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Original Research Article

Evaluation of neutrophil to lymphocyte ratio, platelet to lymphocyte ratio and mean platelet volume relationship with metabolic syndrome in psoriasis patients

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ABSTRACT

Background: Psoriasis is a chronic inflammatory skin disorder associated with systemic inflammation and various comorbidities. Neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), and mean platelet volume (MPV) have been suggested as markers of systemic inflammation and have emerged as unrecognized predictors of the development of metabolic syndrome (MetS).
Methods: This cross-sectional comparative study was conducted at the department of dermatology and venereology, for 17 months, following ethical clearance. A total of 84 psoriasis patients were included, with 42 patients having metabolic syndrome and the remaining 42 patients without having metabolic syndrome. Severity of psoriasis was evaluated by PASI score.
Results: Of the 84 psoriasis patients, 42 had metabolic syndrome and 42 did not. Compared with those without metabolic syndrome, patients with metabolic syndrome had significantly higher mean NLR (2.75±1.31 versus 2.19±0.87; p=0.023) and MPV (10.84±1.23 versus 10.06±1.38 fL; p=0.007), while PLR did not differ significantly.
Conclusions: NLR and MPV levels are significantly elevated and the rise in MPV correlates with disease severity among psoriasis patients with metabolic syndrome. Therefore, NLR and MPV can be utilized as reliable, convenient, and cost-effective inflammatory biomarkers for the early detection of the potential onset of metabolic syndrome in psoriasis patients. This enables screening for metabolic syndrome in individuals with elevated inflammatory markers NLR and MPV, especially in resource-constrained settings like Bangladesh, where screening all psoriasis patients may not be feasible.

Keywords: Psoriasis, Neutrophil to lymphocyte ratio, Platelet to lymphocyte ratio, Mean platelet volume, Metabolic syndrome

INTRODUCTION

Psoriasis, a condition characterized by chronic and relapsing inflammation mediated by the immune system, primarily impacts the skin and joints of individuals with a genetic susceptibility.[1] The exact pathophysiology of psoriasis is yet unknown. The development of the disease involves contributions from both genetic and

environmental factors. Increased keratinocyte proliferation and infiltration of T cells, macrophages, and neutrophils with proinflammatory cytokine production seems to be the main pathophysiology of psoriasis.[2] The initiation of psoriasis through the action of neutrophil-derived IL-1β and TNF-α, along with the observed elevated neutrophil in both psoriatic lesions and peripheral blood, suggests an active involvement of neutrophils in the development of psoriasis.[3] Platelets, frequently elevated in infectious and inflammatory conditions, store various inflammatory cytokines and chemokines like IL-1β and CXCL8, which have significant implications in the pathogenesis of psoriasis.[4] While the neutrophil count is higher, lymphocyte count is lower in psoriasis; suggesting that circulating T-lymphocytes are activated and subsequently recruited from the circulation during the development of psoriasis.[5] The observed rise in platelet levels among individuals with psoriasis compared to those without the condition is likely a result of ongoing chronic inflammation.[6] Mean platelet volume (MPV), a measure of platelet size, is a valuable indicator of platelet activation along with function.[7] When evaluated against disease severity, particularly psoriasis area and severity index (measured by PASI score), it was seen that in several instances these hemogram markers are correlated with the severity of psoriasis.[8] Likewise, these parameters can also indicate a systemic inflammatory state that exists in psoriasis patients.[9] On the ground of this, increased NLR, PLR, and MPV levels are also emerged as unrecognized predictors of metabolic syndrome (MetS) and subclinical atherosclerosis in patients with psoriasis. Metabolic syndrome is an alarming health problem that affects approximately one-quarter of the world's adult population.[10] The presence of metabolic syndrome prominently increases the risk of developing type 2 diabetes and cardiovascular diseases which lead to serious complications like myocardial infarction, stroke, and death.[3]

Currently, there are no universally recognized laboratory markers indicating the disease activity of psoriasis. Parameters like NLR, PLR, and MPV, C-reactive protein (CRP) to cytokines, and adhesion molecules have been studied as objective laboratory parameters for psoriasis. Besides, NLR, PLR, and MPV have also been recognized as promising prognostic indicators for various chronic inflammatory conditions like systemic lupus erythematosus (SLE) and rheumatoid arthritis (RA), as well as for malignancies, stroke, and heart attacks.[11] Furthermore, these parameters are a simpler and cheaper method to assess and obtain from a basic and cost-effective blood test in the healthcare system.[5] However, how all the markers are individually associated with metabolic syndrome remains a debate.

Today, there is a considerable need for cost-effective inflammatory biomarkers in psoriasis that are simple to access, easily attainable, and can recognize the risk of developing metabolic syndrome in psoriasis patients.

METHODS

Cross-sectional comparative study Department of Dermatology and Venereology, Bangladesh Medical University, Dhaka, Bangladesh, total sample size 84 psoriasis patients. The total duration is 17 months, from the acceptance of the protocol in October 2022 until March 2024. Group A included psoriasis patient with metabolic syndrome attending at the Department of Dermatology and Venereology, Bangladesh Medical University. Group B included psoriasis patients without metabolic syndrome attending at the Department of Dermatology and Venereology, Bangladesh Medical University. A purposive sampling technique was applied to collect the sample from the study population during the study period.

Inclusion criteria

Patients who were diagnosed with psoriasis both clinically and/or histopathologically, age >18 years, able to give explained written consents, and able to understand questions and communicate well were included.

Exclusion criteria

Individuals with known cases of chronic inflammatory diseases such as chronic liver disease, hematological diseases, chronic kidney disease, connective tissue disease, coronary artery disease, inflammatory bowel disease, autoimmune disorders, malignancy, thyroid disease, and active infection were excluded.

Data collection tools

A checklist was prepared for each patient. PASI score measuring tool. Informed written consent in Bangla and English. Tools for physical examination. Laboratory investigation reports. A semi-structured questionnaire was developed. The questionnaire was pretested in the same categories of admitted patients. Collection of pictures of the study subject after taking consent.

Data processing and analysis

After collection of all the required data, they were checked, verified for consistency, and tabulated using the statistical package for the social sciences (SPSS) version 26 (IBM Corp., Armonk, NY). Frequencies and percentages were calculated as summary measures for the qualitative variables. Arithmetic mean and standard deviation were used to describe the quantitative variables. The independent sample t-test was used to compare symmetrically distributed continuous variables.

Receiver operator curve analysis was done to show performance of inflammatory markers (NLR, PLR and MPV) in predicting metabolic syndrome in psoriasis patients. A p value <0.05 was considered statistically significant.

Ethical consideration

The study was approved by the institutional review board (IRB) of Bangladesh Medical University. The eligibility of everyone was assessed, and they were informed about the procedure and the study objectives and that there was no chance of any harm to the individuals by inclusion in the study. Individuals were also informed that they are free to refuse to participate or to withdraw at any time. Everyone was interviewed who willingly takes part in the study with consent and the individual's confidentiality was strictly maintained.

RESULTS

Table 1 demonstrates that the mean body weight was significantly higher in group A than in group B (70.85±12.38 versus 62.35±11.27 kg, p=0.001). Similarly, the mean body mass index (BMI) was significantly higher in group A (27.10±4.62 versus 23.65±4.48 kg/m², p=0.001). However, mean height was comparable between the groups (161.92±10.25 versus 162.73±9.47 cm, p=0.709).

Table 2 shows significant differences in metabolic parameters between the two groups. Patients with metabolic syndrome had higher mean waist circumference (94.98±8.63 versus 83.99±8.80 cm), systolic blood pressure (136.31±21.98 versus 117.38±12.06 mmHg), and diastolic blood pressure (89.76±14.90 versus 80.00±8.19 mmHg). Fasting blood glucose and triglyceride levels were also significantly higher in group A (5.85±1.30 mmol/L and 206.57±106.57 mg/dl, respectively). In contrast, high-density lipoprotein cholesterol (HDL) cholesterol was significantly lower in group A than in group B (40.90±8.18 versus 45.50±10.32 mg/dl, p=0.026). All these differences were statistically significant.

Table 3 shows that the mean duration of psoriasis was comparable between group A and group B (5.14±4.76 versus 4.98±5.43 years, p=0.881). The mean age of onset was higher in group A (34.74±13.68 versus 28.69±14.37 years, p=0.052). Plaque psoriasis was the predominant type in both groups (90.5% versus 88.1%). Positive family history was observed in 16.7% of patients in each group. No, statistically significant differences were found in disease duration, age of onset, clinical types, or family history between the groups (p>0.05).

Table 4 shows, the mean PASI score was significantly higher in psoriasis with metabolic syndrome than psoriasis patients without metabolic syndrome (11.80±2.88 versus 10.65±2.18, p=0.042). Overall, maximum patients from both groups had moderate severity of psoriasis (59.5% in group-A and 66.7% in group-B, p=0.498).

Table 5 shows that absolute neutrophil count was significantly higher in psoriasis with metabolic syndrome than patients without metabolic syndrome (7.15±3.71 versus 4.98±1.56, p=0.001). However, absolute lymphocyte count and platelet count was statistically similar between groups (p>0.05).

Table 6 shows psoriasis patients with metabolic syndrome had significantly higher means of NLR (2.75±1.31 versus 2.19±0.87, p=0.023) and MPV value (10.84±1.23 versus 10.06±1.38 fL, p=0.007) than patients without metabolic syndrome. However, the mean PLR value was statistically similar between groups (p>0.05).

Table 1: Anthropometric measurements of the study participants (n=84).

Variables	Group-A (n=42)		Group-B (n=42)		P value
	Mean	SD	Mean	SD	
Height (in cm)	161.92	10.25	162.73	9.47	0.709
Weight (in kg)	70.85	12.38	62.35	11.27	0.001
BMI (kg/m²)	27.10	4.62	23.65	4.48	0.001

Table 2: Features of metabolic syndrome among study participants (n=84).

Variables	Group-A (n=42)		Group-B (n=42)		P value
	Mean	SD	Mean	SD	
Waist circumference (cm)	94.98	8.63	83.99	8.80	<0.001
Systolic BP (mmHg)	136.31	21.98	117.38	12.06	<0.001
Diastolic BP (mmHg)	89.76	14.90	80.0	8.19	<0.001
Fasting blood glucose (mmol/l)	5.85	1.30	5.03	0.50	<0.001
Triglyceride (mg/dl)	206.57	106.57	118.55	59.02	<0.001
HDL (mg/dl)	40.90	8.18	45.50	10.32	0.026

Table 3: Disease related history of the study patients (n=84).

Variables	Group-A (n=42), mean±SD/ N (%)	Group-B (n=42), mean±SD/ N (%)	P value
Duration of psoriasis (year)	5.14±4.76	4.98±5.43	0.881[ns]

Continued.

Variables	Group-A (n=42), mean±SD/ N (%)	Group-B (n=42), mean±SD/ N (%)	P value
Age of onset (year)	34.74±13.68	28.69±14.37	0.052^{ns}
Type of psoriasis			
Plaque	38 (90.5)	37 (88.1)	0.724^{ns}
Guttate	1 (2.4)	1 (2.4)	1.00^{ns}
Sebopsoriasis	2 (4.8)	3 (7.1)	0.645^{ns}
Pustular	1 (2.4)	1 (2.4)	1.00^{ns}
Positive family history of psoriasis	7 (16.7)	7 (16.7)	1.00^{ns}

NS: Not significant

Table 4: Severity of psoriasis among study patients (n=84).

Variables	Group-A (n=42), mean±SD/ N (%)	Group-B (n=42), mean±SD/ N (%)	P value
PASI score	11.80±2.88	10.65±2.18	0.042
Severity of psoriasis			
Mild	17 (40.5)	14 (33.3)	0.498
Moderate	25 (59.5)	28 (66.7)	

Table 5: Hematological findings of the study patients (n=84).

Variables	Group-A (n=42)		Group-B (n=42)		P value
	Mean	**SD**	**Mean**	**SD**	
Absolute neutrophil count (×10^9/l)	7.15	3.71	4.98	1.56	0.001
Absolute lymphocyte coun (×10^9/l)	2.73	0.79	2.42	0.72	0.067
Platelet count (×10^3/µl)	282.03	77.99	292.43	94.39	0.584

Table 6: Comparison of values of inflammatory markers (NLR, PLR and MPV) between groups (n=84).

Variables	Group-A (n=42), mean±SD/ N (%)	Group-B (n=42), mean±SD/ N (%)	P value
NLR	2.75±1.31	2.19±0.87	0.023
PLR	111.86±45.25	130.92±69.13	0.139
MPV (fL)	10.84±1.23	10.06±1.38	0.0

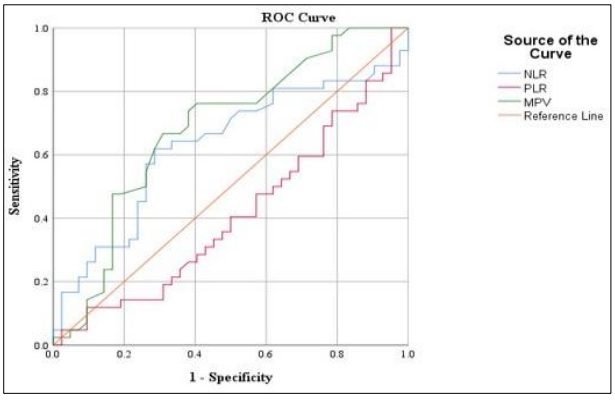


Figure 1: Receiver operator curve showing performance of inflammatory markers (NLR, PLR and MPV) in predicting psoriasis patients with metabolic syndrome (n=84).

Table 7 shows receiver operator curve analysis found significant AUC for NLR (AUC=0.630, 95% CI=0.507-0.752) and MPV (AUC=0.683, 95% CI=0.567-0.799) to predict psoriasis patients with metabolic syndrome. The best cut-offs for NLR and MPV were found to be 2.24 (sensitivity 64.3%, specificity 67.7%) and 10.35 fL (sensitivity 66.7% and specificity 69%), respectively.

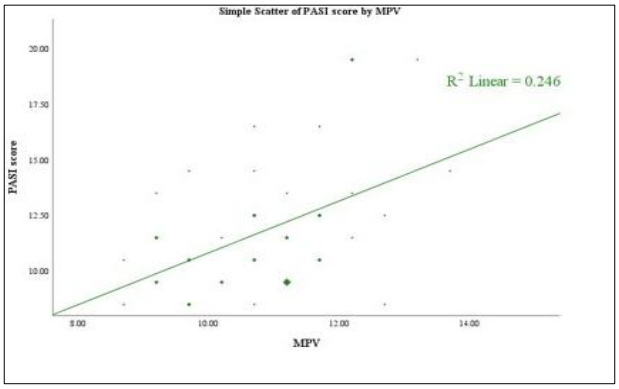


Figure 2: Correlation between MPV and severity of psoriasis in patients with metabolic syndrome using scatter plot diagram (n=42).

Pearson correlation model showed that MPV had significant moderate positive relation with severity of psoriasis according to PASI score in patients with metabolic syndrome (r=+0.496, p value <0.001).

Table 7: Result of ROC curve.

	AUC	95% CI		P value
		Lower	Upper	
NLR	0.630	0.507	0.752	0.041
PLR	0.411	0.288	0.533	0.159
MPV	0.683	0.567	0.799	0.004

DISCUSSION

Metabolic syndrome and psoriasis exhibit overlapping metabolic risk factors, genetic predispositions, and underlying pathogenic pathways. Proinflammatory mediators produced locally in psoriasis also enter systemic circulation and are responsible for the development of metabolic syndrome.[12] This study was conducted to evaluate the relationship of inflammatory markers, NLR, PLR, and MPV in psoriasis patients with metabolic syndrome.

In this study, psoriasis patients with metabolic syndrome had significantly higher mean of NLR than patients without metabolic syndrome (2.75±1.31 versus 2.19±0.87, p=0.023). This finding is distinctively important as previously NLR significance was sought individually with either psoriasis or with MetS. NLR value in psoriasis with MetS versus psoriasis without MetS was not particularly assessed. However, a study conducted by Hammad, Hamdino and El-Nasser in psoriasis versus healthy control showed a significantly increased NLR (2.48±1.78 versus 1.24±0.30, p value=0.001).[13] Several other studies have found a higher value of NLR (p value, <0.05) compared to healthy individuals.[2,14] Meta-analysis of 12 studies in Turkey showed a higher NLR value (p<0.001) in comparison to the control group.[9] When NLR was specifically evaluated against metabolic syndrome, Surendar et al found that NLR was highest in participants with 5 metabolic risk factors MRF (2.31±0.68) followed by 4 MRF (2.18±0.69), 3 MRF (1.95±0.74) (p value <0.001).[15] Similarly, NLR was found to be increased in MetS patients in several other studies.[16,17] In this study, MPV value was found significantly higher in psoriasis patients with MetS compared to without MetS (10.84±1.23 versus 10.06±1.38 fL, p value=0.007). Similarly, a study conducted by Korkmaz demonstrated that among 76 patients with mild PV, including 38 with MetS and 38 without MetS, MPV was significantly higher (10.7±1.1 versus 10.2 ±0.9, p=0.036).[18] On the contrary, Munise and TEMİZ showed that MPV is not significantly linked to psoriasis with MetS.[19] This discrepancy could be possibly due to the criteria of MetS that vary in different races in terms of waist circumference and blood glucose measurement from our study.

Regarding PLR, this study could not find any significant association between the two groups (111.86±45.25 versus 130.92±69.13, p value ≥0.05). Likewise, a significant association was also not established in other studies.[3,14,20] Receiver operator curve analysis found significant AUC for NLR and MPV. The NLR at cut-off=2.24 yielded a specificity of (67.7%) while a sensitivity of (64.3%) with (p value=0.04) and MPV at cut-off=10.35 yielded a specificity of (69%) and sensitivity of (66.7%) with (p value=0.004), to predict metabolic syndrome in psoriasis patients. This indicates that NLR correctly identifies 64.3% of patients with psoriasis with MetS and correctly 67.7% of psoriasis patients without MetS. For the NLR previous studies have evidence of a cut-off=1.66 to differentiate psoriasis from healthy individuals but not to predict MetS in psoriasis.[13] In this study, the severity of psoriasis was assessed using the PASI score. The average PASI score was notably higher in patients with psoriasis and MetS compared to those without MetS (11.80±2.88 versus 10.65±2.18, p=0.042). Similarly, Langan et al noted an association between psoriasis and MetS, which became more pronounce with worsening disease severity.[21] The study reveals that MPV had a significant moderate positive relation with the severity of psoriasis according to the PASI score among psoriasis patients with metabolic syndrome (r=+0.496, p value <0.001) compared to psoriasis patients without metabolic syndrome. These findings suggest that psoriasis with metabolic syndrome represents a more severe form of psoriasis and is characterized by increased platelet activity. Overall factors contributing to inconsistent research findings may include variations in sample size, duration of illness, variation in the severity assessment tool scoring system, study design, (e.g., retrospective versus prospective), comorbid conditions, racial and ethnic diversity among different population.

CONCLUSION

This study demonstrates that psoriasis patients with metabolic syndrome have significantly higher NLR and MPV levels than those without metabolic syndrome, while MPV shows a moderate positive correlation with PASI score. These findings suggest that NLR and MPV may serve as simple, accessible, and cost-effective markers for identifying psoriasis patients who may have metabolic syndrome. As both parameters are obtained from a routine complete blood count, they may be useful preliminary indicators, particularly in resource-limited settings such as Bangladesh. Their use could help clinicians identify patients requiring metabolic assessment and regular follow-up. Early recognition and monitoring may support the prevention or timely management of diabetes mellitus and cardiovascular complications, potentially improving outcomes and quality of life in patients with psoriasis.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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