Airway Management: Managing Risk in Airway Management Procedures

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No financial disclosures
Airway Management

- Position of comfort/sniffing
- Suction
- Open airway
  - HTCL
  - Jaw thrust (C-spine trauma)
- 100% O₂
Format and Objectives

- Talk will be done in 2 parts
  - Pediatric and Adult viewpoint

- Explain concepts and competencies relative to Airway Management

- Identify impact of using team skills and behaviors on patient safety

- Specify challenges and critical success factors to implementation and sustainment

- Describe your best practices, impact and success thus far in using simulation to address airway management risks at your facility
Anatomic Airway Differences: Pediatrics vs. Adults

Protuberant occiput

Narrow nares

Large tongue

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Glottic Opening
Pediatric Airway-Too Purty...
Anatomical differences: Clinical significance

1. Large tongue relative to mouth cavity
2. High tracheal opening compared to Cx vertebrae
3. Shorter trachea
4. Large occiput causes airway flexion.
5. Narrow cricoid ring
6. Tonsils & adenoids large, acute angle between epiglottis and laryngeal opening
7. Small CT membrane

1. Straight blade preferred in infants.
2. Glottic opening more anterior
3. Predisposes to right main stem intubation
4. Sniffing position opens airway
5. Uncuffed tubes + mucosal injury
6. Blind nasotracheal intubation is not indicated in infants and small children.
7. Needle cricothyrotomy difficult

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Pre-term infant


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Physiologic differences: pediatrics vs. adults

- ↑ Respiratory rates and O\textsubscript{2} metabolism (6ml/kg/min vs. 3ml/kg/min)
  - + diminished FRC
    - shorter safe apnea time
- ↑ Chest wall compliance + lower lung compliance
  - Leads to muscle fatigue, \textit{atelectasis}
- Relatively small fixed tidal volume
  - Prone to barotrauma
- Supine position restricts motion of diaphragm
- Higher vagal tone
  - Bradycardia with laryngoscopy or suctioning.
Physiologic differences

Farmery AD, Roe PG: A model to describe the rate of oxyhemoglobin desaturation during apnea. Br J Anaesth 1996; 76:284-91

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Atlanto-occipital Joint

• Normal (adults): 35° of extension
• Reduction in range of motion will affect alignment of 3 airway axes
• Associated with:
  – Goldenhar, Klippel-Feil, dwarfism
  – Trisomy 21
  – JRA, neuromuscular scoliosis, ankylosing spondylitis, TMJ
  – Trauma
Optimal sniffing position

Line from EAM should be anterior to the shoulders

Proper forward movement of head relative to shoulders

Resting position
No Exactly Little Adults....
Pediatric Cord More Recessed
Ok this should be easy....
After which....bloody Airway
The Difficult Airway

• Clinical situation in which a conventionally trained anesthesiologist experiences difficulty with
  – Ventilation of upper airway using face mask
  – Incomplete laryngoscopic visualization
  – Difficulty intubating with standard airway equipment.

•Failed Airway:
  – 3 failed attempts at intubation by skilled provider
  – Failure to maintain SpO₂ >90

ASA task force guidelines
Anesthesiology 98(5): 1269-77, May 2003
Avoid repeated attempts at laryngoscopy

Cannot Intubate

↓

Cannot Intubate, Cannot Oxygenate

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Difficult Airway Box

Four Dimensions of Difficulty

Difficult Bag-mask Ventilation (MOANS)

Difficult Laryngoscopy and Intubation (LEMONS)

Difficult Extraplottic Device (RODS)

Difficult Cricothyrotomy (SHORT)

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Difficult airway box

- **Difficult Bag-Mask**
  - “MOANS”
  - **Mask**
  - **Obesity/obstruction**
  - **Age (>55)**
  - **No teeth**
  - **Stiff** (stiff lungs/Sleep apnea and snoring)

- **Difficult Laryngoscopy & Intubation**
  - “LEMONS”
  - **Look externally**
  - **Evaluate 3-3-2**
  - **Mallampati score**
  - **Obstruction/obesity**
  - **Neck** (C spine mobility)
Difficult Airway Box

• Difficulty with extraglottic device “RODS”
  - Restricted mouth opening
  - Obstruction
  - Disrupted or distorted airway
  - Stiff lungs or C-spine

• Difficult cricothyrotomy “SHORT”
  - Surgery (halo or neck)
  - Hematoma (abcess/inf.)
  - Obesity
  - Radiation (scar tissue)
  - Tumor
Difficult airway
Difficult airway
Difficult Airway Equipment

- Extraglottic devices (EGD)
  - Laryngeal mask airway (LMA)
  - Esophagotracheal combitube
  - Gum elastic bougie/tracheal tube exchangers
- Advanced Instruments
  - Video-laryngoscopes, Fiberoptic scope, lighted stylet
- Cricothyrotomy
Laryngeal Mask Airway (LMA)

- Maximum seal pressure is about 25cm H2O
- Less effective in patients with glottic or subglottic pathology
- Important to choose correct size (weight based)
- Does not prevent aspiration or reflux of gastric contents
Gum elastic bougie and airway exchangers

Central lumen allows for oxygenation
Intubation in PICU’s: It’s complicated!

Provider Characteristics
- Discipline
- Technical
- Behavioral-teamwork

Practice Characteristics
- Drugs
- Techniques

Patient Characteristics
- Severity of illness
- Presence of Difficult Airway

Safety of intubation in PICU

Underlying system
Culture

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Nishisaki, A, Children’s Hospital of Philadelphia
Team Skills and Behaviors

• An estimated one-third of adverse events are attributed to human error and system errors.

• Ineffective team communication is the root cause for nearly 66 percent of all medical errors.
  – Ineffective communication = patient care suffering.

• Heightened medical error vulnerability
  – Team members are under stress
  – Are in high-task situations
  – When they are not communicating clearly or effectively
Key Team Skills and Concepts

Team Competency Outcomes

Knowledge
- Shared Mental Model

Attitudes
- Mutual Trust
- Team Orientation

Performance
- Adaptability
- Accuracy
- Productivity
- Efficiency
- Safety

Reference: TeamSTEPPS - Teamwork Strategies and Tools to Enhance Performance and Patient Safety
Team Satisfaction

• Who cares?

• Communication
  – Influences the quality of working relationships
  – Job satisfaction
  – Impacts patient safety.

• Culture of mutual support
  – Communication done “well”
  – Higher retention

• Elements that contribute to healthcare team satisfaction
  – Feeling supported, e.g., administratively and inter-personally
  – Respected, valued
  – Understood, listened to
  – Having a clear understanding of role and work equity

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# Characteristics of an effective team

<table>
<thead>
<tr>
<th>Organizational structure</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear purpose</td>
<td></td>
</tr>
<tr>
<td>Appropriate culture</td>
<td></td>
</tr>
<tr>
<td>Specified task</td>
<td></td>
</tr>
<tr>
<td>Distinct roles</td>
<td></td>
</tr>
<tr>
<td>Suitable leadership</td>
<td></td>
</tr>
<tr>
<td>Relevant members</td>
<td></td>
</tr>
<tr>
<td>Adequate resources</td>
<td></td>
</tr>
</tbody>
</table>
How is a Team Different from a Group or Committee?

- Teams embody a **collective action** arising out of task interdependency
- Members of the team agree on the goal
- Members agree that they must **work together** to achieve the goal
- Each member is viewed as having one or more important roles to play to successfully achieve the goal
- There is less hierarchy within the unit than in most work groups: Flatten the Hierarchy
### When to use a team?

#### Quality and Acceptance

<table>
<thead>
<tr>
<th>Low Quality/ Low acceptance</th>
<th>High Quality/ Low acceptance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flip a coin</td>
<td>Ask an Expert</td>
</tr>
<tr>
<td>Low Quality/ High Acceptance</td>
<td>High Quality/ High acceptance</td>
</tr>
<tr>
<td>Group decision</td>
<td>Team Consensus</td>
</tr>
</tbody>
</table>
Leadership

• Effective team leaders
  – Organize the team
  – Identify and articulate clear goals (i.e., the plan)
  – Assign tasks and responsibilities
  – Monitor and modify the plan; communicate changes
  – Review the team’s performance; provide feedback when needed
  – Manage and allocate resources
  – Facilitate information sharing
  – Encourage team members to assist one another
  – Model effective teamwork

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“Any road will get you there, when you don’t know where you are going”
The Difficult Airway (DA)

The difficult airway is something you anticipate; the failed airway is something you experience.
Incidence of difficult BMV

• Children:
  Not obese – 2.1%
  Obese – 8.7%

• Healthy children
  – 6.6%
  – Younger age
  – NMB agents
  – ENT procedure
DA in the PICU: A different world

- 15 PICUS 2010 – 2011
- 1,516 children
- Median age 2yo

**Incidence and associated factors of difficult tracheal intubations in pediatric ICUs: a report from National Emergency Airway Registry for Children: NEAR4KIDS**

*Intensive Care Medicine 2014*
• History of DA or upper AW obstruction
• Increased risk of severe events:
  Cardiac arrest in 6.2% of DI
  1.4% non-difficult!
Challenges

• Culture Change

• Concepts with the team members
  – All Staff

• Scheduling training
  – Various groups
  – In Situ is ideal

Critical Success Factors

• Orientation

• Lunch Learns
  – Power of Food

• Engage Leadership Early
  – Clinical and Administrative

• Select leaders in the various groups from whom buy in will be key
Formula for the effective use of simulation

Training Resources \( \times \) Trained Educators \( \times \) Curricular Institutionalization = Effective Simulation-based Healthcare Education

Challenges

- System Backing
  - Both on larger scale
  - And within your unit
- No longer the “cool”
  - Do not want it to become a Fad
- Funding

Critical Success Factors

- Review Failures
- Highlight Successes
- Collect Meaningful Metrics
  - Organization
  - Learners
    - Perception vs. Reality
    - Connect it to Safety
- Donors
- Operationalize
  - Indirect cost savings
Multidisciplinary Simulation
Simulation
Our Best Practices

• Make use of a huddle
  – Per Day and Per Procedure

• Time out

• Checklist
  – Equipment

• Behaviors
  – Role clarity and shared mental model

• Multidisciplinary Team Training

• Work closed loop communication and role clarity into virtually all simulations
  – Application is so widespread.

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Our Multidisciplinary team

Team of healthcare providers that commonly work together working on a common task toward a unified goal

Our intubation team: 7 people

Routine:
Team Lead, Intubation, Primary RT, RT to assist, RN to give Meds, RN to chart, Runner (draw meds, get supplies if needed during the intubation)

Emergent:
Add another MD, Pharmacist, Anesthesiology or ENT (now interdisciplinary)

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Simulation in Pediatrics

Objective: Tracheal intubation in the pediatric intensive care unit is often performed in emergency situations with high risks. Simulation has been recognized as an effective methodology to train both technical and teamwork skills. Our objectives were to develop a feasible tool to evaluate team performance during tracheal intubation in the pediatric intensive care unit and to apply the tool in the clinical setting to determine whether multidisciplinary teams with a higher number of simulation-trained providers exhibit more proficient performance.

Design: Prospective, observational pilot study.

Setting: Single tertiary children’s hospital pediatric intensive care unit.

Subjects: Pediatric and emergency medicine residents, pediatric intensive care unit nurses, and respiratory therapists from October 2007 to June 2008.

Interventions: A pediatric intensive care unit on-call resident, a pediatric intensive care unit nurse, and a respiratory therapist received simulation-based multidisciplinary airway management training every morning. An assessment tool for team technical and behavioral skills was developed. Independent trained observers rated actual intubations in the pediatric intensive care unit by using this tool.

Measurements and Main Results: For observer training, two independent raters (research assistants 1 and 2) evaluated a total of 53 training sessions (research assistant 1, 16; research assistant 2, 37). The correlation coefficient with the facilitator expert (surrogate standard) was .73 for research assistant 1 and .88 for research assistant 2 (p ≤ .001 for both) in the total score. .84 for research assistant 1 and .77 for research assistant 2 (p < .001 for both) in the technical domain, and .63 for research assistant 1 (p = .009) and .84 for research assistant 2 (p < .001) in the behavioral domain. The correlation coefficient was lower in video-based observation (.62 vs. .88, on-site). For clinical observation, 15 intubations were observed in real time by raters. The performance by a team with two or more simulation-trained members was rated higher compared with the team with fewer than two trained members (total score: 127 ± 6 vs. 116 ± 9, p = .012, mean ± sd)

Conclusions: It is feasible to rate the technical and behavioral performance of multidisciplinary airway management teams during real intensive care unit intubation events by using our assessment tool. The presence of two or more multidisciplinary simulation-trained providers is associated with improved performance during real events. (Pediatr Crit Care Med 2011; 12:000–000)

Key Words: intubation; infant; simulation; airway; teamwork

Figure 1. ●●●.

Pediatr Crit Care Med 2011 Vol. 12, No. 5

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# Checklist Tool

## APPENDIX 1

<table>
<thead>
<tr>
<th>Item</th>
<th>T/NT</th>
<th>NT_cat</th>
<th>Points</th>
<th>Checkpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NT</td>
<td>TW</td>
<td>1</td>
<td>Identify oneself</td>
</tr>
<tr>
<td>2</td>
<td>NT</td>
<td>TW</td>
<td>1</td>
<td>Call for help</td>
</tr>
<tr>
<td>3</td>
<td>T</td>
<td>TW</td>
<td>2</td>
<td>Put gloves on hands</td>
</tr>
<tr>
<td>4</td>
<td>T</td>
<td>TW</td>
<td>2</td>
<td>Open airway with head-tilt chin-lift or jaw thrust within FIRST 15 secs</td>
</tr>
<tr>
<td>5</td>
<td>T</td>
<td>TW</td>
<td>1</td>
<td>Choose right size mask</td>
</tr>
<tr>
<td>6</td>
<td>T</td>
<td>TW</td>
<td>2</td>
<td>Check O2 source is turned on. If not, turn it on</td>
</tr>
<tr>
<td>7</td>
<td>T</td>
<td>TW</td>
<td>1</td>
<td>Apply mask correctly</td>
</tr>
<tr>
<td>8</td>
<td>T</td>
<td>TW</td>
<td>3</td>
<td>Provide bag and mask ventilation to see chest rise</td>
</tr>
<tr>
<td>9</td>
<td>NT</td>
<td>SA</td>
<td>3</td>
<td>Ask for blood pressure measurement during bag and mask ventilation</td>
</tr>
<tr>
<td>10</td>
<td>NT</td>
<td>DM</td>
<td>2</td>
<td>Decide to intubate within 60 secs after bag and mask ventilation is started</td>
</tr>
<tr>
<td>11</td>
<td>NT</td>
<td>TW</td>
<td>1</td>
<td>Notify the team for intubation</td>
</tr>
<tr>
<td>12</td>
<td>NT</td>
<td>TM</td>
<td>4</td>
<td>Call for suction system</td>
</tr>
<tr>
<td>13</td>
<td>NT</td>
<td>TM</td>
<td>3</td>
<td>Call for oral airway</td>
</tr>
<tr>
<td>14</td>
<td>NT</td>
<td>TM</td>
<td>1</td>
<td>Call for tracheal tube</td>
</tr>
<tr>
<td>15</td>
<td>T</td>
<td>TM</td>
<td>2</td>
<td>CORRECT size of tracheal tube is called</td>
</tr>
<tr>
<td>16</td>
<td>NT</td>
<td>TM</td>
<td>1</td>
<td>Call for laryngoscope</td>
</tr>
<tr>
<td>17</td>
<td>NT</td>
<td>TM</td>
<td>1</td>
<td>Call for colometric end-tidal CO2 detector</td>
</tr>
<tr>
<td>18</td>
<td>T</td>
<td>TM</td>
<td>2</td>
<td>Wear mask with eye protection</td>
</tr>
<tr>
<td>19</td>
<td>NT</td>
<td>TM</td>
<td>2</td>
<td>Call for sedative and or narcotic medication</td>
</tr>
<tr>
<td>20</td>
<td>NT</td>
<td>TM</td>
<td>2</td>
<td>Call for paralytic medication</td>
</tr>
<tr>
<td>21</td>
<td>NT</td>
<td>TM</td>
<td>2</td>
<td>Confirm an intravenous access is functional</td>
</tr>
<tr>
<td>22</td>
<td>NT</td>
<td>TW</td>
<td>2</td>
<td>Confirm Team Crew at specific task (intubation assistant, person to give medication, person who watches the monitor)</td>
</tr>
<tr>
<td>23</td>
<td>NT</td>
<td>SA</td>
<td>3</td>
<td>Ask for blood pressure cycle measurement before induction</td>
</tr>
<tr>
<td>24</td>
<td>NT</td>
<td>SA</td>
<td>3</td>
<td>Ask for cricoide pressure when sedative/narcotics is given (before paralytics)</td>
</tr>
<tr>
<td>25</td>
<td>T</td>
<td></td>
<td>2</td>
<td>Stop bag and mask ventilation at CORRECT TIMING (after paralyzed) for intubation</td>
</tr>
<tr>
<td>26</td>
<td>T</td>
<td></td>
<td>1</td>
<td>Hold laryngoscope with left hand</td>
</tr>
<tr>
<td>27</td>
<td>T</td>
<td></td>
<td>6</td>
<td>Be able to visualize vocal cord</td>
</tr>
<tr>
<td>28</td>
<td>T</td>
<td></td>
<td>4</td>
<td>Intubate in trachea</td>
</tr>
<tr>
<td>29</td>
<td>T</td>
<td></td>
<td>2</td>
<td>Primary confirmation of tracheal intubation</td>
</tr>
<tr>
<td>30</td>
<td>T</td>
<td></td>
<td>2</td>
<td>Secondary confirmation of tracheal intubation</td>
</tr>
<tr>
<td>31</td>
<td>NT</td>
<td>TW</td>
<td>2</td>
<td>Holding tracheal tube until it is secured</td>
</tr>
<tr>
<td>32</td>
<td>NT</td>
<td>TM</td>
<td>2</td>
<td>Call for chest x-ray</td>
</tr>
<tr>
<td>33</td>
<td>NT</td>
<td>TM</td>
<td>2</td>
<td>Confirm tracheal tube placement by chest x-ray</td>
</tr>
<tr>
<td>34</td>
<td>NT</td>
<td>SA</td>
<td>3</td>
<td>React to hypotension after intubation</td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td>NEAR form is filled</td>
</tr>
<tr>
<td>Global rating</td>
<td></td>
<td></td>
<td></td>
<td>Global rating for BASIC airway management: (1: novice; 3: advanced novice; 5: competent; 7: excellent)</td>
</tr>
<tr>
<td>36</td>
<td></td>
<td></td>
<td></td>
<td>Global rating for ADVANCED airway management: (1: novice; 3: advanced novice; 5: competent; 7: excellent)</td>
</tr>
</tbody>
</table>

The second column (T/NT) denotes the categories of action (technical task vs. behavioral [non-technical] tasks). The third column (NT_cat) denotes the categories of action in behavioral tasks. SA, situation awareness; DM, decision making; TM, task management; TW, teamwork.
• Treat every intubation event as an opportunity to apply these concepts
  – They will become more reflexive in more severe crisis or patient decompensation events.
• Define Roles for all the team members in the room
  – Roles:
    • Organize the room, procedure, charting, giving medications, Runner (OG tube, draw up additional medication)
    – Excuse any non-essential personnel
    – Know everyone’s name
• Leader (organize the room)
  – Team leader reminds everyone about closed loop communication
  – Shares his mental model
  – Flattens the hierarchy
  – Preintubation checklist verbalized
• Get rid of any extra noise

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Impact and Success thus far Using Simulation

- For both nurses and physicians
  - Make use of simulation to inculcate these behaviors early in their experience at Children's
    - Nurse Residency Program
    - PICU Fellow Boot Camp
- Skills training itself
  - Boot Camp Orientation Annually
    - Task trainers, Cadavers, and then high fidelity scenarios
  - Team Training
- Team Training Simulation
  - Currently ongoing
  - Team training behaviors
    - Focus is on team and not the "medicine"
- Provision for Muscle and Behavior memory

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Thank You

- Please save questions for the end
- Transition to one of my adult colleagues and simulation expert
Airway Management: Managing Risk in Airway Management Procedures

Sidhant Nagrani
Tuesday April 21st, 2015
Objectives

• Concepts and Competencies Related to Airway Management
• Difficult Airway Challenges and Planning Ahead
• Impacting Patient Safety using Team Skills
• Using Simulation to Impact Airway Management
• There are times in the care of a patient when we need to “secure” the patient’s airway: patient needs surgery, patient is unable to breath for themselves, patient is vomiting and at risk of aspirating, patient is hemodynamically unstable etc
• Definitive protection of the airway is often achieved through a process called intubation
• Endotracheal intubation is a medical procedure in which a tube is placed into the windpipe (trachea), through the mouth or the nose. In most emergency situations it is placed through the mouth.
• Intubation secures and protects the airway
• There are other methods of definitive airway management: tracheostomy, cricothyrotomy, but these are surgical and invasive
• Other non-definitive ways of airway management: supra-glottic airway devices such as LMAs
Let’s do a quick refresher

AIRWAY ANATOMY
Lateral Wall of the Nasal Cavity

(from Redden RJ: Anatomic considerations in anesthesia. In Hagberg CA, editor: Handbook of difficult airway management, Philadelphia, 2000, Churchill Livingstone, p. 3, Figure 1-2.)
Sagittal Section of the Head and Neck Showing Divisions of the Pharynx

Nasopharynx

Oropharynx

Hypopharynx

(From Redden RJ: Anatomic considerations in anesthesia. In Hagberg CA, editor: Handbook of difficult airway management, Philadelphia, 2000, Churchill Livingstone, p. 7, Figure 1-6.)
Oral Cavity and Oropharynx

Palatopharyngeal fold (posterior pillar)

Hard palate

Soft palate

Uvula

Palatогlossal fold (anterior pillar)

Tonsil

(From Redden RJ: Anatomic considerations in anesthesia. In Hagberg CA, editor: Handbook of difficult airway management, Philadelphia, 2000, Churchill Livingstone, p. 8, Figure 1-7.)
Larynx as Visualized from the Hypopharynx

Vallecula
Epiglottis
Tubercle of epiglottis
Piriform recess
Cuneiform cartilage
Comniculate cartilage

Median glossoepiglottic fold
Lateral glossoepiglottic fold
Aryepiglottic fold
Ventricular fold
Vocal fold
Trachea

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(From Redden RJ: Anatomic considerations in anesthesia. In Hagberg CA, editor: Handbook of difficult airway management, Philadelphia, 2000, Churchill Livingstone, p. 8, Figure 1-8.)
Our goal – Aligning the Axes to Visualize the Vocal Cords

Figure 2.5. (Fig. 7.6 pg 188 From "Principles of airway management" by Finucane and Santora) For the laryngoscopic visualization axis (LVA) to permit laryngeal visualization, appropriate positioning of the head and neck is essential. Inability to extend the neck will result in the divergence of line of sight from the laryngeal visualization vector and persistently poor views. Failure to detect limited head extension is commonly associated with difficult intubations.
Airway Assessment

BOX 55-1

- Visual inspection of the face and neck
- Assessment of mouth opening
- Evaluation of oropharyngeal anatomy and dentition
- Assessment of neck range of motion (ability of the patient to assume the sniffing position)
- Assessment of the submandibular space
- Assessment of the patient’s ability to slide the mandible anteriorly (test of mandibular prognathism)

Components of the Physical Examination of the Airway
Modified Mallampati Classification

- **Class I:** Fauacial pillars, uvula, and soft palate are visualized.
- **Class II:** Base of the uvula and soft palate are visualized.
- **Class III:** Soft palate only is visualized.
- **Class IV:** Hard palate only is visualized.

Patients with sleep apnea often present with tonsillar hypertrophy secondary to the increased upper airway fat deposition and Bernoulli effect.
Figure 2.2. (Fig. 3.3.3 (a and b) pg 129 From "Diagnosis in Otorhinolaryngology" by Matin Onerci). Patients with obstructive sleep apnea (b) have significantly larger tongues than patients without the condition, predisposing them to airway obstruction.
# ASA Physical Status Classification System

ASA PHYSICAL STATUS CLASSIFICATION SYSTEM  
Last approved by the ASA House of Delegates on October 15, 2014

Current definitions (NO CHANGE) and Examples (NEW)

<table>
<thead>
<tr>
<th>ASA PS Classification</th>
<th>Definition</th>
<th>Examples, including, but not limited to</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASA I</td>
<td>A normal healthy patient</td>
<td>Healthy, non-smoking, no or minimal alcohol use</td>
</tr>
<tr>
<td>ASA II</td>
<td>A patient with mild systemic disease</td>
<td>Mild diseases only without substantive functional limitations. Examples include (but not limited to): current smoker, social alcohol drinker, pregnancy, obesity (30 &lt; BM &lt; 40), wellcontrolled DM/HTN, mild lung disease</td>
</tr>
<tr>
<td>ASA III</td>
<td>A patient with severe systemic disease</td>
<td>Substantive functional limitations; One or more moderate to severe diseases. Examples include (but not limited to): poorly controlled DM or HTN, COPD, morbid obesity (BMI ≥40), active hepatitis, alcohol dependence or abuse, implanted pacemaker, moderate reduction of ejection fraction, ESRD undergoing regularly scheduled dialysis, premature infant PCA &lt; 60 weeks, history (&gt;3 months) of MI, CVA, TIA, or CAD/stents.</td>
</tr>
<tr>
<td>ASA IV</td>
<td>A patient with severe systemic disease that is a constant threat to life</td>
<td>Examples include (but not limited to): recent (&lt; 3 months) MI, CVA, TIA, or CAD/stents, ongoing cardiac ischemia or severe valve dysfunction, severe reduction of ejection fraction, sepsis, DIC, ARD or ESRD not undergoing regularly scheduled dialysis</td>
</tr>
<tr>
<td>ASA V</td>
<td>A moribund patient who is not expected to survive without the operation</td>
<td>Examples include (but not limited to): ruptured abdominal/thoracic aneurysm, massive trauma, intracranial bleed with mass effect, ischemic bowel in the face of significant cardiac pathology or multiple organ/system dysfunction</td>
</tr>
<tr>
<td>ASA VI</td>
<td>A declared brain-dead patient whose organs are being removed for donor purposes</td>
<td></td>
</tr>
</tbody>
</table>

*The addition of “E” denotes Emergency surgery: (An emergency is defined as existing when delay in treatment of the patient would lead to a significant increase in the threat to life or body part)*
Are there ways to predict who will have a difficult airway?
# Markers of a difficult Airway

## 1. Difficult Bag-Mask Ventilation

Mnemonic = MOANS

<table>
<thead>
<tr>
<th>Marker</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mask seal</td>
<td>Bushy beards, crusted blood on the face, or disruption of lower facial continuity</td>
</tr>
<tr>
<td>Obesity / Obstruction</td>
<td>Obesity, pregnancy, angioedema, Ludwig’s angina, upper airway abscess, epiglottitis</td>
</tr>
<tr>
<td>Age</td>
<td>Age &gt; 55</td>
</tr>
<tr>
<td>No teeth</td>
<td>May leave denture in edentulous patients.</td>
</tr>
<tr>
<td>Sleep apnea / Stiff lungs</td>
<td>COPD, asthma, ARDS, others</td>
</tr>
</tbody>
</table>
2. Difficult Laryngoscopy and Intubation

Mnemonic = LEMON

<table>
<thead>
<tr>
<th>Look externally</th>
<th>Use your clinical gestalt, evidence of lower facial disruption, bleeding, small mouth, agitated patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluate</td>
<td>Use the 3-3-2 rule: mouth open, mandible, glottis</td>
</tr>
<tr>
<td>Mallampati score</td>
<td>In order of increasing difficulty Class I-IV</td>
</tr>
<tr>
<td>Obstruction / Obesity</td>
<td>Four cardinal signs of upper airway obstruction: stridor, muffled voice, difficulty swallowing secretions, sensation of dyspnea. Obese patients frequently have poor glottic views.</td>
</tr>
<tr>
<td>Neck mobility</td>
<td>May not be able to optimally move the head and neck due to trauma, arthritis, ankylosing spondylitis. Immobilize the neck and consider using video laryngoscopy.</td>
</tr>
</tbody>
</table>
### 3. Difficult Extraglottic Device

Mnemonic = RODS

<table>
<thead>
<tr>
<th>R</th>
<th>Restricted mouth opening</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>Obstruction</td>
</tr>
<tr>
<td>D</td>
<td>Disrupted or Distorted airway</td>
</tr>
<tr>
<td>S</td>
<td>Stiff lung or cervical Spine</td>
</tr>
</tbody>
</table>
Difficult Cricothyrotomy
Mnemonic = SHORT

<table>
<thead>
<tr>
<th>S</th>
<th>Surgery or other airway obstruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>Hematoma (includes infection/abscess)</td>
</tr>
<tr>
<td>O</td>
<td>Obesity</td>
</tr>
<tr>
<td>R</td>
<td>Radiation distortion (and other deformity)</td>
</tr>
<tr>
<td>T</td>
<td>Tumor</td>
</tr>
</tbody>
</table>

There are no absolute contraindications to performing an emergency cricothyrotomy.
Difficult Airway Challenges

Per the 2013 ASA Practice Guidelines for the Management of the Difficult Airway,

“a difficult airway is defined as the clinical situation in which a conventionally trained anesthesiologist experiences difficulty with facemask ventilation of the upper airway, difficulty with tracheal intubation, or both.”

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• So now you have a patient in acute respiratory distress, breathing 50 times a minute, tiring...

• He weighs > 650 lbs, is rated an ASA class IV, has a short neck with a large circumference, a beard, and is using CPAP at home for his obstructive sleep apnea
Your Patient

5’6”
686 lbs
(311kg)
BMI 110.7

FIGURE 1A. Patient with super morbid obesity with large neck and a beard

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What do you do?
Let's be honest here...
Difficult Airway Management

- You need a preset algorithm
- In the emergency department airway management often takes place under semi-emergent or emergent conditions
- First, ensure you can bag the patient
- If you cannot ventilate the patient, DO NOT PARALYZE!!!
Difficult Airway Management

- As long as you can ventilate the patient, you have options

- Consider:
  - Video assisted laryngoscopy
  - Fiberoptic intubation

- If you cannot achieve either after multiple attempts, you can:
  - Call for help
  - Awaken the patient

- If your patient is crashing, you can:
  - try a supra-glottic device
  - Attempt needle cricothyrotomy (as an intermediate measure)
  - Attempt scalpel cricothyrotomy
Grady’s Difficult Airway Algorithm

INTUBATION PATHWAY

1st attempt: your choice (direct, Glidescope, fiberoptic, etc.)
2nd attempt: Glidescope
3rd attempt: airway goes to 3rd year or attending

PREPARE

Have a 7-0 tube loaded tube
Have a bougie ready for all intubation

Document in your note why more than 2 attempts
Grady’s Difficult Airway Algorithm

*Prepare.*
- Have a **7-0 tube loaded** in case you can’t pass your larger tube.
- (This was one of the main reasons reported for failed attempts.)
- Have a **bougie ready** for all intubations.

*Intubation pathway:*
- 1\textsuperscript{st} attempt: **your choice** (direct, Glidescope, fiberoptic, etc.)
- 2\textsuperscript{nd} attempt: **Glidescope**
- 3\textsuperscript{rd} attempt: airway goes to 3\textsuperscript{rd} year or attending
Teaching The Residents How to Approach the Difficult Airway

- Emory EM residency conducts an annual airway teaching day for the residents organized by EM faculty
- Several emergency medicine faculty involved
- Multiple difficult airway concepts: naso-trachial intubation with fiberoptic scope; cricothyrotomy; use of gleidoscope
- Residents gets individual hands-on practice with mannequins, task trainers, as well as animal tracheas
Using Simulation to Impact Airway Management

- Used high-fidelity simulation to both teach and assess moderate sedation.
- The performance of certain procedures in the ED requires sedating the patient to facilitate the procedure.
- We used simulation to both formally assess the procedural sedation skills of 63 ED residents, as well as debrief them on the management of complications of bradypnea/apnea, and hypoxia.
- Performances assessed on the basis of the new Emergency Medicine Milestones.
- Results to be published as part of a multi-center National Accreditation System Project.
Using Simulation to Impact Airway Management

- Used simulation to assess the ability of 63 residents to perform fiberoptic scope awake naso-trachial intubations for a case of angioedema

- Use of appropriate procedural medications

- Assessed technique for use of fiberoptic scope
Awake Fiberoptic Intubation Simulation
Cricothyrotomy Simulation

https://www.youtube.com/watch?v=-daOdF90Ze8
Using Simulation to Impact Airway Management

- Conduct in-situ multi-disciplinary trauma simulations involving trauma surgery, EM residents, trauma nurses, respiratory therapists, and techs

- We have pre-assigned roles for team members
As described by the National Quality Forum:

“Health care organizations must establish a proactive, systematic, organization-wide approach to developing team-based care through teamwork training, skill building, and team-led performance improvement interventions that reduce preventable harm to patients...training programs should systematically address and apply the principles of effective team leadership, team formation [and team processes].”
The Concept of the “High-Reliability Organization”

- A **high reliability organization** (HRO) is an **organization** that has succeeded in avoiding catastrophes in an environment where normal accidents can be expected due to risk factors and complexity.

- Widely applied in fields such as aviation

- Was the original inspiration for the use of high-fidelity simulation in the field of medicine

- Focus on communication and teamwork
Characteristics of High-Reliability Organizations

Figure 1. The circle of safety culture. The common prerequisite is commitment to safety. HRO, high reliability organization; CRM, crisis resource management; FMEA, failure mode effects analysis; RCA, root cause analysis.
### Table 6. Key points of crisis resource management (CRM).  

<table>
<thead>
<tr>
<th>1. Know the environment</th>
<th>9. Prevent and manage fixation errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Anticipate and plan</td>
<td>10. Cross (double) check</td>
</tr>
<tr>
<td>3. Call for help early</td>
<td>11. Use cognitive aids</td>
</tr>
<tr>
<td>4. Exercise leadership and followership</td>
<td>12. Re-evaluate repeatedly</td>
</tr>
<tr>
<td>5. Distribute the workload</td>
<td>13. Use good teamwork</td>
</tr>
<tr>
<td>6. Mobilize all available resources</td>
<td>14. Allocate attention wisely</td>
</tr>
<tr>
<td>7. Communicate effectively</td>
<td>15. Set priorities dynamically</td>
</tr>
<tr>
<td>8. Use all available information</td>
<td></td>
</tr>
</tbody>
</table>

• If a team has tools and strategies it can leverage to build a fundamental level of competency in each of those skills, research has shown that the team can enhance three types of teamwork outcomes:
  
  1. Performance.
  2. Knowledge.
  3. Attitudes.

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QUESTIONS?