Role of Neutrophil-to-Lymphocyte Ratio, Platelet-to-Lymphocyte Ratio, Mean Platelet Volume in Egyptian Patients with Psoriasis Vulgaris

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Psoriasis vulgaris (PsV) is common, incurable, pro-inflammatory systemic disease with waving course that impacts the life quality. This justifies the need for discovering simple biomarkers with key roles in monitoring systemic inflammation and assessing the disease severity. Neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), and mean platelet volume (MPV) have been suggested as markers of inflammation. We aimed to investigate the role of NLR, PLR and MPV as biomarkers for PsV disease and to examine their possible association with disease severity assessed by Psoriasis Area and Severity Index (PASI score) in Egyptian psoriatic patients. This case control study included 36 PsV patients and 36 healthy controls. Hematological parameters were assessed by automated KX21N cell counters. Significant increase was detected in NLR (P< 0.001) and PLR (P< 0.001) in PsV patients when compared to controls. PASI score positively correlated with PLR (r=0.405; *P*=0.014) and negatively correlated with MPV (r= -0.471; *P*=0.004). NLR positively correlated with disease duration/ years (r=0.414; *P*=0.012). ROC curves data output showed that NLR at cut off of 1.66 yielded a specificity of (94.4%) and sensitivity of (61.1%) (*P*<0,001) to differentiate PsV patients from healthy individuals and, PLR at cut-off of 110.6 yielded a higher sensitivity of (77.81%) with specificity of (86.1%) (*P*< 0.001). We concluded that NLR and PLR can serve as biomarkers for systemic inflammation in PsV disease. Increased NLR is more influenced by disease duration than disease severity. PLR and MPV can be applied to monitor psoriasis vulgaris severity and follow up of patients.

Psoriasis is a multi-factorial pro-inflammatory disease. The disease involves an increased risk of concurrent metabolic syndrome, arterial hypertension, cardiovascular diseases, and ischemic brain stroke [1]. Psoriasis is incurable, and impacts the quality of life, including depression, anxiety, and suicide. Prevalence of psoriasis in adults and children ranges from 0.51% to 1.43%, and 0% to 1.37%, respectively, and the incidence is increasing globally [2].

The most common clinical type is psoriasis vulgaris (PsV), accounting for more than 90% of psoriasis cases with waving course of remissions and exacerbations throughout the progression of this chronic disease [3]. Among the most widely used scale to assess psoriasis severity is Psoriasis Area and Severity Index (PASI) score. This index is based on the quantitative assessment of three classic signs which are redness, thickness, and scaling, with consideration to the area of involvement. Still PASI can be to some degree variant between physicians and cannot assess the systemic inflammatory process associated with the disease process [4].

To alleviate the disease progression and social burden, it is critical to analyze the factors associated with the progression of PsV and clarify the disease activity process, to make specific and targeted efforts in severity control [2]. Discovering new biomarkers with key roles in monitoring systemic inflammation associated with chronic plaque psoriasis for patients follow up is still a subject of interest.

Peripheral blood cells might reflect the systemic inflammatory and immune response of patients. Some of those inflammation-related parameters have

yielded prognostic importance [5]. Hematological parameters, being simple, inexpensive and easily assessable marker have been widely investigated as markers of inflammation namely, neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), mean platelet volume (MPV) have been studied in different systemic diseases to be used as an index for the differential diagnosis or prognostic prediction of those diseases [6-8].

Neutrophils and lymphocytes play major roles in inflammatory processes. NLR is calculated as the absolute count of neutrophils divided by the absolute count of lymphocytes. Under inflammatory conditions, neutrophil and lymphocyte counts undergo temporary changes in count [9].

Platelet-to-lymphocyte ratio (PLR) is also a biomarker that denotes the presence of inflammation. Platelet to lymphocyte ratio calculated as the absolute platelet count divided by the absolute lymphocyte count is suggested as a potential marker to determine inflammation [10].

The MPV is the volume of the average circulating platelet in femtoliters (fl), like the mean corpuscle volume (MCV) of red blood cells. MPV is proposed to be an indicator of platelet function and activation. Studies reported that MPV was associated with inflammation and reflect inflammatory burden in different chronic diseases [11].

As PsV represents 90% of psoriatic cases and is associated with fluctuating life long course, in contrast to other acute apparent psoriatic types, hence was the aim to utilize simple, inexpensive NLR, PLR and MPV as inflammatory biomarkers for PsV and to examine the presence of possible association between these markers and PsV severity assessed by PASI.

Material and Methods

Study participants

This case control study included 72 subjects, 36 Psoriasis Vulgaris patients (23 males and 13 females) with mean age of 37.36± 6.84 years. Cases were divided into two groups according to PASI score and diseases severity, Group1 (severe psoriasis) with PASI> 12 [n=16] while Group 2 (mild and moderate psoriasis) with PASI ≤12 [n=20]. 36 gender- and age-matched controls (21 males and 15 females) were recruited, with mean age of 36.39±6.3. The psoriasis patients were obtained from Dermatology Outpatient Clinic in AL-Zahraa University Hospital, Cairo, Egypt. A consent was taken from participants before enrollment in the study. The study was approved by Al-Azhar University research Ethical Committee of Faculty of Medicine for Girls-Institutional Research Board (AFMG-IRB).

Inclusion criteria: 1-Patients with clinical diagnosis of chronic plaque psoriasis, known as PsV. 2- Adult patients > 18 years of both sexes.

Exclusion criteria: 1- Other types of psoriasis (pustular psoriasis, erythrodermic psoriasis and psoriasis associated with psoriatic arthritis). 2- Association with any other chronic autoimmune or inflammatory or infectious disease. 3- Presence of oncogenic diseases.

Patient assessment

- History taking

1-Personal history: name, age, sex, occupation and special habits of medical importance. 2-History of present illness: onset, course, duration of the disease, the last episode, and symptoms of arthritis for exclusion. 3-Medical history: history of other skin or systemic diseases, presence of chronic or active infections. 4-Drug history: history of drug intake for psoriasis or any medical problem. 5- History of surgical operations on last one year. 6- Family history of psoriasis.

- General and dermatological examination

1-General examination to exclude associated systemic diseases. 2-Dermatological examination of Psoriasis included skin, hair, nail and mucous membrane to exclude other dermatological diseases. 3-Dermoscopic and histopathological confirmation for diagnosis of psoriasis vulgaris lesions. 4-Clinical assessment of severity of psoriasis: PASI score was used to assess the severity of the disease according to the British Association of Dermatologists (BAD) [12]. The body was divided into four section (head

(H) (10 % of a person's skin); Arms (A) (20%); trunk (T) (30%) leg (40%). Each of these areas was individually scored, and the four scores were combined into the final PASI for each section, the percent of area of skin involved, was estimated and transformed into a grade from 0 to 6: 0% of involved area, grade: 0; <10% of, involved area grade: 1; 10 to 29% of involved area, grade: 2; 30 to 49% of involved area, grade: 3; 50 to 69% of involved area, grade: 4; 70 to 89% of involved area, grade: 5; 90 to 100% of involved area, grade: 6.

The severity, within each area, was estimated by three clinical signs: erythema (redness), induration (thickness) and desquamation (scaling). Severity parameters were measured on a scale of 0 to4, from non-to maximum.

The sum of the three severity parameters was then calculated for each section of skin, multiplied by the area score for that area and multiplied by weight of respective section (0.1 for head, 0.2 for arms, 0.3 for body and 0.4 for leg).

PASI=0.1(Rh +Th +Sh) Ah +0.2(Ru +Tu +Su) Au +0.3(Rt +Tt +St) At +0.4 (Rl+Tl+Sl) Al.

R=redness, T=thickness, S= scaling, A=area, h=Head, u=Upper extremities, t=Trunk, l=Lower extremities PASI combines the assessment of severity of lesions and the area affected into a single score in the range 0(no disease) to 72 (maximal disease). Patients were classified according to Schmmitt & Wozel (2005) by their PASI score as follow: Mild psoriasis: PASI<7; Moderate psoriasis: PASI 7-12; Sever psoriasis: PASI >12 [13].

- Sample collection

A volume of 2ml of venous blood was drawn from each subject into dipotassium ethylenediaminetetraacetic acid tubes (K2-EDTA) tube for complete blood count to be analyzed within 2 hours.

- Study tools

Complete white blood cell count was done using automated KX21N Hematology cell counter (Sysmex, Kobe, Japan), in Al-Zahraa hospital, Al-Azhar University. Total leucocytic count (TLC), Absolute count of neutrophils, lymphocytes, and platelets were obtained. NLR was obtained by dividing absolute neutrophil count by lymphocyte count; PLR was obtained by dividing absolute platelet count by lymphocyte count. MPV was determined using the automated blood cell counter. The laboratory reference values of lymphocytes and neutrophils were 1.2-3.4 $x10^9$/L and 1.8-6.3 $x10^9$/L. respectively. NLR and PLR cutoffs are not well defined in PsV, that is why the Receiver operating characteristic (ROC curve) was done, while normal reference range of MPV was 9-11fl.

Reagents used for Sysmex KX21N analyzer; Sysmex 20L diluent KX-21N hematology reagent Certificate: Brand Name: XKIVD, ISO9001&13485&CE. Zhejiang, China; Sysmex KX-21N lyse 500ml: Brand Name XKIVD, Model Number: JXK-228, Certificate: CE ISO9001 ISO13485. Zhejiang, China; Cell cleaner 50ml, Model Number: JXK-233, Certificate: ISO9001&13485&CE, Zhejiang, China

Principle and interpretation of results: KX21N identifies three-part differential, the neutrophil, lymphocytes and the mixed {monocytes, eosinophils and basophils). It uses the technology of electrical impedance: Nowakowski *et al.* (2005) in using electrical impedance, cell counting, and sizing are based on the detection and measurement of changes in electrical impedance (resistance) produced by a particle as it passes through a small aperture. Particles such as blood cells are nonconductive but are suspended in an electrically conductive diluent. As a dilute suspension of cells is drawn through the aperture, the passage of each individual cell momentarily increases the impedance (resistance) of the electrical path between two submerged electrodes that are located on each side of the aperture [14].

Performance of KX21N reveals good outcome for quantitative abnormalities. Calibration was performed to compensate for any inaccuracies of the pneumatic, hydraulic, and electric systems. Calibration was carried out by entering calibration values into the unit at installation. Also, periodical calibration and proper quality control to maintain the accuracy was performed. For calibration, 10 samples of fresh normal blood that meets the following conditions: · Blood of a healthy person who is not taking any medication; Blood added with appropriate anticoagulant· Per-sample whole blood volume to exceed 2 mL· HGB value to exceed 10.0 g/dL· HCT value to be within 35.5% - 55.5%. Regarding the quality control (QC) setting; Two kinds of QC methods were performed: External Control method: Control blood is subjected to two consecutive analyses and the mean of them is used as the QC data; Levey-Jennings control chart: which uses the data from a single analysis of control blood as QC data. [15].

Statistical Analysis

Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 26 (IBM Corp., Armonk, NY, USA). Data was summarized using mean, standard deviation, in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data. Comparisons between quantitative variables were done using the non-parametric Mann-Whitney test. For comparing categorical data, Chi square (2) test was performed. Exact test was used instead when the expected frequency is less than 5. Correlations between quantitative variables were done using Spearman correlation coefficient. *P*-values less than 0.05 were considered statistically significant. Receiver operating characteristic (ROC curve) was constructed with area under curve analysis performed to detect best cutoff value of different parameters for detection of psoriasis. P-values less than 0.05 were considered as statistically significant.

Results

The present study included 72 subjects divided into 36 PsV patients, and 36 gender- and age-matched controls. Cases were further subdivided into two groups, Group 1 included severe cases of PASI> 12 [n=16] and Group 2 included those with PASI ≤12 [n=20]. Demographic and clinical data of the study participants are illustrated in (table, 1).

Table 1. Demographic data of PsV patients

Sex: Count (%)	
M	23(63.9%)
F	13(36.1%)
Family History Count (%)	
Yes	9(25.0%)
No	27(75.0%)
Patients' subgroups Count (%) Count (%)	
Severe Psoriasis [PASI>12]	16(44.4%)
Mild to moderate Psoriasis [PASI≤12]	20(55.6%)
Age (year) Mean± SD	37.36±6.84
Disease Duration (year) Mean± SD	12.17±9.78
PASI score Mean± SD	28.51±18.20

PASI, Psoriasis Area and Severity Index

Comparison of hematological parameters between PsV cases and controls is illustrated in (table, 2). Comparison between PsV cases and control revealed, significant increase in NLR and PLR in PsV patients (*P*< 0.001) in both while there was significant decrease in absolute lymphocytic count (ALC) in PsV cases (*P*< 0.001).

Table 2. Comparison of hematological parameters between PsV cases and controls

	PsV cases Mean±SD	Controls Mean±SD	*P* value
TLC (x10^3 \mm$^{3)}$	6.68±1.77	7.24±1.53	NS
ANC (x10^3 \mm$^{3)}$	4.05±1.65	3.73±1.11	NS
ALC (x10^3 \mm$^{3)}$	1.99±0.73	2.98±0.69	< 0.001
NLR	2.48±1.78	1.24±0.30	< 0.001
PLT (x10^3 \mm$^{3)}$	272.11±62.20	247.81±42.67	NS
PLR	157.79±75.07	84.56±26.57	< 0.001
MPV (fl)	9.79±1.23	9.48±0.98	NS

P>0.05 is not significant (NS). ANC, absolute neutrophil count; ALC, absolute lymphocyte count; NLR, neutrophil-to-lymphocyte ratio; PLT, platelets; PLR, platelet-lymphocyte ratio; MPV, mean platelet volume, TLC, total leucocytic count. PsV, Psoriasis Vulgaris.

Comparison of hematological parameters between PsV patients' subgroups is illustrated in (table, 3). Comparison of NLR and PLR between Group1 with severe PsV in relation to Group 2 with mild and moderate group revealed significant increase in Group 1 in NLR and PLR (P=0.001) and (P=0.023), respectively (Fig. 1).

Table 3. Comparison of hematological parameters between Psoriasis Vulgaris patients' subgroups

	PsV patients' subgroups		
	Severe Psoriasis [PASI>12] [n=16] Mean±SD	Mild and moderate Psoriasis [PASI≤12] [n=20] Mean±SD	*P* value
TLC (x10^3 \mm$^{3)}$	7.16±1.65	6.31±1.80	NS
ANC (x10^3 \mm$^{3)}$	4.72±1.84	3.51±1.29	0.042
ALC (x10^3 \mm$^{3)}$	1.67±0.70	2.25±0.67	0.007
NLR	3.55±2.16	1.63±0.63	0.001
PLT (x10^3 \mm$^{3)}$	266.56±50.94	276.55±70.93	NS
PLR	187.06±84.28	134.38±58.95	0.023
MPV (Fl)	9.39±1.45	10.13±0.92	NS

ANC, absolute neutrophil count; ALC, absolute lymphocyte count; NLR, neutrophil-to-lymphocyte ratio; PASI, Psoriasis Area and Severity Index; PLR, platelet-lymphocyte ratio; PLT, platelets; MPV, mean platelet volume, TLC, total leucocytic count; PsV, Psoriasis Vulgaris. P>0.05 is not significant (NS).

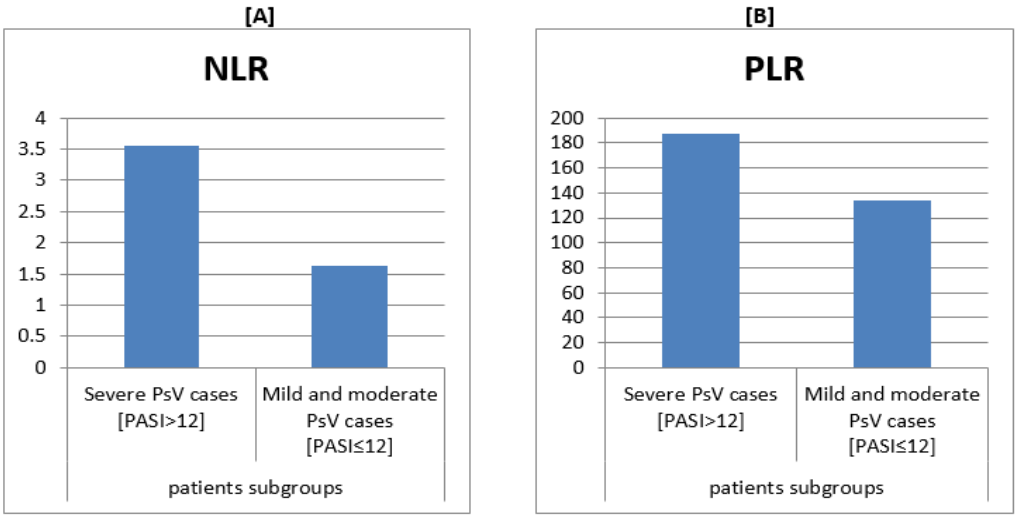

Figure 1. [A] Comparison between Group 1 of severe PsV group with PASI> 12 [n=16] and Group 2 of mild and moderate group with PASI ≤12 [n=20] revealed; [A] Significant increase in NLR in severe PsV group (P=0.001); [B] Significant increase in PLR in severe PsV group (P=0.023). NLR, neutrophil-to-lymphocyte ratio; PASI, Psoriasis Area and Severity Index; PLR, platelet-lymphocyte ratio; PsV, Psoriasis Vulgaris.

Correlation studies of PASI score in PsV patients (n=36) revealed; Positive significant correlation of with PLR (r=0.405; *P*=0.014) (Fig. 2A), Negative significant correlation with MPV (r= -0.471; *P*=0.004) (Fig. 2B). While no significant correlation was detected with NLR (r= 0.265; *P*=0.118).

The current study revealed significant positive correlation of NLR with disease duration/ years (r=0.414; *P*=0.012) (Fig. 3A) and PLR (r= 0.462; *P*< 0.001) (Fig. 3B).

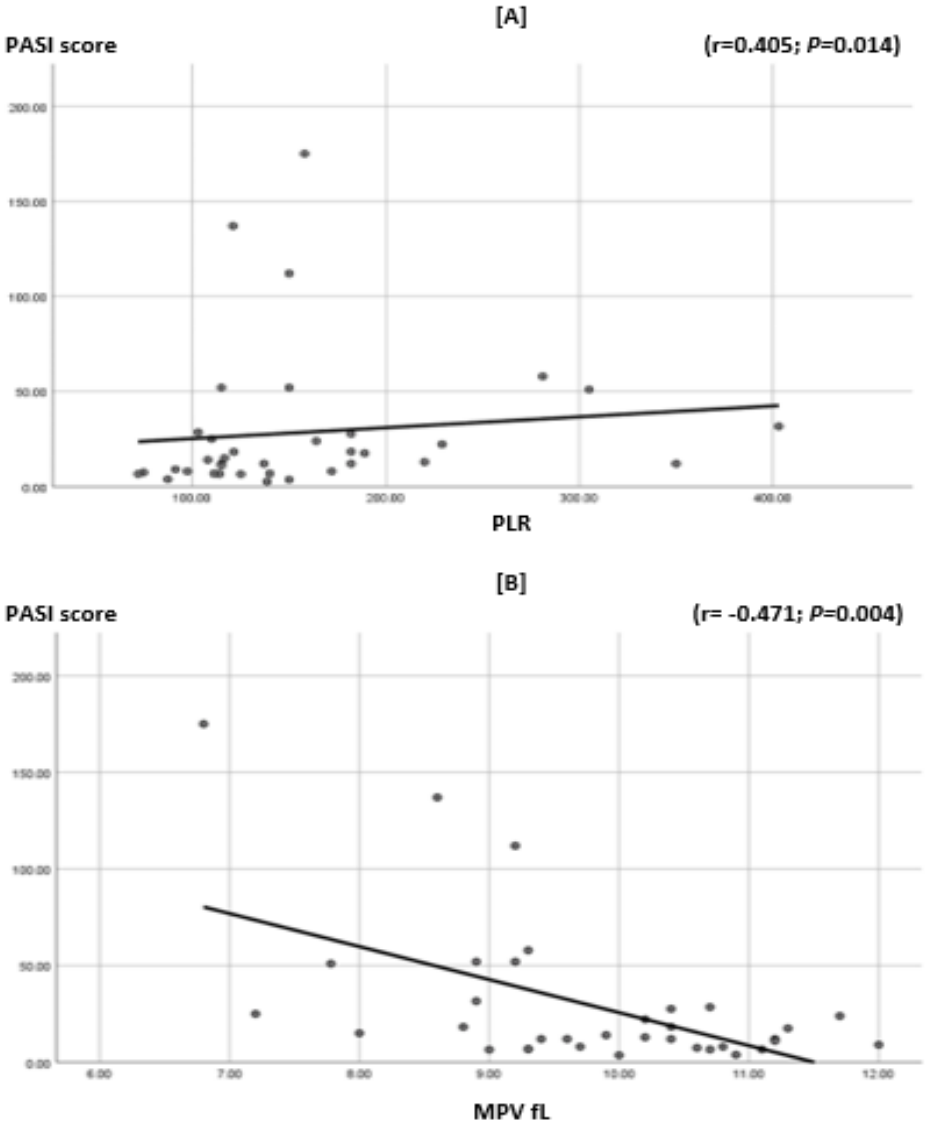

Figure 2. [A] Correlation of PASI score with PLR in PsV cases (n=36) revealed significant correlation (r=0.405; *P*=0.014) [B] Correlation of PASI score with MPV revealed negative significant correlation (r= -0.471; *P*=0.004). MPV, mean platelet volume; NLR, neutrophil-to-lymphocyte ratio; PASI, Psoriasis Area and Severity Index; PLR, platelet-lymphocyte ratio.

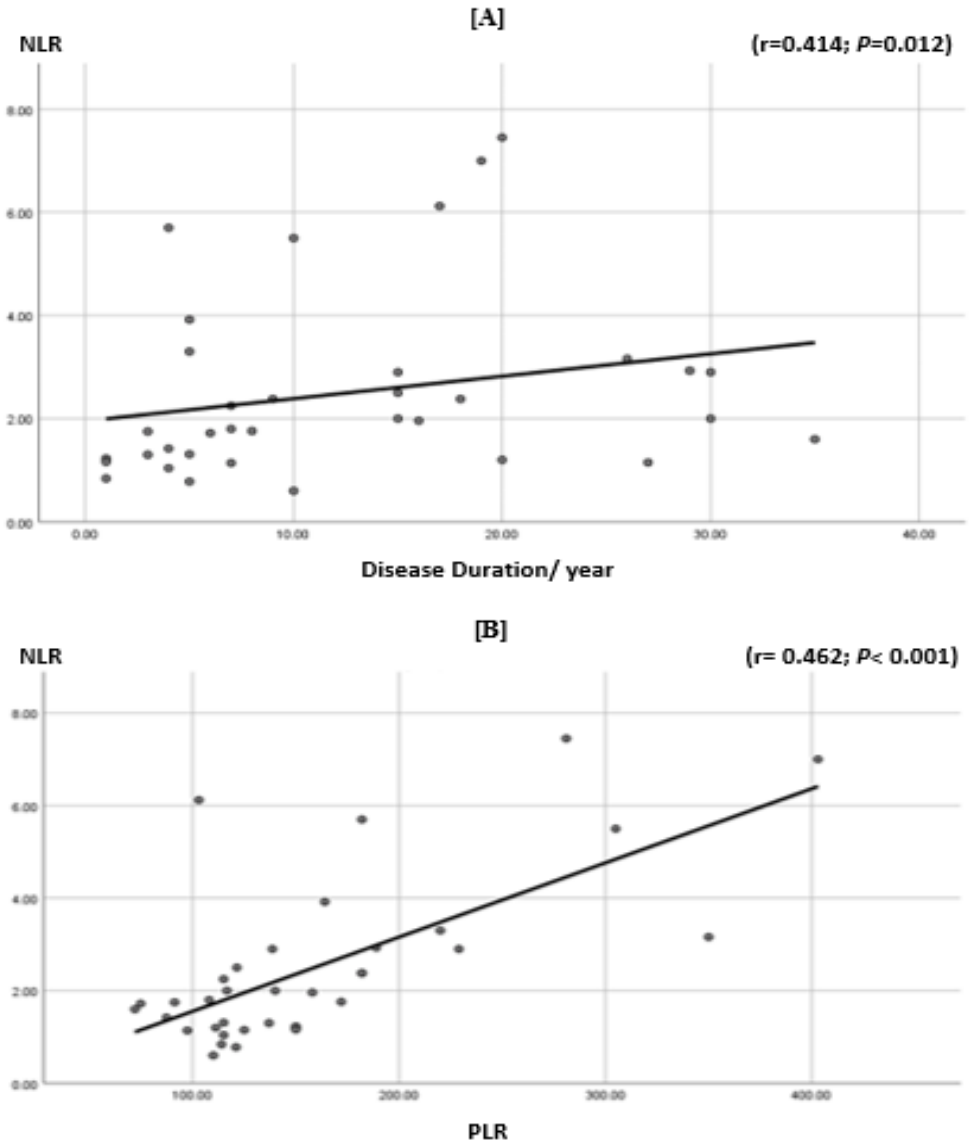

Figure 3. [A] Correlation of NLR in PsV cases (n=36) revealed positive significant correlation with disease duration/ years (r=0.414; *P*=0.012) [B] Correlation of NLR in PsV cases (n=36) revealed positive significant correlation with PLR (r= 0.462; *P*< 0.001). NLR, neutrophil-to-lymphocyte ratio; PLR, platelet-lymphocyte ratio.

The ROC curves were done to determine sensitivity and specificity of NLR and PLR focusing on their ability to discriminate between PsV patients and healthy individuals. NLR at cut off of ≥1.66 and AUC of (0.758) yielded a specificity of 94.4% while sensitivity of (61.1%), with (*P*<0,001) to differentiate PsV patients from healthy individuals on the other hand, PLR at cut-off of ≥110.6 and AUC of (0.888) yielded sensitivity of (77.8.1%) with specificity of (86.1%) and (*P*< 0.001) (table, 4; Fig. 4).

Table 4. Roc curve for differentiative ability to diagnose PsV? of NLR and PLR between PsV, cases and controls

	AUC	*P* value	95% Confidence Interval		Cut off	Sensitivity %	Specificity %
			Lower Bound	Upper Bound			
NLR	0.758	< 0.001	0.642	0.875	1.66	61.1	94.4
PLR	0.888	< 0.001	0.814	0.962	110.60	77.8	86.1

AUC; Area Under the ROC Curve NLR, neutrophil-to-lymphocyte ratio; PLR, platelet-lymphocyte ratio.
P<0.05 is significant

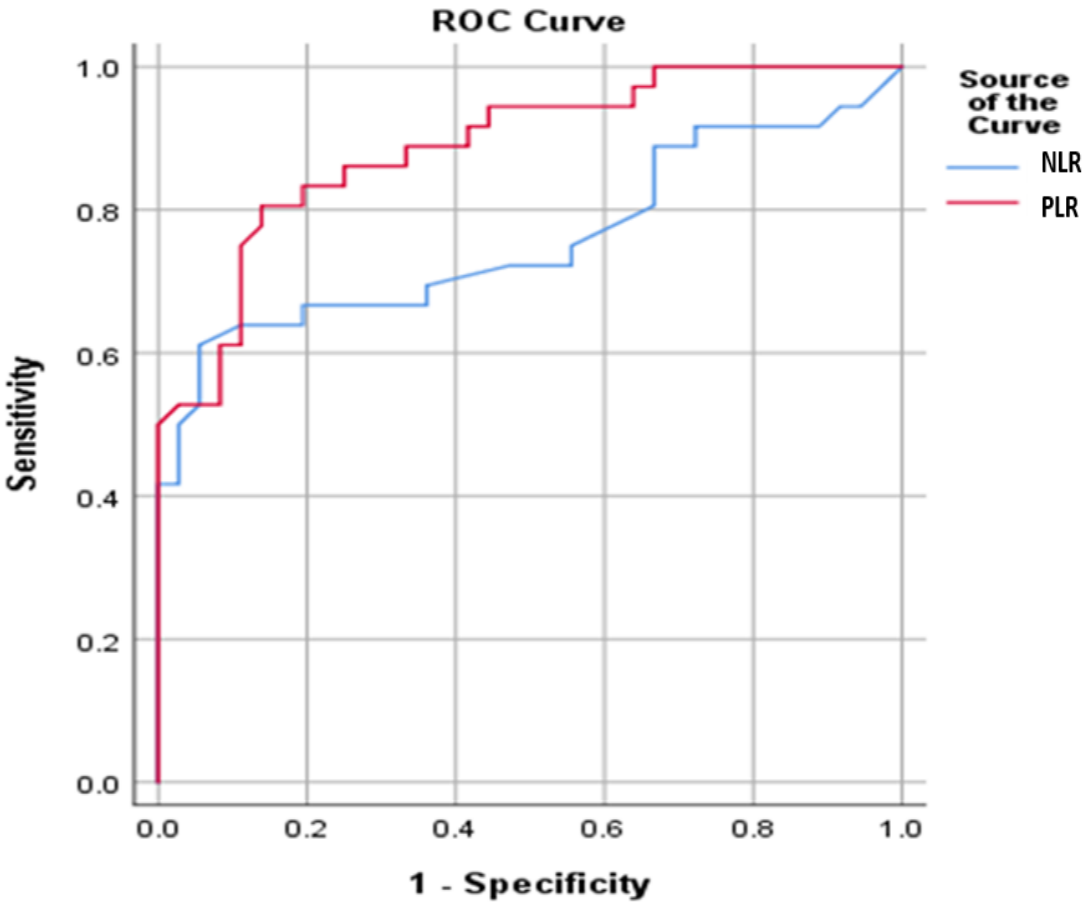

Figure 4. Output data of ROC curves for NLR and PLR. The NLR at cut off = 1.66 and AUC = (0.758) yielded a specificity of (94.4%) while sensitivity of (61.1%), with (*P*<0,001) to differentiate PsV patients from healthy individuals. PLR at cut-off of 110.6 and AUC of (0.888) yielded sensitivity of (77.8.%) with specificity of (86.1%) and (*P*< 0.001). AUC, area under the curve; NLR, neutrophil-to-lymphocyte ratio; PLR, platelet-lymphocyte ratio; ROC, Receiver operating characteristic.

Discussion

Psoriasis is a chronic, systemic, inflammatory disease. The number of psoriasis patients in the whole world were estimated at about 125 million. PsV accounts for 90% of psoriasis cases. Because of its high prevalence, diversity of the clinical picture (from minimal and localized lesions without subjective symptoms to life-threatening conditions), and disease duration (practically a lifetime), psoriasis is a disease that has become a focus of modern medicine [16]. These given data justify the need to find simple, reproducible, convenient and cost-effective biomarkers to evaluate systemic inflammation in PsV patients, and to monitor the disease course.

Inflammatory process leads to changes in one or more cellular lineages of the hematopoietic system. Thus, complete blood count (CBC)-derived parameters and their relation to certain diseases have received attention from researchers [17]. The NLR and PLR, among others, have been shown to be highly sensitive markers of occult inflammation in autoimmune and inflammatory disorders, severity of inflammation and as predictors of poor outcomes in cardiovascular disease, oncologic disease, diabetes mellitus, and hypertension [18]. PsV considered as inflammatory disease justifies the aim of this study to investigate the role NLR, PLR and MPV in PsV and their associations with disease progression.

Comparison of NLR and PLR between PsV cases and control revealed significant increase in PsV patients when compared to control group in both markers, In addition to detected significant decrease in ALC in PsV cases when compared to control ($P< 0.001$). These findings were similar to findings given by Polat *et al*. (2017) who documented the higher elevation in NLR and PLR in patients with chronic psoriasis than controls [4]. Also, Sen *et al*. (2014), Erek Toprak *et al*. (2016) and Ataseven *et al*. (2014) and Yin *et al*. (2016) found that NLR was higher in PsV patients as compared to the control group [19-22, respectively].

This increase in NLR in PsV cases is explained by the nature of PsV as inflammatory disease in which cytokines secreted by T cells or antigen presenting cells, such as Tumor necrotizing factor-alpha (TNF-α), interlukin-8 (IL-8), interferon–gamma (IFN-γ), or granulocyte-colony stimulating factor (G-CSF), seem to be responsible for the priming and increase of neutrophil as they participate in the process of inflammation, antigen presentation, and regulating the activity of other cell types [18]. Also, throughout the process of inflammation, dysregulation in the control of apoptosis of the lymphocytes may lead to decreased lymphocyte production [23]. Neutrophilia or lymphopenia results in high NLR. High NLR points to a predominance of inflammatory factors in the etiopathogenesis of different conditions. Also, the increase in PLR could be explained by increased platelets which is attributed to the inflammation condition, characterized by increased inflammatory cytokines and decreased lymphocytes [9].

Comparison of NLR and PLR between severe PsV group with the mild and moderate group revealed significant increase in NLR and PLR in severe group. These data were in line with Asahina *et al*. (2017) who studied patients with PsV and patients with psoriatic arthritis (PsA) before and after treatment and stated that in PsV patients, the NLR-high and PLR-high subgroups exhibited significantly higher Psoriasis Area and PASI compared with the NLR-low and

PLR-low subgroups, and that the NLR-high subgroup also showed higher CRP levels [24]. Yin *et al.* (2016) showed that patients with ereythrodermic psoriasis which is considered sever and acute clinical subtype when compared to PsV showed higher NLR as indicator of more intense systemic inflammation [22].

Current study revealed that PASI score showed significant positive correlation with PLR in PsV cases. while no significant correlation was detected with NLR.

Our results concerning PLR were in line with Akgül *et al.* (2017) who stated that elevated PLR has been demonstrated to have a significant association with poor prognosis in many diseases [25]. Also, Kim *et al. (*2016), Polat *et al.* (2017) and Asahina *et al.* (2017) [26, 4, 24, respectively] who stated that PASI correlated positively with PLR, which strengthen the believe of PLR being associated with prognostic outcome and development of the disease..

On the other hand Sen *et al*. (2014), Kim *et al.* (2016), Polat *et al.* (2017) and Asahina *et al.* (2017) reported positive correlation between NLR and severity of disease in psoriasis patients and stated that both NLR and PLR are useful markers to evaluate systemic inflammation in psoriatic patients and to determine the severity of systemic inflammation in patients with chronic psoriasis [19, 26, 4, 24]. This discrepancy in NLR association with PASI can be related to the type of patients included in their study as some investigated psoriasis cases generally not PsV per say while others did not exclude psoriatic arthritis as we did.

Like our data Ataseven *et al*. (2014) reported that there were no significant correlations between NLR and PASI, however, NLR levels were higher in psoriasis patients as compared to a control [21]. Also, Paliogiannis *et al.* (2019) stated that NLR and the PLR were significantly associated with the presence, but not with the severity, of psoriasis [27]. Discrepancy could be explained by that this was a metanalysis review including all types of Psoriasis not specifically PsV as ours. Similarly, Balevi *et al.,* (2018) reported no statistically significant association between PASI values and NLR, PLR either before starting treatment or after 1 year of therapy in cases of psoriasis [6].

It is also worth saying that Feng *et al.* (2014) reported the superiority of PLR as a predictive factor for outcome to NLR in patients with esophageal cancer [28], which strengthen our data.

Correlation of PASI score with MPV revealed negative significant correlation. This was in line with Balevi et al. (2018) reported an increase in MPV accompanied by a decrease in PASI values suggested a role of MPV as contributing prognostic hematologic parameters to predict clinical progress and treatment response of patients with moderate-severe psoriasis [6]. Asahina *et al.* (2017) reported that MPV value was negatively associated with the presence of arthritis, but its association with inflammation was less clear than that of NLR or PLR [24].

The MPV is a direct indicator of platelet function and exhibits an inverse correlation with platelet count. When PLTs are activated, they undergo changes in their shape and size. Interestingly, PLT function and size are associated most likely as the larger PLTs that contain more granules are metabolically and enzymatically more active. MPV is an important biological variable [11].

The current study revealed significant positive correlation of NLR with disease duration/ years, which indicates that increased NLR is more associated with

prolonged disease duration than to the progression of the disease staging. Significant positive correlation of NLR with PLR.

Regarding the output data of ROC curves for NLR and PLR. The NLR showed higher specificity to differentiate PsV patients from healthy individuals, as at cut off ≥1.66 and AUC of (0.758) yielded a specificity of (94.4%) while sensitivity of (61.1%), with (P<0,001) on the other hand, PLR at cut-off of ≥110.6 and AUC of (0.888) yielded sensitivity of (77.8.1%) with specificity of (86.1%) and (P< 0.001).

It is concluded that NLR and PLR can serve as simple, convenient and cost-effective biomarkers for systemic inflammation in PsV disease. Increased NLR is more influenced by disease duration than disease severity, and PLR and MPV can be applied to monitor PsV severity and follow up of patients.

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