

A Review on “Diagnosis, Management & Prevention of Rotavirus Infections”

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Abstract: *Background:* Rotavirus is distributed worldwide & is one of the most important causes of diarrhea (gastroenteritis) in infants and children less than five years. Rotavirus constitutes 25 million clinical visits & each year more than 450,000 children under the age of 5 years die because of this infection. Rotavirus is a preventable infection, even though, most deaths from this infection occur in developing countries. According to the report released in 2017 by WHO, each year more than 215,000 children die from this infection which constitutes 3.4% of all death among children. *Objectives:* Diagnosis, Management & Prevention of Rotavirus infections. *Research questions:* 1) What are the best diagnostic techniques for Rotavirus? 2) What are the best treatment & preventive measures for Rotavirus infection? *Method and materials:* The inclusion criteria for the research was any publication in English on Rotavirus gastroenteritis. The keyword "rotavirus" was used to search in the National Library of Medicine's PubMed, Scopus, Research gate & NCBI databases. We also included publications in local medical journals and in local languages for which abstracts in English were available. We further reviewed the cross-referenced articles from the retrieved ones. A total of 112 published articles were identified. Articles published before 2009 & articles cover the structure & genetic epidemiology were excluded. *Results:* The diagnosis of Rotavirus in the stool specimens are confirmed by either ELISA or Immune-chromatography. The determination of genotypes and genetic epidemiology is done using RT-PCR. The best management of Rotavirus infection is based on the treatment of dehydration. There are two live attenuated RV vaccines for the prevention of rotavirus: Rotarix® and RotaTeq®. These vaccines are administered orally at the age of 2, 4 & 6 months of age respectively.

Keywords: Rotavirus, Gastroenteritis, Dehydration, Vaccination, Rotarix, RotaTeq

1. Introduction

1.1 Epidemiology

Rotavirus is distributed worldwide & is one of the most important causes of diarrhea (gastroenteritis) in infants and children less than five years. Rotavirus constitutes 25 million clinical visits & each year more than 450,000 children under the age of 5 years die because of this infection. Rotavirus is a preventable infection, even though, most deaths from this infection occur in developing countries [1]. According to the report released in 2017 by WHO, each year more than 215,000 children die from this infection which constitutes 3.4% of all deaths among children less than five years.

1.2 Pathogenesis

Rotavirus infects the mature enterocytes at the tips of the villous epithelium of the small intestine. The epithelial cells are destroyed and progeny viruses are released which will lead to absorptive diarrhea. The rotavirus NSP4 protein acts as an enterotoxin, and the enteric system is also involved in the emergence of diarrhea & vomiting [2,3]. In comparison to other enteropathogens, rotavirus causes non-bloody diarrhea which will last for a week & does not cause significant inflammation [4].

The physical examination findings for rotavirus infection are often unremarkable except for signs of dehydration. The most common findings of rotavirus gastroenteritis are profuse watery diarrhea, dehydration, electrolytes imbalances, fever & vomiting [5]. Other findings on examination may include the following:

- Hyperactive bowel sounds: A most common finding

- Sunken eyes and/or anterior fontanelle
- Dry or sticky-appearing mucosa
- Rough skin or diarrhea-induced diaper dermatitis
- Tachycardia: Can be disproportionate to the temperature
- Rectal examination: May stimulate the production of watery, heme-negative stools
- Depressed sensorium
- Weight loss

Significantly decreased urine output is an important sign. However, this may be hard to identify in diapered infants, because the massive watery stool output makes it difficult to determine the amount of urine output.

2. Diagnosis

Rotavirus can be identified by several means (i.e., enzyme immunoassay being the most common, latex agglutination, electron microscopy, polyacrylamide gel electrophoresis, reverse transcription PCR & viral isolation from fecal specimens by culture) [6]. However, in most cases, identification of the virus is important for public health or infection control purposes. In general, the use of such testing is less useful in the ED and can take significant time (days to weeks) for results to return. Rotavirus diagnosis by rapid ELISA is simple and easy to perform. This may lead to a significant reduction in the unnecessary usage of antibiotics, which cannot control infection due to rotavirus [7].

3. Management

The management of acute rotavirus gastroenteritis focuses on the treatment and prevention of dehydration. In most

situations, the clinician will not be aware at the start of treatment whether the gastroenteritis is caused by rotavirus or another pathogen. Initial assessment, therefore, focuses on determining the degree of dehydration because this will be used to guide and monitor treatment [8].

Prehospital care of affected infants should be directed toward ensuring a secure airway, breathing, identification of circulatory compromise, and maintenance of adequate circulation. Field personnel may not be able to achieve access in the child with a contracted circulatory volume. Infants who appear significantly dehydrated ideally should have 20 mL/kg isotonic sodium chloride solution or Ringer lactate solution administered en route to the hospital. Patients who are less severely affected need only monitored transport.

Inpatient care: After ensuring proper airway and breathing and assessing circulation, identification and treatment of dehydrated infants is the main objective. In many cases, appropriate rehydration may be accomplished using established oral rehydration protocols. Lethargic children require a fingerstick glucose level immediately either by EMS or in the ED.

For severely dehydrated children, vascular access (often via an IO line) is required. Administer 20 mL/kg boluses until the volume is restored. A total requirement of 60-80 mL/kg is not uncommon. If more than 40 mL/kg is necessary, consider electrolytes, BUN, and creatinine levels. Maintenance of hydration the key issue for children who are not dehydrated. The selection of an appropriate fluid is crucial. Some data show that administration of a bolus of 5% dextrose in 0.9% saline can help lower the level of serum ketones in dehydrated gastroenteritis patients. A reduction in hospitalization rate, however, was not seen in this study comparing patients who received dextrose in 0.9% saline compared with those receiving 0.9% saline [9].

Infants who receive hyperosmolar fluids (e.g. commercial soft drinks, sports drinks, gelatin) and those who are fed high salt-content solutions (e.g. commercial soup, boiled milk) are at risk for significant hypernatremia.

Ideal maintenance beverages for dehydrated infants with viral enteritis are commercial infant solutions such as Pedialyte and Rice-Lyte. These beverages contain a small amount (usually 2-3%) of glucose and the correct balance of sodium and potassium. Rehydrating infants with these beverages may be particularly difficult within the first 2 days of the illness because vomiting frequently occurs.

If the infant is vomiting, administer small, frequent feedings. Once vomiting has resolved, the baby may be given a standard soy-based infant formula. This formula provides adequate energy intake for intestinal healing. Supplemental feedings of oral maintenance solutions may be administered if fluid losses are excessive. Avoid sports drinks and other hyperosmolar beverages for the reasons previously stated. Similarly, excessive free-water intake may predispose the infant to hyponatremia. Antiemetics may be considered for children older than 6 months to control emesis [10]. Antidiarrheal are generally only recommended in cases of

excessive or significantly prolonged diarrhea in which no other etiology has been determined [11]. Antibiotics are not indicated if rotavirus gastroenteritis is suspected [12].

4. Prevention

There are currently 2 FDA-approved rotavirus vaccines to protect against rotavirus gastroenteritis; RotaTeq and Rotarix. These vaccines are indicated in infants aged 6-32 weeks (RotaTeq) and those aged 6-24 weeks (Rotarix). Rotarix is a monovalent vaccine derived from a human G1P[8] isolate. RotaTeq is pentavalent, consisting of a mixture of human bovine RV mono-reassortants, carrying the genes encoding the human G1, G2, G3, G4, and P[8] proteins in a genetic background of the bovine rotavirus Wi79 (G6P[5]). Both vaccines were found to be highly efficacious in phase III clinical trials [13,14,15]. RotaTeq administration has been recommended for children as 3 separate oral doses at ages 2, 4, and 6 months. Rotarix administration is currently recommended as 2 separate doses to patients at ages 2 and 4 months [16]. Rotarix was efficacious in a large study showing that it protected patients against severe rotavirus gastroenteritis as well as decreasing the rate of severe diarrhea or gastroenteritis of any cause [17]. These vaccines are administered orally at the age of 2, 4 & 6 months of age respectively. These vaccine has decreased mortality rate by 50-60% in underdeveloped countries [18,19].

5. Conclusion

Rotavirus causes significant morbidity and mortality in children less than five years. A presumptive diagnosis is made in any child less than five years with acute diarrhea, especially in low resource centers. However definitive diagnosis is made on the stool specimens by using either ELISA or Immune-chromatography. The determination of genotypes and genetic epidemiology is done using RT-PCR. These tests are used for research purposes. The best management of Rotavirus infection is based on the treatment of dehydration. Various strategies have been explored in the control and prevention of rotavirus acute gastroenteritis. The mainstay of prevention is vaccination. There are two live attenuated vaccines for the prevention of rotavirus: Rotarix[®] and RotaTeq[®]. Rotarix[®]. These vaccines are administered orally at the age of 2, 4 & 6 months of age respectively. Vaccination has significantly reduced mortality, morbidity, and transmission rates of rotavirus. Vaccination should however be integrated into pre-existing protocols for managing diarrheal diseases in children, especially in Afghanistan.

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