

Prevalence of Rota & Adeno viral acute gastroenteritis in children < 5yrs of age and study of associated social factors in tertiary care hospital

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Abstract

A descriptive case-control study was conducted over one year to diagnose Rota and Adenovirus acute gastroenteritis by using an economic rapid antigen detection test and to determine associated social factors like age, gender, feeding methods, drinking water, socio-economic status, and Rota vaccine status.

Results: 26% of samples tested positive for Rotavirus and 0.4% were positive for adenovirus, more cases of Rotavirus in > 6 months to 2 years as they are on the mixed feed and more activities. 44% of viral gastroenteritis cases were from lower socioeconomic status. 72% were using boiled cooled tap water and others were using reverse osmosis water only 33.3% of children had been vaccinated against Rotavirus, none from the Rotavirus positive cases. 43.6% of cases were between October to December.

Conclusion: A rapid card Antigen test for Rota and adenovirus will help in the management of cases & can reduce the financial burden of treatment. Acute viral gastroenteritis cases were associated with poor socioeconomic background, more common between the age of 6 months to 2yrs, and all were not vaccinated.

Keywords: Acute gastroenteritis (AGE), rotavirus, adenovirus.

Introduction

Acute gastroenteritis (AGE) can occur at any age, but the severity of the disease may vary depending on age. Diarrheal diseases are an important health issue in children as every child under five years of age experiences a minimum of 2 to 3 episodes of diarrhea yearly

The etiological agents of diarrhea can be viral, bacterial, protozoan, or helminths. Viral agents include rotavirus, enteric adenovirus, Norwalk virus, Astro virus, Calci virus, etc. among viral diarrhea, Rota v is the most common cause of acute gastroenteritis followed by Adenovirus. Bacterial agents include commonly pathogenic and enterotoxigenic Escherichia coli, shigella, salmonella, vibrio cholera, campylobacter jejuni, Yersinia, and Clostridium difficile, etc. Ascaris lumbricoides, Giardia lamblia and Cryptosporidium are the most common parasitic agent ^[1]. Although the exact etiology of diarrhea in developing countries are the subject of much research, there are indications that rates of various bacterial diarrhea

may be decreasing as improvements in oral rehydration solution (ORS) use and access to health care have contributed to the impressive gain in diarrheal mortality^[2].

Diarrheal diseases remain the leading cause of childhood mortality globally as well as in India. Diarrhea is responsible for about 9% of under-five deaths globally and 10% of under-five deaths in India causing around 110,000 deaths annually^[4] Rotavirus is the leading cause of severe diarrhea in children in developed and developing countries^[4-6].

Rotavirus is a double-stranded RNA virus within the family Reoviridae. The primary mode of transmission is via the fecal-oral route with symptoms typically developing after an incubation period of one to two days. The majority of children become infected with rotavirus within the first three years of life, with a peak incidence of Rota viral diarrhea between 6 to 24 months^[7] Previous infection offers protection from subsequent illnesses. However, re-infection is frequent but subsequent illnesses tend to be less severe^[8]. Human adenoviruses (HAdVs) are one of the major causes of several different clinical syndromes including gastroenteritis, respiratory disease, conjunctivitis, hemorrhagic cystitis, and exanthema. They comprise 51 different serotypes (HAdV-1 to HAdV-51) grouped into 6 species, A to F. The enteric serotypes that are mostly associated with gastroenteritis are Ad-40 and Ad-41 which belong to species F. Enteric adenoviruses are associated with protracted diarrhea which may contribute to infant dehydration and malnutrition in developing countries^[6-8]. Spread predominantly by the fecal-oral route^[3, 4]. Usually, after an incubation period of 8 to 10 days, periodic diarrhea occurs, with low-grade fever, vomiting, abdominal pains, and dehydration^[5, 8].

As viral diarrhea in children is responsible for a large number of hospitalization of children and outpatient visits so, therefore, its early detection is necessary to reduce morbidity and mortality. Socioeconomic status (SES) is one of the important indicators to evaluate the health status and nutritional status of a family.

So, this descriptive cross-sectional study was undertaken to determine the prevalence of Rota & Adenoviral AGE by using a rapid Rota & Adenoviral antigen detection card and to assess the seasonal prevalence, relevance of socioeconomic status, breastfeeding and Rotavirus vaccination status to Rota in children <5 years in our tertiary care hospital over a period of one year.

Materials Methods

Inclusion criteria: All-out and inpatient cases with watery diarrhea not greater than one week of admission were included in this study.

Exclusion criteria: those children whose parents did not give consent, children with bloody diarrhea, and nosocomial gastroenteritis acquired during a hospital stay for other diseases were excluded from the study.

Materials and Methods

Specimen Collection

Stool specimens (1-2 ml or 1-2 g) were collected at the onset of the symptoms from hospitalized children aged between 2 months-5 years at a tertiary care hospital and data collection with clinical history were recorded for each child about diarrhea, source of drinking water, breastfeeding and socio-economic status. The stool samples were collected in a clean, dry, waterproof container containing no detergents, preservatives, or transport media, and transferred to the laboratory immediately or within 6 hours following collection, and the tests were performed.

After macroscopic and microscopic examination for helminthic ova, and protozoal cyst, all the samples were processed for bacterial aerobic culture and screened for Rota -Adeno rapid test.

VIKIA® ROTA AND ADENO (Biomerieux France) is a qualitative Antigen detection test based on the immunochromatography technique (ICT) was used. It is a rapid test that depends on the association of monoclonal antibodies specific to rotavirus and adenoviruses respectively. This test uses immunological reactions performed on a test strip by migration. Children meeting the inclusion criteria of cases were enrolled for the study and informed consent was obtained by the parent. A questionnaire was used to collect data regarding socioeconomic variables.

The socioeconomic status of viral acute diarrhea cases was analyzed by the kuppaswamy economic scale to observe any association between acute diarrhea and socioeconomic status [14].



Fig 1: Rota v positive stool sample **Fig 2:** Rapid Rota and Adeno Virus antigen detection test

Results and Discussion

180 children less than 5 years with a history of acute gastroenteritis were taken for study. 98 were male children and 82 were female children (Chart 1). 47(26%) samples were tested positive for Rotavirus and 8(0.4%) were positive for adenovirus, 18 (10%) samples were positive for salmonella and shigella bacterial species, 20(11%) were diagnosed with parasitic infection remaining 87 samples had Escherichia coli and other normal gastrointestinal flora, no parasites were found and negative for Rota- adenoviruses (Chart 2).

All Rota-adeno V positive cases were analyzed for type of feeding; a socioeconomic status it was found that children who were breastfed had a lesser incidence of viral diarrhea compared to formula-fed children at <6 months of age. Thus, it supports the fact that exclusive breastfeeding is protective against Rota -Adeno V breast milk contains high levels of anti-Rota virus secretory Ig A and other Rota virus-specific antibodies, particularly in Indian mothers there were more cases of Rota V in > 6 months to 2years as they are on the mixed feed and more activities (Chart 4). 44% of viral gastroenteritis cases were from lower socioeconomic status (Chart 3). 40(72%) were using boiled cooled tap water and others were using reverse osmosis water. Only 60(33.3%) children had been vaccinated against Rotavirus, none from the Rota V positive cases.

43.6% of viral gastroenteritis cases were between October to December (Chart 5).

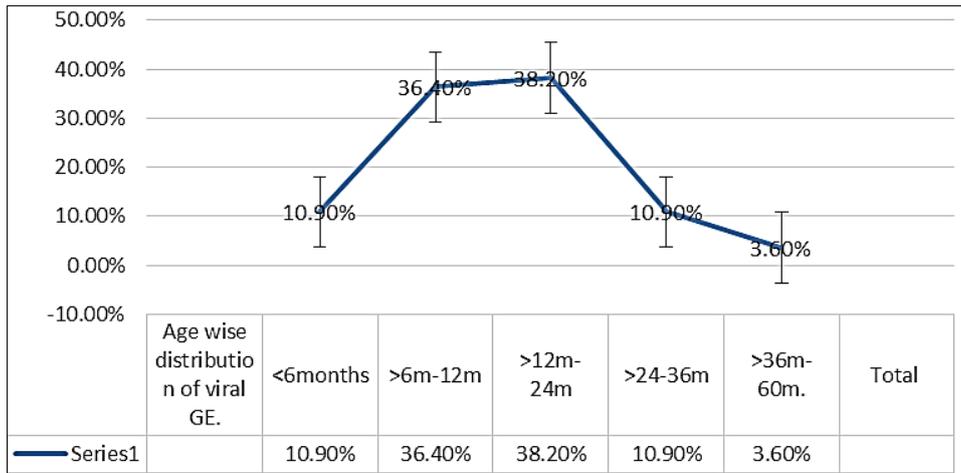


Chart 1: Age-wise distribution of viral GE.

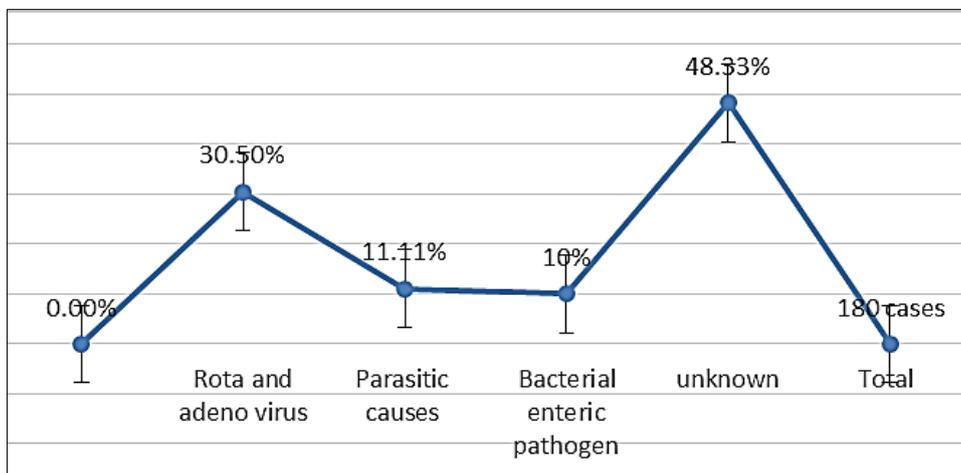


Chart 2: Enteropathogens identified in children suffering from acute diarrhea.

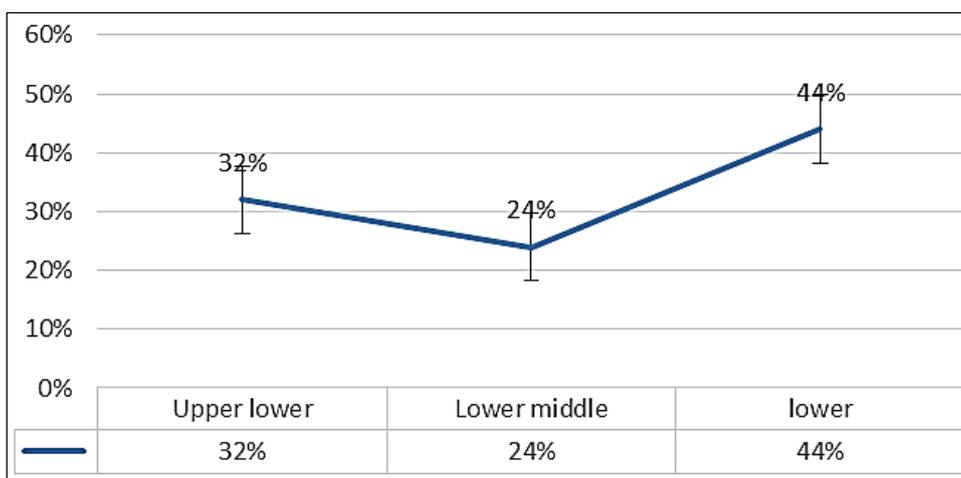


Chart 3: Association between viral GE and socioeconomic status n=55

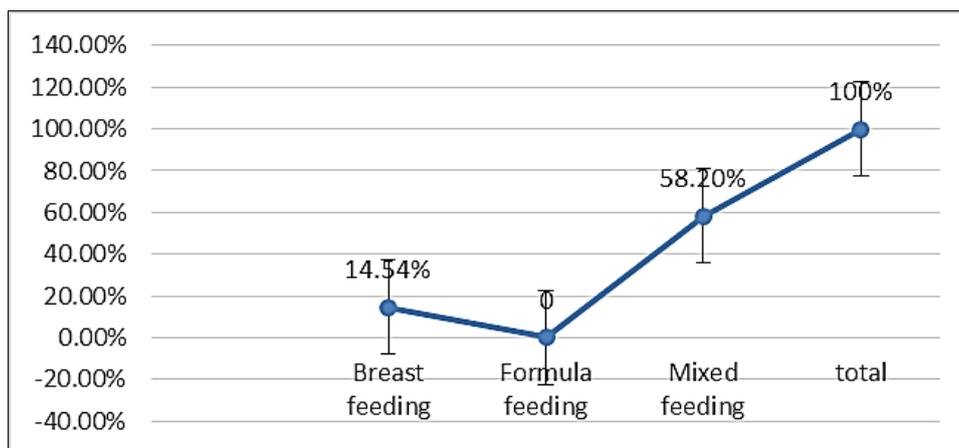


Chart 4: Association between viral GE and type of feeding n=55

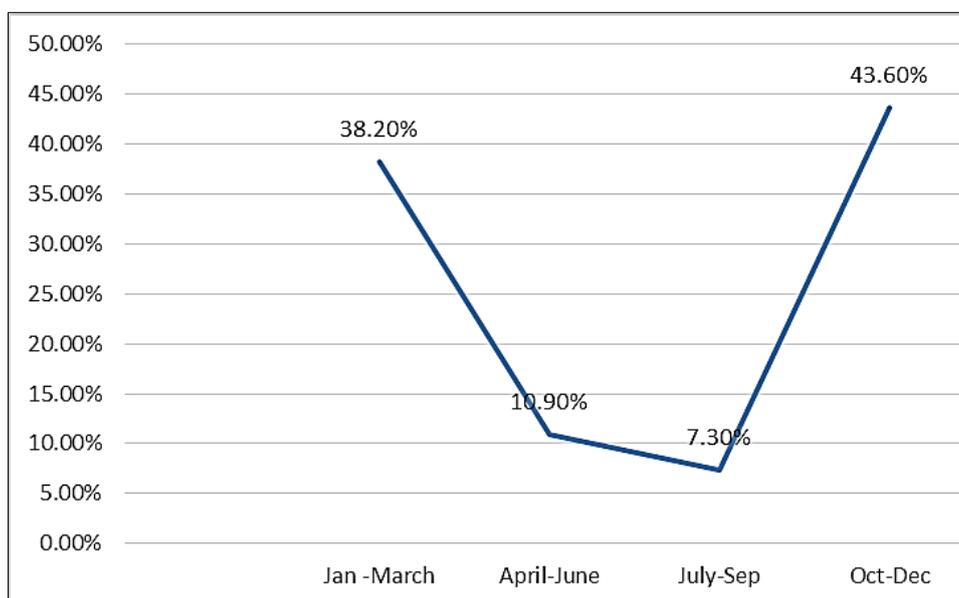


Chart 5: Month-wise distribution of viral GE.

Conclusion

A rapid card Antigen test for Rota and adenovirus will help in the management of cases & can reduce the financial burden of treatment. In this study, viral pathogens were incriminated in 30.5% (55) of patients with diarrhea. 26.1% (47) were attributed to Rotavirus while only 4.4% [8] were positive for Adenovirus. Rota positivity is less in our study compared to Rota positivity in south India [13]. Even though India has introduced the rotavirus vaccine in the Universal Immunization Program, All the positive cases in our study were not vaccinated and were from poor socioeconomic status. More cases from October to December and more cases in the 6 months 24 months of age group. Creating awareness about breastfeeding and good hygiene to prevent the spread of infection, which includes careful hand washing, nappy disposal, preparation and storage of food, drinking water, and availability of oral rehydration solution and vaccination to all is the need of the hour.

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Ethics statement: This article does not contain any studies with human participants or animals performed by any of the authors

References

1. Guidelines for estimating the economic burden of diarrheal disease, with a focus on assessing the costs of rotavirus diarrhea WHO/IVB/05.10)
2. Lancet Bhutta ZA, Das JK, Walker N, *et al.* 2013;381:1487-98.
3. Interventions to address deaths from childhood pneumonia and diarrhea equitable: what works and at what cost? Lancet. 2013;381:1417-29.
4. WHO. Immunization Repository. https://extranet.who.int/immunization_repository/.
5. Kuruvilla S, Schweitzer J, Black RE, Cousins S, Johnson HL, Johnson HL, *et al.*, Global, regional and national causes of child mortality in 2008: a systematic analysis. Lancet. 2010;375:1969-87. DOI: 10.1016/S0140-6736(10)60549-1 pmid: 20466419.
6. Million Death Study Collaborators, Bassani DG, Kumar R, Awasthi S, Morris SK, Paul VK, *et al.*, Causes of neonatal and child mortality in India: a nationally representative mortality survey. Lancet. 2010;376:1853-60. DOI: 10.1016/S0140-6736(10)61461-4 pmid: 21075444.
7. Parashar UD, Burton A, Lanata C, Boschi-Pinto C, Shibuya K, Steele D, *et al.*, Global mortality associated with rotavirus disease among children in 2004. J Infect Dis. 2009;200:S9-15. Doi: 10.1086/605025 pmid: 19817620.
8. Parashar UD, Hummelman EG, Bresee JS, Miller MA, Glass RI. Global illness and deaths caused by rotavirus disease in children. Emerg Infect Dis. 2003;9:565-72. DOI: 10.3201/eid0905.020562 pmid: 12737740.
9. Linhares AC, -Lancet. 2008 Apr;371(9619):1181-9. DOI: 10.1016/S0140-6736(08)60524-3.
10. Efficacy and safety of an oral live attenuated human rotavirus vaccine against rotavirus gastroenteritis during the first 2 years of life in Latin American infants: a randomized, double-blind, placebo-controlled phase III study. Linhares AC(1)
11. Salvadori N, Le Saux; 2010 Canadian Pediatric Society, Infectious Diseases and Immunization Committee Recommendations for the use of rotavirus vaccines in infants <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2952519/>
12. Moon SS, Wang Y, Shane AL, Nguyen T, Ray P, Dennehy P, *et al.* Inhibitory effect of breast milk on infectivity of live oral rotavirus vaccines. Pediatr Infect Dis J. 2010;29:919-23.
13. Human immunity to rotavirus jmm.microbiologyresearch.org/content/journal/jmm/10.1099/00222615-43-6-397
14. Pamela J. Molyneaux Journal of Medical Microbiology, 43, 397-404 DOI: 10.1099/00222615-43-6-397.
15. Clemens J, Rao M, Ahmed F, Ward R, Huda S, Chakraborty J, *et al.* Breast-feeding. Pediatrics Guerrero ML. 1993;92:680-5.
16. Venkatasubramanian S, *et al.*, Rota positivity in south India is 45% between 2005-2009. Interpretation of Rotavirus-positivity Patterns Across India

<https://www.indianpediatrics.net/july2016/july-623-626.htm>

17. Sheik Mohd Saleem S, Shah Sumaya. Modified Kuppaswamy socioeconomic scale updated for the year, 2021. <https://doi.org/10.18231/j.ijfcm.2021.001>.
18. Miner L, Bolding P, Hilbe J, Goldstein M, Hill T, Nisbet R, *et al.* Socioeconomic Status-an overview Science Direct Topics [Internet]. Available from: <https://www.sciencedirect.com/topics/medicine-anddentistry/socioeconomic-status>.
19. Institute of Medicine (US) Committee on Assuring the Health of the Public in the 21st Century. The Future of the Public's Health in the 21st Century. Washington (DC): National Academies Press (US), The Health Care Delivery System, 2002, 5. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK221227/>