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3.1 Why Flow Mediated Dilation Fails to Assess True Endothelial Cell Function? A Computational Based Investigation

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ABSTRACT

Objective and Motivation: Endothelial dysfunction is thought to underpin atherosclerotic cardiovascular diseases. However, the widely used flow mediated dilation (FMD) in-vivotest of endothelial function relates poorly to clinical outcomes. In this study, we investigated potential confounding factors affecting the FMD test that could prevent FMD from evaluating true endothelial cell function.

Methods: Haemodynamics in the larger 116 systemic arteries was simulated using one-dimensional modelling [1] coupled to an endothelial function model relating changes in wall shear stress to changes in local vascular stiffness. Haemodynamics during cuff inflation and deflation were simulated by prescribing time-varying i) transmural pressure changes in the right radial and ulnar 1-D model arterial segments, and ii) peripheral resistances in all right-hand segments. Simulated results were qualitatively tested by comparison against *in-vivo* data [2].

Results: Our main findings were two. Firstly, by turning off the endothelial function in the model we showed that vasoconstriction immediately after cuff deflation is entirely due to a change in transmural pressure, which offsets shear-mediated vasodilation and leads to a peak dilator response occurring after peak blood flow. Secondly, for the same endothelial function, FMD test values dropped with decreasing peripheral vasodilation, increasing arterial stiffness, and decreasing central blood pressure.

Conclusion: The influence of confounding factors on FMD test results suggests that the current FMD test does not assess true endothelial cell function.

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