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Prevention of Ventilator-Associated Pneumonia

GOAL: PREVENT VENTILATOR-ASSOCIATED PNEUMONIA (VAP) AND DEATHS FROM VAP AND OTHER COMPLICATIONS IN PATIENTS ON VENTILATORS BY RELIABLY IMPLEMENTING A SET OF INTERVENTIONS KNOWN AS THE "VENTILATOR BUNDLE."

BACKGROUND

- VAP is an important source of morbidity and mortality in critically ill and postoperative patients receiving mechanical ventilation. VAP is caused by a number of factors, including aspiration of gastric secretions.
  - Craven DE, Steger KA. Nosocomial pneumonia in mechanically ventilated adult patients: epidemiology and prevention in 1996. *Semin Respir Infect.* 1996;11:32-53.

- VAP occurs in up to 15% of patients receiving mechanical ventilation. Risk factors include tracheostomy, multiple central line insertions, reintubation, and the use of antacids. The hospital mortality rate of ventilator patients who develop VAP is 46%, compared to 32% for ventilator patients who do not develop VAP.
  - Ibrahim EH, Tracy L, Hill C, Fraser VJ, Kollef MH. The occurrence of ventilator-associated pneumonia in a community hospital: risk factors and clinical outcomes. *Chest.* 2001;120:555-561.

- VAP is associated with prolongation of mechanical ventilation, ICU stay, and hospital stay, and associated increases in costs.
  - Rello J, Ollendorf DA, Oster G, et al. Epidemiology and outcomes of ventilator associated pneumonia in a large U.S. database. *Chest.* 2002;122:2115-2121.

- Evidence-based guidelines for the prevention of VAP have been developed by government agencies (e.g., CDC) and professional organizations (e.g., Canadian Critical Care Trials Group and Canadian Critical Care Society).
  - Guidelines for Preventing Health-Care-Associated Pneumonia, 2003. Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee. *MMWR.* 2004;53(No. RR-3):1-36.
  - Dodek P, Keenan S, Cook D, et al. Evidence-based clinical practice guideline for the prevention of ventilator-associated pneumonia. *Ann Intern Med.* 2004;141:305-313.

- Such guidelines are not implemented reliably.
  - Rello J, Lorente C, Bodi M, Diaz E, Ricart M, Kollef MH. Why do physicians not follow evidence-based guidelines for preventing ventilator-associated pneumonia? A survey based on the opinions of an international panel of intensivists. *Chest.* 2002;122:656-661.

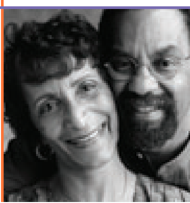
- The Institute of Medicine has identified the prevention of nosocomial infections, including VAP, as a priority area for national action.
  - Adams K, Corrigan JM, eds. *Priority areas for national action: transforming health care quality.* Washington, DC: The National Academies Press, 2003.

- The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) has included reducing the risk of health-care-associated infections, including VAP, in its 2005 National Patient Safety Goals.

  www.jcaho.org

- The prevention of VAP is a component of the Surgical Care Improvement Project (SCIP).

  www.medqic.org/scip



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INTERVENTION – VENTILATOR BUNDLE

The power of a "bundle" is that it brings together those scientifically grounded concepts that are both necessary and sufficient to improve the clinical outcome of interest. The focus of measurement is the completion of the entire bundle as a single intervention, rather than completion of its individual components.

- The "ventilator bundle" includes five components: elevation of the head of the bed to at least 30 degrees, daily "sedation vacations," daily assessment of readiness to extubate, peptic ulcer disease prophylaxis, and deep vein thrombosis prophylaxis. The first three components are directed at preventing VAP and the latter two components at preventing other complications associated with mechanical ventilation.

- Patient positioning – Elevation of the head of the bed to at least 30 degrees leads to a 26% reduction in the incidence of VAP.
  - Drakulovic MB, Torres A, Bauer TT, Nicolas JM, Nogue S, Ferrer M. Supine body position as a risk factor for nosocomial pneumonia in mechanically ventilated patients: a randomised trial. *Lancet.* 1999;354:1851-1858.

- Ventilator weaning – Periodic "sedation vacations" and daily assessment of readiness to extubate may reduce the duration of mechanical ventilation and the risk of VAP.
  - Kress JP, Pohlman AS, O'Connor MF, Hall JB. Daily interruption of sedative infusions in critically ill patients undergoing mechanical ventilation. *N Engl J Med.* 2000;342:1471-1477.

- Peptic ulcer disease (PUD) prophylaxis – Patients with respiratory failure have an increased risk of "stress ulcers" and associated gastrointestinal (GI) bleeding. Medications that reduce gastric acidity have been shown to protect such patients from the development of PUD and GI bleeding.
  - Cook DJ, Fuller HD, Guyatt GH, et al. Risk factors for gastrointestinal bleeding in critically ill patients. *N Engl J Med.* 1994;330:377-381.
  - Cook DJ, Reeve BK, Guyatt GH, et al. Stress ulcer prophylaxis in critically ill patients: resolving discordant meta-analyses. *JAMA.* 1996;275:308-314.
  - Cook D, Guyatt G, Marshall J, et al. A comparison of sucralfate and ranitidine for the prevention of upper gastrointestinal bleeding in patients requiring mechanical ventilation. *N Engl J Med.* 1998;338:791-797.
  - Cook D, Heyland, Griffith L, Cook R, Marshall J, Pagliarello J. Risk factors for clinically important upper gastrointestinal bleeding in patients requiring mechanical ventilation. Canadian Critical Care Trials Group. *Crit Care Med.* 1999;27:2812-2817.

- Deep vein thrombosis prophylaxis – Patients with respiratory failure have an increased risk of deep vein thrombosis. Treatment with anticoagulants (e.g., heparin) has been shown to reduce this risk.
  - Attia J, Ray JG, Cook DJ, Douketis J, Ginsberg JS, Geerts WH. Deep vein thrombosis and its prevention in critically ill adults. *Arch Intern Med.* 2001;161:1268-1279.
  - Geerts WH, Pineo GF, Heit JA, et al. Prevention of venous thromboembolism. The seventh ACCP conference on antithrombotic and thrombolytic therapy. *Chest.* 2004;126:338S-400S.

RESOURCES

- Surgical Care Improvement Project
  www.medqic.org/scip

We welcome your comments, suggestions for revision, and enhancements to this document. Please send suggestions, with contact information when possible, to 100k@IHI.org.

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