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Valvular Heart Disease

VENTRICULAR, VALVULAR, AND VASCULAR ADAPTATION TO AORTIC VALVE STENOSIS. INTEGRATED FREQUENCY-DOMAIN AND WAVE-INTENSITY ANALYSES IN EXPERIMENTAL CHRONIC DISEASE

ACC Moderated Poster Contributions
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Authors: *Raquel Yotti, Javier Bermejo, Jose Luis Rojo-Alvarez, Ian Burwash, Candelas Perez del Villar Moro, Enrique Gutierrez-Ibanes, Ana Gonzalez-Mansilla, Catherine Otto, Francisco Fernandez-Aviles, Hospital General Universitario Gregorio Maranon, Madrid, Spain, University of Washington, Seattle, WA, USA*

The central role of the vascular compartment in the physiology of AS is progressively recognized. However, vascular functional changes during disease progression have never been studied.

Methods: Nine dogs underwent a surgical procedure of cusp restriction and flow probe implantation. Simultaneous high-fidelity pressure, flow, and Doppler-echocardiography measurements were performed after surgery and compared to values obtained after 6 weeks of follow-up. Signals were processed using time-, frequency-domain and wave-intensity (WIA) analyses.

Results: Valve area fell by almost 0.1 cm2, resulting in a progressive decrease in dP/dtmax and prolongation of tau. A significant increase in characteristic impedance (Z0) and compliance (C) was observed, as well as a reduction in effective arterial elastance (Ea) and systemic vascular resistance (SVR). WIA showed that the forward compression wave decreased, and was directly related to valve area (R= 0.52; p<.01) and dP/dtmax (R= 0.61; p<.01). The forward expansion wave correlated to tau (R= 0.40; p<.01) and was also reduced. No changes were observed in backward travelling waves, wave speed, or wave reflexion distance. Zva obtained by ultrasound very poorly correlated with pulsatile parameters of vascular function.

Conclusion: Typical arterial pulse characteristics of AS are caused by a reduction in forward travelling waves secondary to outflow obstruction and impaired LV chamber function. With disease progression SVR falls, whereas Z0 and C increase.

	Early Surgery	6 Weeks Follow-up	p
Valve			
AVA Gorlin (cm^2)	0.56 (0.44 to 0.69)	0.48 (0.35 to 0.61)	<.001
Stroke Volume (ml)	20 (16 to 24)	16 (12 to 20)	<.001
Vascular			
Mean Blood Pressure (mmHg)	101 (92 to 109)	84 (76 to 93)	<0.001
Pulse Pressure (mmHg)	30 (27 to 34)	26 (22 to 29)	<0.001
Valvulo Arterial Impedance (mmHg/ml)	5.98 (5.06 to 6.9)	6.41 (5.47 to 7.35)	0.15
Characteristic Impedance (dynes/s/cm^{-5})	142 (110 to 173)	161 (130 to 192)	0.02
Compliance (· 10^{-3} cm5/dynes)	0.38 (0.17 to 0.58)	0.56 (0.36 to 0.77)	<.001
Systemic Vascular Resistance (dynes/s/cm^{-5})	4710 (3747 to 5673)	4013 (3050 to 4977)	0.005
Ea (dynes/cm^2/ml)	8852 (6889 to 10814)	8227 (6265 to 10189)	0.2
Wave Intensity Analysis			
Wave Speed (m/s)	3.1 (2.4 to 3.8)	3.38 (2.68 to 4.09)	0.15
Peak dIw FCW (· 10^6 W·m^{-2}·s^{-2})	2.15 (1.43 to 2.87)	1.63 (0.91 to 2.35)	<.001
Peak dIw FEW (· 10^6 W·m^{-2}·s^{-2})	-1.05 (-1.41 to -0.68)	-0.75 (-1.12 to -0.38)	0.002
Peak dIw BCW (· 10^6 W·m^{-2}·s^{-2})	0.40 (0.17 to 0.63)	0.41 (0.18 to 0.64)	0.8
Peak dIw BEW (· 10^6 W·m^{-2}·s^{-2})	-0.56 (-1.04 to -0.08)	-0.58 (-1.06 to -0.09)	0.9
Relfexion Distance (m)	0.12 (0.09 to 0.15)	0.13 (0.1 to 0.16)	0.5
Ventricle			
Peak dP/dt_{max} (mmHg/s)	2485 (2110 to 2860)	2128 (1753 to 2503)	0.001
Tau 0 (ms)	46 (38 to 54)	51 (43 to 59)	0.006
Tau (ms)	36 (31 to 42)	39 (34 to 45)	0.004
End-diastolic LVP (mmHg)	12 (10 to 13)	8 (7 to 10)	<.001