Ultrasonographic evaluation of subclinical atherosclerosis in the femoral and carotid arteries of patients with psoriasis

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Background: Psoriasis is a prevailing continual inflammatory affliction, carrying a considerable risk of cardiac diseases, sometimes even not traceable by conventional predisposing factors. Detection of subclinical atherosclerosis in psoriasis by ultrasonography is beneficial, and it has been solitarily explored in carotid arteries. It was found to have a weak predictive value, and so the femoral arteries have now been contemplated. This study aims to determine subclinical atherosclerosis occurrence by evaluating the femoral and carotid arteries' intima-media thickness (IMT) by ultrasonography in patients with psoriasis.

Methods: The study was carried out in the departments of dermatology and radiology at Dr. Pinnamaneni Siddhartha Institute of Medical Sciences & Research Foundation for eight months. The sample size consisted of 30 chronic plaque psoriasis cases and 30 controls, matched for age and sex. Patients with comorbidities were excluded. Femoral & carotid arteries were assessed for IMT by ultrasonography.

Results: In our study, the age range was 30–80 years, and a male (56.7%) preponderance was observed in cases and controls. The mean femoral artery and carotid artery IMTs were remarkably greater in cases than in controls, with P-values < 0.001 and 0.04, respectively. The mean femoral artery IMT was significantly more elevated (1.4 ± 0.63 mm) than the carotid artery IMT (1.0 ± 0.62 mm) in cases ($P = 0.01$).

Conclusion: Ultrasonographic screening of femoral artery IMT enhances the early discernment of subclinical atherosclerosis when compared with carotid artery IMT. Thereby, it helps in the early identification of cardiovascular disease in patients with psoriasis.

Keywords: femoral artery, carotid artery, intima-media thickness, psoriasis, atherosclerosis

INTRODUCTION

Psoriasis is a continual inflammatory, immune-mediated, recurrent affliction affecting the skin and joints of individuals predisposed genetically [1]. This disorder is linked with a considerable risk of cardiovascular disease (CVD), which is sometimes not traceable by conventional predisposing factors.

Augmented intima-media thickness (IMT) is an early anatomical change in atherosclerosis; the IMT of the large peripheral arteries correlates with the existence and development of atherosclerosis in minor arteries like the coronary arteries [2]. Early discernment of subclinical atherosclerosis

and addressing this condition in patients with psoriasis will reduce the probability of coronary artery disease. Henceforth, meticulous screening of patients for subclinical atherosclerosis is necessary, making it essential to have an easy but accurate, quantifiable measure of subclinical atherosclerosis. Among various diagnostic techniques, the B-ultrasonographic mode quantification of IMT has evolved as one of the finest practices for assessing subclinical atherosclerosis.

In various studies, subclinical atherosclerosis screening in psoriasis has solitarily been explored in carotid arteries. It was found to have a weak predictive value, so the femoral artery has now been contemplated for this purpose. Compared to carotid plaques, femoral plaques have been cited as a remarkable indicator of coronary atherosclerosis and coronary fatality in autopsy studies [3,4]. Research among normal adults has shown that femoral plaques are more common than carotid plaques and are more firmly correlated with conventional CVD predisposing factors and coronary calcium [5-7].

The present study aims to evaluate the IMT of the femoral and carotid arteries by ultrasonography in cases of psoriasis, thereby examining the existence of subclinical atherosclerosis.

MATERIAL AND METHODS

The study was conducted at the dermatology and radiology departments of Dr. Pinnamaneni Siddhartha Institute of Medical Sciences & Research Foundation after acquiring assent from the Institutional Ethics Committee. It was done for eight months, from July 2019 to February 2020. The sample consisted of 30 chronic plaque psoriasis cases and 30 controls, matched for age and sex. Patients with earlier diagnosis of or treatment for peripheral or coronary artery disease, acute coronary syndrome, transient ischemic attack or stroke, heart failure, and remarkable kidney or liver dysfunction were eliminated from the study.

After obtaining consent from cases and controls, the medical history and Psoriasis Area and Severity Index (PASI) were evaluated among cases, and ultrasonography (Philips model Affinity 50G, USA) of the common carotid arteries was done. After freezing the image, the IMT of the distal portion [8] of both arteries was measured. IMT measurement was taken from the lumen's leading-edge–intima

juncture to the contrary media-adventitia juncture at 2 cm beneath the bisection of the arteries on either side [9,10], and the mean IMT of three readings was recorded. Similarly, both common femoral arteries were imaged sequentially, from just above the inguinal ligament to its bisection into the superficial femoral branches and profunda femoris. The IMT at the leading edges of the lumen-intima juncture and the media-adventitia juncture was measured twice [9,11,12] at a point 1–2 cm above the bisection of the common femoral arteries, and the mean was noted [9,12]. A detailed sonographic assessment of IMT was performed by an expert radiologist deprived of all clinical details. The radiologist was unaware whether the person being examined was a psoriasis patient or a healthy control, exempting when cutaneous lesions were apparent to the eye.

Statistical Analysis

The data obtained were tabulated and assessed using Statistical Package for the Social Sciences software version 21 (SPSS Inc). Frequency tables, means ± standard deviation, and percentages were used to summarize the age and sex distribution, mean duration, PASI score, and femoral and carotid arteries IMT among cases and controls after normality testing. A chi-squared test was used to test age and sex variables with respect to cases and controls. Independent t-tests and ANOVA tests were used to measure femoral artery intima-media thickness (FIMT) and carotid artery intima-media thickness (CIMT) in cases and controls with respect to age and sex. An independent t-test at a 95% level of significance was used to compare FIMT and CIMT between cases and controls. A Pearson correlation coefficient was used to assess the correlation of FIMT and CIMT in cases with the PASI. Two-tailed *P*-values < 0.05 were contemplated as statistically significant.

RESULTS

Out of 60 study participants, 30 were cases (17 males and 13 females), and 30 were healthy controls (17 males & 13 females), aged from 30 to 80 years. The mean age was 51.23 ± 14.14 and 50.73 ± 13.67 years in the cases and controls, respectively. Male (56.7%) preponderance was observed in both groups. The mean duration of the disease was 3.4 ± 1.2 years, and the mean PASI score of the patients was 12.8 ± 5.2. On comparison between

groups, no statistical difference was seen using the chi-squared test concerning age and gender.

No statistical differences were observed in the FIMT and CIMT of cases and controls with respect to age and sex, as shown in Tables 1 and 2.

The mean FIMT (mm) was remarkably higher in the cases (1.4 ± 0.63 mm) in comparison with controls (0.5 ± 0.09 mm), with a *P*-value < 0.001. Similarly, the mean CIMT (mm) was also higher in the cases (1.0 ± 0.62 mm) in comparison with controls (0.8 ± 0.07 mm), with a *P*-value of 0.04 (Table 3).

All patients in the study group showed increased mean intima-media wall thickness (IMT) compared to controls. Among 30 patients, 16 (53.3%) patients had only increased FIMT, and 14 (46.7%) patients had both increased FIMT and CIMT. Out of these 14, 71.4% (10) had more pronounced changes in the FIMT than in the CIMT. No significant differences were observed in FIMT (0.132) and CIMT (0.15) in cases with respect to the PASI score, with *P*-values of 0.48 and 0.42, respectively.

Among psoriasis patients, the mean FIMT (1.4 ± 0.63 mm) was significantly higher than the mean CIMT (1.0 ± 0.62 mm), with a *P*-value of 0.01. Examples of IMT measurement are presented in Figures 1–4.

Table 3. Comparison of femoral artery intima-media thickness (FIMT) and carotid artery intima-media thickness (CIMT) between cases and controls

	FIMT (mm)		CIMT (mm)	
	Mean	**SD**	**Mean**	**SD**
Cases (30)	1.402	0.63	1.004	0.62
Controls (30)	0.5	0.09	0.8	0.07
P-value	< 0.001		0.04	

DISCUSSION

The link between psoriasis and the possibility of cardiac diseases is contentious, and a systematic review proposed that psoriasis is interrelated with ischemic heart disease but not with cerebrovascular diseases and cardiovascular fatality [13]. Our study also showed that patients with psoriasis are at greater risk of subclinical atherosclerosis.

The precise pathogenesis of psoriasis in aiding atherosclerosis remains ambiguous. Psoriasis is a chronic systemic inflammatory state connected to a hastening of atherosclerotic lesions. Chronic systemic inflammation stimulates endothelial dysfunction, glucose metabolism alteration, and insulin resistance, which play a remarkable role in atherosclerosis development [14,15]. Various immunological factors with a dominant interleukin

Table 1. Comparison of femoral artery intima-media thickness (FIMT) in cases and controls with respect to age and sex

Variables	Cases		Controls	
	FIMT (mm)	*P*-value	FIMT (mm)	*P*-value
Age (years)				
30–40	1.01 ± 0.25		0.50 ± 0.09	
41–50	1.63 ± 0.61		0.47 ± 0.05	
51–60	1.35 ± 0.73	0.22	0.55 ± 0.08	0.57
61–70	1.4 ± 0.61		0.48 ± 0.12	
71–80	1.81 ± 0.89		0.49 ± 0.09	
Sex				
Male	1.57 ± 0.69		0.51 ± 0.10	
Female	1.17 ± 0.46	0.09	0.48 ± 0.08	0.54

Table 2. Comparison of carotid artery intima-media thickness (CIMT) in cases and controls with respect to age and sex

Variables	Cases		Controls	
	CIMT (mm)	*P*-value	CIMT (mm)	*P*-value
Age (years)				
30–40	0.73 ± 0.21		0.76 ± 0.05	
41–50	1.05 ± 0.69		0.80 ± 0.11	
51–60	1.32 ± 0.81	0.54	0.78 ± 0.04	0.53
61–70	0.95 ± 0.81		0.73 ± 0.05	
71–80	1.05 ± 0.90		0.80 ± 0.14	
Sex				
Male	1.12 ± 0.72		0.76 ± 0.07	
Female	0.85 ± 0.45	0.25	0.79 ± 0.08	0.23

Figure 1. Carotid artery intima-media thickness in a patient with psoriasis

Figure 2. Carotid artery intima-media thickness in a participant from the control group
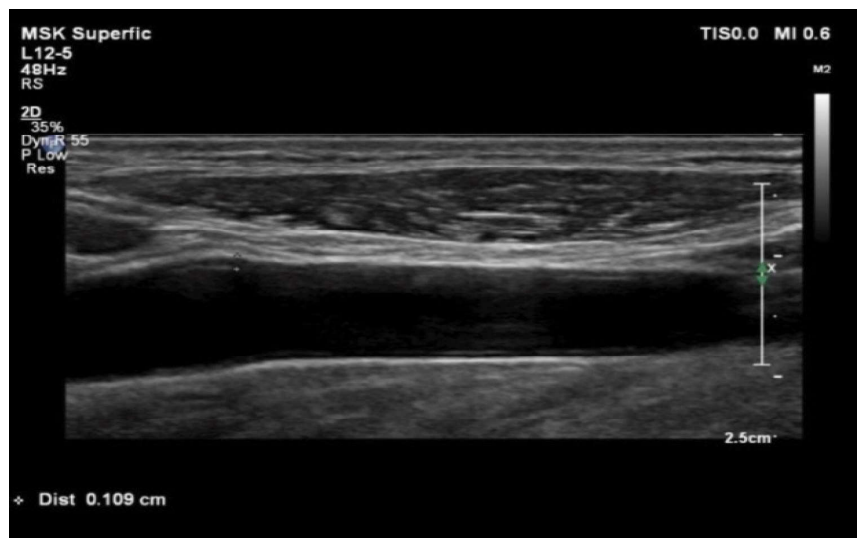

Figure 3. Femoral artery intima-media thickness in a participant from the control group

Figure 4. Femoral artery intima-media thickness in a patient with psoriasis

(IL)-23/Th17 axis and adipocytokines are involved in these processes, such as adiponectin, which suppresses the secretion of tumor necrosis factor (TNF)-α from keratinocytes. The inflammatory scene stimulates keratinocyte multiplication via TNF-α, interferon-γ, and IL-17. Factors, namely C-reactive protein & TNF-α, also contribute to atherosclerosis [16]. Compared with healthy controls, decreased adiponectin levels in normal-weight psoriasis patients were observed [1].

In psoriasis, evaluation of subclinical atherosclerosis by ultrasound in previous studies was carried out only on the carotid arteries. Nevertheless, contentious outcomes were seen, with one research done by Arias-Santiago *et al.* showing a greater prevalence of carotid plaques among cases with psoriasis compared with controls [17]. In contrast, the other two studies noted no remarkable between-group differences in the prevalence of carotid plaques [18,19]. As the need to detect subclinical atherosclerosis early in patients with psoriasis persists, the FIMT has been contemplated.

Ultrasonography data of our study showed that the mean FIMT and CIMT were 1.4 ± 0.63 mm & 1.0 ± 0.62 mm, respectively, in patients with psoriasis. A comparison between both revealed a significant difference ($P = 0.01$), confirming that FIMT improved the discernment of subclinical atherosclerosis among cases with psoriasis compared to CIMT and was in accordance with various studies [20,21]. In our study, no significant association was seen between IMT and PASI. So,

ultrasonography aids in assessing the cardiovascular risk in psoriasis patients without the overt disease, and the PASI does not play a significant role in such conditions.

The increased mean FIMT indicated an elevated risk of CVD in patients with psoriasis in comparison with controls. This may substantiate the postulation that the reason for the increased atherosclerosis risk in these cases is both diseases' common inflammatory pathways. The share of identical inflammatory mediators and similar cellular responses leads to endothelial dysfunction, oxidative stress, and angiogenesis. Auxiliary, genetic predisposition concedes searching for novel techniques of treatment and prevention.

CONCLUSION

Ultrasonographic screening of FIMT enhances the early discernment of subclinical atherosclerosis when compared with CIMT. Thereby, it helps in the early identification of cardiovascular disease in patients with psoriasis.

Conflict of Interest: None declared.

REFERENCES

1. Grozdev I, Korman N, Tsankov N. Psoriasis as a systemic disease. Clin Dermatol. 2014;32:343–350.

2. Stein JH, Korcarz CE, Hurst RT, et al. Use of carotid ultrasound to identify subclinical vascular disease and

evaluate cardiovascular disease risk: a consensus statement from the American Society of Echocardiography Carotid Intima-Media Thickness Task Force. Endorsed by the Society for Vascular Medicine. J Am Soc Echocardiogr. 2008;21:93-111.

3. Dalager S, Falk E, Kristensen IB, et al. Plaque in superficial femoral arteries indicates generalized atherosclerosis and vulnerability to coronary death: an autopsy study. J Vasc Surg. 2008;47(2):296-30.

4. Molnar S, Kere' nyi L, Ritter MA, et al. Correlations between the atherosclerotic changes of femoral, carotid, and coronary arteries. A post mortem study. J Neurol Sci. 2009;287:241–245.

5. Laclaustra M, Casasnovas JA, Ferna'ndez-Ortiz A, et al. Femoral and carotid subclinical atherosclerosis association with risk factors and coronary calcium: the AWHS study. J Am Coll Cardiol. 2016;67(11):1263-74.

6. Lucatelli P, Fagnani C, Tarnoki AD, et al. Femoral artery ultrasound examination: a new role in predicting cardiovascular risk. Angiology. 2016; 68(3):1–9.

7. Lo'pez-Melgar B, Ferna'ndez-Friera L, Oliva B, et al. Subclinical atherosclerosis burden by 3D ultrasound in mid-life: the PESA Study. J Am Coll Cardiol. 2017;70:301–313.

8. Umeh EO, Agunloye AM, AdekanmiAJ, et al. Ultrasound evaluation of intima-media thickness of carotid arteries in adults with primary hypertension at Ibadan, Nigeria. West Afr J Med. 2013;32:62-7.

9. Rietzschel ER, De Buyzere ML, DuprezDA, et al. Interchangeability of carotid and femoral intima-media thickness in risk stratification. Int Angiol. 2001;20:38-46.

10. Allan PL, Mowbray PI, Lee AJ, et al. Relationship between carotid intima-media thickness and symptomatic and asymptomatic peripheral arterial disease. The Edinburgh artery study. Stroke. 1997;28:348-53.

11. Ashley FW Jr., Kannel WB. Relation of weight change to changes in atherogenic traits: the Framingham study. J Chronic Dis. 1974;27:103-14.

12. Held C, Hjemdahl P, Eriksson SV, et al. Prognostic implications of intima-media thickness and plaques in the carotid and femoral arteries in patients with stable angina pectoris. Eur Heart J. 2001;22:62-72.

13. Miller IM, Ellervik C, Yazdanyar S, et al. Meta-analysis of psoriasis, cardiovascular disease, and associated risk factors. J Am Acad Dermatol. 2013;69:1014–1024.

14. Mehlis SL, Gordon KB. The immunology of psoriasis and biologic immunotherapy. J Am Acad Dermatol. 2003;49:S44–S50.

15. Ghazizadeh R, Shimizu H, Tosa M, et al. Pathogenic mechanisms shared between psoriasis and cardiovascular disease. Int J Med Sci. 2010;7:284–289.

16. Ramonda R, Lo Nigro A, Modesti V, et al. Atherosclerosis in psoriatic arthritis. Autoimmun Rev. 2011;10:773–778.

17. Arias-Santiago S, Orgaz-Molina J, Castellote-Caballero L, et al. Atheroma plaque, metabolic syndrome, and inflammation in patients with psoriasis. Eur J Dermatol. 2012;22:337–344.

18. El-Mongy S, Fathy H, Abdelaziz A, et al. Subclinical atherosclerosis in patients with chronic psoriasis: a potential association. J Eur Acad Dermatol Venereol. 2010;24:661–666.

19. Balci DD, Balci A, Karazincir S, et al. Increased carotid artery intima-media thickness and impaired endothelial function in psoriasis. J Eur Acad Dermatol Venereol. 2009;23:1-6.

20. Laclaustra M, Casasnovas JA, Ferna'ndez-Ortiz A, et al. Femoral and carotid subclinical atherosclerosis association with risk factors and coronary calcium: the AWHS study. J Eur Acad Dermatol Venereol. 2016;67(11):1263-74.

21. Alvaro Gonzalez-Cantero et al., Subclinical atherosclerosis in psoriasis. Usefulness of femoral artery ultrasound for the diagnosis and analysis of its relationship with insulin resistance. PLoS One. 2019;14(2):e0211808.