Attrial fibrillation is the most common significant arrhythmia in the general population, with an estimated prevalence of 3% to 4%, which increases to almost 9% after the age of 80 years (1). Atrial fibrillation increases the risk for death by almost 2-fold and the risk for ischemic stroke by approximately 5-fold (1). Almost 1 in 4 strokes occurring after age 80 are due to atrial fibrillation (1).

Although the restoration of sinus rhythm in patients with atrial fibrillation does not appear to confer a survival benefit over heart rate control (2), it may still be desirable in many patients, for symptomatic relief, improvement in left ventricular systolic function, and avoidance of anticoagulant treatment. Pharmacologic cardioversion with antiarrhythmic drugs has a low success rate and is often complicated by side effects that negatively affect its risk/benefit ratio (3). Transcatheter and surgical techniques for atrial fibrillation ablation have therefore been developed. In 1987, James Cox introduced the first surgical treatment of atrial fibrillation, consisting of numerous appropriately placed incisions in the left and right atrial walls to direct the propagation of the sinus impulse and eliminate macro-re-entrant circuits (4), which became known as the Maze procedure. Technical refinements and simplifications led to the Cox Maze III procedure, which has been the mainstay of surgical atrial fibrillation treatment for the past 2 decades. Although also adopted for lone atrial fibrillation, the procedure has found its largest application in patients undergoing surgery for other cardiac indications, especially concomitant mitral valve disease, for which its use in combination with mitral valve repair is especially attractive because of the possibility to avoid lifelong anticoagulation. Despite its high success rates in restoring sinus rhythm (>90% in some series [3]), the Cox Maze III procedure is technically challenging and time consuming, which has led to the introduction of modified techniques aimed at reducing or eliminating the surgical incisions, replacing them with lesions produced by energy sources such as radiofrequency, laser, and cryoablation.

In this issue of the Journal, Buber et al. (5) report on the incidence of stroke in 150 patients who underwent a modified Maze procedure by radiofrequency or cryoablation, without the use of atrial incisions. These patients were the ones who maintained sinus rhythm at 3 months from the procedure and during the follow-up, among an initial group of 236 patients. The investigators looked at the absence of left atrial mechanical activity (LAMC) at 3 months, revealed by the absence of an atrial wave on transthoracic Doppler examination of the mitral inflow, and at left atrial volume as potential predictors of ischemic stroke in a retrospective analysis. Over a mean follow-up period of 24.5 months, 15 strokes occurred (10%). The 47 patients (31%) with no detectable LAMC had a significantly higher incidence of stroke than those with normal LAMC (21% vs. 5%), as did patients with atrial volume indexes in the upper quartile of the distribution (≥33 ml/m²) compared with those with smaller atria (23% vs. 6%). In a multivariate analysis adjusted for an established stroke risk score (CHA₂DS₂-VASc), the absence of LAMC carried an almost 5-fold increase in stroke risk; large atrial volume carried a 3-fold increase. These results persisted when patients with prosthetic valves, who were also the only ones on chronic systemic anticoagulation therapy, were excluded from the analysis. The investigators suggested that LAMC absence and LA volume index ≥33 ml/m² could be used to identify patients at higher stroke risk who could benefit from anticoagulant treatment.

This study has important merits. First, it reminds us that, after a successful Maze procedure, ischemic stroke may still occur, despite the persistence of sinus rhythm (or at least the absence of documented atrial fibrillation recurrence) and the surgical excision of the left atrial appendage, which is the most common location for thrombus formation. Second, it shows that even with the less extensive atrial lesions afforded by the use of radiofrequency and cryoablation compared with surgical incisions, residual atrial dysfunction may still occur and last for a long time (no changes were seen in LAMC between 3 and 12 months). Finally, the study demonstrates the feasibility of performing post-operative stroke risk stratification on the basis of simply obtained echocardiographic indicators of atrial morphology and function. However, several circumstances prevent the general applicability of the results. First, the incidence of stroke (10% over 2 years) was unusually high for patients undergoing the Maze procedure. Very low stroke rates have been reported for the classic Cox Maze III procedure, although the comparison across studies is complicated by differences in surgical
indications, follow-up durations, and anticoagulation strategies. Stroke surveillance and adjudication methods have also differed. In 265 patients followed for up to 11.5 years after surgery, only 1 stroke was reported (6). Over a mean follow-up period of 4 years, no strokes were reported in 139 patients undergoing the procedure for lone atrial fibrillation, and 2 strokes were reported in 64 patients (3%) with concomitant cardiac surgery (7). In a recent series of 435 patients with concomitant mitral valve repair or replacement, 6 strokes (1.4%) occurred over a mean follow-up period of 40.6 months (8). Recently, a study that used radiofrequency ablation in 258 patients with longstanding atrial fibrillation, and is therefore more closely comparable with the study of Buber et al. (5), reported a stroke incidence of 1.6% over a mean follow-up period of 43.7 months; however, almost all patients were chronically anticoagulated (9). The stroke rate observed in the study of Buber et al. (5) appears to be at the high end of those reported for similar procedures, possibly indicating the selection of a population at especially high baseline risk and likely reflecting the absence of anticoagulation.

Second, confirmation by transesophageal echocardiography of effective obliteration of the left atrial appendage was obtained in only 5 of the 15 patients at the time of the stroke, leaving the possibility that thrombus in the surgical stump may have contributed to the clinical event in the others. Factors that affect the likelihood of atrial fibrillation recurrence and left atrial function, such as the duration of atrial fibrillation (10) before surgery and low amplitude of fibrillatory waves on electrocardiography (8,10), were not considered in the analysis.

Finally, like other studies of this type, this was a single-center study, a circumstance that always affects the generalizability of the results. Even with these limitations, the stroke risk stratification on the basis of left atrial size and function assessment proposed by Buber et al. (5) appears reasonable, with the advantage of being based solely on transthoracic echocardiography, a noninvasive test that can easily be performed during the follow-up. Patients with absent LAMC and/or very large atrial volumes might be candidates for further assessment by transesophageal echocardiography, looking for more direct stroke risk indicators, such as spontaneous echo contrast or thrombus in the surgical stump of the appendage, which would further refine the risk prediction and guide the decision to initiate oral anticoagulation. The use of anticoagulation solely on the basis of absent LAMC or large atrial size, although not unreasonable on the basis of the results of Buber et al. (5), will require validation in appositely designed prospective studies.

The field of surgical treatment of atrial fibrillation is rapidly evolving. Better understanding of the mechanisms of atrial fibrillation and more accurate pre-operative identification of the region of origin of the arrhythmia will lead to the refinement and possibly individualization of surgical techniques. Minimally invasive or thoracoscopic approaches, and possibly the elimination of cardiopulmonary bypass, already a reality for pulmonary vein isolation and left atrial appendage excision (3), may make the surgical option available to a larger number of patients, offering a viable alternative to transcatheter techniques or drug treatment in selected patients. A more complete understanding of the effects of surgical ablation on atrial electrophysiology and function will be critical to the success of these techniques, both in restoring normal sinus rhythm and decreasing the risk for atrial fibrillation’s most dreaded complication—thromboembolic stroke.

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