Device Therapy for Acute Systolic Heart Failure and Atrial Fibrillation

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KEYWORDS

• Cardiac resynchronization therapy • Atrial fibrillation • Atrioventricular node ablation • Pacemaker • Internal cardiac defibrillator

KEY POINTS

- Placement of an internal cardiac defibrillator (ICD) requires a waiting period of 40 days after myocardial infarction or 3 months on optimal medical treatment after the diagnosis of congestive heart failure.
- In patients with newly diagnosed cardiomyopathy who require nonelective permanent pacing and also meet the primary prevention criteria for implantation of an ICD, the device should include ICD capability only if left ventricular ejection fraction (LVEF) is not expected to resolve.
- Tachycardia-mediated cardiomyopathy should be suspected in patients with longstanding, uncontrolled tachyarrhythmias.
- Cardiac resynchronization therapy (CRT) must be operating at or near 100% of the time to be effective. In patients with atrial fibrillation, this often necessitates atrioventricular (AV) node ablation.
- CRT over standard pacing is recommended in patients with atrial fibrillation and LVEF less than 35% undergoing AV node ablation, regardless of QRS width.

Case History

A 56-year-old man presents with a first diagnosis of acute severe systolic heart failure and atrial fibrillation and rapid ventricular rates. The echocardiogram shows a global cardiomyopathy and a left ventricular ejection fraction of 15% to 20%. During the hospitalization, the patient has episodes of nonsustained ventricular tachycardia without severe symptoms. Rate control with medical therapy has been unsuccessful and does not seem feasible. Because of the poor heart rate control, management of his heart failure cannot be optimized. After intravenous and then oral amiodarone loading, attempts to restore sinus rhythm during the hospitalization with electrical cardioversion have resulted in sinus rhythm for only 1 to 2 minutes then resumption of atrial fibrillation. The patient has not had syncope or near syncope. The plan is atrioventricular junction ablation. What device do you implant: VVI internal cardiac defibrillator (ICD), VVI pacemaker, cardiac resynchronization therapy (CRT) ICD, or CRT pacemaker?

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INTRODUCTION

The presented case essentially poses 2 important questions that are reviewed in detail within this article. The first is in regard to placement of an internal cardiac defibrillator (ICD) versus pacemaker in a patient with newly diagnosed cardiomyopathy who requires pacing. The second question, which has been the topic of many studies in the last decade, is in regard to the optimal pacing method for patients with atrial fibrillation (AF) undergoing atrioventricular (AV) nodal ablation. Over the course of this article, the reader should be convinced that the best approach to this patient is placement of a cardiac resynchronization therapy pacemaker (CRT-P).

PACEMAKER VERSUS INTERNAL CARDIAC DEFIBRILLATOR

The patient in this case history clearly requires a pacemaker given AV nodal ablation. The question is whether the patient, given his impaired cardiac function, will additionally benefit from an ICD in preventing future sudden cardiac death (SCD) caused by lethal ventricular arrhythmia. Although this seems a simple question, there are several issues in this case that make the decision difficult. In order to fully understand the answer it is important to review the indications for ICD therapy in patients with cardiomyopathy.

This issue was examined thoroughly by several landmark trials. The Multicenter Automatic Defibrillator Implantation Trial (MADIT)-II and the Sudden Cardiac Death in Heart Failure Trial (SCD-HeFT) were 2 large prospective randomized trials looking at the benefit of ICD placement in patients with left ventricular ejection fraction (LVEF) less than 30% and 35%, respectively. The MADIT-II trial enrolled only patients with ischemic cardiomyopathy (ICM) versus the SCD-HeFT trial, which examined patients with heart failure with both ICM and non-ICM. Both showed a large risk reduction in mortality compared with medical therapy alone.[1,2] The Prophylactic Defibrillator Implantation in Patients with Nonischemic Dilated Cardiomyopathy (DEFINITE) study specifically looked at the role of prophylactic ICD in patients with non-ICM and nonsustained ventricular tachycardia (NSVT). This study did not show as clear a benefit as MADIT-II or SCD-HeFT. There was a decrease in arrhythmic death but only a trend toward improved survival.[3] Important to note is that all patients in these studies were required to be stable and on optimal medical therapy. In addition, there was significant variability in the timing of ICD implantation in relation to diagnosis of cardiomyopathy. In The MADIT II trial, patients were excluded if they had revascularization within 3 months or had a myocardial infarction (MI) within 30 days. In the SCD-HeFT trial, the average duration of heart failure at the time of entry into the trial was 2.5 years. In the DEFINITE study, this same measure was 2.8 years.[4]

The patient in this case, however, is presenting with new-onset cardiomyopathy. The question of whether or not prophylactic ICD placement would be beneficial early after diagnosis of cardiomyopathy was addressed in 3 large trials, Prophylactic Use of an Implantable Cardioverter-Defibrillator after Acute Myocardial Infrarction (DINAMIT), Immediate Risk-Stratification Improves Survival (IRIS), and Coronary Artery bypass graft (CABG)-Patch. In DINAMIT, patients who had sustained an MI within 6 to 40 days resulting in cardiomyopathy with EF less than 35% were randomized to ICD therapy versus medical therapy. Although there was a reduction in arrhythmic mortality, nonarrhythmic mortality was actually higher in the ICD group leading to, overall, no difference in mortality between the two groups.[5] In IRIS, patients who had sustained an MI within 5 to 31 days were randomized to ICD therapy versus medical therapy. In contrast to DINAMIT, patients were included if they had either an LVEF of 40% or less or NSVT greater than 3 beats. Similar to DINAMIT, there was a reduction in arrhythmic mortality, however, an increase in nonarrhythmic mortality.[6] In CABG-Patch, patients with an LVEF of 35 or less and abnormal signal-averaged electrocardiogram (ECG) were assigned to either medical therapy or ICD using epicardial patches at the time of CABG. Again, there was no evidence of improved survival.[7]

All 3 of these large studies included only patients with ICM. There is a paucity of data in the population with recently diagnosed non-ICM. Some insight can be gained from studies examining the event rate in patients receiving wearable automated external defibrillators in the waiting period before ICD implantation. In a recent study in a population that included both non-ICM and ICM, there were no shocks within the waiting period.[8] This study included both patients whose LVEF improved to greater than 35% and those whose LVEF remained less than 35%. It should be noted that this was a relatively small study, including only 125 patients, 77 of which were nonischemic. In a much larger study looking only at patients after MI receiving an automated external defibrillator, they found only 1.4% of 8453 patients received appropriate shocks in the immediate post-MI period.[9]

It is clear that ICDs are useful in reducing mortality in patients with an established diagnosis of cardiomyopathy. Although ICDs may also reduce