A1. Airway Management

Managing Risk in Airway Management Procedures

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• Employment:
  • ECRI Institute (non-profit)
  • the Children’s Hospital of Philadelphia
• Depiction of specific devices does not necessarily imply endorsement
After completing this session, the learner should be able to:

• Describe airway management learning objectives for YOUR OWN learners

• Pair airway management devices with airway training models/manikins which are appropriate for your own learners

• Describe the contributions of the individual, the team and the system in mitigating the risks of airway management procedures
Risk is present in many components of airway management

- **Risk**: a calculation, based on both technical and non-technical factors
- **Hazard**: a system state or set of conditions that, together with a particular set of worst-case environment conditions, will lead to an accident (loss)

- **What can go wrong?**
  - Anything that can go wrong might go wrong

Based on: Leveson. Engineering a Safer World, Systems Thinking Applied to Safety; 2011
There’s rules to riding a horse
But the horse won’t necessarily know ‘em

Texas Bix Bender
What can we optimize to provide the best care for our patients?

**Environmental / system conditions**
- Equipment, protocols
- Simulation to evaluate, iteratively improve, practice

**Individual Care Provider skills**
- Technical
  - Techniques for various procedures
- Non-technical
  - Situational awareness
  - Knowing when to ask for help

**Team skills**
- Technical
  - Coordinating resources and actions
- Non-technical
  - Shared mental model
What are the risks in airway management?

- Preconditions, requirements, resources
- Outcomes, results
Needs Assessment

• Determine who your learners are
• Assess their educational needs
  • Learners’ perceptions
  • Learner testing
  • Faculty’s perceptions
  • Academic, credentialing, regulatory, institutional requirements
  • Needs analysis, gap analysis
Develop your Learning Objectives

**Action**
- Perform
- Intubate

**Subject**
- a cricothyrotomy
- 3 different “age” manikins

**Measure**
- [completes one] within 3 minutes
Example of handout including learning objectives

• Objectives:
  • Position patient to optimize airway patency
  • Insert nasopharyngeal or oropharyngeal airway
  • Mask ventilate using one-handed and two-handed techniques to hold the mask

• Introduction
• Equipment and Supplies
• Procedure
• Pearls
• Pitfalls

Deutsch, Malekzadeh, Malloy
Simulation-Based Otorhinolaryngology Emergencies
Boot Camp: How I Do It (Parts 1, 2, 3) 2014
Includes handouts for each station in the online appendices
Individual skills
Laryngeal Anatomy: Pediatric vs Adult

- Proportions
  - Prioritization of breathing versus voice
- Location
  - More cephalad; protected by mandible

The Pediatric Airway
An Interdisciplinary Approach; Myer, Cotton, Shott
Nasopharyngeal Airway

- Select proper size
  - Tip of nose to earlobe
- Lubricate
- Insert gently
  - Bevel toward septum
- Do not force
- Ensure correct placement
  - Separates soft palate from posterior pharyngeal wall
  - Above (cephalad) epiglottis
- Option: Seldinger technique
- Contraindication
  - Midface/head trauma, skull fracture

K Roberts, H Whalley, A Bleetman/ The nasopharyngeal airway: dispelling myths and establishing the facts. 2005
Oropharyngeal Airway

- Unresponsive patient
- Select proper size
  - Oral commissure to earlobe
- Open patient’s mouth
  - Grasp jaw/tongue or
    - Use tongue depressor
- Insert OPA
  - Initially turned 180° (adult) or 90° (child); then rotate into position
- Ensure correct placement
- Remove if patient gags
- Contraindication: recent oral surgery or trauma
Bag-Mask Ventilation

• Contraindications are rare
  • Severe facial trauma, open eye injuries
  • Foreign material in oral cavity
• Interaction between positioning of both provider and patient
  • Head extension, jaw thrust
  • Ensure mask seals against patient’s face
  • Bring patient’s face up into the mask
• Can often temporize
• Bag Mask Ventilation – Positive Pressure Ventilation video by NEJM

video: Bag Mask Ventilation NEJM
Eppich et al Residents’ Mental Model of Bag-Mask Ventilation
Laryngeal Mask Airway

• Alternative to ETT in some circumstances
  • Relatively easy and quick to place
  • May be appropriate if anatomic or traumatic abnormalities make intubation difficult
• Select correct size
  • Weight range typically printed on the LMA
• Deflate and lubricate the cuff
• Slide LMA into place by following the curve of the palate (with firm pressure) until gentle resistance is felt
• Inflate cuff; confirm adequate ventilation, secure the LMA
• Will not protect against aspiration
• Videos: Laryngeal Mask Airway EM Cape Town; Laryngeal Mask Airway NEJM
Endotracheal Intubation

• Keys:
  • Proper positioning

Chevalier Jackson c1936
Endotracheal Tube

• Keys:
  • Proper positioning
  • Good laryngeal visualization

Chevalier Jackson c1936
Augmentative Devices

- Videolaryngoscope
- Fiberoptic laryngoscope
Trach
Emergency airway assessment: Function

Unconscious, unreactive, near death?

- yes: Crash airway: immediate control required
  - fails
  - yes: Difficult airway: some predictability; may evolve
    - fails
    - yes: Failed airway: “can’t intubate, can’t ventilate”
  - no: RSI
    - fails
- no: Difficult airway?
  - yes: Difficult airway: some predictability; may evolve
    - fails
    - yes: Failed airway: “can’t intubate, can’t ventilate”
  - no: RSI
    - fails

Adapted from Ron Walls et al; The Emergency Airway Algorithms in Manual of Emergency Airway Management; 2000
Anatomic predictors: LEMON Law

• Look externally
  • Obesity?
  • Cranio-facial anomaly?
    • Small mandible
    • Facial asymmetry
    • Trisomy 21
    • Midface hypoplasia
  • Tracheotomy?

Anatomic predictors: LEMON Law

- Evaluate by the 3-3-2 rule
  - 3 fingers into the mouth
  - 3 fingers under the chin
  - 2 fingers at the top of the neck

Photo by Pete Pellegrino, MD
http://newborns.stanford.edu/PhotoGallery/Micrognathia1.html
Anatomic predictors: LEMON Law

- Mallampati evaluation
  - Class I and II: no difficulty
  - Class III: moderate difficulty
  - Class IV: severe difficulty

Source: www.sedationfacts.org accessed 12/5/09
Anatomic predictors: LEMON Law

- Obstruction
  - Foreign body
  - Infection
  - Tumor / neoplasm
  - Other masses
Anatomic predictors: **LEMON** Law

- **Obstruction where?**
  - Nose, including choanae, nasopharynx (adenoids)
  - Oral cavity, oropharynx, including tongue, tonsils
  - External or extraluminal compression
    - Peri-tonsillar abscess, esophageal foreign body
Anatomic predictors: LEMON\textsuperscript{N} Law

- Neck mobility
  - Immobility
  - Instability

Image courtesy of Vinay Nadkarni, MD

http://www.chop.edu/centers-programs/trisomy-21-program#.VIAcS90zIU
accessed 12/4/14
Don’t forget...

Image courtesy of Dr. David Molter
Debriefing is essential!
Know your own simulation resources and capabilities

<table>
<thead>
<tr>
<th></th>
<th>NP Airway</th>
<th>Bag-Valve Mask</th>
<th>Laryngeal Mask Airway</th>
<th>Intubation</th>
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<tbody>
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<td>Yes</td>
<td>Yes</td>
<td>Unique #1</td>
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<td>Child</td>
<td>Yes</td>
<td>Yes</td>
<td>Will not work</td>
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<tr>
<td>Adult</td>
<td>Yes, including Seldinger</td>
<td>Very difficult</td>
<td>Cookgas #3.5</td>
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## Comparison of learning modalities

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<tr>
<th></th>
<th>Lecture</th>
<th>Animal Lab</th>
<th>Manikin</th>
<th>Virtual Bronch</th>
<th>Standardized Patient</th>
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</table>

Resident perception, Likert scale, ANOVA significant difference in mean performance scores

Deutsch, Christenson, Curry, Hossain, Zur, Jacobs; Multimodality Education for Airway Endoscopy Skill Development; Annals ORL 2009
Team skills
Environmental / System factors

Critical airway team carts

Kaalan Johnson et al Simulation to Implement a Novel System to Care for Pediatric Critical Airway Obstruction 2012
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