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Rotavirus Diarrhea in Children Under Five in Basrah: Hospital Based Study

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Abstract

Background: Human rotaviruses, particularly of group A are the most important cause of severe dehydrating diarrhea in young children worldwide in both developed and developing countries. Although rotavirus accounts for up to 50% of hospitalizations for severe diarrhea in infants and children, it has been underestimated within the public health community, particularly in developing countries.

This is a cross sectional study which was carried out to determine the frequency of rotavirus diarrhea in hospitalized children under 5 yrs in Basra by stool enzyme linked immunosorbant assay test and study the relation of selected patients' variables to rotavirus diarrhea.

Methods: A hospital-based study includes 120 children aged less than 5 yrs who were admitted to the pediatric wards with acute gastroenteritis over a period of five months from the October 1st, 2015 till March 15th, 2016. All patients underwent physical examination for sign of dehydration and assessment of severity of diarrheal episode by Vesikari score which considered various parameters including frequency, duration of diarrhea, vomiting, temperature, hydration status and the treatment received by the patients. A score of <7 was considered mild, 7-11 was moderate and ≥ was 11 severe. Stool samples were collected within 48 hrs of hospitalization and examination for rotavirus was done by Enzyme Linked Immunosorbant Assay; One Step rotavirus Test (ABON biopharm, China) which is a qualitative immunoassay kit used for the detection of rotavirus in human stool sample.

Result: The frequency of rotavirus infection was 32.5%, about two thirds of admitted children presented with severe diarrheal episodes and one third with moderate diarrhea. Sixty two percent of the studied patients aged 3-12 months with higher frequency of males than females (62.5%, 37.5%) respectively. All studied children with rotavirus infection were below 24 months of age, with higher frequency in males than females (74.36%, 25.64%) respectively with P value 0.001. Reviewing the immunization status history of rotavaccine reveals that; 64 (53.3%) of patients have missed or did not receive any vaccine with approximate percentage (53.8%) in patients who were positive for rotavirus with significant result (P value 0.001) and only 36.7% of children had an immunization status that was appropriate for their age. One third of studied parents were illiterate with higher frequency in mothers than fathers (22.5%, 14.1%) with rotavirus infection in children belong to illiterate parents (25.6%, 7.6%) respectively, with statistically significant results. Bottle feeding with or without complementary diet had been reported in higher frequency of studied patients (59.2%) with positive rotavirus stool test in 71.8% with statistically significant result. Inpatient management of studied children reveals that zinc therapy, oral rehydration solution and antibiotics prescribed for (56.4%, 66.7% and 89.7%) of patients with rotavirus infection respectively.

Conclusion: Routine evaluation of children with acute diarrheal episodes by stool test for rotavirus is recommended to avoid un-rational prescription of antibiotics and proper practice according to integrated management of childhood illness program.

Keywords: Acute diarrhea; Rota virus; Under five children

Introduction

Globally, about 30%-40% of hospitalizations and deaths occur due to diarrhea among children under 5 yrs and about 5% of all child death are attributed to rotavirus infection [1]. The burden of severe rotavirus illness and deaths falls mainly upon children in low and middle income countries. About 50% of rotavirus related deaths are estimated to occur in lower income countries of Asia and sub-Saharan Africa [2]. Several researchers recorded different percentages of infectivity with Rota viruses among Iraqi governorates, rotavirus was detected in (43.3%) of patients with acute diarrhea admitted to Basrah maternity and children's hospital in 1999 [3]. In 2008, a study was carried out by the Iraqi Ministry of Health in three different cities before the introduction of rota vaccine, where rotavirus group A was detected in 40% of children [4].

Although the disease can occur at any age; the severity of rotavirus infection is age-dependent, clinically significant incidents most commonly occur in young infants and children aged 3 to 24 months. In the first three months of life, illness is generally mild as a result of passive trans-placental transfer of

rotavirus antibody. Rotavirus infections can range from asymptomatic infection, mild diarrhea, to severe gastroenteritis with dehydration. After an incubation period of 2-4 days, the symptoms begin abruptly with fever and vomiting, followed by watery diarrhea lasting for 3-8 days [5].

Stool examination by ELISA test has more commonly used for diagnosis of rotavirus infection. It is reliable and inexpensive and has a sensitivity of 105 to 106 viral particles per ml of fecal suspension.

Methods

A cross sectional hospital-based study was carried out to assess the frequency of rotavirus infection in 120 children under 5 yrs of age who were admitted to pediatric wards with acute diarrhea. Acute gastroenteritis is defined as the occurrence of diarrhea (at least three soft or liquid stools in 24 hrs) with or without vomiting lasted no longer than 14 days [6].

Exclusion criteria

1. Children with hospital acquired diarrhea which is defined as an acute episode of diarrhea acquired ≥ 72 hrs of hospitalization [7].

2. Children with chronic diarrhea defined as diarrhea which lasted longer than 14 days duration [6].

Approval from ethical committee and Informed verbal consent was obtained from parents or caregiver for enrollment in the study. A special questionnaire was designed for the purpose of the study including the following information: patient's identity, presenting symptoms, past medical history, feeding history, vaccination history, parents' age and education.

Assessment of severity of diarrheal episodes

The severity of diarrhea was assessed using the Vesikari scoring system (Ruuska and Vesikari, 1990) which had been revised and used in the literature for determining the severity of viral diarrhea based on subsequent vaccine efficacy trials. As per the Vesikari Score Grading, a grade of <7 considered mild, 7-10 moderate and ≥11 severe form [8].

Detection of rotavirus

The collected stool samples were then tested for rotavirus VP6 antigen, using One Step Rotavirus Test (ABON biopharm, China) which is a qualitative immunoassay kit used for the detection of rotavirus in human stool sample.

Results

Selected patients variables and ELISA test

A total of 120 children are included in the study, their ages range from (10 days to 60 months). Mean age is 9.52 ± 0.746 months, 75 (62.5%) are males and 45 (37.5%) are females, 62.5% of children with acute diarrhea are aged >3-12 months, with higher frequency of males than females (62.5%, 37.5%) respectively. Thirty nine patients (32.5%) were positive for rotavirus and 81 (67.5%) were negative. ELISA test shows no significant difference with the age and sex of studied patients **(Table 1)**.

Table 1: Distribution of selected patients variables and ELISA test.

Variable		Positive ELISA test		Negative ELISA test		P value
		No.	%	No.	%	
Age (Months)	0-6	20	35.1	37	64.9	0.511
	>6-12	13	35.1	24	64.9	
	>12-24	6	23.1	20	76.9	
Sex	Male	29	38.7	46	61.3	0.063
	Female	10	22.3	35	77.8	
Total		39	32.5	67.5	100	

Relation of Rotavaccine status , feeding pattern and ELISA test

Sixty four patients (53.3%) had missed or not received rotavaccine and (10%) were infants below 3 months. Non-vaccinated patients had higher frequency of positive ELISA test (38.9%) compared to 25.5% who were appropriately vaccinated children and 25% among those who had missed vaccine. Bottle fed patients had higher frequency of positive ELISA test (39.6%) compared to those non- bottle fed children (10.3%) with statistically significant result **(Table 2a and 2b)**.

Table 2a: Relation of patients' Rotavaccine status, feeding pattern and ELISA test.

Variable		No.	%
Rotavaccine			
Appropriate for age		44	36.7
Missed vaccine		7	5.8
Not vaccinated		57	47.5
Feeding Pattern			
Predominately breast feeding		2	1.6
Bottle feeding		29	24.2
Mixed feeding		14	11.7
Complementary with	Breast	14	11.7
	Bottle	42	35
	Mixed	7	5.8
	Without milk	12	10

Table 2b: Relation of patients' Rotavaccine status, feeding pattern and ELISA test.

Variable	Positive ELISA test		Negative ELISA test		P value
	No.	%	No.	%	
Rotavaccine					
Appropriate for age	12	25.5	35	47.5	0.04
Missed Vaccine	2	25	6	27	
Not vaccinated	21	38.9	33	61.1	
Feeding Pattern					
Bottle feeding	36	39.6	55	60.1	0.03
Non bottle feeding	3	10.3	26	89.7	
Total	39	32.5	81	97.5	

Selected parents' related variables and positive ELISA test

Illiteracy was recorded in more than one third of parents with higher frequency in mothers than fathers (22.5%, 14.2%) respectively. Higher frequency of mothers and fathers who were at twenties of their ages (67.5%, 55%) respectively. There is a higher frequency of positive ELISA test in children belong to low educated mothers than fathers (25.6%, 7.6%) with statistically significant result as shown in **Table 3.**

Table 3: Relation of Parents' age and level of education to positive ELISA test in their children.

Variable				Positive ELISA test		P value
		No.	%	No.	%	
Mother eduction	Illiterate	27	22.5	10	25.6	0.001
	Primary	54	45	16	41	
	Secondar	35	29.2	11	28.2	
	Higher education	4	3.3	2	5.2	
Father eduction	Illiterate	17	14.1	3	7.7	0.001
	Primary	29	24.2	10	25.6	
	Secondar	63	52.5	22	56.4	
	Higher education	11	9.2	4	10.3	
Mother age (years)	<20	19	15.8	7	17.9	0.001
	20-29	81	67.5	23	59	
	30-38	20	42.5	9	23.1	
Father age (years)	<20	3	2.5	0	0	0.001
	20-29	66	55	21	53.8	
	30-39	51	42.5	18	46.15	
Total		39	100			

Relation of severity and treatment of diarrheal episodes with ELISA test

About two third of patients presented with severe diarrheal episodes, received zinc therapy, oral rehydration solution and metronidazole therapy, 94.16% of patients received antibiotics and 65.8% received combination of antibiotics. Positive rotavirus result was recorded in 38.3% of children with severe and 20.5% with moderate diarrheal episodes (P value 0.0003) **(Table 4)**.

Table 4: Severity of diarrhea and treatment received in relation to positive ELISA test patients.

Variable	Positive ELISA test (39)		P-Value
	No.	%	
Vesikari Score			
Moderate 38	8	20.5	0.0003
Severe 81	31	38.3	
Treatment	Yes	No	
Zink (80)	22(56.4%)	17(43.5%)	0.23
ORS (87)	26(66.7%)	13(33.3%)	0.0001
Antibiotics	35(89.7%)	4 (10.25%)	0.001

Logistic regression analysis of selected variables with positive ELISA test patients

Table 5; shows that bottle feeding, missed rotavaccine and children age >3-12 months are risk factors for rotavirus infection with statistically significant result.

Table 5: Logistic regression analysis of selected patients' variables with positive ELISA test.

Factors	p-value	Odd ratio	95% CI
Sex	0.211	1.826	0.711-4.691
Feeding pattern	0.001	0.586	0.390-0.789
Rotavacccine	0.001	2.183	1.406-3.739
Vesikari score	0.120	2.605	0.952-4.125
Patients age	0.03	1.245	1.01-5.521
Mother age	0.261	0.636	0.349-5.811
Father age	0.751	0.688	0.259-4.982

Discussion

Rotavirus is a major cause of diarrhea in children in both developed and developing countries. Most of cases occur in children less than 5 yrs of age [2].

The current study reveals that 32.5% of hospitalized children with acute gastroenteritis are positive for rotavirus infection

which is lower than the results of previous studies carried out in Basrah in 1999 and 2011 in children with acute watery diarrhea; were (43.3%, 40.5%) respectively [3,9]. Furthermore, it is lower than other studies carried out in the region of mid Iraq in 2010, [10] Babylon in 2011, [11] and in Kurdistan region in 2005 [12] which reported the frequency of rotavirus infection as 42.2%, 45.7% and 37% respectively. The possible explanation of such higher frequency of rotavirus in the previous studies is due to the fact that they had been take place before the introduction of rotavaccine to the national immunization schedule in Iraq (2012).

Approximate frequencies (35%, 39.9%) of rotavirus positive cases are recorded in Iran (2007) [13] and in Jordan (2008) [14] respectively.

Rotavirus diarrhea is recorded in children younger than 2 yrs, who are susceptible expected target age group with peak incidence in the age >3-12 months, this is similar to previous studies done in Iraq [3,11,12].

In older children, rotavirus infection can be asymptomatic; probably because they have some degree of protection from previous infection with this virus [15]. Less frequency of rotavirus infection in children less than 3 months, probably because of passive protective effect of maternal antibodies, transferred through placenta or through breast milk, against rotavirus infection during early months of life [5].

Males have a significant higher rate of rotavirus infection than females, similar results have been reported in the previous studies done in Basrah in 1999 and 2011 [3,9]. Some studies found a relation between rotavirus diarrhea and male gender as a risk fact [16,17]. It was found that positive rotavirus result reported in children belong to young mothers with low education. This is in agreement with a study carried out in Sudan (2010) which shows that children of illiterate parents are more infected with rotavirus [4]. This may reflect the relation of educational level of mother with hygiene as a risk factor for rotavirus infection [17].

As well as; higher frequency of rotavirus infection is found among bottle fed infants which is similar to the study carried out in Basra in 2011 [9]. Bottle feeding carries a risk of diarrhea for many reasons such as improper feeding practice, poor sterilization technique and risk of infection, and cow's milk allergy.

Multiple indicator cluster survey in 2011 found that the prevalence of diarrheal diseases in Iraq was 20% in children aged 0-23 months because of the low educational level of mothers, poor hygiene, absence of healthy habits such as hand washing, poor sanitation facilities and water supply, absence of breast feeding, and high frequency of bottle feeding [18].

Exclusive breastfeeding was found to be associated with a lower incidence of rotavirus gastroenteritis. Breastfed infants whose mothers had high titers of antirotavirus-IgA in breast milk remain less affected by rotavirus compared to those with low titers of anti-RV-IgA. Breast milk also contains bioactive components like lactoferrin, lactadherin, secretory IgA, lymphocytes, oligosaccharides and human milk glycans which have a role in developingthe innate immunity in addition to the antimicrobial peptides which are abundant in human milk. Unlike the human ones, bovine lactadherin is not active against Rotavirus infection [19].

Rotavirus infection reported in higher frequency in children with missed rotavaccine doses especially those who did not receive any dose. According to registry data of rota vaccine from public health department in 2015; the coverage rate of 1st and 2nd dose is 62.8%, 51.6% respectively. The low coverage rate is possibly explained by limited and specific age allowed for immunization, the 1st dose is not beyond 3 months and of 2nd dose is not later than 6 months. A study which had been done in Europe showed that two doses of rotavaccine provided high protection against any and severe rotavirus gastroenteritis, along with an overall reduction of admissions for gastroenteritis over two consecutive rotavirus epidemic seasons [20]. Most rotavirus positive cases found to have severe diarrheal disease. The same result had been found in Lebanon and India [21,22]. Rotavirus is a leading cause of severe childhood diarrhea worldwide, accounting for about one third of all cases of severe diarrhea that require hospitalization [23].

The current study found that about two thirds of rotavirus positive cases treated with oral rehydration solution and about half of them treated with zinc therapy and the majority of rotavirus cases are treated unnecessarily with antibiotics. IMCI guideline for management of diarrhea focuses on rehydration and zinc supplements for all diarrheal episodes as well as on giving antibiotic only in case of bloody diarrhea for shigellosis [6]. A house hold survey carried out in Iraq in 2011 reveals that about 24% of children under 5 yrs with diarrheal episodes received ORS with higher frequency in children aged 0-11 months, and 12% treated with increasing fluid intake at home [18].

Routine evaluation of children with acute diarrheal episodes by stool test for rotavirus is recommended to avoid irrational prescription of antibiotics and practice according to integrated management of childhood illness program.

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