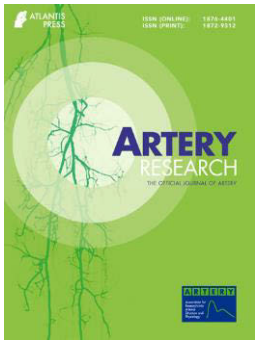

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3.1: STRAIN DISCONTINUITIES IN CAROTID ATHEROSCLEROTIC PLAQUES – A NOVEL MARKER FOR PLAQUE VULNERABILITY?

Tim Vonk, Evelien Hermeling, Floris Schreuder, Werner Mess, Eline Kooi

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Introduction: Increased adiposity is associated with poorer left ventricular (LV) function but the mediating role of blood pressure (BP) and other cardiovascular measures is unknown. We investigated the roles of potential mediators in adolescents in a UK birth cohort, the Avon Longitudinal Study of Parents and Children.
Methods: Fat and lean mass were assessed by dual energy X-ray absorptiometry (DXA) in 2,068 individuals (age 17.7(SD 0.32) years; 45% male; weight 67(SD 13) kg). BP was measured and echocardiography performed. Tissue Doppler systolic (s'), early diastolic longitudinal function (e') and transmitral E/A were used as measures of LV systolic and diastolic function respectively. Mediation was estimated using structural equation modelling; height, sex, socioeconomic position, lean mass and smoking were included as potential confounders in all models.
Results: Table 1 shows the total and direct (total − indirect (mediated)) effects (standardized β) for each potential mediator, alongside %mediation. No convincing associations were found between fat mass and s' or e'.
Conclusions: MAP, HR and EDV, an indicator of preload, are important mediators of the effect of adiposity on diastolic function in adolescence, while TPR appears to account for none of the effect. Absence of mediation by PP, in combination with the mediation by TAC, suggests that stroke volume contributes some mediative effect. These findings emphasise the importance of adiposity and risk factor control in adolescence.

Table 1. Mediation of the association between fat mass and E/A

Mediator	Direct effect (standardized β)	Total effect (standardized β)	% mediation
None	-0.15 *(95%CI -0.20, -0.10)*		
Mean arterial pressure (MAP)	-0.11	-0.14	21
Pulse pressure (PP)	-0.13	-0.13	0
Heart rate (HR)	-0.11	-0.14	21
Total arterial elastance (TAE)	-0.15	-0.14	-7
Total peripheral resistance (TPR)	-0.15	-0.15	0
End-diastolic volume (EDV)	-0.17	-0.15	-13

Oral Session III − Clinical Aspects, Hypertension & Diabetes

3.1
STRAIN DISCONTINUITIES IN CAROTID ATHEROSCLEROTIC PLAQUES − A NOVEL MARKER FOR PLAQUE VULNERABILITY?

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Objective: Rupture of atherosclerotic plaques is ultimately a biomechanical event. We aim to develop and validate a novel method using ultrasound radiofrequency (RF) measurements to determine intraplaque inhomogeneities in the strain distribution with a high axial resolution which may identify rupture-prone plaques.
Methods: Ultrasound examinations were performed on CCAs and ICAs of 17 patients with recent stroke/TIA and 5 asymptomatic patients (39 CCAs and ICAs). Strain distribution was computed from RF data with a depth resolution <0.5 mm. In the plaque-free CCA, radial wall strain was compared with distension for validation. Two observers analyzed the data. In the ICAs, strain inhomogeneities in the plaque were studied.
Results: Within the CCA wall, the strain (observer 1: -7.4 ± 2.7%, observer 2: -6.4 ± 2.6%) had good intra-subject precision (1.6%), accuracy (correlation with relative distension, observer 1: $r = 0.69$; $p < 0.0001$, observer 2: $r = 0.68$; $p < 0.0001$) and intra-observer variability (ICC of 0.681). In the ICA, strain inhomogeneities demarcated in 58% of cases the plaque-adventitia boundary. The percentage of ICAs with ≥1 strain inhomogeneities was increasing with the degree of stenosis ($p = 0.03$, 95%-CI). Strain inhomogeneities were more frequent in ICAs at the symptomatic side of stroke/TIA (odd's-ratio = 4.7; $p = 0.07$). Strain in the deviating strain regions was higher at the symptomatic compared to the asymptomatic side ($p = 0.02$).
Conclusion: The proposed method to assess local radial strain distribution proved to be accurate and precise. In ICA, areas with high strain inhomogeneities were more frequent in symptomatic plaques vs asymptomatic plaques. These strain inhomogeneities could be a promising novel marker for plaque vulnerability.

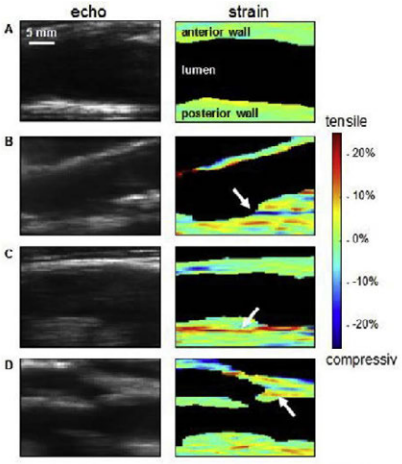

Figure 1. Examples of strain distribution in carotid plaques
Crude B-mode (echo, left panels) and corresponding strain distribution in the ICA (right panels); blood flow direction is from right to left. Note that in some cases the strain distribution is rather homogeneous (A), whereas in other cases a more heterogeneous distribution of strain is observed (B-D). Narrow but elongated regions with highly deviating strain (indicated by the white arrows) are often found near the boundary between the plaque and the supporting adventitia layer (B and D) and can appear either as diastolic-to-systolic wall compression (B) or as wall tension (C and D).

3.2
RESERVOIR PRESSURE INTEGRAL IS INDEPENDENTLY ASSOCIATED WITH THE REDUCTION IN RENAL FUNCTION IN AN OLDER POPULATION

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Background: Central haemodynamic parameters derived from reservoir pressure analysis (RPA-parameters) exhibit prognostic utility. Alterations in reservoir function could have an unfavourable influence on target organs, such as the kidneys. We determined in older adults whether these RPA-parameters would be associated with the reduction in estimated glomerular filtration rate (eGFR) during a 3-year follow-up period.
Methods: We studied 544 individuals (69.4 ± 7.9 yrs, 195F, 235CVD) at baseline and after 3 years. RPA-parameters including reservoir pressure integral (INTPR), peak reservoir pressure, excess pressure integral, systolic and diastolic rate constants were obtained by radial artery tonometry.
Results: After 3 years, 95 individuals (72.4 ± 7.6 yrs, 26F) had an eGFR reduction of more than 5 ml/min/1.73 m^2/year. A multivariate logistic regression analysis revealed that baseline INTPR was independently associated with the eGFR reduction after adjusting for conventional risk factors and baseline renal function [odds ratio 0.975 (95% CI, 0.958−0.993), $p < 0.01$]. When the eGFR reduction was expressed as a continuous variable, baseline INTPR was also independently associated with changes in eGFR ($\beta = 0.115$, $p < 0.01$; multivariate linear regression with adjustment for