Estimates of the incidence of electrical storm (ES) range from 4% over 20.6 months of follow-up in patients with primary prophylactic implantable cardioverter-defibrillators (ICDs)\(^1\) to 20% over 31 months of follow-up in a population with secondary prophylactic ICDs.\(^2\) Although smaller observational series have not identified a clear mortality risk associated with ES,\(^3,4\) larger and more recent series have suggested a large and significant association between repeated ventricular arrhythmic events and death, both sudden and nonsudden.\(^5-8\) It is unclear whether this adverse outcome is a result of repeated ICD shocks or whether recurrent arrhythmias are a marker of sicker hearts that are destined to do poorly. Indeed, the mode of death after ES frequently is related to heart failure. Uncertainty has thus remained about whether interventions for ES can influence mortality beyond the acute period.\(^9\) In this issue of Circulation, Carbucicchio and colleagues\(^10\) describe a large series of patients who underwent catheter ablation after presenting acutely with ES refractory to antiarrhythmic medications.

Ninety-five patients experiencing at least 3 ICD shocks within 24 hours and a mean of 14±8 ICD shocks per day over 3.9±3.6 days despite pharmacological therapy with \(\beta\)-blockade in 97% and amiodarone 350±120 mg/d for \(\approx\)5 months in 94% were included. Eighteen percent of patients had undergone prior catheter ablation for ventricular tachycardia (VT) 16±6 months previously. Patients were brought urgently or as an emergency (within 24 hours for 50 patients [53%] who experienced marked hypotension and required intravenous inotropes) for catheter ablation with a mapping system and irrigated radiofrequency application using common procedural strategies: activation and entrainment of mappable VT and substrate mapping with pace mapping and/or brief entrainment of unmappable VT. In 10 patients, the procedure was performed with cardiopulmonary support because of incessant nontolerated VT. Acute single procedure success (noninducibility of any VT) was achieved in 62 patients (65%), and clinical VT was eradicated in a further 19 patients (20%). In-hospital recurrences led to a second procedure in 12 and a third procedure in 6 patients. Ten patients underwent a repeat procedure that had an epicardial approach. After the final procedure, 68 of 95 patients (72%) had no VT inducible, 17 of 95 (18%) had only nonclinical VT inducible, and 10 of 95 (10%) had \(\approx\)1 clinical VTs that could not be suppressed.

Over a follow-up of 22±13 months, failure to abolish \(\approx\)1 clinical VTs (10 patients) was associated with recurrent VT in all patients, recurrent ES in 80%, and death caused by intractable arrhythmia in 40% (deaths occurred within 3 months). Abolition of all inducible VTs was associated with recurrent VT in only 16%, with no recurrence of ES. Patients who had clinical VT rendered noninducible but still had nonclinical VTs inducible had a higher VT recurrence rate (65%) but no recurrent ES.

Patients with ES are a heterogeneous group, with estimates of 1-year survival from case series varying from \(\approx\)5% to 35%.\(^1,2,5\) The patients reported in the article by Carbucicchio et al\(^10\) were very ill, with more than half the patients requiring inotropic support and almost all of the patients suffering ES despite long-term amiodarone therapy. In this context, the reported survival was remarkable, particularly in the group that had successful ablation. The poor outcomes in the group with unsuccessful ablation may be related to greater severity of cardiac disease, or it is possible that the clinical outcome in this group suggests the natural history of the larger group had they been treated purely pharmacologically. The difference in clinical outcome among the groups with varying procedural outcomes certainly raises the possibility that the latter is the case and supports an aggressive strategy for controlling ES.

Emergency catheter ablations make up a relatively small proportion of procedures in most cardiac electrophysiology laboratories. Recent studies, however, have suggested a role for rapid and early intervention in patients with ES.\(^11,12\) It may be that we should expect a change in case mix and procedural acuity if this strategy can be shown to be beneficial. This study cannot answer the question of whether catheter ablation is appropriate for all patients presenting with ES, but it makes the case for early ablation of patients with ES despite antiarrhythmic drug therapy and supports the need for studies to help define the role of catheter ablation in this high-risk group.

Disclosures

Dr Sapp is a consultant for Biosense-Webster; has received speaker’s honoraria from Medtronic, Biosense-Webster, and St Jude Medical; and has received research funding from Biosense-Webster and Medtronic.

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