

Impairment of Right Ventricular Function in Patients with Pulmonary Hypertension Can Be Determined By a Novel Automated Endocardial Tracking System

Bahar Pirat, Marti L. McCulloch, William A. Zoghbi, Baylor College of Medicine, Houston, TX

Introduction: Right ventricular (RV) function is the major determinant of prognosis in patients with pulmonary hypertension. Evaluation of RV regional and global function however, remains a challenge. A novel software (Velocity Vector Imaging, VVI, Siemens, California) was developed that tracks the endocardial border after *one* initial trace and automatically determines volumes, ejection fraction (EF), myocardial velocity, strain rate (SR) and strain. We tested the hypothesis that this novel method can accurately assess global RV function and detect differences in regional RV function between normals and patients with pulmonary hypertension (PAH).

Methods: Thirty-six patients with PAH (7 Men; mean age 53±15 yrs) and 17 age matched controls were studied retrospectively. Echocardiographic images in apical planes were analyzed both by conventional manual tracing for volumes and EF (method of Disks) and by the novel software. Myocardial velocity, SR and strain were determined at the basal, mid and apical segments of the RV free wall and interventricular septum.

Results: In patients with PAH, mean pulmonary artery pressure and mean EF were 72±19 mmHg and 38±13%, respectively. RV end-diastolic and end-systolic volumes and EF obtained with manual tracing correlated strongly with the same indices obtained by the automated VVI method in all subjects ($r=0.98$, $p<0.001$; $r=0.98$, $p<0.001$; and $r=0.94$, $p<0.001$, respectively). Peak systolic myocardial velocities, peak systolic SR and strain were significantly impaired in patients with PAH compared to controls (Table).

Conclusion: The new automated VVI method can accurately assess RV volumes and EF from a single trace of the RV contour. This method also provides simultaneous quantitation of *regional* RV function that can be applied retrospectively to already stored digital images.

	Velocity (cm/sec)		SR (s^{-1})		Strain (%)	
	PAH	Normals	PAH	Normals	PAH	Normals
Basal RV	5.6 ± 1.8*	7.9 ± 1.6	-1.5 ± 0.9*	-3.3 ± 1.4	-23.8 ± 12*	-45.1 ± 10.5
Mid RV	3.3 ± 1.3†	4.6 ± 1.3	-1.0 ± 0.4*	-1.5 ± 0.3	-17.8 ± 7.8*	-27.3 ± 5.4
Apical RV	1.3 ± 0.7†	1.8 ± 0.7	-1.0 ± 0.4†	-1.5 ± 0.5	-19.1 ± 6.3*	-28.8 ± 6.7
Basal Septal	5.4 ± 2.0†	6.5 ± 1.6	-0.9 ± 0.4*	-1.6 ± 0.6	-18.4 ± 8.1†	-24.4 ± 5.5
Mid Septal	3.2 ± 1.2	3.9 ± 1.1	-1.1 ± 0.6†	-1.6 ± 0.7	-19.2 ± 8.3†	-27.5 ± 9.2
Apical Septal	1.5 ± 0.6	1.7 ± 0.6	-1.0 ± 0.6†	-1.6 ± 0.6	-17.3 ± 5.5*	-25.9 ± 6.8

* $p<0.001$ vs normals, † $p<0.05$ vs normals.