ORIGINAL RESEARCH

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Examination of Socio-demographic, Clinical and Laboratory Findings of Patients Hospitalized in Our Clinic with the Diagnosis of Rotavirus Gastroenteritis

Rotavirüs Gastroenterit Tanısı ile Kliniğimize Yatan Hastaların Sosyo-demografik Özellikleri, Klinik ve Laboratuvar Bulgularının İncelenmesi

Bilal Yılmaz[1], Mehmet Tolga Köle[1], Fatih Karaaslan[2], Kemal Pişmişoğlu[1], Vefik Arıca[3]

[1]University of Health Sciences Turkey, Kartal Dr. Lütfi Kırdar City Hospital, Clinic of Pediatrics, İstanbul, Turkey
[2]İstanbul Yeni Yüzyıl University Faculty of Medicine, Department of Pediatrics, İstanbul, Turkey
[3]University of Health Sciences Turkey, Prof. Dr. Cemil Taşcıoğlu City Hospital, Clinic of Pediatrics, İstanbul, Turkey

Abstract

Objective: Nowadays, viruses are the leading cause of acute gastroenteritis, while Rotavirus (RV) is the most common cause of acute viral gastroenteritis. In this study, the RV antigen positive diagnosis of gastroenteritis patients hospitalized in the pediatric service of the socio-demographic, clinical and laboratory features was aimed to be interpreted by comparison with literature data.

Method: Socio-demographic data of patients hospitalized with the diagnosis of RV gastroenteritis, clinical and laboratory findings were retrospectively evaluated the hospital's file was obtained from the records.

Results: The study of children hospitalized with acute gastroenteritis caused a mean age of 17.68 months from 740 patients who were enrolled, and 270 patients who were positive for RV and RV ratio was found to be 36%. Although the cases were most frequently seen in the spring, the most common months were February, March and April. The most frequent application causes were diarrhea and vomiting and the most common age group was the age group of 6 months-2 years of age. Five patients developed complications were detected. Laboratory findings in 101 patients with C-reactive protein positive (37.4%), 213 patients (78.8%) serum aspartate aminotransferase levels were high, in 94 patients (34.8%) had elevated alanine aminotransferase levels.

Conclusion: Most cases of gastroenteritis were admitted to the service accounted for RV diarrhea and especially important cause of diarrhea is seen in winter and spring seasons. Therefore, the RV detection in cases of gastroenteritis is important to predict patient's clinic and prevent unnecessary use of antibiotics.

Keywords: Child, gastroenteritis, Rotavirus

Öz

Amaç: Günümüzde, akut gastroenterit etkenleri arasında virüsler ilk sırada yer alırken, Rotavirüs (RV) ise akut viral gastroenteritlerin en sık etkenidir. Bu çalışma ile RV antijeni pozitif gastroenterit teşhisi ile çocuk servisinde yatırılan hastaların sosyo-demografik, klinik ve laboratuvar özelliklerinin literatür verileri ile kıyaslanarak yorumlanması amaçlandı.

Yöntem: RV gastroenteriti tanısı ile yatan hastaların sosyo-demografik verileri, klinik ve laboratuvar bulguları hastaneye ait dosya kayıtlarından geriye dönük incelenerek elde edildi.

Bulgular: Çalışmaya akut gastroenterit nedeni ile çocuk kliniğine yatırılan 740 hastadan yaş ortalaması 17,68 ay olan 270 RV pozitif saptanan olgu dahil edilmiş olup, RV oranı %36,5 olarak bulundu. Olgular en sık ilkbahar mevsiminde görülmekle birlikte en sık görüldüğü aylar ise Şubat, Mart ve Nisan ayları idi. En sık başvuru nedeni ishal ve kusma birlikteliği iken en sık görüldüğü yaş grubu 6 ay-2 yaş grubu idi. Beş hastada komplikasyon geliştiği tespit edildi. Laboratuvar bulgularından C-reaktif protein 101 hastada pozitif (%37,4), 213 hastada (%78,8) serum aspartat aminotransferaz düzeyi yüksek, 94 hastada (%34,8) alanin aminotransferaz düzeyi yüksek bulundu.

Sonuç: Servisimize yatırılan gastroenterit olgularının çoğunu RV ishalleri oluşturuyor olup, özellikle kış ve ilkbahar mevsimlerinde görülen önemli ishal nedenidir. Bu nedenle gastroenterit olgularında RV saptanması, hastanın kliniğinin öngörülmesi ve gereksiz antibiyotik kullanımının önüne geçilmesi bakımından önemlidir.

Anahtar kelimeler: Çocuk, gastroenterit, Rotavirüs

Address for Correspondence: Mehmet Tolga Köle, University of Health Sciences Turkey, Kartal Dr. Lütfi Kırdar City Hospital, Clinic of Pediatrics, İstanbul, Turkey
E-mail: mehmet_tolga@hotmail.com **ORCID:** orcid.org/0000-0002-6055-7746 **Received:** 06.11.2023 **Accepted:** 11.03.2024

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Introduction

Rotavirus (RV) continues to be a significant viral pathogen, constituting a serious global health issue and leading to child deaths worldwide (1,2). Among viral agents causing acute gastroenteritis, RV is the most prevalent, with adenovirus being the second (3). Epidemiological data indicates that RV infections are the second leading cause of child deaths. In 2013, approximately 215,000 children worldwide died from RV-related diarrhea, with the majority of these deaths occurring in low-income countries (4). Epidemiological studies reveal that RV infections exhibit seasonal variations worldwide, often peaking during the winter months (5,6).

RV infections, particularly in developing countries, prominently contribute to acute diarrhea in children under the age of 2 and are recognized as a leading cause of dehydration due to acute diarrhea (7,8). A notable characteristic of RV diarrhea is the high rate of hospitalization associated with it (9). Globally, 40% of hospitalizations for severe diarrhea in young children are attributed to RV infections (10). While it is known to be associated with high mortality rates in developing countries, in developed nations, it is linked to high disease rates and economic burden (3).

This study aims to retrospectively analyze the socio-demographic, clinical, and laboratory characteristics of patients diagnosed with RV antigen-positive gastroenteritis who were admitted to the pediatric department over a 2-year period. The goal is to compare the results with existing literature and previous studies.

Materials and Methods

At the University of Health Sciences Turkey, Prof. Dr. Cemil Taşcıoğlu City Hospitall, the medical records of 270 patients who were hospitalized for RV gastroenteritis diagnosis during a 2 year period (01.01.2012-31.12.2013) were retrospectively analyzed. The diagnosis of RV gastroenteritis was established using the qualitative immunochromatographic method (Simple/Stick Rota Adeno Operon, Spain) on fecal samples. Furthermore, bacterial agents such as *Vibrio cholerae, Salmonella, Shigella, Campylobacter, Yersinia enterocolitica,* etc., and parasitic agents were examined using standard microbiological methods. The patients who exhibited bloody findings in the macroscopic examination of fecal samples, showed the presence of parasites in laboratory analysis, and had bacterial growth detected in fecal cultures were excluded from the study. The patients were categorized into three groups based on their age: 0-6 months, 6-24 months, and over 24 months. The socio-demographic characteristics, clinical features, and laboratory findings of the patients were compared. The study was conducted in accordance with the principles of the Helsinki Declaration and received approval from the Ethics Committee of University of Health Sciences Turkey, Prof. Dr. Cemil Taşcıoğlu City Hospital with decision number 177 on February 25, 2014. The study was derived from the thesis titled “inpatients to our clinic with the diagnosis of RV gastroenteritis and socio-demographic, clinical and laboratory findings investigation”.

Statistical Analysis

In the evaluation of data obtained in the study, statistical analysis was performed using SPSS (Statistical Package for Social Sciences) version 15.0 and Graph Pad InStat demo version. In addition to descriptive statistical methods (such as mean, standard deviation, minimum, maximum), in the analyses comparing groups, categorical variables were assessed using the chi-square test and Fisher’s Exact test. For comparisons between two groups, Student’s t-test and Mann-Whitney U test were employed, while One-Way ANOVA (Analysis of Variance) was used for comparisons among three groups, followed by post-hoc Tukey test for pairwise comparisons and Kruskal-Wallis test followed by Dunn’s test. Pearson correlation test was used for assessing correlations. Results were evaluated at a significance level of $p<0.05$ with a confidence interval of 95% ($^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$).

Results

In the study, 270 out of 740 patients who were admitted to the Pediatric Clinic of Prof. Dr. Cemil Taşcıoğlu City Hospital City Hospital at the University of Health Sciences Turkey with complaints of acute diarrhea were included, and they were diagnosed with RV gastroenteritis (36.5%). The ages of the patients ranged from 1 month to 116 months, with 58.9% (n=159) being male and 41.1% (n=111) female. Regarding the presenting complaints, 64.8% (n=175) had diarrhea and vomiting, 18.1% (n=49) had diarrhea, vomiting, and fever, 9.6% (n=26) had only diarrhea, 7% (n=19) had diarrhea and fever, and 0.4% (n=1) had only vomiting. During the follow-up of hospitalized patients, 48.5% (n=131) had a temperature below 37.5 °C, 25.9% (n=70) had a temperature between 38-39 °C, 22.6% (n=61) had a temperature between 37.5-38 °C, and 3% (n=8) had a temperature above 39 °C (Table 1).

When examining the seasonal distribution of cases, 35.9% (n=97) were observed in spring, 31.1% (n=84) in winter, 18.1% (n=49) in autumn, and 14.8% (n=40) in summer (Figure 1). By monthly distribution, cases were as follows: 13.3% (n=36) in February-March-April, 12.2% (n=33) in January, 9.3% (n=25) in May-October, 8.1% (n=22) in June, 5.6% (n=15) in December, 4.8% (n=13) in November, 4.1% (n=11) in September, and 3.3% (n=9) in July-August (Figure 2). Among the patients, 62.6% (n=169) had negative C-reactive protein (CRP), while 37.4% (n=101) had positive CRP.

Regarding the biochemical values of the patients, the average urea level was 27.66±13.86 mg/dL (ranging from 3 to 92, median: 26), the average creatinine level was 0.30±0.13 mg/dL (ranging from 0.05 to 0.86, median: 0.28), the average sodium level was 136.14±4.11 mmol/L (ranging from 125 to 154, median: 136), the average potassium level was 4.29±0.57 mmol/L (ranging from 2.60 to 6.10, median: 4.20), the average aspartate aminotransferase (AST) level was 55.46±30.40 IU/L (ranging from 20 to 323, median: 48), and the average alanine aminotransferase (ALT) level was 35.84±30.93 IU/L (ranging from 6 to 366, median: 29).

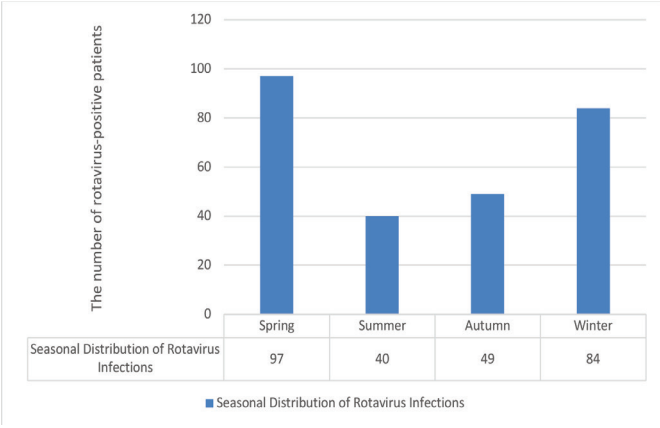

Figure 1. Seasonal distribution of Rotavirus infections

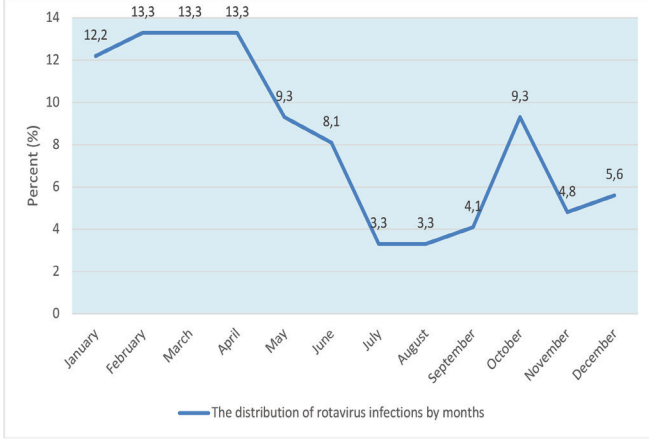

Figure 2. The distribution of Rotavirus infections by months

Table 1. The gender and symptoms of patients hospitalized due to Rotavirus based on age groups

	<6 months		6-24 months		>24 months		chi-square	p
	n	%	n	%	n	%		
Gender								
Male	41	65.1	86	58.1	32	54.2	1.562	0.458
Female	22	34.9	62	41.9	27	45.8		
Symptoms								
Diarrhea	17	25.8	8	5.5	1	1.7	-	**0.0001*** **
Vomiting	0	0.0	1	0.7	0	0.0		
Diarrhea-vomiting	32	48.5	100	69.0	43	72.9		
Diarrhea-fever	10	15.1	6	4.1	3	5.1		
Diarrhea-vomiting-fever	7	10.6	30	20.7	12	20.3		
Fever								
<37.5 °C	34	54.0	77	52.0	20	33.9	-	
37.5-38 °C	18	28.6	28	18.9	15	25.4		**0.034***
38-39 °C	10	15.9	40	27.0	20	33.9		
>39 °C	1	1.6	3	2.0	4	6.8		
Rotavirus related complications								
None	60	95.2	147	99.3	58	98.3	4.070	0.131
Present	3	4.8	1	0.7	1	1.7		
Source of Rotavirus								
Community	50	79.4	125	84.5	54	91.5	3.530	0.171
Nozocomial	13	20.6	23	15.5	5	8.5		

*: p<0.05, ***:p<0.001, n: Number of patients, %: Column percent

Table 2. Laboratory characteristics of patients hospitalized due to Rotavirus

	Mean	SD	Median	Min	Max
WBC (10^3/mm^3)	10.51	4.20	10.00	1.73	27.70
Hemoglobin (g/dL)	11.49	1.32	11.50	6.60	14.72
Hematocrit (%)	34	4	34	20	47
MCV (fL)	78.41	8.26	78.30	52.40	102.00
PC (10^3/µL)	365.64	122.11	359.60	27.80	808.80
NC (10^3/µL)	6.26	4.22	5.75	0.31	22.25
% Neutrophils	56.57	22.04	57.50	3.00	95.00
% Lymphocyte	31.48	19.40	28.50	1.00	78.00
% Monocyte	10.22	6.07	9.00	1.00	67.00
MPV (fL)	7.65	0.90	7.48	5.60	11.94
PDW (%)	16.31	0.64	16.30	12.91	19.00
RDW (%)	14.89	1.77	14.80	11.50	23.17
CRP (mg/L)	13.40	23.58	5.30	1.00	170.00
Urea (mg/dL)	27.66	13.86	26.00	3.00	92.00
Creatinine (mg/dL)	0.30	0.13	0.28	0.05	0.86
Na (mmol/L)	136.14	4.11	136.00	125.00	154.00
K (mmol/L)	4.29	0.57	4.20	2.60	6.10
AST (IU/L)	55.46	30.40	48.00	20.00	323.00
ALT (IU/L)	35.84	30.93	29.00	6.00	366.00

SD: Standard deviation, WBC: White blood cell count, MCV: Mean corpuscular volume, NC: Neutrophil count,, RDW: Red cell distribution width (%), PC: Platelet count*1000, PDW: Platelet distribution width (%), MPV: Mean platelet volume (fL), CRP: C-reactive protein, ALT: Alanine aminotransferase, AST: Aspartate aminotransferase

Among the patients, 78.8% (n=213) had elevated serum AST levels, and 34.8% (n=94) had ALT levels above the upper limit of normal (Table 2).

In those aged below 6 months, the complaint of vomiting was significantly lower compared to those aged 6-24 months and those above 24 months ($p<0.001$). Among those aged over 24 months, the rate of having a fever below 37.5 °C was significantly lower compared to the other two age groups ($p=0.034$, $p<0.05$). Among those aged over 24 months, the length of hospital stay was significantly shorter compared to the other two age groups ($p=0.003$).

Discussion

RV infection is a leading cause of diarrhea-related morbidity and mortality globally among children under the age of 5 (11). Each year, RV gastroenteritis leads to the hospitalization of 2 million children and causes an average of 440,000 child deaths (12). Research related to etiology is of importance for diagnosis, treatment, and prognosis, as identifying viral agents can help prevent unnecessary antibiotic use.

In our study, the prevalence of RV among patients hospitalized for gastroenteritis was 36.5%. When looking at studies abroad, a study in Spain from 2001 to 2005 found a prevalence of 17.1% in children under 5 years of age hospitalized with gastroenteritis (13). In India, a study of children under 5 years hospitalized from 2009 to 2011 found a RV frequency of 35.9% (14). When we look at our country, in a study conducted by Ilktac et al. (15) in Istanbul between 2006-2010, 11711 cases of acute gastroenteritis were examined, and the prevalence of RV was found to be 15.5%. In a study conducted by Konca et al. (16) between March 2012 and February 2013, they determined the prevalence of RV to be 16.5%. In Turkey, studies in different cities and periods, predominantly focusing on the age group of 0-5 years, have reported significantly different RV positivity rates. In our study, which included only hospitalized children, the RV positivity rate was higher at 36.5%.

Although the cause is not known, the seasonal nature of RV diarrhea is well established (2). In temperate climates, RV peaks during the winter months (17). In our study, the seasonal distribution showed that RV gastroenteritis cases were observed in 35.9% in spring, 14.8% in summer, 18.1% in autumn, and 31.1% in winter. The months with the highest incidence of RV diarrhea were February (13.3%), March (13.3%), and April (13.3%), followed by January (12.2%)

and May (9.3%), October (9.3%). A multicenter prospective study in Europe conducted in 2004-2005 similarly found that diarrheal cases occurred most frequently between October and May, with a peak in January to March (18). Studies in Spain also found a higher incidence during the winter months (13). Carneiro et al. (19) conducted a study involving 218 cases of children aged 0-19 years who were hospitalized in Brazil due to severe RV infections. In their research, they examined the clinical and epidemiological findings of these cases. They found that RV-positive cases were most commonly observed in the months of June and July (19). In contrast to many other studies, the reason for the high prevalence of RV gastroenteritis during the summer months in this study was attributed to the unique tropical climate in Brazil. Unlike in other countries where RV is more frequently detected during rainy seasons in winter, in Brazil, it is observed during the summer months due to the specific characteristics of the climate (19).

When examining the clinical features of RV diarrheas, fever, diarrhea, and vomiting are the most common symptoms, either alone or in combination (20). In our study, the most common complaint was diarrhea-vomiting (73.4%), followed by diarrhea-vomiting-fever (16.6%). Only 7.4% of patients presented with diarrhea alone. This may indicate that families are more concerned about vomiting. Additionally, patients under 6 months of age had a significantly lower rate of vomiting as their presenting complaint compared to those aged 6-24 months and over 24 months ($p<0.001$). This observation is consistent with the literature, which suggests that milder infections in the first 6 months are related to transplacental transfer of maternal antibodies and breastfeeding (21). In our study, it was found that the hospital stay was significantly shorter in individuals aged over 24 months compared to the other age groups of 0-6 and 6-24 months. The shorter hospital stay after 24 months of age can be attributed to the natural course of previously experienced infections, which reduces the incidence and severity of subsequent episodes.

After RV infections, viremia can lead to extraintestinal involvement (22). In Taiwan, a study conducted by Wu et al. (23) comparing the clinical characteristics of RV and norovirus gastroenteritis found that AST and ALT levels were higher in cases of RV gastroenteritis. Similarly, in studies by Akelma et al. (24), which covered the years 2005 to 2012 and included 272 patients with confirmed RV infection, it was reported that 42% (15.4%) of the patients had elevated ALT levels, and 69% (25.4%) had elevated AST levels. In our study, 78.8% of the 270 patients had elevated serum AST levels, with an average AST level of 55 IU/L (range: 20-323 IU/L). Serum ALT levels were elevated in 34.8% of the cases, with an average ALT level of 36 IU/L (range: 6-366 IU/L).

Kang et al. (25) retrospectively examined 755 patients with RV infections between 1999 and 2011 and identified 17 patients (2.2%) with febrile seizures and 42 patients (5.5%) with afebrile seizures. In a retrospective study by Hung et al. (26) covering a 10-year period and including 1937 patients with RV gastroenteritis, 40 patients (2.06%) were observed to have afebrile seizures. In our study, convulsions were observed in 2 patients, constituting 0.7% of all patients. In a study conducted by Scheier and Aviner (27) which included 632 patients hospitalized for RV gastroenteritis between May 1999 and May 2010, sepsis was detected in 2 patients (0.32%). In a study by Gözmen et al. (28), among 376 cases of RV gastroenteritis, bacteremia was found in 5 patients (1.3%). In our study, sepsis was observed in 2 patients, constituting 0.7% of all patients.

Study Limitations

The single-center and retrospective nature of our study are limitations. Additionally, the fact that the vaccination status of patients regarding RV was not queried constitutes another limitation of our study. We believe that conducting multi-center, prospective studies would contribute significantly to the understanding of the topic.

Conclusion

The detection of RV, the most common cause of diarrhea in children, is crucial not only for understanding the causative agent but also for predicting the patient's clinical condition and determining the appropriate treatment approach. Additionally, it plays a significant role in contributing to epidemiological knowledge. Identifying the causative agent can help prevent unnecessary antibiotic use and promote the expansion of vaccination programs that have been reintroduced.

Providing the appropriate approach to childhood diarrhea and evaluating the potential benefits of RV vaccines require each country to have its own data. Therefore, in Turkey as well, there is a need to determine the estimated rates of RV diarrhea and the clinical and epidemiological characteristics of the disease. This information is vital for healthcare decision-makers and public health officials to make informed choices regarding prevention and control strategies.

Ethics

Ethics Committee Approval: The study was conducted in accordance with the principles of the Helsinki Declaration and received approval from the Ethics Committee of University of Health Sciences Turkey, Prof. Dr. Cemil Taşcıoğlu City Hospital with decision number 177 on February 25, 2014.

Informed Consent: Not necessary for this manuscript.

Authorship Contributions

Concept: B.Y., M.T.K., F.K., K.P., V.A., Design: B.Y., M.T.K., F.K., K.P., V.A., Data Collection or Processing: B.Y., F.K., K.P., V.A., Analysis or Interpretation: B.Y., M.T.K., V.A., Critical Revision of Manuscript: B.Y., V.A., M.T.K., K.P., Final Approval and Accountabilty: B.Y., M.T.K., F.K., V.A., Supervision: B.Y., M.T.K., Writing: B.Y., M.T.K., F.K., V.A.

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