Airway management Training and Equipment

- Marlize van Dyk
- Anaesthesiologist and Intensivist
- Netcare Unitas Hospital
Unitas Hospital

NETCARE
You're in safe hands
No conflict of interest to declare
Overview

- Training
- Why
- How much
- How
- Equipment
- Difficult airway trolley
- What’s new
The safety margin in airway management can be greatly improved by a first and very important rule:

ALWAYS be Prepared for the expected and unexpected difficult airway.
Safety culture

- Airway management is the “A” in ABC
- Hypoxia
- Securing the airway is time-dependent and potentially life-threatening, thus a stressful and critical task
AM as a critical marker for safety culture

- Defined: a collection of characteristics and attitudes in an organization, promoted by its leaders and internalized by its members, that makes safety an overriding priority
- AM is a good place to start and implement modern safety culture strategies
Safety culture

- After an accident the question is not: ‘who is to blame?’, but rather ‘why was this possible and what can be done to prevent it the next time?’
- Values (what is important),
- Beliefs (how things should work), and
- Norms (the way things work)
High reliability organization (HRO): applied safety culture

- High-risk but high-reliability such as commercial aviation
- Proactive Safety culture
- Optimal structures and procedures
- Initial and recurrent training and practice in routine and emergency simulations
- Organizational learning
Crisis Resource Management applied to difficult AM

- Coordinating, using and applying all available resources to protect and help the patient in the best way possible
- Begins before the crisis to help avoid
- Detect errors asap and minimize negative consequences
- ACRM, Gaba et al gold standard
Do we need training?

- CVCI
- Residents lack knowledge and practical skills in handling the difficult airway
- 97% could not remember ASA difficult airway algorithm

Rosenstock et al
Acta Anaesthesiol Scand 2004
Why do we need airway training?

- ICU intubation difficult
- Emergent
- Pathophysiology of critical ill patient
- Fluid shifts
- Edema
- Previous intubations
- Hypoxia and Hemodynamic instability
- RSI
How much training?

- Study to assess amount of training
- 20 successful intubations in manikins
- 47 intubations before successful in 90% of cases
- Normal airways

Mulcaster

Anaesthesiaology Jan 2003
Difficult intubation in > 10% of cases outside OR

Adverse resp events > 1/3 of >2000 US closed malpractice claims and incl
- Inadequate ventilation
- Esophageal intubation
- Difficult intubation
- Airway obstruction

In 85% brain damage or death
3423 emergency intubation over 8 yr period
- 10.3% difficult airways
- 4.2% complications
  - 2.8% aspiration
  - 1.3% esophageal intubation
  - 0.2% dental damage
  - 0.1% pneumothorax
- Lower complications than other studies but first respondent was anaesthetist with >24 months training
  - Martin et al
Independent risk factors for difficult intubation
- 3 or > attempts
- Grade III or IV Cormack and Lehane view
- Wards or emergency department
Significant increase in rate of complications as number of laryngoscopic attempts increase
- Hypoxia 11.8% vs. 70%
- Regurgitation 1.9% vs. 22%
- Aspiration 0.8% vs. 13%
- Bradycardia 1.6% vs. 21%
- Cardiac arrest 0.7% vs. 11%

Mort Anest and Analg 2004
Editorial BJA May 2011 by Norris, Hardman and Asai

A firm foundation for progress in airway management

The 4th national audit project of the Royal College of Anaesthetists and the Difficult Airway Society

Occurrence of serious airway complications (death, brain damage, surgical airway or unexpected ICU admission)
Fig 1 Primary airway problem
Airway complications in ICU resulted in >60% mortality.

- 25% in ER
- 14% in OR

Causes divided in:
- Patient
- Judgment
- Education
- Training
In ICU

- Trageostomy related events > 50%
- Failed intubations
- ETT displacement
  - Extubation
  - Esophageal intubation
- CICV
- Iatrogenic trauma to airway
- Events more likely out of hours
- Inexperienced staff didn’t follow protocols and had problems with equipment
  - Non-availability
  - Lack of training in use
  - Failure to consider using right equipment
- Rescue techniques had high rate of failure
  - Not prepared
  - Didn’t identify patients
  - Formulate back-up plan
- 10-point care bundle reduced complications by 30-60%
- Need for emergency surgical airways reduced by a comprehensive difficult airway program
- Sustained over 11 yr period
- Berkow et al
- Anesth & Analg 2009
<table>
<thead>
<tr>
<th>Date</th>
<th>Component of difficult airway program</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>Standardized airway cart</td>
</tr>
<tr>
<td>1996</td>
<td>Education of support staff to manage airway cart supplies and equipment</td>
</tr>
<tr>
<td>1996</td>
<td>Difficult airway information added to electronic patient record</td>
</tr>
<tr>
<td>1997</td>
<td>Formalized airway education program</td>
</tr>
<tr>
<td>1997</td>
<td>Preanesthesia assessment form with standardized airway examination</td>
</tr>
<tr>
<td>2000</td>
<td>Simulated airway training</td>
</tr>
<tr>
<td>2001</td>
<td>Continuous updating of current airway technology</td>
</tr>
<tr>
<td>2006</td>
<td>Support staff availability 24 h/d, 7 d/wk</td>
</tr>
</tbody>
</table>
Figure 3. Annual number of emergency surgical airway procedures performed to secure a difficult airway. The difficult airway program was implemented in 1996.
Training methods

- Manikins
- Laerdal Airway Management Trainer
- Different models available
- Good starting point
- Unable to became proficient
Simulators

- AM includes both specialized technical skills and higher-order cognitive skills and behaviors
- Teaching of specific psychomotor skills are well validated
● SimMan simulator
● Unanticipated difficult airway training
● More structured approach
● Reduced equipment misuse
● Repeat training at 6 months intervals

● Kuduvalli et al
● Anaesthesia 2007
Videolaryngoscope

- Most significant development in airway management
- Laryngoscope blades have been unchanged since 1940
- Allows glottic visualization without creating direct line of sight by alignment of oral, laryngeal and tracheal axes
Figure 3. Storz DCI Miller 1 Video Laryngoscope blade showing the direct line of sight view as compared with the camera view.
- Better view of glottis
- Greater success of tracheal intubation
- Easier to use than DL
Novel tool for instruction

The video image allows supervisors real-time guidance and instructions during attempted intubations

University of California cross-over design study

14% higher intubation success rate
Intubation training (on a manikin) with or without video assisted laryngoscopy in students without any intubation experience

Assessment done in OR when intubating patients with direct laryngoscopy

Number of attempts and tooth trauma lower in video-assisted trained group

Low et al
Manikin only trained personnel had significantly higher intubation success on a limited number of patients using the GlideScope vs. Macintosh laryngoscope

- 93% vs. 51%

- Trainees and infrequent intubators

- Nouruzi-Sedeh et al
Tracheal tube exchange: feasibility of continuous glottic viewing with advanced laryngoscopy assistance

Change a high-risk exchange from a blind procedure into one with improved glottic visualization

Thomas Mort

Anesth Analg 2009
Figure 2. Distribution of Laryngoscopy Grades for video laryngoscopy (VL) and direct laryngoscopy (DL).
<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portability</td>
<td>Expensive compared with direct laryngoscopic devices</td>
</tr>
<tr>
<td>Rapid to deploy and limited setup time</td>
<td>Need for training</td>
</tr>
<tr>
<td>Resistant to fogging</td>
<td>Less able to overcome obstacles to the visualization of the laryngeal opening, as compared with the</td>
</tr>
<tr>
<td>Useful where secretions present</td>
<td>other devices discussed</td>
</tr>
<tr>
<td>High-resolution image which can be recorded</td>
<td>Require moderate mouth opening</td>
</tr>
<tr>
<td>No fragile fiberoptic bundles</td>
<td></td>
</tr>
<tr>
<td>Non line-of-sight laryngeal exposure</td>
<td></td>
</tr>
<tr>
<td>Visualized control of ETT insertion and advancement</td>
<td></td>
</tr>
<tr>
<td>No lifting force required</td>
<td></td>
</tr>
<tr>
<td>Excellent for teaching purposes</td>
<td></td>
</tr>
</tbody>
</table>
Cervical spine injuries

- Less C-spine movement
<table>
<thead>
<tr>
<th></th>
<th>Flexible Fiberoptic</th>
<th>Rigid and Semirigid Fiberoptic</th>
<th>Video Laryngoscope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intuitive use/significant new skills not required</td>
<td>−</td>
<td>−</td>
<td>+</td>
</tr>
<tr>
<td>Rapid intubation</td>
<td>−</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Effective in presence of blood and secretions</td>
<td>−</td>
<td>−</td>
<td>+</td>
</tr>
<tr>
<td>Able to physically displace obstructive tissue</td>
<td>−</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Effective intubation in a wide variety of difficult airway scenarios</td>
<td>+++</td>
<td>+</td>
<td>−</td>
</tr>
</tbody>
</table>

Legend:
Range from − − incorrect to +++ correct statement.
Telemedicine

- Videolaryngoscopes linked to telepresence programs to assist with patients whose airway is difficult to manage.
- An airway expert not physically present at the site of intubation can effectively view the intubation real-time and provide audio assistance to the operator to help them properly complete the intubation.

John Sakles

Telemedicine and e-Health Apr 2011
Routine equipment

Facemasks
Oropharyngeal airways
LMAs
ETT
2 x laryngoscope handles
Macintosh blades 3&4
Bougie
Stylet
Magill forceps
Emergency equipment

- McCoy
- ILMA
- ETT – reinforced and microlaryngeal
- FOB/videolaryngoscope
- Cricothyriod cannula
- Surgical cricothyroidototmy kit
Laryngoscopes
McCoy laryngoscope
Rescue devices

- Bougie – used in 14% cases
FIGURE 1. Classic LMA.
FIGURE 3. Single-use (disposable) LMA—The LMA Unique, shown with pediatric sizes (left two devices), are similar to the classic LMA. The 2 right LMAs are adult sizes.
Emergency airway management by intensive care unit nurses with the intubating laryngeal mask airway and the laryngeal tube

- Successful blind intubation 100% with ILMA
- Successful placement of LT in 100%
- Tidal volumes higher than with bag-valve ventilation
- Less gastric distention

Dorges et al.
Crit Care 2000
FIGURE 2. Intubating LMA. A metallic handle is incorporated into the metallic core of the device, aiding positioning. An endotracheal tube is inserted through the metallic core and passed through the glottis via proper positioning of the LMA aperture.
FIGURE 5. Insertion technique of LMA.
FIGURE 6. Bronchoscopy via the LMA. A 3-way adapter allows the insertion of bronchoscope and application of volume ventilation simultaneously.
TABLE 2. Advantages and Disadvantages of Flexible Devices

Advantages
• Allows visualization of the glottic opening even with limited mouth opening
• Minimal hemodynamic stress when properly performed
• Oral and nasal intubation is possible
• Can apply topical anesthesia and insufflate oxygen during intubation
• Can be passed through a laryngeal mask airway
• May be able to bypass an obstruction

Disadvantages
• Expensive
• Require careful maintenance
• Presence of blood/secretions impairs visualization
• Requires practiced expertise for use in acute situations
• Soft tipped which may make manipulation difficult
• Requires a light source
Lightwands
Best practice

- Availability of patient information
- System for pre-intubation evaluation
- On-going education
- Simulated teaching of technical skills
• Advanced airway equipment immediately available
• Well-established algorithms with decision making trees
• Team training
• Crisis management skills training
Thank you for listening