

VAP is a common—and potentially fatal—complication of ventilator care. Following the latest CDC recommendations is the best defense you can offer your patients.

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When you're caring for a patient on a ventilator, one of the last things you want is for him to develop pneumonia. Unfortunately, ventilator-associated pneumonia (VAP)—a bacterial pneumonia in a patient who's been on mechanical ventilation for 48 hours or more—is a frequent complication that exacts a heavy toll.¹

VAP accounts for the majority of the hospital-acquired infections that ventilated patients develop.¹ It also prolongs a patient's stay in the ICU by an average of 4.3 days and costs approximately \$20,000 – \$30,000 to treat.^{2,3} And VAP claims the lives of up to one-third of those who develop it.^{2,4}

Nurses can play an important role in preventing VAP. In fact, the most recent CDC guidelines on preventing hospital-acquired pneumonia contain several nursing interventions specific to VAP.¹ The trick, however, is getting nurses to follow them. Studies have shown that healthcare workers don't always follow even the most basic recommendations.^{5,6}

In order to help your ventilated patients avoid VAP, you need to know how it occurs, what strategies are suggested or recommended, and why it's critical to follow the guidelines.

VAP: How it happens, who's at risk?

VAP is thought to be caused by the microaspiration of bacteria-containing oropharyngeal secretions into the patient's lower airways.^{7,8} This bacterial invasion of the respiratory tract, combined with the weakened immune system of critically ill patients, fosters the development of VAP.

Another potential source of VAP is the entry of bacteria into the lower respiratory tract by the aerosol route.¹ Although it is uncommon, this can occur primarily through contact with contaminated respiratory therapy equipment, such as nebulizers.⁹

Compared to critically ill patients who can breathe on their own, those on mechanical ventilation for more than 24 hours have *at least* a sixfold increased risk of developing hospital-associated pneumonia.¹ Trauma patients, including those who have sustained serious burns, are particularly at risk, as are those with central nervous system disease, chronic lung disease, and cardiac disease.¹ Other factors that put ventilator patients at heightened risk include: being older than 60; undergoing chest or abdominal surgery; or having a depressed level of consciousness, an oral or nasal enteric tube, or daily ventilator circuit changes.¹

Bedside strategies reflect the research

In 1981, the CDC issued guidelines for preventing hospital-acquired pneumonias and other acute lower respiratory infections, based on an extensive review of the literature. The latest version, published in 2004, includes numerous strategies to decrease the rate of VAP.

Each intervention is rated according to the number and strength of the research studies that support it, the theoretical rationale, and the potential financial impact. These interventions, which are [detailed below](#) and summarized with their ratings, focus on airway management, gastric reflux prevention, respiratory equipment maintenance, oral care, and cross contamination.

Airway management. Obviously, the best way to prevent VAP is to limit the amount of time your patient requires mechanical ventilation. The guidelines call for using noninvasive positive-pressure ventilation delivered continuously via a face or nose mask instead of intubation whenever possible.¹ They also advise clinicians to remove a patient's ET tube as soon as possible, and to do everything possible to avoid repeat endotracheal intubation.¹

A key concern is that an ET tube prevents the glottis from closing, which leaves the airway exposed and allows oropharyngeal secretions that accumulate above the tube cuff to leak into the lungs. Because these secretions increase the risk of aspiration—and therefore of VAP—they must be suctioned out, but they can't be reached by typical oral suctioning methods.

To address this, the CDC suggests using a particular type of ET tube, sometimes referred to as a continuous aspiration of subglottic secretions (CASS) tube.¹ It features an additional lumen that ends with an evacuation port just above the cuff, making it possible to remove secretions from above the cuff by applying continuous or intermittent suction through the extra lumen. Studies have found that the use of a CASS tube can significantly reduce the incidence of VAP.^{10,11}

The CDC also offers this suctioning recommendation: Use only sterile fluid to clear a catheter that you're using to suction secretions from the patient's lower respiratory tract if you are planning to reinsert it into the ET tube.¹

The guidelines also recommend using orotracheal rather than nasotracheal intubation, unless contraindicated.¹ This is because nasal tubes are associated with a high incidence of sinus infection, a condition that's particularly difficult to diagnose in critically ill patients.

Gastric reflux prevention. Many ventilator patients have nasogastric tubes that predispose them to gastric reflux, which increases the risk of aspiration.¹² The most important intervention to prevent gastric reflux is one that's controlled by nurses: patient positioning. Unless medically contraindicated, the bed of a patient on mechanical ventilation should remain elevated 30 - 45 degrees at all times.¹⁰

Studies have shown that this simple intervention significantly decreases the incidence of VAP.^{13,14} Yet it is rarely used. One recent study found that a majority of patients for whom bed elevation was indicated had head-of-bed elevation of less than 30 degrees.⁵

Equipment maintenance. One key change in the guidelines is the recommended frequency of respiratory equipment changes. The CDC no longer calls for routine changes of the ventilator circuit (tubing, exhalation valve, and attached humidifier), but instead recommends changing it only when the equipment is visibly soiled or malfunctioning.¹ Studies have found that routine circuit changes do little to prevent the development of VAP.^{1,15,16}

In a related recommendation, the CDC recommends draining and discarding condensate that collects in the ventilator tubing and not allowing it to drain back toward the patient.¹

Oral care. The guidelines suggest implementing a comprehensive oropharyngeal cleaning and decontamination program for all patients at high risk for VAP, but don't outline specific oral care practices.¹ There is, however, one exception: They suggest giving adults who are undergoing cardiac surgery a chlorhexidine gluconate (0.12%) oral rinse during the perioperative period.¹ More research is needed to determine if other types of patients might benefit from this therapy.

Cross contamination. Although the guidelines regarding cross contamination remain unchanged, the importance of taking steps to prevent the transmission of microorganisms from healthcare workers to patients cannot be overemphasized. It's critical to observe standard precautions both before and after contact with a patient's mucous membranes, respiratory secretions, or any object that may be contaminated, such as an ET tube.¹

Like elevating the head of the patient's bed, standard precautions are inexpensive and easily performed—and have been found to be effective in decreasing VAP. Yet here, too, studies have shown poor compliance among healthcare providers.^{6,17,18}

The CDC guidelines also include several interventions for which they give "no recommendation," due to insufficient research or conflicting study results. These include whether to use a single-use, open suction catheter or a multi-use, closed suction catheter; small-bore or large-bore enteral feeding tubes; and continuous or intermittent enteral feedings.¹ While future studies may prove that some of these strategies are more effective than others, there is still not enough data to recommend any of them.

Compliance isn't just a matter of policy

Implementing the CDC's VAP prevention guidelines should be a priority for all hospitals. Review the guidelines (available at www.cdc.gov/ncidod/hip/pneumonia/default.htm) and determine if your facility needs to revise its policies and procedures. If so, you might suggest that a multidisciplinary task force review them and take steps, as needed, to assure compliance.

Even if your organization's policies and procedures are consistent with the guidelines, it's essential to determine how well the staff complies with even such basic strategies as elevating the head of the bed or hand hygiene before and after patient contact. If compliance is low, a staff education program about the significance of VAP and the rationale for the new guidelines may be needed. You can obtain resources to help you evaluate

compliance and educate staff from the American Association of Critical-Care Nurses (800-899-2226; www.aacn.org).

The good news is that the interventions the CDC calls for have proven effective. Reducing the incidence of VAP is truly within your control. It simply requires that you and your colleagues understand the recommendations and are vigilant about following them.

REFERENCES

1. Centers for Disease Control and Prevention. "Guidelines for preventing health-care-associated pneumonia, 2003: Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC)." 2004. www.cdc.gov/ncidod/hip/pneumonia/default.htm (14 Jan. 2005).
2. Bercault, N., & Boulain, T. (2001). Mortality rate attributable to ventilator-associated nosocomial pneumonia in an adult intensive care unit: A prospective case-control study. *Crit Care Med*, 29(12), 2303.
3. Craven, D. E., De Rosa, F. G., & Thornton, D. (2002). Nosocomial pneumonia: Emerging concepts in diagnosis, management and prophylaxis. *Curr Opin Crit Care*, 8(5), 421.
4. Heyland, D. K., Cook, D. J., et al. (1999). The attributable morbidity and mortality of ventilator-associated pneumonia in the critically ill patient. The Canadian Clinical Trial Group. *Am J Resp Crit Care Med*, 159(4, Pt. 1), 1249.
5. Grap, M. J., Cantley, M., et al. (1999). Use of backrest elevation in critical care: Pilot study. *Am J Crit Care*, 8(1), 475.
6. Doebbeling, B. N., Stanley, G. L., et al. (1992). Comparative efficacy of alternating hand-washing agents in reducing nosocomial infections in intensive care units. *N Engl J Med*, 327(2), 88.
7. American Association of Critical-Care Nurses. "AACN practice alert: Ventilator-associated pneumonia." 2004. www.aacn.org/AACN/aacnnews.nsf/GetArticle/ArticleThree212?OpenDocument (2 Dec. 2004).
8. Craven, D. E. (2000). Epidemiology of ventilator-associated pneumonia. *Chest*, 117(4), 186S.
9. Lynch, J. P. 3rd. (2001). Hospital-acquired pneumonia: Risk factors, microbiology, and treatment. *Chest*, 119(Suppl. 2), 373S.
10. Smulders, K., van der Hoeven, H., et al. (2002). A randomized clinical trial of intermittent subglottic secretion drainage in patients receiving mechanical ventilation. *Chest*, 121(3), 858.
11. Valles, J., Artigas, A., et al. (1995). Continuous aspiration of subglottic secretions in preventing ventilator-associated pneumonia. *Ann Intern Med*, 122(3), 179.
12. Kollef, M. H. (1999). The prevention of ventilator-associated pneumonia. *N Engl J Med*, 340(8), 627.
13. Ibanez, J., Penafiel, A., et al. (1992). Gastroesophageal reflux in intubated patients receiving enteral nutrition: Effect of supine and semirecumbent positions. *JPEN J Parenter Enteral Nutr*, 16(5), 419.
14. Drakulovic, M. B., Torres, A., et al. (1999). Supine body position as a risk factor for nosocomial pneumonia in mechanically ventilated patients: A randomized trial. *Lancet*, 354(9193), 1851.
15. Dreyfuss, D., Djedaini, K., et al. (1991). Prospective study of nosocomial pneumonia and of patient circuit colonization during mechanical ventilation with circuit changes every 48 hours versus no change. *Am Rev Respir Dis*, 143(4 Pt 1), 738.

16. Kollef, M. H., Shapiro, S. D., et al. (1995). Mechanical ventilation with or without 7-day circuit changes: A randomized controlled trial. *Ann Intern Med*, 123(3), 168.
17. Kim, P. W., Roghmann, M. C., et al. (2003). Rates of hand disinfection associated with glove use, patient isolation, and changes between exposure to various body sites. *Am J Infect Control*, 31(2), 97.
18. Sharir, R., Teitler, N., et al. (2001). High-level handwashing compliance in a community teaching hospital: A challenge that can be met! *J Hosp Infect*, 49(1), 55.
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VAP prevention at a glance

The latest CDC guidelines for preventing ventilator-associated pneumonia (VAP) include the following interventions, which are rated according to the strength of the research. A rating of IA or IB is "strongly recommended," with IA interventions being "strongly supported by well-designed studies" and IB strategies "supported by certain clinical or epidemiological studies and strong theoretical rationale." Interventions designated IC are required by federal or state regulations, while those designated II are "suggested" by the CDC and supported by suggestive studies or strong theoretical rationale.

Airway Management

- If feasible, use an endotracheal (ET) tube with a dorsal lumen above the cuff to allow suctioning of secretions that accumulate in the subglottic area. (II)
- Perform orotracheal rather than nasotracheal intubation, unless contraindicated. (IB)
- Before deflating the cuff of an ET tube in preparation for tube removal or repositioning, ensure that secretions are cleared from above the tube cuff. (II)
- Use only sterile fluid to remove secretions from a suction catheter that will be put back into the ET tube. (II)

Gastric reflux prevention

- Elevate the head of the bed to an angle of 30 – 45 degrees unless contraindicated. (II)
- Routinely verify placement of the feeding tube. (IB)

Equipment maintenance

- Change the ventilator circuit only when the equipment is visibly soiled or malfunctioning. (IA)
- Periodically drain and discard any condensate that collects in the tubing; do not allow condensate to drain toward the patient. (IB)

Oral care

- Give cardiac surgery patients an oral chlorhexidine gluconate (0.12%) rinse during the perioperative period. (II)

Cross contamination

- Put on gloves before handling respiratory secretions or contaminated objects. (IB)
- Wash hands with soap and water or an alcohol-based antiseptic hand rub before and after contact with mucous membranes, respiratory secretions, or contaminated objects and before and after contact with a patient with any respiratory device. (IA)
- Wear a gown when you anticipate being soiled with respiratory secretions and change it before caring for another patient. (IB)

Source: Centers for Disease Control and Prevention. "Guidelines for preventing health-care-associated pneumonia, 2003: Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC)." 2004.

www.cdc.gov/ncidod/hip/pneumonia/default.htm (14 Jan. 2005).