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Dr. R Rengaraj
Assistant Professor,
Department of Medicine.
Oxford Medical College
Hospital and Research Centre,
Bangalore, Karnataka, India

Dr. Kisalay Saurav
Assistant Professor,
Department of Dermatology,
Vydehi Institute of Medical
Sciences and Research Centre,
Bangalore, Karnataka, India

Correspondence
Dr. Kisalay Saurav
Assistant Professor,
Department of Dermatology,
Vydehi Institute of Medical
Sciences and Research Centre,
Bangalore, Karnataka, India

Dermatological predictors of subclinical atherosclerosis and vascular dysfunction in chronic plaque psoriasis: A cross-sectional study

R Rengaraj and Kisalay Saurav

Abstract
Background: Psoriasis is increasingly recognized as a systemic inflammatory disorder associated with heightened cardiovascular risk. Early identification of subclinical vascular dysfunction in psoriasis patients may aid in preventing future cardiovascular events. This study aimed to evaluate dermatological predictors of cardiovascular risk in patients with chronic plaque psoriasis.
Methods: A cross-sectional observational study was conducted over one year (November 2015 to October 2016) at the Department of Medicine, Oxford Medical College and Hospital, Bangalore. Patients with confirmed stable plaque psoriasis aged >18 years were enrolled. Exclusion criteria included prior cardiovascular disease, autoimmune conditions, malignancy, renal dysfunction, and substance abuse. A total of 180 patients were assessed. Psoriasis severity was quantified using the Psoriasis Area and Severity Index (PASI), Body Surface Area (BSA) involvement, and Dermatology Life Quality Index (DLQI). Non-invasive cardiovascular evaluations included carotid intima-media thickness (CIMT), flow-mediated dilatation (FMD), and pulse wave velocity (PWV). Laboratory parameters such as lipid profile, fasting glucose, high-sensitivity C-reactive protein (hs-CRP), and inflammatory cytokines were measured. Correlation and multivariate logistic regression analyses were performed.
Results: The mean age was 44.6 ± 10.2 years, with 61.1% male participants. Subclinical atherosclerosis was detected in 43.3% of patients. Endothelial dysfunction (FMD <10%) was noted in 58.9%, and increased PWV was present in 44.4%. Higher PASI scores positively correlated with increased CIMT and negatively with FMD. PASI >12, disease duration >10 years, hypertension, dyslipidemia, and elevated hs-CRP independently predicted subclinical atherosclerosis.
Conclusion: Psoriasis severity and systemic inflammation are strong predictors of early cardiovascular dysfunction. Dermatological assessment may serve as an essential tool for cardiovascular risk stratification in psoriasis patients.

Keywords: Chronic plaque psoriasis, subclinical atherosclerosis, vascular dysfunction, PASI score

Introduction

Psoriasis, a chronic, immune-mediated inflammatory dermatosis, has traditionally been regarded as a disorder confined to the skin and joints. However, substantial evidence now implicates psoriasis as a systemic inflammatory condition associated with a markedly increased risk of cardiovascular disease (CVD) [1]. Systemic inflammation, a pivotal pathogenic mechanism in psoriasis, promotes endothelial dysfunction, accelerates atherosclerosis, and predisposes individuals to major adverse cardiovascular events [2]. As a result, psoriasis is increasingly recognized not merely as a cutaneous disorder, but as a complex, multi-system disease with significant cardiovascular implications.

The inflammatory milieu of psoriasis is dominated by elevated levels of pro-inflammatory cytokines such as tumor necrosis factor-alpha (TNF-α), interleukin (IL)-17, and IL-23, which are key drivers of both psoriatic plaques and atherosclerotic plaque formation [3]. Chronic systemic inflammation contributes to endothelial injury, vascular remodeling, and plaque instability, thereby bridging the pathophysiological gap between psoriasis and atherosclerosis. Observational studies have demonstrated that patients with moderate-to-severe psoriasis possess an approximately 50% greater risk of myocardial infarction compared to non-affected individuals, independent of traditional cardiovascular risk factors [4].

Emerging data further suggest that certain dermatological features, including the severity and extent of psoriatic involvement, may serve as surrogate markers of systemic inflammation and vascular risk. Severity scores such as the Psoriasis Area and Severity Index (PASI) and Body Surface Area (BSA) involvement have shown correlations with subclinical atherosclerosis and increased carotid intima-media thickness (CIMT) [5]. Moreover, non-invasive vascular imaging techniques, including carotid ultrasonography and coronary computed tomography angiography, have revealed a higher burden of non-calcified, inflammatory atherosclerotic plaques in psoriasis patients compared to matched controls [6].

The coexistence of psoriasis with traditional cardiovascular risk factors such as obesity, hypertension, dyslipidemia, and insulin resistance further amplifies the atherogenic risk profile of these individuals [7]. Metabolic syndrome, in particular, is disproportionately prevalent among psoriasis patients and contributes synergistically to the heightened cardiovascular morbidity observed in this group. Furthermore, endothelial progenitor cell dysfunction and impaired vascular repair mechanisms have been documented in psoriasis, providing additional mechanistic links to accelerated atherosclerosis [8].

Despite these associations, dermatological predictors that can reliably stratify cardiovascular risk in patients with psoriasis remain incompletely characterized. Identifying specific cutaneous markers predictive of vascular pathology could significantly enhance early cardiovascular risk assessment and preventive strategies in this vulnerable population. Understanding the dermatological indicators associated with underlying atherosclerosis may therefore offer critical opportunities for intervention prior to the manifestation of overt cardiovascular disease.

There is a compelling need for this study to delineate dermatological predictors of cardiovascular risk in psoriasis and to better understand the cutaneous correlates of early atherosclerotic changes, thereby facilitating timely identification and risk mitigation.

Methodology

A cross-sectional observational study was conducted to investigate the dermatological predictors of cardiovascular risk among patients with psoriasis. The study was carried out over a period of one year (from November 2015 to October 2016) at the Department of Medicine at Oxford Medical College and Hospital, Bangalore.

180 adult patients aged between 18 and 65 years with a clinical diagnosis of chronic plaque psoriasis, confirmed by dermatological examination, were recruited. Only patients with stable disease for a minimum of six months were included to minimize the impact of transient disease exacerbations. Exclusion criteria comprised individuals with known cardiovascular disease, systemic autoimmune conditions other than psoriasis, chronic kidney disease, pregnancy, malignancy, or those receiving systemic anti-inflammatory or immunomodulatory therapies within the preceding three months. History of smoking or alcohol dependence was also excluded to control for confounding vascular risk factors.

Demographic details including age, gender, height, weight, and body mass index (BMI) were recorded. Detailed clinical history encompassing disease duration, treatment history, and comorbidities such as hypertension, diabetes mellitus, and dyslipidemia was obtained. A complete dermatological assessment was performed, and psoriasis severity was quantified using the Psoriasis Area and Severity Index (PASI), Body Surface Area (BSA) involvement, and Dermatology Life Quality Index (DLQI) scores.

All patients underwent non-invasive cardiovascular evaluation. Carotid intima-media thickness (CIMT) was measured using high-resolution B-mode ultrasonography performed by an experienced radiologist blinded to the clinical data. CIMT was assessed at three sites along the bilateral common carotid arteries, and mean values were recorded. A CIMT value >0.9 mm or the presence of atherosclerotic plaque was considered indicative of subclinical atherosclerosis.

Endothelial function was evaluated using flow-mediated dilatation (FMD) of the brachial artery, with a value <10% considered impaired. In addition, arterial stiffness was assessed by measuring pulse wave velocity (PWV) using an automated oscillometric device. A PWV >10 m/s was interpreted as abnormal.

Fasting blood samples were collected to assess lipid profile, fasting glucose, high-sensitivity C-reactive protein (hs-CRP), and serum inflammatory cytokines including TNF-α and IL-6. All laboratory analyses were conducted in the institution's central laboratory using standardized protocols.

Data were analyzed using SPSS software and appropriate statistical methods were employed.

Ethical clearance for the study was obtained from the Institutional Ethics Committee of Oxford Medical College and Hospital prior to initiation.

Results

Table 1: Baseline Demographic and Clinical Characteristics (n=180)

Characteristic	Frequency (%)
Age (years) (mean ± SD)	44.6 ± 10.2
Gender	
- Male	110 (61.1%)
- Female	70 (38.9%)
Mean BMI (kg/m²)	27.2 ± 4.5
Hypertension	82 (45.5%)
Diabetes Mellitus	68 (37.8%)
Dyslipidemia	76 (42.2%)
Smoking History	0 (excluded)
Mean Duration of Psoriasis (years)	9.8 ± 6.4
Mean PASI Score	12.5 ± 6.7
Mean BSA Involvement (%)	18.2 ± 9.4
Mean DLQI Score	14.6 ± 5.8

Table 2: Carotid Intima-Media Thickness (CIMT) and Subclinical Atherosclerosis (n=180)

CIMT Category	Frequency (%)
CIMT ≤ 0.9 mm	102 (56.7%)
CIMT > 0.9 mm or plaque present	78 (43.3%)
Mean CIMT (mm)	0.86 ± 0.19

Table 3: Flow-Mediated Dilatation (FMD) and Endothelial Dysfunction (n=180)

FMD Measurement	Frequency (%)
Normal FMD (≥10%)	74 (41.1%)
Impaired FMD (<10%)	106 (58.9%)
Mean FMD (%)	8.2 ± 3.4

Table 4: Pulse Wave Velocity (PWV) and Arterial Stiffness (n=180)

PWV Measurement	Frequency (%)
PWV ≤ 10 m/s	100 (55.6%)
PWV > 10 m/s	80 (44.4%)
Mean PWV (m/s)	10.4 ± 1.7

Table 5: Correlation between Psoriasis Severity and Cardiovascular Parameters

Parameter	r-value	p-value
PASI vs CIMT	+0.42	<0.001
PASI vs FMD	-0.36	<0.001
PASI vs PWV	+0.40	<0.001
BSA vs CIMT	+0.38	<0.001
BSA vs FMD	-0.31	0.002

Table 6: Multivariate Logistic Regression for Predictors of Subclinical Atherosclerosis

Predictor Variable	Adjusted OR (95% CI)	p-value
PASI >12	2.6 (1.4-4.8)	0.002
Duration of Psoriasis >10 years	2.1 (1.1-3.9)	0.015
Hypertension	1.9 (1.0-3.5)	0.041
Dyslipidemia	2.3 (1.2-4.2)	0.008
Elevated hs-CRP (>3 mg/L)	2.8 (1.5-5.1)	0.001

The present study included 180 patients with chronic plaque psoriasis, with a mean age of 44.6 ± 10.2 years. Male participants constituted 61.1% of the study cohort. The mean body mass index (BMI) was 27.2 ± 4.5 kg/m². The prevalence of comorbid hypertension, diabetes mellitus, and dyslipidemia was 45.5%, 37.8%, and 42.2%, respectively. The mean duration of psoriasis was 9.8 ± 6.4 years, with an average Psoriasis Area and Severity Index (PASI) score of 12.5 ± 6.7 and mean Body Surface Area (BSA) involvement of 18.2 ± 9.4%.

Assessment of vascular health revealed that 43.3% of patients had evidence of subclinical atherosclerosis, as indicated by carotid intima-media thickness (CIMT) greater than 0.9 mm or the presence of plaques. The mean CIMT value across the cohort was 0.86 ± 0.19 mm. Endothelial dysfunction, assessed by flow-mediated dilatation (FMD), was observed in 58.9% of participants, with a mean FMD of 8.2 ± 3.4%. Arterial stiffness, evaluated by pulse wave velocity (PWV), was present in 44.4% of patients, with a mean PWV of 10.4 ± 1.7 m/s.

Correlation analysis demonstrated significant relationships between psoriasis severity and cardiovascular parameters. Higher PASI scores showed a positive correlation with increased CIMT (r=+0.42, p<0.001) and PWV (r=+0.40, p<0.001), and a negative correlation with FMD (r=-0.36, p<0.001). Similarly, BSA involvement correlated positively with CIMT (r=+0.38, p<0.001) and negatively with FMD (r=-0.31, p=0.002).

Multivariate logistic regression analysis identified PASI scores greater than 12 (adjusted OR 2.6; 95% CI 1.4-4.8; p=0.002), disease duration exceeding 10 years (adjusted OR 2.1; 95% CI 1.1-3.9; p=0.015), hypertension (adjusted OR 1.9; 95% CI 1.0-3.5; p=0.041), dyslipidemia (adjusted OR 2.3; 95% CI 1.2-4.2; p=0.008), and elevated high-sensitivity C-reactive protein (hs-CRP >3 mg/L) (adjusted OR 2.8; 95% CI 1.5-5.1; p=0.001) as independent predictors of subclinical atherosclerosis.

Discussion

The present study highlights a substantial burden of subclinical atherosclerosis and endothelial dysfunction in patients with chronic plaque psoriasis. Nearly 43.3% of participants exhibited increased CIMT or plaque formation, while 58.9% demonstrated impaired flow-mediated dilatation (FMD), and 44.4% had elevated pulse wave velocity (PWV). These findings support the evolving understanding that psoriasis is not confined to cutaneous manifestations but represents a systemic inflammatory disease with considerable cardiovascular implications.

Takeshita *et al* [1] emphasized that psoriasis is associated with an increased prevalence of cardiovascular comorbidities, independent of traditional risk factors. In the current cohort, the mean CIMT was 0.86 ± 0.19 mm, aligning closely with the observations of Balci *et al* [8], who reported significantly increased CIMT values in psoriasis patients compared to controls.

The high prevalence of endothelial dysfunction observed in this study corroborates the findings of Gonzalez-Juanatey *et al* [9], who demonstrated impaired endothelial function in psoriatic arthritis patients without overt cardiovascular disease. The mean FMD of 8.2 ± 3.4% recorded here is indicative of compromised endothelial responsiveness, which has been previously attributed to the inflammatory milieu inherent in psoriasis.

Arterial stiffness, reflected by a mean PWV of 10.4 ± 1.7 m/s, was documented in nearly half of the study participants. Baumer and Tofler [10] similarly reported that increased arterial stiffness in psoriasis patients correlates with elevated cardiovascular event rates. Chronic low-grade inflammation, oxidative stress, and resultant vascular injury likely contribute to the stiffening of arterial walls observed in these individuals.

The present study also demonstrated a significant correlation between psoriasis severity and cardiovascular parameters. Higher PASI and BSA scores were associated with increased CIMT and PWV and reduced FMD. Mehta *et al* [5] proposed that severe psoriasis confers an approximately 50% greater risk of major cardiovascular events, findings that mirror the current observations where PASI scores greater than 12 were independently predictive of subclinical atherosclerosis.

In addition to dermatological severity, comorbidities such as hypertension, dyslipidemia, and diabetes mellitus were common, present in 45.5%, 42.2%, and 37.8% of the cohort, respectively. Armstrong *et al* [3] have previously highlighted the strong association between psoriasis and metabolic syndrome components, emphasizing the cumulative cardiovascular burden posed by these overlapping risk factors.

High-sensitivity C-reactive protein (hs-CRP) emerged as another independent predictor of subclinical atherosclerosis. Elevated hs-CRP levels, indicative of systemic inflammation, have been shown by Gelfand *et al* [2] to correlate with increased risk of myocardial infarction among psoriasis patients, underscoring the importance of inflammatory biomarkers in cardiovascular risk stratification.

Importantly, multivariate logistic regression confirmed that psoriasis severity, disease duration exceeding ten years, hypertension, dyslipidemia, and elevated hs-CRP levels were independent predictors of subclinical vascular disease. These findings are in concordance with the concept of the

"psoriatic march," proposed by Boehncke *et al* [4], wherein systemic inflammation originating in the skin progressively affects the vascular endothelium, culminating in atherosclerosis.
Higher Psoriasis Area and Severity Index scores, longer disease duration, and elevated inflammatory markers were independent predictors of vascular dysfunction. The coexistence of metabolic comorbidities further exacerbated cardiovascular risk. These findings emphasize the importance of early cardiovascular screening and integrated management in patients with moderate to severe psoriasis to prevent long-term vascular complications.

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