MEAN PLATELET VOLUME VALUE CHANGES IN ACUTE NONINFECTIOUS AND INFECTIOUS DIARRHEA

Original Article

AKUT İNFEKSİYÖZ VE NONİNFEKSİYÖZ İSHALDE ORTALAMA TROMBOSİT HACMİ DEĞİŞİKLİKLERİ

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ABSTRACT

Aim: The aim of this study is to evaluate the usefulness and alterations of MPV according to etiologic agents and Vesicari scores of patients with acute gastroenteritis.

Material and Methods: Children with acute gastro enteritis were tested to detect the relationship between etiological agents, and dehydration levels according to Vesicari scores, platelet counts, and MPV values. The patients were categorized as noninfectious acute diarrhea (groupI), viral etiology (groupII), bacterial etiology (groupIII), and control group (groupIV).

Results: The age distribution of 174 patients was between 0–16 years (mean±SD:4.40±3.56). Dehydration levels in groupII and groupIII were higher than groupI ($p<0.05$). Platelet counts were higher in moderately and severely dehydrated patients than mildly dehydrated patients; however, MPV values were higher in mildly dehydrated patients than moderately and severely dehydrated patients. These differences were not significant ($p>0.05$). Platelet counts were statistically different between groupIII and IV. MPV values were not

different statistically between groups (p>0.05). Vesicari scores in groupII, III, and IV were higher than the scores in groupI (p<0.05).

Conclusion: MPV values in patients with acute bacterial diarrhea were higher than those in patients with acute noninfectious and viral diarrhea.

Keywords: acute gastroenteritis, child, dehydration, mean platelet volume, Vesicari scoring.

ÖZET

Amaç: Bu çalışmada çocuklarda akut gastroenterit ile OTH arasındaki ilişkinin değerlendirilmesi amaçlandı.

Materyal ve Metod: Akut gastroenteritli çocuklarda etiyolojik ajanlar ve Vesikari skoruna göre dehidratasyon düzeyi, OTH (ortalama trombosit hacmi) ve trombosit sayıları arasındaki ilişki incelendi. Hastalar akut gastroenterit etkenlerine göre noninfeksiyöz akut ishal (grupI), viral nedenli gastroenteritler (grupII) ve bakteriyel nedenli gastroenteritler (grupIII) ve kontrol grubu olarak kategorize edildi.

Bulgular: Akut gastroenterit saptanan 174 çocuk hastanın yaşları ortalama 4.40 ± 3.56 yıl (0-16arasında) değişmekteydi. Grup II ve III'ün dehidratasyon düzeyleri grup I'den fazlaydı. Orta ve ağır düzeyde dehidratasyonları olan hastaların trombosit sayıları hafif dehidratasyonu olanlardan fazla olmasına karşılık, hafif derecede dehidratasyonu olanların OTH değerleri orta ve ağır dehidrate olanlara göre yüksekti, bu farklılıklar anlamlı bulunmadı (p>0.05). Trombosit sayıları III. ve IV. gruplar arasında farklılık gösteriyordu, gruplar arasında OTH değerleri bakımından ise anlamlı farklılık yoktu(p>0.05). Vesikari skorları grup II, III ve IV'deki hastalarda grup I'deki hastalara göre anlamlı olarak yüksekti (p<0.05).

Sonuç: Akut bakteriyel ishali olan hastaların OTH değerleri, akut viral ishal ve etken saptanamayan akut ishali olan hastalardan daha yüksek bulunmuştur.

Anahtar Kelimeler: Akut gastroenterit, çocuk, dehidratasyon, ortalama trombosit hacmi, Vesikari skoru.

INTRODUCTION

Acute gastroenteritis accounts for a large proportion (18%) of childhood deaths, with an estimated 1.5 million deaths per year globally, making it the second most common cause of childhood deaths worldwide. The World Health Organization (WHO) and UNICEF (2009) estimate that almost 2.5 billion episodes of diarrhea occur annually among children under five years of age in developing countries, with more than 80% of the episodes occurring in Africa and South Asia (46% and 38%, respectively) (1). The etiology and clinical course may vary with age and etiological agents. In developing countries the morbidity and mortality associated with infectious diarrheas is higher in children under five years of age.Acute gastroenteritis is caused by viruses, bacteria, and protozoa. Of these, while rotavirus, norovirus, and enteric adenovirus are the major agents of acute gastroenteritis, particularly in developed countries, bacterial (Shigella spp, Salmonella spp, Campylobacter spp, Yersinia spp, Escherichia Coli) and parasitic (Entamoeba histolytica, Giardia intestinalis) agents are mostly encountered in developing countries (2,3). The determination of the etiology is important for the treatment, prognosis, and prophylaxis (4).

The platelets have important contributions on the pathogenesis of local and systemic inflammatory diseases. Platelet volume variables are objective parameters for the determination of platelet size (5). Furthermore, they are the determinants of platelet function and activation (6,7). There is an inverse relation between mean platelet volume (MPV) and platelet count in a healthy population (8,9). MPV is used as an

inflammatory determinant because it may demonstrate the disease activity and therapeutic efficacy. Additionally, MPV may decrease or increase according to the intensity of inflammation. It was demonstrated that MPV decreases in low-level inflammation due to large platelets in circulation, while MPV decreases in high-level inflammation because large platelets are used in the inflammated area (10,11). On the other hand, although MPV was shown as a positive acute phase reactant in some studies (12,15), different studies have found it to be a negative acute-phase reactant (16,19).

Vesicari scoring system is a clinical scoring method that was used firstly in 1990 for the clinical severity of children with rotavirus (20). The severity and duration of vomiting and diarrhea, degree of fever, severity of dehydration, and treatment regimen are estimated with this scoring system. Thereafter, patients are categorized as mild (<7points), moderate (7,10points), and severe (≥11 points) according to total score (21).

The relationship between MPV, dehydration level, and etiological agents was evaluated in children with acute gastroenteritis in this study. We aimed to evaluate MPV alterations according to etiologic agents and dehydration levels according to Vesicari scores of patients with acute gastroenteritis. We also aimed to evaluate the usefulness of MPV in distinguishing between noninfectious and infectious (bacterial and viral) etiology.

MATERIAL AND METHODS

The study was conducted at Yeditepe University Faculty of Medicine, Department of Child Health and Diseases between January 2012 and January 2014. The symptoms of patients, the severity and duration of diarrhea, the presence and duration of vomiting, the presence of fever, the presence and severity of dehydration, requirement of hospitalisation, and treatments of patients were evaluated on the basis of hospital records, retrospectively. The severity of diarrhea in patients was evaluated as mild (<7points), moderate (7,10points), and severe (≥11points) according to the 20-point Vesicari scoring system. The stool culture and microscopy, multiplex Polimerase Chain Reaction (PCR) test for bacterial and viral agents, and rapid antigen tests for adenovirus, norovirus, and rotavirus were used to detect etiologic agents. The patients were categorized in three groups depending on etiologic agent patients with negative laboratory tests for either bacteria and viruses. These cases were diagnosed as having noninfectious acute diarrhea (groupI), those with proven viral etiology (groupII), and others with proven bacterial etiology (groupIII). Venous blood samples were drawn into Vacuette tubes (Greiner Bio-One, Monroe, NC).

Tubes were kept on the roller for 10 minutes. Then, Complete Blood Count (CBC) were studied within 45 minutes after the blood samples were drawn. Platelet counts and MPV values were evaluated according to CBC results of the patients.

Statistical analysis was performed by using SPSS 15.0 statistical program software. Results were indicated as mean ± SD; distribution of parameters was tested and the independent sample T test was used for comparison between groups. Pearson's method was used for correlation and relation between indicated parameters. A p value under 0.05 was demanded for statistical significance Statistical analysis was performed by using SPSS 15.0 statistical program software. Platelet counts and MPV values had a normal distribution. For the platelet count and MPV variables, ANOVA test was applied to the comparison between the groups. Tukey test was used to determine the difference between mean platelet counts originated from which groups. Score variable does not conform to the normal distribution. For this reason, Kruskal-Wallis test was applied to the comparison for score variable between groups.

Kruskall-Wallis test was used for the comparison of variables that had not distributed normally. Mann-Whitney U test was used to determine where the differences occur between variables not distributed normally. X-square test was used to determine the Vesicari scores of groups. A p value under 0.05 was demanded for statistical significance. Sensitivity, specifity, and cut-off values of MPV were determined by two group analysis with control group.

RESULTS

A total of 174 children were enrolled in the study. There were 100 (57.5%) males and 74 (42.5%) females with a male/female ratio of 1.35 to 1. The patients were between 0 – 16 years (4.40 ± 3.56) of age.

Viral and bacterial agents were detected in 52 (29.8%) and 49 (28.2%) patients, respectively. No etiologic agents were detected in 73 (42.0%) patients. Bacterial agents were Salmonella spp. (21.3%), Campylobacter spp. (4.0%), Escherechia coli H7 O157 (1.7%), Aeromonas spp. (0.6%), and Clostridium difficile (0.6%). Viral agents were norovirus (9.2%), rotavirus (14.3%), adenovirus (5.7%), and astrovirus (0.6%) (Figure1).

Vesicari scores of patients were 18.4%,32.2%, and 49.4%, mild, moderate, and severe, respectively (Table 1,Figure2).

Median values of Vesicari scores were higher in group II, group III, and group IV than group I (P<0.05) (Figure1 and 2). Dehydration levels in group II and group III were higher than group I (p<0.05).

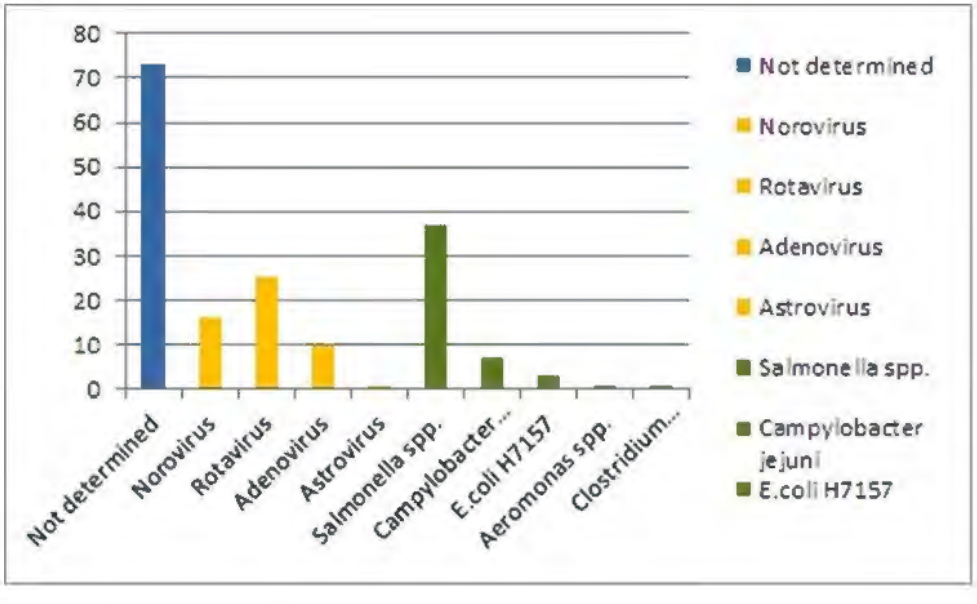

Figure1: Distribution of patients according to etiological agents

Groups according to etiology		N (%)	Platelet counts (/mm^3) Mean ± SD	MPV (fL) Mean ± SD	Dehydration levels according to Vesicari scoring Mean ± SD
Group I		73 (42.0)	304.783 ± 86.31	9.26 ± 0.62	1.9 ± 0.80
Group II	Norovirus	16	348.411 ± 75.88	9.39 ± 0.98	2.6 ± 0.40
	Rotavirus	25	313.040 ± 101.64	9.35 ± 0.76	2.7 ± 0.45
	Adenovirus	10	291.400 ± 73.82	9.48 ± 0.77	1.9 ± 0.87
	Astrovirus	1	325.000 ± 0.00	10.0 ± 0.00	2.0 ± 0.00
	Total	52 (29.8)	320.442 ± 89.91	9.39 ± 0.82	2.5 ± 0.60
Group III	*Salmonella* spp.	37	267.185 ± 73.94	9.44 ± 0.89	2.6 ± 0.58
	Campylobacter spp.	7	267.714 ± 99.85	9.28 ± 0.62	2.71 ± 0.48
	E. coli	3	403.666 ±112.12	9.16 ± 1.15	2.6 ± 0.57
	Aeromonas spp.	1	334.000 ± 0.00	9.4 ± 0.00	3.0 ± 0.00
	C.difficile	1	229.000 ± 0.00	9.7 ± 0.00	3.0 ± 0.00
	Total	**49 (28.2)**	276.163 ± 84.12	9.41 ± 0.84	2.7 ± 0.50

Table 1: Platelet and MPV counts, Vesicari scores, and dehydration levels of group

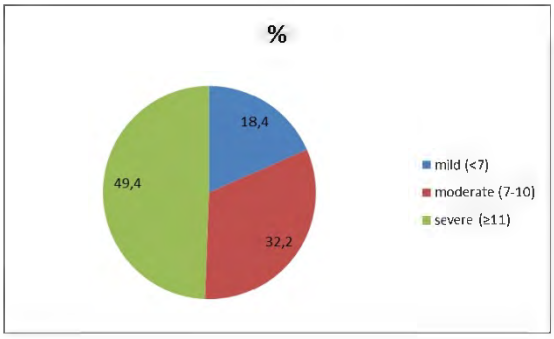

Figure 2: Dehydration levels of patients according to Vesicari scoring

The mean platelet count of patients was 301.270 ± 88.209/mm^3 and mean MPV was 9.34 ± 0.75 fL. Platelet counts were statistically different between group III and IV, mean platelet count in group IV was higher than group III ($p<0.05$). MPV levels were not different statistically between groups ($p>0.05$).

Platelet counts were higher in moderately and severely dehydrated patients than mildly dehydrated patients; however, MPV levels were higher in mildly dehydrated patients than moderately and severely dehydrated patients (Table2).

These differences were not significant ($p>0.05$).Sensitivity and specificity of MPV for group I are 28.4% and 84.3%, for group II respectively (cut-off=8.8fL). Sensitivity, specificity, and cut-off values of MPV for group I, II, and III are showed in Figure3,4 and 5 respectively.

Dehydration level according to Vesicari scoring	**Platelet counts (/mm^3) Mean ± SD**	**MPV (fL) Mean ± SD**
Mild (< 7)	277.531 ± 77.014	9.40 ± 0.68
Moderate (7 - 10)	307.553 ± 95.020	9.35 ± 0.68
Severe (≥ 11)	306.011 ± 87.006	9.32 ± 0.82

Table2:Platelet and MPV counts accoring to dehydration levels of all patient.

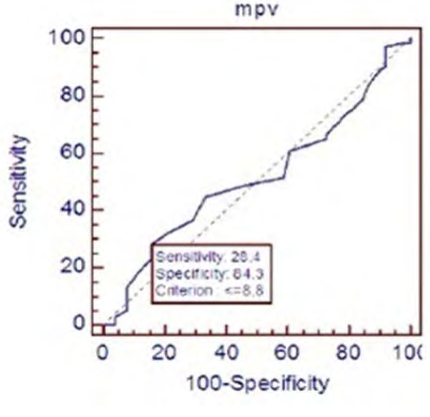

Figure 3: Sensitivity, specificity, and cut-off values of MPV for group I.

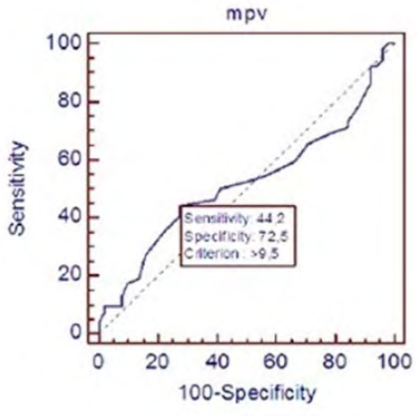

Figure 4: Sensitivity, specificity, and cut-off values of MPV for group II.

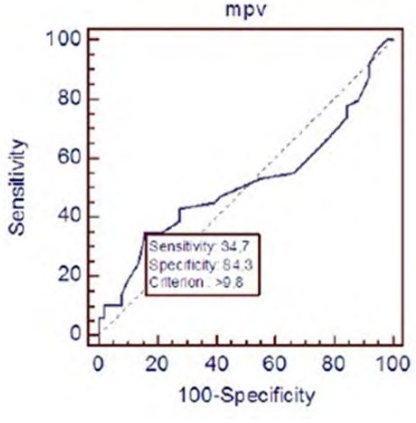

Figure 5:Sensitivity, specificity, and cut-off values of MPV for group III

DISCUSSION

Viral, bacterial, and parasitic agents cause acute infectious diarrheas. Determination of etiologic agents are influenced by the resources of the laboratory, antibiotic use before diagnosis, the ages of patients, season, nutrition habits, socioeconomic status, and geographic distribution of agents (2,4). In our study, viral and bacterial agents were detected in 29.8% and 28.2% of patients, respectively. Viral pathogens were reported in 65.8% as etiological agents of the patients with diarrhea, while bacterial pathogens were reported as etiological agents in 13.8% of patients by Kizirgil et al. from Turkey (22).

Platelets induced during inflammation release some mediators that contribute to the inflammation process. Although MPV may show a significant variety especially in inflammatory and infectious diseases. MPV was suggested as a positive acute-phase reactant (12,15), there were also some studies showing that it is a negative acute-phase reactant (16,19).

There is no study showing that how MPV and platelet values have changed

according to the etiological agent in patients with acute gastroenteritis except the study of Mete et al. from Turkey. MPV was detected as a negative acute-phase reactant among children with acute

gastroenteritis caused by rotavirus in this study (23).

In our study, MPVs' was higher in patients with viral agents than patients with no etiology. Presumably, etiologically undetermined patients had noninfectious diarrhea. This finding may demonstrate that MPVs' did not change in noninfectious diarrhea.

We also concerned whether MPVs' were affected by dehydration levels or not. In our study, MPVs' were not affected by dehydration levels according to Vesicari scoring as in the study of Mete et al (23).

CONCLUSIONS

In conclusion, we suggest that MPV is elevated in cases of acute gastroenteritis due to bacterial causes of gastroenteritis, while in cases of viral causes MPV is not elevated. This finding may be used as a noninvasive, fast and almost everywhere available test when in the treatment of patients with gastroenteritis, particularly children.

List of abbreviations

(WHO): World Health Organization;

(MPV): Mean platelet volume;

(CBC): Complete blood count;

(PCR): Polimerise chain reaction.

Acknowledgements

This research was not funded. We would like to thank Yeşim Gürol and Gülden Çelik (microbiologists at Department of Clinical Microbiology, Faculty of Medicine, Yeditepe University) for their excellent technical assistance in analyzing viruses by PCR. We are also grateful to Cahit Zereycan (writing consultant) for the revision of this paper in English.

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