Diseases of the respiratory system

Pneumonia

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Inflammation of the lung may be caused by allergic reactions (alveolitis), chemical or physical agents (pneumonitis), and infections (pneumonia). The present review deals only with pneumonia, defined as an acute inflammation of the lung due to invasion by micro-organisms.

Causative agents

The classical division into lobar and bronchial pneumonia is now of little practical value—management chiefly depends on whether the pneumonia occurs in a healthy person or in a patient already sick from other causes. Pneumonia arising at home in a previously healthy person, perhaps with an upper respiratory infection or an influenza-like illness, is usually caused by Streptococcus pneumoniae, a virus, or Mycoplasma pneumoniae. Staphylococcus aureus is an important cause of pneumonia during influenza epidemics, and pneumonia in previously fit children can result from Haemophilus influenzae infection. Rare causes of pneumonia in otherwise healthy people include psittacosis (caused by a chlamydia), Q fever (caused by rickettsia), and legionnaire’s disease (caused by a bacterium).

When chronic disease has lowered the patient’s local bronchial defences or general resistance pneumonia can be caused by various organisms, including some with no special affinity for the lungs. Conditions predisposing to such infection are chronic bronchopulmonary disorders, diabetes, malnutrition, alcoholism, prolonged immobilisation, and suppression of immunity either by disease—for example, leukaemia—or by treatment—for example, corticosteroids after an organ transplant. Inhaling organisms from the alimentary tract may cause pneumonia in patients with mouth infections, neurogenic dysphagia, or oesophageal reflux.

The organisms most often responsible for pneumonia in patients with pre-existing disease are Strep pneumoniae, Staph aureus (often penicillin resistant), and, in patients with bronchitis especially, H influenzae. Less common causes are Strep pyogenes, Mycobacterium tuberculosis, Klebsiella spp, and Gram-negative bacilli such as Pseudomonas aeruginosa, Escherichia coli, and Proteus spp. Coliform organisms contribute especially to pneumonia of alimentary origin but are sometimes recovered from the sputum of patients already receiving antibiotics, when they are more often part of the secondary throat flora.

Diagnosis

Pneumonia should be suspected in any patient who develops cough with fever, especially when accompanied by rigors, pleuritic pain, dyspnoea, rapid breathing, or cyanosis. Focal signs of consolidation or pleural friction are often delayed or absent, and the elderly or infirm may have no fever. The sputum may be purulent in patients with pre-existing bronchial disease and profuse, watery, and “rusty” in those with an overwhelming infection. In other cases sputum may be difficult to obtain during the early stages of the disease, especially when coughing is inhibited by pleuritic pain. Nevertheless, an attempt should always be made to collect a sample of sputum for microscopy and culture before an antibiotic is given. If necessary the patient may be encouraged to cough while lying with the painful side upwards; with each cough the attendant firmly supports the affected side with both hands. The sputum sample should be collected in a sterile container and delivered to the nearest laboratory within two hours. In hospital, and especially when the patient has not responded to standard antibiotic treatment, secretions may be recovered by laryngeal swab, percutaneous tracheal puncture, or even needle aspiration of the lung. If the pneumonia is complicated by pleural effusion a sample of this should be withdrawn for microscopy and culture.

Before antibiotics are given blood also must be taken for culture and determination of differential white cell count and agglutinins (virus, mycoplasma, etc). A sample of 12 ml of blood is withdrawn under sterile conditions, 2 ml being injected into each of two blood culture bottles, 4 ml into an anticoagulant tube, and 4 ml into a plain tube for dispatch to the virus reference laboratory (a second sample will be needed for virus studies during convalescence to show whether there is a rising antibody titre).

Antibiotic treatment can then be prescribed while the remaining investigations are arranged. These should include postero-anterior and lateral chest radiographs to show any consolidation and rule out conditions that can either simulate pneumonia—for instance, pulmonary infarction, collapse, and pneumothorax—or predispose to it—for instance, bronchiectasis, neoplasm, and tuberculosis). An electrocardiogram may help to exclude myocardial ischaemia, show whether there is any right ventricular strain, or elucidate a dysrythymia. If facilities...
are available a sample of arterial blood should be obtained for 
$P_{CO_2}$ and $P_{O_2}$ measurements, especially from patients with 
chronic lung disease, to indicate whether oxygen treatment is 
necessary (and safe). The respiratory rate (as well as the heart 
rate and temperature) should be recorded at four-hourly 
intervals, or more often in the seriously ill.

Treatment

Treatment of pneumonia includes eradicating infection, 
correcting hypoxia, relieving cough and pleuritic pain, and 
managing complications. The decision whether to move the 
patient to hospital will obviously depend on such factors as the 
length of the journey and whether there is a competent attendant 
at home. Clinical indications for transfer include signs of 
respiratory failure such as cyanosis, drowsiness and confusion, 
lack of any response to antibiotic treatment within 48 hours, 
fever persisting for more than four or five days, and certain 
complications (see below). Although these are more likely in 
patients with pre-existing lung disease, they may also occur in 
previously symptomless people with some usually virulent infection or 
undetected impairment of resistance.

INFECTION

Treatment of the infection with antibiotics should start at the 
earliest possible moment—which ideally is immediately 
after samples have been taken for culture but, necessarily, before 
the results are available. Choice of the initial antibiotic (see table) 
is based on clinical judgment combined with any micro-
scopic evidence available. The relevant clinical criteria include 
the severity of the illness and, in particular, whether there are any 
signs of bacteraemia—for example, rigors, “shock,” and 
extrapulmonary infection—or respiratory failure—for example, 
extreme dyspnoea, cyanosis, confusion, and impaired cons-
sciousness. Other important factors are the previous health of 
the patient (both general and respiratory), whether he is cur-
rently taking (or has recently taken) antibiotics, and whether 
he is at home or in hospital. Microscopic examination of 
sputum or pleural fluid with appropriate stains provides clues to 
the nature of the prevailing organism—coccal or bacillary, 
Gram-positive or Gram-negative, or acid-fast or otherwise. Pus 
cells in the sputum confirm that infection is bacterial rather than 
only.

There is now such a variety of potent and relatively safe 
broad-spectrum antibiotics that most doctors are reluctant to 
choose a drug effective only against the most “likely” organism. 
For example, pneumonia in a previously healthy person with 

### Antibiotics for pneumonia

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Dose (by mouth unless shown otherwise)</th>
<th>Indications</th>
<th>Side effects and contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxycillin</td>
<td>500 mg thrice daily</td>
<td>First choice, except in cases of penicillin allergy and for patients not responding to these antibiotics</td>
<td>Drug rash</td>
</tr>
<tr>
<td>or ampicillin</td>
<td>1 g four times daily</td>
<td></td>
<td>Drug rash</td>
</tr>
<tr>
<td>Co-trimoxazole</td>
<td>2 tablets thrice daily</td>
<td></td>
<td>Impaired renal or vesicular function</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>80-120 mg 8-hourly IV</td>
<td>First choice in cases of penicillin allergy and for patients not responding to ampicillin (also effective against <em>Pneumocystis carinii</em>)</td>
<td>Drug rash</td>
</tr>
<tr>
<td>or tobramycin</td>
<td>80-120 mg 8-hourly IV</td>
<td>First choice in cases of penicillin allergy and for patients not responding to ampicillin (also effective against <em>Pneumocystis carinii</em>)</td>
<td>Drug rash</td>
</tr>
<tr>
<td>Flucloxacillin</td>
<td>500 mg 6-hourly IV</td>
<td>Fulminating pneumonia (with flucloxacillin) and for Gram-negative infections with bacteriaemia or resistant to other antibiotics</td>
<td>Impaired renal function</td>
</tr>
<tr>
<td>Lincomycin</td>
<td>600 mg 6-hourly IV</td>
<td>Fulminating pneumonia (with gentamicin) and for penicillin-resistant staphylococcal infections</td>
<td>Drug rash</td>
</tr>
<tr>
<td>or cephalothin</td>
<td>1 g 8-hourly IV</td>
<td>Substitutes for flucloxacillin in cases of penicillin allergy</td>
<td>Impaired renal function</td>
</tr>
<tr>
<td>Chloramphenicol</td>
<td>500 mg four times daily</td>
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<tr>
<td>Erythromycin</td>
<td>500 mg four times daily</td>
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<td></td>
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<tr>
<td>or oxytetracycline</td>
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<tr>
<td>Isoniazid</td>
<td>100 mg thrice daily</td>
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<tr>
<td>Rifampicin</td>
<td>450-600 mg daily</td>
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<td></td>
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<tr>
<td>Streptomycin</td>
<td>500 mg twice daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metronidazole</td>
<td>400 mg 8-hourly</td>
<td>Anaerobic infections (as in lung abscess)</td>
<td>Drug rash</td>
</tr>
</tbody>
</table>

IV = Intravenously
IM = Intramuscularly
be enough in an otherwise healthy patient with pneumonia localised to one part of the lung, but otherwise it should be continued for 7-10 days. Several weeks' treatment may be needed for widespread destructive pneumonia with abscess formation—for example, staphylococcal—and in tuberculous infection the drugs are given for 6-12 months or longer.

HYPOXIA

Oxygen is needed only when the arterial oxygen tension falls to less than 10 kPa. If blood gas measurements are not available oxygen should be given to patients who are breathless and to those with either tachypnoea or tachycardia out of proportion to fever. Cyanosis may not be detected, especially in artificial light, until the PaO₂ is dangerously low; so the doctor should not be reassured by its apparent absence.

The optimum method of oxygen delivery, like the choice of antibiotic, depends on the previous health of the patient. Acute severe pneumonia in a patient without chronic airflow obstruction should be treated with oxygen delivered at a rate of 6-8 l/min through a well-fitting mask. Some patients prefer nasal catheters to a mask, and this method of delivery is usually adequate in milder cases. When pneumonia complicates chronic airflow obstruction due to bronchitis, asthma, or emphysema, hypoxia may be profound but there is often chronic hypercapnia as well (Paco₂, greater than 6.5 kPa). In this case the respiratory centre may have become insensitive to further rises in Paco₂ and dependent instead on the drive of hypoxia. Liberal amounts of oxygen may thus diminish respiratory effort and lead to increasing carbon dioxide narcosis. Oxygen should then be delivered in amounts sufficient to preserve the function of vital organs such as the brain, heart, and kidneys but not enough to depress respiration. This can usually be achieved with an oxygen concentration of about 28-30%, delivered by a mask in which the oxygen flow draws air in from the atmosphere by the Venturi principle (Ventimask). Patients who will not tolerate a mask may obtain a similar concentration of oxygen from nasal catheters with an oxygen flow rate of 2-3 l/min. Even with this low concentration of oxygen, a close watch must still be kept for carbon dioxide narcosis with half-hourly observations of respiratory rate and level of consciousness.

COUGH AND PLEURITIC PAIN

In the early stages of pneumonia cough is usually unproductive and sometimes painful. Pain may not only exhaust the patient but also aggravate hypoxia by causing rapid shallow breathing with inadequate alveolar ventilation. If pain is not relieved by local application of heat and a simple analgesic such as dihydrocodeine tartrate (DF 118) or dextropropoxyphene hydrochloride (Distalgesic) then pentazocine hydrochloride (Fortral), 50-100 mg, may be used. Lincreta codeine (BNF) is prescribed for cough or, alternatively, either photocine BPC, 4 ml, or methadone lincreta BPC, 4 ml.

Most drugs that effectively abolish cough or relieve pain are potentially addictive and may also depress the respiratory centre. The most potent of these drugs, notably morphine and pethidine, should therefore be used only for severe symptoms and over a short period and must not be given to patients with chronic airways disorders, especially asthma.

Complications

Complications of pneumonia that may need treatment during the acute illness include pleural effusion and empyema, respiratory and cardiac failure, and the extrathoracic manifestations of bacteremia.

Aspirating a pleural effusion may be necessary for diagnosis (see above), and to relieve dyspnoea or treat empyema. Generally, an effusion should be aspirated if its radiographic size suggests that it could be located without difficulty. If the fluid is turbid 1 meaunit of benzylpenicillin should be injected into the pleural cavity after a sample has been saved for microscopy and culture. Further aspirations, with instillation of the appropriate antibiotic (determined by the fluid culture results) are carried out until no more fluid can be recovered. The patient is then either better or in need of surgical drainage. Empyema is today a rare complication of pneumonia except in patients already ill from other causes.

Respiratory failure may be of two types: acute fulminating pneumonia with "flooding" of the lungs and pneumonia complicating diseases associated with chronic airflow obstruction. In the first type life is threatened by a profound hypoxia due to the massive exudation in the lungs themselves. In addition to antibiotics and oxygen, this condition justifies corticosteroids (intravenous hydrocortisone, 200 mg four-hourly) to suppress the excessive inflammatory reaction. Pneumonia is also a common precipitating cause of respiratory and cardiac failure in patients with pre-existing lung or heart disease; these complications are treated in the usual way with bronchodilators, digitalis, diuretics, and so on. Tracheal intubation to aspirate secretions from the airways and intermittent positive-pressure respiration may be needed as life-saving measures in the most severe cases.

Bacteremia in the acute stage of pneumonia may cause "shock" with hypotension and peripheral circulatory failure. This calls for supportive measures such as intravenous infusions and possibly corticosteroids as well as the appropriate antibiotics. Metastatic infections such as cerebral abscess, meningitis, and peritonitis are now rare complications of pneumonia and their management is beyond the scope of this review.

In looking for treatable causes of presenile dementia we are asked to exclude normal-pressure hydrocephalus. What is a simple screening test for this condition, and when discovered how may it be treated?

There is no simple or inexpensive test for recognising communicating hydrocephalus. The best hope is clinical suspicion. The dementia is normally of recent onset, usually less than a year. The mental impairment is accompanied or preceded by apraxia of gait, which is not quite like the ataxia caused by cerebellar disease or defects in proprioception. It is commonly described as unsteady or uncertain. An early feature is incontinence, which is usually out of proportion to the degree of dementia. There may be a history of head injury, meningitis, or subarachnoid haemorrhage. Cerebrospinal fluid (CSF) pressure is normally below 200 mm of CSF. Only computerised tomography or air studies can diagnose the condition with certainty. The latter are dangerous and may provoke rapid deterioration, with akinetic mutism. The insertion of a ventriculoatrial shunt improves some patients—probably those whose disturbance of gait preceded the mental change. Some patients improve rapidly after 20-30 ml of cerebrospinal fluid has been removed, and these are the ones who will benefit by shunting.¹

¹ Lancet, 1977, 2, 1011.

House dust mite allergy is a common cause of suffering. Is there any commercially available insecticide that is effective against the house dust mite yet non-toxic to man?

There was interest a few years ago in finding an insecticide suitable for use in the home against the house dust mite. Although several insecticides were effective, none were suitable without further development by the manufacturers. We know of no further work on them, and there is no commercially available product.