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Association between disease activity and HALP score in ankylosing spondylitis patients

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ABSTRACT

Objectives: The goal of this research was to assess HALP score (Hemoglobin, Albumin, Lymphocyte, Platelet) as a potential indicator of disease activity among patients with Ankylosing Spondylitis (AS).

Methods: Data from 260 individuals (130 AS patients and 130 healthy controls) were retrospectively reviewed. Clinical and demographic information was collected, and the AS group was divided into remission and active disease subgroups for comparison.

Results: In contrast to the group of healthy controls, AS patients had a lower HALP score (P<0.001). The HALP score was notably lower in the active patient group than in the remission group (P=0.025). The HALP score and the erythrocyte sedimentation rate were found to be negatively correlated (r= -0.307, P<0.001). Additionally, significant negative correlations were identified between the HALP score and the following parameters: Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) (r= -0.208, P=0.017), Bath Ankylosing Spondylitis Functional Index (BASFI) (r= -0.195, P=0.026), Ankylosing Spondylitis Disease Activity Score using C-reactive protein (ASDAS-CRP) (r= -0.199, P=0.024), and Visual Analog Scale (r= -0.229, P=0.009). The optimal HALP score cut-off for determining disease activity was established as ≤0.56 (AUC: 0.619, 95% CI: 0.518-0.721, sensitivity: 80.00%, specificity: 40.00%).

Conclusions: This study found that the HALP score was lower in active AS patients compared to those in remission. Therefore, the HALP score may serve as a potential marker for assessing disease activity in AS patients.

Keywords: Inflammation marker, HALP score, ankylosing spondylitis

Ankylosing spondylitis (AS) is a chronic, progressive inflammatory disorder that primarily affects the axial skeleton, leading to spondylitis and sacroiliitis, but it can also involve peripheral arthritis, enthesitis, dactylitis, anterior uveitis, aortic insufficiency, atherosclerosis, osteoporosis, and subclinical intestinal inflammation [1]. AS has a prevalence of approximately 1 in 200 individuals in the general population, with its onset typically occurring before the age of 45 [2]. It also occurs due to systemic inflammation in AS and causes irreversible damage to the joints, dysfunction and decreased mobility of the patient. When left untreated, AS can cause significant functional decline, loss of work capacity, and a deterioration in quality of life. Thus, early detection of disease activity and accurate prediction of long-term

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prognosis are paramount for effective clinical management [1, 3]. Ankylosing Spondylitis Disease Activity Score-CRP (ASDAS-CRP), Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) and ASDAS-ESR are the current activity indices used to evaluate disease activity in AS. In addition to the CRP or ESR score, this indices also includes four other self-reported items: back pain, peripheral pain or swelling, length of morning stifness, and patient global assessment of disease activity [4]. Though ESR and CRP are routinely used as indicators of rheumatic disease activity, these markers exhibit low sensitivity and specificity. In AS patients, both ESR and CRP are normal in approximately half of the patients despite having active sacroiliitis, especially in the absence of peripheral arthritis. [5-7]. ASDAS-CRP and ASDAS-ESR activity indices are dependent on ESR and CRP, do not reflect disease activity sufficiently in cases of low CRP, ESR is affected by factors such as age and gender, and clinical and these parameters must be brought together for accurate measurement. BASDAI includes parameters such as pain, fatigue, joint swelling and limited movement perceived by patients. Therefore, it causes subjective responses and difficulty in application [4, 5]. Therefore, there is a need for reliable biomarkers that can reflect disease activity more accurately.

The HALP (hemoglobin, albumin, lymphocyte, platelet) score, which includes these markers, is calculated with the formula serum albumin (g/L) × hemoglobin (g/L) × lymphocyte count (/L) ÷ platelet count (/L) [8, 9]. Inflammation-related markers such as CRP, leukocytes, platelets, ferritin and albumin often change their values in diseases with systemic chronic inflammation such as cancer and AS. Many studies have been conducted showing that the HALP score can predict the prognosis of various types of cancer [8, 10]. In a study conducted on anti-neutrophil cytoplasmic antibody-associated vasculitis (ANCA), the HALP score was suggested as a new index to evaluate disease activity. [11-13]. It is important to determine disease activity in AS with systemic inflammation. To our knowledge, there is no previous study examining the relationship between HALP score and disease activity.

The aim of this study was to examine the relationship between disease activity and HALP score in AS patients.

METHODS

Participants

There were 130 AS patients recorded retrospectively in the Rheumatology Clinic of Recep Tayyip Erdoğan University Faculty of Medicine between July 2019 and August 2024. Patients were diagnosed with AS considering the classification guidelines established by the International Working Group of the Assessment of Spondyloarthritis [14]. 130 healthy individuals with normal clinical and laboratory parameters, matched for age, gender and BMI, were included in the study in our outpatient clinic.

Exclusion Criteria

Patients with blood diseases that would affect hematological parameters, liver diseases, kidney diseases such as glomerulonephritis, acute and/or chronic infections, gastrointestinal diseases that would cause protein loss, other rheumatological diseases, pregnancy, diabetes mellitus, and patients with insufficient information were eliminated from the research. Exclusion criteria were established based on clinical, laboratory and imaging findings.

Disease Activity

Visual Analog Scale (VAS): In the clinical setting, VAS is the assessment of pain intensity on a scale from 0 to 10 on a line. 0 represents no pain, and 10 represents the most severe pain level. Patients recorded the intensity of the pain they experienced on this line. Bath Ankylosing Spondylitis Disease Activity Index (BASDAI): An index evaluates the illness activity of AS. It consists of 6 questions in total and evaluates the severity of level of disease's activity on a 0-10 scale. Bath Ankylosing Spondylitis Functional Index (BASFI): An index evaluates functional capacity in individuals with AS. It consists of 10 questions and evaluates the degree of physical function impairment between 0 and 10. Ankylosing Spondylitis Disease Activity Score using C-reactive protein (ASDAS-CRP): It is a score that measures illness activity in patients with AS and also includes CRP levels. It shows illness activity with a score between 0 and 10. The 6-item Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) is used to assess disease activity based on fatigue, spine pain, joint pain/swelling, localized pain

Table 1. Comparison of AS patients' laboratory, clinical, drug-use, and demographic characteristics with those of the healthy group

Variables	Healthy Group (n=130)	AS (n=130)	Cohen's d	P value
Age (year)	40.54 ± 9.81	39.82 ± 10.24	0.072	0.566
BMI (kg/m^2)	28.37 (17.19 - 43.71)	27.34 (16.07 - 43.28)	0.187	0.134
Sex, n (%)				-
Female	70 (53.8)	70 (53.8)	0.000	1.000
Male	60 (46.2)	60 (46.2)		
Family History	-	53 (40.8)	-	-
Duration of illness (year)	-	7.77 ± 5.5	-	-
Alcohol use	2 (1.5)	8 (6.2)	0.242	0.103
Smoking	35 (26.9)	52 (40)	0.280	**0.035**
Peripheral Arthritis	-	25 (19.2)	-	-
Anterior uveitis	-	18 (13.8)	-	-
Dactylitis	-	1 (0.8)	-	-
Enthesitis	-	34 (26.2)	-	-
Sacroiliitis	-	92 (70.8)	-	-
Medications, n (%)				
NSAID	-	55 (42.3)	-	-
Anti-TNF	-	73 (56.2)		
Anti IL-17	-	2 (1.5)		
Laboratory parameters				
WBC (×10^3/µL)	6.550 (3.680-11.900)	7.816 (4.090-15.600)	0.812	**<0.001**
Neutrophils (×10^3/µL)	3.59 (1.78-8.62)	4.92 (2.13-11.39)	0.851	**<0.001**
Lymphocytes (×10^3/µL)	2.12 (1.05-5.36)	2.2 (1.02-4.34)	0.200	0.108
Monocytes (×10^3/µL)	0.39 (0.2-0.85)	0.51 (0.11-0.92)	0.854	**<0.001**
HGB (g/dL)	14 (7.5-17.5)	13 (10-17)	0.511	**<0.001**
PLT (×10^3/µL)	256 (133-416)	298 (192-627)	0,862	**<0.001**
NLR	1.69 (0.52-5.16)	2.18 (0.78-7.75)	0.573	**<0.001**
PLR	119.72 (55.41-246.67)	136.68 (65.67-401.83)	0.411	**0.001**
CRP (mg/L)	2 (0.230)	6 (0.3-94)	1.168	**<0.001**
ESR (mm/h)	7 (2-40)	12 (2-62)	0.584	**<0.001**
Alb (g/dL)	4.6 (4-5.5)	4.5 (3.3-39)	0.437	**0.001**
HALP score	0.55 (0.22-1.21)	0.44 (0.14-5.42)	0.577	**<0.001**
HLA B27	-	79 (60.8)	-	-
ASDAS-CRP	-	2.37±0.92		
BASDAI	-	4.96±2.05		
BASFI	-	3.79±2.41		
VAS	-	6.27±2.67		

Data are shown as mean±standard deviation or median (range) or n (%). AS=Ankylosing Spondylitis, BMI=Body mass index, NSAID=Nonsteroidal anti-inflammatory drugs, Anti-TNF=Anti-tumor necrosis factor, IL-17=Interleukin-17, WBC=White blood cell, PLT=Platelet, NLR=Neutrophil to lymphocyte ratio, PLR=Platelet to lymphocyte ratio, HGB=hemoglobin, CRP=C-reactive protein, ESR=Erythrocyte sedimentation rate, Alb=Albumin, HALP score=hemoglobin (g/dL) × albumin (g/dL) × lymphocyte (10^3/µL) / Platelet (10^3/µL), HLA B27=Human leukocyte antigen-B27, ASDAS-CRP=Ankylosing Spondylitis Disease Activity Score, BASDAI=Bath Ankylosing Spondylitis Disease Activity Index, BASFI=Bath Ankylosing Spondylitis Functional Index, VAS=Visual Pain Score.

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

Variables	Remission AS (n=45)	Active AS (n=85)	Cohen's d	P value
Age (year)	40.67±10.58	39.38±10.09	0.125	0.496
BMI (kg/m^2)	26.95±4.66	27.96±5.82	0.192	0.313
Sex, n (%)				
Female	18 (40)	52 (61.2)	0.265	**0.034**
Male	27 (60)	33 (38.8)		
Family History	17 (37.8)	36 (42.4)	0.040	0.751
Duration of illness (year)	6 (2-21)	6 (1-26)	0.031	0.800
Alcohol use	3 (6.7)	5 (5.9)	0.000	1.000
Smoking	18 (40)	34 (40)	0.000	1.000
Peripheral Arthritis	8 (17.8)	17 (20)	0.038	0.943
Anterior uveitis	4 (8.9)	14 (16.5)	0.148	0.356
Dactylitis	1 (2.2)	0 (0)	-	-
Enthesitis	13 (28.9)	21 (24.7)	0.064	0.759
Sacroiliitis	44 (97.8)	80 (94.6)	0.290	0.141
Medications, n (%)				
NSAID	13 (28.9)	42 (49.4)	0.326	**0.023**
Anti-TNF	32 (71.1	41 (48.2)		
Anti IL-17	0 (0)	2 (2.4)		
Laboratory parameters				
WBC (×10^3/µL)	7.700 (4.090-11.860)	8.170 (4.870-15.600)	0.108	0.386
Neutrophils (×10^3/µL)	4.63 (2.13-7.97)	5 (2.8-11.39)	0.233	0.062
Lymphocytes (×10^3/µL)	2.31 (1.29-3.9)	2.17 (1.02-4.34)	0.138	0.267
Monocytes (×10^3/µL)	0.53 ± 0.17	0.53 ± 0.16	0.004	0.972
HGB (g/dL)	13.9 (11-17)	13 (10-16)	0.146	0.240
PLT (×10^3/µL)	291 (199-627)	301 (192-547)	0.225	0.071
NLR	1.96 (0.78-4.69)	2.28 (1.07-7.75)	**0.307**	**0.015**
PLR	128.28 (72.57-264.74)	139.54 (65.67-401.83)	**0.261**	**0.037**
ESR (mm/h)	12 (2-51)	12 (2-62)	0.088	0.477
CRP (mg/L)	6 (0.3-60.8)	6 (0.4-94)	0.109	0.381
Alb (g/dL)	4.4 (3.7-39)	4.5 (3.3-5.2)	0.050	0.689
HALP score	0.51 (0.23-5.42)	0.42 (0.14-1.01)	**0.280**	**0.025**
ASDAS-CRP	1.3 (0.8-2.2)	2.9 (1.2-5.1)	**1.258**	**<0.001**
BASDAI	3.2 (0.2-3.9)	5.7 (4 -10)	**1.426**	**<0.001**
BASFI	2 (0-7.3)	4.3 (0.2-9.8)	**0.653**	**<0.001**
VAS	4 (0-8)	8 (1-10)	**1.052**	**<0.001**

Data are shown as mean±standard deviation or median (range) or n (%). AS=Ankylosing Spondylitis, BMI=Body mass index, NSAID=Nonsteroidal anti-inflammatory drugs, Anti-TNF=Anti-tumor necrosis factor, IL-17=Interleukin-17, WBC=White blood cell, PLT=Platelet, NLR=Neutrophil to lymphocyte ratio, PLR=Platelet to lymphocyte ratio, HGB=hemoglobin, CRP=C-reactive protein, ESR=Erythrocyte sedimentation rate, Alb=Albumin, HALP score=hemoglobin (g/dL) × albumin (g/dL) × lymphocyte (10^3/µL) / Platelet (10^3/µL), HLA B27=Human leukocyte antigen-B27, ASDAS-CRP=Ankylosing Spondylitis Disease Activity Score, BASDAI=Bath Ankylosing Spondylitis Disease Activity Index, BASFI=Bath Ankylosing Spondylitis Functional Index, VAS=Visual Pain Score.

areas, morning stiffness length, and morning stiffness intensity. Higher total scores indicate increased disease activity. The score ranges from 0 to 10. BASDAI scores ≥4 indicate active disease. Patients classified as in remission were those with BASDAI <4, and patients classified as having active disease were those with BASDAI ≥4 [4, 15].

Data Collection

Gender, age, body mass index (BMI), habits, the duration of the disease, clinic, medications used, hemoglobin, white blood cell, lymphocyte, neutrophil, platelet, neutrophil to lymphocyte ratio (NLR), platelet lymphocyte ratio (PLR), albumin, ESR, CRP, VAS, BASDAI and ASDAS-CRP scores of the individuals included in the study were recorded. The HALP score was determined utilizing the formula the following: hemoglobin (g/L) × lymphocyte count (10^3/μL) × serum albumin (g/L) / platelet count (10^3/μL) [8].

Statistical Analysis

Data analysis was conducted using IBM SPSS 26 software. The Kolmogorov-Smirnov and Shapiro-Wilk tests were applied to assess the normality of the data. For normally distributed data, group comparisons were performed using an independent two-sample t-test, while the Mann-Whitney U test was utilized for non-normally distributed data. Categorical data were compared between groups using the Pearson chi-square test and Fisher's exact test. Effect sizes were presented with Cohen's d (Cohen, 1988), which was developed for proportions tests (Rosenthal & DiMatteo, 2001, p. 71; comp. Elis, 2010, P. 28) and difference tests. The relationship between inflammation scores that were not normally distributed within the patient group was examined using Spearman's rho correlation coefficient. The diagnostic adequacy of BASFI, VAS and ASDAS-CRP scores for BASDAI level 4 and above (active disease) within the patient group was evaluated using the receiver operating characteristic curve (ROC) analysis. For continuous variables, the results are shown as mean ± standard deviation and median (range); for categorical variables, they are shown as frequency (%). The significance level for the study was determined to be less than 0.05.

Table 3. Relationship between HALP score and BASDAI, BASFI, VAS, ASDAS-CRP, CRP and ESR in AS patients

	HALP Score	
	r	P value
BASDAI	-0.208	**0.017**
BASFI	-0.195	**0.026**
VAS	-0.229	**0.009**
ASDAS-CRP	-0.199	**0.024**
CRP (mg/L)	-0.015	0.863
ESR (mm/h)	-0.307	**<0.001**

AS=Ankylosing Spondylitis, BASDAI=Bath Ankylosing Spondylitis Disease Activity Index, BASFI=Bath Ankylosing Spondylitis Functional Index, VAS=Visual Pain Score, HALP score=hemoglobin (g/dL) × albumin (g/dL) × lymphocyte (10^3/μL) / Platelet (10^3/μL), ASDAS-CRP=Ankylosing Spondylitis Disease Activity Score, CRP=C-reactive protein, ESR=Erythrocyte sedimentation rate, r=Spearman's rho correlation coefficient.

RESULTS

The study included a total of 260 participants, comprising 130 individuals diagnosed with AS (age range: 19-68 years, mean age: 39.82±10.24 years) and 130 healthy controls (age range: 19-68 years, mean age: 40.54±9.81 years). No statistically significant differences were found between the AS patients and healthy control groups regarding age, BMI, gender, alcohol consumption, and lymphocyte count (P>0.05). A comparison between the AS and healthy groups revealed statistically significant differences in smoking status (P=0.035), WBC (P<0.001), neutrophil (P<0.001), monocyte (P<0.001), platelet (P<0.001), CRP (P<0.001), ESR (P<0.001), Albumin (P=0.001), NLR (P<0.001), PLR (P=0.001) and HALP score values (P<0.001) (Table 1).

AS patients were divided into two groups based on BASDAI score: 45 patients in the remission group (score <4) and 85 patients in the active group (score ≥4). Gender (P=0.034), medication use (P=0.023), NLR (p=0.015), PLR (P=0.037), HALP score (P=0.025), ASDAS-CRP (P<0.001), BASDAI (P<0.001) and BASFI (P<0.001) results were statistically significantly higher in the active group than in the remission AS group (Table 2).

There was a negative significant correlation between HALP score and BASDAI (Spearman correlation coefficient (r): -0.208, P=0.017), BASFI (r: -0.195, P= 0.026), VAS (r: -0.229, p= 0.009), ASDAS-

Table 4. Receiver operating characteristic curves analysing of the BASFI, VAS, ASDAS CRP, HALP score, NLR, and PLR

	AUC (%95 CI)	P value	Cutt-off	Sensitivity	Specificity
BASFI	0.779 (0.697-0.862)	**<0.001**	≥ 2.9	76.47%	64.44%
VAS	0.901 (0.849-0.953)	**<0.001**	≥ 7.0	74.12%	88.64%
ASDAS-CRP	0.958 (0.927-0.989)	**<0.001**	≥ 2.3	84.71%	100.00%
HALP score	0.619 (0.518-0.721)	**0.025**	≤ 0.56	80.00%	40.00%
NLR	0.622 (0.516-0.728)	**0.023**	≥11.7	92.94%	28.89%
PLR	0.603 (0.501-0.705)	0.056	-		

BASFI=Bath Ankylosing Spondylitis Functional Index, VAS=Visual Pain Score, ASDAS-CRP=Ankylosing Spondylitis Disease Activity Score, HALP score=hemoglobin (g/dL) × albumin (g/dL) × lymphocyte (10^3/μL) / Platelet (10^3/μL), NLR=Neutrophil to lymphocyte ratio, PLR=Platelet to lymphocyte ratio.

CRP (r= -0.199, P=0.024) and ESR (r= -0.307, P<0.001). No negative significant correlation was found between HALP score and CRP (P>0.863). In other words, as HALP score decreased, disease activities and pain scores increased (Table 3).

When the activities of AS patients were evaluated on the receiver operating characteristic curve (ROC), the area under the curve (AUC) was 0.779 [95% confidence interval (CI): 0.697-0.862] for BASFI, 0.901 (95% CI: 0.849-0.953) for VAS, 0.958 (95% CI: 0.927-0.989) for ASDAS-CRP, 0.619 (95% CI: 0.518-0.721) for HALP score, and 0.622 (95% CI: 0.516-0.728) for NLR. The HALP score Cut-off value in assessing disease activity was found to be ≤ 0.56 (sensitivity 80.00%, specificity 40.00%). ROC analyses are shown in Table 4 (Figs. 1 and 2).

DISCUSSION

CRP, ESR, BASDAI, ASDAS CRP and VAS are routinely used as recommended by the guidelines for disease activity, functional status and pain score in AS patients [16, 17]. In this research, a significant association was found between HALP score and ESR, BASDAI, ASDAS CRP, BASFI and VAS. This result showed us that HALP score could be a new marker in the follow-up of disease activity in AS patients. However, no significant relationship was found between CRP and HALP score. CRP is a general biomarker indicating the presence of inflammation in the body and is particularly elevated in acute inflammatory conditions. In chronic inflammatory diseases such as anky-

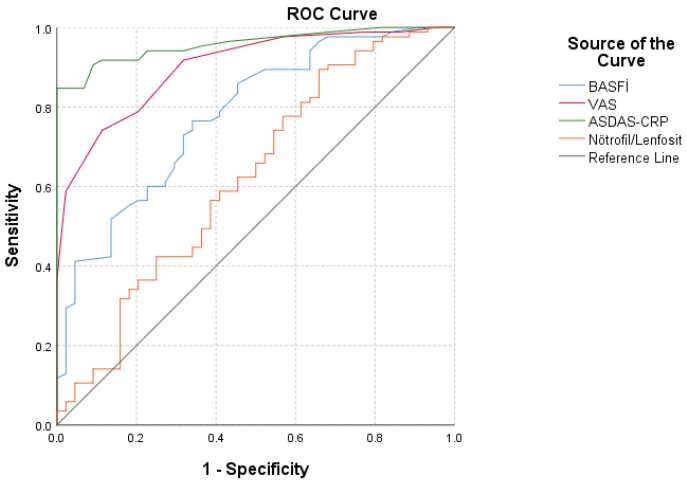

Fig. 1. ROC curve of BASFI, VAS, ASDAS-CRP and NLR values.

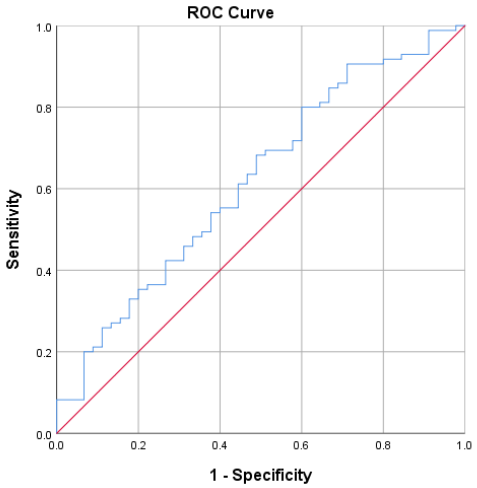

Fig. 2. ROC curve of HALP score.

losing spondylitis, CRP levels may be variable because the severity of inflammation may fluctuate over time. The clinical features and inflammation levels of AS patients may vary from person to person. In some patients, the systemic effects of inflammation may cause significant changes in blood parameters, while in others, they may have lesser effects [18]. In fact, although CRP and ESR are widely used in studies to evaluate the presence of inflammation, acute phase proteins are not specific and especially in patients with non-radiographic axial SpA, the sensitivity of acute phase proteins, which are mostly within normal limits, is low [19, 20].

The HALP score, which evaluates hemoglobin, albumin, lymphocyte and platelet values together, has recently been investigated as an important tool in disease diagnosis and prognosis. This score reflects systemic inflammation, nutrition, impaired immune response and tendency to clot. In addition, since it is easy to calculate, it can be used in diseases with severe inflammation [21, 22]. It has been reported that low HALP score may be an indicator of disease prognosis, chronic systemic inflammation and disease activity in inflammatory conditions such as rheumatoid arthritis [23], anti-neutrophilic cytoplasmic antibody-associated vasculitis [9], stroke [24] and chronic obstructive pulmonary disease [25]. The relationship between the HALP score presented in these studies and AS, an inflammatory disease, is similar to the literature.

In the case of systemic inflammation, hemoglobin and platelets increase, while albumin and lymphocytes decrease. Inflammatory cytokines promote the activation of neutrophils and their accumulation through chemotaxis, leading to a decrease in the number of lymphocytes and albumin in the circulation [26]. Interleukin (IL)-1β and tumor necrosis factor (TNF)-α suppress erythropoietin release from the kidney. In addition, IL-6 increases hepcidin production from the liver. Hepcidin reduces iron absorption from the intestine and reduces iron release from macrophages, leading to decreased hemoglobin production, which in turn causes anemia of chronic disease in patients [12, 27]. In this research, a significant relationship was found between the healthy group and the components of the HALP score other than lymphocyte values (hemoglobin, neutrophil, albumin, platelet), similar to the literature. However, there was a significant relationship between the active AS and remission groups in terms of HALP score. This result makes it important to assess the components of the HALP score together rather than using them for disease activity.

In our study, we found negative correlations between the HALP score and various disease activity indices, but the strength of these correlations was weak. The response of each of the parameters including the HALP score to inflammation, long-term disease activity in AS, and treatment received may be due to the poor correlation between disease activity indices and the HALP score.

The increase in neutrophil count in AS patients is associated with an increase in the differentiation and maturation of blood stem cells under the influence of various cytokines, such as TNF-α and IL-6 [28]. The increase in platelet count has been associated with factors such as thrombin, histamine, TNF-α, and IL-12. Again, anemia and a decrease in albumin may occur due to inflammation [29]. One study found that platelet, neutrophil, lymphocyte, NLR and PLR counts were markers of systemic inflammation in AS [30]. Another study reported that NLR ratio could be a significant biomarker in rheumatoid arthritis and AS patients [31]. In this study, similar to the literature, there was a significant relationship between AS patients and healthy group, active AS and remission group in terms of NLR and PLR.

NLR and PLR are generally used as simple, economical and quickly calculated biomarkers, but the HALP score may provide a more comprehensive assessment as it includes more parameters. ASDAS-CRP is known as a more specific indicator of inflammation and generally shows a stronger diagnostic accuracy [17, 30]. In order to better understand the potential clinical benefits of HALP score, more studies are needed to perform a comparative analysis with these indices and to understand the role of each in assessing disease activity. Additionally, the HALP score may allow for a broader perspective on inflammation and overall health status, thus helping to monitor patients' response to treatment or aid in treatment planning.

In our study, there was a significant difference in smoking status between the healthy group and the AS group. In the study conducted by Nam *et al*. [32], it was reported that AS smoking caused an increase in disease activity and clinical progression of the disease. In addition, smoking affects hematological parameters by increasing platelet and hemoglobin levels and de-

creasing lymphocyte levels [33]. It may affect disease activity similar to the literature in our study and appears to be a confounding factor. However, the high rate of smoking in the patient and healthy groups in society may be a positive aspect of the study in terms of reflecting the real life results.

Limitations

Limited sample size may affect generalizability due to single center and retrospective findings. The accuracy of measurement tools and data collection techniques used in the study may also be a limiting factor. In particular, subjective assessments and surveys may create uncertainty about the accuracy of some responses. Due to the retrospective design of our study, larger prospective studies are needed to confirm the limitations of the HALP score, such as its modest diagnostic performance, and for its clinical use.

CONCLUSION

HALP score was lower in patients with active AS than in patients in remission. It showed a negative significant correlation with disease activity scores and HALP score may be a potential marker that can be easily applied to assess disease activity in AS patients.

Ethical Statement

Ethical approval was obtained from the Recep Tayyip University Non-Interventional Clinical Research Ethics Committee (Approval date:18.07.2024 and no:195). The study was carried out in accordance with the Declaration of Helsinki

Authors' Contribution

Study Conception: OC; Study Design: OC; Supervision: OC; Funding: N/A; Materials: OC; Data Collection and/or Processing: OC; Statistical Analysis and/or Data Interpretation: OC; Literature Review: OC; Manuscript Preparation: OC and Critical Review: OC.

Conflict of interest

The author disclosed no conflict of interest during the preparation or publication of this manuscript.

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