ORIGINAL ARTICLE

Mean Platelet Volume and Neutrophil/Lymphocyte Ratio Among Patients with Ulcerative Colitis as an Indicator of Activation

Ülseratif Kolitli Hastalarda Aktivasyon Göstergesi Olarak Ortalama Trombosit Hacmi ve Nötrofil/Lenfosit Oranı

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Abstract

Introduction: To determine the changes in mean platelet volume (MPV) and the neutrophil/lymphocyte ratio (NLR) in activation period among patients with ulcerative colitis (UC).

Methods: Overall, 83 patients (49 female and 34 male) diagnosed with UC were retrospectively screened and included in this study. The complete blood count results, including hemoglobin, white blood cell (WBC) count, NLR, platelet count, and MPV, of all patients were recorded in both activation and remission periods. The serum C-reactive protein (CRP) and sedimentation levels of all patients were also recorded. Endoscopic disease activities (endoscopic activity index (EAI)) were also noted.

Results: Compared with the remission periods, MPV values were statistically significantly lower (p=0.023) and NLR values were statistically significantly higher (p=0.011) in activation periods. In the correlation analysis, MPV levels were correlated with disease age (p=0.019), hemoglobin (p=0.012), WBC count (p=0.009), platelet count (p=0.001), sedimentation rate (p=0.001), CRP levels (p=0.009), and EAI (p=0.008) during activation periods. Conversely, the NLR did not correlate with MPV, hemoglobin, WBC, platelet count, or sedimentation and CRP levels; however, the NLR was also correlated with EAI (p=0.036).

Discussion and Conclusion: We have studied two inexpensive, easily applicable, and noninvasive serum biomarkers, MPV and NLR, to determine UC activation and found that these two parameters are well correlated with other inflammatory markers and EAI.

Keywords: Activation; Mean Platelet Volume; Neutrophil/Lymphocyte Ratio; Ulcerative Colitis

Ulcerative colitis (UC) is an inflammatory bowel disease (IBD) with an uncertain exact cause. The combination of genetic and environmental factors is thought to be the cause of UC pathogenesis; triggering an immune reaction and an imbalance between pro- and anti-inflammatory cytokines has been suggested to play a central role.[1] In

active IBD, the lymphocytes and macrophages in the mucous membrane are increased in number and activated to secrete many cytokines.[2]

Nowadays, platelets are regarded to play important roles in inflammatory diseases.[3,4] An association of platelet indices with inflammatory markers, such as white blood cell (WBC) count and C-reactive protein (CRP), has been revealed, emphasizing the wide relation between platelets and inflammation.[5] Mean platelet volume (MPV) is the average size of a platelet, which is a marker of platelet activation, since it reflects the production rate and activation of platelets.[6] An inverse correlation between disease activity and MPV levels has been demonstrated in some rheumatologic diseases.[7,8]

In systemic inflammatory response, neutrophils increase and lymphocyte count relatively decreases; therefore, the neutrophil/lymphocyte ratio (NLR) may be regarded as another marker of underlying inflammation.[9] The NLR was defined as a potential biomarker in assessing the outcomes in some inflammatory disorders.[10,11]

In this study, we aimed to determine the changes in MPV and NLR in activation period among patients with UC and also examine the relationship of these parameters with inflammation markers and endoscopic activity index (EAI).

Materials and Methods

A total of 83 patients diagnosed with UC were retrospectively screened. The complete blood count results, including hemoglobin, WBC count, NLR, platelet count, and MPV, of all patients were recorded in both activation and remission periods. The serum CRP and sedimentation levels of all patients were also recorded. Endoscopic disease activities (EAI) were classified according to Schroder et al. Before the treatment, serum tests and activity index were recorded at admission during activation.

Statistical Analysis

All analyses were performed using the Statistical Package for Social Sciences (SPSS) for Windows 17.0 program. Comparisons of demographic features of groups were performed using Fisher's exact test and Pearson's X^2 tests. Correlation analysis was used to determine the association of MPV and NLR with serum CRP, sedimentation levels, and EAI. The results were expressed as mean±standard deviation. $P<0.05$ was considered statistically significant.

Results

Overall, 83 patients (49 female and 34 male) diagnosed with UC were included in this study. The mean age of the

Table 1. Laboratory data of participants during remission and activation periods

	Remission period	Activation period	p
Hemoglobin	12.1 ±1.7	13.1 ±1.8	**0.041**
White blood cell count	5.8±2.3	8.2±2.2	**0.027**
Neutrophil/lymphocyte ratio	2.19± 0.9	2.75±1.4	**0.011**
Platelet count	260.2±94.5	301.6±94.7	**0.009**
Mean platelet volume	8.4±1.2	6.8±0.8	**0.023**
Sedimentation level	16.44±9.2	23.9±18.9	**0.012**
C-reactive protein	7.5±3.1	22.7±19.6	**0.011**

Table 2. Correlation analyses of some factors with Endoscopic Activity Index

Factors	Beta	p
Gender	0.01	0.89
Disease age	0.024	0.87
Hemoglobin	-0.11	0.32
White blood cell count	0.054	0.38
Platelet count	0.079	0.29
Sedimentation levels	0.18	**0.017**
C-reactive protein	0.19	**0.019**
Mean platelet volume	-0.59	**0.008**
Neutrophil/lymphocyte ratio	0.20	**0.036**

study participants was 42.4±9.4 years (range: 19–81 years), and the mean disease age of the patients was 37.9±12.6 months (range: 13–71 months). The laboratory data of the participants during remission and activation periods are summarized in Table 1. Compared with the remission periods, MPV values were statistically significantly lower (p=0.023) and NLR values were statistically significantly higher (p=0.011) in activation periods.

In the correlation analysis, MPV levels were correlated with disease age (p=0.019), hemoglobin (p=0.012), WBC count (p=0.009), platelet count (p=0.001), sedimentation rate (p=0.001), CRP levels (p=0.009), and EAI (p=0.008) during activation periods. Conversely, the NLR did not correlate with MPV, hemoglobin, WBC, platelet count, or sedimentation and CRP levels; however, the NLR was also correlated with EAI (p=0.036) (Table 2).

Discussion

In this study, we have compared the MPV and NLR of patients with UC in activation and remission periods to define the role of these indices in the determination of UC activation. In activation periods, MPV was lower, whereas the NLR was higher. Both MPV and NLR were correlated with

EAI. Moreover, MPV was also correlated with the markers of inflammation, such as sedimentation rate and CRP levels, in activation period.

MPV has been previously studied in patients with UC. In a recent study on 198 patients with IBD and 102 healthy controls, hemoglobin, mean corpuscular volume, MPV, and ferritin levels were lower, whereas the absolute platelet count, red cell distribution width, and platelet distribution width (PDW) were higher in the IBD group than in the controls. In that study, the absolute platelet count was determined to correlate with disease activity in patients with IBD.[12] In another recent study, consisting of 175 patients with IBD (UC: n=103; Crohn's disease (CD): n=72) and 40 healthy subjects as control group, a significant decrease in MPV was determined in patients with IBD when compared to controls. In that study, both PDW and PCT were reported to have a significant correlation with UC disease activity. The authors concluded that alterations in platelet indices in IBD can be regarded as other inflammatory markers mainly to screen disease from active phase to remission phase.[13] Conversely, in the study of Dogan et al.[14] on 69 patients with IBD (UC: n=54; CD: n=15) and 38 healthy controls, no difference was observed between the groups regarding MPV values. Yüksel et al.[15] conducted a study on 61 patients with UC and 27 healthy subjects and showed reduced MPV levels in patients with UC, mainly in patients with active UC, and they suggested that decreased MPV levels may indicate increased disease activity in patients with UC. In a cohort of 271 consecutive patients with IBD compared with healthy controls, statistically significant lower MPV levels were reported in male patients with IBD than in healthy controls. Moreover, in this study, abnormalities in coagulation and fibrinolysis status were suggested to be related to disease activity.[16] Similarly, Kapsoritakis et al.[17] proposed that MPV offers a practical marker of activity in IBD. Similar with our results, in a retrospective study, platelet levels were significantly higher, whereas MPV levels were lower in patients with UC compared with controls; disease activity was negatively correlated with MPV.[18] In a recent review, decreased MPV levels were noted in patients with UC; however, the authors concluded that the usefulness of MPV assessment in clinical practice was limited in that aspect.[19]

The NLR was also considered in UC in a few previous studies. Celikbilek et al.[11] recently demonstrated that the NLR is higher in patients with active UC compared with controls. Similarly, Torun et al.[20] found a correlation between NLR values and WBC count and erythrocyte sedimentation rate levels and suggested that peripheral blood NLR can reflect disease activity.

UC is a disease with remissions and relapses. Early realization of active disease is imperative for decreasing mortality in severe diseases. In that aspect, serum biomarkers play an important role in reflecting the disease activity of IBD. Inexpensive, easy applicable, and noninvasive markers are required in the follow-up of patients to determine the activation. In this study, we have determined that MPV decreases, whereas the NLR increases in the activation periods of patients with UC.

This study has some limitations that should be mentioned. We did not have a control group of healthy subjects; we instead compared the laboratory data of patients in remission and activation periods. Retrospective study design and relatively small study population are the other limitations of this study, which prevented us to make an exact assumption.

In conclusion; we have studied two inexpensive, easy applicable, and noninvasive serum biomarkers, MPV and NLR, for the determination of UC activation and found that these two parameters are well correlated with other inflammatory markers and EAI. Larger studies are warranted to define the exact role of these parameters in the early diagnosis of activation in patients with UC.

References

1. Sun Y, Zhang Z, Zheng CQ, Sang LX. Mucosal lesions of the upper gastrointestinal tract in patients with ulcerative colitis: A review. World J Gastroenterol 2021;27(22):2963–78.
2. Zhang MH, Wang H, Wang HG, Wen X, Yang XZ. Effective immune-inflammation index for ulcerative colitis and activity assessments. World J Clin Cases 2021;9(2):334–43.
3. Grove EL, Hvas AM, Kristensen SD. Immature platelets in patients with acute coronary syndromes. Thromb Haemost 2009;101(1):151–6.
4. Gunluoglu G, Yazar EE, Veske NS, Seyhan EC, Altin S. Mean platelet volume as an inflammation marker in active pulmonary tuberculosis. Multidiscip Respir Med 2014;9(1):11.
5. Santimone I, Di Castelnuovo A, De Curtis A, Spinelli M, Cugino D, Gianfagna F, et al; MOLI-SANI Project Investigators. White blood cell count, sex and age are major determinants of heterogeneity of platelet indices in an adult general pop-

ulation: results from the MOLI-SANI project. Haematologica 2011;96(8):1180–8.

6. Briggs C. Quality counts: new parameters in blood cell counting. Int J Lab Hematol 2009;31(3):277–97.

7. Yazici S, Yazici M, Erer B, Erer B, Calik Y, Ozhan H, et al. The platelet indices in patients with rheumatoid arthritis: mean platelet volume reflects disease activity. Platelets 2010;21(2):122-5.

8. Kisacik B, Tufan A, Kalyoncu U, Karadag O, Akdogan A, Ozturk MA, et al. Mean platelet volume (MPV) as an inflammatory marker in ankylosing spondylitis and rheumatoid arthritis. Joint Bone Spine 2008;75(3):291–4.

9. Jilma B, Blann A, Pernerstorfer T, Stohlawetz P, Eichler HG, Vondrovec B, et al. Regulation of adhesion molecules during human endotoxemia. No acute effects of aspirin. Am J Respir Crit Care Med 1999;159(3):857–63.

10. Halazun KJ, Hardy MA, Rana AA, Woodland DC 4th, Luyten EJ, Mahadev S, et al. Negative impact of neutrophil-lymphocyte ratio on outcome after liver transplantation for hepatocellular carcinoma. Ann Surg 2009;250(1):141–51.

11. Celikbilek M, Dogan S, Ozbakir O, Zararsız G, Kücük H, Gürsoy S, et al. Neutrophil-lymphocyte ratio as a predictor of disease severity in ulcerative colitis. J Clin Lab Anal 2013;27(1):72–6.

12. Voudoukis E, Karmiris K, Oustamanolakis P, Theodoropoulou A, Sfiridaki A, Paspatis GA, et al. Association between thrombocytosis and iron deficiency anemia in inflammatory bowel disease. Eur J Gastroenterol Hepatol 2013;25(10):1212–6.

13. Öztürk ZA, Dag MS, Kuyumcu ME, Cam H, Yesil Y, Yilmaz N, et al. Could platelet indices be new biomarkers for inflammatory bowel diseases? Eur Rev Med Pharmacol Sci 2013;17(3):334–41.

14. Dogan Y, Soylu A, Eren GA, Poturoglu S, Dolapcioglu C, Sonmez K, et al. Evaluation of QT and P wave dispersion and mean platelet volume among inflammatory bowel disease patients. Int J Med Sci 2011;8(7):540–6.

15. Yüksel O, Helvaci K, Başar O, Köklü S, Caner S, Helvaci N, et al. An overlooked indicator of disease activity in ulcerative colitis: mean platelet volume. Platelets 2009;20(4):277–81.

16. Shen J, Ran ZH, Zhang Y, Cai Q, Yin HM, Zhou XT, et al. Biomarkers of altered coagulation and fibrinolysis as measures of disease activity in active inflammatory bowel disease: a gender-stratified, cohort analysis. Thromb Res 2009;123(4):604–11.

17. Kapsoritakis AN, Koukourakis MI, Sfiridaki A, Potamianos SP, Kosmadaki MG, Koutroubakis IE, et al. Mean platelet volume: a useful marker of inflammatory bowel disease activity. Am J Gastroenterol 2001;96(3):776–81.

18. Chen Z, Lu Y, Wu J, Zhang H. Clinical significance of blood platelets and mean platelet volume in patients with ulcerative colitis. J Int Med Res 2021;49(4):3000605211009715.

19. Korniluk A, Koper-Lenkiewicz OM, Kamińska J, Kemona H, Dymicka-Piekarska V. Mean platelet volume (MPV): New perspectives for an old marker in the course and prognosis of inflammatory conditions. Mediators Inflamm 2019;2019:9213074.

20. Torun S, Tunc BD, Suvak B, Yildiz H, Tas A, Sayilir A, et al. Assessment of neutrophil-lymphocyte ratio in ulcerative colitis: a promising marker in predicting disease severity. Clin Res Hepatol Gastroenterol 2012;36(5):491–7.