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Research Article

Changes in Microvascular Reactivity and Systemic Vascular Resistance in Patients With Psoriasis

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Abstract

The aim: of this pilot study was to explore local blood flow in psoriatic plaques and normal skin before and after provocations known to alter cutaneous vascular resistance in order to test whether the increased flow was caused by a failure of normal vascular control processes in plaque skin and what association it has with cardiovascular parameters.

Material and methods: 11 patients who had a diagnosis of psoriasis vulgaris were enrolled in the study. Cutaneous blood flow was recorded over plaque and clinically normal skin. 10 healthy sex and age matched subjects were selected as controls. Blood flow in psoriatic and normal skin was measured by a single- channel Laser Doppler blood flowmeter (Blood Flow meter, AD Instruments Ltd., Oxford, UK). Post-occlusive reactive hyperaemia was assessed on the plaque and non-plaque site. Cardiovascular parameters: heart rate, systolic and diastolic pressure, cardiac output, and vascular resistance were continuously monitored by a Finapres (FINAPRES Medical Systems, The Netherlands).

Results: In patients, basal-LD flow was significantly higher in psoriatic skin compared to non-psoriatic skin and significantly higher than in the controls. However, the post-occlusive hyperaemia test did not reveal significant differences between the patients and control subjects. Systemic vascular resistance was significantly lower in patients with psoriasis compared to healthy individuals.

Conclusions: The results suggest that reduced microvascular resistance is associated with a significant increase in blood flow of psoriatic plaques and with lower systemic vascular resistance.

Keywords: Post-Occlusive Reactive Hyperaemia; Cutaneous Blood Flow; Psoriatic Plaque; Vascular Resistance; Finapres

Introduction

Psoriasis is a chronic, inflammatory skin condition that affects approximately 2% of the population in western countries [1]. Previous studies have shown the prominence of dermal microvascular expansion in lesion skin and suggested that psoriasis is angiogenesis dependent [2]. Morphometric analysis of the vascular changes in psoriasis has shown that there is an increase in the capillary mass, compared with normal skin. The expended capillary bed in psoriasis has an increased blood flow. However, there are conflicting data as to whether their function is also affected [2, 8].

Psoriasis is a multifactorial disorder. Abnormalities, both biochemical and ultrastructure, have been described and it seems highly likely that biochemical and ultra-structural, changes precede clinically obvious disease. However, currently, no technique exists by which the very early changes in psoriasis can be investigated.

There is a substantial and growing body of research evidence showing a strong connection between psoriasis and metabolic syndrome, diabetes, and cardiovascular events. Psoriasis is an independent risk factor for cardiovascular disease, however, the underlying mechanisms are not fully understood [3, 4, 5].

Materials and methods

Cutaneous blood flow was recorded in 11 patients over plaque skin and clinically normal skin at least 4 cm away from the nearest plaque on the forearm between the elbow and the palm. 10 healthy subjects were selected as a control group. The study groups were matched by age, sex and body mass index (Table 1). Blood flow in psoriatic (PS) and normal (NS) skin was measured by single- channel Laser Doppler blood flow meter (Blood Flow meter, AD Instruments Ltd., Oxford, UK). Theoretically, the LD flow (LDF) is determined by the product of the number of red blood cells moving in a sample volume of tissue and the average velocity of red blood cells. We used LDF arterial occlusion test: a sphygmomanometer cuff was placed above the elbow and inflated to 40 mmHg above systolic pressure for 2 minutes, followed by a sudden deflation. Post-occlusive reactive hyperaemia was assessed on the plaque and non-plaque site as a basal (b)-LDF and the maximum of LDF after occlusion. Cardiovascular parameters: heart rate, systolic and diastolic pressure, cardiac output, and vascular resistance were continuously monitored by a Finapres (FINAPRES Medical Systems, The Netherlands). The Finapres is a non-invasive device which continuously measures the arterial blood pressure in a finger and produces a real-time display of the arterial pressure wave. It consists of a finger cuff with an infra-red transmission pletismograph, a servo control box and a monitor unit [6].

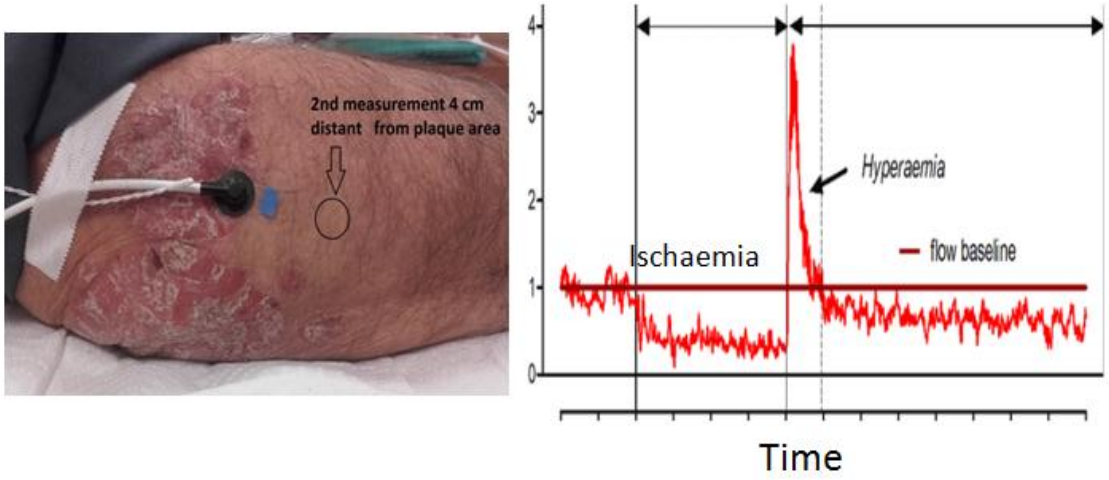
We used analysis of variance ANOVA to compare data between the groups. A repeated measures ANOVA was used to compare data within the patient group. The significance level was $P<0.05$.

Table (1): Description of patients and control variables

Diagnosis	N (M+F)	Age (y) Mean	Age (y) Std.Err.	Age (y) Range	BMI (kg/m^2) Mean	BMI (kg/m^2) Std.Err.	BMI (kg/m^2) Range
Psoriasis vulgaris	11 (6+5)	49,5	3,4	28-63	28,3	1,7	21,3-36
Control	10 (5+5)	48,5	3,5	29-68	27,9	1,8	21,8-41
Std.Err., standart error		p=0,846	ANOVA analysis		p=0,872	ANOVA analysis	

M, male
F, female

Figure (1): Post occlusive reactive hyperaemia setup



Results

The b-LDF in patients was significantly higher in psoriatic skin compared to non-psoriatic skin ($p<0.05$) (Figure 2). Also, a statistically significant difference was found between the b-LDF in psoriatic skin and that in healthy subjects ($p<0.05$) (Figure 3). After 2 minutes of arterial occlusion, the maximum of LDF did not show a significant difference between psoriatic and non-psoriatic skin and there was no difference in LDF between patients and controls. Psoriasis patients had a lower systemic vascular resistance than healthy control subjects ($p<0.05$) (Figure 4).

Figure (2): Cutaneous blood flow in patients non-plague and plaque skin

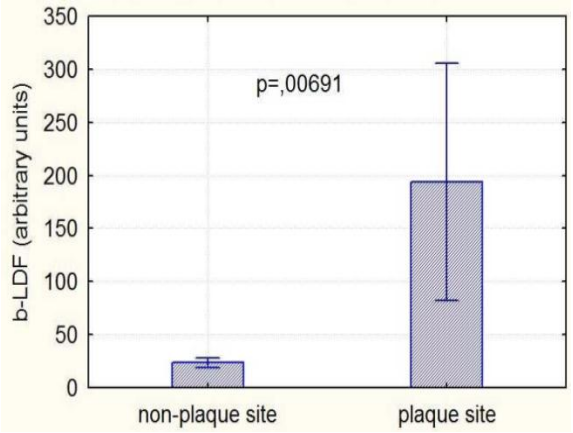


Figure (3): Cutaneous blood flow in patients plague skin and controls

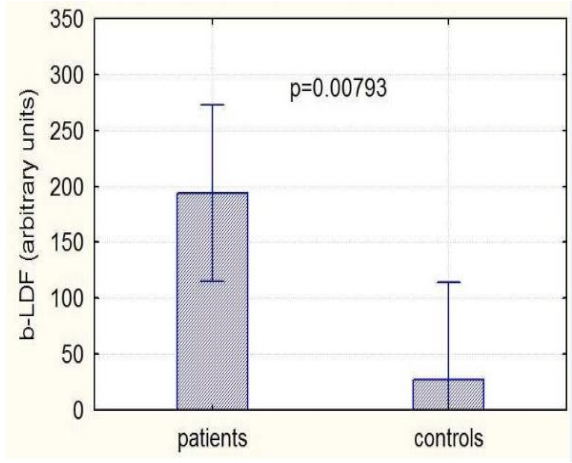
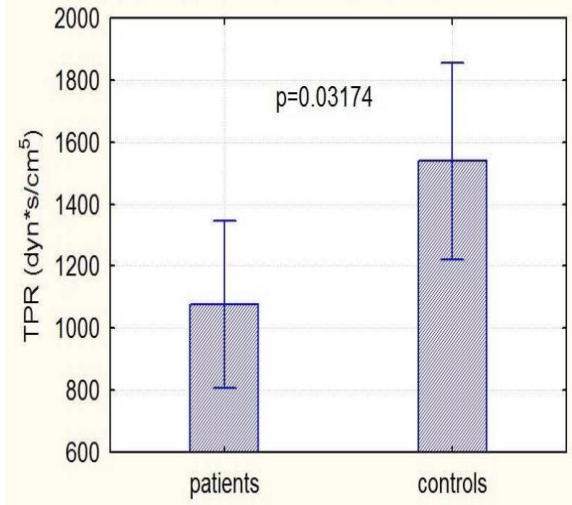


Figure (4): Systemic vascular resistance in patients and controls



Discussion

In our study, the laser Doppler red cell flux (LDF) was significantly greater in patients at plaque sites compared with the sites of clinically intact skin and the skin in normal subjects. This is in agreement with findings of other studies that have demonstrated an elevated cutaneous blood flow in psoriatic plaques compared with non-plaque skin [7]. However, we did not find differences between the cutaneous blood flow in the clinically normal skin of the psoriatic subjects and that of normal subject [8, 9]. The increased blood flow can be related to the expanded capillary bed [10] and an increase in the capillary mass as shown by the previous studies [11]. It has been proposed as a compensatory mechanism to counteract the effects of increased flow and to reduce shear stress. The endothelial cells may respond by undergoing hypertrophy and hyperplasia, resulting in widening and torturosity of the capillary loops [12, 13].

Studies have shown that NO-mediated endothelium –dependent vasodilation was blunted in patients with psoriasis, and the degree of psoriatic symptomology was significantly related to reduction in NO-dependent vasodilation in psoriasis patients suggesting greater disease severity is associated with larger reduction in NO bioavailability [8, 9, 14]. Contrary to our initial hypothesis, the postocclusive reactive hyperaemia test (PORH) did not reveal any significant differences between the LDF in plaques and non-plaque skin. Also, we did not find differences between the LDF in non-plaque skin and that in the skin of normal subjects. Probably it might be explained by such factors as laser penetration depth and skin composition at the recording site [1]. Another possible cause might be related to the stage of the disease and the number of patients investigated.

Psoriasis is believed to be an independent risk factor for cardiovascular disease [1, 3, 15], however, the underlying mechanisms are not fully understood. There is evidence that the reduced resistance of the expanded superficial capillary bed is not solely responsible for the massively elevated blood flow in plaque skin. It is believed that the vascular abnormalities in psoriasis also involve the deeper, larger resistance vessels [10]. Our study showed that psoriasis patients had a lower systemic vascular resistance than healthy control subjects, however, further research is needed to elucidate the underlying mechanisms and

clarify whether this reduction in systemic resistance could be attributed to early manifestations of cardiovascular and immune system dysfunctions

Conclusion

The results of our pilot study suggest that the reduction in microvascular resistance in psoriasis patients is associated with a significant increase in blood flow in psoriatic plaques and, at the same time, with lower systemic vascular resistance. Further research with a larger number of patients should be carried out in order to investigate the relationship between changes in cardiovascular parameters and inflammatory biomarkers in patients with different stages of plaque psoriasis.

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