I read with interest the reports on defibrillation testing (DFT) during implantable cardioverter-defibrillator (ICD) implantation published recently in JACC (1,2). There is a significant, albeit low, risk to serious complications including death during DFT testing. If the implantation data as measured through the device are satisfactory, then should we induce ventricular fibrillation (VF) in a patient who has poor cardiac function? Should we crash a brand new car during its “test-drive” to see whether the airbags will deploy? The following cases, which are mere examples, demonstrate the professional and moral dilemma of DFT testing.

Two patients with severe cardiomyopathy underwent ICD implantation with excellent parameters. In the first case, during DFT testing, first shock to provide a 10-J safety margin and a subsequent maximum output shock failed to defibrillate. External defibrillation restored sinus rhythm but with severe electromechanical dysfunction requiring emergent placement of a ventricular assist device and subsequently a heart transplantation. Was cardiomyopathy in itself responsible for the ICD failure? Did the shocks cause electromechanical dysfunction? Could the patient have survived an out-of-hospital VF episode? Did DFT testing identify deficiencies at implant? In the second case, DFT testing was not performed because of the presence of atrial fibrillation, suboptimal anticoagulation profile, and evidence of sludge in the left atrial appendage by a transesophageal echocardiogram. Electrocardioversion and DFT testing after six weeks of anticoagulation was planned. Unfortunately, in the interim period, the patient met with an unnatural mode of death. Subsequently, the patient’s wife reported that “it may not mean much . . . but the defibrillator did go off . . . many times . . . it did work . . . when my husband died. . . .”

During automobile accidents the airbags drastically reduce morbidity and mortality, but there is also a spectrum of injuries associated with them (3,4). Taking the analogy of the airbags and the ICDs, both of which reduce fatalities, perhaps in the case of the first patient, the “airbag” in itself was not adequate to prevent the fatality and, if anything, perhaps caused “airbag”-associated injuries. In the case of the second patient, the “airbag” deployed appropriately but could not prevent a non-traffic crash–related fatality.

Needless to say, until improvements in science and technology provide conclusive evidence that the ICDs effectively and predictably provide life-saving therapy without actually testing them at the time of implantation, the dilemma of DFT testing will remain unsolved.

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REFERENCES


REPLY

I thank Dr. Kantharia for his interest in our recent paper (1). Identifying the optimal patient-specific implantable cardioverter-defibrillator (ICD) system and its programming, without the need for either ventricular fibrillation (VF) or shocks, is a major research goal. The patients reported by Dr. Kantharia both emphasize the importance of this goal and illustrate poignantly that it remains beyond our grasp.

The first case highlights the unmet need of developing effective treatment for life-threatening, post-VF electromechanical dysfunction (EMD) (2,3). Paradoxically, defibrillation testing may have saved this patient’s life: If VF had occurred as an outpatient, either defibrillation would have failed or the postshock rhythm would have been lethal EMD. To the best of my knowledge, fatal postshock EMD has not been reported after an inappropriate shock. Thus, postshock EMD probably is caused by a combination of VF and shocks, often prolonged VF and multiple shocks.

The second patient died from failed defibrillation with an untested ICD system. This case illuminates the need for a shockless method of assessing ventricular defibrillation efficacy, or at least a method that minimizes the risk of thromboembolism from atrial cardioversion. One consideration is continuous rapid atrial stimulation during ventricular defibrillation or vulnerability testing.

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