Research Article

Rotavirus Vaccination Status in Rotavirus Infection Presenting to Pediatric Emergency Department

Rotavirüs enfeksiyonu nedeniyle çocuk acil servisine başvuran hastalarda rotavirüs aşı durumu

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Abstract

Puspose: The aim of this study was to determine the frequency of rotavirus enteritis (RV-e) and rotavirus vaccination (RV-V) status in patients with acute gastroenteritis (AGE) admitted to the pediatric emergency department and to evaluate the demographic characteristics, seasonal distribution and risk factors of the disease.
Material and Method: The study was conducted in the Pediatric Emergency Department of Aksaray University Training and Research Hospital between January 1, 2023 and December 31, 2023. The study population included a total of 609 patients (229 patients with rotavirus (RV) antigen detected in stool smear and 380 patients with normal stool findings) out of 2156 patients aged 0-16 years admitted due to AGE. Patients were evaluated according to demographic characteristics, vaccination status, seasonal distrubition and hospitalization status.
Results: The mean age of the patients included in the study was 54.01 ± 45.24 months and 45.3% were girls. RV-e positivity rate was 37.6% (229 patients). Of the patients, 90% (n=548) were not vaccinated and 10% (n=61) were vaccinated. RV-e was most common in the spring (38.3%) and fall (24.3%) seasons. RV was detected in 78.9% of 133 patients hospitalized with AGE and this rate was statistically significant compared to those without RV-e (p<0.001). 93.9% of children with RV-e had not received RV-V.
Conclusion: Our study shows that RV-e in our region continues to be an important public health problem. Especially the detection of RV-e in the majority of severe cases requiring hospitalization emphasizes the seriousness of the disease. The low vaccination rates and the significantly lower incidence of infection in vaccinated children reveal the importance of expanding vaccination programs. Knowing the seasonal distribution of rotavirus infections will guide the planning of health services. In future studies, it is recommended to determine rotavirus genotypes and to examine the factors affecting vaccine efficacy in more detail.

Keywords: Rotavirus, gastroenteritis, pediatric emergency, seasonal distribution, vaccination

Öz

Amaç: Bu çalışmanın amacı, akut gastroenterit (AGE) nedeniyle çocuk acil servisine başvuran hastalarda rotavirüs enteriti (RV-e) ve rotavirüs aşısı (RV-V) durumunun sıklığını belirlemek ve hastalığın demografik özelliklerini, mevsimsel dağılımını ve risk faktörlerini değerlendirmektir.

Gereç ve Yöntem: Çalışma, 1 Ocak 2023 ile 31 Aralık 2023 tarihleri arasında Aksaray Üniversitesi Eğitim ve Araştırma Hastanesi Çocuk Acil Servisi'nde yürütülmüştür. Çalışma popülasyonu, AGE nedeniyle başvuran 0-16 yaş arası 2156 hastadan toplam 609 hastayı (dışkı yaymasında rotavirüs (RV) antijeni tespit edilen 229 hasta ve dışkı bulguları normal olan 380 hasta) içermektedir. Hastalar demografik özelliklerine, aşılanma durumlarına, mevsimsel dağılımlarına ve hastanede yatış durumlarına göre değerlendirilmiştir.
Bulgular: Çalışmaya dahil edilen hastaların yaş ortalaması 54,01 ± 45,24 ay olup %45,3'ü kızdı. RV-e pozitiflik oranı %37,6 (229 hasta) idi. Hastaların %90'ı (n=548) aşılanmamış ve %10'u (n=61) aşılanmıştı. RV-e en sık ilkbahar (%38,3) ve sonbahar (%24,3) mevsimlerinde görüldü. AGE nedeniyle hastaneye yatırılan 133 hastanın %78,9'unda RV tespit edildi ve bu oran RV-e olmayanlara göre istatistiksel olarak anlamlıydı (p<0,001). RV-e'li çocukların %93,9'u RV-V almamıştı.

Sonuç: Çalışmamız bölgemizde RV-e'nin önemli bir halk sağlığı sorunu olmaya devam ettiğini göstermektedir. Özellikle hastaneye yatış gerektiren ciddi vakaların çoğunda RV-e tespit edilmesi hastalığın ciddiyetini vurgulamaktadır. Düşük aşılama oranları ve aşılanmış çocuklarda enfeksiyon sıklığının önemli ölçüde düşük olması, aşılama programlarının genişletilmesinin önemini ortaya koymaktadır. Rotavirüs enfeksiyonlarının mevsimsel dağılımının bilinmesi sağlık hizmetlerinin planlanmasına rehberlik edecektir. Gelecekteki çalışmalarda rotavirüs genotiplerinin belirlenmesi ve aşı etkinliğini etkileyen faktörlerin daha ayrıntılı olarak incelenmesi önerilmektedi

Anahtar Kelimeler: Rotavirüs, gastroenterit, pediatrik acil, mevsimsel dağılım, aşılama

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INTRODUCTION

Rotavirus is one of the most important viral agents of AGE in childhood and are an important cause of morbidity and mortality especially in children under 5 years of age (1,2). More than 200,000 deaths due to RV-e occur worldwide every year and the majority of these deaths are observed in low-income countries (3,4). RV-e is typically characterized by vomiting and watery diarrhea and may be accompanied by fever and abdominal pain. Rapid dehydration may develop especially in young children (5). The disease is usually self-limiting within 3-8 days, but hospitalization may be required in severe cases. RV-e peak in temperate climates especially in winter and early spring (6,7). In the pre-vaccination period, rotavirus infections constituted a significant economic burden even in developed countries. For example, they caused approximately 400,000 outpatient visits, 200,000 emergency department visits and 55,000 hospitalizations annually in the USA (8). With the introduction of rotavirus vaccine (RV-V) into the routine vaccination program in 2006, a significant decrease in the disease burden was observed (9,10). The most effective method in the prevention of RV-e is vaccination. The World Health Organization recommended the addition of RV-V to all national vaccination programs in 2009 (11). Today, RV-V is used in more than 100 countries. While the efficacy of the vaccine is 80-90% in developed countries, it is around 50-60% in low-income countries (12).

In this study, we aimed to evaluate the frequency of RV-e in patients to our pediatric emergency department and the effect of RV-V status on the disease course.

MATERIALS AND METHODS

Study Design

This study was conducted in the Pediatric Emergency Department of Aksaray University Training and Research Hospital, which serves an average of 15000 cases per month between January 1, 2023 and December 31, 2023. Ethics committee approval was obtained from the Aksaray Health Sciences ethics committee before the study (ethics committee no: 2024/027-SAGETİK25). Clinical data were obtained from the hospital's electronic medical database and patient files. The study population consisted of patients aged 0-16 years who presented to the Pediatric Emergency Department with diarrhea. Patients with RV antigen detected by stool immunochromatography or normal stool smear results were included in the study. Patients over 16 years of age or patients with pathogens other than RV antigen in stool analysis and patients with missing data were excluded from the study. The patients whose parents could not be contacted by telephone to inquire about vaccination status were excluded. The patients included in the study will be classified according to demographic characteristics such as age, gender, nationality, season of the year and whether they are hospitalized or not. Patients will be divided into two groups as with and without RV-V and the relationship with subgroups will be examined.

Statistical Analysis

Analyses were performed by transferring to SPSS 24.0 (IBM, USA) programme.

Participants were divided into two groups: those with RV-e and normal stool test group.

The normal distribution of the data was evaluated by Shapiro-Wilk test. Categorical variables were expressed as n (%) and continuous variables showing normal distribution were expressed as mean ± standard deviation. Chi-square test was used to compare the percentage distribution of categorical data between groups and Fisher's exact test was used non-normal distribution of qualitative variables
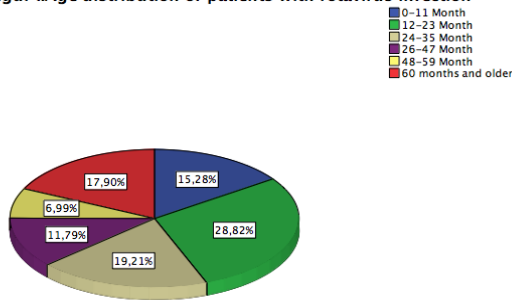
RESULTS

A total of 609 patients (229 with RV-e and 380 with normal stool findings) out of 2156 patients admitted to the pediatric emergency department with AGE were included in the study. The mean age of the patients was 54.01 ± 45.24 months and 45.3% (n=276) were female. Of the patients, 90% (n=548) were unvaccinated and 10% (n=61) were vaccinated. Among patients with RV-e, the most common age group was between 12 and 23 months. (Figure I) Demographic characteristics of patients with AGE are given in Table 1and flowchart.
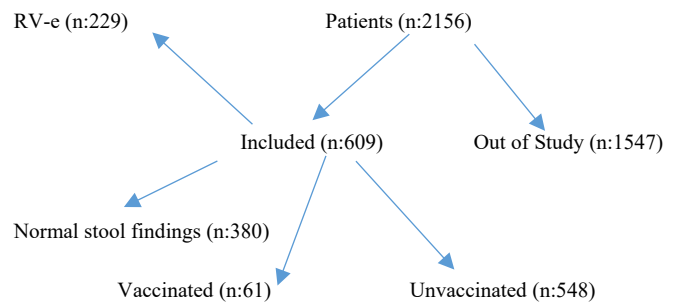
When hospitalization rates were evaluated, 21.8% (n=133) of the patients received inpatient treatment, while 78.2% (n=476) were treated as outpatients. Of 133 patients hospitalized with the diagnosis of AGE, 92.5% did not have RV-V, and there was no difference compared to the normal group (p=0.079). We found that only 6 (2.6%) children with RV-e had RV-V. Of the total of 229 children with RV-e, 215 (93.9%) did not have RV-V and we found a significant difference between the two groups (p<0.001). RV was detected in 78.9% of 133 patients hospitalized with the diagnosis of AGE and was statistically significant compared to those without RV-e (p<0.001). RV-e did not differ by gender, season and refugee status (p=0.895, p=0.296, p=0.598). Evaluation of RV-V is given in Table-2.

Table 1. Demographic characteristics of patients with gastroenteritis

Figur I:Age distribution of patients with rotavirus infection

Legend: 0-11 Month, 12-23 Month, 24-35 Month, 26-47 Month, 48-59 Month, 60 months and older

(15,28% / 28,82% / 19,21% / 11,79% / 6,99% / 17,90%)

Flowchart

RV-e (n:229) ← Patients (n:2156) → Out of Study (n:1547)

Patients → Included (n:609)

Included (n:609) → Normal stool findings (n:380)

Vaccinated (n:61) ← Included → Unvaccinated (n:548)

Features	Subgroup	Number	%
Age (month)		54,01 ±45,2	
Gender	Female	276	45.3
	Male	333	54.7
Nationality	Turkish	507	83.3
	Refugee	102	16.7
Season	Winter	129	21.2
	Spring	233	38.3
	Summer	99	16.3
	Autumn	148	24.3
Infection status	Rotavirus	229	37.6
	Normal	380	62.4
Vaccination	Yes, 2 doses	51	8.4
	Yes, 1 dose	10	1.6
	No	548	90
Hospitalisation	Yes	133	21.8
	No	476	78.2

Table 2. Evaluation of Rotavirus Vaccination

Features	Subgroups	Rotavirus Vaccination Status				Stool Test		
		Yes, 2 Dose n (%)	Yes 1 dose n (%)	No n (%)	p	Rotavirus	Normal n (%)	p
Gender	Female	25 (9.1)	6 (2.2)	245 (88.8)	0.540**	103 (37.3)	173 (62.7)	0.895**
	Male	26 (7.8)	4 (1.2)	303 (91.0)		126 (37.8)	207 (62.2)	
Nationality	Turkish	47 (9.3)	9 (1.8)	451 (89.0)	0.167**	193 (38.1)	314 (61.9)	0.598**
	Refugee	4 (3.9)	1 (1.0)	97 (95.1)		36 (35.3)	66 (64.7)	
Season	Winter	15 (11.6)	2 (1.6)	112 (86.8)	0.550*	41 (31.8)	88 (68.2)	0.296**
	Spring	21 (9.0)	5 (2.1)	207 (88.8)		97 (41.6)	136 (58.4)	
	Summer	6 (6.1)	2 (2.0)	91 (91.9)		38 (38.4)	61 (61.6)	
	Autumn	9 (6.1)	1 (0.7)	138 (93.2)		53 (35.8)	95 (64.2)	
Hospitalisation	Yes	6 (4.5)	4 (3.0)	123 (92.5)	0.079**	105 (78.9)	28 (21.1)	<0.001**
	No	45 (9.5)	6 (1.3)	425 (89.3)		124 (26.1)	352 (73.9)	
Infection status	Rotavirus	6 (2.6)	8 (3.5)	215 (93.9)	<0.001**			
	Normal	45 (11.8)	2 (0.5)	333 (87.6)				

*Fisher's exact test was used, **Chi-square test was used

DISCUSSION

In our study, 37.6% (229 cases) of 609 patients admitted to the pediatric emergency department were found to be RV-e positive. This rate is in the range of 9.8-39.8% reported in previous studies conducted in our country (1,2). The variability in RV-e prevalence in studies conducted in different regions of Turkey may be related to regional differences and vaccination rates during the periods when the studies were conducted. RV-e did not differ significantly according to gender (p=0.540). This finding is consistent with the literature and supports that RV-e affects both genders equally (13). When evaluated according to age groups, RV-e was found most frequently in the 0-12 months (12.9%) and 13-24 months (11.1%) groups. This distribution is in parallel with studies showing that rotavirus infections are observed more frequently in children under 2 years of age (14, 15).

Patel et al. analyzed 99 studies including 6 geographical regions of the world and Cook et al. reported that RV-e was most frequently observed in winter and spring months in studies conducted in 23 countries. Similarly, RV-e was observed most frequently in winter and spring months in our study (7). The fact that RV-e peak in winter months in countries located in the temperate climate zone is explained by the fact that the virus can remain more stable under low temperature and humidity conditions (5). In tropical regions, RV-e can be observed throughout the year. This difference is associated with socioeconomic characteristics and hygiene conditions of societies as well as climatic conditions (6).

RV-e was detected in 78.9% of 133 patients hospitalized with a diagnosis of AGE. This high rate indicates that RV-e have a more severe course and require more frequent hospitalization compared to other viral AGE agents (7). As a matter of fact, RV was responsible for approximately 40% of gastroenteritis requiring hospitalization in children in the pre-vaccine period, and a significant decrease in both hospitalization and mortality rates was found after the vaccine became widespread (8). In our study, it was found that only 2.6% of the patients with RV-e had RV-V. Of those with RV-e, 93.9% did not have RV-V (p<0.001). This result shows the effectiveness of the vaccine in preventing RV-e. It has also been reported in the literature that RV-V has high efficacy in preventing RV-e, especially with severe course (11,12). In developed countries, the efficacy of the vaccine varies between 85-98%. However, vaccine efficacy remains at the level of 50-60% in low-income countries (13).

Our study has some limitations. First, the study was conducted with data from a single center and the results may not be generalizable to the whole population. Secondly, RV was diagnosed only by stool RV antigen test and genotyping by molecular methods was not performed. Finally, recurrent infections and long-term complications could not be evaluated because long-term follow-up data were not available.

CONCLUSION

In conclusion, RV-e remains an important cause of childhood AGE. Vaccination is the most effective method of disease prevention and is particularly successful in reducing severe cases. However, vaccine coverage needs to be increased and factors affecting vaccine efficacy need to be better understood. Future studies will contribute to the development of new vaccine strategies and improve the efficacy of existing vaccines

Declarations

Conflict of interest: The authors of the article declare that they have no conflict of interests.
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