Recognizing and managing severe community-acquired pneumonia

Introduction

Community-acquired pneumonia (CAP) is a common condition. It results in 50 000–83 000 hospital admissions in the UK annually. It is particularly common in the very young and the elderly. Between 22 and 44% of patients with CAP are admitted to hospital (Woodhead et al, 1987; Guest and Morris, 1997). In hospitalized patients, the overall mortality is between 5 and 12%. However, in the older age group (≥65 years) the mortality is around 20% (Myint et al, 2005) and in those patients admitted to the intensive care unit (ICU), it is as high as 50%. Hence it is important to assess patients on admission, to identify those with severe CAP and manage them appropriately.

This article outlines the acute management of CAP in the UK hospital setting.

Definition

CAP is an acute illness with clinical features of lower respiratory tract infection characterized by new radiographical shadowing and no other explanation for the illness.

Aetiology

The commonest pathogen associated with CAP is *Streptococcus pneumoniae* and the profile has not changed over the years (Howard et al, 2005). However, in about a third of patients, no organism can be identified.

The microorganisms tend to have seasonal (*S. pneumoniae*, Legionella, *Coxiella burnetti*, influenza) or annual variations (*Mycoplasma pneumoniae*). Common causal pathogens are listed in *Table 1*.

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Clinical features

The common clinical features are cough, which may be productive of sputum, fever, shortness of breath and pleuritic chest pain. There are no clinical features pathognomic of a particular aetiology, although *S. pneumoniae* is typically associated with onset of fever with chills and pleuritic chest pain. It is important to remember that fever may not be present in older patients (Marrie et al, 1985) and confusion might be a predominant feature. This is difficult to assess as a significant proportion of patients in this age group may have background cognitive impairment. The risk of aspiration pneumonia is high in the older population.

History taking

It is important to find out about the onset and duration of symptoms of cough, fever, dyspnoea and chest pain. Any associated symptoms of upper respiratory tract infection and flu-like symptoms (malaise, generalized aches and weakness) should be documented. History of foreign travel is relevant, especially if travel has been to countries with a high prevalence of infectious diseases like tuberculosis. History of medications including long-term steroids and immunosuppressive treatment should be specifically asked about, as should any antibiotics used for the current illness before hospitalization. It is essential to document the history of smoking and alcohol intake, particularly any binge drinking episodes, which would raise the risk of aspiration.

Table 1. Common pathogens

Bacteria	*Streptococcus pneumoniae*
	Haemophilus influenzae
	Moraxella catarrhalis
	Staphylococcus aureus
	Legionella spp.
	Gram-negative enteric bacilli
Viruses	Influenza A and B
	Respiratory syncytial virus
	Adenovirus
Atypical micro-organisms	*Mycoplasma pneumoniae*
	Chlamydia spp
	Coxiella burnetti

Examination

A good general examination is always helpful. The temperature, pulse and blood pressure should be documented. Presence or absence of cyanosis, clubbing, pallor, icterus and jugular venous pressure (normal or raised) should be checked and documented. Oxygen saturations should be recorded and it is important to note whether the measurement is on room air or supplemental oxygen, in which case the concentration of supplemental oxygen, should be noted. The presence of confusion should also be documented, ideally with a mini mental score, which helps in assessing severity of pneumonia.

On respiratory examination it is vital to note the respiratory rate. The most common findings in patients with lobar pneumonia are dull note on percussion, bronchial breathing and positive whispering pectoriloqy. However, these typical findings may not be present in all patients.

Investigations

Routine blood investigations including full blood count, liver and renal function tests should be measured. Serial measurement of C-reactive protein (CRP) may be useful in monitoring treatment response. Chest X-ray (CXR) is essential to look for segmental or lobar consolidation. In patients with severe pneumonia there might be multilobar involvement. However, in the elderly patient CXR changes might not be significant. Patient's oxygenation status should be noted by doing a pulse oximetry and if oxygen saturation is <92% on room air, arterial blood gas should be taken. Sputum and blood cultures should be sent, preferably before antibiotic treatment. However,

Table 2. Investigations in community-acquired pneumonia

Biochemical	Full blood count
	Renal function test
	Liver function test
	C-reactive protein
Radiological	Chest X-ray
Microbiological	Sputum cultures
	Blood cultures
	Paired serological tests (in severe cases)

Table 3. Guidelines for choice of antibiotics in community-acquired pneumonia

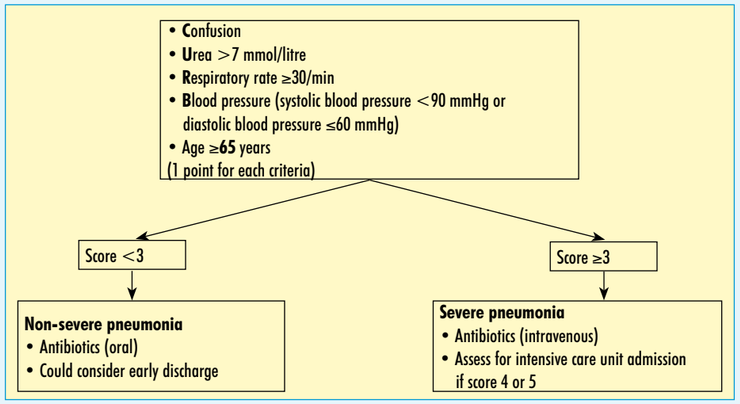
Severity	Preferred	Alternative
Non-severe	Amoxicillin 0.5–1.0 g thrice daily orally + Erythromycin 500 mg four times daily orally OR clarithromycin 500 mg twice daily orally	Levofloxacin 500 mg once daily orally OR Moxifloxacin 400 mg once daily orally
Severe	Co-amoxiclav 1.2 g thrice daily intravenously OR cefuroxime 1.5 g thrice daily OR Cefotaxime 1 g thrice daily intravenously OR cetriaxone 2 g once daily intravenously + Erythromycin 500 mg four times daily OR clarithromycin 500 mg twice daily intravenously	Levofloxacin 500 mg twice daily intravenously or orally + Benzylpenicillin 1.2 g four times daily intravenously

patients may have a dry cough and it may not be possible to get a sputum sample. Blood cultures are positive in only about a quarter of patients at best. Paired serological tests (done 7–10 days apart) for atypical pathogens (*M. pneumoniae*, *Chlamydia* spp, *C. burnetti*), influenza (A and B) virus, respiratory syncytial virus, adenovirus and *Legionella pneumophila* should be done in patients with severe pneumonia or patients unresponsive to standard treatment. The investigations are outlined in *Table 2*.

Recognizing severe pneumonia

It is essential to identify patients with severe pneumonia as early as possible since it has implications for management and mortality. There are various severity assessment tools but the most pragmatic and useful criteria are the CURB-65 (Confusion, Urea, Respiratory rate, Blood pressure, age ≥ 65 years) score devised by Lim et al (2003) as detailed in *Figure 2*. This relies on simple clinical measures and a single laboratory investigation (blood urea) readily available in most UK hospitals. This helps in identifying patients with severe pneumonia and initiating appropriate treatment promptly. Furthermore, by flagging up patients with severe pneumonia, it is possible to keep these patients under close observation so that if their condition deteriorates they can be transferred to ITU immediately.

Figure 2. Flow chart for severity assessment using CURB-65 (Confusion, Urea, Respiratory rate, Blood pressure, age ≥ 65 years) criteria.



Treatment

Antibiotics are the cornerstones of treatment of pneumonia. However, it is also important to ensure adequate supportive treatment – hydration (oral or intravenous), nutrition and good nursing care.

Particular emphasis should be given to oxygenation status. The aim should be to maintain oxygenation above 92%. Supplemental oxygen with nasal specs or venturi mask should be provided if oxygen saturations are below 92%. Venturi mask is preferable since it delivers a more accurate concentration of oxygen than nasal specs.

Antibiotic treatment should be guided by the severity of the patient's pneumonia assessed by CURB-65. However, local antibiotic resistance patterns should be taken into consideration. A guide to antibiotic treatment is outlined in *Table 3* (British Thoracic Society, 2001; BTS Pneumonia Guidelines Committee, 2004). However, there are certain points that need to be considered. If patients have not been treated in the community for the illness and do not have severe pneumonia, then monotherapy with amoxicillin (or alternative in case of penicillin hypersensitivity or allergy) would be sufficient. In patients with non-severe pneumonia, who have been treated with amoxicillin in the community, monotherapy with macrolides alone (erythromycin or clarithromycin) might be sufficient, provided the dose and duration of treatment with amoxicillin was adequate. A safe approach might be to commence patients with non-severe pneumonia on two antibiotics and consider whether monotherapy might be appropriate on the post take ward round in consultation with senior colleagues. When local antibiotics guidelines are available, it is important to consider them before starting treatment.

When there is improvement clinically, antibiotics should be changed from the intravenous to oral route. In case of cephalosporins, switching to oral amoxicillin-clavulinic acid might be more appropriate than use of oral cephalosporins.

Table 4. Complications

Pulmonary	Para pneumonic effusion
	Empyema
	Lung abscess
	Respiratory failure and adult respiratory distress syndrome
Systemic complications	Septicaemia
	Metastatic abscesses
	Organ failure (renal, hepatic)

Complications

The common complications of CAP are listed in *Table 4*.

Conclusions

CAP is common in day-to-day practice. It is important to assess patients properly to identify those with severe CAP and initiate appropriate treatment at the earliest stage. By following a thorough and systematic approach using relatively simple measures, it is possible to manage this potentially life-threatening condition well. BJHM

Conflict of interest: none.

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KEY POINTS

- Community-acquired pneumonia results in 50 000–83 000 hospital admissions in the UK each year.
- It is important to recognize severe community-acquired pneumonia and start treatment early.
- Severe community-acquired pneumonia can be easily recognized by using simple clinical and biochemical parameters by CURB-65 (Confusion, Urea, Respiratory rate, Blood pressure, age ≥ 65 years) criteria.

Pathogen recognition by human lung epithelial cells

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Objective

Microbial stimulation of Toll-like receptors (TLRs) allows cells to recognize distinct pathogen-associated molecular patterns, initiating signalling pathways. Inadequate stimulation leads to microbial colonization, conversely, excessive activation may cause chronic inflammation. As lung epithelium contributes to the pulmonary innate immune system, we hypothesized that differential epithalial TLR activation would regulate the inflammatory response to inhaled pathogens.

Method

Human lung epithelial cells (A549) were treated with TLR2 ligands (Gram-positive *Staphylococcus aureus*, *Streptococcus pneumoniae* or synthetic ligands) and TLR4 ligands (Gram-negative *Pseudomonas aeruginosa*, *Escherichia coli* or endotoxin). Co-treatment with viral TLR3 ligand (viral mimic, Poly(I:C)) was used to investigate synergism. IL-8 release (ELISA) was used as a marker of activation.

Results

Gram-negative bacteria significantly stimulated IL-8 release. Individual Gram-positive ligands (either Pam_3CSK4 or FSL-1) stimulated IL-8 release; in contrast, co-administration of Gram-positive ligands, or treatment with whole Gram-positive bacteria, did not. Activation of TLR3 with viral mimic (Poly(I:C)) significantly stimulated IL-8 release and synergised with TLR4 (endotoxin) and TLR2 (Pam3 Csk 4, or FSL-1) activation.

Conclusions

These data suggest that interactions between Gram-positive bacterial ligands block detection and enhance colonization of the host. Furthermore, the synergism demonstrated between viral and bacterial ligands may explain heightened inflammation and mortality associated with influenza infection complicated by secondary bacterial bronchopneumonia. BJHM

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