Non-invasive assessment of arterial stiffness using oscillometric blood pressure measurement

Hidehiko Komine, Yoshiyuki Asai, Takashi Yokoi and Mutsuko Yoshizawa Institute for Human Science and Biomedical Engineering, National Institute of Advanced Industrial Science and Technology

BioMedical Engineering OnLine 2012, 11:6 doi:10.1186/1475-925X-11-6

Published: 10 February 2012

Abstract (provisional)

Background

Arterial stiffness is a major contributor to cardiovascular diseases. Because current methods of measuring arterial stiffness are technically demanding, the purpose of this study was to develop a simple method of evaluating arterial stiffness using oscillometric blood pressure measurement.

Methods

Blood pressure was conventionally measured in the left upper arm of 173 individuals using an inflatable cuff. Using the time series of occlusive cuff pressure and the amplitudes of pulse oscillations, we calculated local slopes of the curve between the decreasing cuff pressure and corresponding arterial volume. Whole pressure-volume curve was derived from numerical integration of the local slopes. The curve was fitted using an equation and we identified a numerical coefficient of the equation as an index of arterial stiffness (Arterial Pressure-volume Index, API). We also measured brachial-ankle (baPWV) PWV and carotid-femoral (cfPWV) PWV using a vascular testing device and compared the values with API. Furthermore, we assessed carotid arterial compliance using ultrasound images to compare with API.

Results

The slope of the calculated pressure-volume curve was steeper for compliant (low baPWV or cfPWV) than stiff (high baPWV or cfPWV) arteries. API was related to baPWV ($r = -0.53$, $P < 0.05$), cfPWV ($r = -0.49$, $P < 0.05$), and carotid arterial compliance ($r = 0.32$, $P < 0.05$). A stepwise multiple regression analysis demonstrated that baPWV and carotid arterial compliance were the independent determinants of API, and that API was the independent determinant of baPWV and carotid arterial compliance.

Conclusions

These results suggest that our method can simply and simultaneously evaluate arterial stiffness and blood pressure based on oscillometric measurements of blood pressure.