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***Retrospective Cohort Study***

**Effective immune-inﬂammation index for ulcerative colitis and activity assessments**

Zhang MH *et al*. SII evaluate UC and its activity

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**Abstract**

BACKGROUND

The inverse association between systemic immune-inﬂammation index (SII) and overall survival in tumors has been studied.

AIM

To evaluate the hematological indexes in assessing the activity of ulcerative colitis (UC).

METHODS

In this case-control study, 172 UC patients and healthy participants were included. A comparison was made between groups of white blood cells, hemoglobin, platelets, neutrophils, lymphocytes, monocytes, SII, neutrophil-to-lymphocyte ratio (NLR), and platelet-to-lymphocyte ratio (PLR). The relationship between the hematological inflammation has been verified by Spearman correlation analyses. The efficiency of SII, NLR, and PLR in distinguishing UC and severe disease status has been assessed by the receiver operator curve and logistic regression analyses.

RESULTS

The values of SII, NLR and PLR were higher in UC patients than controls (*P* < 0.001) and were positively correlated with Mayo endoscopic score, Extent, degree of ulcerative colitis burden of luminal inflammation (DUBLIN) score and ulcerative colitis endoscopic index of severity (UCEIS). The cut-off NLR value of 562.22 predicted UC with a sensitivity of 79.65% and a specificity of 76.16%. Logistic regression analysis revealed that patients with the SII and NLR levels above the median had a significantly higher risk of UC (*P* < 0.05). Risk factors independently associated with DUBLIN ≥ 3 included SII ≥ 1776.80 (OR = 11.53, *P* = 0.027) and NLR value of 2.67-4.23 (OR = 2.96, *P* = 0.047) on multivariate analysis. Compared with the first quartile, SII ≥ 1776.80 was an independent predictor of UCEIS ≥ 5 (OR = 18.46, *P* = 0.012).

CONCLUSION

SII has a certain value in confirming UC and identifying its activity.

**Key Words:** Ulcerative colitis; Systemic immune-inﬂammation index; Endoscopic score; Neutrophil-to-lymphocyte ratio; Platelet-to-lymphocyte ratio; Disease activity

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**Core Tip:** Although endoscopy examination is the standard for assessing ulcerative colitis (UC) relapse, it is invasive, intolerable and weakly repeatable. Non-invasive parameters can be used to assess disease activity of UC. However, the value of blood routine for predicting UC severity has not been studied in depth. This study evaluated the differential leucocytic ratio, such as systemic immune-inﬂammation index, neutrophil-to-lymphocyte ratio and platelet-to-lymphocyte ratio, to provide easy and reliable methods for disease activity.

**INTRODUCTION**

Ulcerative colitis (UC) is a chronic, non-specific inflammatory condition in the colon, which has recently been increased in Asia. Etiology may be associated with genetic susceptibility, intestinal flora disorders, multiple environmental factors, and abnormal immune disorders[1]. The overall prevalence exceeds 0.3% in North America, Oceania and most European countries[2]. Studies have shown that inflammatory bowel disease (IBD) is the third highest risk factor for colorectal cancer (CRC), and 18% of IBD-related CRC cases occur in patients with a history of less than 8 years[3]. Cross-sectional imaging under endoscopy may accurately reflect current inflammation of the intestines. Endoscopy biopsy holds a dominant role in determining a diagnosis, disease severity, treatment response, recurrence, and CRC. However, it is expensive, invasive, weakly repeatable, and the disease may aggravate by an operation. Hence, we continue to explore the non-invasive measures to determine the severity of UC and the level of inflammatory burden.

Blood, urine, and fecal indicators may prevent these limitations and have been studied to indicate the inflammatory state. Urine markers are rarely studied and have no clinical application so[4]. The most important acute phase serological markers are C-reactive protein (CRP) and the erythrocyte sedimentation rate (ESR), which are useful in predicting relapse, severity, and response to treatment[5-8]. Fecal calprotectin (FC) can be derived from neutrophils and may reflect the destruction of the epithelial barrier and the inflammatory process of the intestine. Compared to blood markers and symptomatic flare, FC is the best to trace relapse, particularly after colectomy, with values ≤ 100 μg/mg, indicating remission without a need to examine colonoscopy[9,10]. However, due to the variation in testing methodologies and cut-off values, non-specific markers, including ESR, CRP, and FC, are vulnerable to various pathological conditions and not generally accepted criteria for disease monitoring[11]. Thus, constant striving for new indicators is to improve diagnostic efficiency, cost performance, safety, and convenience.

Recent studies have shown that platelet-to-lymphocyte ratio (PLR) and neutrophil-to-lymphocyte ratio (NLR) could help to diagnose UC and its activity[12-14]. However, the potential role of PLR and NLR in patients with UC remains controversial. Compared PLR and NLR only consists of two circulating immune cells, the systemic immune-inﬂammation index (SII) integrates platelets (PLT), neutrophils (N), and lymphocytes (L). SII is a useful biomarker of the inflammatory status and immune response. A higher SII value have a relatively low lymphocyte count and high neutrophil and platelet counts, indicating a stronger inflammatory response as well as a weaker cell-mediated immunity. Previous research indicated that elevated SII was a weak prognostic predictor of various malignant solid tumors, including digestive system tumor, renal cancer, germ-cell tumors, metastatic castration-resistant prostate cancers, non- and small cell lung cancers, *etc*[15-17]. Infiltration and metastasis of malignant tumors are inflammatory-mediated processes. However, there was no study available in the literature regarding SII at UC. Hence, in the present research, we evaluated the diagnostic value of SII and examined if SII had more advantages in assessing the severity of the disease than NLR or PLR in patients with UC.

**MATERIALS AND METHODS**

***Participants***

The data included from January 2017 to December 2019, which consists of 172 patients with UC and 172 healthy controls from Huaian No. 1 People’s Hospital. Data on sex, age, duration of illness, frequency of defecation, stool consistency, pulse, and body temperature were extracted from the medical record. The diagnosis of ulcerative colitis was based on the consensus for the diagnosis and treatment of IBD as a UC group. Participants with the hematological disease, liver, and kidney damage, tumors, certain forms of autoimmune diseases, and infections were excluded. The study was approved by the medical ethics committee of The Affiliated Huai’an No. 1 People’s Hospital of Nanjing Medical University Institutional. An informed consent form was waived in a retrospective study.

***Laboratory investigation***

The venous blood was taken from the fasting in the morning and then analyzed by the automatic analyzer certified by our hospital. A blood test can yield measurements of white blood cells (WBC), hemoglobin (HB), PLT, N, L, and M. Based on the above parameters, SII, PLR, and NLR were determined.

***Colonoscopy score***

The patient underwent colonoscopy at the endoscopic center of our hospital after the intestinal preparation. The endoscopic outputs were documented in detail by professional experts, and then rated based on previous literature. Extent is classified as follows[18]: E1 = proctosigmoiditis, E2 = left-sided colitis (distal to splenic flexure), E3 = pancolitis (proximal to splenic flexure). The Mayo endoscopic score (MES)[19] was considered to be 0 points for normal or inactive lesions, 1 point for mild (redness, the reduced texture of blood vessel, and mildly brittle mucosa), 2 points for moderate (significant erythema, disappeared texture of blood vessel, brittle or eroded mucosa), and 3 points (spontaneous mucosal bleeding or ulceration). The score for degree of ulcerative colitis burden luminal inflammation (DUBLIN) is the MES multiplied by the maximal extent score[20]. The ulcerative colitis endoscopic index of severity (UCEIS) includes three parts: Vascular pattern, bleeding, erosions, and ulcer of the mucosa, with each component was graded between 0 and 3 (normal to severe)[21].

***Statistical analysis***

The analysis was performed using SPSS 26.0 (SPSS Inc., Chicago, IL, United States) software. The data has been stratified according to age and gender. The matching of propensity score between patients and controls was precise and fuzzy with 1:1.02 age and sex matching. The Kolmogorov-Smirnov test was done for detecting normality. A comparison of data between groups used by the Mann-Whitney U test for continuous variables and the chi-squared test for categorical variables. The relationship between inflammatory markers in blood and extent, MES, DUBLIN score, and UCEIS was verified by Spearman correlation analyses. The receiver operating characteristic (ROC) curves were constructed to evaluate the diagnostic efficiency of SII, NLR, and PLR. Multivariate logistic regression was performed to identify the risk factor of UC and the severe UC status (DUBLIN score ≥ 3 and UCEIS ≥ 5). The first quartile has been set as a reference, while *P* < 0.05 was set as being statistically significant.

**RESULTS**

***Participants’ clinical characteristics***

The median age of UC and control groups was 48.00 and 47.50 years, respectively (*P* = 0.545). No statistically signiﬁcant difference in age and gender between UC patients and controls has been observed. The median SII values of active UC patients and controls were 1063.23 and 384.86, respectively (*P* < 0.001). UC patients had lower levels of HB and L and higher values of WBC, PLT, N, NLR, PLR, and SII as compared to the healthy subjects (*P* < 0.05) (Table 1).

***Correlation of inflammation markers and endoscopic score***

SII, NLR, and PLR showed a positive correlation with endoscopic severity scores (Extent, MES, DUBLIN score, and UCEIS), while SII was the most reliable indicator of inflammation markers (Table 2). The relationship between NLR, PLR, Extent, MES, DUBLIN score and UCEIS were weak (all *P* > 0.05). Although Spearman correlation analysis in active UC indicated a significant correlation of SII with Extent, DUBLIN score and UCEIS, no correlation was found with MES (*r* = 0.124, *P* = 0.106).

***ROC curves of inflammation markers***

Analysis of the ROC curve showed that the optimum SII cut-off point for UC was 562.22, with area under curve (AUC), sensitivity, speciﬁcity of 0.856, 79.65%, 76.16%, respectively (Table 3). The AUC value of the NLR was 0.858, and there was no statistical difference relative to SII (*P* = 0.86). The cut-off value of NLR was 2.66, with 75% sensitivity and 82.56% specificity. The AUC of SII and NLR were statistically different from that of PLR (*P* < 0.01).

***Inflammation markers for UC and disease severity***

Multivariate logistic regression has shown that SII and NLR are associated with UC and higher endoscopic scores. Compared to the lowest quartile, the SII and NLR levels in the third and highest quartile levels were independent risk factors for UC (*P* < 0.05) (Table 4), but were not the values in other levels. The Odds ratio (OR) for DUBLIN ≥ 3 was 11.53 and 2.96 at SII ≥ 1776.80 and NLR of 2.67-4.23, respectively (*P* < 0.05) (Table 5). Besides, Table 6 shows that the OR was 18.46 at SII ≥ 1776.80 for UCEIS ≥ 5 (*P* < 0.05).

**DISCUSSION**

Blood routine is the most commonly used detection index, but further studies are required for its use as an indicator of IBD activity. The present study aimed to determine if SII could diagnose and predict the severity of the UC. The preliminary findings of our study were the elevated levels of N, P, and the reduced levels of L in patients with UC. Various pathogenic factors may disrupt the balance of the intestinal mucosal immune system, either directly or indirectly. Polymorphonuclear neutrophils are first recruited into the intestine when the body is suffering from an infection or mucosal injury. Activated neutrophils also developed overproduced proteases, including elastase, proteinase, and matrix metalloproteinases, which may reduce the levels of junctional proteins, leading to epithelial barrier defects[22,23]. Lymphocyte subsets were considered to cause the occurrence of IBD ulcers. It has been shown that that abnormal gut-homing lymphocyte has identified endothelial ligands by expressing specific surface receptors, causing overactive immune response and damage to the intestine[24]. Development and clinical trials of the anti-leukocyte adhesion agent are underway, while United States Food and Drug Administration approved the powder injection of vedolizumab in 2014 for moderate to severe UC and CD patients with reduced efficacy of conventional drugs and anti-tumor necrosis factor (anti-TNF) antibodies[25]. Our results have confirmed the lower levels of active UC in peripheral blood lymphocytes. Histopathological examination of UC showed diffuse and chronic infiltration of the inflammatory cell[26]. Neutrophils, lymphocytes, plasma cells, monocytes, and eosinophils can be seen in the lamina propria, neutrophils in the glandular epithelial cells. It is characterized by cryptitis and a formation of the crypt abscess. Substantial evidence suggests that platelets serve as a bridge between coagulation and inflammation[27,28]. Previous studies have indicated that platelet count, PLT-PLT, and PLT-leukocyte aggregates increased in blood circulation, and colonic veins were associated with disease activity[29]. Upon activation, platelets secrete inflammatory molecules derived from platelets, synthesize a series of mediators, and generate extracellular vesicles in IBD inflammatory cascades[30]. Platelets that express P-selectin, glycoproteins (GP)Ⅱb/Ⅲa, CD-40 Ligand (CD40L), and GP53, may interact with inflammatory cells that cause tissue injury. Meanwhile, inflammatory mediators such as interleukin-6 (IL-6) will stimulate bone marrow thrombopoiesis and accelerate the metabolism of PLT, forming a vicious circle[29,31,32]. Drugs that inhibit PLT inflammatory makers may alleviate the course of disease in IBD models despite the risk of aggravating ulcer bleeding. For patients with UC, higher SII values will result from elevated peripheral blood neutrophils and platelets, including lower lymphocytes.

Objective studies[12,33] found that NLR and PLR levels could predict activation of the disease and endoscopic mucosal injury. Similar results were found that NLR, PLR, and SII levels were higher in UC patients and correlated with the endoscopic score. In distinguishing UC, the AUC of SII and NLR was higher than that of PLR, and the SII was an independent indicator of UC and for the status of severe disease. SII is a novel inflammatory marker based on N, L, and P. Chronic intestinal mucosal inflammation in patients with UC has been associated with the risk of hospitalization, colectomy, thrombosis, cardiovascular problems, and malignant tumors[34]. Monitoring the burden of intestinal inflammation is, therefore, critical for evaluating the progress of the disease activity and recognizing patients who need to upgrade their treatment regimens. The differential leucocytic ratio is an easily applicable and cost effective test, which could be more helpful to monitor the inflammatory burden when they are used together with the serum laboratory inflammation index. Other studies suggested that higher levels of SII predicted shorter overall survival or progression-free survival in various malignancies because the inflammatory reaction was crucial for the tumor progression[15,16].

The current goal of UC treatment is mucosal healing. While not all endoscopic scores have thoroughly been validated so far, MES and UCEIS have frequently used indicators to measure endoscopic inflammation activity. The DUBLIN score was determined based on the MES. We found that the NLR, PLR, and SII levels were correlated with endoscopic scores. In this context, Akpinar *et al*[12] demonstrated that NLR and PLR could identify and predict active diseases under endoscopy, as described by the Rachmilewitz endoscopic activity index. Another study showed that lower levels of both baseline NLR and PLR were associated with mucosal healing in UC patients after 54 wk of anti-TNF therapy[35]. Thus, the present study found that the higher levels of SII were independently associated with UC, DUBLIN ≥ 3, and UCEIS ≥ 5 by logistic regression analysis. The risks of treatment failure, colectomy, drug improvement, and enhancement of treatment plan were related to DUBLIN ≥ 3[20]. Four grades of UCEIS scores were stratified: remission (0-1), mild (2-4), moderate (5-6), and severe (7-8)[36]. When UCEIS was ≥ 5, 27/54 (50%) needed rescue therapy, and 18/54 (33%) came to colectomy during the follow-up, as compared to UCEIS ≤ 4[37]. The results of this article show that SII could be used as brief information on activity and degree of mucosal damage prior to the endoscopic examination, in particular for patients with high responsiveness to invasive investigations or unable to obtain equipment during the active period. Although a promising efficacy needs further study, non-invasive indicators do have a supporting role in predicting active lesions.

Some limitations need to be mentioned here. First, this retrospective analysis was not able to remove the possible bias. Second, the cases studied come from a single institution, and it is unknown in their region or country. Third, it was rudimentary to investigate the SII value in the blood, and subsequent studies should be carried out on the relationship between SII and histological injury-related indicators. To conclude, this research first provided evidence that SII could assist diagnosis. Defining a known cut-off value will help to determine the diagnosis and the severity of UC if the present study is further verified.

**CONCLUSION**

Our analysis showed that the SII, NLR and PLR were significantly elevated and were related to endoscopic severity in UC patients, which would help in diagnosing UC and distinguish the endoscopic severity of UC. Moreover, since elevated levels of SII was an independent risk factor of patients with active UC, paying attention to this part of the patient may identify and prevent the progression of the disease as early as possible. The SII values can be used to track the severity of disease and provide physicians with information to adjust treatment protocols, when colonoscopy is not available. Further research is expected between differential leucocytic ratio and histological severity of mucosal injury. This first application of the SII was based on evidence to determine the importance of diagnostic of UC, and the severity of the disease.

**ARTICLE HIGHLIGHTS**

***Research background***

Peripheral blood-derived inflammation-based scores have limited clinical value in ulcerative colitis (UC).

***Research motivation***

Assess the clinical disease activity.

***Research objectives***

Explore a simple and readily available predictor.

***Research methods***

Mann-Whitney U test, spearman correlation analyses, the receiver operator curve, logistic regression analyses.

***Research results***

Systemic immune-inﬂammation index (SII), neutrophil-to-lymphocyte ratio, and platelet-to-lymphocyte ratio values were correlated with endoscopic score.

***Research conclusions***

SII could help confirm UC and identify the activity.

***Research perspectives***

Track the activity of disease and guide adjustment of treatment protocols.

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**Table1 Clinical and laboratory characteristics of patients with ulcerative colitis and healthy controls**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Control (*n* = 172)** | **Ulcerative colitis (*n* = 172)** | ***P* value** |
| Male, *n* (%) | 96 (55.81%) | 91 (52.90%) | 0.588 |
| Age (year) | 47.50 (37.00-56.00) | 48.00 (35.00-57.00) | 0.545 |
| WBC (× 109/L) | 5.37 (4.47-6.29) | 7.26 (5.85-9.23) | < 0.001 |
| HB (g/L) | 138.00 (125.00-152.50) | 131.00 (122.00-143.00) | 0.001 |
| PLT (× 109/L) | 213.00 (179.50-251.00) | 245.00 (197.00-312.00) | < 0.001 |
| N (× 109/L) | 3.11 (2.55-3.86) | 5.48 (4.07-7.25) | < 0.001 |
| L (× 109/L) | 1.67 (1.35-2.08) | 1.25 (0.97-1.70) | < 0.001 |
| M (× 109/L) | 0.30 (0.24-0.37) | 0.33 (0.18-0.49) | 0.295 |
| SII (× 109/L) | 384.86 (282.31-557.42) | 1063.23 (587.24-1787.87) | < 0.001 |
| NLR (%) | 1.83 (1.45-2.47) | 4.31 (2.73-6.47) | < 0.001 |
| PLR (%) | 127.49 (98.71-156.21) | 191.87 (130.97-263.89) | < 0.001 |

WBC: White blood cell; HB: Hemoglobin; PLT: Platelets; N: Neutrophils; L: Lymphocytes; M: Monocytes; NLR: Neutrophil-lymphocyte ratio; PLR: Platelet-lymphocyte ratio; SII: Systemic immune-inflammation index.

**Table 2 Correlation analysis between systemic immune-inflammation index and endoscopic score**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **MES** | | **Extent** | | **DUBLIN** | | **UCEIS** | |
|  | ***r*** | ***P* value** | ***r*** | ***P* value** | ***r*** | ***P* value** | ***r*** | ***P* value** |
| SII | 0.124 | 0.106 | 0.174 | 0.023 | 0.193 | 0.011 | 0.227 | 0.003 |
| NLR | 0.068 | 0.375 | 0.146 | 0.056 | 0.139 | 0.068 | 0.130 | 0.088 |
| PLR | 0.043 | 0.577 | 0.060 | 0.432 | 0.074 | 0.336 | 0.108 | 0.158 |

UCEIS: Ulcerative colitis endoscopic index of severity; MES: Mayo endoscopic score; DUBLIN: Degree of ulcerative colitis burden of luminal inflammation; SII: Systemic immune-inﬂammation index; NLR: Neutrophil-lymphocyte ratio; PLR: Platelet-lymphocyte ratio.

**Table 3 Receiver operating characteristic analyses of systemic immune-inflammation index, neutrophil-lymphocyte ratio and platelet-lymphocyte ratio in diagnosing ulcerative colitis**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variables** | **Cut-off** | **AUC (95%CI)** | **Sensitivity (%)** | **Specificity (%)** | ***P* value** |
| SII | > 562.22 | 0.856 (0.814-0.891) | 79.65 | 76.16 | < 0.001 |
| NLR | > 2.66 | 0.858 (0.817-0.893) | 75.00 | 82.56 | < 0.001 |
| PLR | > 156.54 | 0.754 (0.705-0.799) | 65.70 | 76.16 | < 0.001 |

AUC: Area under the receiver operating characteristic curve; CI: Confidence interval; SII: Systemic immune-inflammation index; NLR: Neutrophil-lymphocyte ratio; PLR: Platelet-lymphocyte ratio.

**Table 4 Multivariate logistic regression analyses of the relationship between inflammatory indicators and ulcerative colitis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **B** | ***P* value** | **Odds ratio** | **95%CI** |
| SII |  |  |  |  |
| ≤ 346.44 | Reference |  |  |  |
| 346.45-574.88 | 0.56 | 0.241 | 1.76 | 0.69-4.52 |
| 574.89-1084.51 | 1.24 | 0.031 | 3.45 | 1.12-10.63 |
| ≥ 1084.52 | 3.03 | 0.001 | 20.64 | 3.57-119.18 |
| NLR |  | | | |
| ≤ 1.69 | Reference |  |  |  |
| 1.70-2.53 | 0.64 | 0.163 | 1.91 | 0.77-4.71 |
| 2.54-4.60 | 1.32 | 0.010 | 3.73 | 1.37-10.18 |
| ≥ 4.61 | 2.53 | 0.001 | 12.52 | 2.77-56.60 |
| PLR |  | | | |
| ≤ 111.93 | Reference |  |  |  |
| 111.94-149.11 | -0.15 | 0.718 | 0.87 | 0.40-1.90 |
| 149.11-203.33 | -0.26 | 0.560 | 0.77 | 0.32-1.84 |
| ≥ 203.34 | -0.38 | 0.517 | 0.68 | 0.21-2.18 |

SII: Systemic immune-inflammation index; NLR: Neutrophil-lymphocyte ratio; PLR: Platelet-lymphocyte ratio.

**Table 5 Multivariate logistic regression analyses of the relationship between inflammatory indicators and degree of ulcerative colitis burden of luminal inflammation ≥ 3**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **B** | ***P* value** | **Odds ratio** | **95%CI** |
| SII |  |  |  |  |
| ≤ 589.63 | Reference |  |  |  |
| 589.64-1047.18 | 0.51 | 0.372 | 1.66 | 0.55-5.04 |
| 1047.19-1776.79 | 0.86 | 0.299 | 2.36 | 0.47-11.98 |
| ≥ 1776.80 | 2.45 | 0.027 | 11.53 | 1.33-100.15 |
| NLR |  | | | |
| ≤ 2.66 | Reference |  |  |  |
| 2.67-4.23 | 1.09 | 0.047 | 2.96 | 1.01-8.65 |
| 4.24-6.46 | 0.85 | 0.237 | 2.33 | 0.57-9.49 |
| ≥ 6.47 | -0.20 | 0.820 | 0.82 | 0.15-4.49 |
| PLR |  | | | |
| ≤ 132.35 | Reference |  |  |  |
| 132.36-190.31 | -0.59 | 0.286 | 0.56 | 0.19-1.63 |
| 190.32-263.47 | -0.33 | 0.620 | 0.72 | 0.20-2.65 |
| ≥ 263.48 | -1.06 | 0.201 | 0.35 | 0.07-1.76 |

SII: Systemic immune-inflammation index; NLR: Neutrophil-lymphocyte ratio; PLR: Platelet-lymphocyte ratio.

**Table 6 Multivariate logistic regression analyses of the relationship between inflammatory indicators and ulcerative colitis endoscopic index of severity ≥ 5**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **B** | ***P* value** | **Odds ratio** | **95%CI** |
| SII |  |  |  |  |
| ≤ 589.63 | Reference |  |  |  |
| 589.64-1047.18 | 1.09 | 0.146 | 2.98 | 0.69-12.94 |
| 1047.19-1776.79 | 1.57 | 0.129 | 4.81 | 0.63-36.56 |
| ≥ 1776.80 | 2.92 | 0.012 | 18.46 | 1.89-180.30 |
| NLR |  | | | |
| ≤ 2.66 | Reference |  |  |  |
| 2.67-4.23 | 0.06 | 0.934 | 1.06 | 0.27-4.23 |
| 4.24-6.46 | 0.05 | 0.954 | 1.05 | 0.20-5.41 |
| ≥ 6.47 | -0.61 | 0.534 | 0.54 | 0.08-3.71 |
| PLR |  | | | |
| ≤ 132.35 | Reference |  |  |  |
| 132.36-190.31 | -1.06 | 0.139 | 0.35 | 0.09-1.41 |
| 190.32-263.47 | -0.96 | 0.212 | 0.38 | 0.09-1.73 |
| ≥ 263.48 | -1.20 | 0.174 | 0.30 | 0.05-1.70 |

SII: Systemic immune-inflammation index; NLR: Neutrophil-lymphocyte ratio; PLR: Platelet-lymphocyte ratio.