Community-Acquired Pneumonia

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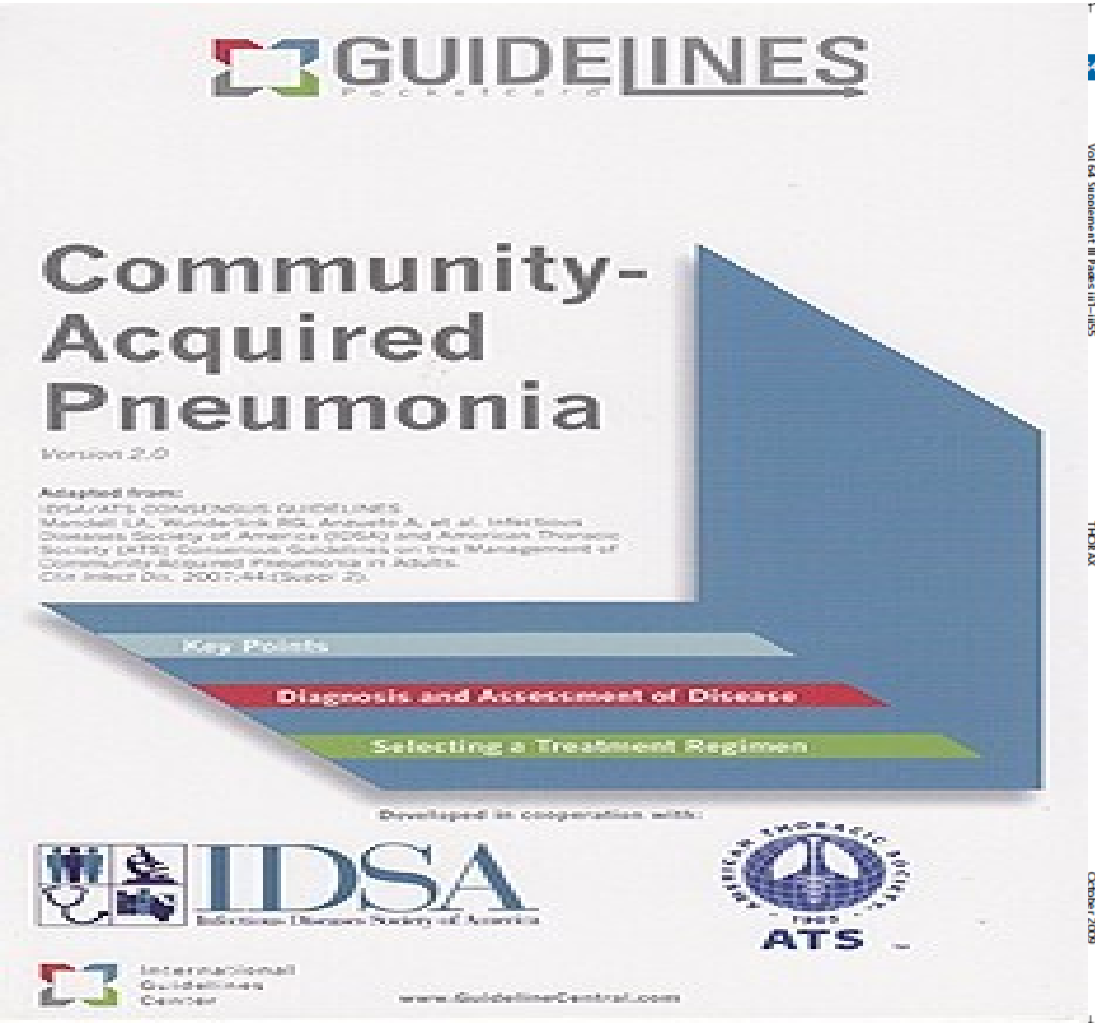
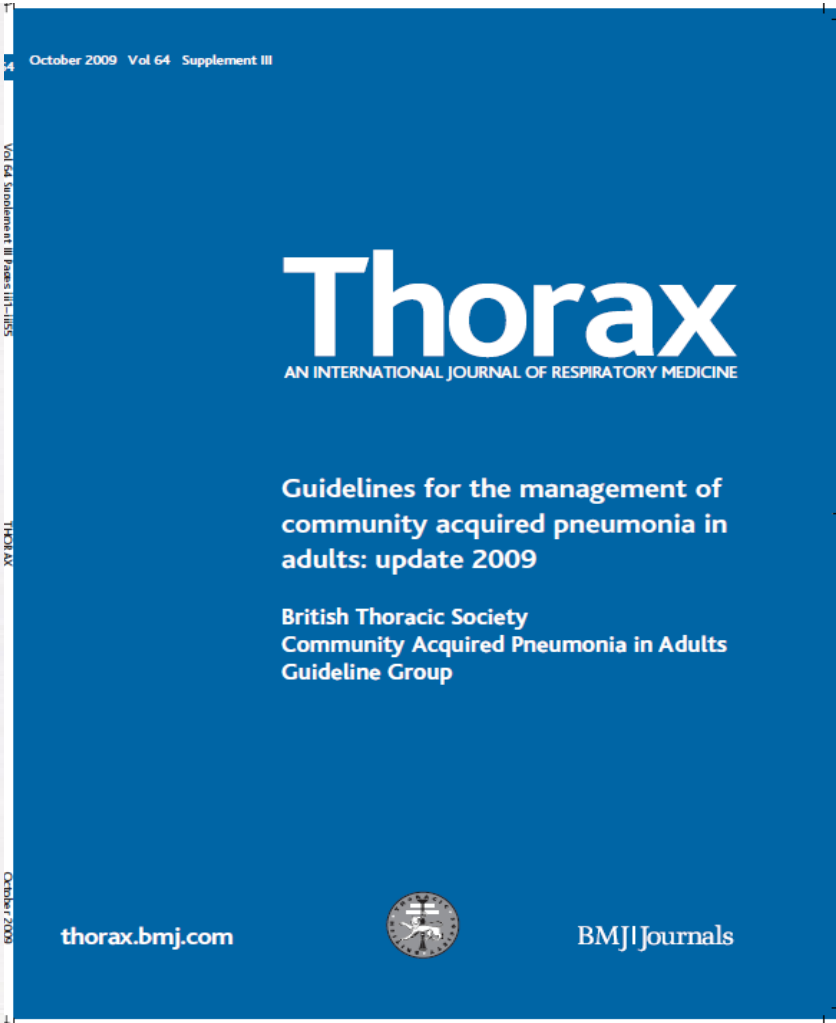
Community-Acquired Pneumonia (CAP)

The IDSA, ATS, ERS, BTS, The Canadian guidelines.

(*Infectious Diseases Society of America and American Thoracic Society)*





Infectious Diseases Society of America/American Thoracic Society Consensus Guidelines on the Management of Community-Acquired Pneumonia in Adults

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Clinical Infectious Diseases 2007; 44:S27–72

1058-4838/2007/4405S2-0001$15.00
DOI: 10.1086/511159

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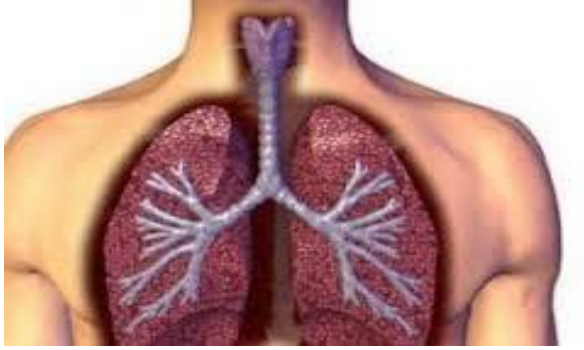


Pneumonia, inflammation of the lung parenchyma,

bacteria or viruses is the most common cause,

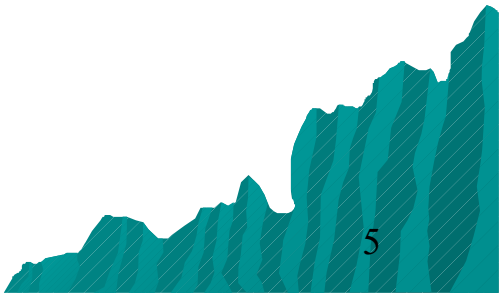
- inhalation of chemicals,
- trauma to the chest wall,
- infection by other infectious agents

rickettsiae, fungi, ….

The IDSA defines Community-Acquired Pneumonia (CAP) as

"an acute infection of the pulmonary parenchyma that is associated with at least some symptoms of acute infection, accompanied by the presence of an acute infiltrate on a chest radiograph or auscultatory findings consistent with pneumonia (such as altered breath sounds and/or localized roles), in a patient not hospitalized or residing in a long-term care facility for more than 14 days before onset of symptoms"

The IDSA: **Infectious Diseases Society of America**



Epidemiology

Pneumonia is a leading cause of death in the world

The sixth most common cause of death in the USA

Every year in the USA, 5-10 million cases of CAP

1.1 million hospitalizations

5,000 deaths

Incidence

In Europe, 44 cases per 1,000 populations per year

two- to four-times higher aged over 60 yrs than in those aged 50 yrs

The mortality rate

less than 1% not hospitalized patients with CAP

12% to 14% hospitalized patients with CAP

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Postgrad Med. 2010 Mar;122(2):130-41. doi: 10.3810/pgm.2010.03.2130.

Burden of community-acquired pneumonia in North American adults.

File TM Jr, Marrie TJ.

Department of Internal Medicine, Northeastern Ohio University, College of Medicine, Rootstown, OH, USA. filet@summa-health.org

Abstract

To determine the burden of community-acquired pneumonia (CAP) affecting adults in North America, a comprehensive literature review was conducted to examine the incidence, morbidity and mortality, etiology, antibiotic resistance, and economic impact of CAP in this population. In the United States, there were approximately 4.2 million ambulatory care visits for pneumonia in 2006. Pneumonia and influenza continue to be a common cause of death in the United States (ranked eighth) and Canada (ranked

Am J Geriatr Pharmacother. 2010 Feb;8(1):47-62. doi: 10.1016/j.amjopharm.2010.01.003.

Community-acquired pneumonia in the elderly.

Fung HB, Monteagudo-Chu MO.

Pharmacy Service, James J. Peters Veterans Affairs Medical Center, Bronx, New York, USA.

Abstract

BACKGROUND: Community-acquired pneumonia (CAP) is a frequent cause of hospitalization and death among the elderly.

OBJECTIVE: This article reviews information on CAP among the elderly, including age-related changes, predisposing risk factors, causes, treatment strategies, and prevention.

METHODS: Searches of MEDLINE (January 1990-November 2009), International Pharmaceutical Abstracts (January 1990-November 2009), and Google Scholar were conducted using the terms community-acquired pneumonia, pneumonia, treatment guidelines, and elderly. Additional publications were found by searching the reference lists of the identified articles. Studies that reported diagnostic criteria as well as the treatment outcomes achieved in adult patients with CAP were selected for this review.

Prevalence in the USA

46,237 elderly patients were monitored over a 3-year period,

CAP rate, 65-69 years, 18.2 cases per 1000 person-years.

Older than age 85 years, 52.3 cases per 1000 person-years.

Approximately 915,900 CAPcases, elderly population, annually in the USA*

* File TM Jr, Marrie TJ. Burden of community-acquired pneumonia in North American adults. *Postgrad Med*. Mar 2010;122(2):130-41

Fung HB, Monteagudo-Chu MO. Community-acquired pneumonia in the elderly. *Am J Geriatr Pharmacother*. Feb 2010;8(1):47-62.

CLASSIFICATION

Anatomic or radiologic distribution

- Lobar - known as focal or nonsegmental pneumonia
- Multifocal / lobular (bronchopneumonia)
- Interstitial (focal diffuse)

Bacterial pneumonia. Radiographic images in a patient with right upper lobe pneumonia.

Most common etiologies of community-acquired pneumonia

Patient type	Etiology
Outpatient	Streptococcus pneumoniae
	Mycoplasma pneumoniae
	Haemophilus influenza
	Chlamydophila pneumoniae
	Respiratory viruses
Inpatient (non-ICU)	*S. pneumoniae*
	M. pneumoniae
	C. pneumoniae
	H. influenza
	Legionella species
	Aspiration
	Respiratory viruses
Inpatient (ICU)	*S. pneumoniae*
	Staphylococcus aureus
	Legionella species
	Gram-negative bacilli
	H. influenza

Identified Pathogens in Community-Acquired Pneumonia

Pathogen	Cases (%)
Streptococcus pneumoniae	20-60
Haemophilus influenzae	3-10
Staphylococcus aureus	3-5
Gram-negative bacilli	3-10
Legionella species	2-8
Mycoplasma pneumoniae	1-6
Chlamydia pneumoniae	4-6
Viruses	2-15
Aspiration	6-10
Others	3-5

Adapted from Mandell LA, Bartlett JG, Dowell SF, et al: Update of practice guidelines for the management of community-acquired pneumonia in immunocompetent adults. Clin Infect Dis 2003;37:1405-1433.

Streptococcus pneumoniae, Haemophilus influenzae , Moraxella catarrhalis (exacerbation of chronic bronchitis)

These 3 pathogens account for approximately 85% of CAP cases *

* Howard LS, et al. Microbiological profile of community-acquired pneumonia in adults over the last 20 years. *J Infect*. 2005;50(2):107-13.

Atypical CAP pathogens

Zoonotic atypical CAP pathogens

Chlamydia psittaci (psittacosis),

Francisella tularensis (tularemia),

Coxiella burnetii (Q fever).

Nonzoonotic atypical CAP pathogens

Legionella species,

M pneumoniae,

*Chlamydia pneumoniae.**

These organisms account for approximately **15%** of all CAP cases.

*Burillo A, Bouza E. Chlamydophila pneumoniae. *Infect Dis Clin North Am.* Mar 2010;24(1):61-71.

Etiology

ICU (Intensive Care Unit), complex.

Polymicrobial infection, 11% of cases.

S pneumoniae, respiratory viruses, and *P aeruginosa*.*

Other gram-negative pathogens

Enterobacter species,

Serratia species,

Stenotrophomonas maltophilia,

Burkholderia cepacia) rarely

* Cilloniz C, et al. Community acquired polymicrobial pneumonia in the intensive care unit: aetiology and prognosis. *Crit Care*. Sep 14 2011;15(5):R209.

	United States[1]	Spain[2]	Sweden[3]	Israel[4]	Asia[5]
Streptococcus pneumoniae	60 (8.2)	613 (17.4)	70 (38)	23 (18.3)	114 (11.9)
Klebsiella pneumoniae	7 (1.0)	0	0	0	60 (6.3)
Haemophilus influenzae	19 (2.6)	70 (2.0)	9 (4.9)	0	59 (6.2)
Pseudomonas aeruginosa	20 (2.7)	50 (1.4)	0	0	26 (2.7)
Staphylococcus aureus	37 (5.0)	25 (0.7)	4 (2.2)	0	19 (2.0)
Mycobacterium tuberculosis	0	0	2 (1.1)	0	13 (1.4)
Moraxella catarrhalis	0	5 (0.1)	7 (3.8)	0	12 (1.3)
Mycoplasma pneumoniae	◇	65 (1.8)Δ	15 (8.2)Δ	23 (18.3)Δ	61/556 (11.0)Δ
Chlamydophila pneumoniae	◇	50 (1.4)Δ	0Δ	26 (20.6)Δ	55/411 (13.4)Δ
Legionella pneumophila	0◇	118 (3.3)Δ	3 (1.6)	9 (7.1)	7/648 (1.1)
Coxiella burnetii		30 (0.8)Δ	0	8 (6.3)Δ	0
Gram-negative enteric bacilli	12 (1.6)	27 (0.8)	0	0	0
Polymicrobial (>1 pathogen identified)	13 (1.8)	208 (5.9)Δ	46 (25.0)Δ	43 (34.1)Δ	60 (6.3)Δ

Pathogenetic Mechanisms in Pneumonia

Mechanism	Frequency
Inhalation of infectious particles	Common
Aspiration of oropharyngeal or gastric contents	Common
Hematogenous deposition	Uncommon
Invasion from infection in contiguous structures	Rare
Direct inoculation	Less common
Reactivation	More common in immunocompromised hosts

Microbiologic Differential Diagnosis of Pneumonia: Historical Features

History	Associated Organisms
Alcoholism	*Streptococcus pneumoniae*, oral anaerobes, *Mycobacterium tuberculosis*
Chronic obstructive lung disease (COPD)	*S. pneumoniae*, *Haemophilus influenzae*, *Moraxella catarrhalis*, *Legionella* spp.
Exposure to bat or bird droppings, construction sites, caves	*Histoplasma capsulatum*
Exposure to birds	*Chlamydia psittaci*
Exposure to rabbits	*Francisella tularensis*
HIV infection	"Typical" bacterial pathogens, *M. tuberculosis*, *Pneumocystis jiroveci*, cytomegalovirus, *Cryptococcus* spp., *Histoplasma* spp., *Coccidioides* spp.
Travel to desert, southwest United States	*Coccidioides* spp., Hantavirus (Sin Nombre virus)
Farm exposure	*Coxiella burnetii* (animals), *Aspergillus* spp. (barns, hay)
Postinfluenza	*S. pneumoniae*, *S. aureus*, *Streptococcus pyogenes*, *H. influenzae*
Aspiration	Mixed aerobic, anaerobic
Marijuana smoking	*Aspergillus* spp.
Anatomic abnormality of lung parenchyma, e.g., bronchiectasis, cystic fibrosis	*Pseudomonas aeruginosa*, *Burkholderia cepacia*, *S. aureus*
Injection drug use	*S. aureus*, anaerobes, *M. tuberculosis*, and *S. pneumoniae*
Obstruction of large airway	Anaerobes, *S. pneumoniae*, *H. influenzae*, *S. aureus*
Incarceration	*M. tuberculosis*
Neutropenia	*Aspergillus* spp., Zygomycetes
Asplenia	*S. pneumoniae*, *H. influenzae*

Adapted from Mandell LA, Bartlett JG, Dowell SF, et al: Update of practice guidelines for the management of community-acquired pneumonia in immunocompetent adults. Clin Infect Dis 2003;37:1405-1433.

Radiographic Patterns of Common Etiologic Agents

Chest Radiographic Pattern	Pathogen
Focal; large pleural effusion	Usually bacteria
Cavitary	Bacterial abscess, fungi, acid-fast bacilli, *Nocardia*
Miliary	Acid-fast bacilli, fungi
Rapid progression/multifocal	*Legionella* spp., *Pneumococcus*, *Staphylococcus*
Interstitial	Viruses, *Pneumocystis jiroveci*, *Mycoplasma*, *Chlamydia psittaci*
Mediastinal widening without infiltrate	Inhalation anthrax

Radiograph of pulmonary infiltrates in influenza pneumonia.

CURB-65 Mortality Prediction Tool for Patients with CAP

The CURB-65 is a simple scoring system easily used in the outpatient office or **emergency room setting**, which assigns 1 point for each of 5 clinical features:

	Clinical Factor	Points
C	Confusion	1
U	Blood urea nitrogen > or = 20 mg/dL	1
R	Respiratory rate > or = 30 breaths/min	1
B	Systolic BP < 90 mm Hg or Diastolic BP < or = 60 mm Hg	1
65	Age > or = 65	1

CURB-65

Total Score	Mortality %	Risk Level	Suggested Site-of-Care
0	0.6%	Low	Outpatient
1	2.7%	Low	Outpatient
2	6.8%	Moderate	Short inpatient / supervised outpatient
3	14.0%	Moderate to High	Inpatient
4 or 5	27.8%	High	Inpatient / ICU

Pneumonia Severity Index (PSI)

- Risk stratification

- Identifying CAP patients (outpatient antibiotics).

- A variety of clinical and laboratory parameters.

- The PSI involves calculating a score, one of 5 risk classes.

Classes I, II, and III: low risk for death, outpatient treatment.

Risk classes IV and V: high risk for death, hospitalized

Pneumonia Severity Index: Point Assignments in Community-Acquired Pneumonia

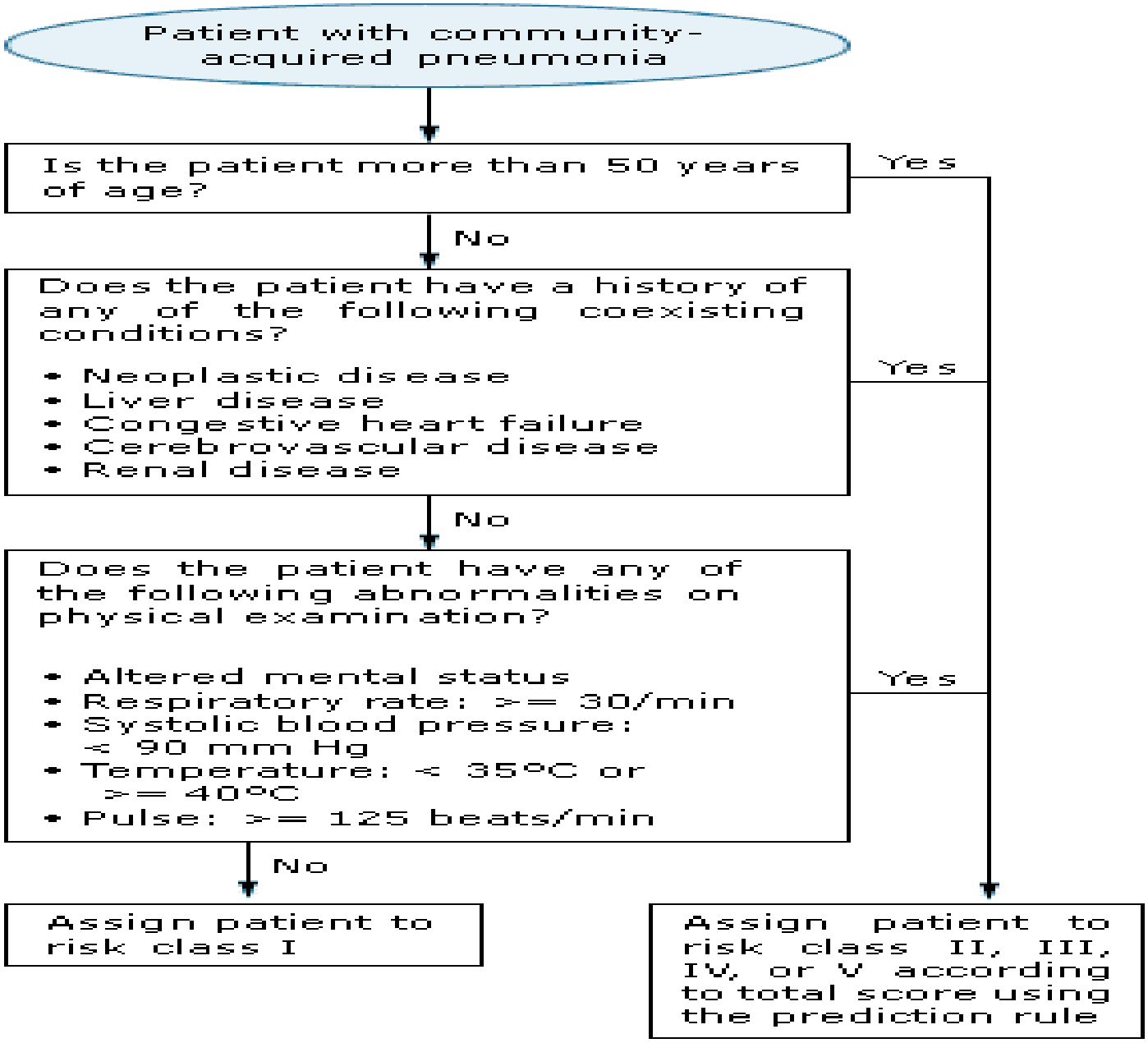
Risk Factor	Point Value
Age	
Men	Age (in yr)
Women	Age (in yr) −10
Nursing home resident	+10
Comorbid Illnesses	
Neoplastic disease	+30
Liver disease	+20
Kidney disease	+10
Cerebrovascular disease	+10
Congestive heart failure	+10
Physical Findings	
Altered mentation	+20
Tachypnea (>30 breaths/min)	+20
Systolic hypotension (<90 mm Hg)	+20
Body temperature (<35° or >40° C)	+15
Heart rate >125 beats/min	+10
Laboratory and Radiographic Findings	
Blood pH (arterial) <7.35	+30
Hypoxemia (arterial Pao_2<60 mm Hg or O_2 saturation <90%)	+10
Serum urea nitrogen (BUN) >30 mg/dL	+20
Na <130 mEq/L	+20
Blood sugar >250 mg/dL	+10
Anemia (hematocrit <30%)	+10
Pleural effusion	10

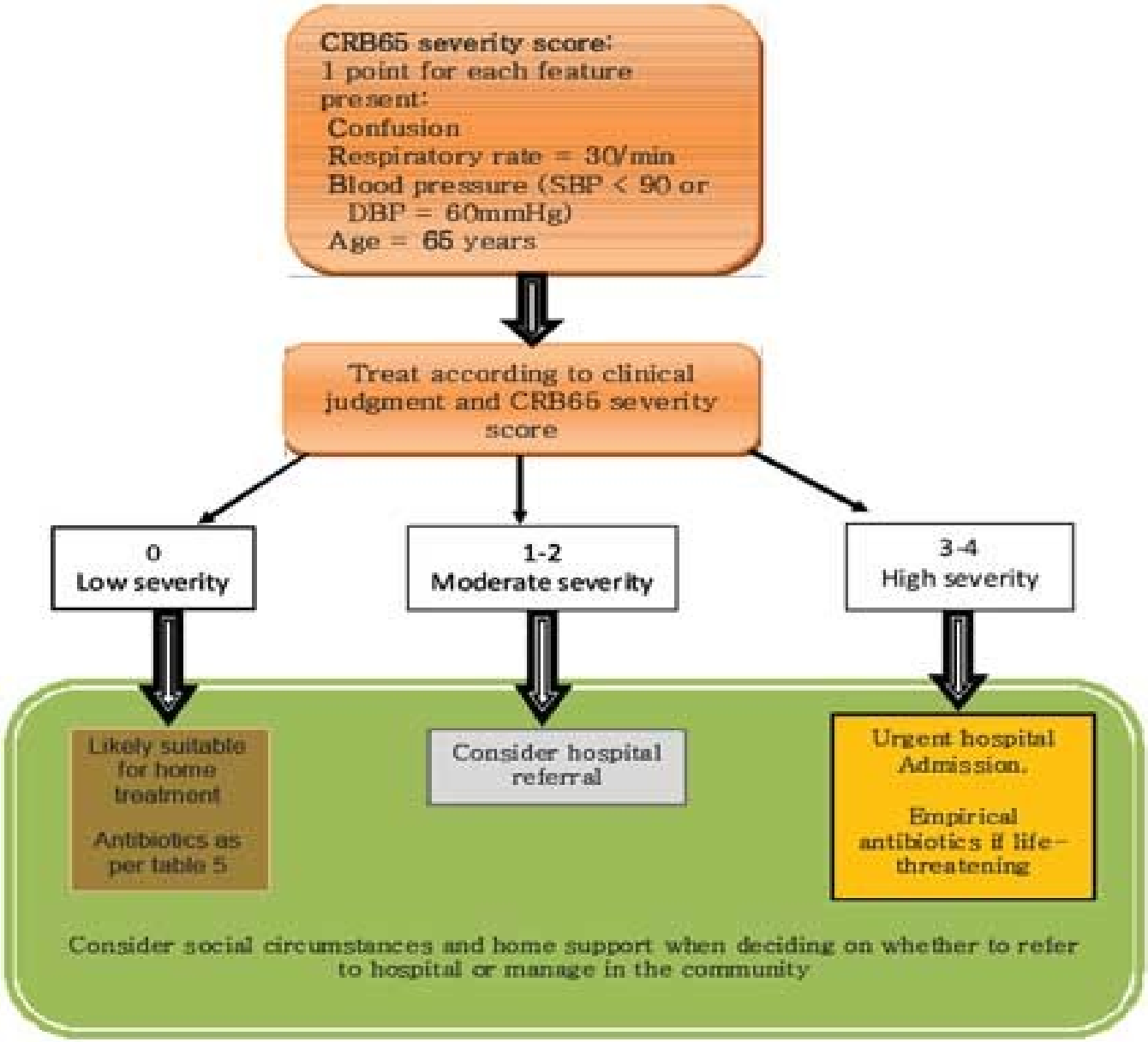
Adapted from Kolleff MH, Micek ST: Methicillin-resistant *Staphylococcus aureus*—a new community-acquired pathogen? Curr Opin Infect Dis 2006;19:161-168.

Pneumonia Severity Index: Risk of 30-Day Mortality By Point Total

Risk Class	Point Score	Mortality (%)
I	No points assigned	0.1
II	<70	0.6
III	71-90	2.8
IV	91-130	8.2
V	>130	29.2

Adapted from Kolleff MH, Micek ST: Methicillin-resistant *Staphylococcus aureus*—a new community-acquired pathogen? Curr Opin Infect Dis 2006;19:161-168.


Patient with community-acquired pneumonia
Is the patient more than 50 years of age?
Yes
No
Does the patient have a history of any of the following coexisting conditions?
• Neoplastic disease
• Liver disease
• Congestive heart failure
• Cerebrovascular disease
• Renal disease
Yes
No
Does the patient have any of the following abnormalities on physical examination?
• Altered mental status
• Respiratory rate: >= 30/min
• Systolic blood pressure: < 90 mm Hg
• Temperature: < 35°C or >= 40°C
• Pulse: >= 125 beats/min
Yes
No
Assign patient to risk class I
Assign patient to risk class II, III, IV, or V according to total score using the prediction rule


CRB65 severity score:
1 point for each feature present:
Confusion
Respiratory rate = 30/min
Blood pressure (SBP < 90 or DBP = 60mmHg)
Age = 65 years
Treat according to clinical judgment and CRB65 severity score
0
Low severity
1-2
Moderate severity
3-4
High severity
Likely suitable for home treatment
Antibiotics as per table 5
Consider hospital referral
Urgent hospital Admission.
Empirical antibiotics if life-threatening
Consider social circumstances and home support when deciding on whether to refer to hospital or manage in the community

Risk Factors

Patients with co-existing illnesses like

- COPD,
- Diabetes Mellitus,
- Renal failure,
- Congestive Heart Failure,
- Coronary Artery disease,
- Malignancy,
- Chronic Neurological disease and
- Chronic liver disease

have increased incidence of CAP

Risk Factors

Patients with CAP and certain co-morbidities have increased mortality.

These risk factors include

Diabetes mellitus,

CHF,

Neurologic disease,

Alcohol consumption,

Bacteremia,

Hypotension,

Tachypnea,

Aspiration pneumonia,

Coronary artery disease,

Immunosuppression,

Active malignancies,

Increasing age,

Leukopenia,

Altered mental status,

Hypoxemia,

Gram-negative infections

Clinical presentation

Temperature greater than 38°C (100.4°F)

Cough with or without sputum,

Hemoptysis

Pleuritic chest pain

Myalgia

Gastrointestinal symptoms

Dyspnea

Malaise, fatigue

Rales, rhonchi, wheezing

Egophony, bronchial breath sounds

Dullness to percussion

Atypical symptoms in older patients

Common Signs and Symptoms of CAP (% frequency)*

Fever (80%)
Cough (90%)
Dyspnea (66%)
Tachypnea (70%)
Sputum Production (66%)
Pleuritic Chest Pain (50%)

** Signs and symptoms may present differently among the elderly.*
Source: References 12-15.

Patient History

Typical bacterial CAP: pulmonary symptoms,

fever,

productive cough

pleuritic chest pain.

Atypical CAP: a variety of pulmonary and extrapulmonary findings

(eg, CAP plus diarrhea), often subacute.

Legionella pneumonia: productive or nonproductive cough, pleuritic chest pain

M pneumoniae or *Chlamydophila pneumoniae* usually nonproductive cough.

Diagnostic Testing for Community-Acquired Pneumonia

All patients with suspected pneumonia

- Chest radiography
- Complete blood count
- Complete metabolic profile
- Blood gases or pulse oximetry

Severely ill or immunocompromised patients, patients with anatomic lung disease

- Sputum Gram stain and culture
- Blood cultures: two sets before antibiotics
- *Legionella* serology, urinary antigen, direct fluorescent antibody testing
- Pneumococcal urinary antigen testing

Inpatients with appropriate history or physical findings

- HIV serology
- *Mycoplasma* serology
- *Chlamydia* serology
- Fungal serology
- SARS-associated coronavirus serology or PCR
- Stains or cultures for fungi, mycobacteria, *Pneumocystis jiroveci*
- Analysis or cultures of pleural or cerebrospinal fluid
- Nasopharyngeal swab for viral direct fluorescent antibody or other rapid technique
- Tuberculin skin testing

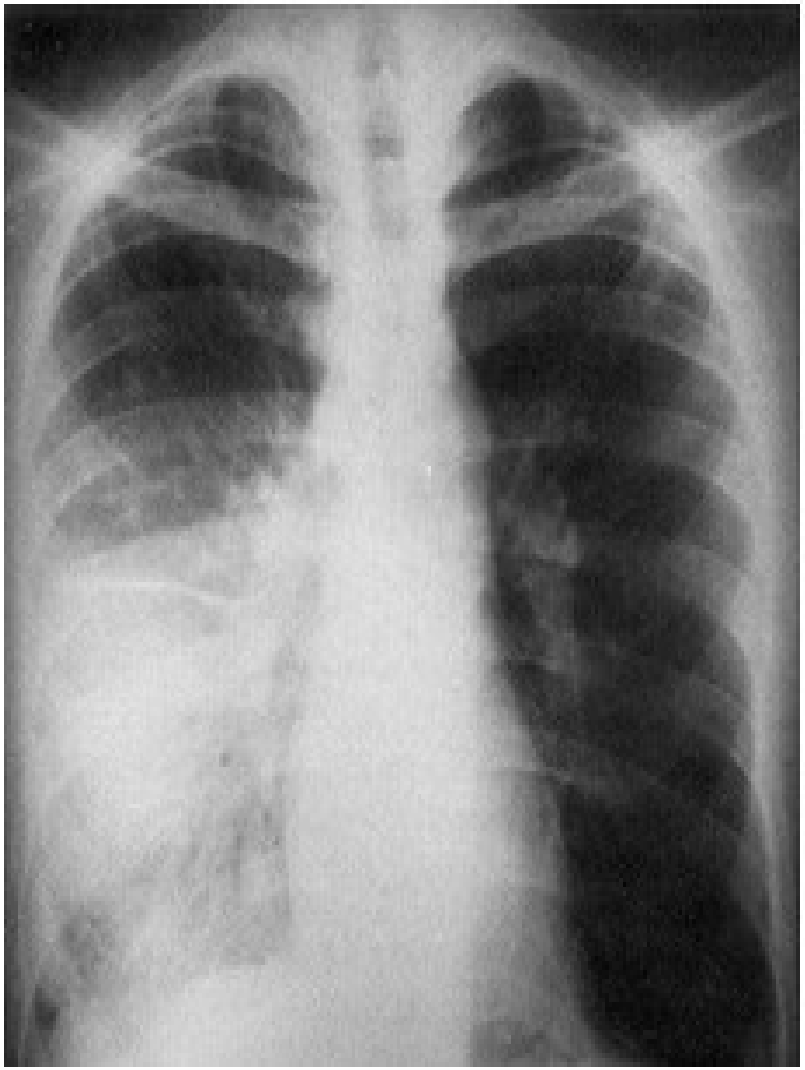
Deteriorating patient without definitive diagnosis of cause

- Bronchoscopy (bronchoalveolar lavage, protected catheter, transbronchial biopsy)
- Thoracoscopic or open-lung biopsy
- Radiographically guided transthoracic aspirate
- *Legionella*, *Chlamydia*, *Mycoplasma* serology
- Fungal serology
- Evaluation for congestive heart failure, pulmonary embolus, neoplasm, connective tissue disease

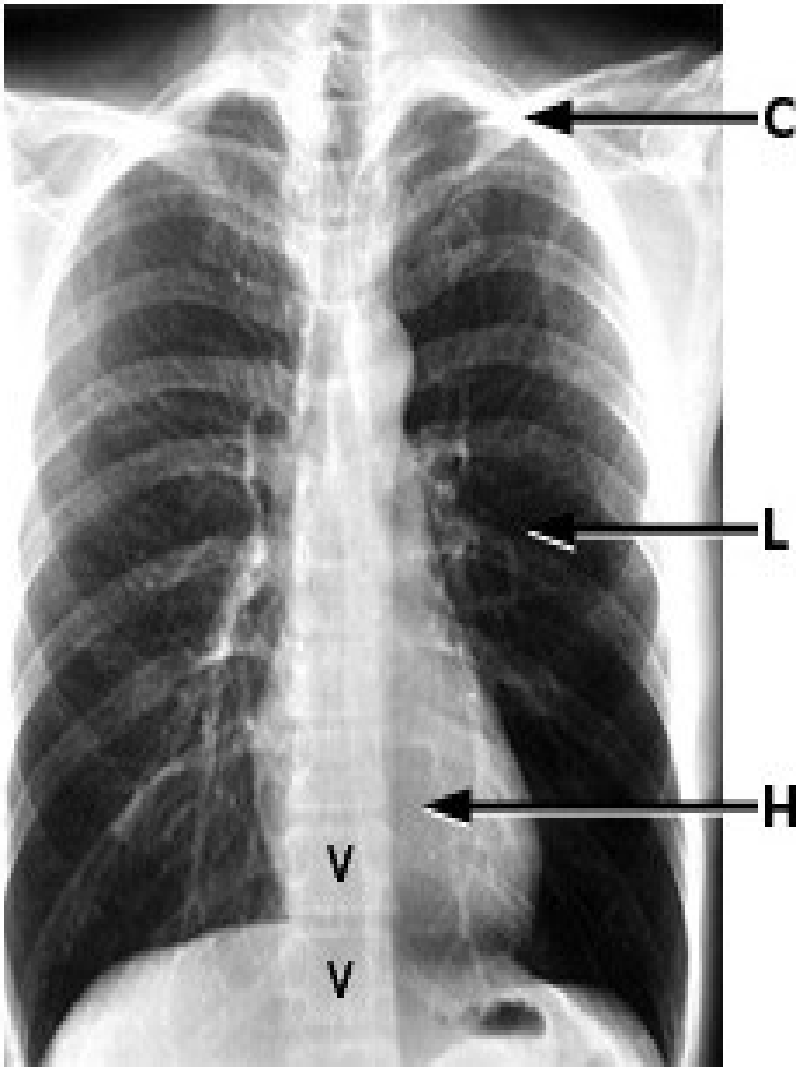
PCR, polymerase chain reaction; PORT, Patient Outcome Research Team; SARS, severe acute respiratory syndrome.

Adapted Mandell LA, Wunderink RG, Anzueto A, et al; Infectious Diseases Society of America; American Thoracic Society. Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. Clin Infect Dis 2007;44 Suppl 2:S27-S72.

Pneumonia



Normal X-Ray



(H) the heart, (L) lungs, (v) vertebrae, and (C) collarbone can be seen.

Chest radiography

Early, negative findings

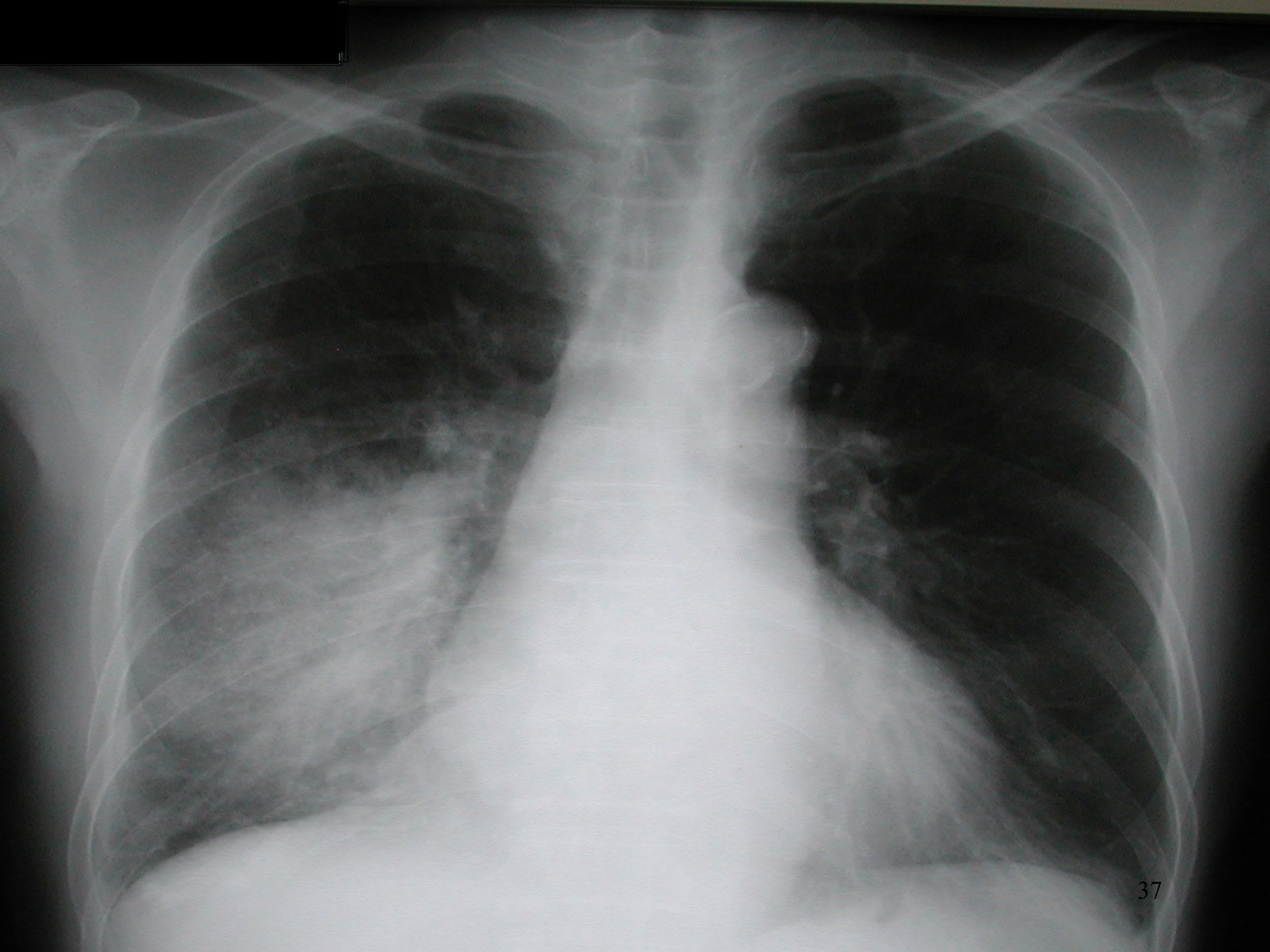
Repeat, within 24 hours

The differentiation of viral pneumonias from nonviral pneumonias.

Viral pneumonias display few or no infiltrates,

but when infiltrates are present, they are almost always

- bilateral,
- perihilar,
- symmetric, - interstitial.



Sputum Studies and Blood Culture

Gram stain and/or culture.

Reliable and diagnostic if performed on a well-collected specimen without many squamous epithelial cells (saliva/contamination) and a predominant organism is present.

Keep in mind !!!

Elderly persons, adequate suitable sputum sample.

Studies in CAP Patients with HIV

CD4 count (a normal or slightly decreased)

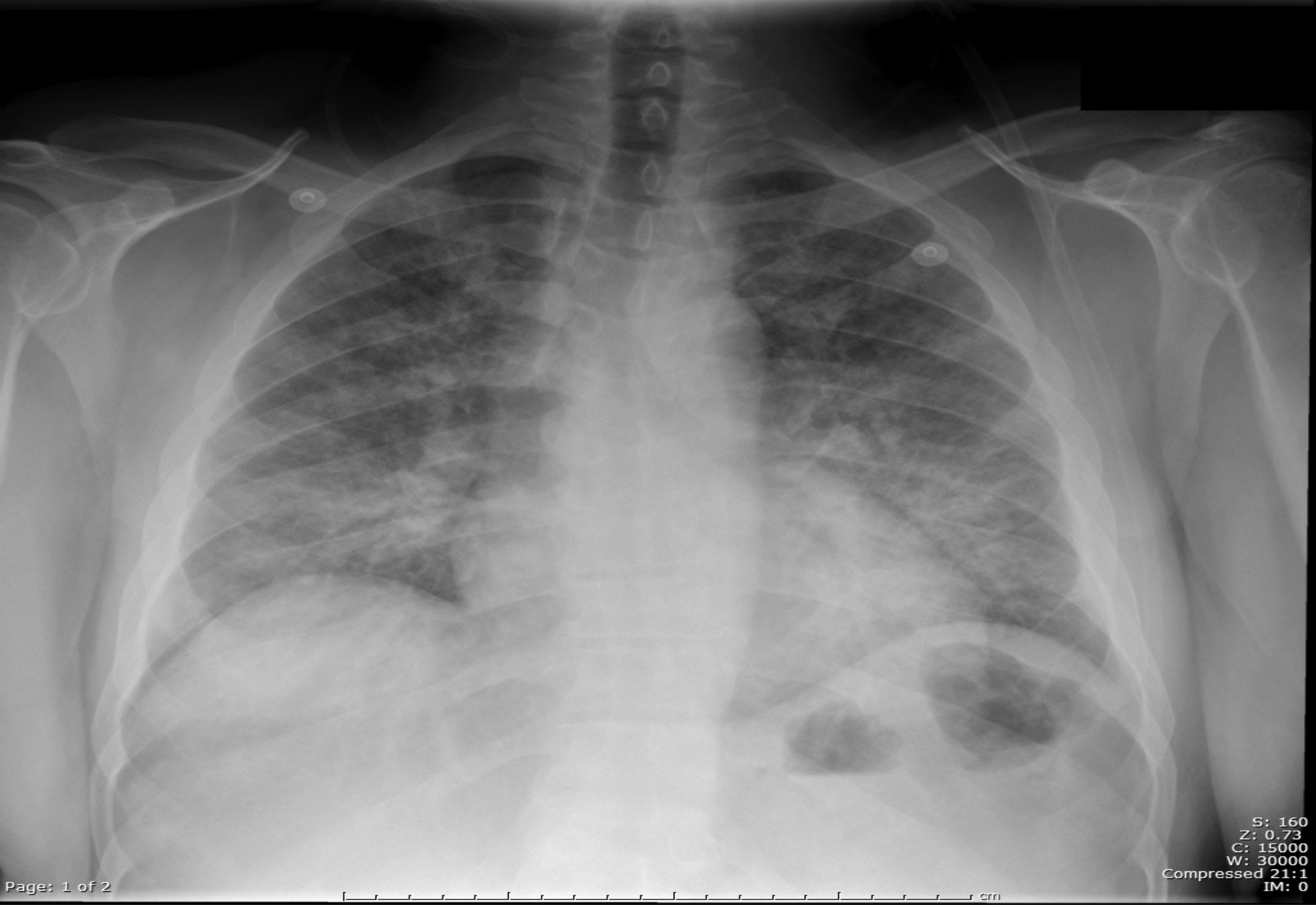
Chest radiographic appearance (focal infiltrates)

Nonfocal infiltrates and hypoxemia → *Pneumocystis* (*carinii*) *jiroveci* pneumonia (PCP) ??

HIV infection ⇔ focal infiltrates → tuberculosis ??

(acid-fast bacillus (AFB) smears of sputum)

HIV infection ⇔ *S pneumoniae* CAP ? → **urinary antigen testing** may be useful.



Chest radiograph demonstrating diffuse bilateral infiltrates in a patient with Pneumocystis carinii pneumonia.

Other Laboratory Tests

Extrapulmonary findings → atypical CAP

Transaminase levels → psittacosis,

→ Q fever, or

→ *Legionella* pneumonia ??

Phosphorous levels

hypophosphatemia or microscopic hematuria → Legionnaires disease

urinalysis,

Ferritin,

creatine phosphokinase (CPK),

C-reactive protein (CRP),

cold agglutinin titers.

FNA, TTA, and Bronchoscopy With BAL

CT scanning

Underlying bronchogenic carcinoma ?

Any abnormalities are not consistent with the diagnosis of pneumonia only.

Pneumococcal pneumonia *produces consolidation in the right upper lobe with multiple air bronchograms (black branching structures) present since the spaces surrounding the air-filled bronchi normally contain air but now are filled with inflammatory exudate*

CAP-associated complications

Empyema (*Str. pneumoniae, Kleb. pneumoniae,* group *A* strept.)

Cavitation *K pneumoniae* infections.

Myocardial infarction, due to fever

Pneumococcal sepsis, 12-24 h, mortality

Morbidity and mortality

Highest in elderly patients and in immunocompromised hosts.

- Comorbidities,
- Increased respiratory rate,
- Hypotension,
- Fever,
- Multilobar involvement,
- Anemia,
- Hypoxia.*

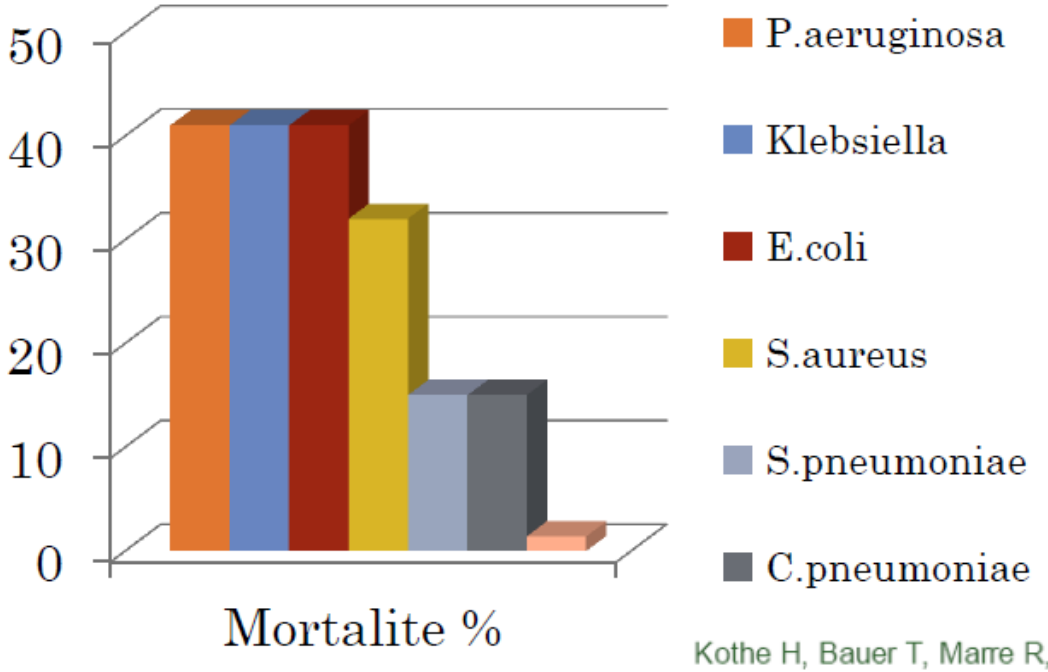
*Nakanishi M, et al. Significance of the progression of respiratory symptoms for predicting community-acquired pneumonia in general practice. *Respirology*. Aug 2010;15(6):969-74.

Mortalite & Etken

- *P.aeruginosa*
- *Klebsiella*
- *E.coli*

%41

- *S.aureus* %32
- *Streptococcus pneumoniae* %12-15
- *Chlamydophila penuemoniae* %12-15
- *Mycoplasma pneumoniae* % 1.4



Kothe H, Bauer T, Marre R, et al. Outcome of community-acquired pneumonia: influence of residence status and antimicrobial treatment. Eur Respir J 2008; 32:139.

Negative prognostic factors

- preexisting lung disease,
- underlying cardiac disease,
- poor splenic function,
- advanced age,
- multilobar involvement,
- delayed initiation of appropriate antimicrobial therapy.

*Falguera M, et al. Etiology and outcome of community-acquired pneumonia in patients with diabetes mellitus. *Chest*. Nov 2005;128(5):3233-9.

Pleural effusion

Usually due to *H influenzae* infection,

Pleural effusion ⇔ CAP ⇔ extrapulmonary manifestations ⇒ *Legionella* inf. ??

Pleural effusion ⇔ appropriate epidemiologic history findings (such as contact with a rabbit or deer), ⇒ tularemia ??

CAP ⇔ large pleural effusion (serosanguineous) ⇒ group A streptococciis

Empyema

Klebsiella,

group A streptococci,

S pneumoniae.

Differential Diagnosis

*Acute bronchitis

*Myocardial infarction

*Congestive heart failure and pulmonary edema

*Pulmonary fibrosis

*Sarcoidosis

*SLE pneumonitis

*Pulmonary drug hypersensitivity reactions (nitrofurantoin)

*Drug-induced pulmonary disease

*Pulmonary embolus or infarction

*Bronchogenic carcinomas

*Radiation pneumonitis

*Wegener granulomatosis

*Lymphomas

*Tracheobronchitis

Hospital Care

Mild CAP → may be treated in an ambulatory setting,

Moderately to severely ill patients with CAP → should be hospitalized.

Severe CAP →
- oxygen and/or ventilatory support
- require invasive ventilation
- nonpermanent artificial airway,
- require admission to an intensive care unit (ICU).

Hospital Care

Severe CAP → underlying severe cardiopulmonary disease,

Direct medical efforts:
- supporting cardiopulmonary function ↔
- administering antibiotics for CAP.

Severe CAP and hypotension or shock →
- Pulmonary embolism ??
- Acute myocardial infarction ??
- Diminished or absent splenic function ??

Empirical Antimicrobial Therapy for Community-Acquired Pneumonia In Immunocompetent Adults

Patient, Setting	Common Pathogens	Empirical Therapy
Outpatients		
<60 yr No comorbid diseases	*Streptococcus pneumoniae* *Mycoplasma pneumoniae* *Chlamydia pneumoniae* *Haemophilus influenzae* *Viruses*	Macrolide or doxycycline
>65 yr or with comorbid disease or antibiotic therapy within last 3 mo	*S. pneumoniae* (drug-resistant) *M. pneumoniae* *C. pneumoniae* *H. influenzae* Viruses Gram-negative bacilli‡ *S. aureus* ‡	Macrolide or doxycycline fluoroquinolone* Beta-lactam¶ and macrolide
Inpatients		
Not severely ill	*S. pneumoniae* *H. influenzae* Polymicrobial Anaerobes *S. aureus* *C. pneumoniae* Viruses	Macrolide and cefotaxime or ceftriaxone, or beta-lactam or beta-lactamase inhibitor¶; fluoroquinolone‡ alone
Severely ill	*S. pneumoniae* § *Legionella* spp. Gram-negative bacilli *M. pneumoniae* Viruses *S. aureus*	Azithromycin, or fluoroquinolone‡ and cefotaxime, ceftriaxone, or beta-lactam or beta-lactamase inhibitor¶ If *P. aeruginosa* possible—IV macrolide or fluoroquinolone and aminoglycoside IV, or antipseudomonal quinolone and antipseudomonal beta-lactam If MRSA possible, add vancomycin or linezolid

*In the outpatient setting, many authorities prefer to reserve fluoroquinolones (levofloxacin, gatifloxacin, moxifloxacin, gemifloxacin) for patients with comorbid diseases or risk factors.
†In most cases, patients with pneumonias caused by these organisms should be hospitalized.
‡Levofloxacin, gatifloxacin, moxifloxacin.
§Critically ill patients in areas with significant rates of high-level pneumococcal resistance and a suggestive sputum Gram stain should receive vancomycin or a newer quinolone pending microbiologic diagnosis.
¶Piperacillin-tazobactam or ampicillin-sulbactam.
¶Cefpodoxime, cefuroxime, high-dose amoxicillin, amoxicillin-clavulanate, or parenteral ceftriaxone followed by oral cefpodoxime. **Cefotaxime, ceftriaxone, ampicillin-sulbactam, or high-dose ampicillin Adapted from Mandell LA, Wunderink RG, Anzueto A, et al; Infectious Diseases Society of America; American Thoracic Society. Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. Clin Infect Dis 2007;44 Suppl 2:S27-S72.

Pathogen-Specific Therapy for Community-Acquired Pneumonia in Adults

Organism	Primary Therapy
Streptococcus pneumoniae, penicillin-susceptible	Penicillin G; amoxicillin
S. pneumoniae, penicillin-resistant	Cefotaxime, ceftriaxone, fluoroquinolone, vancomycin, others, based on susceptibility studies
Haemophilus influenzae	Second- or third-generation cephalosporin, doxycycline, beta-lactam or beta-lactamase inhibitor, azithromycin, TMP-SMX
Moraxella catarrhalis	Second- or third-generation cephalosporin, TMP-SMX macrolide, beta-lactam or beta-lactamase inhibitor
Legionella spp.	Macrolide, tetracycline, fluoroquinolone alone
Mycoplasma pneumoniae	Doxycycline, macrolide
Chlamydia pneumoniae	Doxycycline, macrolide
Anaerobes	Beta-lactam or beta-lactamase inhibitor, clindamycin
Enteric gram-negative bacilli	Third-generation cephalosporin ± aminoglycoside; carbapenem
Pseudomonas aeruginosa	Aminoglycoside + ticarcillin, piperacillin, mezlocillin, ceftazidime, cefepime, aztreonam, or carbapenem
Staphylococcus aureus, methicillin-susceptible	Nafcillin or oxacillin
S. aureus, methicillin-resistant	Vancomycin or linezolid
Bacillus anthracis	Ciprofloxacin or doxycycline + two of the following: rifampin, vancomycin, penicillin, ampicillin, chloramphenicol, imipenem, clindamycin, clarithromycin
Influenza A, within 48 hr of symptom onset or immunocompromised host	Amantidine, rimantadine, oseltamivir, zanamivir
Influenza B, within 48 hr of symptom onset or immunocompromised host	Oseltamivir, zanamivir

*For community-acquired methicillin-resistant *S. aureus*, some clinicians add agents that inhibit toxin production, such as clindamycin, when susceptibility patterns allow.
TMP-SMX, trimethoprim-sulfamethoxazole.
Adapted from Mandell LA, Wunderink RG, Anzueto A, et al; Infectious Diseases Society of America; American Thoracic Society: Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. Clin Infect Dis 2007;44 Suppl 2:S27-S72.

Duration of Therapy

10 to 14 days

Longer courses

tissue necrosis
- Legionella spp.,
- S. aureus,
- Pseudomonas aeruginosa

live intracellularly - C. pneumoniae

Comorbidities local (COPD) or systemic

(hematologic malignancy) immunity.

Failure to Respond to Initial Therapy

- cancers,
- pulmonary edema,
- pulmonary embolus,
- pulmonary hemorrhage,
- connective tissue diseases,
- drug toxicity
- fungi, mycobacterial, P. Jiroveci, Pseudomonas aeruginosa
- a secondary infection, such as postinfluenza staph. pneumonia,
- poor adherence, poor drug absorption, or drug interaction.
- immunodeficiency (HIV, hematologic malignancy)
- anatomic derangement (COPD, bronchiectasis, neoplasm)

Discharge Criteria

Candidates for discharge should have no more than one of the following poor prognostic indicators:

- temperature higher than 37.8° C,
- pulse higher than 100 beats/min,
- respiratory rate higher than 24/min,
- systolic blood pressure lower than 90 mm Hg,
- oxygen saturation lower than 90%, and
- inability to maintain oral intake.

Vaccination

Pneumococcal vaccines prevent pneumococcal bacteremia but not necessarily pneumococcal pneumonia.

Two pneumococcal vaccines are approved in the USA.

Prevnar 13, a pneumococcal 13-valent conjugate vaccine is approved for children aged 6 weeks to 5 years and adults aged 50 years or older.

The 23-valent vaccine (Pneumovax 23) is approved for adults aged 50 years or older and persons aged 2 years or older who are at increased risk for pneumococcal disease.

Vaccination

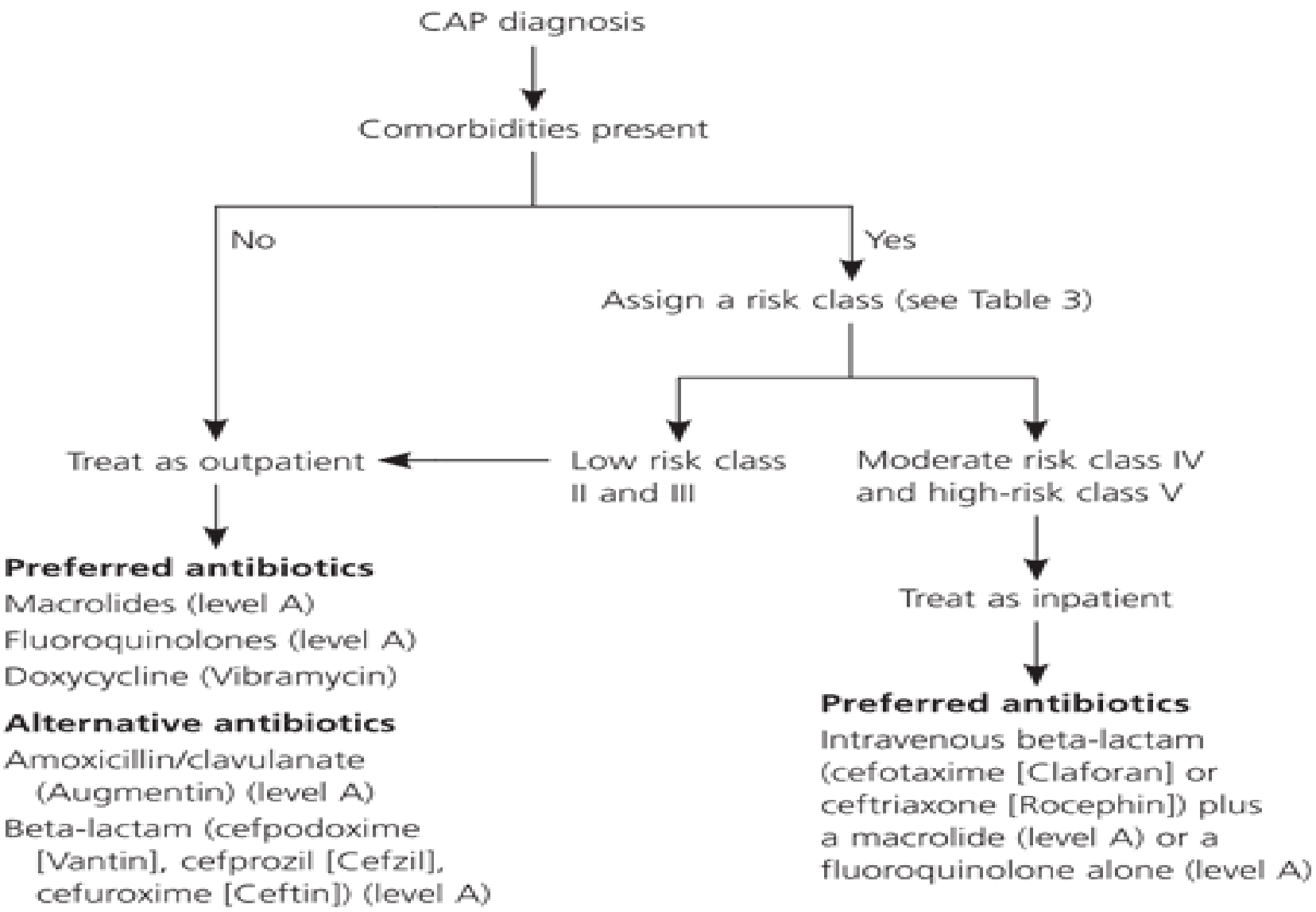
On October 12, 2012, the Advisory Committee on Immunization Practices (ACIP) published updated recommendations for pneumococcal vaccination of high-risk adults.

The committee now recommends routine use of Prevnar 13 in addition to the previously recommended Pneumovax 23 for

- adults aged 19 years and older with immunocompromising conditions (eg, HIV, cancer, renal disease),

- functional or anatomic asplenia,
- cerebrospinal fluid leaks,
- cochlear implants.

Algorithm for the management of CAP



Summary

* Antibiotic therapy for CAP should always be selected with patient characteristics, place of acquisition, severity of disease, and local resistance patterns in mind.

* Antimicrobial therapy should be narrowed whenever a pathogen is identified.

* Most pneumonias, with some exceptions, can be cured with 10 to 14 days of antibiotic therapy.

* Failure to respond to initial therapy should raise questions of diagnosis, treatment adherence, and antimicrobial resistance.


THANK
YOU!