Emergent Management of Airway Complications in the OR and ICU

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A=Airway

- Loss of an airway is a devastating complication
- “Never Events”
- Anticipation is the best preventative strategy
- All great plans go out the window once an airway has been lost
Occurrence and Complications of Tracheal Reintubation in Critically Ill Adults

Nithya Menon MBBS, Aaron M Joffe DO, Steven Deem MD, N David Yanez PhD, Andreas Grabinsky MD, Armagan HC Dagal MD, Stephen Daniel PhD, and Miriam M Treggiari MD PhD MPH

BACKGROUND: Timing and preparation for tracheal extubation are as critical as the initial intubation. There are limited data on specific strategies for a planned extubation. The extent to which the difficult airway at reintubation contributes to patient morbidity is unknown. The aim of the present study was to describe the occurrence and complications of failed extubation and associated risk factors, and to estimate the mortality and morbidity associated with reintubation attempts. METHODS: Cohort study of 2,007 critically ill adult patients admitted to the ICU with an ETT. Patients were classified in 2 groups, based on the requirement for reintubation: “never reintubated” versus “≥ 1 reintubations.” Baseline characteristics, ICU and hospital stay, hospital mortality, and in-patient costs were compared between patients successfully extubated and those with reintubation outside the operating room, using regression techniques. Reasons, airway management techniques, and complications of intubation and reintubation were summarized descriptively. RESULTS: 376 patients (19%) required reintubation, and 230 (11%) were reintubated within 48 hours, primarily due to respiratory failure. Patients requiring reintubation were older, more likely to be male, and had longer ICU and hospital stays. Mortality was significantly higher among patients requiring reintubation.
Can a Difficult Airway be Predicted?
RESPIRATION AND THE AIRWAY

Difficult intubation in obese patients: incidence, risk factors, and complications in the operating theatre and in intensive care units

A. De Jong¹, N. Molinari², Y. Pouzeratte¹, D. Verzilli¹, G. Chanques¹, B. Jung¹,³, E. Futier¹, P.-F. Perrigault⁶, P. Colson⁴, X. Capdevila⁵ and S. Jaber¹,³*

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² Department of Medical Statistics, La Colombière University Hospital, Centre Hospitalier Universitaire Montpellier, Montpellier F-34295, France
³ Institut National de la Santé et de la Recherche Médicale U1046, ⁴ Anesthesiology and Critical Care Department D, Arnaud de Villeneuve Teaching Hospital and ⁵ Anesthesiology and Critical Care Department A, Lapeyronie Teaching Hospital, and Université Montpellier 1, Centre Hospitalier Universitaire Montpellier, Montpellier F-34295, France
⁶ Anesthesiology and Critical Care Department C, Gui de Chauliac Hospital, Montpellier F-34295, France

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**Abstract**

Intubation procedure in obese patients is a challenging task both in the intensive care unit and in the operating theatre (OT). To determine the incidence of difficult intubation in obese patients, we performed a descriptive study of the incidence, risk factors, and complications of difficult intubation in 1107 consecutive patients. Difficult intubation was defined as the need for a second attempt at intubation or the use of a tracheal stylet. The incidence of difficult intubation was 2.0% (n=22), and it was significantly related to BMI > 30 (p = 0.006). The rate of difficult intubation was also significantly increased in patients with a BMI > 30, compared with patients with a normal BMI (p < 0.001). The overall rate of difficult intubation was 2.0% (n=22), and it was significantly related to BMI > 30 (p = 0.006). The rate of difficult intubation was also significantly increased in patients with a BMI > 30, compared with patients with a normal BMI (p < 0.001). The overall rate of difficult intubation was 2.0% (n=22), and it was significantly related to BMI > 30 (p = 0.006). The rate of difficult intubation was also significantly increased in patients with a BMI > 30, compared with patients with a normal BMI (p < 0.001).
Results of multivariate mixed effects regression for final difficult intubation prediction model from the ICU cohort in obese patients (n=210)

<table>
<thead>
<tr>
<th></th>
<th>OR</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mallampati score III or IV</td>
<td>14.10</td>
<td>5.11–38.90</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Obstructive sleep apnoea</td>
<td>2.90</td>
<td>1.04–8.07</td>
<td>0.04</td>
</tr>
<tr>
<td>syndrome</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced mobility of cervical</td>
<td>2.75</td>
<td>0.83–9.12</td>
<td>0.09</td>
</tr>
<tr>
<td>spine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limited mouth opening</td>
<td>4.18</td>
<td>0.89–19.72</td>
<td>0.07</td>
</tr>
<tr>
<td>Severe hypoxaemia (&lt;80%)</td>
<td>3.26</td>
<td>1.02–10.3</td>
<td>0.05</td>
</tr>
<tr>
<td>Coma</td>
<td>3.13</td>
<td>1.08–9.11</td>
<td>0.04</td>
</tr>
</tbody>
</table>

**INSTRUCTIONS**

1. Record demographic information
2. Assess Mallampati classification, IIG etc.
3. Predict difficulty of intubation
4. Obtain C/L score by D/L and then by G/S
5. Note ease of ETT insertion; add comments

<table>
<thead>
<tr>
<th>Date mm/dd/yy</th>
<th>Clinician</th>
<th>Age/Sex</th>
<th>Wt kg</th>
<th>Ht cm</th>
<th>Mallampati (I-IV)*</th>
<th>IIG (f/b or cm.)</th>
<th>TMD (f/b or cm.)</th>
<th>C/S mobility (N/reduced)</th>
<th>Prediction (easy=I/very diff=IV)</th>
<th>C/L by D/L (I-IV)</th>
<th>C/L by G/S (I-IV)</th>
<th>Ease of ETT insertion</th>
</tr>
</thead>
</table>

**Comments**

*Mallampati (Samsoon modification)*

- **Class I** = visualization of the soft palate, fauces, uvula, anterior and posterior pillars.
- **Class II** = visualization of the soft palate, fauces and uvula.
- **Class III** = visualization of the soft palate and the base of the uvula.
- **Class IV** = soft palate is not visible at all.

*IIG = Interincisor gap  TMD = Thyromental distance*  Measured in fingers breadths (if cm please specify)

**C/L (Cormack-Lehane laryngoscopic view)**

- **Class I** = Most of glottis seen
- **Class II** = Only posterior glottis or arytenoids seen
- **Class III** = Only epiglottis seen
- **Class IV** = Epiglottis not seen (no laryngeal structures visualized)

Based on a Design by Dr. Richard Cooper
Severe Life-threatening Complications (%)

Airway Emergencies

Operating Room
- Airway Trauma
- Balloon Rupture
- Esophageal Intubation
- Accidental Extubation

ICU
- Airway Trauma
- Balloon Rupture
- Esophageal Intubation
- Accidental Extubation
Unique Complications

OR
- Airway Fire
- Bleed during Tracheostomy placement
- High-grade Stenosis

ICU
- Reintubation
- Tracheostomy Dislodgement
Operating Room Advantages

• Full anesthesia/surgical teams

• Rigid Instrumentation

• Quick Access to medications

• Optimal patient positioning
ICU Advantages
ICU Advantages

NONE
ICU Disadvantages

- Untrained staff
- Not a routine problem
- Too many non-combatants
- Poor equipment
- Staff not around when disaster occurs
- No definitive team
Preparing for Disaster

- Equipment
- Accessibility
- Drills
Airway Emergencies

Operating Room
- Airway Trauma
- Balloon Rupture
- Esophageal Intubation
- Unexpected Extubation

ICU
- Airway Trauma
- Balloon Rupture
- Esophageal Intubation
- Unexpected Extubation
Preparing for ICU Disaster

Unexpected Extubation
Prevention

- Sedation
- Restrains
- Frequent ETT position checks
- Avoid tension on ETT Circuit
Loss of the Airway

OR

- Patient Easy to Paralyze
- Range of devices and tubes
- Multiple Personnel
- Trach Kits are close

ICU

- Catches everyone off-guard
- Patient often agitated
- Chronically ill patients
- Multiple Other Medical Problems
- Delays in Management
Occurrence and Complications of Tracheal Reintubation in Critically Ill Adults

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## Subject Outcomes Stratified by Requirement for Reintubation

<table>
<thead>
<tr>
<th></th>
<th>All Subjects</th>
<th>No Reintubation</th>
<th>Reintubation</th>
<th>( p^* )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hospital Stay</strong>‡</td>
<td></td>
<td></td>
<td></td>
<td>&lt; .01</td>
</tr>
<tr>
<td>Median (IQR) d</td>
<td>12 (5–22)</td>
<td>10 (5–19)</td>
<td>23 (13–36)</td>
<td></td>
</tr>
<tr>
<td>Mean ± SD d</td>
<td>17.1 ± 18.6</td>
<td>14.5 ± 16.2</td>
<td>28.1 ± 23.7</td>
<td></td>
</tr>
<tr>
<td><strong>Hospital Charges (× $1,000)$§</strong></td>
<td></td>
<td></td>
<td></td>
<td>&lt; .01</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>116.3 (53.1–214.6)</td>
<td>97.2 (44.6–178.8)</td>
<td>223.6 (125.0–333.3)</td>
<td></td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>156.6 ± 145.7</td>
<td>133.4 ± 125.7</td>
<td>256.1 ± 180.0</td>
<td></td>
</tr>
<tr>
<td><strong>Hospital Direct Costs (× $1,000)$‖</strong></td>
<td></td>
<td></td>
<td></td>
<td>&lt; .01</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>28.8 (13.8–54.7)</td>
<td>24.7 (11.3–24.7)</td>
<td>62.3 (33.0–127.2)</td>
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<tr>
<td>Mean ± SD</td>
<td>40.6 ± 39.6</td>
<td>33.7 ± 32.2</td>
<td>70.6 ± 52.6</td>
<td></td>
</tr>
</tbody>
</table>

*P values comparing “no reintubation” versus “reintubation” group, using 2-sample t test with assumption of unequal variance. Stay, cost, and charges have been log transformed prior to fit the regression models; ratios of medians are adjusted for age, sex, Simplified Acute Physiology Score II, and medical versus surgical status.

† Ratio of median ICU stay 2.04 (95% CI 1.85–2.26).
‡ Ratio of median hospital stay 2.20 (95% CI 1.98–2.43).
§ Ratio of median charges 2.04 (95% CI 1.85–2.26).
‖ Ratio of median direct costs 2.20 (95% CI 1.98–2.43).
NA = not applicable
Subject Outcomes Stratified by Requirement for Reintubation

<table>
<thead>
<tr>
<th></th>
<th>All Subjects (N = 2,007)</th>
<th>No Reintubation (n = 1,631)</th>
<th>Reintubation (n = 376)</th>
<th>(p^{*})</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hospital Stay</strong>‡</td>
<td></td>
<td></td>
<td></td>
<td>&lt; .01</td>
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\(^{†}\) Ratio of median ICU stay 2.04 (95% CI 1.85–2.26).

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\(^{§}\) Ratio of median charges 2.04 (95% CI 1.85–2.26).

\(^{‖}\) Ratio of median direct costs 2.20 (95% CI 1.98–2.43).

NA = not applicable
Equipment Matters

• Long History of Endotracheal Intubation

• Proper access equipment

• Proper positioning

• Proper sedation
Intubation in the 1800’s

Figure from *Intubation of the Larynx*, showing the proper position of patient for a successful intubation.

From Rutkow IM. Frank Waxham and Charles Truax's Intubation of the larynx. Archives of Surgery. 137(7):870, 2002
Intubation Set c. 1890
Emergency Tracheal Intubation: Complications Associated with Repeated Laryngoscopic Attempts

Thomas C. Mort, MD

Department of Anesthesiology, Hartford Hospital, University of Connecticut School of Medicine

Repeated conventional tracheal intubation attempts may contribute to patient morbidity. Critically-ill patients (n = 2833) suffering from cardiovascular, pulmonary, metabolic, neurologic, or trauma-related deterioration were entered into an emergency intubation quality improvement database. This practice analysis was evaluated for airway and hemodynamic-related complications based on a set of defined variables that were correlated to the number of attempts required to successfully intubate the trachea outside the operating room. There was a significant increase in the rate of airway-related complications as the number of laryngoscopic attempts increased (≤2 versus >2 attempts): hypoxemia (11.8% versus 70%), regurgitation of gastric contents (1.9% versus 22%), aspiration of gastric contents (0.8% versus 13%) bradycardia (1.6% versus 21%), and cardiac arrest (0.7% versus 11%; P < 0.001). Although predictable, this analysis provides data that confirm the number of laryngoscopic attempts is associated with the incidence of airway and hemodynamic adverse events. These data support the recommendation of the ASA Task Force on the Management of the Difficult Airway to limit laryngoscopic attempts to three in lieu of the considerable patient injury that may occur.

# Complications by Intubation Attempts

<table>
<thead>
<tr>
<th>Complication</th>
<th>2 or fewer attempts (90%)</th>
<th>&gt;2 attempts (10%)*</th>
<th>Relative risk for &gt;2 attempts</th>
<th>95% CI for risk ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoxemia</td>
<td>10.5%</td>
<td>70%</td>
<td>9X</td>
<td>4.20 – 15.92</td>
</tr>
<tr>
<td>Severe hypoxemia</td>
<td>1.9%</td>
<td>28%</td>
<td>14X</td>
<td>7.36 – 24.34</td>
</tr>
<tr>
<td>Esophageal intubation</td>
<td>4.8%</td>
<td>51.4%</td>
<td>6X</td>
<td>3.71 – 8.72</td>
</tr>
<tr>
<td>Regurgitation</td>
<td>1.9%</td>
<td>22%</td>
<td>7X</td>
<td>2.82 – 10.14</td>
</tr>
<tr>
<td>Aspiration</td>
<td>0.8%</td>
<td>13%</td>
<td>4X</td>
<td>1.89 – 7.18</td>
</tr>
<tr>
<td>Bradycardia</td>
<td>1.6%</td>
<td>18.5%</td>
<td>4X</td>
<td>1.71 – 6.74</td>
</tr>
<tr>
<td>Cardiac arrest</td>
<td>0.7%</td>
<td>11%</td>
<td>7X</td>
<td>2.39 – 9.87</td>
</tr>
</tbody>
</table>

* All categories $P < 0.001$ when comparing 2 or fewer attempts to >2 attempts.
Complications by Intubation Attempts

- Hypoxemia
- Severe Hypoxemia
- Esophageal Intubation
- Regurgitation
- Aspiration
- Bradycardia
- Cardiac Arrest

There is no greater (easily reversible) complication in a Hospital than Inadvertant/self Extubation of a Critically ill patient
CRITICAL CARE

Tracheal intubation in the critically ill: a multi-centre national study of practice and complications

G. D. Simpson¹, M. J. Ross², D. W. McKeown³ and D. C. Ray³*

¹ Department of Anaesthesia, Queen Margaret Hospital, Whitfield Road, Dunfermline KY12 0SU, UK
² South East Scotland School of Anaesthesia and ³ Departments of Anaesthesia and Critical Care, Royal Infirmary, Little France Crescent, Edinburgh EH16 4SA, UK
* Corresponding author. E-mail: david.ray@luht.scot.nhs.uk

Editor’s key points
- Complication rates associated with tracheal intubation in critically ill patients are relatively high.
- This paper presents data from the critical care setting.

Background. Complications associated with tracheal intubation may occur in up to 40% of critically ill patients. Since practice in emergency airway management varies between intensive care units (ICUs) and countries, complication rates may also differ. We undertook a prospective, observational study of tracheal intubation performed by critical care doctors in Scotland to identify practice, complications, and training.

Methods. For 4 months, we collected data on any intubation performed by doctors working in critical care throughout Scotland except those in patients having elective surgery and those carried out before admission to hospital. We used a standardized data form to collect information on pre-induction physical status, techniques and in particular, the doctor carrying out the intubation, retrieval techniques and success.
## Reason for intubation (n=794; some records had more than one reason recorded)

<table>
<thead>
<tr>
<th>Reason</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient newly admitted to ICU</td>
<td>432</td>
<td>54</td>
</tr>
<tr>
<td>Patient deterioration</td>
<td>82</td>
<td>10</td>
</tr>
<tr>
<td>Problems with existing airway</td>
<td>84</td>
<td>11</td>
</tr>
<tr>
<td>Change of tracheal tube</td>
<td>38</td>
<td>5</td>
</tr>
<tr>
<td>Failed trial of extubulation</td>
<td>96</td>
<td>12</td>
</tr>
<tr>
<td>Accidental extubation</td>
<td>34</td>
<td>4</td>
</tr>
<tr>
<td>Other</td>
<td>38</td>
<td>5</td>
</tr>
<tr>
<td>Not recorded</td>
<td>28</td>
<td></td>
</tr>
</tbody>
</table>

## Immediate Complications of Tracheal Intubation (n=794)

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>%</th>
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<tbody>
<tr>
<td>$SpO_2$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;90%</td>
<td>327</td>
<td>41</td>
</tr>
<tr>
<td>&lt;80%</td>
<td>172</td>
<td>22</td>
</tr>
<tr>
<td>&lt;70%</td>
<td>89</td>
<td>11</td>
</tr>
<tr>
<td>Systolic AP</td>
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<td></td>
</tr>
<tr>
<td>&lt;90 mm Hg</td>
<td>260</td>
<td>33</td>
</tr>
<tr>
<td>&lt;80 mm Hg</td>
<td>155</td>
<td>20</td>
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<tr>
<td>&lt;70 mm Hg</td>
<td>79</td>
<td>10</td>
</tr>
<tr>
<td>Cardiac arrest</td>
<td>12</td>
<td>1.5</td>
</tr>
<tr>
<td>Oesophageal intubation</td>
<td>17</td>
<td>2</td>
</tr>
<tr>
<td>Failed intubation</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Vomiting/regurgitation</td>
<td>17</td>
<td>2</td>
</tr>
</tbody>
</table>

Anaesthetic experience of intubator and rate of successful intubation for the first attempt at tracheal intubation

<table>
<thead>
<tr>
<th>Months spent in formal anaesthetic training</th>
<th>Number (%)</th>
<th>Number supervised by senior intubator (%)</th>
<th>Success rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;6</td>
<td>74 (10)</td>
<td>73 (99)</td>
<td>69</td>
</tr>
<tr>
<td>6–12</td>
<td>61 (8)</td>
<td>52 (85)</td>
<td>77</td>
</tr>
<tr>
<td>12–24</td>
<td>61 (8)</td>
<td>43 (70)</td>
<td>90</td>
</tr>
<tr>
<td>&gt;24</td>
<td>565 (74)</td>
<td>155 (27)</td>
<td>95</td>
</tr>
</tbody>
</table>

Preparing for Disaster

• Equipment

• Accessibility

• Drills
Microminiature video camera and dual LED light source integrated into the laryngoscope blade
View of the Glidescope display showing an ETT passed through the vocal cords.
Introducing the Glidescope into the mouth. Note the LCD display at the top of the image.

*Image credit: Saturn Biomedical, Inc.*
The Impact of Video Laryngoscopy Use During Urgent Endotracheal Intubation in the Critically Ill

Pierre Kory, MPA, MD,* Keith Guevarra, DO,* Joseph P Mathew, MD,* Abhijith Hegde, MD,* and Paul H. Mayo, MD†

BACKGROUND: The video laryngoscope (VL) has been shown to improve laryngoscopic views and first-attempt success rates in elective operating room and simulated tracheal intubations compared with the direct laryngoscope (DL). However, there are limited data on the effectiveness of the VL compared with the DL in urgent endotracheal intubations (UEIs) in the critically ill. We assessed the effectiveness of using a VL as the primary intubating device during UEI in critically ill patients when performed by less experienced operators.

METHODS: We compared success rates of UEIs performed by Pulmonary and Critical Care Medicine (PCCM) fellows in the medical intensive care unit and medical or surgical wards. A cohort of PCCM fellows using GlideScope VL as the primary intubating device was compared with a historical cohort of PCCM fellows using a traditional Macintosh or Miller blade DL. The primary measured outcome was first-attempt intubation success rate. Secondary outcomes included total number of attempts required for successful tracheal intubation, rate of esophageal intubation, need for supervising attending intervention, duration of intubation sequence, and incidence of hypoxemia and hypotension.

RESULTS: There were 138 UEIs, with 78 using a VL and 50 using a DL as the primary intubating device. The rate of first-attempt success was superior with the VL as compared with the DL (91% vs 68%, P < 0.01). The rate of intubations requiring ≥3 attempts was lower with the VL (0.9%) compared with the DL (4.5%, P < 0.01), unintended esophageal intubations were lower with the VL (0.9%) compared with the DL (5.1%, P < 0.01), and the total number of attempts required for successful intubation was lower with the VL (2.0 vs 2.6, P < 0.01).
<table>
<thead>
<tr>
<th>Variables</th>
<th>VL group ( n = 78 )</th>
<th>DL group ( n = 50 )</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>First-attempt success rate</td>
<td>91% (71)</td>
<td>68% (34)</td>
<td>0.01</td>
</tr>
<tr>
<td>Average number of attempts</td>
<td>1.2 ± 0.56</td>
<td>1.7 ± 1.1</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>UEI requiring ≥3 attempts</td>
<td>4% (3)</td>
<td>20% (10)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Duration (min)(^a)</td>
<td>3.9 ± 3</td>
<td>13.0 ± 6</td>
<td>0.13</td>
</tr>
<tr>
<td>Need for attending intervention</td>
<td>3% (2)</td>
<td>8% (4)</td>
<td>0.21</td>
</tr>
<tr>
<td>( O_2 ) saturation &lt;80%</td>
<td>16% (11/70)(^b)</td>
<td>24% (12)</td>
<td>0.27</td>
</tr>
<tr>
<td>Hypotension (SBP &lt; 70 mm Hg)</td>
<td>15% (11/75)(^b)</td>
<td>12% (6)</td>
<td>0.77</td>
</tr>
<tr>
<td>Esophageal intubation</td>
<td>0% (0)</td>
<td>14% (7)</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

Values given as mean ± SD or percentage \( n \) unless otherwise indicated.

VL = video laryngoscope; DL = direct laryngoscope; UEI = urgent endotracheal intubation; SBP = systolic blood pressure.

\(^a\)Interval between sedative administration and endotracheal tube insertion.

\(^b\)Data not available for all patients.
Video laryngoscopy versus direct laryngoscopy for orotracheal intubation in the intensive care unit: a systematic review and meta-analysis

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Take-home message: Video laryngoscopy for orotracheal intubation in the ICU could be used for the management of ICU difficult OTI. The secondary outcomes were first-attempt success, Cormack 3/4 grades, and complications related to intubation (severe hypoxemia, severe cardiovascular collapse, vocal cord injury, esophageal
Forest Plot of Difficult Intubation

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Video Laryngoscope</th>
<th>Direct Laryngoscope</th>
<th>Odds Ratio M-H, Fixed, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Events</td>
<td>Total</td>
<td>Events</td>
</tr>
<tr>
<td>De Jong 2013</td>
<td>3</td>
<td>70</td>
<td>19</td>
</tr>
<tr>
<td>Griesdale 2012</td>
<td>3</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>Kory 2013</td>
<td>3</td>
<td>78</td>
<td>10</td>
</tr>
<tr>
<td>Lacticova 2013</td>
<td>18</td>
<td>252</td>
<td>31</td>
</tr>
<tr>
<td>Mosier 2013</td>
<td>6</td>
<td>234</td>
<td>6</td>
</tr>
<tr>
<td>Noppens 2012</td>
<td>4</td>
<td>117</td>
<td>8</td>
</tr>
<tr>
<td>Silverberg 2013</td>
<td>5</td>
<td>57</td>
<td>16</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>828</strong></td>
<td></td>
<td><strong>579</strong></td>
</tr>
</tbody>
</table>
Forest Plot of First-attempt Success

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Video Laryngoscopy</th>
<th>Direct Laryngoscopy</th>
<th>Odds Ratio M-H, Random, 95% CI</th>
<th>Odds Ratio M-H, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Events</td>
<td>Total</td>
<td>Events</td>
<td>Total</td>
</tr>
<tr>
<td>De Jong 2013</td>
<td>55</td>
<td>70</td>
<td>96</td>
<td>140</td>
</tr>
<tr>
<td>Griesdale 2012</td>
<td>8</td>
<td>20</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>Kory 2013</td>
<td>71</td>
<td>78</td>
<td>34</td>
<td>50</td>
</tr>
<tr>
<td>Lakticova 2013</td>
<td>130</td>
<td>140</td>
<td>196</td>
<td>252</td>
</tr>
<tr>
<td>Mosier 2013</td>
<td>184</td>
<td>234</td>
<td>34</td>
<td>56</td>
</tr>
<tr>
<td>Noppens 2012</td>
<td>103</td>
<td>117</td>
<td>90</td>
<td>113</td>
</tr>
<tr>
<td>Silverberg 2013</td>
<td>42</td>
<td>57</td>
<td>24</td>
<td>60</td>
</tr>
<tr>
<td>Ural 2011</td>
<td>37</td>
<td>47</td>
<td>42</td>
<td>56</td>
</tr>
<tr>
<td>Yeatts 2013</td>
<td>242</td>
<td>303</td>
<td>259</td>
<td>320</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>1066</strong></td>
<td><strong>1067</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>2.07 [1.35, 3.16]</strong></td>
</tr>
<tr>
<td>Total events</td>
<td>872</td>
<td>782</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: Tau² = 0.27; Chi² = 24.68, df = 8 (P = 0.002); I² = 68%</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Test for overall effect: Z = 3.35 (P = 0.0008)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

M-H = Mantel-Haenszel

Tracheostomy Dislodgement

- Surprisingly frequent cause of ICU Disaster
- Caregivers are lulled into a sense of security
- Every patient with Trach is chronically ill
- Very few personnel available with skill set to manage
- Often occurs in patients with difficult oral airway
- Never event?
Causes/Risks

- Excess tension on Circuit
- Improper Trach appliance
- Obese patient
- Occurs when turning the patient for skin care
What Can Happen

- Reflex is to jam the Trach back into the stoma

- Bleeding
- False Passage
- Airway Perforation
- Patient Death
Blood in the Airway

• Very poorly tolerated in a sedated patient

• 50-100 cc is enough to asphyxiate

• Difficult to extract Clotted Blood
False Passage

- Tracheal “pseudolumen”
- Cannot ventilate
- High Airway Pressures
- SQE
- Bradycardia and Arrest
Perforation

- Placing the trach through the Airway and into the Esophagus
- Cannot ventilated Effectively
- Lower Airway Pressure and some CO2 return can fool staff
- Patients develop hypoxia
- Difficult to repair in critically ill patient
Prevention

• Secure Trach when turning patient

• Avoid excess tension in circuit

• Mark high risk individuals
What to do

• Call for Help

• Start Bagging the patient immediately with finger covering the stoma

• Set Up for Emergency OROTRACHEAL INTUBATION!!!
• Subspecialty personnel will have to decide whether trach can be replaced at bedside

• Fall-back is ALWAYS OROTRACHEAL INTUBATION AND TO CALL FOR HELP
Central Airway Control

Unfortunately a perfect job is an average job...