FactSheet

Pertussis

NATIONAL CENTRE FOR IMMUNISATION RESEARCH & SURVEILLANCE

PERTUSSIS VACCINES FOR AUSTRALIANS: INFORMATION FOR IMMUNISATION PROVIDERS

Disease and epidemiology

- Pertussis, commonly known as 'whooping cough', is a highly contagious infection of the respiratory tract caused by the bacterium *Bordetella pertussis*.
- In Australia, epidemics occur every 3 to 4 years. Infants aged less than 6 months are at the greatest risk of severe disease due to partial immunisation.
- In 2008, 60% of notifications were reported in adults aged 20 years and over.

Who should be vaccinated

- In Australia, pertussis vaccine is available on the National Immunisation Program (NIP) for children at 2, 4, 6 months and 4 years of age. An adolescent booster dose is available via school-based programs at 12–17 years of age (the age of delivery for school-based immunisation programs varies by state and territory).
- The vaccine is also recommended for adults in contact with young children (e.g. healthcare workers, childcare workers) or planning a pregnancy, but is not funded under the NIP for these individuals.

Vaccines

- The paediatric formulation DTPa is only available in combination with other antigens: Infanrix hexa™ (DTPa-hepB-IPV-Hib), Infanrix-IPV™ (DTPa-IPV), Infanrix Penta™ (DTPa-hepB-IPV).
- Four adult formulations (dTpa) containing reduced pertussis antigen content in comparison to the vaccines for young children are available in Australia: Boostrix™ (dTpa) and Boostrix-IPV™ (dTpa-IPV) (available since 2003), and Adacel™ (dTpa) and Adacel Polio™ (dTpa-IPV) (available since 2005).

The disease

Pertussis (whooping cough) is an acute illness caused by the *Bordetella pertussis* bacterium. It is spread by air-borne respiratory droplets when an infected person coughs or sneezes, or via direct contact with secretions from the nose or throat. The time between exposure and development of symptoms is usually 7–20 days. Cases are most infectious in the early stages of illness and are considered infectious up to 21 days following the onset of symptoms. The illness begins with an irritating cough that gradually becomes paroxysmal and lasts for 1–2 months or longer. The illness is characteristically known for causing repeated violent bouts of coughing followed by a characteristic high-pitched inspiratory whoop. However, the high-pitched whoop may be absent in older children, adults, and very young infants. Immunisation greatly reduces the chance of getting the infection, both in children and adults.[1]

Epidemiology

Despite the availability of pertussis vaccines for more than 50 years, pertussis remains a challenging disease to control. Control of pertussis is problematic because

immunity, whether from immunisation or infection, wanes after approximately 6–10 years, resulting in renewed susceptibility to infection. In recent years, there have been periodic epidemics which have occurred at intervals of 3–4 years (1997–98, 2001, 2005–06, 2008–09), set against a background of endemic circulation.[2,3] However, increasing immunisation coverage has been associated with reductions in disease among immunised children and adolescents. Between 1998 and 2008, there were 84,758 notifications of pertussis nationally, ranging from 5,670 in 1998 to 14,347 in 2008.[2] However, the increase in notification rates over time could also be due, in part, to better case ascertainment through the increased availability of serological testing and more sensitive tests (e.g. polymerase chain reaction).

In Australia, pertussis is now a problem among two broad age groups – those older than 20 years (accounting for 60% of notifications in 2008) and those under the age of 6 months (accounting for 21% of notifications in 2008).[2] Adolescents and adults are an important reservoir for infection as they are capable of transmitting pertussis to infants who are too young to have received 2 or more doses of DTPa-containing vaccine which are required for protection. In addition, young infants are more likely to develop severe disease than older age groups.[4-7] Between July 2005 and June 2007, infants aged <1 year accounted for 34% (300 of 882) of pertussis-related hospitalisations.[8] In Australia between 1993 and 2006, there were 21 deaths attributed to pertussis, with all but four of these deaths occurring in infants <12 months of age.[9]

Who should be vaccinated

National Immunisation Program (NIP)

A primary course of 3 doses of diphtheria, tetanus and acellular pertussis antigens (DTPa) at 2, 4 and 6 months of age is recommended for all infants, unless contraindicated.[9] In view of the high morbidity and mortality associated with pertussis in infants aged <6 months, it is very important that the first few doses of vaccine be given on time. The 1st dose of vaccine is immunogenic from the age of 6 weeks, and, during pertussis epidemics, it may be recommended to start the 1st dose as early as 6 weeks of age, if possible. Ideally, the same brand of vaccine should be used for all doses. However, if the brand of previous doses is not known, any brand that is available can be used. As pertussis immunity wanes, a booster dose of DTPa (in combination with IPV) is given prior to school entry at 4 years of age. In addition, a booster dose of adolescent/adult formulation (dTpa) vaccine is given between the ages of 12 and 17 years and is usually administered via school-based immunisation programs (the age of delivery for school-based immunisation programs varies by state and territory).

Others recommended for vaccination

A booster dose of dTpa is recommended for the following groups,[9] but is currently not funded under the National Immunisation Program:

- those planning pregnancy, or for both parents as soon as possible after the birth of an infant (preferably prior to leaving hospital)
- adults working with young children, especially childcare workers and healthcare workers in contact with infants.

Any adult expressing an interest in receiving a booster dose of dTpa should be encouraged to get vaccinated. At this stage, any further booster doses of dTpa beyond those in the schedule are not recommended because the duration of immunity provided by the vaccine is not known.

Adults with no previous history of vaccination should receive a dose of dTpa, followed by 2 subsequent doses of diphtheria/tetanus toxoid-containing vaccine (dT), if there is no record of previous tetanus/diphtheria immunisation. There should be a minimum 4-week interval between doses.

In March 2009, NSW Health began funding dTpa vaccine for all new parents, grandparents and people who care for new babies, available from general practitioners or immunisation providers. Also, in April 2009, the Australian Capital Territory announced availability of free dTpa vaccine for the parents and grandparents of babies <12 months of age. The Northern Territory Department of Health and Families is also funding dTpa vaccine for new mothers. In July 2009, South Australian Health began promoting dTpa vaccine, for prospective parents, new parents, grandparents, childcare workers and health care workers. Queensland Health, in November 2008, encouraged dTpa vaccination for new parents, couples planning a pregnancy, adults and young people who are in close contact with babies. For a limited time, Queensland Health is also providing free vaccination for new parents.

Vaccines

Formulations available

Children under 8 years of age

The paediatric formulation DTPa is only available in combination with other antigens: Infanrix hexa™ (DTPa-hepB-IPV-Hib), Infanrix-IPV™ (DTPa-IPV), Infanrix Penta™ (DTPa-hepB-IPV).[9]

Persons 8 years of age or older

There are four adolescent/adult formulations available, which have a reduced pertussis antigen content in comparison to the vaccines for young children: Boostrix™ (dTpa) and Boostrix-IPV™ (dTpa-IPV) (available in Australia since 2003), and Adacel™ (dTpa) and Adacel-Polio™ (dTpa-IPV) (available since 2005).[9]

Vaccine efficacy

Paediatric formulation (DTPa)

Infants aged <6 months are at higher risk of pertussis because they are only partially immunised. A 3-dose primary series of immunisation with DTPa at 2, 4 and 6 months of age results in 84–89% protective efficacy against disease.[10,11] Further evidence suggests that three doses of acellular pertussis vaccine in the first year of life provides adequate protection until the age of 6 years, by which time a booster dose should have been administered.[12]

Adolescent or adult formulation (dTpa)

In contrast to some other vaccines, no well-accepted immunologic correlate of protection exists for pertussis. The efficacy of the pertussis components of dTpa vaccines administered to adolescents and adults is inferred from the serologic results obtained in infants immunised with paediatric DTPa in pertussis efficacy trials.[13] For both dTpa vaccine formulations, the immune responses to all pertussis vaccine antigens in adolescents and adults 1 month after a single dose of dTpa were non-inferior to those of infants after 3 doses of DTPa.[14,15] A large clinical trial in adolescents and adults demonstrated overall vaccine efficacy against confirmed pertussis of 92%,[16] and a clinical trial in adults demonstrated prolonged immunogenicity from a single dTpa booster dose, with pertussis antibodies remaining above pre-booster dose levels in 85% of participants for 5 years after immunisation.[17]

Vaccine safety

Paediatric formulation (DTPa)

The current acellular pertussis vaccine is safer and more effective than whole cell pertussis vaccine (DTPw) which is no longer used in Australia. Acellular pertussis vaccines are associated with a much lower incidence of fever (20% vs 45%) and local reactions (10% vs 40%) than whole cell pertussis vaccine.[18] Serious side-effects are rare. In 2008, the reporting rate of hypotonic-hyporesponsive episodes (HHE), involving transient episodes of floppiness, pallor and decreased responsiveness, was 10 cases per 100,000 doses of DTPa-IPV and 3 cases per 100,000 doses of DTPa-hepB-IPV-Hib vaccine.[19] These vaccines do not cause encephalopathy[20] or sudden infant death syndrome.[21]

Following the introduction of DTPa in Australia, there was an increase in the incidence of extensive local adverse events, such as redness and swelling at the injection site, in children receiving booster doses at 18 months and 4 years of age.[22] Therefore, in view of prolonged immunity resulting from the primary course of DTPa at 2, 4 and 6 months of age,[12] the 18-month dose was removed from the childhood immunisation schedule in 2003. Reports of injection site reactions collected as part of adverse events surveillance are being closely monitored to observe any effect that removal of the 18-month booster dose from the schedule has on the occurrence of injection site reactions following DTPa vaccination.

Adolescent or adult formulation (dTpa)

The adolescent/adult formulation dTpa contains lower concentrations of diphtheria and pertussis antigens than paediatric formulations. Routine adverse event surveillance monitoring suggests that the vaccine is well tolerated.[23]

Vaccination of women planning pregnancy should be assessed as part of any pre-conception health check. Currently pertussis vaccination is not recommended during pregnancy; however, there is no convincing evidence for pregnancy to be an absolute contraindication to vaccination, particularly as an inactivated vaccine it is unlikely to cause harm to the mother or the fetus. Individual assessment of benefits of protection from vaccination should be weighed against the risk of infection. Breastfeeding mothers can safely be given pertussis-containing vaccine.[24]

Contraindications/precautions

The only contraindications to DTPa and dTpa vaccines are anaphylaxis following a previous dose of an acellular pertussis vaccine, or anaphylaxis following any vaccine component.

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