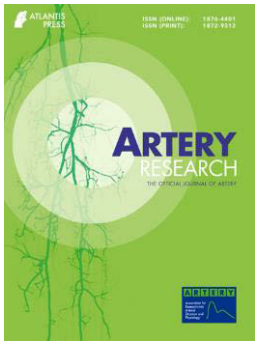

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10.04: LARGE AND SMALL ARTERY STRUCTURE & STIFFNESS IN RELATION TO GLYCAEMIA AND BLOOD PRESSURE IN PRE-MENOPAUSAL WOMEN

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Age-related changes in arterial stiffness are ascribed to collagen and elastin content in the aorta (Ao) which is modulated by the matrix metalloprotienases(MMPs). However, no study has directly compared arterial stiffness and arterial structure in man.

Aortic and internal mammary artery(IMA) tissue were obtained from 10 patients(62 $\pm$ 1 years, 2 female) undergoing coronary artery bypass grafting(CABG). Aortic pulse wave velocity (PWV) was measured prior to CABG. Collagen content was assessed in tissue sections using Sirius Red staining and elastin by ACCUSTAIN. Elastin fragmentation in the Ao media was graded; increasing in severity from 1 to 4. MMP-2 and MMP-9 activity was quantified in the Ao using gelatine zymography. Results are expressed as mean$\pm$SEM , $p<0.05$ considered significant.

The collagen concentration was 50% (intima), 42%(media)and 76 %(adventitia) in the Ao but was lower in the IMA. PWV was significantly associated with Ao medial ($r=0.79$, $p=0.03$) but not intimal or adventitial collagen concentrations. Aortic intimal thickness was related significantly with age($r=0.70$, $p<0.05$) but not PWV. There was no relationship between age and Ao collagen concentration. There was a significant association ($p<0.001$) between increasing elastin fragmentation in the aortic media and PWV but not age. There was no relationship between collagen concentration in the IMA and either PWV or age. Neither latent nor active MMP-2 activity was related with PWV or age. Latent MMP-9 expression was significantly associated with PWV($r=0.66$,$p<0.05$) but not age.

Aortic stiffness is associated with Ao medial collagen content and the degree of elastin fragmentation in man.

10.02
LONGITUDINAL DEVELOPMENT OF FITNESS AND FATNESS FROM ADOLESCENCE TO ADULTHOOD: IMPACT ON ARTERIAL STIFFNESS AT THE AGE OF 36 YEARS. THE AMSTERDAM GROWTH AND HEALTH LONGITUDINAL STUDY (AGAHLS)

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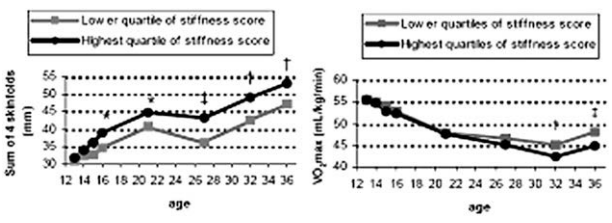
Introduction: Body fatness (BF) and low levels of cardiopulmonary fitness (CF) during adolescence have been associated with arterial stiffness (AS) later in life. How the development over time (i.e. from adolescence to adulthood) of BF and CF impact on AS in adulthood is not known.
Methods: Longitudinal data on BF (sum of 4 skinfolds — SSKF) and CF (VO2max) were derived from the AGAHLS (*n=372*, 197 women; 8 follow-up measures at the ages of 13, 14, 15, 16, 21, 27, 32 and 36 yrs). Arterial stiffness (i.e. carotid, brachial and femoral distensibility and compliance coefficients) was assessed by non-invasive ultrasonography when subjects were 36-yrs-old; a stiffness score (average of the z-scores of these 6 estimates) was calculated. We used generalized estimating equations to compare the patterns of development of SSKF and VO2max levels (adjusted for each other and for potential confounders) over the 24-yr follow-up period between those subjects with 'higher' (i.e. lowest sex-specific quartile) *vs*. 'normal' (higher 3 quartiles) levels of stiffness score at the age of 36 yrs.
Results: In all subjects, SSKF increased and VO2max decreased between the ages of 13 and 36 ($p<0.001$); higher increases in SSKF during *adolescence* and decreased levels of VO2max *in recent but not early years* characterized individuals with higher arterial stiffness at the of age 36 as compared to their 'normal' counterparts (Figure).



Conclusion: Increases in body fatness rather than decreases in cardiopulmonary fitness during adolescence impact on arterial stiffness later in life; lifestyle interventions in the young should therefore target weight control.

10.03
EARLY REFLECTION OBSERVED IN THE PULSE WAVE IN THE COMMON CAROTID ARTERY ORIGINATES FROM EITHER THE CIRCLE OF WILLIS OR THE CAPILLARY BED OF THE FACIAL MUSCULATURE

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Introduction: Arterial wave reflections augment pulse pressures at heart level and manifest as an inflection point in the blood pressure waveform. However, the origin of reflection is still partly unresolved and can not be derived using the waveform from a single location.
Method: Two distension waveforms, spaced at 16.4mm, were simultaneously obtained in the left CCA of 12 young subjects with dual M-line ultrasound. The second derivatives of the distension waveforms were calculated to identify the opening of the aortic valve (AVO) and the inflection point before systolic peak pressure (IP). The time-delay (ΔT) between both time points, either AVO or IP, in the proximal and distal waveform was calculated to obtain the direction of propagation.
Results: Mean time difference between AVO and IP was 38 $\pm$ 8ms. There was a significant time difference in AVO ($p<0.0001$) and IP ($p=0.0012$) between proximal and distal waveform. AVO had a positive delay $\Delta T_{AVO}=3.3\pm1.0$ms. In contrast IP had a negative delay $\Delta T_{IP}=-3.6\pm3.1$ms.
Discussion: Time-delay of AVO and IP are comparable but opposite in sign. Measurements were performed on the CCA, which is a small straight arterial segment without branches, therefore the effect of dispersion or tapering can be ignored and the direction of propagation of IP can only be explained by reflections. Using the time difference between AVO and IP and assuming constant wave-speed, the distance between reflection and measurement site was estimated at 12cm, pointing at the circle of Willis or the capillary bed of the facial musculature as distal reflection sites.

10.04
LARGE AND SMALL ARTERY STRUCTURE & STIFFNESS IN RELATION TO GLYCAEMIA AND BLOOD PRESSURE IN PRE-MENOPAUSAL WOMEN

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Introduction: Diabetes and Hypertension affect large and small artery structure and function. We investigated the relationship between large artery structure (common carotid intima-medial thickness: cIMT), function (aortic pulse wave velocity-aPWV) and structure and stiffness index of small subcutaneous arteries in a group of pre-menopausal women who had undergone an oral glucose tolerance test (OGTT) during pregnancy.
Patients and Methods: 29 pre-menopausal women (age 36.2 years, 95% CI 35.1-37.2) underwent an OGTT and under standardised conditions, assessment of aPWV and biopsy of subcutaneous fat to assess the small arterial structure and function.
Results: cIMT was related to aPWV ($r=0.58$, $p=0.001$) and media cross-sectional area of small arteries (Mcxa, $r=0.43$, $p=0.023$); the latter correlated with small artery stiffness index (saSI, $r=0.34$, $p=0.01$). After adjustment for smoking, these independent parameters influenced vascular indices:

Multiple regression Beta (p value)	aPWV	cIMT	saSI	McxA
Age	0.16 (0.046)			0.49 (0.034)
BMI	0.23 (0.018)			
SBP	0.16 (0.01)			
Fasting glucose	-1.4 (0.03)	-0.004 (0.03)		
Total cholesterol	1.26 (0.034)			
Medial thickness				
cIMT	264.1 (0.003)			
McxA			2.42 (0.04)	

Conclusion: In young women, even without overt diabetes or hypertension, large and small vessel structure & function but not stiffness are closely related. These vascular properties are modulated by degree of current glycaemia and other cardiovascular risk factors.