Evaluation of Ventricular Mass for Hypertrophic Cardiomyopathy using 4D Echocardiography

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Background: Ventricular mass determination is essential for evaluation of the progress of Hypertrophic cardiomyopathy (HCM). Four-dimensional echocardiography (4DE) has been shown able to determine ventricular mass without geometric assumption, but its feasibility on determining mass of HCM has not been reported. Methods: A balloon was sutured into the left ventricle (LV) of 13 porcine hearts and connected to a calibrated pump. The right ventricular (RV) free wall was cut off to better differentiate between the interventricular septum (IVS) and the LV. The RV free wall was sliced into quarters and sutured on the septum one at a time to simulate septal wall thickness. 4D and M-mode images were obtained with a GE Vivid E9 ultrasound system at each simulated HCM model and then analyzed using EchoPAC. Results: Full-volume 4D loops were analyzed using Auto LVQ module. M-mode LV mass calculation was derived according to ASE basic formula. 4D-derived LV mass ($R^2=0.95$) demonstrated superior linear correlation than M-mode derived mass ($R^2=0.55$) when compared with displacement values for HCM models with abnormally thickened septal wall. However, both methods demonstrated excellent correlation with displacement values (both $R^2>0.90$, $p<0.001$) for hearts with normal septal walls. Bland-Altman analyses showed an overestimation in both methods. Conclusions: Full-volume 4D echocardiography is a feasible method for mass determination in HCM with abnormal septal wall.

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