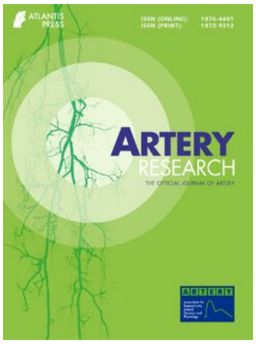

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OR-05: RELATIONSHIP OF COMMON CAROTID ARTERY PERIVASCULAR ADIPOSE TISSUE, ARTERIAL STIFFNESS, AND INTIMA-MEDIAL THICKNESS, IN ADULT HUMANS

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OR-04

IMPORTANCE OF TIME DELAY ESTIMATION METHODS FOR AORTIC PULSE WAVE VELOCITY ASSESSMENT WITH PHASE-CONTRAST MRI

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Background: Pulse wave velocity (PWV) is a validated measure of arterial wall stiffness. Assessments of PWV are highly dependent on pulse transit time estimations between 2 points. No systematic assessments have been performed regarding the best method to assess pulse travel time using phase-contrast MRI.

Aim: To compare the relationship between MRI-derived PWV (distance/transit time) measured by different methods and: (1) Age; (2) Carotid-femoral PWV (CFPWV) assessed with arterial tonometry, the "gold standard" index of arterial stiffness.

Methods: We measured aortic flow using in plane phase contrast MRI in the "candy cane" aortic view among 261 adults. Transit time between the proximal ascending aorta and the distal thoracic descending aorta were assessed from flow velocity curves using various methods for pulse upstroke detection (table).

Results: Aortic PWV assessed based on the peak second derivative of flow demonstrated the best correlation with both age and tonometric CFPWV. The method based on 20% of the upstroke amplitude provided results comparable to the peak second derivative. On the other hand, the cross-correlation method (which is currently the most commonly used) demonstrated weak relationships and often resulted in non-physiologic PWV values (up to >200 m/sec) due to non-parallel up-slopes resulting in falsely short delays between cross-correlated upstrokes. Other methods provided intermediate correlation coefficients with age and CFPWV.

Conclusions: The method to compute the onset of the flow pulsatile upstroke using phase-contrast MRI markedly impacts the assessment of PWV. The peak of the 2nd derivative is the most robust method for PWV estimations. The use of the cross-correlation method, which is most frequently used at present, should be abandoned.

Method	Age	CF PWV
	R Value (P Value)	R Value (P Value)
2nd derivative	0.43 (<0.0001)	0.48 (<0.0001)
Cross-correlation	0.12 (0.11)	0.41 (<0.0001)
DPDT	0.29 (<0.0001)	0.44 (<0.0001)
20% PH	0.42 (<0.0001)	0.46 (<0.0001)
10%	0.22 (0.001)	0.38 (<0.0001)
40%	0.34 (<.0001)	0.46 (<0.0001)
Intersecting tangents	0.35 (<0.0001)	0.42 (<0.0001)

OR-05

RELATIONSHIP OF COMMON CAROTID ARTERY PERIVASCULAR ADIPOSE TISSUE, ARTERIAL STIFFNESS, AND INTIMA-MEDIAL THICKNESS, IN ADULT HUMANS

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Objective: Most arteries in humans are directly surrounded by adipose tissue and it has been hypothesized that an excess of perivascular adipose tissue (PVAT) is involved in the pathogenesis of atherosclerosis and arterial stiffening. There is a lack of research examining the relationships between PVAT with other measures of arterial health (i.e., stiffness and wall thickness). The purpose of the current study was to examine relationships between the carotid PVAT measured through extra-medial thickness (EMT) ultrasonography and other measures of vascular health.

Methods: Central arterial stiffness by pulse wave velocity was obtained with applanation tonometry at the common carotid and femoral arteries, and common carotid artery intima-media thickness (IMT), compliance, distensibility and stiffness index were obtained with simultaneous sonographic imaging and applanation tonometry. Resting measures of heart rate and supine brachial blood pressure were also obtained. Carotid artery EMT and IMT measurements were sonographically imaged in the longitudinal section. Carotid EMT was denoted as the distance between the jugular intima-lumen interface to the carotid media-adventitia interface. Custom semi-automated edge detection software was used for image and data analysis.

Results: Data was collected from 20 healthy young adults (mean age 24.2 ± 13.8 yrs, 5 females). Carotid EMT was significantly correlated to brachial mean arterial pressure ($r = 0.52$, $n = 18$, $p < 0.01$), central pulse wave velocity ($r = 0.45$, $n = 20$, $p < 0.02$), IMT ($r = 0.55$, $n = 20$, $p < 0.01$), and carotid stiffness index ($r = 0.53$, $n = 20$, $p < 0.01$).

Conclusion: These preliminary findings indicate that an increased carotid PVAT may be associated with increases in both regional carotid and central arterial stiffness. Carotid EMT ultrasonography provides an additional tool that correlates significantly with the existing vascular health measures in this cohort. Further studies are needed to determine whether EMT will provide relevant additional information that can assist in the prediction of cardiovascular outcomes and the evaluation of risk reduction interventions.

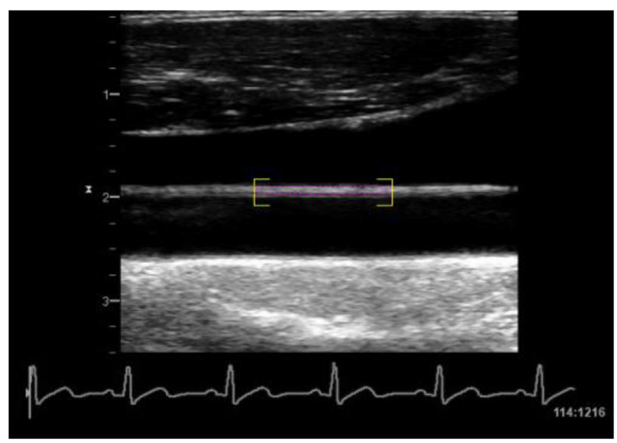

Figure 1 Custom edge-detection software uses a region of interest (yellow box) and quantifies the common carotid artery extra-medial thickness measurement, indicated by the red dotted lines.

Table 1 Pearson correlation of extra-medial thickness and other arterial measures.

Variable	Correlation	Sig. (1-tailed)	*n*
Systolic blood pressure	.366	.062	19
Diastolic blood pressure	−.036	.442	19
Mean arterial pressure	.515*	.014	18
Body mass index	.376	.051	20
Central pulse wave velocity	.449*	.023	20
Intima-medial thickness	.548**	.006	20
Carotid compliance	−.199	.200	20
Carotid distensibility	−.213	.183	20
Carotid stiffness index	.534*	.008	20

* Significance ($p < 0.05$)

** Significance ($p < 0.01$)