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Community acquired pneumonia: assessment and treatment

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Definitions

Pneumonia is an acute illness characterised by symptoms and signs of lower respiratory tract infection, with new radiographic shadowing for which there is no alternative explanation. Community acquired pneumonia (CAP) is pneumonia acquired outside a hospital or long-term care facility. By contrast, hospital acquired pneumonia is pneumonia developing 48 hours after admission.

Epidemiology

The incidence of CAP in the UK is 5–11 per 1,000 adults, increasing with extremes of age. CAP accounts for only 5–12% of lower respiratory tract infections managed by general practitioners. Patients managed in the community have low mortality (<1%). Hospital admission rates for CAP are increasing, with admission indicated in 22–42% of adults with CAP, and associated with mortality of 5–14%. About 5% of patients hospitalised for CAP require treatment in an intensive care unit and these severely unwell patients have a mortality of 35%.[2]

Pathogenesis

Inhalation of airborne pathogens is central to the development of CAP in immunocompetent adults. Aspiration of oropharyngeal/gastric flora, haematogenous spread of infection and invasion from infected adjacent structures are found less commonly. Infection occurs when pathogens invade the lower respiratory tract.

Defective pulmonary defences increase the likelihood of invasion. Mucociliary transport is depressed by age, smoking, dehydration, opiates, viral infection and chronic bronchitis. Anatomic changes such as emphysema, bronchiectasis, and obstructive tumours also inhibit pathogen clearance. Local inflammatory infiltrates contribute to proteolysis and injury to the bronchial epithelium. If host cellular and humoral immune responses are diminished, the risk of pneumonia is also increased.

Thus, the development of pneumonia, as well as its severity, is a balance between pathogen (virulence, inoculum size) and host factors.

Microbiology

The aetiological agent responsible for CAP is established in less than one-third of cases. Nevertheless, evidence suggests CAP is most commonly caused by bacterial infection. *Streptococcus pneumoniae, Haemophilus influenzae* and *Moraxella catarrhalis* account for at least 50% of CAP cases, with *S. pneumoniae* the most commonly identified pathogen.[2] *Mycoplasma pneumoniae, Chlamydophilia pneumoniae, Chlamydophilia psittaci, Coxiella burnetii* and *Legionella pneumophilia* are responsible for up to 15% of cases and may be copathogens in other cases.[3]

The relative frequency of specific pathogens varies between population groups.[2] In elderly patients, *S. pneumoniae* remains the most common pathogen with *M. pneumoniae* and *L. pneumophilia* less frequent. In patients with chronic obstructive pulmonary disease, *H. influenzae* and *M. catarrhalis* are thought to be more common. Alcoholic patients are at increased risk of bacteraemic *S. pneumoniae*, Gram-negative bacteria (especially *Klebsiella*), *Legionella* and mixed infections).

Viruses, fungi and parasites also contribute to CAP. Viral pathogens account for up to 30% of cases, with influenza A and rhinovirus the most common.[4] Viral infection may precede bacterial infection.

The prevalence of polymicrobial CAP is unknown.

Presentation

Typical clinical features of CAP are cough, dyspnoea, fever above 38°C, chills, rigors and pleuritic chest pain. The aetiological agent cannot reliably be predicted from history and examination,[5] but certain clinical features suggest specific pathogens:

- Acute onset, high fevers and pleuritic chest pain are characteristic of *S. pneumoniae*.
- *Legionella* is more commonly associated with multisystem pathology with gastrointestinal symptoms, neurological involvement (eg encephalopathy) or biochemical derangement (eg raised creatine kinase, abnormal liver function tests).[6,7]
- *C. pneumoniae* infection is associated with a prodrome of several days and headache.[8]
- *C. burnetii* infection is thought to cause high fevers and dry cough.[9]
- *Staphylococcus aureus* pneumonia often follows viral infection.
- A purely viral aetiology for pneumonia is more common in children but the presenting features are typically a slow onset of rhinitis and wheeze.[10]

Diagnosis

A full history and examination should be performed for all patients with suspected CAP.

In the community, a pragmatic approach to the diagnosis is appropriate, and investigations such as chest radiography may not be necessary unless the patient is unwell, the diagnosis is unclear, progress is not as expected or pneumonia is recurrent.

Patients sufficiently unwell to require hospital attendance (Fig 1) require chest radiography. CAP may be suggested by the presence of consolidation, air bronchograms, cavitation or parapneumonic effusion (Fig 2). Routine blood tests should be performed, including full blood count, renal and hepatic indices and inflammatory markers. Oxygenation should be assessed by pulse oximetry and also arterial blood gases if saturations are below 94% or there are features of severe pneumonia.[2]

In low-to-moderate severity CAP, microbiological investigations should be selected as clinically indicated. Patients with severe CAP require the full spectrum of microbiological investigations,[2] including blood cultures (Fig 3). Culture yield is greatest prior to the commencement of antibiotics. Paired serological analysis, with post-infectious samples taken 7–10 days after admission, may provide retrospective confirmation of microbiological aetiology.

Assessment of severity

Illness severity in CAP is used as an indicator of prognosis and to guide management. Many different severity assessments are available. Currently, the British Thoracic Society (BTS) recommends the CURB-65 score in conjunction with clinical judgement (Fig 1).[2] CURB-65 stratifies patients based on the presence of confusion, urea above 7 mmol/l, respiratory rate over 30/min, blood pressure (BP) below 60/90 mmHg and age above 65 years. Mortality at 30 days increases with the number of criteria met.

Patients scoring 0–1 (low severity) have a mortality below 3% and can be treated in the community. Patients scoring 2 (moderate severity) have a mortality of 9% and require close observation, possibly with a short hospital admission. Patients scoring 3 or more (high severity) have a mortality of 15–40% and require urgent hospital admission, possibly with high dependency care.

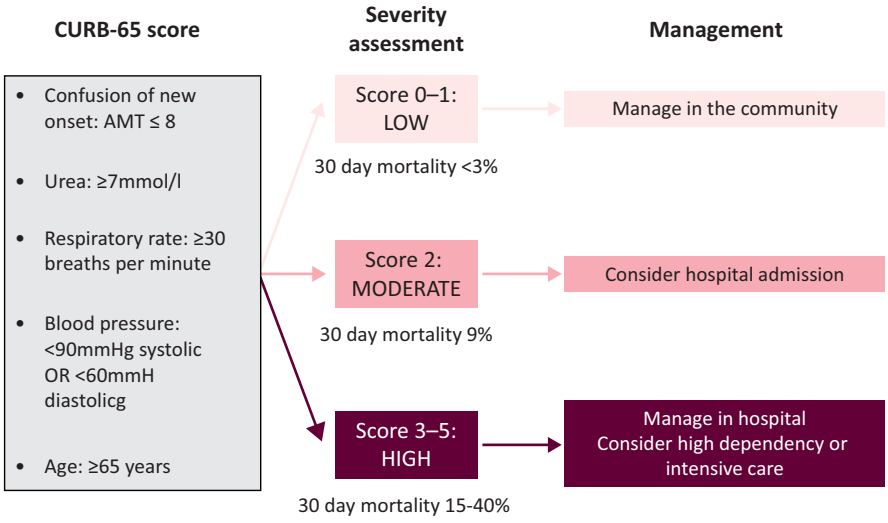


Fig 1. Severity assessment using the CURB-65 score. AMT = abbreviated mental test score. Figure based on BTS guidelines.[21]

Key points

About one-third of patients with community acquired pneumonia (CAP) require admission to hospital

The CURB-65 score should be used to assess disease severity and guide management

Initial management is with empirical antibiotics with or without supplemental oxygen

Adherence to CAP guidelines and management bundles is likely to improve patient outcomes

Vaccination is indicated in patients aged over 65 years or with chronic disease or immunocompromise

KEYWORDS: antibiotic, care bundle, community acquired pneumonia, severity assessment, vaccination

Management

A number of international guidelines for the management of CAP are available but their magnitude makes them difficult to implement and there is evidence of marked variation in clinical practice.[11,12]

The care bundle approach

Care bundles act as an aide-memoire for essential clinical interventions. The aim is to complete the entire bundle as a single intervention, rather than undertaking individual components. Bundle compliance supports improved patient outcomes and efficient use of resources.[13] CAP care bundles are typically based around BTS guidance[2] and include:

- oxygen assessment and appropriate treatment
- severity assessment based on CURB-65, with treatment according to severity
- antibiotic dosing within four hours of presentation
- patient information leaflets.

General supportive care

All patients with CAP should be advised to rest and avoid smoking. Hydration and adequate nutrition should be maintained, with supplemental oxygen used appropriately to maintain saturations 94–98% and PaO_2 >8kPa for those not at risk of hypercapnic respiratory failure. Early mobilisation and prophylaxis for venous thromboembolism are recommended.

Antimicrobial therapy

Initial antimicrobial therapy is often empirical, based on pathogen prevalence and local antibiotic resistance profiles. BTS guidelines[2] provide the framework for most local antibiotic policies (summarised in Fig 4).

Antibiotics should be started promptly (ideally within 4 hours) and continued for a total of seven and 7–10 days in low-to-moderate and high severity CAP,

respectively. Patients treated with parenteral antibiotics should be transferred to oral medication as soon as there is clinical improvement.

Pathogen-directed antibiotics should be used in preference to empirical antibiotics if culture results are available. If *S. aureus* or Gram-negative bacteria are isolated or suspected, a prolonged antibiotic course (up to 21 days) may be appropriate.

Response to treatment

Most patients with CAP respond to treatment over 2–3 days. It should be noted that radiographic evidence of resolution lags behind clinical resolution.[14,15]

The problem in patients who fail to respond to initial antimicrobial therapy may be a resistant or unsuspected pathogen, inadequate dosing or absorption of medication, or misdiagnosis. Such patients should be carefully reviewed with a repeat infection screen and alternative diagnoses considered. Diagnoses which may masquerade as CAP or occur concurrently include:

- pulmonary embolism
- congestive cardiac failure
- lung cancer
- cryptogenic organising pneumonia
- eosinophilic pneumonia
- vasculitis
- pulmonary haemorrhage.

Hospital discharge should not be considered if a patient has any of the following: temperature above 37.8°C, heart rate over 100 bpm, respiratory rate above 24 bpm, systolic BP below 90 mmHg, saturations below 90% on air, altered cognition or is unable to tolerate oral intake.

Complications of community acquired pneumonia

- Local complications of CAP include parapneumonic effusion and empyema which affect 36-66% and fewer than 1% of hospitalised patients, respectively (Fig 2).[16,17] Pleural aspiration is indicated, followed by intercostal drain insertion if organisms or pus are identified or fluid pH is below 7.2.
- Lung abscess is a rare complication. In most cases, abscesses respond to antibiotics but prolonged courses may be necessary, as may surgical drainage.
- Severe pneumonia may be complicated by sepsis and acute respiratory distress syndrome.
- Metastatic infection (endocarditis, septic arthritis, splenic abscess) occurs rarely, with bacteraemia.

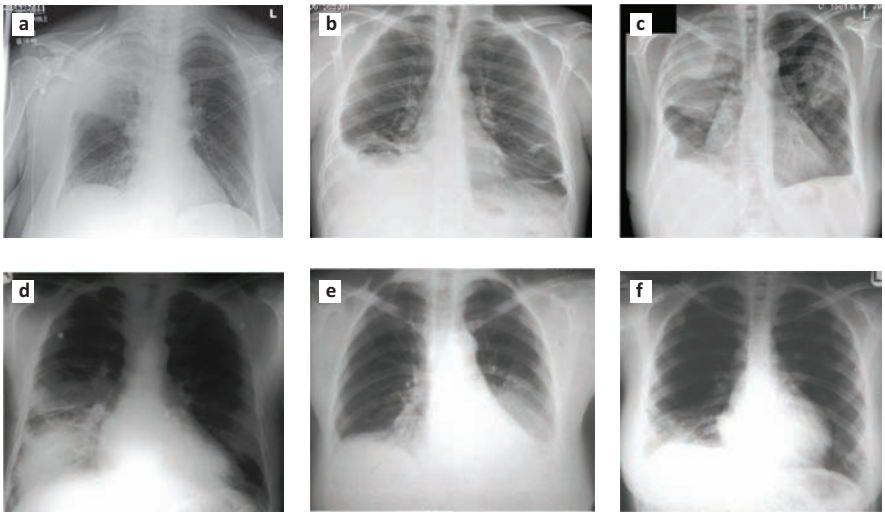
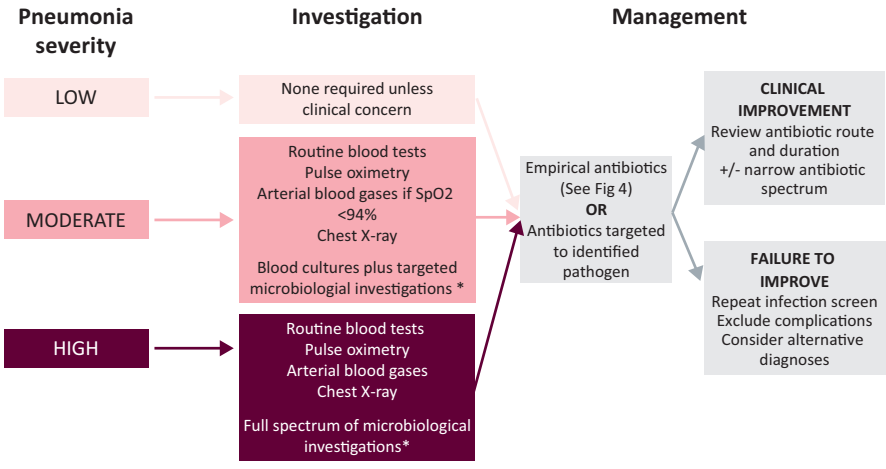


Fig 2. Radiographic features of community acquired pneumonia and its differential diagnoses. CAP and associated complications: a) right upper lobe consolidation; b) right parapneumonic effusion with underlying collapse and linear atelectasis; c) multi lobar consolidation with air bronchograms and loculated effusion (empyema). **Pathologies masquerading as CAP:** d) unilateral pulmonary oedema; e) oesophageal rupture with pneumomediastinum, left side effusion and pulmonary infiltrates; f) pulmonary embolism with right basal infiltrates.



*MICROBIOLOGICAL INVESTIGATIONS
- Culture and sensitivity: blood, sputum, pleural fluid
- Pleural fluid antigen tests: pneumococcus
- Urinary antigen tests: pneumococcus, *Legionella*
- PCR or direct immunofluorescence of respiratory samples : *Mycoplasma*, *Chlamydophilia,* respiratory viruses.
- Paired serology: *Mycoplasma*, *Legionella*, respiratory viruses

Fig 3. Investigation and management according to community acquired pneumonia severity. PCR = polymerase chain reaction. Figure based on BTS guidelines.[2]

Follow-up

Patients should be reviewed six weeks after recovery from CAP. Chest radiograph is indicated only if symptoms persist or there is a clinical suspicion of malignancy.

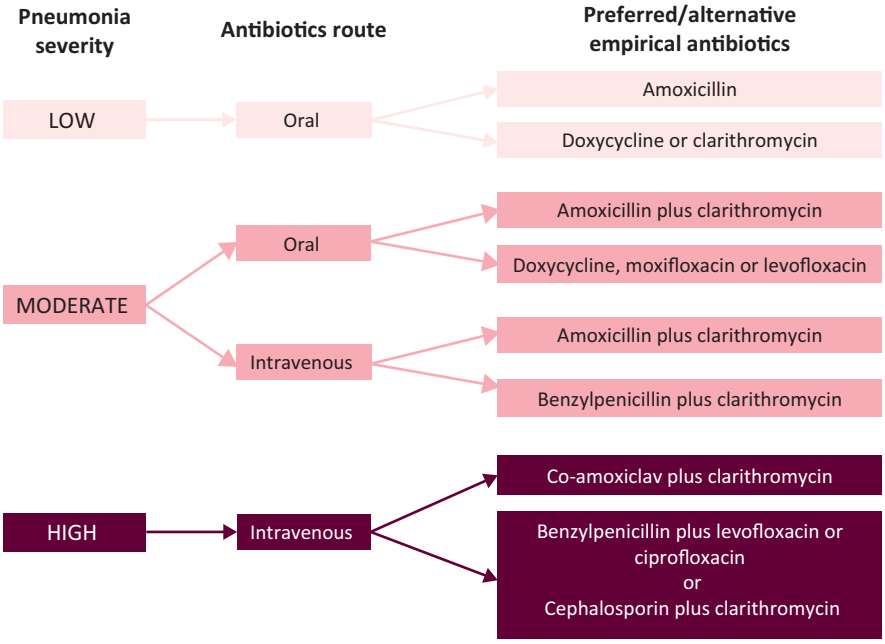


Fig 4. Recommended empirical antibiotic therapy according to community acquired pneumonia severity. Figure based on BTS guidelines.[2]

Prevention

Vaccination against *S. pneumoniae* is widely available. It does not appear to reduce the incidence of CAP or rates of hospitalisation[18] but does reduce illness severity.[19] The Department of Health recommends vaccination for all patients aged over the age of 65 and those at risk of invasive pneumococcal disease (chronic disease, immunodeficiency or immunosuppression).[20] Patients meeting these criteria who are admitted to hospital with CAP should be offered vaccination at convalescence.

Conflict of interests

None declared.

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