CONNECTIVE TISSUE DISEASES

Microvascular clues to macrovascular disease

Detection of preclinical changes in the microcirculation of patients with systemic lupus erythematosus (SLE) might be useful for monitoring disease activity and response to therapy, and could predict cardiovascular complications. Atherosclerosis is a well-known feature of SLE, and previous studies have suggested that alterations in microvascular blood flow and pressure precede macrovascular disease progression, which can lead to organ damage or failure.

In a study published in the October 2009 issue of *Lupus*, Wright *et al.* looked for abnormalities in the ocular microcirculation of patients with SLE and no clinically apparent retinopathy. The investigators used a method known as eigenvector decomposition to analyze changes in flow velocity waveforms, which were measured by color Doppler ultrasonography in the ophthalmic artery and central retinal artery of 54 patients with SLE and 32 controls. Measurement of eigenvector components permits a more comprehensive analysis of waveform data than conventional methods. "Traditional time-domain analysis (generating, for example, the 'resistive index') attempt to characterize waveforms using only a small amount of the information that they contain—most of the waveform data is disregarded," explains Paul Hamilton, one of the study's investigators. "The techniques described in this paper were utilized because they consider the waveforms in their entirety."

All of the patients included in the study were defined as having 'mild' SLE, and there was no excess of conventional cardiovascular risk factors. Using the eigenvector decomposition technique, the investigators found significant alterations in the flow velocity waveforms of the ocular arteries in patients with SLE that were not apparent in controls. "We hypothesize that this finding provides evidence of microvascular dysfunction in these patients when compared with healthy controls," says Hamilton. By contrast, no differences were observed between the groups when waveform data were analyzed using the resistive index.

Interestingly, the microvascular changes observed in these patients vanished on analysis of waveform data captured from the carotid artery. As Hamilton suggests, "This could be due to the fact that reflected waves generated from sites of impedance mismatch in the distal circulation are 'filtered out' from the measured signal the more proximally the signal is collected." This finding highlights, therefore, the importance of measuring hemodynamic changes as close to the organ of interest as possible; in this case, the eye.

The authors now hope to develop a new, easy-to-use vascular tool for the clinic. "We believe that comprehensive analysis of blood velocity waveforms permits the detection of the reflected flow abnormalities that are one of the earliest signs of microvessel dysfunction," says Hamilton. "Detecting these abnormalities in individuals at risk of vascular disease allows the potential for intensive monitoring and therapeutic intervention. The ultimate goal would be to halt disease progression at an early stage."

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Original article Wright, S. A. *et al.* Colour Doppler ultrasound of the ocular circulation in patients with systemic lupus erythematosus identifies altered microcirculatory haemodynamics. *Lupus* **18**, 950–957 (2009).