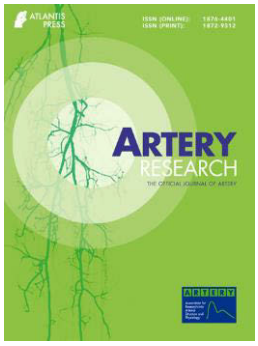

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P127: FLOW DYNAMICS AND ITS RELATION TO BICUSPID AORTOPATHY ASSESSED BY 4D FLOW CMR

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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 $\pm$ 1.96SD) between AdaptModel and RefModel radii and wall thicknesses were 0.029 $\pm$ 1.3mm and 28 $\pm$ 230μm, respectively. AdaptModel pressure and flow waveform characteristics across the proximal-to-distal arterial domain were within the uncertainty bounds of the RefModel (Fig. 1).

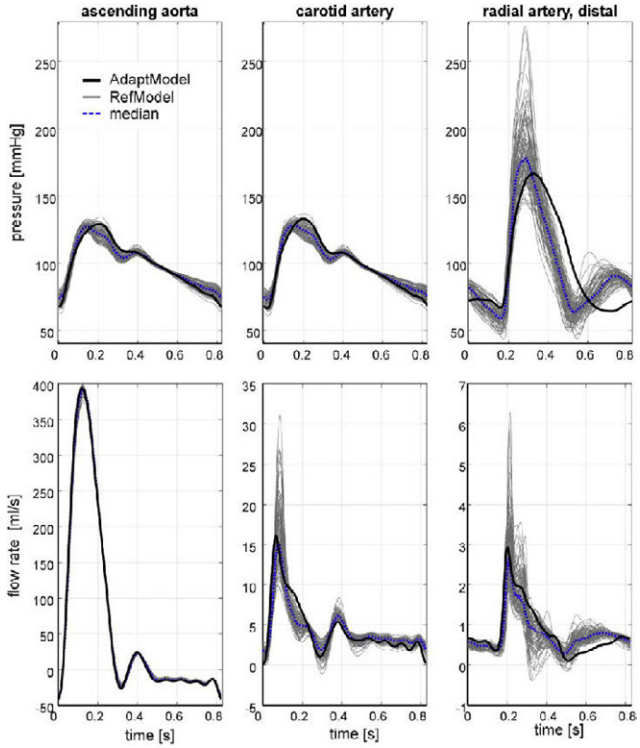

Figure 1 AdaptModel and RefModel pressure and flow waveforms at three arterial locations. For adequate comparison between the AdaptModel and the RefModel a total of 100 RefModel realisations were generated within the measurement uncertainty. The median RefModel is indicated by the blue dotted curves.

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.

P126
COMPARISON OF PULSE WAVE ANALYSIS ASSESSMENT METHODOLOGY IN ELDERLY MEN

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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 $\pm$ 4.7yrs) 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 (cAIx) 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 cAIx were higher in S than V (17 $\pm$ 9 vs 13 $\pm$ 5 mmHg and 29 $\pm$ 10 vs 21$\pm$6% respectively, both $p < 0.001$), and were significantly correlated (cAP $r = 0.65$ cAIx $r = 0.48$ $p < 0.001$), 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 $\pm$ 17 vs 131 $\pm$ 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, cAIx 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

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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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		
	$WSS_{Cireumf}$	1.65	0.05				
Mid	Jet angle	1.07	0.006				

(*continued on next page*)

(*continued*)

		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
	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				
	$WSS_{Cireumf}$	2.43	0.02			2.23	0.037
Dist	IRF	1.01	0.026			1.10	0.026
	$WSS_{Cireumf}$	1.49	0.05				
	SFRR (%)	1.10	0.005				

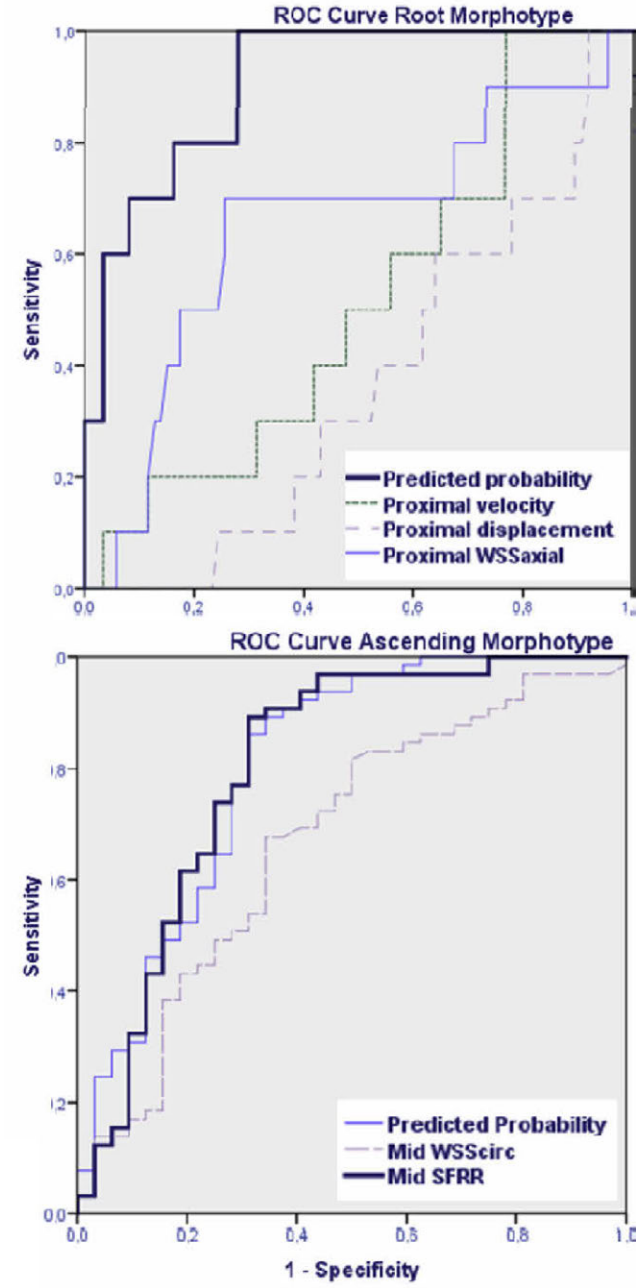

Figure. ROC curves showing flow variables related to aortic dilation morphotypes.

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.

References

1. Mahadevia R, Barker AJ, Schnell S, Entezari P, Kansal P, Fedak PWM, et al. Bicuspid aortic cusp fusion morphology alters aortic three-dimensional outflow patterns, wall shear stress, and expression of aortopathy. Circulation. 2014;129(6):673—82.
2. Della Corte A, Bancone C, Dialetto G, Covino FE, Manduca S, Montibello M V, et al. The ascending aorta with bicuspid aortic valve: a phenotypic classification with potential prognostic significance. Eur J cardio-thoracic Surg. 2014;46(2):240—7.

P128
COMPARISON OF AUGMENTATION INDEX OBTAINED FROM HEM-9000AI AND MOBIL-O-GRAPH IN JAPANESE NORMOTENSIVE INDIVIDUALS

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Background: HEM-9000AI (HEM) is an established device for measurement of radial augmentation index (rAIx) used by applanation tonometry in Japan. Mobil-O-Graph (MOG) is a cuff-based oscillometric device for assessment of central aortic AIx (cAIx) and the usefulness to Europeans has been reported. We compared the AIx 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 AIx 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 ± 2.1cm, respectively. Both rAIx ($70.5 \pm 15.3\%$ vs $83.6 \pm 11.9\%$, $p < 0.001$) and cAIx ($17.2 \pm 7.3\%$ vs $29.7 \pm 9.8\%$, $p < 0.001$) in M were smaller than those in F. Multiple regression analysis revealed that cAIx in M ($R^2 = 0.5176$) was significantly associated with age ($\beta = 0.17$, $p = 0.004$) and cuff size ($p = 0.001$). cAIx 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, cAIx ($R^2 = 0.2245$) 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 cAx using the larger cuff is less sensitive.

P129
SHORT-TERM REPEATABILITY OF NON-INVASIVE AORTIC PULSE WAVE VELOCITY MEASURES

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