

Life and Death after ICD Implantation

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Randomized trials have established that the prophylactic use of implantable cardioverter–defibrillators (ICDs) prolongs survival in patients with left ventricular dysfunction that is due to myocardial infarction¹ or associated with heart failure from any cause.² One of the pivotal trials, the Sudden Cardiac Death in Heart Failure Trial (SCD-HeFT) (ClinicalTrials.gov number, NCT00000609), compared ICD therapy or amiodarone with placebo in 2521 patients with symptomatic heart failure due to ischemic or nonischemic left ventricular dysfunction.² That trial showed that among patients who had an ICD as compared with those who received a placebo, there was an absolute reduction in mortality of 7.2 percentage points over 5 years. However, the use of ICD therapy has been limited by concerns³ that this therapy is expensive, burdensome to patients who may receive painful shocks, and of modest overall benefit, since many recipients are chronically ill and have advanced heart disease. In this issue of the *Journal*, two analyses from the SCD-HeFT trial^{4,5} shed light on these concerns.

Mark and colleagues present a detailed evaluation of the quality of life among recipients of ICDs in SCD-HeFT.⁴ The key findings were that subjective measures of physical function did not differ significantly between the ICD and placebo groups at any time point, but that there was a short-term increase in psychological well-being among patients with ICDs throughout the first year after implantation, a benefit that did not persist to 30 months. The occurrence of ICD shocks reduced the quality of life, but only if quality of life was measured within 1 to 2 months after the shock. There was also a significant improvement in scores on the Minnesota Living with Heart Failure scale among patients with ICDs.⁴ However, the magnitude of this difference was small, and the apparent benefit may have been a false positive finding resulting from multiple testing without statistical correction.

The quality-of-life analysis in SCD-HeFT suggests that, in general, the side effects associated with a prophylactic ICD are not onerous, and the quality of life among ICD recipients is sufficiently good that the cost per quality-adjusted life-year that is saved with ICD therapy makes the therapy economically attractive.⁶ However,

this analysis may have underestimated some of the negative effects of ICD therapy. With an average follow-up of less than 4 years, the time frame is too short to capture all potentially relevant complications associated with ICDs, including late lead failure,⁷ the need to replace the pulse generator, and safety advisories from the manufacturer.

In another report from SCD-HeFT in this issue of the *Journal*, Poole and colleagues examine the prognostic significance of ICD shocks.⁵ Death from all causes was increased by a factor of nearly 6 among patients who received an appropriate shock, with 30% of these deaths occurring within 24 hours after the first appropriate shock. After exclusion of these patients (in whom an appropriate shock was simply a harbinger of imminent death), appropriate shocks were still associated with a risk of death that was increased by a factor of 3.

The risk of death among patients who received more than one appropriate shock was double that among patients who received a single appropriate shock. Inappropriate shocks were also significantly associated with an increased risk of death, although to a lesser extent. These results are similar to those in the Multicenter Automatic Defibrillator Implantation Trial II (MADIT II), which also showed a risk of death that was increased by a factor of 3 after an appropriate ICD shock.⁸ In SCD-HeFT, shocks were much stronger predictors of an adverse outcome in patients with ischemic as compared with nonischemic heart failure (hazard ratio for appropriate shocks, 8.72 vs. 2.61).

What is the mechanism underlying these associations? Although it is plausible that shocks somehow have an adverse effect on myocardial function, this is unlikely to be a major factor. What is much more likely is that the occurrence of a ventricular arrhythmia that causes a shock is signaling a meaningful change in the patient's clinical status. The important message is that the first occurrence of shocks is not a random event in an otherwise stable clinical course but a sign of clinical deterioration in the underlying disease process.

What should we tell patients, and what actions should physicians consider, when shocks begin

to occur? Clearly patients should report the new onset of shocks promptly, since the occurrence of shocks may signal an important change in clinical status or a technical problem such as lead fracture. Physicians need to consider the possible causes of shocks, including a worsening of heart failure and myocardial ischemia. What can be done? Shocks should prompt physicians to ensure that all appropriate therapies to improve the prognosis for heart failure are being used. The greater prognostic significance of appropriate ICD shocks in patients with ischemic heart failure makes revascularization another possible intervention; however, there are currently no prospective data to suggest that this will improve prognosis. Prevention of arrhythmia as a means of improving survival is currently a limited option, owing to the modest efficacy and potential for serious adverse effects of available drugs and ablation techniques. Amiodarone is effective in the prevention of ventricular arrhythmias⁹; however, SCD-HeFT itself finally put to rest the notion that amiodarone could improve survival among patients with heart failure.²

Both of these articles support the idea that reducing the occurrence of shocks is worthwhile. Shocks reduce the quality of life, at least temporarily, and they may have some direct effect on prognosis. Although amiodarone does not prolong survival among patients with heart failure, it dramatically reduces the risk of receiving a shock. In the Optimal Pharmacological Therapy in Cardioverter Defibrillator Patients (OPTIC) trial (ClinicalTrials.gov number, NCT00257959), it reduced the occurrence of a first shock by more than 70% among patients who received an ICD for the treatment of ventricular arrhythmias.¹⁰ The number of shocks can also be reduced by means of careful programming of the ICD, including the use of antitachycardia pacing.¹¹

In summary, these two reports show that modern ICD therapy is prolonging survival in patients with heart failure, with relatively little compromise in the quality of life. It is somewhat disturbing to realize that actually receiving a shock is such an important predictor of death (commonly in association with progressive heart failure). However, it should not be surprising that many patients in whom sudden death from arrhythmia is averted by an ICD ultimately die from heart failure. In severe chronic conditions, most worthwhile interventions only modestly delay death. If a specific therapy is effective

against only one cause of death and does not address the underlying disease process, then death from competing causes is inevitable. Several randomized trials of ICD therapy have shown that a reduction in deaths from arrhythmia is offset either partially or completely by an increase in deaths from other causes.^{8,12,13} Nevertheless, SCD-HeFT has shown us that a prophylactic ICD does buy some time and that this time is worthwhile to patients.

Dr. Healey reports receiving lecture fees and grant support from Boston Scientific; and Dr. Connolly, lecture fees and grant support from St. Jude Medical and grant support from Boston Scientific. No other potential conflict of interest relevant to this article was reported.

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