Doppler parameters and aortic compliance in patients with aortic coarctation

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INTRODUCTION: Patients with aortic coarctation (AoCo) often show a Doppler flow pattern with diastolic flow in the descending aorta. The effect of aortic compliance on flow pattern in AoCo was described in-vitro and with computer models. This study was performed to evaluate the relation between invasive gradients, Doppler flow patterns and arterial stiffness measured by tonometry, in AoCo patients.

METHODS: Forty five invasive gradients and TTE studies were obtained in 28 patients (13 women, 24.7±17.6 years of age). In 17 patients studies were performed before and after intervention. Systolic invasive gradients were measured (Sgrad), and ratio of coarctation to aortic diameter at the diaphragm (AoCo/DAo) calculated. Doppler parameters measured at the time of invasive evaluation, included Doppler corrected gradient (Dgrad), diastolic velocity at end of T wave (DVT), end diastolic velocity (DVQ), systolic and diastolic half pressure times (SHPT and DHPT) and velocity runoff (VR - time for velocity to decrease from maximum value (Vmax) to 33% Vmax). VR, SHPT and DHPT were corrected with Bazett’s formula. Arterial stiffness was assessed by measuring pulsed wave velocity (PWV) between carotid and right radial arteries.

RESULTS: Overall, including patients before and after intervention, mean Sgrad was 24mmHg, mean AoCo/DAo 0.56, mean Dgrad 32 mmHg, mean DVT 1.0m/s, mean DVQ 0.3m/s, mean SHPT 98ms, mean DHPT 65ms and mean VR 372ms. With simple regression models, Sgrad and AoCo/DAo showed correlation with Dgrad, DVT, DVQ, SHPT and DHPT (p<0.01). Multiple regression models provided the formulas Sgrad=-3.63+0.05*DHPT+0.75*Dgrad (R2=0.76) and AoCo/DAo=0.83-0.001*SHPT-0.005*Dgrad (R2=0.51). Continuous Doppler flow in the descending aorta was found in 93% of patients with Sgrad>30 mmHg and AoCo/DAo<0.46. Diastolic tail with measurable DVT was found in patients with Sgrad as low as 7 mmHg (59% of patients with Sgrad between 7 and 26 mmHg). In this group of low to moderate Sgrad, a negative correlation was found between PWV and DVT (p=0.02) suggesting that low aortic stiffness may contribute to persistent diastolic flow.

CONCLUSIONS: Doppler systolic and diastolic parameters correlated well with severity of AoCo. In patients with moderate AoCo, Doppler diastolic flow was associated with a lower compliance of the aorta.