

Tests and Diagnostics

Rotavirus is clinically indistinguishable from diarrheal diseases caused by other gastrointestinal pathogens such as noroviruses, enteric adenoviruses, astroviruses, *Escherichia coli*, and *Salmonella*. In most cases, no additional evaluation is necessary beyond history and physical exam. Findings that suggest rotavirus infection include a mild fever in conjunction with vomiting and watery diarrhea. Fever, presence of an acid-reducing substance in the stool, and low serum bicarbonate levels are more likely in rotavirus induced gastroenteritis. Gross bloody diarrhea likely indicates an alternate organism as the cause of acute gastroenteritis.

Lab testing is generally not performed, but it is the only way to confirm the diagnosis of rotavirus. In severe, intractable cases of infection, a confirmatory lab test may be indicated to solidify the diagnosis of rotavirus. When a laboratory-confirmed diagnosis is desired, a rotavirus antigen can be found in stool samples using enzyme-linked immunosorbent assay (ELISA) or immunochromatography. The addition of reverse transcription PCR (RT-PCR) assays are more sensitive and allow genotyping of virus isolates and as such, may be indicated in epidemiological studies. Additional methods of detection include electron microscopy, polyacrylamide gel electrophoresis, antigen detection assays, and virus isolation. In most cases, confirmation testing is only indicated if it could potentially cut costs by decreasing hospital stay or avoiding unnecessary procedures.

Treatment

Treatment of rotavirus infection is directed at the relief of symptoms and the treatment and prevention of associated dehydration. Oral rehydration salt solutions should initially be attempted. In adults, codeine, loperamide, and diphenoxylate can be added to help with symptom relief and to control the volume of diarrhea. Bismuth salicylate has also been proven to be beneficial in the treatment of rotavirus symptoms but should only be considered when other infectious agents have been ruled out. If symptoms are refractory to oral therapies, and the patient is dehydrated, admission to the hospital and intravenous fluids

may be required.

The findings of some studies suggest that oral administration of human serum immunoglobulins may be beneficial in the treatment of hospitalized children with rotavirus disease. Additional studies indicate that treatments such as probiotics, zinc, and ondansetron may also be effective in the treatment of acute gastroenteritis.

Most patients presenting to an outpatient clinic or the emergency department can be discharged home safely. Adults may benefit from antiemetic medications, but these should be avoided in young children. Hospital admission may be beneficial to patients with signs or symptoms of dehydration, intractable vomiting, electrolyte disturbances, abdominal pain, ileus, renal failure, or pregnancy.

Differential Diagnosis

The differential diagnosis for rotavirus induced acute gastroenteritis is broad and includes a variety of viral, bacterial, and parasitic pathogens, as well as acute abdominal pathology. Viral infections that are known to cause acute viral gastroenteritis similar to that of rotavirus include norovirus, adenovirus, and astroviruses. Of the viral causes of acute gastroenteritis, norovirus has become the most common cause of viral gastroenteritis since the advent of the rotavirus vaccine. Viral infections are known to be the most common cause of acute infectious diarrhea, with less than 5% of stool cultures being positive for non-viral pathogens.

Common bacterial causes of gastroenteritis include infections with *Shigella*, *Salmonella*, *Campylobacter*, *E. coli*, *Yersinia*, *Vibrio*, *Listeria*, and *Clostridium difficile*. Bacterial causes should be ruled out, especially in severe cases of infectious diarrhea, as bacteria are known to cause a more severe form of gastroenteritis than seen with other etiologies. Stool testing for bacterial pathogens is warranted in patients who present with severe symptoms such as dehydration, hypovolemia, severe abdominal pain, or those patients who require hospitalization. Additionally, pregnant women, adults older than 70 years of age, and patients with immunocompromised states should have stool cultures performed to rule out bacterial

causes of infection.

Various parasitic infections can lead to acute gastroenteritis, including *Giardia*, *Cryptosporidium*, *Cyclospora*, *Isospora*, and *Mycobacterium species*. In cases where parasitic causes are suspected, stool samples should be tested for ova and parasites, and appropriate antimicrobial treatment should be initiated if tests are positive.

In patients with acute diarrhea, abdominal pathology should always be ruled out. Acute appendicitis, diverticulitis, inflammatory bowel disease, bowel obstruction, irritable bowel syndrome, ischemic bowel disease, laxative abuse, diabetes, malabsorption syndromes, scleroderma, and celiac sprue can all present with symptoms similar to that of rotavirus infection. When the diagnostic evaluation has failed to yield a cause for acute diarrhea, noninfectious extraintestinal causes should be considered.

Prognosis and Complications

Rotavirus symptoms are typically isolated to the gastrointestinal tract; however, infections can become systemic and lead to extra-intestinal manifestations such as meningitis, encephalitis, and seizures. Children are more likely to present with fever, dehydration, and metabolic acidosis when compared to other pathogenic causes of viral gastroenteritis.

In one study by Karampatsas and colleagues out of the United Kingdom reported that seizures and mild neurologic signs are surprisingly common in rotavirus infections. In this study, encephalitis was only associated with rotavirus positive gastroenteritis. The mechanism of action leading to neurologic sequelae is unclear. Rotavirus RNA is present in the cerebrospinal fluid of some patients with central nervous system symptoms, which may indicate a direct viral invasion. Rotavirus may lead to alterations in calcium homeostasis. Altered calcium homeostasis may induce seizures or lead to an increased susceptibility to seizure activity. A clear association between alterations in calcium homeostasis and seizure activity has not yet been found.

Approximately 500,000 children under 5 years of age die annually secondary to diarrhea with

rotavirus as the leading cause. It is estimated that 200,000 people die annually secondary to rotavirus infection. Severe dehydration is responsible for death in rotavirus infections. Additional complications, including neurologic sequelae, typically resolve with the treatment of rotavirus infection.

Management

Several vaccines have been developed for the prevention of rotavirus over the years. Most of the vaccines are live-attenuated variants of naturally occurring strains. An early vaccine for rotavirus was removed from the market due to an increased risk of intussusception. A newer vaccine is a monovalent human vaccine given in two doses from 6 to 24 weeks. A pentavalent bovine-human reassortant vaccine is also available. It is given in 3 doses from 6 to 32 weeks. Analysis of both newer vaccines shows decreased vaccine efficacy in patients from high-mortality regions when compared to low mortality regions. Both vaccines are considered safe and have no significant increase in adverse events between vaccine and placebo groups. China, India, and Vietnam have vaccines that are licensed locally, and additional vaccines are being evaluated in clinical trials across the world.



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All of the currently available vaccines for rotavirus infection are live attenuated vaccines. These are not without risk, as evidenced by the increased risk of intussusception with the first vaccine's administration. Since the removal of the earliest vaccine from the market, various studies have been performed to evaluate the factors that lead to an increased risk of intussusception. Incidence of intussusception is increased 3 to 14 days after vaccine administration, particularly following the first dose of the vaccine. Additional studies showed that the administration of the vaccine in infants greater than 90 days old lead to over 80% of cases of intussusception. Studies that evaluate the risk of the currently available vaccines in

various age groups are ongoing.

Overall, the benefit of rotavirus vaccination clearly outweighs the risks of adverse events, including intussusception. To further decrease the risk of intussusception, vaccination should be given to individuals in two doses and less than 60 days of age.

Global Issues of Rotaviruses

Rotavirus infections are significantly more lethal in low-income countries when compared with high-income countries. Additionally, the efficacy of vaccines is decreased in low-income countries when compared to high-income countries. Factors such as climate, poverty, poor nutrition, inadequate sanitation, and prevalence of diseases are known to decrease the efficacy of vaccines. Further studies are necessary to determine what alterations can be made to vaccine delivery systems and to better address the vaccination need in low-income areas worldwide.

On a global scale, there are significant disparities in healthcare outcomes between low-income and high-income countries due to the lack of clean water, the absence of resources to maintain adequate hygiene and sanitization, poor education, and the absence of healthcare facilities and vaccine programs. Many low-income countries lack the necessary resources to prevent disease outbreaks, and rotavirus vaccines are not as readily available in these regions. Most rotavirus vaccines are stable only in climate-controlled environments, making it difficult to distribute to temperate regions of the globe where the mortality rate is the highest.

To combat rotavirus mortality on a global scale, it is necessary to invest in research and vaccine development that targets the specific needs of every population impacted by this infection. This includes low-income countries where healthcare resources and funding are lacking. Every attempt should be made to ensure that these regions of the globe have access to adequate nutrition, clean water, necessary hygiene products, and appropriate healthcare facilities to combat the illness. Only when these advancements are made, will we see a truly

significant decrease in the global mortality from rotavirus infections.

Enhancing Healthcare Outcomes

Due to the broad differential diagnosis for acute gastroenteritis, accurate diagnosis of rotavirus infection requires strong interprofessional communication between the patient, family, nurses, emergency room physicians, primary care physicians, infectious disease physicians, and pediatricians. Transmission of rotavirus occurs primarily through the fecal-oral route and is frequently passed between individuals in daycare or household settings. Once an accurate diagnosis is made, the whole interprofessional team must educate the patient and the family on the importance of handwashing and disinfection techniques to prevent the transmission cycle of the virus. Patients should be advised to quarantine and stay home from school until complete symptom resolution.

In patients who require inpatient admission, communication between all members of the healthcare team is critical. Oral and intravenous fluid intake should be closely monitored by the nursing staff and communicated effectively to physicians to ensure the patient is maintaining adequate hydration. Dietary consults may be beneficial to optimize treatment and prevent electrolyte and nutritional deficiencies that may result from the illness. Any cases of emesis or diarrhea should be communicated as well to track the progression of the illness. Educating the patient and family members on all aspects of the illness, including transmission, prevention, and treatment, is critical. Nurses, physicians, dietitians, and additional members of the interprofessional team should take every available opportunity to educate patients and family members.

Source

LeClair CE, McConnell KA. Rotavirus. [Updated 2023 Jan 2]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK558951/>

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