

# The Prevalence of Rotavirus and Adenovirus in the Childhood Gastroenteritis

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## Abstract

**Background:** Acute gastroenteritis stemming from viral causes is very common during the childhood period. Rotavirus and enteric adenovirus are the most common factors of acute gastroenteritis encountered in infants and children. However, the epidemiology of rotavirus and enteric adenovirus gastroenteritis in the east Anatolia region is not well-known.

**Objectives:** We aimed to evaluate the relationship between the distribution of antigen positivity in rotavirus and enteric adenovirus antigen tests required cases and demographic data retrospectively in pediatric patients admitted to our hospital.

**Patients and Methods:** The records of stool sample analyses for 1154 patients admitted to our hospital from June 2011 to December 2011 with complaints of diarrhea were retrospectively examined. The presence of rotavirus and enteric adenovirus antigens in stool specimens was investigated by means of an immunochromatographic test.

**Results:** Viral antigens were detected in 327 (28.3%) stool specimens out of 1154. Among the positive results, the frequency was 73.7% for rotavirus and 26.2% for adenovirus. While the detected rotavirus antigen rate was high for all age groups, it was highest for children under the age of 2, with a rate of 57.1%. Moreover, the rotavirus infections were observed at a rate of 44.3% in winter and of 24.6% in autumn.

**Conclusions:** The most important factor in childhood acute gastroenteritis in east Anatolia is the rotavirus. Rotavirus and adenovirus antigens should be routinely investigated as a factor in fresh stool samples for the accurate diagnosis and treatment of gastroenteritis in children in the winter and autumn months.

**Keywords:** Gastroenteritis, Children, Rotavirus, Adenovirus, East Anatolia

## 1. Background

Acute gastroenteritis can occur at any age, but the etiologic agents and the severity of the disease may vary depending on age (1). Several studies have shown that the most frequent causes of nonbacterial gastroenteritis are the rotavirus and enteric adenovirus, most particularly in children in the age range of 0 - 5 years (1, 2). Gastroenteritis related to viral causes is most often seen in childhood. Children can be infected with the rotavirus several times throughout their lives, and almost every child is infected up to the age of five (2, 3). Gastroenteritis spreads very quickly among children, the the estimated incubation time of the disease being less than 48 hours (4).

Symptoms usually begin within 24 - 48 hours and can vary from mild watery diarrhea following fever and vomiting to severe dehydration and shock (5). Infectious diarrhea is one of the leading causes of death among children. The epidemiology of the adenovirus and rotavirus is not well-known in Igdir province (Turkey).

## 2. Objectives

In this study, we aimed to investigate the relationship between age, gender, and season with respect to the frequency of rotavirus and adenovirus antigens in stool specimens obtained from children aged 0 - 5 who were diagnosed with gastroenteritis and were admitted to our hospital with complaints of diarrhea, vomiting, abdominal pain, and the like.

## 3. Patients and Methods

Included in this study were data of the children admitted to the pediatric outpatient clinic of our hospital from January 2011 to December 2011 with complaints of diarrhea and with watery results of macroscopic examination that microscopically lack of any parasites. Data belonging to stool samples which were reported to be hemorrhagic and in which parasites (*Giardia intestinalis*, *Entamoeba histolytica* adhesin antigen, etc.) were detected

were excluded from evaluation. The medical records of patients aged 0 - 15 with positive results from rotavirus and adenovirus antigen tests in fresh stool specimens were retrospectively inspected, and the demographic data of these cases were recorded. The presence of rotavirus and adenovirus in fresh stool samples was investigated at the microbiology laboratory of our hospital by utilizing an immunochromatographic test (One Step Rapid test, EBR Zhejiang Orient Gene Biotech Co, LTD, Zhejiang, China), in compliance with the chitin procedure. The manufacturer has reported a sensitivity of 99.1% and specificity of 99.9% for the rotavirus and a sensitivity of 99.4% and specificity of 99.9% for the adenovirus. The collected data were analysed using SPSS version 12.0 software (Statistical Package for Social Sciences, SPSS Inc., Chicago, IL, USA). The chi-square test was used for the statistical analyses of the results. A P value of less than 0.05 was considered statistically significant.

#### 4. Results

Viral antigens were detected in 327 (28.3%) out of 1154 samples analysed during the study period. Of the antigen-positive samples, 180 (55.1%) belonged to boys, and 147 (44.9%) belonged to girls. Despite the fact that viral antigenicity was observed most commonly in boys, the difference between the genders was not statistically significant ( $P > 0.05$ ). The rotavirus antigen was identified in 241 (73.7%) specimens, and the adenovirus antigen was identified in 86 (26.2%) specimens. Of the patients with positive rotavirus antigen, 187 (57.1%) were between the ages of 0 and 2, 88 (26.9%) were between the ages of 2 and 5, and 19 (5.8%) were between the ages of 5 and 15. Of the patients with positive adenovirus, 53 (16.2%) were between the ages of 0 and 2, 19 (5.8%) were between the ages of 2 and 5, and 14 (4.3%) were between the ages of 5 and 15 (Table 1). The high prevalence of rotavirus and adenovirus below the age of 2 was found to be statistically significant ( $P < 0.05$ ). When the relationship of antigen positivity of rotavirus and adenovirus with the seasons was scrutinized, a high incidence rate of rotavirus infections in winter months was determined. This was found to be statistically significant ( $P < 0.05$ ). The relationship between the antigen positivity of the adenovirus and the copositivity of the adenovirus-rotavirus with the seasons was not statistically different ( $P > 0.05$ ).

#### 5. Discussion

Diarrhea is among the most important health problems, especially in developing countries. If one considers the fact that every child under 5 years of age experiences

about two episodes of diarrhea yearly, the prevalence of the disease can be understood. In both developing and developed countries, viral gastroenteritis is the most common cause of hospitalization for infants and older children with severe dehydration resulting from diarrhea; it is also a cause of infant mortality. Rotavirus infections are the most common factors in these patients (6, 7). Thus, the feature that makes viral gastroenteritis significant is the excessive rate of hospitalization. In this sense, the burden that the disease places upon families and countries is costly. According to studies carried out outside Turkey, the adenovirus was a factor in 11% - 71% of cases of viral gastroenteritis, and rotavirus in 6% - 22% of cases (8-12). According to studies conducted in Turkey, rotavirus infections constituted 9.8-39.8% of viral gastroenteritis infections, and adenovirus infections 7.8% - 10.0% (8, 13-16).

In the literature, the rotavirus is manifested as the most common cause of viral gastroenteritis. In a study by Tekin et al. that investigated the causes of viral gastroenteritis, the viral antigen was determined to be positive in 170 stool samples (17). The rotavirus and adenovirus constituted 16.7% and 1% of the factors, respectively. In a study by Bayraktar et al., antigen positivity was determined in a total of 348 specimens; antigen positivity for the rotavirus and adenovirus was found to be 23.7% and 1.5%, respectively (18). Coban et al. determined the prevalence of rotavirus- and adenovirus-associated gastroenteritis as 13.6% and 49.3%, respectively (19). Dagi et al. determined the frequency of rotavirus-associated gastroenteritis in children under five years of age as 49.3% (20). Inci et al. determined the frequency of rotavirus-associated acute gastroenteritis in children as 10.6% (21). Bates et al. investigated the prevalence of rotavirus- and adenovirus-associated gastroenteritis and its frequency as 78.3% and 17.8%, respectively (22). We detected 327 cases of viral antigen positivity in stool specimens from a total of 1154 patients aged 0 - 15 with gastroenteritis. Antigen positivity for rotavirus was identified in 241 patients (73.7%), and for adenovirus in 86 (26.2%), for a total of 327 patients.

It has been shown that a vaccine effective in the prevention of rotavirus infection, the most common cause of viral gastroenteritis, provides 70% - 85% protection against rotavirus diarrhea and 85% - 100% protection against severe diarrhea (23). In our study, when we contacted the families, particularly those with children who tested positive for the viral antigen for rotavirus, we asked whether they had had their children vaccinated and learned that none of them had done so. When we compare the antigen positivity for rotavirus and enteric adenovirus in our study with previous similar studies conducted in Turkey, we conclude that the high prevalence of the disease results from a lack of infrastructure, insufficient knowledge of families about

**Table 1.** The Distribution of Cases and Rate of Antigen Positivity According to Demographic Characteristics

Characteristics	Total Number of Children <sup>a</sup> , No. (%)	Rotavirus (+)		Adenovirus (+)	
		No. (%)	P Value	No. (%)	P Value
<b>Gender</b>			> 0.05		> 0.05
Male	180 (55.1)	140 (42.8)		40 (12.2)	
Female	147 (44.9)	101 (30.8)		46 (14)	
<b>Age groups</b>			< 0.05		< 0.05
0 - 2	187 (57.1)	134 (40.9)		53 (16.2)	
2 - 5	88 (26.9)	69 (21.1)		19 (5.8)	
5 - 15	52 (15.9)	38 (11.6)		14 (4.3)	
<b>Seasons</b>			< 0.05		> 0.05
Autumn	80 (24.6)	65 (19.8)		18 (5.5)	
Winter	145 (44.3)	127 (38.8)		27 (8.2)	
Spring	62 (18.9)	36 (11)		22 (6.7)	
Summer	40 (12.2)	13 (4)		19 (5.8)	

<sup>a</sup>Pearson chi-square.

the disease, and the ease of other individuals becoming infected due to inadequate hygiene conditions. Therefore, for families with physicians in our province who are interested in children's health, we planned to provide information regarding appropriate hygiene in protection against viral gastroenteritis, in the reduction of infection with suitable hand cleaning, and in the increase of prevention with vaccines.

Generally, the studies demonstrate that there is no difference in terms of gender with respect to the frequency of viral gastroenteritis. Studies are also available that indicate that in Turkey, there is no difference concerning the role of gender in the prevalence of the disease (17-21). Nor was any significant relationship ( $P > 0.05$ ) shown in this study with respect to gender and viral antigen positivity. Rotavirus and adenovirus gastroenteritis are seen most commonly in children under 2 years of age (11). In contrast, adenovirus gastroenteritis can be observed in children within a broader age range (17-27). In a study carried out in Turkey, children of 0 - 5 years of age with gastroenteritis were evaluated, and of the patients in whom rotavirus was detected, the rates of the cases varied between 26.3% and 65.4% for those less than 12 months old and between 46% and 88.9% for those under 2 years old. Tekin et al. reported in a study carried out in Mardin Province (Turkey) that of rotavirus-positive patients with gastroenteritis, 77% were under the age of 2, 12.3% were in the 2 - 5 year age range, and 2.94% were over 5 years old (17).

According to a study by Bicer et al., from a total of 422 rotavirus-positive cases, 43% were under the age of 12

months, 27% were between the ages of 13 and 24 months, 5.5% were between the ages of 37 and 48 months, 6% were between the ages of 49 and 60 months, and 5% were over the age of 5. These ratios also indicate that most incidences of rotavirus and adenovirus gastroenteritis occur at under 2 years of age (15). Bayraktar et al. reported the prevalence of rotavirus in 348 viral-antigen-positive cases as 50% at the age of 2 (18). In this study, we determined the prevalence of rotavirus cases according to age groups as 187/327 (57.1%) for those under the age of 2, as 88/327 (26.9%) for those between the ages of 2 and 5, and as 52/327 (15.9%) for those between the ages of 5 and 15. We determined the prevalence of adenovirus cases according to age groups as 53/327 (16.2%) for those under the age of 2 and as 19/327 (5.8%) for those between the ages of 2 and 5.

The incidence of coinfection with rotavirus and adenovirus was found to be statistically significant ( $P < 0.05$ ). In addition, the prevalence of rotavirus was statistically significantly higher than infants in the first 3 months ( $P < 0.05$ ). Breastfeeding is known to reduce the incidence of diarrhea, so because infants are breast-fed during the first three months of their lives, it is thought that breast milk plays a role in the low incidence of rotavirus diarrhea during these months (28). Studies on viral gastroenteritis have shown that the prevalence of viral gastroenteritis does not change with gender. We also observed that the rate of viral antigen positivity between female and male children is not statistically significant ( $P > 0.05$ ). It is indicated in various studies that while rotavirus infections are experienced more commonly in the winter months and

in early spring, adenovirus infections can be experienced all year round. Yet although rotavirus antigen positivity is observed all year round, we determined a significant difference between its prevalence in December, January, and February and its prevalence in the other seasons. There was no statistically significant difference between the prevalence of the adenovirus infection and adenovirus-rotavirus coinfection and the seasons.

### 5.1. Conclusion

Viral pathogens play an important role in childhood viral gastroenteritis. In this study, we concluded that in the East Anatolia region, where our hospital provides services, rotavirus and adenovirus are the leading causes of infectious gastroenteritis, which occurs particularly in the autumn and winter months and in children between the ages of 5 and 24 months. This circumstance should not be ignored. Making an accurate diagnosis and treating patients through knowing the factors in gastroenteritis in children aged 5 and especially children under the age of 2 would help provide a rapid recovery of the patients and would prevent unnecessary costs. We think that such studies are important for drawing attention to the disease in areas like east Anatolia with a low socioeconomic status and where the infrastructure is insufficient.

### Footnotes

**Authors' Contribution:** Study concept and design: Gulhan Bora; acquisition of data: Tamer Ozsari and Bulent Kaya; analysis and interpretation of data: Gulhan Bora and Tamer Ozsari; drafting of the manuscript: Gulhan Bora and Tamer Ozsari; critical revision of the manuscript: Gulhan Bora and Tamer Ozsari; statistical analysis: Tamer Ozsari; administrative, technical, and material support: Tamer Ozsari, Bulent Kaya and Kahraman Yakut; study supervision: Gulhan Bora.

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