

Rotavirus Gastroenteritis: A Life Threatening Viral Disease of Global Significance

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Infectious gastroenteritis, caused due to various pathogenic agents like viruses, bacteria, protozoa and helminthes, has a significant impact on human and animal health. Many enteropathogens, such as Hepatitis A virus, Hepatitis E virus, Norovirus, Rotavirus, *Arcobacter butzleri*, *Campylobacter jejuni*, *Clostridium difficile*, *Cronobacter sakazakii*, *Escherichia coli* 0157: H7, *Listeria monocytogenese*, *Vibrio parahaemolyticus*, *Yersinia enterocolitica*, *Giardia lamblia*, *Toxoplasma gondii*, and *Cryptosporidium parvum* have emerged and re-emerged as important causes of morbidity as well as mortality in many countries of the world. Rotaviral gastroenteritis is a newly recognized viral disease of public health and economic importance in developing as well as developed nations. Globally, rotaviral gastroenteritis is estimated to cause 111 million cases, 2 million hospitalization and 500,000 deaths in children below 5-year of age annually. The disease is responsible approximately 100,000 deaths of small children in India each year. In the United States, the direct and indirect costs related with rotavirus infections is estimated around US Dollar one billion. Rotavirus disease is worldwide in distribution, and is reported from many countries, such as Argentina, Australia, Bangladesh, Brazil, Cameroon, China, Congo, Ethiopia, Finland, India, Indonesia, Malaysia, Malawi, Nicaragua, Niger, Nigeria, Pakistan, Paraguay, Portugal, Rwanda, South Africa, Tanzania, Uganda, USA and Venezuela. In tropical countries, the infection is encountered throughout the year. The children of low income countries accounts for over 80% of deaths due to rotavirus infections. High death tolls due to rotavirus gastroenteritis are recorded mainly from African and Asian nations.

The children of poor socioeconomic groups living in rural areas are at a greater risk of rotavirus infections. Rotavirus gets its name from Latin word Rota meaning wheel. The name Rotavirus was suggested by Thomas Henry Flewett who observed rotavirus particle under electron microscope in 1974. The virus was first time cultivated in 1981 in the cell culture obtained from the kidneys of monkey. Besides humans, the infection is recorded in many species of animals, such as antelope, brown bear, cattle, chicken, deer, duck, guinea pig, monkey, mouse, rabbit, sheep, and turkey. In Canada, Group A rotavirus was detected in 18% of raw meat of cattle, pig, and poultry. Rotaviruses are generally species specific but cross species transmission have been demonstrated by experimentally inducing the infection with human rotavirus in monkeys, calves, and piglets. There are some evidences to believe that transmission of rotavirus infection from animal to human may occur thus suggesting the zoonotic potential of the virus. However, additional studies are warranted to establish an unequivocal role of animals in the zoonotic transmission of rotavirus to humans.

The disease is caused by Rotavirus, a double stranded segmented RNA virus, which belongs to the genus *Rotavirus* and family *Reoviridae*, and contains seven distinct antigenic groups, namely A, B, C, D, E, F, and G. Rotavirus group A is the most important cause of disease in humans, however, group B, and C are also implicated in human infections. Group A is responsible for severe, life threatening infection among children worldwide. The virus remains infective in feces for about seven months at room temperature. It is resistant to commonly used disinfectants, such as bleach, iodophores, and quaternary ammonium compounds. Recent studies have indicated that genotypes, such as G1P, G2P, G3P, G4P, and G9P strains are present in about 100% of rotavirus infections of developing nations.

Rotavirus is primarily transmitted through oral-fecal route. Transmission can also occur through the ingestion of contaminated food and water with dirty inanimate objects. The virus is isolated from toys and surface in child care centers. Therefore, fomites play a role in the transmission of rotavirus infection. Nosocomial diarrhea may arise in kinder gardens, and day care centers. Sporadic outbreaks among adolescents and adults are reported in schools, hospitals, and offices. It is pertinent to mention that asymptomatic infection in adults may maintain the transmission of rotavirus infection in the community.

The incubation period of disease is very short (usually 2 days). The clinical manifestation of disease in humans includes diarrhea, vomiting, low grade fever, abdominal pain, dehydration, electrolyte imbalance, hemolytic anemia, shock, and death. Neurological manifestation may be noticed in 2 to 5% of cases. The stools are typically white or greenish yellow without mucus or blood. The symptoms usually last for 3 to 8 days. Children below 5-years of age are commonly affected. Infection can occur in healthy as well as compromised subjects. Rotavirus is the most important etiologic agent of diarrhea among infants below 11 months of age. It is responsible for 5 to 10% cases of gastroenteritis in children aged less than 5-year of age.

Diagnosis of disease can be established by detection of virus in freshly voided stool /feces by electron microscopy, isolation of virus from stool/feces in tissue culture cell line (MA 104), demonstration of antibodies in the sera of patient against rotavirus by compliment fixation, enzyme linked sorbent assay (ELISA), radio immunoassay (RIA), and radial immunodiffusion (RID) techniques. In addition, slide latex agglutination method is useful to detect viral antigen in the clinical specimens. As latex agglutination is simple, rapid, and inexpensive, it can be recommended as a routine screening test in clinical practice.

Recently, reverse transcriptase polymerase chain reaction (RT-PCR) is used to detect and identify all species and serotypes of rotavirus. The disease should be differentiated from other etiologies of gastroenteritis.

Currently, no specific chemotherapeutic agent is available to treat rotaviral gastroenteritis. It is a self-limiting disease in immunocompetent subjects, and recovery occurs within 5 to 10 days. However, the drugs to check diarrhea and fluid therapy to prevent dehydration are advised, especially in infants. In case of severe diarrhea and intractable vomiting, it is imperative to administer intravenous fluid to save the life of patients. It is emphasized to undertake studies to develop safe, potent, and low cost drug, which can be easily afforded by low income countries to treat cases of rotaviral gastroenteritis.

The disease can be controlled by adopting good hygienic practices in day care center, nursery, and hospital, proper sterilization of bottles used for baby feeding, treatment of water with ethylene glycolic acid, immunization of infants, and health education of mothers and hospital staff about the source of infection, mode of transmission, and rules of personal hygiene. Immunization of infant in the first year of life provides 85 to 98% protection against severe rotavirus infection. Currently, two vaccines, namely Rota Teq (Merk Company) and Rotarix (Glaxo Smith-Kline) are widely used for immunization of children, and are found effective to reduce the severity of disease. Very recently, Rotavac produced by Bharat Biotech, India, is considered the cheapest vaccine that costs less than one US Dollar. It is an oral vaccine that should be administered in three dosages at the age of 6, 10, and 14 weeks. In this context, the World Health Organization (WHO) recommended that rotavirus vaccine should be included in all the National Immunization Programme.

Further research on pathogenesis, molecular epidemiology, simple and low cost diagnostic and zoonotic transmission of rotavirus should be undertaken. Sincere attempts should be made to evaluate the efficacy of some chemicals/compounds that show virucidal properties, and can be safely used as potent disinfectant to inactivate the virus during the outbreak of disease.