



## National Center for Infectious Diseases

# Cytomegalovirus (CMV) Infection

## GENERAL INFORMATION

Cytomegalovirus, or CMV, is found universally throughout all geographic locations and socioeconomic groups, and infects between 50% and 85% of adults in the United States by 40 years of age. CMV is also the virus most frequently transmitted to a developing child before birth. CMV infection is more widespread in developing countries and in areas of lower socioeconomic conditions. For most healthy persons *who acquire CMV after birth* there are few symptoms and no long-term health consequences. Some persons with symptoms experience a mononucleosis-like syndrome with prolonged fever, and a mild hepatitis. Once a person becomes infected, the virus remains alive, but usually dormant within that person's body for life. Recurrent disease rarely occurs unless the person's immune system is suppressed due to therapeutic drugs or disease. Therefore, for the vast majority of people, CMV infection is not a serious problem.

However, CMV infection is important to certain high-risk groups. Major areas of concern are (1) the risk of infection to the unborn baby during pregnancy, (2) the risk of infection to people who work with children, and (3) the risk of infection to the immunocompromised person, such as organ transplant recipients and persons infected with human immunodeficiency virus (HIV).

## CHARACTERISTICS OF THE VIRUS

CMV is a member of the herpesvirus group, which includes herpes simplex virus types 1 and 2, varicella-zoster virus (which causes chickenpox), and Epstein-Barr virus (which causes infectious mononucleosis). These viruses share a characteristic ability to remain dormant within the body over a long period. Initial CMV infection, which may have few symptoms, is always followed by a prolonged, inapparent infection during which the virus resides in cells without causing detectable damage or clinical illness. Severe impairment of the body's immune system by medication or disease consistently reactivates the virus from the latent or dormant state.

Infectious CMV may be shed in the bodily fluids of any previously infected person, and thus may be found in urine, saliva, blood, tears, semen, and breast milk. The shedding of virus may take place intermittently, without any detectable signs, and without causing symptoms.

## TRANSMISSION AND PREVENTION

Transmission of CMV occurs from person to person. Infection requires close, intimate contact with a person excreting the virus in their saliva, urine, or other bodily fluids. CMV can be sexually transmitted and can also be transmitted via breast milk, transplanted organs, and rarely from blood transfusions.

Although the virus is not highly contagious, it has been shown to spread in households and among young children in day care centers. Transmission of the virus is often preventable because it is most often transmitted through infected bodily fluids that come in contact with hands and then are absorbed through the nose or mouth of a susceptible person. Therefore, care should be taken when handling children and items like diapers. Simple hand washing with soap and water is effective in removing the virus from the hands.

CMV infection without symptoms is common in infants and young children; therefore, it is unjustified and unnecessary to exclude from school or an institution a child known to be infected. Similarly, hospitalized patients do not need separate or elaborate isolation precautions.

Screening children and patients for CMV is of questionable value. The cost and management of such procedures are impractical. Children known to have CMV infection should not be singled out for exclusion, isolation, or special handling. Instead, staff education and effective hygiene practices are advised in caring for all children.

## **CIRCUMSTANCES IN WHICH CMV INFECTION COULD BE A PROBLEM**

### **Pregnancy**

The incidence of primary (or first) CMV infection in pregnant women in the United States varies from 1% to 3%. Healthy pregnant women are not at special risk for disease from CMV infection. When infected with CMV, most women have no symptoms and very few have a disease resembling mononucleosis. It is their developing unborn babies that may be at risk for congenital CMV disease. CMV remains the most important cause of congenital (meaning from birth) viral infection in the United States. For infants who are infected by their mothers before birth, two potential problems exist:

1. Generalized infection may occur in the infant, and symptoms may range from moderate enlargement of the liver and spleen (with jaundice) to fatal illness. With supportive treatment most infants with CMV disease usually survive. However, from 80% to 90% will have complications within the first few years of life that may include hearing loss, vision impairment, and varying degrees of mental retardation.
2. Another 5% to 10% of infants who are infected but without symptoms at birth will subsequently have varying degrees of hearing and mental or coordination problems.

However, these risks appear to be *almost exclusively associated* with women who previously have not been infected with CMV and who are having *their first infection* with the virus during

pregnancy. Even in this case, two-thirds of the infants will not become infected, and only 10% to 15% of the remaining third will have symptoms at the time of birth. There appears to be little risk of CMV-related complications for women who have been infected at least 6 months prior to conception. For this group, which makes up 50% to 80% of the women of child-bearing age, the rate of newborn CMV infection is 1%, and these infants appear to have no significant illness or abnormalities.

The virus can also be transmitted to the infant at delivery from contact with genital secretions or later in infancy through breast milk. However, these infections usually result in little or no clinical illness in the infant.

To summarize, during a pregnancy when a woman *who has never had CMV infection* becomes infected with CMV, there is a potential risk that after birth the infant may have CMV-related complications, the most common of which are associated with hearing loss, visual impairment, or diminished mental and motor capabilities. On the other hand, infants and children *who acquire CMV after birth* have few, if any, symptoms or complications.

Recommendations for pregnant women with regard to CMV infection:

1. Throughout the pregnancy, practice good personal hygiene, especially handwashing with soap and water, after contact with diapers or oral secretions (particularly with a child who is in day care).
2. Women who develop a mononucleosis-like illness during pregnancy should be evaluated for CMV infection and counseled about the possible risks to the unborn child.
3. Laboratory testing for antibody to CMV can be performed to determine if a woman has already had CMV infection.
4. Recovery of CMV from the cervix or urine of women at or before the time of delivery does not warrant a cesarean section.
5. The demonstrated benefits of breast-feeding outweigh the minimal risk of acquiring CMV from the breast-feeding mother.
6. There is no need to either screen for CMV or exclude CMV-excreting children from schools or institutions because the virus is frequently found in many healthy children and adults.

### **People Who Work with Infants and Children**

Most healthy people working with infants and children face no special risk from CMV infection. However, for women of child-bearing age who previously have not been infected with CMV, there is a potential risk to the developing unborn child (the risk is described above in the Pregnancy section). Contact with children who are in day care, where CMV infection is commonly transmitted among young children (particularly toddlers), may be a source of exposure to CMV. Since CMV is transmitted through contact with infected body fluids, including urine and saliva, child care providers (meaning day care workers, special education teachers, therapists, as well as mothers) should be educated about the risks of CMV infection

and the precautions they can take. Day care workers appear to be at a greater risk than hospital and other health care providers, and this may be due in part to the increased emphasis on personal hygiene in the health care setting.

Recommendations for individuals providing care for infants and children:

1. Female employees should be educated concerning CMV, its transmission, and hygienic practices, such as handwashing, which minimize the risk of infection.
2. Susceptible nonpregnant women working with infants and children should not routinely be transferred to other work situations.
3. Pregnant women working with infants and children should be informed of the risk of acquiring CMV infection and the possible effects on the unborn child.
4. Routine laboratory testing for CMV antibody in female workers is not recommended, but can be performed to determine their immune status.

### **Immunocompromised Patients**

Primary (or the initial) CMV infection in the immunocompromised patient can cause serious disease. However, the more common problem is the reactivation of the dormant virus. Infection with CMV is a major cause of disease and death in immunocompromised patients, including organ transplant recipients, patients undergoing hemodialysis, patients with cancer, patients receiving immunosuppressive drugs, and HIV-infected patients. Pneumonia, retinitis (an infection of the eyes), and gastrointestinal disease are the common manifestations of disease. Because of this risk, exposing immunosuppressed patients to outside sources of CMV should be minimized. Whenever possible, patients without CMV infection should be given organs and/or blood products that are free of the virus.

### **DIAGNOSIS OF CMV INFECTION**

Most infections with CMV are not diagnosed because the virus usually produces few, if any, symptoms and tends to reactivate intermittently without symptoms. However, persons who have been infected with CMV develop antibodies to the virus, and these antibodies persist in the body for the lifetime of that individual. A number of laboratory tests that detect these antibodies to CMV have been developed to determine if infection has occurred and are widely available from commercial laboratories. In addition, the virus can be cultured from specimens obtained from urine, throat swabs, and tissue samples to detect active infection.

CMV should be suspected if a patient:

- has symptoms of infectious mononucleosis but has negative test results for mononucleosis and Epstein Barr virus, or,
- shows signs of hepatitis, but has negative test results for hepatitis A, B, and C.

For best diagnostic results, laboratory tests for CMV antibody should be performed by using

paired serum samples. One blood sample should be taken upon suspicion of CMV, and another one taken within 2 weeks. A virus culture can be performed at any time the patient is symptomatic.

Laboratory testing for antibody to CMV can be performed to determine if a woman has already had CMV infection. However, routine laboratory testing of all pregnant women is costly and the need for testing should therefore be evaluated on a case-by-case basis.

### **Serologic Testing**

The enzyme-linked immunosorbent assay (or ELISA) is the most commonly available serologic test for measuring antibody to CMV. The result can be used to determine if acute infection, prior infection, or passively acquired maternal antibody in an infant is present. Other tests include various fluorescence assays, indirect hemagglutination, and latex agglutination.

An ELISA technique for CMV-specific IgM is available, but may give false-positive results unless steps are taken to remove rheumatoid factor or most of the IgG antibody before the serum sample is tested. Because CMV-specific IgM may be produced in low levels in reactivated CMV infection, its presence is not always indicative of primary infection. Only virus recovered from a target organ, such as the lung, provides unequivocal evidence that the current illness is caused by *acquired CMV infection*. If serologic tests detect a positive or high titer of IgG, this result should not automatically be interpreted to mean that active CMV infection is present. However, if antibody tests of paired serum samples show a fourfold rise in IgG antibody and a significant level of IgM antibody, meaning equal to at least 30% of the IgG value, or virus is cultured from a urine or throat specimen, the findings indicate that an active CMV infection is present.

### **TREATMENT**

Currently, no treatment exists for CMV infection in the healthy individual. Antiviral drug therapy is now being evaluated in infants. Ganciclovir treatment is used for patients with depressed immunity who have either sight-related or life-threatening illnesses. Vaccines are still in the research and development stage.

### **ADDITIONAL INFORMATION**

The Biomedical Research Institute of the St. Paul's Children's Hospital, which no longer conducts research on CMV, has published a brochure titled *CMV: Diagnosis, Prevention, and Treatment* that has been made available for distribution by CDC. This brochure can be obtained by writing to:

Viral Exanthems and Herpesvirus Branch  
DVRD/NCID  
Mail Stop A-15

Centers for Disease Control and Prevention  
Atlanta, GA 30333  
or by calling the Branch at 404-639-1338.

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URL:<http://www.cdc.gov/ncidod/diseases/cmvm.htm>

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