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Association between arterial stiffness and atherosclerosis: the Rotterdam Study.

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Author information

Abstract

BACKGROUND AND PURPOSE: Studies of the association between arterial stiffness and atherosclerosis are contradictory. We studied stiffness of the aorta and the common carotid artery in relation to several indicators of atherosclerosis.

METHODS: This study was conducted within the Rotterdam Study in >3000 elderly subjects aged 60 to 101 years. Aortic stiffness was assessed by measuring carotid-femoral pulse wave velocity, and common carotid artery stiffness was assessed by measuring common carotid distensibility. Atherosclerosis was assessed by common carotid intima-media thickness, plaques in the carotid artery and in the aorta, and the presence of peripheral arterial disease. Data were analyzed by ANCOVA with adjustment for age, sex, mean arterial pressure, and heart rate.

RESULTS: Both aortic and common carotid artery stiffness were found to have a strong positive association with common carotid intima-media thickness, severity of plaques in the carotid artery, and severity of plaques in the aorta (P: for trend <0.01 for all associations). Subjects with peripheral arterial disease had significantly increased aortic stiffness (P:=0.001) and borderline significantly increased common carotid artery stiffness (P:=0.08) compared with subjects without peripheral arterial disease. Results were similar after additional adjustment for cardiovascular risk factors and after exclusion of subjects with prevalent cardiovascular disease.

CONCLUSIONS: This population-based study shows that arterial stiffness is strongly associated with atherosclerosis at various sites in the vascular tree.

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Arterial stiffness and risk of coronary heart disease and stroke: the Rotterdam Study.

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Abstract

BACKGROUND: Arterial stiffness has been associated with the risk of cardiovascular disease in selected groups of patients. We evaluated whether arterial stiffness is a predictor of coronary heart disease and stroke in a population-based study among apparently healthy subjects.

METHODS AND RESULTS: The present study included 2835 subjects participating in the third examination phase of the Rotterdam Study. Arterial stiffness was measured as aortic pulse wave velocity and carotid distensibility. Cox proportional hazards regression analysis was performed to compute hazard ratios. During follow-up, 101 subjects developed coronary heart disease (mean follow-up period, 4.1 years), and 63 subjects developed a stroke (mean follow-up period, 3.2 years). The risk of cardiovascular disease increased with increasing aortic pulse wave velocity index. Hazard ratios and corresponding 95% CIs of coronary heart disease for subjects in the second and third tertiles of the aortic pulse wave velocity index compared with subjects in the reference category were 1.72 (0.91 to 3.24) and 2.45 (1.29 to 4.66), respectively, after adjustment for age, gender, mean arterial pressure, and heart rate. Corresponding estimates for stroke were 1.22 (0.55 to 2.70) and 2.28 (1.05 to 4.96). Estimates decreased only slightly after adjustment for cardiovascular risk factors, carotid intima-media thickness, the ankle-arm index, and pulse pressure. The aortic pulse wave velocity index provided additional predictive value above cardiovascular risk factors, measures of atherosclerosis, and pulse pressure. Carotid distensibility as measured in this study was not independently associated with cardiovascular disease.

CONCLUSIONS: Aortic pulse wave velocity is an independent predictor of coronary heart disease and stroke in apparently healthy subjects.

Comment in

Arterial stiffness, vascular disease, and risk of cardiovascular events. [Circulation. 2006]

Aortic stiffness is an independent predictor of fatal stroke in essential hypertension.

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Abstract

BACKGROUND AND PURPOSE: Pulse pressure is a stronger predictor of cardiovascular events than systolic or diastolic blood pressure in large cohorts of French and North American patients. However, its influence on stroke is controversial. Large-artery stiffness is the main determinant of pulse pressure. The influence of arterial stiffness on the occurrence of stroke has never been demonstrated. Our aim was to establish the relationship between aortic stiffness and stroke death in hypertensive patients.

METHODS: We included, in a longitudinal study, 1715 essential hypertensive patients who had a measurement of arterial stiffness at entry (ie, between 1980 and 2001) and no overt cardiovascular disease or symptoms. Mean follow-up was 7.9 years. At entry, aortic stiffness was assessed from the carotid-femoral pulse wave velocity. A Cox proportional hazard regression model was used to estimate the relative risk (RR) of stroke and coronary deaths.

RESULTS: Mean+/-SD age at entry was 51+/-13 years. Twenty-five fatal strokes and 35 fatal coronary events occurred. Pulse wave velocity significantly predicted the occurrence of stroke death in the whole population. There was a RR increase of 1.72 (95% CI, 1.48 to 1.96; P<0.0001) for each SD increase in pulse wave velocity (4 m/s). The predictive value of pulse wave velocity remained significant (RR=1.39 [95% CI, 1.08 to 1.72]; P=0.02) after full adjustment for classic cardiovascular risk factors, including age, cholesterol, diabetes, smoking, mean blood pressure, and pulse pressure. In this population, pulse pressure significantly predicted stroke in univariate analysis, with a RR increase of 1.33 (95% CI, 1.16 to 1.51) for each 10 mm Hg of pulse pressure (P<0.0001) but not after adjustment for age (RR=1.19 [95% CI, 0.96 to 1.47]; P=0.10).

CONCLUSIONS: This study provides the first evidence, in a longitudinal study, that aortic stiffness is an independent predictor of fatal stroke in patients with essential hypertension.

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