HAYDARPAŞA NUMUNE MEDICAL JOURNAL

DOI: 10.14744/hnhj.2022.16680
Haydarpasa Numune Med J 2023;63(4):484–489

ORIGINAL ARTICLE

Evaluation of Rotavirus-Positive Gastroenteritis Cases in Pediatric Emergency Department

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Abstract

Introduction: Rotavirus is one of the major infectious agents of childhood acute gastroenteritis (AGE). Definitive diagnosis depends on laboratory test results. Our study aimed to compare the laboratory results, number of emergency admissions, and length of hospital stay of patients with an initial diagnosis of AGE in the pediatric emergency department according to the presence of rotavirus antigen.

Methods: 74 patients who tested positive and 91 patients who tested negative for rotavirus antigen in fresh stool specimens admitted to the pediatric emergency service of our hospital between April 1, 2019, and May 1, 2019, were included in our study. Demographic characteristics, laboratory results, and length of hospital stay of both groups of patients were evaluated retrospectively. The Shapiro–Wilk test was used for statistical analysis, whereas the Student t-test and the Mann–Whitney U-test were used for the comparison of quantitative variables, and the Pearson Chi-square test was used for the comparison of qualitative data. A value of $p<0.05$ was considered statistically significant.

Results: Among the patients included in the study, 54.1% of the patients who tested positive for rotavirus antigen were girls and 45.9% were boys, whereas 45.1% of the patients in the control group were girls and 54.9% were boys. The ages of the subjects participating in the study were between 1 and 107 months in the study group and 2–163 months in the control group. Patients' length of stay was 1–47 h in the rotavirus antigen-positive group and 1–34 h in the control group. Evaluation of the number of hospital admissions revealed that recurrent admissions to the emergency department were more common in rotavirus cases, which constituted the study group.

Discussion and Conclusion: It was observed that patients diagnosed with AGE who tested positive for the rotavirus antigen in the emergency department were younger, their length of hospital stay was longer, and the number of admissions to the emergency department was higher. Especially in viral gastroenteritis, unnecessary use of antibiotics should be avoided, and breast milk should be supported to prevent dehydration, as well as rotavirus vaccination, which is not yet in the national vaccination calendar, especially in the infant age group.

Keywords: Acute gastroenteritis; child; rotavirus.

Acute gastroenteritis (AGE), one of the most common infectious diseases in childhood, affects approximately 500 million children each year worldwide[1]. Its high mortality still stands as a serious problem in developing countries. Viruses are the most common cause of AGE, with rotavirus being the most common agent. Rotavirus is transmitted through the fecal-oral route and may cause clinical symptoms ranging from vomiting and mild diarrhea to severe dehydration[2,3]. Although the medical history and physical examination findings are remarkable signs for the disease,

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Submitted Date: 21.11.2021 **Revised Date:** 23.03.2022 **Accepted Date:** 27.04.2022
Haydarpaşa Numune Medical Journal

the definitive diagnosis is made upon the demonstration of rotavirus antigen in fresh stool specimens[4,5]. Rotavirus gastroenteritis, which progresses with abdominal pain, nausea, vomiting, and diarrhea and constitutes the most important cause of diarrhea under 5 years of age, is most frequently observed in infancy (0–24 months). In our study, we aimed to draw attention to rotavirus-related diarrhea by comparing laboratory results, number of emergency admissions, and length of hospital stay of patients who were followed up with an initial diagnosis of AGE in the pediatric emergency department according to the presence of rotavirus antigen.

Materials and Methods

Our study included a total of 165 cases who applied to the pediatric emergency department of SBU Dr. Sadi Konuk Training and Research Hospital between April 1, 2019 and May 1, 2019 with the complaint of diarrhea and received treatment. The study group consisted of 74 patients positive for rotavirus antigen in their fresh stool samples while the control group consisted of 91 rotavirus antigen-negative patients. Demographic characteristics, laboratory results, and length of hospital stay of both groups of patients were evaluated retrospectively. Rotavirus antigen positivity was investigated with an immunochromatographic rapid diagnostic test (One Strep, LINEAR CHEMİCALS SL, Spain) with a sensitivity of 98.2% and a specificity of 100% according to the ELISA test using monoclonal antibodies that selectively detect rotavirus antigen in freshly collected stool samples.

This study was performed with the approval of the Clinical Research Ethics Commitee of Bakırköy Dr. Sadi Konuk Training and Research Hospital (Date: 19.04.2021, Number: 2021-08-26) in accordance with the guidelines of the Declaration of Helsinki.

Results

Our study included a total of 165 cases admitted to the pediatric emergency service of Sadi Konuk Training and Research Hospital with complaints of diarrhea between April 1, 2019 and May 1, 2019. The study group consisted of 74 patients positive for rotavirus antigen in their fresh stool samples and the control group consisted of 91 rotavirus antigen-negative patients. Evaluation of descriptive characteristics according to groups is shown in Table 1. 54.1% (n=40) of the patients in the study group were girls and 45.9% (n=34) were boys, whereas 45.1% (n=41) of the patients in the control group were girls and 54.9% (n=50) were boys. There was no statistically significant difference between the groups in terms of gender distribution (p>0.05). The ages of the subjects participating in the study were observed to be between 1 and 107 months (23.58±22.10) in the study group and 2–163 months (38.60±35.20) in the control group. The ages of the patients positive for rotavirus antigen were statistically significantly lower than those with negative rotavirus antigen (p=0.001; p<0.01).

Evaluation of the length of hospital stay of the patients showed that the mean length of stay was 9.58±7.29 hours (1–47 h) in the study group and 7.7±6.03 hours (1–34 h) in the control group. It was observed that the length of stay in the study group was significantly longer than in the

Table 1. Evaluation of descriptive characteristics according to groups

	Total	Rotavirus (+)	Rotavirus (-)	p
Age (month)				
Mean±SD	31.87±30.88	23.58±22.10	38.60±35.20	[a]0.001**
Min-Mak (Median)	1–163 (20)	1–107 (16.5)	2–163 (27)	
Gender				
Woman	81 (49.1)	40 (54.1)	41 (45.1)	[b]0.250
Male	84 (50.9)	34 (45.9)	50 (54.9)	
Number of applications				
1 Time	87 (52.7)	29 (39.2)	58 (63.7)	[b]0.002**
>1 Time	78 (47.3)	45 (60.8)	33 (36.3)	
Mean±SD	1–6 (1)	1–4 (2)	1–6 (1)	
Min-Mak (Median)	1.62±0.81	1.80±0.81	1.48±0.79	
Duration of Hospitalization (hours)				
Mean±SD	8.55±6.67	9.58±7.29	7.7±6.03	[a]0.022*
Min-Mak (Median)	1–47 (7)	1–47 (8)	1–34 (6)	

[a]Mann–Whitney U-test; [b]Pearson Chi-square test; *p<0.05; **p<0.01; SD: Standard Deviation.

control group. Evaluation of the number of hospital admissions revealed that recurrent admissions to the emergency department were more common in rotavirus cases, which constituted the study group. The rate of having more than one admission among cases with positive rotavirus antigen was statistically significantly higher than cases with negative rotavirus antigen (p=0.002; p<0.01) (Table 1).

Table 2. Evaluation of biochemistry results according to groups

	Total	Rotavirus (+)	Rotavirus (-)	p
WBC				
Mean±SD	11611.58±5789.84	10653.65±4797.59	12390.55±6406.86	[a]0.139
Min-Mak (Median)	2300–35240 (10260)	2300–34110 (10360)	3130–35240 (10260)	
<4000	2 (1.2)	1 (1.4)	1 (1.1)	
4000–10000	78 (47.3)	35 (47.3)	43 (47.3)	
>10000–20000	70 (42.4)	35 (47.3)	35 (38.5)	
>20000	15 (9.1)	3 (4.1)	12 (13.2)	
PLT				
Mean±SD	367207.27±122111.1	364824.32±116291.7	369145.05±127254.2	[c]0.822
Min-Mak (Median)	31200–893000 (356000)	194000–893000 (356000)	31200–874000 (356000)	
<150000	1 (0.6)	0 (0)	1 (1.1)	
150000–400000	112 (67.9)	54 (73)	58 (63.7)	
>400000	52 (31.5)	20 (27)	32 (35.2)	
CRP				
Mean±SD	2.03±4.82	1.43±2.15	2.52±6.18	[a]0.226
Min-Mak (Median)	0–44.8 (0.5)	0–13 (0.6)	0–44.8 (0.4)	
<1	106 (64.2)	47 (63.5)	59 (64.8)	
>1	59 (35.8)	27 (36.5)	32 (35.2)	
Na				
Mean±SD	137.41±3.5	137.16±3.33	137.6±3.64	[c]0.421
Min-Mak (Median)	129–156 (137)	129–148 (137)	129–156 (137)	
<135	27 (16.4)	12 (16.2)	15 (16.5)	
135–144	135 (81.8)	60 (81.1)	75 (82.4)	
>144	3 (1.8)	2 (2.7)	1 (1.1)	
pH				
Mean±SD	7.36±0.07	7.36±0.06	7.37±0.07	[c]0.350
Min-Mak (Median)	7–7.6 (7.4)	7.2 –7.6 (7.4)	7–7.6 (7.4)	
<7.25	5 (3)	1 (1.4)	4 (4.4)	
7.25–7.35	64 (38.8)	33 (44.6)	31 (34.1)	
7.36–7.45	90 (54.5)	39 (52.7)	51 (56)	
>7.45	6 (3.6)	1 (1.4)	5 (5.5)	
HCO_3				
Mean±SD	18.27±3.9	17.99±3.86	18.51±3.95	[c]0.395
Min–Mak (Median)	9.8 –36.5 (17.8)	11.9 –36.5 (17.2)	9.8 –31.9 (18.5)	
<18	84 (50.9)	43 (58.1)	41 (45.1)	
18–24	74 (44.8)	29 (39.2)	45 (49.5)	
>24	7 (4.2)	2 (2.7)	5 (5.5)	
BE				
Mean±SD	−6.56±5.03	−7.32±5.6	−5.94±4.45	[c]0.080
Min-Mak (Median)	−19.8–12.8 (−7)	−16.5–12.8 (−8.2)	−19.8–5.9 (−5.7)	
<−6	91 (55.2)	50 (67.6)	41 (45.1)	
−6–4	70 (42.4)	21 (28.4)	49 (53.8)	
>4	4 (2.4)	3 (4.1)	1 (1.1)	

[a]Mann–Whitney U-test; [b]Pearson Chi-Square Test; [c]Student t-test; SD: Standard deviation; WBC: White blood cell; PLT: Platelet; CRP: C-reactive protein; Na: Natrium; HCO_3: Hydrogen carbonate; BE: Base excess.

Laboratory results of the patient groups are shown in Table 2.

Comparison of the length of hospital stay between the groups according to laboratory data is given in Table 3. When all cases were evaluated, a very weak negative correlation (increased length of hospital stay with increasing Na value) was found between the Na measurements and the length of hospital stay (r=–0.168; p=0.031; p<0.05). There was no statistically significant correlation between pH measurements and the length of hospital stay of the patients included in the study (p>0.05). It was determined that the length of hospital stay was inversely proportional to BE measurements. The negative correlation of 0.291 between BE measurements and the length of hospital stay was found to be statistically significant (r=–0.291; p=0.001; p<0.01).

Discussion

AGE is an acute clinical condition that occurs as a result of inflammation of the small intestine and progresses with abdominal pain, nausea, vomiting, and diarrhea[6]. Although the etiological agents for AGE include bacteria, parasites, or viruses, viruses are the most common causative agents in Türkiye. In developed countries, it constitutes the major group of viral diseases encountered in childhood while it causes epidemics and results in death in children under 5 years of age in developing countries[6,7]. Rotavirus takes the first place among viral gastroenteritis, however, adenovirus 40/41 and astrovirus diarrhea are also found[8].

Rotavirus is most commonly transmitted through the fecal-oral route and is highly contagious. Although it is the most important cause of diarrhea under the age of five, it is most frequently observed in infancy (0–24 months). In different studies, rotaviruses were found to be a factor in 11–71% of viral gastroenteritis[9]. In the study conducted Zeyrek et al.[10] in Diyarbakır, the rate of rotavirus in children aged 3–24 months was found to be 14.1%. Dinç et al.[6] found this rate to be 14,3% in their study covering the period between January 2013 and December 2018. Bicer et al.[11] conducted a 1-year study in Istanbul in 2006, in which the rate of rotavirus positivity was found 32%, being most commonly observed in December, January, and February. Studies covering different regions in Turkey between 1987 and 2005 reported an average of 20% of rotavirus positivity[12]. Although this rate was found to be 34.54% in our study, the fact that the study included cases who applied in April stands as a limitation.

Although the ages of the participants were between 1 and 107 months (23.58±22.10 months) in the rotavirus antigen-positive group, 76% of the patients were 0–24 months old. The ages of patients with negative rotavirus antigen were between 2 and 163 months (38.60±35.20 months). The ages of the rotavirus antigen-positive patients were statistically significantly lower than those with negative rotavirus antigen (p=0.001; p<0.01). In the study conducted by Ersu et al.,[13] 89.2% of the cases with rotavirus antigen-positive stools were under 24 months, and the age range of the cases tested positive for rotavirus antigen was between 7 and 12 months. Rotavirus is more common in younger age groups due to its spread through the fecal-oral transmission and increased contact with the environment and difficulty in maintaining hygiene with crawling and walking of toddlers during this period.

Table 3. Distribution of hospitalization times according to Na, pH, and BE levels

Length of stay	Mean±SD	Min-Mak (Median)	r	p
Na				
<135 (n=27)	10.63±6.1	1–22 (10)		
135-144 (n=135)	7.99±6.4	1–47 (6)	–0.168	0.031*
>144 (n=3)	15±16.52	4–34 (7)		
<7.25 (n=5)	18±11.45	5–34 (21)		
7.25–7.35 (n=64)	8.25±5.16	1–27 (7)	–0.129	0.098
7.36–7.45 (n=90)	8.34±7.12	1–47 (6)		
>7.45 (n=6)	6.83±4.54	3–14 (4.5)		
BE				
<–6 (n=91)	9.52±6.31	1–34 (8)		
–6–4 (n=70)	7.5±7.09	1–47 (5)	–0.291	0.001**
>4 (n=4)	4.75±2.99	2-9 (4)		

r=Spearman's Correlation Coefficient; *p<0.05; **p<0.01; SD: Standard deviation; Na: Natrium; BE: Base excess.

Evaluation of hospitalization duration showed that the mean length of hospital stay of the patients positive for rotavirus antigen was 9.58±7.29 hours, which was 7.7±6.03 h longer than the negative group. In the study of Yasa et al.[3] conducted with rotavirus cases receiving inpatient treatment, the length of hospital stay ranged between 2 and 9 days. Similarly, in the study conducted by Ipek et al.,[14] the length of hospital stay was found to be longer in patients positive for rotavirus compared to those negative for rotavirus, with a mean duration of 8 days.

Evaluation of the number of hospital admissions showed that recurrent admissions to the emergency department were more common in cases with rotavirus. The rate of having more than one admission among cases with positive rotavirus antigen was statistically significantly higher than cases with negative rotavirus antigen ($p=0.002$; $p<0.01$) (Table 1). In their study, Gürbüz et al.[15] reported that rotavirus-related diarrhea exhibited a more severe clinical course and resulted in longer hospitalization periods, but no statistical difference was found when examined with other factors. In a study conducted by Asena et al.,[16] in which patients received inpatient treatment, the mean length of stay of patients with positive rotavirus antigen was 3.61±2.01 days (1–12 days), whereas the mean length of stay was 2.77±1.66 days in the control group.

Analysis of laboratory results of the patients revealed no statistically significant difference between leukocyte and platelet counts, CRP, sodium, and blood gas parameters in both groups. However, it was observed that the length of hospital stay of the patients with hyponatremia (Na <135 mmol/L) was significantly longer in both groups ($p=0.031$; $p<0.05$). The study conducted by Asena et al.[16] reported no statistically significant difference between CRP, hematological, and biochemical parameters, while the number of leukocytes and neutrophils was higher in the rotavirus-negative group, whereas the lymphocyte count was higher in the antigen-positive group. The study of Ipek et al.[14] reported metabolic acidosis in 24.1% of rotavirus-positive patients. The study by Konca et al.[17] conducted in children with AGE in the Southeastern Anatolia revealed metabolic acidosis and hyponatremia in 14.2% and 13.4% of the cases, respectively. In the study of Gün et al.[18] conducted with 34 patients hospitalized in the pediatric intensive care unit due to rotavirus gastroenteritis, hyponatremia was found in 5 patients and hypernatremia was found in 8 patients. In a study conducted by Johansen et al.,[19] 12 of 723 rotavirus-positive gastroenteritis cases were treated in the intensive care unit due to severe dehydration, and hypernatremic dehydration was found in 9.1% of the patients. In a study conducted by Aldemir Kocabaş et al.,[20] hyponatremia was found in 66 (23.9%) of 276 patients and hypernatremia was found in 9 (3.3%). In a study conducted by Sonu Shai et al.[21] in Germany, severe dehydration was found in 39 of 130 patients, and severe hypernatremia (>155 mmol/L) was found in 14 (36%) of 39 patients, and severe hyponatremia was found in 6 (15%). In our study, hyponatremia was found in 16% (n=12) of the patients and hypernatremia was found in 2.7% (n=2).

Conclusion

It was observed that patients diagnosed with AGE who tested positive for the rotavirus antigen in the emergency department were younger, their hospitalization duration was longer, and the number of admissions to the emergency department was higher. Hyponatremia due to dehydration is more common in rotavirus gastroenteritis. It was observed that the patients with metabolic acidosis and hyponatremia had length of hospitalization. With these inferences, unnecessary antibiotic use should be prevented in childhood AGEs by considering viral factors. Regarding disease prevention and health promotion, it is important to support rotavirus vaccination, which is not yet in the national vaccination calendar, and breast milk to prevent dehydration, especially in the infant age group.

Ethics Committee Approval: This study was performed with the approval of the Clinical Research Ethics Commitee of Bakırköy Dr. Sadi Konuk Training and Research Hospital (Date: 19.04.2021, Number: 2021-08-26) in accordance with the guidelines of the Declaration of Helsinki.

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: E.E.S., S.S.H.; Design: E.E.S., Ö.P.; Supervision: E.E.S., Ö.P.; Fundings: E.E.S., S.S.H.; Materials: E.E.S., S.S.H.; Data Collection or Processing: E.E.S., S.S.H.; Analysis or Interpretation: E.E.S., Ö.P.; Literature Search: E.E.S., Ö.P.; Writing: E.E.S., Ö.P.; Critical Review: E.E.S., Ö.P., S.S.H.

Conflict of Interest: None declared.

Financial Disclosure: The authors declared that this study received no financial support.

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