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West Nile Virus Infections in Children

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Viral Gastroenteritis in Children

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Key Words: viral gastroenteritis, norovirus, sapovirus, astrovirus, enteric adenovirus
(*Pediatr Infect Dis J* 2011;30: 63–64)

Gastroenteritis is one of the most common causes of morbidity and mortality in children worldwide and accounts for 2 to 3 million deaths per year with most occurring in young children in developing countries.¹

The causes of gastroenteritis in children vary with the location, time of year, and population studied. Bacterial and parasitic gastrointestinal infections have decreased in frequency as a result of the provision of safe drinking water and disposal of sewage. However, viral gastroenteritis has not declined in a comparable fashion.

Viruses are the most common pathogens causing gastroenteritis in the United States.² Before universal rotavirus immunization was adopted in the United States, approximately one half of all hospitalizations for nonbacterial gastroenteritis in children were caused by rotaviruses. Currently, noroviruses are the most important cause of nonbacterial acute gastroenteritis. In children, other viral pathogens that have been proven to cause gastroenteritis are sapoviruses, astroviruses, and enteric adenoviruses. The viral gastroenteritis pathogens all infect the intestine and cause gastrointestinal symptoms. In contrast, enteroviruses may infect

the intestine but predominantly produce manifestations at extraintestinal sites.

CALICIVIRUS INFECTIONS

Caliciviruses are a family of single-stranded, nonenveloped RNA viruses. The 2 recognized genera that cause disease are noroviruses (Norwalk-like viruses) and sapoviruses (Sapporo-like viruses).³ Caliciviruses have a worldwide distribution, with multiple antigenic types circulating simultaneously in the same region.

Noroviruses are the leading cause of outbreaks of gastroenteritis and an important cause of sporadic gastroenteritis.⁴ Most sporadic infections have been detected in children younger than 4 years of age.⁴

In the United States, more than 90% of the outbreaks for which the cause would previously have been unknown can now be attributed to norovirus.⁵ These outbreaks involve people of all ages, occur in a wide variety of settings, such as nursing homes, hospital wards, day-care centers, cruise ships, restaurants, and catered events, and target a number of high-risk groups, particularly young children and the elderly, travelers, soldiers, and immunocompromised patients.

Noroviruses are transmitted by the fecal-oral route, either by consumption of contaminated food or water or by direct person-to-person spread. Environmental contamination may also act as a source of infection. Noroviruses are highly contagious.⁶ An inoculum of as few as 10 viral particles may be sufficient to infect an individual. The incubation period usually is 24 to 48 hours.

Norovirus infection presents with acute onset of vomiting, watery nonbloody

diarrhea with abdominal cramps, and nausea. Low-grade fever also occasionally occurs. Vomiting is more common in children. Dehydration is the most common complication, especially among the young. Symptoms usually last for 24 to 60 hours.

In the last 10 years, the diagnosis of outbreaks has improved with the increasing use of a norovirus RT-PCR which can be used to test stool and emesis samples, as well as to detect the presence of noroviruses on environmental swabs. This test is available through the state public health laboratories in all 50 states.

No specific therapy exists for norovirus gastroenteritis. Symptomatic therapy consists of replacing fluid losses and correcting electrolyte disturbances.

Sapoviruses mainly infect young children. The illness is milder than that caused by noroviruses.³ Antibody prevalence studies show that virtually all children are infected with sapoviruses by the time they are 5 years of age, indicating that sapovirus infection is widespread, although the illness most likely is sporadic with a high rate of asymptomatic infection. The transmission of sapoviruses is thought to occur by the fecal-oral route with an incubation period of 24 to 48 hours. Sapovirus infections occur year-round, although a winter seasonal peak has been suggested.

Longitudinal studies in The Netherlands and Finland showed that sapovirus gastroenteritis occurs primarily in infants and toddlers.^{7,8} Major symptoms are similar to norovirus gastroenteritis, but vomiting is usually less frequent and diarrhea more common. The disease lasts for 3 to 4 days and is usually self-limited.

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ISSN: 0891-3668/11/3001-0063
DOI: 10.1097/INF.0b013e3182059102

No commercial assay for sapovirus is available and no specific therapy exists. Symptomatic therapy is indicated.

ASTROVIRUS INFECTIONS

Astroviruses are nonenveloped, single-stranded RNA viruses with a characteristic star-like appearance by electron microscopy. Eight human antigenic types are known. Astroviruses have a worldwide distribution. Multiple antigenic types cocirculate in the same region.⁹

Astroviruses are increasingly recognized as significant gastrointestinal pathogens. These viruses have been detected in as many as 10% of sporadic cases of nonbacterial gastroenteritis among young children.¹⁰ Astrovirus infections occur primarily in children less than 4 years of age and have a seasonal peak in the winter. Transmission is person to person via the fecal oral route. Outbreaks often occur in closed populations and attack rates are high in hospitalized children and in children in child care centers. Viral shedding lasts for an average of 5 days after onset of symptoms. Children may shed asymptotically for several weeks after the illness and persistent shedding may occur in immunocompromised hosts.¹¹

Illness caused by astroviruses is characterized by abdominal pain, diarrhea, vomiting, nausea, fever, and malaise. In the immunocompetent host, disease is self-limited, lasting for 5 to 6 days on average. Asymptomatic infections are common.

Commercial tests for diagnosis of astrovirus infection are not available in the United States. Enzyme immunoassays are available in many other countries.

Treatment of astrovirus infection is supportive. Rehydration with oral or intravenous fluid and electrolyte solution is the mainstay of therapy.

ENTERIC ADENOVIRUS INFECTIONS

Adenoviruses are double-stranded, nonenveloped DNA viruses; at least 51 distinct serotypes cause human infections. Serotypes 40, 41, and to a lesser extent, 31 are associated with gastroenteritis.

Enteric adenoviral disease occurs throughout the year and primarily affects children younger than 4 years of age.² Adenovirus infections are most communicable during the first few days of an acute illness, but persistent and intermittent shedding for longer periods is common. Transmission is via the fecal oral route. Asymptomatic infections are common and reinfections can occur.

The clinical picture is similar to that of rotavirus. In contrast to the nonenteric adenoviruses, high fevers and respiratory symptoms are rare. Disease can be persistent and severe in the immunocompromised host.

The preferred method for diagnosis of enteric adenovirus infection is antigen detection by immunoassay techniques. The enteric adenoviruses are not detected by fluorescent antibody assays for respiratory adenoviruses. Treatment of enteric adenovirus infection is supportive.

MANAGEMENT OF VIRAL GASTROENTERITIS IN CHILDREN

Prevention remains the most vital measure in managing viral gastroenteritis. Except for rotavirus, vaccines are not currently available for any of the other viral pathogens. Efforts to interrupt transmission of infection are crucial for viral pathogens such as norovirus. Important measures to prevent spread include proper sanitation methods for food processing and preparation, sanitary water supplies, proper hand hygiene, sanitary sewage disposal, exclusion of infected people from handling food or providing health care, and exclusion of people with gastroenteritis from use of public recreational water. The single most important procedure to minimize fecal-oral transmission in child care is frequent hand hygiene measures combined with staff training and monitoring of staff procedures.

The current mainstay of treatment of acute viral gastroenteritis consists of oral rehydration and early introduction of feedings.¹² Children who are severely dehydrated may require intravenous fluid resuscitation. After initial treatment with IV fluids, these children can be given oral rehydration. When oral hydration therapy is complete, regular feeding should be resumed.

Early refeeding is recommended because luminal contents are a known growth factor for enterocytes and help facilitate mucosal repair following injury. Introducing a regular diet within a few hours of rehydration or continuing the diet during diarrhea without dehydration has been shown to shorten the duration of the disease.

FUTURE IMPROVEMENTS IN MANAGEMENT AND PREVENTION OF VIRAL GASTROENTERITIS

Measures to decrease the duration of diarrheal illnesses are needed. Research on developing new oral rehydration solutions that would decrease the volume of loose stools is ongoing. Probiotics and other natural products that may have an effect on shortening episodes of diarrhea are being studied. Finally, prevention of viral gastroenteritis by immunization would be desirable.

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