Rotavirus is the most common cause of severe diarrhea in infants and young children. Rotavirus, a double-stranded RNA virus of the Reoviridae family, is the most common pathogen identified in young children who are hospitalized for diarrhea, and resulting dehydration. In addition, rotavirus, being highly contagious, is a significant hospital-acquired, nosocomial, infection. Rotavirus is very stable and may remain viable in the environment for weeks or months if not disinfected.

This newsletter will describe risk factors for and transmission of rotavirus. Assessment of rotavirus infection will be discussed, as well as complications and prevention, including hand hygiene and contact isolation.

**Risk Factors:**

**Age:** Virtually all children are infected with rotavirus at least once during their first 3-5 years. Rotavirus occurs most commonly among children between 6 and 36 months of age. Because of protection offered by maternal antibodies, such as antibodies transferred to the fetus through the placenta in the last part of pregnancy, and through breast milk, full-term infants, younger than 6 months of age may not develop symptoms when infected. Symptomatic illness is also uncommon in children older than 5 years of age. Each exposure to rotavirus and/or symptomatic infection offers greater protection against subsequent disease. Although asymptomatic, rotavirus can easily be transferred from older children and adults to susceptible young children. In the United States, rotavirus has a seasonal pattern, with annual epidemics occurring from November to April. The incidence of rotavirus is highest in cooler weather, with 80% of cases occurring in winter. Rotavirus is often a problem in child-care settings.

**Transmission:** The primary mode of transmission of rotavirus is through the ingestion of fluids or food contaminated with feces from an infected person. As young children are oral, they can easily acquire rotavirus infection when they put a contaminated toy or their fingers in their mouths. Large amounts of rotavirus are shed in the stool of infected persons. Only a few particles of rotavirus are needed to transmit infection.

Rotavirus particles remain active on human hands for at least 4 hours, on hard dry surfaces for 10 days, and on wet areas for weeks. Rotavirus infection is highly contagious. The incubation period is approximately 2 days. Therefore, rotavirus can be transmitted to others before any symptoms appear. The communicability period is approximately 10 days. The virus is shed in high titers in the stool for 10 days after initial symptoms appear. Because there are five strains of rotavirus, accounting for 90% of rotavirus illnesses in children younger than 5 years of age in the U.S., after infection, immunity is incomplete—children can be infected with rotavirus more than once. However, repeat infections tend to be less severe than the initial infection.

**Pathophysiology:** The rotavirus enters the body orally, the fecal-oral route, and works by attacking the lining of the small intestine, causing inflammation and severe diarrhea. When a stool specimen is examined by negative-stain electron microscopy, rotavirus has a characteristic wheel appearance. The name, rotavirus, is derived from the Latin, rota, meaning "wheel". This characteristic wheel pattern is key to diagnosing rotavirus.

**Assessment:** Symptoms of rotavirus usually appear two days after a child has been exposed. Although symptoms vary from child to child, most commonly, a young child infected with rotavirus suddenly begins experiencing frequent vomiting. A fever, typically 102 -103 °F (38.8 - 39.4 °C), is common. Diarrhea characteristically begins a day later. Stool output can be copious during the diarrheal phase of the illness. A young child may have diarrhea, watery and typically foul-smelling, every 5-10 minutes. Blood is usually not seen in rotavirus diarrhea. In most children, fever and vomiting will stop after 2 to 3 days, but acute diarrhea may last 3-8 days, predisposing the child to severe dehydration, electrolyte disturbances, and, if ongoing, malnutrition. Rotavirus can be fatal if severe dehydration occurs. Young children, children with impaired health, as well as those who live in crowded environments, and poor sanitation are at particular risk.
PREVENTION: Because of the widespread nature of rotavirus, total prevention of the spread of rotavirus is virtually impossible. Practicing strict hand hygiene is essential. Instead of traditional handwashing, the use of alcohol-based hand rubs by healthcare personnel is highly recommended. Numerous studies have shown that traditional handwashing compliance rates are generally less than 50 percent among healthcare providers. The Centers for Disease Control (CDC) recommends a minimum of 15 seconds to effectively wash one’s hand, which is approximately the time it takes to hum, twice, the “Happy Birthday” song. When washing hands, hands should be rubbed together vigorously, covering all surfaces of the hands and fingers. Hands should then be rinsed with water and dried thoroughly with a disposable towel. Thorough drying of hands is important as more organisms are transferred by wet hands than from hands that are thoroughly dried. With traditional handwashing, healthcare providers must leave a patient’s bedside, walk to a sink, wash their hands, and return to patient care. Using an alcohol-based hand rub may be more suitable and is equally effective.

Healthcare providers and parents should practice hand hygiene before and after coming in contact with the child, especially after diapering a child or helping him or her use the toilet. At minimum, children should have their hands cleaned before eating, as well as after having their diapers changed or using the toilet.

Contact isolation should be implemented for a child with known rotavirus, as well as those with a history of diarrhea and/or exposure to another person infected with the virus. The purpose of the isolation, as well as specific precautions, should be explained to the parents and, if the child is old enough to understand, to him or her, as well.

CONTACT PRECAUTIONS FOR ROTAVIRUS INCLUDE:

- Assign child with rotavirus to a private room with equipment dedicated to the patient.
- Wear a non-sterile gown and clean, non-sterile gloves when entering the infected child’s room. During the course of providing care for a child infected with rotavirus, gloves should be changed and hands washed after contact with infective material that may contain high concentrations of microorganisms—fecal materials.
- Gloves and gown should be removed before leaving the patient’s room and hands washed or cleansed with an alcohol-based rub.

- After glove and gown removal and hand hygiene, insure there is no contact with contaminated environmental surfaces or items in the patient’s room.

A vaccine, Rotashield®, to prevent rotavirus gastroenteritis was first licensed in August 1998, but was withdrawn in 1999 because of its association with intussusception – telescoping of the intestine causing bowel obstruction. Two second-generation rotavirus vaccines (RV), Rotatix® and RotaTeq®, shown to be safe and effective in children, were licensed in 2006 and 2008, respectively, and are part of the immunization schedule for children. Both brands of vaccine are administered orally and contain disabled live virus. A baby should be administered either 2 or 3 doses, depending on which manufacturer is the supplier. The doses are recommended at these ages:
- First Dose: 2 months of age
- Second Dose: 4 months of age
- Third Dose: 6 months of age (if RotaTeq® is used for the vaccination course).

The first dose of RV may be given as early as 6 weeks of age, and should be given by age 15 weeks. The last dose should be given by 8 months of age. RV may be given at the same time as other childhood vaccines. The rotavirus vaccination program in the U.S. has reduced the number of infants and children needing hospitalization or emergency department care for rotavirus disease by about 85%.

IMPLICATIONS: Preventing or treating fluid and electrolyte imbalances is a priority of care. Oral rehydration therapy (ORT), such as the use of Pedialyte®, is the treatment of choice for most cases of dehydration caused by diarrhea. In severe cases of dehydration, parental fluids may be necessary. ORT is administered in small quantities at frequent intervals.

Preventing the spread of rotavirus in the healthcare setting is priority. Strict adherence to hand hygiene, contact isolation, and the proper disposal of contaminated items, such as diapers, clothing, and crib sheets, are effective in preventing the spread of the disease. Environmental surfaces should be cleaned with soap and water and disinfected with a bleach solution. Disinfectants other than bleach are not effective against rotavirus. Parents should be taught effective hand hygiene and the importance of practicing it at home by the entire family. Additionally, signs of dehydration should be reviewed with parents, so they know when to seek emergency medical attention.

Rotavirus is the most common cause of severe diarrhea among children, becoming epidemic in the winter months. Although most young children will become infected with rotavirus, preventing transmission is a key role of healthcare providers.

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**Signs of dehydration include:**

- Lethargy/decreased sensorium
- Thirst
- Sunken eyes
- Depressed anterior fontanel - closes at 12-18 months
- Dry mucous membranes - mouth, lips, and tongue
- Dry, pale, and cool skin
- Poor skin turgor - tenting
- Decreased urinary output - which may be difficult to identify in diapered young children because the massive watery stool output makes it difficult to determine the amount of urine output
- Weight loss

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1. Infection with rotavirus is:
   a. the most common cause of pneumonia in children.
   b. common among breast-fed children younger than 3 months because of transmission of the virus through breast milk.
   c. usually severe in adults due to a decrease in immunity to the virus.
   d. the most common cause of severe diarrhea in children younger than age 5.

2. Which of the following is NOT a typical characteristic of stools associated with rotavirus? They are:
   a. watery.
   b. bloody.
   c. foul-smelling.
   d. frequent.

3. Rotavirus is unstable and remains viable in the environment for approximately 2 hours.
   a. True
   b. False

4. Which of the following is correct regarding immunity associated with rotavirus infection?
   a. Is lifelong after the initial infection.
   b. Doesn’t increase with age.
   c. Is progressive, therefore, future rotavirus infections are less severe.
   d. Subsequent infections are as severe as the initial infection.

5. Which of the following is NOT a common mode of transmission of rotavirus?
   a. Being near an infected child when he/she sneezes.
   b. Eating contaminated food.
   c. Putting a contaminated toy in the mouth.
   d. Drinking contaminated water.
6. Children with rotavirus are contagious before any symptoms appear.
   a. True
   b. False

7. Which of the following is diagnostic of rotavirus?
   a. The clinical manifestations the child presents with.
   b. Stool specimen showing a wheel appearance upon microscopic examination.
   c. An elevated white blood cell count.
   d. A child with diarrhea stools and a fever less than 102 °F (38.8 °C).

8. Sandy, 7 months old, has rotavirus and IV fluids are ordered for him. Which of the following indicates she is dehydrated?
   a. A bulging anterior fontanel.
   b. Increased urinary output.
   c. Moist mucous membranes.
   d. Poor skin turgor - tenting.

9. When caring for Sandy, healthcare providers should wear a gown and:
   a. wear gloves only when changing Sandy’s diaper.
   b. change gloves and wash hands after having contact with fecal material.
   c. use the same stethoscope and BP cuff from patient to patient.
   d. mask when entering her room.

10. The vaccines for Rotavirus, Rotatrix and RotatEq:
    a. are given subcutaneously.
    b. contain hybrid killed virus.
    c. do not interfere with other immunizations.
    d. are given in three doses.