Clinical Policy for the Management and Risk Stratification of Community-Acquired Pneumonia in Adults in the Emergency Department

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INTRODUCTION

Each year, 4 million patients in the United States receive a diagnosis of community-acquired pneumonia (CAP); of those, 600,000 are admitted to the hospital.[1] CAP is the sixth leading cause of death and is responsible for significant morbidity. Several groups have published consensus guidelines on this topic that are well known.[1-4] The Pneumonia Patient Outcomes Research Team (PORT) report published in 1997[5] is an exhaustive study of CAP and has spawned a large number of studies confirming its results and extending its findings.[6-8] The following clinical policy, developed by the Clinical Policies Committee of the American College of Emergency Physicians (ACEP), attempts to summarize and augment the currently available information into evidence-based recommendations that will be helpful to emergency physicians in the evaluation and treatment of CAP in the emergency department.

There are many clinical questions about CAP that remain unanswered, and recommendations made solely on the basis of evidence-based medicine are still few. As with all clinical policies, this policy is advisory only and should not supersede individual physician judgment in specific clinical circumstances.

The objective of this policy is to use evidence from the medical literature to assist the emergency physician in the risk stratification, disposition, and treatment of patients with CAP. The policy outlines an approach that emphasizes key clinical information to determine the severity of disease. Clinical judgment may be complemented by risk stratification to determine whether a patient can be treated as an outpatient or requires admission. Our review of the medical literature did not provide sufficient evidence to support evidence-based standards to many clini-

cal questions. As controlled clinical studies provide additional information, an evidence-based approach to clinical decisionmaking becomes increasingly important.

Inclusion criteria

This clinical policy is intended for patients 18 years of age or older with clinical and radiologic evidence of pneumonia. Patients arriving at the ED from nursing homes are included.

Exclusion criteria

Patients excluded from this policy are those who are critically ill or who require respiratory support in the ED. Excluded also are patients with hospital-acquired pneumonia, patients with pneumonia rehospitalized within 30 days of their previous hospitalization, patients who are pregnant, and patients with HIV or who are otherwise immunocompromised.

Methodology

A MEDLINE search for articles published between January 1992 and February 1998 was performed with the key phrase "community-acquired pneumonia." Articles published before 1992 and after 1998 were added when appropriate. The PORT report *Community-Acquired Pneumonia* and subsequent follow-up articles were some

Table.
Clinical assessment and preliminary risk stratification of a patient with CAP.

Category	Key Variables	Discussion
Demographic	Age ≥65 years	Great impact on morbidity, mortality, and often more complicated course.[15,18,23,31] Illness less obvious.[1,5]
	Nursing home resident	Sicker if from nursing home.[5]
	Sex = male	Females are less sick.[5]
Present illness	None	History not helpful in determining diagnosis and severity of illness.[32]
Coexisting illnesses (comorbidities)	Neoplastic disease*	The presence of comorbid illnesses appears to have a major impact on severity.[1,8]
	Liver disease*	
	Congestive heart failure	
	Cerebrovascular disease	
	Renal disease	
	Alcoholism	Infections are more severe and may require a different antibiotic choice in alcoholics.[5,33]
Physical examination findings	Altered mental status*	The presence of changes in mental status and vital sign changes can impact severity.[5,8]
	Systolic blood pressure <90 mm Hg*	
	Respiratory rate ≥30 breaths/min*	
	Pulse ≥125 beats/min	
	Temperature <35°C (95°F) or ≥40°C (104°F)*	
Laboratory and radiographic findings	Partial pressure of arterial O_2 <60 mm Hg or O_2 Sat <90%*	Low O_2 saturation with patient with CAP impacts severity of illness.[5,8]
	Arterial pH <7.35* (measured or clinically estimated)	Low pH, azotemia, hyponatremia, and anemia impact disease severity.[5,8]
	Blood urea nitrogen ≥30 mg/dL*	
	Sodium <130 mmol/L*	
	Hematocrit <30%	
Radiography	Bilateral effusions*	Independently predicts greater severity.[5,8]
	Pleural effusion	Other criteria, clinically or radiographically, may be helpful in determining the most likely organism.[31,34-37]
	More than one lobe involvement	
	Presence of cavity	
Miscellaneous factors that impact site-of-care decisions	Clinical appearance ("patient looks sick")	Clinical appearance difficult to quantify, but recognition of this appearance is seemingly important. The others are obvious but not tested.[38]
	Unable to maintain oral intake	
	Patient reliability is low	
	Home support is inadequate	

*The literature supports these factors to carry more weight in terms of the severity of CAP.[5,6,8]

of the most applicable to the main focus of our policy. Of the total articles, 118 were selected for analysis by subcommittee members and scored for strength of evidence according to the following criteria:

Strength of evidence Class I—Interventional studies including clinical trials, observational studies including prospective cohort studies, aggregate studies including meta-analyses of randomized clinical trials only.

Strength of evidence Class II—Observational studies including retrospective cohort studies, case-controlled studies, aggregate studies including other meta-analyses.

Strength of evidence Class III—Descriptive cross-sectional studies; observational reports including case series and case reports; consensual studies including published panel consensus by acknowledged groups of experts.

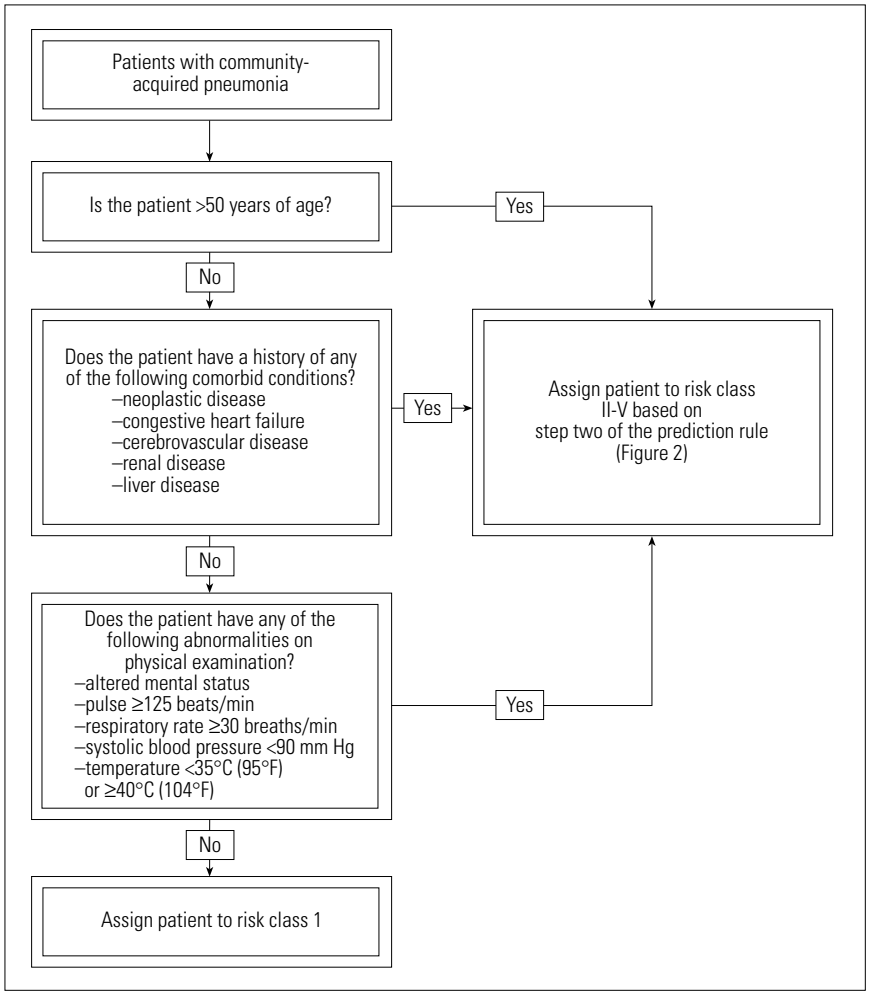
Articles with significant flaws or design bias were downgraded in their strength of evidence.

Strength of recommendations regarding patient management were then made according to the following criteria:

Level A recommendations. Generally accepted principles for patient management that reflect a high degree of clinical certainty (ie, based on "strength of evidence class I" or overwhelming evidence from "strength of evidence class II" studies that directly address all the issues).

Level B recommendations. Recommendations for patient management that may identify a particular strategy or range of management strategies that reflect moderate clinical certainty (ie, based on "strength of evidence class II" studies that directly address the issue, decision analysis that directly addresses the issue, or strong consensus of "strength of evidence class III" studies).

Figure 1.
Identification of patient risk class I[5]: Community-acquired pneumonia.



Level C recommendations. Other strategies for patient management based on preliminary, inconclusive, or conflicting evidence, or, in the absence of any published literature, based on panel consensus.

The reasons for developing clinical policies in emergency medicine and the approaches used in their development have been enumerated.[9] This policy is a product of the ACEP clinical policy development process, including expert review, and is based on the existing literature; where literature was not available, consensus of emergency physicians was used. Expert review comments were received from emergency physicians, members of ACEP's Public Health Committee, and specialty societies including members of the American Academy of Family Physicians, the American College of Chest Physicians, and the Infectious Diseases Society of America. Their responses were used to further refine and enhance this policy. Clinical policies are scheduled for revision every 3 years; however, interim reviews are conducted when technology or the practice environment changes significantly.

Figure 2.
Prediction rule scoring system[5]: Community-acquired pneumonia.

If a patient is younger than 51 years and has no coexisting illnesses or no abnormal physical examination findings, then risk class=I. OTHERWISE, circle the following characteristics and add up the score to determine the risk class.

Patient characteristics	**Points**
Age	
Men	____ Age (years)
Women	____ Age (years-10)
Nursing home resident	+10
Coexisting illnesses	
Neoplastic disease	+30
Liver disease	+20
Congestive heart failure	+10
Cerebrovascular disease	+10
Renal disease	+10
Physical examination findings	
Altered mental status	+20
Respiratory rate ≥30 breaths/min	+20
Systolic blood pressure <90 mm Hg	+20
Temperature <35°C (95°F) or ≥40°C (104°F)	+15
Pulse ≥125 beats/min	+10
Laboratory and radiographic findings **(if study performed)**	
Arterial pH <7.35	+30
Blood urea nitrogen ≥30 mg/dL	+20
Sodium <130 mmol/L	+20
Glucose >250 mg/dL	+10
Hematocrit <30%	+10
Partial pressure of arterial O_2 <60 mm Hg or O_2 Sat <90%	+10
Bilateral pleural effusions	+10
Total points = Age + sex correction + sum of above circled points	

PSI SEVERITY INDEX WITH POINT TOTAL AND SUGGESTED THERAPY

Class	Points	Mortality	Suggested Therapy
Class I*	<51	0.1%	Oral antibiotics at home
Class II	(51-70)	0.6%	Oral antibiotics at home—if vomiting/unreliable, then short stay
Class III	(71-90)	0.9%	Oral antibiotics at home—if vomiting/unreliable, then short stay
Class IV	(91-130)	9.5%	Inpatient stay + IV antibiotics
Class V	>130	26.7%	Inpatient stay (ICU?) + IV antibiotics

*Younger than 51 years of age and no coexisting illnesses or abnormal physical examination findings.

Scope of Application

This clinical policy is intended for physicians working in hospital-based EDs.

PATIENT ASSESSMENT AND RISK STRATIFICATION

In patients with CAP, there are key elements in the history and physical examination, as well as laboratory and radiographic findings, that can be used to assess the risk of death and morbidity. These elements can be useful in the determination of whether a patient needs to be admitted to the hospital, transferred to a nursing home, or treated as an outpatient. Criteria useful in determining whether a patient needs to be admitted to the hospital can be determined by carefully weighing key variables obtained from the clinical assessment of the patient (Table) or from an algorithmic determination used in the PORT analysis (Figures 1 and 2). The PORT study determined, through a logistic regression model, what factors were independently related to patient mortality in an additive fashion[5,8]; it is the largest study of its kind to date. Several studies have appeared subsequently that have validated the PORT findings and demonstrate a reduction in admissions by using the rule.[10,11] The results of this analysis determined 20 statistically significant criteria, that when added together with statistically determined weights, yield a pneumonia-specific severity index (PSI). This index is then used to determine severity classes from I to V that are associated with increasing mortality. Classes I, II, or III are associated with a mortality of less than 1%, whereas patients in Class IV have a mortality of 9.5%, and those in Class V have a mortality of 26.7% (Figure 2). This information can be used to help

decide on the need for hospital admission and the type of bed the patient might require (ie, consider a 24-hour clinical decision unit for Class III patients and ICU admission for Class V patients).

By using Figure 2, the PSI score and class number can be determined. First, from the top of Figure 1, determine whether a patient falls into Class I. If the patient does not, follow through with the scoring dependent on patient characteristics with numeric scoring to determine the PSI score. Add the scores to determine the severity class. Then determine the admission decision on the basis of the severity class in which a patient belongs. Remember that age and sex alone without other characteristics cannot determine a severity class.

Description of patients in the various risk classes[5]

Class I–young (median age, 35 to 37 years); none have pertinent coexisting illnesses or abnormalities.

Class II–typically middle-aged (median age, 58 to 59 years); most are assigned to this group by virtue of age alone.

Class III–typically older (median age, 72 years), and most had at least one pertinent coexisting illness, one physical examination abnormality, or one laboratory or radiographic abnormality.

Classes IV and V–somewhat older (median age, 75 years) and never assigned to the class by virtue of age alone; the majority had abnormalities in 2 (Class IV) or all 3 (Class V) of the pertinent risk factor categories.

This classification scheme, which is based on the PSI, potentially has utility to the emergency physician. All Class I patients and many in Classes II and III are likely candidates for outpatient treatment. The remaining Class II and III patients may be candidates for a short hospital stay (< 24 hours).

Limitations of the PORT PSI classification scheme

1. There may be medical and psychosocial contraindications to outpatient care.
2. Some patients with conditions (eg, immunosuppression) that contribute to decisionmaking are not included in the model's predictors.
3. The dichotomous construction of some of the variables may oversimplify the physician's decisions.
4. It does not include pulse oximetry in the initial determination of class I patients.
5. The physician's clinical judgment should supersede a strict application of this scoring system.
6. PORT was validated as a mortality prediction rule and not as a method for triage of patients with CAP.

Risk stratification as a basis for criteria for hospitalization recommendations:

Level A recommendations. Hospitalize patients in PSI Class IV and V.

Level B recommendations. Identify low-risk patients eligible for outpatient therapy by using the PSI.

Level C recommendations. None specified.

BLOOD CULTURES TO DETERMINE CAUSATIVE ORGANISM

The utility of blood cultures to determine the etiologic agent in unselected patients with CAP is low, ranging from 6% to 11%, with most isolates being *Streptococcus pneumoniae*.[12-16] Furthermore, the presence of a positive blood culture infrequently changes empiric patient management.[12-14,17] However, in those patients with severe pneumonia and/or associated risk factors, the incidence of positive blood cultures may approach 30%.[18-20] Blood cultures may isolate uncommon etiologic organisms (ie, gram-negative organisms or yield agents) demonstrating unusual antibiotic resistance patterns.[21,22] Precise demonstration of the etiologic agent permits judicious antibiotic use. In the elderly, obtaining blood cultures within 24 hours of admission was associated with reduced 30-day mortality.[23]

Blood culture recommendations:

Level A recommendations. None specified.

Level B recommendations. None specified.

Level C recommendations. Obtain blood cultures in all hospitalized patients with CAP.

SPUTUM GRAM STAIN/CULTURE

There is no clear evidence to support the routine use of sputum analysis in patients with CAP.

Sputum analysis is the most common test done in patients with CAP, but its utility remains controversial because the yield is quite variable.[24] Most specimens are proven inadequate, and furthermore, many patients with CAP cannot produce sputum.[25,26] If sputum is available, a Gram stain may be beneficial in documenting *S pneumoniae*, although it is less predictable of other etiologies of CAP.[27,28]

Sputum Gram stain/culture recommendations:

Level A recommendations. None specified.
Level B recommendations. None specified.
Level C recommendations. Consider sputum culture and Gram stain on adequate specimens in high-risk patients who are hospitalized.

EMPIRIC THERAPY OF CAP

As many as 30 antibiotics have been US Food and Drug Administration–approved for pneumonia treatment. Initial therapy should take into consideration likely pathogens, possible antimicrobial resistance patterns, and comorbid conditions. Several expert groups have brought forth recommendations for empiric therapy of CAP.[1-3,24,29] The most recent from the Infectious Diseases Society of America[30] are summarized in the Appendix.

Empiric therapy of CAP recommendations:

Level A recommendations. None specified.
Level B recommendations. None specified.
Level C recommendations. As one option, consider antibiotic therapy as outlined in the Appendix.

TIMELY ADMINISTRATION OF ANTIBIOTICS FOR HOSPITALIZED PATIENTS WITH CAP

The optimal time to administer antibiotics in CAP is not known. One study reported that in patients 65 years or older, those receiving antibiotics within 8 hours of their hospital arrival had a 20% to 30% decrease in 30-day mortality compared with those who received them after 8 hours.[23] No prospective studies were found regarding younger patients.

Administration of antibiotics for admitted patient recommendations:

Level A recommendations. None specified.
Level B recommendations. Start antibiotics in all hospitalized patients diagnosed with CAP, and within 8 hours in patients 65 years or older.
Level C recommendations. None specified.

SUMMARY AND CONCLUSIONS

This clinical policy presents an approach that emphasizes key clinical information to determine the severity of CAP. By using this approach, a determination of whether the patient can be treated as an outpatient or inpatient may be made. Recommendations about the utility of ancillary studies and use of antibiotics are also given. As more of the questions are answered through controlled studies, an evidence-based approach to this problem will become increasingly important in improving the outcome of patients with CAP.

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APPENDIX

Empirical selection of antimicrobial agents for treating patients with CAP.*[30]

Outpatients

Generally preferred are (not in any particular order): doxycycline, a macrolide, or a fluoroquinolone.

Selection considerations (see text, Management of Patients Who Do Not Require Hospitalization).

These agents have activity against the most likely pathogens in this setting, which include *Streptococcus pneumoniae, Mycoplasma pneumoniae,* and *Chlamydia pneumoniae.*

Selection should be influenced by regional antibiotic susceptibility patterns for *S pneumoniae* and the presence of other risk factors for drug-resistant *S pneumoniae.*

Penicillin-resistant pneumococci may be resistant to macrolides and/or doxycycline.

For older patients or those with underlying disease, a fluoroquinolone may be a preferred choice; some authorities prefer to reserve fluoroquinolones for such patients.

Hospitalized patients

General medical ward

- Generally preferred are: an extended spectrum cephalosporin combined with a macrolide or a β-lactam/β-lactamase inhibitor combined with a macrolide or a fluoroquinolone (alone).

Intensive care unit

- Generally preferred are: an extended-spectrum cephalosporin or β-lactam/β-lactamase inhibitor plus either fluoroquinolone or macrolide.
- Alternatives or modifying factors (see text, Management of Patients Who Are Hospitalized, Special Considerations).
  - Structural lung disease: antipseudomonal agents (piperacillin, piperacillin-tazobactam, carbapenem, or cefepime) plus a fluoroquinolone (including high-dose ciprofloxacin).
  - β-Lactam allergy: fluoroquinolone±clindamycin.
  - Suspected aspiration: fluoroquinolone with or without clindamycin, metronidazole, or a β-lactam/β-lactamase inhibitor.

Note. β-Lactam/β-lactamase inhibitor: ampicillin-sulbactam or piperacillin-tazobactam. Extended-spectrum cephalosporin: cefotaxime or ceftriaxone. Fluoroquinolone: gatifloxacin, levofloxacin, moxifloxacin, or other fluoroquinolone with enhanced activity against *S pneumoniae* (for aspiration pneumonia, some fluoroquinolones show in vitro activity against anaerobic pulmonary pathogens, although there are no clinical studies to verify activity in vivo). Macrolide: azithromycin, clarithromycin, or erythromycin. ±, with or without.