Clinical and Cardiac Function Correlates of Aortic Pulse Wave Velocity measured by Cardiac Magnetic Resonance Imaging in Normal Subjects

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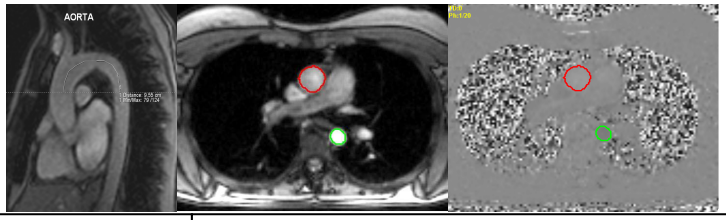
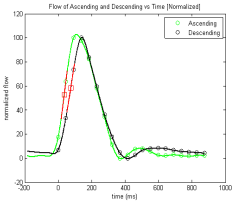
Background: Aortic pulse wave velocity (PWV) is an index of aortic compliance (AC). Arterial stiffening and decreased AC with resultant increase in PWV commonly results from aging, hypertension and atherosclerosis. We evaluated PWV by cardiac magnetic resonance (CMR) imaging and examined its relation to various clinical and cardiac function parameters.

Methods: 191 consenting nondiabetic, volunteers without clinical cardiovascular disease or echocardiographic abnormalities (106 females, 88 hyperlipidemic (36 treated), age: 58.6+/-14.9yrs, BMI: 24.8+/-3.3 were studied. CMR studies were performed on a 1.5 Tesla MR scanner (Siemens Sonata, Germany) using a phased array surface-coil and a spine-coil array. PWV was assessed using breath-held through-plane phase-contrast gradient echo imaging of the ascending and descending aorta at the pulmonary artery level with a VENC of 1.5 m/sec, temporal resolution of 24 frames per second and slice thickness of 6mm. Aortic images were manually contoured using QFlow software (Medis imaging systems, Leiden, the Netherlands) and PWV determined by the ratio of the distance between the ascending and descending aortic planes along a candy-cane view over the time of pressure pulse travel from ascending to descending plane. Pearson and Spearman correlation coefficients were used to examine associations between PWV and age, Coronary CT Calcium (CCT) score, blood pressure, rate pressure product, lipid levels, and cardiac function.



Aorta Candy cane view | Through-plane views of Ascending & Descending Aorta at the Pulmonary artery bifurcation



Flow of ascending and descending aorta vs Time (Normalized)

Results: (Table: 1) Overall and in males and females separately, on univariate analysis, PWV correlated highly with age, moderately with CCT score, and modestly with systolic BP and RPP. There were modest correlations of PWV with lipid levels and a smoking history in males. (All p<0.05) However, after adjustment for age no other variable showed significant associations with PWV. Cardiac function parameters including left ventricular(LV) stroke volume, ejection fraction(EF), and mass index had no association to PWV even after adjusting for age. There was no significant difference in PWV between males and females. (p = 0.2).

Table: 1 Spearman's Correlation Coefficients of Aortic Pulse Wave Velocity

	Total Population			Females			Males		
	n =	Correlation	p-value	n =	Correlation	p-value	n =	Correlation	p-value
	191	Coefficient		106	Coefficient		85	Coefficient	
Age	186	0.64	<0.0001	103	0.66	<0.0001	83	0.6	<0.0001
Height	160	-0.22	0.004	86	-0.17	0.12	74	-0.04	0.73
BMI	132	0.013	0.88	71	0.1	0.41	61	0.05	0.73
Smoking history	181	0.12	0.06	102	0.037	0.71	79	0.31	0.005
Total Cholesterol	104	0.05	0.63	57	0.23	0.08	47	-0.3	0.04
Triglycerides	104	0.009	0.93	57	0.39	0.02	47	-0.33	0.02
HDL	104	0.16	0.09	57	0.005	0.26	47	0.26	0.08
LDL	104	0.03	0.75	57	0.9	0.5	47	-0.3	0.04
CCT Score	80	0.48	<0.0001	42	0.65	<0.0001	38	0.4	0.0002
Systolic BP	186	0.37	<0.0001	104	0.42	<0.0001	82	0.051	0.65
RPP	180	0.32	<0.0001	104	0.32	0.0009	76	0.34	0.004
LV EF	186	0.12	0.11	103	0.09	0.39	83	0.013	0.91
LV Mass-index	186	-0.009	0.89	103	0.15	0.14	83	0.005	0.96
LV Stroke volume	184	-0.17	0.02	103	-0.09	0.35	81	-0.08	0.48

Conclusions: Age is the strongest and most consistent correlate of increased PWV. CCT score also correlates with PWV. After adjustment for age, no other variables show significant associations with PWV.