Evidence-based Anesthesia: Difficult Airway Management

Dennis Spence PhD, CRNA

Disclaimer

- The views expressed in this presentation are those of the author and do not reflect official policy or position of the Department of the Navy, the Department of Defense, the Uniformed Services University of the Health Sciences, or the United States Government.

- The author does not endorse, promote or advertise any products presented in this presentation.

Disclosure

- Nothing to disclose
Objectives

- Review the ASA Difficult Airway Algorithm and Airway Approach Algorithm
- Describe components of the preoperative airway assessment
- Discuss current evidence as it relates difficult airway management
- Describe how to prepare for a difficult intubation
- Review the various equipment/alternative airway devices and methods used for management of the DA

Clinical Vignette

- 67 y/o male presents with angioedema tongue
- PMH- HTN 15 yrs, high cholesterol
- Meds- lisinopril, zocor

How would you manage this airway?

Difficult Airway Management

- Is the approach to the difficult airway changing?
- Is the direct laryngoscope going the way of the rotary telephone?
- What about the Awake Fiberoptic Intubation (AFOB)?
- Do new graduates know how to do an AFOB?
ASA Difficult Airway Algorithm 2013

- Updated evidence and findings from surveys
- No major changes
- Changes some terms used
- Expands step 1 assessment of potential difficulties
- Addition of video-assisted laryngoscopy to algorithm
ASA Difficult Airway Algorithm 2013

The Airway Approach Algorithm

ASA Difficult Airway Algorithm Skeleton
Preoperative Airway Exam

Airway Exam

<table>
<thead>
<tr>
<th>Airway Exam Component</th>
<th>Abnormal Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Length of upper incisors</td>
<td>Relatively long</td>
</tr>
<tr>
<td>2. Relation of maxillary and mandibular incisors during normal jaw closure</td>
<td>Prominent &quot;overbite&quot;</td>
</tr>
<tr>
<td>3. Relation of maxillary and mandibular incisors during voluntary protrusion of mandible</td>
<td>Cannot bring mandibular incisors anterior to maxillary incisors</td>
</tr>
<tr>
<td>4. Interincisor distance</td>
<td>&lt; 3 cm</td>
</tr>
<tr>
<td>5. Visibility of uvula</td>
<td>Not visible when tongue is protruded with patient in sitting position e.g., Mallampati class &gt; II</td>
</tr>
<tr>
<td>6. Shape of palate</td>
<td>Highly arched or very narrow</td>
</tr>
<tr>
<td>7. Compliance of mandibular space</td>
<td>Stiff, indurated, occupied by mass, or nonresilient</td>
</tr>
<tr>
<td>8. Thyromental distance</td>
<td>&lt;3 ordinary finger breaths</td>
</tr>
<tr>
<td>9. Length of neck</td>
<td>Short</td>
</tr>
<tr>
<td>10. Thickness of neck</td>
<td>Thick (&gt;40-42 cm)</td>
</tr>
<tr>
<td>11. Range of motion of head and neck</td>
<td>Patient cannot touch tip of chin to chest or cannot extend neck</td>
</tr>
</tbody>
</table>

Other findings/predictors of DA:
- Obesity, OSA, AHI>30
Mallampati Score

Submandibular & Submental Abscesses
What about upper airway pathology?

Preoperative Endoscopic Airway Exam (PEAE)

- In patients with upper airway pathology does a performance of a PEAE change the plan?

**Asleep Intubations = 83%**
- Majority intubated asleep
  - asleep→asleep = 62%
  - awake→asleep = 20%
- FOB = 4%
- DL/VL = 56%
- N = 1 retrograde wire

**Awake Intubation = 24%**
- awake→awake = 12%
- asleep→awake = 6%

Conclusion: PEAE may ID pts with upper airway pathology who truly need AFOB
Do the same predictors of difficult intubation apply to indirect video laryngoscopy?

Predictors of Difficult Airway with the GlideScope®

Time to Intubate

- Poorer glottic view on DL:
  - $r = -0.273$
- Higher upper lip bit test score:
  - $r = 0.250$
- Short sternothyroid distance:
  - $r = -0.146$
- Most difficulties due to difficulty navigating ETT into glottis

Weak correlations

Predictors of Difficult Airway with the GlideScope®

1st Attempt Success and Mallampati Class

- MP class not predictive of DI
- Other risk factors not individually predictive
Important Question:
Can I ventilate the patient?

Can I ventilate the patient?
Predictors of Impossible Mask Ventilation

(n = 77/53,041)

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck radiation changes</td>
<td>7.1</td>
</tr>
<tr>
<td>Male gender</td>
<td>3.3</td>
</tr>
<tr>
<td>Sleep apnea</td>
<td>2.4</td>
</tr>
<tr>
<td>MP III or IV</td>
<td>2.0</td>
</tr>
<tr>
<td>Presence of beard</td>
<td>1.9</td>
</tr>
</tbody>
</table>

* 1 in 690 IMV
* 25% were DI
* 1 in 2800 IMV + DI

Predictors of DMV + DL

* N = 176,679 DAs = DMV + DL
  * 2.5% DMV
  * 4.4% DL
  * 1 in 250 DMV + DL
  * DMV rate lower w/NMB
    * 2.6% vs. 3.6%, P < 0.01
Airway Exam Summary

- Consider overall airway exam, risk of difficult ventilation, and aspiration risk when making plan
- Coexisting diseases
- Further research needed on predictors of DI with indirect video laryngoscopy
- Err on the side of caution and assume DI
- Always consider AFOB in DI, especially w/ upper airway pathology

Positioning

- What is the optimal position for intubation?

Ramping the Patient

Results

• 99% <3 RF easy FMV
• 95% >3 RF easy FMV
• n = 1 IMV
• DMV n = 90
  • FMV improve w/ sux = 62%
• Intubated 1st attempt = 98.05%
• Bougie used 1st in DA = 1.7%
• AirTrach 2nd = 0.19%
• LMA-C use = 0.024%

Conclusion

• New algorithm successful
• More aggressive use of NMIs + backup devices contribute high success rate
Indirect Video Laryngoscopy

- Does indirect video laryngoscopy improve success rate in novices?
- Does the use of an indirect video laryngoscopy device improve the view in potential difficult airways?
- Does the use of an indirect video laryngoscope device speed up the time to intubation? 1st attempt success in experts?
- Does video laryngoscopy improve success after failed direct laryngoscopy?
- What are the risk factors for failed indirect video laryngoscopy?
- What are the potential complications with indirect video laryngoscopy?
Indirect Video Laryngoscopy & Novices

- N = 20 no experience
- 5 intubations each device

Intubation within 2 minutes
Higher w/ Glidescope
97% vs. 5%, P < 0.01

Time to intubation
Faster w/ Glidescope
63 ± 30 s vs. 89 ± 35 s; P < 0.01
Less Experience


**Table 2. Predictors of Failed Glidescope Intubation**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck pathology, with scar, radiation or mass</td>
<td>4.39; 95% CI: 2.04-9.46</td>
</tr>
<tr>
<td>Thyroidal distance &lt; 6 cm</td>
<td>2.53; 95% CI: 1.38-4.64</td>
</tr>
<tr>
<td>Limited cervical range of motion</td>
<td>1.76; 95% CI: 1.01-3.06</td>
</tr>
<tr>
<td>Institution: UMHS</td>
<td>2.28; 95% CI: 1.3-4.01</td>
</tr>
</tbody>
</table>

Note. Receiver operating characteristic area under the curve result was 0.73, indicating acceptable discriminate ability to predict failed Glidescope intubation.

**Meta-Analysis**

GlideScope® vs. Direct Laryngoscopy

- **Glotic view** (Gr 1 vs. ≥ Gr 2)
  - Anticipated or simulated DA
    - 3.5x more likely GR I view (P < 0.05)
    - + publication bias
- **Intubation Success**
  - Non-experts: 1.8x more likely intubate (P < 0.05)
  - Experts: No improvement vs. DL (P = NS)
- **Time to intubation**
  - Non experts: 43 sec faster intubation (P < 0.05)
  - Experts: 8 sec faster intubation (P = NS)
- **Conclusion**: Improves glottic view, especially in simulated or potential DA. May help non experts more than experts

**Indirect Video Laryngoscopy**

- **Simulated difficult intubations**
  - McGrath, Airtraq, and GlideScope® provide superior intubating conditions compared to Macintosh blade (P < 0.05)
- **Pentax-AWS**: 99.6% of DI (MAC grade view 3-4) were grade 1-2
- **Pentax-AWS**: rescue device success in DI = 99.3%
- **McGrath® Series 5**: 100% success in simulated DI with in-line stabilization
- **Difficult intubation success rate**
  - Pentax-AWS = 100%, GlideScope = 96%, Macintosh blade = 84%
Complications with GlideScope®

- Incidence = 1% (N = 2004 intubations)
- Minor
  - Lip, gum, dental trauma
- Serious
  - Pharyngeal wall trauma, lingual nerve injury, vocal cord trauma, tonsillar perforation
- Causes: blindly passing tube with stylet
- Implication
  - Look down at airway and gently place tube until see on monitor
  - Appropriate size blade
  - Evaluate postop

Conclusion: Indirect Video Laryngoscopy Devices

- All have major role in difficult airway management
- Improved success in DI vs. direct laryngoscopy
- Seeing vocal cords and placing tube 2 different things
- Be careful with blindly placing tube

- Limitations of devices
  - Blood, vomit may obscure view
  - Limited ROM, small TM distance and neck pathology/scar & inexperience increase failure rate

Awake Fiberoptic Intubation

- How do you secure this airway?
  - Awake vs. asleep
  - AFOB vs. Trach?
- Could you ventilate this patient?
- Do you know how to do an AFOB?
Preparation for AFOB

<table>
<thead>
<tr>
<th>Tip</th>
<th>Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explanation</td>
<td>Pt understands reason</td>
</tr>
<tr>
<td>Desiccation</td>
<td>Dry the airway</td>
</tr>
<tr>
<td>Dilation</td>
<td>Prepare the nose</td>
</tr>
<tr>
<td>Topicalization</td>
<td>Obtund reflexes</td>
</tr>
<tr>
<td>Sedation</td>
<td>Maintain meaningful contact</td>
</tr>
<tr>
<td>Procrastination</td>
<td>Don't rush it!</td>
</tr>
</tbody>
</table>

Preparation

- Explain the procedure to them and reason why you are doing it
- **Desiccation**
  - Glycopyrrolate 0.2-0.4 mg IV or IM if IV difficult
  - Takes up to 15 minutes
- **Dilation**
  - Always prepare nose
  - Afrin
- **Topicalization**
  - Nasal passage/nasopharynx
  - Base of tongue/posterior oropharynx
  - Hypopharynx/larynx/trachea

Desiccation

- Glycopyrrolate 0.2-0.4 mg IV or IM if IV difficult
- Takes up to 15 minutes
Airway Innervation

Nasal Topicalization
- Anterior ethmoid nerve & nasopalantine nerve
- Cotton swabs soaking with 4% lidocaine solution or 5% lidocaine ointment
- Advance them slowly into the nasal passage
- Incrementally advance
- Keep in for 5 minutes

Base of Tongue/Post Oropharynx
- Glossopharyngeal nerve (IX)
  - Controls gag reflex
  - posterior third of the tongue
  - vallecula
  - anterior surface of the epiglottis
  - walls of the pharynx
  - tonsils
Base of Tongue/Post Oropharynx

- Nebulizer
  - Good, but careful with lung uptake
- Atomizer
- Glossopharyngeal nerve
  - Blocks vs. cotton swabs

Glossopharyngeal Nerve

Use forceps to slowly advance cotton soaked swabs to pillars and leave for 5 minutes each side.

SLN & RLN

- Superior laryngeal nerve
  - base of tongue
  - posterior surface epiglottis
  - aryepiglottic fold & arytenoids
- Recurrent laryngeal nerve
  - Vocal cords and trachea
Hypopharynx/Trachea Blockade

- Topical vs. blocks
- Syringe w/ LA and angiocatheter
- Hold tongue with gauze
- Drip on base of the tongue
- Drip until stop coughing

Topicalization tips

- Drying agent VIP
- Blocks used less and less
- Test with tongue depressor or suction catheter
- Make sure “numb enough” before going to OR

Sedation

- Options
  - Dexmedetomidine
    - 0.5-1 mcg/bolus over 10 minutes
    - 0.2-0.7 mcg/kg/hr
    - Titrate to effect
  - Midazolam
  - Fentanyl
  - Remifentanil
    - 0.025-0.075 mcg/kg bolus
    - 0.025-0.075 mcg/kg/min
  - VIP ➔ Maintain meaningful contact
Williams & Ovassapian Airways

FOB Conduits

Tips for AFOB
- Take your time with topicalization and procedure
- Soften tube in warm saline & use 0.5 to 1 size smaller ETT
- Position-supine vs. semi-fowlers
- Use Williams or Ovassapian airway
- Jaw thrust to open airway
- Add 10 mL syringe to side-port of FOB to inject LA on VCs
- Rotate tube if meet resistance
- Practice "asleep" FOB on healthy airways
- Do AFOB whenever can to keep up skills
- Other devices- some indirect devices can be used for awake intubation

Rosenstock CV et al. Awake fiberoptic or awake laryngoscopic tracheal intubation in patients with anticipated difficult airway management. Anesthesiology 2012; 116:1210–6
Permission obtained from patient to videotape.

Extubation of Difficult Airway

- Can patient maintain patent airway after extubation?
- Can the patient maintain adequate ventilation?
- Is the patient fully reversed? Fully Awake?
- Do you have a plan on how to reintubate?
- Consider using airway exchange catheter

Airway Exchange Catheter
Worst Case Scenario: Emergency Invasive Airway Access

http://emedicine.medscape.com/article/80241-overview#a15


Difficult Airway Note


Questions?
References

References


