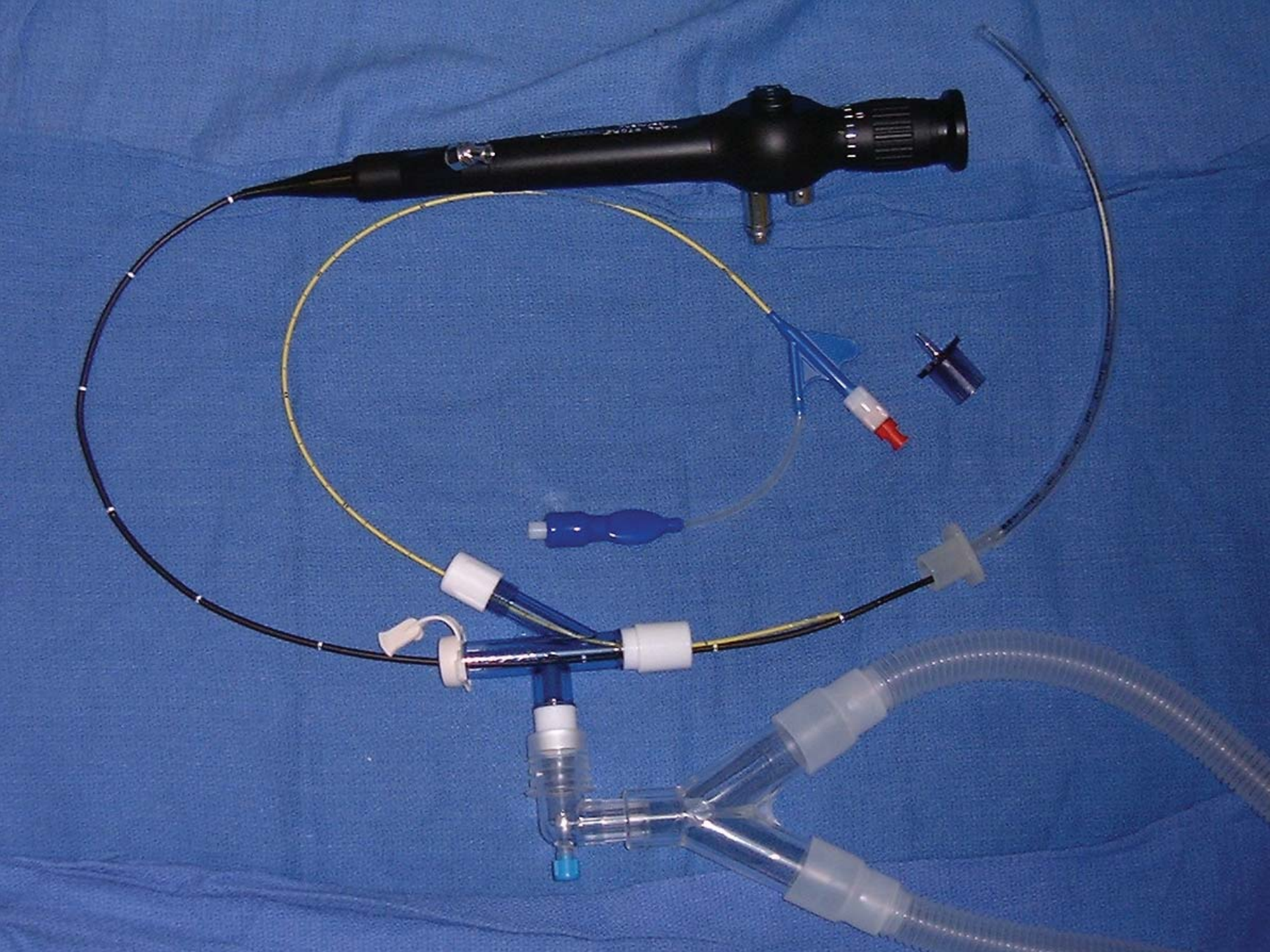
Arndt Endobronchial Blocker

- Replacement for Fogarty catheter which is not designed for bronchial blockade
- Pediatric-sized 5 Fr. Balloon-tipped catheter
- Loops over a fiberoptic scope for insertion into either mainstem bronchus
- Channel allows for oxygen insufflation or lung collapse of surgical lung

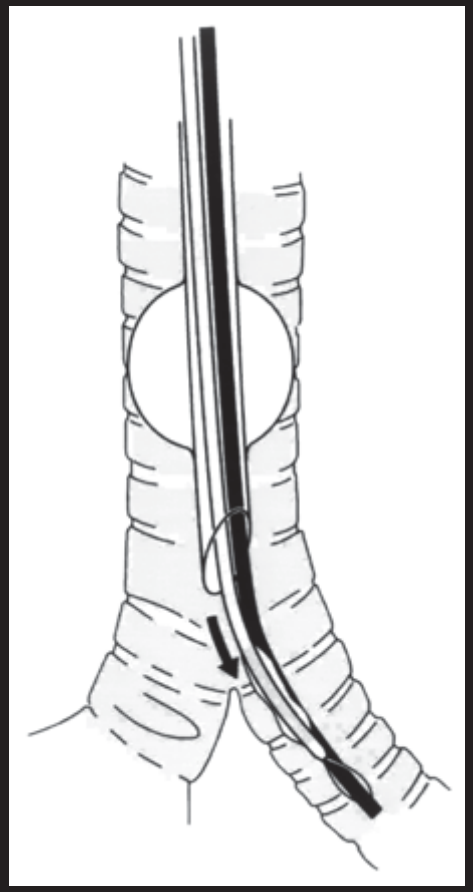
Arndt Endobronchial Blocker

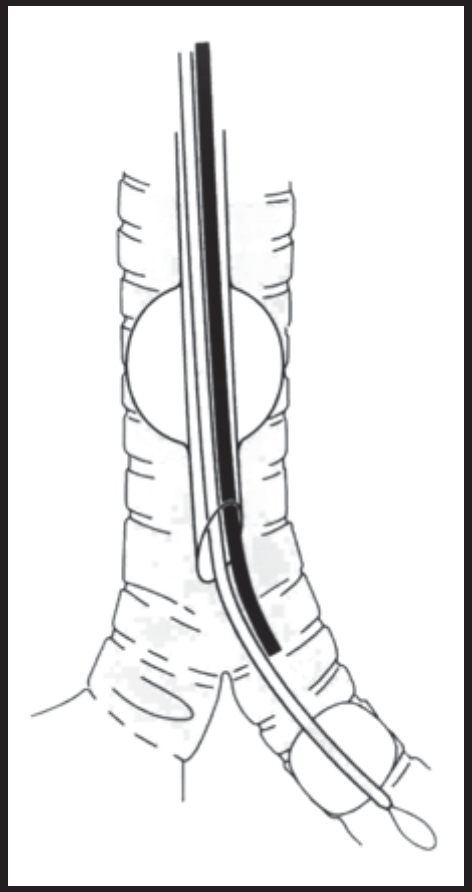
- **Pros**
- Consistent lung isolation
- Easily directed to either lung
- Uses standard ETT
- Cuff designed for bronchial block
- Useful in small children

- **Cons**
- Period of apnea during placement
- May be difficult to block right upper lobe
- Limited to 4.5 ETT

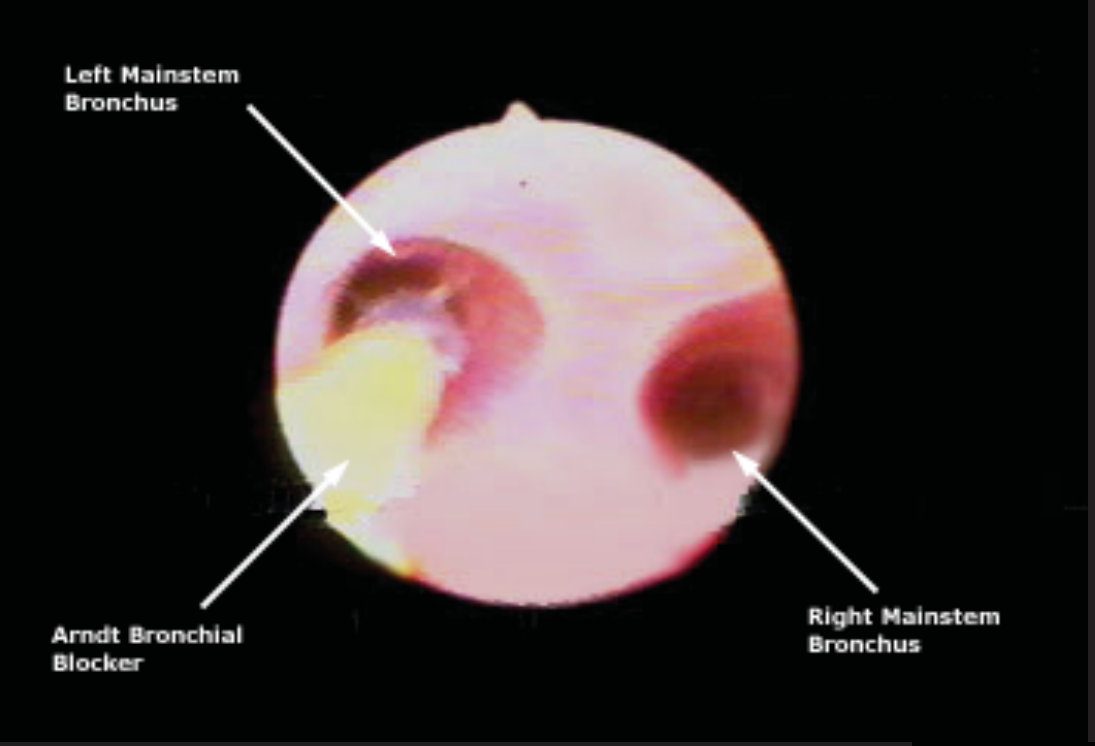


Technique for Endobronchial Blocker Placement





From: Yun, E.S., Saulys, A., Popic, P.M., Arndt, G.A.,
Single-lung ventilation in a pediatric patient using a pediatric fibreoptically-directed wire-guided endobronchial blocker, Can J Anesth, 2002;49:3, 256-61


Left Mainstem Bronchus
Arndt Bronchial Blocker
Right Mainstem Bronchus

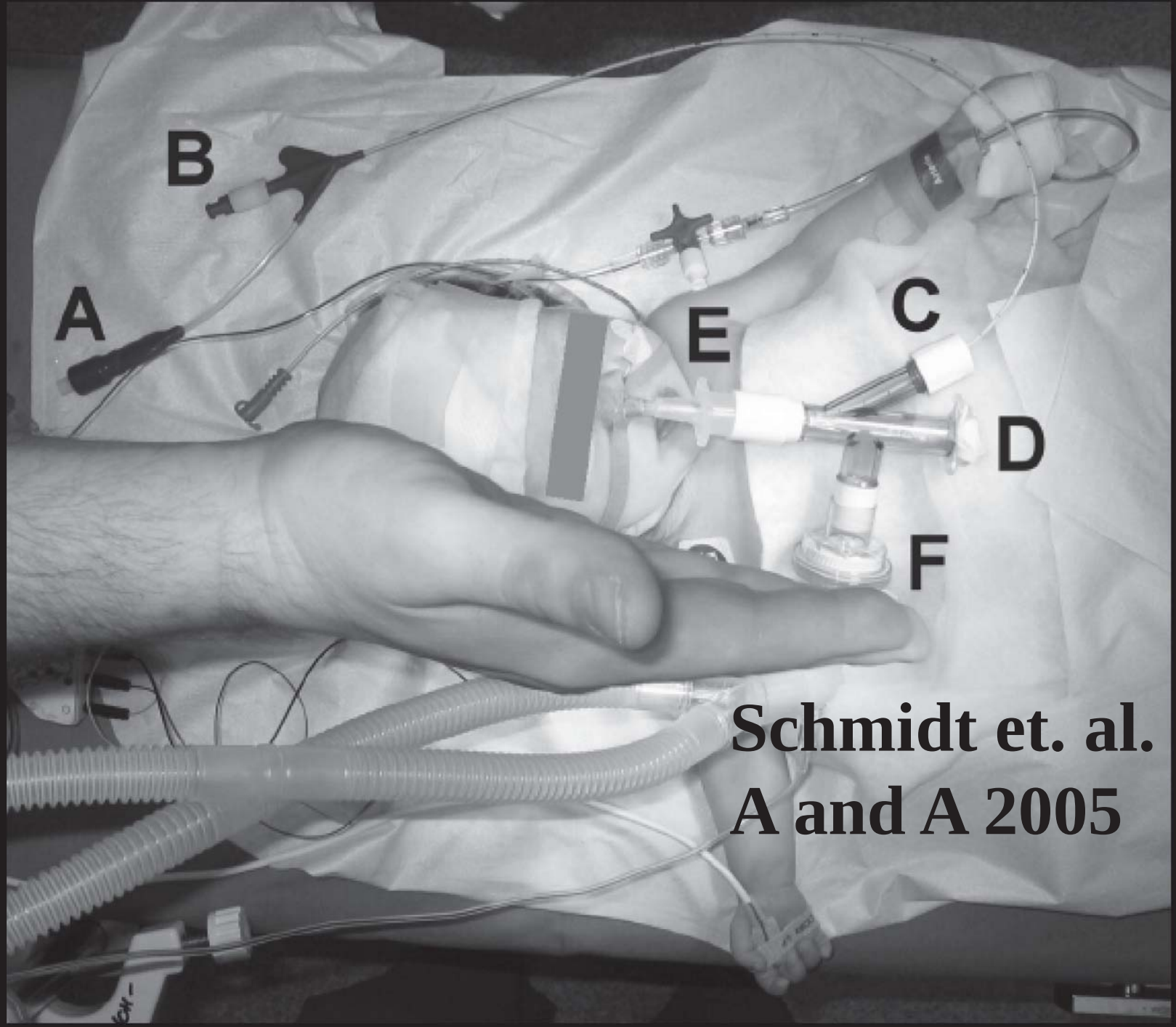

Occluded Left Mainstem Bronchus

Pearls

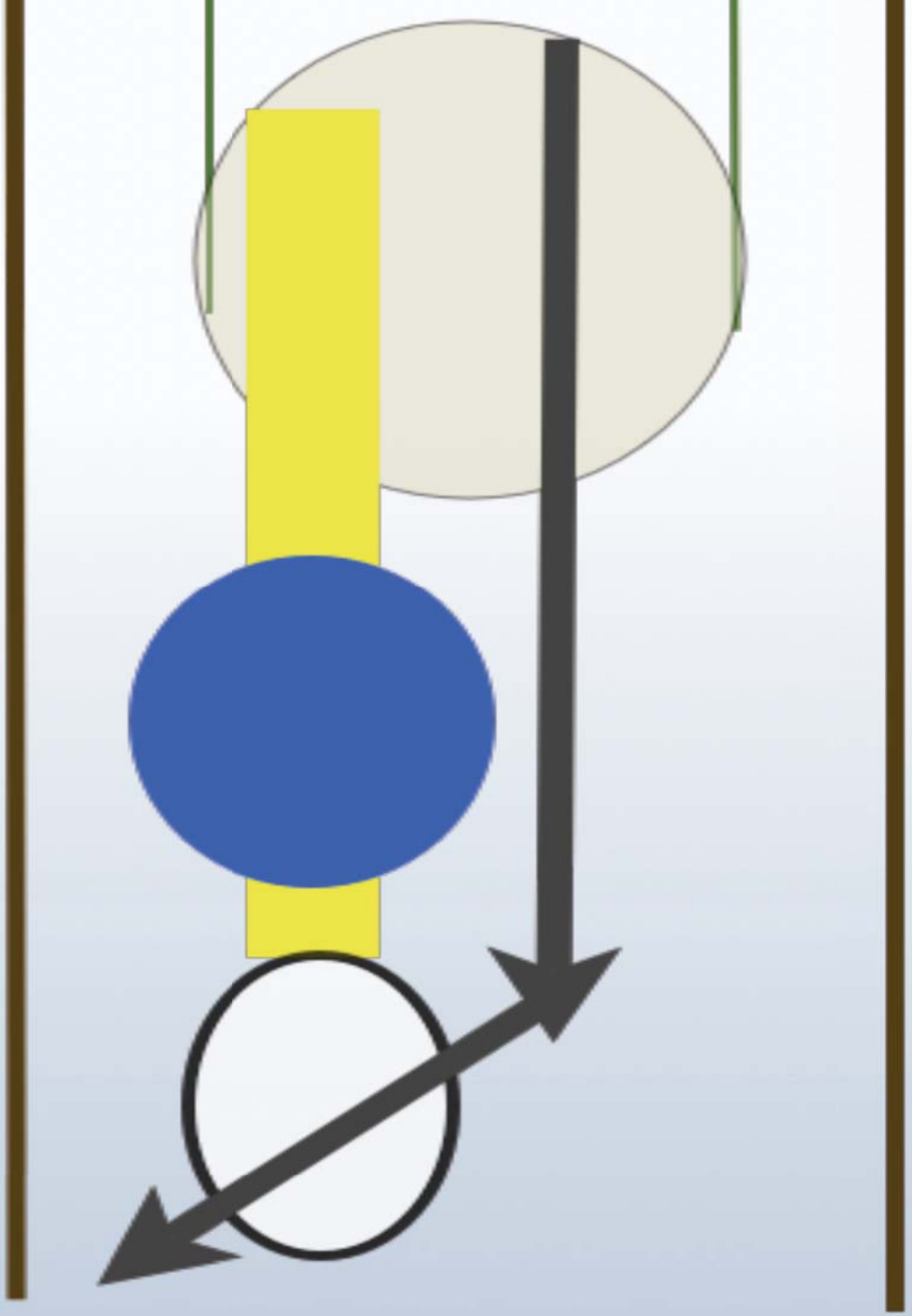
- Re-adjustment may be required after turning or with surgical manipulation of tracheo-bronchial tree
- Right upper lobe may be difficult to collapse
- 2.2 or 2.8 mm OD fiberoptic scope used

Selective
Lobar
Block

Espi C, et. al., Arch Bronconeumol, 2007



Schmidt et. al.
A and A 2005



This patient is a 4-year-old male who was transferred to your hospital because of persistent pneumonia and fever. Chest x-ray demonstrated a 7 cm opacification with an air-fluid level in the left posterior lung in the area of the left upper lobe. The cystic lesion was drained by a CT-guided aspiration, which was minimally therapeutic. The patient has been persistently febrile and is now scheduled for video assisted thoracic surgical decortication on the left side with left pleurodesis.

Key Question: What are the options for intubation at this point including risks and benefits of each?

The patient is intubated with a #5.0 uncuffed endotracheal tube. The surgeon then reminds you that he has requested single lung ventilation of the right lung for this case.

Key Questions: Describe the various techniques for single lung ventilation that are available for this age group. What are the pros and cons for each? Is there any specific advantage to any given technique in this patient?

Single lung ventilation is established with a bronchial blocker and confirmed by auscultation and by fiberoptic visualization. The patient is turned to the right lateral decubitus position. The surgeon inserts the thoracoscope through an incision on the left side of the chest at the 5th intercostal space and confirms absence of ventilation and proceeds with the decortication and pleurodesis.

Shortly thereafter (within 10 minutes), the oxygen saturations drop to 92% with an inspired oxygen level of 50%.

Key Questions: Describe the approach to hypoxia during single lung ventilation in children. What are the treatment options?

Approximately 1 hour into the procedure with the chosen anesthetic technique and mechanical ventilation, the capnograph low CO2 alarm sounds. The oxygen saturation, blood pressure and pulse are all unchanged. The peak-inspiratory pressure has increased by 10 cmH2O and the tidal volumes have decreased significantly.

Key Questions: What is the differential diagnosis? What is a reasonable plan of action?

After you stabilize the patient the surgeon is able to complete the procedure with a total blood loss of 50ml.

Key Questions: Describe a plan for emergence including analgesia and an approach to extubation. Would it differ if the patient required a thoracotomy?

Fiberoptic intubation

David M. Polaner, MD, FAAP
Judit Szolnoki, MD, FAAP

Patient selection:

Indications:

- potentially difficult airway with conventional laryngoscopy
- limited mouth opening
- limited neck motion or unstable cervical spine
- poor laryngoscopic view due to tongue masses, etc.
- placement of bronchial blockers, endobronchial intubation, confirmation of double lumen tube position
- assistance with over-the-wire retrograde intubation techniques (wire through the working channel)

Possible contraindications:

- bleeding (makes visualization very difficult)
- thick and copious secretions (especially with LF-P scope, which doesn't have a working channel for suctioning)

Preparation:

Equipment:

- scope selection: Olympus LF-P can pass through a 3.0 ETT; LF-V can pass through a 4.5; LF-2 can pass through a 5.0
- video system:
    - LF-V has an integrated one-chip camera on the tip (technically not fiberoptic- gives higher quality image, no pixilation, less prone to damage). It requires a specialized video interface.
    - "clip on" video cameras for true fiberoptic systems without integrated video

    - Focus and orient the camera (for clip on video)- the image must be right-side up
    - Lubricate the scope shaft and pass it through the ETT; one can use a piece of tape to keep it from slipping down the shaft.
    - wipe lens with anti-fog solution or alcohol
    - check light source and camera interface

- gauze 4x4's, malleable retractor (for tongue retraction)
- select endotracheal tubes
    - straight versus RAE
    - cuffed, microcuffed, or uncuffed
- nasopharyngeal airways with ETT connector to fit; alternative is a small diameter ETT for nasal insufflation of oxygen and anesthetic vapor
- lubricant: silicone spray for scope shaft, water soluble lubricant (surgilube) for outside of tube
- cotton-tipped applicators

Drugs

- local anesthetics (if used)- calculate dose and if necessary prepare dilution; take any LA to be used for blocks or infiltration early in the case into the account of your total
- general anesthetics (depending on induction technique); useful to have a dose of propofol to give before passing the ETT even if inhalation induction is performed
- oxymetazolone or other nasal vasoconstrictor

Monitoring

- standard ASA monitors
- patient specific monitors as indicated (invasive BP, ICP, etc)
- a vigilant assistant- it is easy to become distracted when focusing on the fiberoptic intubation and neglect to watch the patient's anesthetic depth and hemodynamics!

Patient preparation

- anesthetized: induction technique of choice, but maintain spontaneous ventilation
- awake/ sedated: light premed of benzodiazepine is acceptable, but best option may be dexmedetomidine patiently titrated to effect (1-2 mcg/kg load over 10-20 minutes; the smaller dose is preferable, but takes longer to work).
- decide on oral versus nasal route; dependent on
    - patient indications
    - operative procedure demands
    - patient position
- an option for sedated patients for airway topical anesthesia is to have the patient breathe nebulized lidocaine. One must calculate the dose to avoid toxicity (maximum of 4mg/kg).

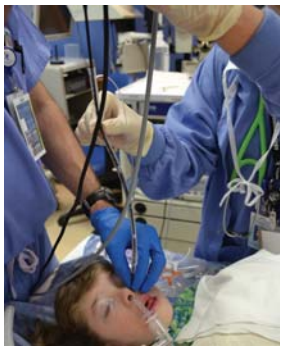
Procedure

General principles

- In anesthetized patients, one can provide oxygen and anesthetic vapor by inserting a nasopharyngeal airway fitted with an appropriately sized endotracheal tube connector in one nare and connecting it to the circuit of the anesthesia machine.
- Gently suction the pharynx before introducing the scope
- Let each landmark take you to the next one- *don't advance if you don't recognize where you are!!*
- To turn the scope left and right you must turn simultaneously with both the hand controlling the scope head and the hand manipulating the scope shaft- if you just turn the head of the scope (especially with the LF-P) you will not turn the tip of the scope, but rather you will create torque along the shaft, potentially shearing the optical fibers.

- Retracting or applying traction to the tongue (with a malleable retractor or by simply grasping it with a gauze square and pulling it forward) helps to open the hypopharyngeal space and improves the view
- Jaw thrust can also assist
- When the cords are in view, ensure adequate depth of anesthesia. If you are using a scope with a working channel (and topical anesthesia was not administered earlier), spray with local anesthetic.
- Aim for the commissure.
- When you have passed beyond the cords, flex the tip downwards, identify tracheal rings and advance to just above the carina. If the view is lost, pull back slightly, reorient your image and re-advance.

- To advance the ETT, you must have the scope stabilized! If working alone, simply lay the head of the scope down on the patient's chest. With an assistant, hold the scope straight and upright. One must stabilize the scope to avoid doubling it back when advancing the tube. Lubricate the outside of the tube, and administer a dose of propofol or other rapidly acting agent to deepen the anesthetic. If the tube hangs up on the arytenoids, rotating it to change the orientation of the bevel may help.



Oral approach

- The major challenge with this approach is keeping the scope in the midline. If you drift to the side, orientation will become increasingly difficult as you approach the glottis.
- Hold the scope so that you can stabilize it with one finger against the palate in order to fix its position in the midline. Advance and rotate the scope shaft with the thumb and forefinger and hold the scope shaft in a midline position against the palate with the 3rd finger.

Nasal approach

- Apply oxymetazolone to nostrils to achieve vasoconstriction using 1-2 drops (30-60mcg) per nostril (do not spray from bottle in a prone patient because of probability of overdosage). The best spray application method may be an atomizer like the MAD Nasal™ device, with a measured amount of drug in a 1ml syringe. One can also use oxymetazolone-soaked cotton tipped applicators to both apply the drug by contact to the turbinates, nasal passages and adenoid tissue and to gently probe the nasal passage for patency.
- Manipulate the scope with the thumb and forefinger; stabilize the scope by positioning your your 3rd and 4th or 4th and 5th fingers against patient's cheek to maintain its orientation.
- Follow the base (inferior aspect) of the nasal passage as you head towards the pharynx and negotiate past the turbinates.

Intubation with the Truview EVO2

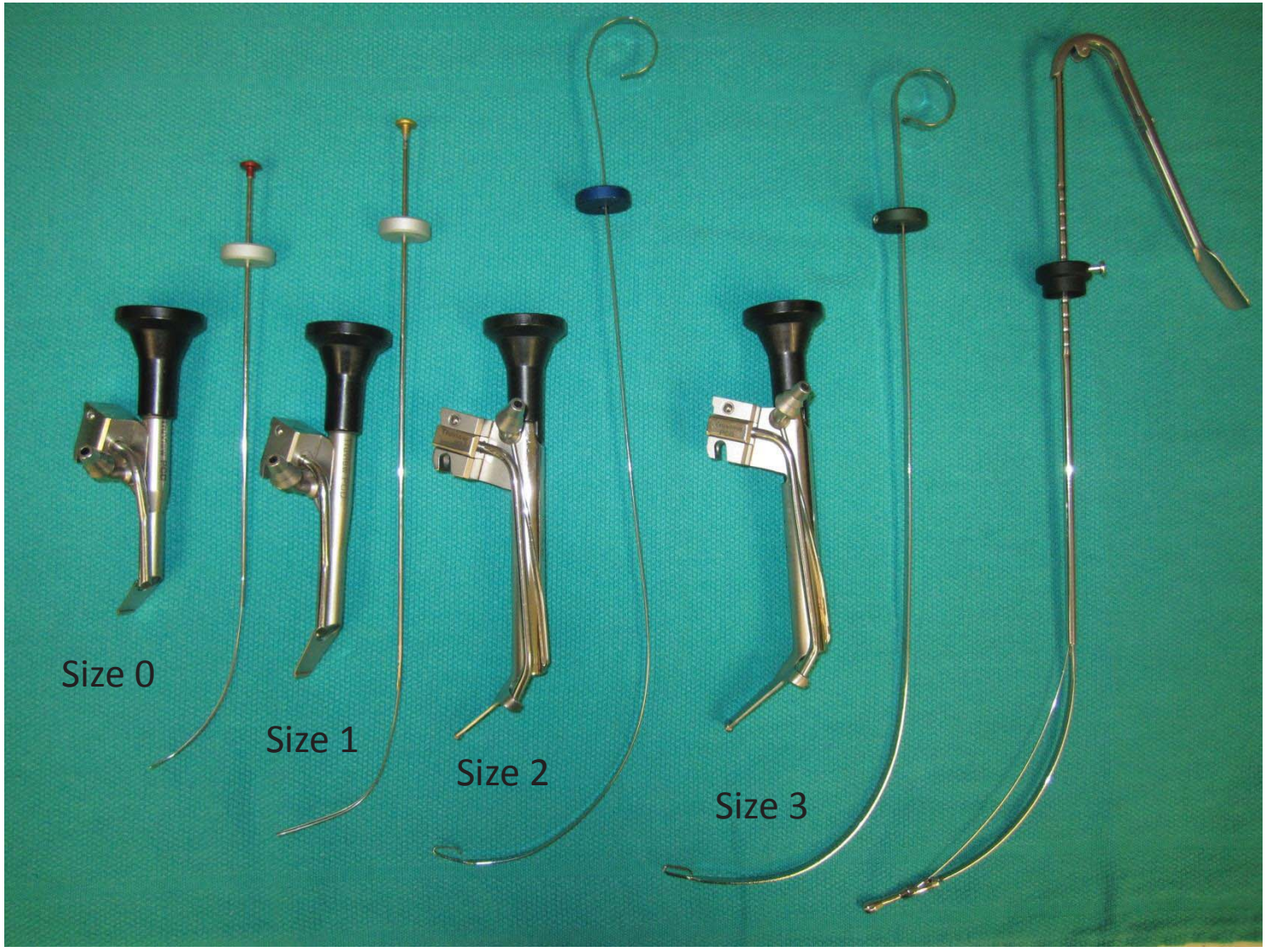
Maria Matuszczak

How does it work ?

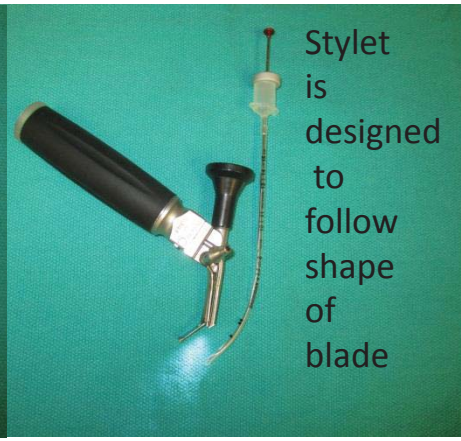
TRU-VIEW EVO 2 INFANT

The angle between the tip of the blade to the straight line of sight

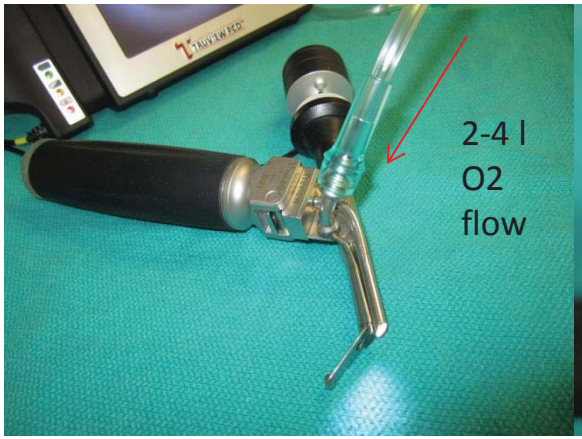
1. Select the appropriate blade and stylet size

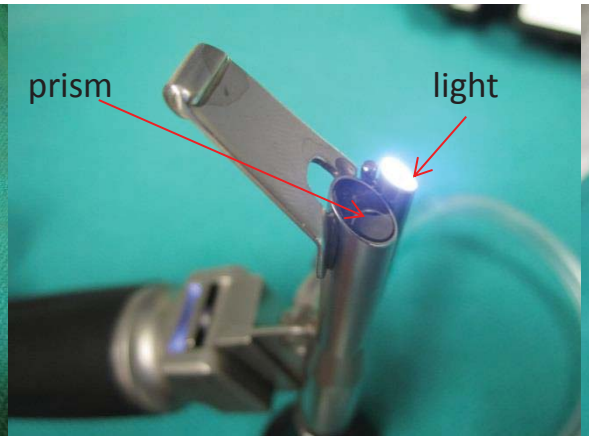


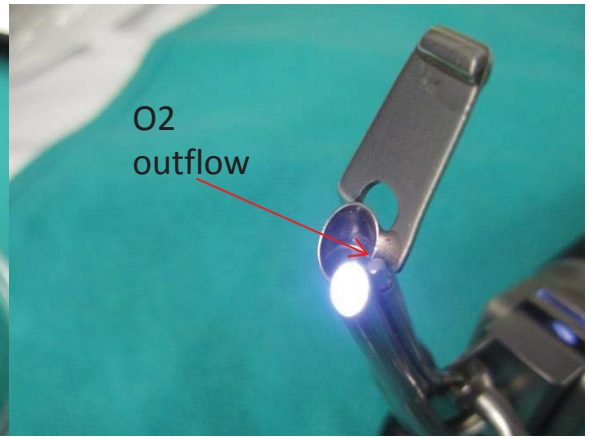
2. Prepare device



3. Connect O2

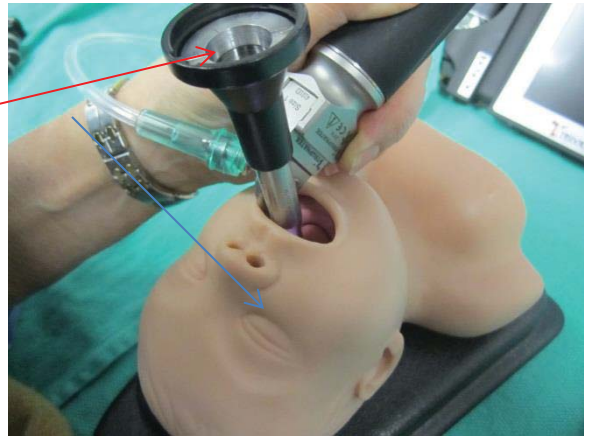






4.Intubation without video screen

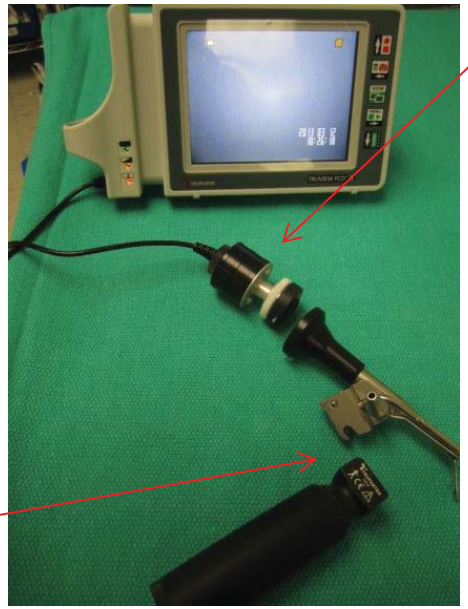
Identify the glottis by looking through the optical tube



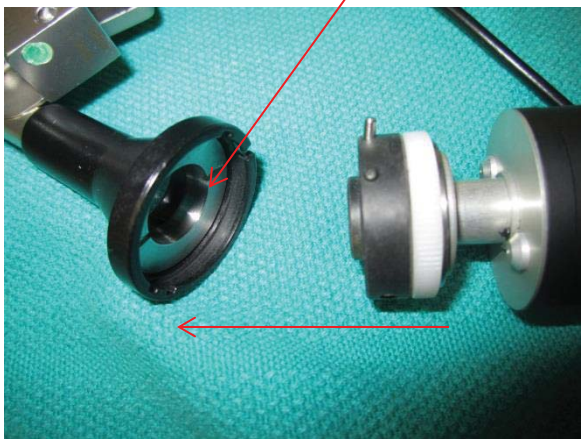
Introduce the ETT parallel to the blade

5.Intubation with video screen

On/off button on top
Not visible here

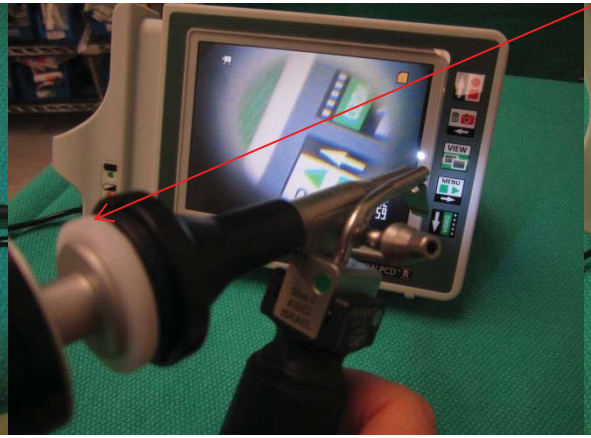


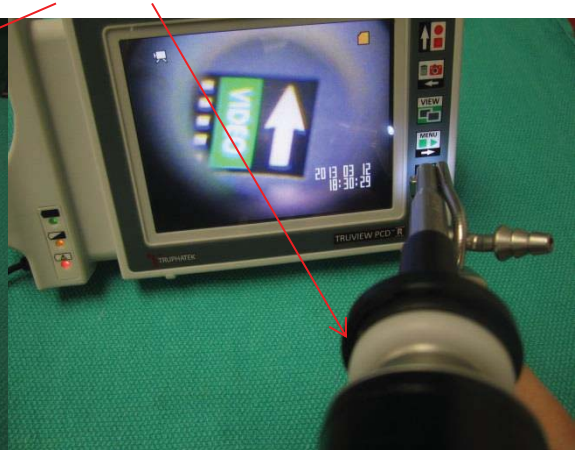
Connect camera to optical tube



Connect handle

Adjust focus with white wheel





6.Suite ….video screen

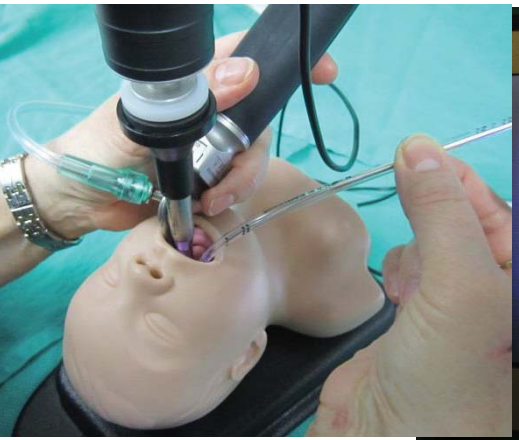
introduce blade carefully

identify uvula

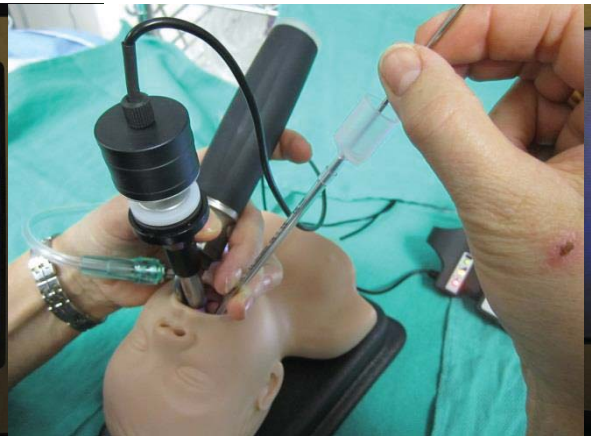
advance into glottis

identify vocal cords

Introduce ETT parallel to blade



Remove stylet once tip is in between vocal cords



7.The four steps of video intubation

1. Look into the **MOUTH** (Looking directly into the patient's mouth, with the device in the left hand, introduce the blade of the video laryngoscope into the oropharynx, gliding down along the tongue)

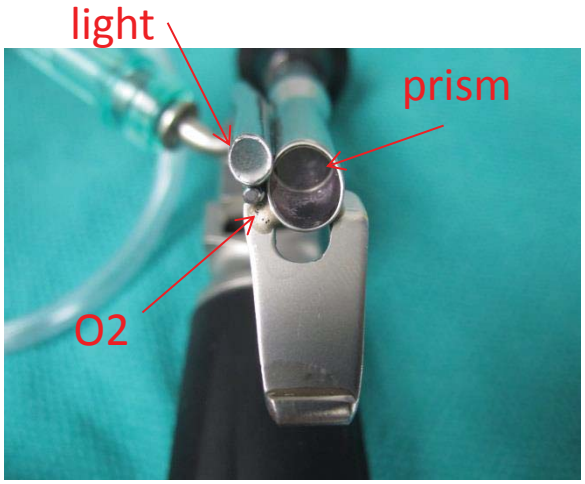
2. Look onto the **SCREEN** (With the laryngoscope inserted, look at the monitor or into the eye piece to identify the epiglottis, then manipulate the scope to get the best view of the glottis)

3. Look into the **MOUTH** (Look directly into the patient's mouth as you guide the distal tip of the ETT into position , following the curve of the blade as close as possible, once the tip pf the ETT is at the tip of the blade…….)

4. Look onto the **SCREEN** (Look at the monitor or into the eye piece to complete the intubation. Gently rotate or angle the ETT to redirect if necessary. Do not advance stylet into trachea. Stop in front of the glottis and slide ETT off the stylet)

8.Tips and tricks

Secretions are a problem for all video laryngoscopes !!
Suction oral cavity , give glycopyrrolyte if too much secretions,
Clean prism and light source with normal saline between attempts when dirty.
Increase oxygen flow between 2-4 L/min, or decrease O2 flow if too much secretion is getting blown over the prism.



Use truflex stylet (ETT =/> 6) for very anterior glottis position, tip of stylet can be moved upwards while advancing ETT towards vocal cords. Stylet should be removed as soon as tip lays in between vocal cords.

Difficult Airway Workshop: Fiberoptic Intubation via LMA

Society for Pediatric Anesthesia
Thomas L. Shaw, MD
Baylor College of Medicine
Texas Children's Hospital

Rationale

- The rationale for the LMA fiberoptic approach is based on the fact that the fiberoptic bronchoscope often faces the glottis as it exits the LMA
- Additionally, the patient can be effectively oxygenated and ventilated via the LMA when an unexpected difficult airway occurs while the fiberoptic bronchoscope is being prepared

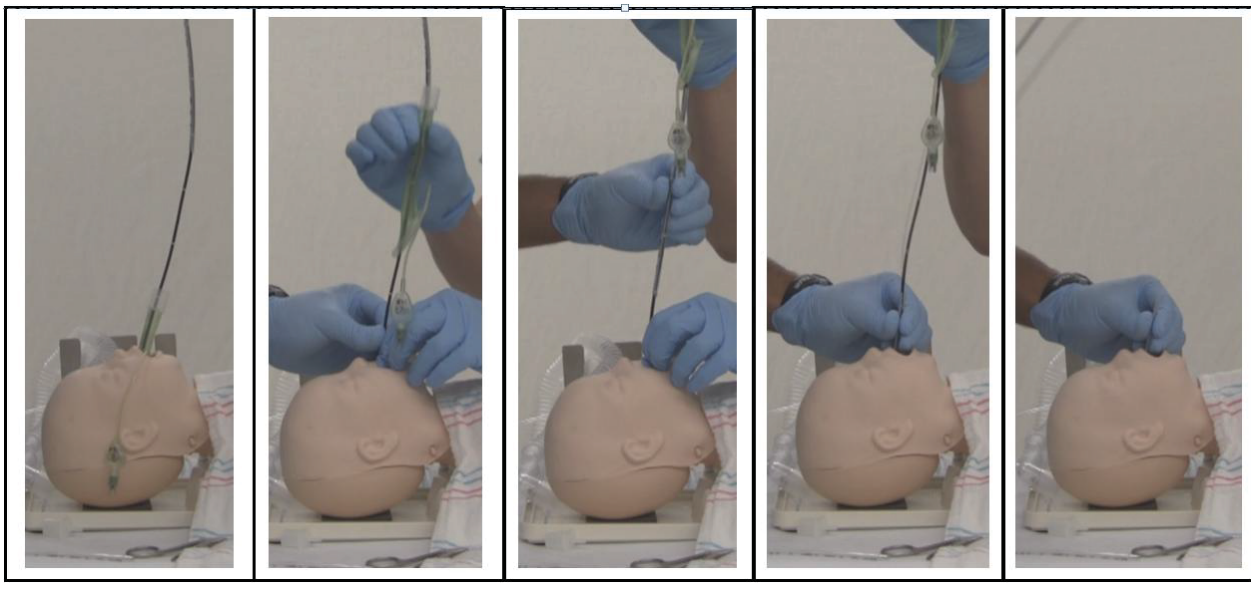
Problems with the LMA Fiberoptic Approach

- LMAs & ETTs are similar in length
- It is hard to stabilize the ETT while withdrawing the LMA
- The ETT may fall out

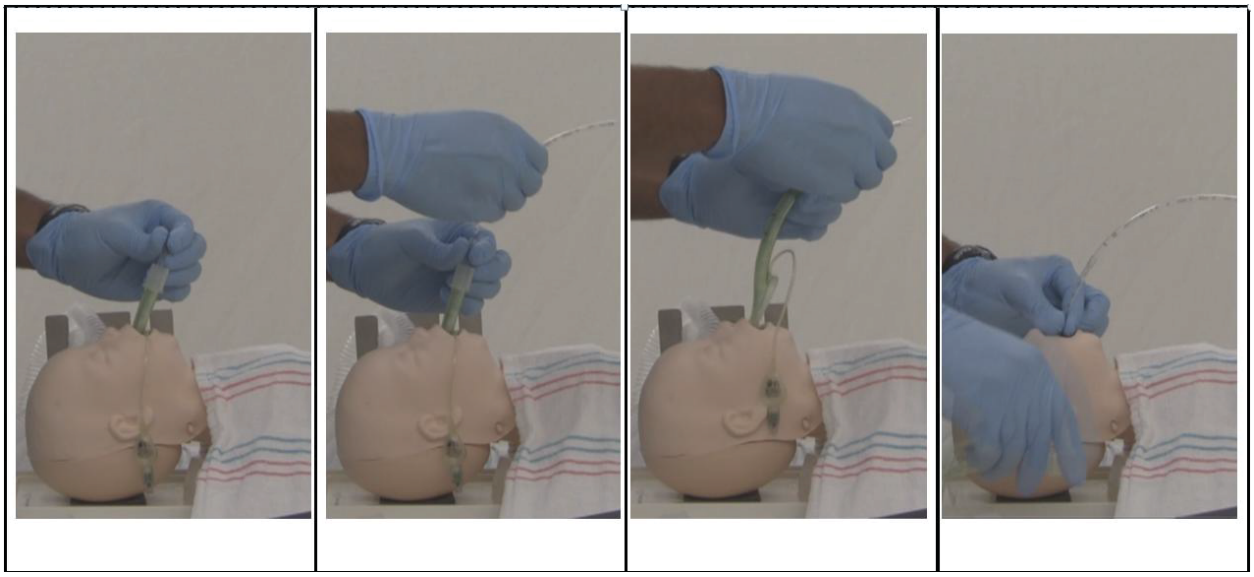
Three LMA Withdrawal Methods

1. **LMA withdrawn first over FOB**: ETT passed thru LMA → threaded over FOB into the trachea
2. **Telescope with another ETT**: Use ETT 0.5 smaller to stabilize tube as LMA is withdrawn. BE CAREFUL NOT TO ADVANCE IN SITU ETT BELOW VOCAL CORDS DURING THIS PROCESS
3. **Tracheal Alligator Forceps**: Use tracheal alligator forceps to stabilize the tube as the LMA withdrawn

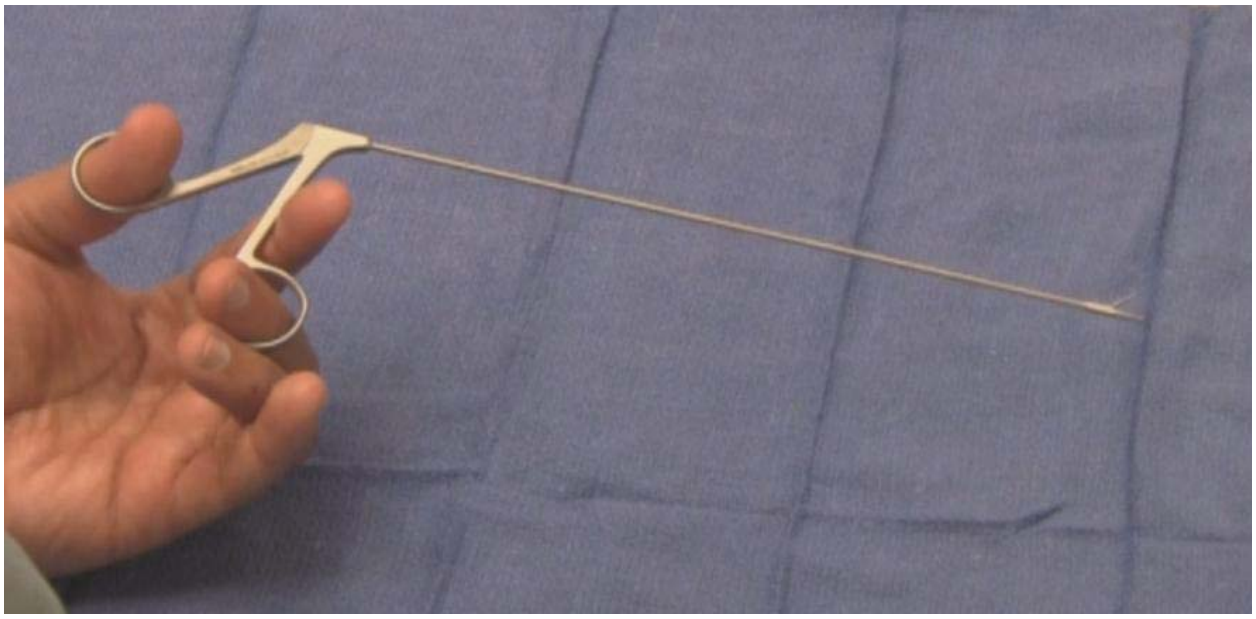
LMA withdrawn first over FOB Technique



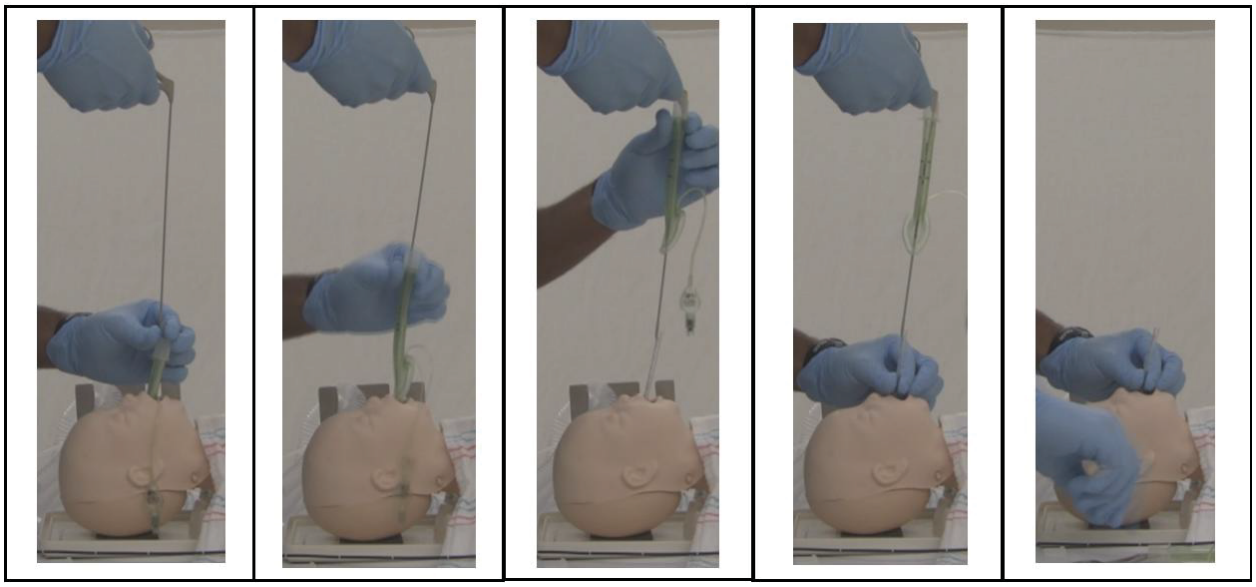
Telescope with another ETT Technique



Tracheal Alligator Forceps



Tracheal Alligator Forceps Technique



LMA and ETT Selection

Weight	LMA Size	Largest ETT	Cuffed Tube Passable
<5	1	3.5 uncuffed	No
5-10	1.5	4.0 uncuffed	No
10-20	2	4.5 uncuffed	No
20-30	2.5	5.0 uncuffed	Yes
30-50	3	6.0 cuffed	Yes
50-70	4	6.0 cuffed	Yes
70-100	5	7.0 cuffed	Yes
>100	6	7.0 cuffed	Yes

Special Attention with Cuffed ETTs

- The pilot balloon of a cuffed ETT does not pass through the internal lumen of pediatric LMA sizes of 1.0 to 2.5. In larger LMAs, the ETT pilot balloon connection may be too short, so that the pilot balloon can become stuck within the LMA during withdrawal

Clinical Pearls

- Thoroughly prepare all needed equipment
- A knowledgeable assistant is crucial
- Ensure proper fit of FOB through the ETT AND through the LMA

- Practice the techniques for removing the LMA on normal airway patients
- When the glottis is seen: consider administering lidocaine or additional sedatives
- Point ETT bevel Down when passing an ETT over FOB via LMA for easy passage

References

1. Auden, SM. (1998) Flexible Fiberoptic Laryngoscopy in the Pediatric Patient. *Anesthesiology Clinics of North America*. **16:4**, 763-793.
2. Ovassapian, A. (2001) The Flexible Bronchoscope: A Tool for Anesthesiologists. *Clinics in Chest Medicine* **22:2**, 281-299.
3. Fulling, PD & Roberts, JT. (2000) Fiberoptic Intubation. International Anesthesiology Clinics. **38:3**, 189-217.

The Children's Hospital *of* Philadelphia®

Hope lives here.

Emergency Invasive Airways

Justin Lockman, MD
Critical Care Medicine and Anesthesiology

Objectives

- Indications for emergency invasive airway (EIA)
- Necessary anatomic knowledge and equipment for EIA in adults and children
- Demonstrate EIA on a patient simulator
- Hands-on practice with EIA

Disclosures

- No relevant financial disclosures

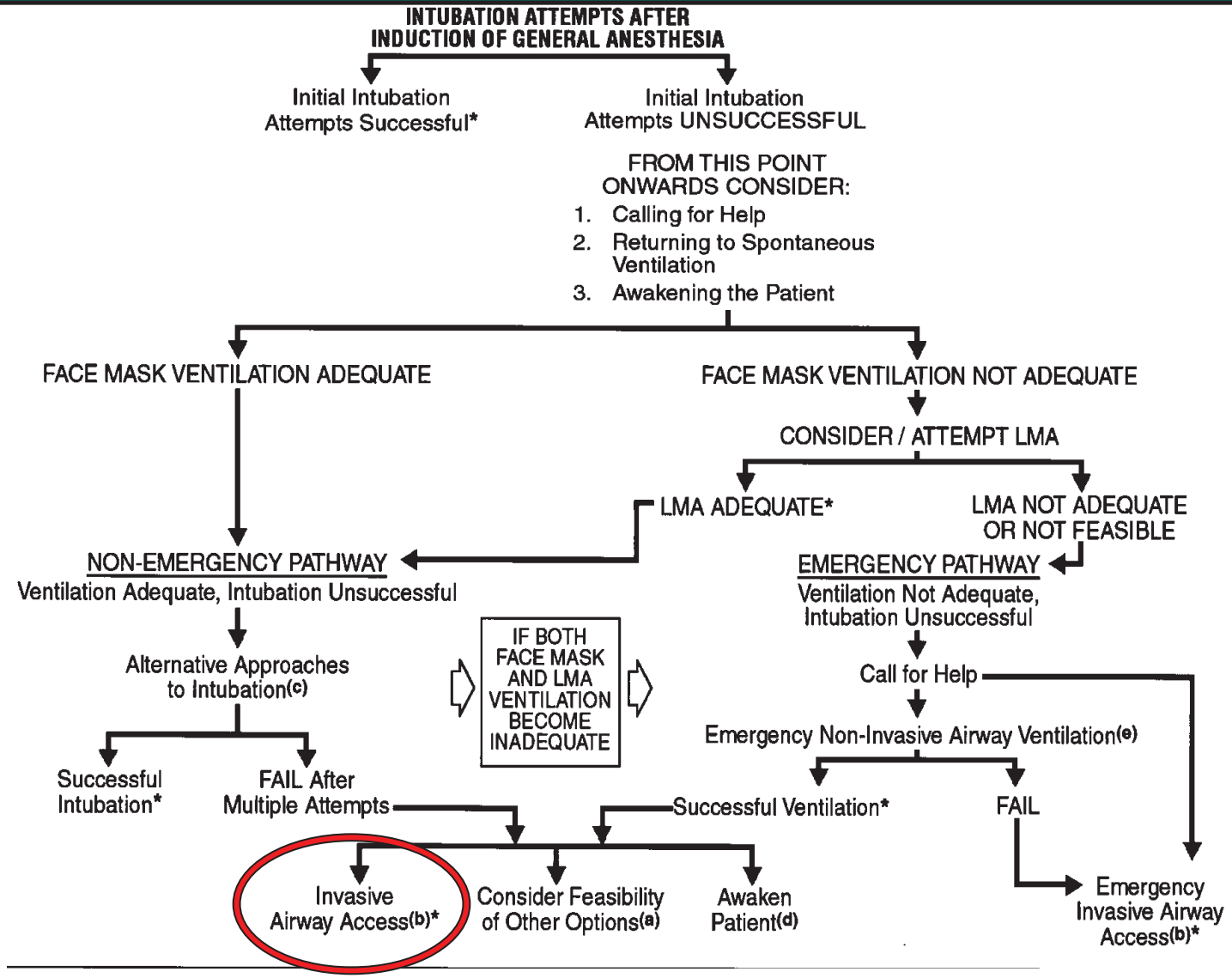
Disclosures

- No relevant financial disclosures
- “A lot of people walk around without a brain. Nobody walks around without an airway” – John J. McCloskey

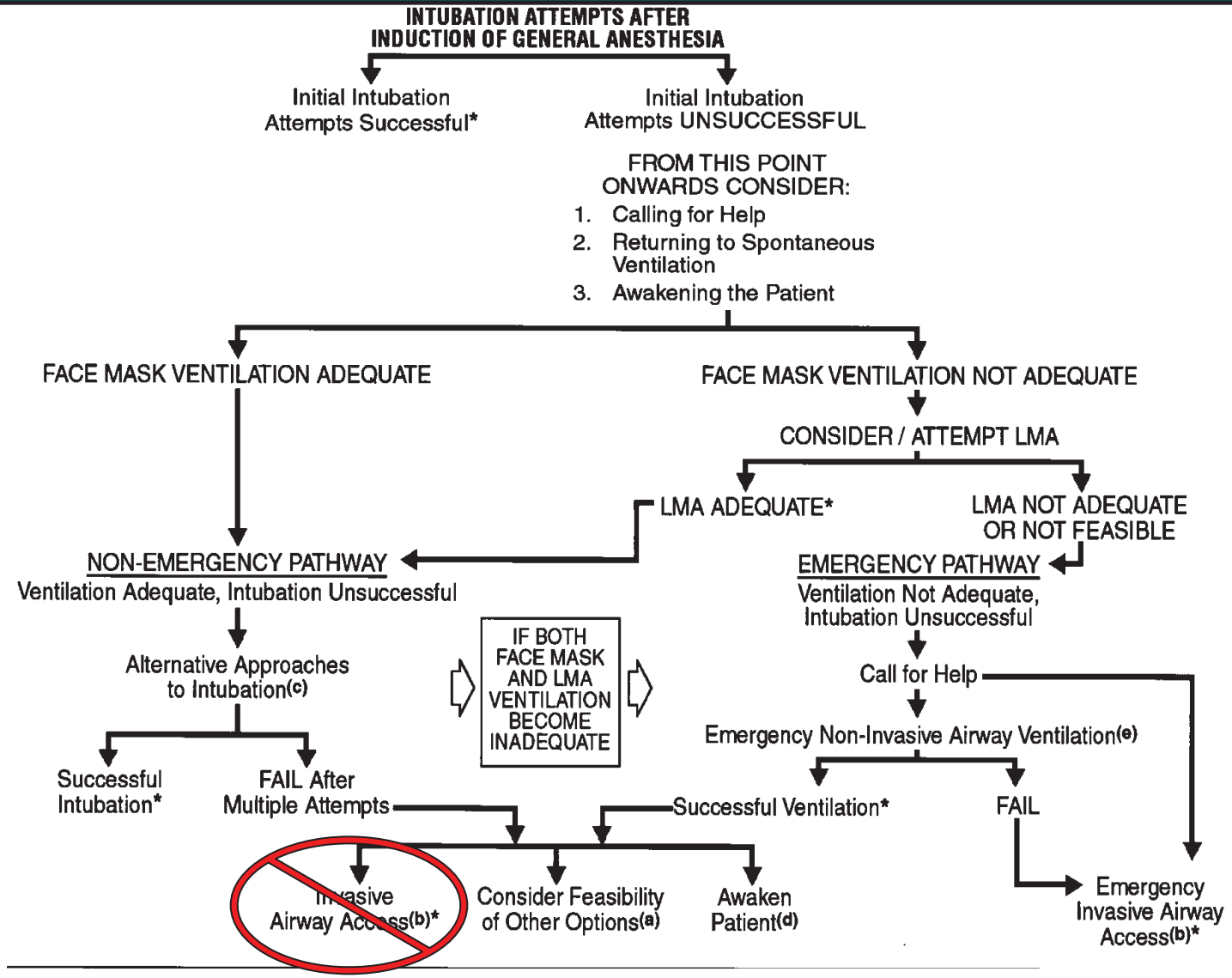
Disclaimer

- The procedures and skills discussed here and demonstrated later are intended to broaden options in a true life-threatening emergency.
- These should rarely, if ever be planned procedures, *especially in infants and children*
- Never induce in a patient when your only "plan B" is emergency invasive airway

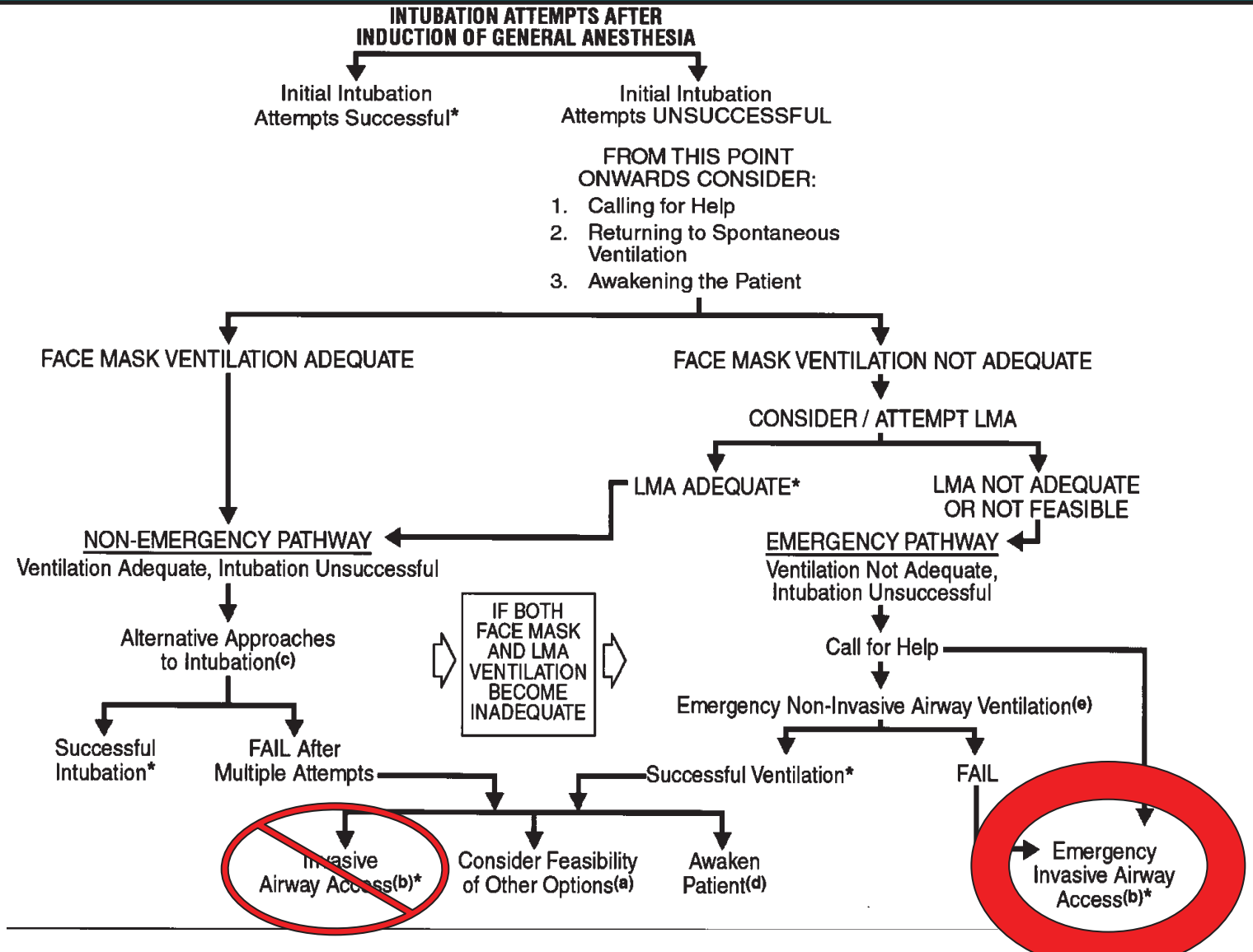
ASA Difficult Airway Algorithm



ASA Difficult Airway Algorithm



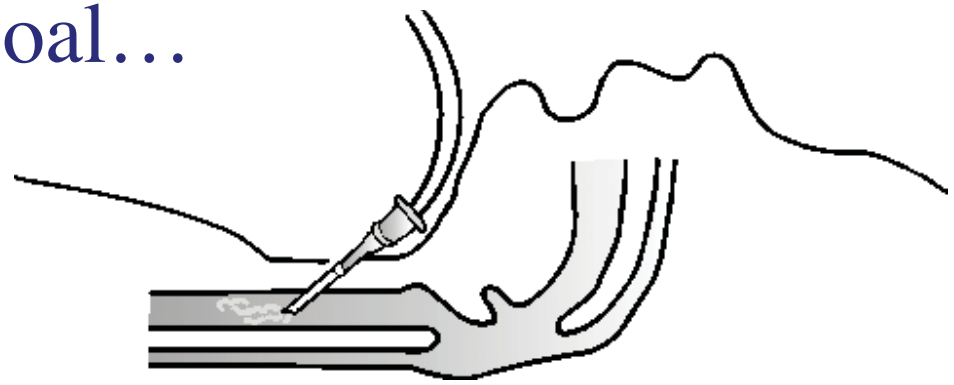
ASA Difficult Airway Algorithm



Needle Cricothyrotomy

Needle Cricothyrotomy

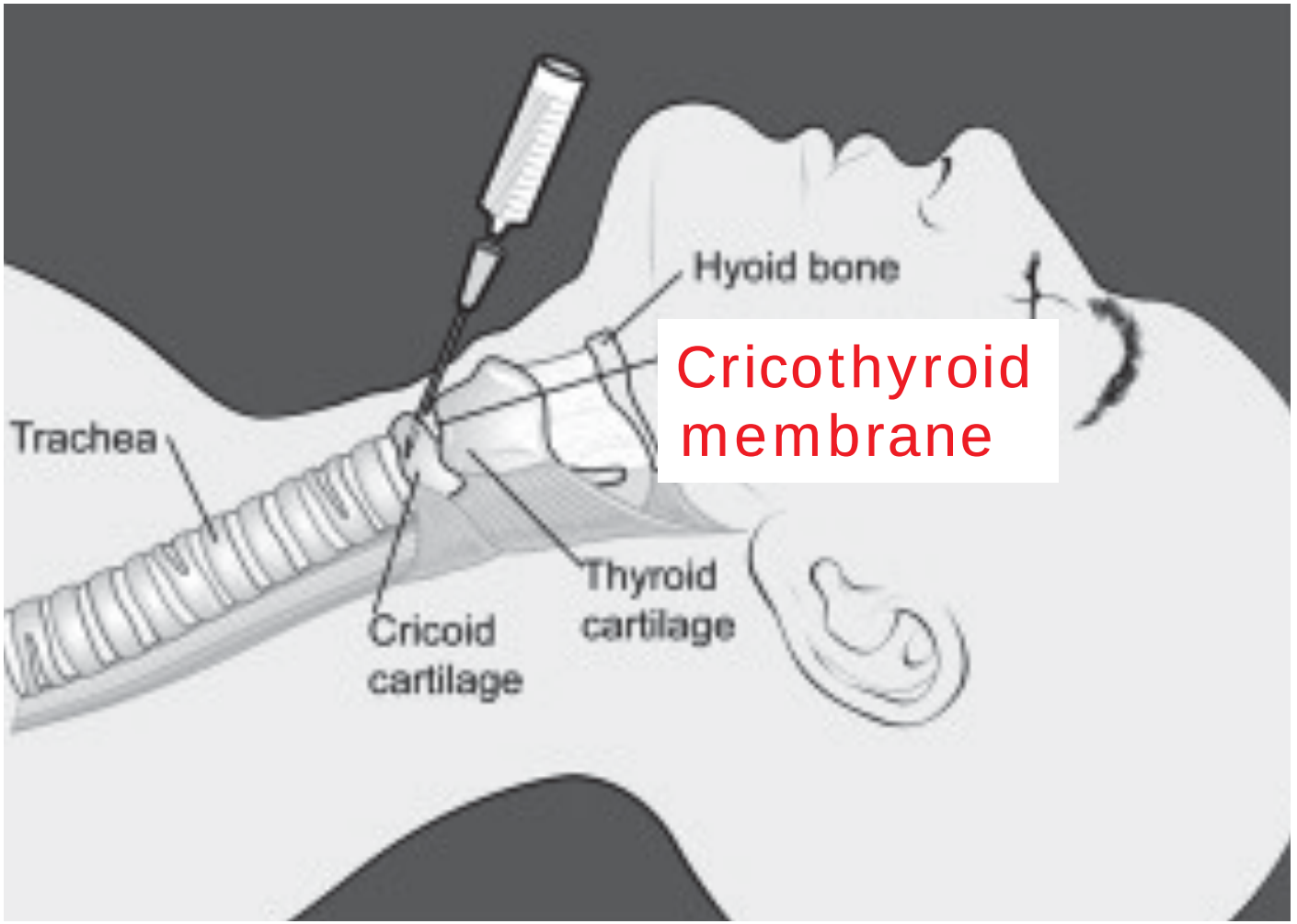
The goal…



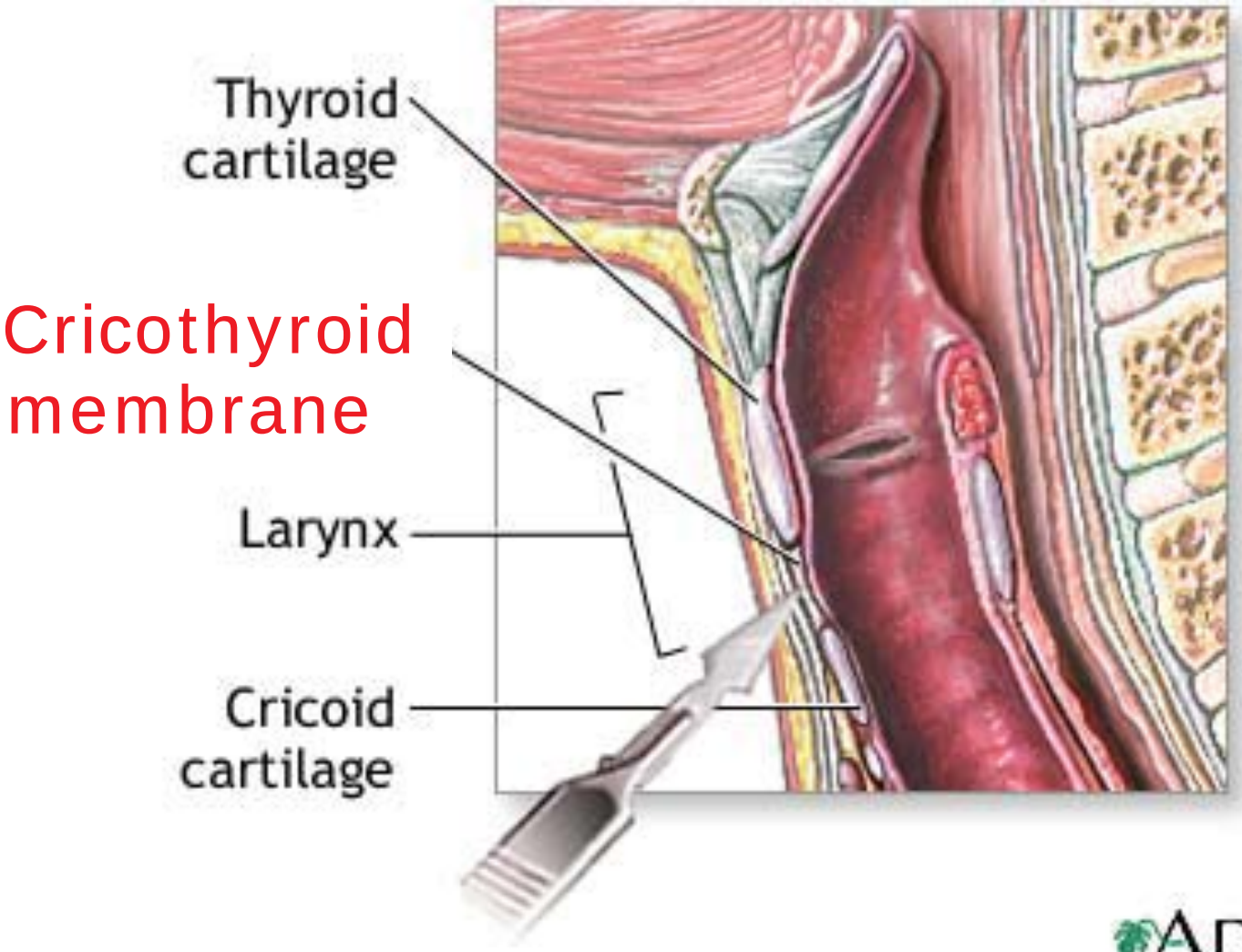
Needle Cricothyrotomy

- Oxygenation more than ventilation
- May be performed in children
- No special equipment necessary

Needle Cricothyrotomy



Needle Cricothyrotomy



Needle Cricothyrotomy

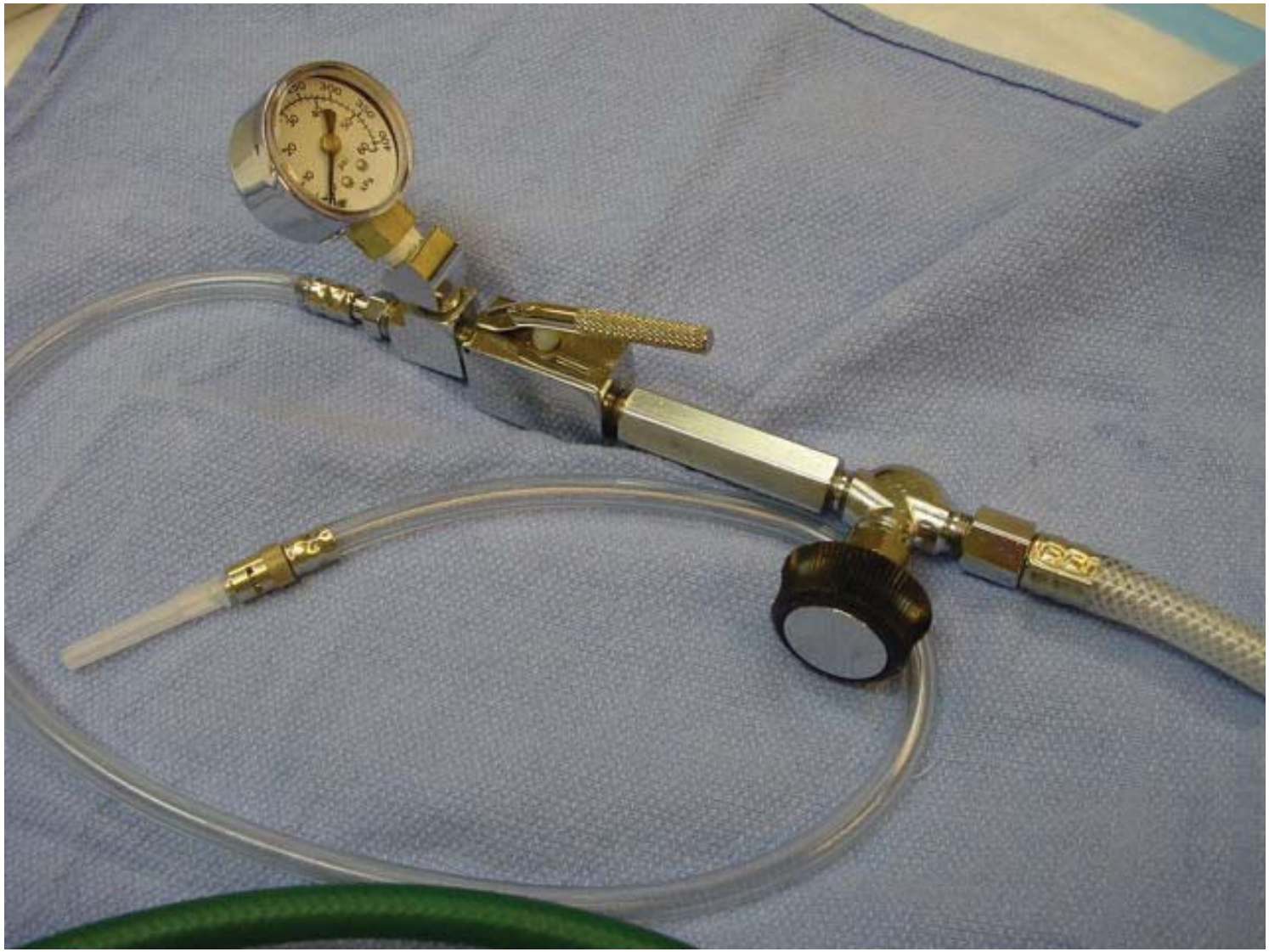
- Supplies:
  - Alcohol swab
  - NON-safety angiocatheter
  - Syringe (saline preferred)

Needle Cricothyrotomy

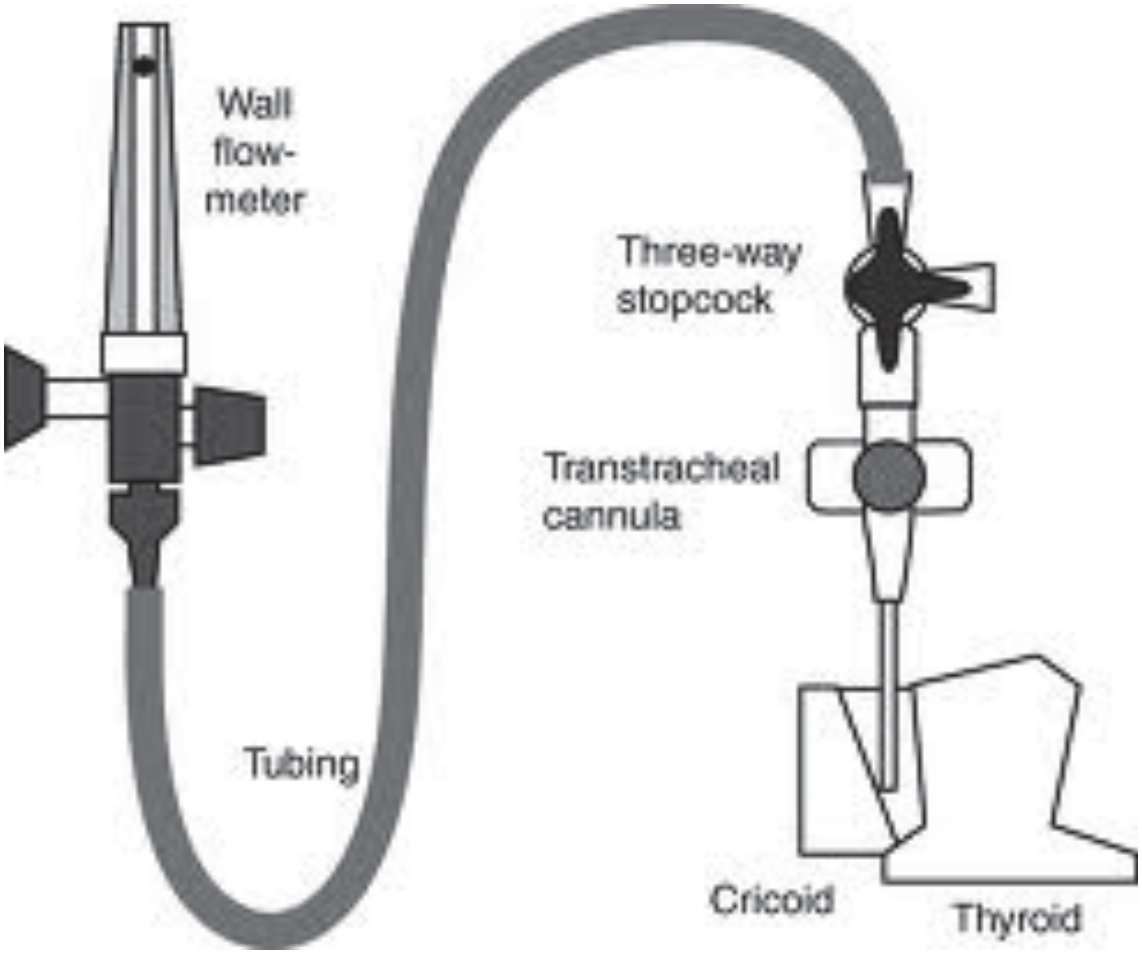
Needle Cricothyrotomy

Needle Cricothyrotomy

Needle Cricothyrotomy



Needle Cricothyrotomy



Needle Cricothyrotomy

Needle Cricothyrotomy

Needle Cricothyrotomy

Needle Cricothyrotomy

Cricothyrotomy

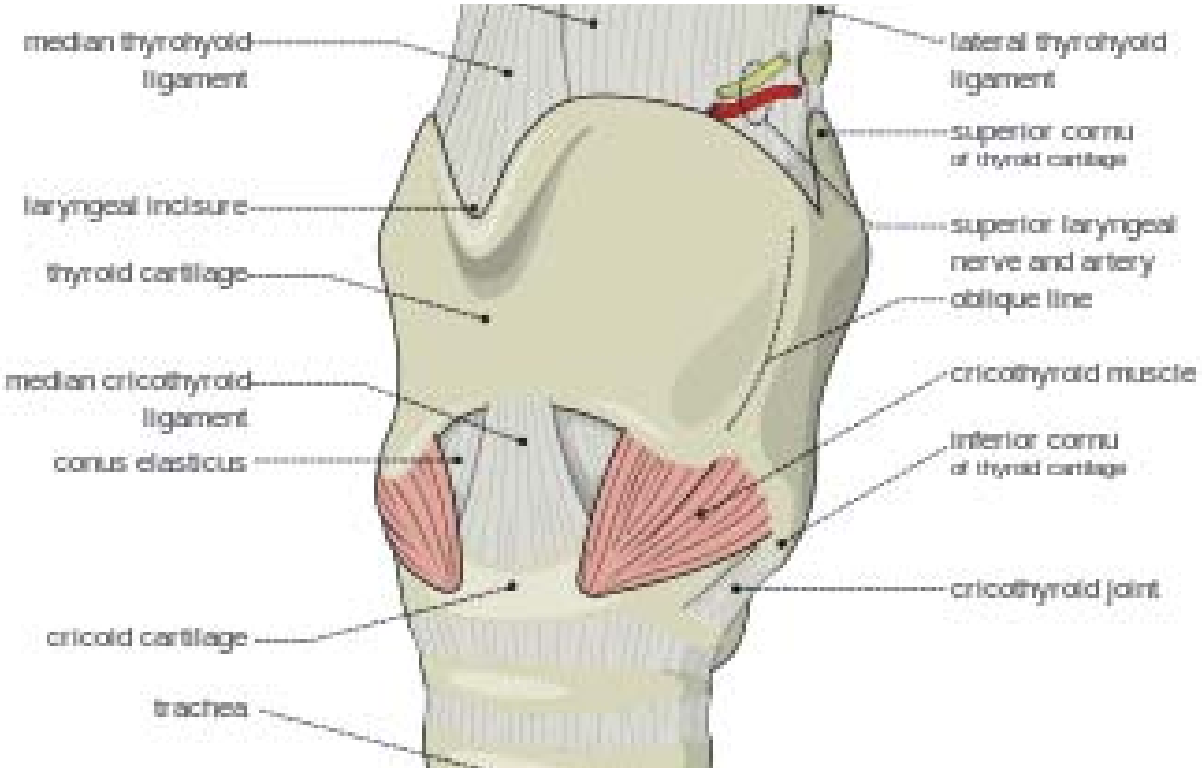
Cricothyrotomy

- Compared to Needle Cricothyrotomy:
  - More effective at CO2 removal
  - More challenging to perform, especially in infants
- Compared to tracheotomy:
  - Easier to perform
  - No c-spine movement required

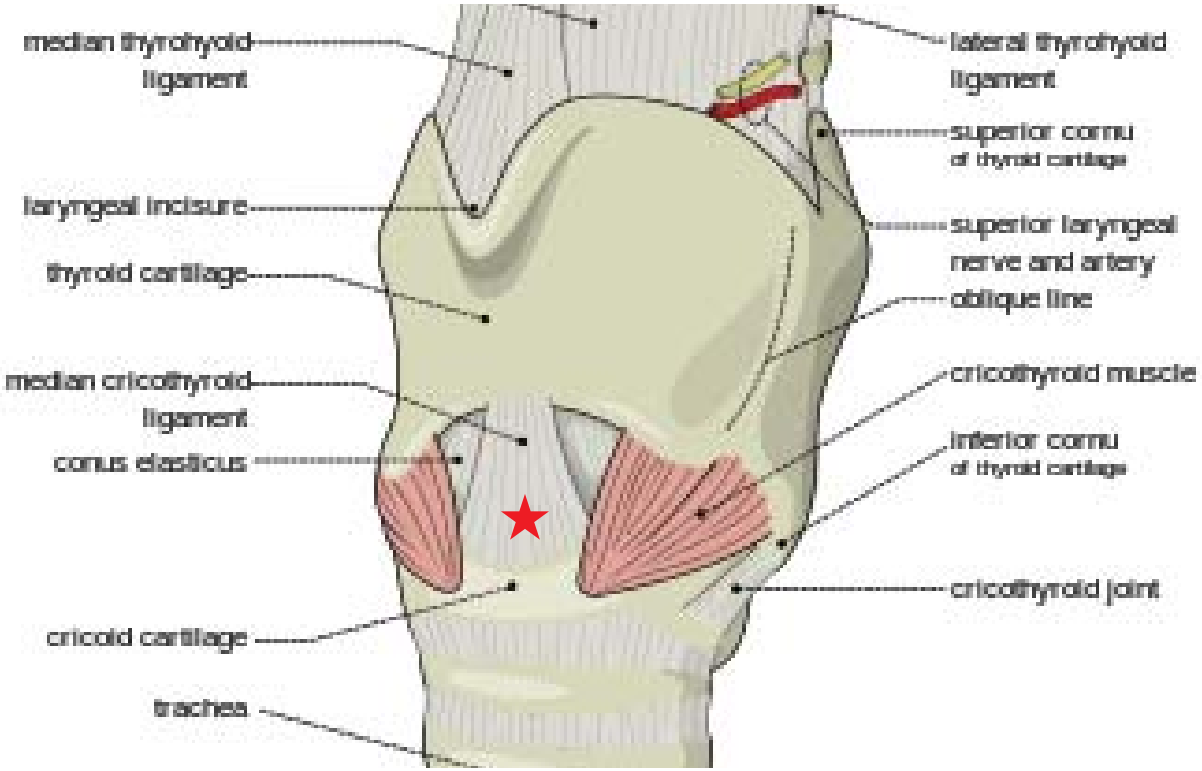
Cricothyrotomy

- Compared to Needle Cricothyrotomy:
  - More effective at CO2 removal
  - More challenging to perform, especially in infants
- Compared to tracheotomy:
  - Easier to perform
  - No c-spine movement required
- This technique is NOT recommended in young children

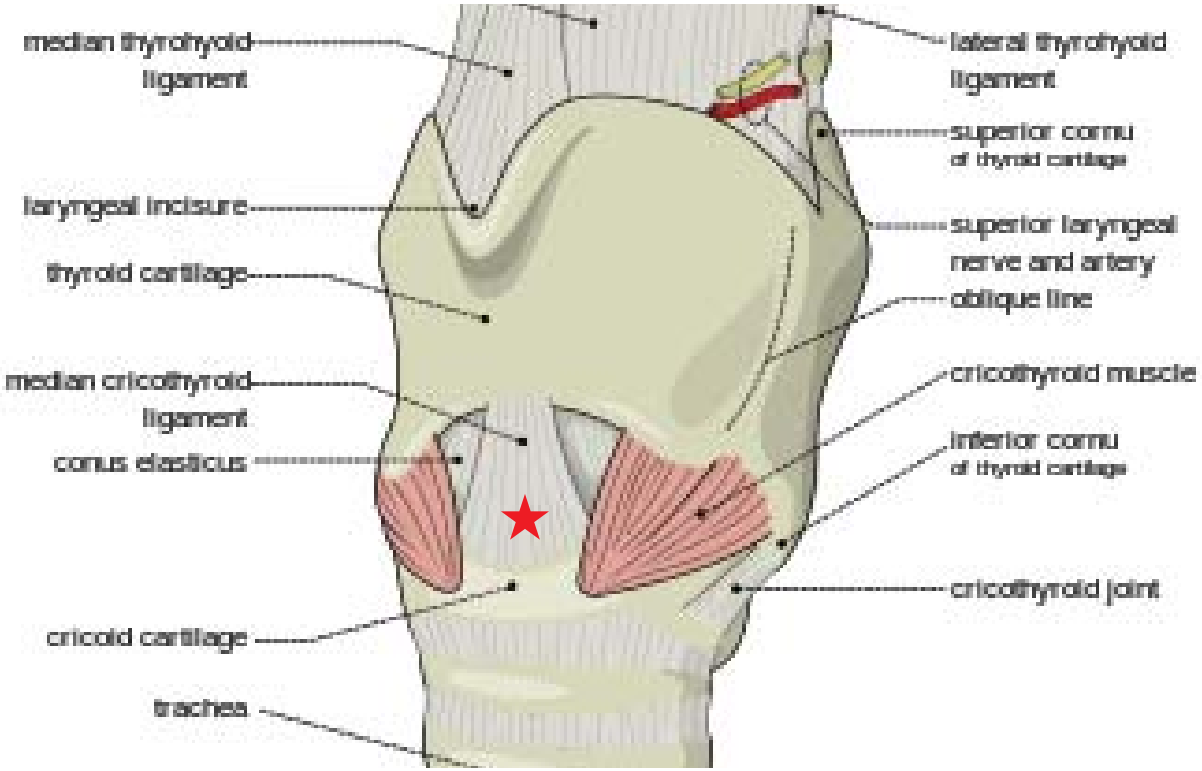
Cricothyrotomy



Cricothyrotomy

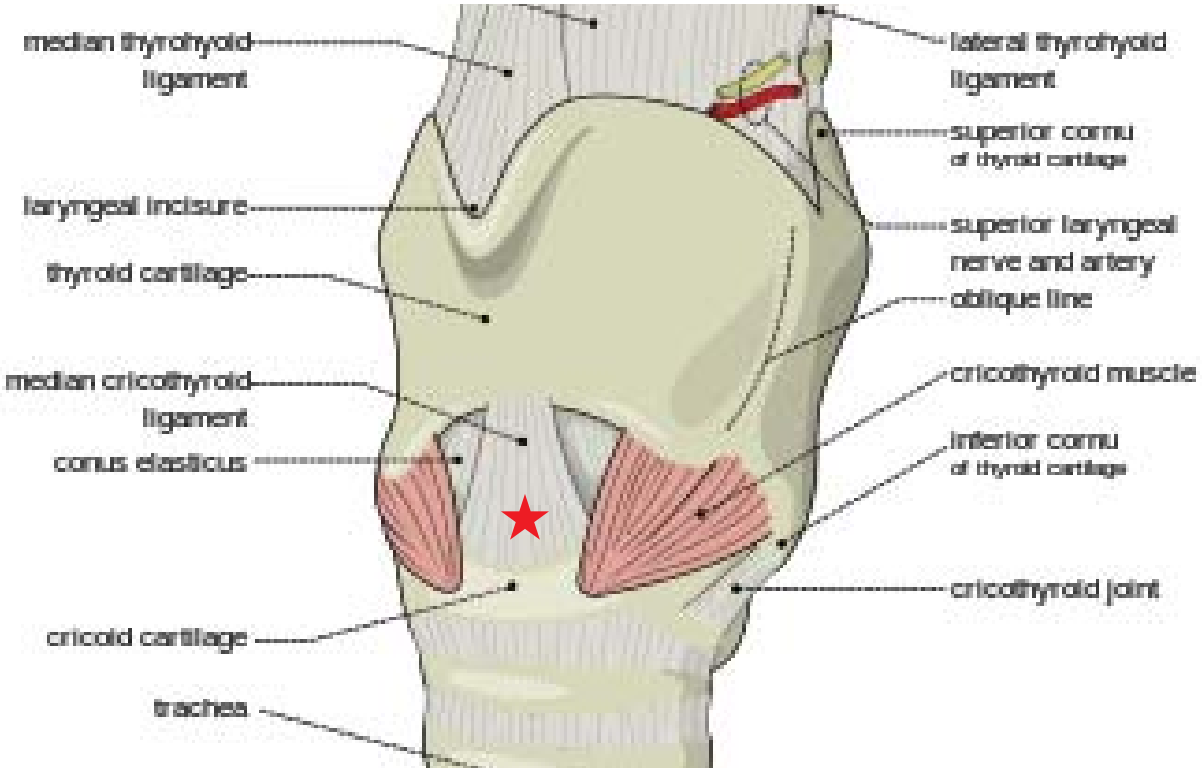


Cricothyrotomy



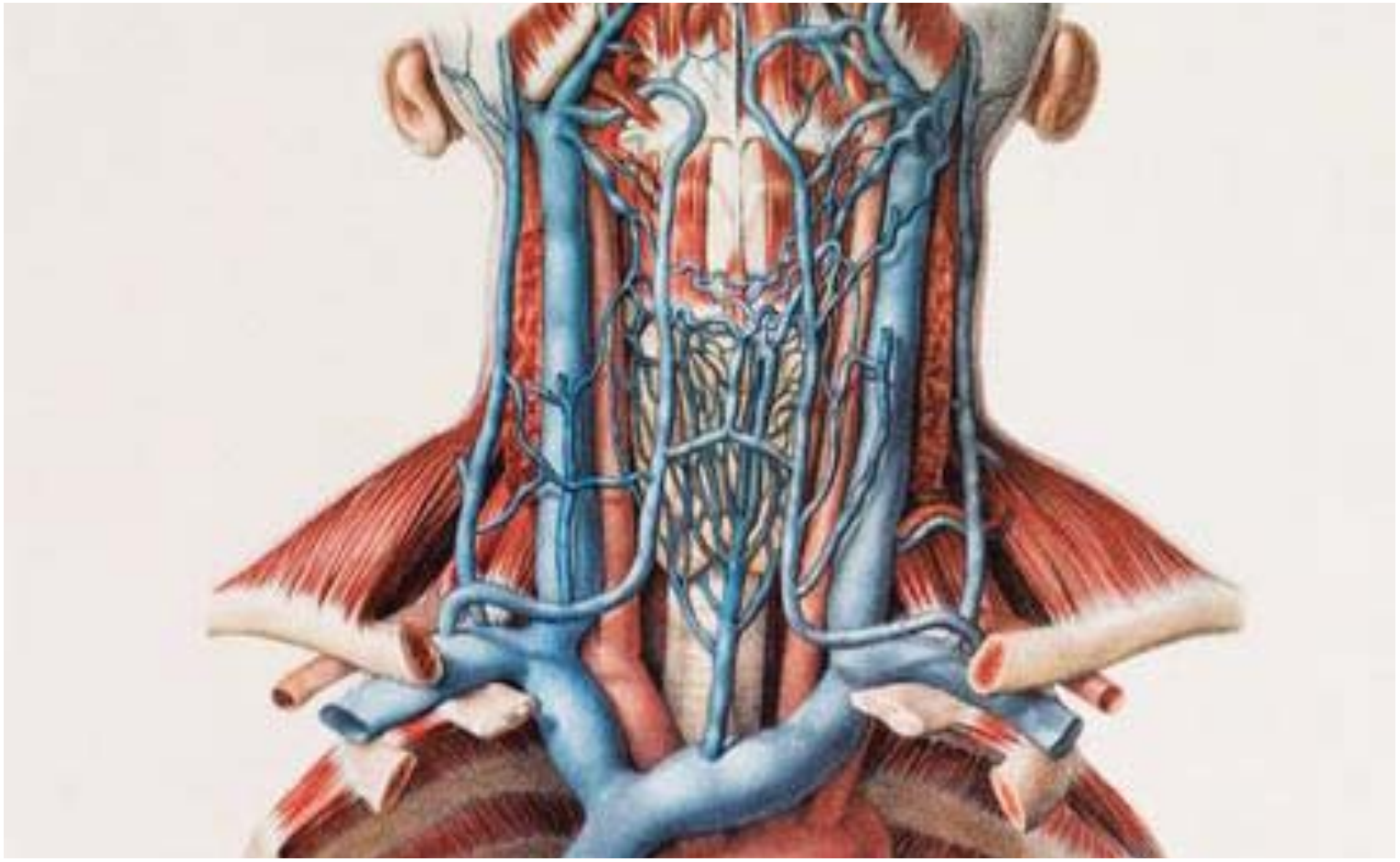
Note: Little muscle/blood vessels in midline

Cricothyrotomy



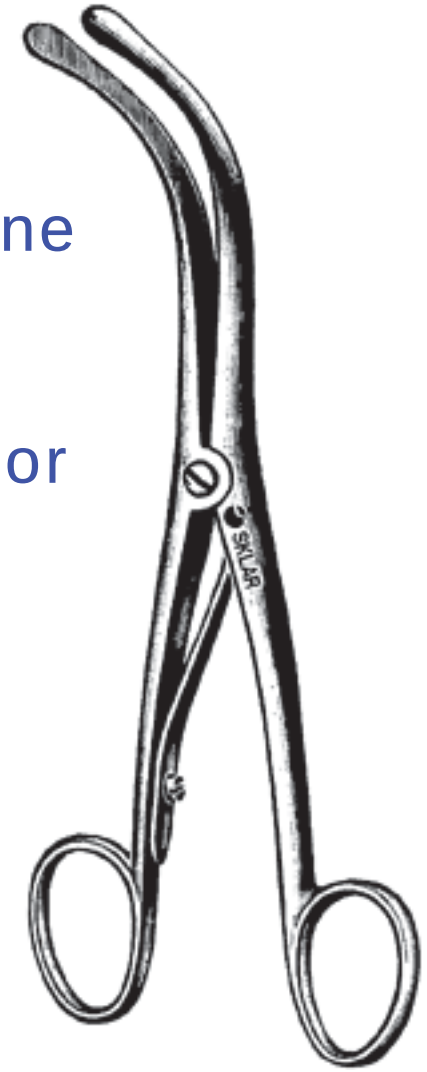
Note: Little muscle/blood vessels in midline
Vertical orientation of ligament

Cricothyrotomy

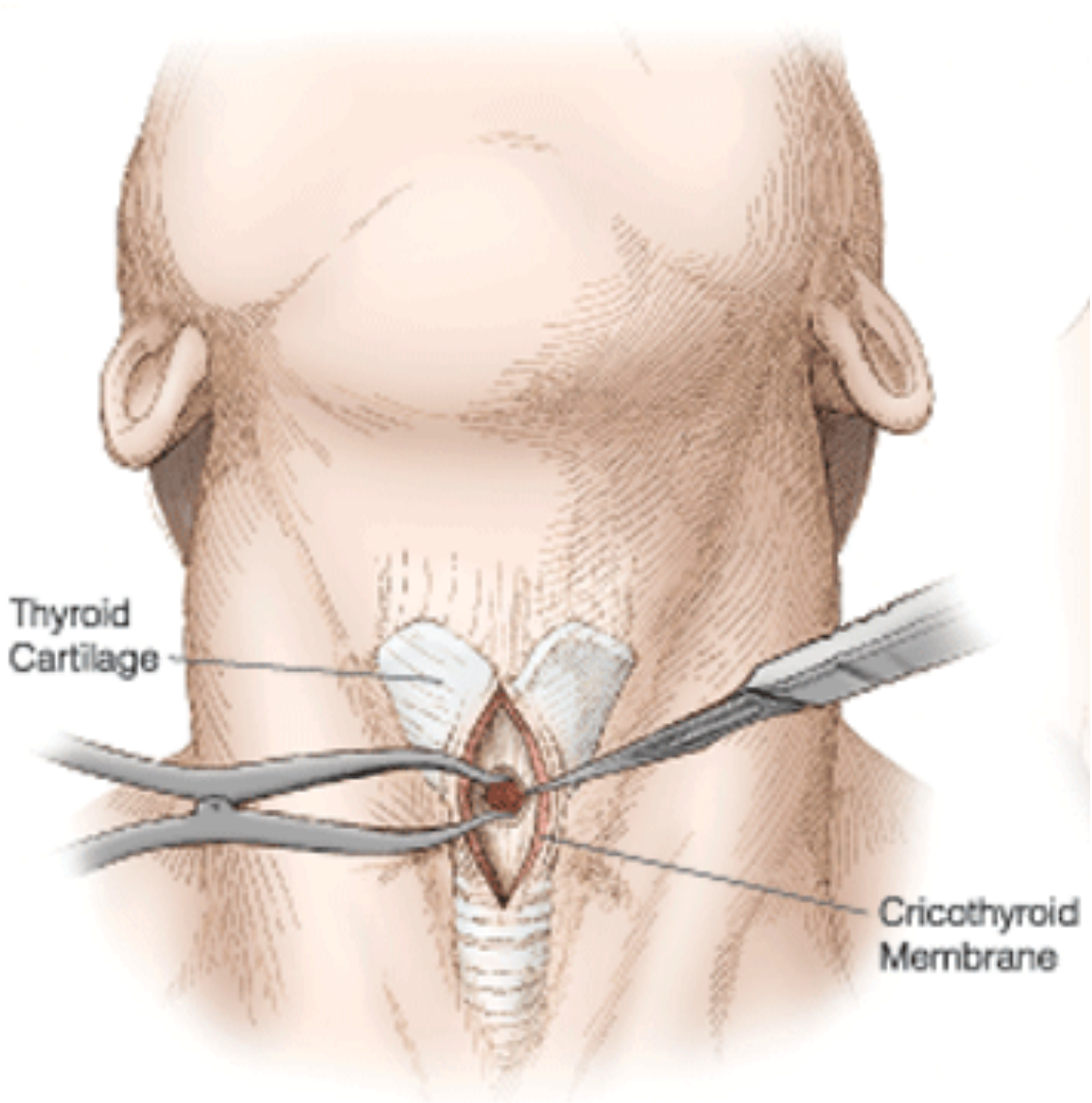


Cricothyrotomy

- Supplies needed:
  - Alcohol/betadine/chlorhexidine
  - Scalpel (11 blade)
  - Hemostat or Trousseau Dilator
  - Endotracheal tube



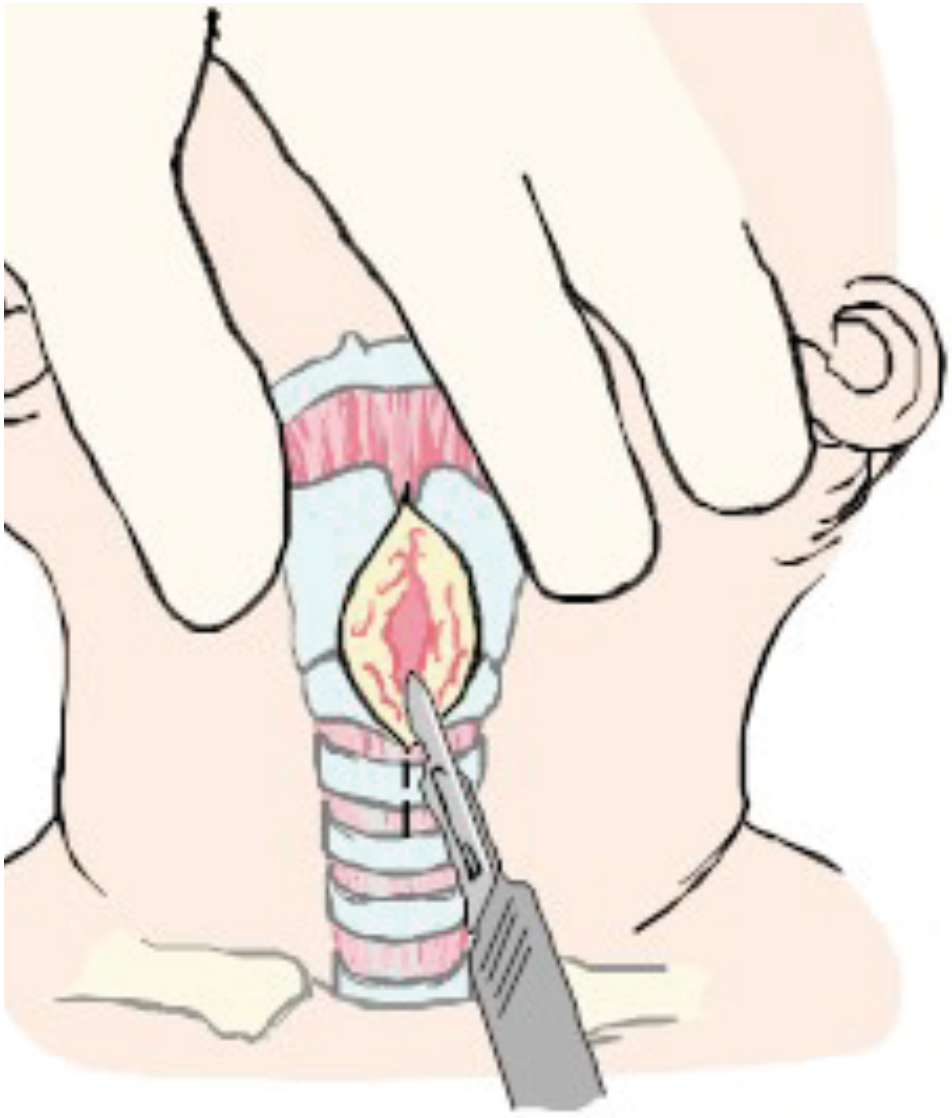
Cricothyrotomy



Cricothyrotomy

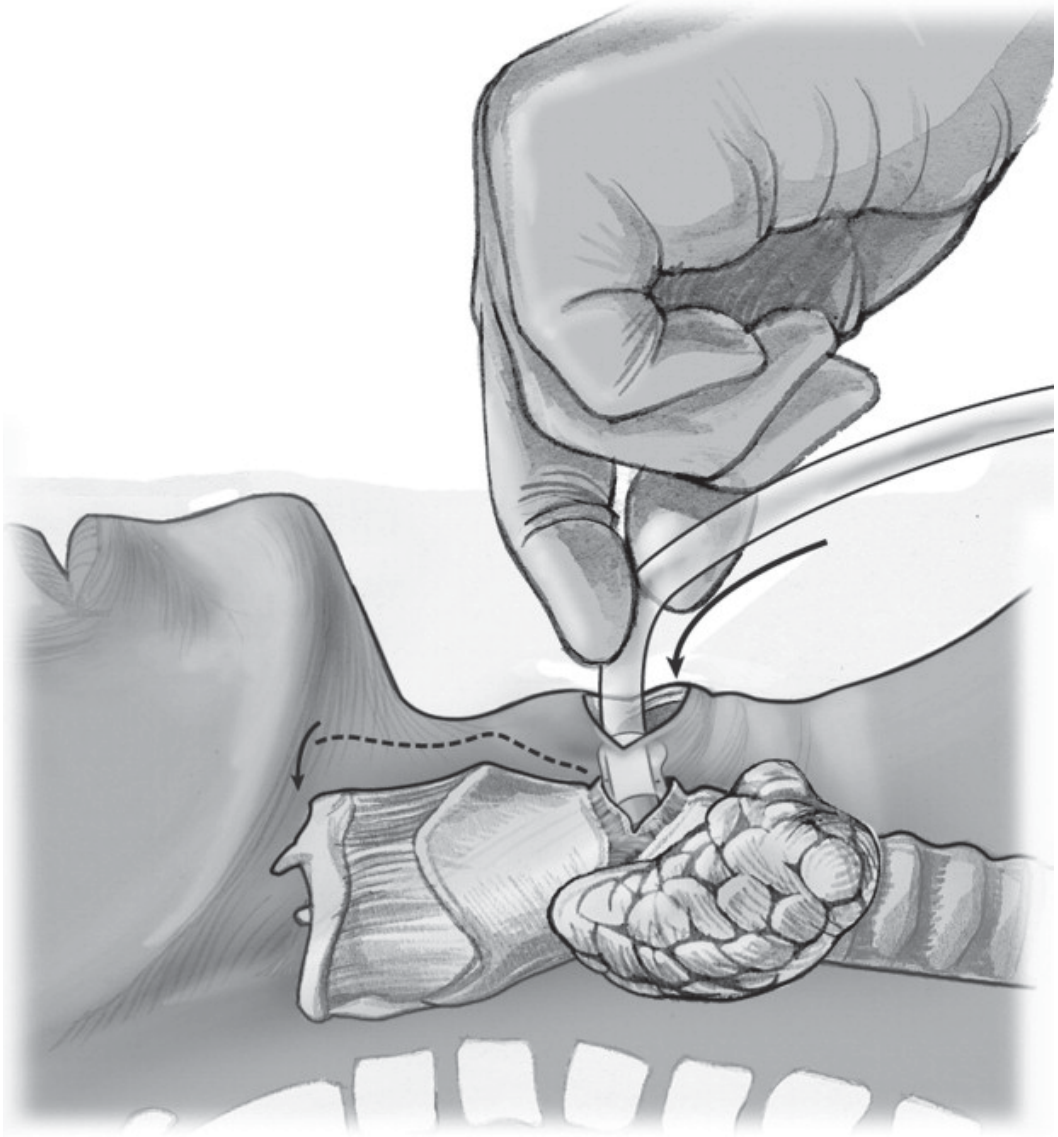
- Steps:
  - Prep (and position) the neck
  - Vertical skin incision
  - Hemostat or fingers to spread apart soft tissues
  - Horizontal incision into larynx
  - Spread with Trousseau dilator, hemostat, or blunt end of scalpel
  - Insert endotracheal tube (6.0 in adults)
  - Check EtCO2

Cricothyrotomy



Cricothyrotomy

Cricothyrotomy



Summary

- Emergency Invasive Airways are RARELY performed in children and should NOT be your alternate plan
- Needle cricothyrotomy requires no special equipment
- Surgical cricothyrotomy provides more effective ventilation but is virtually impossible in infants and small children

Acknowledgements

- SPA
- Mark Rossberg, MD