

# Extubation of Oral Endotracheal Tube of Non-Ventilated Patient in PACU

## Site Applicability

SPH and MSJ Post Anesthetic Care Units (PACU)

## Practice Level

Specialized – Registered Nurses with Critical Care Specialty training working in PACU

## Requirements

- Unconscious, spontaneous breathing, patients may be managed in PACU with an oral endotracheal tube (OETT) in-situ until patient meets established criteria for extubation.
- The critical care RN may remove the OETT in the presence of a physician's order once criteria met.
- Patients that are **outside the scope of practice for RN extubation** include: patients requiring mechanical ventilation, patients with wired jaws, patients with nasotracheal intubation, patients under the age of 18 and patients with a known difficult airway-
- A second critical care RN, RT or physician must be available during extubation.

## Need to Know

OETT removal in the post anesthetic patient requires adequate central respiratory drive, respiratory muscle strength, laryngeal function and a cough of sufficient strength to clear secretions. These conditions are achieved in most patients when the effects of anesthetic agents have dissipated. Delayed extubation can be stressful for the patient, provoking sympathetic nervous system (SNS) reflex activity, excessive retching or gagging against the OETT or self-extubation.

Major complications of extubation include airway obstruction secondary to inadequate pharyngeal muscle tone, bronchospasm, pulmonary aspiration, impaired respiratory gas exchange, negative pressure pulmonary edema and laryngeal edema or laryngospasm (see [Appendix A: Extubation Related Complications](#)). Post extubation, airway reflexes may be depressed, putting the patient at increased risk for aspiration. Therefore, in addition to accurate pre-extubation assessment, PACU patients require close post-extubation monitoring, and immediate detection of and intervention for respiratory distress.

Extubation in PACU by the critical care RN may be performed when the following patient assessment criteria are met:

- **Return of consciousness**
  - Patient must be able to protect their airway
- **Able to follow commands**
  - Squeeze hand
  - Open eyes
- **Return of autonomic reflexes**
  - Cough
  - Gag
  - Swallow
- **Return of adequate muscle tone**
  - Sustained head lift (greater than 5 seconds)
  - Strong hand grips
- **Adequate respiratory function**
  - Respiratory rate greater than 8 and less than 28 breaths per minute
  - Oxygen saturation greater than 92% on room air
  - Symmetrical chest expansion
  - No evidence of accessory muscle use
- **Hemodynamic stability**
  - Vital signs within normal parameters for patient
  - No new reasons for continued artificial airway support

An anesthesia provider must be readily available in case of failed extubation and need for immediate re-intubation. Prior to nurse-led extubation the nurse should be made aware of the ease/difficulty of intubation and/or the Mallampati score.

## Equipment and Supplies

1. Functional suction equipment with yankauer
2. Ambu bag (bag-valve-mask) resuscitator connected to oxygen and ready to use
3. Emergency intubation supplies available in unit (including medications)
4. Functional oxygen available with face mask and/or nasal prongs
5. Oro-pharyngeal and nasal-pharyngeal airways sized to patient
6. 10 mL Luer lock syringe
7. Personal protective equipment, goggle, N95 face mask, gloves, gown (as appropriate)
8. Suction catheter kit and prefilled normal saline instillation vial (if required)

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## Procedure

### Steps

STEPS	RATIONALE
1. Confirm presence of a Physician's order; if verbal order is given ensure it is documented in Cerner as a communication order.	
2. Full assessment to ensure patient meets above established criteria for extubation.	Decrease chance of failed extubation or persistent airway obstruction following airway removal.
3. Ensure all safety equipment is functional and at the bedside.	Equipment is ready to use in case of an emergency.
4. Gather all necessary equipment and supplies.	To properly prepare for the procedure.
5. Wash hands and don personal protective equipment (gloves and goggles/eye protection, N95 face mask; gown if soiling is likely).	To protect self and others from potential contaminants.
6. Explain procedure to patient.	To facilitate patient's cooperation and reduce anxiety.
7. Place patient in Fowler's or semi-Fowler's position when possible.	To facilitate patient's cough and minimize the risk of aspiration.
8. Assess need for endotracheal tube suctioning and only if secretions are present perform suctioning of endotracheal tube.	To clear airway of secretions. Routine suctioning of endotracheal tube is not required and should only be performed when clinically indicated.
9. Suction oropharynx with Yankauer suction to remove any oral secretions and assess gag reflex simultaneously.	To prevent aspiration of oral secretions and coughing during extubation.
10. If bite block is in place, ask patient to open mouth to remove.	The bite block prevents the patient from biting down on the endotracheal tube.
11. Attach a 10 mL Luer lock syringe to the endotracheal tube pilot line.	
12. Remove endotracheal tube tape/ties while holding the tube securely.	

13. Deflate the cuff using the attached 10 mL Luer lock syringe. DO NOT rip or cut the pilot line to allow for passive deflation of the balloon.	Air escapes slowly and when ripped can stretch and cause partial occlusion leaving the balloon partially inflated.
14. Remove endotracheal tube just prior to the peak of inspiration in one quick and smooth motion.	Vocal cords are maximally abducted at peak inspiration. Initial cough response will be more forceful upon extubation.
15. Suction oropharynx if required.	
16. Administer oxygen via simple mask or nasal cannula to maintain O <sub>2</sub> saturation over 92% or as ordered by the physician.	
17. Position patient in semi-fowler's or high fowler's as tolerated.	To facilitate ventilation and deep breathing.
18. Closely monitor chest expansion, respiratory rate, regularity of respirations, and oxygen saturation.	To ensure adequate respiratory function.
19. Report signs and symptoms of impaired respiratory function to anesthesiologist and apply resuscitative measures as necessary.	
20. Document procedure.	

### Documentation

Initial and ongoing assessments are recorded on the Electronic Health Record (Cerner) in *Interactive View* → *Airway Management and Respiratory Bands*. During down-time, documentation is completed in PACU Patient Record (PA015)

### Patient and Family Education

Review with patient and family if present that experiencing a sore throat, hoarseness and/or a stiff neck is normal and will resolve within a day or two. Those feelings usually resolve without treatment.

### Related Documents

1. [B-00-13-10018](#) - PACU: Post Anesthetic Patient in Phase I: Patient Care
2. [B-00-12-10105](#) - Laryngeal Mask Airway (LMA) removal in PACU
3. [B-00-12-12016](#) - Suction and Instillation: Non- Ventilated Patients Using an Open Catheter Technique (Respiratory Therapy)

## References

1. Berkow, Lauren C. (2022). *Complications of airway management in adults*. In UpToDate. Waltham, MA. Retrieved June 28, 2023 from URL: <https://www.uptodate.com/contents/complications-of-airway-management-in-adults>
2. Bittner, E.A. (2022). *Respiratory problems in the post-anesthesia care unit (PACU)*. In UpToDate. Waltham, MA. Retrieved June 28, 2023 from URL: <https://www.uptodate.com/contents/respiratory-problems-in-the-post-anesthesia-care-unit-pacu>
3. Elsevier (2023). *Extubation Criteria for Short-Term Intubation (Perioperative)* – CE. In Elsevier Performance Manager: Clinical Skills. Retrieved June 28, 2023 from: [https://point-of-care.elsevierperformancemanager.com/skills/10798/quick-sheet?skillId=PN\\_160&virtualname=providencehealthcare-canada#scrollToTop](https://point-of-care.elsevierperformancemanager.com/skills/10798/quick-sheet?skillId=PN_160&virtualname=providencehealthcare-canada#scrollToTop)
4. Parotto, M., & Ellard, L. (2022). *Extubation following anesthesia*. In UpToDate. Retrieved June 28, 2023 from: <https://www.uptodate.com/contents/extubation-following-anesthesia>

## Appendices

[Appendix A](#): Extubation Related Complications

## Appendix A: Extubation-Related Complications

If patient is experiencing any of the following signs and symptoms do not hesitate to consult respiratory therapy or anesthesia for assistance in management. The following are considerations for management and may require a physician's order for treatment.

Complication	Risks	Signs & Symptoms	Management
<b>Airway Obstruction:</b>  <b>Mechanical</b> – foreign body (nasal packing), secretions, edema (caused by difficult intubation), location of surgery <b>Physiological</b> – poor muscle tone, relaxed muscles of the tongue and airway combined with limited motor strength due to the effects of anesthesia.	<ul style="list-style-type: none"> <li>Location of surgery (oral, neck).</li> <li>Trauma.</li> <li>Anaphylaxis.</li> <li>Anatomy; wide, short neck, receding jaw.</li> <li>Obesity.</li> </ul>	<ul style="list-style-type: none"> <li>Stertorous (snoring) respirations with partial obstruction.</li> <li>Apnea, no breath sounds on auscultation (total obstruction).</li> <li>Dyspnea, use of accessory muscles.</li> <li>Tracheal tug.</li> <li>Increasing EtCO<sub>2</sub></li> <li>Decreased O<sub>2</sub> saturation (late sign).</li> </ul>	<p><b>Attempt to rouse patient, If no response and no spontaneous respiratory effort</b></p> <ul style="list-style-type: none"> <li>Call a CODE BLUE.</li> <li>Begin bag-valve-mask ventilation.</li> </ul> <p><b>If spontaneous respiratory effort present:</b></p> <ul style="list-style-type: none"> <li>Reposition airway, elevate head of bed greater than 30°, reposition on side or perform jaw thrust (the tongue is the most common cause of airway obstruction following anesthesia.)</li> <li>If obstruction persists:</li> <li>Inspect oropharynx for foreign body.</li> <li>Suction oropharynx as needed.</li> <li>Insert oropharyngeal (unconscious patient only) or nasopharyngeal airway and notify anesthesia.</li> </ul>
<b>Bronchospasm:</b>  Abnormal contraction in the smooth muscle wall of the bronchi and bronchioles, edema of bronchial mucosa, obstruction of airway beyond edema.	<ul style="list-style-type: none"> <li>Endobronchial intubation.</li> <li>Pulmonary edema.</li> <li>Pulmonary aspiration.</li> <li>Emphysema.</li> <li>Smoking.</li> <li>History of bronchospasm.</li> <li>Histamine release associated with medications.</li> <li>Recent upper respiratory tract infection.</li> <li>Asthma.</li> <li>Allergy.</li> </ul>	<ul style="list-style-type: none"> <li>Prolonged expiratory time.</li> <li>Wheezing.</li> <li>Cough.</li> <li>Accessory muscle recruitment, laboured breathing, increased work of breathing (dyspnea).</li> <li>Mechanically ventilated patients: high peak inspiratory pressure.</li> <li>Decreased O<sub>2</sub> saturation.</li> </ul>	<ul style="list-style-type: none"> <li>Elevate head of bed greater than 30°.</li> <li>Provide humidified oxygen.</li> <li>Determine cause and treat (e.g., with endobronchial intubation, reposition tube to terminate in the trachea).</li> <li>Implement beta-2 adrenergic agonist therapy (e.g. salbutamol)</li> <li>If resistant to beta-2 agonist therapy consider anticholinergic therapy (e.g. ipratropium).</li> <li>Non-invasive positive pressure ventilation.</li> </ul>

Complication	Risks	Signs & Symptoms	Management
<b>Pulmonary Aspiration:</b> Inhalation of gastric contents into the lungs, usually via the right mainstem bronchus, results in damage to the lungs from the acidity and volume of aspirate.	<ul style="list-style-type: none"> <li>Decreased level of consciousness.</li> <li>Absent airway reflexes.</li> <li>Emergency surgery – stomach contents unknown.</li> <li>Supine position.</li> <li>Obesity.</li> <li>Pregnancy.</li> <li>Gastroesophageal reflux disease.</li> <li>Solid food ingested less than 6 hours prior to anesthesia.</li> <li>Distention of the stomach with air.</li> </ul>	<ul style="list-style-type: none"> <li>Dyspnea.</li> <li>Productive cough.</li> <li>Crackles or wheezes.</li> <li>Tachypnea.</li> <li>Tachycardia.</li> <li>Decreased O<sub>2</sub> saturation.</li> </ul>	<ul style="list-style-type: none"> <li>Elevate head of bed greater than 30°.</li> <li>When regurgitation occurs gastric contents should be removed from the trachea by turning to the side and suctioning the oropharynx using a Yankauer device.</li> <li>Supplemental oxygen.</li> <li>Diagnosis confirmed by chest X-ray.</li> <li>Suction trachea and bronchi (do not instill saline). If particulate found or suspected, bronchoscopy is indicated to remove any large aspirate.</li> <li>Culture tracheal secretions; antibiotics if positive.</li> <li>Support ventilation and oxygenation as required.</li> </ul>
<b>Impaired Respiratory Gas Exchange:</b> Inadequate neuromuscular blocking agent reversal, opioid induced hypoventilation, pulmonary edema	<ul style="list-style-type: none"> <li>Early extubation.</li> <li>Medications: neuromuscular blocking agents (NMBA), opioids, anesthetic agents.</li> <li>Pulmonary edema.</li> <li>Pulmonary embolus.</li> <li>Aspiration.</li> </ul>	<ul style="list-style-type: none"> <li>Ineffective respiratory effort.</li> <li>Use of accessory muscles of ventilation.</li> <li>Decreased O<sub>2</sub> saturation.</li> <li>Increased EtCO<sub>2</sub>.</li> <li>Bradypnea.</li> </ul>	<ul style="list-style-type: none"> <li>Supplemental oxygen.</li> <li>Perform stir-up regime.</li> <li>Airway support as required.</li> <li>Treat underlying cause, e.g. is additional anticholinesterase (NMBA reversal) indicated?</li> <li>Provide ventilatory support and consider whether control of airway is required.</li> </ul>
<b>Negative Pressure Pulmonary Edema:</b> Caused by an abnormally high negative intrathoracic pressure created when a patient makes a forceful attempt to inhale against an obstruction (e.g. during extubation, biting on an endotracheal tube).	<ul style="list-style-type: none"> <li>Agitation during extubation.</li> <li>Laryngospasm.</li> <li>Removal of an upper airway obstruction.</li> <li>Athletic man.</li> <li>Vocal cord paralysis.</li> </ul>	<ul style="list-style-type: none"> <li>Dyspnea.</li> <li>Agitation.</li> <li>Progressive decreased O<sub>2</sub> saturation</li> <li>Tachycardia.</li> <li>Tachypnea.</li> <li>Crackles audible throughout lung fields.</li> <li>Frothy pink sputum.</li> <li>Wheezing.</li> </ul>	<ul style="list-style-type: none"> <li>Diagnosis confirmed by chest X-ray.</li> <li>Provide supplemental oxygen, if unable to maintain oxygen saturation levels greater than 90% may require re-intubation.</li> <li>Continuous positive airway pressure therapy.</li> <li>High flow nasal prongs may be considered (consult with RT).</li> <li>Mechanical ventilation with positive end expiratory pressure may be required in severe cases.</li> <li>Diuretics may be indicated in select cases.</li> </ul>

Complication	Risks	Signs & Symptoms	Management
<p><b>Laryngospasm:</b></p> <p>An involuntary muscular contraction of the laryngeal cords, partial or complete, blocking inspiratory effort. Typically caused by secretions or stimulation which irritate the larynx and create a reflexive spasm. May occur following extubation, pain, inhalation agents or surgical manipulation (i.e. neck surgery)</p>	<ul style="list-style-type: none"> <li>Foreign body or secretions/stimulation of the vocal folds in association with emergence of anesthesia.</li> <li>Traumatic intubation or emergence.</li> <li>Surgery of head, neck and oral cavity.</li> <li>Too large of endotracheal tube.</li> <li>Hyper-inflated endotracheal cuff.</li> <li>Excessive movement of the endotracheal tube, i.e. bucking, coughing, head motion.</li> <li>Allergic drug reaction.</li> </ul>	<p><b>Partial obstruction</b></p> <ul style="list-style-type: none"> <li>Stridor, high pitched respirations.</li> <li>Increased respiratory effort.</li> <li>Accessory muscle use.</li> <li>Restlessness, agitation, anxiousness.</li> <li>Tachycardia.</li> </ul> <p><b>Complete obstruction</b></p> <ul style="list-style-type: none"> <li>Apnea – absence of stridor or air exchange.</li> <li>Tracheal tug.</li> <li>Worsening hypoxia, can lead to cardiac arrest if left untreated.</li> </ul>	<p><b>If partial obstruction:</b></p> <ul style="list-style-type: none"> <li>Remove any source of irritation (i.e. gentle suctioning for blood or secretions).</li> <li>Provide humidified oxygen by facemask.</li> <li>Provide calm reassurance.</li> <li>Elevate head of bed greater than 45°.</li> <li>Consider epinephrine (1 mg/mL) 5 ampoules (5 mL) via nebulizer.</li> <li>Consider corticosteroids IV to reduce inflammatory response and add stability to cellular membranes.</li> <li>Direct visualization using fiberoptic laryngoscopy may be performed to provide precise diagnosis of laryngeal irritation, edema or paralysis.</li> <li>If re-intubation is determined necessary a smaller OETT should be used.</li> </ul> <p><b>If complete obstruction:</b></p> <ul style="list-style-type: none"> <li>Call a CODE BLUE.</li> <li>Begin bag-valve-mask ventilation.</li> <li>Anticipate muscle relaxation, succinylcholine 0.1 mg/kg IV, this dose will provide muscle relaxation for approximately 2 minutes without fasciculations which potentially could worsen laryngospasm.</li> <li>Re-intubation is only recommended if a problem with ventilation persists as it could lead to increased trauma to larynx.</li> <li>Consider administration of midazolam (0.5 to 1 mg IV) in small incremented doses to reduce patient's anxiety and recall without producing respiratory depression.</li> </ul>



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