Update on the Meningococcal Vaccine

Staff of the Nathaniel Centre

Following on from our article on measles in Issue 69 of the *Nathaniel Report*, and in response to recent cases of meningococcal disease and waning levels of immunity, this article is written to provide a summary about meningococcal disease and the vaccines that are available to protect against it.

What is meningococcal disease?

Meningococcal disease is caused by the bacterium *Neisseria Meningitidis*[1]. There are thirteen different groups of the bacterium and six of these – groups A, B, C, W, X and Y – cause most of the disease cases worldwide[2 3]. Humans are the only known host for these bacteria[4].

Most cases of meningococcal disease in Aotearoa New Zealand are caused by bacterial strains in group B although, since 2017, there have been an increase in the number of cases caused by groups W and Y[5 6]. There have also been limited outbreaks of meningococcal disease due to group A[7].

Neisseria Meningitidis is quite commonly carried in the nose and throat without causing illness[8]. Between 5% and 25% of people carry it worldwide, with carriage rates being highest in older teenagers and younger adults[9]. For reasons that are not well understood, the bacteria can cause infection and serious disease when it is passed onto others[10].

Infection is extremely serious. It can be lethal within a matter of hours and must be treated quickly by medical professionals.

Infection may be local or invasive[11]. Invasive infection, where infection spreads throughout the whole body, occurs when the bacteria pass into the bloodstream[12]. This can lead to infection and swelling of the membranes that cover the brain and spinal cord (known as meningococcal meningitis), and blood poisoning (known as meningococcal septicaemia or meningococcaemia)[13 14 15 16]. The bacteria can also cause pneumonia, and it can affect and damage other areas of the body, such as the heart muscle, joints and abdomen[17].

Infection is extremely serious. **It can be lethal within a matter of hours**[18] and must be treated quickly by medical professionals[19]. Even with rapid treatment, one to two people out ten will die as a result of infection with *Neisseria Meningitidis*[20]. For those who survive infection, one in five people will be left with permanent damage and ongoing complications such as skin scarring, loss of limbs, loss of hearing, seizures, and brain injury[21 22].

Who is at most risk of developing meningococcal disease?

Meningococcal disease can affect anyone[23].

However, rates are highest in children under five years old, and in teenagers and young adults[24 25]. The World Health Organisation (WHO) believes that meningococcal disease is the world's number one vaccine-preventable cause of death amongst children aged under five years old[26 27]. People over the age of sixty-five are also vulnerable to the disease, with this risk increasing further with age[28].

In Aotearoa New Zealand, Māori and Pasifika communities are disproportionately affected by meningococcal disease compared to other ethnicities[29]. For Māori communities, the risk of developing the illness is three times higher than that for other ethnicities, and for Pasifika communities the risk is four times higher[30].

Early symptoms of meningococcal disease can be difficult to spot and they can vary according to age. Babies and toddlers in particular may not exhibit 'classic symptoms'.

Living conditions can increase the risk of contracting the disease, specifically: poverty; living in overcrowded housing; living in college halls of residence or hostels; living in military barracks[31 32 33].

Certain medical conditions can also increase someone's risk for the disease, such as sickle cell anaemia; asplenia (where a person does not have a spleen or has a spleen that does not function as it should); conditions which affect the immune system; HIV; chronic lung conditions; chronic heart conditions; chronic kidney conditions. People who have spinal fluid shunts and cochlear implants also have an increased risk of developing meningococcal disease[34 35 36]. In addition, research has identified smoking and previous infection with influenza type-A as risk factors for developing the disease[37 38].

Particular occupations are also known to increase the risk of developing the disease – for example, people working in microbiology laboratories or medical settings where prolonged exposure to the bacteria is possible[39 40].

What are the symptoms of meningococcal disease?

Early symptoms of meningococcal disease can be difficult to spot and they can vary according to age[41]. Babies and toddlers in particular may not exhibit 'classic symptoms'[42]. The signs and symptoms of meningococcal disease are often similar to those of other illnesses[43].

Symptoms for children, teenagers and adults can include a general feeling of being unwell, fever, chills, headache, a stiff neck, nausea, vomiting, photophobia (being more sensitive to light), altered mental state and confusion, cold hands and feet, severe aches and pains in the muscles, joints, chest or abdomen, rapid breathing, shock, and diarrhoea[44 45 46 47 48].

A dark rash that does not fade when pressed with a glass may also appear for some people, but this occurs in the later stages of the disease, and not everyone will experience this[49 50 51 52 53].

Atypical symptoms are also possible, including pneumonia, septic arthritis, inflammation of the lining of the heart (endocarditis), and inflammation of the epiglottitis and airway (epiglottitis and supraglottitis)[54 55 56 57 58].

Babies and toddlers may display different symptoms to older children, and they may not experience fever. Babies and toddlers may be unsettled and difficult to comfort; they may have difficultly waking (or they may be slow to react or inactive when awake); they may have difficulty feeding; they may vomit; they may have high-pitched crying or screaming; they may have a dislike of bright light; they may have a bulging anterior fontanelle (the soft spot of the skull)[59 60 61 62 63]. If you or someone you know develop these symptoms, seek medical attention immediately.

Basic hygiene precautions, such as covering your nose or mouth when you cough and sneeze, keeping cutlery and crockery clean, not sharing toothbrushes, not sharing pacifiers, and washing and drying hands regularly can help to reduce the risk of spreading the bacteria.

If medical professions suspect meningococcal disease, they will collect samples of blood or cerebrospinal fluid to test for bacterial infection[64 65 66 67 68]. These tests enable medics to identify the exact strain of bacteria that has caused the illness and, consequently, the correct antibiotic treatment that is needed[69 70 71 72 73].

The disease usually progresses very quickly over the course of a few hours[74 75 76 77 78] and it must be treated quickly[79 80 81 82 83].

How is it spread?

Meningococcal disease is spread by prolonged, close contact with someone who carries *Neisseria Meningitidis* or who has the disease[84]. The bacteria are generally spread between people by sharing respiratory or throat secretions, for example through kissing, sharing eating and drinking utensils, sharing toothbrushes or sharing pacifiers[85 86].

The disease is not as contagious as other illnesses such as influenza because the *Neisseria Meningitidis* bacteria cannot live for very long outside the body[87 88]. This means that is not possible to catch the bacteria through casual contact or by breathing the air where someone with meningococcal disease has been[89 90].

Basic hygiene precautions, such as covering your nose or mouth when you cough and sneeze, keeping cutlery and crockery clean, not sharing toothbrushes, not sharing pacifiers, and washing and drying hands regularly can help to reduce the risk of spreading the bacteria[91 92].

How common is meningococcal disease?

Each year, people in Aotearoa New Zealand are admitted to hospital with the illness[93]. The number of cases varies annually. For example, in 2022, 72 cases were reported[94]. This number was higher than the same period in 2020 and 2021, but lower than the same period in 2017, 2018, and 2019[95]. Almost half of the cases were in Māori and Pasifika children under five years of age[96 97 98].

Meningococcal disease typically follows a seasonal pattern, with cases beginning in autumn, peaking in winter, and then continuing into spring[99 100].

The disease has caused various epidemics in this country. In 1985-1986, *Neisseria Meningitidis* bacteria in group A caused an epidemic in Tāmaki Makaurau - Auckland. In 1991-2007, bacteria in group B caused a widespread national epidemic. In 2012, bacteria in group C caused an outbreak in Te Tai Tokerau Northland. In 2018, Te Tai Tokerau Northland experienced another outbreak caused by bacteria in group W[101].

How is meningococcal disease treated?

Meningococcal disease is treated with antibiotics. The type of antibiotic will depend on the strain of *Neisseria Meningitidis* that has caused the illness. Treatment is urgent and **it must start as soon as possible** to increase the chances of survival and to minimise, as much as possible, long-term complications[102].

Depending on how serious the infection is, other treatments may also be required, such as ventilation, surgery to remove dead tissue, amputation, wound care for parts of the body damaged by the infection, and other medications as necessary[103].

Close contacts of the person with the illness should also receive antibiotics proactively to prevent them from getting sick; this practice is called prophylaxis[104]. The risk of infection for close contacts is highest during the first seven days from exposure and may persist for several weeks[105]. If close contacts develop any symptoms, it is vital that they seek out urgent medical assistance[106].

Although it is rare, it is possible to contract meningococcal disease more than once[107].

Prevention through vaccination is the best treatment for meningococcal disease because of the serious risks the illness brings and the difficulty in treating it[108].

What is the vaccine against meningococcal disease?

Vaccines that protect against the disease have been available since the 1970s, but none protect against all the strains of bacteria that cause illness[109 110]. Vaccines to protect against bacterial strains in groups A, C, Y and W were developed first, whilst vaccines to protect against group B were developed more recently[111].

In Aotearoa New Zealand, vaccines are available to protect against bacterial strains in groups A, C, W, Y and B[112 113 114]. For groups A, C, W and Y, the vaccine is called Nimenrix or Menactra[115]. For group C-only protection, the vaccine is called NeisVac-C[116]. For protection against group B, the vaccine is called Bexsero[117]. For the best protection against meningococcal disease, it is recommended that all bacterial strains (A, C, W, Y and B) are vaccinated against[118 119 120].

Since 2008, all babies are offered immunisation against meningococcal disease as part of the free childhood immunisation programme[121]. Immunisation requires a course of doses, and babies and toddlers are not fully protected until they have completed the course[122].

During meningococcal disease outbreaks, an immunisation programme may be put into action to protect those at the highest risk of the disease[123]. This reduces the number of people carrying *Neisseria Meningitidis* in the back of their throats, thereby reducing the spread of the bacteria around the community[124 125]. This contributes to herd immunity whilst also protecting people from invasive disease[126 127].

How effective is the vaccine against meningococcal disease?

Each of the vaccines provide very good protection against the strains of *Neisseria Meningitidis* that they have been developed to protect against[128 129 130 131 132 133].

For the Nimenrix vaccine, between 77-97% people had protective levels of antibodies after vaccination[134 135]. For the NeisVac-C vaccine, between 97-100% people had protective levels of antibodies after vaccination[136]. For the Bexsero vaccine, between 63-100% of people had protective levels of antibodies after vaccination[137]. For each vaccine, the levels of antibodies after vaccination vary according to age[138 139 140].

It is … important to know which vaccine you may have previously received, and to seek medical advice as to whether you are still adequately protected or not[141]. Even if you have been vaccinated in the past, you may not necessarily be protected now.

In older children, adolescents and adults, protection can last up to five years after vaccination[142]. Protection against illness caused by bacterial strains in group A wane the fastest, decreasing quickly over the first year after vaccination[143]. Because protection wanes over time, it is important to stay up to date with boosters[144 145].

In addition to this, vaccines for meningococcal disease have changed over time. It is therefore important to know which vaccine you may have previously received, and to seek medical advice as to whether you are still adequately protected or not[146]. Even if you have been vaccinated in the past, you may not necessarily be protected now[147].

How safe is the vaccine and what are the potential side effects of it?

As with all medicines and medical treatments, vaccines are not 100% completely risk-free[148]. However, evidence from decades of research and monitoring indicates that, on the whole, vaccinating against a given disease is much safer than not vaccinating, and that the vast majority of people can safely be given vaccines[149].

The meningococcal vaccines are considered to have a strong safety profile[150 151 152 153]. The vaccines do not contain live bacteria and they cannot cause meningococcal disease[154 155 156].

However, the vaccine should not be given to anyone with a severe allergy to a previous does of a meningococcal vaccine or to any ingredients within it[157 158 159]. Specialist advise should be sought for people with bleeding disorders, such as haemophilia[160 161 162].

As with any vaccine, medication or food, there is a very small chance of a severe allergic reaction known as anaphylaxis. Anaphylaxis causes life-threatening breathing and/or circulation problems and must be treated with adrenaline. Healthcare workers who give vaccines know how to do this[163].

The most common side effects for each of the three vaccines are discomfort and swelling at the injection site, fever (particularly for the Bexsero vaccine), decreased appetite, nausea, tiredness, irritability, and headache. Rare reactions for Nimenrix, NeisVac-C and Bexsero, respectively, are limb swelling, muscle aches and hives, and urticaria (an allergic skin reaction)[164 165 166 167].

Is there a link between abortion and the meningococcal vaccine?

The formulations in the vaccines are grown on a culture that has no link to human cell lines and, subsequently, there is no link to any morally compromised human cell lines[168].

Endnotes and references are available on request.

Endnotes

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