CHICKENPOX VACCINE

Introduction

Chickenpox (Varicella) is an acute, highly contagious disease caused by *Varicella zoster* virus (VZV). Chickenpox is mostly a mild disorder in childhood but tends to be more severe in adults. It may be fatal, especially in neonates and in immunocompromised persons. Following infection with VZV, the virus remains latent in neural ganglia, and upon subsequent reactivation VZV may cause herpes zoster (shingles), a disease mainly affecting the elderly and immunocompromised persons.

Varicella was at first confused with smallpox, and the first clinical differentiation was done by Heberden in 1767. The varicella zoster virus was first isolated in cell culture in 1952.

Virology

Varicella zoster virus is a double-stranded DNA virus belonging to the *herpesvirus* family. Only one serotype is known, and humans are the only reservoir. VZV shows little genetic variation. Following infection, the virus remains latent in neural ganglia, and upon subsequent reactivation VZV may cause zoster (shingles).

Mode of transmission

Varicella-zoster virus is transmitted by droplets, aerosol or direct contact and enters the host through the nasopharyngeal mucosa, and almost invariably produces clinical disease in susceptible individuals. Patients are usually contagious from 1 to 2 days before the rash onset until the rash dries up about 7 days later. The infectious period may be more prolonged in immune suppressed individuals. Once a case has occurred in a susceptible population, it is very hard to prevent an outbreak.

The incubation period of chickenpox infection is 10-21 days (average 14–16 days); therefore, it takes 14 – 16 days to develop symptoms after being exposed to a person with chickenpox. Secondary attack rate may reach up to 90% among susceptible household contacts.

Clinical Features

Chickenpox is characterized by fever, tiredness and weakness. These symptoms are followed by an itchy, vesicular rash, usually starting on the scalp and face and then spreading out all over the body. Vesicles are more abundant on covered than the exposed parts of the body. It may appear in mucous membranes of the mouth, upper respiratory tract and in conjunctivae. The rash usually begins as small lumps that turn into blisters and dry out to crust and eventually form scabs. It normally takes about 7-10 days for all crusts to disappear.

In about 10-20% of the cases, varicella is followed later in life by herpes zoster, or shingles, a painful vesicular rash with dermatomal distribution. Most cases of zoster occur after the age of 50 or in immunocompromised persons.

Natural infection induces lifelong immunity to clinical varicella in almost all immunocompetent persons. Newborn babies of immune mothers are protected by passively acquired antibodies during their first months of life.

Complications:

Rarely chickenpox may be complicated by secondary bacterial skin infection, pneumonia, acute cerebellar ataxia, aseptic meningitis, transverse myelitis, encephalitis, and thrombocytopenia. In rare cases, it involves the viscera and joints. Complications are predominantly seen among infants, adults and imunocompromized persons.

Herpes Zoster may occasionally result in permanent neurological damage such as cranial nerve palsies and contralateral hemiplegia, and visual impairment following zoster ophthalmia.

Congenital varicella syndrome has been reported after varicella infection in pregnancy and may result in skin scarring, limb defects, ocular anomalies and neurologic malformations in the new born. Infection early in pregnancy may be associated with less risk of congenital varicella syndrome compared to 13-20 weeks gestation.

Newborn infants whose mothers have varicella at term (5 days before delivery to 2 days after delivery), are at risk to develop severe varicella due to immaturity of their cell-mediated immunity and absence of transplacental maternal antibodies.

Epidemiology

Global Situation

Varicella and herpes zoster occur worldwide. In temperate areas; varicella has a distinct seasonal fluctuation, with the highest incidence occurring in winter and early spring. Less seasonality is reported in tropical areas. Herpes zoster has no seasonal variation and occurs throughout the year. Some data suggest that in tropical areas, varicella infection occurs more commonly among adults than children.

Situation in Sri Lanka

Chickenpox is a notifiable disease in Sri Lanka and all cases of chickenpox should be notified to the local Medical Officer of Health. In year 2010 a total number of 3412 suspected chickenpox cases were notified from the whole country.

Chickenpox vaccine

Except for vaccination, no countermeasures are likely to control the dissemination of varicella or the frequency of zoster in a susceptible community. Varicella-zoster immune globulin and antiherpesviral drugs are very costly, and mainly used for post-exposure prophylaxis or the treatment of varicella in persons at high risk of severe disease.

Varicella vaccines based on the attenuated Oka-strain of VZV have been marketed since 1974. Extensive safety, efficacy and cost-effectiveness have warranted the introduction of varicella vaccine into the childhood immunization programmes of several industrialized countries.

Routine childhood immunization against varicella may be considered in countries where this disease is a relatively important public health and socioeconomic problem, where the vaccine is affordable, and where high (85-90%) and sustained vaccine coverage can be achieved.

Characteristics of the chickenpox Vaccine

Chickenpox vaccine is a live attenuated freeze dried vaccine (lyophilized), derived from the Oka strain of VZV and must be reconstituted before use. The virus was attenuated by sequential passage in human embryonic lung cell culture, embryonic guinea pig fibroblasts, and in WI-38 human diploid cells.

Each 0.5ml dose of the reconstituted vaccine contains not less than $10^{3.3}$ plaque-forming units (PFU) of the varicella-zoster virus. The vaccine also contains amino acids, human albumin, lactose, neomycin sulphate, and polyalcohols. It does not contain a preservative.

Live attenuated varicella vaccine is currently available as a monovalent vaccine. It is anticipated that quadrivalent combination vaccines containing measles, mumps, rubella and varicella vaccines (MMRV) will be available in the near future

Indications

Varicella vaccine is indicated for active immunization against varicella of non – immune susceptible individuals from one year of age.
Groups who would particularly benefit from vaccination include:

- non-immune people in high-risk occupations where exposure to varicella is likely (such as healthcare workers, teachers and workers in childcare centres),
- non-immune women before pregnancy to avoid congenital or neonatal

varicella (They should be advised to avoid pregnancy for 3 monthes following each dose of vaccine),

- non-immune household contacts, (both adults and children), of immunocompromised patients with no history of the disease,

- close contacts of varicella (or zoster) case may be vaccinated within 3 days, and possibly up to 5 days of exposure.

Efficacy

After observation of study populations for periods of up to 20 years in Japan and 10 years in the United States of America, more than 90% of immunocompetent persons who were vaccinated as children were reported protect from varicella.

Immunity following vaccination appears to be long-lasting, and is probably permanent or life long in the majority of vaccinees. Breakthrough infection is significantly milder, with fewer lesions among them.

Some studies show that varicella vaccine is 70 to 100% effective in preventing illness or modifying the severity of illness if used within 3 days, and possibly up to 5 days, after exposure.

Among healthy adolescents and adults 13 years of age and older, an average of 78% develop antibodies after first dose, and 99% develop antibodies after a second dose given 4 to 8 weeks later.

Immunization Schedule

Varicella vaccine is not yet included into the Sri Lankan National Immunisation Schedule. A single dose of 0.5 ml is recommended to administer sub cutaneously after completion of 12 months of age to 12 years for those who are not previously immune to Varicella Zoster.

Persons above 13 years are recommended to be vaccinated with two doses. After the initial dose, the second dose is given 6-10 weeks apart.

It is not yet sufficiently documented that the varicella vaccine, administered either in childhood or in adult populations, will protect against zoster.

Dosage & Administration

Varicella is a lyophilized vaccine and is provided with a vaccine specific diluent (sterile water for injection). It should be reconstituted only with the diluent supplied using a sterile syringe and needle.

A single dose of 0.5 ml is recommended for children and adults and should be administered by subcutaneous injection into the upper arm.

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 one month.

Storage

Varicella vaccine should be stored in the dark at +2°C to +8°C temperature. For long term storage, a temperature at –20°C is recommended. It is important to protect both the lyophilized and reconstituted vaccine from light. The diluent should not be frozen but should be kept cool in the main compartment of the refrigerator.

The reconstituted varicella vaccines can be stored at +2°C to +8°C (preferably in the dark) for up to 6 hours if not used immediately. Any opened vaccine vials remaining at the end of an immunization session (or after 6 hours) should be discarded.

Cautions and Contraindications

The following conditions are considered as contraindications for the use of varicella vaccine.

- Presence of one of the general contraindications for any vaccine.
- History of an allergy to neomycin, gelatin or any other vaccine components.
- Anyone who has experienced anaphylaxis to a previous dose of varicella vaccine.
- persons who are severely immunocompromised as a result of congenital disease, HIV infection, advanced leukaemia or lymphoma, serious malignant disease, or treatment with high-dose steroids or in persons who are receiving immunosuppressive therapeutic radiation.
- Pregnancy.
- A family history of congenital or hereditary immunodeficiency, unless the immune competence of the potential vaccine recipient is demonstrated.

Aerosolized steroid preparations are not a contraindication to vaccination. Persons whose immunosuppressive therapy with steroids discontinued for 1 month (3 months for chemotherapy) may be vaccinated.

HIV-infected children with CD4 T-lymphocyte percentage of 15% or higher and older children and adults with a CD4 count of 200 per microliter or higher may be considered for vaccination.

Precautions

Administration of blood, plasma or immunoglobulin less than 5 months before or 3 weeks after varicella immunization is likely to reduce the efficacy of the vaccine.

Due to the theoretical risk of Reye's syndrome, the use of salicylates is discouraged for 6 weeks following varicella vaccination.

Adverse Events

In general, adverse reactions to varicella vaccination are rare and mild. The most common adverse reactions following varicella vaccine are local reactions, such as pain, soreness, erythema, and swelling at the injection site.

A varicella-like rash at injection site is reported by 3% of children and by 1% of adolescents and adults following the second dose. These lesions generally occur within 2 weeks, and are most commonly maculopapular rather than vesicular. A generalized varicella-like rash is reported by 4–6% of recipients of varicella vaccine, with an average of five lesions. Most of these generalized rashes occur within 3 weeks and most are maculopapular.

Systemic reactions are not common following the varicella vaccination.

Sources

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