Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(3): 164-166

Received: 24-03-2019
Accepted: 27-04-2019

Vipul Chaudhary
Department of Biotechnology, Deen Bandhu Chhotu Ram University of Science and Technology, Murthal Sonepat Haryana, India

Varun Anand
Department of Pediatric Trauma and Emergency, All India Institute of Medical Sciences, Raipur, Chhattisgarh, India

Pamela Singh
Department of Biotechnology, Deen Bandhu Chhotu Ram University of Science and Technology, Murthal Sonepat Haryana, India

Correspondence
Vipul Chaudhary
Department of Biotechnology, Deen Bandhu Chhotu Ram University of Science and Technology, Murthal Sonepat Haryana, India

Rotavirus: A correlation of animals and human

Vipul Chaudhary, Varun Anand and Pamela Singh

Abstract
Diarrhoeal disease is one of the major public health concerns and represents the second most cause of mortality among children below 5 years of age in developing countries. Globally Rotavirus is transmitted by the fecal oral route, causes life intimidating gastroenteritis amongst human and cattle which has enforced the focused efforts to develop vaccines by understanding narrative therapeutic mechanisms of gastrointestinal virus pathogenesis. Rotavirus is the most common and contagious virus that cause diarrhea in infants and viral diarrhea in calves. Therefore worldwide endogenous government health policies and WHO have taken vast preventive and controlling measure to overcome the disease burden of Rotavirus.

Keywords: Diarrhoea, vaccine, rotavirus, cattle

Introduction
This article incorporates the latest literature regarding the correlation of Rotavirus infection in human and animal. Genus Rotavirus is a 70-75nm double stranded RNA (ds RNA) virus, icosahedral symmetry (20 triangular facets resembling wheel) in shape belongs to Reoviridae family, Sedorevirinae sub-family. Term Rotavirus has derived from the Latin word- Rota meaning wheel. It has a complex morphology with a buoyant density of 1.36 g/ml in Cesium chloride (CsCl) having two layered capsid. Genome of Rotavirus has 11 ds RNA with 6 each structural protein (VP) and Non-structural protein (NSP) without envelope. Nucleic acid has 2 layers of capsid- inner capsid (VP6) and outer capsid (VP7) [1]. VP6 antigen is the inner shell of Rotavirus which is further divided into 7 groups (A-G) out of which group A is the most common species to infect humans. Rotavirus was first identified as a virus particle in duodenal biopsy of children with diarrhoea under electron microscope in 1973 by Bishop and colleagues.

Rotavirus infects the villous structure of epithelial cells of the small intestine where it can replicate and causes clinical sign and symptoms of the disease. It is highly resistant virus having an incubation period of 2 days and can able to survive in stools even at room temperature for months. It mostly affects children under 5 years of age. WHO in 2013, estimated 215 000 deaths of under 5 years age from Rotavirus infection. Two oral vaccines were recommended, one as a common strain of human rotavirus and other one is reassorted bovine-human rotavirus; are available internationally as national health supply or commercially. According to an Indian study incidence of rotavirus in buffalo calves and calves with age <1 month was 17.5% (07/40) and 27.3% (15/55) respectively [2]. Another western Indian study found positive rotaviruses via RNA-PAGE in stool samples among the buffalo, poultry and humans as 12.5%, 7.84% and 20.25% respectively [3].

Rotavirus primarily affects from 6 months to 5 years of age [4]. According to an epidemiological study that included 29 different studies, 75% of children are affected with Rotavirus by 3 years of age [5]. In a study conducted at Uganda between 2012-2013 under 5 years of age it was found that eating uncooked vegetables (OR = 1.45, 95% CI = 1.03-2.03) and dogs (OR = 1.9, 95% CI = 1.04-3.75) augment the menace of rotavirus infection [6]. According to a south Indian study in which animals (627) and human (394) stool samples were collected and RNA extraction with reverse-transcription PCR done where 35 (5.5%) animals (1 bullock, 2 goats, 32 cows) and 158 (5.5%) humans were found to be infected with Rotavirus [7]. In China, fecal samples were taken from 767 children from less than 5 years of age out of which 263 (34.3%) samples were positive for Rotavirus [8].

Multiple studies and theories have been described related to rotavirus infection and majority of Theories are taken from animal studies. These include malabsorption because of enterocyte

Destruction, secretion abnormalities due to functional changes at the villus epithelium, motility defect, and epithelial damage secondary to villus ischemia, toxin production and stimulation of the enteric nervous system. On occasion even after Rotavirus enterocyte infection, no diarrhea occurs which advocates the multitude nature of viral and host that impinge on the ailment production [9].

Clinical Presentation

Rotavirus is most common agent that are responsible for diarrhea among children under 5 years of age around the globe. Many studies have proved its virulence of causing diarrhea in animal models and children. Their structural descriptions have been well explained in the literature whose components play role in causing signs and symptoms of the disease. Clinical spectrum of Rotavirus varies from subclinical diarrhea with no dehydration to acute gastroenteritis (AGE) with severe dehydration [10]. It is the widest cause of diarrhea among children in which dehydration grade varies as per World Health Organization (WHO) classification.

Infected children present with varying range of presentation from subclinical to moderate that can be tackled by home based management to severe presentation which requires day care or hospitalization. It carts incubation period of 1-7 days which starts with fever and vomiting and abate by the second day of illness with onset of watery loose stools persisting for 5-8 days. Stools have no blood or whole blood cells but may lead to complications like dehydration, electrolyte imbalance and shock if not treated within the early time frame. Other than gastrointestinal; neurological manifestations too have been reported including seizures, cerebellitis and encephalopathy but as a complication. According to a retrospective, case-control study conducted from June 2011 to December 2013 at three locations of UK that included children aged 1 month to 16 years with AGE, in which metabolic acidosis (pH 7.30 vs 7.37, p-value = 0.011) and fever (74% versus 46%; p-value = 0.005) were more hospitalized in contrast to non-rotavirus AGE (93% versus 73%; P = 0.019) [11]. In a systematic review of articles published between 1990 and 2011 reporting pathogens in children <5 years of age hospitalized with diarrhea; 712 000 deaths due to diarrhea were reported for 2011 out of which Rotavirus caused 197 000 [Uncertainty range 110 000–295 000] deaths [12].

Since primary infection and vaccine together don't give enduring immunity thus recurrent episodes may occur in the same patient. But rigorousness of first infection is worse than the consequential episodes. Route of transmission is fecal-oral route either directly or through fomites. Contaminated water and food also augment the transmission.

Diagnosis and investigations

Clinical diagnosis is made by most of the clinicians or physicians with the typical age of presentation, duration of illness and pattern of loose stools. According to a study done at Turkey where fresh stool samples were compared for specificity and sensitivity with various short duration resultant investigating methodology (RIDAQUICK Rotavirus/ Adenovirus Combi Test; Genx Rotavirus Test, and ELISA antigen) it was concluded that the ELISA and immuno chromatographic methods, had high sensitivity and low specificity [13].

According to a study done at tertiary hospital, antigen detection by enzyme immunoassay (EIA) is the best method to do large scale stool sample screening than latex agglutination (LA) and polyacrylamide gel electrophoresis (PAGE) [14].

Treatment

Rotavirus causes a range of intensity of gastroenteritis, requiring immediate correction of dehydration caused by its consequence. WHO has given grading of dehydration and its related correction but it should be kept in mind that on-going losses and maintenance therapy should also be considered to decrease the duration of the correction. Oral rehydration therapy (ORT) is preferred over intravenous unless dehydration is severe or moderate (if not accepting orally well). In calves if electrolyte fluids are given via stomach tube, it may deposit in rumen and not absorbed thus in case of shock intravenous fluids are preferred. Fruit juices, sports drink, carbonated drinks should be avoided. In infants <6 months of age, breast feeding should be advised after each loose stool, other than that of normal breast feeding.

No role of antibiotics in the treatment thus should be discouraged in both animal and human. Oral zinc (10 mg in age <6 months and 20 mg >6 months of age for 14 days) has also been advised by WHO in children with gastroenteritis. Role of probiotics have been proved to decrease the duration of illness by 1-2 days but studies of developing countries are lacking; because of its high cost it should be wisely used [15]. According to a recent Indian study, oral nitazoxanide a broad spectrum antiparasitic agent (100 mg in 12–47 months, 200 mg in ≥4 yr) for 3 days was found to decrease the duration of illness [16].

Vaccination

After few clinical studies, WHO in 2009 recommended to add the Rotavirus vaccine in national immunization schedule especially in countries with high diarrhea associated deaths [17]. Two types of vaccines have been recommended by Centers for Disease Control and Prevention (CDC) American body- Human bovine pentavalent reassortant live vaccine- (Rota Teq- RV5), which is given in 3 doses at 6, 10 and 14 weeks of life. Another vaccine is Human monovalent live attenuated vaccine (Rotarix- RV1), which is given in 2 doses at 6 and 10 weeks of life. But as per latest studies more immunogenicity occurs with 10 and 14 week protocol, which too has been implemented by Indian Academic of Pediatrics (IAP). National Immunisation schedule has adopted it at few areas only because of financial constraints. Minimum age of giving first vaccination is 6 weeks.

Two vaccines (Rotarix and Rota Teq) are available that are effective for specific strain of area but new generation vaccines are in streamline to overcome infections from other strains and to decrease the mortality rate grounded by rotavirus. According to a systematic review and meta-analysis RV-1 and RV-5 reduced the hospitalisation and emergency visit by 85% and 90% respectively in Latin America [18].

Conclusion

Controlling hygienic standards by blocking the fecal-oral route transmission can play a chief role in decreasing the morbidity and mortality burden from the country but numerous studies have proved that it is not the only factor that solves the rationale. Addition factor as vaccination before one year of age might augment the preventive policy of health care system. More randomized control studies and meta-

analysis are required in future to support the benefit of vaccination against Rotavirus especially at low income health care facilities. Colostrum introduction especially from vaccinated dams, in the early life of calves produces antibodies and helps in prevention of diarrhoeal infection. As Rotavirus is a viral disease without any available antiviral therapy, it mandates to correct dehydration immediately to decline the mortality associated with it. Still the vaccine is not included in all states of country but in future it may act as barrier to this treatable condition. Explaining the importance of ORS via electronic and social media may help in decreasing the burden of disease.

Conflict of Interest: None

References

1. Rotavirus-classification, structure composition and properties, replication, mode of transmission, pathogenesis, clinical symptoms, laboratory diagnosis, treatment, prevention and control. Online Biology Notes, 2017. http://www.onlinebiologynotes.com/rotavirus-classification-structure/. 21 May, 2017.
2. Nataraju SM, Chattopadhyay UK, Krishnan T. A study on the possibility of zoonotic infection in rotaviral diarrhoea among calves and buffalo calves in and around Kolkata, India. Eur Rev Med Pharmacol Sci. 2009; 13(1):7-11.
3. Niture GS, Karpe AG, Prasad M. Characterization of buffalo, poultry and human rotaviruses in Western India. Veterinarski Arhib. 2011; 81(3):307-19.
4. Haffejee IE. The epidemiology of rotavirus infections: a global perspective. Journal of Pediatric Gastroenterology and Nutrition. 1995; 20(3):275-86.
5. Malek MA, Teleb N, Abu Elyazeed R, Riddle MS, Sherif ME, Steele AD *et al*. The epidemiology of rotavirus diarrhea in countries in the Eastern Mediterranean Region. Journal of Infectious Diseases. 2010; 202(1):S12-22.
6. Bwogi J, Malamba S, Kigozi B, Namuwulya P, Tushabe P, Kiguli S *et al*. The epidemiology of rotavirus disease in under-five-year-old children hospitalized with acute diarrhea in central Uganda, 2012-2013. Archives of Virology. 2016; 161(4):999-1003.
7. Rajendran P, Kang G. Molecular epidemiology of rotavirus in children and animals and characterization of an unusual G10P [15] strain associated with bovine diarrhea in south India. Vaccine. 2014; 32:A89-94.
8. Sai L, Sun J, Shao L, Chen S, Liu H, Ma L. Epidemiology and clinical features of rotavirus and norovirus infection among children in Ji'nan, China. Virology Journal. 2013; 10(302):1-8.
9. Ramig RF. Pathogenesis of intestinal and systemic rotavirus infection. Journal of Virology. 2004; 78(19):10213-20.
10. Parashar UD, Nelson EA, Kang G. Diagnosis, management, and prevention of rotavirus gastroenteritis in children. British Medical Journal. 2013; 347(f7204):1-19
11. Karampatsas K, Osborne L, Seah ML, Tong CY, Prendergast AJ. Clinical characteristics and complications of rotavirus gastroenteritis in children in east London: A retrospective case-control study. PloS one. 2018; 13(3):e0194009.
12. Lanata CF, Fischer-Walker CL, Olascoaga AC, Torres CX, Aryee MJ, Black RE. Global causes of diarrheal disease mortality in children< 5 years of age: a systematic review. PloS one. 2013; 8(9):e72788.
13. Artiran S, Atalay A, Gökahmetoglu S, Ozturk MA, Balci N, Cakir N *et al*. Investigation of rotavirus with various methods in children with acute gastroenteritis and determination of its molecular epidemiology in Kayseri Province, Turkey. Journal of clinical Laboratory Analysis. 2017; 31(2):e22030.
14. Pereira LA, Raboni SM, Nogueira MB, Vidal LR, de Almeida SM, Debur MC *et al*. Rotavirus infection in a tertiary hospital: laboratory diagnosis and impact of immunization on pediatric hospitalization. Brazillian Journal of Infectious Disease. 2011; 15(3):215-9.
15. Crawford SE, Ramani S, Tate JE, Parashar UD, Svensson L, Hagbom M *et al*. Rotavirus infection. Nature Reviews Disease Primers. 2017; 3(17083):1-16.
16. Mahapatro S, Mahilary N, Satapathy AK, Das RR. Nitazoxanide in acute rotavirus diarrhea: a randomized control trial from a developing country. Journal of Tropical Medicine. 2017; 7942515:1-5.
17. Arora R, Swaminathan S. Ready to Measure Impact? The Introduction of Rotavirus Vaccine in India. Indian Academy of Pediatrics. 2016; 53(7):565-67.
18. Velázquez RF, Linhares AC, Muñoz S, Seron P, Lorca P, De Antonio R *et al*. Efficacy, safety and effectiveness of licensed rotavirus vaccines: a systematic review and meta-analysis for Latin America and the Caribbean. BMC Pediatrics. 2017; 17(14):1-12.