MASTERING AIRWAY MANAGEMENT

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It is one thing to need an airway and another to manage one. Just as we learned in pathology, neonatal airways are somewhat different than the adults. The reasons some of these patients may need them can vary as well.

Always think: facilitate, facilitate, protect, protect

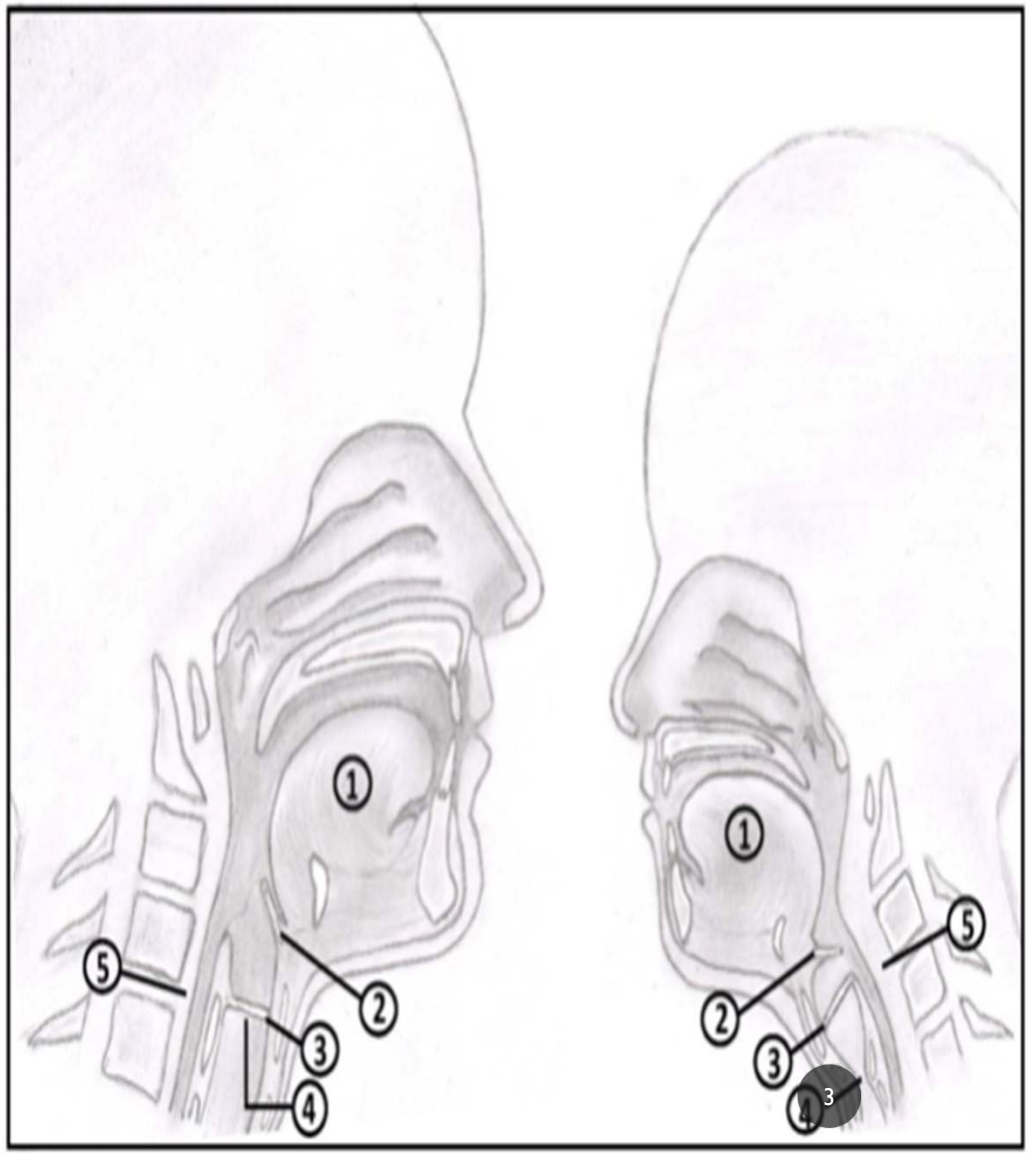
Facilitate mechanical ventilation, facilitate suctioning, protect from aspiration, protect the airway

OBJECTIVES

- Briefly review normal neonatal/adult airway
- OPA/NPA/Laryngeal Mask
  - Insertion of these airways
    - Q1
- ET Tubes and Intubation
  - Equipment/Bags
    - Q2
    - Q3
- Suction review
- VAP considerations
- Tracheostomies and their mysteriousness
- Extubation – planned and inplanned

NEONATAL AIRWAY

- There are many ways a neonates airway differs from an adults
  - Larger tongue
  - Narrow epiglottis that is angled above the glottis (parallel in adults)
  - Cricoid is more narrow (adults – glottis is most narrow)
  - Larynx is more superior (C3-4; adults is C4-5). This is where we get the "more anterior larynx).



PHARYNGEAL AIRWAYS OPA/NPA →

- Indications for OPA
  - Facilitate bag mask ventilation and oral suctioning
  - Use as a bit block with an ET tube or during seizures (support base of tongue
  - UNCONSCIOUS patients
- Indication for NPA
  - Can be used for CONSCIOUS and older patients
  - Support base of tongue
  - Facilitate tracheal suctioning and decrease trauma of NT SX
  - Use in newborns with pierre robin syndrome
  - Pharyngeal swelling

- Complication of OPA
  - These devices should be left unsecured, which poses a threat to unintentional movement and removal.
  - If the pt gags then please remove the airway, perform sx if indicated, and give some O's
  - Vomiting
  - Laryngospasm and improper size (covered on the next slide)
- Complications of NPA
  - Most common is trauma – make sure to use lube
  - Due to high vascularity of nose, epistaxis is common as well - change NPA Qday
  - Improper size (covered on the next slide)

PHARYNGEAL AIRWAYS OPA/NPA →

- Sizing OPA
  - If the OPA is too small then there is a chance for oral tissue displacement that can cause further obstruction
  - If it is too large then it can become an obstruction itself
  - **Measure from angle of jaw to corner of mouth - video**
- Sizing NPA
  - This airway will not be effective if it is too small
  - It can become an obstruction if it is too large
  - **Measure from earlobe to tip of the nose**
    - Outer diameter should be roughly the same size as the pts nose - video

QUESTION

A patient is brought in to the emergency room with a GCS of 3. The patient does not respond to oral suctioning and does not have an intact pharyngeal (gag) reflex. There is no one present that can clinically place an endotracheal tube. Which easily usable adjunct airway listed could be used to facilitate ventilation?

a. OPA

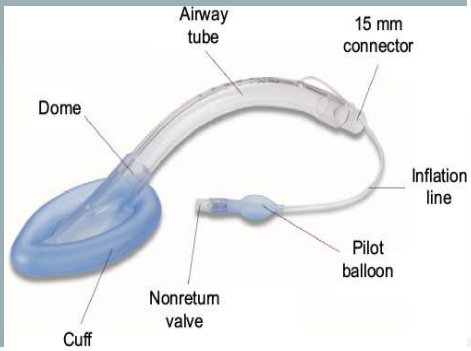
b. NPA

c. Tracheostomy

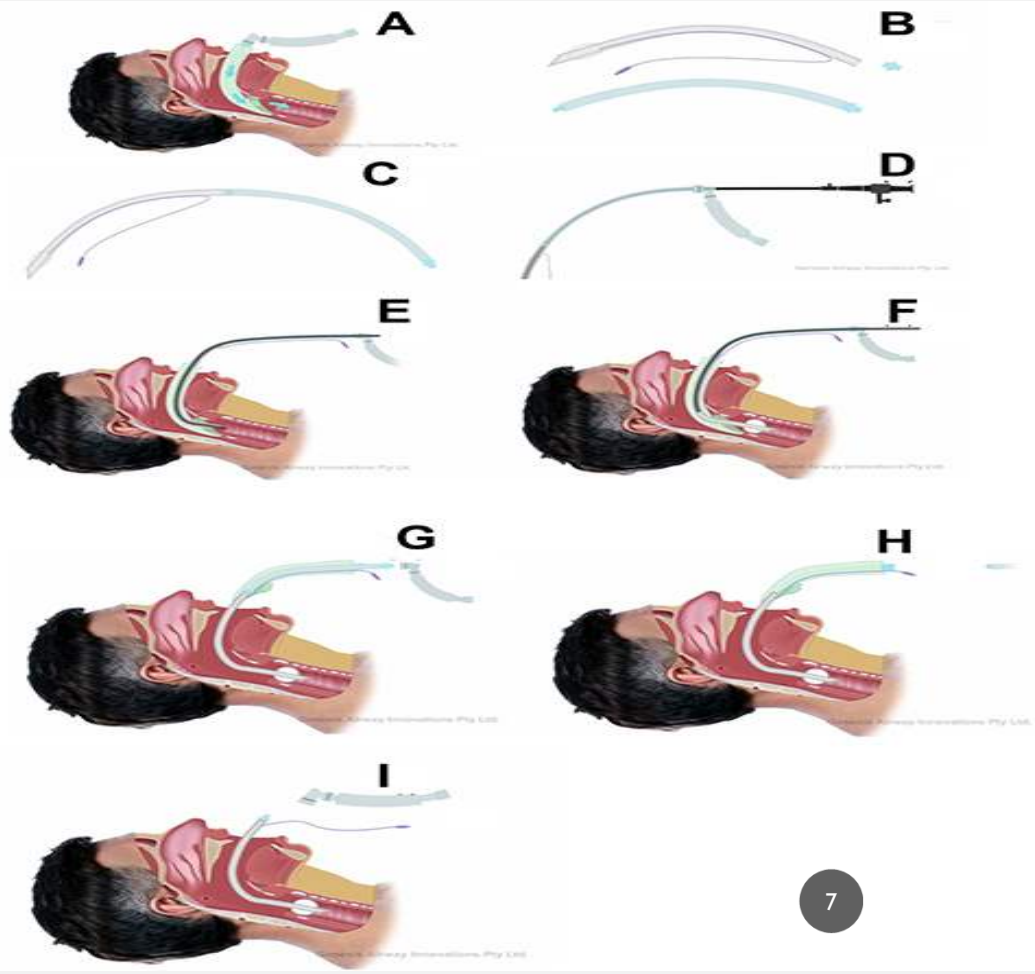
d. Carlen tube

LARYNGEAL MASK AIRWAY (LMA)

- These devices are indicated:
  - Short-term ventilation such as during surgery
  - Difficult intubation
  - Airway management prior to hospital arrival
  - When no one present is skilled at intubation
- Does not require laryngoscope
- Placed in the pharynx superior to the epiglottis
- Sized
  - Neonates: 0.5 – 1.0
  - Children: 2.0, 2.5, 3.0



- ET tube be inserted through the inner lumen
- Cuff volume is included with specific LMA



INTUBATION EQUIPMENT →

- Appropriate blade size (covered later)
  - Miller (straight)– should be at the level of the arytenoid cartilage
  - MacIntosh (curved) - fits into vallecula, lift epiglottis
  - Stylet (shapes the tube)
- Appropriate tube size (covered later)
  - One size smaller, one size bigger
  - Check cuff before use (if cuffed)
- BVM (self inflating/flow inflating)
- Laryngoscope
  - Always held left handed and contains battery
  - fiber optic and video laryngoscopes

- **Neonates** – generally uncuffed and have a vocal cord guide (black line).
- Tube size and Blade Size

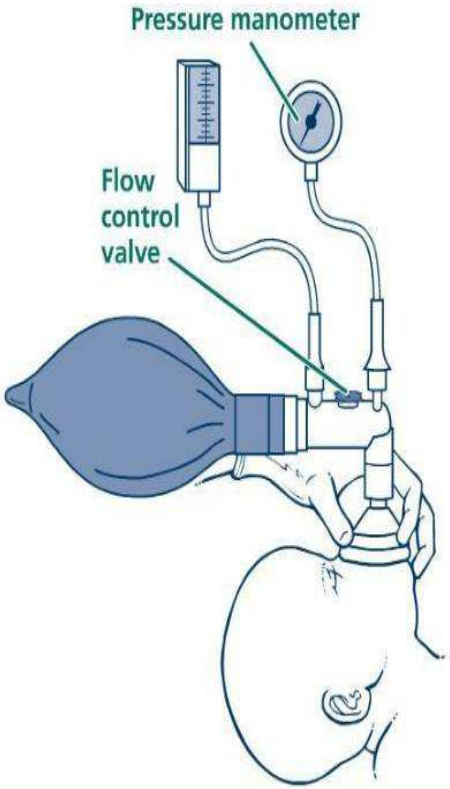
Weight (g)	Gest. Age (wks)	Tube size	Blade
<1000	<28	2.5	Miller 00
1 - 2000	28-34	3.0	Miller 0
2 - 3000	34-38	3.5	Miller 0
>3000	>38	3.5 – 4.0	Miller 1

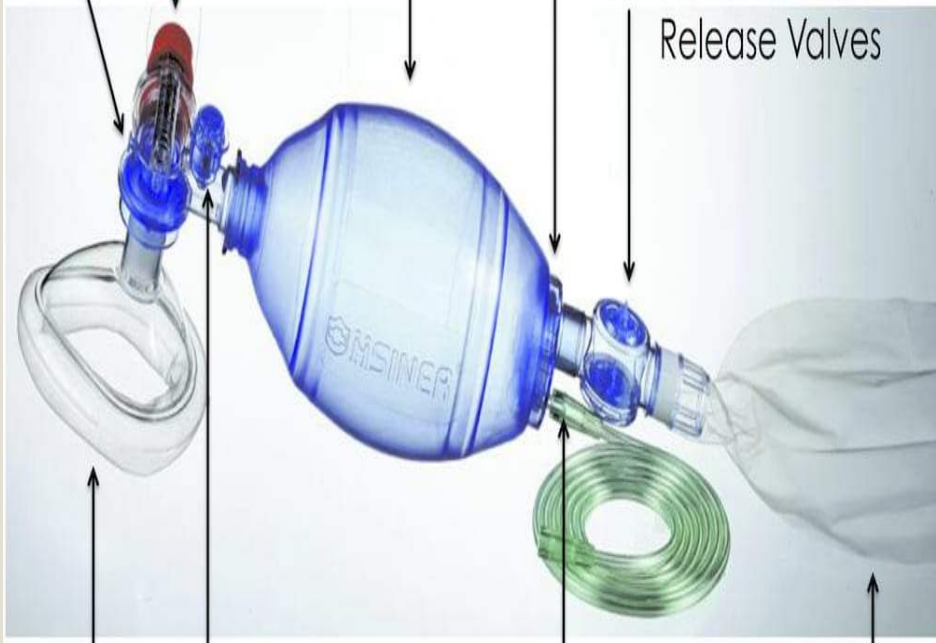
- Tube length estimation: ET tube size x 3

SELF VS FLOW INFLATED

- Self
  - Easier to use
  - Can use with RA
  - Bag always refills
  - 60-80% unless reservoir
  - Harder to feel lung compliance
- Flow
  - Not as user friendly
  - Cant be used without free flowing O2
  - Deflates with poor mask fit
  - FiO2 can be adjusted and can provide free-flow O2
  - Patient bag differences easily felt
  - Fine control of VT
  - CPAP

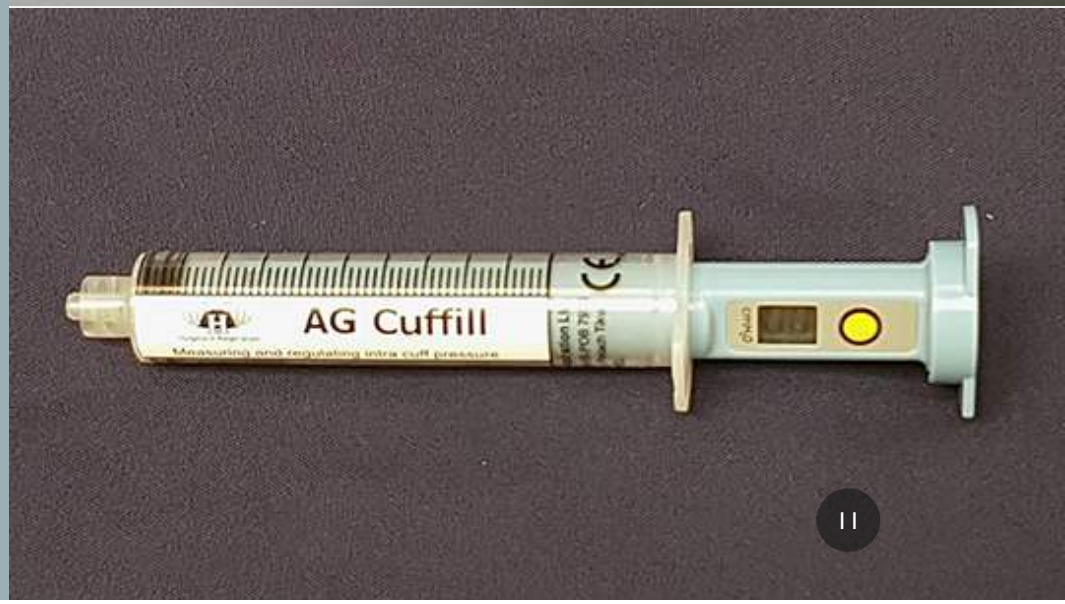
Safety Features: Flow-inflating Bag





INTUBATION EQUIPMENT →

- Cuff pressures can be monitored via Posey Cufflator or manual pressure manometer
- Checked Q8H
- Should not exceed 20 - 30cmH2O
- If >20 -30cmH20 is used to seal the airway then consider a new airway
- If it reads zero then check connections
- If there is no readily available means of measuring cuff pressure then use Minimal Leak Technique
  - Inject air into the cuff until no leak is heard
  - Withdraw just enough air to hear a slight leak at peak inspiration



INTUBATION EQUIPMENT →

- Pediatric patients that must use cuffed tube, the cuff should be low pressure, high volume (floppy) cuffs
  - Cuff pressure should not exceed 15 - 20cm H2O
  - High cuff pressure with a consistent leak indicates that the tube is too small.
- If the tube is too small there can also be increased airway resistance
- If the tube is too large then there can be decreased perfusion to the tracheal wall, necrosis and stenosis, poor gauge of air leak, vocal cord and glottic damage

Age	Blade	Tube	Suction
6m	Mil 1	3.5	8
1y	Mil 1	4.0	8
2y	Mil 2	4.5	10
4y	Mil 2	5.0	10
6y	Mil 2	5.5	10
8y	Mil/Mac 2	6.0	10
10y	Mil/Mac 3	6.5	12
12	Mil/Mac 3	7.0	12
>12 F >12 M	Mil/Mac 3 Mil/Mac 3	7.0 – 8.0 8.0 – 8.5	12 12

$$Tube\ Size = \frac{Age\ (in\ years) + 16}{4}$$

INTUBATION

- Uncuffed ET tubes are generally used for children <8yo due to anatomical difference (more anterior and narrower).
- Reasons for intubation have been mentioned: facilitate, facilitate, protect, protect with the addition of administering meds
- Nasal intubation may be performed and follows the same procedure with minor changes
  - Tube is passed through the nose until it is visualized in the pharynx
  - Magill forceps are then used to maneuver the tube into place
  - AAP - NRP

- Preoxygenate for age (roughly 5mins) if possible
- Recommend meds (sedative and paralytics)
- Sniffing position (check hyper-extension in neonates/infants)
- Miller blade is best for neonates
- Lift blade to visualize intubation landmarks
- Insert appropriately typed and sized tube
  - Uncuffed generally have a glottic marker for depth
  - Cuffed tube – insert until cuff has passed the vocal cords
- Secure tube
- OG tubes may be indicated for gastric overdistention

QUESTION

A 4yo patient is undergoing intubation due to epiglottitis and the attending asks the respiratory therapist what size/type ET tube and blade they should use. What should the RT suggest?

a. 7.0 cuffed ET tube/Mill 6

b. 5.0 uncuffed ET tube/Mill 2

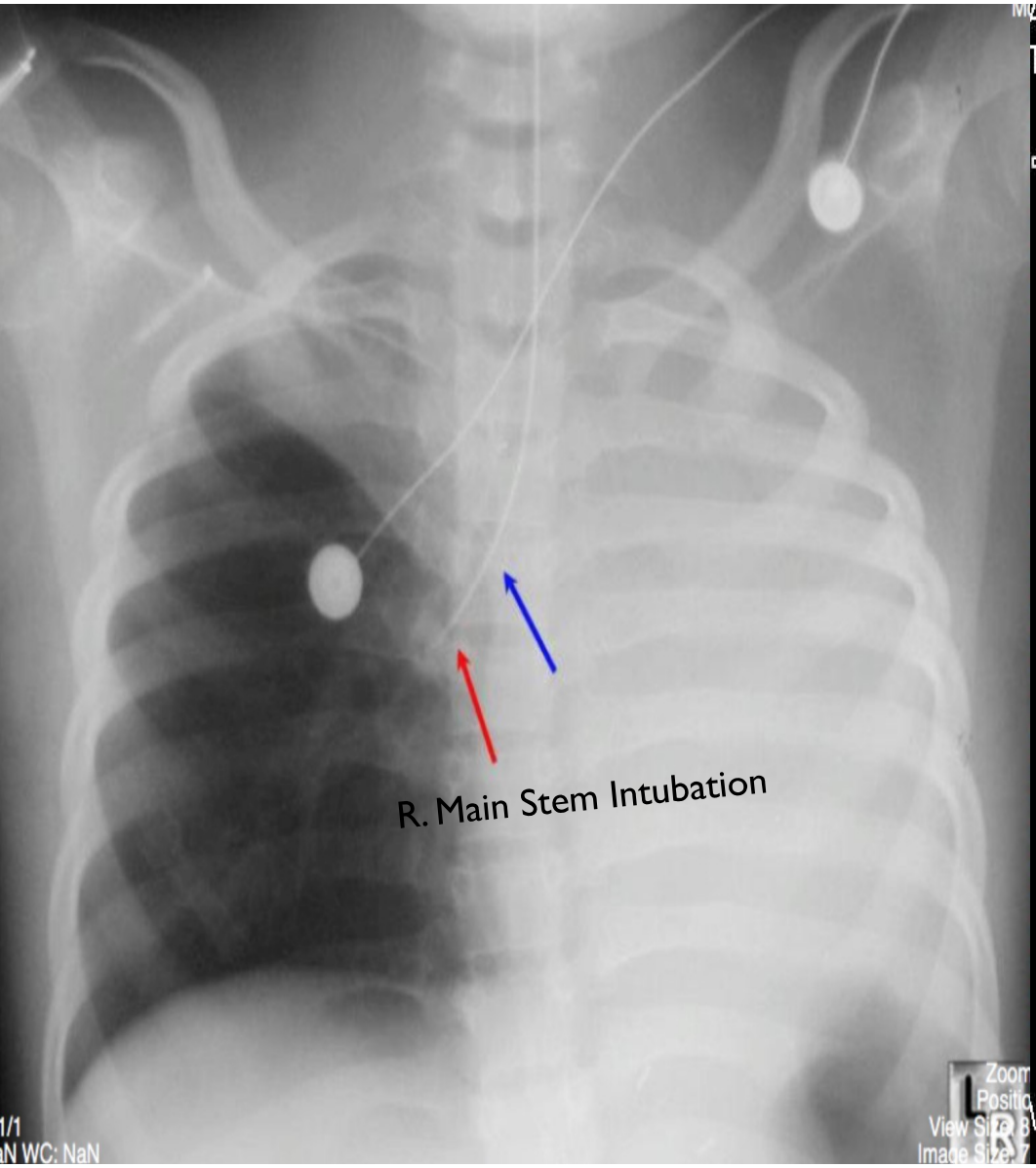
c. 6.5 uncuffed ET tube/Mc 2

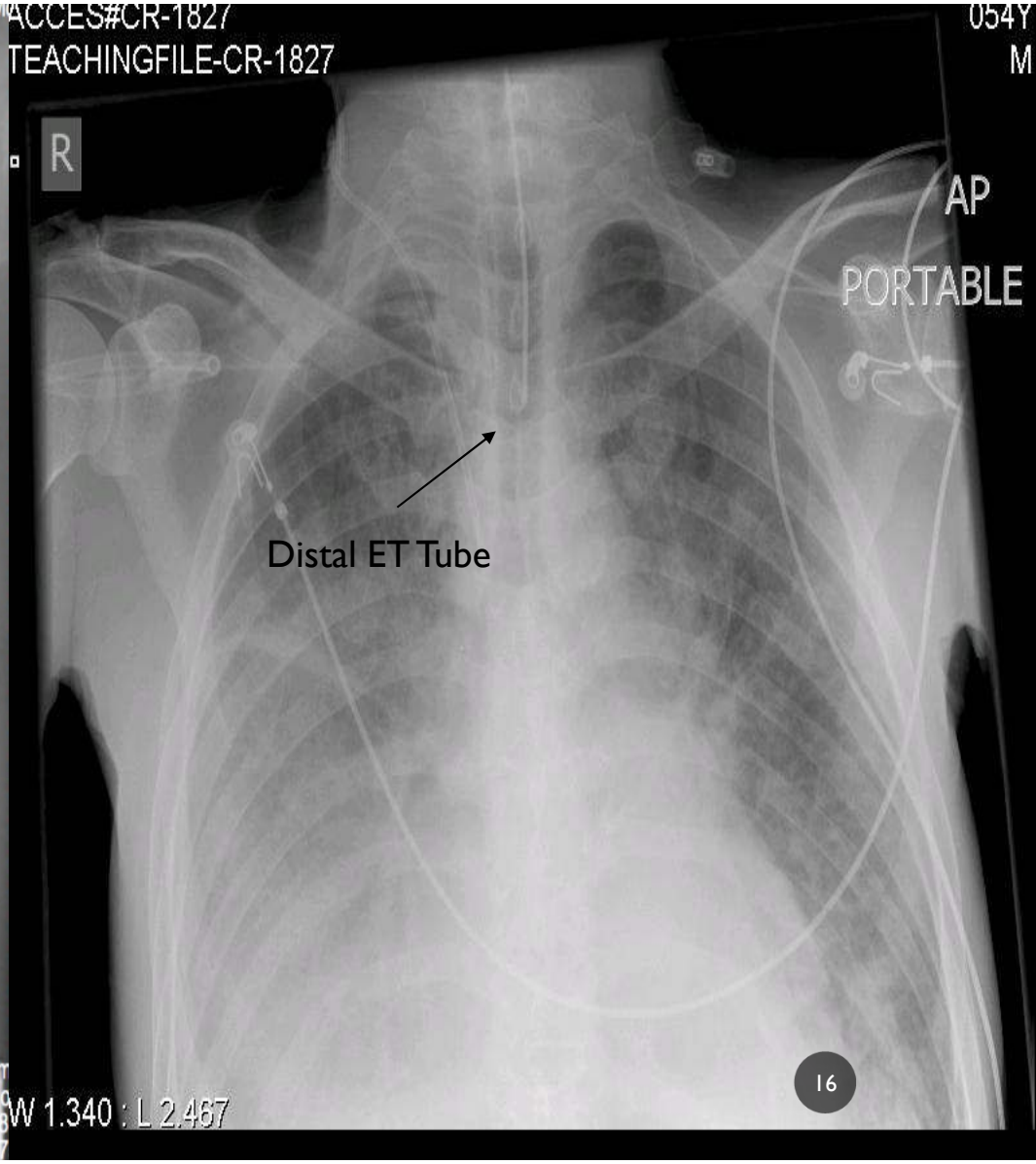
d. 5.0 cuffed ET tube/Mc 3

IMMEDIATELY AFTER INTUBATION

- To assess tube placement:
  - Observe chest rise, SpO2, color change, heart rate
  - Auscultate chest and abdomen
  - Check for condensation inside of tube
- Capnography and CO2 detector
  - Depends heavily on perfusion
    - Will read inaccurately if there is an air leak or perfusion is decreased
  - Will read inaccurately if there is esophageal intubation
    - Think: if I accidently intubate the esophagus, and the child drank a soda just before the incident

CHEST X-RAY ***CONFIRMS*** DEPTH AND PLACEMENT


R. Main Stem Intubation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054Y
M
R
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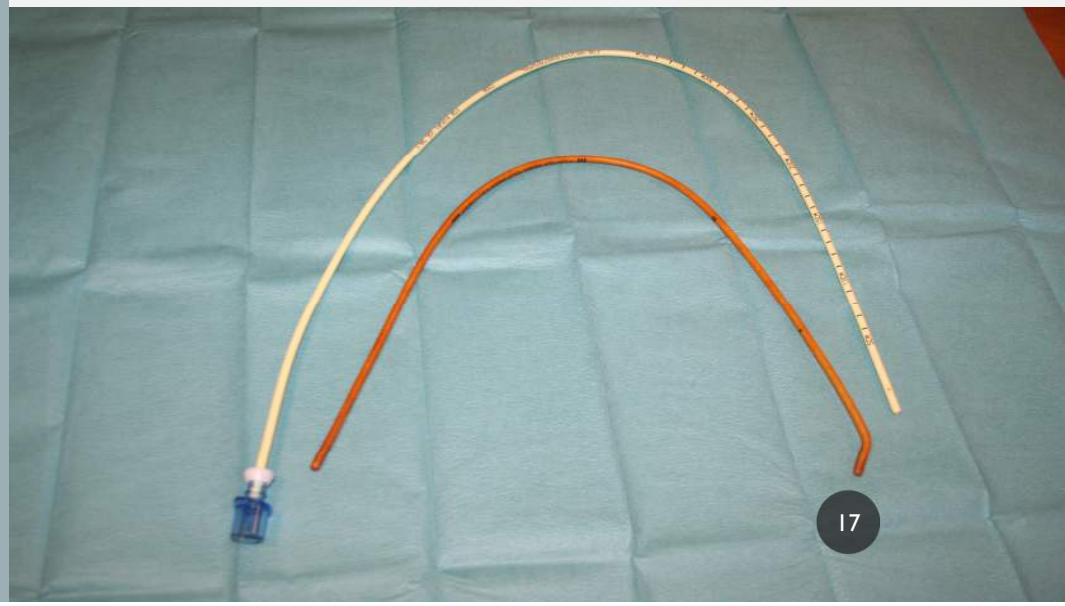
PORTABLE
Distal ET Tube
16
W 1.340 : L 2.467

TUBE EXCHANGERS

Tube should be exchanged or removed if:

- If unable to pass catheter (occlusion)
- If cuff integrity is weak
- If pressures are >20 cmH2O without an air leak when using an uncuffed tube – exchange for a smaller tube.

- Tube exchangers
  - Bougie – a flexible wire or tube
  - Easy replacement of ET tube without need for laryngoscope
    - Inserts through the ET tube
    - Remove old ET tube over the changer
    - Slide the new ET over the exchanger



QUESTION

A pediatric patient has just been intubated and placed on a ventilator. What should the respiratory therapist recommend to confirm tube placement and depth?

a. Colorimetric CO2 detector

b. cm marking on the ET tube

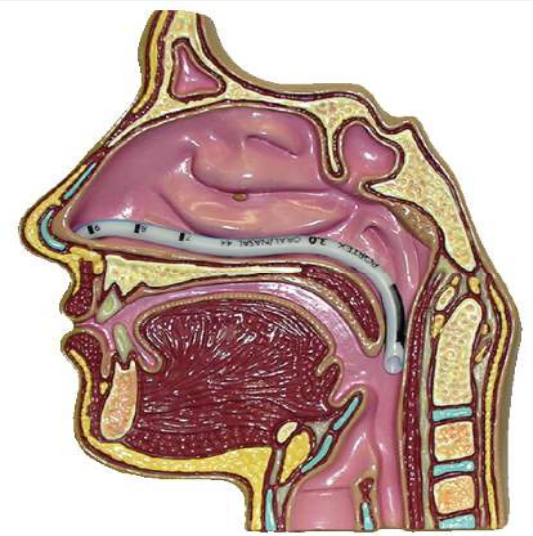
c. xray

d. Returned volume on ventilator

SUCTION →

- There are a few reasons why we suction
  - Keep a patent airway
  - Stimulate cough
  - Specimen collection
    - Indications for suction
  - Increase secretions
  - Airway obstruction
  - Weak/absent cough
  - Swallowing difficulty

- There are also a number of hazards
  - The most common is trauma
  - Hypoxemia
  - Infection
  - Atelectasis
  - Vagal stimulation
  - Bronchospasms
  - Accidental extubation (uncuffed tubes)



- Can perform suction via oral, nasal, or artificial route (ET/Tracheostomy)

SUCTION →

- Procedure for OT/NT suction
  - Preoxygenate if indicated
  - Nasal is easiest
  - Advance only during inhalation
  - Lubricate
  - When performing NT Sx advance by staying close to the septum
  - Remember: suction mouth before nose in neonates

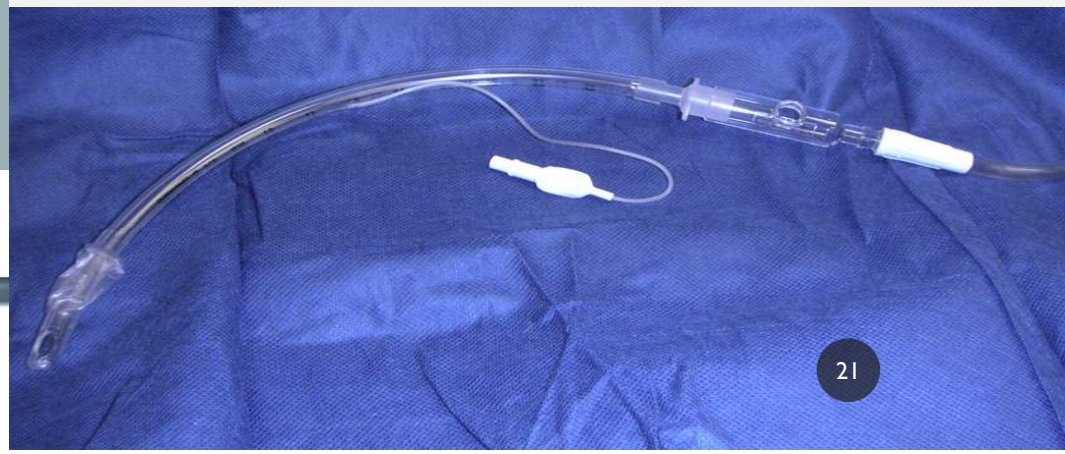
$$Catheter\ Size\ (Fr) = \frac{ID\ of\ Tube}{2} x\ 3$$

- ET/Trach Procedure
  - Preoxygenate and maintain during entire procedure
    - Infants: 10-20% more than what they are on
    - Children: 100% for 1-2m
  - Vacuum pressure: adjusted with tube occluded
    - Neonates: 60 - 80 mmHg
    - Peds: 80 – 100 mmHg
    - If no suction – check connections and change full suction canisters

SUCTION →

- Types of catheters/suction
  - Standard
  - Inline (Ballard) (VAP)
  - Coude' – Left mainstem
  - Bulb - neonates (M before N)
  - Oral - yankaur/tonsil suction
  - Meconium Aspirator
  - Lukens – Sputum trap

- In-line suction
  - Do not have to remove patient from the ventilator
  - Reduces risk of VAP
  - No >10s in airway; No longer than 5s suction
  - Turning patients head to the right may help with L. mainstem suction
  - If hazard occurs then decrease suction or suction time



VAP PREVENTION

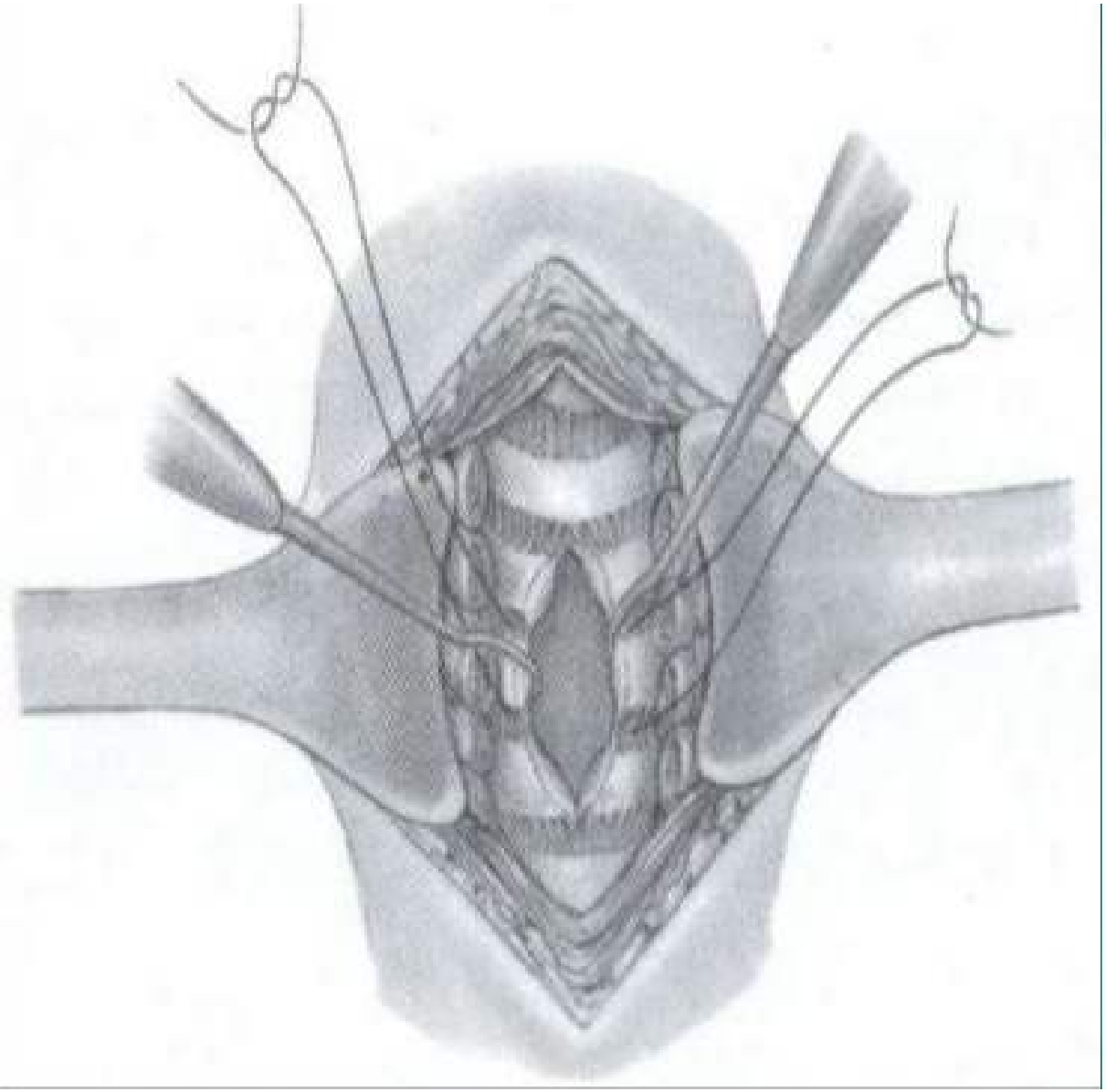
- Hand washing
- Oral care
- Head of bed 30-45 degrees
- Gentle suction
- Use MDI instead of SVN
- Subglottic secretion removal tubes - continuous aspiration of subglottic secretion (CASS tubes).

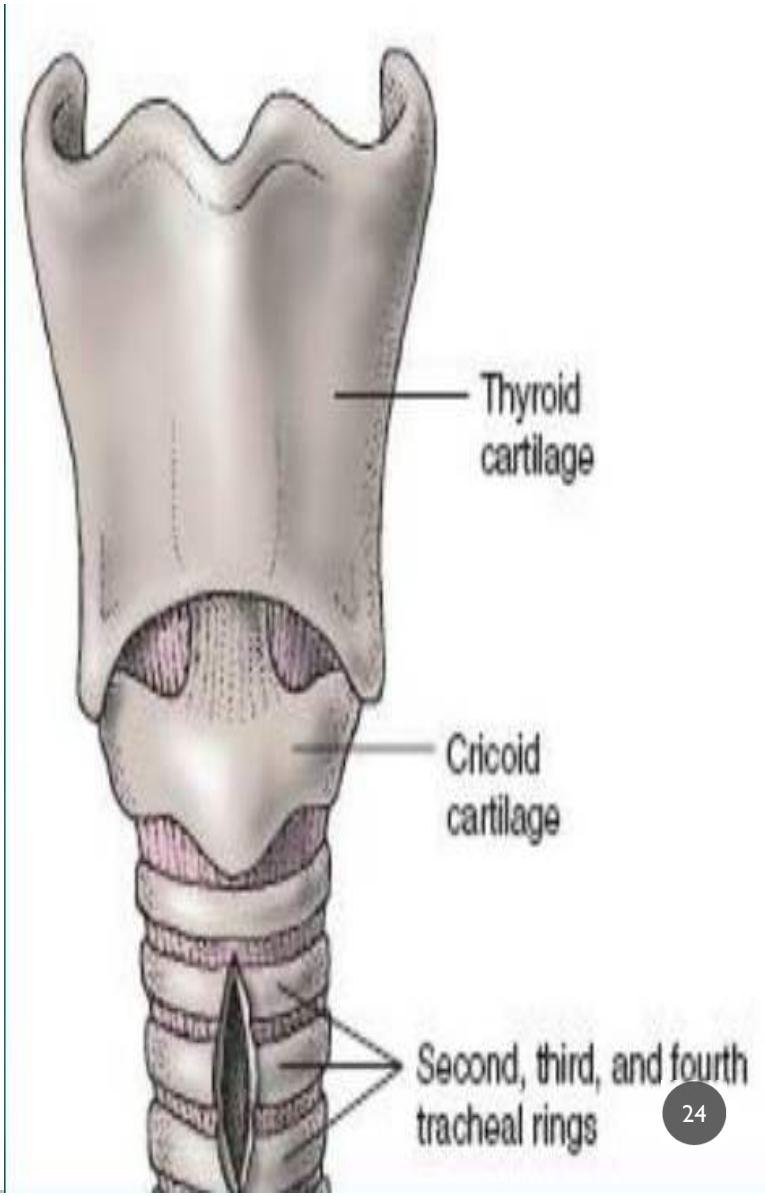
- Minimize intubation time
  - Frequent SBT or evaluation for extubation
  - NIPPV when able
- Vent circuit care
  - Closed system/inline suction
  - Heated wire circuits
  - Condensation drains
  - Minimize circuit disconnect and routine circuit changes

TRACHEOSTOMY →

- Indicated when long term intubation is needed, there is an anatomical blockage that prevent intubation, or there is a need for secretion removal
- There are a number of advantages and complications
- Advantages
  - More stable airway
  - Patient is able to eat, speak
  - Can use home vent
  - Less airway resistance than ET tube
  - Cuts anatomical dead space in half

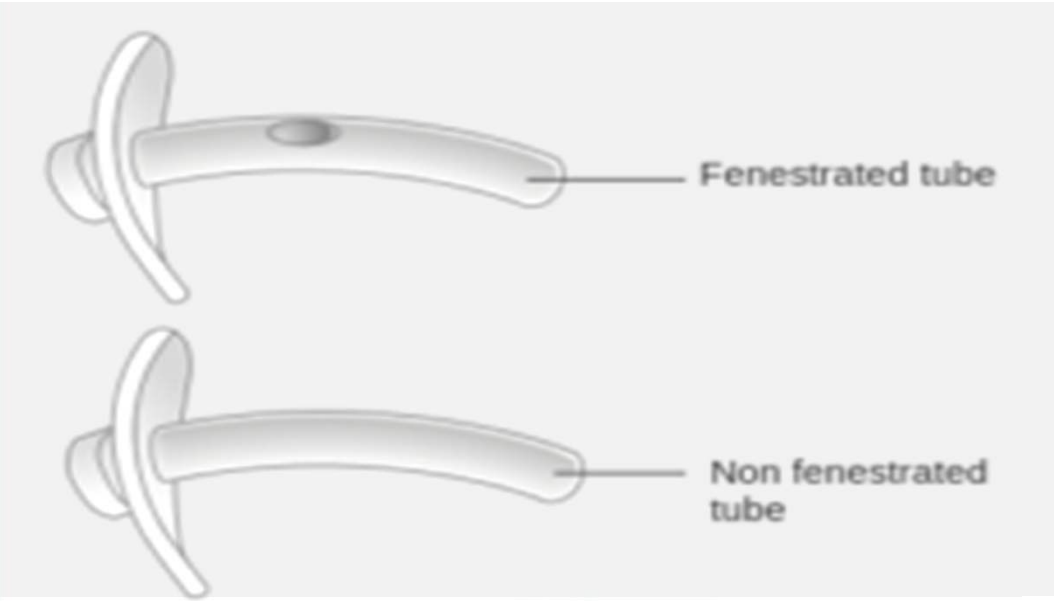
- Complications
  - Immediate
    - Bleeding (common)
    - Pneumo
    - Subcu emphysema
    - Air embolism
    - Accidental decannulation
  - Later
    - Infection
    - Hemorrhage (tracheoinnominate artery fistula)
    - Obstruction
    - Tracheoesophageal fistula
    - Accidental decannulation




Thyroid cartilage
Cricoid cartilage
Second, third, and fourth tracheal rings

TRACHEOSTOMY →

- Fenestrated →
  - Has opening in the outer cannula above the cuff (unless cuffless)
  - Used for weaning and allows patient to talk (cuff inflated)
- Tracheal button
  - Retains stoma
- Speaking valve (Passy-Muir) →
  - One way valve
  - Valve opens during inhalation and closes during exhalation, forcing air through the vocal cords
  - DEFLATE THE CUFF (single most important thing to remember)



TRACH CARE

- Entire trach should be changed one week after tracheotomy by the physician that placed the airway and then routinely ever 1 – 2 weeks
- Is disposable inner cannula, simply toss and replace with a new inner cannula of the same size BID or PRN
- Replace split gauze or other form of skin – trach barrier BID or PRN
- Clean the stoma and neck as well as any exposed hardware BID or PRN
- Change trach ties as needed

TRACH CHANGE

- If </= 1 week old then MD needs to change it, and only if emergent
- If > 1 week but < 2 weeks, 2 RTs can change if the provider is available
- If >2 weeks then have at it
- Gather equipment
  - BVM, O2, intubation equipment, one same size trach and one smaller, lubrication gel, obturator

- Suction trach (oxygenate and re-oxygenate)
- Release ties, have patient take a breath, deflate the cuff, and remove
- Insert the new trach sideways and then down
- Once at the flange then remove the obturator
- Verify placement and tie it back down

EXTUBATION

- Evaluate
  - Ventilation and oxygenation status
  - Hemodynamically stable
  - RSBI <100 – 105
  - Minimal vent settings
  - Airway protection
  - Leak test
- Have reintubation equipment ready
- Suction above and below the cuff, if applicable – pay close attention to nasal drainage/rhinitis as infants are obligate nose breathers.

- Remove securement device
- Deflate the cuff
- Remove the tube at peak inhalation
- Encourage patient to cough immediately after extubation
- Administer O2/humidity as needed
- Complications and Management
  - Respiratory distress or marked stridor
    - reintubate
  - Moderate distress or stridor
    - O2, cool mist, racemic epi neb, steroids, and/or heliox
  - Mild distress or stridor
    - Humidity and O2 as needed

UNPLANNED EXTUBATION/DECANNULATION

- Risk factors
  - Improperly secured airway
  - Misplaced ET tube (too high)
  - Lack of adequate sedation
  - Lack of adequate restraints
  - Procedures (x-ray, trach care, suction, etc).

- Safety equipment that should be at the bed side at all times
  - BVM and oxygen
  - Suction equipment
  - ET tube intubation equipment
  - Replacement tubes same size and one smaller
  - If trach becomes dislodged, occlude the stoma and bag the patient – can also use a cuffed ET tube in true emergencies

DIFFICULT AIRWAY

- Can use LMA in difficult intubations
- Flexible Fiberoptic Intubation
  - ET placed over fiberoptic laryngoscope
  - Scope is then advanced into the trachea
  - ETT is slid into place
  - Scope is removed
  - Fiberoptic bronchoscope can be used
- Larygnoscopic visualization devices
  - Illuminated stylet/bougie

- Laryngoscope blade video
  - Make sure there is suction due to video view obstruction
- No more than three attempts at intubation
- Retrograde intubation, cricothyrotomy, and emergency trach require a physician

CONCLUSION

- Neonatal airways are different
- The same can be said about artificial airways as well
- There are a number of airway adjuncts
- Intubation requires a plethora of gadgets
- Self inflating = limited FiO2 and always refills Flow inflating = consistent FiO2 and requires gas source (can be used as CPAP)
- An immediate assessment is needed post-intubation; Xrays confirm
- Suction shouldn't be limited but finessed
- VAP prevention is critical
- Tracheostomies aren't that scary
- Extubation can be planned or unplanned – you should plan for them
- Difficult airways are a thing and there are tools to help us

Stay tuned for the Phlegm Fighter Gameshow!