



Extubation in the Emergency Department and Resuscitative Unit Setting

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Introduction

- Given the development of ED-ICUs/resuscitation units and the increasing boarding of critically ill patients in ED, extubation in the ED may become a more common practice.
- Selecting the appropriate patient and following a practical, organized approach is paramount to safely and successfully performing this procedure.

Difference between extubation in the ED vs ICU

- ED patients are usually early in their clinical course and often undifferentiated, thus predicting success of intubation is challenging.
- Given the nature of most EDs, close monitoring poses the biggest obstacle to extubation. ICU nursing ratios (1:1 or 1:2) are more favorable than typical ED nursing ratios (1:3 or 1:4) for the intensive monitoring that is necessary post extubation. Skilled clinicians and nurses are needed who can promptly recognize and manage extubation failure, and re-intubation if necessary.
- In the critical care literature, there has been debate about acceptable reintubation rate, ranging from 5%- 15%. However, goal reintubation rates in the ED should be near zero. Patients with low risk of reintubation should be selected and extubation should be deferred if there is any question regarding readiness.

Selection of Patients for extubation in the ED/Resuscitative Unit

- **Inclusion Criteria**
 - Resolution of initial indication for intubation
 - Clinician should have a definitive understanding of the initial indication of IMV and the expected clinical course
 - Ideal clinical presentations for which ED extubation can be safely attempted include: clinical sobriety after acute intoxication, airway protection for procedural sedation, and head trauma with improving mental status and negative neuroimaging
 - Able to oxygenate and ventilate on minimal ventilator settings
 - Patient should be spontaneously breathing on minimal ventilatory setting
 - PS 5 cm H₂O (to overcome the resistance of the tube) and PEEP \leq 5 cm H₂O
 - CPAP only PEEP \leq 5 cm H₂O
 - Blood gas should be checked to ensure adequate oxygenation (O₂ sat $>$ 92% and PaO₂ $>$ 70 mm Hg) and adequate ventilation (PaCO₂ 38- 42 mmHg)
 - Spontaneous breathing trial (SBT) can be helpful for clinicians to determine extubation readiness, particularly if the patient was intubated for cardiovascular or pulmonary pathology

- Rapid Shallow Breathing Index (respiratory rate (bpm)/tidal volume (L)) can be performed during SBT and used as a dynamic measure of extubation readiness.
- RSBI less than 105 is widely cited as an acceptable criterion for extubation success. We recommend using an RSBI of less than 75 breaths in the ED as a lower cutoff. It is more specific and will potentially reduce the risk of extubation borderline patients
- Awake and able to follow commands
 - Dexmedetomidine is an excellent anxiolytic as it does not affect respiratory drive and may facilitate extubation in patients with agitation from pain and discomfort from the ET tube
 - Be cautious with delirious patients
 - Head lift should always be included in neurological exam as cervical mobility and strength are vital for clearing secretions
- Hemodynamically stable
- Uncomplicated initial intubation
 - Review intubation documentation
- Expected to maintain airway patency postextubation
- Anticipated hospital course does not require mechanical ventilation
 - Avoid patients with disease processes that usually progressively worsen or have unpredictable clinical courses, i.e.- drowning, ARDS, Spinal cord injuries
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Physiological Aspects of Extubation and Management of Complications

- Hypoxemia
 - The transition from positive pressure ventilation (PPV) to negative-pressure ventilation can lead to significant physiologic cardiopulmonary challenges.
 - Postextubation cardiac dysfunction is one of these well-described complications. Significant increases in left ventricular transmural pressure and afterload can occur after extubation. This can clinically present as an increased work of breathing, hypertension, pulmonary edema, hypoxemia, and progressive recurrent respiratory failure.
 - Cardiogenic Hypoxia is managed similarly to sympathetic crashing pulmonary edema
 - Hypoxia can also come from pulmonary cause, i.e. significant de-recruitment, atelectasis, increased airway resistance, shunt
- Airway Assessment and Management of Postextubation Stridor
 - Intubation documentation should be reviewed if you did not perform the intubation and resolution of any noted edema should be resolved prior to extubation attempt
 - Laryngeal edema is the most common cause of postextubation stridor
 - The cuff leak test is used to predict postextubation stridor and is a surrogate marker of laryngeal edema
 - IV methylprednisolone/dexamethasone and nebulized epinephrine are the mainstay treatment of postextubation stridor.
 - Consider reintubation if the patient is in severe respiratory distress, or if the stridor does not improve after 1 to 2 hours after treatment.

Palliative Extubation

- Providing comfort, alleviating patient or family distress, and effective team communication should be the cornerstone of any palliative extubation.

Take Home Points

- Consider it. Consider extubation in appropriate patients that meet the proposed inclusion criteria. All intubated patients do not belong in the ICU.
- Avoid Borderline patients. Our goal is near zero reintubation rates
- Be Organized. Have a systematic approach to extubation, coupled with objective data and clinical presentation
- Prepare your setting. Ensure that there is adequate monitoring and nursing assignment. Also have difficult airway equipment and RSI medications readily available.
- Understand the post-extubation physiology. Be prepared to trouble shoot post-extubation complications
- Be Humble. Recognize extubation failure and don't delay re-intubation if necessary.

