CHAPTER 9

Respiratory infections

CHAPTER OUTCOMES

After reading this chapter, you should be able to:

- State the prevalence of lower respiratory tract infection and pneumonia in hospital inpatients
- Discuss the increasing importance of community-acquired pneumonia
- List the organisms responsible for lower respiratory tract infection
- Explain why postoperative and ventilated patients are at particular risk of developing lower respiratory tract infection and suggest strategies to help to reduce these risks
- List the organisms responsible for upper respiratory tract infection and suggest preventive strategies in each case

Introduction: the importance of respiratory infections

Respiratory infections are common in both hospital and community settings. The third national prevalence survey conducted in 2006 found that infections of the lower respiratory tract (not pneumonia) and pneumonia together accounted for 19.9 per cent of HCAIs in acute hospitals (Hospital Infection Society/Infection Control Nurses Association, 2007). Hospital-acquired infections affecting the respiratory tract cause considerable morbidity and mortality. This type of respiratory infection generally affects those who are critically ill.

Other respiratory infections and those arising from pathogens in the respiratory tract – pulmonary tuberculosis, severe acute respiratory syndrome (SARS), Legionnaire's disease and meningococcal meningitis – are covered in Chapter 14. Drugs used to treat tuberculosis are outlined in Chapter 4.

Lower respiratory tract infections

Lower respiratory tract infections (LRTIs) involve the bronchi and alveoli (Figure 9.1). They include two serious conditions – acute bronchitis and pneumonia:

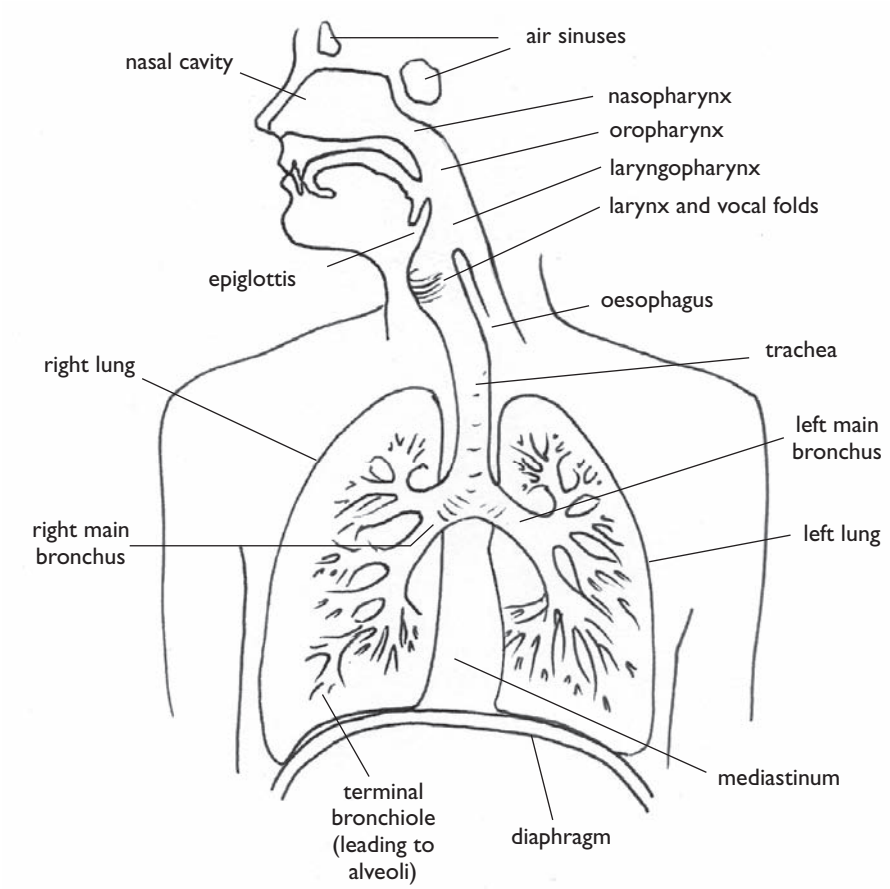

Figure 9.1 The respiratory tract

- **Acute bronchitis** (inflammation of the bronchi) is an acute respiratory infection in which the dominant symptom is coughing without localized infection. This should not be confused with chronic bronchitis, which is a type of chronic obstructive pulmonary disease (COPD). Acute bronchitis is usually a community-acquired infection and typically arises as a complication of upper respiratory tract infection (URTI) caused by a virus, when bacterial infection supervenes. Some children seem prone to bronchitis. It appears to be related to poor living conditions (overcrowding, poor hygiene and poor nutrition) and is exacerbated by maternal smoking, especially during pregnancy. Individuals who have experienced childhood bronchitis are at risk of developing further symptoms during their teenage years if they then smoke.
- **Pneumonia** (inflammation of the lung) is a serious condition, responsible for most deaths caused by infection of the respiratory tract, especially in older adults and infants. It may be acquired in hospital or the community. The alveoli become filled with pus, air is excluded, and the lung is said to be 'consolidated'. In bronchopneumonia, consolidation is widely distributed; in lobar pneumonia, it is localized.

Hospital admission is arranged to:

- Administer antibiotics – although many cases are viral, this may be difficult to determine, and no time must be lost in instituting treatment
- Provide physiotherapy – percussion, breathing exercises and postural drainage.

Community-acquired pneumonia

In the community, bacterial pneumonia is most frequently caused by *Streptococcus pneumoniae* (Riley and Riley, 2003). Infection is most common in people with pre-existing health problems, frequently developing as a complication of some other respiratory infection (for example influenza or measles). Treatment is complicated because some strains of *Streptococcus pneumoniae* are now resistant to penicillin. Vaccination has been recommended in the UK since 2003 (Bedford and Lane, 2006). The pneumococcal vaccine is part of the childhood immunization programme (Chapter 2) and it is also offered to people over 65 years of age. It is also recommended for people following splenectomy and those with dysfunction of the spleen, sickle cell disease, coeliac disease, chronic renal disease, chronic respiratory disease, chronic heart conditions, liver disease, diabetes mellitus, immunosuppression and HIV. Following vaccination, about 80 per cent of healthy adults develop a good antibody response within three weeks. Practice nurses working in primary care settings usually offer immunization.

Other bacteria responsible for community-acquired pneumonia include *Mycoplasma pneumoniae*, *Haemophilus influenzae*, *Legionella pneumophila* (Chapter 14) and *Staphylococcus aureus*, including the strain that produces the Panton–Valentine leukocidin toxin (see below).

INFORMATION BOX 9.1

Panton–Valentine leukocidin

Some strains of the bacterium *Staphylococcus aureus* produce a virulent toxin known as 'Panton–Valentine leukocidin' (PVL), which damages white blood cells. This strain of *S. aureus* is responsible for several infections including a life-threatening, community-acquired pneumonia in previously fit and healthy children and young adults.

Resource

Health Protection Agency – www.hpa.org.uk.

Hospital-acquired pneumonia

In the third national prevalence survey of infection in hospitals, pneumonia was the third most common (13.9 per cent) HCAI in acute hospitals (Hospital Infection Society/Infection Control Nurses Association, 2007). It mainly affects critically ill and postoperative patients. Risk factors include obesity, impaired consciousness, a history of smoking and underlying respiratory disease. In hospital, bacteria, viruses or fungi can cause pneumonia, but most hospital-acquired pneumonia is caused by *S. aureus* and Gram-negative opportunists (Inglis et al., 1993).

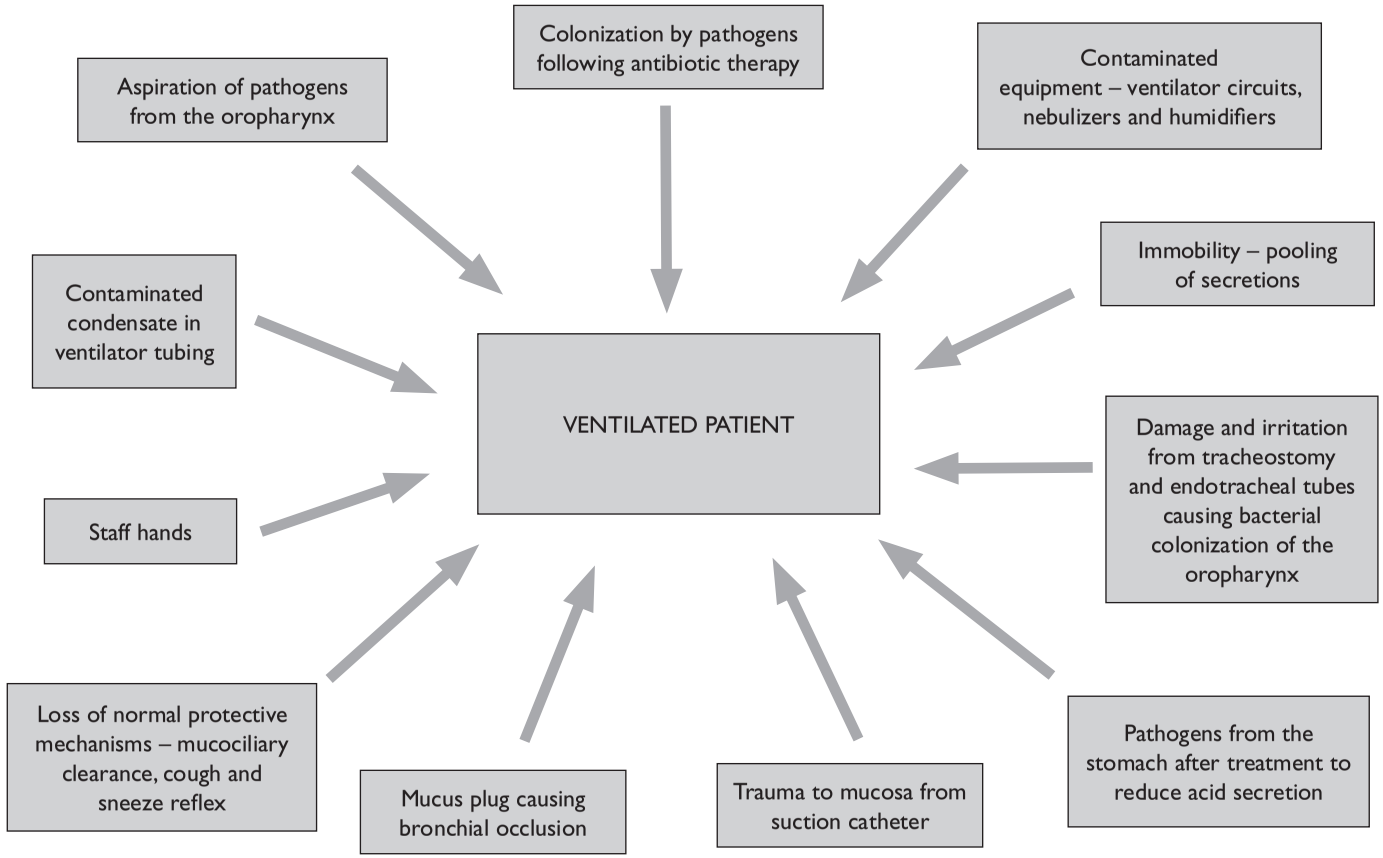

Figure 9.2 Infection risks in ventilated patients

Infection can arise from other people by cross-infection or from an environmental source (as, for example, with *Legionella pneumophila*). The bacteria responsible are frequently resistant to antibiotics (Koeman et al., 2001). Airborne transmission is not a major route in hospital except for *L. pneumophila*. Instead, most cases of hospital-acquired pneumonia develop in patients who require mechanical ventilation (Figure 9.2). Ventilator-associated pneumonia (VAP) is diagnosed if infection arises more than 48 hours after endotracheal intubation and mechanical ventilation. These patients are at particular risk because they have lost the protective coughing and sneezing reflexes, their risk being increased further by antibiotic therapy and other invasive procedures.

VAP occurs when the bronchioles and alveoli become contaminated with pathogens. In health, they are kept free of microorganisms by the mucociliary escalator: foreign particles become trapped in the mucus, are wafted upwards by ciliary action and are eventually swallowed. However, the upper respiratory passages harbour bacteria, including potential pathogens, and these may be transferred to the lower airways during invasive procedures.

Sources of pathogens for hospital-acquired pneumonia

There are a variety of sources of pathogens, such as those from the oropharynx, which can cause hospital-acquired pneumonia.

Aspiration of pathogens from the oropharynx

The aspiration of pathogens colonizing the oropharynx is the most important source of bacterial pneumonia in hospital inpatients. Although many healthy people aspirate their secretions during sleep, the body's immunological defences deal with these. In ventilated patients, the risk of aspiration is increased by the presence of endotracheal and tracheostomy tubes, and because the patients are sedated or have been anaesthetized.

Colonization of the oropharynx

Colonization of the oropharynx increases the risk of developing pneumonia and complicates its treatment. Gram-negative bacilli replace the normal flora if the patient receives antibiotics (Johanson et al., 1972).

Colonization of the stomach

Colonization of the stomach results if the patient receives drugs to neutralize (for example antacids) or suppress (H_2-receptor antagonists, for example cimetidine) the secretion of gastric acid. These are commonly prescribed for the critically ill patient to reduce the risk of peptic ulceration caused by stress (Craven et al., 1986).

Endotracheal and tracheostomy tubes

Endotracheal and tracheostomy tubes irritate the respiratory mucosa and promote Gram-negative colonization of the oropharynx. Contaminated secretions enter the

trachea from the mouth and pharynx, secretions then seeping down through the space between the outer wall of the endotracheal tube and the tracheal wall. The endotracheal tube should provide an airtight seal sufficient to occlude this space, but leakage is possible during the periodic deflation of the cuff. Bacteria of the same strain have been isolated from the mouth and trachea of ventilated patients (Sanderson, 1983).

Contaminated ventilator circuits

Contaminated ventilator circuits may lead to cross-infection by delivering bacteria-laden air directly to the lower airways (Phillips, 1967).

Nebulizers

Nebulizers create aerosols of minute droplets that penetrate deeply into the narrowest airways and thus present a significant problem. This is especially so for small-volume medication nebulizers (Botman and de Krieger, 1987).

Humidification

Humidification of the circuit is essential to prevent dehydration of the airways. Humidifiers do not produce aerosols so if the water in the reservoir becomes contaminated, the bacteria are less likely to be inhaled. However, water vapour tends to condense in the tubing (Stucke and Thompson, 1980). The condensate may become heavily contaminated and can drain into the trachea, increasing the risk of infection (Craven et al., 1984).

Tracheobronchial suction

Tracheobronchial suction, intended to reduce the risk of infection in pooled secretions, may contribute to its development if poor technique results in the transfer of bacteria (Fiorentini, 1992). Mucous membranes are more easily damaged by trauma than skin, and abrasions from the suction catheter further increase the risk of infection (see below).

PRACTICE APPLICATION 9.1

Reducing Infection Risks Associated with Tracheobronchial Suctioning

Patients who require suctioning of their respiratory secretions have a high risk of developing healthcare-associated pneumonia. This risk is increased for patients with a tracheostomy and those being ventilated.

Activity

- Access the article by Moore (2003) and read the list in Box 4 (p. 50). Identify the points that directly relate to reducing infection risks and discuss them with your mentor.

- Find out how often the suction container and tubing are changed in your placement or workplace.

Resource

Moore T (2003) Suctioning techniques for the removal of respiratory secretions. *Nursing Standard* **18**(9): 47–53.

Bronchial occlusion with mucus plug

Postoperative respiratory infection arises when a bronchus becomes occluded with a plug of tenacious mucus. The patient may be frightened to move after surgery and reluctant to expectorate, especially if pain is poorly controlled. After some major surgery, immobility is complete because the patient is sedated and ventilated. Occlusion results in the pooling of secretions in the air passages distal to the obstruction, which then collapse when the air within the alveoli is absorbed but not replaced. Gaseous exchange in that area ceases. The tissue is still perfused, but the blood reaching it no longer receives oxygen and cannot be relieved of carbon dioxide. There is a change in the normal ventilation/perfusion ratio, which produces a right-to-left shunt. The bigger the mucus plug, the greater the problem, because a larger airway is obstructed. An extensive area of the lung will thus be affected, leading to collapse (atelectasis). Conditions are now favourable for bacterial growth and multiplication.

Prevention of hospital-acquired pneumonia

The risk of developing hospital-acquired pneumonia can be reduced by early ambulation and physiotherapy to improve lung expansion in postoperative patients (see below).

PRACTICE APPLICATION 9.2

Preventing Postoperative Chest Infection

Postoperative chest infections can be prevented by early ambulation and by teaching deep breathing exercises during the preoperative period, either individually or to groups of people (Lindeman and Van Aernan, 1971). As more operations are performed on a day-case basis with only a few hours before surgery, there will be an increasing need to organize pre-assessment clinics to provide information and teaching for the postoperative period. Written, audio or web-based information may also be provided. The importance of reducing smoking before surgery can be emphasized at the same time if necessary. Other actions include:

- Anaesthetic equipment should be disinfected between patients, taking care to avoid recontamination during its assembly so that spread by contact is avoided
- Effective pain control should be ensured in order to allow physiotherapy and early ambulation
- Patients with abdominal or chest incisions can be taught how to support the wound during deep breathing and coughing

- An upright position allows chest expansion and prevents the stasis of respiratory secretions
- Postoperatively, physiotherapy is important to encourage coughing and expectoration. If infection occurs, the mucus plug may have to be removed by bronchoscopy and aspiration if physiotherapy is insufficient to dislodge it. Antibiotics are of secondary importance to mechanical clearing
- Maintain hydration, as dehydration increases the viscosity of respiratory secretions (sputum), which then become difficult to dislodge

For critically ill patients, hospital-acquired pneumonia remains difficult to prevent and expensive to treat (Kelleghan et al., 1993). Some general ways of preventing pneumonia in intubated patients having mechanical ventilation are outlined below.

INFORMATION BOX 9.2

Preventing pneumonia in ventilated patients

- Wash the hands before and after every contact with an intubated patient
- Use clean gloves for all routine contact with respiratory equipment and wash the hands afterwards
- Use heat–moisture exchange (HME) filters with microbial filtration where possible; otherwise, date and change the ventilator circuits every 48 hours (Craven et al., 1982)
- Date and change the connector tubing every 24 hours (Craven et al., 1982)
- Remove condensation from the ventilator tubing if humidification is being used: it may support the growth of Gram-negative bacteria, leading to colonization and infection (Stucke and Thompson, 1980)
- Change oxygen masks and tubing between patients
- Store all respiratory equipment clean and dry
- Provide oral care at an appropriate frequency, as the mouth can operate as a source of respiratory pathogens. The use of an oral antiseptic, such as chlorhexidine 2 per cent, during oral hygiene for intubated patients having mechanical ventilation is provisionally recommended in draft guidance from the National Institute for Health and Clinical Excellence (NICE) (2007) in collaboration with the National Patient Safety Agency
- Position the patient to prevent the stagnation of respiratory secretions. The draft guidance from NICE (2007) recommends that intubated patients having mechanical ventilation be positioned in a sitting or semi-recumbent position unless this is inappropriate, such as patients with spinal injuries
- Provide physiotherapy
- Ensure effective pain relief to permit movement and physiotherapy

NB The NICE guidance *Technical Patient Safety Solutions for Prevention of Ventilator-associated Pneumonia in Adults* is expected to be issued August 2008.

Contaminated equipment has been incriminated in outbreaks (Gorman et al., 1993), but risks can be reduced by autoclaving any equipment used in respiratory therapy. This includes the ventilator and its circuits, nebulizers, humidifiers and non-disposable equipment used during endotracheal suction. If autoclaving is not possible, equipment can be decontaminated in an automated washing machine or with chemical disinfectants followed by rinsing with tap water.

Ventilators

Ventilators need not be routinely decontaminated if filters are used to protect the inspiratory and expiratory circuits. The routine use of heat–moisture exchange (HME) filters and closed suction systems in ventilators has reduced the risk of VAP. HME filters cut down the need to humidify the gases being administered to ventilated patients.

The routine disinfection of equipment is no longer necessary, the HME filter alone being changed every 24–48 hours. Where HME filters are not used, changing the circuits is recommended every 48 hours (Craven et al., 1982). Condensate collecting in ventilator tubing should be regularly drained.

Humidifiers

Humidifiers should always be used during oxygen therapy to prevent dehydration of the respiratory mucosae. They should be filled with sterile water and decontaminated every 48 hours (Craven et al., 1982).

Nebulizers

Nebulizers used to deliver medication easily become contaminated. They should be washed with detergent and dried every time they are used. Mouthpieces should be changed every 24 hours (Cobben et al., 1996).

Upper respiratory tract infections

Upper respiratory tract infections (URTIs) involve the nasal passages, pharynx, tonsils and epiglottis (see Figure 9.1 above). Most are minor infections acquired in the community and are caused by viruses. URTIs can, however, have serious consequences for the very young and older adults. They also account for a high proportion of days lost from work and school in the UK, so their impact on the health of individuals and their social and economic consequences should not be dismissed.

Coughs and colds

Coughs and colds (the common cold is also known as 'coryza') are mainly caused by rhinoviruses, members of the picornavirus group. There are about 200 different types so somebody who has just recovered from one cold may succumb to another caused by a different rhinovirus. It was traditionally believed that transmission occurred by inhaling virus particles contained in airborne droplets, but there is

evidence that it also takes place by contact, especially via the hands. In laboratory simulations, Gwaltney et al. (1978) showed that volunteers' hands became contaminated after shaking hands with infected subjects; they were more likely to develop colds than individuals exposed to viral aerosols released by sneezing. Rhinoviruses survive in the inanimate environment if they are protected by mucus. Objects that are handled frequently (door knobs, light switches and crockery, for example) thus become contaminated, and the viruses are passed to a new host, reaching the eyes or nose when the face is touched. General hygiene and handwashing are especially important in schools to prevent infection by rhinoviruses. Self-inoculation is the most common form of transmission (Hendley et al., 1973).

Colds are a nuisance and can cause problems in people with pre-existing respiratory difficulties, especially older adults (Nicholson et al., 1996). There is no evidence that developing an URTI is related to becoming wet or 'chilled'. Colds are common in the UK, which has been attributed to the damp climate, but they also develop in hot, dry countries. In babies and young children, URTI is usually harmless, as it is in adulthood, but it can interfere with feeding and may be associated with acute otitis media (see below) or involvement of the lower airways. The community nurse's advice is helpful, reassuring parents and determining whether medical intervention is necessary for colds (Taylor, 1988). Medical treatment is seldom necessary (see below). The nasal discharge associated with colds contains virus particles, dead cells from the nasal mucosa and bacteria, but these are of the same type as are present in health. Bacterial invasion of the damaged epithelium is rare, and antibiotics are seldom required (see Chapters 1 and 4).

Other viruses responsible for 'colds' include:

- Parainfluenza virus
- Reoviruses
- Coxsackie viruses
- Adenoviruses
- Respiratory syncytial virus (RSV) (see below)
- Coronaviruses (NB a specific coronavirus causes SARS; Chapter 14)
- Echoviruses.

PRACTICE APPLICATION 9.3

Managing URTIs in Babies and Children

- **Antipyretics** reduce an elevated temperature. Paracetamol dose calculated on body weight is safe and has valuable analgesic properties. Aspirin and aspirin-containing preparations should not be given to children under the age of 16 years, as it has been associated with the development of encephalopathy (brain disease) and hepatitis (inflammation of the liver – Reye's syndrome)
- **Decongestant drops** may be helpful before a feed to allow an infant to breathe as well as to swallow

- **Antihistamines** may be useful in cases of allergy when the nasal mucosa is swollen, but they do not speed recovery. They cause drowsiness, which may be annoying in older children
- **Antitussive medicines** to suppress coughing are of possible value if the household has been disturbed all night or the child is distressed
- **Antibiotics** are not usually necessary as most infections are viral. They are of value only when there is evidence of bacterial infection, such as streptococcal throat infection or in some cases of associated acute otitis media

Activity

- Investigate the advice available to parents or carers of a child with an URTI.

Resources

British National Formulary – www.bnf.org/.

NHS Direct – www.nhsdirect.nhs.uk/.

Acute otitis media and otitis media with effusion

Acute otitis media (AOM) is inflammation of the middle ear; it is a common childhood complaint. It typically leads to pain, raised temperature and discharge from the ear (otorrhoea); the child rubs the ear and is fretful and irritable. The middle ear is lined with respiratory mucosa and often becomes inflamed during an URTI. Purulent fluid collects in the middle ear causing the tympanic membrane (ear drum) to bulge and change in appearance. This increases pressure and causes pain. The tympanic membrane may perforate under pressure to release bloodstained mucopurulent discharge, which relieves pain and other symptoms.

Antibiotics should not be routinely prescribed for the initial treatment of AOM, although delayed treatment after 72 hours if the child's condition has not improved is another approach (Scottish Intercollegiate Guidelines Network, 2003). A short initial course of antibiotics, such as amoxicillin, may be beneficial for some groups of children, such as those under two years of age with severe disease. Pain-relieving drugs (paracetamol), which also reduce temperature, are useful. When frequent attacks of AOM occur, the child should be referred to an otolaryngologist (ear and throat specialist) (Scottish Intercollegiate Guidelines Network, 2003).

Otitis media with effusion (OME), often known as 'glue ear', is the term used to describe inflammation accompanied by the collection of viscous fluid within the middle ear. OME, which usually resolves spontaneously, should not be treated with antibiotics (Scottish Intercollegiate Guidelines Network, 2003). Some groups of children with OME should be carefully monitored so that hearing loss and problems with speech and language developmental delay, behavioural problems and difficulties at school can be detected. Referral to an otolaryngologist is required if problems occur. In some cases, the fluid is aspirated from the middle ear and grommets (plastic aeration tubes) inserted through the tympanic membrane into the middle ear.

Croup

Croup (laryngeal spasm) is a feature of viral infection involving the larynx and trachea. The child initially develops a snuffly nose, inspiration then becoming noisy and sounding harsh (stridor). This is distressing for the child and frightening for the parents/carers. Treatment traditionally involved the use of steam to liquefy secretions and relieve obstruction, the modern alternative being a steamy bathroom. Most children recover without treatment, but croup remains a worrying condition because:

- Children occasionally develop airway obstruction and exhaustion, and thus require emergency admission to ensure that the airway remains patent
- Rarely, acute epiglottitis supervenes, emergency treatment being essential. This is usually caused by bacteria such as *Haemophilus influenzae*
- Children occasionally experience repeated attacks of croup, suggesting allergy.

Respiratory syncytial virus

Respiratory syncytial virus (RSV) is a virus responsible for acute respiratory infection in infants and young children, often severe in babies under the age of six months. Bronchiolitis (inflammation of the bronchioles) and pneumonia may result, and death is not uncommon. In older children, RSV infection is usually milder. By the age of four years, most children show serological evidence of previous infection, but this does not necessarily result in lasting immunity. Outbreaks of RSV have been documented in the community and may occur in hospital, especially among very sick children, contributing to morbidity and mortality. Virus particles are present in nasal secretions, nosocomial spread being via the hands. This is supported by the results of a study in which the incidence of RSV declined after a strict handwashing regimen was introduced among staff and parents (Isaacs et al., 1991).

Pertussis

Pertussis (whooping cough) is caused by a small Gram-negative bacterium called *Bordetella pertussis*. Following exposure to a source of infection, the bacteria become attached to ciliated cells lining the respiratory mucosa. Nonspecific symptoms without the typical cough develop within 5–7 days. The child appears to have a cold but is highly infectious, releasing a large number of bacteria from the nasopharynx. Finally, the infection enters the paroxysmal phase, characterized by coughing that ends in 'whoop' and/or vomiting. However, the presentation varies and may be a persistent cough alone. Pertussis is particularly severe in infants under six months of age (Bedford and Elliman, 2006). Vaccination is an important public health measure in the control of this frightening and unpleasant infection, which can in severe cases be life-threatening. The bacteria are never carried in a healthy throat (Weiss and Hewlett, 1986).

Diphtheria

Diphtheria is caused by the Gram-positive bacillus *Corynebacterium diphtheriae*. It is a very rare infection in the UK, but travellers to Eastern Europe, countries of the

former Soviet Union and areas in the developing world may be exposed to the organism. The disease results in an acute respiratory illness characterized by the formation of a tenacious 'membrane' (consisting of white blood cells, bacteria and respiratory epithelium) within the upper respiratory tract. This membrane can cause laryngeal obstruction, leading to death without emergency treatment, such as a tracheostomy, to maintain a patent airway. *Corynebacterium diphtheriae* also produces an exotoxin that circulates in the blood to cause complications such as myocarditis and peripheral neuropathy.

The management of patients and contacts with diphtheria includes:

- Informing the proper officer of the relevant public health authority, as diphtheria is a notifiable disease
- Case isolation
- PPE – gloves, aprons and masks – for staff and visitors
- Treating the patient with penicillin and diphtheria antitoxin
- Treating contacts with erythromycin and immunizing them with diphtheria toxoid
- Meticulous attention to oral hygiene and pain relief
- Monitoring vital signs, especially respiration. Cardiac monitoring should be undertaken if myocardial involvement is suspected.

It is important to stress that active immunization against diphtheria, administered during childhood, is very effective. Others who may need immunization include contacts of a case of diphtheria, healthcare workers, laboratory staff and those who travel to countries where the disease is endemic.

Influenza

RNA viruses belonging to the family of orthomyxoviruses, which have an affinity for mucoproteins present on the surface of human and other mammalian cells, cause influenza. There are three types of influenza virus: A, B and C. The surface of each type is coated with a number of specific antigens (V, H and N) to which the host responds by secreting the corresponding antibody. Standard nomenclature is employed to classify the different strains according to their surface antigens.

Influenza is transmitted via infected nasopharyngeal secretions, resulting in an acute illness with fever, headache, anorexia, myalgia and profound malaise, although (contrary to popular belief) relatively minor respiratory symptoms. The antiviral drugs oseltamivir and zanamivir are used within 48 hours of the onset of symptoms to shorten the duration of symptoms for specified groups. For post-exposure prophylaxis in specified groups and for use in influenza epidemics (see Further Reading). Severe colds are sometimes erroneously labelled 'flu' by sufferers. In young people, influenza is an unpleasant, debilitating illness, disrupting work or school. The consequences can be grave for older adults or those in poor health (Riley and Riley, 2003). Pneumonia may supervene. This is usually attributed to colonization of the traumatized respiratory epithelium by potential patho-

gens (*Staphylococcus aureus* and *Haemophilus influenzae*), but in some cases the virus itself may be responsible.

Influenza viruses are widespread throughout the world, producing epidemics every few years. Spread across the community is most common for type A, which is the most virulent (Grist, 1989), type C being least likely to cause epidemics. Worldwide pandemics have been recorded but are difficult to predict. In 1918, 20 million people – including young adults – died from influenza. More recently, the pandemic of Asian flu resulted in a high incidence of infection but a lower rate of mortality. Most major outbreaks represent the emergence of new variants of influenza virus with different surface antigens (antigenic drift). This is most marked with type A. The population has no immunity against the new antigens so infection becomes rife. The existence of the three different strains of the virus (A, B and C), the differences in the surface antigens displayed by members of the same strain and the phenomenon of antigenic drift contribute to the difficulties of controlling influenza. No single vaccine will give lasting immunity. Instead, annual vaccination is necessary as each new strain emerges. Immunizing those over 65 reduces the rate of influenza-related hospital admissions (Riley and Riley, 2003). At-risk groups benefiting from immunization include all those over 65 years of age and those:

- Over six months of age who have:
  - chronic respiratory disease including asthma who require use of a nebulizers
  - chronic heart disease
  - chronic renal disease
  - diabetes requiring insulin or hypoglycaemic drugs
  - immunosuppressive conditions
- Living in long-stay facilities (see below)
- NHS staff who deal with or support patients/clients and social service care staff (Department of Health, 2007).

PRACTICE APPLICATION 9.4

Protecting Care Home Residents against Flu

Residents in care homes and other long-stay facilities benefit from an annual influenza vaccination. Hayward et al. (2006) conducted a study to determine whether or not the vaccination of staff is also beneficial for residents.

Activity

- Access the article by Hayward et al. (2006). Consider their findings and discuss them with your mentor.
- If you work in a care home:
  - are carers and other staff offered flu vaccination?
  - are residents routinely vaccinated against flu?

Uptake of the vaccine is usually high (Health Protection Agency, 2006). The influenza vaccine, prepared from inactivated, highly purified viruses, is cheap and safe with few side-effects (Govaert and Dinant, 1993).

Most offers of immunization are made within the primary care setting, and most people who accept request it the following year. Practice nurses are in a key position to run immunization clinics, maintain registers of people at risk and liaise with practice managers so that reminders and repeat prescriptions are issued. The failure of susceptible people to accept vaccination is serious because it leads to increased mortality, although many deaths will not be directly attributed to the influenza itself. Outbreaks are expensive because a large number of patients are admitted to hospital over a short period of time and normal services are disrupted (Grist, 1989).

Avian influenza

Avian influenza ('bird flu') is a highly contagious disease of birds caused by influenza A viruses (Campbell, 2006). In birds it can present as a mild illness with low mortality to a highly contagious disease with nearly 100 per cent mortality rate. The bird flu that has recently affected wild birds, poultry and some people is the highly pathogenic strain H5N1. It is a threat because the virus can remain viable in bird droppings for long periods and is able to spread among birds and from birds to other animals through ingestion and inhalation. Migratory birds often carry H5N1 without symptoms but domestic flocks of poultry appear especially susceptible to rapid, fatal epidemics. The widespread occurrence of H5N1 has prompted concern that it might give rise to a new human influenza illness with pandemic potential, although so far it appears to have infected only people having close contact with birds. However, once established in a human population, the virus could spread rapidly and there is at present little available to prevent this because effective vaccines and antiviral drugs are presently in low supply. A global strategy for tackling avian flu has been recommended because it is a highly pathogenic condition that has the potential to spread rapidly across countries and continents, disrupting the lives of millions of people, threatening regional and international trade depending on the poultry industry and outstripping the health resources of any individual country. As well as a global strategy, the World Health Organization (2005) has recommended that all countries develop a national strategy to control avian influenza. In the UK, the Department of Health (2005) has responded by developing a contingency plan to minimize the spread of the new virus, provide treatment, cope with the eventuality of large numbers of people falling ill and dying and reduce its impact on the health and social services and its economic consequences. Drugs having the greatest potential for treatment are oseltamivir and zanamivir.

SELF-ASSESSMENT

1. Which of the following operate as respiratory pathogens?
   (a) staphylococci
   (b) rhinoviruses
   (c) Gram-negative bacteria
   (d) all of these

2. Bacterial community-acquired pneumonia is most frequently caused by *Streptococcus pneumoniae*. True? or False?
3. Pneumonia accounts for 13.9 per cent of HCAIs in acute hospitals. True? or False?
4. Which groups of patients in hospital are most likely to develop pneumonia?
5. Name five sources of pathogens for hospital-acquired pneumonia.
6. A pyrexial child with an upper respiratory tract infection may benefit from which of the following?
   (a) two paracetamol tablets
   (b) an antitussive
   (c) aspirin
   (d) paracetamol dose calculated on body weight
7. The pathogen responsible for whooping cough is *Haemophilus influenzae*? True? or False?
8. Which groups of people should be offered an annual influenza vaccination?

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