EDITORIAL

The Ins and the Outs of Cardiac Dyssynchrony

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Systolic heart failure is a common consequence of ischemic or nonischemic cardiomyopathy and is accompanied by an increase in left ventricular end systolic and end diastolic volumes as well as a reduction in the left ventricular ejection fraction. The myocardial substrate for this mechanical dysfunction is frequently associated with prolongation of intraventricular conduction manifest as a wide QRS complex on the ECG, with QRS duration ≥ 120 ms. One of the more marked forms of this conduction disturbance is the left bundle branch block pattern (LBBB). A recent expert consensus publication¹ from the American Heart Association Electrocardiography and Arrhythmias Committee, the Council of Clinical Cardiology, and the Heart Rhythm Society defined complete LBBB as having the following characteristics: QRS duration ≥ 120 ms in adults; broad notched or slurred R wave in leads I, aVL, V₅, and V₆; absent q waves in I, V₅, and V₆; R peak time > 60 ms in leads V₅ and V₆; ST and T waves usually opposite in direction to QRS; and LBBB may change the mean QRS axis in the frontal plane to the right or to the left. This LBBB intraventricular conduction disturbance is accompanied by a dyssynchronous left ventricular contraction pattern and increased myocardial strain,² and when it occurs in the presence of structural and functional cardiac disease it contributes to progressive adverse cardiac remodeling. Cardiac resynchronization therapy is effective in improving impaired cardiac function,^{3–5} especially in patients with LBBB, and this beneficial effect results beneficial reverse remodeling.

In this issue of *Annals*, Oloveira Neto et al.⁶ analyzed the correlation between ECG parameters and mechanical dyssynchrony in patients with symptomatic heart failure and LBBB. A total of 50 pa-

tients were studied with New York Heart Association class III or IV symptoms and left ventricular ejection fraction averaging 22%. Color tissue Doppler was used to evaluate mechanical intraventricular and interventricular dyssynchrony. QRS duration, the amplitude of the S wave in the precordial leads, and QRS notching in the lateral and inferior leads were significantly correlated with the degree of mechanical dyssynchrony.

Several recent publications have documented improvement in left ventricular function with cardiac resynchronization therapy in at-risk cardiac patients.^{3–5,7,8} In the MADIT-CRT trial, the best benefit was achieved in patients with LBBB.⁹ Echocardiographic studies showed marked improvements in left ventricular volumes and ejection fraction with resynchronization therapy. These improvements in the structure and function of the heart during the first year of resynchronization therapy were associated with a reduction in subsequent heart failure events.

How does resynchronization therapy improve myocardial contractility in heart failure patients with LBBB and its associated dyssynchrony? The study by Bertini et al.¹⁰ provides valuable insight into this process. In the normal myocardium, left ventricular contraction involves a synchronous wringing and twisting motion of the helically arranged myofibers such that the heart squeezes the blood out of the left ventricular chamber into the aorta in less than 300 ms. In LBBB, this wringing and twisting contraction pattern is markedly impaired with a resultant asynchronous squeeze. With left ventricular resynchronization pacing, contractile synchrony is improved with augmentation in the ejection fraction and reduction in ventricular volumes.

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Risk stratification is an essential part of clinical medicine for it is well known that high-risk patients consistently receive better results from appropriate therapy than low-risk patients. Although patients with heart failure and LBBB achieve a very good result from cardiac resynchronization therapy, it is likely that patients having LBBB characteristics that were significantly correlated with mechanical dyssynchrony as highlighted in the current publication by Oliveira Neto et al. would achieve the best response to cardiac resynchronization therapy.

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