Congestive heart failure (HF) is a major and growing public health problem. The therapeutic approach includes non-pharmacological measures, pharmacological therapy, mechanical devices, and surgery. Despite the benefits of optimal pharmacological therapy, the prognosis is still not ideal. At this time, cardiac resynchronization therapy (CRT) has gained wide acceptance as an alternative treatment for HF patients with conduction delay. As an innovative, pacemaker-based approach to the treatment of patients with HF, CRT uses a three-lead biventricular pacemaker system and can restore the cardiac synchronicity by resynchronizing the atrioventricular, interventricular, and intraventricular contraction. The clinical benefits of CRT have been demonstrated in clinical studies, including improvement in HF symptoms, quality of life, exercise capacity, and mortality.\(^2,3\)

Based on the results of multi-center clinical studies such as PATH-CHF,\(^4\) Insync,\(^5\) MUSTIC,\(^6\) and MIRACLE,\(^7\) the 2002 ACC/AHA/NASPE guideline for the implantation of cardiac pacemakers ranked CRT as a class IIa indication for patients with advanced HF and prolonged QRS interval.\(^8\) With the publication of the CARE-HF trial, CRT gained further acceptance because it decreased the all-cause mortality by 36% compared with optimal drug therapy.\(^9\) Based on these definite effects, the ESC and ACC/AHA adjusted the guideline for HF and made CRT a class I indication.\(^10,11\) The guideline suggested that CRT should be applied in patients with reduced ejection fraction and ventricular dyssynchrony (QRS duration >120ms) and who remain symptomatic despite optimal medical therapy. In 2006, the Chinese Society of Pacing and Electrophysiology (CSPE) also defined the indications for CRT and listed it as a class I indication.\(^12\)

In the guideline, cardiac dyssynchrony was listed as one criterion for the application of CRT. Cardiac synchronicity in systole and diastole is important because it assures an effective and efficient ejection fraction. In some patients with dilated cardiomyopathy, the activation sequence may change markedly and so the cardiac output may be depressed. As an effective intervention for patients with HF, CRT has been demonstrated to improve symptoms and reduce mortality by restoring cardiac synchronicity. However, 20% to 30% of patients still do not respond to CRT. According to the mechanism of CRT, that is to resynchronize the atrio-ventricular, ventricular-ventricular contraction, it becomes desirable to identify patients with great mechanical dyssynchrony because they are the best responders to CRT. However, the criteria for dyssynchrony have changed a lot recently. Prior studies had defined the “wide QRS duration” on the surface ECG as an indicator for dyssynchrony. However, recent criteria derived from echocardiography, have been suggested better markers, especially those drawn from tissue Doppler imaging.

The Predictors of Response to Cardiac Resynchronization Therapy (PROSPECT)\(^13\) study is now underway to examine whether the prospectively defined echocardiographic parameters of systolic dyssynchrony are able to predict a favorable response to CRT on both clinical composite end points and LV reverse remodeling parameters.

CRT has been carried out in China since 1999. Until 2005, only 800 CRT devices have been implanted in China. The reasons might be because of the high costs for CRT devices and the technical difficulty encountered with implantation of the left ventricular (LV) lead. However, many major medical centers in China had applied this therapy and gained some solid experience.\(^14,18\)

Based on the guideline, CRT is eligible for patients with HF regardless of their underlying etiologies. Patients with ischemic or nonischemic cardiomyopathy were both candidates for CRT. However, whether the outcome of CRT is related to the type of underlying heart disease has not been fully investigated. We observed the effect of CRT on 142 patients with different etiology of HF- ischemic or nonischemic cardiomyopathy. After CRT, the cardiac function was significantly and evenly improved without significant difference in ischemic or non-ischemic etiologies.\(^19\)

The key hurdle for a wide application of this therapy has been the technical problem involving the implantation of LV pacing leads. Placing the LV lead at the target site typically involves cannulating the coronary sinus, performing coronary venous angiography, and placing the LV lead to achieve adequate lead performance. Implantation of CRT is a complex procedure with some potential for complication, including coronary sinus perforation, phrenic nerve...
stimulation, and LV lead dislodgement. It is reported that the success rates in the Insync, MUSTIC, MIRACLE, and COM- PANY trials were 84%, 86%, 93%, and 87%, respectively. We have conducted a study to analyze the complications of CRT in patients with HF. LV lead implantation was attempted through the coronary sinus for all 117 patients, and was successfully implanted in 111 patients. The success rate was 95%. The main procedure-related complications in our study included coronary sinus perforation (3.4%), phrenic nerve stimulation (1.7%), and LV lead dislodgement requiring replacement (1.7%). These rates were in line with other published reports and suggested that CRT implantation was associated with an acceptable low complication rate.

To date, the major obstacle to successful implantation continues to be inability to cannulate the coronary sinus, and inability to place the LV lead in the appropriate branch of cardiac veins. In order to minimize the complication rate, we need to select the appropriate patients, stabilize their medical condition prior to implantation, and to provide optimal and appropriate care during the peri- and post-operative period.

In summary, as an effective interventional therapy for patients with HF, CRT has been demonstrated to improve symptoms and reduce mortality by restoring cardiac synchronicity. Although the implantation of CRT is rather difficult and associated with certain complication, CRT is still safe and feasible for patients with HF. With the extension of CRT indication and reduction of the cost of CRT devices, an increasing number of people in China will benefit from CRT regardless of their underlying etiology, ischemic or nonischemic cardiomyopathy.

References