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Systemic Immune Inflammation Index in Ankylosing Spondylitis Patients

Ankilozan Spondilit Hastalarında Sistemik İmmün Enflamasyon İndeksi

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Abstract

Objective: Our objective was to assess the relationship between disease activity and the systemic immune-inflammation index [SII; (platelet count × neutrophil count / lymphocyte count)] in individuals with ankylosing spondylitis (AS).
Materials and Methods: A total of 201 participants (130 AS patients and 71 healthy volunteers) aged 18-65 years were included in this single center cross-sectional study. Based on their ratings on the Bath Ankylosing Spondylitis Disease Activity index (BASDAI), patients with AS were split into two groups: remission (n=90, those with BASDAI <4) and active disease (n=40, those with BASDAI >4). The study employed Spearman correlation analysis to assess the relationship between SII and C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), BASDAI, Ankylosing Spondylitis Disease Activity score-ESR (ASDAS-ESR), and ASDAS-CRP. The effectiveness of SII and other measures in evaluating the disease activity in the active AS and remission AS groups was ascertained using receiver operating characteristic curve analysis.
Results: SII values were significantly higher in the AS group than healthy controls, as well as in the active AS group than AS patients in remission (p<0.001 for each). SII values were positively correlated with CRP [Spearman correlation coefficient (rs): 0.384, p<0.001], ESR (rs: 0.243, p=0.005), BASDAI (rs: 0.668, p<0.001), ASDAS-ESR (rs: 0.619, p<0.001) and ASDAS-CRP (rs: 0.700, p<0.001) values. The optimal cut-off value for the determination of AS disease activity was found to be 530.22×10^9/L (area under the curve: 0.902, 95% confidence interval: 0.838-0.947, sensitivity: 72.50% and specificity: 92.22%).
Conclusion: When assessing the activity of AS disease, SII appears to be a useful biomarker.
Keywords: Ankylosing spondylitis, C-reactive protein, neutrophil to lymphocyte ratio, systemic immune-inflammation index

Öz

Amaç: Ankilozan spondilit (AS) hastalarında sistemik immün-enflamasyon indeksi [SII; (platelet sayısı × nötrofil sayısı / lenfosit sayısı)] ile hastalık aktivitesi arasındaki ilişkiyi değerlendirmeyi amaçladık.
Gereç ve Yöntem: Tek merkezli kesitsel çalışmamıza 18-65 yaş arası toplam 201 katılımcı (130 AS hastası ve 71 sağlıklı gönüllü) dahil edildi. AS hastaları Bath Ankilozan Spondilit Hastalık Aktivite indeksi (BASDAI) skorlarına göre remisyon grubu (n=90, BASDAI <4 olanlar) ve aktif hastalık grubu (n=40, BASDAI ≥4 olanlar) olmak üzere iki gruba ayrıldı. SII'nin C-reaktif protein (CRP), eritrosit sedimantasyon hızı (ESH), BASDAI, Ankilozan Spondilit Hastalık Aktivite skoru-ESH (ASDAS-ESH) ve ASDAS-CRP ile korelasyonu Spearman korelasyon analizi ile değerlendirilmiştir. Aktif AS ve remisyondaki AS gruplarında SII ve diğer parametrelerin hastalık aktivitesini değerlendirmedeki performansını belirlemek için alıcı işletim karakteristik eğrisi analizi kullanıldı.
Bulgular: SII değerleri AS grubunda sağlıklı kontrollere göre ve aktif AS grubunda remisyondaki AS hastalarına göre anlamlı derecede yüksekti (her biri için p<0,001). SII değerleri CRP [Spearman korelasyon katsayısı (rs): 0,384, p<0,001], ESH (rs: 0,243, p=0,005), BASDAI (rs: 0,668, p<0,001), ASDAS-ESH (rs: 0,619, p<0,001) ve ASDAS-CRP (rs: 0,700, p<0,001) değerleri ile pozitif korelasyon gösterdi. AS hastalık aktivitesini belirlemek için optimal kesme değeri $530,22 \times 10^9$/L olarak bulunmuştur (eğri altındaki alan: 0,902, %95 güven aralığı: 0,838-0,947, duyarlılık: %72,50 ve özgüllük: %92,22).
Sonuç: SII, AS hastalık aktivitesini değerlendirmede etkili bir biyobelirteç gibi görünmektedir.
Anahtar kelimeler: Ankilozan spondilit, C-reaktif protein, nötrofil/lenfosit oranı, sistemik immün-enflamasyon indeksi

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Introduction

Ankylosing spondylitis (AS), a chronic inflammatory rheumatic disease, is characterized by inflammatory low back pain resulting from spondylitis and sacroiliitis. The condition typically peaks in the second and third decades of life (1). Apart from spinal involvement, other musculoskeletal findings (i.e., arthritis, enthesitis and dactylitis) and findings related to extra-articular involvement (i.e., anterior uveitis, psoriasis and inflammatory bowel disease) may also accompany the clinical picture (2). In the advanced stages of the disease, kyphosis and limited spine mobility may appear with the development and progression of syndesmophytes in the vertebrae (3). These conditions likely to occur in the course of the disease may limit physical functions and impair quality of life in AS patients (4). When monitoring AS patients, erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) are commonly used to gauge the level of inflammation (5). Besides the conventional acute phase reactants, other markers calculated from complete blood count parameters such as neutrophil-to-lymphocyte ratio (NLR) and platelet (PLT)-to-lymphocyte ratio (PLR) have also been investigated in many studies (6-11).

The Ankylosing Spondylitis Disease Activity score-CRP (ASDAS-CRP), the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI), and the ASDAS-ESR are the current measures used to evaluate AS disease activity.

Systemic immune-inflammation index (SII), calculated from complete blood count parameters using a formula of "PLT x neutrophil count / lymphocyte count", was firstly defined as a useful index in hepatocellular cancer patients (12). Later on, its potential utility has also been considered for other malignancies, ulcerative colitis, uveitis, Bell's palsy, irritable bowel syndrome, hidradenitis suppurativa, psoriasis and obstructive sleep apnea syndrome (13-24). In the setting of rheumatic diseases, SII is suggested to be used as a novel index in assessment of disease activity in rheumatoid arthritis, Behçet's disease, adult-onset Still's disease and anti-neutrophil cytoplasmic antibody-associated vasculitis (25-28). Already there are 2 studies evaluating the SII in relation to disease activity in AS patients (29,30). In one of these studies, only 50 AS patients were evaluated (30). In the other study, correlation of SII with CRP, ESR and BASDAI was evaluated, correlation assessment was not performed with ASDAS (29).

Therefore, the purpose of our study was to assess the relationship in a larger group of AS patients between ASDAS and SII values in addition to ESR, CRP, and BASDAI.

Materials and Methods

This single center cross-sectional study included 130 patients (aged 18-65) who were being followed at rheumatology outpatient clinics of Bursa Uludağ University Faculty of Medicine, Department of Physical Medicine and Rehabilitation and who had been diagnosed with AS based on Modified New York criteria (31).

Patients with comorbid diseases such as hypertension, diabetes mellitus, coronary artery disease, metabolic syndrome, malignancy, infection, anemia, parathyroid diseases, thyroid dysfunction, chronic obstructive respiratory disease, obstructive sleep apnea syndrome, allergic rhinitis, asthma, active smoking and other inflammatory rheumatic diseases were excluded from the study. A total of 71 healthy volunteers with no pathological findings on physical examination and laboratory tests on their admission to outpatient clinics served as the control group. The study protocol was approved by the Bursa Uludağ University Faculty of Medicine Clinical Research Ethics Committee (approval date: February 23, 2022, decision no: 2022-4/25). Informed consent was obtained from all subjects in accordance with the Declaration of Helsinki. Data on patient demographics (age, gender), educational status, occupational status, disease duration, medical treatments, CRP and ESR levels, neutrophil, lymphocyte and PLT counts were recorded. SII, NLR and PLR values were calculated.

Disease activity was assessed with BASDAI, ASDAS-ESR and ASDAS-CRP scores. Based on exhaustion, spinal pain, joint pain/swelling, areas of localized soreness, morning stiffness length, and morning stiffness intensity, the 6-item BASDAI index is used to assess disease activity. Higher total scores indicate increased disease activity. The score ranges from 0 to 10 (32). BASDAI scores ≥4 denotes the active disease. Patients classified as being in remission were those with a BASDAI <4, and patients classified as having active disease were those with a BASDAI >4.

Statistical Analysis

The conformity of continuous variables to the normal distribution was examined using the Shapiro-Wilk test. Continuous variables were expressed using mean ± standard deviation or median (minimum:maximum) values; categorical variables were expressed as n (%). The Mann-Whitney U test and the independent samples t-test were used to compare the groups based on the findings of the normality test. Categorical variables were analyzed using the chi-square test. The correlation of SII values with CRP, ESR, BASDAI, ASDAS-ESR and ASDAS-CRP values were examined with Spearman correlation analysis. SPSS (Version 26.0. Armonk, NY: IBM Corp.) program was used for statistical analysis. Power analysis is calculated to be 99% and the effect size was 0.66. Type I error was accepted as 5% and $p<0.05$ was considered to be statistically significant.

Results

In total, 201 people were included in our study: 130 patients with AS diagnoses and 71 healthy controls. Age and gender differences between the AS group and the healthy control group were not statistically significant ($p>0.05$). When comparing the AS group to the healthy control group, the values of SII, neutrophil, PLT, and NLR were considerably greater ($p<0.05$). Regarding PLR and lymphocyte levels, there was no discernible difference between the two groups ($p>0.05$).

Demographic and clinical characteristics and laboratory results of all participants are summarized in Table 1.

When AS patients were evaluated with respect to BASDAI score, 90 patients with a score <4 were considered in the remission group, and 40 patients with a score ≥4 were in the active group. There was no statistically significant difference between active AS and remission AS groups in terms of age, gender, disease duration, education level and occupational status (p>0.05). SII, neutrophil, lymphocyte, PLT, CRP, ESR, NLR, PLR, BASDAI, ASDAS-ESR and ASDAS-CRP values were significantly higher in the active AS group than in the AS in remission (p<0.05). The clinical and demographic characteristics and laboratory results of the active AS and the remission AS groups are summarized in Table 2.

SII values were found to be positively correlated with CRP [Figure 1a: Spearman correlation coefficient (rs): 0.384, p<0.001], ESR (Figure 1b: rs: 0.243, p=0.005), BASDAI (Figure 1c: rs: 0.668, p<0.001), ASDAS-ESR (Figure 1d: rs: 0.619, p<0.001) and ASDAS-CRP (Figure 1e: rs: 0.700, p<0.001) values. Data on correlation analysis of SII values with ESR, CRP, BASDAI, ASDAS-ESR and ASDAS-CRP values are shown in Table 3 and Figure 1.

Receiver operating characteristic (ROC) curve was used to evaluate disease activity in AS patients. Area under the ROC curve was found to be 0.902 for SII [95% confidence interval (CI): 0.838-0.947], 0.837 for NLR (95% CI: 0.762-0.896), 0.812 for PLR (95% CI: 0.734-0.875), 0.728 for ESR (95% CI: 0.643-0.802) and 0.732 for CRP (95% CI: 0.647-0.806). The optimal cut-off point for SII in evaluation of disease activity was found to be 530.22×10^9/L (sensitivity: 72.50%, specificity: 92.22%). ROC curve analyses are shown in Table 4 and Figure 2.

Discussion

In AS, similar to the other inflammatory rheumatic diseases, indicators are needed to determine and monitor disease activity. ESR, CRP, BASDAI, ASDAS-ESR and ASDAS-CRP are routinely used for this purpose in AS patients. In order to evaluate AS disease activity, studies have been conducted on new indicators that can be calculated from complete blood count parameters (6-11,29,30). In order to offer a new indicator, we studied SII and found that it is positively correlated with inflammation and disease activity in AS patients.

Table 1. Clinical, demographic and laboratory parameters of AS patients and healthy controls

	AS (n=130)	Control (n=71)	p-value
Age (year)	44 (26-63)	43 (18-64)	0.583
Sex, n (%)			
Female	34 (26.2)	25 (35.2)	0.197
Male	96 (73.8)	46 (64.8)	
Level of education, n (%)			
Primary education	50 (38.5)	-	-
High school	47 (36.1)	-	
University	33 (25.4)	-	
Job, n (%)			
Housewife	14 (10.8)	-	-
Retired	32 (24.6)	-	
Employee	56 (43.1)	-	
Officer	20 (15.4)	-	
Freelancer	8 (6.2)	-	
Medications, n (%)			
NSAIDs	24 (17.5)	-	-
bDMARDs	111 (81)	-	
Sulfasalazine	2 (1.5)	-	
Neutrophils ($\times10^9$/L)	4.26 (2.08, 8.30)	3.44 (2.11, 5.86)	**<0.001**
Lymphocytes ($\times10^9$/L)	2.50 (1.21, 4.85)	2.44 (1.51, 3.82)	0.494
PLT ($\times10^9$/L)	261.40 (157.00, 499.80)	236.90 (135.00, 339.00)	**0.007**
NLR	1.58 (0.73, 4.48)	1.48 (0.79, 2.82)	**0.007**
PLR	107.67 (42.69, 251.97)	98.04 (39.82, 160.31)	0.143
SII ($\times10^9$/L)	435.33 (177.74, 1297.02)	371.54 (163.73, 532.23)	**<0.001**

Data are reported as mean ± standard deviation and median (minimum:maximum). AS: Ankylosing spondylitis, bDMARDs: Biological disease-modifying antirheumatic drugs, NLR: Neutrophil-to-lymphocyte ratio, NSAIDs: Non-steroidal anti-inflammatory drugs, PLR: Platelet-to-lymphocyte ratio, PLT: Platelet, SII: Systemic immune-inflammation index. P<0.05= statistical significance level

Table 2. Clinical, demographic, and laboratory parameter comparisons between the AS patient population in remission and the active group

	Active AS (n=40)	Remission AS (n=90)	p-value
Age (year)	44.70 (SD:9.56)	44.42 (SD:8.47)	0.869
Sex, n (%)			
Female	14 (35.0)	20 (22.2)	0.136
Male	26 (65.0)	70 (77.8)	
Disease duration (year)	12 (1-37)	12 (1-41)	0.340
Level of education, n (%)			
Primary education	12 (30.0)	38 (42.2)	0.431
High school	17 (42.5)	30 (33.3)	
University	11 (27.5)	22 (24.4)	
Job, n (%)			
Housewife	5 (12.5)	9 (10.0)	0.707
Retired	8 (20.0)	24 (26.7)	
Employee	19 (47.5)	37 (41.1)	
Officer	7 (17.5)	13 (14.4)	
Freelancer	1 (2.5)	7 (7.8)	
Medications, n (%)			
NSAIDs	15 (36.6)	9 (9.4)	**<0.001**
bDMARDs	26 (63.4)	85 (88.5)	
Sulfasalazine	0 (0)	2 (2.1)	
Neutrophils ($\times10^9$/L)	5.01 (2.61-8.30)	4.04 (2.08-7.57)	**<0.001**
Lymphocytes ($\times10^9$/L)	2.23 (1.21-3.73)	2.57 (1.42-4.85)	**<0.001**
PLT ($\times10^9$/L)	298.00 (178.10, 499.80)	244.25 (157.00, 446.00)	**<0.001**
NLR	2.21 (1.15, 4.48)	1.43 (0.73, 3.77)	**<0.001**
PLR	139.55 (68.58, 246.87)	92.30 (42.69, 251.97)	**<0.001**
SII ($\times10^9$/L)	665.14 (384.32, 1297.02)	380.29 (177.74, 1237.39)	**<0.001**
CRP (mg/L)	6.93 (2.00, 198.30)	2.00 (0.4, 19.90)	**<0.001**
ESR (mm/h)	12.50 (4, 88)	4 (2, 46)	**<0.001**
BASDAI	4.85 (4.00, 8.00)	1.20 (0.00, 3.20)	**<0.001**
ASDAS-ESR	2.99 (2.00, 5.30)	1.41 (0.50, 3.20)	**<0.001**
ASDAS-CRP	3.30 (2.10, 5.60)	1.45 (0.60, 2.50)	**<0.001**

Data are reported as mean ± standard deviation (SD) and median (minimum:maximum). ASDAS-ESR: Ankylosing Spondylitis Disease Activity score-erythrocyte sedimentation rate, ASDAS-CRP: Ankylosing Spondylitis Disease Activity score-C-reactive protein, AS: Ankylosing spondylitis, BASDAI: Bath Ankylosing Spondylitis Disease Activity index, bDMARDs: Biological disease-modifying antirheumatic drugs, CRP: C-reactive protein, ESR: Erythrocyte sedimentation rate, NLR: Neutrophil-to-lymphocyte ratio, NSAIDs: Non-steroidal anti-inflammatory drugs, PLR: Platelet-to-lymphocyte ratio, PLT: Platelet, SII: Systemic immune-inflammation index. P<0.05= statistical significance level

In the presence of inflammation, an increase in neutrophil and PLT counts and a decrease in lymphocyte counts are expected (33). The increase in neutrophil count in AS patients is suggested to be associated with an increase in the differentiation and maturation of hematopoietic progenitor cell through many cytokines, such as tumor necrosis factor-alpha (TNF-α), interleukin (IL)-1, IL-6, IL-8 and granulocyte macrophage colony stimulating factor (6). Decrease in lymphocyte counts in AS patients is considered to occur as a result of apoptosis; and although the exact mechanism is not clear, the increase in PLT counts has been suggested to be mediated by factors such as thrombin, histamine, TNF-α and IL-12 (29). Given the association of inflammation with increase in neutrophil and PLT counts and decrease in lymphocyte counts, the NLR, PLR and SII values as calculated from neutrophil, lymphocyte and PLT values can also be expected to be high, in relation to inflammation, in AS patients.

While neutrophil and PLT values were found to be greater in AS patients compared to the healthy control group (p<0.001 for each), no significant difference was identified in lymphocyte values (p=0.336) in a study by Liang et al. (11). Regarding the values of lymphocytes, PLT, and neutrophils, our findings are

consistent with this research. Liang et al. (11) also reported significantly higher PLR and NLR values in the AS group compared to the healthy control group (p values: p<0.001, p=0.006, respectively). In our results, NLR values were significantly higher (p=0.007) in the AS group compared to the healthy control group in line with the study by Liang et al. (11), however, no significant difference was found in terms of our PLR values (p=0.143). Also, while Liang et al. (11) reported that PLR values (p=0.045) but not NLR values (p=0.086) were significantly higher in patients with BASDAI ≥4 compared to those with BASDAI <4, our findings revealed that both PLR and NLR values (p<0.001 for each) were significantly higher in active AS group than in the remission AS group.

Hence, we obtained similar results with the study of Liang et al. (11) in terms of PLR but different results in terms of NLR.

In a study conducted in AS patients by Coşkun et al. (6), neutrophil, PLT and NLR values were reported to be significantly higher (p<0.001 for each) in the AS vs. control group, and our results are in line with this study. In terms of lymphocyte values, while Coşkun et al. (6) reported significantly lower lymphocyte counts in the AS group (p=0.012), our findings revealed no significant difference in terms of lymphocyte values.

Similar to our results, Gökmen et al. (10) reported significantly higher neutrophil and NLR values in AS patients vs. control

Table 3. SII and CRP, ESR, BASDAI, ASDAS-ESR, and ASDAS CRP correlations in AS patients

AS (n=130)		
	rs	**p-value**
CRP	0.384	<0.001
ESR	0.243	0.005
BASDAI	0.668	<0.001
ASDAS-ESR	0.619	<0.001
ASDAS-CRP	0.700	<0.001

AS: Ankylosing spondylitis, ASDAS-ESR: Ankylosing Spondylitis Disease Activity score-erythrocyte sedimentation rate, ASDAS-CRP: Ankylosing Spondylitis Disease Activity score-C-reactive protein, BASDAI: Bath Ankylosing Spondylitis Disease Activity index, CRP: C-reactive protein, ESR: Erythrocyte sedimentation rate, SII: Systemic immune-inflammation index, rs: Spearman correlation coefficient; p<0.05= statistical significance level.

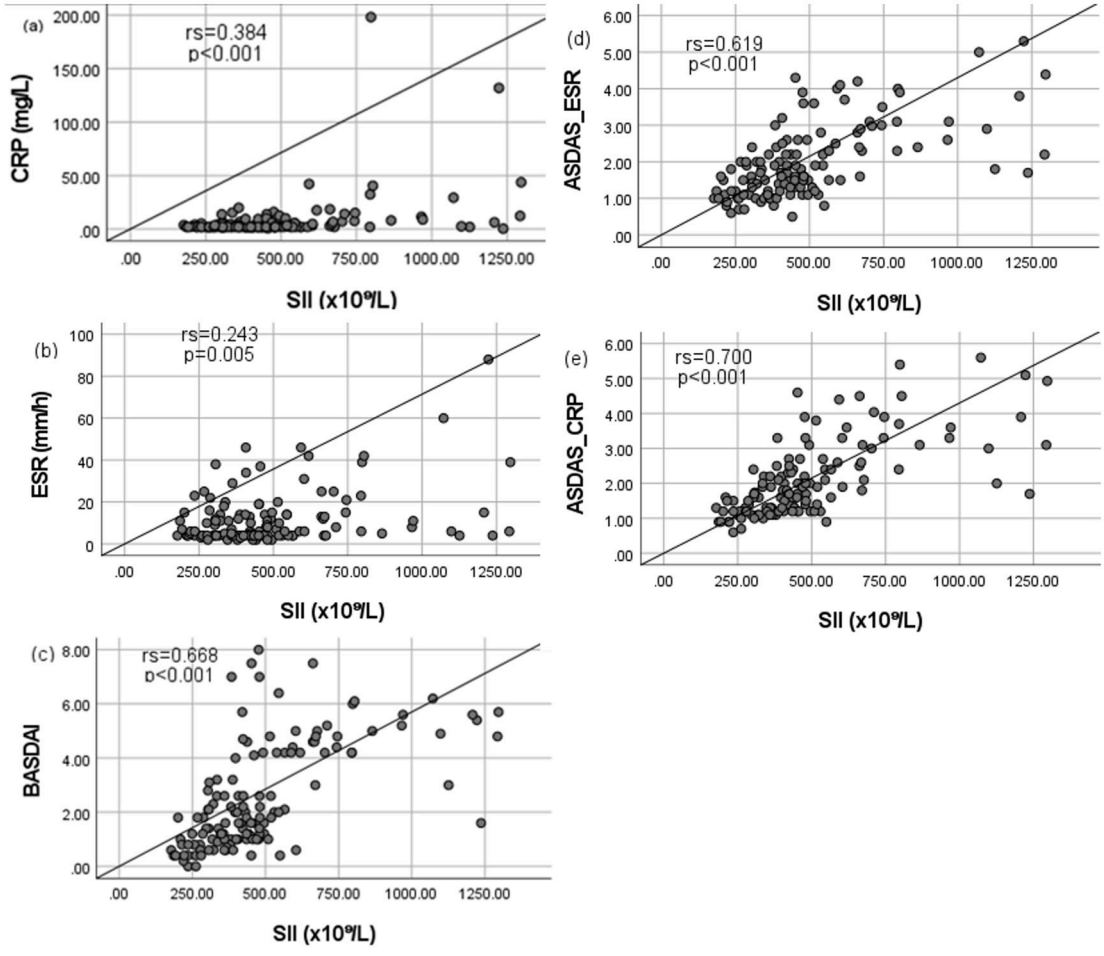

Figure 1. SII correlations with CRP (a), ESR (b), BASDAI (c), ASDAS-ESR (d), and ASDAS-CRP (e)
ASDAS-ESR: Ankylosing Spondylitis Disease Activity score-erythrocyte sedimentation rate, ASDAS-CRP: Ankylosing Spondylitis Disease Activity score-C-reactive protein, BASDAI: Bath Ankylosing Spondylitis Disease Activity index, CRP: C-reactive protein, ESR: Erythrocyte sedimentation rate, SII: Systemic immune-inflammation index

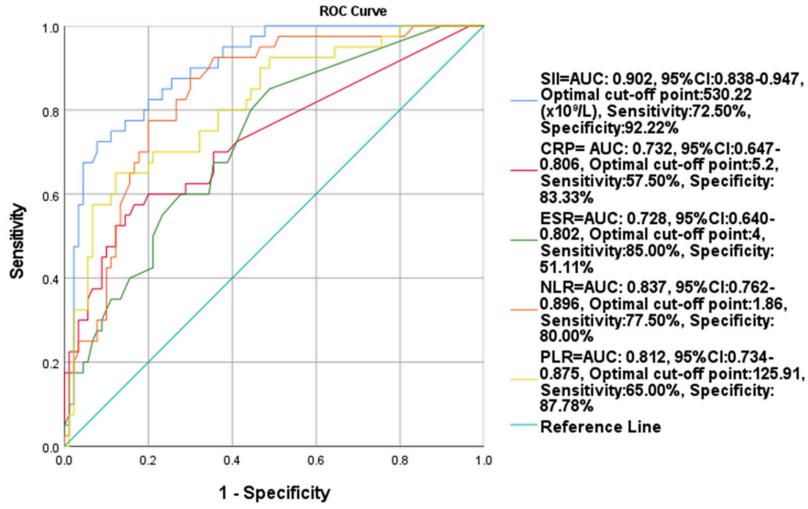

Figure 2. SII, NLR, PLR, CRP, and ESR receiver operating characteristic (ROC) curves to distinguish AS patients from those who are in remission
AS: Ankylosing spondylitis, AUC: Area under the curve, CI: Confidence intervals, CRP: C-reactive protein, ESR: erythrocyte sedimentation rate, NLR: Neutrophil-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio, SII: Systemic immune-inflammation index

Table 4. Receiver operating characteristic curves analysing of the SII, CRP, ESR, NLR, and PLR

	AUC	95% CI	Optimal cut-off point	Sensitivity	Specificity
SII	0.902	0.838-0.947	530.22 (×10⁹/L)	72.50%	92.22%
CRP	0.732	0.647-0.806	5.2 (mg/L)	57.50%	83.33%
ESR	0.728	0.643-0.802	4 (mm/h)	85.00%	51.11%
NLR	0.837	0.762-0.896	1.86	77.50%	80.00%
PLR	0.812	0.734-0.875	125.91	65.00%	87.78%

AUC: Area under the curve, CI: Confidence intervals, CRP: C-reactive protein, ESR: Erythrocyte sedimentation rate, NLR: Neutrophil-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio, SII: Systemic immune-inflammation index

group (p<0.001 for each), along with no significant difference between groups in terms of lymphocyte values (p=0.23).

In a study by Zeb et al. (7), on NLR and PLR values in AS patients and control subjects, NLR and PLR values were reported to be significantly higher in AS patients than in healthy controls, as well as in the active AS (BASDAI ≥4) vs. remission AS (BASDAI <4) group (p<0.01 for each). Our results support this study in terms of NLR values. When PLR values are taken into account, our investigation indicated that, in contrary to Zeb et al.'s (7) work, there was no significant difference (p=0.143) between the AS group and the control group. However, PLR values were considerably greater (p<0.001) in the active AS group compared to the remission AS group.

Seng et al.'s (8) investigation on axial spondyloarthritis patients revealed no discernible difference in NLR and PLR values (p=0.60 and p=0.40, respectively) between the groups with active and inactive illness. The neutrophil, lymphocyte, PLT, NLR and PLR values seem to vary across different studies, including the present study. Instead of using NLR and PLR values calculated from lymphocyte with neutrophil or PLT counts only, usage of SII value, obtained by a calculation including all of these parameters (neutrophil, lymphocyte and PLT), seems to be more valuable tool in determining the disease activity.

Two previous studies to date have investigated the SII, as a novel marker, in AS patients (29,30). One of them evaluated the indexes calculated from complete blood count parameters in inflammatory rheumatic diseases. The authors reported significantly higher SII levels in AS patients compared to healthy controls (p<0.001), and also in active AS patients compared to inactive AS patients (p=0.013). It was also noted that SII values were correlated with ESR (p=0.003), CRP (p=0.001) and ASDAS (p=0.013) values. In ROC curve analysis, the cut-off value for SII was reported to be 697.66 [area under the curve (AUC): 0.674, 95% CI: 0.504-0.845, sensitivity: 71.4%, specificity: 53.3%] (30). Our findings also revealed significantly higher SII values in AS patients vs. healthy controls, and in active AS group vs. remission AS group (p<0.001 for each), in addition to correlation of SII values with ESR (p=0.005), CRP (p<0.001), ASDAS-ESR (p<0.001) and ASDAS-CRP (p<0.001) values. We also found a correlation of SII with BASDAI (p<0.001), which was not evaluated in the above-mentioned study. In the ROC curve analysis, we determined the cut-off value for SII as 530.22×10⁹/L (AUC: 0.902, 95% CI: 0.838-0.947, sensitivity: 72.50%, specificity: 92.22%).

SII values were shown to be considerably higher in AS patients compared to the healthy control group and in the active AS

group compared to the AS group in remission in Wu et al.'s (29) other AS study (p<0.001 for both). The data also showed a positive correlation between SII levels and CRP (rs=0.483, p<0.001), ESR (rs=0.374, p<0.001), and BASDAI (rs=0.667, p<0.001) values, as reported by the authors. The best indicator for assessing disease activity was found to be SII, with a reported cut-off value of 513.2 in ROC curve analysis (AUC: 0.877, 95% CI: 0.813-0.941, sensitivity: 86.84%, specificity: 83.33%). Our findings also revealed correlations between SII and ESR, CRP, BASDAI. We have also found correlation of SII with ASDAS-ESR and ASDAS-CRP, which was not assessed in the study by Wu et al. (29).

The single-center design and the relatively small sample sizes for the AS and healthy control groups are the two main limitations of our investigation. Owing to the cross-sectional design of our investigation, it was not possible to assess how patient-taken drugs affected SII levels. To ascertain whether SII is a useful tool for evaluating AS disease activity, more extensive prospective multi-center trials are required.

Conclusion

Our findings revealed that SII, which can easily be calculated from readily available complete blood count parameters routinely ordered in the follow up of AS patients, is a simple useful and efficient index in assessment of disease activity in AS patients, without causing any additional cost.

Ethics

Ethics Committee Approval: The study protocol was approved by the Bursa Uludağ University Faculty of Medicine Clinical Research Ethics Committee (approval date: February 23, 2022, decision no: 2022-4/25).

Informed Consent: Informed consent was obtained from all subjects in accordance with the Declaration of Helsinki.

Authorship Contributions

Surgical and Medical Practices: S.M., L.A., Concept: S.M., A.A., L.A., B.B.Y., Design: S.M., A.A., L.A., B.B.Y., Data Collection or Processing: S.M., A.A., L.A., B.B.Y., Analysis or Interpretation: S.M., A.A., L.A., B.B.Y., Literature Search: S.M., A.A., L.A., B.B.Y., Writing: S.M., L.A.

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