

# Episode 27: Airway Management

On this episode: Dr. Jed Wolpaw

In this episode I review the ABA topic of airway management. This is obviously a huge topic but in this episode I highlight key points about the components of airway management recommended by the ABA including identification of a difficult airway, management of a difficult airway, the difficult airway algorithm, different tools and adjuncts, and different types of tubes. This will be the final post of 2016. Thanks so much to all of you for listening and being a part of ACCRAC's inaugural year in 2016. Here's wishing you a wonderful start to your 2017!

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## Definitions

- ASA Task Force definition for difficult mask ventilation: “inability of an unassisted anesthesiologist to maintain oxygen saturation measured by pulse oximetry at 92% or the inability to prevent or reverse signs of inadequate ventilation during positive pressure mask ventilation under general anesthesia”
- Definition for difficult laryngoscopy: “not being able to get any better than Lehane grade 4 view”
- Definition for difficult intubation: “insertion of endotracheal tube requires greater than 3 attempts or more than 10 minutes”

## Statistics

- Elective intubations: 1 to 2 out of 1000 are failed intubations
- Obstetrics: 1 in 300 are difficult intubations
- In ED: 1% to 2% are difficult intubations
- About 93% of pt who are difficult intubation are unanticipated
- ~25% identified difficult intubations were actually difficult

## Evaluation of Patient

- Look at past charts for previous intubations and surgeries
- On physical exam, look for: airway obstruction, tumors, deviation of uvula, deviation of neck, stridor, hoarse voice
- Review past imaging to see if there is mass
- Review reason for surgery

## Risk Factors for Difficult Airway Management

- Infections of neck and oropharynx
- Previous neck/throat surgeries or radiation
- Problems with mouth opening (eg. previous trauma or soft tissue disorders)
- Problems with neck mobility (eg. C-spine precautions, rheumatoid arthritis)
- Obesity, OSA
- Neck mass
- Dentation problems
- Micrognathia
- Pregnancy
- Recent intubation causing edema
- History of angioedema
- Craniofacial syndrome
- Burns or trauma to airway
- Any obvious airway obstruction

## Mallampati Score

- Modified Mallampati Score (original score did not have class IV):
  - o Class I: soft palate, uvula, fossa, tonsillar pillars are visible
  - o Class II: soft palate, at least some of uvula, fossa are visible
  - o Class III: soft palate, base of uvula are visible
  - o Class IV: only hard palate visible are visible

- Mallampati score done with patient sitting upright opening mouth and sticking tongue out
  - o NOT supposed to say "ah"
- Class III and IV predict difficult intubation, but only 5% of people who are Class III or IV are actually difficult intubations
- British Journal of Anesthesia published study in 2011 → only 35% of patients who were difficult intubations had been identified as Mallampati Class III and IV

## Cormack-Lehane Score

- Cormack-Lehane Score
  - o Grade I: full view of glottis
  - o Grade IIa: partial view of glottis
  - o Grade IIb: only posterior portion of glottis or arytenoids
  - o Grade III: only epiglottis
  - o Grade IV: only soft tissue
- Grade IIb view or worse is predictive of difficult intubation

## Mnemonics

- LEMON for predicting difficult intubation
  - o Look externally
  - o Evaluate 3-3-2
  - o Mallampati score
  - o Obstruction (ie. OSA)
  - o Neck mobility
- BONES for predicting difficult mask ventilation
  - o Beards
  - o Obesity
  - o No teeth
  - o Elderly
  - o Sleep apnea or bad snoring
- RODS for predicting difficult LMA placement
  - o Restricted mouth opening
  - o Obstruction
  - o Distorted airway
  - o Stiff lungs OR C-spine
- SHORT for predicting difficult surgical airway
  - o Surgery (prior)
  - o Hematoma
  - o Obesity
  - o Radiation or distortion
  - o Tumor

## 3-3-2 Rule

- Normal mouth opening should be 3 of patient's finger breadths
  - Normal mandible dimension should allow 3 of patient's finger breadths between mentum and hyoid bone
  - Distance from thyroid cartilage to hyoid bone should be 2 of patient's finger breadths
-

- Patient's with less than 3-3-2 is worrisome

## Upper Lip Bite Test

- Tell patient to try to bite up as high as they can with lower dentition
- Classification:
  - o Class I: bite above vermilion border of upper lip
  - o Class II: bit on outer mucosa of upper lip
  - o Class III: can't get bottom teeth onto outer mucosal of upper lip
- Upper Lip Bite Test had sensitivity in the 70s and specificity in the 90s

## Height To Thyromental Distance

- Patient's height (cm)/thyromental distance (cm) > 23.5 predicts difficult intubation
- Shah and colleagues showed height to thyromental distance had sensitivity in the 70s and specificity in the 90s

## Awake vs. Asleep Intubation

- When putting patient to sleep, need to ensure able to ventilate
  - o Remember BONES mnemonic for difficult ventilation
    - Having 2 out of 5 risk factors has 72% sensitivity and 73% specificity for difficult BVM
  - o Additional risk factors for difficult ventilation: active tumor, abscess, laryngeal edema

## NMB

- Using NMB will improve view by ~1 Cormack-Lehane grade
- Remifentanyl 4mcg/kg + propofol 2mg/kg vs. succinylcholine + propofol
  - o Remifentanyl and propofol produced similar intubation conditions to succinylcholine and propofol
  - o Remifentanyl at this dose can cause significant bradycardia and chest rigidity → may need to give NMB to relieve chest wall rigidity

## ASA difficult airway algorithm

- Once decided to induce patient, there are two pathways when cannot intubate:
  - o Non-emergency pathway: cannot intubate, able to mask ventilate
    - Try other ways to intubate: video laryngoscopy, LMA, bougie
    - If cannot, either wake patient up or try other strategies
  - o Emergency pathway: cannot intubate, cannot ventilate
    - Call for help
    - Then try to place supraglottic airway (ie. LMA)
    - If that doesn't work, call for help and pursue emergency airway access (eg. cricothyrotomy, tracheostomy, transtracheal jet ventilation, retrograde wire)
- [ASA Difficult Airway Algorithm](#)

## Retrograde wire

- Topicalize patient like for awake intubation
  - Place needle through cricothyroid membrane
  - Thread wire up through cords and grab it with forceps through the mouth
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- Thread either a catheter over needle and endotracheal tube over catheter OR directly thread endotracheal tube over wire
- Risks:
  - o Time consuming
  - o No guarantee tube will successfully follow wire down through cords
  - o Could puncture things with wire
  - o Could go through and through trachea and puncture esophagus
- Advantages:
  - o Good for patients with distorted anatomy, but breathing spontaneously
  - o Able to stop to mask ventilate throughout process

## Video Laryngoscopy

- Video laryngoscopy is most common rescue device
- Advantages:
  - o Better view; direct laryngoscopy has ~1% failure rate in expert hands
  - o Others can see the view which is good for giving direction and teaching
  - o Higher success rate
  - o Useful for awake intubation with ketamine
  - o Avoids esophageal intubation
  - o Less hemodynamic response to intubation
- Does not decrease strain on neck for c-spine
- Disadvantages:
  - o May be difficult to pass tube even with a good view → may need stylet or back scope out a little to let larynx fall down
  - o Fogging or secretions could obscure view
  - o Lose depth perception
  - o Equipment failure
  - o More expensive
  - o Some sizes don't fit well in patients with bad mouth opening

## LMA Types

- LMA Classic is original reusable design
- LMA Unique is a disposable design
- LMA Fastrach is an intubation device with insertion handle, rigid shaft, and curvature
- LMA Flexible is a softer LMA
- LMA ProSeal has channel for suctioning gastric contents and allows for higher pressure
- LMA Supreme is like the LMA ProSeal, but with bite lock
- LMA C-trach has built in fiber optics
- If LMA cuff is overinflated, could cause damage to oropharynx → want to use minimum amount of air in cuff that still allows for ventilation of patient

## Esophageal airways

- Used in prehospital settings because easy to place, but it is not a secure airway
- Eg. King tube is single tube with two balloons → single tube designed to go into esophagus when inserted blindly
  - o Large balloon inflates in oropharynx to prevent air from going out

- Small balloon inflates in esophagus
- Tube has holes in-between allowing air entry into trachea
- Eg. Combitube → also designed to be placed blindly
  - 15cc balloon is placed in esophagus and 100cc balloon is placed in oropharynx
  - It has two lumens; if it happens to be placed in the trachea, only blow up 15cc balloon and advance second tip out into trachea to ventilate patient

## Surgical Airway

- Cricothyrotomy is an emergency airway → not a permanent airway because of risk of damage to cords; however, studies are actively investigating whether this is true
  - Incision is done through cricothyroid membrane
- Tracheostomy is a surgical airway with the incision halfway between sternal notch and thyroid cartilage (2<sup>nd</sup> or 3<sup>rd</sup> tracheal ring)

## Transtracheal Jet Ventilation

- High failure rates when used in cannot intubate cannot ventilate situations
- High risk of barotrauma especially in pediatric patients

## Single Lung Ventilation

- Two methods: double lumen tube vs. bronchial blocker
  - Bronchial blocker advantages:
    - Able to isolate specific section of lung because could place blocker beyond right or left mainstem
    - Size of patient doesn't matter → can't adjust the size of double lumen tube
    - Easy to ventilate patient when placing it because endotracheal tube in place
    - Able to take out bronchial blocker if patient needs ventilation at end of case without removing entire tube
  - Bronchial blocker disadvantages:
    - Costs more
    - Moves around more easily so may become dislodged
- Absolute indications for one lung ventilation: pus or blood in one lung, one sided bronchopleural fistula, lavage of one lung, large bullae or cyst on one lung worrying about rupturing, video-assisted thoracoscopic surgery (VATS) surgery
- Relative indications: lobectomy, pneumonectomy

## Bougie

- Bougie is long flexible plastic catheter with tip angled up at a 30-45 degrees angle allowing feel of tracheal rings
  - Most commonly used as rescue device → with a grade III view, place bougie under epiglottis and advance; should feel bumps in trachea
  - Caution that if angled tip is not up, may not feel rings → orientation of bougie is important

## Tube Exchangers

- Aintree intubation catheter → large internal diameter allows placement over fiberoptic scope; typically used when intubating through LMA

- Cook exchange catheter → typically used to replace existing endotracheal tube and switching it out for another one

## Endotracheal Tube Types

- Cuffed tubes have two types:
  - High pressure low volume
    - Advantage is does not allow little rivulets to develop between mucosa and cuff because of rigid contact → this decreases risk of aspiration as rivulets could allow secretions to track down
  - Low pressure high volume → standard endotracheal tube we use
    - Advantage is don't produce a lot of pressure to one portion of trachea limiting damage to tracheal mucosa

## RAE tubes

- Named after their inventors Ring, Adair and Elwyn in 1975
- Oral RAE comes out of mouth and makes acute bend over chin
- Nasal RAE comes out of nose and makes acute bend over forehead
- Helps keep tube out of the way
- Advantages: opens up surgical field
- Disadvantage: can't control depth → only way to get longer tube is to use a larger tube

## MLT Tube

- Microlaryngoscopy tube = long, thin tube; 5.0 tube, but longer than normal which allows use in regular size adult
- Advantages: used for vocal cord surgery to allow more room to operate
- Disadvantages: higher PEEP pressures → need longer expiration time to allow exhalation

## Laser Tubes

- Regular PVC tubes wrapped in foil and non-reflective coating → used for laser surgery to protect PVC tube from laser
- Cuff is not wrapped so vulnerable → cuff filled with blue crystals so if inject saline to inflate, it will dissolve into blue liquid which serves as indicator for rupture
  - High pressure, low volume cuff → higher pressure allow fluid to spray out if cuff ruptures

## Armored/Reinforced Endotracheal Tube

- Standard PVC tubes with wire coil wrapped throughout allowing it to bend much more without kinking
- Used in neuro, prone, and facial surgery where you may want to move tube out of way
- Tube still needs bite lock because if patient bites down, it could create permanent kink
- Like regular tubes, this tube is also MRI conditional
- Don't have preset slight curve → have to intubate with stylet or have one ready

## Parker Flex-Tip Tube

- Tube with tapered curved tip designed to pass easily by airway structures (eg. arytenoids) without causing trauma to them



- Useful in Seldinger's techniques, and when intubating over fiberoptic or exchange catheter
- Has Murphy's eye on both sides of tube

#Do you have questions on airway approach?

#Are there other techniques you use?

#Are there other tests like the upper lip bite test that you use and like?

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## References

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P. J. Shah, K. P. Dubey, J. P. Yadav. Predictive value of upper lip bite test and ratio of height to thyromental distance compared to other multivariate airway assessment tests for difficult laryngoscopy in apparently normal patients, J Anaesthesiol Clin Pharmacol, Volume 29, Issue 2, June 2013, Pages 191–195

UCSF Website Links To Different Airway Devices:

- [RAE Tubes](#)
- [MLT Tubes](#)
- [Laser Tubes](#)
- [Armored Endotracheal Tubes](#)
- [Parker Flex-Tip Tubes](#)

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