Flow Acceleration Time: A Novel Diagnostic Parameter for Prosthetic Aortic Valve Stenosis.

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Objective: Diagnosing prosthetic aortic valve (PAV) stenosis, especially in mechanical valves, is challenging. We postulated that ejection dynamics, particularly acceleration time (AT) and the ratio of AT to ejection time (ET) can differentiate PAV stenosis from normals and those with patient-prosthesis mismatch.

Methods: Doppler echocardiographic studies were reviewed and quantitated in 58 patients with PAV (22 mechanical and 36 bioprosthetic; age 66.9±14.5 years; valve size range 19-27 mm). Three groups of patients were identified: 1) patients with normal prostheses (n=34) evaluated within 3 months of surgery 2) patients with patient-prosthesis mismatch (n=10) and 3) documented PAV stenosis (n=14) with surgical confirmation. Quantitative Doppler parameters included ejection dynamics (AT, ET and AT/ET) and conventional PAV parameters of effective orifice area (EOA) and gradient.

Results: Summary of the Doppler parameters is presented in Table 1. Patient with PAV stenosis had significantly lower EOA and higher gradients compared to normals and mismatch. Flow ejection parameters (ET, AT and AT/ET) were significantly longer in the stenotic valves. Patients with prosthetic mismatch, while having a normal absolute EOA, had gradients and ejection dynamics intermediate, between normal and stenotic valves. Receiver-Operating characteristic curve analysis showed that AT discriminated best PAV stenosis from normals and patients with mismatch (area under ROC= 0.97). A cut off of AT = 100 msec had a sensitivity of 93% and specificity of 90% for PAV stenosis.

Conclusion: In prosthetic aortic valves, ejection dynamics, particular acceleration time, are reliable, angle independent diagnostic parameters for identifying prosthetic valve stenosis.

Table 1: Doppler Echocardiographic parameters in normal PAV, stenotic valves and patients with mismatch.

Echo Parameters	Normal PAV	Patient-prosthesis mismatch	PAV Stenosis
EOA (cm^2)	**1.66 ± 0.7**	**1.4 ± 0.4**	**0.6 ± 0.1†‡**
Mean pressure Gradient (mm Hg)	**13 ± 7**	**36 ± 8†**	**52 ± 15†‡**
ET (msec)	**240 ± 39**	**263 ± 35**	**313 ± 42†‡**
AT (msec)	**68 ± 18**	**87 ± 20†**	**129 ± 18†‡**
AT/ET	**0.28 ± 0.06**	**0.33 ± 0.06†**	**0.41 ± 0.03†‡**

†P<0.05 vs. normal valves.
‡P<0.05 vs. patient-prosthetic mismatch valves.