

Research Article

Rotavirus and Adenovirus Positivity in Child Diarrhoea in a Tertiary Hospital

Rıdvan Guckan¹, Cetin Kılinc¹, Osman Aydin¹, Zeynep Hulya Durmaz¹, Aslihan Dilara Demir¹, Gökçe Celep¹ and Keramet-tin Yanik^{2*}

¹Sabuncuoğlu Serafeddin Education and Research Hospital, Amasya University, Amasya, Turkey

²Department of Medical Microbiology, Faculty of Medicine, Ondokuz Mayıs University, Samsun, Turkey

Abstract

Rotavirus and Adenovirus are the majority of the viral factors of acute gastroenteritis which is responsible for child mortality. These viruses are the most common reasons for the viral gastroenteritis in children aged 6-24 months. The aim of this study is to determine the age, seasonal distribution and the positivity rate of Rotavirus and Adenovirus infections among children with diarrhea who were admitted to a tertiary care education and research hospital. The 5412 children (2992 (55%) male and 2420 female (45%)) between the ages of 0-6 were included in the study. The data of them were obtained retrospectively between January 2013 and January 2015 from the results of laboratory reports. Rotavirus Ag in 395 (7.2%) and Adenovirus Ag in 20 (0.36%) of the patients were studied and 7 (0.12%) of them were determined as positive for both factors. It was determined that Rotavirus positivity was higher in patients during the colder months compared to others. Positive cases were observed mostly in children between the ages of 0 and 2, followed by the group of children who were 1-year old. As a result, clinician should remember rotavirus infections in pediatric gastroenteritis which are observed particularly in winter, according to the distinctive diagnosis. It is decided that Rotavirus Ag-ELISA tests are applicable and sensitive in the diagnosis of the Rotavirus infection. Thus, unnecessary antibiotic usage can be prevented with the help of a sensitive diagnosis of the infection.

Keywords: Gastroenteritis; Positivity; Rotavirus; Season and age

*Corresponding author: Keramet-tin Yanik, Department of Medical Microbiology, Faculty of Medicine, Ondokuz Mayıs University, Tip Fak İtesi, 55139 Kurupelit, Samsun, Turkey, Tel: +90 5072329215; Fax: +90 3624576091; E-mail: keramettinyanik@omu.edu.tr

Citation: Guckan R, Kılinc C, Aydin O, Durmaz ZH, Demir AD, et al. (2015) Rotavirus and Adenovirus Positivity in Child Diarrhoea in a Tertiary Hospital. J Infect Non Infect Dis 1: 007.

Received: June 10, 2015; **Accepted:** September 22, 2015; **Published:** October 06, 2015

Introduction

Gastroenteritis causes death of 5-10 million children per year [1]. Viral gastroenteritis is among the second most common diseases observed in developed countries [2]. Rotavirus, which is a genus in the Reoviridae family, is an important factor for the society-derived and nosocomial acute infectious gastroenteritis observed in the early childhood [1]. It causes viral gastroenteritis which might lead to serious clinical mortality, especially in children aged 6-24 months [1,3,4]. Except the Rotavirus and Adenoviruses, which are also common factors for diarrhea, are usually detected as the gastroenteritis factor in children younger than 2 years old and these viruses may also cause infections such as conjunctivitis cystitis and meningoencephalitis. Rota virus infections are frequently observed during the cold seasons. Infections are generally transmitted orally and faecally and the resistance to disinfectants makes the contamination much easier [4-6]. As the clinical findings are non-specific, the certain diagnosis can be made with laboratory examinations. Laboratory tests are very important in the diagnosis. Imaging methods such as electron microscopy, cell culture techniques, serological tests and the detection methods for antigens and nucleic acids can be used in the exact diagnosis. Besides, chromatographic immunoassays are rapid, inexpensive, highly sensitive and easy serological tests. The test should be easy, fast, cheap and highly sensitive. In order to diagnose the viral gastroenteritis, the incidence of infectious pathogens and factors affecting them should be determined by performing surveillance studies since effective treatment methods have not yet been developed. Epidemiological surveillance and the control of viral gastroenteritis is very crucial due to the lack of effective treatments and unnecessary use of antibiotics [4,5].

The aim of this study is to reveal the positivity of the infection as well as the seasonal differences according to the age distribution by detecting Rotavirus Ag and Adenovirus Ag in stool samples of the patients between the ages of 0-6 with diarrhea using ELISA technique.

Material and Methods

Retrospective data were obtained from patients who were diagnosed with an acute gastroenteritis and admitted to several clinics of Sabuncuoğlu Serafeddin Education and Research Hospital in Amasya, in the North coast of Turkey, between January 2013 and January 2015. This hospital is in the middle of the Blacksea region, in Turkey. We accepted only one specimen per patient. 5412 stool specimens were examined in microbiology laboratory between January 2013 and January 2015. The fresh stool samples were tested by using Rotavirus and Adenovirus antigen tests (Xiamen, Boson Biotech Co. Ltd., China) according to manufacturers' instructions. This test is a combo test which is a rapid chromatographic immunassay for the qualitative detection of rotavirus and adenovirus antigens in human faeces samples. Rapid Adeno/Rota Virus Antigen Combo Test is a sandwich solid phase immunochromatographic assay. To perform the test, an aliquot of diluted stool sample is added to the sample well of the test cassette. The sample flows through a pad containing antibodies against adenovirus and rotavirus coupled

Viruses	Total (n)	0-1 (%)	1-2 (%)	2-3 (%)	3-4 (%)	4-5 (%)	5-6 (%)
Rotavirus	395	128 (32.4)	133 (33.6)	65 (16.4)	31 (7.8)	22 (5.5)	16 (4)
Adenovirus	20	7 (35)	4 (20)	4 (20)	2 (10)	2 (10)	1 (5)
Rota-Adeno	7	5 (71.4)	1 (14.2)	1 (14.2)	-	-	-

Table 1: Distribution and percentages of Rotavirus and Adenovirus positive frequency compared to ages.

n - Samples number; % - percent

to red-colored colloidal gold. If the sample contains adenovirus or rotavirus antigens, the antigen will bind to the antibody coated colloidal gold particles to form antigen-antibody-gold complexes. These complexes move on the nitrocellulose membrane by capillary action toward the test line region on which adenovirus and rotavirus specific antibodies are immobilized separately. As the complexes reach the test line, they will bind to the antibody corresponding to the virus on the membrane to create the line. A red control line will always appear in the result window to indicate that the test has been correctly performed and the test device functions properly. If virus is not present or lower than the detection limit of the test, only the control line will be visible. If the control line is not seen, the test is invalid. Test results were positively and negatively evaluated by comparing according to the control band. Test sensitivity and specificity has been reported as 98.2% and 97.8% for Rotavirus and 99% and 98% for Adenovirus by the manufacturer.

Results

A total of 5412 patients, 2992 (55%) male and 2420 (45%) female, between the ages of 0-6, who were pre-diagnosed with acute gastroenteritis, were included in the study. 82% of the cases were admitted to outpatient clinics. Rotavirus was detected in 395 (7.29%), Adenovirus was detected in 20 (0.37%), and both viruses were detected in 7 (0.12%) samples. Rotavirus was mostly observed in 128 patients (32.4%) who were between 0-1 years old and in 133 patients who were between 1-2 years old (33.6%). Adenovirus positivity was mostly seen in 0-1 years of children (7 patients of 20; 35%) (Table 1).

When we observed the seasonal changes in Rotavirus and Adenovirus positive cases, it was determined that Rotavirus positivity was found higher in winter compared to other seasons (173 patients of 395; 43.7%) (Table 2). There was no significant seasonal difference between the positivity rates of the antigens of enteric Adenovirus and Rotavirus-Adenovirus.

Discussion

It is known that diarrhea leads to death in the 21% of children who are younger than 5 years old throughout the world and 8.4% of deaths are observed in children who are between the 0-14 years old in our country [7,8]. Rota virus causes diarrhea in the 10-20% of the cases in developing countries and even death of many patients every year [3,4]. Rotavirus is the most common reason for infectious diarrhea in children who are younger than 6 years old in the world. This virus, which causes severe diarrhea in 6-24 months old children, is particularly responsible for the 30-60% of the watery diarrhea. *Rotavirus enteritis* is an important reason for the morbidity and mortality in babies and children under the age of 2 in developing countries. Approximately 40-70% of diarrhea cases which require hospitalization are caused by Rotavirus. In addition, Rotaviruses constitute almost the half of the causative microorganisms of nosocomial gastroenteritis in babies between 0-2 years old [1,4].

According to the etiological research studies performed by Nazik et al., Rotavirus positivity in gastroenteritis patients, who live in Istanbul was 20.6% [9], Kizirgil and Karakoc found that it was 31.9% in Elazig [10]. Besides, Borsa et al., detected Rotavirus positive cases in Mardin was 19.9% [11], Gül et al., determined the Rotavirus positivity in Kahramanmaraş was 25.7% [12]. Otag et al., found the Rotavirus infection in 28.6% of patients living in Mersin [13]. Yarkin and Torun detected Rotavirus infection in 21.8 % of the patients in Adana [14]. In our study, Rotavirus positivity was detected in 395 patients of 5412 (7.29%) children. According to our results, Rotavirus positivity rates were much lower than the rates found in other studies performed in Turkey. The difference in the rates may be related to the different kinds of the tests that are used to diagnose the disease, experience of the personnel conducting the test, time of disease, sample taking method, quality of the sample, season and the socio-economical conditions [1,4]. However, the use of rota vaccine, which has been applied for the last five years in our city, may play an important role in these low infection rates. Rotavirus vaccination has not yet been included in the childhood vaccination calendar in Turkey. Vaccination is optional and has also a certain fee. Thus, there is no data with respect to the number of patients who had received the rotavirus vaccine. According to the studies conducted in different parts of the world to determine the rotavirus positivity rates, it has been reported that the positivity rate is 16% in Germany [15], 17-69% in the United States of America [16], 20% in Pakistan [17], and 11% in Kenya [18]. Ahlywalia et al., reported that the incidence of adenovirus gastroenteritis during the period of infancy was 4.1% [19]. While Rotavirus positivity rates constituted the majority in 1-2 age groups with a rate of 33.6% (133) and 66% of the positive cases were between the 0 and 2 years old. In the studies performed by Hilmioglu et al. [20] with children aged in 0-1, by Asci et al., [21] with children aged in 0-2, it has been detected that the Rotavirus positivity is higher than the other age groups. Furthermore, in many studies conducted in Turkey is in line with our study and this infection has been detected mostly in children between the ages of 0-2 [9,22,23]. In our study, there were 173 (43.7%) positive cases in winter months.

According to the studies performed by Yunus Bulut et al., [8] in Malatya, Turkdagi et al., [24] in Konya, Balkan et al., [25] in Erzurum, Borsa et al., [11] in Mardin, Rota virus was detected most frequently in winter in Turkey. The reports obtained from the different regions of Turkey, the Adenovirus positivity rates were found by Tekin et al., [26] as 1% in Mardin, Altindis et al., [27] found as 4.5% in Afyon, Albayrak et al., [28] found as 4% in Ankara, Kurtoglu et al., found as 4.4% [29], Otag et al., found as 3.3% in Mersin [13], Balkan et al., found as 8.2% in Erzurum [25], Turkdagi et al., and Findik found as 1.3% in Konya [24]. In line with other studies in terms of Adenovirus rates, we found 20 patients (0.37%) were positive. Although Adenoviruses, similar to Rotaviruses, are detected mostly in children aged 0-2 (11 patients, 55%), they can be an infectious agent in every season different from Rotaviruses which can be observed mostly in winter.

Viruses	Total (n)	Winter* (%)	Spring (%)	Summer (%)	Autumn (%)
Rotavirus	395	173 (43.7)	118 (29.8)	25 (6.3)	79 (20)
Adenovirus	20	6 (30)	5 (25)	9 (45)	-
Rota-Adeno	7	1 (14.2)	-	-	6 (85.7)

Table 2: Seasonal distribution of Rotavirus and Adenovirus positive diarrhea frequency.

*Winter (December, January, February), Spring (March, April, May), Summer (June, July, August), Autumn (September, October, November), n - Samples number, % - percent

Gastroenteritis may be caused by more than one microorganism simultaneously. Although bacteria-virus combinations can be seen, the most common one is the virus-virus combination [27]. In our study, Rotavirus-Adenovirus combination was observed together in 7 (0.12%) patients and Otaget al al., found this rate as 0.76% in Mersin [13], Balkan et al., found as 0.3% in Erzurum [25] and Turkdagi and Findik found as 1% in Konya [24]. Our results are also in line with the findings of other researchers.

Gastroenteritis is seen frequently in the childhood and it is more severe than the gastroenteritis observed in adults. These infections, which lead to high mortality and morbidity rates, are also a reason for a serious amount of economic losses. The determination of the main causative microorganisms for the childhood gastroenteritis, such as the age range and the diagnosis time of the disease, will be beneficial in the diagnosis, treatment and follow-up processes of these infections. According to our results, Rotavirus occurrence rate in Amasya was a little lower compared to the general rates of the infection detected in Turkey. Adenovirus occurrence rate was also calculated similar to the rates found in other studies performed in Turkey. Similar to the other, Rotavirus and Adenovirus infections are observed frequently in children aged 0-2. Although adenovirus positivity is similar in every season, Rotavirus positivity is particularly high in winter. In order to prevent the unnecessary antibiotic usage, further Rotavirus research is recommended in children who are admitted to the hospital with acute gastroenteritis complaints particularly in winter. It has been considered that studies will be more useful when the standardized methods are used and when the different types of samples from various geographical regions are included. Rotaviruses and Adenoviruses can be rapidly determined by the immune chromatographic tests by using stool samples.

References

- Bass DM (2015) Rotaviruses, Caliciviruses and Astroviruses. In: Kliegen MR, Stanton B, St Geme J, Schor NF, Behrman RE (eds.). *Nelson Textbook Of Pediatrics*, Elsevier, Netherlands. Pg no: 11-37.
- Yarkin F (2004) Gastroenteritis virüs. In: Ustacelebi S, Abacioglu H, Badur S (eds.). *Molecular, clinical, diagnostic virology*. Gunesbookstore, Ankara, Turkey. Pg no: 245-258.
- Nazik H, Ilktaç M, Öngen B (2006) Investigation Of Frequency Of Rotavirus In Childhood Acute Gastroenteritis. *Ankem Derg* 20: 233-235.
- Offit PA, Clark HF (2000) Rotavirus. In: Mandell GL, Bennet JE, Dolin R (eds.). *Principles and Practice of Infectious Disease*. (5thedn), Churchill, Livingstone, Philadelphia. Pg No: 1696-703.
- Ozturk R (2004) Reovirus family and other gastroenteritis virus. In: Willke Topcu A, Soyletir G, Doganay M (eds.). *Infectious Diseasesand Microbiology*. (2ndedn), Nobel medical book store, Istanbul, Turkey. Pg no: 1564-1575.
- La Rosa AM, Champlin R, Mirza N, Gajewski J, Giral S, et al. (2001) Adenovirus Infections in Adult Recipients of Blood and Marrow Transplants. *CID* 32: 871-876.
- Refik Saydam National Public Health Agency (2004) Burden Of Disease Final Report. National Burden Of Disease And Cost Effectiveness Project, Başkent University, Ankara, Turkey.
- Bulut Y, İşeri L, Aşel E, Durmaz B (2003) The Positivity of Rotavirus in Children with Suspected Acute Gastroenteritis. *İnönü Üniversitesi Tıp Fakültesi Dergisi* 10: 143-145.
- İlkaç M, Şahin A, Nazik H, Öngen B (2012) Investigation Of Rotavirus Frequency And Following Up The Rotavirus Season Among Children With Acute Gastroenteritis: Evaluation Of Five-Year Results. *Ankem Derg* 26: 25-29.
- Kizirgil A, Karakoçan S (2012) Detection of the etiologic agents of the childhood acute gastroenteritis. *Nobel Med* 8: 60-65.
- Borsa BA, Tokman HB, Cagatay P (2013) Determination of Rotavirus and Adenovirus Frequency Among 0-5 Year Old Children with Acute Gastroenteritis in Mardin Gynecology and Children Diseases Hospital. *Ankem medical Journal*. 27: 75-79.
- Gül M, Garpardıç M, Çıragıl P, Aral M, Karabber H, et al. (2005) Investigation of frequency of Rotavirus and Adenovirustypes 40/41 in children with gastroenteritis between 0-5 years of age. *Ankem Derg* 19: 64-67.
- Otag F, Direkel S, Ozgur D, Delialioğlu N, Emekdaş G, et al. (2012) Investigation of rotavirus and enteric adenovirus antigens in pediatric patients with acute gastroenteritis by rapid immunochromatographic method. *Mersin Üniversitesi Sağlık Bilimleri Derg* 5: 18-23.
- Yarkin F, Torun E, Tezi YL (2009) Molecular epidemiology of rotavirüs infections in children with acute gastroenteritis in our region. *Microbiology ABD, Çukurova Üniversitesi Institute of Health Sciences*. Thesis No: TF2008YL5, Adana, Turkey.
- Mass G, Baumeister HG, Freitag N (1997) Viruses as causal agents of gastroenteritis in infants and young children. *MMV Munch Med Wochenschr* 12: 1029-1034.
- Begue RE, Gastanaduy AS (1999) Acute gastroenteritis virüs. In: Armstrong D, Cohen J (eds.). *Infectious Diseases (1stedn)*. Mosby Harcourt Publishers, Barcelona, Spain. Pg no: 581-584.
- Khalil K, Lindblom G-B, Mazhar K, Khan SR, Kajiser B (1993) Early child-health in Lahore, Pakistan: VIII Microbiology. *Acta Paediatr* 82: 87-94.
- Aihara M (1997) Infectious disease in Kenya—epidemiological study of diarrhoeal disease in children. *Rinsho Byori*. 45: 421-426.
- Ahluwalia GS, Scott-Taylor TH, Klisko B, Hammond GW (1994) Comparison of detection methods from enteric clinical specimens. *Diagn Microbiol Infect Dis* 18: 161-166.
- Hilmioğlu S, Yüce K (1994) Investigation of Frequency of Rotavirus in Gastroenteritis. *Infection journal* 8: 163.
- Asci Z, Seyrek A, Kizirgil A, Ozen A, Yılmaz M (1996) Rotavirüs diarrhea in children in the 0-6 age group to investigate the prevalence of ELISA and latex agglutination method. *İnfeksiyon derg* 10: 263-5.
- Inci A, Urhan B (2015) Frequency of Rotavirus in Children with Acute Gastroenteritis. *Journal of Clinical and Analytical Medicine* 6: 449-451.
- Bicer S, Col D, Erdag GC, Giray T, Gural Y, et al. (2014) A Retrospective Analysis of Acute Gastroenteritis Agents in Children Admittedto a University Hospital Pediatric Emergency Unit. *Jundishapur J Microbiol*. 7: 9148.
- Dağı HT, Fındık D (2014) Investigation of rotavirus and adenovirus antigens in patients with acute gastroenteritis. *J Clin Exp Invest* 5: 256-260.
- Balkan CE, Çelebi D, Çelebi O, Altöparlak U (2012) Investigation of Rotavirus and Adenovirus Frequency Among 0-5 Years Old Children with Acute Gastroenteritis in Erzurum. *Türk Microbiology Community Journal* 42: 51-54.

26. Tekin A (2010) The frequency of rotavirus and entericadenovirus in children with acute gastroenteritis in Mardin. *J Clin Exp Invest.* 1: 41-45.
27. Altindis M, Bestepe G, Ceri A, Yavru S, Kalaycı R (2008) Frequency Of Rotavirus And Enteric Adenovirus Infection in Children With Acute Gastroenteritis. *SDÜ Týp Fak Derg* 15: 17-20.
28. Albayrak N, Caglayık DY, Altaş AB, Korukluođlu G, Ertek M (2011) Evaluation of the results of acute viral gastroenteritis data in Refik Saydam National Public Health Agency, Virology Reference and Research Laboratory in 2009. *Türk Hij Den Biyol Journal* 68: 9-15.
29. Kurtođlu MG, Inci A, Özdemir M, Baysal B (2010) Seasonal and Age Distribution of Adenovirus Gastroenteritis in Children. *Türk Mikrobiyol Cem Derg* 40: 157-162.