

25

Pneumococcal

Pneumococcal meningitis

NOTIFIABLE

Pneumococcal

The disease

Pneumococcal disease is the term used to describe infections caused by the bacterium *Streptococcus pneumoniae* (also called pneumococcus).

S. pneumoniae is an encapsulated Gram-positive coccus. The capsule is the most important virulence factor of *S. pneumoniae*; pneumococci that lack the capsule are normally not virulent. Over 90 different capsular types have been characterised. Prior to the routine conjugate vaccination, around 69% of invasive pneumococcal infections were caused by the ten (14, 9V, 1, 8, 23F, 4, 3, 6B, 19F, 7F) most prevalent serotypes (Trotter *et al.*, 2010).

Some serotypes of the pneumococcus may be carried in the nasopharynx without symptoms, with disease occurring in a small proportion of infected individuals. Other serotypes are rarely identified in the nasopharynx but are associated with invasive disease. The incubation period for pneumococcal disease is not clearly defined but it may be as short as one to three days. The organism may spread locally into the sinuses or middle ear cavity, causing sinusitis or otitis media. It may also affect the lungs to cause pneumonia, or cause systemic (invasive) infections including bacteraemic pneumonia, bacteraemia and meningitis.

Transmission is by aerosol, droplets or direct contact with respiratory secretions of someone carrying the organism. Transmission usually requires either frequent or prolonged close contact. There is a seasonal variation in pneumococcal disease, with peak levels in the winter months.

Invasive pneumococcal disease is a major cause of morbidity and mortality. It particularly affects the very young, the elderly, those with an absent or non-functioning spleen and those with other causes of impaired immunity. Recurrent infections may occur in association with skull defects, cerebrospinal fluid (CSF) leaks, cochlear implants or fractures of the skull.

History and epidemiology of the disease

The pneumococcus is one of the most frequently reported causes of bacteraemia and meningitis in children and adults. In 2000, the World Health Organisation estimated that there were around 14.5 million episodes of serious pneumococcal disease globally, resulting in about 826 000 deaths in children aged under five years of age. There is marked seasonality with invasive pneumococcal disease, with a consistent winter peak every year (December to February) (Trotter *et al.*, 2010). The pneumococcus is also the commonest cause of community-acquired pneumonia, as well as non-invasive, upper respiratory tract infections such as otitis media and sinusitis.

Since 1992, pneumococcal polysaccharide immunisation (see below) has been recommended for people with medical conditions for whom pneumococcal infection was likely to be more common or serious.

In recent years, the pneumococcal vaccination recommendations have undergone a number of changes:

- in 2002, a pneumococcal conjugate vaccine (PCV) containing polysaccharide from seven common capsular types (PCV7) became available and was recommended for immunisation of at-risk groups under the age of two years
- in 2003, pneumococcal polysaccharide (PPV) immunisation was recommended for all people aged 65 and over
- in 2004, the PCV7 policy was extended to at-risk children under five years of age
- in 2006, PCV7 was added to the routine childhood immunisation programme
- in 2010, a pneumococcal conjugate vaccine containing polysaccharide from thirteen common capsular types (PCV13) replaced PCV7. PCV13 aims to protect against 6 additional serotypes compared with PCV7.

Prior to the introduction of PCV7 into the childhood immunisation programme in 2006, there were 6,354 confirmed cases of invasive pneumococcal disease in England and Wales during the 2005/06 epidemiological year, with an estimated incidence of 11.9 cases per 100,000 population for all invasive pneumococcal infections and 0.6/100,000 for pneumococcal meningitis (Trotter *et al.*, 2010). Children and older adults had the highest risk of invasive pneumococcal disease. The serotypes covered by PCV7 were responsible for 73% of all invasive pneumococcal infections in children age <2 years (Trotter *et al.*, 2010).

The pneumococcal vaccination

There are three types of pneumococcal vaccine licensed in the UK:

- pneumococcal polysaccharide vaccine (PPV) contains purified capsular polysaccharide from each of 23 capsular types of pneumococcus (PPV23) 1, 2, 3, 4, 5, 6B, 7F, 8, 9N, 9V, 10A, 11A, 12F, 14, 15B, 17F, 18C, 19F, 19A, 20, 22F, 23F, 33F
- pneumococcal conjugate vaccine (PCV13) contains polysaccharide from thirteen common capsular types 1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, 23F. These are conjugated to protein (CRM197) using similar manufacturing technology to that used for *Haemophilus influenzae* type b (Hib) and meningococcal conjugate vaccines
- The pneumococcal polysaccharide and pneumococcal conjugate vaccines do not contain thiomersal. The vaccines are inactivated, do not contain live organisms and cannot cause the diseases against which they protect
- pneumococcal conjugate vaccine (PCV10) contains polysaccharide from ten common capsular types 1, 4, 5, 6B, 7F, 9V, 14, 18C, 19F, 23F. These are conjugated to protein D (derived from non-typeable *Haemophilus influenzae*) or tetanus toxoid or diphtheria toxoid carrier proteins. PCV10 is not currently used in the UK immunisation programme

Pneumococcal polysaccharide vaccine (PPV)

Most healthy adults develop a good antibody response to a single dose of PPV by the third week following immunisation. Antibody response may be reduced in those with immunological impairment and those with an absent or dysfunctional spleen. Children younger than two years of age show poor antibody responses to immunisation with PPV. It is difficult to reach firm conclusions about the effectiveness of PPV, but overall efficacy in preventing pneumococcal bacteraemia is probably 50 to 70% (Mangtani *et al.*, 2003; Fedson, 1999; Fine *et al.*, 1994; Butler *et al.*, 1993; Melegaro and Edmunds, 2004). Current evidence suggests that PPV is not effective in protecting against non-bacteraemic pneumococcal pneumonia (Jackson *et al.*, 2003). It does not prevent otitis media or exacerbations of chronic bronchitis. The vaccine is relatively ineffective in patients with multiple myeloma, Hodgkin's and non-Hodgkin's lymphoma (especially during treatment) and chronic alcoholism.

The vaccine does not protect against pneumococcal infection due to capsular types not contained in the vaccine, but the 23 types included account for about 96% of the pneumococcal isolates that cause serious infection in the UK (Health Protection Agency, 2003).

The length of protection is not known and may vary between capsular types. Post-immunisation antibody levels usually begin to wane after about five years, but may decline more rapidly in asplenic patients and children with nephrotic syndrome (Butler *et al.*, 1993).

There is no evidence of effectiveness of PPV in children under two years of age (Fedson *et al.*, 1999).

Pneumococcal conjugate vaccine (PCV)

The antibody response in young children can be improved by conjugating the polysaccharide to proteins such as CRM197, a non-toxic mutant of diphtheria toxin. Pneumococcal conjugated vaccines are known to be highly immunogenic in children from two months of age. In 2006, contrary to the licensed schedule, the UK introduced a reduced two-dose infant priming doses for PCV7, providing protection against serotypes 4, 6B, 9V, 14, 18C, 19F, and 23F, at two and four months, followed by a booster after the first birthday. This programme achieved very high vaccine coverage (>90%) and resulted in a rapid and sustained reduction in overall IPD and in IPD due to the PCV7 serotypes across all age groups because of the direct and indirect (herd) protection (Miller *et al.*, 2011). The large declines in PCV7-type IPD were offset by small increases in non-PCV7 type IPD across all age groups. Overall, however, IPD incidence fell from 16.1 per 100,000 in the pre-vaccine period (2000-06) to 10.6 per 100,000 in 2009-10, an overall reduction of 34% (Miller *et al.*, 2011).

In subsequent studies conducted in the UK comparing PCV7 with PCV13 in infants, post-immunisation antibody responses were comparable for all serotypes common to both vaccines (Snape *et al.*, 2010). Studies have also shown good functional antibody responses to the additional six serotypes in PCV13. The replacement of PCV7 with PCV13 in April 2010 led to further reductions in IPD to 6.85 per 100 000 in 2013/14, resulting in a 56% overall reduction in overall IPD incidence when compared with the pre-PCV7 baseline (Waight *et al.*, 2015). By 2013/14, more than 70% of all IPD cases were due to serotypes not covered by PCV13 (Waight *et al.*, 2015).

Storage

Vaccines should be stored in the original packaging at +2°C to +8°C and protected from light. All vaccines are sensitive to some extent to heat and cold. Heat speeds up the decline in potency of most vaccines, thus reducing their shelf life. Effectiveness cannot be guaranteed for vaccines unless they have been stored at the correct temperature. Freezing may cause increased reactogenicity and loss of potency for some vaccines. It can also cause hairline cracks in the container, leading to contamination of the contents.

Presentation

PCV10, PCV13 and PPV23 are supplied as single doses of 0.5ml.

PCV 10 and PCV13

Storage can cause the vaccine to separate into a white deposit and clear supernatant. The vaccine should be shaken well to obtain a white homogeneous suspension and should not be used if there is any residual particulate matter after shaking.

PPV23

The polysaccharide vaccine should be inspected before being given to check that it is clear and colourless.

Vaccines must not be given intravenously.

Dosage and schedule

PCV13

For infants under one year of age:

- first dose of 0.5ml of PCV13 at eight weeks of age
- second dose of 0.5ml at 16 weeks of age (at least two months after the first dose)
- a third dose of 0.5ml should be given after their first birthday (at least 2 months after the last PCV13 dose)

Unimmunised or partially immunised children aged one year and up to two years of age:

- a single dose of 0.5ml of PCV13
- children and adults in a clinical risk group (table 25.1)
- see recommendations below

PPV23

Adults over 65 years and at-risk groups aged two years or over:

- a single dose of 0.5ml of PPV23

PCV10

Not currently recommended in the UK National Immunisation Programme. See the SPC for potential dosing schedules.

Administration

Vaccines are routinely given into the upper arm in children and adults or the anterolateral thigh in infants under one year of age. This is to reduce the risk of localised reactions, which are more common when vaccines are given subcutaneously (Mark *et al.*, 1999; Diggle and Deeks, 2000; Zuckerman, 2000). However, for individuals with a bleeding disorder, vaccines should be given by deep subcutaneous injection to reduce the risk of bleeding.

Pneumococcal vaccines can be given at the same time as other vaccines such as DTaP/IPV/Hib/HepB, 4CMenB, MMR, MenC, Hib/MenC and influenza. The vaccines should be given at separate sites, preferably in different limbs. If given in the same limb, they should be given at least 2.5cm apart (American Academy of Pediatrics, 2003) (see **Chapter 11**). The site at which each vaccine was given should be noted in the individual's records.

Disposal

Equipment used for vaccination, including used vials, ampoules or syringes, should be disposed of by placing it in an approved, puncture-resistant 'sharps' box according to local authority regulations and guidance in Health Technical Memorandum 07-01: Safe management of healthcare waste (Department of Health, 2013).

Recommendations for the use of pneumococcal vaccine

The objective of the immunisation programme is to protect all of those for whom pneumococcal infection is likely to be more common and/or serious, i.e.:

- infants as part of the routine childhood immunisation programme
- those aged 65 years or over
- children and adults in the clinical risk groups shown in Table 25.1

Primary care staff should identify patients for whom vaccine is recommended and use all opportunities to ensure that they are appropriately immunised, for example:

- when immunising against influenza
- at other routine consultations, especially on discharge after hospital admission.

Primary immunisation

PCV13

PCV13 is recommended for infants from two months of age as part of the routine childhood immunisation schedule.

The primary course of PCV13 vaccination consists of two doses with an interval of two months between each dose. The recommended schedule for vaccination is two and four months of age. If the primary course is interrupted then give a dose of PCV13 as soon as possible followed by the booster dose on or after the first birthday, allowing an interval of two months between the doses.

PPV23

Adults 65 years or over

A single dose of PPV23 should be administered.

Table 25.1 Clinical risk groups who should receive the pneumococcal immunisation

Clinical risk group	Examples (decision based on clinical judgement)
Asplenia or dysfunction of the spleen	This also includes conditions such as homozygous sickle cell disease and coeliac syndrome that may lead to splenic dysfunction.
Chronic respiratory disease (chronic respiratory disease refers to chronic lower respiratory tract disease)	This includes chronic obstructive pulmonary disease (COPD), including chronic bronchitis and emphysema; and such conditions as bronchiectasis, cystic fibrosis, interstitial lung fibrosis, pneumoconiosis and bronchopulmonary dysplasia (BPD). Children with respiratory conditions caused by aspiration, or a neurological disease (e.g. cerebral palsy) with a risk of aspiration. Asthma is not an indication, unless so severe as to require continuous or frequently repeated use of systemic steroids (as defined in Immunosuppression below).
Chronic heart disease	This includes those requiring regular medication and/or follow-up for ischaemic heart disease, congenital heart disease, hypertension with cardiac complications, and chronic heart failure.
Chronic kidney disease	Nephrotic syndrome, chronic kidney disease at stages 4 and 5 and those on kidney dialysis or with kidney transplantation.
Chronic liver disease	This includes cirrhosis, biliary atresia and chronic hepatitis.
Diabetes	Diabetes mellitus requiring insulin or oral hypoglycaemic drugs. This does not include diabetes that is diet controlled.
Immunosuppression	Due to disease or treatment, including patients undergoing chemotherapy leading to immunosuppression, bone marrow transplant, asplenia or splenic dysfunction, HIV infection at all stages, multiple myeloma or genetic disorders affecting the immune system (e.g. IRAK-4, NEMO, complement deficiency) Individuals on or likely to be on systemic steroids for more than a month at a dose equivalent to prednisolone at 20mg or more per day (any age), or for children under 20kg, a dose of 1mg or more per kg per day.
Individuals with cochlear implants	It is important that immunisation does not delay the cochlear implantation.
Individuals with cerebrospinal fluid leaks	This includes leakage of cerebrospinal fluid such as following trauma or major skull surgery. Conditions related to CSF leaks include all CSF shunts.
Occupational risk	Please see page 9

Reinforcing immunisation

PCV13

A reinforcing (booster) dose of PCV13 is recommended on or after the first birthday. This vaccine is given at the same time as the Hib/MenC, 4CMenB and MMR vaccines (see **Chapter 11**).

PPV23

Antibody levels are likely to decline rapidly in individuals with no spleen, splenic dysfunction or chronic renal disease (Giebink *et al.*, 1981; Rytel *et al.*, 1986) and therefore re-immunisation with PPV23 is recommended every five years in these groups. Revaccination is well tolerated (Jackson *et al.*, 1999). Testing of antibody levels prior to vaccination is not required. Although there is evidence of a decline in protection with time (Shapiro *et al.*, 1991), there are no studies showing additional protection from boosting individuals with other indications, including age, and therefore routine revaccination is not currently recommended.

Individuals with unknown or incomplete vaccination histories

Unless there is a reliable history of previous immunisation, individuals should be assumed to be unimmunised. The full UK recommendations should be followed. Unimmunised or partially immunised children who present late for vaccination and before the age of one year should receive two doses of PCV13 two months apart¹, and a further dose on their first birthday, at least two months after the last PCV13 dose¹. An unimmunised or partially immunised child aged between one and under two years of age should have a single dose of PCV13. Routine immunisation with PCV is not offered after the second birthday unless the individual is at increased risk of pneumococcal disease.

Risk groups

Children and adults in at-risk groups as outlined in table 25.1 may require additional protection against pneumococcal disease. The vaccine(s) and schedule used will depend on the age at presentation, their routine vaccination status and the nature of the underlying condition:

Infants diagnosed with at-risk conditions from birth to two years of age

All at-risk infants younger than one year (see Table 25.1), including those severely immunocompromised², should be given PCV13 according to the schedule for the routine immunisation programme, at 8 weeks, 16 weeks and on their first birthday. At-risk infants who present late for vaccination should be immunised according to 'Individuals with unknown or incomplete vaccination histories' above. A single dose of PPV23 should be then given when they reach the age of two years, at least two months after the last dose of PCV.

Children in this age group who are severely immunocompromised² and those with asplenia, splenic dysfunction or complement disorders are recommended to have an additional PCV13 dose. A second dose of PCV13 should be given at least two months after the routine dose due on their first birthday¹. A single dose of PPV23 should be then given when they reach the age of two years, at least two months after the last dose of PCV.

¹ the intervals may be reduced to one month if necessary to ensure that the immunisation schedule is completed

² including bone marrow transplant patients, patients with acute and chronic leukaemia, multiple myeloma or genetic disorders affecting the immune system (e.g. IRAK-4, NEMO, complement deficiency)

Children diagnosed with at-risk conditions from two years to under ten years of age

Children diagnosed (or first presenting as) at-risk aged from two to under ten years of age who completed the recommended routine PCV immunisation schedule at 8 weeks, 16 weeks and on their first birthday should also receive PPV23. A single dose of PPV23 should be given, at least two months after the last dose of PCV. Children in this age group who are previously unvaccinated or partially vaccinated for PCV should receive one dose of PCV13, followed by a single dose of PPV23 at least two months later.

Severely immunocompromised² children in this age group may have a sub-optimal immunological responses to the vaccine and should be given an additional dose of PCV13 even if they are fully vaccinated. A single dose of PPV23 should then be given, at least two months after the last dose of PCV. If PPV23 has already been administered, then wait at least six months after the PPV23 dose to give PCV13 in order to reduce the theoretical risk of pneumococcal serotype-specific hypo-responsiveness.

Children aged 10 years onwards and adults diagnosed with at-risk conditions

Individuals diagnosed (or first presenting as) from ten years of age should receive a single dose of PPV23, regardless of prior PCV vaccination. No additional PPV23 is recommended when they reach 65 years of age.

Older children and adults who are severely immunocompromised² should be offered a single dose of PCV13 followed by PPV23 at least two months later (irrespective of their previous pneumococcal vaccinations). If PPV23 has already been administered, then wait at least six months after the PPV23 dose to give PCV13 in order to reduce the theoretical risk of pneumococcal serotype-specific hypo-responsiveness.

Timing of vaccination for individuals with splenic dysfunction or those requiring splenectomy or commencing immunosuppressive treatment

Because of the high risk of overwhelming infection, particularly for pneumococcal disease, vaccination against pneumococcal infection is recommended for all individuals who have splenic dysfunction. Because of this high risk, individuals with conditions which may lead splenic dysfunction in the future, including haemoglobinopathies such as sickle cell disease and coeliac syndrome, should also be vaccinated. See Chapter 7 for an example schedule including the other vaccines indicated in these groups.

Children and adults requiring splenectomy or commencing immunosuppressive treatment should be vaccinated according to the age-specific advice outlined above for risk groups. Ideally, pneumococcal vaccine should be given four to six weeks before elective splenectomy or initiation of treatment such as chemotherapy or radiotherapy. Where this is not possible, it can be given up to two weeks before treatment. If it is not possible to vaccinate beforehand, splenectomy, chemotherapy or radiotherapy should never be delayed.

If it is not practicable to vaccinate two weeks before splenectomy, immunisation should be delayed until at least two weeks after the operation. This is because there is evidence that

² including bone marrow transplant patients, patients with acute and chronic leukaemia, multiple myeloma or genetic disorders affecting the immune system (e.g. IRAK-4, NEMO, complement deficiency)

functional antibody responses may be better from this time (Shatz *et al.*, 1998). If it is not practicable to vaccinate two weeks before the initiation of chemotherapy and/or radiotherapy, immunisation can be delayed until at least three months after completion of therapy in order to maximise the response to the vaccine. Immunisation of these patients should not be delayed if this is likely to result in a failure to vaccinate.

For leukaemia patients, PCV13 should be given from six months after completion of chemotherapy, and for bone marrow transplant patients, PCV13 should be offered 9-12 months following transplantation.

Individuals at occupational risk

There is an association between exposure to metal fume and pneumonia and infectious pneumonia, particularly lobar pneumonia (Palmer *et al.*, 2003; Palmer *et al.*, 2009; Industrial Injuries Advisory Council, 2010; Toren *et al.*, 2011) and between welding and invasive pneumococcal disease (Wong *et al.*, 2010). PPV23 (single 0.5ml dose in those who have not received PPV previously) should be considered for those at risk of frequent or continuous occupational exposure to metal fume (e.g. welders) taking into account the exposure control measures in place. Vaccination may reduce the risk of invasive pneumococcal disease but should not replace the need for measures to prevent or reduce exposure.

Contraindications

There are very few individuals who cannot receive pneumococcal vaccines. When there is doubt, appropriate advice should be sought from a consultant paediatrician, immunisation co-ordinator or consultant in communicable disease control rather than withholding the vaccine.

The vaccines should not be given to those who have had:

- a confirmed anaphylactic reaction to a previous dose of the vaccines
- a confirmed anaphylactic reaction to any component of the vaccines

Confirmed anaphylaxis is rare. Other allergic conditions, such as rashes, may occur more commonly and are not contraindications to further immunisation. A careful history of the event will often distinguish between true anaphylaxis and other events that are either not due to the vaccine or not life-threatening. In the latter circumstance, it may be possible to continue the immunisation course. Specialist advice must be sought on the vaccines and the circumstances in which they could be given. The risk to the individual of not being immunised must be taken into account.

Precautions

Minor illnesses without fever or systemic upset are not valid reasons to postpone immunisation. If an individual is acutely unwell, immunisation should be postponed until they have fully recovered. This is to avoid confusing the differential diagnosis of any acute illness by wrongly attributing any signs or symptoms to the adverse effects of the vaccine.

Pregnancy and breast-feeding

Pneumococcal vaccines may be given to pregnant women when the need for protection is required without delay. There is no evidence of risk from vaccinating pregnant women or those who are breast-feeding with inactivated viral or bacterial vaccines or toxoids (Plotkin and Orenstein, 2004).

Premature infants

It is important that premature infants have their immunisations at the appropriate chronological age, according to the schedule. The occurrence of apnoea following vaccination is especially increased in infants who were born very prematurely.

Very premature infants (born \leq 28 weeks of gestation) who are in hospital should have respiratory monitoring for 48-72 hrs when given their first immunisation, particularly those with a previous history of respiratory immaturity. If the child has apnoea, bradycardia or desaturations after the first immunisation, the second immunisation should also be given in hospital, with respiratory monitoring for 48-72 hours (Pfister *et al.* 2004; Ohlsson *et al.* 2004; Schulzke *et al.* 2005; Pourcyrus *et al.*, 2007; Klein *et al.*, 2008).

As the benefit of vaccination is high in this group of infants, vaccination should not be withheld or delayed.

Immunosuppression and HIV infection

Individuals with immunosuppression and HIV infection (regardless of CD4 count) should be given pneumococcal vaccines in accordance with the recommendations above.

Studies on the clinical efficacy of PPV23 in HIV-infected adults have reported inconsistent findings, including one study from the developing world where a higher risk of pneumonia was observed in vaccinees (Watera *et al.*, 2004). Observational studies in developed countries have not confirmed this finding, and most experts believe that the potential benefit of pneumococcal vaccination outweighs the risk in developed countries (USPHS/ IDSA, 2001).

For children with HIV infection (regardless of CD4 count), clinicians may also wish to consider the joint guidance from the Paediatric European Network for Treatment of AIDS Vaccines Group and the Children's HIV Association (Menson *et al.*, 2012). Further guidance for the immunisation of HIV-infected individuals is provided by the Royal College of Paediatrics and Child Health (RCPCH; <http://www.rcpch.ac.uk/>), the British HIV Association (BHIVA 2015; <http://www.bhiva.org/vaccination-guidelines.aspx>) and the Children's HIV Association (CHIVA; <http://www.chiva.org.uk/guidelines/immunisation/>).

Adverse reactions

PCV13

Anyone can report a suspected adverse reaction to the Medical and Healthcare products Regulatory Agency (MHRA) using the Yellow Card reporting scheme (<http://yellowcard.mhra.gov.uk/>).

The safety of the vaccine was assessed in controlled clinical studies and the safety profile of Prevenar13® was similar to Prevenar®. For Prevenar13®, The most commonly reported adverse reactions in children 6 weeks to 5 years of age were vaccination-site reactions, fever, irritability, decreased appetite, and increased and/or decreased sleep. Reports of all adverse reactions can be found in the summary of product characteristics for Prevenar 13® available at <https://www.medicines.org.uk>.

PPV23

Mild soreness and induration at the site of injection lasting one to three days and, less commonly, a low grade fever may occur. More severe systemic reactions are infrequent. In general, local and systemic reactions are more common in people with higher concentrations of antibodies to pneumococcal polysaccharides.

Management of cases, contacts and outbreaks

Cases of invasive pneumococcal disease (IPD)

Any case of invasive pneumococcal infection or lobar pneumonia believed to be due to *S. pneumoniae* should prompt a review of the patient's medical history to establish whether they are in a recognised risk group and whether they have been appropriately immunised. Unimmunised or partially immunised at risk individuals should be vaccinated upon discharge from hospital whenever possible.

Cases in small children under five years of age

Clinicians should ensure that children diagnosed with IPD have completed the recommended national immunisation schedule. Infants who are younger than 12 months of age at the time of IPD and who are unvaccinated or partially vaccinated should complete the recommended immunisation schedule.

Immunised children who subsequently develop IPD caused by one of the pneumococcal vaccine serotypes should be assessed for possible underlying immune deficiency. If the child falls into one of the clinical risk groups in Table 25.1, then additional vaccinations should be offered as recommended in this chapter.

Isolates from all cases of IPD should be referred to the national reference laboratory for serotyping. All new cases of IPD in children in aged <5 years England and Wales, regardless of serotype, will be followed up by Public Health England (for England and Wales) and Health Protection Scotland. Some cases may require serotype-specific antibody and/or additional pneumococcal vaccination testing depending on the pneumococcal vaccination status of the child and the infecting pneumococcal serotype.

Contacts

Close contacts of pneumococcal meningitis or other invasive pneumococcal disease are not normally at an increased risk of pneumococcal infection and therefore antibiotic prophylaxis is not indicated. Clusters of invasive pneumococcal disease should be discussed with local health protection teams.

Outbreaks

Outbreaks of pneumococcal respiratory disease in hospitals and residential care homes need prompt investigation. Control measures including vaccination may be appropriate; these should be agreed in discussion with local health protection or infection control teams. For further information see the interim UK guidelines for the public health management of clusters of serious pneumococcal disease in closed settings (Health Protection Agency, 2008).

Supplies

- 13-valent PCV (Prevenar 13[®]) is manufactured by Pfizer (Medical Information Tel: 01737 331111; Fax: 01737 332507; E-mail: MedInfoUK@Pfizer.com). It is supplied by Movianto UK Ltd (01234 248631) as part of the national childhood immunisation programme
- 23-valent PPV is manufactured by MSD UK. MSD vaccines are distributed by AAH LTD (Tel: 0844 561 2008)
- 10 valent PCV (Synflorix[®]) is manufactured by GlaxoSmithKline Tel 0800 221 441

In Northern Ireland, supplies should be obtained from local childhood vaccine- holding centres. Details of these are available from the regional pharmaceutical procurement service (Tel: 028 9055 2386).

Information materials

A patient card and information sheet for asplenic and hyposplenic patients are available from:

Department of Health publications (Tel: 0300 123 1002).

(E-mail: dh@prolog.uk.com). or in Scotland from:

The Health Protection Team (Immunisation) Health Directorates Scottish Executive Area 3ES
St Andrews House Regent road Edinburgh EH1 3DG

(Tel: 0131 244 2241).

(Fax: 0131 244 2157).

(E-mail: chris.sinclair@scotland.gsi.gov.uk).

Or in Wales a leaflet *A guide for people without a working spleen* and a patient card are available from:

The Welsh Assembly Government Publications Centre (02920 823683)

(E-mail: assembly-publications@wales.gsi.gov.uk)

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