Basic Airway Management Course

Jordan Nickols, MD

East Alabama Health

Managing the Airway

Jordan Nickols, MD

East Alabama Health

Goals and Objectives

- Discuss the indications for intubation
- Review airway assessment
- Explore methods for aligning the axes
- Investigate the concept of bag valve mask
- Review the basic steps for intubation
- Discuss post intubation steps

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Indications for Intubation

- Failure to maintain or protect the airway
- Failure of ventilation
- Failure of oxygenation
- Therapy / Evaluation is required that mandates intubation

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Failure to protect or maintain airway

- Altered mental status (GCS <8)
- Excessive Secretions
- Bleeding
- Hematoma
- Angioedema
- Among Others

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Failure to Ventilate

- Inability to remove pCO2
- COPD
- Narcotic OD
- Myasthenia Gravis
- Stroke
- Other

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Failure to Oxygenate

- Inability to maintain pO2 > 60
- CHF
- Pneumonia
- ARDS
- Pulmonary Embolism
- Other

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NASAL OXYGEN DELIVERY DEVICES

by Nick Mark MD

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PURPOSE:

- Nasal cannula can be used to deliver supplemental O2. Conventional nasal cannula are commonly used deliver low flow rates & ***moderate*** FiO2.
- High flow nasal cannula (HFNC) delivers higher flow rates achieving a ***higher*** FiO2 with greater patient comfort.
- In hypoxemic respiratory failure use of HFNC is associated with a lower rate of requiring intubation & lower ICU mortality compared to CNC or NIPPV. HFNC can prevent re-intubation after thoracic and cardiac surgeries. Extubation to HFNC is also associated with lower rates of re-intubation.

PHYSIOLOGY OF HEATED HIGH FLOW NASAL CANNULA

- Higher flow ***washes out CO2*** from anatomical dead space in the nasopharynx
- Higher flow ***overcomes resistance*** against expiratory flow and creates a small positive nasopharyngeal pressure (approximately 0.7 cmH2O of PEEP for every 10 lpm of flow)
- Patients in respiratory distress generate high flows and will entrain ambient air with conventional nasal cannula. HFNC can match demand ***so F_IO_2 remains relatively constant***
- Warm humidified gas ***preserves mucociliary function*** & ***is more comfortable*** for patients

For ***low flow*** O2 delivery systems, only the **flow rate** is specified. The flow rate *roughly* determines FIO2

1 LPM ≃ 3-4% FIO2 INCREASE

For ***high flow*** O2 delivery systems two parameters are selected:

- Flow rate (on the **flowmeter**)
- FiO2 (on the **gas blender**)

CONVENTIONAL NASAL CANNULA (CNC)

FLOW 1 – 6 LPM

FIO2 ~24 – 45%

RESERVOIR NASAL CANNULA (RNC)

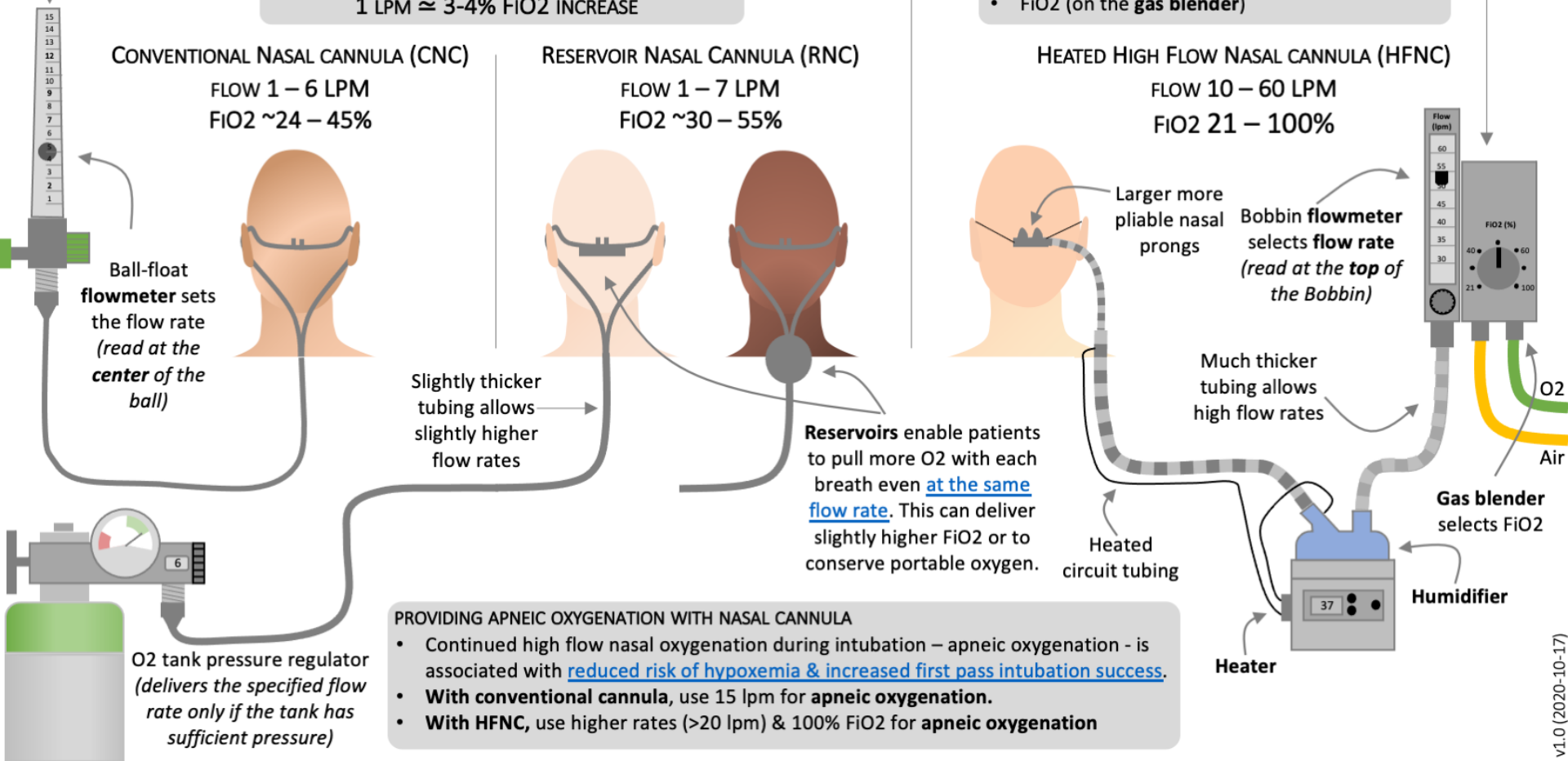
FLOW 1 – 7 LPM

FIO2 ~30 – 55%

HEATED HIGH FLOW NASAL CANNULA (HFNC)

FLOW 10 – 60 LPM

FIO2 21 – 100%



PROVIDING APNEIC OXYGENATION WITH NASAL CANNULA

- Continued high flow nasal oxygenation during intubation – apneic oxygenation - is associated with reduced risk of hypoxemia & increased first pass intubation success.
- **With conventional cannula**, use 15 lpm for **apneic oxygenation.**
- **With HFNC,** use higher rates (>20 lpm) & 100% FiO2 for **apneic oxygenation**

v1.0 (2020-10-17)

OXYGEN DELIVERY BY MASK

by Nick Mark MD

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PURPOSE:

- Masks are often used to deliver supplemental O2, typically at higher flow rates & greater FiO2 than by nasal cannula.
- The choice of mask often depends on how much supplemental O2 is required. The goal is provide the minimum necessary achieve the goal.
  - In general, the goal SpO2 should be ≥94% in most people, or 88-92% in people at risk for hypercarbic respiratory failure.
- The amount of oxygen delivered is approximate and can depend on many factors:
  - Patient's inspiratory effort (faster inspiratory flow will entrain more ambient air)
  - Face seal (looser seal will entrain more ambient air)
- Note that higher flow rates can rapidly deplete portable O2 tanks.

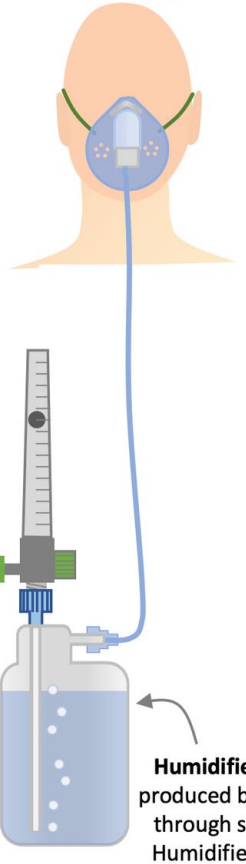
See also Nasal Oxygen Delivery OnePager

SIMPLE MASK (SM)

AKA *HUDSON'S MASK*

FLOW 6 – 10LPM

FiO2 35-50%

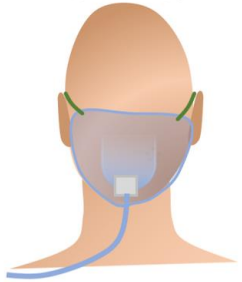


Humidified Oxygen is produced by bubbling O_2 through sterile water. Humidified O_2 ***may*** be more comfortable for patients on higher flow rates (>4 lpm)

FACE TENT (FT)

FLOW 10 – 15LPM

FiO2 30 – 40%

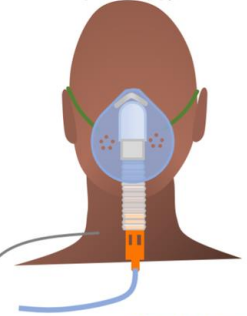


Face Tents are loose fitting & may be useful in people who do not tolerate a tight-fitting mask (e.g. facial trauma, recent surgery, etc)

VENTURI MASK (VM)

FLOW 2 – 15 LPM

FiO2 24-60%



Blended gas mixture (e.g. 31% oxygen) mixture depends on flow rate & the size of the valve openings

A **venturi mask** uses a small valve to mix **oxygen** & **ambient air** to achieve a desired FiO2. The venturi valves are color coded; each is sized to provide a *different* FiO2 for a specified flow rate:

Valve	Flow	FiO2
BLUE	2 lpm	24%
WHITE	4 lpm	28%
ORANGE	6 lpm	31%
YELLOW	8 lpm	35%
RED	10 lpm	40%
GREEN	15 lpm	60%

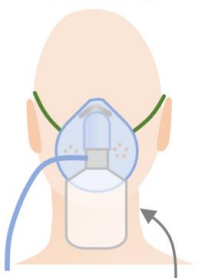
Ambient air (21% oxygen) is entrained through the valve openings by the Venturi effect

Oxygen Line (100% oxygen)

PARTIAL REBREATHER (PR)

FLOW 10 – 15 LPM

FiO2 60 – 80%



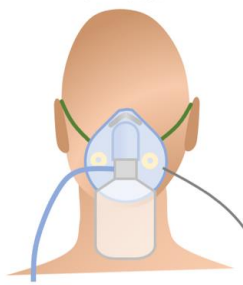
The addition of an **inflatable reservoir** increases delivered oxygen.

- In the NRB this reservoir is filled with 100% oxygen.
- In the PR this reservoir fills with a mixture of oxygen and exhaled air/CO2. This is why PR masks are seldom used.

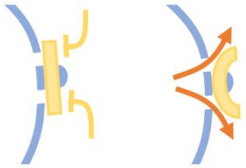
NON-REBREATHER (NRB)

FLOW 10 – 15 LPM

FiO2 ~80%



Non-rebreather masks have two one-way valves over the exhalation ports. These permitting exhalation but maintain a higher FiO2.
Note: this can be dangerous if the O2 supply is exhausted/interrupted!



Ambient air is blocked from entering the mask (keeps FiO2 higher)

Carbon Dioxide Can be exhaled freely (avoids rebreathing CO_2)

NON-INVASIVE POSITIVE PRESSURE VENTILATION by Nick Mark MD

ONE onepagericu.com @nickmmark Link to the most current version →

PURPOSE & DEFINITIONS:

- Non-invasive positive pressure ventilation (NIPPV) is a method of supporting **ventilation** and **oxygenation**. NIPPV can be used in acute respiratory failure to avoid endotracheal intubation. **EPAP** (expiratory pressure) = **PEEP** = **CPAP**

INDICATIONS:

- COPD exacerbation (↓intubation, ↓ mortality)
- Cardiogenic pulmonary edema (↓ mortality)
- Other causes of respiratory failure
- DNI status
- Extubation to NIPPV

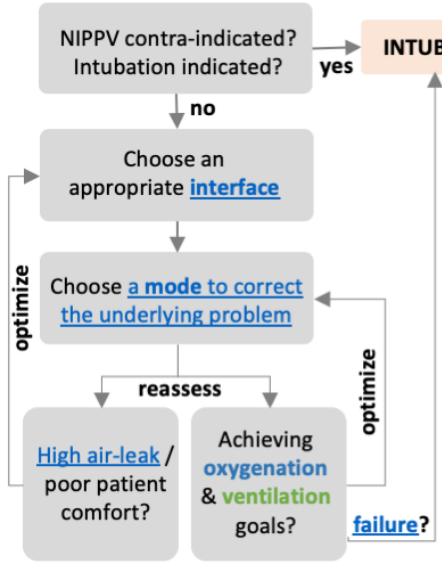
CONTRA-INDICATIONS:

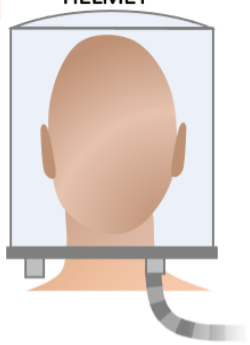
- Unresponsiveness/coma
- Inability to trigger breath
- Inability to protect airway / remove mask
- Risk of emesis / copious secretions
- Recent head/neck surgery

ABG: pH / PCO2 / PaO2 / HCO3 — Pulse Ox: SpO2

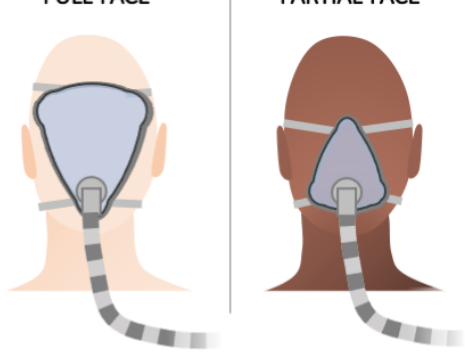
VENTILATION
To increase the pH → increase the **driving pressure** (IPAP – EPAP)

OXYGENATION
To increase PaO2 / SpO2 adjust **oxygenation parameters** (FiO2 & EPAP)

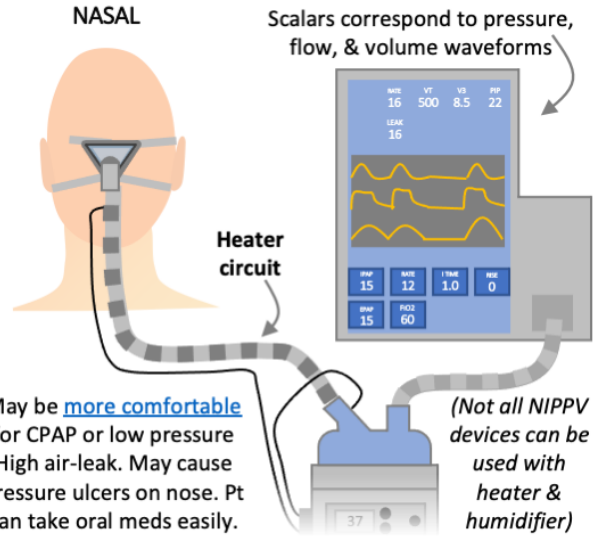




May be better tolerated, may reduce the likelihood of requiring intubation, & decrease mortality. No risk of pressure ulcers.



Patients can tolerate higher pressures using masks than nasal interface. Full face masks are less likely than partial to cause pressure ulcers, & generally have less air-leak. Comfort is variable.



May be more comfortable for CPAP or low pressure High air-leak. May cause pressure ulcers on nose. Pt can take oral meds easily.

(Not all NIPPV devices can be used with heater & humidifier)

Mode	Description	Pro's	Con's	Ventilator settings / example	Monitor
CPAP Continuous positive airway pressure	Delivers a continuous pressure (CPAP == EPAP == PEEP) throughout the respiratory cycle, holding open collapsible airways and improving oxygenation. Patient triggers all breaths.	Improves **oxygenation**; relatively well tolerated. Useful in obstructive apneas, reduces intubations in CHF exacerbations.	Does not assist ventilation (risk of hypoventilation)	**EPAP, FIO2** **+8, 60%**	Ventilation
S/T Spontaneous Timed (a.k.a **BiLelel**, BiPAP)	Sets, an inspiratory (IPAP) & expiratory pressure (EPAP). Every breath is supported with positive pressure. Patient triggers breaths, there is also a backup rate. (Similar to pressure support) T - time/pressure/flow, C – flow, L - pressure	Improves **ventilation** & **oxygenation**. Useful in COPD to avert intubation & reduce mortality. May also reduce mortality in patients with immunosuppression presenting with hypoxemic respiratory failure.	Can have volutrauma	**Backup RR, IPAP, T_i, Risetime, EPAP, FIO2** **8 bpm, 16 cmH_2O, 1 sec, 0.15 sec, +8, 60%**	Ventilation Volumes
AVAPS Adaptive volume assured pressure support (a.k.a. iVAPs)	Hybrid mode that dynamically adjusts inspiratory pressure (IPAP) to deliver a desired tidal volume. (Analogous to PRVC/VC+ modes) T - time/pressure/flow, C – volume, L - volume	Ensures minimum **ventilation** (within a desired pressure range). Not proven superior	Can have volutrauma With greater patient effort (e.g. gasping) will provide less support.	**Backup RR, Goal TV, P_{min}, P_{max}, Risetime, PEEP, FIO2** **8 bpm, 450cc, 10, 20, 0.15 sec, +8, 60%**	Ventilation pressures & volumes

Therapy is required that mandates intubation

- Severe Head Injury – Hyperventilation
- Combative – Need to evaluate/treat
- Surgical intervention/ anesthesia
- Other

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Evaluating the airway

- **Dentition**
  - prominent upper incisors, receding chin
- **Distortion**
  - edema, blood, vomitus, tumor, infection
- **Disproportion**
  - short chin-to-larynx distance, bull neck, large tongue, small mouth
- **Dysmobility**
  - TMJ and cervical spine immobility

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Lemon Law*

- Look Externally
- Evaluate the 3-3-2 Rule
- Mallampati
- Obstruction
- Neck Mobility

*Walls RM, Murphy MF (2008). *Manual of Emergency Airway Management; 3rd edition*. Philadelphia: Lippincott Williams and Wilkins.

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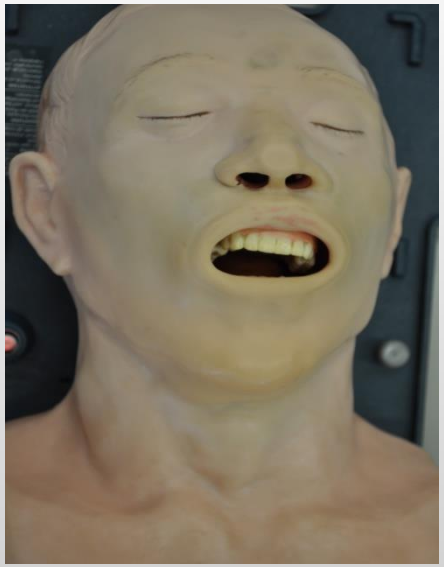
Look Externally

- abnormal face shape
- sunken cheeks
- edentulous
- "buck teeth"
- receding mandible
- "bull-neck"
- narrow mouth
- obesity
- face or neck pathology



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Dentition

- Overbite can impose a variable degree of limitation on alignment of axes during intubation
- Remove teeth that might dislodge during laryngoscopy
- Remove dentures

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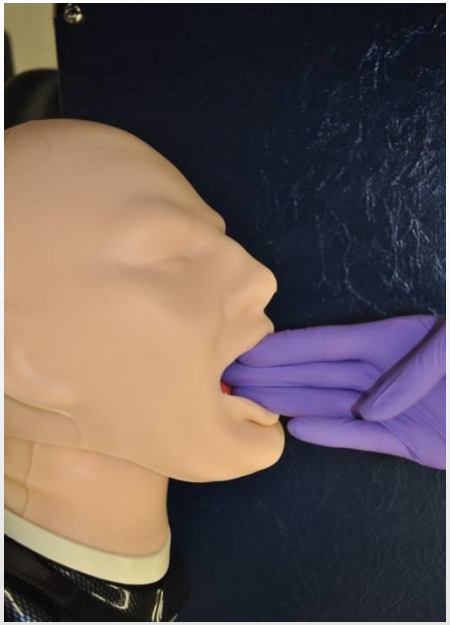
Evaluate the 3-3-2 Rule

Mouth opening > 3F



(F=fingerbreadths)

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Evaluate the 3-3-2 Rule

- Hyoid-chin distance > 3F

(F=fingerbreadths)

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Evaluate the 3-3-2 Rule

Thyroid cartilage - mouth floor distance > 2F

(F=fingerbreadths)

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3-3-2 rule not met,
anticipate challenging anatomy

< 3F

< 3F

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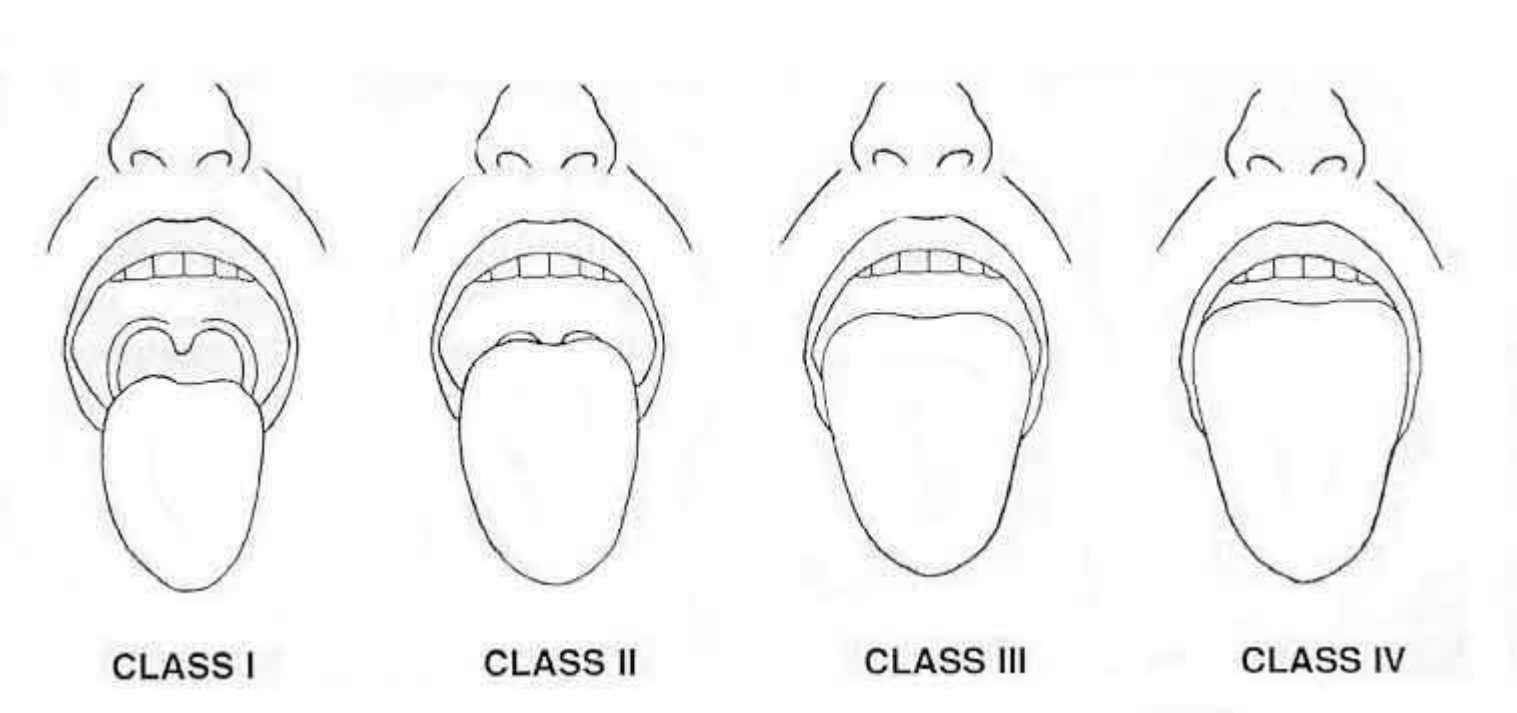
Mallampati Airway Classification



Classes III & IV are associated with difficulty

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Obstruction

- Peri-tonsillar abscess
- Epiglottitis
- Retro-pharyngeal abscess
- Blood
- Tumor

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Neck Mobility

- Extension of the neck at the atlanto-occipital joint brings the oral, pharyngeal, and laryngeal axes into alignment.

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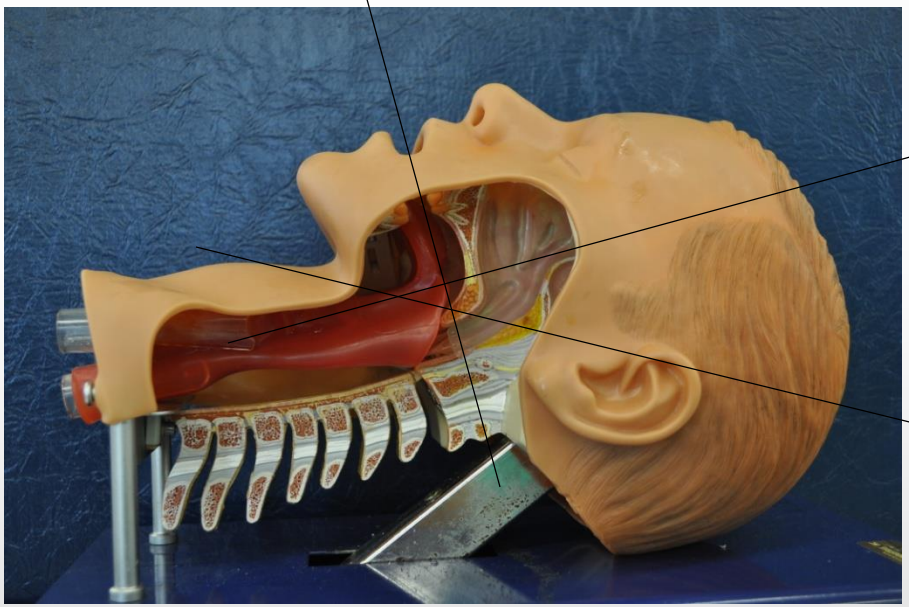
Aligning the Axes
(creates a more direct approach for ventilation during BVM and improved visualization of vocal cords during intubation)



Head on bed, neutral position

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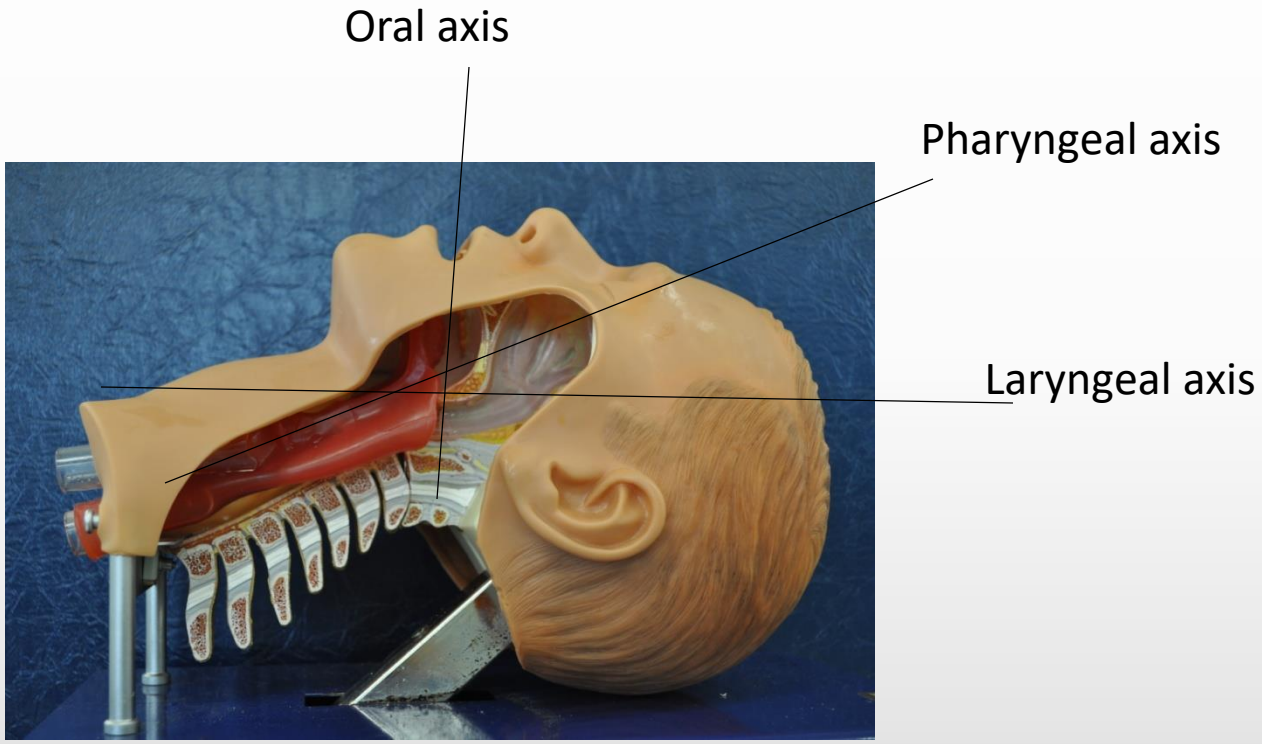
Aligning the Axes



Head Elevated, neutral position

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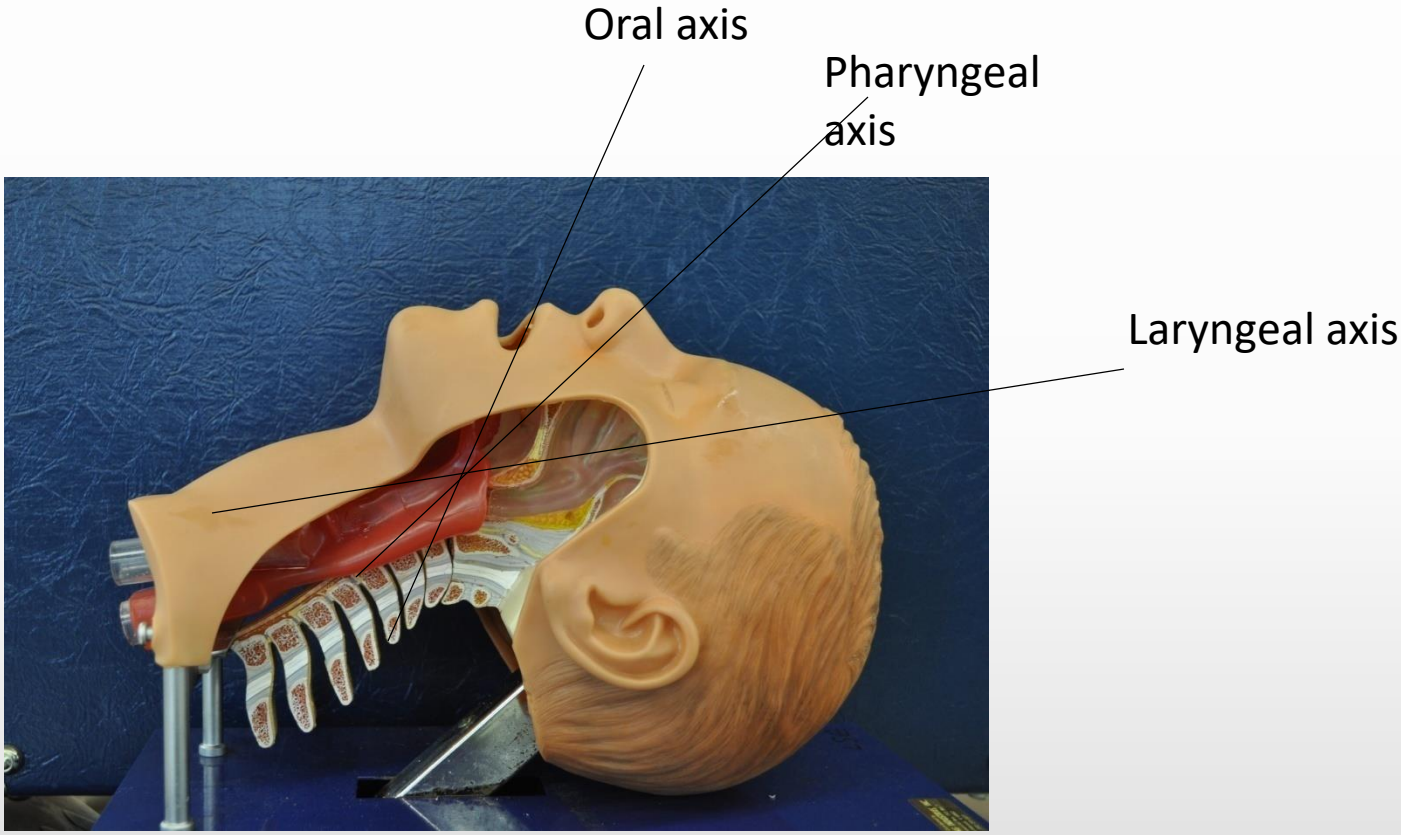
Aligning the Axes



Head elevated and extended

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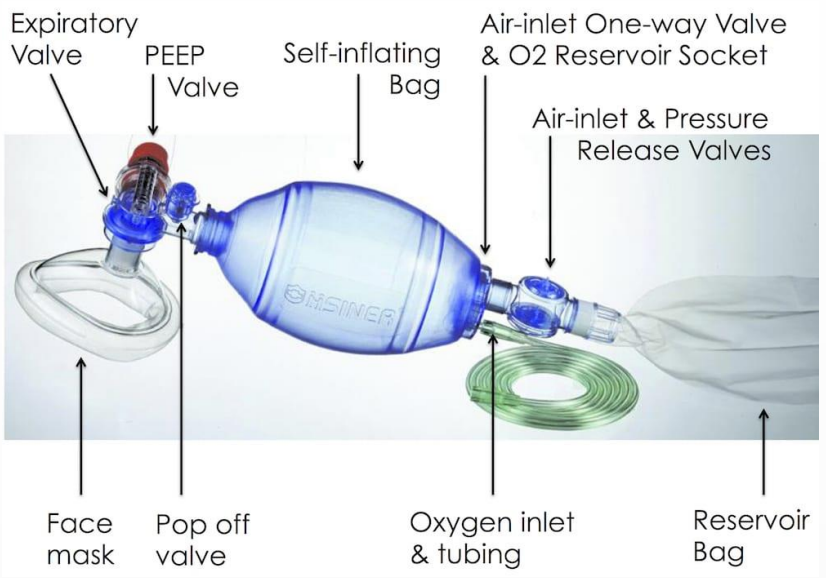
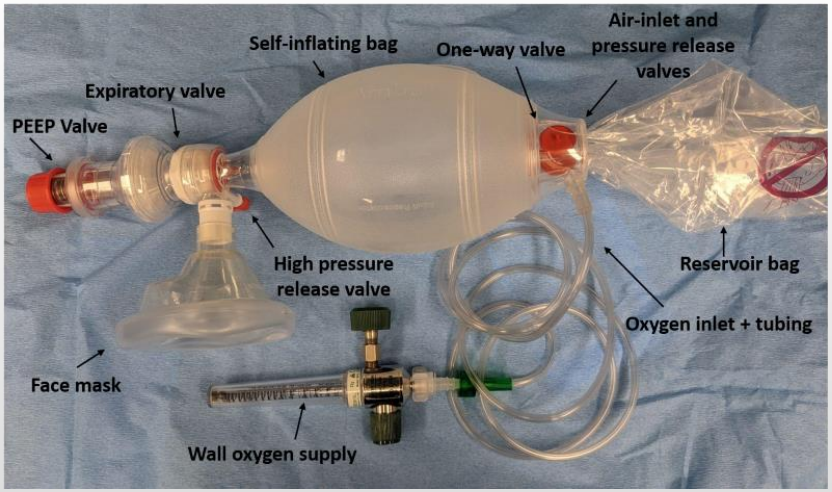
Bag Valve Mask

- Make sure it is the right size
  - Adult
  - Child
  - Infant
- Facial Landmarks
  - Bridge of nose
  - Malar eminences
  - Mandibular alveolar ridge

Bag Valve Mask

- Anatomy of a BVM
- Delivers 90 to 97% oxygen
  - Spontaneously breathing
  - Ventilated





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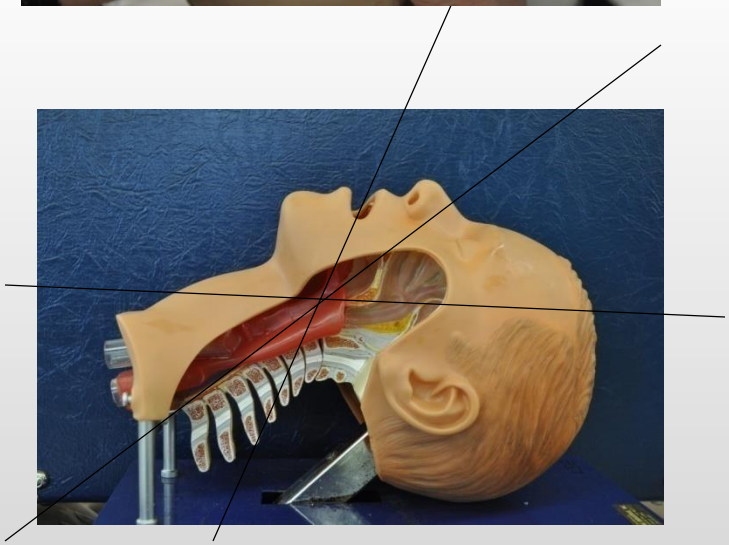
Bag valve mask

- Use both hands to make a seal (two operators)
- Lift the jaw
- Align the axes



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Single-operator BVM

- Use one hand to make a seal
- Use other hand to deliver breaths
- Lift the jaw
- Align the axes

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MOANS*

- BVM assessment/ difficulty is anticipated if these factors are present:
  - **M**: **M**ask seal difficulty
    - (Beards and facial injuries)
  - **O**: **O**besity, obstruction
  - **A**: **A**ge (>55)
  - **N**: **N**o teeth
  - **S**: **S**tiff (also **s**leep apnea and **s**noring)
    - Decreased lung compliance

*Walls RM, Murphy MF (2008). *Manual of Emergency Airway Management; 3rd edition*. Philadelphia: Lippincott Williams and Wilkins.

**The Difficult Airway Course™*

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Bag Valve Mask

- Use adjuncts
  - Nasopharyngeal Airway
  - Oropharyngeal Airway

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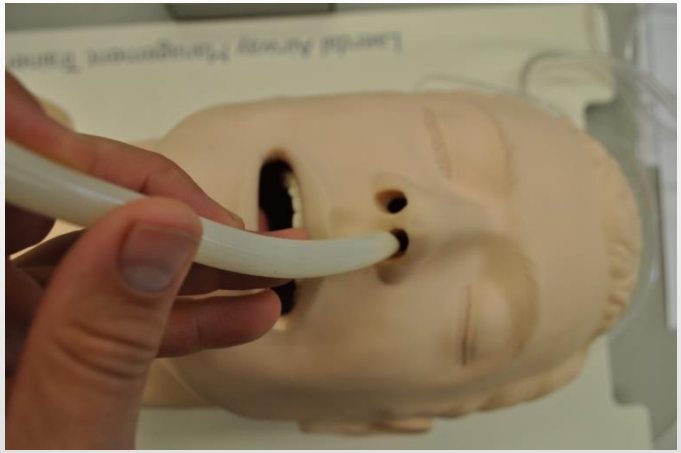
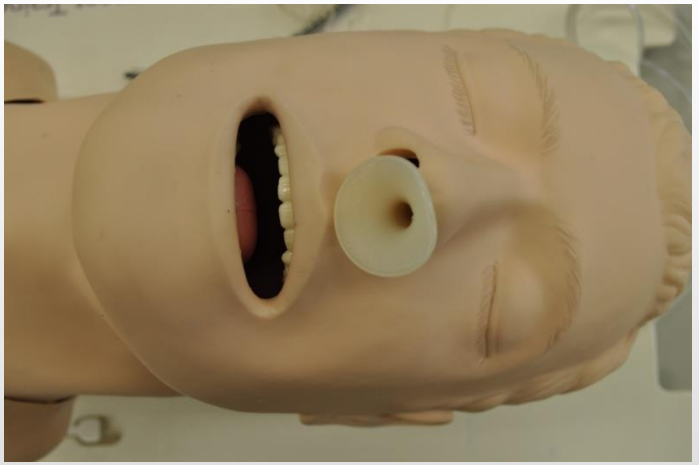
Adjuncts

- Nasopharyngeal Airway
  - Advance until airflow heard
  - Can be used in semi-conscious patient





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BVM adjuncts

- Oropharyngeal Airway
  - Unconscious / No gag (could result in vomiting if not)
  - Insert with tongue blade or rotate




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EMCrit Call/Response Intubation Checklist

Plan

HOp Killers-Hemodynamics, Ox, pH
RSI · Awake · DSI · RSA · ICP/Vascular
Induction Agent/Muscle Relaxant
Push-Dose Pressors
Failed Airway Plan Verbalized
Cric-Con Evaluation (± Mark/Inject)
Post-Intubation Sedation

Patient Prep

Denitrogenation
Oxygenated (Consider CPAP)
Look in Mouth · Dentures
Positioning
(Face Parallel, Ears/Notch, 30° Head-Up, Collar Plan)
Monitors (Pulse Ox Visible)
Reliable Access
Nasal Prongs for ApOx
± Gastric Tube

Equipment

Table
BVM (± PEEP Valve) on Oxygen
Waveform Capnograph on BVM & Tested
Video Laryngoscope
Intubation Equipment
(Tube, 2x Bend Stylet, 2 Syringes, Back-Up Laryngoscope, OPA, Tube-Securing Device)
Failed Airway Equipment at Bedside
(At minimum: Bougie, SGA, Scalpel)
Suction x 2

Team

Roles Assigned for Each Stage of Failed Airway Plan
Pulse Ox Watcher/Reoxygenation Role Assigned
ELM/Head Elev. Assistant Briefed
Team is all in PPE

by Weingart S, Nickson C, Rabinovich J, Strayer R.
version 2013-02-06

Fold and use only this side during Checklist Procedure

Awake Intubation

- **Glycopyrrolate** 0.2 mg IV & **Ondansetron** 4mg IV (give as early as possible)
- Suction mouth and then pad dry with gauze
- **Nebulized Lidocaine 4%** 3ml @ 6 lpm
- **Atomized Lidocaine 4%** 3ml sprayed into posterior oropharynx
- **Viscous Lidocaine lollipop** 2%, *place on tongue depressor*
- Preoxygenate
- Position
- Restrain arms
- Switch to nasal cannula at 15 lpm
- Sedate with aliquots of **Ketamine** (10-20 mg) or 1-2 ml **Ketamine-Heavy Ketofol** (75 mg Ketamine, 25 mg propofol in the same syringe)
- **Atomized Lidocaine 4%** 3ml sprayed through cords
- Intubate awake or place bougie, then sedate/paralyze

Pretreatment

3-5 minutes prior to intubation

- **Lidocaine** 1.5 mg/kg for High-ICP/Vascular with elevated BP
- **Fentanyl** 3 mcg/kg for High-ICP/Vascular with elevated BP (alternatively Remifentanil 3 mcg/kg)
- **Scopolamine** 0.4 mg for amnesia in hypotensive pt intubation

Info

Go to emcrit.org/airway

Initial Post-Intubation Analgo-Sedation

- **Fentanyl** 2 mcg/kg bolus then 1 mcg/kg/hr
  or
- **Hydromorphone** 0.5-1 mg bolus then repeat q 10 minutes until analgesia

and

- **Midazolam** 0.05 mg/kg bolus then 0.025 mg/kg/hr
  or
- **Propofol** 0.5 mg/kg bolus then 20 mcg/kg/min
  or
- **Ketamine** 1 mg/kg bolus then 0.3 mg/kg/hr

Titrate to calm, spontaneously-breathing patient

Cric-Con

- All Airways: Discuss/Feel/See Kit (5)
- Diff. but Stable: Mark/Kit to Bedside/US (4)
- Diff. & Hypoxemic: Inject / Prep / Open Kit / Scalpel in Hand (3)

Push-Dose Epi

- In a 10 ml syringe, add 9 ml NS
- Into this syringe draw up 1 ml of **Cardiac-Arrest (1:10000) Epinephrine**
- Shake Syringe Hard
- Label "Epinephrine 10 mcg/ml"
- Dose 0.5-2 ml (5-20 mcg) q 1-3 min
- Throw away at end of shift if unused

Intubation Meds

Drug	Normotensive Dose	Normotensive Dose (70 kg Pt)	Hypotensive Dose
Ketamine	2 mg/kg	140 mg	0.5 mg/kg
Ketofol (100 mg ketamine, 100 mg propofol to make 20 ml)	0.2 ml/kg	14 ml	[redacted]
Etomidate	0.3 mg/kg	20 mg	10 mg
Propofol	1.5-3 mg/kg	150 mg	15 mg
Succinylcholine	1.5-2 mg/kg	140 mg	2 mg/kg
Rocuronium	1.2 mg/kg	80 mg	1.6 mg/kg
Vecuronium	0.3 mg/kg	20 mg	[redacted]

Sux Contra

- Malignant Hyperthermia History
- Strokes with hemiparesis > 72 hours old
- ICU Stay > 2 weeks
- Burns/trauma > 72 hours old
- NMJ Disease
- Myopathies/Muscular Dystrophies
- Preexisting Hyperkalemia or Strong suspicon
- Guillain-Barre

Initial Vent

- Assist Control/Volume Mode
- Vt 8 ml/kg IBW
- RR 16 (10 in asthma/copd)
- IFR 60 l/min
- PEEP 5 (0 in asthma/copd)
- FiO2 40%

Low pH Tube

- Place on Vent (SIMV-Volume, Vt 550, FiO2 100%, IFR 30 lpm, PS 10, PEEP 5, RR 0)
- Place on ETCO2
- RSA or Vent as Bag (Change RR to 16)
- Change Vent to (IFR 60 lpm, RR 30, VT 8 ml/kg, FiO2 40%)
- Confirm same ETCO2 and send ABG

AirQs

- Females: 3.5, 7.5 ET Max, inflate 4 ml, 18 cm to tip
- Males: 4.5, 8.5 ET Max, inflate 5 ml, 20 cm to tip

Pre-oxygenation

- Administer 100% O2 for 5 minutes
- Nitrogen Washout
- 3-5 minutes of apnea before <90% sat
- “No-Bagging”

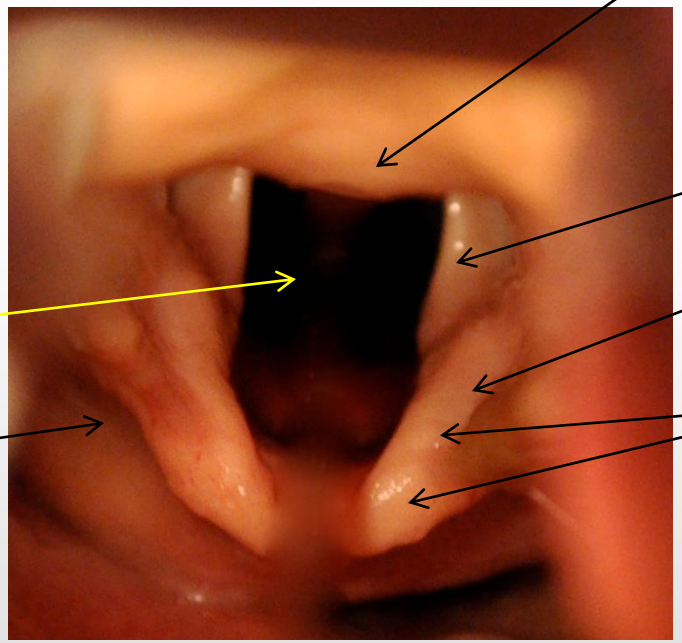
East Alabama Health

Intubation

- Anatomy
- Endotracheal Tube
- Laryngoscopes
  - Miller
  - Macintosh
  - Glidescope
- Procedure
- Adjunctive Procedures

East Alabama Health

Anatomy



East Alabama Health

Intubation

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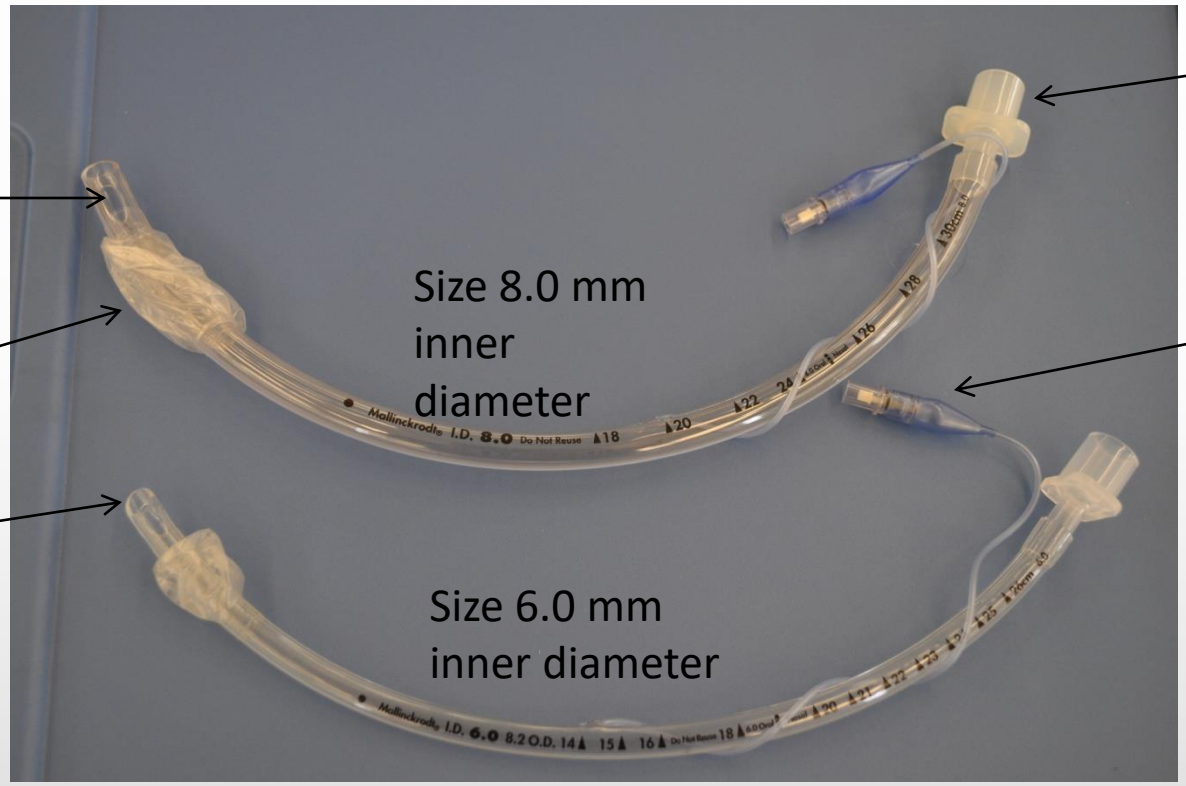
Endotracheal Tube Anatomy



Adult Size: 7.5-8.5 mm inner diameter (generally)

East Alabama Health

Intubation

- Anatomy
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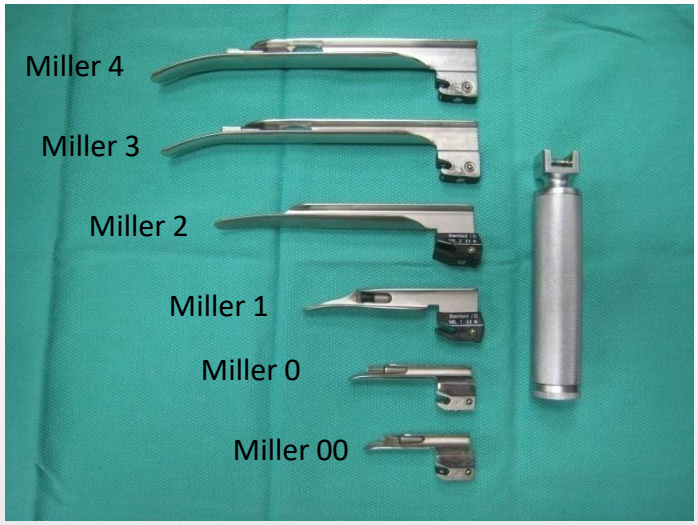
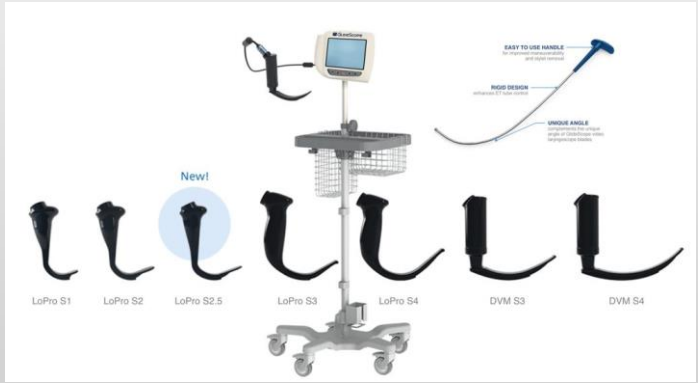
East Alabama Health

Laryngoscope Blades

- Macintosh (curved)
  - Sizes 0-4
  - Placed in vallecula
  - 3-4 for most adults
- Miller (straight)
  - Sizes 00-4
  - Lifts epiglottis
  - 2-3 for most adults
- Glidescope hyperangulated blade
  - Size 3 for most adult patients





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Intubation

- Anatomy
- Endotracheal Tube
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  - Miller
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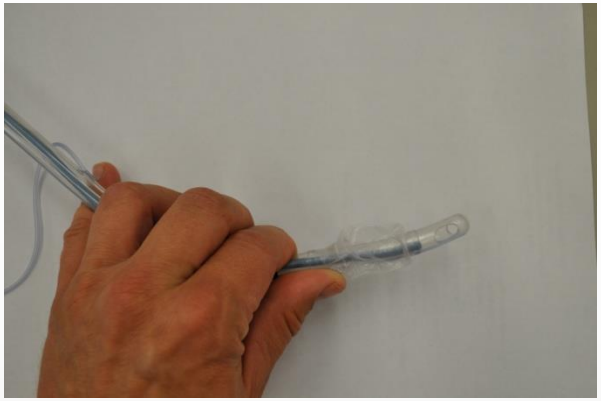
Preparation

- Select appropriate size
- Have next size up/down available
- Place stylet inside tube – provides rigidity
- Be sure stylet does not protrude through end of ETT – this can cause tracheal damage during insertion
- Curve tube manually – or create a bend in stylet before inserting into ETT
  - Ridgid and curved stylet for Glidescope already in standard position typically.
- Inflate/deflate balloon to test balloon integrity
- Have available equipment: BVM hooked up to O2, medications, suction, bougie/ backup plan



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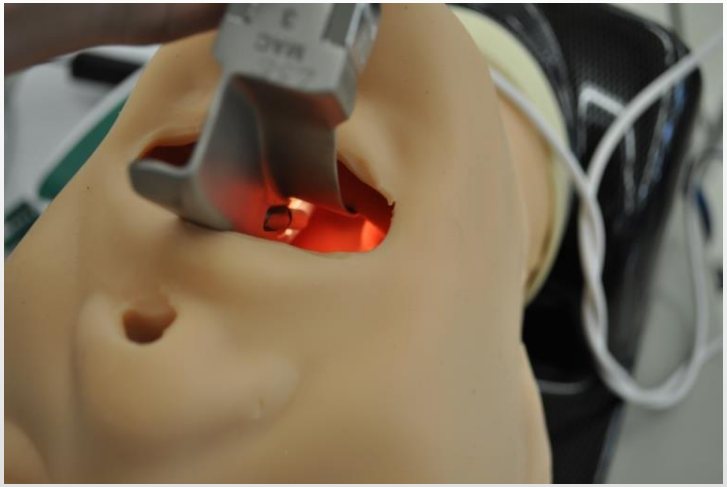
The Procedure (direct visualization)

- Place patient in the proper position
- Align the axes
- Hold laryngoscope with left hand
- Introduce blade into right side of the mouth
- Sweep tongue left



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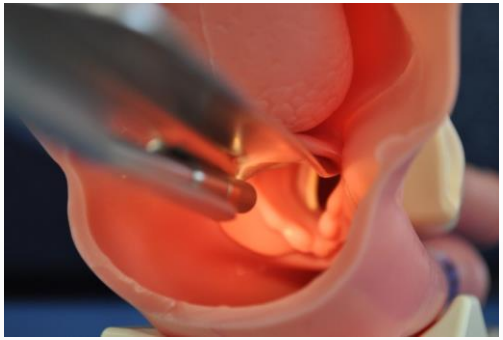
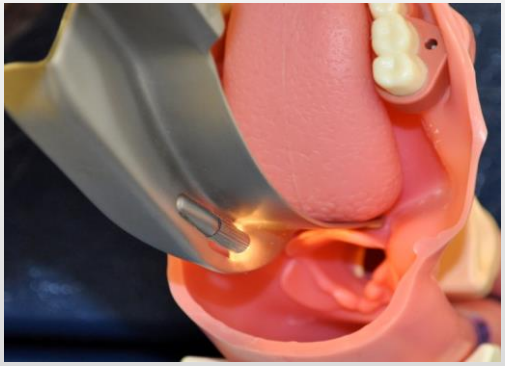
The Procedure

- Straight blade: lift epiglottis
  - Advance straight blade blindly and gently until it is in the esophagus
  - Slowly withdraw blade under visualization until the epiglottis/cords are exposed



- Curved blade: place in valeculla and lift
  - Advance curved blade along the tongue until it is in the valeculla



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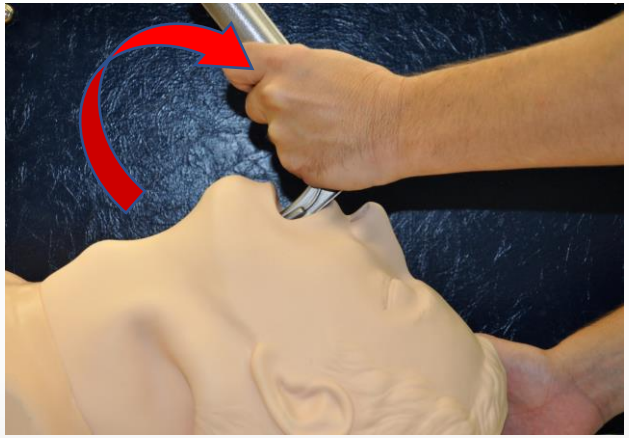
Correct

Incorrect



- Once blade is positioned correctly, lift entire laryngoscope upwards and outwards.
- This flips the epiglottis upwards and exposes the glottis below.

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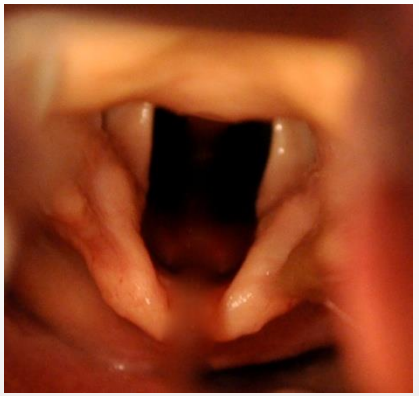
Placing the endotracheal tube

- Once cords are visualized, maintain your view
- Ask for ET tube - an assistant should place tube into your right hand
- Place ET tube into patient's mouth from the side
- Assistant may pull patient's lip gently to the right to facilitate passage of ET tube
- Do not obstruct your view – do not avert your view of cords



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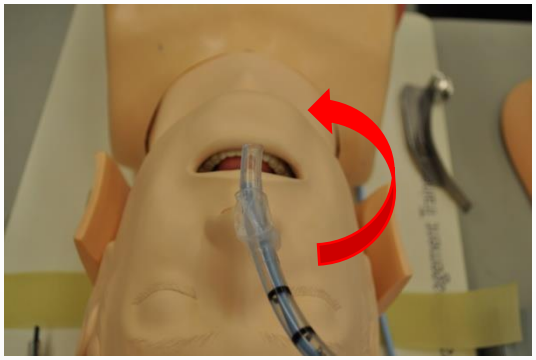
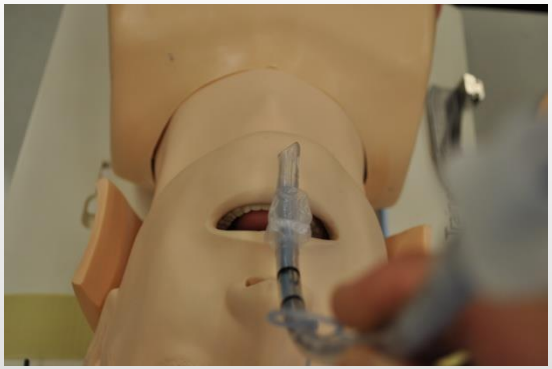
Passing the ET tube

- Rotate tube 90^0 to align bevel with cords
- Advance ET tube through the cords
- Visualize tube passing through cords
- Avoid right mainstem intubation
- Inflate and check balloon
- Secure tube - generally 23 cm at teeth in male, 21 cm in female





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Video laryngoscopy

1. Look in the mouth to introduce laryngscope
2. Look at the screen for best glottic view
3. Look in the mouth to introduce the tracheal tube
4. Look at the screen to intubate

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Look in the mouth to introduce laryngoscope

- Note scissor technique
- With Video laryngoscopy, you insert midline

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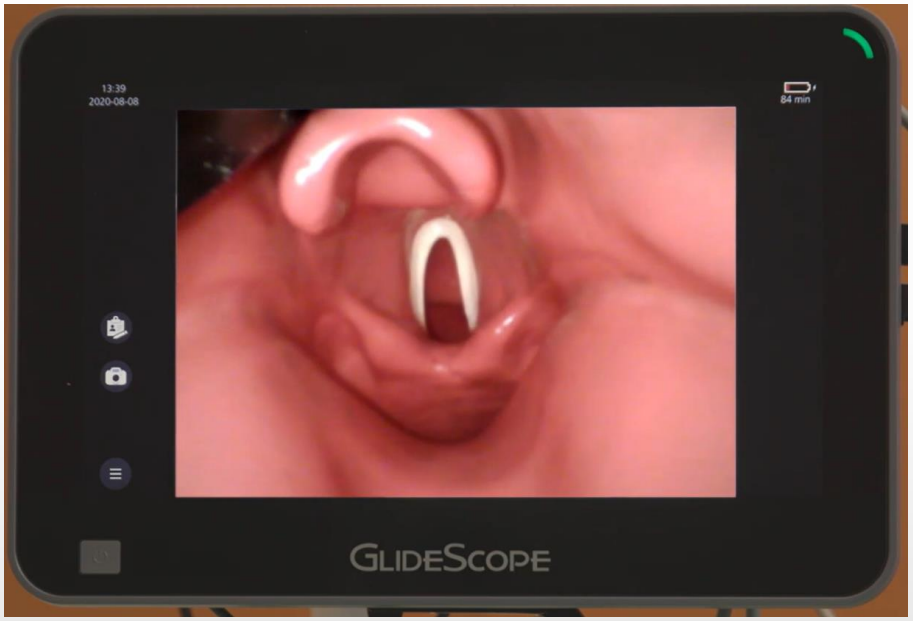
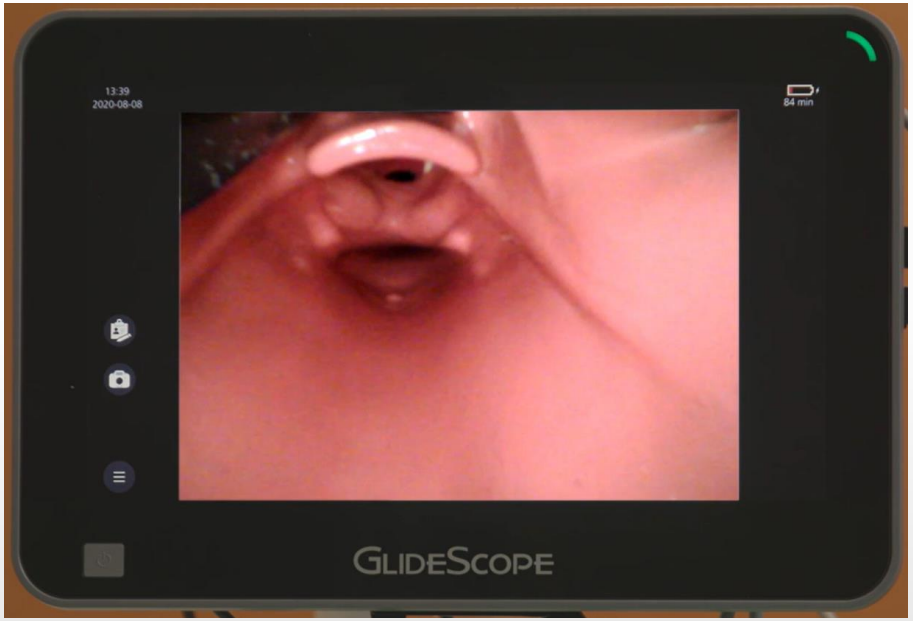
Look at the screen for best glottic view





Which is better?

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Look in the mouth to introduce the tracheal tube

Follow until you reach and pass the posterior oropharynx to prevent soft palate and mucosal injury

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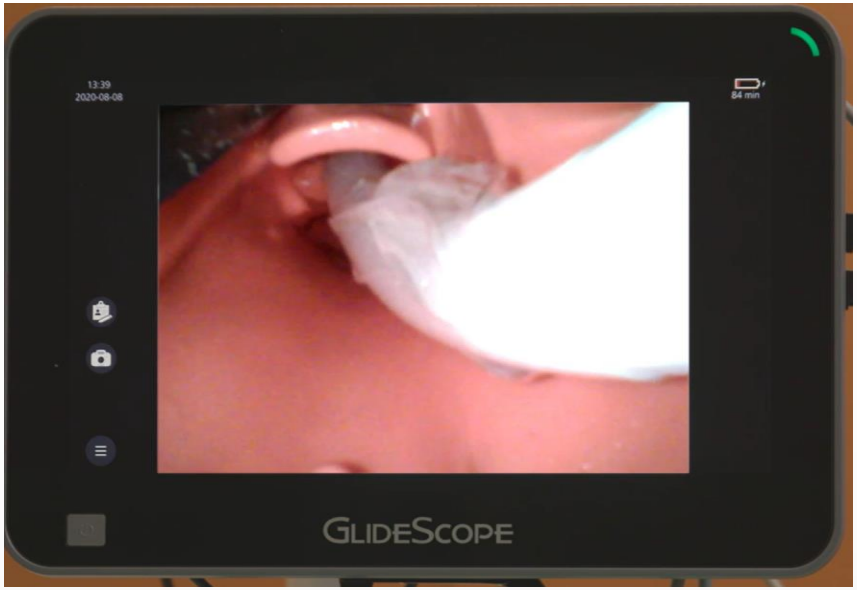
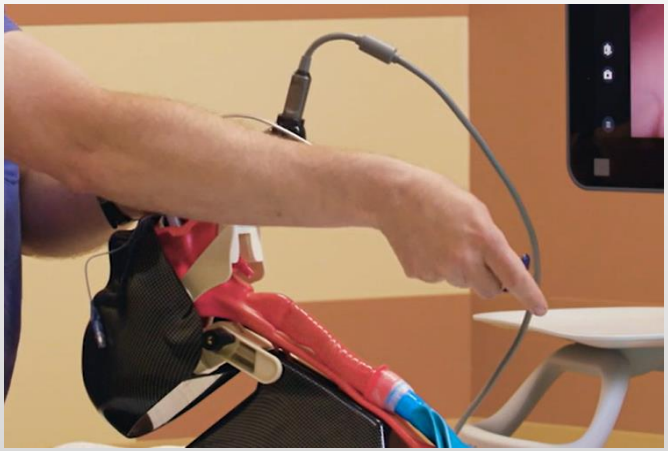
Look at the screen to intubate

- Not tube passing just over the arytenoid cartilage.



"Pop" the stylet and complete insertion

Remove the stylet out and away from you to avoid grabbing the ETT



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Intubation

- Anatomy
- Endotracheal Tube
- Laryngoscopes
  - Miller
  - Macintosh
- Procedure
- Adjunctive Procedures

East Alabama Health

Sellick's Maneuver

- Pressure on anterior cricoid cartilage
- Occludes esophagus & prevents passive regurgitation
- Commence with RSI
- Release when balloon is up

May reduce airway patency and worsen laryngeal view

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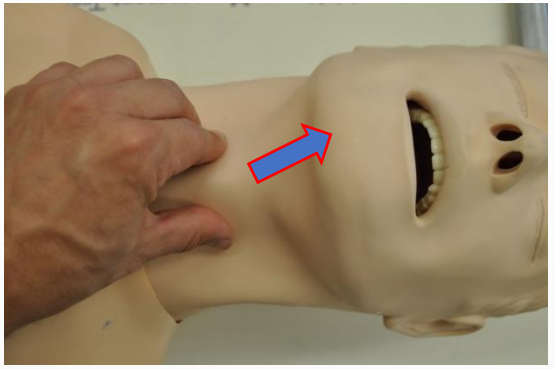
BURP Maneuver

- Backwards
  - Posterior Pressure
- Upwards
  - Tilt Larynx upwards
- Rightward (patient's right)
  - Move larynx to right
- Pressure



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BURP maneuver

- Consider performing it yourself with your right hand during laryngoscopy with left hand

  - When optimal view is achieved, ask assistant to perform maneuver in that position

  - You right hand is now free for ET tube placement

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Goals and Objectives

- Discuss the indications for intubation
- Review airway assessment
- Explore methods for aligning the axes
- Investigate the concept of bag valve mask
- Review the basic steps for intubation
- Discuss post intubation steps

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Confirmation of ETT placement

- Pulse Oximetry
- Capnography
- Fogging of the tube
- Auscultation
- Chest wall motion
- CXR

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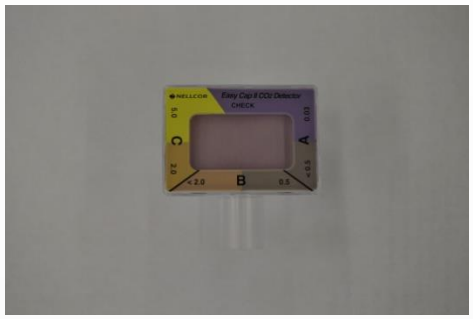
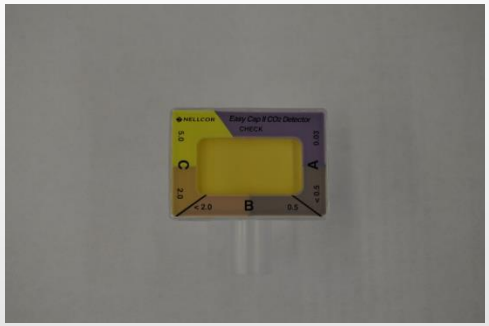
End Tidal CO_2 detection

- Colorimetric capnometry
  - Color change signifies correct placement
  - Turns from purple to yellow
- Continuous capnography
  - Waveform and CO_2 level can be monitored continuously
- Emesis may alter response
- Low flow state may cause slow change
- May take a few breaths
  - To exchange dead space





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Problems after Intubation

- DOPE
  - **D**isplaced tube
    - *Lung sounds and CXR*
    - *Direct visualization*
  - **O**bstructed tube
    - *Biting tube, secretions, mucous plug, etc.*
  - **P**neumothorax
    - *Lung sounds, sub-cutaneous air? and CXR*
  - **E**quipment failure
    - *Remove from ventilator and manually bag ventilate*

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References

- *The Difficult Airway Course™*
- Walls RM, Murphy MF (2008). *Manual of Emergency Airway Management; 3rd edition*. Philadelphia: Lippincott Williams and Wilkins.
- Naguib M, Scamman FL, O'Sullivan C, Aker J, Ross AF, Kosmach S, Ensor JE. Predictive performance of three multivariate difficult tracheal intubation models: a double-blind, case-controlled study. Anesth Analg. 2006 Mar;102(3):818-24.
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- Orebaugh SL. Difficult airway management in the emergency department. J Emerg Med 2002; 22:31.

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Airway Management Algorithms and RSI

Trey Wages, MD

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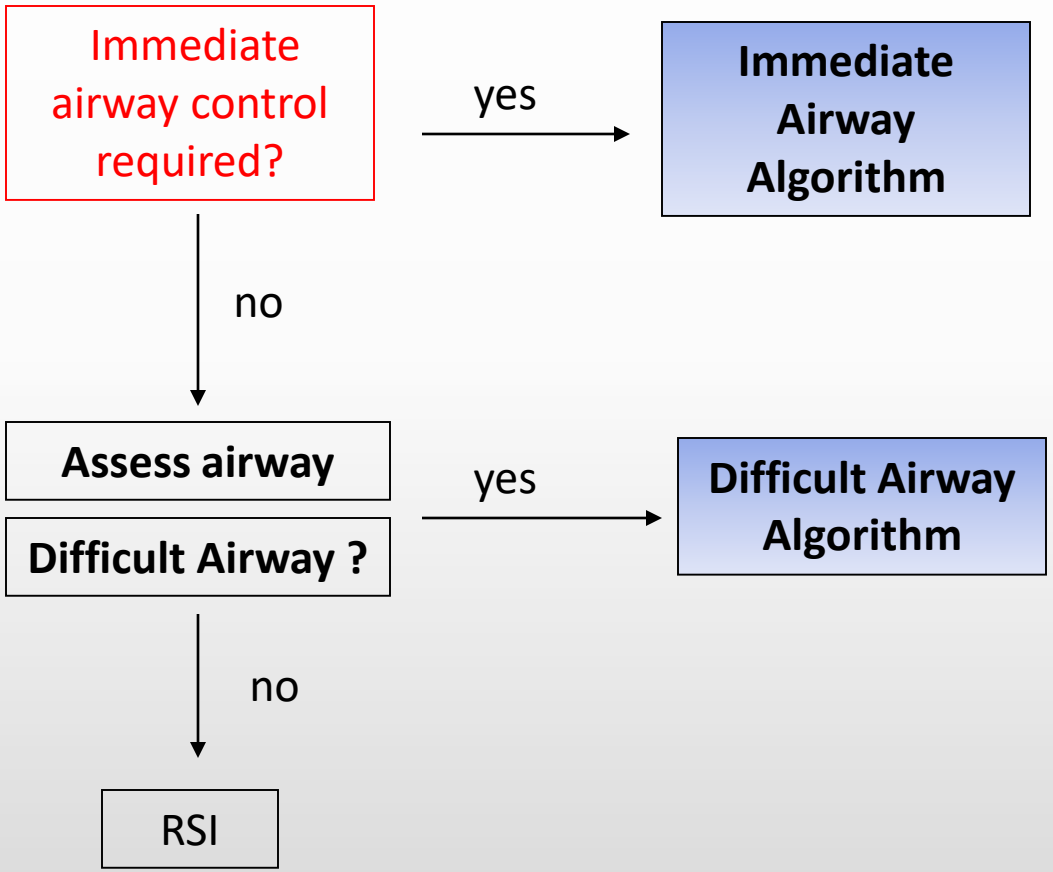
Airway Algorithm
Basic Approach



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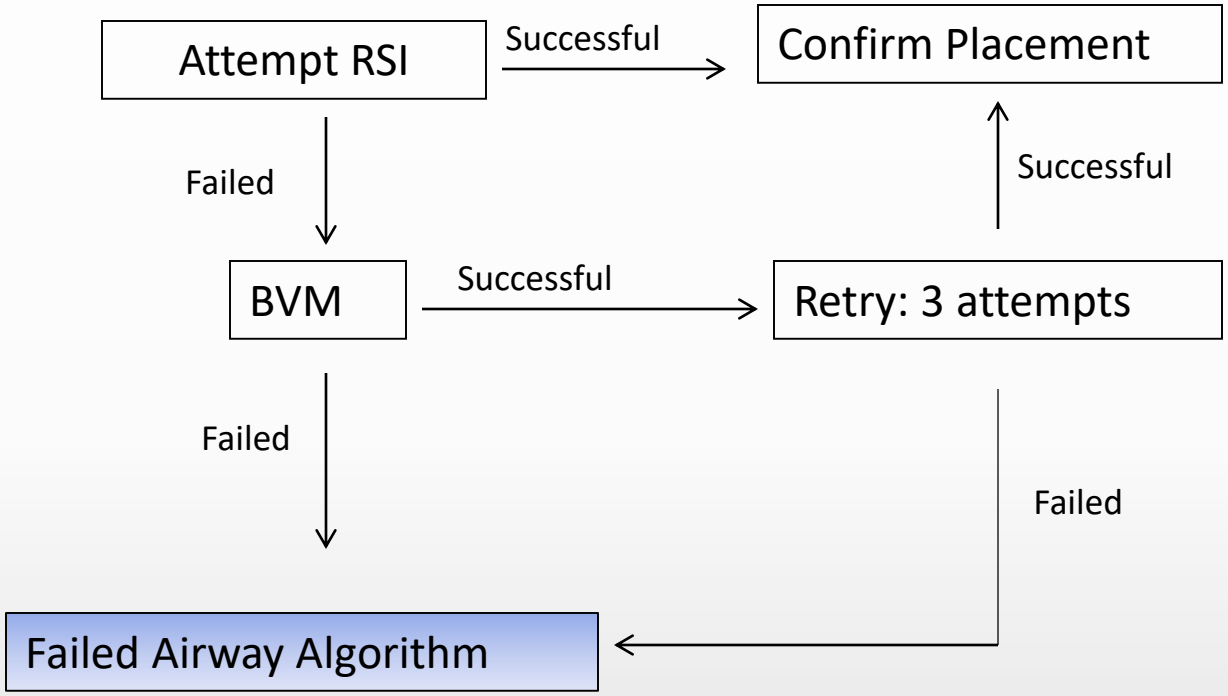
Airway Algorithm



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Airway Algorithms

Immediate Airway Algorithm	Patient is unresponsive and/or respiratory failure is present
Difficult Airway Algorithm	Difficult airway is predicted or confirmed by previous attempt
Failed Airway Algorithm	The patient cannot be intubated or oxygenated…or…3 failed attempts

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Airway Algorithms

Immediate Airway Algorithm

Patient is unresponsive and/or respiratory failure is present

Difficult Airway Algorithm

Difficult airway is predicted or confirmed by previous attempt

Failed Airway Algorithm

The patient cannot be intubated or oxygenated…or…3 failed attempts

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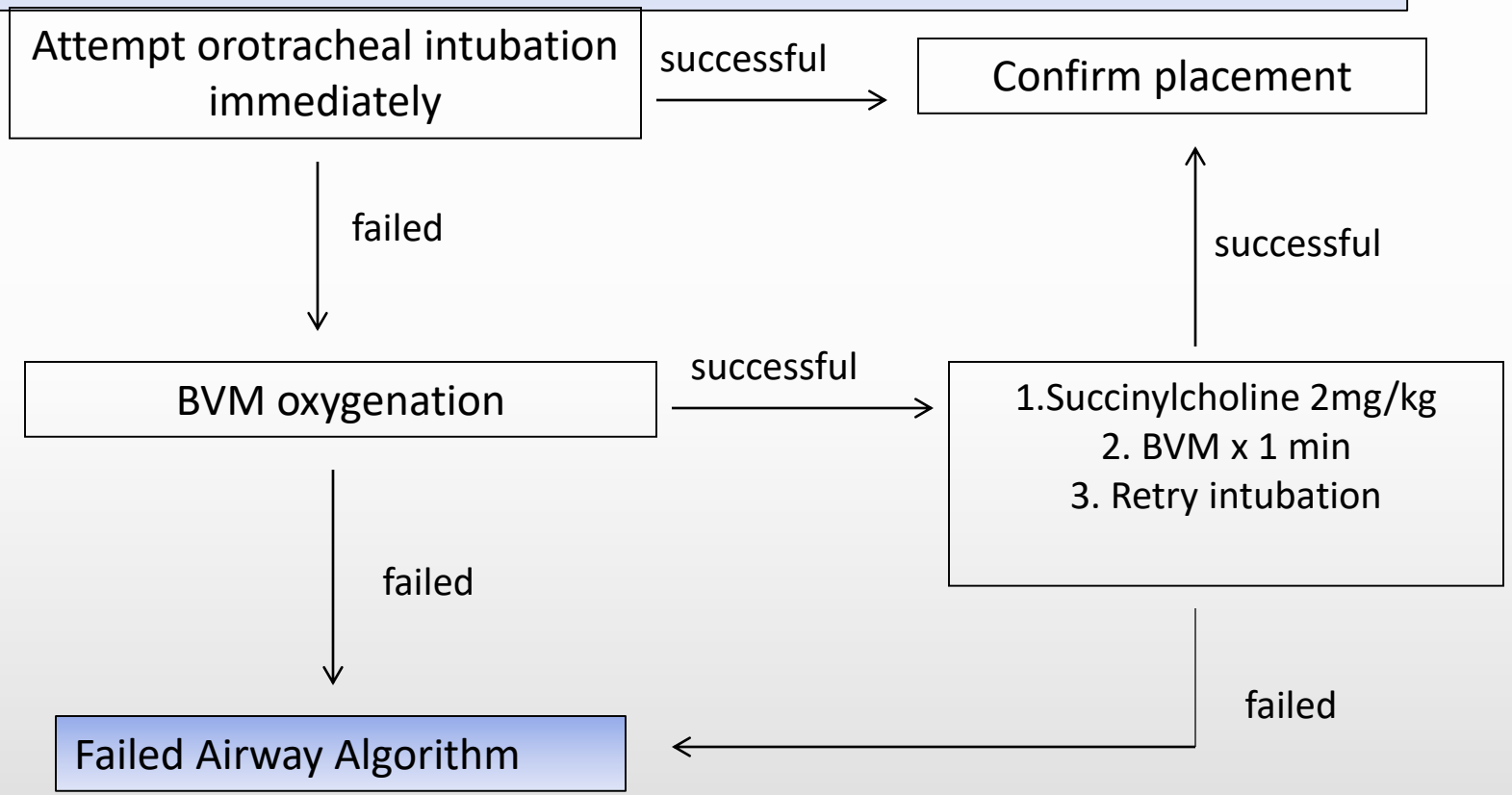
Immediate Airway Algorithm



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Airway Algorithms

Immediate Airway Algorithm

Patient is unresponsive and/or respiratory failure is present

Difficult Airway Algorithm

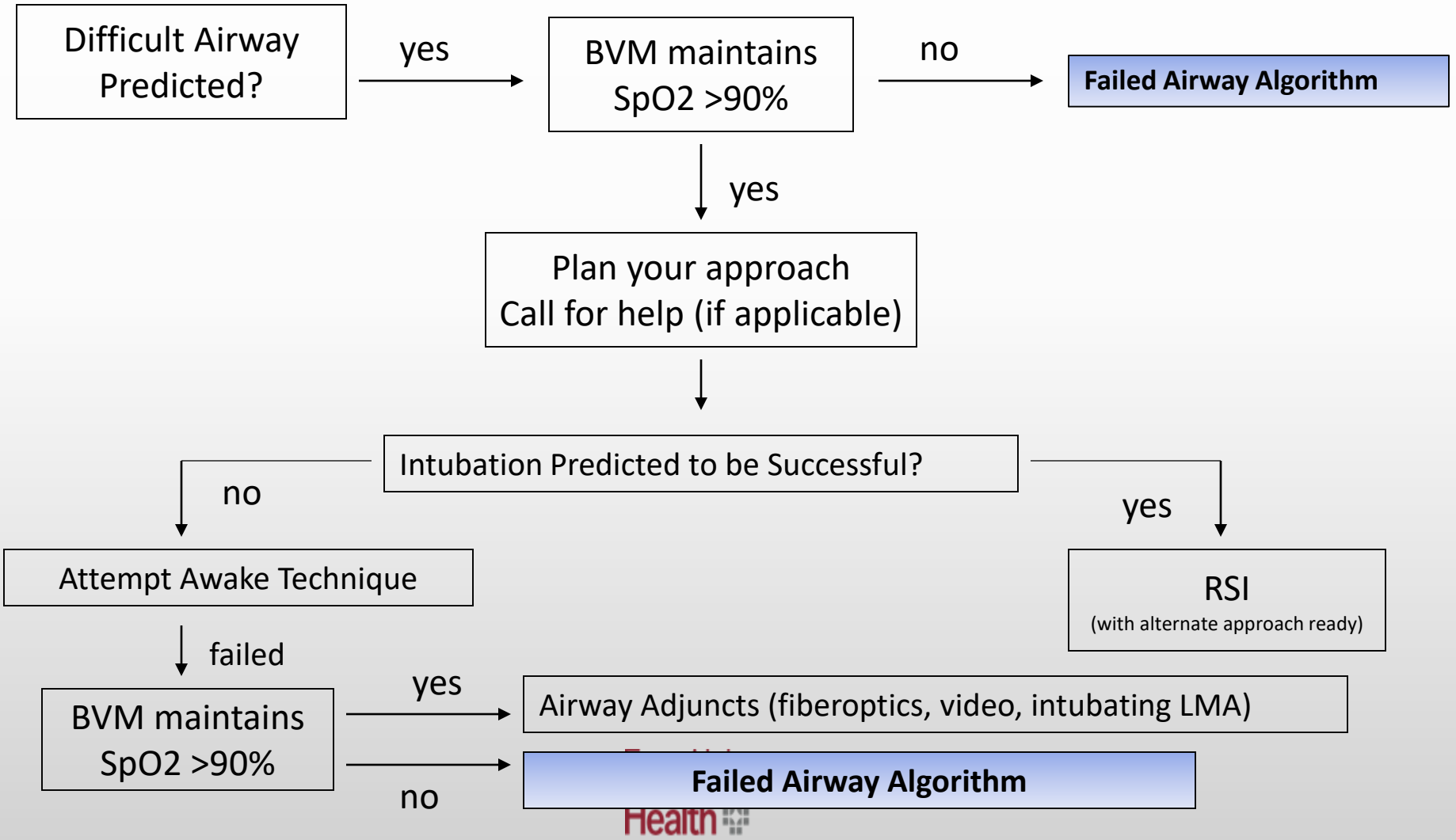
Difficult airway is predicted or confirmed by previous attempt

Failed Airway Algorithm

The patient cannot be intubated or oxygenated…or…3 failed attempts

East Alabama Health

Difficult Airway Algorithm



Airway Algorithms

Immediate Airway Algorithm

Patient is unresponsive and/or respiratory failure is present

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Difficult airway is predicted or confirmed by previous attempt

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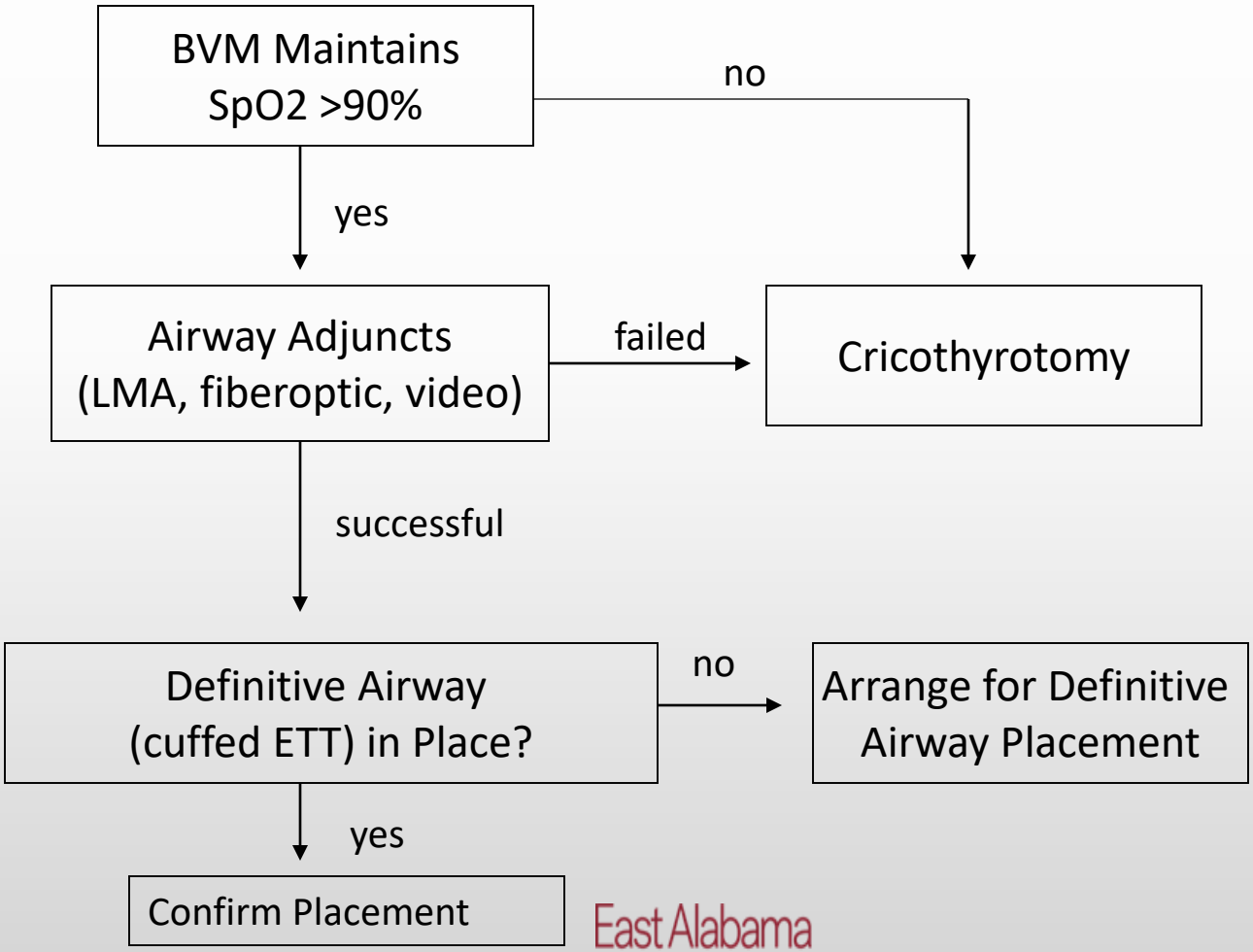
East Alabama Health

Failed Airway Algorithm



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Predicting a Difficult Airway

- Anticipation of the difficult airway can be critical to avoiding disaster
- Several assessment tools and scoring systems have been developed
- No single method has been proven or validated

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Question: Do you regularly evaluate patients prior to intubation?

These tools may help you anticipate difficulty with different aspects of airway management…

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Airway Assessment Tools

- Several assessment tools for predicting intubation difficulty[%]
  - Examples: Wilson risk score, Arné model, Naguib model
  - Most found in anesthesiology literature
  - Vary in sensitivity and specificity

- Some require measurement of patient height, weight, neck circumference, neck length, neck movement
  - Not always feasible in ED patients

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Airway Assessment Tools

- Simple tools for airway assessment in the emergency setting
- LEMON,MOANS, SHORT, RODS*

The Difficult Airway Course™

***Walls RM, Murphy MF (2008). *Manual of Emergency Airway Management; 3rd edition*. Philadelphia: Lippincott Williams and Wilkins.**

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MOANS*

- BVM difficulty is anticipated if these factors are present:
  - **M**: **M**ask seal difficulty
    - (Beards and facial injuries)
  - **O**: **O**besity, obstruction
  - **A**: **A**ge (>55)
  - **N**: **N**o teeth
  - **S**: **S**tiff (also **s**leep apnea and **s**noring)
    - Decreased lung compliance

**The Difficult Airway Course™*

*Walls RM, Murphy MF (2008). *Manual of Emergency Airway Management; 3rd edition*. Philadelphia: Lippincott Williams and Wilkins.

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LEMON*

- Helps predict challenging laryngoscopy:
  - **L**: **L**ook externally
  - **E**: **E**valuate 3:3:2
    - 3 finger breadth mouth opening
    - 3 finger breadth submental distance
    - 2 finger breadth thyromental distance
  - **M**: **M**allampatti Score
  - **O**: **O**bstruction
  - **N**: **N**eck Mobility

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SHORT*

- Cricothyrotomy difficulty is anticipated if these factors are present:
  - **S**: **S**urgery
    - Any anatomical distortion or disruption of neck/glottic region
  - **H**: **H**ematoma (or mass)
  - **O**: **O**besity
  - **R**: **R**adiation
    - Radiation therapy can disrupt anatomy and cause scarring
  - **T**: **T**umor

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RODS*

- Difficulty with an extraglottic device is anticipated with:
  - **R**: **R**estricted mouth opening
  - **O**: **O**bstruction
  - **D**: **D**isrupted or distorted airway
  - **S**: **S**tiff lungs or cervical spine

**The Difficult Airway Course™*

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Rapid Sequence Intubation

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Goals and Objectives

1. Review the principles of Rapid Sequence Intubation (RSI) and explore the fundamental steps of RSI
2. Investigate induction agent options for RSI
3. Discuss paralytic medications for RSI

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1. Review the principles of Rapid Sequence Intubation (RSI) and explore the fundamental steps of RSI
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Rapid Sequence Intubation

- Cornerstones of RSI:
  - Presumes patient has not fasted / has full stomach
  - Pre-oxygenation followed by potent induction agent and neuromuscular blocking agent
  - No interposed positive pressure ventilation
    - to minimize risk of gastric distention and aspiration

Rapid Sequence Induction

- Steps for RSI:
  - Preparation
  - Pre-oxygenation
  - Pre-treatment
  - Paralysis
  - Proof of Placement

* Be sure you can BVM patient *

* Always have a back-up plan in place *

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Preparation

- Assess patient for difficulty
- Establish plan and back-up plan
- Suction, BVM, Oropharyngeal Airway
- Monitor, IV, Pulse Ox
- Drugs drawn up
  - Intubation
  - Post-intubation care

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Pre-oxygenation

- Administer 100% O2 for 3-5 minutes (2 minutes in children)
- Or 8 deep breaths in 60 seconds
- Allows oxygen to replace nitrogen
- Permits a few minutes apnea before <90% sat
- No positive-pressure ventilation with BVM

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Pre-Treatment

- Administered to prevent the potential adverse effects of intubation including:
  - Reflex ICP increase in patients with elevated ICP
  - Sympathetic adrenergic surge in vascular emergencies
  - Bronchospastic response in patient with reactive airway disease

- Given 3 minutes before induction/paralytic agents
  - Lidocaine
  - Opioid

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Pre-Treatment

- Lidocaine
  - Mitigates ICP rise and bronchospasm
  - 1.5 mg / kg IV
- Opioid (i.e., Fentanyl)
  - Helps blunt ICP response to intubation
  - Moderates sympatho-adrenal response to intubation
  - 1-3 mcg/kg IV

East Alabama Health

Goals and Objectives

1. Review the principles of Rapid Sequence Intubation (RSI) and explore the fundamental steps of RSI
2. Investigate induction agent options for RSI
3. Discuss paralytic medications for RSI

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Induction (Sedation)

- Midazolam
- Etomidate
- Ketamine
- Propofol
- Fentanyl

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Midazolam

- Sedative hypnotic
- No effect on ICP
- May drop BP
- 60-90 second delay to onset
- Amnestic effect
- 0.1-0.3 mg/kg

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Etomidate

- Decreases ICP (minimal)
- Little effect on BP
- Myoclonic jerking
- Adrenal suppression in sepsis?
  - debated
- 0.3 mg/kg
- 30-45 seconds to onset

East Alabama Health

Ketamine

- Dissociative state
- Sympathomimetic
  - Increased BP
  - Bronchodilation
- Hypersalivation
  - Atropine
- Increased ICP?
  - Recent data does not support theory of increased ICP in patients with neurologic injury

Ketamine

- Emergence Phenomenon
  - Ativan
- 1-2 mcg/kg
- 30-45 seconds

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Propofol

- Quick onset
- Brief duration of action
- Hypotension
  - Decreased peripheral resistance
  - Pretreatment with fluid bolus
- In patient with poor LV function, loss of preload and PPV can prove fatal

Propofol

- 1-2 mg/kg
- 10-15 seconds
- Maintenance infusion

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Fentanyl

- Opioid
- Rapid onset
- Generally neutral BP effect – can cause decrease
- Chest wall rigidity
  - Not reversed with Narcan
  - Paralysis
- 1-2 mcg/kg

Remifentanil

- More rapid onset
- Extremely brief duration
- 1-2 mcg/kg
- Few cardiovascular effects
- ? ICP effects
- Chest wall rigidity

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Goals and Objectives

1. Review the principles of Rapid Sequence Intubation (RSI) and explore the fundamental steps of RSI
2. Investigate induction agent options for RSI
3. Discuss paralytic medications for RSI

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Paralytic Agents

- Depolarizing
  - Succinylcholine
- Non-depolarizing
  - Rocuronium
  - Vecuronium

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Succinylcholine

- Gold Standard
- 45-60 second onset
- 6-12 minute duration
- Persistent depolarization
  - Therefore fasciculations
- Hydrolyzed by pseudocholinesterase

Succinylcholine

- Possible side effects or adverse reactions:
  - Fasciculations
    - Increased ICP
    - Increased intraocular pressure
    - Increased intragastric pressure
  - Hyperkalemia
  - Bradycardia or asystole
  - Malignant hyperthermia

Hyperkalemia

- Burn
- Crush
  - 3-7 days before administration
- Renal Failure
- Skeletal Muscle Disorders

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Nondepolarizing Agents

- Competitively block ACH receptor
- Flaccid paralysis

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Rocuronium

- 45-90 seconds to onset
- 20-75 minute duration
- Higher dosing
  - Quicker onset
  - Prolonged duration
- Few Cardiovascular effects
- Safe in Renal Failure

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Rocuronium

- Safe in Children
- Safe in patients with neuromuscular disorders
- 0.6 to 1 mg/kg

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