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P127: FLOW DYNAMICS AND ITS RELATION TO BICUSPID AORTOPATHY ASSESSED BY 4D FLOW CMR

Lydia Dux-Santoy Hurtado, Jose F. Rodriguez-Palomares, Andrea Guala, Raquel Kale, Gisela Teixido-Tura, Filipa Valente, Giuliana Maldonado, David Garcia-Dorado, Artur Evangelista

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datasets of 10 patients scheduled for vascular access surgery. Datasets comprised of wall thicknesses and radii of 7 central and 11 arm arterial segments. We simulated reference models (RefModel, $n = 10$) using complete data and adapted models (AdaptModel, $n = 10$) using data of one brachial artery segment only. The remaining AdaptModel geometries were estimated using adaptation. In both models, mean brachial pressure, brachial artery distensibility, heart rate and aortic inflow were prescribed. We evaluated agreement between RefModel and AdaptModel geometries, as well as between pressure and flow waveforms of both models.

Results: Limits of agreement (bias ± 1.96 SD) between AdaptModel and RefModel radii and wall thicknesses were 0.029 ± 1.3 mm and 28 ± 230 μ m, respectively. AdaptModel pressure and flow waveform characteristics across the proximal-to-distal arterial domain were within the uncertainty bounds of the RefModel (Fig. 1).

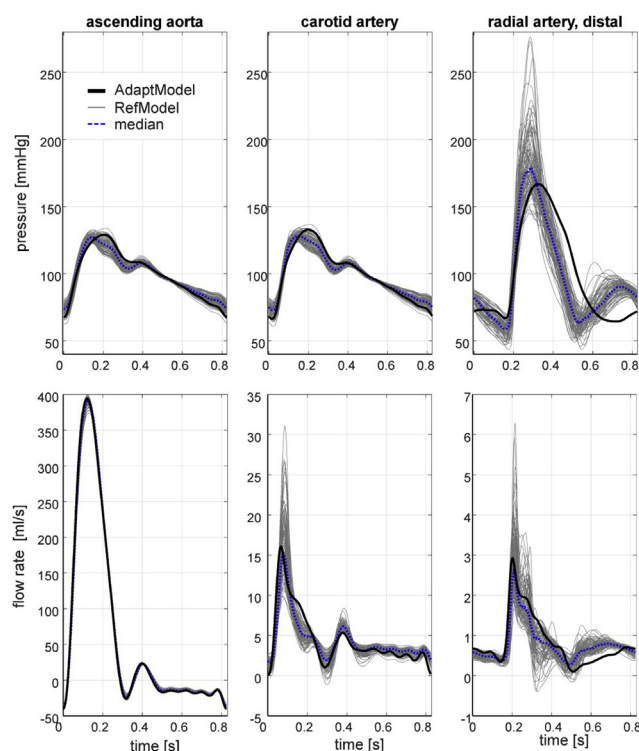


Figure 1 AdaptModel and RefModel pressure and flow waveforms at three arterial locations. For adequate comparison between the AdaptModel and the RefModel a total of 100 RefModel realisations were generated within the measurement uncertainty. The median RefModel is indicated by the blue dotted curves.

Conclusions: Our adaptation-based PWP model enables personalisation even when not all required data is available.

Reference

[1]: Kroon, W., Huberts, W., Bosboom, M., & van de Vosse, F. (2012). A numerical method of reduced complexity for simulating vascular hemodynamics using coupled 0D lumped and 1D wave propagation models. Computational and mathematical methods in medicine, 2012.

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COMPARISON OF PULSE WAVE ANALYSIS ASSESSMENT METHODOLOGY IN ELDERLY MEN

Elizabeth Ellins¹, Kirsten Smith¹, Lucy Lennon², Olia Papacosta², Goya Wannamethee², Peter Whincup³, Julian Halcov¹

¹Swansea University, UK

²UCL, UK

³St George's University of London, UK

Background: Both the Sphygmocor (S) and Vicorder (V) devices can be used for pulse wave analysis (PWA). However, large studies comparing data from both devices are lacking.

Methods: 1,722 men (78.5 ± 4.7 yrs) from the British Regional Heart Study underwent PWA with S and V devices. Brachial blood pressure (BP) was assessed by V and by Omron-HEM907 (S). Measures of central Augmentation Pressure (cAP) Augmentation Index (cAlx) and central (c) BP were compared. **Results:** Data were successfully obtained in 1,380 (80%) with S and 1,706 (99%) with V. 1,373 men had both S and V data. cAP and cAlx were higher in S than V (17 ± 9 vs 13 ± 5 mmHg and 29 ± 10 vs $21 \pm 6\%$ respectively, both $p < 0.001$), and were significantly correlated (cAP $r = 0.65$ cAlx $r = 0.48$ $p < 0.001$), but with greater differences at higher values. Brachial BP readings were greater with V vs Omron (mean difference $1.1 \pm 9.7/3.7 \pm 6.3$ mmHg). Mean cBP was higher in V than S (139 ± 17 vs 131 ± 19 mmHg) and despite strong correlation between measures (0.87 $p < 0.001$), cBP was more likely to be greater with S than V cBP at higher cBPs.

These differences between V + S remained directionally consistent even after adjustment for risk factors (with multiple regression analysis) and when S PWA results were recalculated using V BP in a subsample ($n = 58$).

Conclusion: PWA evaluations were more frequently successful with using V than S in elderly men. Differences in cAP, cAlx and cBP found between devices were not due to differences in BP calibration values. Further research is needed to understand the causes and clinical implications of these differences

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FLOW DYNAMICS AND ITS RELATION TO BICUSPID AORTOPATHY ASSESSED BY 4D FLOW CMR

Lydia Dux-Santoy Hurtado, Jose F. Rodriguez-Palomares, Andrea Guala, Raquel Kale, Gisela Teixido-Tura, Filipa Valente, Giuliana Maldonado, David Garcia-Dorado, Artur Evangelista
Hospital Universitari Vall d'Hebron, Department of Cardiology, Vall d'Hebron Institut de Recerca (VHIR), Universitat Autònoma de Barcelona, Barcelona, Spain

Purpose: Different altered flow dynamics may influence ascending aorta (AAo) dilation morphotypes in bicuspid aortic valve (BAV) (1). Using 4D-flow CMR, we aimed to identify flow variables related to root or ascending dilation in BAV.

Methods: One-hundred and one BAV patients (no severe valvular disease, aortic diameters < 45 mm) underwent 4D-flow on GE 1.5 T Signa scanner (GE Healthcare, Waukesha, USA). Peak velocity, jet angle, normalized flow displacement, in-plane rotational flow (IRF), systolic flow reversal ratio (SFRR) and wall shear stress (WSS) were evaluated at proximal, mid and distal AAo. Dilation morphotypes were classified as non-dilated, ascending and root (2), using z-score > 2 . Univariate and multivariate linear regression were used to identify factors related to dilation. ROC curves were performed to assess the relationship between variables obtained in the multivariate analysis and dilation morphotypes.

Results: Fusion phenotype was right-left (RL) in 78 patients, and right-non coronary (RN) in 23. Dilation morphotype was non-dilated in 24 patients, root in 11 and ascending in 66. On univariate analysis, BAV phenotype (RN), displacement and circumferential WSS presented the highest odds ratios (Table). On multivariate analysis, sex (male), proximal velocity and axial WSS were related to root morphotype (AUC 0.91, $P < 0.001$), while RN-BAV, distal IRF, and mid-AAo SFRR and circumferential WSS were related to ascending morphotype (AUC 0.81, $P < 0.001$) (Table and Figure).

Table. Univariate and multivariate factors related to of aortic dilation and dilation morphotypes.

	Univariate analysis of aortic dilation		Multivariate analysis of aortic dilation			
			Root morphotype		Ascending morphotype	
	Odds Ratio	P-value	Odds Ratio	P-value	Odds Ratio	P-value
BAV phenotype (RL/RN)	3.23	0.02			1.33	0.008
Sex (Male)	1.10	0.02	4.67	0.005		
Prox Peak velocity	1.02	0.028	1.10	0.043		
Jet angle	1.05	0.037				
Displacement	3.56	0.001	1.11	0.021		
IRF	1.01	0.002				
WSS _{axial}	1.20	0.003	7.64	0.008		
WSS _{circumf}	1.65	0.05				
Mid Jet angle	1.07	0.006				

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		Univariate analysis of aortic dilation		Multivariate analysis of aortic dilation			
		Odds Ratio	P-value	Root morphotype		Ascending morphotype	
				Odds Ratio	P-value	Odds Ratio	P-value
Dist	Displacement	2.46	0.002				
	IRF	1.01	0.007				
	SFRR (%)	1.20	0.001			1.2	<0.001
	WSS _{axial}	1.21	0.05				
	WSS _{Circumf}	2.43	0.02			2.23	0.037
	IRF	1.01	0.026			1.10	0.026
	WSS _{Circumf}	1.49	0.05				
	SFRR (%)	1.10	0.005				

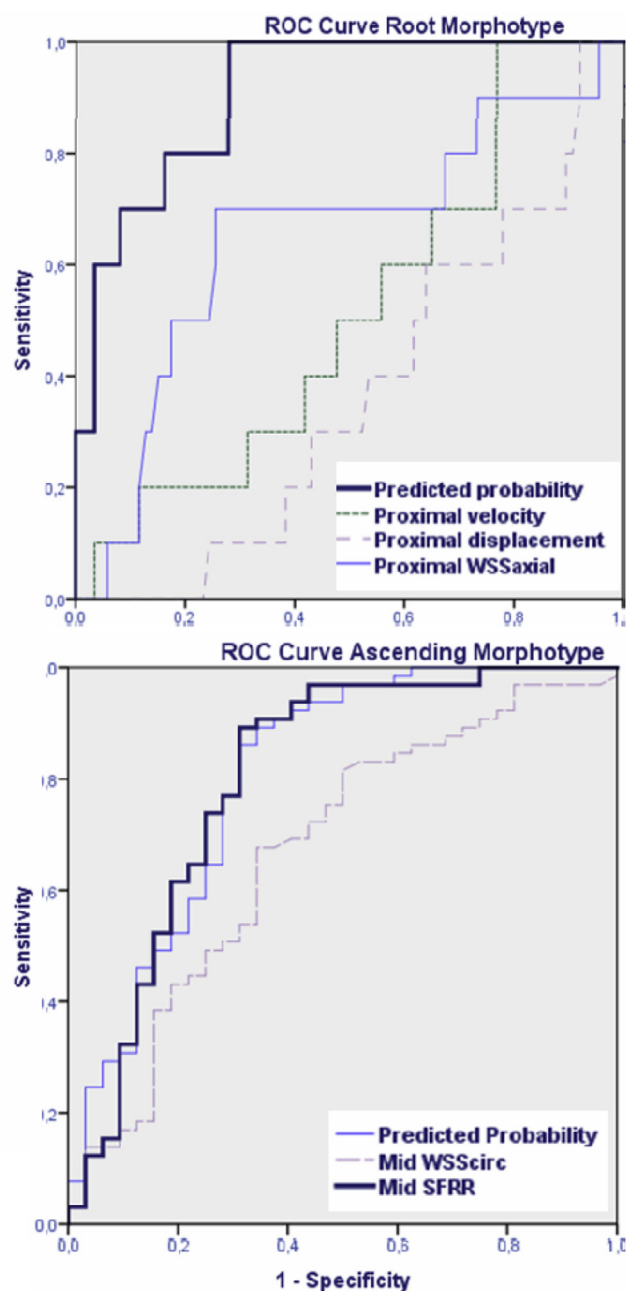


Figure. ROC curves showing flow variables related to aortic dilation morphotypes.

Conclusions: Different altered flow parameters are related to root and ascending morphotypes in BAV. Further longitudinal studies are warranted to evaluate the impact of these flow parameters in determining the risk for aortopathy.

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COMPARISON OF AUGMENTATION INDEX OBTAINED FROM HEM-9000AI AND MOBIL-O-GRAPH IN JAPANESE NORMOTENSIVE INDIVIDUALS

Masakazu Obayashi¹, Michihiro Kohno², Shigeki Kobayashi³, Michiaki Kohno^{3,1}, Masafumi Yano³

¹Sanyo-Onoda Municipal Hospital, Japan

²Kohno Clinic, Japan

³Yamaguchi University Graduate School of Medicine, Japan

Background: HEM-9000AI (HEM) is an established device for measurement of radial augmentation index (rAlx) used by applanation tonometry in Japan. Mobil-O-Graph (MOG) is a cuff-based oscillometric device for assessment of central aortic Alx (cAlx) and the usefulness to Europeans has been reported. We compared the Alx between HEM and MOG in Japanese normotensive subjects.

Methods: We enrolled 106 normotensive volunteers (47 male, 21 to 79 years). The left radial arterial waveform was recorded with the HEM. MOG were taken on the left arms, which arm circumferences (ACs) were measured to allow the correct choice of cuff (two sizes available; 20–24 and 24–32 cm). We performed multiple regressions for Alx and key variables in HEM and MOG.

Results: The ACs in M and F were 25.7 ± 1.9 (mean $\pm$ SD) cm and 23.5 ± 2.1 cm, respectively. Both rAlx ($70.5 \pm 15.3\%$ vs $83.6 \pm 11.9\%$, $p < 0.001$) and cAlx ($17.2 \pm 7.3\%$ vs $29.7 \pm 9.8\%$, $p < 0.001$) in M were smaller than those in F. Multiple regression analysis revealed that cAlx in M ($R^2 = 0.5176$) was significantly associated with age ($\beta = 0.17$, $p = 0.004$) and cuff size ($p = 0.001$). cAlx obtained using the smaller cuff was significantly increased compared to the larger cuff ($25.1 \pm 5.9\%$ vs $14.8 \pm 5.9\%$). In F, cAlx ($R^2 = 0.2245$) tended to be associated with age ($\beta = 0.16$, $p = 0.072$) and was significantly associated with height ($\beta = -0.62$, $p = 0.007$) and heart rate ($\beta = -0.26$, $p = 0.0029$).

Conclusions: The brachial cuff-based waveform recordings are useful for Japanese normotensive individuals. However, the mean AC is close to the bound of two cuff sizes and the measurement of lower cAlx using the larger cuff is less sensitive.

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SHORT-TERM REPEATABILITY OF NON-INVASIVE AORTIC PULSE WAVE VELOCITY MEASURES

Andrea Grillo¹, Paolo Salvi², Sandrine Millasseau³, Matteo Rovina⁴, Corrado Baldi⁴, Francesco Moretti⁵, Lucia Salvi⁶, Andrea Faini², Renzo Carretta⁴, Filippo Scalise⁷, Gianfranco Parati^{2,5}

¹University of Milano-Bicocca, Italy

²Department of Cardiovascular Neural and Metabolic Sciences, IRCCS Istituto Auxologico Italiano, Milan, Italy

³Pulse Wave Consulting, St Leu La Foret, France

⁴Department of Medical, Surgical and Health Sciences, University of Trieste, Italy

⁵Department of Medicine and Surgery, University of Milano-Bicocca, Milan, Italy

⁶Department of Internal Medicine and Medical herapeutics, University of Pavia, Pavia, Italy

⁷Policlinico di Monza, Interventional Cardiology Laboratory, Monza, MB, Italy

Objective: To compare the short-term repeatability of aortic pulse wave velocity (PWV) measures obtained with non-invasive devices.