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# Rota virus Diarrhea in Hospitalized Children

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## ABSTRACT

**Objective:** To determine the frequency and clinical features of Rota virus diarrhea in children presenting in a tertiary care hospital.

**Study Design:** A cross-sectional, observational study.

**Place and Duration of Study:** National Institute of Child Health, Karachi, from January to June 2007.

**Methodology:** A total of three hundred children of either gender aged 1 month to 5 years, who presented with diarrhea of < 7 days as a primary illness were enrolled. Children with bloody diarrhea or nosocomial gastroenteritis acquired during hospitalization for other disease were not included. Detection of Rota virus in stool was done by enzyme linked immunoassay.

**Results:** Out of 300 children, 188 (63%) tested positive and 112 (37%) tested negative for Rota virus. Positive Rota virus cases in 7 – 12 months of age was (n = 34, 18.08%). Overall, 151 (80.3%) children with Rota virus were less than 3 years old. 182 (60.7%) had fever, 118 (39.3%) had vomiting and 156 (82.9%) children had both fever and vomiting.

**Conclusion:** This study shows that Rota virus is a common organism causing diarrhea in children less than 3 years of age. There is a need to incorporate Rota virus vaccine in the national EPI program to decrease the disease burden as highlighted in this study.

**Key Words:** Diarrhea. Dehydration. Rota virus.

## INTRODUCTION

Rota virus is the most important etiological agent of acquired diarrhea in infants and young children and is a vaccine preventable disease, is considered to be most common pathogen responsible for causing severe diarrhea and dehydration in children less than 5 years of age. According to WHO estimates in 2004 over five million children aged < 5 years died from Rota virus infection. About half of these deaths occurred in India, Nigeria, the Democratic Republic of the Congo, Ethiopia, China and Pakistan.<sup>1</sup> Recent estimates show that about 65,000 children die each year in the Eastern Mediterranean Region (EMR) which also includes Pakistan. Although the mortality is higher in the low-income countries of the region, the burden of severe Rota virus disease among less than 5 years old children requiring hospitalization and clinical visits is equally shared by all the countries of the region.<sup>2</sup>

Rota virus infection results in a large number of hospitalizations, costs and mortalities.<sup>3,4</sup> The global and national estimates from WHO state that the proportions of hospitalizations due to Rota virus diarrhea ranged from 16% to 66% with a median proportion of 38% (inter-

quartile range, 26% – 43%).<sup>5</sup> Pakistan has a population of more than 17 million, of which 43% are children. WHO estimates show that the mortality due to Rota virus in children less than 5 years is 95/100,000 in under five populations.<sup>1</sup>

In 1998, the US Food and Drug Administration approved a live virus vaccine (Rota Shield) for use in children but it was linked to an increased risk for intussusception. Because the immune response to the infection reduces the occurrence and severity of subsequent infections, diarrhea due to Rota virus may be controlled through vaccination.<sup>6</sup> Rota virus illness typically begins with the sudden onset of diarrhea and vomiting. The diarrhea is usually watery and rarely has blood in it. Fever may be present in most of the patients.

The purpose of this study was to determine the frequency of Rota virus in children hospitalized with diarrhea lasting for less than 7 days.

## METHODOLOGY

It was a cross-sectional, observational study conducted at Diarrhea Treatment Unit, National Institute of Child Health, Karachi, from January to June 2007. Three hundred patients of either sex from 1 month to 5 years with symptoms of acute gastroenteritis of less than 7 days were included in the study. Children with bloody diarrhea and those who acquired gastroenteritis during hospitalization for treatment of other disease were excluded. Written consent was taken from parents/caregiver after explaining the purpose of study. No charges were demanded from the caregiver for the overall treatment. As it was not an interventional study

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approval from ethical committee of the institute was not sought.

Stool samples were collected as soon as possible within 24 – 48 hours to avoid nosocomial infection. Stool containers were labeled with the unique patient identifier. One spoon full of diarrhea stool recently voided in diaper was transferred into the labeled container with the spoon provided in container. Stool specimens with the request and feedback form were sent to hospital laboratory. Short-term storage was done at 2 – 80°C in the laboratory for detection of Rota virus by EIA (enzyme linked immunoassay) within 20 minutes of collection. Reagent used was DAKO IDEIA present in Rota virus EIA detection kit that contains a positive control and a negative control which were performed with each assay to ensure that kit reagents were used; the positive control was deep blue and easily distinguished from the negative control. The negative control was colourless or faint blue.

For the purpose of the study, diarrhea was defined as the acute occurrence (symptoms of onset less than 7 days) of at least 3 looser than normal or watery stools in a 24 hours period; vomiting was defined as two or more episodes of vomiting un-explained by other reasons. Dehydration was categorized into no dehydration (not enough signs to classify as some or severe dehydration), some dehydration (two or more of the following signs: (a) restless, irritable, (b) sunken eyes, (c) drinks eagerly, thirsty and (d) skin pinch goes back slowly) and severe dehydration (two or more of the following signs: a. lethargic or unconscious, (b) sunken eyes, (c) not able to drink or drink poorly and (d) skin pinch goes back very slowly).

Data was entered and analyzed in Statistical Package for Social Sciences (SPSS) version 10. Frequencies and percentages were calculated for all qualitative/ categorical variables including gender, age groups, symptoms, number of vomiting, duration of symptoms and result of Rota virus detection (positive or negative). Mean and standard deviation was computed for age. Chi-square test was used to see the association of age groups and gender with Rota virus (positive or negative), at 5% level of significance.

### RESULTS

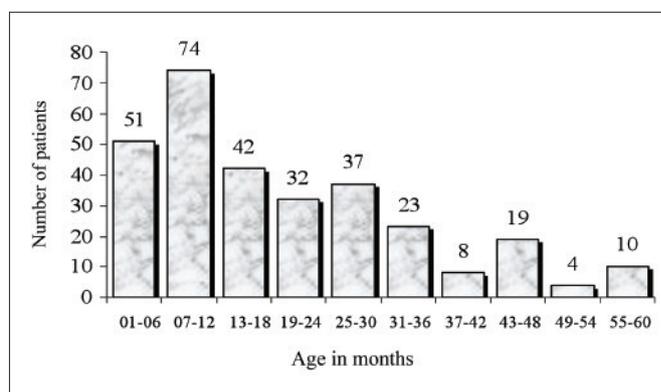
A total of 300 children admitted with complaint of acute watery diarrhea were evaluated. Out of 300 children, 180 (60%) were males and 120 (40%) females (M: F ratio = 1.5: 1). The mean age of children was 20.56 (SD ± 15.14) months and age range was 1 - 60 months. The highest frequency of symptoms was observed in 74 (24.6%) children who were between 7 - 12 months of age, 51 (17%) children were between 1 - 6 months. A total of 177 (59%) children had symptoms for 1 - 3 days, and 123 (41%) children had symptoms from 4 - 6 days.

Fever was seen in 182 (60.7%) children and vomiting in 118 (39.3%). Out of 118 children who presented with vomiting, 70 (59.3%) had 5 - 7 episodes of vomiting, 37 (31.3%) children had 2 - 4 episodes while 11 (9.3%) children had 8 - 9 episodes of vomiting. A total of 195 (65%) children had diarrhea for 1 - 3 days and 104 (34.7%) children had diarrhea for 4 - 6 days and only one child continued to have diarrhea for 7 - 9 days. About 8 - 11 episodes of diarrhea per day were seen in 181 (60.3%) children, 12 - 15 episodes per day in 68 (22.7%) children and 4 - 7 episodes per day in 51 (17%) children.

Rota virus was positive in 188 (63%) children that was significantly high proportion as compared with 112 (37%) children who were found to be negative for Rota virus ( $p < 0.001$ ). The highest frequency of Rota virus positive cases (34, 18.08%) was observed in children between 7 - 12 months of age. The frequency of Rota virus disease in children of other age groups was found to be 15.4% (n=29) between ages of 1 - 6 months, 10.1% (n=19) cases each between ages of 13 - 18 months and 19 - 24 months, 15.9% (n=30%) cases between ages of 25 - 30 months and 10.6% (n=20) cases between ages of 31 - 36 months. A total of 151 (80.31%) children with Rota virus were under 3 years of age. A significant association was seen between age and Rota virus ( $p < 0.001$ ). Rota virus was detected more frequently in

**Table I:** Distribution of Rota virus according to age groups (n=300).

Age group (in months)	Rota virus		Number of patients
	Negative	Positive	
01-06 months	22	29	51
07-12 months	40	34	74
13-18 months	23	19	42
19-24 months	13	19	32
25-30 months	7	30	37
31-36 months	3	20	23
37-42 months	1	7	8
43-48 months	3	16	19
49-54 months	0	4	4
55-60 months	0	10	10
Total	112	188	300



**Figure 1:** Age distribution (n = 300). Mean ± SD = 20.56 ± 15.14 months, range = 1 - 60 months.

males 116 (61.7%) than in females 72 (38.3%) although association between gender and Rota virus was not significant (p = 0.436).

Significant association was found between clinical features of diarrhea and Rota virus (p < 0.001). Rota virus was detected more frequently in children presenting with fever ( n = 105) 57.7% out of 182 febrile cases.

**Table II:** Duration of diarrhea in days (n = 300).

Duration in days	Number of patients (%)
1 - 3	195 (65)
4 - 6	104 (34.7)
7 - 9	1 (0.3)

**Table III:** Episodes of vomiting and diarrhea per 24 hours.

Number of vomiting per 24 hours	Number of patients n (%)	Diarrheal episodes per 24 hours	Number of patients n (%)
2 - 4	37 (31.3)	04 - 07	51 (17)
5 - 7	70 (59.3)	08 - 11	181 (60.3)
8 - 10	11 (9.3)	12 -15	68 (22.7)
Total episodes of vomiting 118		Total episodes of diarrhea 300	

**Table IV:** Association of clinical features of diarrhea with Rota virus (n = 300).

Patients	Vomiting		Fever	
	Present	Absent	Present	Absent
Rota virus +ve n=188	51(27.1%)	137 (72.8%)	105 (55.8%)	83 (44.1%)
Rota virus -ve n=112	67 (59.8%)	45 (40.1%)	77 (68.7%)	35 (31.2%)
P-value	< 0.001		0.027	

## DISCUSSION

Rota viruses are the main pathogens responsible for diarrheal disease worldwide especially in developing countries. They result in a large number of hospitalizations, costs and mortalities. Each year, Rota viruses cause approximately 111 million episodes of gastroenteritis in children, which result in 25 million visits to clinic, 2 million hospitalizations and 3,52,000 to 5,92,000 deaths. Virtually, all children become infected with Rota virus in the first 3 - 5 years of life, but severe diarrhea and dehydration occur primarily among children aged 3-35 months. On a worldwide basis, nearly every child experiences Rota virus gastroenteritis by 5 years of age.<sup>7</sup>

A study conducted in Karachi showed Rota virus incidence to be 12.3% in 1990 and 24.4% in 1991.<sup>8</sup> Children between the age group of 6 - 24 months were more commonly affected by Rota virus infection. A study in Washington DC found that most children have developed Rota virus antibodies by age of 2 years, which helps to explain the observed decreased incidence in later childhood.<sup>9</sup>

Rota virus has an incubation period of 2 - 3 days. Illness typically begins with the sudden onset of diarrhea and vomiting. Fluid loss from diarrhea and vomiting are sometimes severe enough to cause dehydration. Fever is present in most patients. There is no significant difference in clinical presentations of patients with Rota virus and without Rota virus diarrhea.

Dual or mixed infection with human Rota virus and other enteropathogens, namely *E-coli*, *Giardia lamblia* and *Entamoeba histolytica* were found in 15% of children in a study done in South Africa.<sup>10</sup> Such mixed infections tend to prolong the duration of diarrhea.<sup>11</sup> Since bacteriological studies were not performed, the bacterial etiology of diarrheal episodes cannot be commented upon.

No test was performed for the identification of specific Rota virus serotypes, but group-A Rota viruses are the single most important cause of severe acute diarrhea in young children throughout the world.<sup>12</sup> It is a cause of significant morbidity and mortality among children younger than 5 years of age in India. Of the approximately 600,000 deaths annually due to Rota virus worldwide, more than 1, 50,000 occur in India.<sup>13,14</sup>

About 20 – 30% cases of diarrhea are due to Rota viruses,<sup>15,16</sup> making the development and testing of an effective Rota virus vaccine a necessity. World Health Organization recommends that national immunization programs of all countries should include Rota virus vaccine. Results from developed countries where this has been done have shown significant reductions in the burden of severe childhood diarrhea. Clinical trials in the developing world are needed to look at the benefits of Rota virus vaccination in developing countries where vaccines are likely to have their greatest impact.<sup>17</sup>

An important limitation of this study is that it was done on in-patient children presenting with diarrhea. In order to have current estimates on Rota virus both community and hospital based studies are required. Thus, the need for a national level registry for Rota virus need to be maintained and the Rota virus vaccine should be added to the national immunization programme as a primary prevention against this preventable form of diarrheal disease.

## CONCLUSION

The study has shown that Rota virus is a common cause of diarrhea in children younger than 5 years of age. Rota virus was found in 63% (188/300) of diarrheal cases. About 80% of the Rota virus infection was found in children less than 3 years of age, whereas it was 18% in the infant age group.

**Disclosure:** It is a dissertation based article.

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