

## Biventricular Devices for Treatment of Congestive Heart Failure

Congestive heart failure is a progressive condition in which the heart's function gradually deteriorates resulting in diminished cardiac performance and pumping ability. Ultimately, blood flow to vital and nonvital organs is reduced, leading to a variety of symptoms including shortness of breath, lack of energy, swelling, etc. Patients with heart failure often require repeated hospitalizations for treatment and adjustment of medications. Medications have been the primary mode of therapy for heart failure and have made important inroads in the high risk of death that many heart failure patients face. However, patients with extreme forms of heart failure often remain highly symptomatic despite maximum medical therapy, and face grave risk

Another one of the manifestations of heart failure is a delay in the electrical activation of the heart. Anywhere between one quart and one half of all heart failure patients have this electrical abnormality, often called bundle branch block or intraventricular conduction delay, on the electrocardiogram. If you have heart failure, your physician can readily tell you if you have this common abnormality. If present, electrical delay will adversely affect heart function resulting in a variety of problems relating to pumping action of the heart and the ability of the heart to fill adequately. An abnormal electrocardiogram in the setting of heart failure also increases the risk of death.

Recently, major advances have been made in technology that can overcome the problems created by the electrical abnormalities described above. Specifically, a therapeutic intervention termed "cardiac resynchronization" will reverse many or all of these abnormalities. Cardiac resynchronization is accomplished by a procedure called biventricular pacing. With this procedure, a standard two-wire pacemaker is placed in the right-sided cardiac chambers, and an additional wire is threaded through the vein that travels on the back of the heart to overly the left-sided pumping chamber. By stimulating the right and left-sided chambers simultaneously, the heart is "resynchronized". When this is accomplished, the vast majority of patients have improved cardiac function and reversal of all the clinical consequences created by bundle branch block. The procedure can be successfully performed in 85-95% of patients with a risk of about 2-4%.

Controlled clinical trials have been completed and published. These clearly indicate an improvement in overall heart failure outcome for patients treated with biventricular pacing devices, such that symptoms are improved, exercise capacity are increased, and hospitalization rates are reduced. Whether this form of pacing results in an improved overall outcome is still uncertain and is the subject of ongoing clinical trials.

Many patients with heart failure also face a risk of potentially fatal abnormalities of the heart rhythm, or cardiac arrest. When this occurs, unless a patient is rapidly resuscitated, sudden death may result. Standard treatment for a patient who is at high risk of this event or who has survived such an event, is the implantable cardiac defibrillator (reviewed elsewhere on this website). Biventricular pacing systems can be combined with the implantable defibrillator in appropriate patients to accomplish the dual desirable endpoints of improving heart failure and preventing sudden death.

For patients who have an unsuccessful implantation procedure of a biventricular pacing system, alternatives have recently become available. These include the very innovative approach of robotic implantation of the left-sided lead directly on the heart surface. Using robotic techniques, a very small incision is made in the chest wall and the robotic arm places leads directly on the heart surface, the incision is closed and the lead is connected to the pacing system. This procedure can be accomplished in virtually all patients who have previously had a pacemaker attempt.