

The Prevalence of Rotavirus Infection in Baquba- Diyala Province

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Abstract

Background: Rotavirus infection is the leading single cause of severe diarrhea among infants and young children. More than 500,000 children under 5 years of age die from rotavirus infection each year, and almost 2 million more become severely ill.

Objectives: To determine the prevalence of rotavirus infection among patients with diarrhea in Baquba- Diyala province, and to explore the effect of certain relevant factors.

Materials and methods: The present study was extended from 1/July/2007 to 1/September/2008 in Baquba city. A total of 300 fecal specimens were collected from patients suffering from acute diarrhea. The patients include 136 (45.3%) females with mean age (7.8 ± 4.7) years, and 164 males with mean age (5.3 ± 3.4) years. BioRad-Rota kit is a highly sensitive agglutination test was used for detection of rotavirus in fecal specimens. Bacterial co-infections were identified by culturing on differential and selective media, and the final diagnosis followed the standard bacteriological criteria. Parasitic co-infections were detected by general stool examination. All data were statistically analyzed.

Results: The results showed that the overall infection rate by rotavirus among patients was 20.3%, and the highest infection rate was among those below 5 years of age. Rotavirus infection among adult patients was also recorded. Females had an insignificantly higher infection rate compared to males (22.1% vs. 18.9%). Patients consuming river's water had significantly higher infection rate compared to those used municipal or tank water (34.5%, 14.1% and 18.5%) respectively. Patients (below 2 years) feed artificially had higher infection rate compared to those on breast or mixed feeding

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(28.2%, 19.1% and 18.8%) respectively. Although, the rotavirus infections were recorded around the year, the highest infection rate was during spring and winter seasons (22.5% vs 21.4%). It was also found that neither bacterial nor parasitic co-infections were significantly associated with rotavirus infection.

Conclusion: Rotavirus infection as a cause of acute diarrhea was common in Diyala province, and particularly affects children below 5 years of age.

Keywords: Rotavirus, acute diarrhea, gastroenteritis

Introduction

Rotavirus is a double-stranded RNA virus belongs to the family Reoviridae. It is the leading single cause of severe diarrhea among infants and children [1, 2]. There are seven groups of this virus, referred to as A-G. Rotavirus A, which accounts for more than 90% of rotavirus gastroenteritis in human, is endemic worldwide [3, 4]. By the age of five, nearly every child in the world has been infected with rotavirus at least once [5, 6]. However, with each infection, immunity develops and subsequent infection is less severe [7, 8]. Rotavirus is transmitted by the faeco-oral route. It infects cells lining the small intestine and produces an exotoxin, which induces gastroenteritis, leading to severe diarrhea and sometimes death through dehydration [9, 10]. Rotavirus infections are responsible for about 20% of cases, and accounts for 50% of the cases requiring hospitalization, and an estimated 611000 resulting in death [11, 12]. Males are twice as likely to be admitted to hospital as females [13]. In temperate areas, rotavirus infections occur primarily in the winter, but in the tropics they occur throughout the year probably due to seasonal changes in temperature and humidity [14, 15]. Outbreaks of rotavirus A diarrhea are common among hospitalized infants, young children and elderly people in nursing homes [16, 17]. In addition to its impact on human health, rotavirus also infects animals, and is a pathogen of livestock [18].

Materials and methods

The present study was extended from 1/July/2007 to 1/September/ 2008 in Baquba city. A total of 300 fecal specimens were collected from patients suffering from acute diarrhea attending Al-Batool Hospital for Maternity and Children as well as three Primary Health care Centers in Baquba. The patients include 136 (45.3%) females with mean age (7.8 ± 4.7) years, and 164 males with mean age (5.3 ± 3.4) years. Information including age, sex, residence,

type of feeding, source of water supply were collected in special form preconstructed for this purpose. BioRad-Rota kit is a highly sensitive agglutination test was used for detection of rotavirus in fecal specimens. Bacterial co-infections were identified by culturing on differential and selective media, and the final diagnosis followed the standard bacteriological criteria. Parasitic co-infections were detected by general stool examination performed by two laboratory professionals. All data were statistically analyzed using computerized assisted SPSS (Statistical Package for Social Science) version 13. Statistical results below 0.05 were considered significant.

Results

A description regarding the age, sex, residence, source of water supply and type of feeding for patients was shown in table (1).

Table (1): description of study group.

Variables	Control group	
	No.	%
Age (Ys):		
≤ 1 year	5	14.3
≤ 2 years	2	5.7
≤ 5 years	8	22.9
< 10 years	8	22.9
10-17 years	7	20
18 +	5	14.3
Total	35	100
Sex:		
Female	18	51.4
Male	17	48.6
Total	35	100
Residence:		
Urban	20	57.1
Rural	15	42.9
Total	35	100
Source of water supply:		
Municipal water	29	82.9
Rivers	3	8.6
Tanks	3	8.6
Total	35	100
Type of feeding(< 2 years):		
Breast	3	50
Artificial	2	33.3
Mixed	1	16.7

The overall rotavirus infection rate among patients with acute diarrhea as detected by agglutination test was 20.3%. The highest infection rate was found among those patients < 5 years old (80.3%). The infection rate among adult patients was (8.2%), table (2).

Table (2): Rotavirus infection rate among patients according to the age.

Age	No. tested	No. positive (%)	95% CI
≤ 1 year	86	16 (26.2%)	10.4-26.8
≤ 2 years	69	18 (29.5%)	15.7-36.5
≤ 5 years	79	15 (24.6%)	10.4-27.6
< 10 years	24	1 (1.6%)	3.8-12.2
10-17 years	21	6 (9.8%)	9.2-48
18 +	21	5 (8.2%)	5.6-42
Total	300	61 (20.3%)	15.8-24.8

Although it was insignificant, the infection rate was higher among female patients compared to male patients (22.1% vs. 18.9%), table (3).

Table (3): Rotavirus infection rate among patients according to the sex.

Sex	No. tested	No. positive (%)	P value
Female	136	30 (22.1%)	P Chi-Square = 0.5 [NS]
Male	164	31 (18.9%)	

The infection rate was significantly higher among patients consuming rivers' water for drinking (34.5%) compared to those using municipal or tanks water (14.1% and 18.5%) respectively, table (4).

Table (4): Rotavirus infection rate among patients according to the source of drinking water.

Source of drinking water	No. tested	No. positive (%)	P value
Municipal	185	26 (14.1%)	P Chi-Square < 0.001
Rivers	87	30 (34.5%)	
Tanks	27	5 (18.5%)	

Regarding the type of feeding for those patients less than 2 years of age, the results showed that the highest infection rate was among those on bottle feeding (28.8%) compared to those on breast or mixed feeding (19.1% and 18.8%) respectively. However, the difference was failed to reach the statistical significance, table (5).

Table (5): Rotavirus infection rate among patients according to the type of feeding.

Type of feeding	No. tested	No. positive (%)	P value
Breast feeding	89	17 (19.1%)	P Chi-Square = 0.29 [NS]
bottle feeding	73	21 (28.8 %)	
Mixed feeding	32	6 (18.8%)	

The results also revealed that the infection rate was significantly higher among patients reside in rural areas compared to those reside in urban areas (13.7% vs 26.1%), table (6).

Table (6): Rotavirus infection rate among patients according to the residency.

Residency	No. tested	No. positive (%)	P value
Urban	139	19 (13.7%)	P Chi-Square = 0.008
Rural	161	42 (26.1)	

The seasonal distribution of rotavirus cases showed that the highest infection rate was in spring (22.5%) followed by winter (21.4%), and the least infection rate was in summer (9.1%), table (7).

Table (7): Rotavirus infection rate among patients according to the season.

Season	No. tested	No. positive (%)	P value
Winter	103	22 (21.4%)	P Chi-Square = 0.59 [NS]
Spring	40	9 (22.5%)	
Summer	22	2 (9.1%)	
Autumn	135	28 (20.7)	

Regarding the bacterial and parasitic co-infections, the shigella spp., salmonella spp., E. coli, Giardia lambelia and E. histolytica were recorded. However, the results revealed that none of them were significantly associated with the increase in the rate of rotavirus infection, table (8).

Table (8): Bacterial and parasitic co-infections with rotavirus.

Bacterial or parasitic cause of diarrhea	Total No.	Positive rotavirus(%)	P value	PR	95% CI	Inverse PR
Shigella spp. Positive	18	2 (11.1%)	< 0.001	0.14	(0.04-0.53)	7.1
Negative	37	29 (78.4%)				
Salmonella spp. Positive	19	3 (15.8%)	< 0.001	0.2	(0.07-0.58)	5
Negative	37	29 (78.4%)				
E.coli Positive	58	15 (25.9%)	< 0.001	0.33	(0.21-0.53)	3
Negative	37	29 (78.4%)				
Giardia lambelia Positive	36	6 (16.7 %)	< 0.001	0.21	(0.1-0.45)	4.8
Negative	37	29 (78.4%)				
E. histolytica Positive	132	6 (4.5%)	< 0.001	0.06	(0.03-0.13)	16.7
Negative	37	29 (78.4%)				
Total Positive	263	32 (12.2%)	< 0.001	0.16	(0.11-0.22)	6.3
Negative	37	29 (78.4%)				

PR: Probable risk CI: Confidence intervals

Discussion

The present study was carried out because of the importance of rotavirus infection as a cause of acute gastroenteritis among infants and children, beside the lack of such previous study in Diyala province. Study samples were collected from Al-Batool Hospital for Maternity and Children as well as three Primary Health Care Centers (Al-Tahrir, Al-Sarie and Al-Takia) to achieve more representative samples.

The results revealed that the overall rotavirus infection rate among patients was 20.3%, and that the age group < 5 years was mostly affected. The present results were consistent with other Iraqi researchers [19,20] who reported an infection rate of 24.4% and 26.3% respectively among children < 5 years using slide agglutination technique. However, other workers [21, 22] reported a slightly higher infection rates 32.1% and 40% respectively. Nevertheless, worldwide studies have yielded variable results depending on the geographical area, age of patients included and the laboratory technique employed; for instance, in Korea (Koh et al., 2008) [23] reported an infection rate of 41.3% among children < 5 years, while in Thailand [13] reported an infection rate of 48% among the same age group. In Saudi Arabia,

the infection rate was 30%, and that children < 2 years were mostly affected [24]. In studies using polymerase chain reaction (PCR) for detection of viral RNA in stool of patients, (Chitambar et al., 2008) [25] reported a detection rates of 80.6% and 19% respectively among children < 5 years old.

Rotavirus infection among young adults (10-17) years and adults (18 and more) years recorded in the current study was 9.8% and 8.2% respectively. These results were in agreement with those reported by other workers [26-28]. As the infection by rotavirus at childhood, and subsequent subclinical infections confer a protective levels of IgA, which are usually serotype-specific. So, the infection of adults by rotavirus may be partially explained by fading up of these IgA by the time or emergence of new viral reassortants [29].

The significantly higher infection rate among patients consuming rivers water for drinking compared to other sources of water supply is consistent with almost all previous studies affirming the importance of contaminated water for transmitting the virus [30]. Of note, several studies have documented the detection of rotavirus from rivers and surface waters by molecular techniques [4, 31]. Contamination of water undoubtedly comes through human and probably animal excreta, and in this regard it has been documented that one gram of the faeces of infected person contains more than 10 trillion of viral particles, and that only 10-100 viral particles are needed to transmit the infection [1].

The present study as well as others [19] are in agreement that infants (< 2 years) feed artificially are more liable for infection by rotavirus. It has been reported that human breast milk contains several factors that may play a role in preventing infection and of these is a glycoprotein, lactoherine, which is able to bind to and prevent rotavirus replication, beside the natural immune defense mechanisms [32, 33].

The significantly higher infection rate among rural is inconsistent with other studies [24,34]. The low health education, beside that many rural areas use rivers or well waters for drinking and swimming due to shortage of municipal water. Additionally, in rural areas, farm animals are often breeds indoor, and therefore constitute another source of infection, suggesting that rotavirus infection may be among zoonotic diseases [18, 35].

The absence of significant difference in the infection rate regarding the patient's gender is also reported by other workers, suggesting the exposure of both sexes to equal risk for infection [19, 24,28,34].

The rainfall and floods that usually occur at winter and spring time sweeps up debris including human and animal excreta downward the rivers and increasing the concentration of rotavirus in river's water. Human consumption of water either directly from the rivers or indirectly from water treatment stations increases the rotavirus infection rate. This is the plausible explanation of the high rotavirus infection during spring and winter seasons obtained by the current study as well as other studies [24,34]. It is worth to mention that outbreaks of acute gastroenteritis due to contamination of municipal by rotavirus have been documented [36].

Multiple studies have documented rates of co-infection by rotavirus and other enteropathogens range 3%-22% [26,37]. These co-infections include viral-viral, viral-bacterial, viral-parasitic or all together. Although most of studies failed to found a significant association between rotavirus and other enteropathogens; However, it affirms that co-infection by these enteropathogens aggravate the clinical picture of the disease and extend the hospital stay period [38,39].

The present study concluded that rotavirus infection is a common cause of acute gastroenteritis particularly among patients < 5 years old in Diyala province.

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