Title: The Arteriograph: measuring axillo-brachial rather than aortic stiffness?

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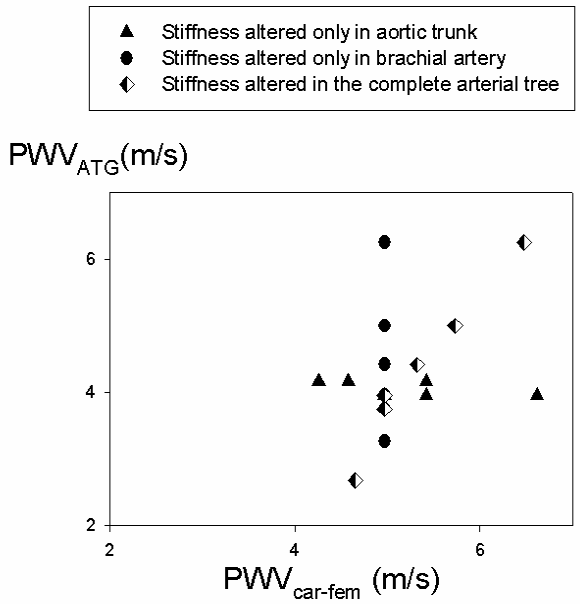
Introduction: A new device to measure PWV, the Arteriograph (Tensiomed, Budapest, Hungary), claims to measure aortic pulse wave velocity (PWV) from the recording of a brachial blood pressure waveform during supra-systolic pressure inflation of a simple brachial cuff. By occluding the brachial artery (BA), the pressure waveform shows pronounced first and secondary peaks. The time difference between these two peaks is considered a measure of the aortic stiffness. The aim of this work is to validate the working principle of the Arteriograph in a computer model of the arterial tree.

Methods: The model includes the aorta and all major large and mid-sized arterial segments and provides physiological pressure and flow waveforms along the arterial tree with great accuracy. Arterial stiffness was varied over the patho-physiological range, both with and without occlusion of the BA. PWV calculated using the Arteriograph-method (PWV-ATG) was compared with the gold-standard carotid-femoral PWV (PWV-CF). Wave intensity analysis was used to study the origin and nature of the observed waves.

Results: BA occlusion generates a total reflection at the upper arm which introduces a pronounced second peak in the brachial pressure curve. A parameter study, uniformly altering arterial stiffness over the complete arterial tree, showed that PWV-ATG was lower (20 %) than but correlated well with PWV-CF ($r = 0.98$, $p=0.001$). However, selectively altering the stiffness of the aortic or the axillo-brachial pathway demonstrated that the time delay between the first and secondary peak is determined solely by the stiffness of the axillo-brachial pathway, and not by aortic stiffness. The observed wave patterns in the BA were fully explained by positive and negative reflections at the occluded BA and axillo-aortic junction, respectively.



Discussion: Our data indicate that the Arteriograph-method picks up wave reflection phenomena confined to the brachial artery, and derived values of PWV rather reflect axillo-brachial stiffness than aortic stiffness.