CHICKENPOX
(Varicella)

✓DISEASE AND EPIDEMIOLOGY

Clinical Description:

Varicella-zoster virus (VZV) causes two distinctly different clinical diseases.

Chickenpox:

The primary infection is known as chickenpox. It often starts with a mild prodrome of low-grade fever and malaise. After a day or two of prodrome or as the first evidence of illness, the generalized, pruritic (itchy) rash begins along with constitutional symptoms (anorexia, listlessness).

The rash initially appears on the face and trunk, and then spreads to the arms and legs. It may also infect mucous membranes of the oropharynx, respiratory tract, vagina, conjunctiva, and the cornea. It develops into superficial, delicate vesicles that break, leaving open sores that dry and crust over into brown scabs. Chickenpox sores appear in crops, with lesions in several stages of development (maculopapules, vesicles, scabs) present at the same time.

The acute disease lasts from 3-5 days, with resolution of the lesions taking 1-2 weeks.

Shingles:

People who have been infected with VZV can have a reactivation of the infection, which is known as shingles or herpes zoster. Herpes zoster is common among older age groups or those who are immunosuppressed. About 20% of the population will have herpes zoster. This disease presents with vesicular eruptions, typically unilateral and in the dermatome (area of skin) served by a nerve branch, most often on the trunk. Shingles can be quite painful. Disease resolution takes several weeks to a month.

Causative agent:

Chickenpox is caused by the varicella-zoster virus (VZV), a member of the *Herpesvirus* group.

Differential diagnosis:

The differential diagnosis includes smallpox, herpes simplex virus, coxsackie viruses, and impetigo. Smallpox lesions start on the extremities, whereas chickenpox lesions start on the trunk. Smallpox lesions are all in the same stage of development (crop) versus chickenpox lesions that are in different stages of development.

Laboratory identification:

Chickenpox is generally diagnosed clinically. Laboratory testing may be appropriate if the presentation is unusual. Lab test methods include:

Serology:

This is the lowest cost alternative. Both IgG and IgM testing can be performed.

- IgG testing requires that an acute and convalescent serum sample be drawn, 10-14 days apart. The serum should be separated from the cells as soon as possible. Acute and convalescent specimens must be labeled as such; parallel testing is preferred. Transport serum at 2-8°C.
- Because results early in the disease may be equivocal, if initial IgM testing is negative, a second sample should be collected 10-14 days after the first. The serum should be separated from the cells as soon as possible. Transport serum at 2-8°C.

PCR:

This is usually the method of choice for laboratory diagnosis, but may have limited availability and the cost may be prohibitive. Vesicular fluid and scabs are suitable specimens. Vesicular fluid should be collected using a Dacron swab with a plastic shaft (wood, cotton, and calcium alginate may interfere with the test). Each sample should be placed in a snap cap tube or other suitable container. DO NOT place the specimen in transport medium. Samples for PCR may be transported at ambient temperature or at 2-8°C. PCR samples are not suitable for other testing methods. The sensitivity of the test is improved by submitting five specimens from different lesions.

DFA:

This is a lower cost alternative to PCR, but is somewhat less sensitive. Vesicular fluid, tissue, or skin scrapings are all acceptable specimens. The specimen should be immediately placed in viral transport media and be transported at 2-8°C.

Culture:

Because the varicella-zoster virus is difficult to culture, culturing is not routinely recommended. Additionally, results may take several days and are not readily available. Viral culture is recommended for cases of severe disease, particularly in the immunocompromised. Vesicular fluid, tissue, or skin scrapings are all acceptable specimens. The specimen should be immediately placed in viral transport media and be transported at 2-8°C.

> **UPHL:** The Utah Public Health Laboratory can perform PCR, DFA, and culture testing. However, PCR testing is not routinely performed as a diagnostic test to confirm Varicella-Zoster virus infection. If PCR testing is to be requested, UPHL should be contacted before specimen submission.

Treatment:

Several antivirals are active against VZV, including acyclovir, valacyclovir, famciclovir, and foscarnet. Valacyclovir and famciclovir are approved for use only in adults. These drugs may be beneficial if given within 24 hours of rash onset. Studies suggest that they may result in a reduction in the severity of disease and the number of days in which new lesions appear. Antiviral drugs have **not** been shown to decrease transmission of chickenpox, reduce the duration of absence from school, or reduce complications. Antivirals are not recommended for routine treatment of otherwise healthy infants and children.

Antivirals may be considered for:

- Persons older than 13 years
- Persons with a chronic cutaneous or pulmonary disorders
- Persons receiving long-term salicylate therapy
- Children receiving short, intermittent or aerosolized courses of corticosteroids
- Immunocompromised children and adults with viral-mediated complications should receive intravenous administration

Case fatality:

For normal childhood chickenpox, mortality is less than 2 per 100,000 cases. The risk in adults is 15 times higher. Neonates (usually 5-10 days) and patients with leukemia are susceptible to severe and possibly fatal chickenpox infection, with case fatality rates of 30% and 5-10%, respectively.

Reservoir:

Humans are the only known hosts of VZV.

Transmission:

Chickenpox is primarily spread by droplet or airborne spread of respiratory secretions or vesicle fluid, but may also spread by direct contact with an infected person or contact with an object that has touched a blister's fluid (shirts, pants, etc.). Secondary attack rates among susceptible household contacts can be as high as 90%. Chickenpox is extremely contagious. Immunologically susceptible children/adults can acquire chickenpox from direct contact with herpes zoster lesion fluid.

Incubation period:

The incubation period is usually 14-16 days, but can range from 10-21 days.

Period of communicability:

A patient is contagious for roughly 7-10 days starting 1-2 days (sometimes 5) before rash onset, and continuing until scabs have formed on all lesions (usually 5 days after rash onset). Patients with altered immunity may be contagious for a longer period of time.

Susceptibility:

Anyone can catch chickenpox, although it is most common in children under 15 years. Recovery from chickenpox usually results in lifetime immunity to chickenpox. Children who are immunocompromised (especially with leukemia) have a more serious illness that can take longer to resolve.

Epidemiology:

Chickenpox can occur sporadically year-round, however outbreaks occur most frequently in winter and early spring. Chickenpox affects males and females equally, and people of all races are susceptible.

Before the availability of a vaccine, chickenpox mainly affected children, with at least 90% of the population acquiring chickenpox by the age of 15 years. The highest age-specific incidence was among children 1-4 years of age, followed by children 5-9 years of age. Since the introduction of the vaccine, the incidence of chickenpox and disease-related hospitalizations has decreased by 70-80%. Cases have declined across all age groups, but mostly in children 1-4 and 5-9 years of age. Reye syndrome is a rare complication that occurs in children with chickenpox or influenza that have taken aspirin. The etiology of Reye syndrome is unknown.

Since 2004, 60% of all chickenpox cases reported to the Utah Department of Health are in children 5-9 years of age, followed by 23% in children 10-14 years of age. Since 2004, an average of 48 cases of chickenpox are reported each month, with the most cases being reported February – May, and October and November. The average number of cases each month remains the same for persons less than 4 years of age and 15 years of age and older. During the summer months (June, July, and August) the average number of cases reported in children 5-14 years of age decreases dramatically, suggesting that transmission primarily occurs in schools.

✓PUBLIC HEALTH CONTROL MEASURES

Public health responsibility:

- Prevent illness in high-risk individuals through disease investigation and administration of vaccine.
- Promote vaccination to reduce disease burden in the community.
- Provide education to the general public (regarding disease transmission) and to clinicians (regarding disease diagnosis, reporting, and prevention).
- Monitor disease trends.
- Monitor the impact of vaccination on incidence, morbidity, and mortality.

Prevention:

The most effective control is widespread active immunization.

Chemoprophylaxis:

Varicella-zoster immune globulin (VariZIG) can prevent chickenpox if given within 96 hours of exposure. It is recommended for use in high-risk persons including:

- Immunocompromised patients.
- Neonates whose mothers have signs and symptoms of chickenpox around the time of delivery (i.e., 5 days before to 2 days after).
- Premature infants born at $\geq$28 weeks of gestation who are exposed during the neonatal period and whose mothers do not have evidence of immunity.
- Premature infants born at <28 weeks of gestation or who weigh $\leq$1,000 g at birth and were exposed during the neonatal period, regardless of maternal history of chickenpox disease or vaccination.
- Pregnant women.

VariZIG is available under an investigational new drug application submitted to the FDA (as of March, 2006). It can be acquired for prestocking or immediate use through a single distributor, FFF Enterprises. For additional information on acquiring VariZIG, please visit

http://www.fffenterprises.com/Products/VariZIG.aspx . For dosage and administration recommendations, please reference MMWR 55(08);209-210 http://www.cdc.gov/mmwR/preview/mmwrhtml/mm5508a5.htm.

If VariZIG is unavailable, IGIV (intravenous immunoglobulin) can be used. Vaccination within 3 days, and possibly 5 days, of exposure has been shown to prevent or reduce the severity of disease.

Vaccine:

Vaccination is the primary method of prevention. A live, attenuated vaccine has been available since 1995. It is recommended that the following groups be vaccinated:

- All children <13 years of age should routinely be given two doses of varicella-containing vaccine. The first dose should be given at 12-15 months of age and the second at 4-6 years of age. The second dose can be given at an earlier age provided it has been at least 3 months since the first dose. However, if the second dose is given at least 28 days after the first, the second dose does not need to be repeated.
- A second dose catch-up varicella vaccination is recommended for children and adolescents who previously had received one dose. Catch-up second dose can be administered at any interval longer than 3 months after the first dose.
- All other individuals ≥13 years of age without evidence of immunity should be vaccinated with two doses of varicella vaccine separated by 4-8 weeks.

For the 2006-2007 school year in Utah, all children in kindergarten through 4th grade as well as 7th graders are required to be vaccinated or have previous history of varicella disease

Chickenpox vaccine is 80%–85% effective against infection and more than 95% effective against severe disease. Breakthrough infection (chickenpox in a vaccinated individual) can occur, but is usually milder with fewer lesions. Children with breakthrough chickenpox usually do not have a fever, tend to be out of school for a shorter amount of time than children with natural infections, and have lesions that generally do not blister and scab.

97% of healthy children under age 13 years will develop detectable levels of antibody after one vaccination, however, only 80% of persons 13 years and older will respond to a single dose. Two doses administered 4-8 weeks apart for persons 13 years and older produces detectable levels of antibodies in 99% of vaccinees.

A vaccine for shingles was licensed in 2006 and recommended for persons 60 years of age and older. The vaccine reduces the risk of shingles by 51% and the risk of post-herpetic neuralgia (a painful complication of shingles) by 67%. Vaccine efficacy lasts for at least 3 years, although the ultimate length of efficacy is unknown.

Isolation and quarantine requirements:

Isolation: Non-hospitalized patients should be voluntarily isolated in their house until all of their lesions have scabbed over.

Hospital: Airborne and contact isolation is required of all chickenpox cases until all lesions are crusted. Only immune individuals should care for the patient. VariZIG should be considered for susceptible high-risk contacts of the sick person.

Quarantine: Only in the school setting should contacts of cases be routinely quarantined. Recommendations follow in the *School/childcare outbreak control recommendations* section.

School/childcare outbreak control recommendations:

One Case Identified

Persons with symptoms should be excluded from school/childcare until all lesions have scabbed over, even if no laboratory confirmation is performed or an outbreak is not recognized.

Optional: Parents of vaccine-exempt students should be notified of their child's possible exposure once **one** case of chickenpox occurs in the school.

Optional: Parents of students in the same kindergarten class or grade level of a chickenpox case should be educated on the signs and symptoms of the disease, the availability of a second dose of vaccine, told to keep children home if they suspect they are ill, and to inform the school if their child has chickenpox.

Outbreak Definition

Schools and childcare facilities are the most common sites for chickenpox outbreaks. A chickenpox outbreak in a school setting is defined as:

- 5 or more cases within a 2-month period in the same school facility

An outbreak is considered over when no new cases occur within 2 months from the date the last case was considered infectious.

Note: Because daycares, after school programs, preschools, Head Start programs, charter schools, and private schools can differ significantly from traditional public school settings, the local health officer in each local health department may make adjustments to the outbreak definition for settings where it is deemed necessary.

A Confirmed Outbreak

Once an outbreak is confirmed, parents should be notified of their child's possible exposure to chickenpox. They should be educated on the signs and symptoms of the disease, the availability of a second dose of vaccine, told to keep children home if they suspect they are ill, and to inform the school if their child has chickenpox. Teachers and other school employees should also be educated on the signs and symptoms of chickenpox. Children with signs and symptoms should be sent home and encouraged to consult a medical professional. Pregnant teachers and employees should be identified, and their immune status determined. Those without an appropriate immune history should be encouraged to consult with a medical professional. Laboratory diagnosis is not necessary (or even required) to make a chickenpox diagnosis!

Exclusions of vaccine-exempt students should occur once at least 5 cases have occurred within a 2-month period among students in the same kindergarten class or grade level. Exclusions should only be made to students within the same kindergarten class and grade level. Vaccine-exempt

students should remain out of school for days 10-21 after the last known case is considered non-infectious. Days 10-21 are the critical days for vaccine-exempt students to be out of school, however, local health departments may choose to exclude students for the full 21 days after exposure to simplify the exclusion policy. Vaccination within 3 days, and possibly 5 days, of exposure has been shown to prevent or reduce the severity of disease. However, since an adequate immune response can take up to 2 weeks to develop, disease may still result even if vaccination occurs soon after exposure. Parents should still be cautioned to watch for signs of illness even if their child receives the vaccine within 5 days of exposure, and should keep the child home if they suspect their child is ill. If parents of vaccine-exempt students choose to vaccinate their children, the exclusionary period does not apply and students may return to school as soon as they are vaccinated.

For the 2006-2007 school year in Utah, all students in kindergarten through 4th grade as well as 7th graders are required to be vaccinated for chickenpox. Exclusions do not apply to students without a vaccination requirement, although any sick child, regardless of vaccination requirement, should be excluded until all lesions have scabbed.

R396-100-8. Exclusions of Students Who Are Under Exemption and Conditionally Enrolled Status.
(1) A local or state health department representative may exclude a student who has claimed an exemption or who is conditionally enrolled from school attendance if there is good cause to believe that the student has a vaccine preventable disease and:
(a) has been exposed to a vaccine-preventable disease; or
(b) will be exposed to a vaccine-preventable disease as a result of school attendance.
(2) An excluded student may not attend school until the local health officer is satisfied that a student is no longer at risk of contracting or transmitting a vaccine-preventable disease.

A Prolonged Outbreak
Because persons can be infectious before symptoms appear, exclusions can have a limited value on preventing transmission. Outbreaks in the school setting have been documented to persist for up to 6 months. Chickenpox vaccination has been effective in controlling chickenpox outbreaks. ACIP now recommends that a second dose of vaccine be offered to exposed persons with a history of one dose of chickenpox vaccine, providing that the appropriate time interval has passed since the first dose (3 months for people 12 months to 12 years of age and at least 4 weeks for people ≥13 years of age).
Optional: A second dose of vaccine should be recommended to all students if cases are still being diagnosed 60 days after the initial rash onset of the first identified case, or once 20 cases have been identified. Efforts should be focused on students with active cases in their kindergarten class or grade level or siblings of active cases.

The local health officer in each local health department may evaluate individual cases and outbreaks to make any necessary adjustments to exemptions.

✓CASE INVESTIGATION

Reporting:

Chickenpox should be reported within 3 working days of identification to the local health department or the Utah Department of Health. Herpes zoster is not a reportable condition.

Case definition:

Varicella (Chickenpox) (1999):

Clinical Case Definition

An illness with acute onset of diffuse (generalized) maculo-papulovesicular rash characteristic of varicella, without other apparent cause

Laboratory Criteria

- Isolation of VZV from a clinical specimen, OR
- Direct fluorescent antibody (DFA), OR
- Polymerase chain reaction (PCR), OR
- Positive serologic test for IgM antibody, OR
- Significant rise (at least a 4 fold rise) in serum varicella IgG antibody level.

Case Classification

Probable: a case that meets the clinical case definition, is not laboratory confirmed, and is not epidemiologically linked to another probable or confirmed case.

Confirmed: a case that is laboratory confirmed or that meets the clinical case definition and is epidemiologically linked to a confirmed or probable case

Comments

Two probable cases that are epidemiologically linked would be considered confirmed, even in the absence of laboratory confirmation.

In vaccinated persons who develop varicella more than 42 days after vaccination (breakthrough disease), the disease is almost always 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 confirmation of cases of varicella is not routinely recommended; laboratory confirmation is recommended for fatal cases and in other special circumstances.

✓INVESTIGATION PROCESS FOR HIGH-RISK CASES OR EXPOSURES

The majority of chickenpox case investigations will not require any case management or contact tracing. In the event that a case is identified in a person at high-risk for complications or in a setting where persons at high-risk for complications may have been exposed, the local health department may choose to more thoroughly investigate.

Case management:

Treatment:

Determine if case is at high-risk for complications.

- Persons older than 13 years
- Persons with a chronic cutaneous or pulmonary disorders
- Persons receiving long-term salicylate therapy
- Children receiving short, intermittent or aerosolized courses of corticosteroids
- Immunocompromised children and adults with viral-mediated complications should receive intravenous administration of VariZIG or IGIV

Consider antiviral treatment if at high-risk.

Isolation:

Children with chickenpox should be excluded from school or child-care settings until all lesions have crusted over. Voluntary isolation from work and other settings where close contact may transmit the disease is desirable. Educate patient to refrain from contact until all lesions have crusted over. Follow the isolation and quarantine requirements (listed above) for health care workers or residents in a hospital or long term care facility.

Education:

Provide an educational fact sheet to the patient (or parent of the patient). If the patient works at or attends a childcare or school, work with the school administration to send notification letters to other students/parents/teachers as necessary.

Identify case contacts:

Close contacts are people who have the following contact with the case patient during the infectious period (7-10 days starting 1-2 days [sometimes 5] before rash onset until scabs have formed on all lesions [usually 5 days after rash onset]).

- Household and immediate family members (those who spend many hours together or sleep under the same roof);
- Those who have direct contact with respiratory secretions;
- Those who have direct or indirect contact with blister fluid;
- Healthcare workers with face-to-face contact with a patient; and
- Those who share confined space during the communicable period. Such contacts may include:
    - Core groups of close friends, social contacts, boyfriends, girlfriends,
    - Students within the same kindergarten class or grade level,
    - Contacts at church activities and employment,
    - Participants in extracurricular activities (such as fieldtrips), and
    - Children attending after-school care or a playgroup.

Health care personnel:

All health care workers (HCWs) should be immune to chickenpox either through natural infection or vaccination. HCWs without a reliable history should have laboratory documentation of seroconversion. If a susceptible HCW is exposed to VZV, they should be furloughed from work for days 10-21 after exposure. Because receipt of VariZIG can prolong the incubation period by one week, susceptible employees receiving VariZIG should be furloughed for days 10-28 after exposure. Because of the possibility of breakthrough disease, several options for monitoring vaccinated HCWs that are potentially exposed to VZV exist. Serological testing for immunity

immediately after exposure is recommended. Those with detectable antibodies are unlikely to become infected. Persons without detectable antibodies may be retested in 5-6 days. If detectable antibodies are present, these persons are unlikely to become ill. If a HCW is tested twice, and both times antibodies are not detected, the HCW may be furloughed for days 10-28 after exposure or monitored daily for symptoms of chickenpox.

Case contact management:

Asymptomatic contacts:

- Exclude vaccine-exempt children without history of disease from school/childcare or contact with children when necessary.
- Recommend vaccine to susceptible persons.
- Recommend medical consultation for exposed susceptible persons at high-risk of severe disease (VariZIG may be warranted).
- Provide educational materials informing of exposure and recommending vaccination.

Symptomatic contacts:

- Exclude from school/childcare settings until infectious period has passed.
- Consider vaccination of susceptible persons to lessen disease severity.
- Consider treatment of active cases with antiviral therapy (adolescents, adults, and high-risk only).
- Provide educational materials informing of exposure.

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