Direct Surgery for Ventricular Tachycardia: Is Nonguided Misguided?*

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Background

Direct and effective surgery for control of ventricular tachycardia due to coronary artery disease began with the visually guided encircling ventriculotomy reported by Guiraudon et al. (1) in 1978. In 1979, Josephson et al. (2) reported on the results of map-guided endocardial resection. Subsequently, Moran et al. (3) described visually guided extended endocardial resection. More recently, cryosurgery and laser ablation have been used around the arrhythmogenic subendocardial border zone, separately or in combination with other surgical techniques (4-7). These procedures were adopted by others and combined techniques were used in the same patients, as reported in this issue of the Journal by Zee-Cheng and associates (8).

Comments on Operative Techniques

Zee-Cheng et al. (8) used encircling endocardial ventriculotomy/endocardial resection in 20 and cryoablation in 2 of their 46 patients. They used a modified encircling ventriculotomy 3 to 5 mm in depth. The original description of this procedure (1) called for an incision ≥1 cm deep in the nontrabeculated left ventricular septum and an incision to the depths of the subepicardium on the trabeculated free wall; after completion these incisions were repaired. This procedure resulted in a high operative mortality but good control of ventricular tachycardia; it was not widely adopted in its original form (6,7). The hemodynamic and electrophysiologic effects of this procedure were subsequently studied (9-11). Marked reduction in regional coronary blood flow and further myocardial dysfunction occur in the isolated segment. It is relatively easy to assess the depth of the encircling endocardial ventriculotomy on the nontrabeculated left ventricular septum, but more difficult to assess it on the trabeculated free wall. Whether Zee-Cheng et al. were trying to avoid left ventricular dysfunction or to reduce the risk of possible left ventricular perforation by limiting the depth of the ventriculotomy is not clear. Their modified technique appears to have had little adverse effect on left ventricular dysfunction as judged by their low overall operative mortality. The effectiveness of a 3 to 5 mm deep encircling endocardial ventriculotomy in controlling postoperative ventricular tachycardia in the patients in whom the technique was used alone is also not clear. The use of endocardial resection primarily of the septum in 20 of the 46 patients may have represented efforts to improve the results of the modified encircling endocardial ventriculotomy. Septal endocardial resection alone has been reported to be effective in a large proportion of patients with anterosuperior infarction and ventricular tachycardia. Zee-Cheng et al. used cryosurgery as an additional ablative technique in two patients.

One might hope that the cardiac surgeon, who is unlimited by the constraints of the electrophysiology laboratory, could extirpate offending areas of myocardium with great success. But the surgeon faces other considerations: the duration of pump time, the perils of prolonged normothermia during mapping, the need for removing adequate tissue balanced against the possibility of adding a septal patch, and repair or replacement of the mitral valve. Extensive visually guided endocardial resection can proceed rather rapidly because mapping is not required, but it cannot truly be depended on to remove all the diseased endocardium, and compromises are likely to be made in the region of the septum and the papillary muscles (extensive use of cryosurgery, laser or other techniques may be helpful). The need for resection to be as complete as possible in patients who have not been benefited by multiple drug trials is emphasized by the finding that such patients often have several widely separated arrhythmogenic areas in the heart (12).

Role of map-guided surgery. In some patients, mapping allows excision of a smaller amount of myocardium or scar than would otherwise be necessary. Mapping may be useful if visual landmarks are unclear. Mapping with use of a bipolar hand-held electrode to obtain sufficient endocardial sites for a complete activation map can be time consuming and is impossible if a tachycardia is nonsustained. In as many as 80% of patients with sustained ventricular tachycardia, the arrhythmia has multiple clinical and nonclinical morphologic features, and activation sequence mapping may not be obtainable in as many as 36% of tachycardias (12). In
addition, tachycardia induction may be made more difficult once a ventriculotomy is performed. Efforts to improve the yield and reduce the time required for mapping include the use of an endocardial sock electrode placed through the mitral valve and plunge electrodes placed after epicardial mapping, in both instances using a computer to compile the data generated rapidly (13). Irrespective of the technique used, not all forms of tachycardia may be inducible at any time and some mapped tachycardias may not have a "site of origin."

An early study (14) comparing electrophysiologically guided versus unguided surgery for ventricular tachycardia in the same institution may be misleading if applied in today's context. The classical combination of aneurysmectomy and coronary bypass surgery often leaves behind the arrhythmogenic area in the subendocardial border zone. Many of the earlier map-guided operations involved patients with a single clinical ventricular tachycardia configuration (2). Today the surgical team is likely to be faced with a patient who has multiple tachycardias, who has not shown an adequate response in drug trials and for whom an implantable defibrillator is not considered adequate, perhaps because of frequently recurrent arrhythmia episodes. Patients with a single well tolerated ventricular tachycardia configuration that can be easily mapped and a good ventricle are seen less often by present day surgeons because these are the patients who may well respond to drugs or catheter ablation. When such patients appear in the operating room, perhaps because coronary revascularization is also required, they are the patients in whom map-guided surgery is most likely to be successful.

At present, a comparison among the various surgical techniques, whether visually guided or map-guided, is not possible and a randomized trial is unlikely. The 37% rate of inducibility of tachycardia reported by Zee-Cheng et al. (8) is higher than the 17% rate reported in the registry compiled by Borggrefe et al. (15) of map-guided operations.

Implications and Conclusions

The report by Zee-Cheng et al. (8) in this issue of the Journal should be taken as a record of an important institutional experience, not necessarily as a prescription for the treatment of life-threatening ventricular arrhythmias. For various reasons, some of their patients received only limited drug therapy before surgery, and subsequently received effective therapy with drugs that had not been tested preoperatively. The surgical techniques were ecletic and applied with a good deal of restraint. When the series was begun, the implantable defibrillator was not yet available and it was not clear that this device could be a major adjunct to antitachycardia surgery. Whereas their present results do not seem as promising as those reported from other centers with respect to ventricular arrhythmias, the authors point out that almost two-thirds of their 3 year cardiac mortality rate of 35% was due to sudden death, indicating that with additional protection (e.g., the implantable defibrillator) long-term survival will be very good.

References