Standardization in the Measurement of Left Ventricular Wall Mass Two-Dimensional Echocardiography

NATHANIEL REICHEK

SUMMARY Two-dimensional echocardiography is superior to M-mode echocardiography for estimation of left ventricular mass when left ventricular shape is markedly abnormal. Left ventricular mass measurement by two-dimensional echocardiography depends on careful experimental calibration of the echocardiographic instrument using either a standard phantom or actual heart slices, an appropriate geometric algorithm, and short axis images to determine myocardial cross-sectional area. Several well-validated algorithms are available, of which the short-axis area-length technique is the simplest. In hypertensive heart disease, in which left ventricular shape is usually close to normal, two-dimensional echocardiography may offer a smaller standard error than M-mode, but this issue requires further evaluation. Further, it is uncertain whether the incremental accuracy of two-dimensional echocardiography in hypertensive heart disease would offset its increased cost and complexity relative to M-mode echocardiography. (Hypertension 9 [Suppl II]: II-30-II-32, 1987)

KEY WORDS • two-dimensional echocardiography • left ventricular mass • left ventricular hypertrophy

ESTIMATION of left ventricular (LV) mass in vivo in humans was first performed with biplane, cut-film ventriculography. 1 Subsequent studies demonstrated that M-mode echocardiographic mass estimates had comparable reliability,2 but both methods had relatively large standard errors (roughly 30 g). Thus, for individual subjects, a difference in serial change of roughly 60 g would be required to have 95% confidence that a real difference existed or that a real change had taken place. Since the normal mass range is 90 to 215 g, and severe hypertrophy produces masses of 300 to 400 g, both methods are sensitive only to large changes or differences between individuals. Further, in studies of patient groups, changes in LV mass with therapeutic interventions generally are less than 100 g.3 Thus, relatively large patient populations might be required to determine whether an apparent change is statistically significant.

For these reasons, the advent of two-dimensional (2D) echocardiography led to considerable interest in application for LV mass measurement. As with M-mode echocardiography, the most pressing issues have been selection of a geometric model and of a reliable method for determination of dimensions. Two approaches have been developed that have proven successful when compared to postmortem LV mass.4-6 At this time, neither approach has been shown to be superior to the other and both are appropriate for research and clinical application.

Our laboratory has applied the very simple area-length algorithm of Wyatt and co-workers,6 which uses a single papillary

From the Department of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania.
Address for reprints: Nathaniel Reichek, M.D., University of Pennsylvania, 3400 Spruce Street, Philadelphia, PA 19104.

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Byrd and co-workers have used a more complex apical geometric algorithm combined with short-axis imaging at midventricular level for mean myocardial thickness and have relied on calibration with a standard phantom. Results appear to be comparable in reliability to those obtained with our method. This method is simpler with respect to the calibration step, which does not require postmortem hearts, but requires a programmable calculator or microcomputer because of the complexity of the geometric algorithm. No direct comparison of the two methods has been performed.

These two approaches have in common rigorous calibration procedures and reliance on short-axis midventricular images for determination of mean myocardial thickness. Since studies lacking rigorous calibration methods have met with less success, instrument calibration may be a central issue in 2D determination of LV mass. Byrd et al. has also stressed meticulous attention to standardization of technique, which is clearly an essential point when serial studies are planned.

In summary, two satisfactory methods for 2D echocardiographic measurement of LV mass have been described. Each has certain advantages, but it is unclear whether either is clearly superior. Also unclear is whether 2D echocardiography has sufficient incremental value to warrant substitution of 2D for M-mode LV echocardiographic mass determination in all LV mass applications, or whether its advantages are restricted to settings where major LV shape deformities exist. Further studies to clarify these issues are required.

References


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N Reichel

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