

18 Varicella (Chickenpox and Shingles)

18.1 Introduction

Chickenpox was at first confused with smallpox until the first clinical differentiation was made by Heberden in 1767. The varicella zoster virus (VZV) was first isolated in cell culture in 1952. Varicella (chickenpox) is a highly infectious disease caused by human herpes virus type 3 (varicella zoster virus). It is usually, but not invariably, a mild, self-limited disease in otherwise healthy children, but the severity of disease and risk of complications are usually greater in adolescents and adults.

Varicella can also cause severe and even fatal disease in immune-suppressed individuals (eg, children with acute leukaemia), in whom the mortality may be as high as 7–10 percent. Mortality in previously healthy children is less than 2 per 100,000 cases, increasing up to 15-fold in adults. Reactivation of latent VZV results in herpes zoster (shingles), a disease with considerable morbidity.

18.2 The illness

Varicella is one of the most infectious diseases known (along with pertussis and measles). Transmission occurs via airborne droplets, or contact with infected respiratory tract secretions or vesicular lesions. A maculo-papular rash, which becomes vesicular, appears first on the face and scalp, later spreading to the trunk and abdomen and eventually to the limbs. The vesicles dry and crust after three to four days, but may be followed by further lesions. A wide variation in the number of lesions is possible, ranging from a few to many hundred. The hallmark of the disease is the presence of lesions at all stages. Lesions may be found in the mouth and at times in the vagina, where they can be the cause of considerable distress. The rash is pruritic and is usually associated with mild fever, malaise, anorexia and listlessness.

Superinfection with Group A beta haemolytic streptococci is a potentially serious complication, which may be fatal. Other complications include varicella pneumonia (more common in adolescents and adults), acute cerebellar ataxia (more common in infants and children, and almost always self-limited), and, rarely, encephalitis, with permanent neurological disability or fatal outcome. Transverse myelitis, thrombocytopenia and rarely, involvement of the viscera and joints may also occur.

Salicylates (aspirin-containing analgesics) should not be given to children with chickenpox because of the association between Reye syndrome (an acute encephalopathy with hepatic failure) developing after an infectious illness such as influenza or natural varicella infection and the use of salicylates.

The incubation period of varicella is 10–21 days (usually 14–16 days). The incubation period can be longer: up to 28 days for those who receive zoster immunoglobulin or intravenous immunoglobulin. The virus is plentiful in the naso-pharynx initially, and in the vesicles before they dry up. The infectious period is from one to two days before the rash emerges until the rash dries up about seven days later. The infectious period may be more prolonged in immune-suppressed individuals.

The disease may be more serious in adults, particularly in pregnant women, and the risk of severe disease is greatly increased in neonates and immune-suppressed individuals. Congenital varicella syndrome has been reported after varicella infections in the first half of pregnancy and may result in congenital malformations, skin scarring, other anomalies, spontaneous abortion or fetal death. The observed incidence of congenital varicella syndrome, in retrospective and prospective studies, ranges from 0.7 percent to 2 percent.¹ There is a higher risk when maternal infection occurs between 13 and 20 weeks gestation compared with 0 and 12 weeks (2 percent compared with 0.4 percent).²

The onset of chickenpox in pregnant women, from five days before delivery to two days after delivery, is estimated to result in severe varicella in 17 to 30 percent of their newborn infants. Although varicella is rarely fatal, half the deaths from chickenpox in infants aged less than 12 months occur during the first month of life.

Nosocomial varicella is a serious problem in hospitals, particularly paediatric and neonatal units, with large numbers of vulnerable children at risk of exposure from other patients and family members, as well as staff. When an exposure occurs in a hospital setting it can be time consuming and expensive to prevent a potentially serious nosocomial outbreak.³

Herpes zoster (shingles) results from reactivation of latent varicella virus infection. The majority of cases of zoster occur in adults aged 40 years or older; if it occurs in adults aged less than 40 years, HIV testing is recommended. The dermatomal distribution of the vesicular rash is the key diagnostic feature. Herpes zoster is uncommon in infants and children but may occur after chickenpox in infancy. When it occurs in those aged less than two years it may reflect *in utero* chickenpox, with the greatest risk arising following exposure between 25 and 36 weeks gestation, with reactivation in early life. Herpes zoster occurs more commonly in immune-suppressed individuals, and there is evidence that up to 10 percent of children treated for a malignant neoplasm may develop herpes zoster.

18.3 Epidemiology

The epidemiology of this infection appears to be similar in all developed countries with temperate climates. Epidemics occur each winter/spring, with some variability from year to year. Approximately 3 percent of each birth cohort are infected during infancy. Thereafter, 8–9 percent of the birth cohort are infected each year throughout childhood, so that by age 10 years less than 15 percent, and by age 14 years less than 10 percent, remain susceptible.

The average age for infection is seven years. The infection rate drops rapidly in adolescence and young adulthood to about 1 percent per year. By age 40 years almost the entire birth cohort (over 97 percent) have been infected, so that only a few adults remain susceptible. Transmission of the virus is less efficient in tropical climates. Adolescent and adult immigrants to New Zealand from such countries are more likely to be susceptible, placing them at risk of contracting chickenpox in their new environment. Being older, they are more likely to suffer severe disease.

The characteristics of infection conspire at times to maximise the disruption to families. If a child is exposed outside the home, by the time the symptoms occur the child will have been infectious for several days. This means that any susceptible household contacts will become unwell just as the first child is starting to recover. This results not only in morbidity but also in financial consequences for parents missing work.

By contrast, herpes zoster is a sporadic disease occurring as a reactivation of the VZV in individuals who have previously had chickenpox. VZV is present in lesions of herpes zoster and is transmissible from the vesicles to other susceptible individuals. About 4 percent of individuals will suffer a second episode of shingles. Third episodes are rare.

Approximately one in three people will develop zoster during their lifetime, rising to 50 percent for those who reach 80 years. A common complication of zoster is post-herpetic neuralgia, a chronic, often debilitating pain condition that can last months or even years. The risk for post-herpetic neuralgia in patients with zoster is 10–18 percent, although it is uncommon in healthy children and the risk rises with age. Another complication of zoster is eye involvement, which occurs in 10–25 percent of zoster episodes and can result in prolonged or permanent pain, facial scarring and loss of vision.

Varicella vaccine has been introduced into childhood immunisation programmes overseas, including the US from 1995 and Australia from 2005. Following the introduction of varicella vaccine onto the childhood schedule, the incidence of infection with wild-type virus decreases, and therefore adults are less likely to boost immunity to latent herpes zoster. It was

hypothesised that lack of boosting may lead to an increase in herpes zoster in older adults. However, a study in the US⁴ from 1992 to 2002 has shown that although the incidence of varicella decreased in children (from 2.63 cases per 1000 person-years in 1992 to 0.92 cases per 1000 person-years in 2002), there was no increase in herpes zoster in adults of any age: the age-adjusted rate of herpes zoster was 4.05 cases per 1000 person-years in 1992 and 3.7 cases per 1000 person-years in 2002.

New Zealand epidemiology

In New Zealand it is expected that 90 percent of children will have had varicella infection before adolescence, with peak incidence in the five to nine years age group. With higher participation rates in early childhood services, a greater proportion of infections may now be occurring in preschool-aged children.

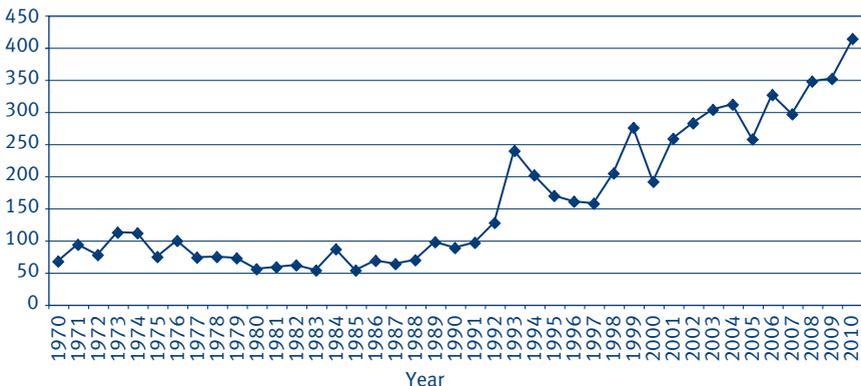
In New Zealand varicella is not a notifiable disease, so accurate data collection is limited for uncomplicated varicella, and hospital discharge data depend on accurate coding. This may result in under-reporting of complications secondary to varicella infection.

Hospitalisation³

New Zealand hospital discharge information for varicella between 1970 and 2010 is shown in Figure 18.1. The rate of hospital discharges for the 0–4 and 5–9 years age groups was higher compared with older age groups because the disease is most common in childhood. However, adults, adolescents and infants are more likely to suffer severe illness or the complications of chickenpox.⁵

Figure 18.1 Hospitalisations for varicella, 1970–2010

Number of hospitalisations



Source: Ministry of Health

Based on overseas rates, it is estimated that up to one case of congenital varicella syndrome may be expected in New Zealand each year, although few have been reported.

Mortality

Mortality data are available for the period 1980 to 2009. Nine deaths were attributed to chickenpox over the 14-year period 1980 to 1993, of which four occurred in children, two in infants and three in adolescents or adults. None of the cases who died had a contributory cause of death recorded. From 1994 to 2009 there were 15 deaths associated with varicella: two were children aged 0–4 years, two were children aged 5–9 years, five were adults aged 20–64 years and six were adults aged 65 years or older. Larger series from other developed temperate climate countries suggest that up to 10 percent of chickenpox deaths may involve individuals with immune-suppression.

In summary, in a typical year New Zealand is estimated to experience approximately 50,000 chickenpox infections, of which 150–200 result in hospitalisation, one to two cases result in residual long-term disability or death, and 0.5–1 cases result in severe congenital varicella syndrome. About two-thirds of this burden is borne by otherwise healthy children and less than one-tenth by children with a disease associated with immune-suppression.

18.4 Vaccines

VZV was first isolated in the 1950s. An attenuated (live) VZV (Oka strain) developed in Japan was found suitable for vaccine use. Currently Varilrix and Varivax (both based on the Oka strain) are approved for use and are available for distribution in New Zealand. Two quadrivalent measles, mumps, rubella and varicella vaccines (MMRV) are approved for use and are available for distribution in New Zealand (see also chapter 10).

Varilrix (GSK)

Varilrix is a live attenuated virus vaccine presented as a lyophilised powder for reconstitution with the supplied diluent. The vaccine should be stored in the refrigerator at +2°C to +8°C, although the diluent may be stored at room temperature. Reconstituted vaccine must be used immediately.

Varilrix should be administered by subcutaneous injection in the deltoid area (see section 2.4). Until 2011, the manufacturer had recommended one dose for children aged 9 months to 12 years and two doses six weeks apart for those aged 13 years and older. The manufacturer now recommends two 0.5 mL doses six weeks apart for all individuals from age 9 months, for the benefit of an enhanced immune response to the varicella virus. The vaccine

can be administered concurrently with other vaccines, but in a separate syringe and at a different site. If not administered concurrently, the vaccine must be separated from other live vaccines (eg, measles, mumps and rubella – MMR) by at least four weeks.

Varivax (MSD)

Varivax is a live attenuated virus vaccine presented as a lyophilised powder for reconstitution with the supplied diluent. The vaccine should be stored in the refrigerator at +2°C to +8°C, but may also be stored in the freezer. When the vaccine is transferred from the freezer to the refrigerator it should not be refrozen. Reconstituted vaccine must be used immediately.

Varivax should be administered by subcutaneous injection in the deltoid area (see section 2.4). A single 0.5 mL dose is sufficient for children aged 12 months to 12 years inclusive; individuals aged 13 years and older require two doses, given four to eight weeks apart.

Priorix-Tetra (GSK)

Priorix-Tetra quadrivalent MMRV vaccine is presented as a ‘cake’ with a slightly pink colour in a glass vial. The sterile diluent is clear and colourless and presented in a glass prefilled syringe or ampoule. The cake should be stored at +2°C to +8°C and the diluent at room temperature. After reconstitution it should be used immediately. Priorix-Tetra should be administered by subcutaneous injection in the deltoid area (see section 2.4). As with Varilrix, the manufacturer now recommends two 0.5 mL doses of Priorix-Tetra for children aged 9 months to 12 years for the benefit of an enhanced immune response to the varicella virus.

ProQuad (MSD)

ProQuad quadrivalent MMRV vaccine is supplied in vials as a sterile lyophilised preparation together with vials of diluents (containing sterile water). The lyophilised preparation should be stored at +2°C to +8°C and the diluent at room temperature. ProQuad should be administered by subcutaneous injection in the deltoid area (see section 2.4). A single 0.5 mL dose is sufficient for children age 12 months to 12 years inclusive. If a second dose is recommended, ProQuad can be used for this dose.

Zostavax (MSD)

Zostavax is supplied in vials of lyophilised powder containing a minimum of 19,400 PFU (plaque forming units) of the Oka/Merck strain of varicella zoster virus (VZV) when reconstituted with the accompanying vial of diluent. It is administered by subcutaneous injection as a single dose (see section 2.4). A single 0.65 mL dose is sufficient for adults aged 50 years and older.

Zostavax is a higher titre formulation of the varicella vaccine and has been

tested as a vaccine to protect against herpes zoster.⁶ By mimicking the immune response seen following a dose of shingles and boosting cell-mediated immunity in older adults, zoster may be prevented by the high-titre vaccine.

In a large clinical trial of 38,586 adults aged 60 years and older, with either a history of chickenpox or of having lived in the US for more than 30 years, the participants received the high-dose zoster vaccine or a placebo. The results showed that the zoster vaccine reduced the burden of illness of zoster by 61 percent in all age groups, by 65.5 percent in the age group 60–69 years and by 55.4 percent in those aged 70 years and older. There was also a 66.5 percent reduction in post-herpetic neuralgia in all age groups. Over five years of follow-up the incidence of zoster and post-herpetic neuralgia was reduced. In the individuals who received the zoster vaccine but developed zoster, the illness was less severe. Zostavax is approved for use in New Zealand, though it was not marketed (available) at the time of writing.

Efficacy and effectiveness

Although both clinical efficacy and immunogenicity data exist for varicella vaccines, which support their licensure, the best evidence of varicella vaccine effectiveness comes from the experience of at least 10 years of vaccine use (Varivax) in the US. Following the introduction of single-dose varicella vaccination in 1996, coverage for children aged 19–35 months has risen to 88 percent in 2005.⁷ These immunisation rates have resulted in a 71–84 percent reduction in varicella cases, an 88 percent decrease in varicella-related hospitalisation and a 92 percent decrease in varicella deaths in one- to four-year-old children when compared to the pre-vaccine era.

However outbreaks of varicella still occur even in highly immunised populations.⁷ Vaccine effectiveness for a single dose is in of the order of 80–85 percent and if a single-dose strategy is retained there are likely to be ongoing outbreaks of varicella. The frequency and severity of breakthrough varicella increases with time following a single dose.⁸

After a second dose in children the immune response is markedly enhanced, with over 99 percent of children attaining an immune response thought to provide protection, and the geometric mean antibody titre is also significantly increased. Over a 10-year period, estimated vaccine efficacy of two doses for prevention of any varicella disease is 98 percent (compared to 94 percent for a single dose), with 100 percent efficacy for the prevention of severe varicella. The likelihood of breakthrough varicella is reduced by a factor of 3.3.^{7,9} Because of these data the US authorities now recommend a two-dose strategy for varicella prevention, with the first dose at 12–15 months of age and the second at four to six years of age, as for MMR.^{7,10}

18.5 Recommended immunisation schedule

Varicella vaccine is not yet on the Schedule. It is, however, recommended for children from age 12 months to 12 years.

Varicella vaccine can be administered at 15 months with MMR, Hib and PCV10 vaccines. Because the risk of febrile seizures for those aged 12–23 months is higher following MMRV than MMR+V (see section 18.6), this dose should be administered as single-antigen varicella vaccine. (This requires four injections at the 15-month visit.) For a second dose of varicella vaccine, or first doses after age four years, either single-antigen varicella vaccine or MMRV can be used. Because chickenpox is circulating liberally in the community, providing boosting, for those small numbers of children who received varicella vaccine, a second dose is not essential for children aged less than 13 years.

Varicella immunisation in a two-dose schedule is recommended, but not funded, for:

- adults and adolescents who were born and resided in tropical countries, if they have no history of varicella infection
- susceptible adults and adolescents (ie, those who have no prior history of chickenpox – a second dose of single-antigen varicella vaccine is required for those aged 13 years and older)
- children with chronic liver disease who may in future be candidates for transplantation – varicella vaccine has been found to be safe and immunogenic in children with chronic liver disease and is therefore recommended early in the disease and prior to liver transplantation¹¹
- children with deteriorating renal function, as early as possible before transplantation – varicella immunisation of children with end-stage and pre-end-stage renal failure results in a high rate of seroconversion and persistence of protective antibody titres¹²
- children likely to undergo solid organ transplant
- children with HIV infection at CDC stage N1 or A1 – a recent study has found varicella vaccine is safe and effective when given to children aged one to eight years with HIV infection at CDC stage N1 or A1:¹³ two doses were given, four weeks apart
- susceptible individuals who live or work in environments where transmission of VZV is likely (eg, staff in early childhood services, residents and staff members in institutional settings)
- susceptible individuals who live and work in environments where transmission can occur (eg, college students, inmates and staff members of correctional institutions, and military personnel)

- susceptible non-pregnant women of childbearing age
- susceptible international travellers¹
- health care workers (see below)
- post exposure (see section 18.8).

Immune suppressed individuals

The vaccine should not be given to immune-suppressed children except under the direction and care of a specialist paediatrician, following a suitable protocol.¹ Immune-suppressed individuals are at highest risk of severe varicella and zoster infections. The original vaccine formulations, in particular Varivax, have been studied in immune-suppressed children (most of whom were children with leukaemia). Approximately 20 percent of these vaccine recipients required acyclovir because of a rash developing up to four weeks after vaccination. Despite this, the study concluded that the vaccine Varivax was safe, immunogenic and effective in these children.¹⁴

Where immune-suppressed individuals cannot be vaccinated, it is important to vaccinate the household members and other close contacts (with either vaccine) to provide 'ring fence' protection (see section 18.6). Immunisation of children with congenital T-cell immune deficiency syndromes is generally contraindicated, but those with impaired humoral immunity may be immunised (see below for further contraindications).

Health care workers

In 1999 all acute care hospitals were advised that the varicella vaccines were available for use in adults and that hospitals should incorporate the use of varicella vaccine for health care workers in their occupational health programme. All health care workers on obstetric, paediatric and neonatal units, and those caring for immune-suppressed children and adults, should be immunised with varicella vaccine if they are susceptible to varicella. When a health care worker has a good history of prior varicella infection,¹⁵ no blood test is required. If there is not a good history of varicella infection, a blood test to assess susceptibility will be necessary, as many individuals with no clinical history of varicella are immune (see below).

If a health care worker who has clinical contact with patients develops a rash as a result of the vaccine (around 5 percent), they must be excluded from contact with immune-suppressed or other at-risk patients and allocated other duties, or excluded from their place of work, for the duration of the rash. Whenever exposure to wild chickenpox occurs, previously vaccinated health care workers should examine themselves daily for 21 days for a rash. If a rash appears they should seek advice from their occupational health service.

Susceptibility

When assessing susceptibility, it has been found that maternal recall of varicella or characteristic rash is reliable evidence of immunity. In people with no history or recall of the rash, 70–90 percent are found to be immune.¹⁶ Consult with the local laboratory about the availability and interpretation of tests.

18.6 Expected responses and adverse events following immunisation (AEFI)

Experience with the varicella vaccines used in Japan and other countries indicates that, in general, side-effects including local reactions, fever and mild papulovesicular rash in normal healthy individuals are mild and self limiting. About 5–7 percent (Varivax) or 2–6 percent (Varilrix) of healthy children develop a mild rash three weeks after vaccination. The mean number of vesicles is five, which compares to several hundred in wild varicella in an unimmunised child. After Varivax, PCR analysis from rashes that occurred within 14 days of vaccination was more likely to identify the presence of wild type VZV, whereas PCR from a rash developing > 14 days and ≤ 42 days post-vaccine was more likely to identify the vaccine virus.¹

Vaccine-associated virus transmission to contacts is rare (only five instances, resulting in six secondary cases), and the risk of transmission exists only if a rash develops on the immunised individual.¹⁶ When an immune-suppressed individual inadvertently comes in contact with a vaccinee who has a varicella-like rash, the administration of zoster immunoglobulin (ZIG) should be considered (see below).¹ Acyclovir may also be considered for the immune-suppressed individual if symptoms develop.¹⁷

The Oka strain of varicella used in the available vaccines can establish latent ganglionic infection in vaccinees and later reactivate to produce clinical zoster (shingles). To date, there has been insufficient follow-up time to determine whether the risk of zoster is lower in healthy vaccinees than in naturally infected individuals. However, a cohort study in children with acute lymphoblastic leukaemia (who have a high rate of zoster in childhood) has shown that vaccinees had less than one-fifth the zoster rate of their naturally infected counterparts.¹⁴

Data from the US indicate that the incidence of febrile seizure following MMRV vaccine for children age 12–13 months is 9 per 10,000 compared to 1 per 2000 following MMR+V vaccines. This is why MMRV is not recommended as a first dose for children prior to their fourth birthday. MMRV can be given as a first dose to children after their fourth birthday, and to children of any age as a second dose.

Zostavax is generally well tolerated. In clinical trials injection site reactions

occurred more commonly in Zostavax recipients than in placebo recipients. Zoster-like rashes occurring in the 42 day period following vaccination are much more likely to be due to wild varicella zoster virus than to the vaccine virus.

Adverse events should be reported to CARM, PO Box 913, Dunedin, using the prepaid postcard HP3442, or via online reporting at <http://otago.ac.nz/carm> (see 'AEFI reporting process' in section 2.5).

18.7 Contraindications

See section 1.8 for general contraindications for all vaccines.

Varicella vaccination is contraindicated for:

- individuals with primary or acquired T-cell immune deficiency states – consult the child's paediatrician for advice¹⁸
- children on high-dose steroids (ie, children on 2 mg/kg per day or more of prednisone or its equivalent, or 20 mg per day if their weight is over 10 kg)
- children on salicylates, because of the association between Reye syndrome, natural varicella infection and salicylates – the vaccine manufacturers advise against the use of salicylates for six weeks after varicella vaccine is given; there has been no reported association between the vaccine and Reye syndrome, but avoidance of salicylates is recommended as a precaution,¹⁶ and physicians need to weigh the theoretical risk from the vaccine against the known risk of varicella disease in children receiving long-term salicylate therapy
- individuals with known systemic hypersensitivity to neomycin
- women during pregnancy – women should be advised to avoid pregnancy for three months after vaccination, because the vaccine's safety for the fetus has not yet been demonstrated.

Contraindications to Zostavax include:

- a history of hypersensitivity to any component of the vaccine, including gelatin and neomycin
- primary and acquired immune deficiency states due to conditions such as: acute and chronic leukaemias; lymphoma; other conditions affecting the bone marrow or lymphatic system; immune-suppression due to HIV/AIDS; cellular immune deficiencies
- immune-suppressive therapy (including high-dose corticosteroids); however, Zostavax is not contraindicated for use in individuals who are receiving topical/inhaled corticosteroids or low-dose systemic

corticosteroids, or who are receiving corticosteroids as replacement therapy (eg, for adrenal insufficiency)

- active untreated tuberculosis
- pregnancy.

18.8 Control measures

At present, VZV is not a notifiable disease.

Post-exposure prophylaxis with zoster immunoglobulin (ZIG)

ZIG is a high-titre immunoglobulin (IG) available from the New Zealand Blood Service for passive immunisation of varicella in high-risk individuals. It is effective if given within 96 hours of exposure, but should be administered as soon as possible. Intravenous IG (IVIG) can be given when ZIG is unavailable.

The decision whether to offer ZIG will depend on:

- the likelihood that infection will result from a given contact
- the exposed individual's susceptibility to varicella (ie, no history of varicella infection or demonstrated absence of antibodies)
- the likelihood that an individual will develop serious complications if infected.

Contact can be defined as follows:

- household contact – individuals living in the same house are very likely to be infected if susceptible
- playmate contact – this can be defined as more than one hour of play indoors with an infected individual
- newborn infant contact – this occurs when the mother of a newborn infant develops chickenpox (but not shingles) from one week before to one week after delivery.

Susceptibility

In general, a positive past history of chickenpox can be taken as indicating immunity, provided there has not been an intervening bone marrow transplant. Maternal recall of varicella or characteristic rash is reliable evidence of immunity. In people with no history or recall of the rash, 70–90 percent are found to be immune. Consult with the local laboratory about the availability and interpretation of tests.

Provided exposure has occurred and susceptibility is likely, ZIG is recommended for:

- newborn infants whose mother had onset of chickenpox but not zoster within seven days before or after delivery (see below)
- hospitalised premature infants whose mothers have no history of chickenpox, or who are less than 28 weeks gestation or 1000 g in weight, irrespective of maternal history
- immune-compromised individuals.

Care of pregnant women after exposure

Pregnant women are at higher risk of severe complications of varicella. If an immune-competent pregnant woman is exposed to varicella, it is recommended, where possible, that her varicella antibodies be assessed if she has no past history of varicella. If there is no evidence of immunity two possible courses of action are available: either administer ZIG, or await the onset of symptoms and as soon as possible commence the administration of acyclovir, which is effective in this situation and now regarded as safe in pregnancy. Discuss the clinical circumstances with an infectious diseases physician before deciding on which course of action is best.

Intravenous acyclovir is recommended for the pregnant patient with severe complications of varicella. ZIG given to a pregnant woman within five days of delivery may not protect the fetus/neonate. The neonate should receive ZIG on delivery and may need treatment with acyclovir (for further information see Appendix 8).

Dosage of ZIG

The ZIG prepared by CSL in Melbourne, from New Zealand donors, contains 100 IU/mL (ie, 200 IU per 2 mL vial). The recommended dose is 6 mL for adults, 4 mL for children aged 6–12 years, and 2 mL for children aged 0–5 years. ZIG should be given intramuscularly, not intravenously. If ZIG is not available IVIG can be used. The titre of anti-varicella antibody will vary between lots and the blood transfusion centre haematologist needs to be contacted to confirm the appropriate dose when IVIG is used.

Hospital outbreaks

In the event of a hospital outbreak:

- susceptible staff should be excluded from contact with high-risk patients from day 8 to day 21 after exposure to varicella or zoster
- hospital staff who have no past history of chickenpox and who will be in

contact with pregnant women or high-risk patients should be screened for varicella zoster antibodies; those who are not immune should be offered vaccination.

Exclusion from school or early childhood services

Parents/guardians should be advised that:

- infected children should be excluded from early childhood services or school until fully recovered, or all lesions have crusted
- high-risk children should be excluded from early childhood services or school for the duration of the outbreak.

Post-exposure vaccination and outbreak control

Varicella vaccine may be used for post-exposure prophylaxis. Data from the US and Japan from household, hospital and community settings indicate that the varicella vaccine is effective in preventing illness or modifying varicella severity if used within three days, and possibly up to five days, of exposure. The US ACIP recommends the vaccine for use in susceptible individuals following exposure to varicella.⁵

If exposure to varicella does not cause infection, post-exposure vaccination should induce protection against subsequent exposure. If the exposure results in infection, no evidence indicates that administration of the varicella vaccine during the pre-symptomatic or prodromal stage of illness increases the risk for adverse events following immunisation. Note that although this method of immunisation may be successful, it is not necessarily reliable.¹⁹ Immunisation before exposure is therefore recommended as the preferred method of preventing outbreaks.

For more details on control measures, refer to the *Communicable Disease Control Manual 2011*²⁰ or the *Control of Communicable Diseases Manual*.²¹

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