REFRACTORY VENTRICULAR TACHYCARDIA AS AN INDICATION FOR VENTRICULAR ASSIST DEVICE SUPPORT

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Ventricular assist device support has historically been used to treat patients with severe refractory heart failure defined by a specific set of hemodynamic criteria. These have included a cardiac index of less than $2.0 \text{ L} \cdot \text{m}^{-2} \cdot \text{min}^{-1}$, systemic hypotension with a mean arterial pressure of less than 60 mm Hg, and elevated cardiac filling pressures (left or right atrial pressure >20 mm Hg). With experience and wider availability of ventricular assist device technology the criteria for determining the initiation of assist device support have been somewhat relaxed. Earlier intervention it is hoped may reduce morbidity. However, most patients currently receiving ventricular assist device support continue to be hemodynamically compromised and at significant risk for death. Refractory ventricular arrhythmias develop in a subgroup of patients with heart failure. This group often have adequate hemodynamic parameters as long as the arrhythmia is controlled. The inability to predict the onset of ventricular tachyarrhythmia and evaluate the likelihood of successful conversion places these patients at a risk for death on a par with that of those with hemodynamic compromise.

Two men in their 50s with ischemic cardiomyopathy and long histories of refractory ventricular arrhythmias were evaluated and listed for cardiac transplantation at our institution during 1998. Both patients had received maximum therapy to control their arrhythmias, including amiodarone, an intracardiac defibrillator, a pacemaker, and several attempts at ectopic focus ablation. While these patients were awaiting location of a donor heart their conditions deteriorated and they required continuous hospitalization. Within a short period their congestive heart failure had improved in response to conventional medical therapy including low-dose inotropic support. During the next 3 to 6 weeks their conditions worsened, necessitating increased medications. In addition, more frequent and refractory episodes of ventricular tachycardia developed. In the hope of stabilizing and possibly controlling the ventricular tachycardia until transplantation could be accomplished it was decided to place ventricular assist devices.

Before ventricular assist device placement both patients had cardiac indexes greater than $2.2 \text{ L} \cdot \text{m}^{-2} \cdot \text{min}^{-1}$ and systemic mean arterial pressures greater than 60 mm Hg. Pulmonary capillary wedge and pulmonary arterial pressures were elevated. The serum creatinine concentrations were 1.3 mg/dL and 1.7 mg/dL. The patients were ambulatory but confined to the intensive care unit. Without the arrhythmia problems these patients would not have been considered for ventricular assist device placement at that time. The implants were placed electively during periods of hemodynamic stability. Both patients had Thoratec left ventricular assist devices (Thoratec Laboratories Corporation, Pleasanton, Calif) implanted with left ventricular apex to aortic cannulation. The implantation procedures were uneventful, with both patients requiring small doses of inotropic drugs to augment right ventricular function.

During the first 12 hours after the operation ventricular tachycardia occurred intermittently; however, these episodes were short and left ventricular assist device flow and other hemodynamic parameters remained stable. Refractory ventricular tachycardia at the rate of 150 to 160 beats/min developed in the second patient approximately 14 hours after the operation. This continued for 12 hours and was finally converted with a combination of drugs and pacemaker manipulations. During this 12-hour period the left ventricular assist device output, arterial pressure, filling pressures, urinary output, and other hemodynamic parameters remained stable. The patient was awake and appropriate.

On the seventh postoperative day for first patient and the 10th postoperative day for the second patient each had conversion to ventricular tachycardia at rates between 150 to 170 beats/min. Both patients had been progressing well and were in the step-down unit. They remained in stable condition with left ventricular assist device flows in excess of 5 L/min. The first patient was transferred to the intensive care unit because he had some angina and shortness of breath with his arrhythmia. He remained in ventricular tachycardia for 8 days, after which time he required radiofrequency ablation of the ectopic focus. He had conversion to a ventricularly paced rhythm at a rate of 90 beats/min and remained in this rhythm for 2 months until he received his transplant.

The other patient had several episodes of ventricular tachycardia, ranging in duration from a few hours to several days, before a combination of amiodarone and mexiletine along with pacemaker manipulations produced a stable rhythm. He remained ventricularly paced at a rate of 100 beats/min until cardiac transplantation was successfully accomplished 6 weeks later.

In these cases the indications to proceed with ventricular

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assist device support were similar. The incidence and severity of the ventricular tachycardia were increasing. Because the amount of time necessary to locate a donor heart was unknown, it was thought wise to proceed with left ventricular assist device placement in the hope of stabilizing the patient's condition during the waiting period. In both cases the ventricular arrhythmias actually worsened after left ventricular assist device implantation. Fortunately, the rates of the ventricular tachycardias were relatively slow (150-170 beats/min) and the rhythm never deteriorated to ventricular fibrillation. For this reason, despite the fact that the arrhythmia itself worsened, the patients remained in hemodynamically stable condition and had improvement while receiving left ventricular assist device support. Eventually a combination of conventional and mechanical support therapies subdued the tachyarrhythmias and provided a period of stabilization during which both patients could be rehabilitated for transplantation. One patient was able to undergo successful ablation because of the stability provided by the left ventricular assist device. Before left ventricular assist device placement he would not have been able to tolerate this procedure. The other patient was considered for ablation; however, we were able to control his arrhythmia pharmacologically.

Finally, both these cases were far more complicated than we had anticipated. As previous experience has taught us, most patients with left ventricular assist devices tolerate ven-

tricular tachycardia well.¹⁻³ Like others we remain concerned about preserving right ventricular function in a patient with only a left ventricular assist device who has prolonged episodes of ventricular tachycardia. One of the dangers to avoid is overly aggressive treatment of a patient whose condition is hemodynamically stable. Some would suggest that it is advisable to place biventricular assist devices in any patient who is at risk for development of ventricular tachyarrhythmia. In the future we will be more inclined to use biventricular assist devices.⁴

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