EDITORIAL

Heart Failure: A Central Factor in Progressive Mechanical and Electrical Cardiac Dysfunction

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Heart failure is one of the major challenges facing medicine and the cardiology profession. Many complications of heart disease are decreasing, but the prevalence of heart failure is increasing. It is estimated that approximately 5 million people in the United States are affected with heart failure, and heart failure accounts for more than 2 million hospitalizations per year.[1]

A century ago, heart failure was the result of the ravages of rheumatic heart disease. During the last half of the 20th century, rheumatic fever was brought under control, and heart failure secondary to end-stage hypertension, coronary heart disease, and nonischemic cardiomyopathy began to dominate the scene. Our generation has witnessed the therapeutic benefit and life-prolonging effect of diuretics, digoxin, beta-blockers, angiotensin-converting enzyme inhibitors, and aldosterone receptor blockers. More recently, cardiac resynchronization therapy with biventricular pacing has been shown to improve the functional state of patients and increase survival in those with advanced heart failure on optimal pharmacologic therapy.[2,3]

Heart failure is a clinical syndrome associated with exercise intolerance, exertional or resting dyspnea, and signs of pulmonary and/or systemic venous congestion. We typically grade the functional manifestations of heart failure in terms of the New York Heart Classification, with Class III heart failure associated with symptoms at less than ordinary activity, and Class IV with symptoms at bed rest. Short- and long-term mortality is directly related to the degree of functional impairment. Heart failure has been categorized as being due to systolic heart failure with a reduced ejection fraction and diastolic heart failure with reduced diastolic compliance but with a normal or near-normal ejection fraction.

Regardless of the etiology of heart failure, decompensated heart failure is associated with secondary neurohumoral activation, especially of the sympathetic nervous system and the rennin–angiotensin system. Activation of the sympathetic nervous system is a central actor in dysfunctional regulation of the altered cardiac mechanical and electrical activities in heart failure. It has been known for many years that increased concentrations of catecholamines result in vasoconstriction (augmented afterload), increased myocardial oxygen consumption, and reduction in the threshold for ventricular tachyarrhythmias. Once appreciated, vasodilator and beta-blocker therapies became the treatment of choice for patients with heart failure.

The introduction of the implanted cardioverter defibrillator (ICD) has resulted in improved survival in patients with ischemic and nonischemic cardiomyopathy.[4,5] Our research group recently evaluated the role of post-enrollment heart failure in patients enrolled in the MADIT-II trial.[4] The development of heart failure after enrollment in the trial was the major factor associated with the development of ventricular tachyarrhythmias as determined by interrogation of stored electrograms in the ICD.[6] The clinical course of patients after termination of ventricular tachyarrhythmias was also informative. Successful appropriate therapy by the ICD for ventricular tachycardia and ventricular fibrillation was associated with 80% survival at 1 year after arrhythmia termination, with late mortality dominated by heart failure. The evidence

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strongly suggests that life-prolonging ICD therapy transforms a sudden cardiac death risk into a later increased risk for heart failure. Thus, cardiac patients at risk for sudden cardiac death and heart failure are likely to benefit from a combination of optimal pharmacologic therapy, implantation of a defibrillator, and resynchronization therapy with biventricular pacing. The selection of patients for ICD and biventricular pacing therapy rests heavily on findings from non-invasive testing.

REFERENCES

1. American Heart Association. Heart and Stroke 2000 Statistical Update. Washington, DC, American Heart Association, 2001.
2. Bristow MR, Saxon LA, Boehmer J, et al. Cardiac-resynchronization therapy with or without an implantable defibrillator in advanced chronic heart failure. N Engl J Med 2004;350:2140–2150.
3. Cleland JG, Daubert JC, Erdmann E, et al. The effect of cardiac resynchronization on morbidity and mortality in heart failure. N Engl J Med 2005;352:1539–1549.
4. Moss AJ, Zareba W, Hall WJ, et al. Prophylactic implantation of a defibrillator in patients with myocardial infarction and reduced ejection fraction. N Engl J Med 2002; 346:877–883.
5. Bardy GH, Lee KL, Mark DB, et al. Amiodarone or an implantable cardioverter-defibrillator for congestive heart failure. N Engl J Med 2005;352:225–237.
6. Moss AJ, Greenberg H, Case RB, et al. Long-term clinical course of patients after termination of ventricular tachyarrhythmia by an implanted defibrillator. Circulation 2004; 110:3760–3765.