ORIGINAL ARTICLE

AHI EVRAN MEDICAL JOURNAL
E-ISSN: 2619 - 9203

Investigation of Adenovirus and Rotavirus Frequencies and Seasonal Distribution in Patients with Gastroenteritis

Gastroenteritli Hastalarda Rotavirüs ve Adenovirüs Sıklığının ve Mevsimsel Dağılımının Araştırılması

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ÖZ

Amaç: Çalışmada hastanemize akut gastroenterit nedeniyle başvuran tüm yaş gruplarını içeren olgularda rotavirüs grup A ve enterik adenovirüs serotip 40 ve 41 insidansının ve mevsimsel dağılımının belirlenmesi amaçlanmıştır.

Araçlar ve Yöntem: Ocak 2016-Aralık 2019 tarihleri arasında akut gastroenterit ön tanısı almış tüm yaş gruplarını içeren hasta sonuçları retrospektif olarak incelenmiştir. Dışkı örneklerinde rotavirüs antijeni araştırılan 10.049 hasta sonucu ve adenovirüs antijeni araştırılan 11.482 hasta sonucu çalışma kapsamına alınmıştır. Rotavirüs ve adenovirüs pozitifliği immünokromatografik yöntem kullanılarak araştırılmıştır.

Bulgular: Rotavirüs ve adenovirüs antijen pozitifliğinin yıllara göre dağılımında; her iki viral etken için de en yüksek pozitiflik, 2016 yılında ve kış mevsiminde tespit edilmiştir. Buna göre 2016 yılında rotavirüs pozitiflik oranı %18.4; adenovirüs pozitiflik oranı %3.5 olarak bulunmuştur. Rotavirüs en sık 0-2 yaş aralığında tespit edilirken, adenovirüs antijen pozitifliği en sık 3-5 yaş aralığında görülmüştür.

Sonuç: Viral gastroenteritlerle mücadele kapsamında epidemiyolojisinin mutlaka sürveyans çalışmalarıyla takip edilmesi gerekmektedir. Dört yıllık verilerin yer aldığı çalışmamız ülke verilerinin oluşturulmasına katkı sağlayacaktır.

Anahtar Kelimeler: adenovirüs; akut gastroenterit; rotavirüs

ABSTRACT

Purpose: The aim of the study was to determine the incidence and seasonal distribution of rotavirus group A and enteric adenovirus serotypes 40 and 41 in all age groups admitted to our hospital with acute gastroenteritis.

Materials and Methods: Results of the patients from all ages with the pre-diagnosis of acute gastroenteritis between January 2016 and December 2019 were retrospectively evaluated. A total of 10,049 patient results in which rotavirus antigen was investigated in stool samples and 11.482 patient results in which adenovirus antigen was investigated in stool samples were included in the study. Rotavirus and adenovirus positivities were investigated by using immunochromatographic method.

Results: In the distribution of rotavirus and adenovirus antigen positivity according to years, the highest positivity for both viral agents was recorded in 2016 and in winter months. According to this result, rotavirus positivity rate was 18.4% and adenovirus positivity rate was 3.5% in 2016. While the frequency of rotavirus antigen positivity was the highest in the age group between 0-2 years the frequency of adenovirus antigen positivity was the highest in the age group between 3-5 years.

Conclusion: The epidemiology of the disease must absolutely be followed up with surveillance studies within the scope of fight against viral gastroenteritis. Our study in which there are data of four years will contribute to establishing the country data.

Key Words: acute gastroenteritis; adenovirus; rotavirus

Received: 15.11.2020; Accepted: 03.07.2021

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How to cite: Esenkaya Taşbent F, Gülseren YD, Özdemir M. Investigation of adenovirus and rotavirus frequencies and seasonal distribution in patients with gastroenteritis. Ahi Evran Med J. 2021;5(3):218-222. DOI: 10.46332/aemj.826098

INTRODUCTION

Acute gastroenteritis is among the important public health problems around the world. It is the second most important cause of child morbidity after respiratory tract infections in developing countries. In addition, these infections constitute an important part of health-care costs.[1] Gastroenteritis may be caused by infections or factors other than infections. Detection of active microorganism in infectious diarrhea is important in terms of clinical course, treatment, and measures to be taken.[2]

Viral gastroenteritis constitutes an important part (50-70%) of infectious diarrhea cases. The frequency of rotavirus infections is at similar rates in both developed and developing countries regardless of hygiene and socioeconomic conditions. That is why it is called "democratic virus".[3,4] However, more than 80% of mortalities due to the virus are seen in developing countries. It causes high rate of morbidity and economic loss in developed countries. It is estimated that it caused the death of 128.000 children between the ages of 0-5 in 2016 around the world. Its clinical course is slow in adult patients while it may have a severe clinical course in immunosuppressed patients. [5-7]

Adenoviruses in which serotype 40 and 41 in F group are globally distributed are an important cause of acute gastroenteritis in neonates and young children. Although it mostly has a mild clinical course, it may result in dehydration causing electrolyte abnormality in patients who cannot hydrate.[2] Viral excretion may continue for weeks even when the infection findings disappear, and it may result in an epidemic especially in places such as hospitals and day-care centers.[8]

As its clinical measures and effective treatment have not been developed yet, epidemiological data on viral gastroenteritis are still up to date. Each country must create their own data for the decision to put rotavirus vaccine into the national vaccination program and measures to be taken for protection. Our study aimed to determine the frequency of rotavirus group A and enteric adenovirus serotypes 40 and 41 in patients including all age groups who were admitted to our hospital with acute gastroenteritis.

MATERIALS and METHODS

The study was approved by Necmettin Erbakan Üniversitesi Meram Tıp Fakültesi Ethics Committee (2020/2423). Results of the patients from all ages who were admitted to a tertiary care hospital with the pre-diagnosis of acute gastroenteritis within 4 years between January 2016 and December 2019 were retrospectively evaluated. A total of 10.049 patient results in which rotavirus antigen was investigated in stool samples and 11.482 patient results in which adenovirus antigen was investigated in stool samples were included in the study. In addition, some demographic data, such as the distribution of the test results according to the years, age, gender, season and units where the samples were sent, were also recorded.

A cassette test (LUNGENE Rota/Adenovirus Combo Test, Hangzhou Clongene Biotech, China) which was developed on the principle of qualitative immunochromatographic method and can simultaneously detect both antigens was used to detect the presence of rotavirus and adenovirus antigens in fresh stool samples.

The test was used in the direction of the recommendations of the manufacturer by controlling the quality with separate positive control antigens when each box was opened. Data collected were analysed with SPSS (version 22, Chicago, IL, USA) software program. The distribution of antigen positivities according to years, gender, age, and seasons was statistically evaluated with Pearson Chi-Square test. Statistical significance was accepted as $p<0.05$.

RESULTS

When the distribution of Rotavirus antigen positivities according to the years was evaluated, the highest positivity rates were recorded in 2016 and 2018. Rotavirus positivity rates of male and female gender were similar, and the highest positivity rate among the age groups was found in the age group between 0-2 years. When the distribution according to the seasons was evaluated, the highest positivity rate was observed in winter months. When the distribution according to the departments was evaluated, the highest positivity rate was observed in patients admitted to the emergency department (Table 1).

Table 1. Distribution of rotavirus antigen rates according to year, gender, age groups, season and departments

Variables	Rotavirus Positive n (%)	Rotavirus Negative n (%)	p
Year			
2016	245 (18.4)	1083 (81.6)	p<0.001
2017	364 (13.7)	2276 (86.3)	
2018	521 (16.8)	2562 (83.2)	
2019	543 (18.1)	2455 (81.9)	
Gender			
Female	720 (16.6)	3598 (83.4)	P=0.9
Male	953 (16.6)	4778 (83.4)	
Age Groups			
0-2 years	1269 (22)	4401 (78)	p<0.001
3-5 years	231 (13.2)	1507 (86.8)	
6-16 years	164 (6.6)	2311 (93.4)	
>16 years	9 (5.4)	157 (94.6)	
Season			
Autumn	545(17.3)	2601(82.7)	p<0.001
Winter	533(26.7)	1459(73.3)	
Spring	374(17.6)	1740(82.4)	
Summer	221(7.9)	2576(92.1)	
Departments			
Inpatient Service	139 (10.6)	1168 (89.4)	p<0.001
Outpatient Clinic	112 (13)	747 (87)	
Emergency Clinic	1422 (18)	6459 (82)	

Table 2. Distribution of Adenovirus antigen rates according to year, gender, age groups, season and departments

Variables	Adenovirus Positive n (%)	Adenovirus Negative n (%)	p
Year			
2016	49 (3.5)	1336 (96.5)	p<0.001
2017	91 (2.7)	3243 (97.3)	
2018	120 (3.4)	3388 (96.6)	
2019	56 (1.7)	3199 (98.39	
Gender			
Female	120 (3.4)	4862 (97.6)	P=0.05
Male	196 (3)	6304 (97)	
Age Groups			
0-2 years	194 (3)	6175 (97)	p<0.001
3-5 years	83 (4.2)	1851 (95.8)	
6-16 years	38 (1.3)	2760 (98.7)	
>16 years	1 (0.2)	380 (99.8)	
Season			
Autumn	95 (2.7)	3309 (97.3)	p=0.003
Winter	84 (3.5)	2276 (96.5)	
Spring	73 (2.9)	2363 (97.1)	
Summer	64 (1.9)	3218 (98.1)	
Departments			
Inpatient Service	16 (1.04)	1518 (98.96)	p<0.001
Outpatient Clinic	35 (2.6)	1281 (97.4)	
Emergency Clinic	265 (3)	8296 (97)	

When the distribution of adenovirus antigen positivities according to years was evaluated, the highest positivity rate was again recorded in 2016 and 2018. Adenovirus positivity was higher in male patients. The highest positivity rate among the age groups was found in the age group between 3-5 years. When the distribution according to the seasons was evaluated, the highest positivity rate was observed in winter months. When the distribution according to the departments was evaluated, the highest positivity rate was observed in patients admitted to the emergency department (Table 2).

DISCUSSION

Rotavirus is the most important factor of gastroenteritis in children below the age of 5 in both developed and developing countries. According to the distribution of rotavirus infection around the world, the rates were reported to vary as 30% in Latin America, 40% in Europe and between 34-40% in Africa and Middle East.[9] In a review of various studies investigating the epidemiology of rotavirus gastroenteritis, its frequency was found in a wide range between 7.8% and 57%.[10] Globally, the most common enteric adenovirus serotypes 40 and 41 were reported to be an agent in patients with gastroenteritis at the rates ranging from 1% to 20%.[11] Adenovirus positivity was reported in varying rates in our country. While the rate was reported as 1.5% in the study by Bayraktar et al.[12], a higher rate (23%) was reported in the study by Akinci et al.[13]

In this study, data for the years 2016, 2017, 2018 and 2019 were evaluated. Although there is a statistically significant difference in the distribution by years, there is no regular course of increasing or decreasing adenovirus or rotavirus positivity rates over the years. Therefore, there is no scientific data to explain the change over the years.

Various studies in our region reported the rotavirus positivity rates between 13.3% and 21%. [14-16] In our study, the lowest rotavirus positivity rate was 13.7% recorded in 2017 and the highest rate was 18.4% recorded in 2016. Studies in which the frequency of adenovirus is investigated in our region report the positivity rates ranging from 2.3% to 4.4%. In our study, the lowest adenovirus positivity rate was 1.7% recorded in 2019 and the highest positivity rate was 3.5% recorded in 2016.

Rotavirus epidemics are seen in cold months in regions with mild climate, and sporadic cases are seen in every season of the year. The infection is more prevalent in the driest and coldest times of the year in tropical regions.[2] While the virus is rapidly inactivated in humid heat, it easily spreads in dry air.[17] In studies reported from different regions of the country, the frequency of rotavirus infection was reported to be higher in winter months.[18,19] Our region is in the Central Anatolia Region and has a continental climate. In this study, the frequency of the agent was the highest in winter months. Adenovirus was reported to be seen throughout the whole year without revealing any seasonal feature. Among the studies reported from different cities in our country, some report that adenovirus positivity is seen throughout the whole year while some report that it reveals a seasonal feature.[20-23] Agent positivity is also highest in winter months in this study.

Rotavirus infections can be seen during the whole life span. However, the ages after 5-6 months, when the antibodies transmitted from mother disappear, are the periods when the infants are most sensitive.[2] Recurrent infections can be experienced in milder or asymptomatic course. The rate of symptomatic infection decreases by age. Prospective studies reported that the rate of symptomatic disease was the highest in the age below 2 and the lowest in the age about 45.[24] In our study, rotavirus positivity was reported to be highest in the age group of 0-2 years. Avci et al.[21] reported that the highest viral frequency rate was in the ages between 6 months and 24 months, which is consistent with our study. Akinci et al.[13] reported that rotavirus antigen positivity was the highest in the ages below 2 years.[13] Studies revealed that mostly the children below the ages of 2 were affected by enteric adenovirus infections. However, the agent positivity rate was higher in children below the age of 5 than in the age group below 2 years in this study.

No statistically significant difference was found between rotavirus and adenovirus antigen positivity and gender in our study, which is similar to the results of previous studies.[25,26]

A large number of studies previously performed revealed that rotavirus was the most common among the viral gastroenteritis agents. The second most common agent was reported to be astrovirus in some studies and adenovirus in some other studies.[27] Contrary to previous studies, adenovirus positivity was three times higher in the study in Guatemala. It was suggested that this difference was due to the climate.[28] One of the most important limitations of our study was that agents other than rotavirus and adenovirus were not detected. In the study in which viral agent distribution was analysed in the stool samples collected from 11 different cities in our country, norovirus was the most common agent.[1] Moreover, Ozdemir et al.[14] found the frequency of norovirus as 11.7% in their studies including patients between the ages of 1 and 84.

In our study, an important portion of the patients who were both rotavirus and adenovirus positive were observed to be followed up in the emergency department. Oguz et al.[29] reported in their studies that an important portion (66%) of the patients who were rotavirus positive were hospitalized and received treatment in the emergency department, and stated that rotavirus infections put a large burden on the emergency department.

The epidemiology of the disease must absolutely be followed up with surveillance studies within the scope of the fight against viral gastroenteritis. When the number of tests is considered, it is seen that viral agents take an important place in health care costs. Therefore, establishing their own epidemiological data is quite important for countries. Positivity rates of viral gastroenteritis vary in studies from different regions of our country. Geographical features of the regions may play a role in this variance. In addition, kit-related variance in sensitivity and specificity may be another factor. Analyzing the samples collected from an institution like Public Health Institution of Turkey with the same method and kit will contribute to establishing more reliable data.

Conflict of Interest

The authors declare that there is not any conflict of interest regarding the publication of this manuscript.

Authors' Contributions

Concept/Design: FET, YDG, MÖ. Data Collection and/or-Processing: FET, YDG, MÖ. Data analysis and interpreta

tion: FET, YDG, MÖ. Literature Search: FET, YDG. Drafting manuscript: FET. Critical revision of manuscript: YDG, MÖ. Supervision: MÖ.

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