Pneumonia, Ventilator-Associated: Prevention

What We Know

› Ventilator-associated pneumonia (VAP) is a life-threatening infection of the lower airways that may develop in patients who are intubated and receiving mechanical ventilation.\(^{(1,2,6,7,10,11,13,14)}\) (For more information on VAP, see Quick Lesson About ... Pneumonia, Ventilator-Associated)

• VAP is defined as pneumonia that occurs 48 hours or longer after endotracheal intubation\(^{(1,2,7,11)}\)

• Between 10% and 20% of patients requiring mechanical ventilation for more than 48 hours develop VAP, with consequences including prolonged hospitalization and mechanical ventilation, high mortality rates, and increased hospital costs\(^{(1,9,11,13)}\)

• VAP results from pathogenic invasion of the otherwise sterile lower respiratory tract in critically ill and, therefore, immunocompromised individuals. It is caused by microbial colonization of the aerodigestive tract and aspiration of colonized oropharyngeal and/or gastric secretions into the lower airways\(^{(2,6,7,9,10,11)}\)

– Factors associated with increased risk for developing VAP include longer duration of intubation, altered neurologic status, advanced age, malnutrition, suppressed immune system, and use of acid-suppressing medications (e.g., proton pump inhibitors [PPIs; e.g., omeprazole], H2 blockers [e.g., ranitidine])\(^{(11)}\)

› Strategies for prevention of VAP may include\(^{(1,2,3,5,6,9,10,11,12,13)}\)

• good hand hygiene and use of gloves\(^{(11)}\)

• elevating the head of the bed to 30–45° after enteral feedings to prevent aspiration, unless contraindicated\(^{(1,2,6,11,12)}\)

• regular or continuous suctioning of oropharyngeal secretions\(^{(11,12)}\)

– Authors of a systematic review and meta-analysis published in 2011 concluded that the use of endotracheal tubes with subglottic secretion drainage can reduce the incidence of VAP by ~ 50%\(^{(9)}\)

• maintenance of appropriate endotracheal cuff pressures to minimize aspiration risk\(^{(2,6,11)}\)

• daily sedation breaks and spontaneous breathing trials as appropriate to wean from mechanical ventilation\(^{(2,11)}\)

• prophylactic antibiotic treatment to reduce the incidence of VAP in areas where the incidence is unacceptably higher\(^{(1,13)}\)

– Researchers in a study of 129 comatose ICU patients reported that a single dose of antibiotic prophylaxis at the time of intubation significantly reduced the incidence of early-onset VAP (i.e., VAP that develops within the first 4 days of intubation) but did not affect rates of late-onset VAP\(^{(13)}\)

• use of silver-impregnated endotracheal tubes, antiseptic-impregnated tubes, and endotracheal tubes that allow subglottic suctioning may reduce the risk of VAP\(^{(2)}\)

• implementation of high-quality intensive oral hygiene, including oral swabbing, thorough toothbrushing, use of antiseptic mouthwash such as chlorhexidine gluconate...
(CHX; a broad spectrum antibacterial solution) rinse 0.12%, and regular suctioning of oral secretions\(^{(1,2,5,10,11,12)}\)

– The American Association of Critical-Care Nurses recommends providing mouth care every 2–4 hours in mechanically ventilated patients\(^{(2)}\)

– Cochrane reviewers evaluated 17 randomized trials including 2,402 patients and concluded that routine oral care including CHX rinse or gel is associated with a 40% reduction in VAP risk compared with placebo or usual care. They found no significant differences in mortality, duration of mechanical ventilation, and duration of ICU stay\(^{(10)}\)

- Some experts have noted limitations in the evidence supporting the efficacy of CHX oral care. Among these is the fact that the body of evidence is heavily influenced by 3 large studies including cardiac surgery patients who tend to experience only short duration of intubation. Additional limitations include variations in the CHX treatment regimens used and failure to disclose other VAP prevention strategies employed in the studies\(^{(1,5)}\)

- Investigators who conducted a systematic review of 16 randomized trials including 3,630 patients found evidence that CHX-based oral care reduces risk of VAP in cardiac surgery patients, but not in other patients in the ICU\(^{(5)}\)

• administration of probiotics\(^{(4)}\)

– Investigators who undertook a recent meta-analysis concluded the administration of probiotics is associated with a 41% reduction in the incidence of VAP in trauma patients. Probiotics also reduced the incidence of other healthcare-associated infections and the length of ICU stay, but did not affect mortality rates\(^{(4)}\)

• staff education, careful monitoring of respiratory status, and meticulous patient care using aseptic technique for invasive procedures and other infection-control strategies\(^{(12)}\)

› Tracheostomy has been associated with a lower incidence of VAP than endotracheal intubation among critically ill patients requiring intubation. However, the evidence is inconclusive, and researchers in some studies have reported that tracheostomy may even increase the risk of VAP by disrupting airway integrity or by increasing the risk of bacterial contamination\(^{(8,14)}\)

› Although it is known that individual interventions can significantly reduce VAP incidence, evidence on the efficacy of a “ventilator care bundle,” a set of evidence-based practices used in combination to further improve outcomes, has been mixed\(^{(6,11)}\)

• Recent evidence, however, suggests that increased compliance with the ventilator care bundle including head of bed elevation, daily sedation breaks, gastric ulcer prevention, and deep vein thrombosis prophylaxis from 50% to 82%, resulted in a 42% reduction in the incidence of VAP\(^{(6)}\)

What We Can Do

› Learn more about VAP so you can accurately assess your patients’ personal characteristics and health education needs; share this knowledge with your colleagues

› Implement strategies to prevent VAP in your patients who are being mechanically ventilated\(^{(2,6,11,12)}\)

• Elevate the head of the bed 30–45° (unless contraindicated), especially during and for 3 hours after enteral feedings, to reduce risk of aspiration

– Frequently reposition and turn the patient from side to side since the patient may slide down in bed

• Follow facility protocol for tracheal suctioning and airway clearance

– If possible, advocate for use of a silver-impregnated endotracheal tube that allows continuous drainage of subglottic secretions and may prevent infection

• Provide antiseptic oral care to prevent colonization of the upper airways

– Perform comprehensive oral hygiene including daily oral assessment, and frequent toothbrushing, use of mouth swabs, use of mouthwash (e.g., CHX), and suctioning of oral secretions

• Closely monitor cuff pressure, ensuring that it is 20–30 cm H2O to prevent descent of microbes into the lower airway and aspiration

• Follow facility protocol for breaks from sedation, spontaneous breathing trials, and assessment of readiness to wean from mechanical ventilation

• Follow facility protocol for venous thromboembolism and pressure ulcer prophylaxis due to the patient’s sedentary state

• Change ventilator circuits weekly, when broken, or according to facility protocol to minimize introduction of contaminants to the circuit

• Adhere to facility infection control protocols for hand hygiene, contact barrier precautions, and preventing contamination from respiratory therapy equipment to help prevent VAP
**Coding Matrix**

References are rated using the following codes, listed in order of strength:

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<tr>
<th>Code</th>
<th>Description</th>
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<td>SR</td>
<td>Published systematic or integrative literature review</td>
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<td>RCT</td>
<td>Published research (randomized controlled trial)</td>
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<td>R</td>
<td>Published research (not randomized controlled trial)</td>
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<td>C</td>
<td>Case histories, case studies</td>
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**References**


