

HOSPITAL PHYSICIAN®

CRITICAL CARE MEDICINE BOARD REVIEW MANUAL

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Hospital-Acquired and Ventilator-Associated Pneumonia in Adults

Editor:

John D. Buckley, MD, MPH

Program Director, Fellowship in Pulmonary Disease and Critical Care Medicine, Henry Ford Health System, Detroit, MI

Contributors:

Bashar Bash, MD

Senior Fellow in Pulmonary Disease and Critical Care Medicine, Henry Ford Hospital, Detroit, MI

John D. Buckley, MD, MPH

Program Director, Fellowship in Pulmonary Disease and Critical Care Medicine, Henry Ford Health System, Detroit, MI

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Cover Illustration by Kathryn K. Johnson

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Hospital-Acquired and Ventilator-Associated Pneumonia in Adults

Bashar Bash, MD, and John D. Buckley, MD, MPH

INTRODUCTION

Hospital-acquired pneumonia (HAP), including ventilator-associated pneumonia (VAP), remains a common and significant problem in hospitals and intensive care units (ICUs) and is associated with significant morbidity, prolonged lengths of stay, and additional cost. Many variables influence the incidence and outcome of these conditions, and proper understanding of the risk factors, prevention, and treatment can favorably impact the outcome.

In this review, different variables associated with HAP are discussed, including general issues related to HAP and specifics about VAP. The reader is encouraged to differentiate the two conditions when specific literature is quoted. More recently, “health care–associated pneumonia” has emerged as new terminology; this term is not used in this review.

DEFINITIONS

HAP is defined as pneumonia occurring 48 hours or more after hospital admission. Infections thought to be incubating at the time of admission are excluded.¹ In critically ill, mechanically ventilated patients, the term *early-onset VAP* describes pneumonia occurring within the first 4 days of ventilation that has not been judged to have been incubating prior to the initiation of mechanical ventilation. *Late-onset VAP* describes pneumonia occurring after 4 days of mechanical ventilation. Pneumonia has been clinically defined by the presence of new or persistent infiltrates (other than those of non-infectious origin) on chest radiography and at least 2 of the following criteria: (1) fever of 38°C (100.4°F) or more, (2) leukocytosis of $10.0 \times 10^3/\text{mm}^3$ or more, or (3) purulent respiratory secretions.²

EPIDEMIOLOGY

Available data suggest that the incidence of HAP ranges from 5 to 10 cases per 1000 hospital admissions, and this number increases by as much as 6- to 20-fold in patients who are mechanically ventilated.¹ In

mechanically ventilated patients, the average incidence of HAP is 1% to 2% per day during the first month of ventilation.³ However, because most patients are ventilated for short periods, up to half of all episodes of VAP are classified as early-onset.⁴ Data from the Canadian Critical Care Trials Group reported a decreasing daily hazard of VAP during mechanical ventilation (ie, 3% per day during the first week versus 1% per day during the third week and beyond).³ This indicates that long-term survivors in the ICU exhibited a lower intrinsic risk per day for VAP than did short-term ventilated patients. The overall incidence of pneumonia acquired in the ICU ranges from 10% to 70%. This percentage varies in relation to concomitant comorbidity in a given patient population, with pneumonia occurring in approximately 10% of patients requiring ICU care after general surgery, 20% of intubated patients, and up to 70% of those with acute respiratory distress syndrome.⁵

Since the 1980s, nosocomial pneumonia has become the second most common nosocomial infection in the United States after urinary tract infection (UTI).⁶ It is also second to UTI in ICU settings in the United States.⁷ In the European Prevalence of Infection Study (EPIS) in ICUs, pneumonia (47%) and lower respiratory tract infections (18%) were most common, followed by UTIs (18%) and blood stream infections (12%).⁸

Among nosocomial infections, pneumonia has been associated with the greatest morbidity and mortality, with a crude mortality rate of 30% to 40%.^{9,10} Yet, not all of these deaths were from pneumonia, and thus attributable mortality of pneumonia must be considered. Attributable mortality has been defined as the percentage of HAP deaths that would not have occurred in the absence of infection. Although most studies assessing ICU outcomes of VAP have shown prolonged lengths of stay, morbidity, and cost, there are conflicting results regarding attributable mortality. Several studies have failed to show increased mortality in ICU patients with VAP.⁹⁻¹¹ Others have shown increased mortality, particularly in patients with antibiotic-resistant bacteria.^{12,13} The attributable length of stay also varied among studies, ranging from 4 to 9 days on average.