Surgical treatment of Atrial Fibrillation
State of Art : 2019

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Severance Hospital, Yonsei University College of Medicine
Using Scars to Study Arrhythmias

Automaticity

Micro-Reentry

Macro-Reentry
Using Scars to Study Arrhythmias
Using Scars to Study Arrhythmias
Interruption of Reentrant Circuits
Goal 1: Cure the Atrial Fibrillation
Goal 2: Leave Atrium Capable of NSR
Goal 1: Cure the Atrial Fibrillation
Goal 2: Leave Atrium Capable of NSR
Goal 1: Cure the Atrial Fibrillation
Goal 2: Leave Atrium Capable of NSR
Evolution of AF surgery

- Left atrial isolation
- Corridor technique
- Cox Maze I & II
- Cox–Maze III
- Cox–Maze IV
- Mini-Maze
Sealy in 1973

His Bundle Ablation

Cox in 1980

Left Atrial Isolation Procedure

Cox in 1986

Atrial Transection Procedure

2 macro-reentrant circuits: 1 around the SVC and IVC orifices and 1 around the pulmonary veins and the orifice of the LAA
1 entrance site, 1 exit site, 1 true route between the entrance and exit, and multiple "blind alleys" branching off from the 1 true route
the maze pattern of lesions specifically **avoid compartmentalization** of the atrial myocardium and all areas of the atrial myocardium would remain contiguous for both atria to be activated and functional postoperatively.
Final suggestion
Intra-atrial conduction delay that resulted in the LA and LV being activated simultaneously, resulting in apparent loss of LA transport function because the LA was contracting against a closed mitral valve.

In 1997, the minimally invasive cryosurgical Maze-III procedure that was performed through a 6-cm RMT, and all the surgical lesions were replaced by cryosurgical lesions.

It was extremely difficult to perform technically and required complete transection of the SVC above the RA in order to obtain sufficient operative exposure of the internal LA.

Modification using a combination of bipolar RF clamps and linear Cryoprobes.
Cornerstone of AF surgery

Table 7. COMPARISON OF THE EFFECTS OF THE THREE DIFFERENT TYPES OF MAZE PROCEDURES ON SEVERAL LONG-TERM POSTOPERATIVE PARAMETERS*

<table>
<thead>
<tr>
<th>Postoperative Parameter</th>
<th>Maze-I (%)</th>
<th>Maze-II (%)</th>
<th>Maze-III (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blunted SA node chronotropy</td>
<td>88</td>
<td>21</td>
<td>6</td>
</tr>
<tr>
<td>Iatrogenic SA node injury</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pacemaker requirement</td>
<td>56</td>
<td>29</td>
<td>24</td>
</tr>
<tr>
<td>Atrial flutter recurrence</td>
<td>13</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>Atrial fibrillation recurrence</td>
<td>6</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Dysfunctional left atrium</td>
<td>28</td>
<td>36</td>
<td>6</td>
</tr>
</tbody>
</table>

* Note that the Maze-III modification has resulted in substantial improvement in all of these parameters.
Modification of Cox Maze III
Cox Maze III operation

6-7cm
LAA internal occlusion by double layer suture
Evolution of Lesion set to Cox IV
Illustrated techniques for performing the Cox-Maze IV procedure through a right

Jason O. Rhee
Division of Cardiothoracic Surgery
Hospital, St

School of Medicine, Barnes-Jewish
Minimally invasive surgery for atrial fibrillation—Wolf Mini Maze procedure

Randall K. Wolf and Sandra Burgess
Thoracoscopic surgical ablation

Just 3 port site scar
The Five-Box Thoracoscopic Maze Procedure

John Sirak, MD, Danielle Jones, RN, David Schwartzman, MD

Cox maze operation modifications
Cox maze III modifications
Modified Maze Procedure for Patients With Atrial Fibrillation Undergoing Simultaneous Open Heart Surgery

Yoshio Kosakai, Akira T. Kawaguchi, Fumitaka Isobe, Yoshikado Sasaki, Kiyoharu Nakano, Kiyoyuki Eishi, Yoshitsugu Kito, and Yasunaru Kawashima

How I Perform the Maze Procedure

Areas of cryoablation shown in white

Cryoprobe latera

LAA, LSA, PSA, SN, 4 cm, IVC, SVC, RAA, MV, FO, TV
Long-term outcome of combined valve repair and maze procedure for nonrheumatic mitral regurgitation

Tomoyuki Fujita MD, Junjiro Kobayashi MD, Koichi Toda MD, Hiroyuki Nakajima MD, Yutaka Iba MD, Yusuke Shimahara MD, Toshikatu Yagihara MD

79%, 70%, and 63% after 5, 10, and 15 years

J Thorac Cardiovasc Surg 2010
Mid-Term Results of the Cox Maze III Procedure Combined With Open Mitral Commissurotomy for the Treatment of Rheumatic Mitral Stenosis

Hyungtae Kim, MD; Pyo Won Park, MD; Kiick Sung, MD; Young-Tak Lee, MD; Tae-Gook Jun, MD; Wook Sung Kim, MD; Ji-Hyuk Yang, MD; Joomin Hwang

Maintenance rate of SR
1 year 91.7%
3 years 89.2%
5 years 89.2%

Circ J 2010; 74
Outcome of the modified maze procedure for atrial fibrillation combined with rheumatic mitral valve disease using cryoablation

Man-Jong Baek, Sam-Sae Oh, Chang-Ha Lee, Chan-Young Na

Fig. 1. Three models for cryoablation in

Interactive CardioVascular and Thoracic Surgery, April 2005
Intraoperative Modified Cox Mini-Maze Procedure for Long-Standing Persistent Atrial Fibrillation

Yong Qiang Cui MD, PhD, Ling Bo Sun MD, PhD, Yan Li MD, Chun Lei Xu MD, Jie Han MD, Hui Li MD, Xu Meng MD

Ann Thorac Surg 2008;85
Atrial fibrillation surgery simplified with cryoablation to improve left atrial function

Jae Won Lee, MD, Suk Jung Choo, MD, Kun Il Kim, MD, Jae Kwan Song, MD, Duk Hyun Kang, MD, Jong Min Song, MD, Hyun Song, MD, Sang Kwon Lee, MD, Meong Gun Song, MD

Ann Thorac Surg 2001;72
Long-term outcome of modified maze procedure combined with mitral valve surgery: Analysis of outcomes according to type of mitral valve surgery

Joon Bum Kim MD, Tae Jin Yun MD, Cheol Hyun Chung MD, Suk Jung Choo MD, Hyun Song MD, Jae Won Lee MD

3 and 5-year atrial fibrillation–free rates, respectively, were 88.7% ± 2.4% and 80.9% ± 3.7% in repair (MVP) group and 83.2% ± 3.1% and 77.3% ± 4.1% in replacement (MVR) group

Log rank test, p=0.099

Years after operation

J Thorac Cardiovasc Surg 2010;139
Long-Term Outcomes of the Maze Procedure Combined With Mitral Valve Repair: Risk of Thromboembolism Without Anticoagulation Therapy


Su Kyung Hwang, MD, Jae Suk Yoo, MD, Joon Bym Kim, MD, Sung-Ho Jung, MD, Suk Jung Choo, MD, Cheol Hyun Chung, MD, Jae Won Lee, MD.

Ann Thorac Surg 2015
Concomitant ablation of atrial fibrillation in rheumatic mitral valve surgery

Wan Kee Kim MD, Ho Jin Kim MD, Joon Bum Kim MD, PhD, Sung-Ho Jung MD, PhD, Suk Jung Choo MD, PhD, Cheol Hyun Chung MD, PhD, Jae Won Lee MD, PhD

Postoperative Rhythm Outcomes

Freedom from AF occurrence at 5 years was \(76.5\% \pm 1.8\%\)

\(J\) Thorac Cardiovasc Surg 2019
Surgical ablation for atrial fibrillation for two decades: Are the results of new techniques equivalent to the Cox maze III procedure?

Read at the 93rd Annual Meeting of The American Association for Thoracic Surgery, Minneapolis, Minnesota, May 4-8, 2013.

John M. Stulak, MD, Rakesh M. Suri, MD, DPhil, Harold M. Burkhart, MD, Richard C. Daly, MD, Joseph A. Dearani, MD, Kevin L. Greason, MD, Lyle D. Joyce, MD, PhD, Soon J. Park, MD, Hartzell V. Schaff, MD

Division of Cardiovascular Surgery, Mayo Clinic and Foundation, Rochester, Minn

J Thorac Cardiovasc Surg 2014;147

No AAD
Mean follow-up: 111 ± 44 months (range, 36–223 months).

Table 2. Results of Submitted 12-Lead Electrocardiogram After the Cox-Maze III Procedure

<table>
<thead>
<tr>
<th>Rhythm</th>
<th>No. (%)</th>
<th>(N = 320)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sinus</td>
<td>219 (68)</td>
<td></td>
</tr>
<tr>
<td>Nodal</td>
<td>25 (8)</td>
<td></td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>37 (12)</td>
<td></td>
</tr>
<tr>
<td>Atrial flutter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right-sided</td>
<td>1 (0.3)</td>
<td></td>
</tr>
<tr>
<td>Left-sided</td>
<td>3 (1)</td>
<td></td>
</tr>
<tr>
<td>Ectopic atrial tachycardia</td>
<td>1 (0.3)</td>
<td></td>
</tr>
<tr>
<td>Pacing-dependent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atrial pacing</td>
<td>18 (6)</td>
<td></td>
</tr>
<tr>
<td>Ventricular pacing</td>
<td>5 (1.6)</td>
<td></td>
</tr>
<tr>
<td>Dual-chamber pacing</td>
<td>11 (3)</td>
<td></td>
</tr>
</tbody>
</table>

82%
Long-term outcome following concomitant mitral valve surgery and Cox maze procedure for atrial fibrillation

Read at the 97th Annual Meeting of The American Association for Thoracic Surgery, Boston, Massachusetts, April 29-May 3, 2017.

Niv Ad MD,*,†,‡, A. Sari D. Holmes PhD, Paul S. Massimiano MD,‡, Anthony J. Rongione MD,‡, Lisa M. Fornaresio PhD.

**TABLE 2. Results of the mixed model logistic regression analysis for atrial arrhythmia recurrence**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Odds ratio</th>
<th>95% Confidence interval</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>1.01</td>
<td>0.99-1.03</td>
<td>.208</td>
</tr>
<tr>
<td>Female</td>
<td>1.07</td>
<td>0.69-1.66</td>
<td>.773</td>
</tr>
<tr>
<td>Ejection fraction (%)</td>
<td>0.99</td>
<td>0.97-1.01</td>
<td>.430</td>
</tr>
<tr>
<td>Left atrium size (cm)</td>
<td>1.06</td>
<td>0.85-1.32</td>
<td>.614</td>
</tr>
<tr>
<td>Duration of AF (y)</td>
<td>1.07</td>
<td>1.03-1.11</td>
<td>.001</td>
</tr>
<tr>
<td>Nonparoxysmal AF type</td>
<td>1.05</td>
<td>0.57-1.94</td>
<td>.873</td>
</tr>
<tr>
<td>Surgeon experience</td>
<td>0.98</td>
<td>0.96-0.997</td>
<td>.025</td>
</tr>
<tr>
<td>Cryothermia only energy source</td>
<td>0.64</td>
<td>0.41-0.99</td>
<td>.045</td>
</tr>
<tr>
<td>Minimally invasive</td>
<td>0.99</td>
<td>0.47-2.06</td>
<td>.973</td>
</tr>
<tr>
<td>Mitral valve repair</td>
<td>0.68</td>
<td>0.43-1.06</td>
<td>.087</td>
</tr>
</tbody>
</table>

AF, Atrial fibrillation.
The long-term safety and efficacy of concomitant Cox maze procedures for atrial fibrillation in patients without mitral valve disease

Read at the 98th Annual Meeting of The American Association for Thoracic Surgery, San Diego, California, April 28-May 1, 2018.

Niv Ad MD a, b, C, Sari D. Holmes PhD d, Anthony J. Rongione MD b, Vinay Badhwar MD a, Lawrence Wei MD a, Lisa M. Fornaresio PhD d, Paul S. Massimiano MD b

Similar proportion of patients who received Cox maze in sinus rhythm (A) and sinus rhythm off class I/III antiarrhythmic medications during follow-up (B) for patients with and without concomitant MV procedures.

Similar Safety and Efficacy of Concomitant Cox Maze Procedures With and Without Mitral Valve Surgery

J Thorac Cardiovasc Surg 2019
Minimally Invasive Stand-Alone Cox Maze Procedure for Persistent and Long-Standing Persistent Atrial Fibrillation

Perioperative Safety and 5-Year Outcomes

Niv Ad, Sari D. Holmes, and Ted Friehling

Originally published 1 Nov 2017 | https://doi.org/10.1161/CIRCEP.117.005352 | Circulation: Arrhythmia and Electrophysiology. 2017;10

<table>
<thead>
<tr>
<th>Months</th>
<th>Patients at Risk (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>99 (0.73–0.87)</td>
</tr>
<tr>
<td>24</td>
<td>87 (0.66–0.83)</td>
</tr>
<tr>
<td>36</td>
<td>75 (0.65–0.80)</td>
</tr>
<tr>
<td>60</td>
<td>49 (0.53–0.71)</td>
</tr>
</tbody>
</table>

Circ Arrhythm Electrophysiol. 2017;10
Results of a Minimally Invasive Surgical Pulmonary Vein Isolation and Ganglionic Plexi Ablation for Atrial Fibrillation

Single-Center Experience With 12-Month Follow-Up


Circ Arrhythmia Electrophysiol. 2009
Long-term outcomes of minimally invasive surgical ablation for atrial fibrillation: A single-center experience

Aditya Saini MD *, Yuhning L. Hu MD *, Vigneshwar Kasiraj MD †, Frederick T. Han MD, FHRS †, Muhammad Z. Khan MBBS *, Luke Wolfe MS †, Sampath Gunda MD, MHA *, Jayanti N. Koneru MBBS *, Kenneth A. Ellenbogen MD, FHRS *

Heart Rhythm 2017;14
Long-Term Results of a Minimally Invasive Surgical Pulmonary Vein Isolation and Ganglionic Plexi Ablation for Atrial Fibrillation

Shuai Zheng, Yan Li, Jie Han, Haibo Zhang, Wen Zeng, Chunlei Xu, Yixin Jia, Jiangang Wang, Kequan Guo, Yuqing Jiao, and Xu Meng

A

B

AF-free Survival

Follow up (months)

0 12 24 36 48 60 72

0.0 0.2 0.4 0.6 0.8 1.0

Patients at risk: 139 99 82 74 60 32 2

Type of AF

persistent
long-standing persistent
paroxysmal

Patients at risk
Paroxysmal 108 78 67 62 52 28 2
Persistent 17 11 6 6 4 1 0
long-standing 14 10 9 6 4 3 1

Follow up (months)
“AF HeartTeam” Guided Indication for Stand-alone Thoracoscopic Left Atrial Ablation and Left Atrial Appendage Closure

Sacha P. Salzberg, MD,1 Wim-Jan van Boven, MD, PhD,1 Christophe Wyss, MD,1 David Hürlimann, MD,1 Ivano Reho, MD,1 Thomas Zerm, MD,3 Georg Noll, MD,1 Maximilian Y. Emmert, MD, PhD,2 Roberto Corti, MD,1 and Jürg Grünenfelder, MD1
Five hundred and fifty-eight patients were included in our analysis, with median age 62 years (IQR 56–68 years) and 70% male. Patient characteristics and procedural details are shown in Table 1. Paroxysmal AF was present in 43% and 53% of patients had a history of failed previous catheter ablation (mean number of 1.7 procedures). The average duration of AF was 5 years and the mean CHA2DS2-VASc score was 1.4 (SD 1.3; range 0–6). All patients received PVI, with additional lesions applied in the majority of patients (Table 1). The LAA was excluded in all but 12 patients (97.5%); the reasons for not excluding the LAA were prior watchman device implantation (n = 4), adhesions (n = 4), poor exposure (n = 2), request by the patient (n = 1), and an aborted procedure due to bleeding (n = 1). The median hospital length of stay was 4 days (IQR 3–6). During the admission, 30.5% of patients (170/558) developed at least one episode of AF, flutter, or another atrial tachyarrhythmia. At discharge, 12.5% (70/558) were in AF. A proportion of these patients were scheduled for electrical cardioversion in the outpatient setting due to inadequate anticoagulation status during admission, or due to patient preference.
Thoracoscopic ablation for the treatment of atrial fibrillation: a systematic outcome analysis of a multicentre cohort

Charlotte van Laar, Mohamed Bentala, Timo Weimar, Nicolas Doll, Martin J Swaans, Sander G Molhoek, Frederik N Hofman, Johannes Kelder, Bart P van Putte

475 patients, October 2012 and October 2015

Freedom from ATA

100%
90%
80%
75%
65%
50%
25%
0%

Number at risk
461
411
303
190

Time (months)

Europace. 2019
Surgical Ablation of Atrial Fibrillation in the United States: Trends and Propensity Matched Outcomes


#### Conclusions
Contemporary utilization of SA is increasing across all operative categories. Performance of SA is accompanied by a 30-day reduction in mortality and stroke.

- July 2011 to June 2014, 86,941 AF patients
- 48.3% (42,066 of 86,941) underwent SA

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Overall (n = 57,478)</th>
<th>No Ablation (n = 28,739)</th>
<th>Ablation (n = 28,739)</th>
<th>RR (95% CI)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>4.31 (2,480)</td>
<td>4.50 (1,292)</td>
<td>4.13 (1,118)</td>
<td>0.92 (0.85 - 0.99)</td>
<td>0.0422</td>
</tr>
<tr>
<td>Reoperation for bleeding</td>
<td>3.61 (2,075)</td>
<td>3.73 (1,073)</td>
<td>3.49 (1,602)</td>
<td>0.93 (0.86 - 1.02)</td>
<td>0.1195</td>
</tr>
<tr>
<td>Permanent stroke</td>
<td>1.06 (1,124)</td>
<td>2.13 (612)</td>
<td>1.78 (512)</td>
<td>0.54 (0.74 - 0.94)</td>
<td>0.0028</td>
</tr>
<tr>
<td>Transient ischemic attack</td>
<td>0.38 (218)</td>
<td>0.42 (121)</td>
<td>0.34 (97)</td>
<td>0.80 (0.61 - 1.05)</td>
<td>0.1064</td>
</tr>
<tr>
<td>Prolonged ventilation &gt;48 hours</td>
<td>16.31 (9,373)</td>
<td>16.75 (4,813)</td>
<td>15.87 (4,560)</td>
<td>0.95 (0.90 - 0.99)</td>
<td>0.0224</td>
</tr>
<tr>
<td>Renal failure</td>
<td>4.02 (2,585)</td>
<td>4.35 (1,219)</td>
<td>4.88 (1,366)</td>
<td>1.12 (1.03 - 1.22)</td>
<td>0.0107</td>
</tr>
<tr>
<td>Pacemaker</td>
<td>6.57 (3,946)</td>
<td>5.89 (1,693)</td>
<td>7.84 (2,253)</td>
<td>1.33 (1.24 - 1.43)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Phrenic nerve injury</td>
<td>0.06 (33)</td>
<td>0.06 (26)</td>
<td>0.06 (17)</td>
<td>1.06 (0.53 - 2.14)</td>
<td>0.8555</td>
</tr>
<tr>
<td>Readmission 30 days</td>
<td>13.36 (7,347)</td>
<td>12.79 (3,511)</td>
<td>13.92 (3,836)</td>
<td>1.09 (1.03 - 1.13)</td>
<td>0.0011</td>
</tr>
</tbody>
</table>
Conclusions

This is the first report on the preoperative use of the ECUVE in surgical candidates for concomitant surgical procedures. The fact that a biatrial mechanism for atrial fibrillation was detected in all patients emphasizes the importance of a Cox-Maze III/IV procedure to treat patients with valvular heart disease and nonparoxysmal atrial fibrillation. Preoperative mapping has the potential to significantly improve our understanding of the pathophysiology in atrial fibrillation and better guide the surgical ablation procedure of choice in a single patient.
“Coke” as a generic for all sweet, brown, carbonated drinks. However, there is a difference between an actual Coca-Cola and other sweet, brown, carbonated drinks.
Thus, the Left-Sided Maze procedure is not a maze procedure. Other procedures like the Dallas lesion set and the 5-Box Maze procedure, neither of which has any RA lesions, are also not maze procedures. Yet, when any of these non-maze procedures fail, a common refrain from patients is: “I had a maze procedure but it didn’t work.” The only true maze procedures are the historical Maze-I and Maze-II procedures and the contemporary Maze-III and Maze-IV procedures because they are the only ones that adhere to the maze concept.
No coronary sinus lesions were performed, and notoriously unreliable unipolar surgical ablation devices were used to create many of the left atrial lesions and all of the right atrial lesions.
A. Wolf “Mini Maze”

This is NOT a Maze Procedure!

B. “Left-Sided Maze”

This is NOT a Maze Procedure!

C. The “Dallas” Lesion Set

This is NOT a Maze Procedure!

D. The “5-Box” Maze

This is NOT a Maze Procedure!
Conclusions

The addition of atrial fibrillation ablation to mitral valve surgery significantly increased the rate of freedom from atrial fibrillation at 1 year among patients with persistent or long-standing persistent atrial fibrillation, but the risk of implantation of a permanent pacemaker was also increased. (Funded by the National Institutes of Health and the Canadian Institutes of Health Research; ClinicalTrials.gov number, NCT00903370.)

They failed to mention the coronary sinus lesion as a part of their “Bi-Atrial Maze Procedure,” suggesting that no patient in that multicentre trial received a true maze procedure.
Sick Sinus Syndrome After the Maze Procedure Performed Concomitantly With Mitral Valve Surgery

Min Soo Cho, MD; Ran Heo, MD; Xin Jin, MD; Jung-Bok Lee, PhD; Sahmin Lee, MD, PhD; Dae-Hee Kim, MD, PhD; Joon Bum Kim, MD, PhD; Jun Kim, MD, PhD; Sung-Ho Jung, MD, PhD; Suk Jung Choo, MD, PhD; Jong-Min Song, MD, PhD; Gi-Byoung Nam, MD, PhD; Kee-Joon Choi, MD, PhD; Duk-Hyun Kang, MD, PhD; Cheol Hyun Chung, MD, PhD; Jae Won Lee, MD, PhD; You-Ho Kim, MD, PhD; Jae-Kwan Song, MD, PhD

A

Sick sinus syndrome (%)

Biatrial maze
LA maze

P = 0.002
6.1 ± 1.2%
1.4 ± 0.8%

Number at risk
Biatrial maze 513
LA maze 237

Years
0 2 4

B

Recurrent AF (%)

Biatrial maze
LA maze

P = 0.002
28.2 ± 2.3%
17.6 ± 2.7%

Number at risk
Biatrial maze 513
LA maze 237

Years
0 2 4

J Am Heart Assoc. 2018
The reasons new permanent pacemakers are required after a maze procedure include the high success rates of the surgery with subsequent unmasking of preoperative sick sinus syndrome, excessive extracardiac dissection that damages the autonomic nerve input to the heart, premature pacemaker implantation for a temporary junctional rhythm immediately postoperatively, surgical error, and patient selection.
Take home messages

• Cox maze operation is very strict technique and limited categorized in real world many modifications

• Beating Heart surgical ablations with or without endovascular addition is inferior than classic Cox lesion setting

• Cox maze operation is not so complex and difficult, so we should routinely consider for AF treatment, also improve minimal approach
LA transport function was quantified by the ratio of peak flow velocities of the atrial filling wave (A) to the early filling wave (V) (peak A/E).
Risk Factors of Recurrence of Atrial Fibrillation (AF) After AF Surgery in Patients With AF and Mitral Valve Disease

Yosuke Ishii MD, PhD *, Shun-ichiro Sakamoto MD, PhD *, Yasuo Miyagi MD, PhD *, Yasuhiro Kawase MD *, Toshiaki Otsuka MD, PhD † †, Takashi Nitta MD, PhD *

LAD=64.2±5.6mm(Q4:58.0-82.0mm)
The Society of Thoracic Surgeons 2017 Clinical Practice Guidelines for the Surgical Treatment of Atrial Fibrillation

Vinay Badhwar, MD, J. Scott Rankin, MD, Ralph J. Damiano, Jr, MD, A. Marc Gillinov, MD, Faisal G. Bakaeeen, MD, James R. Edgerton, MD, Jonathan M. Philpott, MD, Patrick M. McCarthy, MD, Steven F. Bolling, MD, Harold G. Roberts, MD, Vinod H. Thourani, MD, Rakesh M. Suri, MD, DPhil, Richard J. Shemin, MD, Scott Firestone, MS, Niv Ad, MD

Division of Cardiothoracic Surgery, West Virginia University, Morgantown, West Virginia (VB, JSR, NA); Division of Cardiothoracic Surgery, Washington University, St. Louis, Missouri (RJD); Division of Thoracic and Cardiovascular Surgery, Cleveland Clinic, Cleveland, Ohio (AMG, FGB, RMS); Department of Cardiothoracic Surgery, Baylor Plano Heart Hospital, Plano, Texas (JRE); Department of Cardiothoracic Surgery, Sentara Heart Hospital, Norfolk, Virginia (IMP); Division of Cardiac Surgery, Northwestern University Feinberg School of Medicine, Chicago, Illinois (PMM); Department of Cardiac Surgery, University of Michigan, Ann Arbor, Michigan (SFB); Department of Cardiovascular Services, Florida Heart and Vascular Care at Aventura, Aventura, Florida (HGR); Division of Cardiothoracic Surgery, Emory University, Atlanta, Georgia (VHT); Division of Cardiothoracic Surgery, University of California Los Angeles David Geffen School of Medicine, Los Angeles, California (RJS); and The Society of Thoracic Surgeons, Chicago, Illinois (SF)
• Surgical ablation for atrial fibrillation (AF) can be performed without additional risk of operative mortality or major morbidity, and is recommended at the time of concomitant mitral operations to restore sinus rhythm. (Class I, Level A)

• Surgical ablation for AF can be performed without additional operative risk of mortality or major morbidity, and is recommended at the time of concomitant isolated aortic valve replacement, isolated coronary artery bypass graft surgery, and aortic valve replacement plus coronary artery bypass graft operations to restore sinus rhythm. (Class I, Level B nonrandomized)
• Surgical ablation for symptomatic AF in the absence of structural heart disease that is refractory to class I/III antiarrhythmic drugs or catheter-based therapy is reasonable as a primary stand-alone procedure to restore sinus rhythm. (Class IIA, Level B randomized)

• Surgical ablation for symptomatic persistent or longstanding persistent AF in the absence of structural heart disease is reasonable as a stand-alone procedure using the Cox-Maze III/IV lesion set compared with PVI alone. (Class IIA, Level B nonrandomized)
• Surgical ablation for symptomatic AF in the setting of left atrial enlargement (4.5 cm) or more than moderate mitral regurgitation by pulmonary vein isolation alone is not recommended. (Class III no benefit, Level C expert opinion)

• It is reasonable to perform left atrial appendage excision or exclusion in conjunction with surgical ablation for AF for longitudinal thromboembolic morbidity prevention. (Class IIA, Level C limited data)

• At the time of concomitant cardiac operations in patients with AF, it is reasonable to surgically manage the left atrial appendage for longitudinal thromboembolic morbidity prevention. (Class IIA, Level C expert opinion)

• In the treatment of AF, multidisciplinary heart team assessment, treatment planning, and long-term follow-up can be useful and beneficial to optimize patient outcomes. (Class I, Level C expert opinion)
News from the Heart Rhythm Society

2017 HRS/EHRA/ECAS/APHRS/SOLAECE expert consensus statement on catheter and surgical ablation of atrial fibrillation

Hugh Calkins MD (Chair) 1, Gerhard Hindricks MD (Vice-Chair) 2, 8, Riccardo Cappato MD (Vice-Chair) 3, 8, Young-Hoon Kim MD, PhD (Vice-Chair) 4, 6, Eduardo B. Saad MD, PhD (Vice-Chair) 5, 6, Luis Aguinaga MD, PhD 4, 1 Joseph G. Akar MD, PhD 7, Vinay Badhwar MD 8, 9, Josep Brugada MD, PhD 9, 10, John Camm MD 10, 10, Peng-Sheng Chen MD 11, Shih-Ann Chen MD 11, 6, Mina K. Chung MD 13, Jens C.O. Nielsen DMSc, PhD 14, 10, Anne B. Curtis MD 15, 8, D. Wyn Davies MD 10, 6, John D. Day MD 12, André d’Avila MD, PhD 14, 11, ... Teiichi Yamane MD, PhD 10, 11

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**Indications for Concomitant Open (Such as Mitral Valve) Surgical Ablation of AF**

- Symptomatic AF
  - Paroxysmal AF
    - AA Drugs
    - Surgical Ablation
  - Persistent AF
    - AA Drugs
    - Surgical Ablation
  - Long-standing Persistent AF
    - AA Drugs
    - Surgical Ablation

---

**Indications for Concomitant Closed (Such as CABG or AVR) Surgical Ablation of AF**

- Symptomatic AF
  - Paroxysmal AF
    - Ila
  - Persistent AF
    - Ila
  - Long-standing Persistent AF
    - Ila

---

**Indications for Stand-Alone Surgical Ablation of AF**

- Symptomatic AF
  - Paroxysmal AF
    - AA Drugs
    - Surgical Ablation
  - Persistent AF
    - AA Drugs
    - Surgical Ablation
  - Long-standing Persistent AF
    - AA Drugs
    - Surgical Ablation
• Class IIa
  • 1. An AF surgical ablation procedure is reasonable for selected patients with AF undergoing cardiac surgery for other indications. *(Level of Evidence: C)*

• Class IIb
  • 1. A stand-alone AF surgical ablation procedure may be reasonable for selected patients with highly symptomatic AF not well managed with other approaches. *(Level of Evidence: B)*
4.4.2. Cardiac Surgery—LAA Occlusion/Excision

<table>
<thead>
<tr>
<th>COR</th>
<th>LOE</th>
<th>Recommendation</th>
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<tbody>
<tr>
<td>IIb</td>
<td>B-NR</td>
<td>1. Surgical occlusion of the LAA may be considered in patients with AF</td>
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<tr>
<td></td>
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<td>undergoing cardiac surgery (S4.4.2-1), as a component of an overall heart</td>
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<td>team approach to the management of AF.</td>
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<td></td>
<td><strong>MODIFIED:</strong> LOE was updated from C to B-NR because of new evidence.</td>
</tr>
</tbody>
</table>

Referenced studies that support the modified recommendation are summarized in [Online Data Supplement 5](#).
• The mitral line blocks conduction through the myocardium of the LA isthmus, but the coronary sinus can also conduct electrical activity across the LA isthmus. Thus, **if the coronary sinus is ignored, 10% to 15% of patients will develop perimital flutter postoperatively**, even in the presence of a perfect mitral line.
(i) A horizontal atriotomy, continued medially as a linear cryolesion across the posterior tricuspid annulus, (ii) a cavocaval lesion, and (iii) a lateral cryolesion from the midportion of the atriotomy to the tip of the right atrial appendage (RAA).
Left Atrial Ablation Versus Biatrial Ablation in the Surgical Treatment of Atrial Fibrillation


Joon Bum Kim MD, Ji Hyun Bang MD, Sung Ho Jung MD, Suk Jung Choo MD, Cheol Hyun Chung MD, Jae Won Lee MD
Perioperative management

The influence of age on atrial fibrillation recurrence after the maze procedure in patients with giant left atrium

Seung Hyun Lee MD, Joon Bum Kim MD, Won Chul Cho MD, Cheol Hyun Chung MD, Sung Ho Jung MD, Suk Jung Choo MD, Jae Won Lee MD

Figure 1. Kaplan-Meier analysis of atrial fibrillation (AF) recurrence over time in patients with giant left atrium 50 years old or younger and older than 50 years.

J Thorac Cardiovasc Surg 2011;141
How I Perform the Maze Procedure

Yoshio Kosakai
From the Takarazuka City (Municipal) Hospital, Takarazuka, Hyogo, Japan
Recovery of Left Atrial Contractile Function After Maze Surgery in Persistent Longstanding Atrial Fibrillation

Yasir Abu-Omar MBChB, DPhil, Benjamin S. Thorpe PhD, Carol Freeman MPhil, Christine Mills MSc, Victoria E.A. Stoneman PhD, Deepa Gopalan, Bushra Rana MBBS, Tomasz J. Spyt MD, Linda D. Sharples PhD, Samer A.M. Nashef MBChB, PhD
Long-Term Risk of Ischemic Stroke After the Cox-Maze III Procedure for Atrial Fibrillation

Presented at the Poster Session of the Fifty-third Annual Meeting of the Society of Thoracic Surgeons, Houston, TX, Jan 21-25, 2017.

Anders Albåge MD, PhD *, Ulrik Sartipy MD, PhD b,c, Göran Kennebäck MD, PhD d, Birgitta Johansson MD, PhD a, Henrik Scherstén MD, PhD f, Lena Jidéus MD, PhD a
Swedish Arrhythmia Surgery Group *
Surgical Atrial Fibrillation Ablation Improves Long-Term Survival: A Multicenter Analysis


Using Scars to Treat Arrhythmias

- **1900**: Reentry Explained (1914)
- **1930**: Scars used to *study* arrhythmias
- **1960**: WPW Surgery (1968)
- **1990**: Scars used to *treat* Arrhythmias
- **2020**
Surgical Minimally Invasive Pulmonary Vein Isolation for Lone Atrial Fibrillation: Midterm Results of a Multicenter Study

Gijs E. De Maat, BSc, Alberto Pozzoli, MD, Marcoen F. Scholten, MD, PhD, more...

First Published May 28, 2019 | Research Article