Editorial Comment

Synchronicity and Ventricular Arrhythmias in Hypertension

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Tissue Doppler imaging (TDI) is a relatively new echocardiographic technique that uses Doppler principles to measure the velocity of myocardial motion. TDI can assess left ventricular systolic and diastolic function (1, 2), right ventricular function (3), and left ventricular filling pressure (4). In addition, TDI is one of the most useful methods to assess cardiac dyssynchrony, because TDI can detect the relative timing of peak systolic contraction in multiple myocardial regions (5). Cardiac mechanical dyssynchrony, both intra- and interventricular, has become increasingly recognized as a major determinant of therapeutic response to cardiac resynchronization therapy (CRT) in patients with heart failure. In recent years, TDI has attracted attention as a method to identify responders to CRT in terms of symptomatic improvement or reverse left ventricular remodeling (6, 7). In contrast, few studies have used TDI to investigate left ventricular systolic and diastolic synchronicity in patients with hypertension (8, 9). Iwakami and Numao (8) measured regional myocardial velocity in hypertensive patients with left ventricular hypertrophy and in normotensive individuals using TDI and found regional wall motion abnormalities and nonuniformity during the early diastolic phase in hypertensive hearts with left ventricular hypertrophy. Kosmala *et al.* (9) reported that systolic and diastolic synchronicity was impaired in hypertensive patients and most advanced in hypertensive patients with diabetes mellitus. On the other hand, it should be noted that there are limitations to tissue Doppler interrogation. As with all Doppler techniques, TDI measures only the vector of motion that is parallel to the direction of the ultrasound beam. In addition, TDI measures absolute tissue velocity and is unable to discriminate passive from active motion.

There are some reports about the relationship between synchronicity and ventricular arrhythmia. D'Andrea *et al.* (10) evaluated left ventricular regional systolic asynchrony in patients with hypertrophic cardiomyopathy using pulsed Doppler myocardial imaging and reported that an intraventricular systolic delay >45 ms (receiver operating characteristic [ROC] curve) identified a subgroup of hypertrophic cardiomyopathy patients with nonsustained ventricular tachycardia. Fauchier *et al.* (11) demonstrated that left intraventricular dyssynchrony evaluated using equilibrium radionuclide angiography was an independent predictor of major adverse cardiac events, including sustained ventricular tachycardia/ventricular fibrillation in idiopathic dilated cardiomyopathy. The anatomical and electrical substrate in patients with cardiomyopathy may determine a regional delay in systolic activation of the left ventricular wall, with consequent prolongation of intraventricular systolic delay, and may establish a single macroscopic or multiple microscopic reentrant circuits, generating monomorphic or polymorphic life-threatening ventricular tachyarrhythmias. However, further studies are needed to clarify this mechanism precisely.

Ventricular arrhythmias occur often in patients with left ventricular hypertrophy associated with systemic hypertension, suggesting an underlying arrhythmogenic substrate (12). Galinier *et al.* (13) investigated the prognostic value of arrhythmogenic markers in 214 hypertensive patients and found that in multivariate analysis only non-sustained ventricular tachycardia was an independent predictor of global and cardiac mortality, increasing the risk of global death 2.6-fold and cardiac death 3.5-fold. Therefore, it is very important to discriminate between patients with ventricular arrhythmias

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and those without. Tan *et al.* (14) investigated the effects of ventricular arrhythmia on left ventricular synchronicity in hypertensive patients, and found that left ventricular synchronicity indexes, time to peak velocity during sustained systole (T_s), SD of T_s (T_s -SD), and T_s -max, were prolonged in hypertensive patients with ventricular arrhythmia compared with controls or with hypertensive patients without ventricular arrhythmia. That study also showed that T_s -max was positively correlated with the numbers and the duration of ventricular arrhythmia and left ventricular mass index. They proposed a T_s -max value of 70 ms as a cutoff value to detect hypertensive patients with ventricular arrhythmia. Therefore, their report suggests that the TDI method may become a useful and convenient tool to find high-risk patients with hypertension.

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