

# Prognostic value of pan-immune inflammation value in patients with ulcerative colitis

 Yalcin Yerhan,<sup>1</sup>  Murat Ispiroglu,<sup>2</sup>  Nurten Seringec Akkececi,<sup>3</sup>  Kadir Gisi,<sup>2</sup>  Bulent Kantarceken<sup>2</sup>

<sup>1</sup>Department of Internal Medicine, Kahramanmaraş Sutcu Imam University Faculty of Medicine, Kahramanmaraş, Türkiye

<sup>2</sup>Department of Gastroenterology, Kahramanmaraş Sutcu Imam University Faculty of Medicine, Kahramanmaraş, Türkiye

<sup>3</sup>Department of Physiology, Kahramanmaraş Sutcu Imam University Faculty of Medicine, Kahramanmaraş, Türkiye

## ABSTRACT

**Introduction:** A novel index called the pan-immune inflammation value (PIV) reflects the body's systemic inflammation and immunological response. This study aimed to determine whether the PIV can be used as a diagnostic biomarker in assessing disease activity in patients with ulcerative colitis (UC).

**Materials and Methods:** According to the Truelove and Witts criteria, this retrospective study included 64 clinically active UC patients and 64 UC patients in remission. For the differential diagnosis of active UC patients from patients in remission, the cut-off value was estimated by making receiver-operator curves (ROC) of PIV, platelet-to-lymphocyte ratio (PLR), and neutrophil-to-lymphocyte ratio (NLR).

**Results:** There were no significant differences between the active UC patients and UC patients in remission regarding demographic characteristics such as age and gender. C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), NLR, PLR, and PIV were significantly elevated in active UC patients than those in remission ( $p < 0.001$ ). According to ROC curve analysis, PIV had the greatest predictive accuracy for active UC (358.37 was the optimal PIV cut-off for active UC) with specificity and sensitivity of 71.9% and 73.4%, respectively (AUC:0.821,  $p < 0.001$ ).

**Conclusions:** PIV can be accepted as a promising marker that contributes to the evaluation of disease activation/remission and severity for ulcerative colitis.

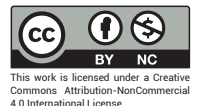
**Keywords:** Ulcerative colitis, pan-immune inflammation value, biomarker, disease activity, remission, postoperative complications



Received: 30.10.2025 Revision: 17.02.2026 Accepted: 23.02.2026

Correspondence: Nurten Seringec Akkececi PhD, Department of Physiology, Faculty of Medicine, Kahramanmaraş Sutcu Imam University, Kahramanmaraş, Türkiye

e-mail: seringec@hotmail.com



This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

## Introduction

Ulcerative colitis (UC) is a chronic disease characterized by widespread mucosal inflammation in the large intestine. In the vast majority of cases, it affects the rectum and may extend proximally in a symmetrical, circumferential manner.<sup>[1]</sup> UC is characterized by mucosal inflammation that relapses.<sup>[2]</sup> The main clinical signs include bloody diarrhea with marked tenesmus. In individuals with UC, general symptoms such as weight loss, fatigue, and fever are more common when a large part of the colon is affected. UC is a chronic disease that usually has an intermittent course and manifests itself with relapses lasting weeks or even months.<sup>[3]</sup> The course of the disease is determined by exacerbations and remissions that occur spontaneously or in response to treatment changes or intervening diseases.<sup>[1]</sup> Inducing and maintaining remission of the disease is the objective of treatment. Assessing disease activity can help optimize treatment for UC patients. When evaluating the activity of UC, C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), and fecal calprotectin are commonly utilized.<sup>[2]</sup> The platelet-to-lymphocyte ratio (PLR) and neutrophil-to-lymphocyte ratio (NLR) are also among the recently used indices to evaluate active UC.<sup>[4]</sup> A normal CRP or ESR may be present in certain patients with severely active UC.<sup>[2]</sup> These are nonspecific markers that could be impacted by additional inflammatory factors.

Pan-immune inflammation value (PIV) is calculated from a complete blood count (CBC) and a marker used to assess the severity of inflammation. The values of monocyte, neutrophil, platelet, and lymphocyte count were used to calculate the PIV.<sup>[5]</sup> PIV has been shown to have the ability to demonstrate inflammation and may forecast longer survival in cases of septic shock.<sup>[6]</sup> PIV has also been linked to the severity and presence of hepatic steatosis, a condition in which inflammation is a major factor.<sup>[7]</sup>

This study was purposed to investigate whether the PIV can be used as a diagnostic biomarker in assessing disease activity in patients with UC.

## Materials and Methods

This retrospective study included a total of 128 UC patients, consisting of 64 clinically active ulcerative colitis patients and 64 ulcerative colitis patients in remission, randomly selected from patients who presented to our hospital between January 2023 and January 2024 and for whom complete clinical data were available. Patients diagnosed with UC over 18 were included in the study. Pa-

tients with any infection, hematological or neoplastic disorder, cancer, chronic renal failure, chronic liver or heart disease, autoimmune disease, recent blood transfusions, or major blood losses that would have affected blood cell count were excluded from the study. UC was diagnosed according to endoscopic, radiological, histological, and standard clinical criteria. Patients diagnosed with UC were evaluated for active or remission according to the Truelove Witts criteria<sup>[8]</sup> (defecation frequency (more than 4), presence or absence of blood in the stool, fever (37.5 or more), sedimentation rate (>30 mm/h), anemia (<10 mg/dl) and tachycardia (>90 beats/min)). As described by previous studies<sup>[4,9-11]</sup>, patients in the mild group were classified as being in remission, whereas those with moderate or severe UC were classified as having active disease. This study is approved by the Kahramanmaraş Sütçü İmam University Ethics Committee (No. 2023/24-02, Date: 05/12/2023). This study was conducted based on the Declaration of Helsinki.

The clinical and demographic findings were obtained from the medical records. PIV, NLR, and PLR were calculated as follows, respectively: (Neutrophil count  $\times$  platelet count  $\times$  monocyte count) / lymphocyte count, (neutrophil count/lymphocyte count), (platelet count/lymphocyte count). The PLR, NLR, and PIV values were compared between patients in active and remission periods.

The sample size of the study was determined using G power analysis. Since there are no reference studies on this subject in the literature, the type 1 error level alpha ( $\alpha$ ) was taken as 0.05, the type 2 error level beta ( $\beta$ ) as 0.20, the power of the test as 0.80, and the effect size as 0.5. A total of 128 people were included in the study, 64 in the active patient group and 64 in the remission patient group.

## Statistical Analysis

The Levene test and the Kolmogorov-Smirnov test were used to evaluate homogeneity of variance and compliance of the variables with a normal distribution, respectively. The assumptions of parametric testing were not fulfilled by our data. Categorical data was analyzed using the Chi-Square Test. When comparing independent groups (active patient-remission patient groups), the Mann-Whitney U Test was employed. The Spearman Correlation Coefficient was used to assess the connection between the variables.

Categorical variables were displayed as numbers and percentages n (%), whereas continuous variables were displayed as mean  $\pm$  standard deviation. For the differential

diagnosis of active ulcerative colitis patients from patients in remission, the cut-off value was estimated by making an ROC (Receiver Operator Curve) curve of PIV measurement values, and sensitivity and specificity values were found. "SPSS 17.0 for Windows" was utilized to assess the data. For the assessment of statistical significance, the p-value of 0.05 was selected.

## Results

This study included 64 active UC patients and 64 sex and age-matched UC patients in remission, with ages of  $45.33 \pm 14.87$  and  $46.63 \pm 14.54$  years, respectively. Between UC patients in remission and those who were active UC patients, there were no significant differences in sex and age (Table 1).

When the clinical features of UC patients in remission and active UC patients are compared, there were no significant differences between the groups in disease duration and medication ( $p=0.134$ ,  $p=0.495$ , respectively), while there were significant differences between the groups in body temperature, daily defecation, and heart rate ( $p<0.001$ , for all) (Table 1).

**Table 1. Demographic characteristics and clinical features of active UC patients and UC patients in remission**

Parameter	Remission (n=64)	Active (n=64)	p
Age (years)	$46.63 \pm 14.54$	$45.33 \pm 14.87$	0.535 <sup>a</sup>
Sex (n %)			0.288 <sup>b</sup>
Female	37 (57.8)	31 (48.4)	
Male	27 (42.2)	33 (51.6)	
Disease duration (months)	$9.33 \pm 5.60$	$7.92 \pm 5.28$	0.134 <sup>a</sup>
Medication (n %)			0.495 <sup>b</sup>
ASA	41 (64.1)	33 (51.6)	
Monoclonal antibody	1 (1.6)	1 (1.6)	
ASA/Azathioprine/Monoclonal antibody	1 (1.6)	4 (6.3)	
ASA/Azathioprine	6 (9.4)	9 (14.1)	
Body temperature	$36.71 \pm 0.43$	$37.15 \pm 0.63$	$<0.001^a$
Daily defecation	$2.83 \pm 1.24$	$8.95 \pm 2.43$	$<0.001^a$
Heartbeat (beats/min)	$73.75 \pm 8.27$	$79.00 \pm 8.56$	$<0.001^a$

ASA: Acetylsalicylic acid; <sup>a</sup>: Mann-Whitney U Test; <sup>b</sup>: Chi-Square Test.

When the laboratory findings of UC patients in remission and active UC patients are compared, there was no significant difference between the groups in monocyte ( $p=0.328$ ), while there were significant differences between the groups in lymphocyte, hemoglobin, WBC, neutrophil, platelet, ESR, and CRP ( $p=0.028$ ,  $p=0.004$ ,  $p<0.001$ , for all others, respectively). NLR, PLR, and PIV values were  $2.46 \pm 1.24$ ,  $142.20 \pm 60.93$ , and  $516.13 \pm 245.14$ , respectively, in active UC patients and  $1.54 \pm 0.50$ ,  $138.81 \pm 39.52$ , and  $275.68 \pm 133.15$  in remission UC patients. NLR, PLR, and PIV were significantly elevated in active UC patients than those in remission ( $p<0.001$ , for all) (Table 2).

PIV was correlated with WBC ( $r=0.547$ ), ESR ( $r=0.427$ ), CRP ( $r=0.431$ ), NLR ( $r=0.683$ ), PLR ( $r=0.331$ ), and the number of defecations per day ( $p<0.001$ , for all).

According to ROC analysis, the differential diagnostic power of PLR between active ulcerative colitis patients and patients in remission was not statistically significant (AUC: 0.474,  $p=0.613$ ). The optimal NLR cut-off for active UC was 1.87, with specificity and sensitivity of 79.7% and 64.1% (AUC: 0.751,  $p<0.001$ ), respectively. ROC analysis revealed that PIV was the best biomarker to differentiate patients with active ulcerative colitis from patients in remission (AUC: 0.821,  $p<0.001$ ) (Table 3).

**Table 2. Laboratory findings of active UC patients and UC patients in remission**

Parameter	Remission (n=64)	Active (n=64)	p
WBC, $10^9$	$6.37 \pm 2.02$	$11.48 \pm 2.57$	$<0.001^a$
NEUT, $10^9$	$3.61 \pm 1.33$	$6.38 \pm 1.39$	$<0.001^a$
LYM, $10^9$	$2.43 \pm 0.69$	$3.08 \pm 1.33$	0.028 <sup>a</sup>
PLT, $10^9$	$320.33 \pm 77.14$	$379.20 \pm 102.84$	$<0.001^a$
MON, $10^9$	$0.57 \pm 0.19$	$0.59 \pm 0.15$	0.328 <sup>a</sup>
HB, g/l	$12.05 \pm 2.26$	$10.98 \pm 1.87$	0.004 <sup>a</sup>
ESR (mm/h)	$7.06 \pm 7.41$	$43.55 \pm 22.53$	$<0.001^a$
CRP (mg/dl)	$3.66 \pm 1.23$	$39.14 \pm 23.38$	$<0.001^a$
NLR	$1.54 \pm 0.50$	$2.46 \pm 1.24$	$<0.001^a$
PLR	$138.81 \pm 39.52$	$142.20 \pm 60.93$	$<0.001^a$
PIV	$275.68 \pm 133.15$	$516.13 \pm 245.14$	$<0.001^a$

WBC: White blood cell; NEUT: Neutrophil; LYM: Lymphocyte; PLT: Platelet; MON: Monocyte; HB: Hemoglobin; ESR: Erythrocyte sedimentation rate; CRP: C-reactive protein; NLR: Neutrophil-to-lymphocyte ratio; PLR: Platelet-to-lymphocyte ratio; PIV: Pan-immune inflammation value; <sup>a</sup>: Mann-Whitney U Test.

**Table 3. Results of the receiver operating characteristic curve analysis for the NLR, PLR, and PIV**

	AUC	95% CI	Cut-off	Sensitivity	Specificity	p
NLR	0.751	0.667-0.836	1.87	64.1	79.7	<0.001
PLR	0.474	0.372-0.576	130.98	48.4	56.2	0.613
PIV	0.821	0.751-0.892	358.37	73.4	71.9	<0.001

PIV: Pan-immune inflammation value; NLR: Neutrophil-to-lymphocyte ratio; PLR: platelet-to-lymphocyte ratio.

## Discussion

This study aimed to determine whether the PIV can be used as a diagnostic biomarker in assessing disease activity in patients with ulcerative colitis (UC). As a result of this study, PIV can be accepted as a promising marker that contributes to the evaluation of disease activation/remission and severity for ulcerative colitis.

Ulcerative colitis (UC) is a chronic disease characterized by widespread mucosal inflammation in the large intestine.<sup>[1]</sup> Platelets and neutrophils actively participate in the inflammatory responses.<sup>[12,13]</sup> In cases of chronic inflammation, platelets (PLTs) contribute to the amplification of immunological and inflammatory responses.<sup>[14]</sup> In UC, changes in PLT number and function (such as enhanced PLT activation and thrombocytosis) are observed.<sup>[14]</sup> Thrombocytosis has been reported to be associated with UC severity and disease activity.<sup>[15]</sup> Neutrophils have been reported to play a role in the development of intestinal mucosal inflammation and pathogenesis in inflammatory bowel diseases such as UC.<sup>[16]</sup> Studies on the application of CBC-based indices, such as the PLR and NLR, in the prediction of UC disease activity have been conducted.<sup>[4,17]</sup> Feng et al.<sup>[4]</sup> found that NLR and PLR were increased in patients with active UC compared to those in remission and stated that PLR and NLR could be used as markers of disease activity in patients with UC. Akpınar et al.<sup>[17]</sup> stated that NLR and PLR in the active UC group were higher than in the remission and control groups and that high NLR and PLR could predict active disease. As a result of our study, we found that NLR and PLR in active UC patients were higher than in patients in remission. However, in our study, NLR had predictive accuracy for active UC while PLR did not.

In recent years, studies suggesting that PIV plays an important role in the prognosis of inflammatory<sup>[6]</sup>, rheumatic<sup>[18]</sup>, and cardiovascular<sup>[19]</sup> diseases have attracted attention. Neutrophils play an important role in the occurrence and increase of histological damage in the intestinal mu-

cosa in the case of activation in UC patients.<sup>[20]</sup> In the mesenteric vascular system, platelet aggregations participate in neutrophilic accumulations and cause thrombosis, but also show inflammatory properties.<sup>[21]</sup> During active periods of UC, lymphocytes are directed to the intestinal mucosa, and as a result, lymphopenia develops in the peripheral blood.<sup>[22]</sup> The importance of macrophages, which are the most common leukocyte cell subgroups of the intestinal mucosal lumen, in the pathophysiology of ulcerative colitis has been understood in the study conducted with human monocytes.<sup>[23]</sup> Neutrophils, macrophages, and monocytes are involved in the pathophysiology of inflammatory bowel diseases.<sup>[24]</sup> It has been shown that monocytosis and a low lymphocyte/monocyte ratio may serve as diagnostic biomarkers for disease activity in UC patients.<sup>[24]</sup> It has been reported that PIV has better predictive power than NLR.<sup>[25]</sup> It has been proven that PIV is a promising marker for rheumatoid arthritis that contributes to the assessment of disease activation/remission and severity.<sup>[18]</sup> A recent study found that PIV was an independent diagnostic predictor of ulcerative colitis.<sup>[26]</sup> As a result of our study, we found that the PIV in active UC patients was higher than in patients in remission and was an independent diagnostic biomarker in assessing disease activity in patients with UC. Additionally, PIV was correlated with WBC, ESR, CRP, NLR, PLR, and the number of defecations per day. Furthermore, in our study, PIV had the greatest predictive accuracy for active UC. Compared with NLR and PLR, PIV showed superior predictive efficacy in distinguishing patients with active UC from those in remission. This higher predictive ability of PIV could be attributed to its inclusion of platelets, neutrophils, lymphocytes, and monocytes that play a role in the pathophysiology of UC.

PIV can be easily obtained from the patient's CBC results. With the implementation of PIV in routine monitoring and follow-up, doctors can easily evaluate the disease's activity and determine whether additional examination or treatment adjustments are necessary.

Our study has some limitations. First, we used a relatively small sample size in our retrospective study, which was conducted at a single center. Second, there may be selection bias, like all retrospective studies. The third limitation is that patients in the mild group were categorized as being in remission according to Truelove and Witts criteria.

## Conclusion

PIV can be accepted as a promising marker that contributes to the evaluation of disease activation/remission and severity for ulcerative colitis.

## Disclosures

**Ethics Committee Approval:** This study is approved by the Kahramanmaraş Sütçü İmam University Ethics Committee (No. 2023/24-02, Date: 05/12/2023).

**Peer-review:** Externally peer-reviewed.

**Conflict of Interest:** The authors declare no conflict of interest.

**Funding:** The authors declare that they have not received any financial support from any source for this research.

**Author contributions:** Concept – Y.Y., M.I., N.S.A.; Design – Y.Y., M.I., N.S.A.; Supervision – Y.Y., M.I., N.S.A., K.G., B.K.; Materials – Y.Y., M.I., K.G., B.K.; Data Collection – Y.Y., M.I., K.G., B.K.; Analysis and/or interpretation – Y.Y., M.I., N.S.A.; Literature Search – Y.Y., M.I., N.S.A.; Writing – Y.Y., M.I., N.S.A.; Critical Review – Y.Y., M.I., N.S.A., K.G., B.K.

**Data Availability:** The data that support the findings of this study are available from the corresponding author upon reasonable request.

**Acknowledgments:** None.

## References

- Kornbluth A, Sachar DB; Practice Parameters Committee of the American College of Gastroenterology. Ulcerative colitis practice guidelines in adults: American College of Gastroenterology, practice parameters committee. *Am J Gastroenterol* 2010;105(3):501–23.
- Rubin DT, Ananthakrishnan AN, Siegel CA, Sauer BG, Long MD. ACG clinical guideline: Ulcerative colitis in adults. *Am J Gastroenterol* 2019;114(3):384–413.
- Zheng K, Zhang S, Wang C, Zhao W, Shen H. Health-related quality of life in Chinese patients with mild and moderately active ulcerative colitis. *PLoS One* 2015;10(4):e0124211.
- Feng W, Liu Y, Zhu L, Xu L, Shen H. Evaluation of neutrophil-to-lymphocyte ratio and platelet-to-lymphocyte ratio as potential markers for ulcerative colitis: A retrospective study. *BMC Gastroenterol* 2022;22(1):485.
- Uluştaş F, Çobankara V. Pan-immune-inflammation value (PIIV) in lupus nephritis. *Med Sci Discov* 2023;10(4):234–8.
- Turan YB. The prognostic importance of the pan-immune-inflammation value in patients with septic shock. *BMC Infect Dis* 2024;24(1):69.
- Demiröz Taşolar S, Çiftçi N. Role of pan immune inflammatory value in the evaluation of hepatosteatosis in children and adolescents with obesity. *J Pediatr Endocrinol Metab* 2022;35(12):1481–6.
- Truelove SC, Witts LJ. Cortisone in ulcerative colitis: Final report on a therapeutic trial. *Br Med J* 1955;2(4947):1041–8.
- Toran S, Tunc BD, Suvak B, Yıldız 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.
- Xu M, Cen M, Chen X, Chen H, Liu X, Cao Q. Correlation between serological biomarkers and disease activity in patients with inflammatory bowel disease. *Biomed Res Int* 2019;2019:6517549.
- Acarturk G, Acay A, Demir K, Ulu MS, Ahsen A, Yuksel S. Neutrophil-to-lymphocyte ratio in inflammatory bowel disease: As a new predictor of disease severity. *Bratisl Lek Listy* 2015;116(4):213–7.
- Jones HR, Robb CT, Perretti M, Rossi AG. The role of neutrophils in inflammation resolution. *Semin Immunol* 2016;28(2):137–45.
- Thomas MR, Storey RF. The role of platelets in inflammation. *Thromb Haemost* 2015;114(3):449–58.
- Zhou Y, Zhu F, Jing D, Wang Q, Zhou G. Ulcerative colitis and thrombocytosis: Case report and literature review. *Medicine* 2023;102(20):e33784.
- Giannotta M, Tapete G, Emmi G, Silvestri E, Milla M. Thrombosis in inflammatory bowel diseases: What's the link? *Thromb J* 2015;13:14.
- Zhou GX, Liu ZJ. Potential roles of neutrophils in regulating intestinal mucosal inflammation of inflammatory bowel disease. *J Dig Dis* 2017;18(9):495–503.
- Akpınar MY, Ozin YO, Kaplan M, Ates I, Kalkan IH, Kilic ZMY, et al. Platelet-to-lymphocyte ratio and neutrophil-to-lymphocyte ratio predict mucosal disease severity in ulcerative colitis. *J Med Biochem* 2018;37(2):155–62.
- Tutan D, Doğan AG. Pan-immune-inflammation index as a biomarker for rheumatoid arthritis progression and diagnosis. *Cureus* 2023;15(10):e46609.
- Peng A, Zhang B, Wang S, Feng Y, Liu S, Liu C, et al. Comparison of the value of various complex indexes of blood cell types and lipid levels in coronary heart disease. *Front Cardiovasc Med* 2023;10:1284491.
- Smith AM, Rahman FZ, Hayee B, Graham SJ, Marks DJ, Sewell GW, et al. Disordered macrophage cytokine secretion underlies impaired acute inflammation and bacterial clearance in Crohn's disease. *J Exp Med* 2009;206(9):1883–97.

21. Collins CE, Rampton DS, Rogers J, Williams NS. Platelet aggregation and neutrophil sequestration in the mesenteric circulation in inflammatory bowel disease. *Eur J Gastroenterol Hepatol* 1997;9:1213–7.
22. Lin H, Bai Z, Wu Q, Chu G, Zhang Y, Guo X, et al. Inflammatory indexes for assessing the severity and disease progression of ulcerative colitis: A single-center retrospective study. *Front Public Health* 2022;10:851295.
23. Dharmasiri S, Garrido-Martin EM, Harris RJ, Bateman AC, Collins JE, Cummings JRF, et al. Human intestinal macrophages are involved in the pathology of both ulcerative colitis and Crohn disease. *Inflamm Bowel Dis* 2021;27(10):1641–52.
24. Cherfane CE, Gessel L, Cirillo D, Zimmerman MB, Polyak S. Monocytosis and a low lymphocyte to monocyte ratio are effective biomarkers of ulcerative colitis disease activity. *Inflamm Bowel Dis* 2015;21(8):1769–75.
25. Russo P, Palermo G, Iacovelli R, Ragonese M, Ciccarese C, Maioriello G, et al. Comparison of PIV and other immune inflammation markers of oncological and survival outcomes in patients undergoing radical cystectomy. *Cancers* 2024;16(3):651.
26. Mete Yıldırım A, Yıldırım O. Association between pan-immune inflammatory value and ulcerative colitis. *Curr Med Res Opin* 2024;40(4):599–603.