Difficult Intubation in Critically Ill Adults
Disclosures

- None
Goals

- Review the ASA Difficult Airway Algorithm
- Review the current guidelines for tracheal intubation of critically ill patients
- Discuss recent trends in the literature and best-practices
What is a "Difficult Intubation"?

- Per the 2022 American Society of Anesthesiologists Practice Guidelines for Management of the Difficult Airway
  - "Tracheal intubation requires multiple attempts or tracheal intubation fails after multiple attempts"
DIFFICULT AIRWAY INFOGRAPHIC: ADULT PATIENTS

Part 1: Pre-Airway Management Decision Making Tool (planning)

This tool can be used to choose between the awake or post-induction airway strategy. Each assessment should be made by the clinician managing the airway, using their techniques of choice.9

Suspected difficult laryngoscopy or intubation with direct or video laryngoscope?

- Yes
  - Suspected difficult ventilation with facemask or supraglottic device?
    - Yes
      - Significantly increased risk of aspiration?
        - Yes
          - Increased risk of rapid desaturation?
            - Yes
              - Part 2: Awake Airway Management
            - No
              - No
                - No
                  - Part 3: Airway Management with Induction of Anesthesia
                - No
              - No
            - No
          - No
        - Yes
          - Part 2: Awake Airway Management
      - No
        - Part 3: Airway Management with Induction of Anesthesia
    - No
      - Part 2: Awake Airway Management
  - No
    - Part 3: Airway Management with Induction of Anesthesia

Any one factor alone (assessed difficulty with intubation or ventilation, or aspiration or desaturation risk) may be clinically important enough to warrant an awake intubation.

Other patient factors may require an alternative strategy (e.g., patient inability to cooperate)
Part 2: Awake Airway Management

Review airway strategy for awake airway management\textsuperscript{a,b}

- **Awake technique**
- **Elective invasive airway\textsuperscript{f,g}

Success confirmed by adequate ventilation\textsuperscript{c}

- **Fail to establish tracheal intubation**

**Awake non-emergency pathway**

Postpone\textsuperscript{d,e} or consider risks and benefits of:
- Alternative awake technique\textsuperscript{b}
- Awake elective invasive airway\textsuperscript{f,g}
- Alternative anesthetic techniques
- If unstable or can’t be postponed, induction of anesthesia (Part 3) with preparations for emergency invasive airway\textsuperscript{f,g,h}

**Deliver oxygen / optimize oxygenation\textsuperscript{i}

- Consider call for help
Does this algorithm apply to critically ill patients?

- Limitations in the critically ill:
  - Difficult to obtain a traditional airway assessment
  - Sub-optimal intubating environment & positioning
  - Less availability of airway devices than in the OR
  - Propensity for hemodynamic instability
  - Often awakening the patient will not result in resolution of respiratory distress
  - Awake fiberoptic intubation is frequently not a viable option
What are the outcomes?

- Most recent (2021) prospective analysis: International Observational Study to Understand the Impact and Best Practices of Airway Management in Critically Ill Patients (INTUBE)
  - Cardiovascular instability occurred in 42.6% of intubations
  - Severe hypoxemia (SpO2 < 80%) in 9.3%
    - 5% w/ 1 attempt, 20% with 2 attempts, >30% w/ 3 attempts
  - Cardiac arrest in 3.1%
  - Difficult Intubation in 4.7% of intubations
Are there any guidelines for the intubation of critically ill adults?

- In 2017 the BJA published their Guidelines for the Management of Tracheal Intubation in Critically Ill Adults
  - 1st major societal guidelines specifically focusing on intubations in this patient population
Can't Intubate, Can't Oxygenate (CICO) in critically ill adults

CALL FOR HELP

Declare "Can't Intubate, Can't Oxygenate"

Plan D: Front Of Neck Airway: FONA

Extend neck
Ensure neuromuscular blockade
Continue rescue oxygenation
Exclude oxygen failure and blocked circuit

Scalpel cricothyroidotomy

Equipment:
1. Scalpel (wide blade e.g. number 10 or 20)
2. Bougie (14 French gauge)
3. Tube (cuffed 5.0-8.0mm ID)

Laryngeal handshake to identify cricothyroid membrane

Palpable cricothyroid membrane
Transverse stab incision through cricothyroid membrane
Turn blade through 90° (sharp edge towards the feet)
Slide Coudé tip of bougie along blade into trachea
Railroad lubricated cuffed tube into trachea
Inflate cuff, ventilate and confirm position with capnography
Secure tube

Impalpable cricothyroid membrane
Make a large midline vertical incision
Blunt dissection with fingers to separate tissues
Identify and stalkise the larynx
Proceed with technique for palpable cricothyroid membrane as above

Post-FONA care and follow up
- Tracheal suction
- Recruitment manoeuvre (if haemodynamically stable)
- Chest X-ray
- Monitor for complications
- Surgical review of FONA site
- Agree airway plan with senior clinicians
- Document and complete airway alert

*This flowchart forms part of the DAS, IC, PCCM, RCSA Guidelines for tracheal intubation in critically ill adults and should be used in conjunction with the text.
Recognizing a possible difficult intubation in the critically ill adult

### TABLE 5. MACOCHA SCORE CALCULATION WORKSHEET

<table>
<thead>
<tr>
<th>Factors</th>
<th>Points</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>Factors related to pathology</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>Factor related to operator</td>
<td></td>
</tr>
<tr>
<td>Nonanesthesiologist</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

*Definition of abbreviation: MACOCHA = Mallampati score III or IV, Apnea syndrome (obstructive), Cervical spine limitation, Opening mouth <3 cm, Coma, Hypoxia, Anesthesiologist nontrained. Coded from 0 to 12: 0 = easy; 12 = very difficult.*
MACOCHA Score

- >3 represents a potential difficult airway
  - >5 has ~50% chance of difficult intubation

- However, not associated with adverse events in the INTUBE study when dichotomized into < 3 or ≥ 3
Setup Optimization

A. Six member intubation team (if only one intubator then 2nd intubator role not applicable)

B. Five member intubation team (if only one intubator then 2nd intubator role not applicable)

C. Four member intubation team (if only one intubator then 2nd intubator role not applicable)
### Intubation Checklist: critically ill adults – to be done with whole team present.

#### Prepare the patient
- Reliable IV / IO access
- Optimise position
  - Sit-up?
  - Mattress hard
- Airway assessment
  - Identify cricothyroid membrane
  - Awake intubation option?
- Optimal preoxygenation
  - 3 mins or ETO$_2$ > 85%
  - Consider CPAP / NIV
  - Nasal O$_2$
- Optimize patient state
  - Fluid / pressor / inotrope
  - Aspirate NG tube
  - Delayed sequence induction
- Allergies?
  - ↑ Potassium risk?
    - avoid suxamethonium

#### Prepare the equipment
- Apply monitors
  - SpO$_2$ / waveform ETCO$_2$ / ECG / BP
- Check equipment
  - Tracheal tubes x 2
  - cuffs checked
  - Direct laryngoscopes x 2
  - Videolaryngoscope
  - Bougie / stylet
  - Working suction
  - Supraglottic airways
  - Guedel / nasal airways
  - Flexible scope / Aintree
  - FONA set
- Check drugs
  - Consider ketamine
  - Relaxant
  - Pressor / inotrope
  - Maintenance sedation

#### Prepare the team
- Allocate roles
  - One person may have more than one role.
  - Team Leader
  - 1$^{\text{st}}$ Intubator
  - 2$^{\text{nd}}$ Intubator
  - Cricoid force
  - Intubator’s assistant
  - Drugs
  - Monitoring patient
  - Runner
  - MILS (if indicated)
  - Who will perform FONA?
- Who do we call for help?
- Who is noting the time?

#### Prepare for difficulty
- Can we wake the patient if intubation fails?
- Verbalise “Airway Plan is:"
- Plan A:
  - Drugs & laryngoscopy
  - Plan B/C:
    - Supraglottic airway
    - Face-mask
    - Fibreoptic intubation via supraglottic airway
  - Plan D:
    - FONA
    - Scalpel-bougie-tube
- Does anyone have questions or concerns?
Pre/Per-Oxygenation

- HFNC as apneic oxygenation might be beneficial by lowering the incidence of severe hypoxemia in patients with mild hypoxemia.

- OPTINIV: Combination of HFNC & NIV (mean P/F ratio of 122). The combination intervention maintained a higher SpO2 during intubation than HFNC alone.
Plan B/C: rescue oxygenation after failed intubation

- A failed intubation attempt occurs in 10–30% of critically ill intubations and should be anticipated
- In the era of video-laryngoscopy, fiberoptic devices, and numerous supraglottic devices, how do we protocolize the salvage of a failed intubation?
Management after initial failed intubation: The Vortex Model

- Premise: only 3 ‘non-surgical’ techniques to establish a patent airway: face mask, supraglottic airway, or ETT

- If a best effort at each of these ‘lifelines’ is unsuccessful, then airway patency must be restored via ‘CICO rescue’ (emergency front-of-neck access)
Progression down the vortex can occur in any direction.
Progression down the vortex terminates in "FONA" Rescue
GREEN ZONE

REOXYGENATE
OPTIMISE S\textsubscript{2}O\textsubscript{2}, OPTIMISE F\textsubscript{RC}O\textsubscript{2}

ASSEMBLE RESOURCES
PERSONNEL, EQUIPMENT, LOCATION

MAKE A PLAN
MAINTAIN, CONVERT, REPLACE
MAKE/PROCEED, LIFELINE/NECK, RE-ENTER FUNNEL

CONSIDERATIONS FOR PLANNING IN THE GREEN ZONE

- SITUATION: URGENCY, COMPLEXITY
- AIRWAY: STABILITY, OXYGEN SATURATION, TIER OF GREEN ZONE
- PATIENT: ASPIRATION RISK, PROSPECT OF WAKING
- CLINICIAN: EXPERIENCE
What has changed since the 2017 BJA Guidelines?

- In 2023 Critical Care Medicine published a review in their Annual Update in Intensive Care and Emergency Medicine 2023 entitled "Managing the Physiologically Difficult Airway in Critically Ill Adults"
  - Presents summaries of evidence-based strategies that mitigate potential technical and physiological difficulties associated with intubating critically ill patients
**Risks and risk prediction**

Cardiovascular instability, hypoxemia, and cardiac arrest are the most common adverse events associated with tracheal intubation.

Risk factors for cardiovascular collapse include age, shock, hypoxemia, advanced critical illness, and propofol administration.

**Hemodynamic optimization**

Etomidate and ketamine may impact hemodynamics less than propofol.

A crystalloid bolus prior to intubation has not been associated with improved hemodynamics, even in patients receiving positive pressure ventilation.

Given the frequency of cardiovascular instability, vasopressors should be readied as part of preparation for tracheal intubation.

**Mitigating hypoxemia**

Standard pre-oxygenation strategies are inadequate to safely extend the apneic interval in patients with moderate to severe respiratory failure.

Non-invasive ventilation can be used with or without high flow nasal oxygen and is more effective than high flow nasal oxygen alone.

While historically avoided, bag-mask ventilation improves oxygenation during airway management and can be employed either preemptively or for rescue.

**First pass success**

Multiple attempts at intubation increase the risk of adverse events.

Depending on the preferences and expertise of the intubating clinician, video laryngoscopy or direct laryngoscopy with adjuncts may improve first pass success.

Checklists improve adherence to complex, multi-step processes and may help prompt preparation for physiologic trespass.
Recent changes in the literature regarding intubations of critically ill patients

- PreVent Trial (2019): compared bag-mask ventilation vs its avoidance during the interval between RSI and tracheal intubation
  - SpO2 was higher in the bag-mask ventilation group (96% vs. 93%), and the incidence of a SpO2 < 80% was lower compared to the control group (10.9% vs. 22.8%)
  - Challenges the dogma that mask ventilation must be strictly avoided in RSI
The Bougie as a First-Pass Device

- BEAM Trial (2018):
  - Single-center trial: in ED intubations the bougie improved first-pass success rates compared to ETT w/ stylet

- BOUGIE Trial (2021):
  - Multicenter, randomized trial: bougie did not have a better or worse first-pass success rate than ETT w/ stylet in critically ill patients. No difference in the rate of tracheal injury

- Bottom Line:
  - In experienced hands, the bougie appears to increase first-pass success rates, but this advantage does not carry over to intubators who do not use the bougie as their standard operating procedure
The Era of Video-Laryngoscopy

- DEVICE Trial (2023): Among critically ill adults undergoing tracheal intubation in an ED or ICU, the use of VL resulted in a higher incidence of first-pass success than the use of DL.

- Consistent with a 2024 CCM review and meta-analysis that found "VL is a more effective and safer strategy compared with DL for increasing successful intubations on the first attempt and reducing esophageal intubations in critically ill patients"
Should we employ an intubation checklist?

- In the largest systematic review and meta-analysis in 2020, checklist use was associated with a decrease in hypoxic events (RR 0.75), but no difference in other secondary outcomes including first-pass success.

- Despite this, CCM still includes the use of intubating checklists as a key strategy and suggests that this is an area in need of further study.
Brass Tacks

- Thoughtful preparation is key: checklists, standardized positioning, and airway assessment tools should be employed
- Simplified, multidisciplinary protocols standardize the language and progression through a difficult airway
- NIV and HFNC can reduce hypoxia in the critically ill, and HFNC can provide peri-oxygenation throughout the intubation
- The bougie is a safe and viable intubating tool in this population, and if routinely used may improve first-pass success
- Video laryngoscopy improves first-pass success in this population, and will likely become the new standard of care
References


