EDITORIAL

Surgical Ablation of Atrial Fibrillation — When, Why, and How?

Hartzell V. Schaff, M.D.

In 1987, Dr. James L. Cox performed the first maze procedure for surgical ablation of atrial fibrillation.[1] Previous efforts at surgical correction were not uniformly successful, and some procedures corrected cardiac rhythm but did not restore synchronized atrial contraction. Cox's maze procedure, performed with a precise pattern of incisions and suturing of the right and left atria, proved highly successful in restoring sinus rhythm and, in many patients, reestablishing atrial transport function. There is, however, a lack of consensus regarding indications for surgical ablation of atrial fibrillation.

In patients with structural heart disease, atrial fibrillation is a common coexisting problem, and ablation can be performed concomitantly with valvular surgery and correction of congenital defects. To lessen the additional time required to perform the standard maze III procedure, surgeons have developed simplified atrial lesion sets, focused on isolating the orifices of the pulmonary veins, and used alternative energy sources to create atrial ablation lines to minimize the durations of ischemic time and cardiopulmonary bypass. Unfortunately, wide variability in surgical methods and the heterogeneity of patients with atrial fibrillation have contributed to controversies of when, why, and how adjunctive surgical ablation should be applied.[2]

With this background, it is evident that rigorously controlled, prospective evaluations of surgical ablation would be welcome, and the report by Gillinov and associates of their randomized study of adjunctive surgical ablation, now published in the *Journal*, clarifies some issues.[3] The principal aim of the study was modest — to determine the effectiveness of surgical ablation of atrial fibrillation in patients undergoing mitral-valve repair or replacement. Among study patients with preoperative persistent or long-standing persistent atrial fibrillation, the addition of an ablation procedure to mitral-valve surgery increased the rate of freedom from atrial fibrillation at both 6 months and 12 months postoperatively from 29.4% (the rate among controls) to 63.2% ($P<0.001$), with similar early mortality in the two groups. As the authors discuss, this improvement in freedom from atrial fibrillation is consistent with the findings of many previous nonrandomized and randomized studies. Strict assessment of cardiac rhythm with 3-day continuous Holter monitoring at 6 months and 12 months may explain the lower apparent success rate in the ablation group as compared with the 80 to 90% rate of freedom from atrial fibrillation 1 year postoperatively in larger, nonrandomized, single-center studies.[4,5]

The decision to perform concomitant surgical ablation of atrial fibrillation, however, depends not only on confirmation of early safety and effectiveness, but also on clinical benefit. In this randomized study, there was no significant difference in secondary end points of functional class, quality-of-life measures, or medication use between patients who had atrial fibrillation ablated at the time of mitral-valve surgery and those who had mitral-valve operations alone. The authors point out that the investigation was not powered to detect differences in the individual or composite end points, but readers will notice the absence of even a trend toward fewer major cardiac or cerebrovascular adverse events in patients undergoing concomitant ablation of atrial fibrillation. This puzzling finding is explained in part by the study population, which included many older patients (average age, >69 years) as well as patients who underwent mitral-valve replacement (44%) and patients who had addition-

al, non–ablation-related procedures (61%). Outcomes for such patients are determined largely by the underlying valve disease and by ventricular function rather than cardiac rhythm. In addition, patients in the control group who did not undergo concomitant ablation had amputation or exclusion of the left atrial appendage and anticoagulation with warfarin, approaches that probably explain the similar risk of stroke in patients who underwent ablation and controls.

An unanticipated finding was the relatively high rate of the implantation of a permanent pacemaker that was associated with surgical ablation of atrial fibrillation; approximately one in five patients received pacemakers, an incidence 2.5 times greater than that among control patients. More procedural detail is necessary to understand the reason for the higher risk of pacemaker implantation, and it is possible that misplaced ablation lines contributed to atrioventricular block. But it is also true that ablation of atrial fibrillation does not guarantee a return of sinus rhythm, because many patients with atrial fibrillation, especially older patients, will have underlying sinus-node dysfunction and chronotropic insufficiency.

In the subanalysis of patients who underwent surgical ablation, there was no apparent benefit of right-atrial lesions, and this will be important information to surgeons who use cryothermy and radiofrequency energy sources. Yet, this finding may not apply to the maze III procedure performed with incision and suturing, in which right-atrial lesions are reliably transmural.

In North America, concomitant surgical ablation is performed in approximately 60% of patients with preoperative atrial fibrillation who undergo mitral-valve operations,[6] and the early results of this randomized study by Gillinov et al. are unlikely to change surgical practice dramatically. Indeed, these findings emphasize the importance of selecting patients who might benefit most from ablation of atrial fibrillation during mitral-valve surgery. This includes patients who have severe symptoms of tachyarrhythmia and patients undergoing mitral valvuloplasty who would not require long-term anticoagulation therapy if sinus rhythm could be maintained postoperatively.

Disclosure forms provided by the author are available with the full text of this article at NEJM.org.

From the Mayo Clinic, Rochester, MN.

This article was published on March 16, 2015, at NEJM.org.

1. Cox JL. The first Maze procedure. J Thorac Cardiovasc Surg 2011;141:1093-7.
2. Cox JL. The longstanding, persistent confusion surrounding surgery for atrial fibrillation. J Thorac Cardiovasc Surg 2010;139:1374-86.
3. Gillinov AM, Gelijns AC, Parides MK, et al. Surgical ablation of atrial fibrillation during mitral-valve surgery. N Engl J Med. DOI: 10.1056/NEJMoa1500528.
4. Ad N, Holmes SD, Massimiano PS, Pritchard G, Stone LE, Henry L. The effect of the Cox-maze procedure for atrial fibrillation concomitant to mitral and tricuspid valve surgery. J Thorac Cardiovasc Surg 2013;146:1426-34.
5. Stulak JM, Suri RM, Burkhart HM, et al. Surgical ablation for atrial fibrillation for two decades: are the results of new techniques equivalent to the Cox maze III procedure? J Thorac Cardiovasc Surg 2014;147:1478-86.
6. Ad N, Suri RM, Gammie JS, Sheng S, O'Brien SM, Henry L. Surgical ablation of atrial fibrillation trends and outcomes in North America. J Thorac Cardiovasc Surg 2012;144:1051-60.

DOI: 10.1056/NEJMe1501493