

## **chapter 3b – microvascular recruitment in skin and blood pressure**

*Phenotyping the microcirculation with contrast-enhanced ultrasound*

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*To the editor,*

In their interesting review, Struijker-Boudier et al. (1) provide a critical appraisal of current methods to study the microcirculation. In the extensive review contrast enhanced ultrasonography (CEU) remains undiscussed, whereas this method holds great promise as a tool in hypertension-research.

Contrast-enhanced ultrasonography is an imaging tool which enables quantification of microvascular perfusion in organs and tissues. 2-5 It utilizes gas-filled microbubbles, typically with a lipid shell, that are inert, remain entirely within the vascular space, and possess an intravascular rheology similar to that of erythrocytes (2). Therefore, they specifically enhance imaging of the (micro-) vessels. During intravenous infusion of these microbubbles and attainment of a steady state, microbubbles can be destroyed with high energy ultrasound. Subsequently, new microbubbles will flow into the region of interest. The rate of microbubble replenishment, represents microvascular flow velocity (MFV). When the microbubbles are fully replenished, a plateau of video-intensity is reached, corresponding to the relative microvascular blood volume (MBV). The product of MFV and MBV is a measure of microvascular perfusion (3). Since microbubbles are distributed through the entire vasculature, simultaneous study of microvascular beds of different organs (e.g. skeletal muscle, the heart and kidney) is possible (4).

Surprisingly, although CEU has been used to study the pathophysiological role of microvascular perfusion in obesity-related insulin resistance and other metabolic syndrome characteristics, no data are available on the relation with blood pressure/hypertension. In a post-hoc analysis of a recent study measuring microvascular perfusion in skeletal muscle with CEU, (5) we assessed the association of muscle microvascular perfusion with blood pressure. In this healthy, normotensive group (table), blood pressure was inversely related with skeletal muscle perfusion in the forearm (SBP  $\beta = -0.50$ ,  $p = 0.05$ ; DBP  $\beta = -0.49$ ,  $p = 0.03$  and MAP  $\beta = -0.53$ ,  $p = 0.02$ ) after adjustment for sex and age. These relationships did not change after additional adjustment for BMI. This post-hoc analysis shows the potential of CEU to be applied in blood pressure and hypertension research.

Apart from the mentioned imaging capabilities, microbubbles can be targeted using antibodies, and loaded with interventional drugs. Therefore, CEU combines the assets of intravital microscopy, capillary videomicroscopy and other imaging strategies. Minimally invasive, low-cost and patient-friendly, CEU has proven itself as a validated and valuable technique to phenotype the microcirculation in metabolic as well as blood pressure research.

## References

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