Should surgical ablation for atrial fibrillation be performed in patients with a significantly enlarged left atrium?

Niv Ad, MD, Linda Henry, PhD, Sharon Hunt, MBA, and Sari D. Holmes, PhD

Objective: One established predictor for failure of surgical ablation for atrial fibrillation is increased left atrial size. Surgeon perception is that surgical ablation in these patients is ineffective and should not be performed. The purpose of this study was to determine whether a larger left atrial size carries a prohibitive risk for failure and embolic events after surgical ablation.

Methods: In patients undergoing surgical ablation without left atrial reduction (N = 373), left atrial size was measured via transthoracic echocardiography within 6 months before surgery. Large (>5.5 cm; n = 83) and small (≤5.5 cm; n = 290) left atrial size groups were compared on outcomes.

Results: Patients in the large left atrium group were younger (P = .02) and had lower operative risk (European System for Cardiac Operative Risk Evaluation, P = .01), but they were not different in type (P = .51) or duration of atrial fibrillation (P = .93). The large left atrium group was less likely to be in sinus rhythm at 1 year (86% vs 93%, P = .04), but there was no difference in sinus rhythm without antiarrhythmic drugs (77% vs 85%, P = .10). By 2 years, the large and small left atrium groups were similar in sinus rhythm (85% vs 90%, P = .35). Freedom from embolic stroke was similar (P = .70) despite the majority of patients not taking anticoagulation at 1 year.

Conclusions: The large left atrium group had acceptable return to sinus rhythm and sinus rhythm without antiarrhythmic drugs. The embolic stroke rate was low despite the majority of patients not taking anticoagulation. If patients are managed appropriately post-ablation, left atrial size should not be a discouragement when evaluating surgical candidates with atrial fibrillation. (J Thorac Cardiovasc Surg 2014;147:236-41)

ACD

The first Cox-Maze procedure for surgical ablation of atrial fibrillation (AF) was performed more than 25 years ago, and despite some changes in the lesion set, the basic concepts of the procedure have remained the same. However, the advent of new technology has provided an opportunity for the lesions to be completed with alternate energy sources, primarily cryothermia and radiofrequency, allowing for less time spent on bypass and a less tedious procedure.[1-5]

Current long-term results for surgical ablation of AF range from 70% to 90% depending on whether any modifications to the original lesion set were made, especially in patients with nonparoxysmal AF.[2,6] Along with the reporting of results, many investigators have reported the predictors of failure in their cohort of patients.[7-11] A consistent finding for most investigators has been the size of the left atrium (LA) at the time of surgery, such that the larger the LA (>5.5 cm) the higher the rate of failure.[7-11] As a result, the perception among surgeons is that surgical ablation in patients with an enlarged LA is highly ineffective and should not be performed. There are no clear data on whether certain LA dimensions are related to results and thereby prohibit surgical ablation.

The purpose of this study was to explore the variables associated with failure of the full Cox-Maze procedure as originally designed.[1,12] Specifically, we sought to (1) examine the traditional predictors of failure (age, gender, left atrial size, and duration of AF) at 12 months to determine the relevancy when newer ablative devices are used; and (2) determine whether preoperative left atrial size greater than 5.5 cm carries a risk for recurrent atrial arrhythmia and embolic events after surgical ablation.

MATERIALS AND METHODS

This was a cohort study whereby all patients with preoperative left atrial size measurement who underwent surgical ablation without left atrial reduction surgery between January 2005 and August 2012 were followed prospectively (N = 518). A total of 373 consecutive patients were available for analysis with follow-up data at 1 year. There were 145 patients who did not complete 1-year follow-up, in whom there were 6 operative deaths (<30 days; 1.2%) and 21 deaths during the first year of follow-up.

All patients were included in our unique AF registry, which stores detailed information collected prospectively about the surgical ablation case including preoperative and postoperative data. Rhythm status using electrocardiography and 24-hour Holter, and clinical follow-up were collected and verified at 3, 6, 9, 12, 18, and 24 months and yearly thereafter. The definition for success or failure of surgical ablation was according to

From the Inova Heart and Vascular Institute, Falls Church, Va.

Disclosures: Niv Ad reports consulting fees from Estech, Medtronic, and Atricure. The other authors have nothing to disclose with regard to commercial support.

Read at the 39th Annual Meeting of The Western Thoracic Surgical Association, Coeur d'Alene, Idaho, June 26-29, 2013.

Received for publication June 26, 2013; revisions received Sept 6, 2013; accepted for publication Sept 17, 2013; available ahead of print Nov 4, 2013.

Address for reprints: Niv Ad, MD, Cardiac Surgery, Inova Heart and Vascular Institute, Falls Church, VA 22042 (E-mail: Niv.Ad@inova.org).

0022-5223/$36.00

http://dx.doi.org/10.1016/j.jtcvs.2013.09.037

Abbreviations and Acronyms
AF = atrial fibrillation
CI = confidence interval
LA = left atrium
OR = odds ratio
SR = sinus rhythm

the Heart Rhythm Society guidelines.[13] Data from this AF registry were merged with data from the Society of Thoracic Surgeons database at the Inova Heart and Vascular Institute. Left atrial size was measured via transthoracic echocardiography within 6 months before surgery. All patients underwent standard transthoracic examination using the routine protocols from our accredited cardiac diagnostics department. The anteroposterior left atrial diameter was measured from the parasternal long-axis view using M-mode measurements. All perioperative outcomes were determined according to the Society of Thoracic Surgeons database definitions. This study was approved by the institutional review board at the Inova Heart and Vascular Institute, and a waiver of patient consent for our research program was obtained (studies 06.022 and 12.055).

Surgical Ablation Technique

Surgical ablation was performed by multiple surgeons. In 87% of patients, the complete Cox-Maze III/IV lesion set was performed as described previously.[7,12] In the remaining 13% of patients, pulmonary vein isolation or limited left-sided surgical ablation was performed in patients presenting with intermittent AF (paroxysmal or persistent AF). Cryothermia only (Medtronic, Inc, Minneapolis, Minn) was used as the sole energy source in 44% of patients, bipolar radiofrequency was used in 10% of patients, and a combination of cryothermia and bipolar radiofrequency (Atricure, West Chester, Ohio) was used in the remaining 46% of patients.

Statistical Analysis

Continuous data are presented as mean ± standard deviation, and categorical data are presented as frequency (percent) unless otherwise noted. All analyses were conducted using SPSS version 17.0 (SPSS Inc, Chicago, Ill). Group comparisons for perioperative and rhythm outcomes were conducted in 2 groups based on left atrial size: large (>5.5 cm) and small (≤5.5 cm). There are multiple publications related to left atrial size as a predictor for failure in electrophysiology and surgical literature. The left atrial sizes mentioned are usually between 5 and 6 cm.[14] Therefore, we chose 5.5 cm as the reference cutoff.

Categorical variables were compared using the chi-square test or Fisher's exact test, and continuous measures were examined with Student's independent samples *t* test or Mann–Whitney *U* test as appropriate, based on parametric test assumptions. The impact of left atrial size (as a continuous measure) on rhythm status also was analyzed using univariate logistic regression. Failure in these analyses was defined as recurrence of AF at the time point of interest. In addition, multivariate logistic regression was conducted to examine the predictors of failure at 1 year in all patients and within the large LA group only. The factors included in this model were age, gender, diabetes, ejection fraction (%), peripheral vascular disease, hypertension, additive European System for Cardiac Operative Risk Evaluation, duration of AF (years), ablation energy source, surgical ablation lesion set (full vs limited), number of concomitant surgeries, and left atrial size as a continuous variable (for the full sample analysis only).

RESULTS

Patient Characteristics

Since 2005, there were 373 patients with surgical ablation and 1-year follow-up. The large LA group (>5.5 cm) included 83 patients, and the small LA group (≤5.5 cm) included 290 patients. The large LA group was younger ($P = .02$), had lower operative risk (European System for Cardiac Operative Risk Evaluation, $P = .01$), had fewer patients with diabetes mellitus ($P = .02$) and hypertension ($P = .02$), had lower ejection fraction ($P = .03$), and had significantly more concomitant mitral valve surgery ($P < .001$; Table 1). There were no differences in type or duration of AF between the groups ($P = .93$).

Perioperative Morbidity

Between January 2005 and August 2012, a total of 518 patients with preoperative transthoracic echocardiography and left atrial size measurements underwent a surgical ablation procedure. A total of 145 patients were excluded from the analysis, in whom there were 6 operative deaths (<30 days; 1.2%) and 21 deaths during the first year of follow-up, leaving 373 patients for the final analysis. Perioperatively, the large LA group was not different from the small LA group on permanent stroke (0% vs 0.7%, $P = 1.00$), prolonged ventilation greater than 24 hours (5% vs 6%, $P = .80$), pneumonia (1% vs 3%, $P = .69$), reoperation for bleeding (1% vs 5%, $P = .32$), new renal failure (4% vs 2%, $P = .38$), new renal failure requiring dialysis (2% vs 1%, $P = .31$), and readmission within 30 days (10% vs 12%, 0.70).

Sinus Rhythm Outcomes

Results indicated that the large LA group was less likely to be in sinus rhythm (SR) at 1 year compared with the small LA group (86% vs 93%, $P = .04$; Table 2). However, the large LA group was not different from the small LA group in terms of SR without class I/III antiarrhythmic drugs at 1 year (77% vs 85%, $P = .10$). By 2 years, the large LA group was similar to the small LA group in SR overall (85% vs 90%, $P = .35$) and SR without antiarrhythmic drugs (73% vs 81%, $P = .28$). Furthermore, at 1 year, patients with left atrial size 7.5 cm or greater (n = 7) showed reasonable rates of SR (86%) and SR without antiarrhythmic drugs (71%). The large LA group did not require more cardioversions (23% vs 18%, $P = .34$) during follow-up.

The incidence of embolic stroke was low in both the small (n = 5, 1.7%) and large (n = 1, 1.2%) LA groups. Freedom from embolic stroke during follow-up was found to be similar across LA groups (log rank = 0.15, $P = .70$; Figure 1) despite the majority of patients in both the small and large LA groups not taking warfarin at 12 months (67% vs 61%, $P = .35$). The majority of patients who remained on warfarin at 12 months were treated with anticoagulation for non-AF indications (ie, deep vein thrombosis, pulmonary embolism), and this did not differ significantly across LA groups (55% vs 71%, $P = .14$; Table 2).