

Biatrial or Left Atrial Lesion Set for Ablation During Mitral Surgery: Risks and Benefits



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Background. Controversy exists when performing surgical atrial fibrillation ablation whether there is an increase in postoperative complications using biatrial (BA) lesions compared with only left atrial (LA) lesions, and some studies indicate similar efficacy. This study compares the clinical outcomes of BA and LA ablation lesions in mitral valve surgery patients.

Methods. From 2004 through 2014, 2,137 patients had mitral valve surgery with or without other surgeries in a single center. Of those, 836 (39%) had preoperative atrial fibrillation, and of those, 724 (86%) underwent atrial fibrillation ablation surgery; 257 patients had BA lesion sets and 359 had LA lesion sets. Propensity score matching of BA and LA patients was performed.

Results. Baseline differences included more postoperative complications in the BA group, specifically, permanent pacemaker placement (13% versus 7%; $p = 0.006$). Freedom from atrial fibrillation off antiarrhythmic

drugs (72% BA versus 75% LA; $p = 0.50$), postoperative ablation (7% BA versus 5% LA; $p = 0.20$), stroke (0.11 versus 0.11 per 10 person-years; $p = 0.91$), and survival were similar between the groups. After matching, patients in the LA group had a higher freedom from postoperative ablation ($p = 0.015$), but no difference in freedom from atrial fibrillation off antiarrhythmic drugs (79% BA versus 69% LA; $p = 0.09$), and no difference in permanent pacemaker placement (10% versus 12%; $p = 0.57$).

Conclusions. Patients undergoing mitral surgery with LA or BA ablation had similar outcomes, survival, and complications. Limiting lesions to the LA is an effective alternative to BA ablation for patients undergoing ablation with concomitant mitral valve surgery.

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Of patients undergoing mitral valve surgery, approximately 27% have atrial fibrillation (AF) [1]. Surgical ablation of AF is an effective therapeutic option for patients undergoing cardiac surgery and is recommended by medical societies for selected patients undergoing concomitant cardiac surgery [2, 3]. The original biatrial (BA) Cox maze III ablation lesions were complex; and more limited lesions, especially isolated left atrial (LA) lesions, have been reported with good results [2, 4, 5]. Controversy exists, however, and some centers strongly believe BA lesions should be used despite their own data showing equal efficacy to LA lesions only [6, 7]. A recent prospective randomized trial showed no difference in freedom from AF off antiarrhythmic drugs between BA and LA lesions [5]. Furthermore, studies have shown an

increase in postoperative complications with BA ablation lesion sets compared with ablation limited to the left atrium, so the highest benefit—but lowest risk—lesion set remains unclear [2, 5, 8].

At Northwestern, we have never endorsed the concept that all patients must be treated with BA lesions, and have used different lesions in patients at surgeons' discretion and based on the best available evidence from the literature at the time [9]. We approach the question with equipoise; the best lesion set is not settled. We hypothesized equal efficacy between BA and LA lesions for patients with AF undergoing concomitant mitral valve

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surgery, and sought to use our database to address this question.

Patients and Methods

Data for all patients were obtained from the Bluhm Cardiovascular Institute's Clinical Trial Unit Cardiovascular Research Database and medical record review (Institutional Review Board project STU00012288). Subjects refusing participation were excluded from the analysis.

Between April 2004 and June 2014, 2,137 consecutive patients underwent mitral valve surgery, of whom 838 (39%) had preoperative AF. Of those, 724 (86%) underwent concomitant surgical ablation. This study examines 616 patients, 359 (58%) exclusively having LA surgical ablation and 257 (42%) having BA; lesion set choice was at the discretion of the surgeon, using cryoablation with or without bipolar radiofrequency ablation. Patients treated by seven surgeons are included, and 79% were treated by one surgeon (proportional means model).

The LA lesion set included a “box” lesion around the pulmonary veins along with a cryoablation mitral annular connection lesion, including the coronary sinus (Fig 1A). The LA appendage lesion was rarely used in our cohort. The BA ablation included the LA lesion set and lesions to the inferior vena cava, superior vena cava, and tricuspid annulus, and a cryoablation lesion into the coronary sinus (Fig 1B). Most BA lesions were with tricuspid surgery, and the right atriotomy extended into the right atrial appendage. We did not perform the Cox maze IV as only one lesion went to the tricuspid valve annulus, and the cryolesion inside the coronary sinus is not part of the Cox maze IV.

The postoperative management protocol for AF [10] included patient discharge on a regimen of antiarrhythmic drugs and anticoagulation therapy unless contraindicated. Cardioversion was recommended for recurrent atrial flutter or AF after surgery. At 3 months, sinus rhythm was confirmed by electrocardiogram, and then Holter monitoring or outpatient telemetry was utilized per Heart Rhythm Society recommendations. If AF was detected on the screening electrocardiogram and no further treatment

pursued, the rhythm outcome was deemed a failure and further monitoring was not obtained for follow-up purposes. Therefore, Holter or long-term monitoring was obtained in 74% of patients at last follow-up. If sinus rhythm was documented, antiarrhythmic drugs were discontinued. The process was repeated at 6 months, and every 6 months for 2 years, to evaluate freedom from AF off antiarrhythmic drugs to make anticoagulation therapy decisions. Our protocol does not encourage long-term use of antiarrhythmic drugs. Referral for cardioversion or catheter ablation is made for AF recurrence. If the patient is not a candidate for catheter ablation, then antiarrhythmic drugs are discontinued. Patients received surveys at 3, 6, and 12 months, then annually. Medical records were obtained to verify operations, cardioversion, catheter ablation, or hospitalizations. Rhythm follow-up was available for 90% of the cohort (523 of 581). The Society of Thoracic Surgery definitions were used for complications.

Mortality data were aggregated continuously, consulting sources that included the following: (1) Cardiovascular Research Database registry; (2) reviews of medical records and correspondence with the treating physician; (3) online death indexes, including the Social Security Death Index and genealogy resources (ancestry.com); and (4) newspaper death notices. Utilizing these sources, mortality follow-up information was available on 100% of the cohort.

Statistics

Variables with continuous distributions were summarized using mean $\pm$ SD or median (interquartile range). The LA and BA ablation groups were compared based on two-sample Student's *t* tests or Wilcoxon's rank sum tests. Binary and categorical variables were summarized using proportions and compared based on the χ^2 test or Fisher's exact test. To account for potential baseline differences between the LA and BA groups, 1:1 propensity score matching with a caliper of size 0.2 logit propensity score SD units was used. For each baseline covariate included in the propensity score model, balance between groups was assessed using standardized differences [11]. The

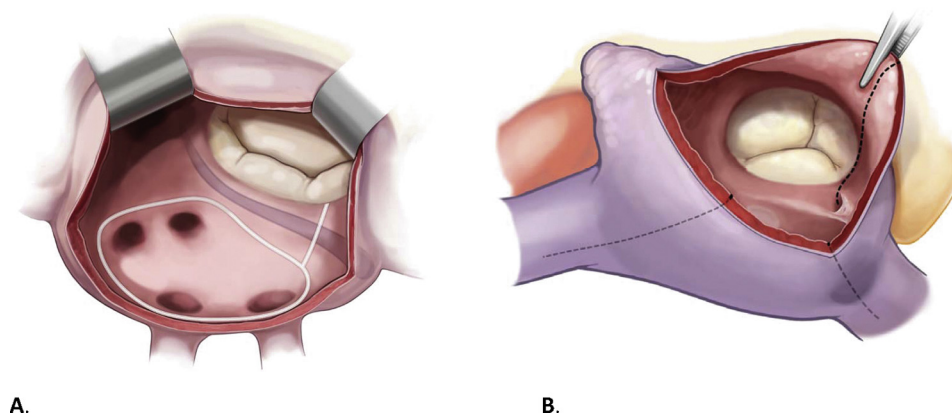


Fig 1. (A) Left atrial lesion set with a box lesion isolating the pulmonary veins and a mitral isthmus lesion. (B) The right atriotomy typically extended from the base of the right atrial appendage across the free wall (most associated with tricuspid surgery). Lesions from the atriotomy to the cavae were created with bipolar radiofrequency or cryoablation. The lesion from the atriotomy to, and along, the tricuspid annulus and into the coronary sinus for 1 to 2 cm (to create a 360-degree coronary sinus lesion) was always created with cryoablation.

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