

# Meningococcal disease

## MENINGOCOCCAL VACCINES FOR AUSTRALIANS: INFORMATION FOR IMMUNISATION PROVIDERS

### Disease and epidemiology

- Meningococcal disease is caused by the bacterium *Neisseria meningitidis*.
- There are 13 serogroups; the most common are A, B, C, W<sub>135</sub> and Y.
- In Australia, serogroups B and C cause most disease.
- Meningococcal infection may cause meningitis or septicaemia.
- In 2008, the notification rate of meningococcal disease had declined to 1.4 cases per 100,000 population. The decline has largely been due to the meningococcal C vaccination program.

### Who should be vaccinated

- It is recommended that a single dose of meningococcal C conjugate vaccine be given to all children at 12 months of age.
- From 2003 until 2007, the meningococcal catch-up program provided one dose of MenCCV for all children who turned 1–19 years of age during 2003.
- Routine vaccination with tetravalent meningococcal polysaccharide vaccines is not recommended except in certain situations.

### Vaccines

- There are two types of meningococcal vaccine: meningococcal C conjugate vaccines (MenCCV) and the tetravalent meningococcal polysaccharide vaccines (4vMenPV).
- MenCCV only provides protection against serogroup C.
- 4vMenPV provides short-term protection against serogroups A, C, W<sub>135</sub> and Y.
- Conjugate meningococcal C vaccine provides an improved antibody response and longer term protection compared to polysaccharide vaccine, especially in young children.
- Common adverse events following vaccination may include pain, redness and swelling at the injection site, fever, irritability, anorexia and headache.

### The disease

Meningococcal disease is caused by the bacterium *Neisseria meningitidis*, commonly known as the meningococcus. There are 13 serogroups distinguished by differences in the surface polysaccharides of the outer membrane capsule. Meningococcal serogroups are designated by letters of the alphabet. Globally, serogroups

A, B, C, W<sub>135</sub> and Y most commonly cause disease. In Australia, serogroups B and C predominate.<sup>1</sup>

Meningococcal disease occurs most commonly as either septicaemia or meningococcal meningitis, or as a combination of both. Other infections may include pneumonia, arthritis, epiglottitis, pericarditis and conjunctivitis. Today, even with antibiotic treatment, the

mortality risk is high at approximately 10%. Furthermore, approximately 10–20% of patients who survive will develop permanent sequelae.<sup>2</sup>

### **Clinical features**

The symptoms of meningococcal disease may be non-specific and can include: sudden onset of fever, a rash of red-purple spots or bruises, cold hands, thirst, joint pain, aching muscles headache, neck stiffness, photophobia, nausea, vomiting, drowsiness and coma.<sup>3</sup>

Not all symptoms may be present at once. The typical meningococcal disease rash is not always present but, if it occurs, it doesn't disappear with gentle pressure on the skin.<sup>3</sup>

### **Transmission**

Meningococci are carried and transmitted only by humans. About 10% of the population can carry meningococcus in their throat and/or nose at any one time without being unwell. These people are known as carriers and they may pass the bacteria to others. The disease is transmitted by respiratory droplets, and has an incubation period of 1–10 days, most commonly 3–4 days. It is passed only by regular, close contact such as prolonged household contact or intimate oral contact. Other risk factors for meningococcal infection may include: exposure to smokers, crowded living conditions, certain inherited disorders of the immune system, functional or anatomical asplenia, and recent or current upper respiratory tract viral illness.<sup>4</sup>

### **Management of meningococcal disease**

Prompt diagnosis and emergency treatment of cases is important. Urgent medical treatment should be sought. If meningococcal disease is suspected, the patient should be given parenteral penicillin and transferred to hospital. Close contacts should receive information, antibiotics and vaccination (for non-serogroup B cases). The relevant public health unit should be contacted as soon as possible and can provide guidance on early clinical and public health management. Please also see:

*Guidelines for the early clinical and public health management of meningococcal disease in Australia – revised edition 2007*<sup>3</sup>

<http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-pubs-other-mening-2007.htm>

Further information is also available from the Australian Government Department of Health and Ageing fact sheet *Meningococcal disease and vaccination*

<http://www.health.gov.au/internet/main/Publishing.nsf/Content/health-pubhlth-strateg-communic-factsheets-mening.htm>

## **Epidemiology**

The serogroup A meningococcus causes disease predominantly in the developing world, including Africa and Asia, whereas the serogroup B meningococcus is the major cause of sporadic disease in most developed countries. In the 1990s, a new strain of serogroup C emerged with increased disease rates in Australia and the United Kingdom. Serogroup C meningococci have been associated with small clusters of meningococcal disease in schools, universities and nightclubs in Australia over the past decade or so. In Australia, disease follows a seasonal trend with most cases occurring in winter or early spring.<sup>1</sup>

Young children <5 years of age, and young adults (15–24 years of age) are at highest risk of developing meningococcal disease.<sup>5</sup>

The overall notification rate of meningococcal disease to the National Notifiable Diseases Surveillance System (NNDSS) increased gradually from 1.8 per 100,000 in 1991 to a peak of 3.5 per 100,000 in 2001.<sup>5</sup> The rate has now fallen to 1.3 per 100,000 in 2008.<sup>6</sup>

The rate of notifications varies between Australian states and territories, with the Northern Territory regularly experiencing the highest notification rates although overall numbers are small. Notifications to the NNDSS include cases that were diagnosed on clinical grounds alone, and those that were confirmed using laboratory methods.

Of the 318 meningococcal notifications in 2006, 267 (84%) were serogrouped. Of these, 223 (83.5%) were serogroup B, 24 (9%) were serogroup C and 20 (7.5%) were serogroups Y and W<sub>135</sub>.

## **Who should be vaccinated**

In 2003, the Australian government commenced the National Meningococcal C Vaccination Program which provided free meningococcal C conjugate vaccine to all children aged 1–19 years. In the same year, a single dose of meningococcal C vaccine at 12 months of age was included on the National Immunisation Program (NIP). Studies have shown that a single dose of meningococcal C conjugate vaccine (MenCCV) in children aged 12 months or more is sufficient to induce a strong protective antibody response.<sup>5</sup> The duration of immunity and whether a booster dose will be required is not yet known but is under evaluation.

## National Immunisation Program (NIP)

### Routine vaccination – meningococcal C conjugate vaccines<sup>5</sup>

In Australia, it is recommended that a single dose of MenCCV be given to all children at the age of 12 months but not before. Data from a Netherlands study shows that vaccination with MenCCV after the 1<sup>st</sup> birthday results in longer protection than multiple doses in infancy.

Currently, the Netherlands vaccinates with MenCCV at 14 months of age. The United Kingdom gives 3 doses at 3, 4 and 12 months of age due to the difference in epidemiology of disease there with more cases in infants.

### Others recommended for vaccination

#### Vaccination of people at high risk for meningococcal disease<sup>5</sup>

The MenCCV vaccine is also recommended for:

- close contacts of meningococcal disease cases due to serogroup C, >2 months of age, who have not been previously vaccinated
- control of outbreaks caused by serogroup C
- laboratory personnel who handle *N. meningitidis*
- those >6 weeks of age with inherited defects of properdin or complement, or functional or anatomical asplenia.

Children who have been immunised with MenCCV vaccine under the age of 12 months (for example according to an overseas schedule) will require a booster dose at 12 months of age.

#### Meningococcal polysaccharide vaccines (4vMenPV)<sup>5</sup>

Routine vaccination with 4vMenPV is recommended only in the following situations:

- people who intend to travel to parts of the world where epidemics of group A, W<sub>135</sub> or Y disease are frequent (see the [World Health Organization](#))
- close contacts, ≥2 years of age, of cases of serogroup A, W<sub>135</sub> or Y meningococcal disease
- control of outbreaks caused by serogroup A, W<sub>135</sub> or Y
- laboratory personnel who handle *N. meningitidis*
- those ≥2 years of age with inherited defects of properdin or complement, or functional or anatomical asplenia
- pilgrims attending the annual Hajj (certificate of vaccination is a condition of entry to Saudi Arabia).

A single revaccination with 4vMenPV is indicated for people at continued high risk of infection, particularly

children first vaccinated before 4 years of age. As antibodies decline rapidly over 2 to 3 years, revaccination should be given 3 to 5 years later.

For further information about recommendations for the use of meningococcal vaccines, please refer to Chapter 3.12 of the 9<sup>th</sup> edition of *The Australian Immunisation Handbook* (2008).<sup>5</sup>

## Vaccines

There is no vaccine that offers protection for all serogroups of meningococcal disease. *N. meningitidis* has evolved many sophisticated defence mechanisms to evade host defences. There are two types of meningococcal vaccines used in Australia: the meningococcal C conjugate vaccines (MenCCV) and the tetravalent meningococcal polysaccharide vaccines (4vMenPV).<sup>5</sup>

In the MenCCV vaccine, an oligo- or polysaccharide antigen is conjugated to a carrier protein which changes the nature of the antibody response from T cell-independent to a T cell-dependent response. This results in a greater antibody response, especially in younger children, improved functional activity and induction of immunological memory, providing longer term protection.<sup>5</sup>

4vMenPVs protect against serogroups A, C, W<sub>135</sub> and Y. The polysaccharide vaccine induces antibodies within 10–14 days of vaccination in about 90% of recipients aged >2 years. The main limitation of this vaccine is the inability to induce T cell-dependent immunity. Immunity decreases during the first few years following a single dose, particularly in infants and young children. Clinical protection persists for at least 3 years in school children and adults. The duration of immunity may also be complicated by the induction of immunological hyporesponsiveness to the serogroup C component that can result in a reduced immune response. This response has been noted in both children and adults. Furthermore, there is little response to the serogroup C component of 4vMenPV before 18 months of age and little response to serogroup A before 3 months of age.<sup>5</sup>

In Australia, there is currently no serogroup B meningococcal vaccine. There has been one in New Zealand but it is specific to a particular strain of serogroup B meningococci that caused a long-lasting epidemic in that country.<sup>7</sup> The vaccine was known as meningococcal B outer membrane vesicle (trade name MeNZB) and was targeted at all children aged 6 weeks to 19 years.<sup>8</sup> This special targeted vaccination program was

ceased in 2008 as the epidemic was considered to be under control.

In the USA, a tetravalent meningococcal conjugate vaccine (MCV4) was registered in 2005 and it is recommended for the routine vaccination of adolescents aged 11–12 years.<sup>9</sup> This vaccine is not currently available in Australia.

#### **Meningococcal C conjugate vaccines<sup>5</sup>**

**Meningitec** – Wyeth Australia Pty Ltd: meningococcal serogroup C–CRM<sub>197</sub> conjugate vaccine

**Menjugate syringe** – CSL Biotherapies/Novartis Vaccines and Diagnostics: meningococcal serogroup C–CRM<sub>197</sub> conjugate vaccine

**NeisVac-C** – Baxter Healthcare: meningococcal serogroup C–tetanus toxoid protein conjugate vaccine

#### **Meningococcal polysaccharide vaccines<sup>5</sup>**

**Mencevax ACWY** – GlaxoSmithKline: serogroup A, C, W<sub>135</sub> and Y meningococcal polysaccharide vaccine.

**Menomume** – Sanofi Pasteur Pty Ltd: serogroup A, C, W<sub>135</sub> and Y meningococcal polysaccharide vaccine

#### **Administration**

##### **Meningococcal C conjugate vaccines**

The MenCCV dose is 0.5 mL, given by IM injection.

##### **Meningococcal polysaccharide vaccines**

The 4vMenPV dose is 0.5 mL, given by SC injection.

For further information about administration, please refer to Chapter 3.12 of the 9<sup>th</sup> edition of *The Australian Immunisation Handbook* (2008).<sup>5</sup>

#### **Vaccine safety**

Common adverse events caused by MenCCVs are pain, redness and swelling at the injection site, fever, irritability, anorexia and headaches. Local reactions to 4vMenPVs include erythema, induration, tenderness, pain and local axillary lymphadenopathy. Fever and chills occur in approximately 2% of young children and may persist for 48 hours or longer, but significant adverse events are rare.<sup>5</sup>

According to routine surveillance reports from the Adverse Drug Reactions Advisory Committee database, injection site reactions were reported at a rate of 7.9 per 100,000 doses in the period 2003–2005. Also during this period, severe allergic reactions were reported at a rate of 0.4 per 100,000 doses; there were four reports of anaphylaxis at a rate of 0.1 per 100,000 doses (Lawrence G et al, Evaluation of the Australian meningococcal C immunisation program, unpublished).

#### **Contraindications/precautions**

The absolute contraindications to MenCCV are anaphylaxis following a previous dose or anaphylaxis following any component of the vaccine. Previous serogroup C disease is not a contraindication for vaccination with MenCCV.

The absolute contraindications to 4vMenPV are anaphylaxis following a previous dose or anaphylaxis following any component of the vaccine.<sup>5</sup>

For further information on the use of meningococcal vaccines, please see the 9<sup>th</sup> edition of *The Australian Immunisation Handbook* (2008).<sup>5</sup>

#### **Coverage of the MenCCV Program**

Since the introduction of meningococcal C vaccine in 2003, coverage continues to increase each year. The estimated coverage of the initial program, between 1 January 2003 and 30 June 2006, was 72% overall. Coverage for the routine component (children born 2002–2004) was 90% and coverage for the ‘catch-up’ group (those born 1984–2001) was estimated at 70% (Lawrence G et al, Evaluation of the Australian meningococcal C immunisation program, unpublished). National coverage for one dose of MenCCV (measured at 24 months of age) was approximately 88% in 2006 and 93% in 2008.<sup>10</sup>

#### **References**

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#### Useful websites (accessed November 2009)

The Children's Hospital at Westmead – Meningococcal infection fact sheet

<http://www.chw.edu.au/parents/factsheets/mencoccj.htm>

The Royal Children's Hospital Melbourne – Meningococcal infection fact sheet

[http://www.rch.org.au/kidsinfo/factsheets.cfm?doc\\_id=3738](http://www.rch.org.au/kidsinfo/factsheets.cfm?doc_id=3738)

NSW Health – Infectious disease factsheet: meningococcal disease

<http://www.health.nsw.gov.au/factsheets/infectious/meningococcal.html>

Immunise Australia Program

<http://www.immunise.health.gov.au/>

National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases

<http://ncirs.edu.au/>

World Health Organization – International Travel and Health

<http://www.who.int/ith/en/>