Left Ventricular Hypertrophy Demonstrated by Four-Dimensional Myocardiography by Helical Computed Tomography

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We present 4D images of hypertrophied myocardium in patients with essential hypertension, hypertrophic cardiomyopathy with asymmetrical septal hypertrophy, and apical hypertrophic cardiomyopathy using helical computed tomography (CT) (Figures 1 through 4).

Previously, we reported on 4D CT-ventriculography, which can assess right and left ventricular morphology and motion.\(^1\) In 4D ventriculography, we used only information about the inner cavities of the heart, and we discarded information regarding the myocardium. However, it is important to estimate the extent and function of the hypertrophied myocardium. Therefore, we retrieved and dealt with information about the myocardium as demonstrated in a 4D manner (4D myocardiography).

Methods of data acquisition were the same for 4D CT-ventriculography as was reported previously.\(^1\) Four-dimensional myocardiography can analyze the detailed characteristics of hypertrophic myocardium in both ventricles noninvasively. It provides an assessment of myocardial volume, shape, and size and the extent of myocardial hypertrophy in any cardiac phase and in any perspective.

References

Figure 1. Two-dimensional images from cardiac axes of hypertrophied myocardium in patients with essential hypertension (HT; left), hypertrophic cardiomyopathy (HCM; middle) with asymmetrical septal hypertrophy (*), and apical hypertrophy (**; right).

Figure 2. Images from a patient with essential hypertension at end-diastole (ED) and end-systole (ES). Left, 4D myocardioangiography (4D-MG); middle, 4D ventriculography (4D-VG); and right, water-marked display of 4D myocardioangiography and 4D ventriculography. The 4D ventriculography shows both right and left ventricular cavities and wall motion. The 4D myocardioangiography provides detailed myocardial images and whole dynamics of wall motion and systolic thickening of both ventricles. Myocardial hypertrophy is concentric and uniform. RV indicates right ventricle; LV, left ventricle; and IVS, intraventricular septum. Animated version of figure can be found at http://www.circulationaha.org.
Figure 3. Views from a patient with hypertrophic cardiomyopathy with asymmetrical septal hypertrophy (*) at end-diastole (ED) and end-systole (ES). Left, 4D myocardio- 
graphy (4D-MG); middle, 4D ventriculography (4D-VG); and right, watermarked display of 4D myocardiology and 4D ventriculography. The 4D myocardiology and watermarked images clearly demonstrate asymmetrical septal hypertrophy. The mid-interventricular septum (IVS) bulges into left ventricular cavity (LV). The 4D ventriculography demonstrates the bending (“banana”-shaped) left ventricle (**). Left ventricle is usually more involved in hypertrophic process than right ventricle (RV); however, hypertrophy in both ventricles was observed in this patient. Animated version of this figure can be found at http://www.circulationaha.org

Figure 4. Views from a patient with apical hypertrophy at end-diastole (ED) and end-systole (ES). Left, 4D myocardiology (4D-MG); middle, 4D ventriculography (4D-VG); and right, watermarked display of 4D myocardiology and 4D ventriculography. The 4D myocardiology and the watermarked display clearly demonstrate the apical hypertrophy (*). The 4D myocardiology discloses severe hypertrophy confined to apex and interventricular septum (IVS) at the apex. LV indicates left ventricle; RV, right ventricle. Animated version of this figure can be found at http://www.circulationaha.org
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