ORIGINAL ARTICLE

Prevalence and clinical profile of rotavirus in children ≤ 5 years admitted in a tertiary care Hospital in Western Maharashtra

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Abstract

Background: Diarrhea is the second leading cause of mortality in children less than 5 years. Rotavirus is the commonest pathogen which causes diarrhea in children. As a result of dehydration and its hazardous consequences, it causes various deleterious effects on a child resulting in growth failure and malnutrition and sometimes leading to death. **Aims & Objectives**: To determine the prevalence and elucidate the clinical pattern of rotavirus diarrhea and differentiate it from non-rotavirus diarrhea in children ≤ 5 years hospitalized for acute diarrhea. **Material & Methods**: It was a cross-sectional study carried out between October 2014 and September 2016 on a total of 189 patients admitted for acute diarrhea in a tertiary care hospital. Stool samples were processed for identification of rotavirus antigen by ELISA. Clinical characteristics along with the seasonal variation of the infection were also studied. **Result**: Prevalence of rotavirus in the present study was estimated to be 36.5%. Infection occurred mostly in the age group of 7 – 12 months (46.3%) followed by 1 – 6 months (31.8%). Positive cases had associated clinical features as vomiting (69.5%), fever (55%) and peri-anal redness (33.3%). Maximum no. of rotavirus cases occurred in the winter season (42%). **Conclusion**: Rotavirus diarrhea does not follow a specific clinical pattern and lead to substantial morbidity in the study population.

Keywords

Breastfeeding; Children; Diarrhea; ELISA; Rotavirus

Introduction

Acute diarrhea is a major public health problem amounting for more deaths than AIDS, malaria and measles combined worldwide. (1) Rotavirus has been acknowledged as the foremost cause of gastroenteritis worldwide accounting for nearly 215,000 deaths annually in children below 5 years. According to WHO, India bears the highest burden of rotavirus deaths globally accounting for nearly 47000 (22%) deaths. (2) Rotavirus infection occurs regardless of socioeconomic status and environmental conditions though the outcome differs significantly between developed and

developing countries ascribed to various reasons including awareness and medical facilities. (3) The disease having an incubation period of 1 to 3 days presents with symptoms like fever, diarrhea and vomiting similar to any other gastrointestinal diseases though they tend to be more profound in rotavirus infection. (4, 5) The diagnosis of rotavirus diarrhea is mainly clinical even so some laboratory investigations like enzyme immunoassay and latex agglutination are available for confirmation of the infection. (5) Treatment is supportive with the mainstay of the replacement of fluid and electrolyte losses with early initiation of refeeding. (6) Antivirals have no role in the treatment of the disease; however, immunization with rotavirus vaccine can be an effective strategy to prevent illness.

Aims & Objectives

1. To determine the prevalence and elucidate the clinical pattern of rotavirus diarrhea.
2. To differentiate it from non-rotavirus diarrhea in children ≤ 5 years hospitalized for acute diarrhea.

Material & Methods

The present cross-sectional observational study was carried out in children aged ≤ 5 years admitted for the primary cause of acute diarrhea in the pediatric ward of a tertiary care hospital during October 2014 to September 2016. The study was granted permission by the Institutional Ethical Committee and written informed consent was taken from the parents of the study subjects before carrying out the study.

Inclusion Criteria:

1. Children aged less than or equal to 5 years.
2. All children with the primary diagnosis of acute diarrhea (>3 unformed stools in any 24 hour period of fewer than 7 days duration).
3. Only admitted children were considered in the study.

Exclusion Criteria:

1. Children who visited OPD with complaints of acute diarrhea.
2. Children getting diarrhea during hospital stay admitted for any other cause.
3. Children with blood in stools.
4. Infants from Neonatal Intensive Care Unit.

IMNCI guidelines were followed for the assessment of dehydration. Stool samples were collected within 24 hours of admission to hospital in a sterile container and transported same day to the laboratory for analysis. If the sample was not processed on the same day, it was kept in the refrigerator under zero degrees Celsius. Stools were collected by reverse diaper method.

Reverse diaper method: In this method, children were worn the diaper on the reverse side, which is made up of polyethylene to prevent absorption of watery stools and collect an adequate sample.

The ELISA test was performed by PREMIER® Rotaclone® Rotavirus kit manufactured by Meridian Bioscience®, Inc. which utilizes monoclonal antibodies directed against VP6 antigen. Data was interpreted and analyzed using Microsoft Excel and Fisher's Exact Test using GraphPad InStat® software version 3.06

Results

The study subjects comprised of 189 children in the age group of 0-5 years with mean age of 10.3 (±7.7) months. There were a total of 118(62.4%) males and 71(37.5%) females amongst the study subjects. The distribution of children varied from 47.08% in the age group of 7-12 months to 4.23% in the age group of ≥ 25 months. Results were plotted on the basis of age, sex, month, season, clinical features along with other characteristics.

The present study revealed 36.5% prevalence of rotavirus amongst the study subjects with male predominance in 41 cases (59.4%) and 28 (40.5%) female cases. The subjects found positive for rotavirus had multiple clinical features which majorly included vomiting (69.5%), fever (55.0%) and peri-anal redness (33.3%). A strong statically significant association was observed among the rotavirus positive and negative cases for vomiting while other variables had no significant association. (Table 1) The present study revealed a seasonal variation of rotavirus diarrhea with maximum number of cases during winters (42.0%) while least number of cases during springs (15.9%). (Table 2)

The present study also revealed age wise distribution of the rotavirus positive cases which observed most cases in the age group of 7-12 months (46.3%) age group followed by 1- 6 months (31.8%). The study revealed decreasing trend of rotavirus positive cases with the advancement of age though it is not statistically significant (p=0.89) but shows the increased risk of rotavirus in infants. (Figure1) Rotavirus positive cases (n=69) mostly had some

dehydration (57.9%) followed by no dehydration (27.5%) and severe dehydration (14.4%). (Figure 2)

It was observed that most of the rotavirus positive cases (n = 69) were from lower middle class (46.3%, n= 32) followed by upper lower class (43.4%, n= 30) with least cases from upper class and lower class (1.4%, n = 1). (Figure 3)

Out of 189 enrolled children, 135 were exclusively breastfed up to 6 months and 54 were not exclusively breastfed up to 6 months. When a child was breastfed exclusively till 6 months rotavirus positivity in the stool sample was 31.1%. In a child without breastfeeding, very high incidence i.e. 50% of rotavirus positivity was observed. When the trend was assessed statistically, it was significant comparison. p = 0.01. (Figure 4)

Discussion

We believe the present study to be the first study from Satara District, a semi-urban part of Western Maharashtra to report the prevalence of rotavirus in children hospitalized for acute diarrhea. Rotavirus positivity was 36.5% in our study. Extensive studies have been done on rotavirus across India to estimate its prevalence and characteristics. A study done in Lucknow (7) reported a prevalence of 26% in the hospitalized children whereas Kelkar *et al*. (8) from Pune quoted prevalence of 28.15%. Gagandeep *et al*. (9) in 2009 estimated prevalence as 39% all over India. Sengupta *et al*. (10) observed a prevalence of 89.8% in their study whereas Ghosh, *et al*. (11) of only 4.6%. This exhibits a very high variability of rotavirus infection in children around the globe.

In our study, a slightly higher male preponderance was observed (M: F = 1.6:1). Sengupta *et al*. (10) observed 1.9:1 M: F ratio and Samantray *et al*. (12) observed M: F ratio of 1.3:1 which are comparable to our study. The reason may be increased vulnerability of male children to infection or higher probability of them being escorted to medical supervision due to gender partiality. Rotavirus positivity was, however, similar in both the groups (34.7% and 39.4% in males and females respectively) and p value was not significant. Vomiting was the most common symptom associated with rotavirus positive cases followed by fever and peri-anal redness in respective order. In our study, 69.5% of rotavirus positive children had complained of vomiting. A study done by Singh *et al*. (13) shows 72.1% cases of rotavirus with complain of vomiting. Even though a triad of fever, diarrhea and vomiting were observed in many children, we could not identify any particular pattern to distinguish them from other causes of gastroenteritis clinically. When immunization status was compared between rotavirus positive and rotavirus negative group there was no significant association i.e. p = 0.26. The occurrence of rotavirus diarrhea in spite giving the full course of immunization with rotavirus vaccine needs to be evaluated in future studies. The percentage of rotavirus immunization was only 7.4% which might be accredited to the high cost of vaccine making it non-affordable to a wider section of society.

Although admissions for diarrhea occurred round the year but as presumed we recognized a definite peak in winter (42%) i.e. November to January. Gagandeep *et al*. (9) noticed peak during January and December. Similar results were seen in the study done by Sengupta *et al*. (10), Ashwin Borade *et al*. in Pune (14) and Panikar *et al*. (15). The mean age of children came out to be 10.3 (±7.7) months. Kang, *et al*. (16) quoted a mean age of 12.9(±9) months in their study. The frequency of rotavirus positive cases was most in the children below 1 year of age (78.1%). Srivastava S, *et al*. (7) observed 86.1% rotavirus positive cases below 1 year. Out of 69 positive cases, the highest number of rotavirus positive cases was in the age group 7-12 months (46.3%). Saravanan, *et al*. (17) and Ballal, *et al*. (18) quoted 62.5% and 65% respectively in the age group 7-12 months. Children may have increased chance of getting infected with rotavirus after 6 months of age when introduced to top feeding due to the weaning effect of maternal antibodies in breast milk and although infants are frequently brought with diarrhea, they tend to have milder illness compared to their older counterparts. (19) According to WHO scientific study, (20) dehydration is common in rotavirus infection. We reported maximum no. of rotavirus cases with some dehydration (57.9%) followed by no dehydration (27.5%) and severe dehydration (14.4%). So, a total of 72.3% (n=50) children with rotavirus antigen in their stool had dehydration. Singh *et al*. (18) found dehydration in 88.5% patients. Interestingly, severe dehydration was present in the least no. of cases for which the basis may be the early admission of the child before signs of severe dehydration appear along with increased awareness of Oral Rehydration Therapy among the parents. As with area, infections are considered to occur more in lower class compared to upper class because of various factors like less hygiene and illiteracy. Classes were divided

on the basis of modified Kuppuswamy classification and tables were plotted. Most of the cases out of the 69 rotavirus positive children were from the lower middle class and upper lower class (46.3% and 43.4% respectively). Both lower and upper class had only 1 case each representing only 1.4% of cases. It signifies that children from both classes have equal vulnerability to get infected by rotaviral diarrhea. Researchers have noted that rotavirus is resilient and highly contagious and, therefore, improvements in water and sanitation are unlikely to be effective preventive measures of rotavirus disease, supporting the advocacy for mass vaccination programs. (21)

Breast feeding has innumerable benefits to a child. It protects a child against various infections and diseases. It is believed that breast feeding can significantly protect a child against rotavirus infection. Various studies have documented the protective efficacy of breast feeding against rotavirus diarrhea. A prospective study in Egypt showed a lower incidence of rotavirus diarrhea in infants fed on breast milk (22) and others have shown evidence that breastfeeding offers protection against severe rotavirus infections only. (23) Some prospective studies have found that breastfed infants manifested a milder rotavirus disease. (22) In our study, rotavirus positivity was very high in children who were not exclusively breast-fed (50%) compared to children who were exclusively breastfed (31.1%). The relation was also significant statistically ($p = 0.01$) supporting the protective efficacy of breastfeeding.

Conclusion

Rotavirus frequently cause diarrhea in children below 5 years with a peak in the winter season. In our study, rotavirus diarrhea occurred more frequently in lower middle socioeconomic class however no difference was found related to clinical presentation among the rotavirus and non-rotavirus group. Breastfeeding was found to be protective for rotavirus infection.

Recommendation

National programs concerning advantages of breastfeeding and increase awareness in the community may help in diminishing the disease load. Commencement of rotavirus vaccine into the national immunization program would be an effective way to decrease the enormous morbidity and mortality caused by rotavirus in Indian children.

Limitation of the study

There may be a larger population of children suffering from diarrhea in the general public who do not present to medical centre for treatment due to financial constraints which were not considered in the study and also infants were excluded from the study admitted in NICU as there is no standard definition for diarrhea in neonates.

Relevance of the study

The study will help in accessing the rotavirus burden and its consequences on the health along with its financial implication on the society

Authors Contribution

CDA: Concept design, final approval of draft version; AG: Acquisition and interpretation of data, drafting of manuscript; GSK: Sampling, interpretation of results; LM & PK: Critical revision and drafting of manuscript.

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Tables

TABLE 1 VARIABLES OF CHILDREN WITH ROTAVIRAL AND NON – ROTAVIRAL DIARRHEA

VARIABLE		TOTAL n = 189	ROTA +VE n = 69	ROTA –VE n = 120	p VALUE
SEX	MALE	118	41(34.7%)	77(65.2%)	0.53
	FEMALE	71	28(39.4%)	43(60.5%)	
FEVER		89	38(42.6%)	51(57.3%)	0.09
VOMITING		109	48(44.0%)	61(55.9%)	0.01
PERI-ANAL REDNESS		48	23(47.9%)	25(52.0%)	0.08
IMMUNIZATION		14	3(21.4%)	11(78.5%)	0.26

TABLE 2 DISTRIBUTION OF PATIENTS WITH RESPECT TO SEASON

MONTHS	SEASON	TOTAL n = 189	ROTA +VE n = 69	ROTA –VE n = 120	p VALUE
NOV-JAN	WINTER	66	29(43.9%)	37(56%)	0.3
FEB-APR	AUTUMN	49	17(34.6%)	32(65.3%)	
MAY-JULY	SUMMER	45	12(26.6%)	33(73.3%)	
AUG-OCT	SPRING	29	11(37.9%)	18(62%)	

Figures

FIGURE 1 DISTRIBUTION OF PATIENTS WITH RESPECT TO AGE (MONTHS)

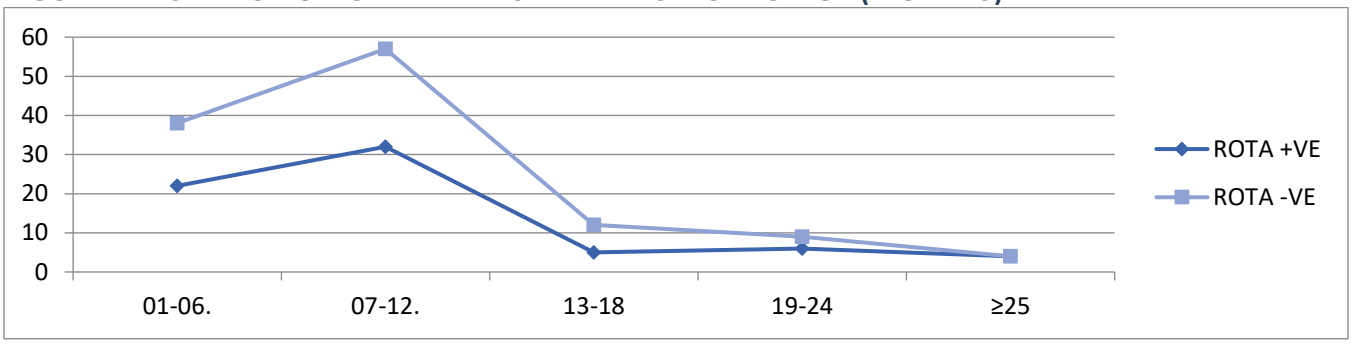

FIGURE 2 DISTRIBUTION OF PATIENTS WITH RESPECT TO DEGREE OF DEHYDRATION (IMNCI)

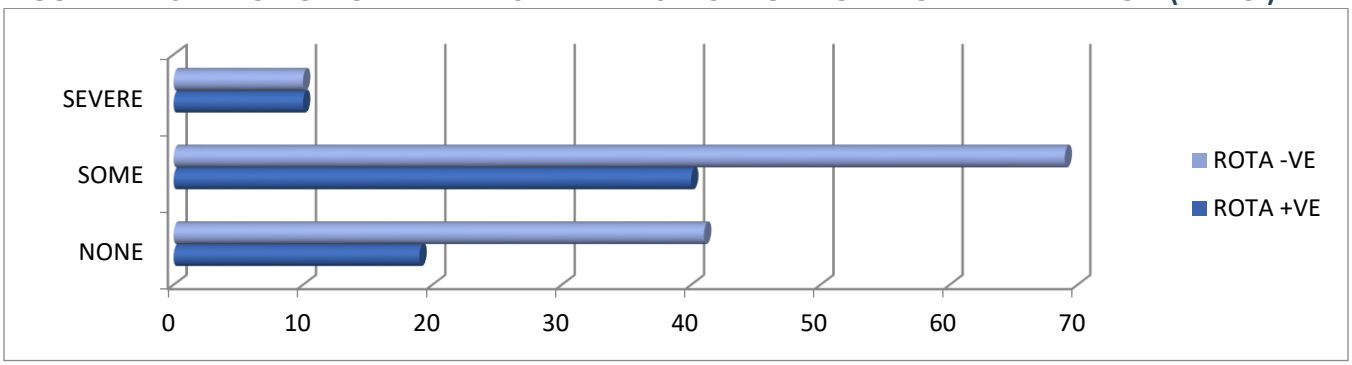

FIGURE 3 DISTRIBUTION OF PATIENTS WITH RESPECT TO SOCIOECONOMIC STATUS

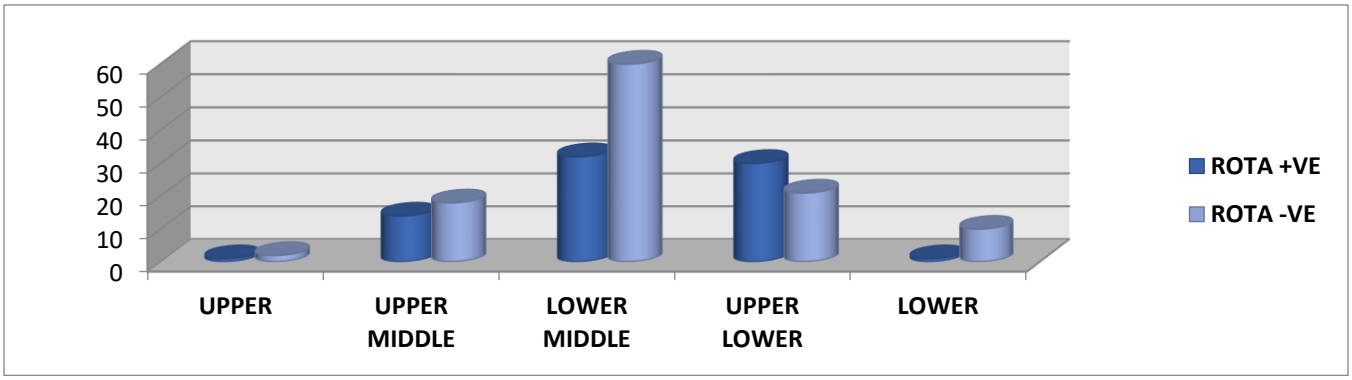

FIGURE 4 DISTRIBUTION OF PATIENTS WITH RESPECT TO EXCLUSIVE BREASTFEEDING