Low-Energy Atrial Defibrillation
A Promising New Technique

Albert L. Waldo, MD

Temporary epicardial wire electrodes placed during open heart surgery for potential diagnostic and/or therapeutic use in patients in the immediate postoperative period have been used safely and effectively as part of standard care for a long time.\textsuperscript{1–4} We have also known that synchronized delivery of a low-energy DC shock for cardioversion of atrial fibrillation is very effective.\textsuperscript{5–21} With the presentation by Liebold et al\textsuperscript{22} of the study of 100 consecutive patients undergoing open heart surgery, we now have the demonstration of a new clinical application of both the use of temporary epicardial atrial wire electrodes and low-energy DC cardioversion of atrial fibrillation. The article by Liebold et al\textsuperscript{22} is actually about 2 things. One is a new therapeutic modality in the treatment of atrial fibrillation in the period immediately after open heart surgery. The other is the efficacy, safety, and tolerance of so-called low-energy atrial defibrillation.

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It is widely recognized that atrial fibrillation is a common and important problem in patients who have had open heart surgery. As recently summarized,\textsuperscript{21} many studies have examined its potential cause(s), prevention, and treatment. Unfortunately, although these studies have provided some insights, the problem has abated little. Thus, according to the study by Liebold et al,\textsuperscript{22} the demonstration of a new, effective treatment, low-energy atrial defibrillation with temporary epicardial wire electrodes placed on each atrium, is most welcome. The technique, initially studied in an animal model,\textsuperscript{12,16} also permits standard use of epicardial wire electrodes for recording (diagnostic) and pacing (therapeutic and diagnostic) purposes, just as the traditional temporary epicardial atrial wire electrodes have been used in the past.\textsuperscript{1–4} Nevertheless, use of this technique does not change the problem, which is frequency of postoperative atrial fibrillation. Rather, it offers a much easier way to provide DC cardioversion of atrial fibrillation, when indicated, than the traditional delivery of a transthoracic DC shock. Early or late recurrence of atrial fibrillation notwithstanding, the technique of low-energy atrial defibrillation with temporary epicardial atrial wire electrodes should find a place in the standard treatment regimen for atrial fibrillation after open heart surgery.

Perhaps the more important implications of the study by Liebold et al\textsuperscript{22} pertain to the use of low-energy DC cardioversion of atrial fibrillation with the implantable atrial defibrillator. The use of an implantable atrial defibrillator system to deliver low-energy shocks between special catheter electrodes permanently placed in the right atrium and coronary sinus has been under systematic study for many years, first in experimental models and more recently in patients.\textsuperscript{5–21} It is clear that the device can be used successfully to defibrillate the atria in most patients with paroxysmal or persistent atrial fibrillation. It is also clear that if the shock is synchronized to ventricular activation so that it is not delivered during the T wave of the preceding QRS complex, something that the device has been reliably programmed to do, the shock can be delivered safely.\textsuperscript{15,16,22,24} The latter is possible in large measure because cardioversion of atrial fibrillation is not an emergency. Therefore, the device can wait for an R-R interval that is long enough to permit the shock to be delivered to avoid the T wave of the previous QRS complex. This has been demonstrated in the first 51 patients studied systematically and followed up for \textgreek{g}6 months\textsuperscript{21} and continues to be demonstrated in the \textgreek{g}190 patients who have had the device implanted to date.\textsuperscript{25} Thus, although efficacy and safety remain important, and rigorous ongoing studies dealing with these issues need to be completed, relevant data to date are encouraging. The third issue is tolerance of the low-energy atrial defibrillation shock by the patient. The results of the study by Liebold et al\textsuperscript{22} demonstrate that delivery of the low-energy shock is indeed tolerable without anesthesia. This is consistent with other available data that indicate that although delivery of the shock by the implantable atrial defibrillator is associated with discomfort, the shock is indeed tolerable, with patients willing to accept \textless;3 to 4 shocks per episode without the need for anesthesia.\textsuperscript{20,21,26–28}

In sum, we should be encouraged by the data from the study by Liebold et al\textsuperscript{22} in which low-energy shocks were delivered directly to the atria to treat atrial fibrillation, in this instance by use of temporary epicardial wire electrodes placed in patients after open heart surgery. Besides providing data to support use of the technique when appropriate in patients after open heart surgery, data from the study by Liebold et al\textsuperscript{22} have the most favorable implications related to wider application of the technique, in which the implantable atrial defibrillator delivers shocks between catheter electrodes placed in the right atrium and coronary sinus. This is an exciting time in the study of atrial fibrillation. The article by Liebold et al\textsuperscript{22} provides important new data that have both practical clinical applications and yet wider clinical implications.
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