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ARAŞTIRMA / RESEARCH

Frequency of rotavirus and enteric adenovirus in children with acute gastroenteritis in Halfeti district, Sanliurfa, Turkey

Şanlıurfa'nın Halfeti ilçesindeki akut gastroenteritli çocuklarda rotavirüs ve adenovirüs sıklığı

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Abstract

Purpose: The aim of this study was to evaluate the frequency, epidemiological characteristics, clinical and laboratory data of rotavirus and enteric adenovirus agents in children presenting with diarrhea.

Materials and Methods: In this study, the records of patients with diarrhea between the ages of 0-144 months who applied to Halfeti State Hospital between July 2017 and July 2019 and diagnosed with acute gastroenteritis and whose rotavirus and enteric adenovirus tests (examined by immunochromatographic methods) were requested were evaluated retrospectively. The frequency of rotavirus and adenovirus gastroenteritis, demographic data, clinical status, laboratory findings of these patients; age groups, gender and seasonal distribution were examined.

Results: Six hundred and forty patients were included in the study. The median age of the patients was 22 months and 57% were male. Rotavirus was detected in 40% of the patients and adenovirus was found in 10.2% of the patients. The hospitalization rates of children with positive rotavirus were higher than other groups. The children with rotavirus are mostly in winter; children with adenovirus mostly in spring; rotavirus and adenovirus negative children were admitted to the emergency department mostly during the summer months.

Conclusion: The stool examinations were important in the diagnosis of rotavirus and adenovirus gastroenteritis causing high mortality and morbidity; we think that unnecessary antibiotic use will decrease with appropriate treatment and the incidence of the disease and hospitalization cost burden will decrease with increasing rotavirus vaccination rates for Turkey.

Keywords:. Acute gastroenteritis, adenovirus, child, epidemiology, rotavirus

Öz

Amaç: Bu çalışmada hastanemize ishal yakınması ile başvuran çocuklarda, rotavirüs ve enterik adenovirüs etkenlerinin sıklığının, epidemiyolojik özelliklerinin, klinik ve laboratuvar verilerinin değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntem: Çalışmamızda Temmuz 2017-Temmuz 2019 tarihleri arasında Halfeti Devlet Hastanesine başvuran, yaş aralığı 0-144 ay olan, ishal yakınmasıyla başvurup akut gastroenterit tanısı alan ve taze dışkı örneklerinde rotavirüs ve enterik adenovirüs testi (immünokromatografik yöntemlerle incelenen) istenen hastaların kayıtları retrospektif olarak incelendi. Rotavirüs ve adenovirüs gastroenteritinin sıklığı, bu hastalara ait demografik verileri, klinik durumları, laboratuvar bulguları; yaş grupları, cinsiyet ve mevsimsel dağılımlarına göre incelendi.

Bulgular: Çalışmaya 640 hasta dahil edildi. Hastaların yaş ortalaması 22 ay olup, %57' si erkekti. Hastaların %40' ında rotavirüs, %10,2' sinde adenovirüs saptandı. Rotavirüs pozitif olan çocukların yatış oranlarının diğer gruplara göre daha yüksek olduğu istatistiksel olarak anlamlı görüldü. Rotavirüsü olan çocukların daha çok kış aylarında; adenovirüsü olan çocuklarında daha çok bahar aylarında; Rotavirüs ve Adenovirüs negatif olan çocuklarında daha çok yaz aylarında acil servise başvurdukları tespit edildi.

Sonuç: Yüksek mortalite ve morbiditeye sebep olan rotavirüs ve adenovirüs gastroenteritlerinin tanısının konulmasında gayta tetkiklerinin önemli olduğu; uygun tedavilerin yapılmasıyla gereksiz antibiyotik kullanımının azalacağı, rotavirüs aşılama oranlarının arttırılması ile hastalığın görülme oranının ve yatış maliyet yükünün de ülkemiz açısından azalacağını düşünmekteyiz.

Anahtar kelimeler: Akut gastroenterit, adenovirüs, çocuk, epidemiyoloji, rotavirüs

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INTRODUCTION

Acute gastroenteritis (AGE) is an important cause of infectious death in children. Especially in developing countries, the incidence and the possibility of serious disease is higher[1]. It ranks first three among deaths due to infections in the world. Despite all precautions, diarrhea-related deaths affect 2-3 million people worldwide every year. Most of these deaths occur in children under 5 years of age[2-4]. Viruses are known to be the most common cause of AGE, and rotavirus, human calici viruses (norovirus and sapoviruses), adenovirus 40/41 and astrovirus are the most common causes of AGE in children[5].

Rotavirus, a member of the reoviridae family, which is frequently encountered as a viral agent in acute gastroenteritis, is a double-stranded 70 nm RNA virus that has an icosahedral, envelope-like, wheel-like appearance[6]. Rotavirus diarrhea, which occurs in temperate climate regions, mostly in winter and in children under 2 years of age, occurs in developing countries earlier than in developed countries, clinically more severe and mortality rates are higher[7]. Adenovirus is an envelope-free (naked), medium-sized (80-100 nm) virus with double-stranded linear DNA with icosahedral symmetry[8]. Types 40 and 41 of adenoviruses can be isolated as gastroenteritis agents in almost every region of the world and cause important sporadic outbreaks among children in nurseries, summer camps and public ponds[7]. Cell culture, detection of viral antigen and detection of viral nucleic acid are the definitive diagnostic methods in the detection of the causative virus, but various commercial antigenic techniques such as rapid, highly sensitive enzyme immunoassay and latex agglutination can also be used routinely in laboratories[9].

In our study, rotavirus, adenovirus frequency, age, sex, and duration of hospitalization, hospitalization status and hospitalization period were investigated retrospectively among patients with acute gastroenteritis who applied to Sanliurfa Halfeti State Hospital pediatric outpatient clinic and emergency department. Although there is no similar study for Halfeti, Sanliurfa province of Turkey, our study aimed to contribute to the literature in this region and to understand the role and importance of viral agents in gastroenteritis in children.

MATERIALS AND METHODS

In the present study, records of patients with acute gastroenteritis aged 0-144 months who were admitted to Halfeti State Hospital between July 2017 and July 2019 and who were asked for rotavirus and enteric adenovirus test (examined by immunochromatographic methods) in fresh stool samples were examined retrospectively. The presence, sensitivity and specificity of rotavirus and enteric adenovirus antigens in the fresh stool samples were investigated by the qualitative immunochromatographic test kit (Rapid test diagnostics adenovirus / rotavirus AV-RV combo card test) that reported with high compatible. Pediatric patients aged 0-144 months with acute gastroenteritis were included in the study. The diagnosis of AGE was accepted as> 3 / day watery defecation in the last week without antibiotics and thought to be unrelated to food[10]. The data of the cases with macroscopic examination of the feces were watery and microscopically free of any parasites were included in the study.

Stool specimens and rectal swab material that were reported to be hemorrhagic or with parasites were not included in the study. Data collection, hospital information processing system and patient files in the archive, epicrisis; the age, sex, admission date, hospitalization, first-time complaints, first-time blood tests, and fecal adenovirus and rotavirus antigen tests of the patients were recorded.

Cost analysis data were obtained from hospital data processing records and invoice information documents considering the components such as drugs used for patients, materials used, radiological imaging performed, laboratory examinations made, and the bed price that occurred during the stay in the service. All costs calculated in our study consist of direct medical costs. Due to the difficulty of calculation and retrospective study, indirect costs such as health personnel expenses, loss of parents' job, transportation, meal and diaper expenses are not included in the study. TL values in cost analysis of patients; For each month between the dates of the study, the average foreign exchange buying rates determined by the Turkish Republic Central Bank were calculated and converted to USD.

Ethics committee approval (session no: 10, date: 09.09.2019) was obtained from the Non-Interventional Clinical Research Ethics Committee

of Harran University Faculty of Medicine before the initation of the study.

Statistical analysis

SPSS 25.0 software was used for statistical analysis of the data. Categorical measurements were calculated as numbers and percentages, and continuous measurements were calculated as mean and standard deviation (median and minimum-maximum where necessary). Chi square test or Fisher test statistics were used to compare categorical variables. Chi square test or Fisher test statistics were used to compare categorical variables. Kruscal Wallis test was used to compare the continuous measurements between the groups since no parametric distribution prerequisite was provided. Mann Whitney U test was used for pair comparisons. Statistical significance was accepted as 0.05 in all tests.

RESULTS

The number of patients included in the study was 640 that 365 (57%) were male, 275 (43%) were female. The median age of the children included in the study was 22 (min-max: 1-144) months. While 600 (93.8%) patients were citizens of the Republic of Turkey, 40 (6.2%) patients were Syrian refugee. The patients are divided into four groups; 204 (31.9%) patients were rotavirus positive group, 13 (2%) patients were adenovirus positive group, 52 (8.1%) patients were rotavirus and adenovirus positive group, 371 (58%) patients were rotavirus and adenovirus negative group. 25.3% of the patients presented to the hospital with fever, 26.4% with vomiting, 97.3% with diarrhea and 30.2% with fatigue. While 193 (32.1%) of 600 Turkish patients were rotavirus positive, 48 (8%) were rotavirus and adenovirus positive, 346 (57.6%) were rotavirus and adenovirus negative; of the 40 Syrian patients, 11 (27.5%) were rotavirus positive, 4 (10%) were rotavirus and adenovirus positive, 25 (62.5%) were rotavirus and adenovirus negative, and there was no statistically significant difference between the groups in terms of nationality (p = 0,692). Also there was no statistically significant difference was found between the groups in terms of gender (p = 0.457).

When the age distribution is analyzed according to the disease groups, the age distribution of rotavirus and adenovirus negative group was found that they were at a younger age compared to the rotavirus positive group and the rotavirus and adenovirus positive group. The difference between age groups is due to this. While 46.6% of patients in the rotavirus positive group and 55.8% of patients in the rotavirus and adenovirus positive group were in the 25-60 months period; 25.9% of the rotavirus and adenovirus negative groups were in this age group. This difference was found statistically significant (p1&4 = 0,001, p3&4 = 0,001).

For the treatment status; 159 (77.9%) of 204 rotavirus positive patients, 7 (53.8%) of 13 adenovirus positive patients, 28 (53.8%) of 52 rotavirus and adenovirus positive patients were hospitalized. It was found that the rate of hospitalization of rotavirus positive children was statistically higher than the other groups (p = 0.001). There was no statistically significant difference between adenovirus positive group and rotavirus and adenovirus positive groups in terms of inpatient treatment. All comparison of demographic variables by groups are shown in Table 1.

Children with positive rotavirus mostly in the winter months; children with positive adenovirus mostly in the spring months; children who were negative of rotavirus and adenovirus mostly applied to the hospital in the summer months. The distribution of the number of admissions among patients by years and months are shown in Table 2. There was no significant difference between the length of hospitalization between the groups. Rotavirus positive and rotavirus and adenovirus positive patients had an average of 8 times diarrhea per day, and was statistically significantly higher compared to rotavirus and adenovirus negative group (p = 0.001). When the average direct cost analysis of the patients is examined; It was determined that the rotavirus positive group was 101.2 USD and the rotavirus and adenovirus positive group was 102.5 USD and statistically higher than the other groups (p = 0.001). Comparison of groups length of hospitalization, diarrhea per day and direct costs analysis given in Table 3.

In blood gas tests; there was no statistically significant difference between pH and pCO2 values. Mean HCO3 values were 17.5 ± 3.8 in the rotavirus positive group, 17.9 ± 5.1 in the rotavirus and adenovirus positive group, and 19.3 ± 4.0 in the rotavirus and adenovirus negative group. Rotavirus positive and rotavirus and adenovirus positive groups were found to have statistically lower HCO3 values than other groups (p = 0.001). There was no statistically significant difference between the groups in terms of complete blood count and biochemical tests

Table 1. Comparison of demographic variables by groups

		Total (n)	Rotavirus (+)[1]		Adenovirus (+)[2]		Rotavirüs+ adenovirüs (+)[3]		Rotavirüs+ adenovirüs (-)[4]		p
			n	%	n	%	n	%	n	%	
Age (months)	0-6	42	8	3.8	2	15.3	0	0.0	32	8.6	p1&2:0.824 p1&3:0.238 p1&4:**0.001** p2&3:0.464 p2&4:0.460 p3&4:**0.001**
	7-12	125	25	12.3	1	7.7	5	9.6	94	25.3	
	13-24	189	63	30.9	3	23.1	15	28.8	108	29.1	
	25-60	226	95	46.6	6	46.2	29	55.8	96	25.9	
	>60	58	13	6.4	1	7.7	3	5.8	41	11.1	
	Total	640	204	100	13	100	52	100	371	100	
Gender	Male	365	107	52.5	8	61.5	31	59.6	219	59.0	0.457
	Female	275	97	47.5	5	38.5	21	40.4	152	41.0	
	Total	640	204	100	13	100	52	100	371	100	
Nationality	Citizens of the Republic of Turkey	600	193	94.6	13	100.0	48	92.3	346	93.3	0.692
	Syrian refugee	40	11	5.4	0	0.0	4	7.7	25	6.7	
	Total	640	204	100	13	100	52	100	371	100	
Treatment status	Inpatient treatment	195	159	77.9	7	53.8	28	53.8	1	0.3	p1&2:**0.047** p1&3:**0.001** p1&4:**0.001** p2&3:1.000 p2&4:**0.001** p3&4:**0.001**
	Ambulatory treatment	445	45	22.1	6	46.2	24	46.2	370	99.7	
	Total	640	204	100	13	100	52	100	371	100	

Table 2. Distribution of the number of admissions among patients by years and months

		Rotavirus (+)		Adenovirus (+)		Rotavirüs+ adenovirus (+)		Rotavirüs+ adenovirus (-)ve	
		n	%	n	%	n	%	n	%
Total number of applications by years	2017	58	28.4	0	0.0	24	46.2	26	7.0
	2018	58	28.4	6	46.2	18	34.6	66	17.8
	2019	88	43.2	7	53.8	10	19.2	279	75.2
	Total	204	100	13	100	52	100	371	100
Total number of applications by months	January	23	11.3	1	7.7	5	9.6	15	4.0
	February	15	7.4	2	15.4	2	3.8	21	5.7
	March	27	13.2	3	23.1	8	15.4	30	8.1
	April	18	8.8	2	15.4	5	9.6	24	6.5
	May	27	13.2	2	15.4	4	7.7	43	11.6
	June	15	7.4	3	23.1	2	3.8	86	23.2
	July	3	1.5	0	0.0	0	0.0	85	22.9
	August	1	0.5	0	0.0	0	0.0	28	7.5
	September	2	1.0	0	0.0	0	0.0	0	0.0
	October	5	2.5	0	0.0	8	15.4	1	0.3
	November	37	18.1	0	0.0	8	15.4	22	5.9
	December	31	15.2	0	0.0	10	19.2	16	4.3
	Total	204	100	13	100	52	100	371	100

Table 3. Comparison of groups length of hospitalization, diarrhea per day and direct costs analysis

Mean (min-max)	Rotavirus (+)[1] (n=204)	Adenovirus (+)[2] (n=13)	Rotavirus+ Adenovirus (+)[3] (n=52)	Rotavirus+ Adenovirus (-)[4] (n=371)	p
Length of hospitalization (days)	6 (2-18)	6 (3-8)	7 (3-18)	5 (5-5)	0.276
Diarrhea per day	8 (4-16)	7 (5-10)	8 (4-15)	6 (4-13)	p1&2:0.021 p1&3:0.338 p1&4:0.001 p2&3:0.049 p2&4:0.123 p3&4:0.001
Costs (USD)	101.2 (5.2-486.6)	76.4 (18.9-216.2)	102.5 (3.9-557.8)	19.4 (0.2-203.9)	p1&2:0.060 p1&3:0.738 p1&4:0.001 p2&3:0.184 p2&4:0.001 p3&4:0.001
Costs (TL)	500.0 (29.9-1953.3)	442.7 (109.4-1253.9)	510.0 (23.0-2035.8)	112.1 (1.4-1120.3)	p1&2:0.187 p1&3:0.416 p1&4:0.001 p2&3:0.634 p2&4:0.001 p3&4:0.001

Table 4. Studies conducted in Turkey

Researcher, year	Rotavirus rate (%)	Adenovirus rate (%)
Bayraktar et al., 2010	23.7	1.5
Tekin et al., 2010	16.5	1.0
Balkan et al., 2012	25.9	8.5
Otag et al.,2012	28.9	3.3
Gultepe et al.,2013	13.0	8.5
Turkdagı et al., 2014	9.8	1.3
Sugecti et al.,2015	18.1	1.5
Nazik et al.,2016	7.4	1.7
Kizilirmak et al.,2017	16.0	6.0
Kose et al.,2019	20.1	5.2

DISCUSSION

Gastroenteritis caused by viruses causes epidemics and deaths each year in children in undeveloped and developing countries. Viral gastroenteritis is accepted as one of the most important viral diseases of childhood in developed countries[11,12]. Gastroenteritis agents vary according to the geographical region, season and age of the patient. Rotaviruses are the most common cause of viral gastroenteritis in the literature and adenoviruses are the second most common cause of viral gastroenteritis[13]. When we look at some countries of the world, the rotavirus positivity rate is 17-69% in the United States, 16% in Germany, 20-28% in India, and 20% in Pakistan. According to these data, the incidence of the disease is similar in the developed and developing countries, suggesting that the level of development does not affect the frequency of rotavirus gastroenteritis[14]. In the studies conducted in our country, the incidence of rotavirus can be determined as 9.8-39.8%[15].

Rotavirus prevalence studies in our country have reported different rates in different regions and age groups. The highest rotavirus antigen positivity was reported to be under 2 years of age, in this age group it was reported as 52.4% in the study of Akinci et al., 66.2% in the study of Kocak et al. [16-18]. In the study

of Altindis et al.[19] they found that the frequency of rotavirus in children with gastroenteritis was 12.5% in their study. In the study of Ilktac et al. in a 5-year study evaluating the frequency of rotavirus in children with acute gastroenteritis between 0-18 years, rotavirus antigen positivity was found to be 19.2%, 14.5%, 17.3%, 16.6% and 11% in 2006, 2007, 2008, 2009, 2010, respectively. In the same study, rotavirus antigen positivity was reported to be most common in children aged 0-5 years with 86% [20].

Berk et al. [21] in their study in the 0-16 age group, rotavirus antigen test positivity was determined to be 30.8% in 2009 and 24.3% in 2010. It is seen that; Rotavirus antigen positivity changes in studies conducted in different regions, different age groups or in the same region in different years (Table 4). In our study, rotavirus positivity was found to be 40%, adenovirus positivity was 10.2% and both viruses pozitivity were found to be 8.1%. In our study, similar to other studies, rotavirus and enteric adenovirus infections are most common under 5 years of age; unlike other studies, it was most frequently detected between 25-60 months. In the district where the study was conducted, it was found that these rates were high; It can be explained by the presence of a large family structure, inadequate hygiene conditions, the use of well water in villages, insufficient sewage system and the lack of rotavirus vaccine.

In our study, the hospitalization rates of children with rotavirus were found to be significantly higher than the other groups. In rotavirus diarrhea, the clinical presentation of the disease is more severe than other diarrheal agents, and it is also longer in hospitalization period. The disease limits itself in 4-8 days[22]. Chen et al.[23] found that the mean duration of hospitalization was 5 days in rotaviruses and adenoviruses. The average cost of children with rotavirus pozitive and rotavirus and Adenovirus positive was also statistically higher than other groups. The least cost was in rotavirus and adenovirus negative group. In a study conducted in Şişli Etfal Training and Research Hospital in 2010; duration of hospitalization due to rotavirus infection was approximately 3.7 days and the total cost per patient was estimated to be approximately 151 USD. It was determined that approximately 65% of this amount is composed of diagnostic and treatment expenditures[24]. In a study conducted in Mexico, the total medical cost per inpatient was 211 USD and 92% of this cost was determined as diagnostic and treatment costs[25]. In our study, the average cost of rotavirus positive group was 101.2 USD, the average cost of adenovirus positive group was 76.4 USD, the average cost of rotavirus and adenovirus positive group was 102.5 USD, and the average cost of rotavirus and adenovirus negative group was 19.4 USD. There was a significant difference between negative and positive groups in terms of cost calculation.

In our study, children with rotavirus were more likely to have winter; children with adenovirus mostly in spring; rotavirus and adenovirus negative children were admitted to emergency service mostly in summer months. The seasonal distribution of rotavirus infections is well known. Various studies in the world and in our country have reported that this infection typically starts in early autumn and continues until the beginning of the spring, while it is observed in Europe during the winter months[26].

The diarrhea duration of children with rotavirus positive and rotavirus and adenovirus positive groups was found to be significantly higher than other groups. Similar to our study, Ipek et al. (2009) found that hospital stay and diarrhea days were higher in rotavirus positive cases compared to negative cases in rotavirus positive cases[27]. In blood gas tests; the highest HCO3 value is in rotavirus and adenovirus negative group was 19.3 ± 4.0 and the lowest HCO3 value was 15.5 ± 3.8 in the rotavirus positive group. These results were related to metabolic acidosis due to dehydration due to severe fluid loss and these low HCO3 values in rotavirus positive group were statistically significant when compared with negative group. No significant change was observed in other blood tests.

In conclusion, viral agents are very important in gastroenteritis as seen in our study. It is thought that correct diagnosis of rotavirus and adenovirus gastroenteritis, which causes high mortality and morbidity, will make appropriate treatment of the disease, reduce unnecessary antibiotic usage, pay attention to hygiene conditions and rotavirus vaccination will decrease the cost spent for the disease.

Yazar Katkıları: Çalışma konsepti/Tasarımı: AB, SB; Veri toplama: AB, SB; Veri analizi ve yorumlama: AB, SB ; Yazı taslağı: AB, SB; İçeriğin eleştirel incelenmesi: AB, SB; Son onay ve sorumluluk: AB, SB; Teknik ve malzeme desteği: SB; Süpervizyon: AB, SB; Fon sağlama (mevcut ise): yok.
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REFERENCES

1. Walker CLF, Rudan I, Liu L, Nair H, Theodoratou E, Bhutta ZA et al. Global burden of childhood pneumonia and diarrhoea. Lancet. 2013;381:1405-16.
2. Kosek M, Bern C, Guerrant RL. The global burden of diarrhoeal disease, as estimated from studies published between 1992 and 2000. Bull World Health Organ. 2003;81:197-204.
3. WHO. WHO 2004 report. Diarrhoeal diseases (Updated February 2009). http://www.who.int/vaccine_research/diseases/diarrhoeal/en (Accessed 15/05/2019).
4. United Nations. Millenium Development Goals Report. New York, United Nations, 2005.
5. Gülen A, Hacımustafaoğlu M. Çocuklarda akut infeksiyöz gastroenteritlere genel yaklaşım. ANKEM Dergisi. 2013;27:147-57.
6. Öztürk R. Reovirus ailesi ve diğer gastroenterit virusları. In İnfeksiyon Hastalıkları ve Mikrobiyolojisi cilt 2 (Eds A Wilke Topçu, G Söyletir, M Doğanay):1224-32. İstanbul, Nobel Tıp Kitabevi, 2002.
7. Kurugöl Z, Devrim İ. Gastrointestinal enfeksiyonlar. Çocuk Enfeksiyon Dergisi. 2014;8:71-81.
8. Bayrakçı B, Özütemiz Ö. Postinfeksiyöz irritabl barsak sendromu. Güncel Gastroenteroloji Dergisi. 2009;13:153-7.
9. Türkiye Halk Sağlığı Kurumu. Ulusal Mikrobiyoloji Standartları. Akut Sendromik Yaklaşım Rehberi. Ankara, TC. Sağlık Bakanlığı, 2015.
10. Black RE, Cousens S, Johnson HL, Lawn JE, Rudan I, Bassani DG et al. Global, regional, and national causes of child mortality in 2008: a systematic analysis. Lancet. 2010;375:1969-87.
11. Kapikian AZ, Hoshino Y, Chanock RM. Field's Virology. Philadelphia, Lipincott Williams & Wilkins. 2001.
12. Bass DM. Rotavirüs and other agents of viral gastroenteritis. In Nelson Textbook of Pediatrics, 17th ed (Eds RE Behrman, EM Kliegman, HB Jenson) 1081-3. Philadelphia, WB Saunders, 2004.
13. Akıncı N, Erener Ercan T, Yalman N, Eren A, Severge B, Ercan G. Akut gastroenteritli çocuklarda adenovirus ve rotavirus. Çocuk Enfeksiyon Dergisi. 2007;1:98-101.
14. Çelebi S, Ayyıldız A, Babacan M, Tuncel ME. İvegen ishalli 0-2 yaş grubu çocuklarda enteropatojenlerin bulunma oranı. İnfeksiyon Dergisi. 1992;6:31-4.
15. Tuncer S, Ceyhan M, Yurdakök K. Akut gastroenteritli çocuklarda adenovirus tip 40 ve tip 41' in önemi. V. Ulusal İnfeksiyon Hastalıkları Kongresi, 1995, İstanbul, Bildiri Özet Kitabı. 1995;102.
16. Akıncı N, Ercan TE, Yalman N, Eren A, Severge B, Ercan G. Akut gastroenteritli çocuklarda adenovirus ve rotavirus. Çocuk Enfeksiyon Dergisi. 2007;1:98-101.
17. Koçak M., Çalışkan E., Köksal AO. Keçiören Eğitim ve Araştırma Hastanesi pediatri servisinde gastroenterit tanısıyla izlenen çocuklarda rotavirus sıklığının araştırılması. ANKEM Dergisi. 2014;28:134-7.
18. Oğuz S., Kurt F., Tekin D., Kocabaş BA, İnce E., Suskan E. Burden of rotavirus gastroenteritis in the pediatric emergency service. Çocuk Enfeksiyon Dergisi. 2014;8:99-104
19. Altındiş M, G Beştepe, A Çeri, S Yavru, R Kalaycı. Akut İshal yakınmalı çocuklarda rota ve enterik adenovirus sıklığı. SDÜ Tıp Fakültesi Dergisi. 2008:15:17-22.
20. İlktaç M., Şahin A., Nazik H., Öngen B. Akut gastroenteritli çocuklarda rotavirus sıklığının araştırılması ve rotavirus sezonunun takibi: beş yıllık sonuçların değerlendirilmesi. ANKEM Dergisi. 2012;26:25-9.
21. Berk E, Kayman T. Akut gastroenteritli çocuk hastalarda rotavirus sıklığı. ANKEM Dergisi. 2011;25:103-6.
22. Bernstein DI, Ward RL. Rotaviruses. In: Textbook of Pediatric Infectious Diseases, 5th edition (Eds RD Feigin, JD Cherry, GJ Demmler, SL Kaplan):2110-33. Philadelphia, Saunders, 2004.
23. Chen SY, Chang YC, Lee YS, Chao HC, Tsao KC, Lin TY et al. Molecular epidemiology and clinical manifestations of viral gastroenteritis in hospitalized pediatric patients in northern Taiwan. J Clin Microbiol. 2007;45:2045-57.
24. Sancar M., Dalgıç N., Haşim Ö., Pullu M. Bir eğitim araştırma hastanesindeki rotavirüslü çocuklarda yatış maliyeti. Çocuk Enfeksiyon Dergisi. 2011;5:7-11
25. Constenla D, Velazquez FR, Rheingans RD, Antil L, Cervantes Y. Economic impact of a rotavirus vaccination program in Mexico. Rev Panam Salud Publica. 2009;25:481-90.
26. Kim JS, Kang JO, Cho SC, Jang YT, Min SA, Park TH et al. Epidemiological profile of Rotavirus infection in the Republic of Korea: results from prospective surveillance in the Jeongeub District. J Infect Dis. 2005;1:49-56.
27. İpek IO, Paketçi C., Bozaykut A. Seren L. Bir yaş altı çocuklarda rota sıklığı. Zeynep Kamil Tıp Bülteni. 2009;40:33-5.