

Case 25

The patient was a 1-year-old male admitted to the hospital in December because of fever and dehydration. His parents reported that he had a 1-day history of fever, diarrhea, emesis, and decreased urine output. On admission, his vital signs revealed a temperature of 39.5°C, slight tachycardia with a pulse rate of 126/min, and respirations of 32/min. He was very somnolent. His general physical examination was remarkable only for hyperactive bowel sounds. Laboratory tests showed a leukocytosis with a white blood cell (WBC) count of 14,200/ μ l with 80% polymorphonuclear leukocytes (PMNs). Urinalysis was significant for a high specific gravity and ketones (consistent with the patient's dehydration). Stool, blood, and urine samples were sent for culture. A stool sample was also checked for ova and parasites. There were no fecal leukocytes. The patient was given intravenous normal saline and had nothing by mouth. Over the next 48 h his emesis abated. Once he was rehydrated and was tolerating oral feedings, he was discharged home. All culture for bacterial pathogens gave negative results, but a rapid viral diagnostic test was positive (Fig. 1).

1. What is the differential diagnosis?
2. What is the most common cause of pediatric gastroenteritis? Briefly outline the pathophysiology seen with this organism. Is there any seasonality to this infection?
3. What rapid diagnostic test was used?
4. Which treatment is effective? Can this disease be prevented?
5. What special infection control precautions are necessary in the hospital setting when caring for a patient with gastroenteritis?



Figure 1

Case Discussion

1. The differential diagnosis for acute diarrhea includes bacterial, parasitic, and viral etiologies of gastroenteritis. Because of the absence of fecal leukocytes, agents of invasive diarrhea such as *Salmonella*, *Shigella*, and *Campylobacter* spp. and *Entamoeba histolytica* are less likely, although certainly possible. The leading parasitic possibilities include *Giardia* and *Cryptosporidium* spp., especially if this child was in a day care center. The viruses that can cause gastroenteritis include rotavirus (most frequent), enteric coronaviruses and unclassified small round viruses, Norwalk and Norwalk-like viruses, enteric adenovirus, calicivirus, and astrovirus. Vomiting is frequently seen in viral gastroenteritis and less frequently in infections with the other agents listed, making a viral agent much more likely in this particular case.

2. Group A rotavirus is the most common diarrheal pathogen seen in children less than 5 years old in the United States. The disease is seen primarily during winter months in temperate zones. Because of this, it is frequently referred to as “winter vomiting disease.” Disease seasonality is not as obvious in tropical areas. The clinical disease spectrum varies from asymptomatic infection to severe, fatal disease. The disease is usually self-limited, lasting approximately 1 week. Patients with rotavirus infections have watery diarrhea and frequent vomiting. These symptoms can be severe, resulting in significant dehydration. Fatalities are seen primarily in the malnourished and immunocompromised.

It is estimated that as many as 70,000 children are hospitalized annually in United States due to rotaviral disease. In the developing world, rotavirus is a major cause of death in children less than 5 years of age, with an estimated 870,000 deaths occurring annually. The pathophysiology of disease caused by this virus is beginning to be more clearly understood. It has long been known that the virus causes blunting and atrophy of the small intestinal villi and that this cellular damage in some way results in the watery diarrhea typical of rotavirus. However, watery diarrhea has usually been associated with organisms that induce diarrhea through the action of an enterotoxin. Recent studies suggest that a nonstructural rotavirus protein, NSP4, may act as an enterotoxin, better explaining the pathophysiology of the watery diarrhea observed in these patients.

3. The enzyme immunoassay (EIA) for rotavirus antigen (Fig. 1) was positive. This test and latex agglutination are the most common tests used to detect rotavirus. The virus was first discovered in the stools of children with vomiting and diarrhea by using electron microscopy. It was named for its characteristic wheel-like (“rota”) morphologic appearance on electron microscopy. However, this technique is not routinely used because of the ease of EIA and latex agglutination.

4. Effective treatment to date includes aggressive use of intravenous and/or oral rehydration therapy. Oral rehydration is limited to patients without severe vomiting. There is no specific antiviral agent for rotavirus infections.

As already mentioned, rotavirus is a major cause of morbidity and mortality among young children throughout the world. Because initial rotavirus infections frequently protect against subsequent infections, this virus is an ideal candidate for vaccine development. Currently a live, attenuated vaccine which offers protection against all four serotypes of group A rotavirus is nearing Food and Drug Administration approval in the United States. The vaccine is reasonably effective at preventing severe diarrheal disease due to rotavirus, but mild diarrhea may still occur postvaccination, indicating that improvements in this vaccine are still needed. In addition to vaccine, standard hygienic practices which prevent the spread of organisms by the fecal-oral route are important in preventing the spread of this virus (see answer 5 for further details).

5. Because this pathogen can remain infectious on inanimate objects for days and on hands for as long as 4 h, it is an important cause of both day care center and nosocomial diarrheal disease outbreaks. Strict handwashing and the use of gloves by health care workers delivering care to patients with gastroenteritis are necessary. Hospital outbreaks of rotavirus infection have occurred when health care workers have transmitted the virus from one patient to another.

References

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2. Lieberman, J. M. 1994. Rotavirus and other viral causes of gastroenteritis. *Pediatr. Ann.* **23**:529–534.