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The Effects of COVID-19 Infection Control Measures on the Frequency of Rotavirus and Enteric Adenovirus in Children

COVID-19 Enfeksiyon Kontrol Önlemlerinin Çocuklarda Rotavirüs ve Enterik Adenovirüs Sıklığı Üzerine Etkileri

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Abstract

Objective: The coronavirus disease 2019 pandemic has caused many changes in our lifestyle, such as the flow of our daily lives, communication between individuals, traveling, eating, and drinking habits. These changes have reduced the risk of viral infections. In this study, it was aimed to examine the changes in the frequency of rotavirus and enteric adenovirus in children due to changes in lifestyle such as hand hygiene, physical distance and eating habits in individuals before and during the COVID-19 pandemic.

Material and Methods: We analyzed data obtained from the laboratory electronic records of hospitals in our region to assess the changes of rotavirus and adenovirus frequency and number of patients admitted to the hospital during the COVID-19 pandemic period compared to pre-pandemic years. Rotavirus and enteric adenovirus antigens were studied using a qualitative immunochromatographic method.

Results: Between January 2018 and July 2021, a total of 68.504 patient samples were tested, 60.513 (88.3%) before the COVID-19 pandemic and 7991 (11.7%) during the pandemic. Mean age of the patients was determined as 4.7 years. Before the pandemic, a total of 6.815 (11.3%) samples for rotavirus and 1.873 (3.1%) samples for adenovirus were found positive. During the pandemic period, a total the 598 (7.5%) samples for rotavirus and 164 (2%) samples for adenovirus were found positive. Monthly median test numbers for rotavirus and adenovirus significantly fell about 75% (1.926 vs 493, p< 0.001). In addition, monthly median positivity rates of rotavirus (10.9% vs 7.1%, p= 0.002) and adenovirus (2.9% vs 1.8%, p< 0.001) reduced about 35% and 38%, respectively, after the onset of the pandemic as compared to the pre-pandemic years. The decrease in mean monthly test numbers and the reduction in the fre-

Öz

Giriş: COVID-19 pandemisi, günlük hayatımızın akışı, bireyler arasındaki iletişim, seyahat, yeme-içme alışkanlıkları gibi yaşam tarzımızda birçok değişikliğe neden oldu. Bu değişiklikler birçok viral enfeksiyonun riskini azalttı. Çalışmamızda, COVID-19 pandemisi öncesi ve sonrası bireylerde el hijyeni, fiziksel mesafe ve beslenme alışkanlıkları gibi yaşam tarzındaki değişikliklere bağlı olarak çocuklarda rotavirüs ve enterik adenovirüs sıklığındaki değişiklikleri incelenmesi amaçlandı.

Gereç ve Yöntemler: Bölgemizdeki hastanelerin laboratuvar elektronik kayıtlarından elde edilen verileri, COVID-19 pandemi döneminde rotavirüs ve adenovirüs sıklığı, hastaneye başvuran hasta sayısının pandemi öncesi yıllara göre değişimini değerlendirmek için analiz edildi. Rotavirüs ve enterik adenovirüs antijenleri, kalitatif bir immünokromatografik yöntem kullanılarak çalışıldı.

Bulgular: Ocak 2018 ile Temmuz 2021 arasında, COVID-19 pandemi öncesi 60.513 (%88.3), pandemi döneminde 7.991 (%11.7), toplam 68.504 hasta numunesi test edildi. Hastaların ortalama yaşı 4.7 yıl olarak belirlendi. Pandemi öncesinde 6.815 (%11.3) rotavirüs, 1.873 (%3.1) adenovirüs örneği pozitif bulundu. Pandemi döneminde ise 598 (%7.5) rotavirüs, 164 (%2) adenovirüs örneği pozitif bulundu. Pandemi öncesi yıllara kıyasla pandemi döneminde, rotavirüs ve adenovirüs aylık medyan test sayıları yaklaşık %75 (1.926'dan 493, p< 0.001), rotavirüs aylık medyan pozitiflik oranı yaklaşık %35 (%10.9'dan %7.1, p= 0.002) ve adenovirüs pozitiflik oranı %38 (%2.9'dan %1.8, p< 0.001) azaldı. Aylık ortalama test sayılarındaki, pozitif örneklerin sıklığındaki azalma enfeksiyon kontrol önlemleri nedeniyle pandemi sırasında her iki patojenin sıklığının önemli ölçüde azaldığını göstermektedir.

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quency of positive samples collectively indicated that the frequencies of both pathogens substantially reduced during the pandemic because of infection control measures.

Conclusion: The fact that the COVID-19 pandemic forces us to comply with infection control rules and change our lifestyle shows us that these rules are very important not only in controlling the pandemic, but also in controlling other viral infections.

Keywords: COVID-19, rotavirus, enteric adenovirus, gastroenteritis

Sonuç: COVID-19 pandemisinin bizleri enfeksiyon kontrol kurallarına uymaya ve yaşam tarzımızı değiştirmeye zorlaması, bize bu kuralların sadece pandemiyi kontrol etmede değil, diğer viral enfeksiyonları kontrol etmede de çok önemli olduğunu göstermektedir.

Anahtar Kelimeler: COVID-19, rotavirüs, enterik adenovirüs, gastroenterit

Introduction

The coronavirus disease 2019 (COVID-19) pandemic has caused many changes in our lifestyle, such as our daily lives, communication between individuals, traveling, eating and drinking habits. The use of masks has protected individuals from the infection of many respiratory viruses. The importance of hand hygiene and environmental cleaning has increased. In addition, more attention has been paid to the use of clean water and food hygiene. These have reduced the risk of viral infections associated with food and water. In this context, we could observe a reduction in some viral infections such as rotavirus and enteric adenovirus.

Diarrhoeal diseases (gastroenteritis) are an important health issue that affects all ages of people and causes death in the world. Globally, an estimated 800.000 infants and young children die due to diarrhoeal diseases each year. Studies have reported that the most common cause of diarrhoeal diseases is viral pathogens. Rotavirus and enteric adenovirus have been shown to be the most common viral pathogens (1,2).

Rotavirus, a member of the Reoviridae family, is a double-stranded, icosahedral, non-enveloped RNA virus (3). Adenovirus is a non-enveloped virus with icosahedral symmetry and double-stranded linear DNA (4). Rotavirus infection is almost universal, and approximately 95% of children experience rotavirus gastroenteritis by age five. Epidemiological studies have shown that rotavirus is responsible for approximately 35% to 50% of hospitalizations in children (5). According to the estimation of the World Health Organization (WHO), rotavirus causes approximately 527.000 deaths, more than two million hospitalizations and 25 million outpatients annually (6). Also, according to WHO global surveillance network for rotavirus in 2009, 36% of hospitalizations for diarrhoea among children aged <5 years for whom a stool specimen was tested were caused by rotavirus infection (7). Adenoviruses most commonly infect the conjunctiva, respiratory or gastrointestinal tract and can cause outbreaks of gastroenteritis. Adenoviruses are the second most common cause of gastroenteritis in children after rotaviruses.

Since viral gastroenteritis does not show pathogen-specific clinical differentiation, it is important to detect viral agents in the clinical microbiology laboratory, prevent both rotavirus and adenovirus infections, take infection control measures, and guide the treatment correctly.

Infection control measures implemented during the COVID-19 pandemic period have led to a decrease in the incidence of viral and all other infections. In this study, we aimed to examine the changes in the frequency of rotavirus and enteric adenovirus due to changes in lifestyle such as hand hygiene, physical distance and eating habits in individuals before and during the COVID-19 pandemic.

Materials and Methods

Data Collection

Data of the patients between January 2018 and July 2021, who had been tested for rotavirus and adenovirus, were collected from the laboratory electronic records of hospitals in our region. Also, data were analyzed to assess the changes of rotavirus and adenovirus frequency and number of patients admitted to the hospital in our region during the COVID-19 pandemic period compared to pre-pandemic years.

Antigen Test for Detection of Rotavirus and Enteric Adenovirus

Rotavirus and enteric adenovirus antigens in fresh stool samples were studied using a qualitative immunochromatographic (True Line Rota/Adenovirus, BioCare Diagnostics, China) method in line with the manufacturer's recommendations. Sensitivity and specificity of the test have been reported by the manufacturer as 99.9% and >97.8% for rotavirus and >99.9% and 99.4% for adenovirus, respectively.

This immunochromatographic test method is based on the detection of rotavirus and adenovirus antigens in stool with anti- rotavirus (R test line) and anti- adenovirus antibody (A test line) on the test membrane. The antigen test was performed by mixing the stool samples with extraction buffer and dropping three drops (approximately 100 µL) into the sample section of the kit. After 5-15 minutes of incubation at room temperature, the formation of a colored line in the R (rotavirus) and A (adenovirus) regions of the test together with the control line (C) was considered positive, and the absence of a colored line in the test line region was considered negative.

Data Analysis

Statistical analyses were performed using IBM SPSS for Windows, version 22.0 (IBM-SPSS Inc, Armonk, NY). Comparisons of the distributions of patient numbers and positivity rates between before and during pandemic period were performed by Mann-Whitney U test. Data were summarized by median, minimum and maximum (range= R) values. Significance level was considered as 0.05.

Results

Between January 2018 and July 2021, a total of 68.504 number of patient samples were tested. Median age of the patients was determined as 4.7 years (2 months-13 years). Positive test number of rotavirus was 7.413 (10.8%) and of adenovirus, it was 2.037 (3%) in this period. Before the COVID-19 pandemic, in 2018, 2019, and in two months of 2020, a total of 60.513 (88.3%) samples were tested. A total of 6.815 (11.3%) samples were found positive for rotavirus, and 1.873 (3.1%) samples were positive for adenovirus. From the onset of COVID-19 pandemic to the end of July 2021, 7.991 (11.7%) patient samples were tested, and 598 (7.5%) were found positive for rotavirus and 164 (2%) were positive for adenovirus. The distribution of the tested of samples, positive rotavirus, and adenovirus numbers by months are shown in the Figure 1. The positive ratio of rotavirus and adenovirus tests by months are shown in the Figure 2.

Median numbers of samples tested each month were 1926 (R= 1356-4257) and 493 (R= 165-1337) before and during the COVID-19 pandemic, respectively (p< 0.001). Median ratio of the rotavirus-positive sample before and during the pandemic were 10.9% (R= 6.6-23.2) and 7.1% (R= 0.5-12.6), the decrease was found to be statistically significant (p= 0.002). Median of

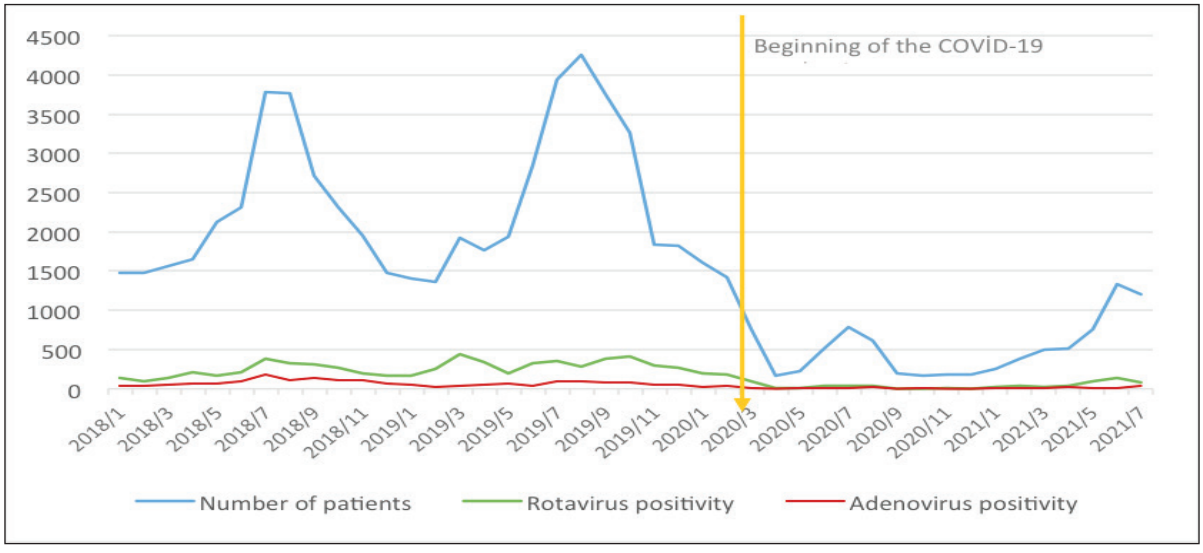

Figure 1. Distribution of the tested specimens: positive rotavirus and adenovirus numbers by months.

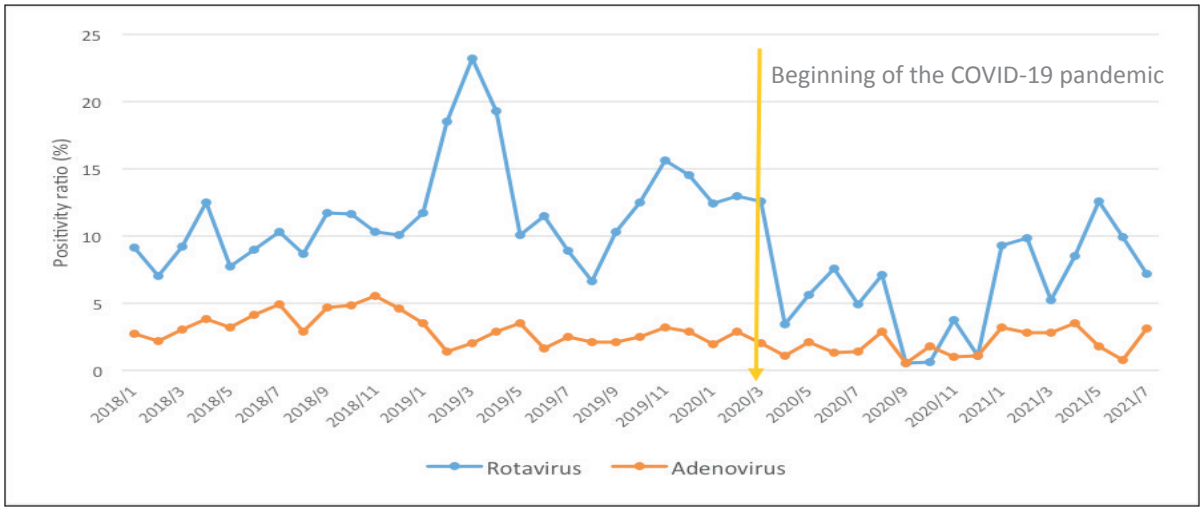

Figure 2. Distribution of positive rotavirus and adenovirus ratio by months.

the adenovirus positive samples ratio before and during the pandemic found as 2.9% (R= 1.4-5.5) and 1.8% (R= 0.5-3.5), and the reduction was statistically significant (p< 0.001).

Discussion

The COVID-19 is an infectious disease caused by SARS-CoV-2 that mainly affects the respiratory system. Furthermore, COVID-19 outbreak has the potential to be one of the most significant pandemics of the last century (8). In our country, COVID-19 pandemic measures and prohibitions started after the first case was seen in March 2020. Since the COVID-19 pandemic began, the lifestyle and habits of individuals have changed all over the world in order to be protected from this pandemic. Among these lifestyle changes, more attention to hand hygiene and environmental cleaning, compliance with physical distance rules, and changes in eating habits are the most common ones. The prohibitions applied during the COVID-19 pandemic and the attention of individuals to hygiene rules will cause changes in the incidence of other viral infections.

Viral gastroenteritis is an important problem, especially among children. The frequency of viral gastroenteritis agents varies according to regions and countries. According to global surveillance data, the incidence of rotavirus has been reported to be between 12-68% worldwide. The incidence of rotavirus is reported to be 10-65% in Africa, 5-25% in America, 20-40% in Europe, and 30-50% in Asian countries, respectively (9,10). In various studies conducted in our country, rotavirus positivity has been reported between five and 32% (9-12). Tapisiz et al. have reported that the median detection rate of rotaviruses in 117.741 children examined for gastroenteritis in our country was 31.8% at the age of <5 years, and they have also determined that number of children reported to be presenting with a complication related to rotavirus was 11.7% (11). In a multicentre study conducted in our country, it has been shown that rotavirus was responsible for gastroenteritis in 32.4%-67.4% of children under the age of five, who were hospitalized (13). The incidence of enteric adenovirus infection varies by countries. While this rate is 1-8% in developed countries, it varies between 2-32% in developing countries (14). In various studies conducted in our country, adenovirus positivity has been reported between 1-14% (12,15). Çomce et al. (15) have reported that adenovirus was detected in 3.1%, and rotavirus was detected in 22.4% of all cases.

Rotavirus spreads from person to person, mainly by faecal oral transmission (3,5). According to the World Health Organization data, rotavirus cases are more common in winter months while they occur throughout the year in tropical climates. Annual epidemics in the United States are seen in the southern regions in November-December and continue until April-May in the northern and eastern regions. Rotavirus positivity is reported at a higher rate in the winter season in North African countries. In West Africa, it has been stated that the cases are mostly seen in July and November. In studies conducted in our country, it is seen that rotavirus cases intensify in winter, spring, and autumn months (7,9-12). In our study, we determined that gastroenteritis cases caused by rotavirus and adenovirus seen in winter and autumn months (Figure 1).

Hand, self, and food hygiene are important in the prevention of viral gastroenteritis. During the COVID-19 pandemic, these issues have become more important for the community to prevent the spread of SARS-CoV-2. Li et al. (16) have reported that the frequency of intestinal infections fell significantly in pediatric outpatients during COVID-19 outbreak as compared to the same period of 2019. They have found that the positivity of adenovirus decreased from 2.69% to 1.58%, and the positivity of rotavirus reduced from 14.41% to 7.15% after the onset of the pandemic. Chan (17) has reported that the rate of the positive rotavirus tests dropped abruptly after the first global spread of COVID-19 compared to the same period in the past seven years (17). Wang et al. (18) have reported that test positive rates for all enteric viruses decreased in 2020 compared to average levels in 2012-2019, with a relative decrease from 3.54% to 1% for adenovirus and from 9.87% to 4.59% for rotavirus.

In this study, we observed a sudden decrease in the tested samples for rotavirus and enteric adenovirus after the detection of the first COVID-19 case in our country. In the following 17 months throughout the pandemic, we determined that the monthly median test numbers for rotavirus and adenovirus significantly fell about 75% (1926 vs 493, p< 0.001). This could indicate that the number of children who developed viral gastroenteritis reduced in our community, which was most likely be related to the increase in peoples' compliance on hygiene rules, curfews, and other pandemic measures, and during the COVID-19 pandemic. We further found that the monthly median positivity rates of rotavirus (10.9% vs 7.1%, p= 0.002) and adenovirus (2.9% vs 1.8%, p< 0.001) in the studied samples ratio reduced about 35% and 38%, respectively, after the onset of the pandemic as compared to the pre-pandemic years (Figure 2). In addition to the decrease in the monthly test numbers, the reduction in the frequency of positive samples have collectively indicated that the frequencies of both pathogens substantially reduced during the pandemic because of infection control measures. Furthermore, this may also indicate that the awareness and knowledge of communicable diseases has increased in the society.

In conclusion, these findings demonstrate that changing in the lifestyle, using mask, hand and food hygiene, social distancing, eating-at-home and other pandemic infection control measures, which have been conducted to prevent the spread of SARS-CoV-2 in community, could also reduce the

spread of other viral pathogens such as rota and adenovirus. The fact that the COVID-19 pandemic forces us to comply with these rules and change our lifestyle shows us that this is very important not only in controlling the pandemic, but also in controlling other viral infections.

Ethics Committe Approval: The approval for this study was obtained from İnönü Faculty of Medicine Ethics Committee (Decision no: 2021/2455, Date: 19.10.2021).

Informed Consent: Patient consent was obtained.

Peer-review: Externally peer-reviewed.

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