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VAP Fact Sheet and Guideline Summary

OVERVIEW

VAP is responsible for:

- More than 50 percent of all antibiotic use in the ICU[1]
- Significant mortality rate—up to 27percent[2]
- Increased ICU stays up to 22 days, hospital stays up to 25 days[2]
- Increased hospital cost per patient of more than $40,000[2]
- 11 percent of all hospital-acquired infections[3]

PATHOGENESIS

VAP is directly linked to the aspiration of colonized secretions.

Oropharyngeal Colonization

- The oropharyngeal colonizing flora is often the source of the causative organisms of VAP.[4]
- Interventions that reduce oropharyngeal colonization reduce the incidence of VAP.[5]
- The sequence of colonization in patients undergoing mechanical ventilation is the oropharynx (36 h), the stomach (36-60 h), the lower respiratory tract (60-84 h) and thereafter the endotracheal tube (60-96 h)[6]
- While microaspiration of contaminated secretion is the primary pathway for VAP, biofilm on the endotracheal tube may play a role in maintaining the infection.[7]

Microaspiration

- The major source of infection may be contaminated oropharyngeal secretions that leak through folds of the inflated ETT cuff.[8, 9]
- Microaspiration occurs in virtually 100 percent of inflated high-volume, low-pressure ETT cuffs.[8]
- Microaspiration is reduced but still present in the semirecumbent position compared to the supine position.[10]

INTERVENTIONS

VAP-reduction interventions generally focus on reducing oropharyngeal colonization or preventing aspiration of colonized secretions

Oropharyngeal Colonization

- Peptic Ulcer Disease (PUD) Prophylaxis

  Both H2 antagonists and antacids have been identified as risk factors for VAP because they decrease intragastric acidity, which can result in greater colonization of pathogenic bacteria. However, trials investigating alternative therapies have been inconclusive regarding the prevention of VAP. The American Thoracic Society suggests that the risks and benefits of PUD prophylaxis regimens should be weighed before prescribing.

- Daily Oral Care with Chlorhexidine

  Oral care is designed to reduce VAP by reducing oropharyngeal bacterial colonization.

- Selective Decontamination of the Digestive Tract

  Gram-negative bacterial colonization of the stomach during critical illness is considered to be the source of microorganisms isolated from sputum cultures of patients with VAP. Selective decontamination of the digestive track (SSD) uses prophylactic antibiotic therapy to reduce bacterial colonization.

- Silver-Coated Endotracheal Tube

  Biofilm on the endotracheal tube is considered to be a source of reinfection in patients with VAP. Silver has a very effective broad-spectrum antimicrobial effect and is believed to reduce biofilm on endotracheal tubes.

Microaspiration Prevention

- Semirecumbent Position

  This method is typically defined as raising the head of the bed to an angle of 30-45 degrees, and is thought to reduce VAP by decreasing the migration of gastric pathogens.

- Cuff Pressure Monitoring

  ETT cuffs that are not frequently monitored are often outside recommended cuff pressure range. It has been proposed that maintaining the ETT cuff pressure to the appropriate level may prevent secretions from being aspirated through the microchannels on the cuff.

- Subglottic Secretion Drainage

  Subglottic secretion drainage removes oral and gastric secretions from the subglottic space, preventing microaspiration that could lead to VAP. Continuous or intermittent aspiration of subglottic secretions is done with a specialized endotracheal tube with a separate dorsal lumen.

- Cuff Shape and Thickness
  - Ultrathin Cuff

    An ultrathin cuff membrane may reduce the formation of channels within the ETT cuff through which pathogens may leak compared to conventional thickness cuffs.

  - Taper-Shaped Cuff

    The unique design of some ETT tapered-shaped cuffs may reduce the formation of channels within the ETT cuff through which pathogens may leak compared to barrel-shaped cuffs.

PREVENTION OF VENTILATOR-ASSOCIATED PNEUMONIA

Summary of Published Guidelines

Guidelines can be a valuable evidence-based resource for facilities seeking to improve their practices to reduce ventilator- associated pneumonia (VAP). Following is a summary of selected guidelines, recommendations, bundles and practice alerts for the prevention of healthcare-associated or ventilator-associated pneumonia. This summary includes guidelines from the American Thoracic Society (ATS) and Infectious Diseases Society of America (IDSA), the Centers for Disease Control and Prevention (CDC), the Canadian Critical Care Society (CCCS), the Agency for Healthcare Research and Quality (AHRQ), the Institute for Healthcare Improvement (IHI), the American Association of Critical Care Nurses (AACN), Safer Healthcare Now (SHN) and the Society for Healthcare Epidemiology of America (SHEA/IDSA). For the complete recommendations and supporting documentation from each organization, please refer to the published guideline or document.

MICROASPIRATION PREVENTION

INTERVENTION	ATS/ISDA[11]	CDC/HICPAC[12]	CCCS/CCCTG[13]	AHRQ[14]	IHI[15]	AACN[16]	SHN[17]	SHEA/ IDSA[18]
Continuous aspiration of subglottic secretions	I	II	x (Consider)	x	VI	x	B-II	
Enteral nutrition preferred to parenteral	II	UNRESOLVED ISSUE	X					
Maintain endotracheal cuff pressures >20 cm H_2O	II	x						
Oral preferred to nasal gastric tube placement	II							
Oral preferred to nasal intubation	II	IB	x	x	x			
Recommendation for closed suction or single-use open suction	No Preference	Closed						

ATS/IDSA Guidelines

Evidence Level	Definition
Level I (high)	Evidence comes from well-conducted, randomized controlled trials.
Level II (moderate)	Evidence comes from well-designed, controlled trials without randomization or large case series with systematic analysis of disease patterns and/or microbial etiology.
Level III (low)	Evidence comes from case studies and expert opinion.

CDC Guidelines

Evidence Level	Definition
Category IA	Strongly recommended for implementation and strongly supported by well-designed experimental, clinical or epidemiologic studies.
Category IB	Strongly recommended for implementation and supported by some clinical or epidemiologic studies and by strong theoretical rationale.
Category IC	Required for implementation, as mandated by federal or state regulation or standard.
Category II	Required for implementation, as mandated by federal or state regulation or standard.
No Recommendation; Unresolved	Practices for which insufficient issue evidence or no consensus exists about efficacy.

AACN Guidelines

Evidence Level	Definition
Level I	Manufacturer recommendation only.
Level II	Theory based; no research data to support recommendations. Recommendations from expert consensus group may exist.
Level III	Laboratory or bench data only; no clinical data to support recommendations.
Level IV	Limited clinical studies to support recommendations.
Level V	Clinical studies in a variety of patient populations and situations to support recommendations.
Level VI	Clinical studies in a variety of patient populations and situations to support recommendations.

CCCS/CCCTG – AHRQ/IHI/SHN

x	Denotes intervention recommended by guideline.
x (Consider)	Denotes intervention marked as to be considered in guideline.

OROPHARYNGEAL COLONIZATION PREVENTION

INTERVENTION	ATS/ISDA	CDC/HICPAC	CCCS/CCCTG	AHRQ	IHI	AACN	SHN	SHEA/ IDSA
Appropriate hand disinfection	I	1A	x	x				
Contaminated condensate should be carefully emptied from ventilator circuits and condensate should be prevented from entering either the endotracheal tube or inline medication nebulizers	II	IB	1B					
Develop and implement a comprehensive oral-hygiene program (which might include the use of an antiseptic agent) for patients in acute-care settings or residents in long-term care facilities at high risk of developing healthcare-associated pneumonia	II	x	x	A-1				
Do not routinely change the patient's ventilator circuit based on duration of use	IA	x	VI	IA				
Modulation of oropharyngeal colonization by the use of oral chlorhexidine	Not Recommended	UNRESOLVED ISSUE	x	x				
Passive humidifiers or heat-moisture exchangers	Unresolved	UNRESOLVED ISSUE	x					
Routine use of selective digestive decontamination	Not Recommended	UNRESOLVED ISSUE	x	Unresolved				
Semirecumbent positioning	I	II	x	x	x	VI	x	B-II
Stress bleeding prophylaxis with either H_2 antagonists or sucralfate	Either	UNRESOLVED ISSUE	Sucralfate not recommended	H_2 antagonists	H_2 antagonists preferred/ consider PPIs	Avoid histamine receptor 2 (H_2)–blocking agents and proton pump inhibitors for patients who are not at high risk for developing a stress ulcer or stress gastritis		

OTHER								
INTERVENTION	ATS/ISDA	CDC/HICPAC	CCCS/CCCTG	AHRQ	IHI	AACN	SHN	SHEA/IDSA
Avoid intubation and reintubation when possible	I	II						x
Deep venous thrombosis (DVT) prophylaxis					x		x	
Kinetic beds			Consider					Not Recommended (B-II)
Maintaining adequate staffing levels in the ICU	II							
Noninvasive ventilation when possible	I	II						x
Practices that promote patient mobility and autonomy							x	
Reduce duration of intubation and mechanical ventilation through protocols to improve the use of sedation and to accelerate weaning	II				x		x	x
Staff education and involvement	I	1A			x		x	x
Surveillance of ICU infections	II	1B			x			x
Tight glycemic control	I							Unresolved

Reference(s)

1. Richards MJ, Edwards JR, Culver DH, Gaynes RP. Nosocomial infections in combined medical-surgical intensive care units in the United States. *Infect Control Hosp Epidemiol.* 2000;21(8):510-515.
2. Warren DK, Shukla SJ, Olsen MA, et al. Outcome and attributable cost of ventilator-associated pneumonia among intensive care unit patients in a suburban medical center. *Crit Care Med.* 2003;31(5):1312-1317.
3. Klevens RM, Edwards JR, Richards CL, Jr., et al. Estimating health care-associated infections and deaths in U.S. hospitals, 2002. *Public Health Rep.* 2007;122(2):160-166.
4. Garrouste-Orgeas M, Chevret S, Arlet G, et al. Oropharyngeal or gastric colonization and nosocomial pneumonia in adult intensive care unit patients. A prospective study based on genomic DNA analysis. *Am J Respir Crit Care Med.* 1997;156(5):1647-1655.
5. Chlebicki MP, Safdar N. Topical chlorhexidine for prevention of ventilator-associated pneumonia: a meta-analysis. *Crit Care Med.* 2007;35(2):595-602.
6. Feldman C, Kassel M, Cantrell J, et al. The presence and sequence of endotracheal tube colonization in patients undergoing mechanical ventilation. *Eur Respir J.* 1999;13(3):546-551.
7. Deem S, Treggiari MM. New endotracheal tubes designed to prevent ventilator-associated pneumonia: do they make a difference? *Respir Care.* 2010;55(8):1046-1055.
8. Blunt MC, Young PJ, Patil A, Haddock A. Gel lubrication of the tracheal tube cuff reduces pulmonary aspiration. *Anesthesiology.* 2001;95(2):377-381.
9. Cardenosa Cendrero JA, Sole-Violan J, Bordes Benitez A, et al. Role of different routes of tracheal colonization in the development of pneumonia in patients receiving mechanical ventilation. *Chest.* 1999;116(2):462-470.
10. Orozco-Levi M, Torres A, Ferrer M, et al. Semirecumbent position protects from pulmonary aspiration but not completely from gastroesophageal reflux in mechanically ventilated patients. *Am J Respir Crit Care Med.* 1995;152(4 Pt 1):1387-1390.
11. American Thoracic Society, Infectious Diseases Society of America. Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. *Am J Respir Crit Care Med.* 2005;171(4):388-416.
12. Center for Disease Control. Guidelines for preventing health-care-associated pneumonia, 2003 recommendations of the CDC and the Healthcare Infection Control Practices Advisory Committee. *Respir Care.* 2004;49(8):926-939.
13. Dodek P, Keenan S, Cook D, et al; Canadian Critical Care Trials Group; Canadian Critical Care Society. Evidence-based clinical practice guideline for the prevention of ventilator-associated pneumonia. *Ann Intern Med.* 2004;141(4):305-313.
14. Shojania KG, Duncan BW, McDonald KM, Wachter RM, Markowitz AJ. Making health care safer: a critical analysis of patient safety practices. *Evid Rep Technol Assess (Summ).* 2001;(43):i-x, 1-668.
15. Prevent Ventilator-Associated Pneumonia. Institute for Healthcare Improvement. 100,000 Lives Campaign. http://www.ihi.org/IHI/Programs/Campaign/VAP.htm.
16. American Association of Critical Care Nurses. Practice Alert: Ventilator Associated Pneumonia. January 2008. http://www.aacn.org/WD/Practice/Docs/Ventilator_Associated_Pneumonia_1-2008.pdf.
17. Safer Healthcare Now! Campaign April 2009 How-to Guide: Prevention of VAP. http://www.saferhealthcarenow.ca/EN/Interventions/VAP/Pages/default.aspx.
18. Coffin SE, Klompas M, Classen D, et al. Strategies to prevent ventilator-associated pneumonia in acute care hospitals. *Infect Control Hosp Epidemiol.* 2008;29 Suppl 1:S31-40.

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