Direct Current Cardioversion of Atrial Fibrillation—The Next 40 Years

Atrial fibrillation affects more than 2.5 million people in the United States. Almost 4 decades have passed since Lown et al first reported on successful direct current (DC) “cardioversion” of atrial fibrillation to sinus rhythm, thereby profoundly altering the treatment of the most common, sustained arrhythmia. Although restoration of sinus rhythm has been shown to provide symptomatic and physiologic benefits, it results in adverse events, including potentially catastrophic clinical thromboembolism in up to 6% of patients who are not receiving warfarin anticoagulation before cardioversion. Nonrandomized, relatively small series have suggested that 3 to 4 weeks of warfarin before cardioversion leads to an 80% reduction in cardioversion-related thromboembolism, providing the rationale for the current strategy of 3 to 4 weeks of warfarin before cardioversion. Although classically these adverse events were believed to be related to migration of thrombi present at the time of cardioversion, recent data show that the pericardioversion period is associated with atrial stunning and potential new thrombus formation. Few data exist regarding the incidence of subclinical thromboembolism. Studies have highlighted the importance of therapeutic warfarin during the postcardioversion period because of atrial stunning and delayed recovery of atrial mechanical function.

In this issue of the Mayo Clinic Proceedings, Gentile et al report on the largest single-center experience regarding safety of elective DC cardioversion of atrial fibrillation. In this retrospective analysis of 834 consecutive successful electrical cardioversions occurring between 1990 and 1994, the overall clinical thromboembolism rate was 0.9%.

Patients with a therapeutic international normalized ratio greater than 2 or a prothrombin time greater than 17 to 20 seconds for at least 3 weeks before cardioversion had no clinical embolic events. Hypertension and diabetes mellitus were independently associated with an increased risk of thromboembolism—risk factors that have also been associated with clinical thromboembolism among patients with chronic atrial fibrillation who were not cardioverted. These investigators apparently did not examine risk among patients with prior thromboembolism, a strong risk factor for thromboembolism among those with chronic atrial fibrillation.

In the study by Gentile et al, it is noteworthy that transesophageal echocardiography (TEE) was performed before 200 cardioversions and that 4 patients (2%) with a “negative” TEE for thrombus experienced a clinical thromboembolic event. This rate is somewhat higher than our study found but is consistent with that of the multicenter Assessment of Cardioversion Using Transesophageal Echocardiography (ACUTE) trial. Technical issues, including the use of a monoplane TEE probe (common during the early 1990s and inferior to current multiplane technology), may explain these results. In addition, despite our strong preference to defer cardioversion in such patients, 7 patients in the study by Gentile et al who had echocardiographic evidence of left atrial or left ventricular thrombi were cardioverted—all without adverse events. Finally, for a consecutive series encompassing 4 years, surprisingly few patients (16%) had repeated cardioversions.

Among atrial fibrillation patients without antecedent long-term warfarin, the prevalence of atrial thrombi is about 12%. Seidl et al recently compared clinical thromboembolism following DC cardioversion after 3
weeks of warfarin with or without precardioversion TEE. Somewhat concerning, the prevalence of thrombi after 3 weeks of warfarin was 7.7%. Among patients without TEE evidence of thrombus, the clinical thromboembolism rate was similar to that in those who underwent cardioversion in the absence of TEE. Interestingly, of the 9 patients with embolic complications in the series by Seidl et al, only 1 had hypertensive heart disease, and all 9 patients had normal left ventricular systolic function.

Rarely do medical procedures withstand the test of time unscathed, and the clinical role of DC cardioversion will not be the exception. We are now immersed in a debate about the true benefit of cardioversion. The therapeutic goal of cardioversion is long-term maintenance of sinus rhythm with the accompanying symptomatic and hemodynamic benefit along with the potential (although unproven) benefit of reduced clinical thromboembolism. Even with aggressive antiarrhythmic therapy, cardioversion is associated with recurrence rates that may exceed 50% at 1 year. Recent data from the randomized Atrial Fibrillation Follow-up Investigation of Rhythm Management (AFFIRM) and the RAt Control vs. Electrical cardioversion for persistent atrial fibrillation (RACE) trials have raised questions about the underlying value of cardioversion and maintenance of sinus rhythm. Preliminary results of both studies showed similar thromboembolism rates and quality-of-life measures among groups who were aggressively maintained in sinus rhythm (with use of antiarrhythmics and repeated DC cardioversions) and those who were managed with rate control and long-term warfarin.

New techniques such as pulmonary vein isolation with use of percutaneous catheter techniques are showing increased promise for long-term suppression or at least substantial reduction in atrial fibrillation burden. These procedures are frequently accompanied by “early recurrences” of atrial fibrillation that require DC cardioversion with concomitant anticoagulation or TEE. The role for repeated cardioversion in these patients will undoubtedly evolve as this procedure is further refined and studied.

Thus, the clinician must assess the potential benefit of cardioversion for the individual patient. If the decision favors cardioversion, Gentile et al have provided further proof of the efficacy of 3 to 4 weeks of warfarin anticoagulation before cardioversion. Although the approach to cardioversion may continue to evolve over the coming decades, the efficacy of 3 to 4 weeks of precardioversion warfarin (or short-term anticoagulation and screening TEE) in combination with 1 month of postcardioversion anticoagulation is likely to remain.

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