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Three-Dimensional Echocardiography for Evaluating Left Ventricular Function in Patients With ST Elevation Myocardial Infarction: A Pilot Study

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To the Editor: Two-dimensional echocardiography has been used for decades to evaluate left ventricular systolic function. Live 3-dimensional echocardiography provides accurate measurements of left ventricular volumes and ejection fraction (EF) with fewer geometric assumptions.[1,2] The aims of this pilot study were to quantify left ventricular volumes and EF by 3-dimensional echocardiography and evaluate the reproducibility of these measurements compared with 2-dimensional echocardiography.

We recruited patients admitted to the hospital with a diagnosis of ST elevation myocardial infarction and referred for clinically indicated transthoracic echocardiography. Bedside echocardiographic images were obtained by the same experienced echocardiographer (A.M.A.-O.) using iE33 equipment (Philips Medical Systems, Bothell, WA) and second harmonic mode. Q lab-Advanced Quantification software (Philips Medical Systems) was used for both 2- and 3-dimensional tracings. For 2-dimensional mode, the left ventricular volumes and EF were calculated using the biplane Simpson method.[3] For the 3-dimensional mode, the left ventricular volumes and EF were calculated by the software after 2 independent experienced cardiologists (A.M.A.-O. and F.B.) manually traced the endocardial border. For each variable, 3 tracings were obtained and averaged for each imaging modality.

From October 2006 to April 2007, we recruited 30 patients (mean ± SD age, 61±15 years; 77% men; body mass index, 30.0±4.9 kg/m^2). Images were adequate for analysis by both 2-and 3-dimensional methods in 24 of the 30 patients; feasibility was 80%. By 2-dimensional echocardiography, end-diastolic volume was 85±26 mL; end-systolic volume, 42±17 mL; and EF, 54±7.6%. By 3-dimensional echocardiography, end-diastolic volume was 88±26 mL; end-systolic volume, 40±15 mL; and EF, 55±8%.

The correlation between the 2 echocardiographic techniques was high for the evaluation of EF (r=0.90; P<.001), left ventricular end-diastolic volume (r=0.93; P<.001), and left ventricular end-systolic volume (r=0.92; P<.001). Inter-observer and intraobserver correlations for end-systolic volume and EF were similar for the 2 imaging techniques. However, for end-diastolic volume, interobserver correlations were better for 3-dimensional echocardiography, and intraobserver correlation also tended to be better for 3-dimensional echocardiography (Table).

Echocardiography equipment is portable, and thus images can be obtained at bedside with minimal discomfort or risk to the patient. In this pilot study, the bedside use of real time 3-dimensional echocardiography had adequate feasibility. Most of the study patients had a high body mass index and were older than 60 years, features associated with reduced imaging quality.[4] The reproducibility for 3-dimensional echocardiography was slightly superior to that for 2-dimensional echocardiography for measurement of end-diastolic volume. In previous studies that compared 3-dimensional echocardiography to cardiac magnetic resonance imaging, assessment of EF was similar by both techniques.[1,2] In another study of patients with prior myocardial infarction that compared both 3-dimensional echocardiography and single photon emission computed tomography to the reference cardiac magnetic resonance imaging, 3-dimensional echocardiography was more accurate than single photon emission computed tomography with less underestimation of volumes.[5]

Future advances in the technology for live 3-dimensional echocardiography and use of contrast echocardiography should improve the feasibility of this technique for evaluating left ventricular volumes and EF.

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TABLE

Pearson Correlation Coefficients Comparing 3-D and 2-D Echocardiography by 2 Independent Observers and Intraobserver Intraclass Correlation Coefficients for 24 Patients[a]

	Observer								
	A vs B			A			B		
	Imaging			Imaging			Imaging		
	3-D	2-D	*P* value	3-D	2-D	*P* value	3-D	2-D	*P* value
EDV	0.95	0.81	.02	0.89	0.70	.05	0.94	0.87	.13
ESV	0.87	0.82	.57	0.90	0.83	.30	0.94	0.92	.60
EF	0.76	0.59	.30	0.89	0.86	.65	0.78	0.78	>.99

[a] EDV = end-diastolic volume; EF = ejection fraction; ESV = end-systolic volume; 2-D = 2-dimensional; 3-D = 3-dimensional.