Congenital Cytomegalovirus (CMV) Infection & Hearing Loss

Overview of Congenital Cytomegalovirus (CMV) Infection

Congenital CMV infection is the most common intrauterine infection in the United States today. The incidence of congenital CMV infection varies by geography and the underlying CMV seroprevalence in the maternal population. Incidence estimates of congenital CMV infection range between 0.2% and 2.2%, with an estimated 0.5% to 1.0% of all newborns in the United States infected with CMV in the prenatal period. Interestingly, the incidence of congenital CMV infection is higher in populations where the underlying CMV seroprevalence or preexisting immunity is higher in the mothers. Whether the increase in congenital CMV infection in these populations is due to certain exposure factors in the maternal delivery populations or the racial and ethnic composition of the population or a combination of these factors is not known.

Congenital CMV infection at birth may manifest with symptoms such as generalized petechiae, direct hyperbilirubinemia, hepatosplenomegaly, purpuric rash, microcephaly, seizures, focal or general neurologic deficitis, retinitis and intracranial calcifications. However, 90-95% of infants with congenital CMV infection will have no clinically apparent symptoms (asymptomatic) at birth. Most congenital CMV infections go unnoticed in the nursery since the majority of infected newborns will have no clinically apparent disease at birth.

Both symptomatic and asymptomatic infants may later develop sequelae, with more severe and frequent sequelae occurring in the symptomatic infants. Sequelae following congenital CMV infection include sensorineural hearing loss (SNHL), retinitis, mental retardation, microcephaly, seizures, and cerebral palsy. The most common sequelae following congenital CMV infection is SNHL.

Sensorineural Hearing Loss due to CMV

The association between congenital cytomegalovirus (CMV) infection and SNHL has been known for over four decades, although the mechanism by which the virus causes hearing impairment in some children and not others is still not fully understood today. Approximately 30-50% of children with clinically apparent disease (symptomatic) and 8-12% of children without clinically apparent (asymptomatic) congenital CMV infection will develop SNHL.

Hearing loss due to congenital CMV infection does not have a pathogenomonic audiometric configuration and is variable in the severity of loss. Unilateral and bilateral hearing losses may occur in children with congenital CMV infection, with loss varying from unilateral high frequency losses (4-8 khz frequencies only) to profound bilateral losses. Progression and fluctuation of hearing loss have been observed in children with congenital CMV infection. Complicating the diagnosis of SNHL in children due to congenital CMV infection is the fact that less than half of the hearing loss due to CMV infection is present at birth. Other CMV infected children may go on to develop late onset loss during the preschool and early school years. Approximately 33 to 50% of SNHL due to congenital CMV infection is late onset loss.

The fact that congenital CMV infection can only be confirmed in the newborn period has made it difficult to estimate the proportion of SNHL that is attributable to congenital CMV infection in childhood populations. A recent review estimates that congenital CMV infection accounts for approximately 21% of all hearing loss at birth. Since late onset losses may occur following CMV infection, about 25% of hearing loss in children by four years of age is likely CMV-related hearing loss. These numbers suggest that CMV is the leading nongenetic cause of hearing loss in children in the United States.

Identifying Congenital CMV Infection

The diagnosis of congenital CMV infection at birth is usually by the detection of the virus in urine or saliva within the first three weeks of life. The detection of CMV in saliva or urine can be readily accomplished in newborns with congenital CMV infection because infected infants shed large amounts of virus. Traditional virus isolation in tissue culture in which viral cytopathic effect (CPE) is detected by light microscopy has been the standard. In the past two decades, rapid viral diagnosis utilizing centrifugation-enhanced inoculation of the specimen onto the monolayer of fibroblasts followed by the detection of CMV antigens such as shell vial assay or the detection of early antigen fluorescent foci (DEAFF) have been used with comparable sensitivity and specificity to standard viral isolation procedures. The rapid methods provide results within 24-hours, compared with the longer time frame (2-4 weeks) for tissue culture method. PCR methods to identify CMV DNA from dried blood spots, urine and saliva have been explored in recent years. Although CMV may be identified by PCR methods, the sensitivity and specificity of these methods have not been established to date.

Children with Hearing Loss due to CMV

Most children with congenital CMV infection do not develop hearing loss, however it is unclear which children with congenital CMV infection will develop hearing loss and, among those who do develop loss, whether or not the loss will continue to deteriorate. Approximately 50% of children with SNHL due to congenital CMV infection will have progressive losses. Since late onset hearing loss along with fluctuations and progression of the loss may occur with CMV related hearing losses, children with congenital CMV infection should have hearing tests every six months to monitor possible changes to their hearing loss. However, at times when hearing loss appears to be changing, audiological evaluations may be needed every three months to assess and document the changes in the hearing status of the child infected with CMV. In addition, parents should be encouraged to observe their child for signs that her hearing may be changing, i.e., not hearing the dog barking, turning up the volume of the television, not wanting to wear hearing aids when before she did not mind, etc. Finally, parents and health care providers should select communication methods that accommodate changing hearing loss and when considering hearing aids chose those with the most flexible gain.

References

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