

Varicella-Zoster Infections (Chickenpox and Shingles)

Summary

Varicella (chickenpox) is a highly contagious rash illness caused by varicella-zoster virus (VZV). Prior to widespread vaccination, the disease was a near-universal childhood experience and diagnosis was often made clinically. High uptake of the varicella vaccine since its introduction to the United States in the 1990s dramatically reduced cases of classical chickenpox infections. However, vaccine breakthrough cases of varicella, which often presents atypically, has become more common as vaccination rates increase. These factors contribute to making clinical diagnoses of chickenpox less reliable than before widespread adoption of the vaccine. Sporadic suspected cases of chickenpox should ideally be confirmed via polymerase chain reaction (PCR) testing. Direct fluorescent antibody (DFA), viral culture, or a significant rise between acute and convalescent serology are also acceptable for confirmation.

Universal immunization is recommended, and the varicella vaccine can also be used for post-exposure prophylaxis (PEP) in exposed susceptible persons as appropriate.

Herpes zoster (“shingles”) is a re-activation of latent varicella-zoster virus in the dorsal root ganglia. A person with shingles can transmit the varicella virus to a susceptible person, giving them chickenpox, but they cannot spread shingles itself.

Agent

Varicella-zoster virus (also called human herpesvirus 3).

Transmission

Reservoir:

Humans.

Mode of transmission:

Person-to-person transmission occurs when the virus comes into contact with the mucosa of the upper respiratory tract or the conjunctiva, most commonly by the airborne route or by direct contact with patients with chickenpox or herpes zoster. *In utero* infection can also occur as a result of transplacental passage of virus during maternal varicella infection.

Period of communicability:

Chickenpox is contagious beginning 1-2 days before onset of rash and continuing until all lesions have crusted (lesions usually crust over after 4-7 days but can take longer in people with altered immunity.) Susceptible exposed persons should be considered potentially infectious from day 8 through day 21 following exposure.

Uncomplicated shingles is approximately 20% as infectious as chickenpox; the blister fluid is capable of spreading varicella virus until lesions are crusted and dry. Disseminated shingles (which can occur in people who are immunocompromised) should be presumed to be as infectious as classic chickenpox, including via airborne and droplet transmission, for the duration of the person’s illness.

Clinical Disease

Incubation period:

The chickenpox rash usually appears 14-16 days after exposure (but ranges from 10-21 days); this may be prolonged to 28 days or more after administration of varicella-specific immune globulin (Vari-ZIG) or intravenous immune globulin (IVIG).

Illness:

Some infections are subclinical or missed due to few lesions appearing, especially breakthrough infections (i.e., infections of vaccinated persons). Children may have a mild prodrome of low-grade fever, malaise, or mild upper respiratory tract symptoms. Rash is often their first sign of disease. A prodrome is more often seen in adolescents and adults.

Classically, the chickenpox rash often begins as small red dots on the face, scalp, torso, and/or upper arms or legs, progressing over the next 10-12 hours to small bumps, blisters, and vesicles. The rash continues in successive crops, with lesions at several stages of maturity present at the same time (i.e., macules, papules, vesicles, and dried crusts). The vesicles (blisters) tend to be intensely itchy. There may be upwards of 500 lesions, and if severe, lesions may occur on the conjunctiva, mucous membranes, palms, and soles. Lesions usually do not scar unless unusually deep or secondarily infected. The disease can be more severe in adolescents, adults, and people who are pregnant or immunocompromised.

In vaccinated persons who develop varicella more than 42 days after vaccination (breakthrough disease), the disease is almost always mild with <50 skin lesions and shorter duration of illness. The rash may also be atypical in appearance (maculopapular with few or no vesicles) and resemble a number of other similar rashes which make clinical diagnoses extremely unreliable. Breakthrough disease is more likely in persons who received only one dose of varicella vaccine rather than two.

After the chickenpox illness has resolved, the varicella-zoster virus remains latent in the dorsal root ganglia for life. Herpes zoster (shingles) is a dermatomal re-activation of that virus, resulting in localized nerve pain and grouped vesicular lesions appearing in the distribution of 1-3 adjacent dermatomes, usually contained to either the left or right side of the body. Shingles becomes more likely with increasing age or reduced immunocompetence, and a person can get shingles more than once. Shingles can become disseminated (crossing >3 dermatomes), though this usually only occurs in immunocompromised persons.

Complications

Prior to the widespread use of varicella vaccine, an average of 100-125 people die of chickenpox each year in the United States. Hospitalization rates for chickenpox range from 1-2 per 1,000 cases in children to 14 per 1,000 cases in adults.

Secondary bacterial infections of the lesions are the most common cause of hospitalization and can lead to death. Primary viral pneumonia is the most common complication in adults, while secondary bacterial pneumonia is more common in infants under a year old. Central nervous system complications can occur among unvaccinated children, cerebellar ataxia occurs in 1 in 4,000 cases, and encephalitis occurs in 1 in 50,000 cases.

Pregnant women, newborns or infants under 1 year old, adults or adolescents over 15 years old, and immunocompromised persons are all at higher risk for severe disease and complications.

Congenital Varicella Syndrome can occur if a pregnant person develops chickenpox during (approximately) the first 20 weeks of gestation. Incidence is estimated to be between 0.4% and 2% among newborns born to women who develop varicella during the first or second trimester. Congenital varicella syndrome can cause abnormalities such as hypoplasia of an extremity, skin scarring, localized muscle atrophy, encephalitis, chorioretinitis, cortical atrophy, microcephaly,

and low birth weight. Additionally, children infected with varicella virus *in utero* can develop shingles early in life. The risk of congenital varicella syndrome is not associated with maternal shingles during pregnancy.

Laboratory Diagnosis

For both unvaccinated and vaccinated persons, PCR is preferred for laboratory confirmation. Positive DFA, culture, or a four-fold rise from acute to convalescent varicella IgG antibody are also confirmatory, though less sensitive (DFA, culture) or practical (paired serology). A single positive IgG antibody result should not be used for diagnosis, and a four-fold rise in IgG antibody does not always occur in vaccinated persons.

Commercially available IgM testing is not recommended for diagnosis, due to common false-positive results and inadequate sensitivity and specificity. A negative IgM result should not be used to rule out the diagnosis. A positive varicella IgM antibody does not necessarily indicate active disease with chickenpox and should not be used to confirm a diagnosis in the absence of rash. However, The Centers for Disease Prevention and Control (CDC) has advised that in the presence of a varicella-like rash and no other more likely diagnosis, a positive IgM can be enough to prompt public health actions and may meet the criteria for a Probable case.

Note that varicella laboratory testing cannot distinguish chickenpox from shingles; a rarely used exception is IgG avidity testing, available only at CDC, which can help determine if a person's varicella IgG antibodies were developed recently or long ago.

Laboratory tests available for varicella confirmation:

Test	Specimen	Comments
PCR (polymerase chain reaction)	Vesicular swabs or scrapings; scrapings from maculopapular lesions; scabs from crusted lesions; biopsy tissue	Very sensitive and specific for detecting VZV. Results rapidly available (within 3 hours). Can also be used to distinguish vaccine strain from wild-type (available at CDC and Vaccine Preventable Disease Reference Centers).
DFA (direct fluorescent antibody)	Vesicle scraping; swab of lesion base (must include cells)	Can identify VZV. More rapid and sensitive than culture, but less sensitive than PCR.
Tissue culture	Vesicular fluid; biopsy specimens from sterile sites (e.g., CSF, joint fluid)	Used to detect the presence of viable VZV. Significantly less sensitive than PCR, requires up to a week for results. Can be expensive. Limited commercial availability [but is available at New Mexico's Scientific Laboratory Division (SLD)].
Tzanck smear	Vesicle scraping; swab of lesion base (must include cells)	Detects multinucleated giant cells with inclusions. Diagnostic of alpha herpes viruses (VZV, herpes simplex viruses). Less sensitive than DFA and not specific for varicella.

IgM	Acute or convalescent serum specimens for VZV IgM	IgM is inconsistently detected, even among patients with PCR-confirmed disease. Not a reliable method for routine confirmation, especially in vaccinated persons, but positive result in presence of varicella-like symptoms indicates current/recent VZV immune response. However, positive results in the absence of clinical disease, would not be considered confirmation of active varicella disease due to limits in specificity.
EIA (enzyme immunoassay)	Acute and convalescent serum specimens for IgG	Requires special equipment. Specific but may not be sensitive enough to identify vaccine-induced immunity.
LA (latex agglutination)	Acute and convalescent serum specimens for IgG	Rapid (15 min). No special equipment needed. More sensitive but less specific than EIA. Can produce false-positive results.
IFA (indirect fluorescent antibody)	Acute and convalescent serum specimens for IgG	Requires special equipment. Good sensitivity, specificity; however, accurate interpretation requires an experienced operator.
gpELISA (glycoprotein-based enzyme-linked immunosorbent assay)	Acute and convalescent serum specimens for IgG	Highly specific and sensitive but not widely or commercially available. Suitable for evaluation of vaccine seroconversion.

Table adapted from CDC Manual for the Surveillance of Vaccine-Preventable Diseases

Treatment

Healthy, immunocompetent children generally will not need antiviral treatment. Itchiness can be soothed with oatmeal baths or calamine lotion. The lesions should be kept clean and dry, and patients should avoid picking at them to prevent secondary bacterial infections.

Antiviral treatment with acyclovir, valacyclovir, or famciclovir may be administered for cases at higher risk of severe illness, which includes immunocompromised persons, unvaccinated people over 12 years old, those with chronic skin or lung conditions, those on long-term salicylate therapy, those receiving short or intermittent courses of corticosteroids, or sometimes unvaccinated household contacts of cases (since secondary cases in a household tend to be more severe than the index cases).

Children with varicella should not receive salicylates or aspirin because of the risk of developing Reye syndrome.

Surveillance

Case Definition (2024)

Clinical case definition:

In the absence of a more likely alternative diagnosis:

- An acute illness with a generalized rash with vesicles (maculopapulovesicular rash), **or**
- An acute illness with a generalized rash without vesicles (maculopapular rash).

Note that in vaccinated persons who develop varicella more than 42 days after vaccination (breakthrough disease), the disease is usually mild with fewer than 50 skin lesions and shorter duration of illness. The rash may also be atypical in appearance (maculopapular with few or no vesicles).

Laboratory Criteria:

Confirmatory Laboratory Evidence

- Positive polymerase chain reaction (PCR) for varicella-zoster virus (VZV) DNA^a, **or**
- Positive direct fluorescent antibody (DFA) for VZV DNA, **or**
- Isolation (viral culture) of varicella virus from a clinical specimen (such as scabs, vesicular fluid, or cells from the base of a lesion), **or**
- Significant rise (i.e., at least a four-fold rise or seroconversion^a) in paired acute and convalescent serum VZV immunoglobulin G (IgG) antibody level^a

Supportive Laboratory Evidence

- Positive test for serum VZV immunoglobulin M (IgM) antibody^{a,b}

^a Not explained by varicella vaccination during the previous 6-45 days

^b IgM serology has limited value as a diagnostic method for VZV infection and is not recommended for laboratory confirmation of varicella. However, an IgM positive result in the presence of varicella-like symptoms can indicate a likely acute VZV infection. A positive IgM result in the absence of clinical disease is not considered indicative of active varicella.

Epidemiologic Linkage Criteria:

Confirmatory Epidemiologic Linkage Evidence:

- Exposure to or contact with a laboratory-confirmed varicella case, **or**
- Can be linked to a varicella cluster or outbreak containing ≥ 1 laboratory-confirmed case, **or**
- Exposure to or contact with a person with herpes zoster (regardless of laboratory confirmation)

Presumptive Epidemiologic Linkage Evidence:

- Exposure to or contact with a probable varicella case that had a generalized rash with vesicles.

Confirmed –

- Meets clinical evidence **and** confirmatory laboratory evidence **or**
- Meets clinical evidence with a generalized rash with vesicles **and** confirmatory epidemiologic linkage evidence.

Probable -

- Meets clinical evidence with a generalized rash with vesicles

or

- Meets clinical evidence with a generalized rash without vesicles **and**
 - Confirmatory or presumptive epidemiologic linkage evidence, **or**
 - Supportive laboratory evidence (IgM+)

or

- Has a provider diagnosis of varicella or chickenpox but no rash description **and**
 - Confirmatory or presumptive epidemiologic linkage evidence, **or**
 - Confirmatory or supportive laboratory evidence

Reporting:

Report all confirmed or probable cases of primary varicella (chickenpox) to the Infectious Disease Epidemiology Bureau (IDEB) at 1-833-SWNURSE (1-833-796-8773). Information needed includes: patient's name, age, sex, race, ethnicity, home address, home phone number, occupation, health care provider, varicella immunization history, an estimated number of lesions (e.g., <50, 50-249, 250-499, >500) and the name of the diagnosing health care provider. Investigation information should also be entered in NMEDSS per established procedures.

Case Investigation:

Case investigation is routinely done by regional public health nurses, who will interview the case (or their proxy), arrange testing if needed, and identify and assess susceptible contacts. Central Epidemiology will assist as needed, especially with outbreaks.

Control Measures

1. Case management

a. Isolation:

- i. Exclude infected persons from childcare, school, health care, or contact with immune-impaired individuals until all lesions are crusted and dry. Zoster (shingles) that can be covered by clothing does not require exclusion except for contact with immune-impaired persons.
- ii. For hospitalized patients, standard, airborne, and contact precautions should be used for as long as the rash remains vesicular (minimum of 5 days after the onset of rash).
- iii. For breakthrough cases who do not have vesicular lesions to crust over (i.e., only macular or papular lesions), isolation should continue until no new lesions have appeared for 24 hours.
- iv. Immunocompromised persons with herpes zoster or patients with disseminated herpes zoster require airborne and contact precautions for the duration of illness.

2. Contact management

a. Evidence of immunity to varicella includes any of the following:

- Documentation of age-appropriate vaccination
 - Preschool-aged children (12 months or older): 1 dose

- School-aged children, adolescents, and adults: 2 doses
 - Note that post-immunization serologic testing is neither necessary nor recommended following immunization, including in health care personnel. Up-to-date vaccination status supersedes titer results.
 - Laboratory evidence of immunity (e.g., positive IgG titer)
 - Note that commercial assays can be used to assess disease-induced immunity, but are not sensitive enough to reliably detect vaccine-induced immunity (i.e., may yield false-negative results)
 - Laboratory confirmation of disease
 - Birth in the United States before 1980 (except for health care personnel, pregnant women, and immunocompromised persons).
 - History of herpes zoster (shingles) based on healthcare provider diagnosis or verification of disease history
 - Healthcare provider diagnosis or verification of varicella disease
 - For persons reporting a history or presenting with atypical and/or mild cases, assessment by a physician is recommended, and should be accompanied by either a) an epidemiologic link to a typical varicella case, or b) evidence of laboratory confirmation at the time of acute disease. If such documentation is lacking, a person should not be considered as having a valid history of disease due to other diseases mimicking mild or atypical varicella.
- b. Quarantine/Post-exposure Prophylaxis (PEP):
- i. Contacts should be assessed for evidence of immunity (as shown above). Susceptible contacts (i.e., persons without evidence of immunity) should be assessed for eligibility for PEP:
 - Varicella vaccine is $\geq 90\%$ effective in preventing illness or modifying the severity of illness when given within 3 days of exposure, and approximately 70% effective when given up to 5 days after exposure. However, varicella vaccine is contraindicated for some people, including those who are severely immunocompromised, pregnant, or < 12 months old.
 - Even if > 5 days have elapsed since exposure, vaccination will still protect against future exposures, which can reduce the spread and duration of outbreaks.
 - Varicella-Zoster Immune Globulin (VariZIG) is recommended for those who are at risk for severe varicella, have no evidence of immunity, and cannot receive varicella vaccine. It is most effective when given as soon as possible after exposure but may be effective if given up to 10 days after exposure. (VariZIG can be ordered from www.varizig.com or www.fffenterprises.com if needed.)
 - If VariZIG is not available, a single dose (400 mg/kg) of intravenous immune globulin (IVIG) may be used as a substitute within 10 days of exposure.

- If neither VariZIG nor IVIG are available, acyclovir may be administered at 80 mg/kg/day in four divided doses for 7 days, up to a maximum dose of 800 mg four times per day, beginning 7-10 days after exposure. However, data on the effectiveness of this strategy is limited.

3. Hospital Exposures

- a. Susceptible patients exposed in a hospital setting should be assessed for PEP eligibility and discharged as soon as possible. If they need to remain hospitalized, they should be placed in airborne and contact precautions from day 8 through day 21 after exposure to the index patient, or through day 28 if they received VariZIG or IVIG.
- b. Healthcare workers who have only received one dose of varicella vaccine should receive a second dose, preferably within 3-5 days of exposure, as long as it has been >4 weeks since their first dose. After receiving the second dose, management is similar to that of two-dose recipients (below).
- c. Healthcare workers who have received two doses of varicella vaccine should self-monitor or be monitored daily by an employee health program for symptoms and be restricted from work immediately if symptoms such as fever or suspicious skin lesions occur.
- d. Healthcare workers with no evidence of immunity (which should be a rare occurrence) should receive varicella vaccine as soon as possible and be furloughed or excused from patient contact from day 8 through day 21 after exposure, or through day 28 if they received VariZIG or IVIG.

4. Newborn infants exposed to varicella

- a. VariZIG or IGIV are recommended within 10 days of exposure for neonates in the following circumstances:
 - i. Infant born to a mother who developed chickenpox within 5 days before delivery or within 48 hours after delivery.
 - ii. Hospitalized, preterm infant born at 28 weeks or more of gestation, and the mother has no evidence of varicella immunity.
 - iii. Hospitalized, preterm infant born at less than 28 weeks of gestation or had a birth weight of 1000g or less, regardless of the mother's immunity.
- b. The infant should be under airborne and contact precautions through 21 days of age, or 28 days if VariZIG or IVIG was administered.

5. Prevention

- a. Immunization: Universal immunization with a live-attenuated varicella vaccine is recommended for infants beginning at 12 months of age, with a second dose recommended at 4-6 years of age.
 - i. The second dose may be administered earlier, but if the person is aged 12 months through 12 years of age, the interval between doses should be at least 3 months.
 1. If the second dose is administered less than 3 months but more than 28 days after the first dose in someone aged 12 months

through 12 years of age, it is an administration error, but the dose does not need to be repeated.

2. The minimum interval between doses for people aged 12 years or older is 28 days.
 - ii. Vaccination may be done using either single-antigen varicella vaccine (if aged 12 months or older) or combined measles-mumps-rubella-varicella (MMRV) vaccine (if aged 12 months to 12 years). To reduce the possibility of side effects such as febrile seizure, the preference is to give MMR and single-antigen varicella vaccine separately for the first dose(s), and use the combined MMRV vaccine for the second dose.

Managing Varicella in Childcare Centers and School Settings

1. Report all suspected childcare center or school outbreaks to IDEB at 1-833-SWNURSE (1-833-796-8773).
2. Exclude infected persons from childcare or school until all lesions are crusted, or if there are no blisters/vesicular lesions to crust until no new lesions have appeared for 24 hours.
3. Identify all non-immune students and staff, including non-immune pregnant persons and immunocompromised individuals, who have been exposed to varicella and consult IDEB for further recommendations.
4. Varicella vaccine should be recommended for those who are not up-to-date for their age and for whom varicella vaccination is not contraindicated, ideally within 3-5 days of exposure.
5. For non-immune people who cannot receive varicella vaccine (such as pregnant or immunocompromised individuals or those under 12 months old), consult with the Center for Health Protection (CHP) for further guidance.
6. Monitor exposed individuals/classrooms for additional suspected cases for 21 days after the last date someone with chickenpox attended childcare or school, and report any additional suspected cases to CHP.

References

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See Chickenpox (Varicella) Fact Sheets ([English](#)) ([Spanish](#)).

See Shingles (Zoster) ([English](#)) ([Spanish](#)).