Ventilator Associated Events: Prevention - Pediatric/Neonatal - Inpatient Clinical Practice Guideline

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CPG Contact for Content:
Names: Sarah Van Hoof, BSN, RN- Infection Control
Phone Number: (608) 440-6378
Email Address: svanhoof@uwhealth.org

CPG Contact for Changes:
Name: Lindsey Spencer, MS- Center for Clinical Knowledge Management (CCKM)
Phone Number: (608) 890-6403
Email Address: lspencer2@uwhealth.org

Coordinating Team Members:
Nasia Safdar, MD- Medical Director of Infection Control
Jamie Limjoco, MD Neonatal Intensive Care Unit
Michael Wilhelm, MD- Pediatric Intensive Care Unit
Anne Moseley, Director, Pediatric Nursing and Patient Care Services
Deb Soetenga, CNS- Pediatric Intensive Care Unit
Laura Konkol, CNS- Neonatal Intensive Care Unit
Angela Baker- Neonatal Intensive Care Unit Manager
Rhonda Yngsdal-Krenz, RRT- Respiratory Therapy Manager

Review Individuals/Bodies:
Vivek Balasubramaniam, MD- Pediatrics- Pulmonary

Committee Approvals/Dates:
Clinical Knowledge Management (CKM) Council (03/24/2016)

Release Date: March 2016 | Next Review Date: March 2018
Executive Summary

Guideline Overview

This CPG is intended for all healthcare workers who care for patients receiving mechanical ventilation in the pediatric and neonatal intensive care unit (PICU, NICU) and Universal Care Unit) or any overflow unit caring for pediatric and neonatal patients, and the infection control department. In pediatric populations, the pathogenesis of VAP is not well studied, however several factors have been identified as being risk factors for VAP in NICU and PICU patients. The Pediatric and Neonatal VAP prevention bundles include interventions extrapolated from adult literature and pediatric and neonatal collaboratives aimed at reducing the incidence of VAP in these populations.

Key Practice Recommendations

1. Adhere to strict hand hygiene practices
2. Use noninvasive positive pressure ventilation whenever possible
3. Drain ventilator circuit water away from patient every 2-4 hours or before repositioning or when condensate accumulates
4. Minimize duration of ventilation
5. Avoid unplanned extubation and reintubation
6. Avoid opening and disconnecting the ventilator equipment
7. Wear gloves according to standard precautions as outlined in UWHC policy
8. Wear sterile gloves for intubation and each new endotracheal tube attempt for neonatal intensive care unit patients

Companion Documents

1. Prevention of Ventilator Associated Events (VAE) – Adult – Inpatient Clinical Practice Guideline
2. AFCH Initial Ventilator Management Algorithm
3. AFCH Ventilator Management for Restrictive Lungs Algorithm
4. AFCH Ventilator Weaning Algorithm

Scope

Disease/Condition(s): Ventilator associated pneumonia (VAP)

Clinical Specialty: NICU, PICU, Universal Care Unit, Respiratory Therapy, Nursing, Infection Control

Intended Users: Physicians, Advanced Practice Providers, Nursing, Respiratory Therapy

Objective(s): To provide an evidence-based guideline for inpatient management of pediatric and neonatal/infant patients requiring continuous invasive ventilation via endotracheal tube or tracheostomy for the prevention of VAP.

Target Population: All patients (birth to 18 years) requiring continuous invasive ventilation in the pediatric and neonatal/infant units for guidance of preventing VAP.

Interventions and Practices Considered:

- Strategies to detect VAP
- Strategies to prevent VAP:
  - General strategies
  - Strategies to prevent aspiration
  - Strategies to reduce colonization of the oropharyngeal cavity
Methodology

Methods Used to Collect/Select the Evidence:
Electronic database searches (e.g., PUBMED) were conducted by the guideline author(s) and workgroup members to collect evidence for review. Expert opinion, clinical experience, and regard for patient safety/experience were also considered during discussions of the evidence.

Methods Used to Formulate the Recommendations:
The interdisciplinary workgroup members agreed to adopt recommendations developed by external organizations and/or arrived at a consensus through discussion of the literature and expert experience. All recommendations endorsed or developed by the guideline workgroup were reviewed and approved by other stakeholders or committees (as appropriate).

Methods Used to Assess the Quality and Strength of the Evidence/Recommendations:
Recommendations developed by external organizations, such as the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA) or Centers for Disease Control (CDC), maintained the evidence grades assigned within the original source document and were adopted for use at UW Health.

Internally developed recommendations, or those adopted from external sources without an assigned evidence grade, were evaluated using an algorithm adapted from the Grading of Recommendations Assessment, Development and Evaluation (GRADE) methodology (Figure 1 in Appendix A).

Rating Scheme for the Strength of the Evidence/Recommendations:
See Appendix A for the rating scheme(s) used within this document.

Definitions
- Ventilator associated pneumonia (VAP) is defined as hospital-acquired pneumonia in a patient receiving invasive ventilation, including CPAP via an endotracheal tube or tracheostomy, for at least 48 hours. Pneumonia is identified by using a combination of radiologic, clinical, and microbiologic criteria, as defined by the CDC, National Health and Safety Network (NHSN) Protocol for Ventilator Associated Events, January 2016 http://www.cdc.gov/nhsn/PDFs/pscManual/6pscVAPcurrent.pdf.
- Ventilator: A device used to assist or control respiration inclusive of the weaning period, through a tracheostomy or by endotracheal tube.

Introduction
Mechanical ventilation is an essential, life-saving therapy for patients with critical illness and respiratory failure. Studies have estimated that more than 300,000 patients receive mechanical ventilation in the United States each year. These patients are at high risk for complications and poor outcomes including death. Ventilator-associated pneumonia is one of the complications that can occur in patients receiving mechanical ventilation. Such complications can lead to longer duration of mechanical ventilation, longer stays in the ICU and hospital, increased healthcare costs, and increased risk of disability and death.

In pediatric populations, the pathogenesis of VAP is not well studied, however several factors have been identified as being risk factors for VAP in NICU and PICU patients. The Pediatric and Neonatal VAP prevention bundles include interventions extrapolated from adult literature and pediatric and neonatal collaboratives aimed at reducing the incidence of VAP in these
population. This guideline was developed based on the available evidence in the literature and collaboration with other pediatric and neonatal facilities to establish defined standards for prevention of ventilator associated pneumonia at the University of Wisconsin Hospital and Clinics and American Family Children’s Hospital.

**Recommendations**

For the purpose of this guidelines, the below prevention strategies apply to pediatric and neonatal patients unless otherwise indicated.

**Strategies to Detect VAP**

VAP are identified by using a combination of criteria including: imaging (chest x-ray), clinical (signs and symptoms such fever, leukocytosis or leukopenia, new onset of cough, rales, worsening gas exchange), and laboratory (sputum or BAL culture) for those pediatric patients that have been on mechanical ventilation for >2 calendar days.

**Methods for Surveillance**

1. Active surveillance is used to identify patients with possible VAP using an electronic surveillance systems and Health Link clarity reports.
2. Conduct continuous active surveillance for VAP through the Infection Control Department.

**General Strategies**

1. Adhere to hand-hygiene guidelines published by the CDC and UWHC Policy #13.08 Hand Hygiene. *(CDC Category IA)*
2. Use noninvasive positive pressure ventilation whenever possible. *(Neonates: SHEA-IDSA Grade I; Pediatrics SHEA-IDSA Grade II)*
3. Drain ventilator circuit water away from patient every 2-4 hours or before repositioning or when condensate accumulates.
4. Minimize duration of ventilation. *(SHEA-IDSA Grade I)*
5. Avoid unplanned extubation and reintubation. *(SHEA-IDSA Grade III)*
6. Avoid opening and disconnecting the ventilator equipment *(SHEA-IDSA Grade III)*
7. Wear gloves according to standard precautions as outlined in UWHC Policy #13.07. *(CDC Category 1A)*
8. Wear sterile gloves for intubation and each new endotracheal tube attempt for neonatal intensive care unit patients.

**Provider Responsibilities**

1. Perform daily assessments of readiness to wean ventilation and use unit-specific weaning protocols. *(Neonates: SHEA-IDSA Grade III; Pediatrics: SHEA-IDSA Grade II)*
2. Avoid gastric over distention. *(UW Health Low quality evidence, strong recommendation)*

**Nursing Responsibilities**

1. Maintain patients in a semi recumbent position unless there are contraindications. *(SHEA-IDSA Grade III)*
   a. Pediatric: 30 - 45 degrees
   b. Neonatal/Infant:
      i. ≤ 48 weeks corrected gestational age (CGA) 15-30 degrees
      ii. >48 weeks CGA 30-45 degrees
   a. Replace the oral suction catheter every 24 hours, the canister every three days and tubing daily or when visibly soiled. *(SHEA-IDSA Grade II)*
i. Neonatal/Infant (for patients less than 1 year)
   1. ≤ 48 weeks CGA – Every 3-4 hours use cotton tip applicator
dipped in fresh expressed breast milk (EBM) to coat buccal
mucosa, use new applicator each pass
   a. If fresh EBM is not available, use thawed BM or sterile
water.
   b. Use colostrum if available for oral cares
2. Infants >48 weeks CGA
   a. If breast feeding, every 3-4 hours use cotton tip applicator
dipped in fresh EBM to coat buccal mucosa, use new
applicator each pass (if fresh EBM not available, use
thawed breast milk or sterile water
   b. If not breastfeeding, every 3-4 hours moisten mouth with
swabs soaked in clean water or physiological saline.

ii. Pediatric (for patients greater than 1 year)
   1. Perform oral care every 4 hours between brushing. Cleanse
mouth with toothette; soak in sodium bicarbonate with H2O2
solution. After cleansing, a mouth moisturizer should be applied.
   (SHEA-IDSA Grade III)
2. Patient’s ≥ 1 year: Brush teeth/gums every 12 hours with
chlorhexidine gluconate solution. (SHEA-IDSA Grade II)

3. Suctioning
   a. In-line suctioning is preferred. (SHEA-IDSA Grade III)
   b. Always use separate suction tubing for oral suctioning and ETT suctioning.
   When possible use a separate suction canister also.
   c. Suction oral pharynx prior to ET tube suctioning.
   d. DO NOT routinely instill normal saline prior to suctioning.
   e. Insert the suction catheter only to the end of the ET tube to prevent airway
trauma.
   f. Preoxygenate 30-60 sec prior to suctioning.

Respiratory Therapy Responsibilities
1. When appropriate, maintain an endotracheal cuff pressure to minimal occlusion volume.
   (Pediatric: SHEA-IDSA Grade III)
2. Change in-line suction catheters, tubing and canisters every three days or when visibly
soiled. (SHEA-IDSA Grade II)
3. Ventilator circuit should be changed every month or when visibly soiled. (Neonates: SHEA-IDSA Grade III; Pediatrics: SHEA-IDSA Grade II)
4. Clean high touch surface on respiratory equipment once per day.
5. Change the resuscitation bag once a month or when visibly soiled.
UW Health Implementation

Potential Benefits:
Establishment of effective and consistent methods to detect, prevent, and treat VAP in the neonatal and pediatric population.

Potential Harms:
Patients with mechanically-assisted ventilation have a high risk of developing healthcare-associated pneumonia.

Pertinent UW Health Policies & Procedures
1. UWHC Nursing Policy #13.16 Basic Care –Inpatient Pediatrics (Birth-18 years of age)
2. UWHC Nursing Policy #7.11P Care of the Intubated Patient (Pediatric & Neonatal)
3. UWHC Policy #2.09 Guidelines for Administration of Invasive & Non-Invasive Respiratory Support in Nuclear Medicine Procedures
4. UWHC Policy #13.08 Hand Hygiene
5. UWHC Respiratory Therapy Policy #2.02 Mechanical Ventilation Adult and Pediatric
6. UWHC Nursing Policy #7.19 Care of the Patient with a Tracheostomy Tube (Pediatric)
7. UWHC Respiratory Therapy Policy #3.43 Placement, Care and Removal of ETT
8. UWHC Respiratory Therapy Policy # 3.42 Suctioning

Patient Resources
1. HFFY #4437: Ventilators
2. HFFY #7282: Keeping Your Family Member Safe While On A Ventilator
3. HFFY #7169: Keeping Your Child Safe with Oral Care While on a Ventilator- FAQs
4. HFFY #6337: Intubation and Mechanical Ventilation in the ICU
5. HFFY #3091 Caring for Your Child’s Tracheostomy

Guideline Metrics: Current strategies to capture guideline metrics are through manual chart review and include number of patients with VAP that received oral care.

Implementation Plan/Tools
1. Guideline will be housed on uConnect in a dedicated folder for CPGs.
2. Release of the guideline will be advertised in the Physician/APP Briefing newsletter.
3. Links to this guideline will be updated and/or added in appropriate Health Link or equivalent tools, including:

Order Panels
Mechanical Ventilation- Pediatric [O147629]
Mechanical Ventilation- Neonatal [RT0080]

Disclaimer
Clinical practice guidelines assist clinicians by providing a framework for the evaluation and treatment of patients. This guideline outlines the preferred approach for most patients. It is not intended to replace a clinician’s judgment or to establish a protocol for all patients. It is understood that some patients will not fit the clinical condition contemplated by a guideline and that a guideline will rarely establish the only appropriate approach to a problem.
Appendix A. Evidence Grading Scheme(s)

Figure 1. GRADE Methodology adapted by UW Health

GRADE Ranking of Evidence

<table>
<thead>
<tr>
<th>Grade</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>We are confident that the effect in the study reflects the actual effect.</td>
</tr>
<tr>
<td>Moderate</td>
<td>We are quite confident that the effect in the study is close to the true effect, but it is also possible it is substantially different.</td>
</tr>
<tr>
<td>Low</td>
<td>The true effect may differ significantly from the estimate.</td>
</tr>
<tr>
<td>Very Low</td>
<td>The true effect is likely to be substantially different from the estimated effect.</td>
</tr>
</tbody>
</table>

GRADE Ratings for Recommendations For or Against Practice

<table>
<thead>
<tr>
<th>Rating</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>The net benefit of the treatment is clear, patient values and circumstances are unlikely to affect the decision.</td>
</tr>
<tr>
<td>Weak/conditional</td>
<td>Recommendation may be conditional upon patient values and preferences, the resources available, or the setting in which the intervention will be implemented.</td>
</tr>
</tbody>
</table>

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE (SHEA/IDfSA):

<table>
<thead>
<tr>
<th>Grade</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. High</td>
<td>Highly confident that the true effect lies close to that of the estimated size and direction of the effect. Evidence is rated as high quality when there is a wide range of studies with no major limitations, there is little variation between studies, and the summary estimate has a narrow confidence interval.</td>
</tr>
<tr>
<td>II. Moderate</td>
<td>The true effect is likely to be close to the estimated size and direction of the effect, but there is a possibility that it is substantially different. Evidence is rated as moderate quality when there are only a few studies and some have limitations but not major flaws, there is some variation between studies, or the confidence interval of the summary estimate is wide.</td>
</tr>
<tr>
<td>III. Low</td>
<td>The true effect may be substantially different from the estimated size and direction of the effect. Evidence is rated as low quality when supporting studies have major flaws, there is important variation between studies, the confidence interval of the summary estimate is very wide, or there are no rigorous studies, only expert consensus.</td>
</tr>
</tbody>
</table>

NOTE: Based on Grades of Recommendation, Assessment, Development, and Evaluation (GRADE) and the Canadian Task Force on Preventive Health Care.
RATING SCHEME FOR CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)

CDC Categories of Evidence

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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<tbody>
<tr>
<td>Category IA</td>
<td>Strongly recommended for implementation and strongly supported by well-designed experimental, clinical or epidemiologic studies</td>
</tr>
<tr>
<td>Category IB</td>
<td>Strongly recommended for implementation and supported by some clinical or epidemiologic studies and by strong theoretical rationale</td>
</tr>
<tr>
<td>Category IC</td>
<td>Required implementation, as mandated by federal or state regulation or standard</td>
</tr>
<tr>
<td>Category II</td>
<td>Suggested for implementation and supported by suggestive clinical or epidemiologic studies or by strong theoretical rationale</td>
</tr>
<tr>
<td>No Recommendation; Unresolved Issue</td>
<td>Practices for which insufficient evidence or no consensus exists about efficacy</td>
</tr>
</tbody>
</table>

References

6. Centers for Disease Control and Prevention, National Health and Safety Network, surveillance definition of ventilator associated events, July 2013


