Cerrahpaşa Med J 2024; 48(1): 30-33 ORIGINAL ARTICLE

Frequency of Rotavirus and Adenovirus in Turkish and Immigrant Patients with Acute Gastroenteritis

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Abstract

Objective: The objective of this study was to investigate the prevalence and seasonal distribution of rotavirus and enteric adenovirus in patients with acute gastroenteritis.

Methods: The results of 2960 patients admitted to Ankara Training and Research Hospital with gastroenteritis between March 2018 and August 2019 were investigated retrospectively. A chromatographic immunoassay (Rotavirus and Adenovirus Combo Rapid Test, General Diagnostica Inc., Rancho Cucamonga, CA, USA), detecting both viruses simultaneously, was used according to the manufacturer's instructions.

Results: Of the 2960 patients, 1286 (43.4%) were female, 1674 (56.6%) were male, and 2873 (97.7%) and 87 (2.3%) were under 18 years old and 18 years and older, respectively. The number of Turkish and refugee patients was 2590 (87.5%) and 370 (12.5%), respectively. Viral antigens of 281/2960 (9.5%) were positive for rotavirus, and 54/2960 (1.8%) were positive for adenovirus. Of the Turkish patients, 243/2590 (9.4%) were rotavirus positive, and 51/2590 (1.9%) were adenovirus positive. Among the refugee patients, 38/370 (10.3%) were rotavirus positive, and 3/370 (0.8%) were adenovirus positive. The highest prevalence of rotavirus and adenovirus, according to age groups, was determined at 12-36 months of age (25.3%) and 49-59 months of age (3.2%), respectively. The highest prevalence of rotavirus and adenovirus positivity was in spring (17.8%) and in autumn (2.9%), respectively.

Conclusion: Rotavirus is the most common cause of gastroenteritis during infancy and childhood. Additionally, enteric adenovirus is an important cause of gastroenteritis during this period. Since these viral infections may have serious complications, rapid diagnosis is important, and detection of both viruses among various populations may be useful for epidemiological purposes.

Keywords: Enteric adenovirus, rotavirus, viral gastroenteritis

Introduction

Rotavirus (RV) infections are a leading cause of severe, dehydrating gastroenteritis in children <5 years of age. Despite the global introduction of vaccinations for rotavirus over a decade ago, rotavirus infections still result in >200 000 deaths annually, mostly in low-income countries.[1] The majority of deaths caused by RV were reported in low-income and low-middle-income countries.[2] The latest estimate from the World Health Organization (WHO) for RV deaths every year around the world was 215 000 in 2013.[3] Vaccination is considered the most effective preventive approach against RV diseases. By June 2017, 85 countries had introduced RV vaccination in their national immunization programs.[4] Although RV vaccination is currently not included in the national immunization program in Türkiye, both rotavirus vaccines, "Rotarix" and "Rotateq," are available. Also, a rotavirus surveillance network study was conducted in Türkiye before the introduction of the national immunization program, although it has not been implemented.[5,6] In the Middle East and North Africa region, and according to the WHO, RV vaccination is part of the national immunization programs in 12 countries. These countries are Bahrain, Djibouti, Iraq, Israel, Jordan, Libya, Morocco, Qatar, Saudi Arabia, Sudan, United Arab Emirates, and Yemen.[2] However, Syria is not among these countries. Because of the intense arrival of Syrian refugees to Türkiye in recent years, and due to the lack of RV vaccination as part of the national immunization in Syria, and the convenience of reaching RV vaccine and optional vaccination in Türkiye, it is possible that the RV prevalence might be higher in Syrian people than in Turkish people.

Adenovirus (AdV) is another important etiological agent of severe gastroenteritis among infants and young children.[7] Types 40 and 41 of HAdV-F have global distributions and are responsible for 1%-20% of diarrhea cases worldwide. HAdV species A (types 12,

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18, and 31), C (types 1, 2, and 5), and D (types 28, 29, 30, 32, 37, and 43-46) have also been associated with diarrhea;[6,7] although, they are only rarely compared to HAdV-F40/41.[8] The fecal–oral route, droplets, and contaminated food and surfaces play a role in the transmission of RV and AdV.[1,9] No effective treatments have been developed for viral gastroenteritis; therefore, regional and local epidemiological information on RV and AdV infection is important for healthcare practitioners and officials to develop suitable vaccines and implement infection control measures.[7] The aim of this study was to investigate the prevalence and seasonal distribution of RV and enteric AdV in Turkish and refugee children with acute gastroenteritis in Ankara.

Methods

Study Design

A total of 2960 Turkish (2590) and immigrant (370) patients with acute gastroenteritis that applied to Ankara Hospital (a hospital in Ankara with low- and middle-income patients) Pediatrics Clinics from March 2018 to August 2019 were included in the study. Stool samples from these patients were collected and sent to the microbiology laboratory for RV and enteric AdV antigen tests. Demographic data of patients, including age, gender, hospital application date, and clinical symptoms, were recorded. Rotavirus and AdV Ag test results with other data of the patients were evaluated and analyzed.

Laboratory Study

A rapid chromatographic immunoassay test (Rotavirus and Adenovirus Combo Rapid Test, General Diagnostica Inc., Rancho Cucamonga, Calif, USA) for the qualitative detection of RV and enteric AdV that can detect both viruses simultaneously in fecal specimens was used according to the manufacturer's instructions (sensitivity was 97.3% and 95.2% for rotavirus and adenovirus, respectively, and specificity was 97.1% for RV and 97.7% for AdV, respectively). The test is a kind of lateral flow test operating on the same principles as the enzyme-linked immunosorbent assays. The test contains anti-rotavirus antibodies and anti-adenovirus antibody-coated particles on the membrane. During testing, the specimen reacts with particles coated with anti-rotavirus antibody and anti-adenovirus antibody. The mixture migrates upward on the membrane chromatographically by capillary action to react with anti-rotavirus antibody and anti-adenovirus antibody on the membrane and generate a colored line. The presence of these colored lines in the test line region indicates a positive result, while their absence indicates a negative result. To serve as a procedural control, a colored line will always appear in the control line region, indicating that proper volume of specimen has been added and membrane wicking has occurred.

Statistical Analysis

Statistical analysis of RV and AdV positivities based on age groups, sex, seasons, and monthly distributions was compared. The collected data were analyzed by using The Statistical Package for Social Sciences version 20.0 software (IBM Corp.; Armonk, NY, USA). To determine whether RV and AdV positivity varied by various characteristics of the patients in the study, the Pearson's X^2 test was used.

Ethics Approval

This study was approved by the Ethics Committee of Ankara Keçiören Training and Research Hospital (Approval No: 2012-KAEK-15/1817, Date: February 13, 2019). Informed consent was obtained from the patients and children's guardian before sample collection.

Results

Of the 2960 patients, 1286 (43.4%) were female and 1674 (56.6%) were male. The number of Turkish and immigrant patients was 2590 (87.5%) and 370 (12.5%), respectively (Table 1). Viral antigens of 281/2960 (9.5%) patients were positive for RV, and 54/2960 (1.8%) were positive for AdV, and the co-existence of RV and AdV was in 25 patients (0.84%). The mean age of the patients was 5.5 years. The highest prevalence of RV according to age groups was determined at 25-36 months of age (12.8%) and 13-24 months of age (12.5%). The highest AdV frequency was in children 0-12 and 49-59 months of age (3.2%). Rotavirus frequency was lowest in patients older than 18 years (2.3%). There was a statistically significant difference for RV positivities in different age groups ($P < .0001$). Adenovirus positivity rates according to age groups were similar to each other ($P = .428$). Rotavirus and AdV positivity rates according to age groups are given in Table 2. Among Turkish patients, 243/2590 (9.4 %) were RV positive, and 51/2590 (1.9%) were AdV positive. Among immigrant patients, 38/370 (10.3%) were RV positive, and 3/370 (0.8%) were AdV positive. No statistically significant difference was found for the positivity rates of RV and AdV in Turkish and immigrant patients ($P = .586$, $P = .119$). Rotavirus and AdV positivity rates of female and male patients were similar (RV: 9.95%, 9.13%; AdV: 2.33%, 1.43%), and there was no statistically significant difference ($P = .454$, $P = .070$). Co-existence rates of RV+AdV were 0.93% for females and 0.77% for males ($P = .688$). Rotavirus frequencies were higher in winter and spring, as expected. However, AdV rates were similar in each season. The highest prevalence of RV and AdV positivity was in spring (17.8%) and autumn (2.9%), respectively (Figure 1). Rotavirus frequency was highest in March (25.3%) and lowest in the summer months. Adenovirus frequency was highest in November (5%). The positivity rates of RV and AdV according to months are given in Figure 2. A statistically significant difference in RV positivities in the summer and winter/spring months was detected ($P < .0001$).

Table 1. The Demographic Data of the Patients

Mean Age	**5.5 Years (0-80 Years Old)**	
Gender	1674 male	1286 female
Nationality	2590 Turkish	370 immigrant

Table 2. Rotavirus and Adenovirus Positivity Rates of Age Groups

Age Groups	**RV Positivity Rate**	***P***	**AdV Positivity Rate**	***P***
0-12 months	7.36%	<.0001	3.15%	.428
13-24 months	12.54%		1.39%	
25-36 months	12.80%		1.40%	
37-48 months	9.09%		1.92%	
49-59 months	11.17%		3.19%	
5-18 years	6.83%		2.03%	
≥18 years	2.29%		0%	

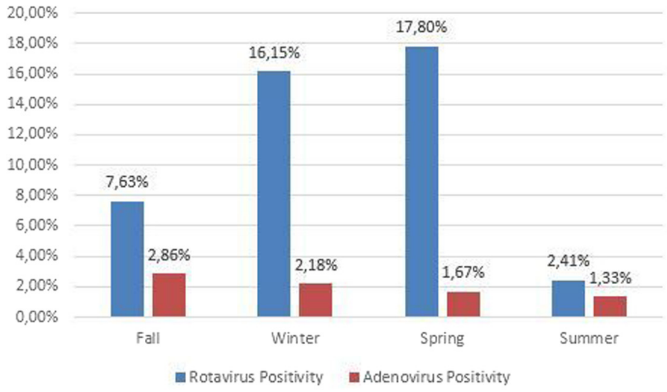

Figure 1. Rotavirus and adenovirus positivity rates according to seasons.

Discussion

The frequencies of RV and enteric AdV were investigated in a total of 2960 Turkish and refugee patients with acute gastroenteritis in one and a half-year process. The easiest and fastest method for the laboratory diagnosis of viral gastroenteritis is rapid immunochromatographic antigen tests. Although the reliability of these methods is not as high as enzyme-linked immunoassays or molecular methods, they offer rapid diagnosis, especially in laboratories with limited testing capacity. Therefore, they provide the best alternatives to be used in diagnosis, today.[10] The sensitivity and specificity of rapid tests are approximately 80%-100% and 54%-100%, respectively.[11] The sensitivity and specificity of the kit that was used in this study were also high (over 95%).

In this study, the RV positivity rate (9.5%) was higher than that of the AdV (1.8%). The positivity rates of Turkish and refugee patients were similar; there is only a slight increase (1%) of RV in refugee patients compared to Turkish patients. In addition, AdV rates were higher in Turkish patients than in refugee patients. However, these differences were not statistically significant. In a study by Akan et al in 2009, RV and AdVpositivity rates were 19% and 9% in patients aged 0-64 years, respectively.[12] In their 2015 study, Bozkurt et al[13] reported an RV rate of 33.6% and AdV of 16% in children. Another study conducted in Northern Cyprus in 2019 detected 12.7% RV positivity and 9.6% AdV positivity in patients aged 0-92 years.[14] In Iraq, Jaff et al.[15] reported 22% RV and 3% AdV positivity rates, respectively, in children under 5 years of age in 2016. El-Mohammady et al[16] in Egypt found that RV and AdV were present in 19% and 4.7%, respectively, of 2112 pediatric patients with acute diarrhea as a single or co-pathogen. Similar to our results, it is observed that in many studies, the frequency of RV is higher than that of enteric AdV[17, 18].

In general, viral gastroenteritis studies report that there is no statistically significant difference in terms of gender.[5] Our study showed similar results to the literature, and there was no statistically significant difference in RV, AdV, and RV+AdV positivities based on gender.

In this study, the highest RV frequency was detected in 1-3 years of age, while the highest AdV frequency was detected in 0-12 and 49-59 months of age patients. A statistically significant difference in rotavirus positivities of different age groups was detected in our study. This difference is probably caused by the low RV positivity rate of patients older than 18 years old (2.3%). Generally, RV and enteric AdV gastroenteritis are seen in children under 5 years old, and most commonly under 2 years of age. In a systematic review by Tapisiz et al, 98 studies from Türkiye were analyzed. The highest RV rate was in children under 2 years of age (25.9%). The detection rate for children older than 5 years of age (10.9%) was lower than that for children 0-5 years old (31.8%).[19] However, although RV gastroenteritis is much more common in children under 5 years old, AdV gastroenteritis can be observed in children within a broader age range.[17,20] A nationwide RV surveillance study from Türkiye reported that RV positivity according to age groups was the highest in the age group of 13-24 months.[5] In a study by Tekin et al. carried out in Mardin Province (Türkiye), RV and AdV antigen-positive cases were most frequently seen in children between 5 and 24 months of age.[21] Celik et al[22] reported in their study that children aged 0-2 years constituted the largest age group regarding RV and AdV frequency. Bicer et al[23] presented in their study that the majority of RV and AdV cases (74.6%) were in children between 0 and 2 years old.

Rotavirus was detected most frequently in the spring and winter seasons in the present study. In contrast, the RV rate was very low in summer (2.4%). RVs generally peak in cold months, so these data are compatible with the literature.[20] Rotavirus positivity according to months caused a significant difference because of the high rates in cold months and low rates in hot months in this study. Additionally, it has been demonstrated in the literature that AdV gastroenteritis is more common in colder months.[22,23] Celik et al[22] investigated the relationship between RV and AdV frequencies and their weather conditions. They reported that temperature and humidity have direct relations with RV rates; however, there was no relation between AdV infections and weather conditions.[22] Malek et al[24] reported in their systematic literature review about RV infections in Eastern Mediterranean countries that, there is no clear relationship between the timing of the peak in rotavirus activity and season; however, in some countries, clear peaks in rotavirus detection occurred during the cooler months. In contrast, El-Mohammady et al[16] reported that they detected higher RV and AdV rates in warm months (from May to October) in Egypt.

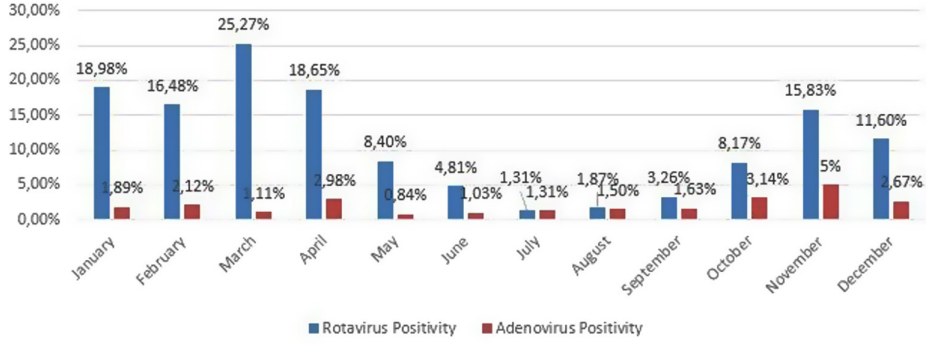

Figure 2. Monthly distribution of rotavirus and adenovirus rates.

In the study of Coban et al[25]from the South of Türkiye, RV frequency was highest in winter months. In our study, the highest frequency of AdV infections occurred in November (5%), followed by December (2.7%). The other months had similar results, and there was no statistically significant difference among the AdV frequencies of months (P = .190).

Consequently, in this study, we have investigated the frequencies of RV and AdV in Turkish and refugee patients who are in a broad age range. The total number of patients included in this study is quite high. However, we could not detect any differences between Turkish and refugee patients. A limitation of this study is that we do not have the RV vaccination data of the patients. Therefore, the immunity status of refugee patients is not known. Although the immunity status of Turkish patients is also not known, the RV vaccines are available in Türkiye, and recently, most of the children in Türkiye are vaccinated against RV due to the parents' decisions. We consider that maybe some of the refugee patients could have the opportunity to be vaccinated because most of them were born in Türkiye. We also analyzed the seasonality of RV and AdV ratios and observed a significant difference in the monthly distribution of RV cases, as expected.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of Ankara Keçiören Training and Research Hospital (Approval No: 2012-KAEK-15/1817, Date: February 13, 2019).

Informed Consent: Written informed consent was obtained from the patients and guardians of the children who participated in this study.

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