Mechanical Ventilation Invasive

Setting: Inpatient  Population: Adult  Keywords: device, VAP, ventilator, lung injury, vent, ventilator-associated pneumonia, breathing

Clinical Description

Care of the hospitalized patient experiencing the need for controlled or assisted breathing through an artificial airway.

Key Information

- Laryngeal mask airways may be used for short-term use to facilitate breathing; however, they do not offer aspiration protection and should be changed to an endotracheal tube if there is a need for a prolonged artificial airway.
- Cuff must be deflated (if present) prior to using a speaking valve or capping a tracheostomy tube. Some speaking tracheostomies may have exceptions to this rule. Consider a cuffless tracheostomy, if speaking valve or cap use will be routine.
- To reduce the risk of pulmonary aspiration, a swallow evaluation should be performed prior to oral intake.
- Bleeding may be present following intubation and tracheostomy placement. Persistent bleeding should be reported to physician.
- Enteral feeding is preferred over parenteral due to physiologic benefits, such as gut integrity and function, stress ulcer prophylaxis and reduction of infection risk.

Clinical Goals

By transition of care

A. The patient will demonstrate achievement of the following goals:
   - Effective Communication
   - Optimal Device Function
   - Mechanical Ventilation Liberation
   - Optimal Nutrition Delivery

B. Patient, family or significant other will teach back or demonstrate education topics and points:
   - Education: Overview
   - Education: Self Management
   - Education: When to Seek Medical Attention
• Absence of Device-Related Skin and Tissue Injury
• Absence of Ventilator-Induced Lung Injury

Correlate Health Status

Correlate health status to:

• history, comorbidity
• age, developmental level
• sex, gender identity
• baseline assessment data
• physiologic status
• response to medication and interventions
• psychosocial status, social determinants of health
• barriers to accessing care and services
• health literacy
• cultural and spiritual preferences
• safety risks
• family interaction
• plan for transition of care

Communication Impairment (Mechanical Ventilation, Invasive)

Signs/Symptoms/Presentation

• agitation
• anxiety
• artificial airway present inhibiting vocalization
• fear
• frustration expressed
• irritability
• maladaptive communication behavior (e.g., facial expressions, hand or head movements)
• powerlessness
• social withdrawal

Problem Intervention(s)

Ensure Effective Communication

• Acknowledge and validate intensity and complexity of voicelessness. Maintain eye contact when speaking and awaiting response.
• Promote calming presence. Involve patient in decision-making and care to promote inclusion, self-efficacy, confidence and sense of control.
• Establish a nonverbal communication method. Use augmentative techniques to preserve self-identity and self-esteem, such as writing tools, letter board, computer, flash cards or picture boards.
• If longer-term airway, consider alternative communication methods that facilitate speech, such as speaking valve, tracheostomy, cap or electrolarynx. Evaluate need to deflate cuff when using these devices to allow exhalation.
• Keep call system within reach; adapt to meet needs.
• Assess and monitor for signs of biopsychosocial concerns that may affect ability to communicate, such as delirium, anxiety and depression.

Associated Documentation

• Communication Enhancement Strategies

Device-Related Complication Risk (Mechanical Ventilation, Invasive)

Signs/Symptoms/Presentation

• air auscultated in stomach
• airflow out of mouth
• breath sounds unequal
• chest movement asymmetrical
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- difficulty passing suction catheter
- excessive cough
- gastric distension
- gurgling sound from throat
- inability to ventilate
- mechanical ventilation with an artificial airway
- no airflow from device
- restlessness
- upper airway sounds increased
- work of breathing increased

Vital Signs

- heart rate increased
- respiratory rate increased
- SpO2 (peripheral oxygen saturation) decreased
- EtCO2 (end-tidal carbon dioxide) increased

Laboratory Values

- PaCO2 (arterial carbon dioxide) increased
- PaO2 (partial pressure of arterial oxygen) decreased

Diagnostic Results

- CXR (chest x-ray) confirmation of abnormal tube position
- EtCO2 (end-tidal carbon dioxide) waveform abnormal
- obstruction visualized with bronchoscopy
- ultrasonography abnormal tube position

Problem Intervention(s)

Optimize Device Care and Function
• Maintain semirecumbent position to minimize aspiration risk.
• Provide oral care regularly with antimicrobial solution and subglottic suction to reduce the risk of infection; perform prior to cuff deflation.
• Assess tube size, depth, location and securement frequently to minimize the risk of tube displacement; regularly confirm placement with radiography or ultrasonography.
• Facilitate regular mechanical ventilator and humidification equipment checks to ensure proper function; monitor and manage ventilator and alarm settings.
• Provide humidiﬁcation and evaluate need for suctioning to minimize risk of airway obstruction; regularly replace closed in-line suction equipment.
• Perform ongoing tracheostomy and stoma care to prevent infection; minimize excessive moisture around device; replace or clean inner cannula or tracheostomy regularly to prevent obstruction from secretions.
• Monitor and manage cuff pressure routinely, if present; deflate cuff when not clinically indicated.
• Provide emergency equipment that includes appropriate-sized manual resuscitation bag, mask, suction equipment and cleaning supplies; replace device or assist breathing if displacement occurs.

Associated Documentation

• Airway Safety Measures
• Aspiration Precautions

Inability to Wean (Mechanical Ventilation, Invasive)

Signs/Symptoms/Presentation

• confusion
• continued need for mechanical ventilation
• disconnected from reality
• fear
• inability to decrease ventilator settings
• increase in oxygenation or ventilation requirements
• level of consciousness decreased
• lung compliance decreased
• muscle weakness
• positive fluid balance
• respiratory effort absent
• unable to follow commands

Vital Signs

• heart rate increased
• respiratory rate increased
• blood pressure increased or decreased
• SpO2 (peripheral oxygen saturation) decreased
• EtCO2 (end-tidal carbon dioxide) increased

Laboratory Values

• ABG (arterial blood gas) abnormal

Problem Intervention(s)

Promote Extubation and Mechanical Ventilation Liberation

• Assess for pain, agitation and delirium regularly, utilizing a validated tool; minimize medication effects that may contribute to agitation, delirium or delay extubation.
• Encourage early rehabilitation using therapeutic intervention and functional mobility training to minimize deconditioning, weakness, functional dependence and delirium.
• Assess readiness to wake up, breathe, wean and extubate; consider protocol approach to reduce ventilator and intensive care days.
• Perform spontaneous awakening trial; adjust medication to minimize effects that may contribute to extubation failure.
• Perform SBT (spontaneous breathing trial); consider low inspiratory-pressure support.
• Facilitate clustered care and uninterrupted sleep/rest pattern that supports home sleep routine; promote calm environment.
• Acknowledge fear and anxiety related to the patient’s and support system’s experience of prolonged mechanical ventilation; encourage complementary therapies, such as music therapy.
• Perform a cuff leak test to predict postextubation risk for swelling or stridor; consider intravenous or inhaled steroids for high-risk patients.
• Consider prophylactic noninvasive ventilation after extubation for high-risk patients [e.g., COPD (chronic obstructive pulmonary disease), heart failure, elderly].
• Consider the need for a longer-term airway.

**Associated Documentation**

- Environmental Support
- Medication Review/Management
- Sleep/Rest Enhancement

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**Nutrition Impairment (Mechanical Ventilation, Invasive)**

**Signs/Symptoms/Presentation**

- inability to intake nutrition via oral route

**Problem Intervention(s)**

**Optimize Nutrition Delivery**

- Perform a nutritional assessment; include a nutrition-focused physical exam.
- Determine calorie, protein, vitamin, mineral and fluid requirements; use indirect calorimetry if nutrition support is required.
- Initiate early enteral nutrition support; consider another form of stress ulcer prophylaxis, if enteral feeding is contraindicated.
- Optimize protein intake, unless contraindicated.
- Consider postpyloric versus gastric tube feeding for patient at increased risk of aspiration.
- Advocate for, and adjust, infusion rate, formulation or volume based on feeding tolerance and clinical status (e.g., hemodynamic stability); minimize unnecessary interruptions.
- Anticipate the need for a promotility agent, if reduced gastric emptying or delayed bowel motility is suspected.
Monitor nutrition delivery to ensure safe practices (e.g., confirmation of tube placement, tube patency, medication delivery, head of bed elevation, oral care).

Associated Documentation

- Nutrition Support Management

Skin and Tissue Injury (Mechanical Ventilation, Invasive)

Signs/Symptoms/Presentation

- bleeding
- localized swelling
- redness
- skin blanching
- skin integrity disrupted
- stoma granulation
- stridor
- tracheal granuloma
- voice hoarse

Problem Intervention(s)

Maintain Skin and Tissue Health

- Monitor depth of suction catheter advancement to minimize the risk of internal tracheobronchial tissue injury.
- Reposition and resecure endotracheal tube regularly; ensure proper tube location.
- Monitor tightness of securement device, as well as skin and mucosal areas, regularly; consider skin barrier protection.
- Minimize pressure points and prevent traction on device, using careful positioning, flexible extenders and props.
- Assess and monitor for the presence of bleeding that may indicate injury to tracheobronchial tissue. Notify provider for persistent bleeding.
- Anticipate the need for further treatment or procedure, if bleeding persists.
• Anticipate adjunct therapy, such as cool mist, racemic epinephrine, corticosteroid or heliox, for symptoms related to airway swelling or stridor after removal of tube.

Associated Documentation

• Device Skin Pressure Protection

Ventilator-Induced Lung Injury (Mechanical Ventilation, Invasive)

Signs/Symptoms/Presentation

• lung compliance decreasing
• oxygenation requirements increasing (e.g., FiO2 or positive end expiratory pressure needs)
• ventilatory requirements increasing (e.g., minute volume, respiratory rate)

Vital Signs

• heart rate increased or decreased
• respiratory rate increased
• SpO2 (peripheral oxygen saturation) decreased
• EtCO2 (end-tidal carbon dioxide) increased

Laboratory Values

• oxygen index increased
• PaO2 (partial pressure of arterial oxygen) decreased
• PaO2/FiO2 ratio decreased

Diagnostic Results

• bronchoscopy abnormal
Problem Intervention(s)

Facilitate Lung-Protection Measures

- Provide oxygen therapy judiciously to maintain oxygenation goals; adjust to avoid hyperoxia.
- Monitor and limit ventilator tidal volumes to minimize volutrauma; initiate low tidal-volume strategy (e.g., less than 8 mL/kg for ideal body weight).
- Monitor and limit ventilator pressure to reduce risk of barotrauma; maintain less than 30 cm H2O (e.g., plateau, inspiratory pressure delta).
- Apply PEEP (positive end expiratory pressure) to minimize atelectasis; adjust for changes in lung compliance and oxygenation.
- Monitor fluid balance closely to minimize the risk of fluid overload.
- Monitor ventilator waveforms and promote patient-ventilator synchrony; adjust ventilator settings and sedation.

Prevent Ventilator-Associated Pneumonia

- Assess readiness to extubate; perform sedation interruption and spontaneous breathing trial.
- Maintain semirecumbent position to minimize aspiration risk.
- Provide ongoing oral care to reduce pathogens in oral cavity; anticipate antiseptic oral decontamination.
- Consider the use of antiseptic (e.g., chlorhexidine gluconate) cloths for daily bathing.
- Minimize ventilator circuit breaks; consider use of closed suction device.
- Minimize microaspiration risk; consider the use of ultrathin polyurethane tapered endotracheal tubes with subglottic secretion drainage, as well as cuff pressure monitoring.
- Assess need for stress ulcer and venous thromboembolism prophylaxis due to increased risk during mechanical ventilation.

Associated Documentation

- Lung Protection Measures
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Setting: Inpatient  
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- Head of Bed (HOB) Positioning
- Oral Care
- VAP Prevention Measures

General Education

- admission, transition of care
- orientation to care setting, routine
- advance care planning
- diagnostic tests/procedures
- opioid medication management
- oral health
- medication management
- pain assessment process
- safe medication disposal
- tobacco use, smoke exposure
- treatment plan

Safety Education

- call light use
- equipment/home supplies
- fall prevention
- harm prevention
- infection prevention
- MDRO (multidrug-resistant organism) care
- personal health information
- resources for support

Education: Mechanical Ventilation, Invasive: Overview
Education: Mechanical Ventilation, Invasive: Self-Management

- CPR education
- VAP prevention
- VTE prevention

Education: Mechanical Ventilation, Invasive: When to Seek Medical Attention

- unresolved/worsening symptoms

References


American Association for Respiratory Care (AARC). Endotracheal suctioning of mechanically ventilated patients with artificial airways. Respiratory Care. 2010;55(6), 758-764. [Quality Measures, Clinical Practice Guidelines]


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Setting: Inpatient
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The purpose of Mechanical Ventilation for the Adult is to review the pulmonary system, indications for intubation, intubation, mechanical ventilation, complications, care of the patient on the ventilator, and extubation. It is important for healthcare providers who care for patients requiring mechanical ventilation understand how to properly care for the patient. After successful completion of this course, you will be able to: 1. Delineate the major components of ventilation. 2. Analyze the indications and contraindications for intubation and mechanical ventilation. 3. Compare modes of ventilation. 4. Maximize the benefit of the mechanical ventilator in patient with COVID19. 5. Provide objective parameter for intubation and ventilation of COVID19 patients.

III. Targeted population.