

# Burden of Rotavirus Gastroenteritis in the Pediatric Emergency Service

Sinan Oğuz<sup>1</sup>, Funda Kurt<sup>1</sup>, Deniz Tekin<sup>1</sup>, Bilge Aldemir Kocabaş<sup>2</sup>, Erdal İnce<sup>2</sup>, Emine Suskan<sup>1</sup>

<sup>1</sup>Department of Pediatrics, Division of Pediatric Emergency, Ankara University Faculty of Medicine, Ankara, Turkey

<sup>2</sup>Department of Pediatrics, Ankara University Faculty of Medicine, Ankara, Turkey

## Abstract

**Objective:** Rotavirus has an important role in viral childhood gastroenteritis all over the world. Acute gastroenteritis constitutes an important part of pediatric emergency department admissions. We aimed to evaluate the burden of rotavirus gastroenteritis in the pediatric emergency department.

**Material and Methods:** Patients who were admitted to Ankara University Faculty of Medicine Pediatric Emergency Department between August 1, 2011 and July 31, 2012 with a diagnosis of acute gastroenteritis were included in this study. Clinical characteristics and the data of patients with a positive rotavirus antigen test in stool were analyzed retrospectively. Stool samples were examined by using an immunochromatographic test (CerTest Rota Kart BIOTEC, Zaragoza, Spain).

**Results:** In the study period, 3046 stool samples for rotavirus antigen were evaluated, and 552 patients (284 boys, 268 girls) were found to have positive test results. The ages of the patients ranged from 36 days to 14.59 years, with a median of 1.70 years; 58.1% of the patients were under 2 years. The patient admissions were more frequent in winter and less frequent summer months. It was determined that 46% of the patients were followed up in the pediatric emergency department or pediatric infection disease services; 66.8% of these patients were under 2 years, and no patients were hospitalized over the age of 5.

**Conclusion:** As a result, rotavirus gastroenteritis had a higher frequency under 2 years of age and in winter; also, hospitalizations were more frequent in this age group. Most of the patients were followed up in the pediatric emergency department and discharged after the treatment; thus, the burden of hospital inpatient services was reduced. Pediatric emergency departments have an important role in the treatment of rotavirus gastroenteritis. (*J Pediatr Inf* 2014; 8: 99-104)

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## Correspondence

### Address:

Sinan Oğuz  
Department of  
Pediatrics, Division of  
Pediatric Emergency,  
Ankara University  
Faculty of Medicine,  
Ankara, Turkey  
Phone: +90 312 595 67 95  
E-mail:  
sinoguz@yahoo.com

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## Introduction

Acute gastroenteritis in childhood is the second most frequent cause of mortality and morbidity after respiratory diseases. Rotavirus is one of the most important reasons of acute viral gastroenteritis; it is common in all ages, but it is more frequent between 6 months and 2 years. It is commonly known that almost all children are infected with rotavirus until the age of five and clinical acute gastroenteritis develops in most them. Although it is more common in winter, it can be seen in all seasons within a year especially in developing countries (1-3). Rotavirus is

transmitted by the faecal-oral route. The virus taken in by oral route is incompletely inactivated by gastric acid. It is thought that 1-10 viruses freed from gastric acids may constitute intestinal infection (2, 4, 5).

Rotavirus especially damages the small intestine villus cells. Therefore, as a result of damages in these cells, disaccharides cannot be absorbed and fluid and electrolyte loss occurs. As the intestinal motility increases, fluid loss increases and disease gets more severe. Besides, the fact that NP4 protein of rotavirus behaves like enterotoxin and contributes to the severity of clinical status (4, 5). Even though it is



usually a self-limiting infection, mortality due to fluid loss and electrolyte disorders rarely occurs. After 2-4-day incubation period, it starts with fever, vomiting and watery diarrhea. Fever and vomiting decrease in the second day of the disease, but diarrhea lasts for about a week. Especially infants may suffer from dehydration due to large volume of watery stool and vomiting. Infection may be prolonged in patients with immune system disorders (1-4).

Children with diarrhea complaints are frequently admitted to pediatric emergency departments, and first assessment and treatment is given there. There are many studies in Turkey that have investigated the epidemiologic characteristics of rotavirus gastroenteritis. These studies have mostly investigated epidemiologic characteristics and laboratory findings. However, there are limited numbers of studies that have investigated the impact of this disease over pediatric emergency departments. In this study, we aimed to retrospectively investigate the gastroenteritis cases admitted in the pediatric emergency department of a university hospital with diarrhea and reveal the burden of rotavirus gastroenteritis, in addition to epidemiologic characteristics.

## Material and Methods

The data of patients aged 0-18 years in whose stool rotavirus antigen test was positive admitted with the early diagnosis of acute gastroenteritis to the Pediatric Emergency Department of Faculty of Medicine at Ankara University between 1<sup>st</sup> of August 2011 - 31<sup>st</sup> of July 2012 were investigated retrospectively in this study. The stools samples were sent without any delay to the microbiology laboratory of our university hospital and were analyzed with regards to rotavirus by using immunochromatographic test (CerTest Rota Kart BIOTEC Spain).

The demographic information of the patients such as age and gender, season of admission (autumn, winter, spring and summer), type of treatment (outpatient-basis, emergency observation unit, hospitalization) were obtained from the records of the hospital's information system and evaluated.

The SPSS 16.0 package program was used for statistical analyses, compliance test (Shapiro-Wilk test) was performed for the normal distribution of the age data and it was found that it did not comply with the normal distribution. In order to analyze the categorical data, chi-square test was used; and for the analysis of permanent variables, Mann-Whitney U test was used. The level of significance was defined as  $\alpha=0.05$ .

## Results

Throughout the study, 3046 stool samples were evaluated for rotavirus antigen and 552 patients (18.1%) were found to have positive test results. During the same study period, a total of 62783 patients were admitted to the pediatric emergency department, rotavirus was positive in 0.9% of those admissions of rotavirus positive patients, 284 (51.4%) were male and 268 (48.6%) female. No statistically significant difference was found between the two genders ( $p=0.097$ ). It was found that median age of rotavirus antigen positive patients was 1.7 years (36 days-14.59 years old) and those of negative cases 1.9 (30 days-17.9 years old). This difference was statistically significant ( $p=0.037$ ).

It was revealed that 58.1% of the cases were children under 2 years of age. The most frequent admissions (40.3%) were in winter, and the least frequent in summer (8.9%). Various characteristics of the patients were summarized in Table 1. It was revealed that almost half of the cases (46%) were monitored through hospitalization in the emergency observation unit in the pediatric infectious diseases clinic, and most of the cases (66.8%) were patients under two years of age, and no child over the age of five was hospitalized. These differences were statistically significant. It turned out that hospital stay of inpatients was median 4 (1-8) days. Treatment types and p values of the cases are illustrated in Table 2. It was found that during the same period, 62783 cases were admitted to the pediatric emergency department and 5501 of those cases were followed up in the emergency observation unit for various reasons. Four point six % of the cases followed up in the pediatric emergency observation unit were made up of rotavirus positive cases.

## Discussion

Acute gastroenteritis is an important infectious disease causing mortality and morbidity in childhood. Factors such as bacteria, virus, parasites and amoeba play a role in the etiology. Rotavirus infections are the primary cause of acute gastroenteritis in childhood. They are responsible for a majority of diarrhea-related hospitalizations in Turkey as well as all over the world (6, 7). According to the data of the World Health Organization in January 2012, 453000 children lost their lives worldwide due to rotavirus infections in 2008. Most of the mortality occurred in undeveloped countries (8). It is highly noticeable that there is a great amount of mortality from a vaccine preventable disease.

Even though history and clinical characteristics are sufficient for the diagnosis of viral gastroenteritis, laboratory tests are needed in order to show etiologic agent. It is difficult and inconvenient to isolate rotavirus through the culture. In order to identify viral antigens in the stool, ELISA and latex agglutination tests are used for the diagnosis of rotavirus infections. Immunochromatographic tests are based on the identification of antigens; they are preferred because they are compatible with ELISA, produce results in a short time and can be tested with little samples (9-11). In our hospital, one-step colored Immunochromatographic card test (CerTest Rota Card BIOTEC Spain) performing the qualitative identification of rotavirus in stool samples is used. It was found that specificity of this test was 98% and sensitivity 99%. It was revealed in our study that 0.9% of emergency department admissions were composed of rotavirus positive cases. However, 4.6% of the cases followed up in the emergency observation unit were made up of rotavirus positive cases. Similarly, 8.7% of all the cases admitted to emergency department during the same period were followed up for various causes in the emergency observation unit. Follow-up rate of rotavirus positive cases in the emergency observation unit reached as

**Table 1. Distribution of cases according to various characteristics**

Characteristic	Number (%)
Gender	
• Female	268 (%48.6)
• Male	284 (%51.4)
Age Groups	
• 0-24 months	321 (%58.1)
• 24-60 months	175 (%31.8)
• >5 years	56 (%10.1)
Seasonal characteristics	
• Autumn	167 (%30.2)
• Winter	223 (%40.3)
• Spring	113 (%20.4)
• Summer	49 (%8.9)

**Table 2. Treatment type according to age**

	<2 years Number (%)	2-5 years Number (%)	>5 years Number (%)	Total Number (%)	p
Hospitalization in the Pediatric Infectious Diseases Clinic	32 (%10)	7 (%4)	-	39 (%7.1)	0.004
Pediatric Emergency Observation Unit	139 (%43)	65 (%37)	13 (%23)	217 (%39.3)	0.014
Outpatients	150 (%47)	103 (%59)	43 (%77)	196 (%53.6)	0.001
Total (number)	321	175	56	552	

far as 46.4%. This particular situation very well illustrates the burden of this disease on the pediatric emergency departments. Given the fact that median hospital-stay of the hospitalized cases was four days, we are, therefore, of the opinion that rotavirus gastroenteritis placed a huge burden on the inpatient clinics.

In various studies done in Turkey, it was reported that rotavirus prevalence rate was 15.5%-53% (6, 7, 12-20). In 18.1% of the stools samples evaluated in our study, rotavirus was found to be positive. This rate is compatible with the rates of previous studies such as Ankara (19), Eskişehir (17) and İstanbul (15).

Although rotavirus is common in every age group, it causes symptomatic infections most frequently in children under two. The largest groups of cases in our study were children under two. Besides, 171 (66.8%) of the 256 patients treated through hospitalization or followed up in the emergency observation unit were composed of cases under two years of age. In a study Kurugöl et al. carried out in İzmir in 2000 (18), they found that 39.8% of 920 acute gastroenteritis cases were rotavirus positive and they emphasized that 80.7% of the patients were cases under two. In a multi-centered study in which 411 cases hospitalized for diarrhea, it was revealed that 338 cases were tested for rotavirus antigen and 53% positivity was found (6). It was found, on the other hand, that 83.8% of the rotavirus positive cases were under two. Karadağ et al. demonstrated (16) that 37.6% of the 404 rotavirus positive gastroenteritis cases were treated through hospitalization, and rotavirus positive gastroenteritis patients required more hospitalization in comparison to rotavirus negative cases.

Recurrent infections in children over two are milder and less asymptomatic due to partial immunity generated by the rotavirus. Thirteen of the 56 cases in our study were followed up in the emergency observation unit and there was no hospitalized case.

The months during which rotavirus is common, vary according to the geography and developmental state of the country. While it is common in every month of the year in tropical and undeveloped countries, it is seen mainly in winter season in Turkey and central European

**Table 3. Comparison of previous studies in Turkey and our study n (%)**

Characteristic	Current study	M. Hacımustafa-oğlu et al. (7)	S. Biçer et al. (12)	E. Berk and T. Kayman (13)	M. İlktaç et al. (15)	K. Kaşifoğlu et al. (17)	M. Meral et al. (19)
Study period	August 2011-July 2012	2008	January 2007-January 2008	January 2009-January 2011	2006-2010	2005-2011	April 2009-February 2010
Location of Study	Ankara	Bursa	İstanbul	Kayseri	İstanbul	Eskişehir	Ankara
Positivity/number of cases (%)	552/3046 (%18.1)	473/1790 (%26.4)	422/1767 (%23.9)	958/3445 (%27.8)	1818/11711 (%15.5)	247/1241 (%19.9)	53/251 (%21.1)
Investigation method	immunochromatographic kart test (CerTest Rota Kart BIOTEC Spain)	Monoclonal rotavirus antigen kit (BioMérieux, France)	immunochromatographic test kit (Rida Quick, r-biopharm)	immunochromatographic test kits in 2009 for 1871 cases MK Bio (Inc. San Diago, ABD), in 2010 for 1574 cases Simple/Stick Rota Adeno (Operon, Spain)	immunochromatographic test kits (Combi-Strip, CORIS BioConcept, Belgium; Rotavirus and Adenovirus Rapid Combo Test Device, MK Bio, Germany)	Kit used with the method of Enzyme Linked Fluorescent Assay (ELFA) (Vidas Rotavirus; Biomerieux, France)	With the ELISA method (Rotaclone, Meridian Diagnostics, Inc., USA)
Gender n (%)							
Female	268 (%48.6)	191 (%40)	189 (%44.8)	419 (%43.7)	751 (%41.3)	114 (%46.2)	26 (%49.1)
Male	284 (%51.4)	282 (%60)	233 (%55.2)	539 (%56.3)	1067 (%58.7)	133 (%53.8)	27 (%50.9)
Ages n (%)							
0-24 months	321 (%58.1)	326 (%69)	299 (%70.8)	674 (%70.3)	1000 (%55)	-	-
24-60 months	175 (%31.8)	80 (%17)	102 (%24.2)	199 (%20.7)	362 (%20)		
>5 years	56 (%10.1)	67 (%14)	21 (%5)	85 (%9)	256 (%25)		
Season (%)							
Autumn	167 (%30.2)	91 (%19.2)	49 (%11.6)	258 (%27.6)	-	31 (%13.2)	27 (%50.9)
Winter	223 (%40.3)	190 (%40.2)	194 (%46)	334 (%38.4)		105 (%36.2)	13 (%24.5)
Spring	113 (%20.4)	145 (%30.6)	125 (%29.6)	267 (%31.9)		76 (%18.7)	8 (%15.1)
Summer	49 (%8.9)	47 (%10)	54 (%12.8)	99 (%12.3)		35 (%11.3)	5 (%9.4)
Footnote: Data with no definite number were marked by the symbol "-".							

countries (2). In our study, rotavirus cases were frequent mostly in winter, and especially in December with 111 cases (20.1%). In studies done in different parts of Turkey, similar results were obtained (6, 7, 12-20). The comparison of our study and other studies done in Turkey is summarized in Table 3.

It is possible to be protected against rotavirus infections through vaccination. International studies proved that there were observable decreases in both hospital admissions and hospitalizations after vaccination (21-24). The vaccine is still in the national vaccine calendar in many countries. Some Turkish studies also produced similar results and revealed that the vaccine was efficient and reduced the costs (25, 26). One should not consider the cost of the disease as the treatment costs in the hospital. Given the fact that the hospitalized cases or those

followed up in the emergency observation units are accompanied at least by one parent, the loss of the labor force will be clearly understood. Since this disease that places a significant burden on pediatric emergency departments and families is vaccine-preventable, we are of the opinion that the vaccine should be added to the national vaccination calendar.

The most important limitation of our study is that it is a retrospective study. We failed to reach the data regarding for how long the cases were monitored in the emergency observation unit. However, it is notable that a majority part of the rotavirus positive cases were monitored in the emergency observation unit until they clinically improved or hospitalized as inpatients. There is a need for prospective studies including the period of emergency department monitoring.

## Conclusion

In conclusion, it was revealed that the prevalence of rotavirus gastroenteritis increased in children under two and in winter season. It was also found that frequency of hospitalization in the same age group was higher. Majority of the inpatient cases were monitored in the pediatric emergency observation units and discharged; therefore, the inpatient burden of the hospital was reduced. We are of the opinion that pediatric emergency departments are crucially important in the follow-up and treatment of rotavirus gastroenteritis.

**Ethics Committee Approval:** Ethics committee approval was not received due to the retrospective nature of this study.

**Informed Consent:** Written informed consent was not obtained due to the retrospective nature of this study.

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