

- Large studies have validated a scoring system the Pneumonia Severity Index (PSI) that stratifies patients with CAP according to their age, co-morbidities and severity, to define their risk of death

problems:

1. Young patients with widespread chest X-ray changes or who are hypoxic on air (eg PaO₂ <70 mm Hg; O₂ saturation <94%) should be considered to be at high risk, regardless of their PSI class.
2. PSI provides a guide to overall mortality risk, but some patients may worsen during the initial 24 to 48 hrs
3. Patients in PSI class IV and V are at greatest risk of requiring ICU admission, but 14% to 32% of patients with CAP requiring ICU admission initially have PSI class III or less.

Patient-Related Factors	Laboratory Abnormalities
Male sex	Blood urea ^a ; nitrogen >19.6 mg/dL
Absence of pleuritic chest pain	Leukocytosis or leukopenia
Nonclassic clinical presentation	Multilobar radiographic abnormalities
Neoplastic illness	Rapidly progressive radiographic abnormalities during therapy
Neurologic illness	Bacteremia
Age >65 years	Hyponatremia (<130 mmol/L)
Family history of severe pneumonia or death from sepsis	Multiple organ failure
Abnormal Physical Findings	Respiratory failure
Respiratory rate >30 breaths/min on admission	Hypoalbuminemia
Systolic (<90 mm Hg) or diastolic (<60 mm Hg) hypotension	Arterial pH <7.35
Tachycardia (>125 beats/min)	Pleural effusion
High fever (>40°C) or afebrile	Pathogen-Related Factors
Therapy-Related Factors	High-risk organisms
Delay in initial antibiotic therapy (more than 4 hours)	Type III pneumococcus, <i>Staphylococcus aureus</i> , gram-negative bacilli (including <i>Pseudomonas aeruginosa</i>), aspiration organisms, severe acute respiratory syndrome (SARS)
Initial therapy with inappropriate antibiotic therapy	Possibly high levels of penicillin resistance (minimal inhibitory concentration of at least 4 mg/L) pneumococcus
Failure to have a clinical response to empirical therapy within 72 hours	

- For patients requiring intensive care management, broad-spectrum antimicrobials are initially required to treat *Streptococcus pneumoniae*, *Legionella pneumophila*, and enteric Gram-negative bacilli.

- In nontropical regions, use:
azithromycin 500 mg IV, daily
OR
erythromycin 500 mg to 1 g IV (preferably through a central line), 6-hourly
PLUS EITHER
ceftriaxone 1 g IV, daily
OR
cefotaxime 1 g IV, 8-hourly
OR THE COMBINATION OF
benzylpenicillin 1.2 g IV, 4-hourly
PLUS
gentamicin 4 to 6 mg/kg IV, daily

- In patients with immediate penicillin hypersensitivity, in addition to azithromycin or erythromycin, use:
moxifloxacin 400 mg IV, daily.

- Modify therapy after microbiological diagnosis. Duration of therapy for class V CAP depends on the rate of patient response and the result of microbiological investigations.

- Switch to oral antibiotics after there has been significant improvement and the patient has been stable for 48 hours (generally a total (IV + oral) of 7 to 14 days therapy will be required).

- In some regions of tropical Australia, *Burkholderia pseudomallei* and *Acinetobacter baumannii* are important causes of severe CAP, with *B. pseudomallei* being second in incidence only to *Streptococcus pneumoniae*.

- Risk factors for *B. pseudomallei* and *A. baumannii* include diabetes, alcoholism, chronic renal failure and chronic lung disease.

- In these regions, as initial therapy use:
meropenem 1 g IV, 8-hourly
OR
imipenem 1 g IV, 6-hourly
PLUS EITHER
azithromycin 500 mg IV, daily
OR
erythromycin 500 mg to 1 g IV (preferably through a central line), 6-hourly.

- Modify therapy after microbiological diagnosis

- Treatment duration depends on the rate of patient response and the aetiology of the pneumonia.

Pneumonia Severity Index

risk factors for poor outcome

antibiotic therapy of severe CAP requiring ICU

community acquired pneumonia

general

- Community-acquired pneumonia (CAP) in adults is often caused by a single organism, the most common being *Streptococcus pneumoniae*, which is responsible for most cases of severe illness and death, particularly in the elderly.

- Other important causes of bacterial CAP in adults include:

- (i) *Mycoplasma pneumoniae*,
- (ii) *Chlamydia* (*Chlamydia pneumoniae*) and
- (iii) *Legionella* species.
- (iv) *Haemophilus influenzae* (is responsible for less than 5% of cases of CAP and is seen predominantly in chronic obstructive pulmonary disease.)

- The choice of antibiotic for CAP is usually empirical because the clinical presentation and X-ray appearances are not sufficiently specific to direct therapy against any one of the likely causative organisms, and standard microbiological tests have a relatively low yield

- Patient mortality and hospital length of stay are significantly reduced if antimicrobial therapy is commenced within 8 hours (and preferably 4 hours) of initial presentation with CAP.

epidemiological clues to aetiology

Condition	Commonly Encountered Pathogens
Alcoholism	<i>Streptococcus pneumoniae</i> (including penicillin-resistant), anaerobes, gram-negative bacilli (possibly <i>Klebsiella pneumoniae</i>), tuberculosis
Chronic obstructive pulmonary disease/current or former smoker	<i>S. pneumoniae</i> , <i>Haemophilus influenzae</i> , <i>Moraxella catarrhalis</i>
Residence in nursing home	<i>S. pneumoniae</i> , gram-negative bacilli, <i>H. influenzae</i> , <i>S. aureus</i> , <i>Chlamydia pneumoniae</i> , consider <i>M. tuberculosis</i> . Consider anaerobes, but less common.
Poor dental hygiene	Anaerobes
Bat exposure	<i>Histoplasma capsulatum</i>
Bird exposure	<i>Chlamydia psittaci</i> , <i>Cryptococcus neoformans</i> , <i>H. capsulatum</i>
Rabbit exposure	<i>Francisella tularensis</i>
Travel to southwestern USA	<i>Coccidioidomycosis</i> , hantavirus in selected areas
Exposure to farm animals or parturient cats	<i>Coxiella burnetii</i> (Q fever)
Postinfluenza pneumonia	<i>S. pneumoniae</i> , <i>S. aureus</i> , <i>H. influenzae</i>
Structural disease of lung (e.g., bronchiectasis, cystic fibrosis)	<i>P. aeruginosa</i> , <i>P. cepacia</i> , or <i>Staphylococcus aureus</i>
Sickle cell disease, asplenia	<i>Pneumococcus</i> , <i>H. influenzae</i>
Suspected bioterrorism	Anthrax, tularemia, plague
Travel to Asia	Severe acute respiratory syndrome (SARS), tuberculosis, melioidosis

RISK FACTORS FOR DEVELOPING SEVERE COMMUNITY-ACQUIRED PNEUMONIA

Advanced age
Comorbid illness (e.g., chronic respiratory illness, cardiovascular disease, diabetes mellitus, neurologic illness, renal insufficiency, malignancy)
Cigarette smoking
Alcohol abuse
Absence of antibiotic therapy before hospitalization
Failure to contain infection to its initial site of entry
Immune suppression
Genetic polymorphisms in the immune response

risk factors for severe community acquired pneumonia

investigation

Test	Sensitivity	Specificity	Comment
Chest radiograph	65%-85%	85%-95%	Computed tomography is more sensitive to infiltrates. Recommended for all patients.
Computed tomography	Gold standard	Not infection specific	Should not be done routinely but helpful to identify cavitation and loculated pleural fluid. Recommended in the evaluation of nonresponding patients.
Blood cultures	10%-20%	High when positive	Usually shows pneumococcus (in 50%-80% of positive samples) and defines antibiotic susceptibility. Recommended in patients with severe CAP.
Sputum Gram's stain	40%-100% depending on criteria	0-100% depending on criteria	Can correlate with sputum culture to define predominant organism and can use to identify unsuspected pathogens. Recommended if sputum culture obtained. May not be able to narrow empirical therapy choices.
Sputum culture			Use if suspect drug-resistant or unusual pathogen, but positive result cannot separate colonization from infection.
Oximetry or arterial blood gas			Both define severity of infection, need for oxygen, if hypercarbia is suspected, a blood gas sample is needed. Recommended in severe community-acquired pneumonia.
Serologic testing for <i>Legionella</i> , <i>Chlamydia pneumoniae</i> , <i>Mycobacterium pneumoniae</i> , viruses			Accurate, but usually requires acute and convalescent titers collected 4 to 6 weeks apart. Not routinely recommended.
<i>Legionella</i> urinary antigen	50%-80%		Specific to serogroup 1, but the best acute diagnostic test for <i>Legionella</i>
Pneumococcal urinary antigen	70%-100%	80%	False positives if recent pneumococcal infection. Can increase sensitivity with concentrated urine