

Is there a relationship between rotavirus positive and negative gastroenteritis and ABO blood groups?: A retrospective cohort study

Mervan Bekdas, Asist. Prof.^{a,b}, Fatih Demircioglu, Asoc. Prof.^{a,b}, Sevil Bilir Goksugur, Asist. Prof.^{a,b}, Beyhan Kucukbayrak, M.D.^{a,c} and Erol Kismet, Prof.^{a,b}

ABSTRACT

Introduction. Rotavirus is the most common cause of severe diarrhea in children. There is only a few clinical studies about the relationship between rotavirus gastroenteritis and ABO blood groups.

Objective. The aim of this study was to investigate the role of blood groups, if any present, in the incidence of rotavirus gastroenteritis, and the severity of the gastroenteritis.

Methods. The file records of babies born in our hospital and diagnosed with acute gastroenteritis in their follow up were investigated retrospectively.

Results. The study was conducted with 219 (36.3%) rotavirus positive and 383 (63.6%) rotavirus negative patients. The A blood group was detected more commonly in the rotavirus positive group compared to the rotavirus negative group (50.6 vs. 42.2%, $p=0.047$). Hospitalization rates of the cases with rotavirus gastroenteritis among children with the A blood group (30.6 vs. 8%, $p=0.001$) were significantly higher.

Conclusions. Rotavirus gastroenteritis was determined to be more common in children with A blood group. The hospitalization rates of such patients were detected to be higher. Therefore, rotavirus gastroenteritis among children with blood group A should be monitored closely.

Key words: rotavirus, gastroenteritis, child, ABO blood groups.

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INTRODUCTION

Rotavirus is a double strand RNA virus that belongs to the family of reoviridae. Rotaviruses are divided into 7 groups depending on the variances in VP6 protein.¹ In humans, only group A, B and C rotavirus infections are reported.² The most frequent rotavirus infection, group A, causes 21-65% of severe gastroenteritis cases during childhood. Rotavirus infection may manifest in various clinical pictures ranging from

asymptomatic infection to severe gastroenteritis with dehydration.³ Each year, about 2 million infants die due to gastroenteritis, mostly in the developing countries and about 1/3 of these mortalities are associated with rotavirus gastroenteritis. The majority of the mortalities are reported in developing countries. On the other hand, the mortality rate is lower, whereas the morbidity is higher in developed countries.⁴ In Europe, rotavirus gastroenteritis results in 29 661/100 000 of infants to apply to the hospital, 368/100 000 of infants to be hospitalized and 1/100 000 of infants to die.^{5,6} Though the mortality rates are detected to be higher in the developing countries, rotavirus remains to be important across the world due to the morbidity, hospitalization rates and economic load that it causes in developed countries.

There are evidences of a close relationship between the blood group types and some microbial agents such as *Helicobacter pylori*⁷ and noroviruses.⁸ The purpose of this study was to investigate the role of blood groups, if any present, in the incidence of rotavirus gastroenteritis, and the severity of the gastroenteritis.

MATERIAL AND METHODS

This retrospective study was conducted in Izzet Baysal Maternity and Children's Hospital upon the approval of the local Ethics Committee. Most births (85%) in our city take place in our hospital. All babies born in our hospital are routinely checked for their blood group. A number of 6924 babies who were born at our hospital and followed in a two year period between January 1st 2009 and December 31st 2011 were included. Out of these babies, the file records of the 602 cases who were brought to pediatric emergency service or pediatric outpatient clinic with complaints of diarrhea, vomiting, and/or dehydration, and diagnosed with gastroenteritis cases were investigated. Acute gastroenteritis was defined as defecating for 3 or more times in a day.⁶ Patients with an age of older than 24 months, who are under

a. Department of Pediatrics.

b. Faculty of Medicine Abant Izzet Baysal University.

c. Izzet Baysal State Hospital, Bolu, Turkey.

E-mail Address:

Mervan Bekdas, Prof. Asist.: merbek14@yahoo.com

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antibiotic therapy, who are diagnosed with cystic fibrosis, immunodeficiency, food allergy, malabsorption syndromes or malnutrition before and whose file information and/or blood groups were missing were excluded from the study. The clinical features and laboratory findings were investigated. Rotavirus antigen was searched for all patients within the first 30 minutes following the collection of stools. Stool samples were tested using immunochromatographic (Rida Quick, R-Biopharm, Germany) method. The blood group types were determined with slide agglutination test. Some of the acute gastroenteritis cases were hospitalized. Hospitalization criteria were: severe dehydration, bloody diarrhea, inability to retain oral feeding, persistent vomiting, and age of <3 months old, altered mental status and failure of treatment. None of the infants had been immunized with rotavirus vaccine before.

Statistical analyses were performed using SPSS version 15.0. Mean \pm SD was used for homogeneous group distribution calculations and median (min-max) was used for heterogeneous group distribution calculations. In the statistical analysis, student-t and Mann Whitney U tests were used and a $p < 0.05$ value was regarded as significant.

RESULTS

During the investigation period, 602 cases whose blood groups were recorded before and who were brought to our hospital with acute gastroenteritis were included in the study. While 219 (36.3%) of cases were rotavirus positive, 383 (63.6%) were rotavirus negative (*Table 1*). Among the patients with an established rotavirus

gastroenteritis diagnosis 128 (58.4%) were male, and 91 (41.5%) were female. The median age of patients was 9 months, with a range of 1-24 months.

One hundred and sixty-nine (77.1%) rotavirus positive patients had outpatient treatment, and 50 (22.8%) patients were hospitalized. On the other hand, out of 383 rotavirus negative patients, only 33 (8.6%) were hospitalized. Rotavirus positive patients were hospitalized for 1-12 days, and the average hospitalization time was 2.5 days. However rotavirus negative patients were hospitalized for 1-4 days, with an average of 1.5 days. The statistical analysis between the two groups in terms of the hospitalization rate and the duration of hospitalization revealed a significant difference.

In the rotavirus positive gastroenteritis group, O blood group was detected in 57 (26%) cases, A blood group in 111 (50.6%), B blood group in 32 (14.6%), and AB blood group in 19 (8.6%) cases. As for the distribution of blood groups in rotavirus negative patients, O blood group was detected in 122 (31.8%), A blood group in 162 (42.2%), B blood group in 65 (16.9%), and AB blood group in 34 (8.9%) cases. There was no significant difference in terms of the incidence of O, B and AB blood group types between the rotavirus positive and negative patient groups. However, the prevalence of 50.6% of A blood group in rotavirus positive group was significantly higher when compared with the rotavirus negative group.

The distribution of blood groups among cases with and without rotavirus gastroenteritis is summarized in the *Table 2*. When the cases with rotavirus gastroenteritis in the blood group A

TABLE 1. Demographical data and laboratory findings of patients with rotavirus +/- gastroenteritis

Specifications	Rotavirus(+) GE	Rotavirus(-) GE	p
	n: 219	n: 383	
Age (months) ¹	8 (1-22)	9 (1-24)	0.7
Male ²	128 (58.4)	198 (51.6)	0.11
O blood group ²	57 (26)	122 (31.8)	0.13
A blood group ²	111 (50.6)	162 (42.2)	0.047*
B blood group ²	32 (14.6)	65 (16.9)	0.44
AB blood group ²	19 (8.6)	34 (8.9)	0.93
Hospitalization rate ²	50 (22.8)	33 (8.6)	0.001*
Hospitalization time (days) ¹	2.5 (1-12)	1.5 (1-4)	0.022*

1: Median (Min-Max); 2: n(%); *: Significant; GE: Gastroenteritis.

were compared with the cases with no rotavirus gastroenteritis, it was determined that the hospitalization rates were significantly different.

DISCUSSION

Rotavirus gastroenteritis is a very contagious disease, and it is commonly seen across the world.⁹ Most of the children are infected with rotavirus more than once in the first 3 years of their lives.¹⁰ Rotavirus gastroenteritis, which is widespread across the world, remains to be an important public health problem.⁶

In Europe, the cases with rotavirus gastroenteritis are staying in the hospital for 2.5 to 5 days.⁶ Similarly, in our patients, the average hospitalization time was 2.5 days.

The infection is nonspecific or asymptomatic especially during the first months of life.¹¹ This characteristic feature may cause delays in diagnosis and admittance of the patients to the hospital with more severe diseases.³ For this reason the diagnosis should be verified with laboratory examinations on stool samples.¹⁰ In our study, it was shown that the rotavirus positive cases were hospitalized in a significantly higher rate and for a longer time.

The distribution of ABO blood groups in general population in Turkey is reported as follows: 30.8-33.3% for the blood group O, 42.6-43.8% for the blood group A, 16.2-16.8% for the blood group B and 7.4-9.2% for the blood group AB.^{12,13} The ABO blood group ratios we identified in our study in the rotavirus negative gastroenteritis group are compatible with the ratios previously identified in our country. However, among the rotavirus positive gastroenteritis group, A blood group was more common than the rotavirus negative group. This

result suggests that the blood group A may be a receptor and host-susceptibility factor for the rotavirus gastroenteritis. The VP4 structural protein included in the external cover of virus has many crucial functions such as bonding to the cell, penetration, hemagglutination, neutralization and virulence. For viral infectivity, VP4 should be divided into VP5 and VP8.¹⁴ Penetration of the virus into the cell is enabled by the binding of rotavirus to the receptors containing sialic acid. The first contact happens through VP8.¹⁴ ABO blood group antigens exist not only in erythrocytes, but also in epithelial cells.¹⁵ Just like the sialic acid in animal rotavirus VP8, the human rotavirus VP8 at the same localization binds to A blood group antigens.¹⁵ However, in the study of Yazgan et al,¹⁶ any association between ABO blood groups and rotavirus has not been established.

CONCLUSIONS

Blood group A is detected more frequently in infants with rotavirus infection. Moreover, the hospitalization rates of such patients with blood group A are determined to be higher. Therefore, rotavirus gastroenteritis among children with blood group A should be monitored closely. ■

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TABLE 2. Hospitalization time and hospitalization rate of patients with rotavirus +/- gastroenteritis according to ABO blood group

Specifications	Rotavirus(+) GE	Rotavirus(-) GE	p
Hospitalization time (days)	O blood group ¹	2 (1-4)	0.82
	A blood group ¹	2 (1-12)	0.87
	B blood group ²	2.2 ± 0.8	0.52
	AB blood group ²	2.6 ± 0.5	0.57
Hospitalization rate	O blood group ³	8/57 (14)	0.11
	A blood group ³	34/111 (30.6)	0.001*
	B blood group ³	5/32 (15.6)	0.35
	AB blood group ³	3/19 (15.7)	0.64

1: Median (Min-Max), 2: Mean ± SD; 3: n/total(%); *: Significant; GE: Gastroenteritis.

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