



INTERNATIONAL  
SOCIETY  
FOR INFECTIOUS  
DISEASES

# GUIDE TO INFECTION CONTROL IN THE HOSPITAL

CHAPTER 32:

## Pneumonia

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### **Topic Outline**

Key Issues  
Known Facts  
Suggested Practice  
Suggested Practice in Under-Resourced Settings  
Summary  
References

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## KEY ISSUES

Implementation of guidelines for preventing, diagnosing and treating pneumonia can reduce the mortality and morbidity associated with this condition.

The implementation of various measures at a time (prevention bundles) have proven in clinical trials to be more effective than isolated single measures to reduce the risk of acquisition of nosocomial pneumonia (Objective zero pneumonia).

Abbreviations:

- CAP: Community-Acquired Pneumonia
- HAP: Hospital-Acquired Pneumonia
- HCAP: Healthcare-Associated Pneumonia
- VAE: Ventilator-Associated Events
- VAP: Ventilator-Associated Pneumonia

## KNOWN FACTS

- There are three types of pneumonia related with healthcare. Hospital-acquired pneumonia (HAP) occurs 48 hours or more after admission and does not appear to be incubating at the time of admission; ventilator-associated pneumonia (VAP) is a type of hospital-acquired pneumonia that occurs more than 48 to 72 hours after endotracheal intubation; healthcare-associated pneumonia (HCAP) is present on admission in a patient who has been hospitalized for two or more days within 90 days of the infection, resides in a nursing home or long-term care facility, receives recent intravenous antibiotic therapy, chemotherapy, or wound care within the past 30 days of the current infection, attends a hospital or hemodialysis clinic, or has a family member with a multi-drug-resistant pathogen.

- Recently, a new term has been defined by the US Centers for Diseases Control and Prevention (US CDC) for surveillance purposes. The term ventilator-associated events encompasses any pneumonia-like presentation 48 to 72 hours after endotracheal intubation with or without microbiological documentation. VAE definitions include criteria for ventilator-associated conditions (VACs), infection-related ventilator-associated complications (IVACs), possible pneumonia, and probable pneumonia.
  - Hospital-acquired (or nosocomial) pneumonia (HAP), ventilator-associated pneumonia (VAP) and healthcare-associated pneumonia (HCAP) are leading causes of morbidity and mortality in hospitalized patients. HCAP accounts for more than a 30% of pneumonias found on admission and it is frequently linked to multidrug resistant microorganisms. Mortality, length of stay and hospital charges progressively increase within pneumonia category from Community-Associated Pneumonia (CAP), to HCAP and HAP, with VAP being the most severe and the most expensive type of pneumonia. VAP affects ventilated, critically ill patients with a reported prevalence between 6% and 52% and shows a hospital mortality rate that excess the rate of death due to central line infections, severe sepsis, and respiratory tract infections in the non-intubated patient. Early VAP is caused by community acquired pathogens whereas late VAP occurs after 4 days of hospital admission and it is usually caused by multidrug-resistant organisms.
- The pathogenesis of CAP, HCAP and HAP in non-intubated patients is related to microaspiration of contaminated oropharyngeal secretions into the lung in persons with compromised defense mechanisms that impair to eradicate the aspirated bacteria. Therefore, many of the potentially modifiable risk factors are similar across these entities and the same prevention strategies may be applied.
- The pathogenesis of VAP is related to aspiration of oropharyngeal- or gastric content that has been colonized by endogenous flora or by

pathogens from the environment, especially the hands or attire of healthcare workers, or pathogens attached to the respiratory equipment. It is well known that endotracheal-tube biofilm formation may sustain tracheal colonization and increase the risk of VAP.

## SUGGESTED PRACTICE

### Healthcare-Associated Pneumonia and Hospital-Acquired Pneumonia in Non-Ventilated Patients

Compared to VAP, the literature evaluating prevention strategies for HCAP and HAP in non-intubated patients is scarce. There is reasonable evidence that oral care, early mobilization interventions, swift diagnosis and treatment of dysphagia reduce HAP. In addition, prevention of nosocomial influenza cross-infection has shown a positive impact on HAP reduction.

Strategies that might reduce incidence of HCAP and HAP also include staff and patients' education, prevention of cross-infection, enhance immunity against infection through vaccination, improve oral hygiene and administration of probiotics to reduce colonization, control of comorbid conditions and, pharmacological interventions to increase the sensitivity of the cough reflex and improve the swallowing reflex.

On the other hand, the impact of bed position and stress bleeding prophylaxis remains uncertain. The use of routine antibiotic prophylaxis for HAP prevention should be avoided.

## Ventilator-Associated Pneumonia

Nowadays it is accepted that overall application of evidence-based interventions is not always reliable. Frequency and consequences of VAP have shown significant reductions when a limited number of measures (bundle) are selected and a more trained and coordinated care team set emphasis on working reliably. Bundles to prevent VAP may differ among centres but must include solid level-one evidence and don't get too large or become too difficult to measure and manage.

In 2014, the Society of Healthcare Epidemiology of America and the Infectious Diseases Society of America reviewed the quality of evidence and benefit of strategies proposed to prevent ventilator-associated pneumonia in acute care hospitals (Table 1) (Table 2), which may guide prioritization of bundle's components.

Recently, improvement of quality of care has led bundles' design to VAE prevention instead VAP prevention. Therefore, the Institute for Healthcare Improvement (IHI) proposed a bundle that included measures to prevent ventilator associated pneumonia, venous thromboembolism, and stress-induced gastrointestinal bleeding. IHI five components of care to prevent VAE are:

1. Elevation of the Head of the bed
2. Daily Sedative Interruption and Daily Assessment of Readiness to Extubate
3. Peptic Ulcer Disease Prophylaxis
4. Deep Venous Thrombosis Prophylaxis
5. Daily Oral Care with chlorhexidine

To achieve the highest effectiveness, bundles must be accompanied by education and training of healthcare personnel and surveillance of performance activities and results.

## SUGGESTED PRACTICE IN UNDER-RESOURCED SETTINGS:

Under-resourced countries show greater rates of ventilator associated pneumonia than in US hospitals (13.1 versus 0.9 per 1,000 ventilator-days). Multidimensional approaches have shown to work in under-resourced countries as good as in US hospitals. As an example, a study carried out in Cuba used a bundle of infection control interventions, education, outcome surveillance, process surveillance, feedback of ventilator associated pneumonia rates and performance feedback of infection control practices. The multidimensional approach allowed reducing the baseline of ventilator associated pneumonia from 52.63 per 1000 mechanical-ventilator days to 15.32 per 1000 mechanical ventilator days during the intervention. Similar efficacy of the multidimensional approach has been obtained in another study that included ICUs from Argentina, Brazil, China, Colombia, Costa Rica, Cuba, India, Lebanon, Macedonia, Mexico, Morocco, Panama, Peru, and Turkey with a 55.83% relative rate reduction of ventilator-associated pneumonia at the end of the study period.

## SUMMARY

Nosocomial pneumonia is currently classified as hospital-acquired (or nosocomial) pneumonia, ventilator-associated pneumonia and healthcare-associated pneumonia. It constitutes the second most common cause of nosocomial infection overall. The primary mechanism for acquisition of nosocomial pneumonia is the occurrence of microaspiration or macroaspiration of upper respiratory secretions into the lungs. Preventive

measures are directed to reduce the risk of overt or subclinical aspiration of bacteria colonizing the upper respiratory tract. There are high-benefit, evidence-based strategies showing decrease in the average duration of mechanical ventilation, length of stay and/or costs which benefits likely outweigh the risks. To prevent ventilation associated events there are a series of 5 measures that grouped together have proven to be more effective than single measures to improve patients' outcomes.

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