ICD Therapy in Coronary Artery Disease

A Reappraisal in 2005

Gerian Grönefeld, Johannes Manegold, Carsten W. Israel, Stefan H. Hohnloser

Abstract
25 years after the first coronary artery patient received an implantable cardioverter defibrillator (ICD), many randomized controlled trials on prophylactic ICD therapy have been conducted. Taken together, these trials allow an evidence-based approach to primary prevention of sudden cardiac death in patients after a myocardial infarction. Patients with chronic ischemic cardiomyopathy, a long history of heart failure, and an ejection fraction of \( \leq 0.30 \) benefit from preventive device therapy and are thus candidates for prophylactic defibrillator implantation. For this purpose, a single-chamber device appears to be appropriate, since there have been no prospective studies showing convincing clinical benefit by adding an atrial lead. For similar patients who have additional intraventricular conduction delays, a biventricular ICD must be considered. However, this decision must be based on individual considerations until more data from prospective trials become available. Prophylactic ICD therapy should not be used in patients with recent myocardial infarction. There is convincing evidence that ICD benefit in coronary patients accrues after a considerable time having elapsed from the most recent infarct, presumably at least 6 months or perhaps longer.

Key Words: Coronary artery disease · Implantable cardioverter defibrillator · Sudden cardiac death

Zusammenfassung

Schlüsselwörter: Koronare Herzkrankheit · Implantierbarer Kardioverter-Defibrillator · Plötzlicher Herztod

1 Division of Cardiology, Department of Medicine, J.W. Goethe University, Frankfurt/Main, Germany.
Introduction
25 years ago, the first defibrillator worldwide was implanted in a patient at the Johns Hopkins University in Baltimore, USA, by Michel Mirowski et al. [1]. The patient was a 57-year-old man with coronary artery disease, an inferior myocardial infarction and coronary artery bypass surgery in the past. He had survived an episode of out-of-hospital cardiac arrest and was implanted on February 4, 1980. Since then, contemporary implantable cardioverter defibrillator (ICD) therapy has evolved into a cornerstone of prevention of sudden cardiac death for which patients suffering from coronary artery disease remain the main target population of device therapy. Following several large randomized clinical trials in patients with aborted sudden death, sustained ventricular tachycardia (VT), and syncope with inducible sustained VT or ventricular fibrillation (VF) [2], ICD therapy is now generally recommended as the prime therapy for secondary prevention of sudden death. However, most patients who have an out-of-hospital cardiac arrest do not survive. Accordingly, the use of a prophylactic ICD is a conceptually attractive option for high-risk patients. Several trials on primary preventive ICD therapy in coronary artery disease patients have been conducted over the last 10 years and have helped to better define the role of ICD therapy in improving survival in this common disease entity. Particularly over the last year, three major randomized trials have been published which undoubtedly will help to refine the selection of appropriate patients for ICD therapy. This brief review summarizes these actual as well as previous relevant randomized controlled trials on prophylactic ICD therapy in patients with coronary artery disease.

Prior ICD Studies in Coronary Artery Disease Patients
In 1996, the MADIT 1 trial was the first randomized controlled trial to demonstrate that coronary artery disease patients who were carefully selected on the basis of spontaneous nonsustained VT on Holter monitoring and inducibility of sustained arrhythmias in the electrophysiological laboratory benefited from prophylactic ICD therapy [3]. Shortly thereafter, however, the CABG-Patch trial in patients undergoing coronary artery bypass surgery who had a positive signal-averaged ECG showed no improved survival, when they were randomly allocated to receive an ICD [4]. These seemingly discrepant results caused some confusion but demonstrated that careful selection of patients most likely to benefit from ICD therapy is mandatory. The MUSTT study which was not a randomized ICD trial showed that in patients with inducible VT electrophysiologically guided antiarrhythmic drug therapy was of no value, but that mortality was reduced when nonresponders to drug therapy received a device [5]. The MADIT 2 study [6] proved that coronary patients with a reduced left ventricular function (LVEF < 0.31) had a better outcome not only in terms of arrhythmic but in fact also in all-cause mortality when they received a defibrillator. Importantly, the MADIT 2 investigators did not use any additional risk stratification to select the patients. The key enrollment features of all of these ICD studies are summarized in Table 1. These trials have led to a substantial increase in ICD use worldwide which in turn has led to a considerable debate about the cost-effectiveness of prophylactic ICD therapy. Particularly the question whether all coronary patients with clinically significant ventricular dysfunction after myocardial infarction should receive an ICD has been the subject of intense discussion.

Recent ICD Trials in Coronary Artery Disease Patients
During the last 12 months, three important randomized controlled trials of ICD therapy in coronary artery disease patients have been published [7–9]. The results of these multicenter trials can help to refine the selection of appropriate patients for ICD therapy.

The international DINAMIT study asked the important question whether patients undergoing ICD therapy shortly after an acute myocardial infarction which has resulted in significant impairment of left ventricular function who also show evidence of impaired cardiac autonomic tone will benefit from ICD therapy [7]. A total of 674 infarct survivors were randomized to ICD therapy or control during the first 6–40 days after their heart attack. After a mean follow-up of 30 months, all-cause mortality was not substantially different between the two groups despite a highly significant reduction in arrhythmogenic mortality (hazard ratio 0.42, 95% confidence intervals 0.22, 0.83; p = 0.009). This reduction, however, was completely offset by an increase in nonarrhythmic mortality in the group of ICD recipients (hazard ratio 1.75, 95% confidence intervals 1.11, 2.76; p = 0.02). Most of this mortality was due to cardiovascular nonarrhythmic deaths. Accordingly, this trial identified a group of coronary artery patients with risk