Tracheal Intubation in ICU: Life saving or life threatening?

Prof. Sheila Nainan Myatra
Department of Anaesthesia, Critical Care & Pain
Tata Memorial Hospital
Mumbai, India
sheila150@hotmail.com
Three Fundamental Differences….

- ICU Environment related factors
- Patient factors
- Operator factor
Operating Room Environment
ICU Environment
Three Fundamental Differences….

- ICU Environment related factors
- Operator factors
Intubation Skills and Supervision

- ETI performed by a junior supervised by a senior protected against complications
- Supervision by an attending anesthesiologist was associated with fewer complications
- In Scotland, higher first-time success rate and few technical complications; longer formal training in anaesthesia and junior trainees routinely supervised.

Three Fundamental Difference….

- ICU Environment related factors
- Operator factors
- Patient factor
Oxygen Delivery vs. Consumption

Low Cardiac Output
Anaemia
Lung Disease
Low FRC

Fever
Sepsis
Tachypnea

DO2

VO2
Poor Response to Pre-oxygenation
Little Oxygen Reserve

• Pre-oxygenation by bag-valve-mask for 4 minutes
• 34 stable controls undergoing cardiac surgery
  – PaO$_2$ increased from 79 $\pm$ 12.3 to 403.6 $\pm$ 71.8
• 34 unstable patients intubated in the ICU
  – PaO$_2$ increased from 64.2 $\pm$ 3.5 to 86.8 $\pm$ 9.5
  – 41% had <5% change from baseline PaO$_2$
  – Only 6% had $\Delta$PaO$_2$ > 50 mmHg with preoxygenation
  – Only 15% patients reached a PaO$_2$ of 100mmHg

Lung Volume

Normal

ETO2 0.9

Closing Volume

Low FRC

Residual Volume

O2

O2
Low FRC, and high O2 consumption
Rapid desaturation during apnea
## Multiple Intubation Attempts

<table>
<thead>
<tr>
<th>Complication</th>
<th>≤ 2 attempts</th>
<th>&gt; 2 attempts</th>
<th>Risk Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoxemia</td>
<td>10.5%</td>
<td>70%</td>
<td>9 (4.2 -15.9)</td>
</tr>
<tr>
<td>SpO₂ &lt; 70%</td>
<td>1.9%</td>
<td>28%</td>
<td>14 (7.4 – 24.3)</td>
</tr>
<tr>
<td>Esophageal Intubation</td>
<td>4.8%</td>
<td>51.4%</td>
<td>6 (3.7 – 8.7)</td>
</tr>
<tr>
<td>Aspiration</td>
<td>0.8%</td>
<td>13%</td>
<td>4 (1.9 – 7.2)</td>
</tr>
<tr>
<td>Bradycardia</td>
<td>1.6%</td>
<td>18.5%</td>
<td>4 (1.7 – 6.7)</td>
</tr>
<tr>
<td>Cardiac arrest</td>
<td>0.7%</td>
<td>11%</td>
<td>7 (2.4 – 9.9)</td>
</tr>
</tbody>
</table>

- Limit attempts at intubation to 2

Esophageal Intubation in ICU

- Single episode: 51% hypoxemia,
- Risk of hypoxemia 11-fold (95% CI, 7.7–13.2)
- ≥2 Eso Ints: 85% incidence of hypoxemia

Use Capnography to diagnose esophageal intubation

Induction of Anaesthesia

Muscle Relaxant

Facemask Ventilation

Laryngoscopy

Intubation

IPPV

Preoxygenation

Physiologically Difficult Airway

Apnea

Difficult Intubation

Hypoxia

Hypotension
Three Fundamental Differences:

- ICU Environment related factors
- Patient factors
- Operator factor
## Complications of Intubation in Critically ill

<table>
<thead>
<tr>
<th>Study</th>
<th>DI / MA %</th>
<th>Hypoxia %</th>
<th>Hypotension %</th>
<th>Oeso Int %</th>
<th>Aspiration %</th>
<th>Cardiac Arrest %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schwartz 1995</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mort 2004</td>
<td>10</td>
<td>4.7</td>
<td>9.7</td>
<td>2.1</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>Griesdale 2006</td>
<td>13.2</td>
<td>19.1</td>
<td>9.6</td>
<td>7.4</td>
<td>5.9</td>
<td>0</td>
</tr>
<tr>
<td>Jaber 2008</td>
<td>12</td>
<td>26</td>
<td>25</td>
<td>4.6</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Martin 2011</td>
<td>10.3</td>
<td>1.3</td>
<td>2.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mayo 2011</td>
<td>20</td>
<td>14</td>
<td>6</td>
<td>11</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Bowles 2011</td>
<td>9</td>
<td>14</td>
<td>26</td>
<td>1</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Simpson 2012</td>
<td>0</td>
<td>22</td>
<td>20</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

• 184 complications Sept 1, 2008, to Aug 31, 2009
• > 60% events in ICU led to death or brain damage (compared with 14% in anaesthesia)
• Events in ICU and the ED more likely than during GA
  – to occur out-of-hours
  – be managed by doctors with less anaesthetic experience
  – lead to permanent harm.
• Failure to use capnography contributed to 74% of cases of death or persistent neurological injury
Tracheal intubation in the ICU: Life saving or life threatening?

Jigeeshu V Divatia, Parvez U Khan, Sheila N Myatra
Department of Anaesthesia, Critical Care and Pain, Tata Memorial Hospital, Mumbai, Maharashtra, India

ABSTRACT

Tracheal intubation (TI) is a routine procedure in the intensive care unit (ICU), and is often life saving. However, life-threatening complications occur in a significant proportion of procedures, making TI perhaps one the most common but underappreciated airway emergencies in the ICU. In contrast to the controlled conditions in the operating room (OR), the unstable physiologic state of critically ill patients along with underevaluation of the airways and suboptimal response to pre-oxygenation are the major factors for the high incidence of life-threatening complications like severe hypoxaemia and cardiovascular collapse in the ICU. Studies have shown that strategies
Strategies to improve outcome
### Intubation Difficulty: MACOCHA Score

Mallampati score III / IV; Apnea syndrome (obstructive); Cervical spine limitation; Opening of mouth < 3 cm; Coma, Hypoxia; Anesthesiologist nontrained.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors related to patient</td>
<td></td>
</tr>
<tr>
<td>Mallampati score III or IV</td>
<td>5</td>
</tr>
<tr>
<td>Obstructive sleep apnea syndrome</td>
<td>2</td>
</tr>
<tr>
<td>Reduced mobility of cervical spine</td>
<td>1</td>
</tr>
<tr>
<td>Limited mouth opening &lt; 3 cm</td>
<td>1</td>
</tr>
<tr>
<td><strong>Factors related to pathology</strong></td>
<td></td>
</tr>
<tr>
<td>Coma</td>
<td>1</td>
</tr>
<tr>
<td>Severe hypoxemia (&lt;80%)</td>
<td>1</td>
</tr>
<tr>
<td><strong>Factor related to operator</strong></td>
<td></td>
</tr>
<tr>
<td>Nonanaesthesiologist (&lt;24 months training)</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>12</td>
</tr>
</tbody>
</table>

Score from 0 to 12: 0 = easy; 12 = very difficult.
Non-Invasive Ventilation to Improve Preoxygenation

- NIV for 3 min (PSV, PEEP 5) vs. nonrebreather BVM

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>NIV</th>
</tr>
</thead>
<tbody>
<tr>
<td>SpO₂ after preoxygenation</td>
<td>93 ± 6%</td>
<td>98 ± 2%</td>
</tr>
<tr>
<td>SpO₂ during TI</td>
<td>81 ± 15%</td>
<td>93 ± 8% *</td>
</tr>
<tr>
<td>SpO₂ &lt; 80% during TI</td>
<td>12 (46%)</td>
<td>2 (7%) *</td>
</tr>
<tr>
<td>SpO₂ 5min after TI</td>
<td>94 ± 6%</td>
<td>98 ± 2</td>
</tr>
</tbody>
</table>

Baillard et al. AJRCCM 2006;174:171-77
High Flow Nasal Canula (HFNC) Oxygen therapy

Continuous delivery of transnasal high-flow (50-70L/min) humidified oxygen
Use of High-Flow Nasal Cannula Oxygen Therapy to Prevent Desaturation During Tracheal Intubation of Intensive Care Patients With Mild-to-Moderate Hypoxemia*

Romain Miguel-Montanes, MD¹; David Hajage, MD²; Jonathan Messika, MD¹,³,⁴; Fabrice Bertrand, MD¹; Stéphane Gaudry, MD¹,³,⁴; Cédric Rafat, MD¹; Vincent Labbé, MD¹; Nicolas Dufour, MD¹,³,⁴; Sylvain Jean-Baptiste, MD¹; Alexandre Bedet, MD¹; Didier Dreyfuss, MD¹,³,⁴; Jean-Damien Ricard, MD, PhD¹,³,⁴

• Before Period: Preoxygenation with nonrebreathing bag reservoir facemask (NRM)
  – 6l/min O2 thru nasal catheter during apnea

• After Period: Preoxygenation with high-flow nasal cannula oxygen (HFNC) 60L/min, FiO2 1.0
  – Continued during apnea

• HFNC improved preoxygenation and reduced prevalence of severe hypoxemia

Crit Care Med 2015; 43:574–583
High-flow nasal cannula oxygen during endotracheal intubation in hypoxemic patients: a randomized controlled clinical trial

PREOXYFLOW RCT in 6 French ICUs
HFNC vs HFFM
119 patients
Apnoeic oxygenation via high-flow nasal cannula oxygen combined with non-invasive ventilation preoxygenation for intubation in hypoxaemic patients in the intensive care unit: the single-centre, blinded, randomised controlled OPTINIV trial

Samir Jaber¹, Marion Monnin¹, Mehdi Girard¹, Matthieu Conseil¹, Moussa Cisse¹, Julie Carr¹, Martin Mahul¹,
Drugs for Intubation

655 patients who needed sedation for emergency intubation

0.3 mg/kg of etomidate (n=328) or 2 mg/kg of ketamine (n=327) followed by succinylcholine

No difference in mean maximum SOFA in first 3 days
No difference in intubating conditions
More patients with adrenal insufficiency with etomidate
86% vs. 48%
Comparison of Etomidate and Ketamine for Induction During Rapid Sequence Intubation of Adult Trauma Patients.

- 968 patients, including 526 with etomidate and 442 with ketamine
- Patients induced with ketamine had ICU-free days, ventilator-free days and hospital mortality similar to those of patients induced with etomidate.

Ann Emerg Med. 2017
Rapid Sequence Intubation vs. No Muscle Relaxant

<table>
<thead>
<tr>
<th></th>
<th>RSI</th>
<th>No MR</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cases</td>
<td>166</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td>Cases with complications</td>
<td>46</td>
<td>52</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Multiple attempts (≤3)</td>
<td>41</td>
<td>29</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Multiple attempts (≥4)</td>
<td>3</td>
<td>16</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Esophageal intubation</td>
<td>5</td>
<td>12</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Unable to intubate</td>
<td>1</td>
<td>12</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Airway trauma</td>
<td>0</td>
<td>19</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Aspiration</td>
<td>0</td>
<td>10</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Death</td>
<td>0</td>
<td>2</td>
<td>.03</td>
</tr>
</tbody>
</table>

RSI significantly reduces complications of emergency airway management and should be used by physicians trained in its use.

Am J Emerg Med 1999;17:141-144
Videolaryngoscopy in ICU?
Two Recent RCTs

Semlar et al 150 patients, single centre trial
- Better glottic visualization with VL (MacGrath/Glidescope/ Olympus)
- Similar first attempt success rate (VL 68.9% vs DL 65.8%; \( p = 0.68 \))
- Time to intubation, lowest SpO2, complications, and in-hospital mortality were not different

MACMAN RCT, 371 patients, 7 ICUs in France
- Similar first-pass intubation success MacGrath VL vs. DL (67.7% vs 70.3%)
- Similar median time to successful intubation - 3 minutes (range, 2 to 4 minutes) for both VL and DL
- Posthoc analysis, \textbf{more severe life-threatening complications} (9.5%) in VL compared to DL(2.8%, \( P = .01 \))
Videolaryngoscopy *versus* direct laryngoscopy for emergency orotracheal intubation outside the operating room: a systematic review and meta-analysis

CMAC® [1.32 (1.08–1.62); *P*=0.007] compared with DL. There was greater first-pass intubation with VL compared with DL amongst novice/trainee clinicians [OR=1.95 (1.45–2.64); *P*<0.001], but not amongst experienced clinicians or paramedics/nurses. There was no difference in first-pass intubation with VL compared with DL during cardiopulmonary resuscitation or trauma. VL compared with DL was associated with fewer oesophageal intubations [OR=0.32 (0.14–0.70); *P*=0.003], but more arterial hypotension [OR=1.49 (1.00–2.23); *P*=0.05]. In summary, VL compared with DL is associated with greater first-pass emergency intubation in the ICU and amongst less experienced clinicians, and reduces oesophageal intubations. However, VL is associated with greater incidence of arterial hypotension. Further trials investigating the utility of VL over DL in specific situations are required.
Video laryngoscopy does not improve the intubation outcomes in emergency and critical patients – a systematic review and meta-analysis of randomized controlled trials

Conclusions: On the basis of the results of this study, we conclude that, compared with direct laryngoscopy, video laryngoscopy does not improve intubation outcomes in emergency and critical patients. Prehospital intubation is even worsened by use of video laryngoscopy when performed by experienced operators.
Guidelines
First Guideline for Tracheal Intubation in the ICU

The All India Difficult Airway Association 2016 guidelines for tracheal intubation in the Intensive Care Unit

Address for correspondence: Prof. Jigeeshu Vasishtha Divatia, Department of Anesthesiology, Critical Care and Pain, Tata Memorial Hospital, Dr. Ernest Borges Road, Parel, Mumbai - 400 012, Maharashtra, India. E-mail: jdivatia@yahoo.com


Department of Anaesthesiology, Critical Care and Pain, Tata Memorial Hospital, Mumbai, Maharashtra, Department of Anaesthesiology and Critical Care, J N Medical College and Hospital, AMU, Aligarh, Uttar Pradesh, Department of Anaesthesiology and Critical Care, JIPMER, Puducherry, Department of Onco-Anaesthesiology and Palliative Medicine, Dr. BRAIRCH, All India Institute of Medical Sciences, Department of Anaesthesia, All India Institute of Medical Sciences, New Delhi, Department of Anaesthesiology, Kasturba Medical College, Manipal, Department of Anaesthesiology and Critical Care, K S Hegde Medical Academy, Nitte University, Mangalore, Karnataka, Kailash Cancer Hospital and Research Centre, Department of Anaesthesia, Vadodara Institute of Neurological Sciences, Vadodara, Gujarat, Department of Anaesthesia, Kanchi Kamakoti CHILDS Trust Hospital, Chennai, Tamil Nadu, Department of Anaesthesiology, North Bengal Medical College, Darjeeling, West Bengal, India

Indian J Anaesth 2016;60:922-30
AIDAA 2016 Guidelines for Tracheal Intubation in the Intensive Care Unit

STEP 1: Preoxygenation and Induction of anaesthesia
- Two persons (one experienced)
- Optimize preoxygenation with one of the following:
  - Noninvasive ventilation with 100% O₂ pressure support of 5-15 cm H₂O with PEEP of 5 cm H₂O for 3 minutes (nasal cannula with O₂ flow at 15 L/min)
  - HFNC O₂ therapy
  - Induction - Etomidate or Ketamine with Succinylcholine (if not contraindicated) or Rocuronium
  - Use cricoid pressure
  - IPPV with bag-valve mask with reservoir bag (use external PEEP valve set to 5-10 cm H₂O if available) / IPPV with PEEP using the ventilator

Face mask ventilation unsuccessful

Face mask ventilation successful

STEP 2: Laryngoscopy and tracheal intubation
- Single attempt at tracheal intubation
  - only if SpO₂ ≥ 95%
- Failed intubation

Succeed
- Confirm tracheal intubation using capnography

Failed ventilation through SAD

STEP 3: Insert SAD to maintain oxygenation
- Continue nasal oxygen using O₂ flow at 15 L/min OR HFNC O₂
- Preferably use second generation SAD
- Maximum two attempts (only if SpO₂ ≥ 95%)
- Mask ventilation between attempts
- Consider changing size or type of SAD
- Maintain depth of anaesthesia

Succeed
- Consider one of the following options:
  1. Percutaneous or surgical tracheostomy
  2. Intubate through the SAD using a FOB only, provided expertise is available

Surgical or Percutaneous tracheostomy

STEP 4: Rescue face mask ventilation
- Complete Ventilation Failure
- CALL FOR ADDITIONAL HELP

Succeed
- Convert to a tracheostomy at the earliest

STEP 5: Emergency cricothyroidotomy
- Continue nasal oxygen using O₂ flow at 15 L/min OR HFNC O₂ and efforts at rescue face mask ventilation
- Perform one of the following techniques
  - Surgical cricothyroidotomy
  - Wide bore cannula cricothyroidotomy
  - Needle cricothyroidotomy (use pressure regulated jet ventilation and attempt to keep the upper airway patent)

Succeed

Post-procedure plan
- 1. Further airway management plan
- 2. Treat airway oedema if suspected
- 3. Monitor for complications
- 4. Counselling and documentation

This flow chart should be used in conjunction with the text

FOB = Fibreoptic bronchoscope
HFNC = High flow nasal cannula
IPPV = Intermittent positive pressure ventilation
SpO₂ = Oxygen saturation
PEEP = Positive end-expiratory pressure
SAD = Supraglottic airway device
O₂ = Oxygen

IJA 2016;60:922-30
STEP 1: Preoxygenation and induction of anaesthesia

- Two persons (one experienced)
- Optimise preoxygenation with one of the following:
  - Noninvasive ventilation with 100% O₂, pressure support of 5-15 cm H₂O with PEEP of 5 cm H₂O for 3 minutes (nasal cannula with O₂ flow at 15 L/min)
  - HFNC O₂ therapy
- Induction - Etomidate or Ketamine with Succinylcholine (if not contraindicated) or Rocuronium
- Use cricoid pressure
- IPPV with bag-valve mask with reservoir bag (use external PEEP valve set to 5-10 cm H₂O if available) / IPPV with PEEP using the ventilator
Face mask ventilation unsuccessful

Face mask ventilation successful

**STEP 2: Laryngoscopy and tracheal intubation**

- Continue nasal oxygen using O₂ flow at 15 L/min OR HFNC O₂
- Direct/video laryngoscopy
- Maximum two attempts (repeat attempts only if SpO₂ ≥95%)
- Mask ventilation between attempts
- Optimise position, use external laryngeal manipulation, release cricoid pressure, use bougie/stylet if required
- Consider changing device/ technique/operator between attempts
- Maintain depth of anaesthesia

Failed Intubation

Succeed

Confirm tracheal intubation using capnography
**STEP 3: Insert SAD to maintain oxygenation**

- Continue nasal oxygen using $O_2$ flow at 15 L/min OR HFNC $O_2$
- Preferably use second generation SAD
- **Maximum two attempts** (only if $SpO_2 \geq 95\%$)
- Mask ventilation between attempts
- Consider changing size or type of SAD
- Maintain depth of anaesthesia

**Failed ventilation through SAD**

**STEP 4: Rescue face mask ventilation**

- Continue nasal oxygen using $O_2$ flow at 15 L/min OR HFNC $O_2$
- Ensure neuromuscular blockade
- Final attempt at face mask ventilation using optimal technique and adjuncts

**Consider one of the following options:**

1. Percutaneous or surgical tracheostomy
2. Intubate through the SAD using a FOB only, provided expertise is available

**Succeed**

**Surgical or Percutaneous tracheostomy**
Complete Ventilation Failure

CALL FOR ADDITIONAL HELP

STEP 5: Emergency cricothyroidotomy

- Continue nasal oxygen using $O_2$ flow at 15 L/min OR HFNC $O_2$ and efforts at rescue face mask ventilation
- Perform one of the following techniques
  - Surgical cricothyroidotomy
  - Wide bore cannula cricothyroidotomy
  - Needle cricothyroidotomy (use pressure regulated jet ventilation and attempt to keep the upper airway patent)

Succeed

Convert to a tracheostomy at the earliest

This flow chart should be used in conjunction with the text

FOB = Fibreoptic bronchoscope
HFNC = High flow nasal cannula
IPPV = Intermittent positive pressure ventilation
$O_2$ = Oxygen

PEEP = Positive end-expiratory pressure
SAD = Supraglottic airway device
$SpO_2$ = Oxygen saturation

Post - procedure plan
1. Further airway management plan
2. Treat airway oedema if suspected
3. Monitor for complications
4. Counselling and documentation
AIDAA 2016 Guidelines for Tracheal Intubation in the Intensive Care Unit

**STEP 1: Preoxygenation and Induction of anaesthesia**
- Two persons (one experienced)
- Optimise preoxygenation with one of the following:
  - Noninvasive ventilation with 100% O2 pressure support of 5-15 cm H2O with PEEP of 5 cm H2O for 3 minutes
  - (nasal cannula with O2 flow at 15 l/min)
  - HFNC O2 therapy
- Induction - Etomidate or Ketamine with Succinylcholine (if not contraindicated) or Rocuronium
- Use cricoid pressure
- IPPV with bag-valve mask with reservoir bag (use external PEEP valve set to 5-10 cm H2O if available) / IPPV with PEEP using the ventilator

**STEP 2: Laryngoscopy and tracheal intubation**
- Single attempt at tracheal intubation only if SpO2 ≥ 95%
- Continue nasal oxygen using O2 flow at 15 l/min OR HFNC O2
- Direct/video laryngoscopy
- Maximum two attempts (repeat attempts only if SpO2 ≥ 95%)
- Mask ventilation between attempts
- Optimise position, use external laryngeal manipulation, release cricoid pressure, use bougie/stylet if required
- Consider changing device/technique/operator between attempts
- Maintain depth of anaesthesia

**Failed Intubation**
- Continue nasal oxygen using O2 flow at 15 l/min OR HFNC O2
- Preferably use second generation SAD
- Maximum two attempts (only if SpO2 ≥ 95%)
- Mask ventilation between attempts
- Consider changing size or type of SAD
- Maintain depth of anaesthesia

**STEP 3: Insert SAD to maintain oxygenation**
- Continued

**STEP 4: Rescue face mask ventilation**
- Continue nasal oxygen using O2 flow at 15 l/min OR HFNC O2
- Ensure neuromuscular blockade
- Final attempt at face mask ventilation using optimal technique and adjuncts

**Complete Ventilation Failure**
- Continue nasal oxygen using O2 flow at 15 l/min OR HFNC O2 and efforts at rescue face mask ventilation
- Perform one of the following techniques
  - Surgical cricothyroidotomy
  - Wide bore cannula cricothyroidotomy
  - Needle cricothyroidotomy (use pressure regulated jet ventilation and attempt to keep the upper airway patent)

**STEP 5: Emergency cricothyroidotomy**
- Post - procedure plan
  - 1. Further airway management plan
  - 2. Treat airway oedema if suspected
  - 3. Monitor for complications
  - 4. Counselling and documentation

This flow chart should be used in conjunction with the text

FOB = Fibreoptic bronchoscope
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IPPV = Intermittent positive pressure ventilation
O2 = Oxygen
PEEP = Positive end-expiratory pressure
SAD = Supraglottic airway device
SpO2 = Oxygen saturation

**CALL FOR HELP**

**CALL FOR ADDITIONAL HELP**

**Succeed**
- Confirm tracheal intubation using capnography
- Consider one of the following options:
  1. Percutaneous or surgical tracheostomy
  2. Intubate through the SAD using a FOB only, provided expertise is available

**Surgical or Percutaneous tracheostomy**

**Succeed**
- Convert to a tracheostomy at the earliest

IJA 2016;60:922-30
Guidelines for the management of tracheal intubation in critically ill adults

A. Higgs1,*, B. A. McGrath2, C. Goddard3, J. Rangasami4, G. Suntharalingam5, R. Gale6, T. M. Cook7 and on behalf of Difficult Airway Society, Intensive Care Society, Faculty of Intensive Care Medicine, Royal College of Anaesthetists

1Anaesthesia and Intensive Care Medicine, Warrington and Halton Hospitals NHS Foundation Trust, Cheshire, UK. 2Anaesthesia and Intensive Care Medicine, University Hospital South Manchester, Manchester, UK. 3Anaesthesia & Intensive Care Medicine, Southport and Ormskirk Hospitals NHS Trust.
Conclusion

- Airway Management in ICU is not just an extension of airway management in OR
- The environment, the patient and operator factor related factors make airway management more challenging in ICU
- Consider every ICU intubation as difficult airway and use specific strategies to improve outcome
- This life saving procedure can turn into a potentially life threatening situation if not managed appropriately