Rotavirus Infection as Cause of Diarrhoea in Under-3-Years Children at Siddhartha Medical College, Vijayawada AP - A Hospital Based Cross Sectional Study

Anil Kumar Paruchuri[1], Gowri Edagotti[2], Ramu Pedada[3], Haresh Morri[4]

[1, 2, 4] Department of Paediatrics, Siddhartha Medical College, Vijayawada, Andhra Pradesh, India.
[3]Department of Paediatrics, Government Medical College, Anantapur, Andhra Pradesh, India.

ABSTRACT

BACKGROUND

Diarrhoeal diseases are significant public health problems that lead to morbidity and mortality of infants and children particularly in developing countries and developed countries too. Rotavirus is the most important virus responsible for severe diarrhoea among young children. India being a developing country, the incidence of diarrhoeal diseases is high. In this part of Andhra Pradesh, low socioeconomic status, bad feeding, and child-rearing practices along with malnutrition contribute to the high morbidity and mortality due to diarrhoeal disease caused by rotavirus infection.

METHODS

This cross-sectional hospital-based study was conducted from January 2018 to December 2018 in the Department of Paediatrics, Old Government Hospital, Siddhartha Medical College, Vijayawada, Andhra Pradesh after obtaining ethical clearance from Ethical and Research Committee of our institute. One hundred (100) children, fulfilling the selection criteria who were admitted in the three paediatric wards were the subjects of study.

RESULTS

In this present study, the incidence of rotavirus infection was high in children aged ≤ 12 months and least in children between the age group of 25 to 36 months. In our study, we found that majority of cases with rotavirus infection occurred from September to February (60 %). Reverse transcription – polymerase chain reaction (RT-PCR) test done for the 24-enzyme linked immuno sorbent assay (ELISA) test negative samples of this study group. Out of 24 ELISA negative samples, PCR detects 4 samples as positive as PCR test is more sensitive than ELISA.

CONCLUSIONS

Rotavirus diarrhoea is the most common cause of severe gastroenteritis (GE) in children below five years of age in most regions of India. In this part of Andhra Pradesh, the low socioeconomic status, bad feeding, and child-rearing practices along with malnutrition contribute to the high morbidity and mortality due to diarrhoeal disease caused by rotavirus infection. This data on rotavirus disease burden may likely support evidence-based decisions regarding any further intervention.

KEYWORDS

Rotavirus, Diarrhoea, Diarrhoeal Diseases, Gastroenteritis (GE) Children, RT-PCR

Corresponding Author:
Dr. Gowri Edagotti,
Flat No. 102, CBR Residency,
Gunadala, Vijayawada-520004,
Andhra Pradesh, India.
E-mail: gowrie24@gmail.com

DOI: 10.18410/jebmh/2021/502

How to Cite This Article:
Paruchuri AK, Edagotti G, Pedada R, et al. Rotavirus infection as cause of diarrhoea in under 3 years children at Siddhartha Medical College, Vijayawada AP - A hospital based cross sectional study. J Evid Based Med Healthc 2021;8(30):2731-2737. DOI: 10.18410/jebmh/2021/502

Submission 15-02-2021,
Peer Review 24-02-2021,
Acceptance 14-06-2021,
Published 26-07-2021.

BACKGROUND

Diarrhoeal diseases are significant public health problems that lead to morbidity and mortality of infants and children particularly in developing countries and developed countries too.[1] Diarrhoea is leading killer of children accounting for approximately 8 percent of all deaths among children under age 5 worldwide in 2017. This translates to over 1300 young children dying each day or about 480,000 children a year.[2] The World Health Organisation (WHO) estimate that almost 1.7 billion episodes of diarrhoea occur annually in children of < 5 years age in developing countries.[3] In India, diarrhoea is the third leading killer of children, responsible for 10 % of all deaths in young children < 5 years of age, kills an estimated 1,17,285 children in India each year.[2] Rotavirus is the most important virus responsible for severe gastroenteritis among young children. Diarrhoea is defined as "an increase in volume or fluidity of stools, change in consistency and increase in the frequency of passing stools". The measurement of stool liquid content is impractical, and the assessment of stool frequency is preferred for diagnostic purposes.[4]

According to WHO, diarrhoea is the" passage of loose or watery stools at least three times in 24-hours time", but the importance of change in stool consistency rather than frequency.[5] Diarrhoeal diseases can further be divided into acute and chronic. Acute diarrhoea is the most usual form of diarrhoeal illness which has an abrupt onset, resolves within 14 days and is caused by infectious diseases. Chronic diarrhoeas last for at least two weeks.[6] Persistent diarrhoea usually arise secondary to disease complications such as protein energy malnutrition (PEM). WHO estimates show that the mortality due to rotavirus in children < 5 years is 33/1,00,000 in under five populations.[7] Rotavirus infection caused 128500 deaths among children younger than 5 years in 2016.[8] Four countries (India, Nigeria, Pakistan and The Democratic Republic of Congo) accounted for approximately half (49 %) of all estimated rota virus deaths in 2013. 10 countries (India, Nigeria, Pakistan, Democratic Republic of Congo, Angola, Ethiopia, Afghanistan, Chad, Niger & Kenya) accounted for almost two-thirds of all deaths (65 %) in 2013. In India, Rotavirus causes approximately 47,100 deaths annually in children < 5 years of age, it is 22 % of all rotavirus deaths that occurred globally.[9]

Objectives

- To study the frequency of rotavirus infection as an etiological agent in acute diarrhoea. To evaluate the predisposing factors for acute rotavirus diarrhoea.
- To compare frequency of rota viral infection in vaccinated and non-vaccinated groups.
- To determine the frequency of rota viral diarrhoea during different months of a year, among different socio-economic classes.
- To determine the frequency of rota viral diarrhoea among children with different levels of mother's education and with different locality of living (rural/ semi urban/urban etc).

METHODS

This cross-sectional hospital-based study was conducted from January 2018 to December 2018 in the Department of Paediatrics, Old Government Hospital, Siddhartha Medical College, Vijayawada, Andhra Pradesh. Before the commencement, the ethical clearance was obtained for the study (with Registration number: M170602038. Dt: 18/12/2017) from Ethical and Research Committee, Siddhartha Medical College, Vijayawada.

After taking written informed consent, detailed history of a patient with specific reference to the duration of diarrhoea, number of stools per day, feeding pattern, hygiene, rotaviral vaccination status and source of drinking water recorded as per the proforma. 100 children in the age group between zero to three years and with diarrhoea less than six days of duration, fulfilling the selection criteria who were admitted in the three paediatric wards were the subjects of study. 100 stool samples were collected from inpatients (children up to three years of age) with complaint of diarrhoea of less than six days of duration. Rotavirus antigen detection is done by performing ELISA tests. Rotavirus molecular diagnosis is made by performing the PCR test. Consent was taken from caregivers for taking stool samples. Kuppuswamy's socio-economic status scale 2019 was used to measure the socioeconomic status of the families of our patients in this study. The collected findings were recorded on a predesigned and pretested proforma. The collected data was analysed to determine the frequency of rota virus infections among the admitted cases with acute diarrhoea in the inpatient wards.

Inclusion Criteria

Children in the age group between zero to three years and with diarrhoea less than six days of duration.

Exclusion Criteria

Children of above three years of age.
Patients who had diarrhoea for more than six days duration.
Patients with bloody diarrhoea and non-consenting caregivers.

Statistical Analysis

The data collected was entered into Microsoft Excel spread sheet. Categorical data was expressed as ratios, rates and percentages. Continuous data was expressed as mean ± standard deviation. Chi-square test and Fisher's exact test was used to find the association between two variables.

A probability value of less than or equal to 0.050 at 95 % confidence interval was considered as statistically significant, less than or equal to 0.010 was considered as statistically highly significant and more than 0.050 was considered as statistically not significant.

Clinical & Demographic Variables		Total Tested	Rota Virus Infection			
			Present (n = 24)		Absent (n = 76)	
			Number	%	Number	%
Gender	Male	60	10	41.66 %	50	65.79 %
	Female	40	14	58.34 %	26	34.21 %
	Total	**100**	**24**	**100 %**	**76**	**100 %**
	Statistics		chi–square = 4.42, df = 1, P = 0.035, statistically significant.			
Age group (months)	0 - 6	13	2	8.33 %	11	14.47 %
	7 - 12	32	13	54 %	19	25 %
	13 - 24	24	7	29.34 %	17	22.37 %
	25 - 36	31	2	8.33 %	29	38.15 %
	Total	**100**	**24**	**100 %**	**76**	**100 %**
	Statistics		chi–square = 10.962, df = 3, P = 0.012, statistically significant.			
Mother's education	Illiterate	9	5	20.83 %	4	5.26 %
	Primary education	33	9	37.5 %	24	31.58 %
	Secondary education	39	7	29.18 %	32	42.10 %
	Intermediate	14	2	8.33 %	12	15.78 %
	Graduation	2	1	4.16 %	1	1.31 %
	Post-Graduation	3	0	0 %	3	394 %
	Total	**100**	**24**	**100 %**	**76**	**100 %**
	Statistics		chi–square = 8.303, df = 5, P = 0.140, statistically not significant.			
Socio-economic status (Kuppuswamy classification)	Class - 1	0	0	0 %	0	0 %
	Class - 2	9	1	4.16 %	8	10.52 %
	Class - 3	39	6	25 %	33	43.42 %
	Class - 4	48	14	58.33 %	34	44.73 %
	Class - 5	4	3	12.5 %	1	1.31 %
	Total	**100**	**24**	**100 %**	**76**	**100 %**
	Statistics		chi–square = 8.813, df = 3, P =0.031. Statistically significant.			
Exclusive breastfeeding	Yes	90	19	79.17 %	71	93.42 %
	No	10	5	20.83 %	5	6.58 %
	Total	**100**	**24**	**100 %**	**76**	**100 %**
	Statistics		chi–square = 4.118, df = 1, P = 0.042, statistically significant.			
Locality	Rural	52	13	54.16 %	39	51.31 %
	Semi urban	20	5	20.84 %	15	19.75 %
	Urban	28	6	25 %	22	28.94 %
	Total	**100**	**24**	**100 %**	**76**	**100 %**
	Statistics		chi–square = 0.141, df = 2, P = 0.932, statistically not significant.			
Hydration status	No dehydration	54	7	29.17 %	47	61.84 %
	Some dehydration	44	17	70.83 %	27	35.52 %
	Severe dehydration	2	0	0 %	2	2.64 %
	Total	**100**	**24**	**100 %**	**76**	**100 %**
	Statistics		chi–square = 9.406, df = 2, P = 0.009, statistically significant.			
Rotavirus vaccination	Yes	48	2	16 %	46	60.5 %
	No	52	22	84 %	30	39.5 %
	Total	**100**	**24**	**100 %**	**76**	**100 %**
	Statistics		chi–square = 19.907, df = 1, P = 0.000008, statistically significant.			

Table 1. Distribution OF Clinical and Demographic Variables in the Present Study Population

RESULTS

In this present study, the incidence of rotaviral diarrhoea is high in children aged ≤ 12 months and least in children between the age group of 25 to 36 months. Statistically significant (P = 0.012). (Table - 1). In this study, 60 % of the children with diarrhoea were boys, and 40 % were girls with the boy to girl ratio of 1.5 : 1, the rotavirus infection was positive in 41.66 % of the boys compared to 58.34 % of girls. Statistically significant (P = 0.035). (Table - 1).

Month	Rotavirus Infection			
	Positive (Number)	%	Negative (Number)	%
January	3	12.5	8	10.66
February	2	8.5	7	9.31
March	1	4	3	4
April	0	0	2	2.66
May	1	4	3	4
June	2	8.5	4	5.32
July	1	4	4	5.32
August	1	4	6	7.89
September	3	12.5	8	10.64
October	3	12.5	9	11.97
November	4	16.5	12	15.96
December	3	12.5	10	13.33
Total	24	100	76	100

Table 2. Month Wise Distribution of Diarrhoeal Cases (Rotavirus Positive/Negative) in the Present Study

In this present study, most of the mothers had secondary education (39 %). The incidence of rotavirus infection was significantly high in children whose mothers had primary education (37.5 %) compared to those children whose mothers were intermediate (8.33 %), and graduate (4.16 %) This is statistically not significant (P < 0.140). In this present study, the majority of the children with rotavirus diarrhoea belonged to class 4 socioeconomic strata (58.33 %) according to Modified Kuppuswamy classification (Table - 1).

This is statistically significant (P = 0.031). In our study, rota virus infection was present in 5 (50 %) out of 10 non-breast-feeding children when compared to 19 (21.11 %) out of 90 breast feeding children. This is statistically significant (P = 0.042). In this present study, majority of children with rotavirus diarrhoea belonged to rural areas (54. 16 %) which is statistically not significant (P = 0.932). Majority of children with rotavirus diarrhoea were having some dehydration (70.83 %) in the present study and is statistically significant (P = 0.009). In this present study, majority of children with rotavirus diarrhoea were not immunised with rotavirus vaccine (84 %); statistically significant (P = 0.000008). In our study, majority of the cases with rotavirus infections occurred from September to February (60 %). In this present study, ELISA positivity of rotavirus diarrhoea was 24 % (Table - 3). RT-PCR test was done for the 24 ELISA test negative samples of this study group. Out of 24 ELISA negative samples, PCR detected 4 samples as positive as PCR test is more sensitive than ELISA (Table - 4). In the present study, there was no mortality among the diarrhoea

cases admitted including the rotavirus diarrhoea positive cases.

Elisa Test for Rotavirus Antigen	Distribution (n=) Number	%
Positive	24	24
Negative	76	76
Total	100	100

Table 3. Distribution of Elisa Test Results (Positive/Negative) for Rotavirus Antigen in the Present Study

PCR Test for Rotavirus among Elisa Test Negative Samples	Total Samples Tested	PCR Test Positive Number	%
	24	4	16 %

Table 4. Distribution of RT-PCR Test for Rotavirus in the Present Study Group

DISCUSSION

In this century, it is important to note that some new diseases, which are not known previously, and many new diseases are emerging and becoming a global health problem. In the gastrointestinal tract infections, diarrhoeal diseases account for high morbidity and mortality in several parts of the world. Estimated that each year, 1.7 billion cases of diarrhoea occur among under-five children. Treatment for diarrhoea can cause serious financial difficulties, contributing to the cycle of poverty. In India, diarrhoeal diseases are a major health problem among under-five children. Acute diarrhoeal diseases are responsible for about 10 % of deaths in under five children, even though there is an availability of easily implementable interventions and the existence of national guidelines for management at the community level. India has a diarrhoea mortality rate of 5 per 1000 live births. It is estimated that around 22 % of cases are due to a viral origin and among them, rotavirus gastroenteritis is estimated to be the leading cause of diarrhoea.[10] There are various studies in India about the incidence of rotavirus infection from multiple parts of the country, but there is paucity of data from this south part of the country. Hence, this study was undertaken to estimate the incidence of diarrhoea due to rotavirus among inpatient (admitted) children younger than three years of age and to evaluate the predisposing factors for acute diarrhoea and to study the clinical outcome of rotavirus diarrhoea. In the present study, the detection of rotavirus was done at viral research and diagnostic laboratories (VRDL) sponsored by Indian council of medical research (ICMR). Overall, incidence of rotavirus-positive children with diarrhoea ranges from 20 to 50 % in different studies. The incidence of rotavirus infection observed in the present study was 24 % which is within the reported range but slightly high to a recent study by S. Purwar et al.[11] Belgaum, Karnataka where authors reported rotavirus incidence is 22 % among children less than five years of age. The incidence of the rota virus diarrhoea observed in this study was almost in correlation compared to a recent study from Tirupathi, Chittoor district of Andhra Pradesh state by Manohar Badur et al.[12] where the incidence of rotavirus diarrhoea in under five children was 25.6 %. The incidence of the rotavirus diarrhoea observed in this study was similar compared to a recent study from Guntur district of Andhra Pradesh state by P. Jyothi et al.[13] where the incidence of rota virus diarrhoea in under five children was 25 %. However in India, lower incidence rates of rotavirus diarrhoea have been reported from Lucknow (19.2 %), and Karnataka (19.9 %) and a higher incidence rate was observed in Vellore (35.4 %), Manipur (49.9 %) and Thane (69.2 %).[14] The wide variation found in the incidence rates of rotavirus diarrhoea can be attributed to the use of different methods of detection namely immuno-chromatographic test, latex slide agglutination test which is less sensitive than ELISA of rotavirus antigen from the stool. The variation may also be due to a difference in climatic conditions like high rainfall, other factors like local food habits, medical health facilities and socio-demographic determinants like inadequate water supply, improper night soil disposal system. A study to estimate the incidence of rotavirus infection in children with diarrhoea admitted to hospital in Taiz, Yemen, during a 16 months period showed that rotavirus incidence was as high as 45.2 % in children with diarrhoea.[15] As shown in table – 1 of our study, children with diarrhoea were 60 % of boys and 40 % of girls. The boy to girl ratio was 1.5 : 1, but the incidence of rotavirus infection which was positive in male children was 41.66 % and in female children it was 58.34 %, i.e., more than males. The difference was statistically significant (P = 0.035) but suggesting that the occurrence of rotavirus infection is more common in female child. A study from Tirupathi, Chittoor district of Andhra Pradesh by Manohar Badur et al. reported that out of 107 male patients, 24 were positive for rotavirus and out of 80 female patients, 24 were positive for rotavirus. In this study, incidence of rotavirus infection was more in female child. This study correlates with present study. A study from Guntur district of Andhra Pradesh by P. Jyothi et al. reported that, out of 28 male patients, 8 were positive for rotavirus and out of 16 female patients 3 were positive for rotavirus. Male incidence was up to 40 % higher than that of female cases. But in present study, female preponderance was seen. Rotavirus diarrhoea occurs at an early age in children in developing countries than in children in developed countries. The median age of children hospitalised with rotavirus diarrhoea in developing countries is 9 - 12 months and 60 % of the children are less than 1 year old. In contrast, the median age in developed countries is 13 - 16 months, and the highest proportion of cases present in the second year of life.[16] As shown in table -1, our study found diarrhoea was most common in children aged between 7 to 12 months. Rotavirus infection was high in children aged between 7 to 12 months (54 %) and it is observed that only 2 children infected with rotavirus whose age is between 25 to 36 months (8.33 %), and this difference was statistically significant (P = 0.012). According to the WHO scientific researchers, majority of cases of rotavirus infection are in children with age group of 6 - 24 months with a peak incidence at 9 - 12 months which was also observed in our study. Sae Satish pol et al.[17] in their study from Pune reported rotavirus positivity in children aged 7 - 12 months is 51.4 %, in 13 - 18 months is 25.75 %, in 19 - 24 months is 11.4 %, which correlates well with the present study. Wg Cdr B.M. John et al.[18] in their study from Bangalore reported rotavirus positivity in children aged

0 - 6 months is 14.28 %, in 6 - 10 months is 25.4 %, in 11 – 15 months is 24.7 %, in 15 - 20 months is 23.9 %, which correlates well with the present study. P. Jyothi et al.[13] in their study from Guntur reported rotavirus positivity in children aged 0 - 6 months is 18.2 %, 6 - 12 months is 36.4 %, 13 - 24 months is 27.3 %, which correlates well with the present study. As shown in table - 2 about seasonal variation, in this study, peak prevalence was noted in November (16.5 %). Manohar Badur et al.[12] stated regarding seasonality that some studies in India had found no association between rotavirus infection and the time of year. Other studies have observed that an increase in rotavirus-associated diarrhoea during the winter months, October - February throughout the country. Rotavirus was markedly seasonal in northern India but was less seasonal in southern India with a more tropical climate. In the present study, the number of cases increased from September to February. Sae Satish pol et al.[17] in their study from Pune reported rotavirus infections were detected in all months of the year. However, maximum positivity was observed during November - February (74.3 %), and correlated with our study. As shown in table – 1, in the present study, most of the mothers of children suffering from diarrhoea had secondary education (39 %) followed by primary education (33 %), while only 2 % of the mothers were graduates and 3 % were post-graduates. It is well established that different measures of social deprivation like poor maternal education, influence the incidence of rota virus diarrhoea. The same was true in the present study. The incidence of rotavirus infection was significantly high in children whose mothers had primary education (37.5 %) compared to those children whose mothers were secondary education (29.18 %), intermediate level education (8.33 %), graduates (4.15 %) and no child shows positive rota virus infection whose mothers were post-graduates. It is statistically not significant (P < 0.140) but suggesting that poor educational status of the mother associated with an occurrence of rotavirus diarrhoea. In a study by Nakawesi JS. et al.[19] from Uganda, mother's education is independently associated with rotavirus diarrhoea. In 52.5 % rotavirus, positive diarrhoea children mother's education was secondary and above, which is nearly correlated with the present study. As shown in table -1 in our study, most of the children with rotavirus diarrhoea belonged to class 4 (58.33 %) and class 3 (25 %) socio economic strata according to modified Kuppuswamy's classification. This is statistically significant (P = 0.031). These findings suggest a strong association between rotavirus diarrhoea and low socioeconomic status. Similar to the findings of this study, a study from Dakshina Kannada[20] reported the prevalence of rotavirus diarrhoea to be high in children with monthly family income between Rs. 5000 to Rs. 15000 (65.71 %) while lower prevalence was noted in children with family income of > Rs. 30000 (2.86 %). Natalie L. Adams et al.[21] from United Kingdom reported that rotavirus infections were more in low socio-economic groups compared to higher socio-economic status. In low socio-economic groups, there is overcrowding, poor hygiene practices, lack of proper sanitation measures, poor nutrition, lack of safe drinking water and poor access to medical health facilities. As shown in table – 1, we found rota virus infection present in 5 (50 %) out of 10 non-breast-feeding children when compared to 19 (21.11 %) out of 90 breast feeding children. This is statistically significant (P = 0.042). Aleksandra Krawczyk et al.[22] from Manipal, Karnataka reported that there is a significant benefit in the incidence of rotavirus diarrhoea among children by practising exclusive breastfeeding throughout first six months of life. Infants who were not breastfed had a six-fold higher risk of dying from the infectious disease in their first two months of life, including from diarrhoeal disease. Breast milk contains high levels of anti-rotavirus secretory IgA antibodies, particularly in Indian mothers. As shown in table – 1, in the present study, the incidence of rotavirus infection is more in rural areas compared to semi-urban and urban areas. In this study, the incidence of rotavirus diarrhoea in rural areas is 54.16 %, in semi-urban areas it is 20.84 %, and in urban areas, it is 25 %. This is statistically not significant (P = 0.932). S. K. Yachha et al. from Chandigarh, India reported that the incidence of rotavirus diarrhoea is high in rural areas compared to semi urban and urban areas. Among rural, semi-urban and urban communities, the overall incidences of rotavirus diarrhoea were 7.3 %, 3.2 % and 2.3 % and episode-related incidences of 31.8 %, 7.4 % and 5 %, respectively. These findings nearly correlate with the present study. This observation may be due to relative under-development of rural area in our country resulting in certain host environmental factors contributing to the infection. Sasirekha Ramani and Gagandeep Kang[23] from Vellore reported that data from 22 Indian cities, a total of 15,476 samples were tested. Rotavirus positivity ranged from 6 to 45 % (median 20.8 %). Neeraj Teotia et al.[24] from Meerut, Uttar Pradesh reported that the increasing trend in the proportion of rotavirus cases in admitted children had reported 26.1 % before 2000 to 38.3 % after 2005. The proportion was higher (41.2 %) in hospitalised children, and those with rotavirus diarrhoea had a longer duration of diarrhoea and were more likely to be dehydrated. These findings correlated well with the present study. As shown in table - 1 of present study among the children with rotavirus infection, majority of the children (70.83 %) had some dehydration, no dehydration was present in 29.17 % while severe dehydration was not found. This is statistically significant (P = 0.009). Dehydration is common in rotavirus infection. In most cases, deaths are caused by fluid losses. As shown in table - 1 in our study, rotavirus infection was positive in 16 % of rotavirus vaccine immunised patients and in 84 % of non-immunised patients. This difference statistically significant (P = 0.00008). The Government of India launched the Rotavirus vaccination in 2016. It was introduced in Andhra Pradesh in the year 2016. In El Salvador, the introduction of RV1 vaccine leads to a 76 % decrease in the number of hospitalisations due to rotavirus GE and a 32 % reduction in all-cause GE hospitalisation within two years.[25] Santhoshini Vaijinath et al.[26] from Bangalore, India reported that 78 (85.7 %) positivity for rotavirus in 91 unimmunized patients. This shows rotavirus vaccination can reduce the rotavirus diarrhoea in children less than 5 years of age. In our study, we had no mortality in the study group. In this study among the children with rotavirus infection, majority of the children (29.17 %) had

no dehydration, some dehydration is present in 70.83 % while severe dehydration is not found. So, these patients are treated well with low osmolarity ORS, if children are not accepting orally, then they are treated with intravenous fluids. P. Jyothi et al. from Guntur reported that there is no mortality in their study. This finding matched with the present study. As shown in table - 4 in the present study, rotavirus infection was positive in 16 % of the 24 ELISA negative stool samples of the study population, tested by polymerase chain reaction test. Polymerase chain reaction test performed at viral research and diagnostic laboratories (VRDL) sponsored by ICMR. In this study, total 100 samples were not tested by PCR because this test is very costly. Neeraj Kumar et al.[27] in their study from Jaipur, Rajasthan reported that a total of 20/135 (14.8 %) samples were found to be positive for rotavirus infection by ELISA. Positivity of RV by PCR was 3 /135 (24.44 %). A variety of sensitive conventional or real-time reverse transcription polymerase chain reaction (RT-PCR) methods have been developed based on primers specific for several different rotavirus genes. The sensitivity of ELISA is ~55 % while for PCR 100 % (almost double). Similarly, specificity of RT-PCR (100 %) is greater than ELISA (94.12 %). So, it is concluded that the RT-PCR technique is better than ELISA for the detection of rotavirus. The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were calculated using qRT-PCR as a standard. Overall, the present study showed a high incidence of rotavirus diarrhoea in the study area as one fourth (24 %) of the study population was found to be infected. Vaccines offer the most promising tool for preventing morbidity and mortality caused by rotavirus. Licensed and safer rotavirus vaccine is available currently and effective in preventing the disease.[28] The epidemiological profile of these viruses in India will be of considerable importance to both policymakers and vaccine developers in determining the composition, dosage, and program for a vaccine to be used in India. However, improvement of socio-economic status and patient education will have a significant impact on preventing rotavirus diarrhoea.[29]

CONCLUSIONS

Acute diarrhoeal diseases are among the principal causes of mortality in infants and young children in many developing countries. Rotavirus diarrhoea is the most common cause of severe gastroenteritis in children below five years of age in most regions of India. Rotavirus diarrhoea leads to dehydration which requires hospital admission for correction of dehydration and in out-patients, diarrhoea may be due to non-rotavirus causes those having no dehydration or in some patients, they have some dehydration which can be corrected with plenty of fluids and ORS at home. In this part of Andhra Pradesh, the low socioeconomic status, bad feeding and child-rearing practices along with malnutrition contribute to the high morbidity and mortality due to diarrhoeal disease caused by rotavirus infection. It has been observed that with good hygiene and sanitation, bacterial and parasitic diarrhoea had declined maximally, but there will be less of an effect on rotavirus diarrhoea. The predominance of vomiting over the diarrhoea makes treatment with oral rehydration more difficult. Thus, immunisation is an essential preventive strategy towards control of rotavirus infection. In this study, significant 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. Since this was a hospital-based cross-sectional study and the results are less likely to be an exact reflection of the disease burden in the society, this data on rotavirus disease burden may likely support evidence-based decisions regarding any further interventions.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
Financial or other competing interests: None.
Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

REFERENCES

[1] Al-Madani A, Al-Areqi L, Al-Sallami S, et al. Rotavirus diarrhoea in children of Taiz, Yemen. Prevalence-risk factors and detection of genotypes. Int J Pediatr 2014;2014:928529.
[2] Diarrhoeal disease – UNICEF data. https://data.unicef.org >child-health >diarrhoeal disease. October 2019.
[3] Diarrhoeal disease. Fact sheet Geneva: World Health Organization, May 2017.
[4] Thapar N, Sanderson IR. Diarrhoea in young children: an interface between developing and developed countries. Lancet 2004;363(9409):641-653.
[5] World Health Organization: treatment of diarrhoea: a manual for physicians and other senior health workers. WHO/CDR/95.3. Geneva, 1995.
[6] World Health Organization: Persistent diarrhoea in children: CCD/DDM/85.1. Geneva: Diarrhoeal Disease Control, 1985.
[7] Estimated rotavirus deaths for children under 5 years of age. Geneva, World Health Organization, 2013.
[8] Troeger C, Khalil IA, Rao PC, et al. Rotavirus vaccination and the global burden of rotavirus diarrhoea among children younger than 5 years. JAMA Pediatr 2018;172(10):958-965.
[9] Tate JE, Burton AH, Boschi-Pinto C, et al. Global, regional and national estimates of rotavirus mortality in children <5 years of age, 2000–2013. Clin Infect Dis 2016;62(Suppl 2):S96-S105.
[10] Diarrhoea: Why children are still dying and what can be done? Geneva: The United Nations Children's Fund (UNICEF)/ World Health Organization (WHO), 2009.
[11] Marcdante K, Kliegman R. Nelson Text book of Pediatrics. Vol. 2. 1st South Asian edn. Elsevier India 2016.
[12] Badur M, Latha MN, RaviKumar P, et al. Prevalence of rotavirus diarrhoea among under-5 hospitalised children in a Government tertiary hospital, Tirupati. J NTR Univ of Health Sci 2015;4(2):112-116. www.jdrntruhs.org

[13] Jyothi P, Prasanthi K, Kamala P. Prevalence of rotavirus diarrhoea in children below 5 years, a pilot study. Int J Current Microbiol App Sci 2016;5(8):71-74. http://www.ijcmas.com
[14] Ameta P, Nayak VH, Goyal SC. Prevalence and seasonal distribution of rotavirus diarrhoea in hospitalised children less than five-year-old in south Rajasthan. International J Biomed Res 2015;6(3):214-218.
[15] Al-Badani A, Al-Areqi L, Majily AL, et al. Rotavirus diarrhoea among children in Taiz, Yemen. Prevalence-risk factors and detection of genotypes. International Journal of Pediatrics 2014;2014:928529. http://dx.doi.org/10.1155/2014/928529.
[16] Cicirello HG, Das BK, Gupta A, et al. High prevalence of rotavirus diarrhoea among neonates born at hospitals in Delhi, India: predisposition of newborns for infection with unusual rotavirus. Pediatr Infect Dis J 1994;13(8):720-724.
[17] Pol SS, Dedwal KA, Ranshing SS, et al. Prevalence and characterisation of rotaviruses in children hospitalised for diarrheal disease in a tertiary care hospital, Pune. Indian J Med Microbiol 2017;35(1):33-36.
[18] John BM, Devgan A, Mitra B. Prevalence of Rotavirus diarrhoea in children below two years presenting with diarrhoea. Med J Armed Forces India 2014;70(2):116-119. www.elsevier.com/locate/mjafi.
[19] Nakawesi JS, Wobudeya E, Ndeezi G, et al. Prevalence and factors associated with rotavirus infection among children admitted with acute diarrhoea in Uganda. BMC Pediatr 2010;10(69):69.
[20] Shetty AK, Kalekhan FM, Muthiravalapil SJ, et al. Detection of rotavirus and adenovirus diarrhoea in children below five years, in Dakshina Kannada District, a coastal region of Karnataka State, India. Muller J Med Sci Res 2014;5(2):143-148.
[21] Adams NL, Rose TC, Hawker J, et al. Relationship between socioeconomic status and gastrointestinal infections in developed countries: a systematic review and meta-analysis. PLoS One 2018;13(1):e0191633.
[22] Krawczyk A, Lewis MG, Venkatesh BT, et al. Effect of exclusive breastfeeding on rotavirus infection among children. The Indian J Pediatr 2016;83:220-225.
[23] Ramani S, Kang G. The burden of disease & molecular epidemiology of group a rotavirus diarrhoeas in India. Indian J Med Res 2007;125(5):619-632.
[24] Teotia N, Upadhyay A, Agarwal S, et al. Rotavirus diarrohea in children presenting to an urban hospital in Western Uttar Pradesh, India. Indian Pediatrics 2016;53(7):627-629.
[25] Paulke-Korinek M, Rendi-Wagner P, Kundi M, et al. Universal mass vaccination against rotavirus diarrhoea: impact on hospitalization rates in Austrian children. Pediatr Infect Dis J 2010;29(4):319-323.
[26] Santhoshini V, Sangeetha S, Prakash R, et al. Rotavirus diarrhoea in children less than five years with reference to their vaccination status in a tertiary care hospital. International Journal of Current Microbiology and Applied Sciences 2016;5(3):206-211.
[27] Neeraj K, Bharti M, Mehra SK, et al. Comparative evaluation of antigen ELISA technique and PCR for detection of Rotavirus in stool samples of paediatric patients with diarrhoea. JMSCR 2018;6(6):846-852.
[28] Payne DC, Manual for the Surveillance of Vaccine-Preventable Diseases Atlanta: Centers for Disease Control and Prevention; 2014.
[29] Shimizu H, Phan TG, Nishimura S, et al. An outbreak of adenovirus serotype 41 infection in infants and children with acute gastroenteritis in Maizura City, Japan. Infect Genet Evol 2007;7(2):279-284.