Challenges of diagnosing and managing pneumonia in primary care

Pneumonia has historically been a challenging condition to define. It has been suggested that it is not a single disease but a group of specific infections, each of which has a different epidemiology, pathogenesis, presentation and clinical course (Jain and Bhardwaj, 2019). However, pneumonia can be broadly described as a condition that arises from an infection in the lower respiratory tract, where tissues become inflamed, which subsequently causes their function to be impaired.

Community-acquired pneumonia (CAP) is the term for pneumonia that is acquired outside of the hospital setting; in contrast, hospital-acquired pneumonia is defined as pneumonia that occurs ≥48 hours after hospital admission (National Institute for Health and Care Excellence, 2014). Overlapping both of the above, healthcare-associated pneumonia is pneumonia that is acquired in any healthcare setting (hospital, nursing home, long-term residential care setting, and so on).

This article describes the epidemiology and pathophysiology of pneumonia, before focusing on the specific challenges of diagnosing and managing the condition in the primary care setting.

Epidemiology

Pneumonia is one of the most common infectious diseases that is treated in hospitals in the UK. Despite advances in diagnosis and treatment, it contributes to significant mortality and morbidity. According to the World Health Organization (2018), it is one of the leading causes of death worldwide.

The disease has a significant impact on the health economy, both in the UK and globally; it remains the sixth largest cause of death in the UK, where it is responsible...
Pathophysiology

Human lung tissue (parenchyma) consists of millions of alveoli – tiny air sacs covered in a fine mesh of capillaries (Fig 1a). It is within these alveoli that the exchange of carbon dioxide and oxygen (gaseous exchange) takes place. In the absence of functional alveoli, this exchange cannot occur and, therefore, the body is unable to function.

The lungs inhale several litres of air every minute – and up to 100L/min during exercise. This constant exposure to air and environmental particles makes lung tissue susceptible to contact with infectious organisms. Moreover, the respiratory tract is proximal to the nasopharyngeal and oropharyngeal tracts, which can also host potentially infectious agents. To combat and destroy pathogens, the respiratory tract employs a host of practical defenses (such as the cough reflex and the sticky mucus that lines the airways, nasal hair and respiratory cilia), while the immune system produces a host of cells, such as macrophages, leukocytes and cytokines.

Pneumonia occurs when an infectious organism manages to bypass the practical defenses of the respiratory tract and reaches the alveoli. Its presence triggers a response from the immune system, but that response also causes a state of inflammation in the alveoli, where fluid and pus develop (Fig 1b). The alveoli subsequently become ‘airless’, which inhibits gaseous exchange.

Various organisms can cause pneumonia, including:

- Viruses;

Table 1. Impaired bodily mechanisms that can lead to pneumonic infection

<table>
<thead>
<tr>
<th>Impaired mechanism</th>
<th>Factors causing impairment (risk factors for pneumonia)</th>
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| Reduced cough reflex                   | ● Neuromuscular disease  
● Neurological disease  
● Thoracic or abdominal surgery       |
| Altered consciousness                  | ● Coma  
● Seizure  
● Alcoholism  
● Central nervous system depressants |
| Altered pharyngeal flora               | ● Malnutrition  
● Dehydration  
● Poor dental hygiene  
● Alcoholism  
● Diabetes  
● Impaired saliva production          |
| Impaired mucociliary escalator         | ● Smoking  
● Severe malnutrition  
● Exposure to gases, hot air and/or cold air  
● Upper airway obstruction            |
| Immune and alveolar macrophage dysfunction | ● Smoking  
● Immunosuppressive therapy  
● Immunodeficiency disorders  
● Malnutrition  
● Starvation                           |

Source: Adapted from Singh (2012)
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Table 2. Investigations to consider in the community

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Rationale</th>
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<tbody>
<tr>
<td>Baseline observations</td>
<td>Recording blood pressure, pulse, respiratory rate and temperature is good practice, especially to exclude sepsis. It is also important to measure oxygen saturation (done by using pulse oximetry). Patients with oxygen saturations of ≤94% require assessment in hospital for potential oxygen therapy.</td>
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<tr>
<td>PoC CRP testing</td>
<td>PoC testing of CRP is now recommended by the National Institute for Health and Care Excellence (2016) when it is not clear whether a patient has pneumonia or antibiotics should be prescribed.</td>
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</tbody>
</table>
| Chest X-ray                       | A chest X-ray is not routinely required for patients presenting in primary care, but should be considered if there is:  
   - Doubt about the diagnosis  
   - A poor response to treatment  
   - A risk of an underlying pathology (such as lung cancer)  
   A chest X-ray confirming pneumonia will often show shadowing or consolidation (Fig 2) |
| Sputum sampling                   | A sputum sample is not routinely required for patients presenting in primary care (or patients with low-severity pneumonia), but should be considered if:  
   - The patient does not respond to empirical therapy  
   - The patient has signs and symptoms of TB  
   - There is epidemiological evidence of TB |
| Respiratory PCR, urine PCR, serological sampling | Respiratory PCR, urine PCR or serological sampling are not routinely required for patients presenting in primary care unless there:  
   - Has been a recent outbreak of Legionnaires’ disease  
   - Are clinical or epidemiological reasons for conducting them |

CRP = C-reactive protein; PCR = polymerase chain reaction; PoC = point-of-care; TB = tuberculosis

● Bacteria;  
● Fungi.

The most common pneumonia-causing pathogen in the UK is Streptococcus pneumoniae (or pneumococcus) bacterium. Other common pneumonia-causing bacteria include Haemophilus influenzae, Mycoplasma pneumoniae and Staphylococcus aureus. Viruses are also common causes of pneumonia, especially seasonal community viruses such as influenza, parainfluenza and respiratory syncytial viruses. Fungal pneumonia is less common, but fungi known to cause pneumonia include Pneumocystis jiroveci, Coccidioides and Aspergillus species (Bit.ly/BMJPneumonia).

The body employs an array of mechanisms to defend the respiratory tract from infection. These defence mechanisms may become impaired, altered, reduced or dysfunctional because of a variety of health, social and environmental factors. Table 1 outlines the impaired bodily mechanisms that may lead to pneumonia infection, along with what may have caused them to become impaired (risk factors for pneumonia).

Signs and symptoms

The signs and symptoms of pneumonia are highly variable, and its clinical course can also vary greatly between individuals; symptoms may develop gradually over a number of days but may also appear much faster.

Common symptoms of pneumonia include:

- Coughing up mucus;  
- Fever;  
- Difficulty breathing and/or reduced exercise tolerance;  
- Chest pain or discomfort;  
- Lethargy.

Signs of pneumonia that may be detected when examining an individual include:

- On inspection – respiratory distress, rigors, cough, dyspnoea;  
- On palpation – decreased chest expansion (shallow breathing) or asymmetry, tactile fremitus;  
- On percussion – dull sound;  
- On auscultation – decreased air entry, crepitation, bronchophony.

Pneumonia is a causative factor for sepsis. Severe sepsis is life-threatening; its symptoms include:

- Tachypnoea;  
- Hypotension;  
- Confusion or altered consciousness;  
- Hypoxia;  
- Rigors;  
- Tachycardia.

Diagnosis

Diagnosing CAP in primary care can be challenging, as it may be difficult to distinguish from:

- Non-pneumonic respiratory infections;  
- Diagnoses such as congestive cardiac failure;  
- Established respiratory conditions such as chronic obstructive pulmonary disease.

Diagnosis is often made empirically, because it is not appropriate or feasible to perform a chest X-ray for all patients who present with a cough or other lower respiratory tract symptoms. Despite a wealth of studies, there is no evidence-based consensus on clinical signs or symptoms that are highly predictive of CAP; as a result, diagnosis is based on:

- The health professional’s clinical judgement;  
- Careful history taking;  
- Exploration of signs, symptoms and comorbidities;  
- Clinical examination;  
- Local epidemiology.

The clinical judgement of health professionals in diagnosing pneumonia in primary care has been studied. One study demonstrated that GPs’ clinical judgement had a negative predictive value (correctly ruling out pneumonia) of 96%, but a sensitivity (diagnosis after history and physical examination) of only 29%; meaning 71% of pneumonias evident on X-ray had not been suspected clinically (Van Vught et al, 2013). The study highlighted that health professionals needed additional support to be able to consistently detect pneumonia in primary care.

Given the challenges that exist when it comes to diagnosing pneumonia in primary care, the British Thoracic Society (Lim et al, 2009) recommends putting less emphasis on ‘labeling’ patients with either a lower respiratory tract infection (LRTI) or suspected CAP, and more on determining how ill they are, whether they...
need antibiotics and where treatment will best be delivered. Agonising between a diagnosis of LRTI or CAP can be an unhelpful distraction.

The investigations required to confirm a diagnosis of pneumonia vary depending on the severity of the case, comorbidities and local epidemiological evidence. Investigations in the community differ from those in a hospital setting, where some techniques are more readily available. Table 2 highlights the investigations to consider in the community.

The fact that it may be difficult, in primary care, to confirm a diagnosis of CAP without additional tests means there is a risk of unnecessary antibiotic prescribing. C-reactive protein (CRP) is a biochemical marker in the blood that often rises in response to infection and inflammation. Point-of-care testing of CRP levels is increasingly used in primary care to help decision making and is now recommended by NICE (2016) in certain circumstances.

Management
The most important factor for the management of suspected CAP is whether the patient requires treatment in hospital or can be managed safely at home. Pneumonia carries a high risk of death for patients in certain situations, so it is critical that these patients receive correct and prompt treatment.

The decision on whether to treat a patient at home or in hospital remains a matter of clinical judgement. Health professionals should take into account:

- Disease severity and how ill the individual is;
- Clinical observations;
- Social circumstances (including the availability of support at home);
- Comorbidities;
- Age;
- Risk of non-adherence to medication.

To determine disease severity (and hence the appropriate place of treatment), the CRB65 score can be used (Fig 3).

Patients who are deemed suitable to receive treatment at home should receive empirical antibiotics (based on clinical judgement rather than diagnostic tests) – amoxicillin, doxycycline and clarithromycin are often used; local policies will dictate the choice of antibiotic. Patients should be advised to rest, hydrate and stop smoking. Over-the-counter analgesics such as paracetamol or non-steroidal anti-inflammatory drugs, if tolerated, can be used for fever and pleuritic chest pain. Good nutrition is important, so supplementation may be helpful.

Patients should be reviewed after 48 hours – or earlier if clinically indicated. Table 3 summarises the nursing care plan.

“Constant exposure to air and environmental particles makes lung tissue susceptible to contact with infectious organisms”
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Table 3. Nursing care plan for managing pneumonia in primary care

<table>
<thead>
<tr>
<th>Issue</th>
<th>Nursing care</th>
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| Pain and fever   | ● Advise the patient to take over-the-counter paracetamol or non-steroidal anti-inflammatory drugs  
|                  | ● Recommend fan therapy and reduction of layers                              |
| Cough            | ● Advise the patient to take over-the-counter cough suppressants              |
| Hydration        | ● Advise the patient to maintain good hydration                              |
| Nutrition        | ● Advise the patient to maintain good nutrition; consider supplementation    |
| Bowls            | ● Monitor the patient for diarrhoea (a side-effect of antibiotics) and infection with Clostridium difficile |
| Psychological    | ● Provide information on what the patient can expect in terms of recovery time to reduce anxiety and avoid unnecessary visits |
| Safety netting   | ● Ensure the patient, relatives and carers are aware of what to do and who to contact if they think symptoms are getting worse |
| Prevention       | ● Recommend influenza and pneumococcal vaccines as directed by the British Thoracic Society (2015) after resolution of illness  
|                  | ● Direct the patient to smoking cessation services                             |
|                  | ● Promote good dental and oral hygiene                                        |

While patients should start to show signs of improvement after 48 hours, complete recovery can be a long process. It is quite common for patients to experience symptoms for several weeks after treatment. As a general guide:

- Week 1 – fever should be resolved;
- Week 4 – sputum production and pleuritic chest pain should have diminished;
- Week 6 – cough and dyspnoea should have substantially diminished;
- Month 3 – most symptoms should have resolved but fatigue may still be present;
- Month 6 – a full and complete recovery should be achieved.

Challenges and opportunities

Currently in primary and community care in the UK, there are wide variations in service provision, infrastructure and resources such as workforce and equipment. For example, although recommended by NICE (2016), point-of-care testing of CRP is not routinely used because availability of the necessary equipment, which often depends on local funding, is patchy.

It is positive that respiratory care has been identified as a clinical priority in NHS England’s (2019) NHS Long Term Plan; this should bring additional funding as a respiratory care programme is developed. However, realising the ambitions of the plan will depend on whether adequate funding is allocated in the forthcoming spending review. Funding is needed in many areas, including education and continuing professional development for nurses; CAP is common, so improving nurses’ awareness and knowledge of the condition will enhance patient care.

Further resources

The British Thoracic Society (BTS) has produced resources to support professionals caring for adult patients with community-acquired pneumonia (CAP). Available to download at Bit.ly/BTS_CAP, they include:

- CAP care bundle
- BTS National Adult Community Acquired Pneumonia Audit 2018/19
- BTS Guidelines for the Management of Community Acquired Pneumonia in Adults
- BTS CAP Guideline and the NICE Pneumonia Guideline: How they Fit Together

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