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Original Research Article

Prevalence and Seasonal distribution of Rotavirus Diarrhea in hospitalized children less than 5 year old in South Rajasthan

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Abstract

Objectives: To estimate the prevalence and seasonal distribution of Rotavirus diarrhea in hospitalized children less than 5 years in South Rajasthan.

Design: Cross-sectional study.

Setting: Bal-Chikitsalaya, RNT Medical College, Udaipur, Rajasthan.

Methods: Hospitalized children less than 5 years admitted for acute diarrhea were examined and standardized proforma was used to collect the demographic and clinical profile of the children. Severity of the illness was classified as per *Vesikari scoring* system and the dehydration was treated as per WHO protocol. Stool samples were collected and tested for gross appearance, routine microscopy, pH, reducing sugar and *Rotaviral antigen* by a commercial enzyme Immunoassay kit (SD BIOLINE KIT).

Results: Out of 300 children, 94(31.33%) were positive for Rotavirus. The prevalence of Rotaviral diarrhea in children was as follows: <6 months-14.8%, 6-12 months- 45.7%, 12-24 months- 38.3% and >24 months- 0.01%. Rotaviral diarrhea was more common during Winter and Spring months (September to April) 91.4%, with highest prevalence in the months of November (52%), December (68%) and January (56%). Rotavirus negative diarrhea had high prevalence (62.6%) during summer and monsoon months (March-August). Out of 94 rotavirus positive children, 6 cases (6.38%) had no dehydration, 55(58.51%) had some dehydration and 33 (35.10%) had severe dehydration. Among the Rotavirus positive children, vomiting was present in 70 (74.46%) children and fever in 52 (55.31%) children.

Conclusions: The prevalence of Rotaviral diarrhea in children less than 5 years in southern Rajasthan is high and it is more common during Winter and Spring seasons of the year**.**

Keywords: Rotavirus diarrhea, South Rajasthan

1.Introduction

The World Health Organization (WHO) and UNICEF estimate that almost 2.5 billion episodes of diarrhea occur annually in children <5 year of age in developing countries, with more than 80% of the episodes occurring in Africa and South Asia, 46% and 38%, respectively[1]. In India diarrhea is the third leading killer of children, responsible for 13% of all deaths in children below 5 years of age and kills an estimated 300,000 children in India each year[2]. Rotavirus infection is responsible for 40% of childhood diarrhea hospitalization and 527,000 deaths annually or 29% of all deaths due to diarrhea among children <5 year of age globally[3][4]. In India, Rotavirus causes approximately 39% of childhood diarrhea hospitalization and approximately 1.13 lac deaths annually in children < 5 years of age[3]. Data on rotavirus disease burden are needed across India to support credible, evidence-based decisions regarding any intervention. There is a lack of nationally representative data on the incidence of severe rotavirus disease in India[5]. No studies on Rotavirus diarrheal disorders from Rajasthan could

be searched in the literature and hence, this study was done to estimate the prevalence and seasonal distribution of Rotaviral diarrhea.

2. Methods

This was a hospital based observational study conducted in Bal-chikitsalaya, M B Hospital, Rabindranath Tagore Medical College, Udaipur, Rajasthan.

Children <5 years who presented to the hospital with acute watery diarrhea and required hospitalization were enrolled after informed consent was obtained from the parent or guardian. The study was conducted over a period of 12 months between January 1, 2013 and December 31, 2013.

2.1 Sample Size: 21

Sample size has been calculated using this formula

$$n = \frac{Z^2 P(1-P)}{d^2}$$

Where n=sample size,

Z = Z statistic for a level of confidence,

P = expected prevalence or proportion (in proportion of one)

d = precision (in proportion of one)

1.98 × 1.980 × 0.23(1-0.23)/0.05 × 0.05 = 277

Expecting the prevalence of rotavirus in acute diarrheal cases to be 23.5% (10) accepting 5% of allowable error and Z=1.98 for 95 % confidence interval. Sample size in the present study has been calculated to be approximately 300**.**

First hospitalized child for acute diarrhea on each day, for first 25 days of a month were included in the study to complete the target sample size of 300 and, if because of any reason, a child could not be enrolled on any day, it would be enrolled the following day.

A case of diarrhea was defined as increased stool frequency or change in the consistency of stool, compared with the usual pattern in a child less than 5 years. The indications for hospitalization were (i) severe dehydration requiring intravenous hydration, (ii) malnourished children with dehydration, (iii) toxic appearance, changing mental status or seizure, (iv) fever >38.5°C for infants <6 months, (v) high output diarrhea, >10 large volume stools per day, (vi) poor oral intake or persistent vomiting and, (vii) suboptimal or no response to ORT[6][7].

Hospitalized children <5 years of age admitted with acute diarrhea were examined by trained medical staff. The child's parent or guardian was interviewed concerning date of onset of diarrhea and associated symptoms like vomiting and fever. Information was collected on the duration and frequency of diarrhea, duration and frequency of vomiting, degree of fever, presence and severity of dehydration, and treatment. Detailed examination was done, dehydration was classified and treated as per WHO protocol and severity of illness was classified as per Vesikari scoring system for diarrheal illness[8].

Stool was collected in a sterile screw- top container during acute illness, preferably on the day of presentation to hospital. All collected stool samples were labelled with information that included a unique identification number and the date of collection. Then samples were tested for gross appearance, routine microscopy, ph, reducing sugar and Rotaviral antigen by a commercial enzyme immunoassay kit (SD BIOLINE KIT). Enzyme immunoassay has a sensitivity of 96%, 99% specificity, 98% of positive predictive value and 98% of negative predictive value[9].

2.2 Data management and statistical analysis

All statistical analysis were performed using SPSS (Statistical Package for Social Sciences) software (SPSS version 17; SPSS Inc, Chicago, IL). Chi square test was applied. P <0.05, <0.01 and <0.005 were considered as statistically significant, very significant and highly significant respectively.

3. Results

A total of 300 children were included in the study, of which, maximum number of children were in the age group of 4-24 months (256, 85.33%), only 25(8.33%) of the children were less than 3 months and 19(6.33%) were above 2 years of age.

Out of 300 children tested, 94(31.33%) were positive for Rotavirus. The prevalence of Rotaviral diarrhea in children was as follows, <6 months- 14.8%, 6-12 months- 45.7%, 12-24 months- 38.3% and >24 months- 0.01%. (Table no 1)

Rotaviral diarrhea was more common during winter and Spring months (September to April) 91.4%, with highest prevalence in the months of November (52%), December (68%) and January (56%). Rotaviral negative diarrhea had high prevalence (62.6%) during summer and monsoon months (March-August). (Figure no 1)

Out of the 94 Rotavirus positive children, vomiting was present in 70 (74.46%) children and fever in 52 (55.31%) children and, Among the 206 rotavirus negative patients, vomiting was present in 73(35.43%) children and fever was present in 96(46.60%) children. (Table no 2).

Out of 94 rotavirus positive children, 6 cases (6.38%) had no dehydration, 55(58.51%) had some dehydration and 33(35.10%) had severe dehydration. Severe dehydration was more common in rotavirus diarrhea than in rotavirus negative diarrhea and this correlation was statistically significant (p value <0.05.) (Table no 3).

Among the rotavirus positive children, diarrhea was controlled within 7 days in 88.29% of children, vomiting within 3 days in 98.57% and fever within 3 days in 94.23% of children. (Table no 4)

Table 1: Distribution of the acute diarrhea cases and rotavirus positivity according to age

Age group of children (months)	Rotavirus status of children		Total
	Positive	Negative	
1-3	4	21	25
4-6	10	25	35
7-9	14	29	43
10-12	29	34	63
13-15	21	28	49
16-18	9	28	37
19-24	6	23	29
25-36	1	8	9
37-48	0	6	6
49-59	0	4	4
Total	94	206	300

P value <0.05, χ^2 *=20.882*

Figure 1: Seasonal variation of rotavirus positive and rotavirus negative diarrhea children

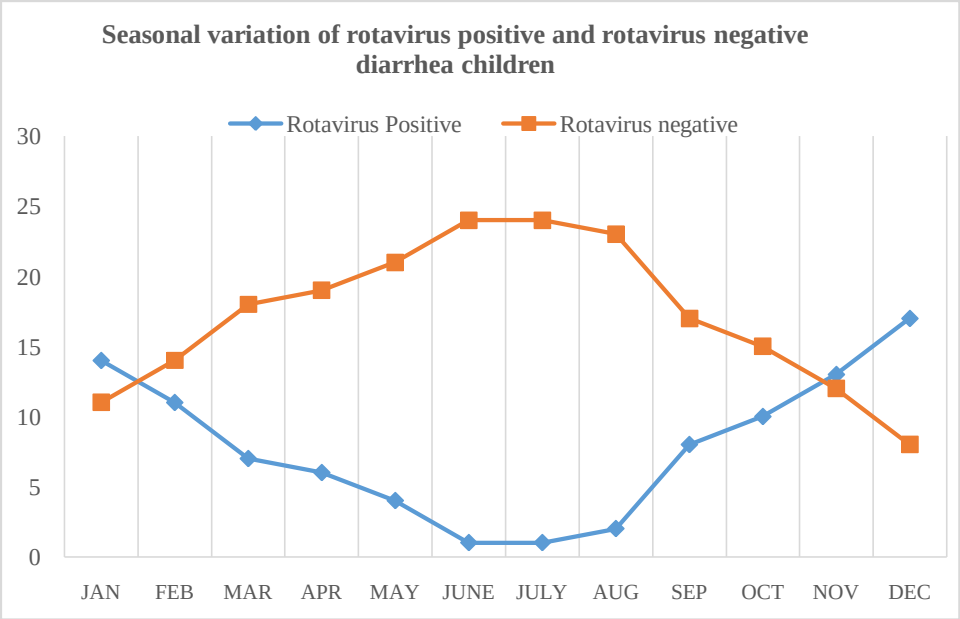

Table 2: Clinical profile of patients of rotavirus positive diarrhea

Clinical profile	No. of patients
Duration of illness before hospitalization	
Diarrhea	**94**
<6 hours	6 (6.38%)
6-24 hours	12(12.76%)
1-3 days	59 (62.76%)
3-7 days	17 (18.08%)
Vomiting	**70 (74.46 %)**
<6 hours	4 (5.71%)
6-<24 hours	21(30%)
1-3 days	43 (61.42%)
3-7 days	2 (2.85%)
Fever	**52 (55.31%)**
<1 day	11 (21.15%)
1-3 days	36 (69.23%)
>3 days	5 (9.61%)

Table 3: Distribution of acute diarrhoea and rotavirus Positivity in relation to degree of dehydration

Degree of dehydration	Rotavirus status(n=300)		Total
	Positive	Negative	
No	6(6.38%)	15(7.28%)	21(7%)
Some	55(58.51%)	152(73.78%)	207(69%)
Severe	33(35.10%)	39(18.93%)	72(24%)
Total	94	206	300

P value= <0.05, χ^2 value=7.768

Table 4: Clinical outcome of rotaviral diarrhoea patients

Time interval for control of diarrhea	No of patients
<1 day	2 (2.12%)
1-3 days	19 (20.21%)
3-7 days	62 (65.95%)
>7 days	11(11.70%)
Time interval for control of vomiting	
<1 day	53 (75.71%)
1-3 day	16 (22.85%)
>3 days	1 (1.42%)
Time interval for control of fever	
<1 day	10 (19.23%)
1-3 days	39 (75%)
>3 days	3 (5.76%)

4. Discussion

This study was done to assess the prevalence and seasonal distribution of Rotaviral diarrhea in Rajasthan, as there in no data available till date. In this study Rotavirus was positive in 31.33% of diarrhea related hospital admissions in South Rajasthan, which correlates very well with other studies conducted in India. Bahl *et al*[10] reported 23.5% positivity, Banerjee *et al*[11] reported 27.4% positivity, and Ramani and Kang[12] reported 20-35% positivity. Comparatively, lower prevalence rates of rotavirus diarrhea had been reported in India from Bangalore (16.3%)[13], Calcutta (14.6%)[14], and Chandigarh (15.9%)[15]**;** because they used different method of detection (latex slide agglutination test which is less sensitive to ELISA) of rotavirus antigen from stool, as well as because of difference in climate and socio demographic status.

Rotavirus diarrhea occurs at an early age in children in developing countries than in children in developed countries. The median age of children hospitalized with rotavirus diarrhea in developing countries is 6-9 months, and 80% of the children are less than 1 year old[16]. In contrast, the median age in developed countries is 13-16 months and the highest proportion of cases occur in second year of life[17].

In this study, maximum Rotavirus positivity was found in the age group of 4-18 months (88.29%, p value<0.05) (Table 1), which correlates well with numerous studies conducted in India. Dutta *et al*[18] revealed that rotavirus was most frequently detected in the age group of 6-11 months (26.6%), and was not detected at all above 24 months of age. Nath *et al*[19] demonstrated that the overall prevalence of rotavirus diarrhea was significantly higher in children below 2 year as compared to those between 2-5 years of age. Phukan *et al*[20] showed rotavirus diarrhea was significantly high in children between 11 to 20 months (37.75%).

In this study, Rotaviral diarrhea was more common during winter and Spring months (September to April) 91.4%, with highest prevalence in the months of November (52%), December (68%) and January (56%). Rotaviral negative diarrhea had high prevalence (62.6%) during summer and monsoon months (March-August). Bahl *et al*[10], Nath *et al* [19] and Phukan *et al*[20] reported similar observation as in this study with peaks during winter months.

The strengths of this study include use of the WHO protocol for diagnosis and management of diarrhea and laboratory confirmation of Rotavirus diarrhea. Potential limitations are the small study population and the lack of ability to extrapolate disease burden to milder disease, as this was a hospital-based study.

In conclusion, this study highlights that rotavirus diarrhea accounts for a large proportion of diarrheal disease in hospitalized children less than 5 years in South Rajasthan and it is more prevalent during winter and spring months of the year.

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