Susceptibility to Atherosclerosis in Patients With Psoriasis and Psoriatic Arthritis as Determined by Carotid–Femoral (Aortic) Pulse-Wave Velocity Measurement

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Introduction and objectives. In this study we analyzed the susceptibility to atherosclerosis of patients with psoriasis and psoriatic arthritis (PsA) by determining the femoral-carotid pulse wave velocity (PWV), which is a measure of the viscoelastic properties of blood vessels.

Methods. The study included 25 patients with psoriasis (age 18-63 years, 13 male), of whom 9 had arthritis, as well as 39 sex- and age-matched healthy control subjects (age 24-70 years, 25 male). The systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate, body mass index (BMI), and waist-to-hip ratio (WHR) of all participants were recorded and, in patients, skin lesions were assessed using the psoriasis area and severity index (PASI). Arterial distensibility was determined by automatic carotid–femoral PWV measurement using the Complior Colson device.

Results. Mean PWV, SBP and DBP were significantly higher in psoriatic patients than in control subjects (P=.036, P<.001, and P=.005, respectively). In PsA patients, the mean WHR, SBP, DBP and PWV were all significantly higher than in control subjects (P=.001, P=.031, P=.001, and P=.014, respectively).

Conclusions. The carotid-femoral PWV is increased in patients with psoriasis and PsA.

Key words: *Psoriasis. Psoriatic arthritis. Atherosclerosis. Pulse wave velocity.*

Vulnerabilidad a la aterosclerosis en pacientes con psoriasis y artritis psoriásica, según las determinaciones de la velocidad de la onda de pulso carótido-femoral (aórtica)

Introducción y objetivos. En este estudio hemos analizado la vulnerabilidad a la aterosclerosis de los pacientes con psoriasis y artritis psoriásica (APs) mediante la determinación de la velocidad de la onda del pulso (VOP) carótido-femoral, que es una medida de las propiedades viscoelásticas de los vasos sanguíneos.

Métodos. Se incluyó en el estudio a 25 pacientes con psoriasis (edad, 18-63 años; 13 varones), de los que 9 presentaban artritis, así como a 39 individuos control sanos, emparejados por sexo y edad (edad, 24-70 años; 25 varones). Se registraron los valores de presión arterial sistólica (PAS), presión arterial diastólica (PAD), frecuencia cardiaca, índice de masa corporal (IMC) y cociente cintura/cadera (CCC) de todos los participantes, y en los pacientes se evaluaron las lesiones cutáneas con el empleo del Psoriasis Area and Severity Index (PASI). Se determinó la distensibilidad arterial con una medición automática de la VOP carótido-femoral utilizando el dispositivo Complior Colson.

Resultados. Los valores medios de VOP, PAS y PAD fueron significativamente mayores en los pacientes con psoriasis que en los individuos de control (p = 0,036, p < 0,001 y p = 0,005, respectivamente). En los pacientes con APs, los valores medios de CCC, PAS, PAD y VOP fueron significativamente superiores que en los individuos de control (p = 0,001, p = 0,031, p = 0,001 y p = 0,014, respectivamente).

Conclusiones. La VOP carótido-femoral está aumentada en los pacientes con psoriasis y APs.

Palabras clave: *Psoriasis. Psoriatic arthritis. Atherosclerosis. Pulse wave velocity.*

INTRODUCTION

Psoriasis is a hereditary, chronic inflammatory skin disorder and psoriatic arthritis (PsA), which has been defined as an inflammatory arthritis associated with psoriasis, appears to be linked to increased

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cardiovascular mortality and morbidity.[1] Several factors might explain the raised cardiovascular risk: smoking, hypertension, reduced physical activity, an altered lipid profile, chronic inflammation with elevated levels of inflammatory factors (eg, platelet-activating factor), hyperhomocysteinemia or hypercoagulability.[2-4] Measurement of the pulse-wave velocity (PWV) and carotid intima–media thickness (CIMT) have been used to evaluate the viscoelastic properties of large arteries. The PWV is an index of arterial wall stiffness, which is inversely related to arterial distensibility and relative arterial compliance.[5]

In this study, we investigated arterial distensibility in patients with psoriasis and PsA by measuring the PWV.

METHODS

This cross-sectional study involved 25 patients with psoriasis (age, 18-63 years; 13 male), which was diagnosed on the basis of its clinical characteristics, and 39 sex- and age-matched healthy control subjects (age, 24-70 years; 25 male). Nine of the patients also had arthritis, which was considered to be PsA. Systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate, body mass index (BMI), and the waist-to-hip ratio (WHR) were coded for all participants and, in patients, the psoriasis area and severity index (PASI) score was derived.

Exclusion criteria were previous myocardial infarction, congestive heart failure, renal failure (ie, plasma creatinine >1.8 mg/dL), valvular heart disease, atrial fibrillation, anemia (ie, hematocrit <35%), obesity (ie, BMI >35 kg/m^2) and a WHR ≥1.

The carotid–femoral PWV and arterial blood pressure were measured in each participant by the same observer with the subject in the supine position after resting for at least 20 minutes. Arterial distensibility was assessed by automatic carotid-femoral PWV measurement using the Complior Colson device (France); the technical characteristics of this device have been described elsewhere, and indicate that inter- and intra-observer repeatability coefficients are >0.9.[6] The PWV was calculated by measuring the pulse transit time and the distance traveled by the pulse between the 2 recording sites (ie, the right femoral and common carotid arteries): PWV = distance (m) / transit time (s).

Statistical Analysis

Statistical analysis was carried out using SPSS version 8.0. All values are expressed as a mean (standard deviation). The results obtained were assessed by a Mann-Whitney *U* test. Pearson correlation coefficients were calculated. Finally, a *P* value less than .05 was considered significant.

RESULTS

The mean ages of the patients and control subjects were 45.7 (11.5) years (range, 18-63 years) and 42.0 (11.7) (range, 24-70 years), respectively. The mean PWV, SBP, and DBP in psoriatic patients were significantly higher than in control subjects (U=335, P=.036; U=237, P<.001; and U=294, P=.005, respectively). The mean serum cholesterol, triglyceride and high-density lipoprotein levels in patients were 202 (54) mg/dL, 160 (96) mg/dL, and 48 (11) mg/dL, respectively. Seven patients (28%) had dyslipidemia or hypertension or both. When only normolipemic and normotensive patients were considered, the results were the same: the mean PWV, SBP, and DBP were significantly higher in patients than in control subjects (U=210, P=.030; U=185, P=.006; and U=194, P=.013, respectively).

The demographic and cardiovascular characteristics of patients and healthy control subjects are summarized in Table.

There were good correlations between BMI, SBP, DBP and heart rate and the PWV in all groups (r=0.392, P=.001; r=0.397, P=.001; r=0.288, P=.021; and r=0.307, P=.014, respectively). In patients with psoriasis, there were good correlations between the PWV and age, WHR and low-density lipoprotein level (r=0.773, P<.001; r=0.623, P=.001; and r=0.584, P=.017, respectively).

The mean PASI score in patients was 8.82 (9.1) (range, 0–34). There was no correlation between the PWV and the PASI score.

Nine psoriatic patients (36%) were regarded as having PsA. The differences between parameters for patients with and without arthritis were not significant (ie, P>.05 for all). However, the mean WHR, SBP, DBP, and PWV in PsA patients were significantly higher than in control subjects (P=.001; P=.031; P=.001; and P=.014, respectively).

DISCUSSION

Atherosclerosis is a multifocal, immunoinflammatory disease affecting medium and large arteries. There is growing evidence that, in addition to traditional risk factors, vascular wall inflammation plays a key role in the pathogenesis of vascular diseases and the atherosclerotic process.[7] In disorders that are inflammatory in nature, the chronic inflammatory state per se has been linked to an acceleration in the atherosclerotic process. The existence of this link is supported by the increased incidence of cardiovascular disease observed in disorders such

Demographic and Cardiovascular Characteristics of Patients With Psoriasis and Healthy Control Subjects

Parameter	Psoriatic Patients	Healthy Control Subjects	*P*
Age, mean (SD), y	45.7 (11.5)	42.0 (11.7)	>.05 (.05)[a]
BMI	27.2 (4.4) (19.5-34)	31.6 (8.1) (20.4-34.2)	.034 (>.05)[a]
WHR	0.88 (0.09)	0.77 (0.12)	<.001 (.001)[a]
SBP, mm Hg	127.6 (12.3)	114.6 (12.4)	<.001 (.031)[a]
DBP, mm Hg	79.6 (11.7)	71.7 (8.1)	.005 (.001)[a]
Heart rate, beats/min	85.9 (8)	86 (8.3)	>.05 (>.05)[a]
PWV, m/s	10.7 (2.2)	9.6 (2)	.036 (.014)[a]

BMI indicates body mass index; DBP, diastolic blood pressure; PWV, pulse-wave velocity; SBP, systolic blood pressure; WHR, waist-to-hip ratio.
[a]Patients with psoriatic arthritis versus healthy control subjects..

as systemic lupus erythematosus and rheumatoid arthritis.[8,9]

Psoriasis is a hereditary, chronic inflammatory skin disorder that may have systemic effects, involving, for example, the kidneys, eyes and joints, and leading to amyloidosis.[10] It has been demonstrated that psoriasis and PsA are associated with increased cardiovascular mortality and morbidity.[1] Traditional and non-traditional cardiovascular risk factors might explain the enhanced cardiovascular risk. Seishima et al[11] showed that apolipoprotein levels were elevated in psoriasis and suggested that abnormal lipoprotein metabolism may be related to the high incidence of atherosclerosis in the condition. Vanizor Kural et al[3,4] demonstrated that biochemical markers for susceptibility to atherosclerosis, such as an elevated homocysteine concentration, altered endothelial cell-mediated protein levels, increased lipid levels and increased high-density lipoprotein oxidation, may be important in the development of atherothrombotic complications in patients with psoriasis. Recently, González-Juanatey et al[12,13] demonstrated the existence of susceptibility to atherosclerosis and endothelial dysfunction in patients with PsA by measuring the CIMT and flow-mediated endothelial dependent vasodilatation. Several traditional and non-traditional risk factors might explain the increased cardiovascular risk. Alternatively, genetic factors associated with susceptibility to inflammatory arthritis may also lead to a high prevalence of atherosclerosis.[14] It seems that increased susceptibility to atherosclerosis is a major risk factor for cardiovascular morbidity and mortality in patients with psoriasis.[15] In this study, we evaluated the susceptibility to atherosclerosis of patients with psoriasis by measuring the carotid–femoral PWV. The mean PWV was found to be significantly higher in psoriatic patients than in control subjects ($P<.05$). The present study is the first to demonstrate that the PWV, which is a measure of the viscoelastic properties of blood vessels, is increased in patients with psoriasis and PsA.

Both blood pressure and heart rate are known to be determinants of the arterial PWV.[6,16] Arterial distensibility depends on the variation in blood pressure level, and especially on pulse pressure. With increasing age, systolic blood pressure and pulse pressure gradually become more important than diastolic blood pressure.[17] Stiffness is greater when blood pressure is high and lower when blood pressure is low because of mechanical changes related to arterial wall stretching and the resulting changes in the relative contributions of elastin and collagen fibers to the elastic modulus.[18] On PWV measurement, patients with psoriasis and PsA had a higher SBP and DBP. High blood pressure may also have resulted in reduced arterial distensibility in the patient group. There were good correlations between age, SBP and DBP and PWV in our study, which is in agreement with other reports in the literature.

Obesity, which is a traditional cardiovascular risk factor, could be a sign of inactivity and may be associated with insulin resistance. In addition, the WHR in patients with PsA was significantly higher than in control subjects ($P=.001$). This finding indicates that arteries become less elastic as the BMI and WHR increase, and that arterial stiffening is observed at higher BMIs and WHRs.

There was a good correlation with heart rate in both patients and healthy control subjects. An increased resting heart rate is associated with increased cardiovascular mortality.[20] Mangoni et al[16] showed that, in rats, arterial distensibility increased in parallel with the increase in heart rate. A high heart rate shortens the time available for recoil, which leads to arterial stiffening.

A raised BMI or WHR, which are traditional cardiovascular risk factors, could be a sign of inactivity and could be associated with hyperlipidemia, hyperinsulinemia, hypertension, and inflammation.

In addition, they might also have an adverse affect on the vascular system by decreasing arterial distensibility.[19,20] In this study, we found significant correlations between the carotid–femoral PWV and BMI and WHR.

In conclusion, in this study we showed that the viscoelastic properties of blood vessels are altered in patients with psoriasis and PsA.

Study Limitations

Subjects with known cardiovascular disease or cardiovascular risk factors, such as a previous myocardial infarction, diabetes mellitus, peripheral arterial disease, and cerebrovascular disease, were carefully excluded from the study, which resulted in a small sample size. Therefore, the results of this study will need to be confirmed in a larger group of patients.

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