Healthcare-Associated Pneumonia in the Emergency Department

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ABSTRACT

Emergency medicine clinicians frequently diagnose and treat patients with pneumonia. The recent recognition of healthcare-associated pneumonia (HCAP) mandates that emergency medicine clinicians remain current and able to distinguish this from community-acquired pneumonia. This article reviews the diagnosis and management of HCAP from the perspective of the emergency medicine clinician.

KEYWORDS: Healthcare-associated, pneumonia, emergency department

The emergency department (ED) is often the initial point of contact for many patients presenting with community-acquired pneumonia (CAP), accounting for over 1.5 million visits annually.1 The majority of these patients are managed with an outpatient regimen of oral antibiotics, and the use of prediction scores has helped identify those patients who may warrant inpatient care and possibly intensive care unit resources. With the recognition of healthcare-associated pneumonia (HCAP), emergency medicine clinicians have had to revolutionize their standard approach to patients presenting with CAP. The categorization of pneumonia is primarily based on historical data points, traditionally distinguishing CAP from hospital-acquired pneumonia (HAP) and ventilator-associated pneumonia (VAP) (Table 1).2 Emergency medicine clinicians must now carefully screen their patients for previous healthcare contacts and prior antibiotic exposure (Table 1).2 These historical data points, when positive for: healthcare admissions, clinic visits, recent antibiotic use, and dialysis, predispose patients to multidrug-resistant (MDR) pathogens. Patient presentations for CAP and HCAP may be similar, but their treatment and diagnostic choices may differ dramatically. The failure to recognize HCAP exposures and the associated MDR pathogen risks can lead directly to poor outcomes for these patients accessing the ED for pneumonia treatment.

DEFINITIONS

Traditionally, pneumonia has been categorized into CAP and the nosocomial pneumonias HAP and VAP. However, recently a fourth category, HCAP, has been introduced. This reflects the emerging understanding that patients presenting from the community who have been exposed to healthcare environments or antibiotics may have a pathogenesis that more closely resembles HAP than CAP.

The American Thoracic Society (ATS) and Infectious Diseases Society of America (IDSA) have recently published guidelines for the diagnosis and management of HCAP. According to the 2005 ATS/IDSA guidelines, HCAP is defined as a patient with pneumonia and any of the following historical features: (1) hospitalization for 2 or more days in an acute care facility within 90 days of infection, (2) resident of a nursing home or long-term care facility, (3) attended a hospital or hemodialysis clinic, (4) has received intravenous antibiotic, chemotherapy, or wound care within 30 days of infection.3

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HAP is defined as a pneumonia that has developed 48 hours or more after hospital admission. VAP is defined as a pneumonia that has developed 48 hours or more after endotracheal intubation. CAP is defined as a patient presenting to the hospital or clinic from the community who does not meet any of the foregoing definitions (Table 1).

It should be noted that, based on these definitions, CAP and HCAP will predominantly present to outpatient settings such as clinics and the ED. HAP and VAP diagnoses are traditionally made in the inpatient setting; however, a high level of suspicion should be used in patients that have recently been discharged or that present as transfers from other facilities.

EPIDEMIOLOGY
Kollef et al’s recent retrospective epidemiological and outcome study of a multicenter database of 4543 patients with culture-positive pneumonia showed that 48.9% had CAP, 21.7% had HCAP, 18.4% had HAP, and 11% had VAP. Skilled nursing facilities accounted for nearly half of all patients with HCAP (49.6%). Demographic and clinical characteristics of patients with HCAP appeared to be more similar to those of patients with HAP than to those of patients with CAP. In addition, there were a statistically significant greater number of comorbidities in the HCAP group than in the CAP cohort.4

PATHOGENS
CAP is typically caused by Streptococcus pneumoniae, and atypical organisms such as Mycoplasma pneumoniae, Chlamydia pneumoniae, and respiratory viruses. Kollef et al found that the microbes most commonly found in HCAP appear to be Staphylococcus aureus (46.7%), and Pseudomonas species (25.3%). Of the S. aureus species, 56.8% were found to be methicillin-resistant S. aureus (MRSA). In addition, HCAP was found to have significantly more Acinetobacter species than CAP (2.6% vs 1.6%; p < 0.05). The microbiological and resistance patterns found in HCAP were more similar to those of HAP and VAP than to those of CAP.4

Emergency medicine (EM) physicians should be aware of resistance patterns found in their community and geographic area. Drug-resistance patterns and pathogens causing nosocomial and healthcare-related infections are in a continuous state of flux and directly impact community patients presenting to the ED.

MORTALITY
Kollef et al showed that HCAP has similar outcomes to that of HAP. Mortality rates in the HCAP and HAP groups were nearly identical (19.8% vs 18.8%; p > 0.05) and significantly higher than those of the CAP group (19.8% vs 10%; p < 0.0001). In addition, length of stay and cost were significantly higher with HCAP than with CAP.4

IDENTIFYING PATIENTS AT RISK FOR HCAP
History
By definition, HCAP involves the recent exposure of the patient to healthcare environments. It is important to elucidate the historical features that define HCAP. The clinician should ask about recent hospitalizations, length of hospitalization, nursing home or long-term care facility admissions, attendance at hemodialysis clinics, recent intravenous antibiotics, chemotherapy, or wound care. Such information can change the management from one geared to CAP to one focused on HCAP (Table 2).

Table 1 Definitions: The American Thoracic Society/Infectious Diseases Society of America Guidelines2

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Community-acquired pneumonia (CAP)</td>
<td>Patients with pneumonia who do not meet HCAP, HAP, or VAP criteria</td>
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<tr>
<td>Healthcare-associated pneumonia (HCAP)</td>
<td>Hospitalized for &gt; 2 days in an acute care facility within 90 days of infection, residing in a nursing home or long-term care facility</td>
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<td></td>
<td>Attending a hospital or hemodialysis clinic</td>
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<td></td>
<td>Receiving intravenous antibiotic therapy or immunosuppressive therapy or wound care within 30 days of infection</td>
</tr>
<tr>
<td>Hospital-acquired pneumonia (HAP)</td>
<td>Pneumonia occurring ≥ 48 hours post–hospital admission</td>
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<tr>
<td>Ventilator-associated pneumonia (VAP)</td>
<td>Pneumonia occurring &gt; 48–72 hours postintubation</td>
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Table 2 Questions for All Pneumonia Patients in the Emergency Department to Aid in Healthcare-Acquired Pneumonia Diagnosis

1. Have you been hospitalized within the past 90 days?
2. Do you reside in a nursing home or long-term care facility?
3. Do you receive hemodialysis?
4. Have you attended a healthcare setting for same-day procedures or sought care in an emergency department within the past 30 days?
5. Have you received antibiotics, chemotherapy, or wound care within the past 30 days?
6. Are you immunocompromised?
7. Have you had contact with someone who had been diagnosed with a multidrug-resistant infection?
Physical Examination
In patients presenting to the ED with pneumonia, there is no specific physical exam finding that differentiates HCAP from CAP. However, there are physical exam findings that can raise suspicion for HCAP. Patients who are bedridden, profoundly disabled, incontinent, or malnourished, or who have indwelling catheters, contractures, difficulty swallowing, or require feeding tubes are all likely to have had recent exposure to a healthcare environment and have an increased risk for HCAP. Such findings are especially important in patients if the history is incomplete or difficult to obtain. In addition, the presence of these findings in patients presenting with pneumonia should trigger the clinician to add HCAP to the differential diagnosis and prompt further historical information.

Management
The initial ED management of the patient with HCAP is dictated by the severity of illness. Assessment of the airway, ventilation, and circulatory status are paramount, and intervention occurs as required. Supplemental oxygen is provided if the patient is hypoxic, intubation is indicated for respiratory failure and intravenous saline, and possible vasopressor agents are administered for septic shock.

LABORATORY TESTING/DIAGNOSTIC STUDIES

Laboratory Testing All patients with HCAP should have a complete blood count, basic serum chemistries, and liver function panel obtained. Serum lactate should be measured in those who have severe illness. Additional testing, such as D-dimer, B-type natriuretic protein, and cardiac enzymes, may be indicated. Abnormalities detected may alter treatment regimens and may assist in discharge planning.

Pulse Oximetry Oxygen saturation should be measured by pulse oximetry in all patients with pneumonia, including HCAP. Additionally, arterial blood gas analysis should be obtained in patients with abnormally low oxygen saturation, with tachycardia, those that have underlying respiratory disease such as chronic obstructive pulmonary disease, and those requiring ventilator support.

Chest Radiographs A chest radiograph must be acquired in all patients suspected of having any type of pneumonia, including HCAP. Ideally a posterior-anterior and lateral radiograph is preferable to a portable image to increase accuracy. There is no evidence to suggest that radiographic findings differ between CAP and HCAP. A negative radiograph does not exclude the diagnosis of HCAP, particularly if the patient demonstrates symptoms and signs of pneumonia. Computed tomography of the chest is a more sensitive study and may be obtained in the presence of diagnostic uncertainty.

Microbiological Testing The recommendations for microbiological testing for patients with HCAP are distinctly different than those for patients with CAP. The IDSA/ATS consensus guidelines published in 2007 acknowledge that microbiological testing for patients with CAP remains controversial. Based upon the frequent low yield and the minimal impact regarding clinical care, routine testing for patients with CAP is now considered optional for patients without severe disease. Blood samples and expectorated sputum for culture are indicated for patients with CAP with more severe disease and in those where the results of the cultures are likely to change the clinical management, such as those with underlying comorbid diseases and those with cavitary lesions on chest radiographs.

The reasoning behind the differing recommendations between CAP and HCAP is that early empirical therapy for patients with HCAP must be quite broad to ensure adequate activity against a rather large pool of potential pathogens, pathogens that more closely resemble those identified in patients with HAP and VAP as opposed to those identified for CAP. Early and appropriate antibiotic therapy has been shown to improve outcomes in patients with HCAP, in particular, improvements in mortality. If microbiological testing yields a pathogen, or pathogens, then the initially broad antibiotic regimen may be narrowed or “deescalated” as quickly as possible to reduce the unnecessary exposure of antimicrobials. Thus the recommendations are to obtain cultures of both sputum and blood samples on all patients suspected of having HCAP, regardless of severity of disease. Preferably the samples should be collected prior to the administration of antibiotics. However, delay of antibiotics to secure sputum or blood samples must be avoided.

ANTIBIOTIC SELECTION
The consensus guidelines from the ATS/IDSA for the management of patients with HAP, VAP, and HCAP delineate the need for early delivery, appropriate selection, and adequate dosing of antibiotics. The guidelines also highlight the distinction between recommendations for patients with HCAP, who should be treated more similarly to patients with HAP or VAP than those with CAP. Within the ED the selection of antibiotics is empirical and based upon likely pathogens and the likely antimicrobial resistance of those pathogens. It is imperative for emergency physicians to be familiar with the local susceptibility and resistance patterns of common pathogens because antimicrobial resistance patterns vary according to geographic regions and between hospitals. Current hospital-based antibiograms must be made available in the ED.
The pneumonia severity index (PSI) is a prognostic model used to assess the risk of mortality, and the possible need for hospitalization, in patients with CAP. The CURB-65 model, another tool used to assess the need for admission for patients with CAP, does not require as many data points and is easily recalled. Neither model has been validated, nor studied, in patients with HCAP. However, it seems these two measures of objective criteria may be useful in decision making regarding admission for patients with HCAP.

**Pneumonia Severity Index** The PSI classifies patients with CAP into five risk categories from class I (associated mortality < 1%) up to class V (associated mortality 27%). The first step of implementing the PSI integrates the age of the patient, comorbidities, and physical findings. Patients less than 50 years of age, without comorbid illnesses and no abnormalities on physical examination, are assigned to class I and may be strongly considered for outpatient therapy. The next step of the PSI includes data from laboratory testing and radiography to assign patients to the remaining four classes. Patients assigned to risk class III and above should be considered for admission to the hospital.

**CURB-65** CURB-65 is an illness severity measure based upon the presence of confusion, uremia, respiratory rate, blood pressure, and age. It is a much simpler measure than the PSI; 1 point is assigned for each of the following: confusion, uremia (BUN > 20 mg/dL), respiratory rate > 30/minute, blood pressure < 90 mm Hg systolic or ≤ 60 mm Hg diastolic, and age > 65 years. The higher the score the greater the associated mortality, from < 1% with a score of 0 to 57% with a score of 5. Patients with scores of 0 or 1 may be considered for outpatient therapy, whereas those with a score of 2 or more should be hospitalized.

**Intensive Care Unit** Admission to the intensive care unit (ICU) is required for patients requiring invasive mechanical ventilation due to respiratory failure and/or vasopressors for septic shock. The presence of three or more “minor criteria” also warrants admission to the ICU. These minor criteria include multilobar infiltrates, BUN > 20 mg/dL, confusion, PaO2:FiO2 ratio ≤ 250, serum lactate > 4, asplenia, alcoholism/cirrhosis, and unexplained metabolic acidosis. Additionally, patients with a PSI risk class of V and/or a CURB-65 score of 3 or greater are often candidates for ICU admission.

**Outpatient Therapy** Once a patient with HCAP has been determined to have mild disease and may be safely treated as an outpatient, microbiological testing should proceed with sputum Gram staining and culture of both sputum and blood. There is currently a lack of evidence to support the utility of this recommendation.

### Table 3 Antibiotic Regimens for Healthcare-Acquired Pneumonia

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<th>Regimen</th>
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<tr>
<td><strong>Antipseudomonal β-lactam PLUS</strong></td>
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<tr>
<td>Piperacillin/tazobactam</td>
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<tr>
<td>Imipenem</td>
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<td>Meropenem</td>
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<tr>
<td>Cefepime</td>
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<tr>
<td>Cefazidime</td>
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<tr>
<td><strong>Antipseudomonal fluoroquinolone PLUS</strong></td>
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<tr>
<td>Ciprofloxacin</td>
</tr>
<tr>
<td>Levofloxacin</td>
</tr>
<tr>
<td>Anti-MRSA* agent</td>
</tr>
<tr>
<td>Vancomycin</td>
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<tr>
<td>Linezolid</td>
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*MRSA, methicillin-resistant *Staphylococcus aureus.*
and until such data demonstrate otherwise, we suggest to continue with aggressive microbiological investigation and to err on the side of caution in investigating potential pathogens.

There is also no evidence to support which antimicrobial agent, or agents, are preferable in this scenario. Monotherapy with an oral fluoroquinolone (levofloxacin or moxifloxacin) has been proposed as a practical choice. A study of 680 nursing home patients with HCAP compared usual care versus a clinical pathway that allowed for oral therapy with levofloxacin in the nursing home for patients with nonsevere disease. Mortality and health-related quality of life were comparable between the two groups.

Patients selected to be treated as outpatients should be instructed to follow up within 1 to 2 days for clinical reassessment and evaluation of culture results.

**METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS**

MRSA is a well-known pathogen in HAP and VAP. Recently, MRSA has been identified as a pathogen in HCAP. A retrospective review of a large inpatient database revealed *S. aureus*, both MRSA and methicillin-sensitive *S. aureus*, to be the dominant pathogen in HCAP. This report was limited by its retrospective design and inclusion of only culture-positive hospitalized patients. Therefore, the actual incidence of *S. aureus*, in particular MRSA, in HCAP remains unknown.

Within the past decade the emergence of community-acquired MRSA (CA-MRSA) has dramatically demonstrated how antimicrobial resistance alters the management of common infectious diseases. CA-MRSA predominantly causes skin and soft tissue infections but reports of severe pneumonia continue to be published. Pneumonia caused by CA-MRSA frequently afflicts previously healthy adults and children. This disease is characterized by a severe illness with necrotizing multilobar involvement, cavity lesions, and hemoptysis. The mortality is high. Risk factors may include postinfluenza illness, prior infection or colonization with CA-MRSA, history of injection drug use, and perhaps close contact with another who is infected or colonized with CA-MRSA. Empirical treatment with either vancomycin or linezolid is a mandatory component of antibiotic therapy for patients suspected of MRSA pneumonia.

**CONCLUSION**

There is a need for EM clinicians to distinguish between CAP and HCAP in patients presenting to the hospital with pneumonia. There are discrete patient populations at risk for MDR pathogens, and HCAP is one of the diseases that alter clinicians’ traditional approach to patients presenting from the community. These patients must be identified early to benefit from aggressive, broad spectrum antibiotic therapy, and the diagnostic strategies required are more comprehensive than community-acquired infections. HCAP presents numerous clinical challenges to EM care providers centered on early recognition, appropriate diagnostic studies, and therapeutic antibiotic regimens. The body of knowledge surrounding HCAP is dynamic and rapidly expanding, but it is not yet complete. As the level of evidence surrounding the further refinement of patient risk factors, diagnostics, epidemiology, and treatment options improves, effective educational strategies can be employed to impact physician behaviors. It is essential that EM clinicians remain integrated with specialty care services at the forefront of HCAP recommendations to offer the greatest benefits to our patients and effective education to our providers.

**REFERENCES**

