What’s New in Airway Management

Monday, Sept. 28th, 2015

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Learning Objectives

Importance of Airway Management
Trauma Airway Scenarios
Airway tools
Other things to consider
Harborview Medical Center

Level I Trauma Center
(Washington State, Alaska, Idaho, Montana)

25 Operating rooms - 14,000 surgeries/year

69,000 ED visits - 18,000 admissions

4120 Trauma admissions
697 patients directly to OR
American Society of Anesthesiologists Article

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What's New In ... Difficult Airway Management Algorithm in Trauma Updated by COTEP Carin A. Hagberg, M.D.
Chair, Committee on Trauma and Emergency Preparedness

Olga Kaslow, M.D., Ph.D.
Committee on Trauma and Emergency Preparedness
Figure 1

Recognized DA
Cooperative patient
Hemodynamically stable
Maintains adequate O₂

Awake Intubation with FIS or VAL

Initial intubation attempt successful*

Unsuccessful (a)

BVM Ventilation Adequate

1. Call for help
2. BVM ventilation
3. Maintain delivery of supplemental O₂
4. Maintain CP

INVASIVE AIRWAY ACCESS (b)

BVM Ventilation Not Adequate

Consider/Attempt SGA (a)

SGA Adequate*

SGA Not Adequate or Not Feasible

Non-Emergency Pathway
Ventilation adequate, intubation unsuccessful

Alternate approaches to intubation (c)

Success*

Fail (d)

Emergency Invasive Airway Access (f)

Anesthesia infiltration or regional nerve blockade are of limited value in extensive trauma surgery.
Prehospital Airway Management
Learning Objectives

Importance of Airway Management
Trauma Airway Scenarios
Airway tools
Other things to consider
Timing is Everything: Delayed Intubation is Associated with Increased Mortality in Initially Stable Trauma Patients

Emily Miraflor, M.D., Kelly Chuang, M.D., Marvin A. Miranda, B.A., Wendy Dryden, B.A., Louise Yeung, M.D., Aaron Strumwasser, M.D., and Gregory P. Victorino, M.D.

Department of Surgery, UCSF-East Bay, Alameda County Medical Center, Oakland, California

Submitted for publication January 7, 2011

Background. The indications for immediate intubation in trauma are not controversial, but some patients who initially appear stable later deteriorate and require intubation. We postulated that initially stable, moderately injured trauma patients who experienced delayed intubation have higher mortality than those intubated earlier.

Methods. Medical records of trauma patients intubated in the Emergency Department of a Level I Trauma Center were reviewed. The presence of rib fractures was noted. Patients were divided into two groups: those intubated within 1 hour of arrival and those intubated after 1 hour. Mortality was compared between the two groups.

Key Words: intubation; trauma; thoracic trauma; respiratory failure.

INTRODUCTION

Airway management is a top priority in trauma resuscitation. The need for intubation has long been recognized as critical to patient survival. The timing of intubation has been shown to impact outcomes. Delayed intubation has been associated with increased mortality, particularly in trauma patients.
Timing is Everything: Delayed Intubation is Associated with Increased Mortality in Initially Stable Trauma Patients

Emily Miraflor, M.D., Kelly Chuang, M.D., Marvin A. Miranda, B.A., Wendy Dryden, B.A., Louise Yeung, M.D., Aaron Strumwaasser, M.D., and Gregory P. Victorino, M.D.

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**FIG. 2.** Mortality in moderately injured patients by timing of intubation. Moderately injured patients (ISS < 20) intubated late had a higher mortality, 11.8%, than those intubated early, 1.8% (*P* = 0.045). The mortality risk reduction with earlier intubation was 85%.
Prehospital Rapid Sequence Intubation Improves Functional Outcome for Patients With Severe Traumatic Brain Injury

A Randomized Controlled Trial

Stephen A. Bernard, MD*, ¶, Vina Nguyen, BSc†, Peter Cameron, MD‡, ¶, Kevin Masci, §,
Mark Fitzgerald, MBBS*, ¶, David J. Cooper, MD‡, ¶, Tony Walker, B Paramed Std, MEd, §, Paul Myles, MD‡, ¶,
Lynne Murray, BAppSc‡, ¶, David, McD, Taylor, MD||, Karen Smith, BSc, MEd, PhD§, Ian Patrick, §,
John Edington, MB, ChB§, Andrew Bacon, MBBS§, Jeffrey V. Rosenfeld, MD, MS‡, ¶, and Rodney Judson, MBBS||

Results: A total of 312 patients with severe TBI were randomly assigned to paramedic rapid sequence intubation or hospital intubation. The success rate for paramedic intubation was 97%. The proportion of patients with favorable outcome was 80 of 157 patients (51%) in the paramedic intubation group compared with 56 of 142 patients (39%).
Factors influencing emergency intubation in the pre-hospital setting—a multicentre study in the German Helicopter Emergency Medical Service

M. Helm1*, B. Hossfeld1, S. Schäfer2, J. Hoitz3 and L. Lampl1

1Department of Anaesthesiology and Intensive Care Medicine—HEMS ‘Christoph 22’, Federal Armed Forces Medical Center Ulm, Germany. 2Department of Anaesthesiology and Intensive Care Medicine—HEMS ‘Christoph 23’, Federal Armed Forces Medical Center Koblenz, Germany. 3Department of Anaesthesiology and Intensive Care Medicine—HEMS ‘Christoph 29’, Federal Armed Forces Medical Center Hamburg, Germany
The overall [intubation] success rate was 100%; in 87.4% the first attempt was successful.
Observational study of the success rates of intubation and failed intubation airway rescue techniques in 7256 attempted intubations of trauma patients by pre-hospital physicians

D. Lockey¹,²*, K. Crewson¹, A. Weaver¹ and G. Davies¹

¹ London’s Air Ambulance, The Helipad, Royal London Hospital, Whitechapel, London E1 1BB, UK
² School of Clinical Sciences, University of Bristol, Bristol, UK
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Editor’s key points

- There are limited recent data on airway management by physicians in an out-of-hospital setting.
- In this large retrospective series of pre-hospital trauma cases, the initial success rate for tracheal intubation was 99.3%.
- Tracheal intubation was more likely to be successful when performed by a physician with primary training in anaesthesia.
- The need for a surgical airway (0.7%) was lower than in most other reported series.

Background. Effective airway management is a priority in early trauma management. Data on physician pre-hospital tracheal intubation are limited; this study was performed to establish the success rate for tracheal intubation in a physician-led system and examine the management of failed intubation and emergency surgical cricothyroidotomy in pre-hospital trauma patients. Failed intubation rates for anaesthetists and non-anaesthetists were compared.

Methods. A retrospective database review was conducted to identify trauma patients undergoing pre-hospital advanced airway management between September 1991 and December 2012. The success rate of tracheal intubation and the use and success of rescue techniques were established. Success rates of tracheal intubation by individuals and by specialty were recorded.

Results. The doctor-paramedic team attended 28,939 patients; 7256 (25.1%) required advanced airway management. A surgical airway was performed immediately, without attempted laryngoscopy, in 46 patients (0.6%). Tracheal intubation was successful in 7158 patients (99.3%). Rescue surgical airways were performed in 42 patients, seven had successful insertion of supraglottic devices, and two patients had supraglottic device insertion and a surgical airway. One patient breathed spontaneously with bag-valve-mask support during transfer. All rescue techniques were successful. Non-anaesthetists performed 4394 intubations and failed to intubate in 41 cases (0.9%); anaesthetists performed 2587 intubations and failed in 11 (0.4%) (P=0.02).

Conclusions. This is the largest series of physician pre-hospital tracheal intubation; the success rate of 99.3% is consistent with other reported data. All rescue airways were successful. Non-anaesthetists were twice as likely to have to perform a rescue airway intervention than anaesthetists. Surgical airway rates here (0.7%) are lower than most other physician-led series (median 3.1%, range 0.1–7.7%).

Keywords: airway management; complications; intubation; intubation; pre-hospital emergency care

Immediate and effective airway management is a priority in the resuscitation of critically injured patients. There are data to suggest that, in some Emergency Medical Service (EMS) systems, paramedic airway management performed by the ambulance service does not appear to meet the needs of seriously injured patients with airway compromise.¹–⁵ Some pre-hospital services, particularly in Europe, provide physicians to manage critically ill patients. Data on physician pre-hospital intubation are limited, despite the fact that this intervention has been carried out on a daily basis in EMS systems worldwide for many years.⁶ This study reports a retrospective observational database review of physician airway management in an urban pre-hospital trauma service, which dispatches a physician-paramedic team to major trauma patients. The study was conducted in our physician-led pre-hospital system to establish success rates of intubation, the frequency and management of failed intubation in the pre-hospital trauma patient, and the rates of failed intubation between the two main groups of physician providers within the system (anaesthetists and non-anaesthetists).

Intubation success rates and an effective failed intubation rescue plan are both quality markers of an EMS system conducting rapid sequence induction.⁷ The study was designed to use intubation success rates as a quality indicator to establish
Non-anaesthetists performed 4394 intubations and failed to intubate in 41 cases (0.9%); anaesthetists performed 2587 intubations and failed in 11 (0.4%)
RSI with direct Laryngoscopy
99.2% to 99.7% success rate.

Remaining patients underwent cricothyrotomy.
The Process of Prehospital Airway Management: Challenges and Solutions During Paramedic Endotracheal Intubation*

Matthew E. Prekker, MD, MPH1,2; Heemun Kwok, MD, MS1,3; Jenny Shin, MPH1;
David Carlbom, MD1,2; Andreas Grabinsky, MD3; Thomas D. Rea, MD, MPH1,4

Objectives: Endotracheal intubation success rates in the prehospital setting are variable. Our objective was to describe the challenges encountered and corrective actions taken during the process of endotracheal intubation by paramedics.

Design: Analysis of prehospital airway management using a prospective registry that was linked to an emergency medical services administrative database.

Setting: Emergency medical services system serving King County, Washington, 2006–2011. Paramedics in this system have the capability to administer neuromuscular blocking agents to facilitate intubation (i.e., rapid sequence intubation).

Patients: A total of 7,523 patients more than 12 years old in whom paramedics attempted prehospital endotracheal intubation.

Interventions: None.

Measurements and Main Results: An intubation attempt was defined as the introduction of the laryngoscope into the patient’s mouth, and the attempt concluded when the laryngoscope was removed from the mouth. Endotracheal intubation was successful on the first attempt in 77% and ultimately successful in 99% of patients (7,433 of 7,523). Paramedics used a rapid sequence intubation strategy on 54% of first attempts. Among the subset with a failed first attempt (n = 1,715), bodily fluids obstructing the laryngeal view (50%), obesity (28%), patient positioning (17%), and facial or spinal trauma (6%) were identified as challenges to intubation. A variety of adjustments were made to achieve intubation success, including upper airway suctioning (used in 43% of attempts resulting in success), patient repositioning (38%), rescue bougie use (19%), operator change (16%), and rescue rapid sequence intubation (8%). Surgical cricothyrotomy (0.4%, n = 27) and bag-valve-mask ventilation (0.8%, n = 60) were rarely performed by paramedics as final rescue airway strategies.

Conclusions: Airway management in the prehospital setting has substantial challenges. Success can require a collection of adjustments that involve equipment, personnel, and medication often in a simultaneous fashion. (Crit Care Med 2014; 42:1372–1378)

Key Words: airway management; intubation; paramedics; prehospital emergency care; registries

Endotracheal intubation is performed to optimally oxygenate, ventilate, and protect critically ill patients from aspiration. Its use in the prehospital setting has been questioned due to concerns regarding both safety and efficacy (1–6), and some advocate abandoning this procedure in favor of alternative methods of invasive or noninvasive respiratory support (7, 8). In the context of this ongoing controversy, endotracheal intubation remains an established practice worldwide in many emergency medical services (EMS) systems. These systems have committed to training ground-based paramedics (9), flight nurses (10), or prehospital physicians (11–13) to perform endotracheal intubation in austere environments and face the inherent challenges of
### The Process of Prehospital Airway Management: Challenges and Solutions During Paramedic Endotracheal Intubation*

Matthew E. Prekker, MD, MPH\(^1\); Heermun Kwok, MD, MS\(^2\); Jenny Shin, MPH\(^3\); David Carlbom, MD\(^4\); Andreas Grabinsky, MD\(^5\); Thomas D. Rea, MD, MPH\(^1\)

<table>
<thead>
<tr>
<th>Variable</th>
<th>All Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final airway outcome, (n) (%)</td>
<td></td>
</tr>
<tr>
<td>Endotracheal intubation</td>
<td>7,433 (98.8)</td>
</tr>
<tr>
<td>Surgical cricothyrotomy</td>
<td>27 (0.4)</td>
</tr>
<tr>
<td>Needle jet ventilation</td>
<td>3 (&lt;0.1)</td>
</tr>
<tr>
<td>Bag-valve-mask ventilation</td>
<td>60 (0.8)</td>
</tr>
<tr>
<td>No. of attempts to achieve successful intubation, (n) (%)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>5,807 (78)</td>
</tr>
<tr>
<td>2</td>
<td>1,265 (17)</td>
</tr>
<tr>
<td>(\geq 3)</td>
<td>361 (5)</td>
</tr>
</tbody>
</table>
Emergency Airway Management

Who is managing the airway?
The person, with the highest level of training and the most experience available should supervise or perform a medical procedure.
Learning Objectives

Importance of Airway Management

Trauma Airway Scenarios

Airway tools

Other things to consider
Video Assisted Laryngoscopy
Case Report

A Rare Complication of Tracheal Intubation: Tongue Perforation

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Supraglottic Devices
Use of the Laryngeal Mask Airway Supreme in pre-hospital difficult airway management

Anatolij Truhlar\textsuperscript{a,b,*}, David Z. Ferson\textsuperscript{c}
Gum Elastic Bougie

Eschmann
DIFFICULT AIRWAY...

NO BOUGIE! WTF
Eschmann
Bag-Mask Ventilation
Learning Objectives

- Importance of Airway Management
- Trauma Airway Scenarios
- Airway tools
- Other things to consider
Injury to neck / face / airway
Difficult Airway Access
Cervical Spine Trauma
Assessment of cervical spine movement during laryngoscopy with Macintosh and Truview laryngoscopes

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Abstract

Background: Truview laryngoscope provides an indirect view of the glottis and will cause less cervical spine movement since a ventral lifting force will not be required to visualize the glottis compared to Macintosh laryngoscope.

Materials and Methods: A randomized crossover study to assess the degree of movement of cervical spine during endotracheal intubation with Truview laryngoscope was conducted in 25 adult ASA-I patients. After a standard anesthetic technique, laryngoscopy was performed twice in each patient using in turn both the Macintosh and Truview laryngoscopes. A baseline radiograph with the head and neck in a neutral position was followed by a second radiograph taken during each laryngoscopy. An experienced radiologist analyzed and measured the cervical movement.

Results: Significant cervical spine movement occurred at all segments when compared to the baseline with both the Macintosh and Truview laryngoscopes (P < 0.001). However, the movement was significantly less with Truview compared to the Macintosh laryngoscope at C2-C3 (21%; P = 0.005) and C3-C4 levels (32%; P = 0.009). The atlantoaxial distance (AAD) traversed while using Truview laryngoscope was significantly less than with Macintosh blade (26%; P = 0.001). Truview blade produced a better laryngoscopic view (P = 0.005) than Macintosh blade, but had a longer time to laryngoscopy (P = 0.04).

Conclusion: Truview laryngoscope produced a better laryngoscopic view of glottis as compared with Macintosh laryngoscope. It also produced significantly less cervical spine movement at C2-C3 and C3-C4 levels than with Macintosh laryngoscope in patients without cervical spine injury and without manual in-line stabilization (MILS). Further studies are warranted with Truview laryngoscope using MILS.

Key words: Airway, anesthetic techniques, equipment, laryngoscopes, Truview Macintosh, monitoring, radiological

Introduction

Direct laryngoscopy with Macintosh laryngoscope involves extension of the head at the occipitoatlantoaxial complex and flexion of lower cervical vertebrae in order to align oral, pharyngeal, and laryngeal axes; and therefore, allow intubation under direct vision. This maneuver causes maximum movement of the cervical spine which may be hazardous in patients with suspected/confirmed cervical spine injury carrying risk of neurological deterioration. Performance of manual in-line stabilization (MILS) to reduce cervical movement during laryngoscopy as well as application of cricoid pressure to avoid aspiration deteriorates the laryngeal exposure and makes intubation difficult.

Since the cervical movement associated with the use of Macintosh laryngoscope is substantial, other devices have been evaluated and studied for their effect on cervical spine movement. It has been found that cervical movement is greatest with Macintosh, followed by McCoy, and is least with Bullard laryngoscope. Laryngoscopic devices which enable a non-line-of-sight view of glottis are likely to cause less movement of cervical spine because less ventral force is required to visualize the glottic aperture. Airway Scope®, GlideScope®, and Airtraq® have been shown by many authors to minimize movement of cervical spine in patients who require immobilization of the cervical spine.

Truview® laryngoscope (Truphatek International Ltd, Netanya, Israel) is a fiber optic device which enables an
Assessment of cervical spine movement during laryngoscopy with Macintosh and Truview laryngoscopes

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Abstract

Background: Truview laryngoscope provides an indirect view of the glottis and will cause less cervical spine movement since a ventral lifting force will not be required to visualize the glottis compared to Macintosh laryngoscope.

Table 1: Summary of percentage movement of cervical spine with various intubating devices

<table>
<thead>
<tr>
<th>Author</th>
<th>Device</th>
<th>Percentage reduction in C-spine motion</th>
<th>Segmental level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turkstra et al.</td>
<td>Glidescope</td>
<td>50</td>
<td>C₂-C₅</td>
</tr>
<tr>
<td>Hirabayashi et al.</td>
<td>AWS</td>
<td>37, 37, 68</td>
<td>C₀-C₁, C₁-C₂, C₃-C₄</td>
</tr>
<tr>
<td>Hirabayashi et al.</td>
<td>Airtraq</td>
<td>19, 16, 44</td>
<td>C₀-C₁, C₁-C₂, C₃-C₄</td>
</tr>
<tr>
<td>Turkstra et al.</td>
<td>Airtraq</td>
<td>53, 95, 33</td>
<td>C₀-C₃, C₂-C₅, C₅-Th</td>
</tr>
<tr>
<td>Our study</td>
<td>Truview</td>
<td>32, 18, 22</td>
<td>C₆-C₇, C₁-C₃, AOD</td>
</tr>
</tbody>
</table>

Learning Objectives

Importance of Airway Management
Airway tools
Other things to consider
Summary

- Early Intubation and controlled ventilation
- Cervical Spine Protection
- Decompress stomach after intubation
- Low pressure/volume ventilation
Basic Considerations

- Trauma patients are **not** NPO
- Always Pre-Oxygenate
- Hypotension is more dangerous than recall
System Change

- Manage (difficult) trauma intubations by/with Anesthesia

- Help with training of prehospital provider and Emergency physicians
What’s New in Airway Management

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