

3.14 PERTUSSIS

Bacteriology

Pertussis (whooping cough) is caused by *Bordetella pertussis*, a fastidious, Gram-negative, pleomorphic bacillus. There are other organisms (such as *Bordetella parapertussis*, *Mycoplasma pneumoniae* and *Chlamydia pneumoniae*) which can cause a pertussis-like syndrome.¹ Identification of pertussis is limited by patient and physician awareness and the limited sensitivity of diagnostic tests; it is generally believed to be significantly under-diagnosed.

Clinical features

Pertussis is an epidemic respiratory infection with an incubation period of 7 to 20 days. In unvaccinated individuals, *B. pertussis* is highly infectious, spreading by respiratory droplets to 80% of susceptible household contacts.² The characteristic paroxysmal cough with inspiratory whoop seen in unvaccinated children is less common in older children and adults who have varying degrees of immunity acquired from vaccination or infection. It has been estimated that *B. pertussis* accounts for up to 7% of cough illness per year in adults and, each year, more than 25% of adults experience a coughing illness of at least 5 days' duration.^{2,3} Even in adults, pertussis can be associated with significant morbidity, with cough persisting for up to 3 months, and other significant symptoms, such as sleep disturbance or, rarely, rib fracture.⁴

Death due to pertussis is rare in people >10 years of age. However, the case fatality rate in unvaccinated infants <6 months of age is estimated to be 0.8%.^{5,6} The most common cause of death in pertussis infection is pertussis pneumonia, sometimes complicated by seizures and hypoxic encephalopathy.² Both hospitalisations and deaths are likely to be under-estimated.⁷ In Australia between 1993 and 2005, there were 18 deaths attributed to pertussis, all but 2 in infants <12 months of age.⁸⁻¹¹

Epidemiology

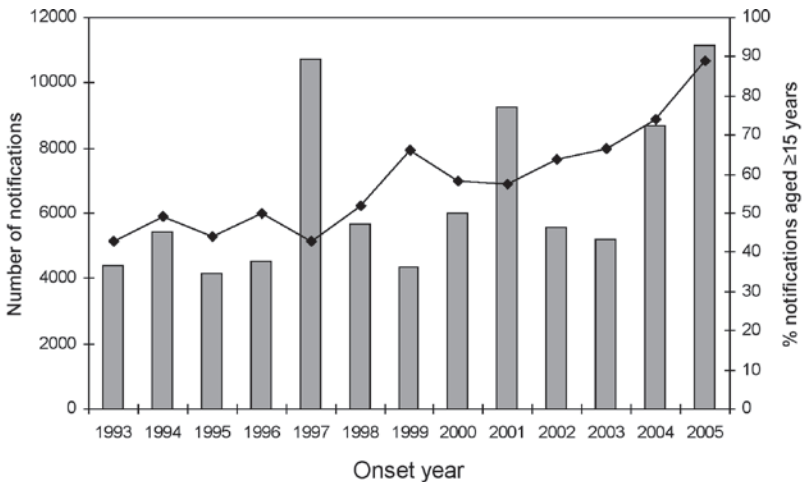
Epidemics occur every 3 to 4 years. In unvaccinated populations, these outbreaks can be very large. In vaccinated populations, outbreaks are smaller, with greatly reduced mortality and morbidity, and may continue to occur every 3 to 4 years or be more widely spaced. Maternal antibody does not provide reliable protection against pertussis, and the maximal risk of infection and severe morbidity is before infants are old enough to have received at least 2 vaccine doses.⁷ In recent years, among highly immunised communities, many cases of pertussis in adults and adolescents, due to waning immunity, have been recognised due to the increased availability of serological testing.^{6,12} These individuals are a significant reservoir of infection. From 1993 to 2005, 4 epidemics of pertussis

occurred in Australia. A total of more than 84 000 cases was reported in this time, an annual incidence of 22.8 to 57.4 cases per 100 000 population.¹³

Introduction of a fifth dose of diphtheria, tetanus and pertussis vaccine (DTP) for 4–5-year-old children in August 1994 was followed by a pattern of decrease in notifications consistent with a vaccine effect, occurring first among children aged 5 and 6 years, followed by those in the 7–9-year age group.^{14,15} Subsequently, the average age of those notified with pertussis has continued to increase.

In 2004–2005, more than 70% of pertussis notifications were in individuals >15 years of age^{13,16} compared with 40 to 50% in the early 1990s. This supports the need for booster doses in those >10 years of age, both to reduce individual morbidity, and to reduce transmission to those most at risk (infants <6 months of age).¹⁷ Vaccination of adolescents, who have a high risk of pertussis infection, and adults in contact with very young infants, is expected to result in the greatest health benefits. A single booster dose using an adolescent/adult formulation acellular pertussis-containing vaccine (dTpa) has been included in the National Immunisation Program (NIP) for 15–17-year-olds since January 2004.

Figure 3.14.1: Pertussis notifications by year of onset, Australia 1993–2005. The percentage of notifications in those aged ≥15 years is shown (◆)



Vaccines

Acellular pertussis-containing vaccines have been used for both primary and booster vaccination of children in Australia since 1999. There are a number of acellular pertussis vaccines, which contain 3 or more purified components of *B. pertussis*. In the 3 component vaccines, these are pertussis toxin (PT), filamentous haemagglutinin (FHA) and pertactin (PRN). In the 5 component vaccines, fimbrial antigens or agglutinogens are also included. Acellular pertussis vaccines with 3 or more antigens have similar efficacy to good quality whole-cell vaccines¹⁸ and are immunogenic and safe. Although serious adverse events such as hypotonic-hyporesponsive episodes can still occur, they are much less common than with whole-cell vaccines.¹⁸ Vaccines containing DTPa are also available in various combinations with inactivated polio, hepatitis B and *Haemophilus influenzae* type b vaccines.

The acronym DTPa, using capital letters, signifies child formulations of diphtheria, tetanus and acellular pertussis-containing vaccines. The acronym dTpa is used for adolescent/adult formulations which contain substantially lesser amounts of diphtheria toxoid and pertussis antigens (see formulations).

The adolescent/adult formulation dTpa vaccines are immunogenic, safe and well tolerated in adults.¹⁹⁻²¹

Formulations for children aged <8 years

- **Infanrix hexa** – GlaxoSmithKline (DTPa-hepB-IPV-Hib; diphtheria-tetanus-acellular pertussis-hepatitis B-inactivated poliomyelitis vaccine-*Haemophilus influenzae* type b (Hib)). The vaccine consists of *both* a 0.5 mL pre-filled syringe containing 30 IU diphtheria toxoid, 40 IU tetanus toxoid, 25 µg pertussis toxoid (PT), 25 µg filamentous haemagglutinin (FHA), 8 µg pertactin (PRN), 10 µg recombinant HBsAg, 40 D-antigen units inactivated polioviruses type 1 (Mahoney), 8 D-antigen units type 2 (MEF-1) and 32 D-antigen units type 3 (Saukett) adsorbed onto aluminium hydroxide/phosphate; phenoxyethanol as preservative; traces of formaldehyde, polymyxin and neomycin *and* a vial containing a lyophilised pellet of 10 µg purified Hib capsular polysaccharide (PRP) conjugated to 20–40 µg tetanus toxoid. The vaccine *must be reconstituted* by adding the entire contents of the syringe to the vial and shaking until the pellet is completely dissolved. May also contain yeast proteins.
- **Infanrix-IPV** – GlaxoSmithKline (DTPa-IPV; diphtheria-tetanus-acellular pertussis-inactivated poliomyelitis vaccine). Each 0.5 mL pre-filled syringe contains 30 IU diphtheria toxoid, 40 IU tetanus toxoid, 25 µg PT, 25 µg FHA, 8 µg PRN, 40 D-antigen units inactivated polioviruses type 1 (Mahoney), 8 D-antigen units type 2 (MEF-1) and 32 D-antigen units type 3 (Saukett) adsorbed onto aluminium hydroxide; phenoxyethanol as preservative; traces of formaldehyde, polymyxin and neomycin.

- **Infanrix Penta** – GlaxoSmithKline (DTPa-hepB-IPV; diphtheria-tetanus-acellular pertussis-hepatitis B-inactivated poliomyelitis vaccine). Each 0.5 mL pre-filled syringe contains 30 IU diphtheria toxoid, 40 IU tetanus toxoid, 25 µg PT, 25 µg FHA, 8 µg PRN, 10 µg recombinant HBsAg, 40 D-antigen units inactivated polioviruses type 1 (Mahoney), 8 D-antigen units type 2 (MEF-1) and 32 D-antigen units type 3 (Saukett) adsorbed onto aluminium hydroxide/phosphate; phenoxyethanol as preservative; traces of formaldehyde, polymyxin and neomycin. May also contain yeast proteins.

Formulations for people aged ≥8 years

Combination vaccines

- **Adacel** – Sanofi Pasteur Pty Ltd (dTpa; diphtheria-tetanus-acellular pertussis). Each 0.5 mL monodose vial contains ≥2 IU diphtheria toxoid, ≥20 IU tetanus toxoid, 2.5 µg PT, 5 µg FHA, 3 µg PRN, 5 µg pertussis fimbriae (FIM) 2+3; 1.5 mg aluminium phosphate; phenoxyethanol as preservative; traces of formaldehyde.
- **Adacel Polio** – Sanofi Pasteur Pty Ltd (dTpa; diphtheria-tetanus-acellular pertussis-inactivated poliomyelitis vaccine). Each 0.5 mL monodose vial contains ≥2 IU diphtheria toxoid, ≥20 IU tetanus toxoid, 2.5 µg PT, 5 µg FHA, 3 µg PRN, 5 µg FIM 2+3, 40 D-antigen units inactivated polioviruses type 1 (Mahoney), 8 D-antigen units type 2 (MEF-1) and 32 D-antigen units type 3 (Saukett); 1.5 mg aluminium phosphate; phenoxyethanol as preservative; traces of formaldehyde, polymyxin, neomycin and streptomycin.
- **Boostrix** – GlaxoSmithKline (dTpa; diphtheria-tetanus-acellular pertussis). Each 0.5 mL monodose vial or pre-filled syringe contains ≥2 IU diphtheria toxoid, ≥20 IU tetanus toxoid, 8 µg PT, 8 µg FHA, 2.5 µg PRN, adsorbed onto 0.5 mg aluminium hydroxide/phosphate; 2.5 mg phenoxyethanol as preservative. May contain traces of formaldehyde.
- **Boostrix-IPV** – GlaxoSmithKline (dTpa-IPV; diphtheria-tetanus-acellular pertussis-inactivated poliomyelitis vaccine). Each 0.5 mL pre-filled syringe contains ≥2 IU diphtheria toxoid, ≥20 IU tetanus toxoid, 8 µg PT, 8 µg FHA, 2.5 µg PRN, 40 D-antigen units inactivated polioviruses type 1 (Mahoney), 8 D-antigen units type 2 (MEF-1) and 32 D-antigen units type 3 (Saukett) adsorbed onto aluminium hydroxide/phosphate; traces of formaldehyde, polymyxin and neomycin.

Transport, storage and handling

Transport according to *National Vaccine Storage Guidelines: Strive for 5*.²² Store at +2°C to +8°C. Do not freeze. Protect from light.

Dosage and administration

The dose of DTPa-combinations, dTpa and dTpa-IPV is 0.5 mL by IM injection.

Do not mix DTPa-containing vaccines with any other vaccine in the same syringe, unless specifically registered for use in this way.

Recommendations

(i) Vaccination of children and adolescents

Acellular pertussis antigens are given in combination with diphtheria and tetanus toxoids (DTPa) in a primary course of vaccination at 2, 4 and 6 months of age. In view of the high morbidity and occasional mortality associated with pertussis under the age of 6 months, receipt of the first dose of vaccine as soon as possible after 2 months of age should be strongly emphasised. If the primary course is interrupted, it should be resumed but not repeated; catch-up doses may be given as little as 4 weeks apart. The same formulation of vaccine should be used for each of the 3 doses. If it is not known which brand was used, vaccination should be provided using any available brand.

For the booster dose of DTPa given at 4 years of age, all brands of DTPa-containing vaccines are considered interchangeable. In view of the prolonged immunity now known to result from a primary course of DTPa at 2, 4 and 6 months of age,²³ the 18-month dose was omitted in 2003. It is expected that postponing receipt of a fourth dose of DTPa until 4 years of age will reduce the proportion of children experiencing extensive local reactions, which occurred in 2% of children following a fourth dose at 18 months of age.^{24,25}

A second booster, between 12 and 17 years of age, using the adolescent/adult formulation dTpa, is essential for maintaining immunity to pertussis through the adolescent period and into early adulthood. By the age of 17 years, young adults should have received 5 doses of a pertussis-containing vaccine. Most adolescents would have either had at least 3 previous doses of a pertussis-containing vaccine or been exposed to the pertussis bacterium. Therefore, if documentation of previous vaccinations is not readily available, it can be safely assumed that a dose of dTpa at 12–17 years is indeed a booster dose.

For details on the management of children who have missed doses in the NIP schedule, see Section 1.3.5, *Catch-up*.

(ii) Vaccination of adults

dTpa vaccines are recommended in Australia for booster vaccination of individuals ≥ 8 years of age who have previously had a primary course of

diphtheria-tetanus-pertussis vaccine. dTpa vaccines have a lower content of diphtheria and pertussis antigens than DTPa formulations for young children.

Primary vaccination

If a 3-dose primary course of diphtheria/tetanus toxoids is given to an adolescent/adult without a previous history of having received pertussis-containing vaccine, the preferred option is that dTpa replace the first dose of dT, to provide pertussis immunity as early as possible,²⁶ with subsequent doses as dT. In the event that dT is *not* available, dTpa can be used for all primary doses, but this is not routinely recommended as there are no data on the safety, immunogenicity or efficacy of dTpa for primary vaccination. For detailed recommendations regarding a primary dT course in adults, see Chapter 3.21, *Tetanus*.

Duration of protection and spacing of booster doses

A single booster dose of dTpa is recommended for the following groups provided that no documented dTpa booster dose has been previously received:

- Adults planning a pregnancy, or for both parents as soon as possible after delivery of an infant (preferably before hospital discharge), unless contraindicated.¹⁷ Other adult household members, grandparents and carers of young children should also be vaccinated. This recommendation is based on evidence from several studies of infant pertussis cases, which indicated that family members, particularly parents, were identified as the source of infection in more than 50% of cases and were the presumed source in a higher proportion.²⁷⁻²⁹
- Adults working with young children. Vaccination is especially recommended for childcare workers (see Chapter 2.3, *Groups with special vaccination requirements*, Table 2.3.6 *Recommended vaccinations for those at risk of occupationally acquired vaccine-preventable diseases*).^{30,31}
- All healthcare workers (see also Chapter 2.3, *Groups with special vaccination requirements*, Table 2.3.6 *Recommended vaccinations for those at risk of occupationally acquired vaccine-preventable diseases*). Several case reports have documented nosocomial infection in young infants acquired from healthcare workers.^{30,31}
- Any adult expressing an interest in receiving a booster dose of dT vaccine should be encouraged to do so with dTpa vaccine. At the age routinely recommended for tetanus and diphtheria booster (50 years), dTpa produces immune responses to tetanus and diphtheria antigens equivalent to dT vaccine, and would also provide protection against pertussis.³²

Data on the duration of immunity to pertussis following a single booster dose of dTpa are limited in adults and adolescents.^{20,33} Although subsequent doses of dTpa may prove beneficial, especially in high-risk groups such as healthcare workers, such boosters are unlikely to be required before 10 years and recommendations must await further data.

Minimum interval between dTpa and other tetanus/diphtheria-containing vaccines

A single dose of dTpa can be administered at any time after a dose of a vaccine containing tetanus and diphtheria toxoids.

Recent studies from Canada have shown that a single dose of dTpa can be safely administered as soon as 18 months after a previous dose of a vaccine containing tetanus or diphtheria toxoids.³⁴⁻³⁶ Where a tetanus- or diphtheria-containing vaccine has been given even less than 18 months previously, the benefits of protection against pertussis are likely to outweigh the risk of an adverse event,³⁷ and justify vaccination with dTpa or dTpa-IPV.

Special considerations

Previous pertussis infection

Vaccination with pertussis vaccine in children, adolescents or adults who have had laboratory-confirmed pertussis infection is safe but will not confer any additional protection. If there is any uncertainty about a previous diagnosis of pertussis, then vaccinate. In particular, incompletely vaccinated infants <6 months of age who develop pertussis may not mount an adequate immune response following infection and should receive all routinely scheduled vaccines, including pertussis.

Pre-existing neurological disease and pertussis vaccination

Infants and children known to have active or progressive neurological disease can be safely vaccinated with DTPa-containing vaccines. A large Canadian study found no evidence of encephalopathy following acellular pertussis vaccines.³⁸ For infants and children with stable neurological disease (including cerebral palsy), or a family history of idiopathic epilepsy or other familial neurological disorder, the risk of adverse events following DTPa-containing vaccines are essentially the same as for other infants of the same age.

Contraindications

The only true contraindications to acellular pertussis vaccines are:

- anaphylaxis following a previous dose of an acellular pertussis vaccine, or
- anaphylaxis following any vaccine component.

Precautions

Children who have a hypotonic-hyporesponsive episode (defined in 'Adverse events' below) following DTPa-containing vaccines should receive further doses as scheduled in the National Immunisation Program. Supervision may be required under some circumstances and specialist advice can be obtained from a clinic specialising in the assessment and management of putative adverse events

following vaccination (see Appendix 1, *Contact details for Australian, State and Territory Government health authorities and communicable disease control*).

A history of extensive limb swelling after a booster dose of DTPa is not a contraindication to adolescent/adult formulation dTpa at 12–17 years of age (or older).²⁴ Parents of children about to receive the booster dose of a DTPa-containing vaccine (at 4 years of age) should be informed of the small but well-defined risk of this adverse event which, even when extensive, is usually not associated with significant pain or limitation of movement.

Adverse events

Significant adverse events following pertussis vaccination should be reported as set out in Section 1.5.2, *Adverse events following immunisation*.

- Acellular pertussis vaccines are associated with a much lower incidence of fever (approximately 20%, very common) and local adverse events (approximately 10%, common) than whole-cell pertussis vaccines (approximately 45% and 40%, respectively) which are no longer used in Australia).^{18,39}
- Following the introduction of DTPa in Australia, there was an increase in the incidence of extensive local adverse events in children receiving booster doses at 18 months and 4 years of age.⁴⁰

Extensive limb swelling, defined by swelling and/or redness involving at least half the circumference of the limb, and the joints both above and below the injection site, was common (occurring in 2% of vaccinees) following a booster dose of DTPa given at 18 months of age; this was 1 reason for ceasing this booster dose in 2003. Although it is still too early to assess the effect that removing the 18-month booster dose has had on the incidence of local adverse events following the booster dose at 4 years of age, recent anecdotal reports of much less extensive swelling are encouraging.⁴¹

Such reactions commence within 48 hours of vaccination, last for 1 to 7 days and resolve completely without sequelae.²⁵ The pathogenesis of extensive limb swelling is poorly understood. In an analysis of fourth and fifth dose follow-up studies that examined 12 different DTPa vaccines, 2% (common) of 1015 children who received consecutive doses of the same DTPa vaccine reported entire thigh swelling, which resolved completely.²⁵

- Children who experience a febrile convulsion after a dose of DTPa-containing vaccines are at increased risk (albeit low) of further febrile convulsion following a subsequent dose of DTPa-containing vaccines. These risks can be minimised by appropriate measures to prevent fever, so vaccination is still recommended.

Febrile convulsions are very infrequently reported following DTPa-containing vaccines. The risk is even lower in infants who complete their primary course at 6 months of age, as febrile convulsions are uncommon under 6 months of age.

- Hypotonic-hyproresponsive episodes (HHE), defined by an episode of pallor, limpness and unresponsiveness 1 to 48 hours after vaccination, often preceded by irritability and fever, occur rarely following DTPa. Shallow respiration and cyanosis may also occur in an HHE. The whole episode lasts from a few minutes to 36 hours. In Australia during 2005, 1.33 cases of HHE were reported per 100 000 doses of DTPa or DTPa-hepB vaccines given.⁴¹ Follow-up of children with HHE shows no long-term neurological or other sequelae and they can receive further doses of DTPa-containing vaccines.⁴²
- Pertussis vaccine does not cause infantile spasms or epilepsy.
- Sudden infant death syndrome (SIDS) is not associated with either DTPa or any pertussis-containing vaccine.⁴³ Some studies suggest a decreased risk of SIDS in children who have been vaccinated (see Appendix 5, *Commonly asked questions about vaccination*).

The public health management of pertussis

(i) Management of cases

The clinical case definition of pertussis is either (i) an acute cough lasting ≥ 14 days with at least one of post-tussive vomiting, apnoea or whoop, or (ii) a cough of any duration in a person epidemiologically linked to a laboratory-confirmed case. The diagnosis can be definitively confirmed by either culture or PCR of a per-nasal swab or nasopharyngeal aspirate. The serological tests available in most areas of Australia are based on detection of IgA antibodies to *B. pertussis* antigens and are insensitive, so that false negative results are a problem, especially if performed on only one occasion.⁴⁴ In those who have not received a pertussis-containing vaccine within the previous 5 years, detection of IgA to pertussis antigens is highly specific in the presence of appropriate symptoms. If pertussis is suspected in someone who has received a pertussis-containing vaccine within 5 years, PCR is the diagnostic method of choice, but has progressively decreasing sensitivity with increased duration of symptoms. In a research setting, an IgG PT level of at least 125 EU/mL has been shown to be indicative of a recent or active pertussis infection; however, this assay is not available in routine pathology laboratories.^{45,46}

A detailed history is required when a case of pertussis is suspected, including date of onset, vaccination status and details of household contacts. To reduce the risk of transmission, cases should be commenced on antibiotic therapy on clinical suspicion, but only if commenced within 21 days of the onset of coryza. There is no evidence of any reduction in pertussis transmission following antibiotic treatment if the case has had symptoms for more than 21 days. Appropriate macrolide antibiotics for treatment of pertussis are azithromycin, clarithromycin and erythromycin. An alternative for those unable to take macrolides is trimethoprim-sulfamethoxazole. Table 3.14.1 shows the dose regimens for each of these antibiotics. (See also 'Variations from product information' below.)

Table 3.14.1: Recommended antimicrobial therapy and chemoprophylaxis regimens for pertussis in infants, children and adults⁴⁷⁻⁵⁴

Age group	Azithromycin	Clarithromycin	Erythromycin	TMP-SMX*
<1 month	10 mg/kg single dose for 5 days [†]	Not recommended	If azithromycin is unavailable; ≤7 days old: 10 mg/kg/dose 12-hourly for 7 days; [‡] 8–28 days old: 10 mg/kg/dose 8-hourly for 7 days	Not recommended in infants <2 months of age unless macrolides cannot be used
1–5 months	10 mg/kg single dose for 5 days	7.5 mg/kg/dose twice daily for 7 days	10 mg/kg/dose 6-hourly for 7 days	≥2 months of age; TMP: 4 mg/kg twice daily, SMX: 20 mg/kg twice daily for 7 days
Infants (≥6 months) and children	10 mg/kg single dose on day 1, then 5 mg/kg single dose for days 2–5 (maximum 250 mg/day)	7.5 mg/kg/dose (up to a maximum dose of 500 mg) twice daily for 7 days (maximum 1 g/day)	10 mg/kg/dose (up to a maximum dose of 250 mg) 6-hourly for 7 days (maximum 1 g/day)	TMP: 4 mg/kg, SMX: 20 mg/kg twice daily for 7 days (maximum 160 mg TMP and 800 mg SMX 12-hourly)
Adults	500 mg single dose on day 1, then 250 mg single dose for days 2–5	500 mg twice daily for 7 days	Erythromycin: 250 mg 6-hourly for 7 days; Erythromycin ethyl succinate (EES): 400 mg 6-hourly for 7 days	TMP: 160 mg twice daily, SMX: 800 mg twice daily for 7 days

* Trimethoprim-sulfmethoxazole

† Preferred for this age; refer to ‘(c) Pertussis in pregnancy’ and ‘(d) Use in infants and infantile hypertrophic pyloric stenosis’ below.

‡ Please refer to ‘(d) Use in infants and infantile hypertrophic pyloric stenosis’ below.

Cases should be excluded from, for example, childcare facilities and school, until they have taken 5 days of antibiotic treatment. All cases, both suspect and confirmed, should be notified to the State/Territory public health authorities (see Appendix 1, *Contact details for Australian, State and Territory Government health authorities and communicable disease control*).

(ii) Management of contacts of cases

(a) Vaccination

Since a primary course of 3 or more injections is required to protect against pertussis, infant vaccination cannot be effectively used to control an outbreak. However, unvaccinated or partially vaccinated contacts up to their 8th birthday should be offered DTPa-containing vaccines and older individuals a single dose of dTpa (see Section 1.3.5, *Catch-up*).

Passive immunisation with normal human immunoglobulin has not been shown to be effective in the prevention of pertussis.

(b) Chemoprophylaxis

In the usual clinical setting of delayed presentation and imperfect compliance, the benefit of chemoprophylaxis in preventing the secondary transmission of pertussis is likely to be limited.^{49,55} In view of this, the well established (mainly gastrointestinal) side effects of erythromycin and the cost of the newer macrolides, the use of chemoprophylaxis for prevention of secondary cases should be reserved for those settings where the benefit is greatest. These settings are best defined by the chance of transmission and the high risk of severe complications should transmission occur. Close contacts can be defined as those who either live in the same household (but not occasional 'sleepover' contacts unless they too are at increased risk of severe disease), or work in or attend the same institutional setting (eg. maternity hospital ward, newborn nursery, childcare centre) as a case.

Based on these principles, prophylaxis is recommended for the following 'high-risk' contacts of pertussis cases:

- All household members when the household includes any child <24 months of age who has received fewer than 3 effective doses of pertussis vaccine (ie. commenced after 6 weeks of age with at least a 4-week interval between doses, and the last dose given at least 14 days previously).
- Any woman in the last month of pregnancy, regardless of vaccination status (see 'Pertussis in pregnancy' below).
- All other children and adults in the same care group if the case, regardless of his/her vaccination status, attended childcare for more than 1 hour while infectious and that care group includes 1 or more children <24 months of age who have received fewer than 3 effective doses of pertussis vaccine.
- Healthcare staff, regardless of vaccination status, working in a maternity hospital or newborn nursery. Chemoprophylaxis is not recommended routinely for healthcare staff caring for older infected children or adults.
- Where a case worked in a maternity ward or newborn nursery for more than an hour while infectious, then all babies in that ward should receive antibiotics.

Antibiotic regimens for chemoprophylaxis are the same as for cases (Table 3.14.1 above). Antibiotics should be given only if commenced either within 21 days of the onset of any symptoms, or within 14 days of the onset of the paroxysmal cough in the case. Childcare contacts in the same room as the case, who are not age-appropriately vaccinated, should be excluded from childcare until the expiry of 14 days from their last exposure to the infectious case, unless they have already completed 5 days of a recommended antibiotic treatment, in which case they may return.

(c) Pertussis in pregnancy

Treatment of pregnant women with pertussis onset within a month of delivery is important for the prevention of neonatal pertussis and, if the onset is within 3 weeks of delivery, their newborn babies should also be given antibiotic therapy (Table 3.14.1). Erythromycin use earlier in pregnancy has well documented safety (Category A). There are only limited data on the use of azithromycin in pregnancy (Category B1).

(d) Use in infants and infantile hypertrophic pyloric stenosis

Several studies have shown an increased risk of infantile hypertrophic pyloric stenosis (IHPS) when erythromycin is given for prophylaxis following exposure to pertussis, especially in the first 2 weeks of life.^{56,57} While there are, as yet, no data available on the effectiveness of azithromycin use in infants <1 month of age, published case series report fewer adverse events following azithromycin use when compared with erythromycin and, to date, there have been no reports of IHPS in infants following use of azithromycin, although the size and number of these studies is limited.^{58,59} Therefore, on currently available evidence, and because of the risks of severe pertussis in this age group, azithromycin is preferred to erythromycin for treatment and prophylaxis in infants aged <1 month by US authorities. Azithromycin is available as a suspension and approved for use in Australia, but treatment and prophylaxis of pertussis are not currently referred to in the product information. Parents of newborns prescribed either erythromycin or azithromycin should be informed about the possible risks for IHPS and counselled about signs of developing IHPS.

Use in pregnancy

Refer to Chapter 2.3, *Groups with special vaccination requirements*, Table 2.3.1 *Vaccinations in pregnancy*.

Variations from product information

The product information for both *Infanrix hexa* and *Infanrix Penta* states that these vaccines may be given as a booster dose at 18 months of age. NHMRC recommends that a booster dose of DTPa (or DTPa-containing vaccines) is not necessary at 18 months of age. However, DTPa-containing vaccine may be used for catch-up of the primary schedule in children <8 years of age.

The product information for Infanrix-IPV states that this vaccine may be used as a booster dose for children ≤ 6 years of age who have previously been vaccinated against diphtheria, tetanus, pertussis and poliomyelitis. NHMRC recommends that booster doses of DTPa and IPV be given at 4 years of age; however, this product may be used for catch-up of the primary schedule or as a booster in children < 8 years of age.

The product information for adolescent/adult formulations of dTpa-containing vaccines states that these vaccines are indicated for booster doses only. NHMRC recommends that, when a 3-dose primary course of diphtheria/tetanus toxoids is given to an adolescent/adult, that dTpa replace the first dose of dT, with 2 subsequent doses of dT. If dT is *not* available, dTpa can be used for all 3 primary doses, but this is *not* routinely recommended.

The product information for Adacel and Boostrix (adolescent/adult formulations of dTpa) states that these vaccines are recommended for use in those aged > 10 years. However, NHMRC recommends that they may be used in people aged ≥ 8 years. The product information also states that dTpa should not be given within 5 years of a tetanus toxoid-containing vaccine. However, NHMRC recommends that a single dose of dTpa vaccine can be administered at any time following receipt of a diphtheria and tetanus toxoid-containing vaccine.

The product information for both clarithromycin and azithromycin do not list the treatment or prophylaxis of pertussis as an approved indication for either antibiotic. NHMRC recommends that these antibiotics may be used for the treatment or prophylaxis of pertussis as per Table 3.14.1 above.

References

Full reference list available on the electronic *Handbook* or website <http://immunise.health.gov.au>.