

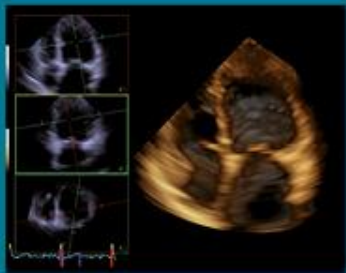
# EuroValve

October 24-25, 2014

## Surgical ablation of AF in Valvular Heart Disease

Pr Philippe Kolh, MD, PhD  
*University Hospital of Liège,  
BELGIUM*





# EuroValve

October 24-25, 2014

## Faculty disclosure

*Philippe KOLH*

*I disclose the following financial relationships:*

**Receive grant/research support** from AstraZeneca

**Advisory board** of AstraZeneca

**Paid speaker** for B. Braun, Lilly

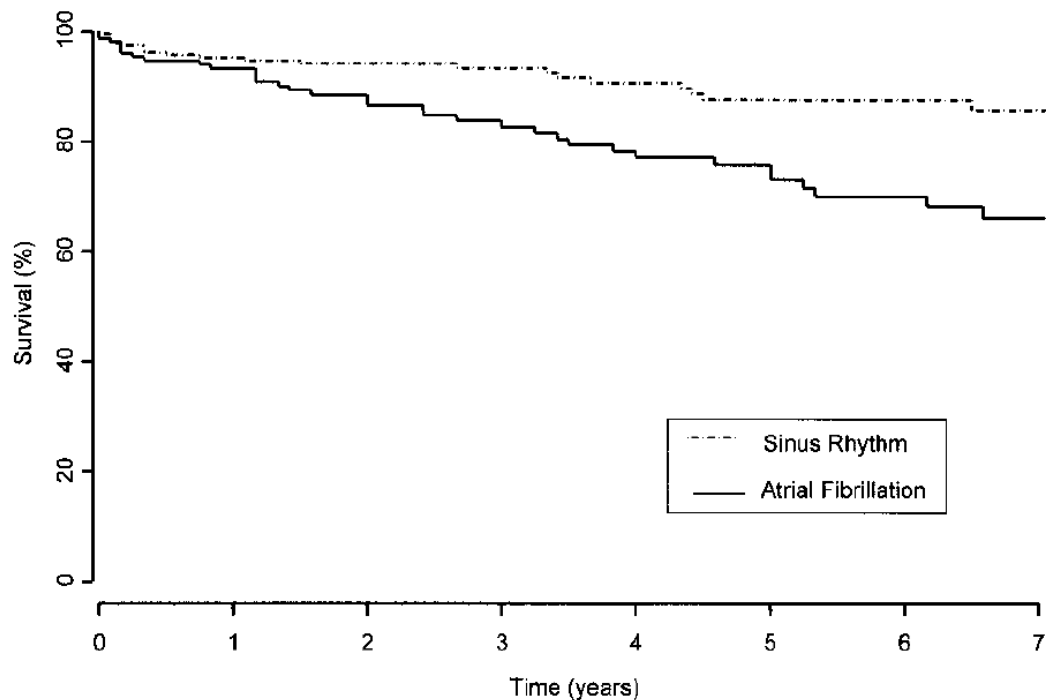


**WHY**

# Influence of Atrial Fibrillation on Outcome Following Mitral Valve Repair

Eric Lim, MBChB, MRCS; Clifford W. Barlow, DPhil, FRCS; A. Reza Hosseinpour, FRCS; Christopher Wisbey, BA; Kate Wilson, RN, BSc; Willis Pidgeon, RN; Susan Charman, MSc; John B. Barlow, HonDSc, MD, FRCP; Francis C. Wells, MS, FRCS

Circulation 2001; 104[suppl I]:I-59-I-63



- Age ( $p < 0.041$ )
- AF ( $p < 0.002$ )
- L Ventricular dysfunction ( $p < 0.001$ )

**Figure 1.** Survival by preoperative rhythm.

# Improved Patient Survival With Concomitant Cox Maze III Procedure Compared With Heart Surgery Alone

Yves Louagie, MD, PhD, Michel Buche, MD, Philippe Eucher, MD, Jean-Claude Schoevaerdt, MD, Marina Gerard, MD, Jacques Jamart, MD, MS, and Dominique Blommaert, MD, PhD

Cardiovascular Department and Biostatistical Unit, Université Catholique de Louvain, Cliniques Universitaires de Mont-Godinne, Yvoir, Belgium

*Background.* The benefit of the Cox Maze procedure combined with heart surgery was evaluated at long-term follow-up.

*Methods.* The outcome for 37 patients who underwent a Cox Maze III procedure combined with heart surgery (Maze group) was compared with that of 66 patients who had heart surgery alone (control group). All patients were in persistent atrial fibrillation preoperatively. The two groups had similar preoperative characteristics and were operated upon during the same era (1996 to 2004).

*Results.* Five-year survival, including hospital deaths, was 89% ± 5% in the Maze group and 60% ± 7% in the control group (log rank  $p = 0.008$ ). Causes of death were predominantly related to heart failure (1 of 37 in the Maze group and 12 of 66 in the control group;  $p = 0.02$ ) and to sudden death (0 of 37 in the Maze group and 9 of

66 in the control group;  $p = 0.02$ ). After correction for preoperative variables, Cox regression analysis showed that the Maze procedure improved survival independently ( $p = 0.019$ ). In a subgroup of patients with left atrial diameter of more than 60 mm preoperatively, the 5-year survival estimate was 92% ± 6% in the Maze group versus 59% ± 9% in the control group (log rank  $p = 0.012$ ). The 5-year estimate of conversion to sinus rhythm was 91% ± 7% in the Maze group and 33% ± 7% in the control group (log rank  $p < 0.001$ ).

*Conclusions.* The restoration of sinus rhythm by a Maze procedure combined with heart surgery markedly improved long-term survival in this series.

(Ann Thorac Surg 2009;87:440-7)

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European Journal of Cardio-thoracic Surgery 36 (2009) 272–279

EUROPEAN JOURNAL OF  
CARDIO-THORACIC  
SURGERY

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## Risk factors analysis on failure of maze procedure: mid-term results<sup>☆</sup>

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### Abstract

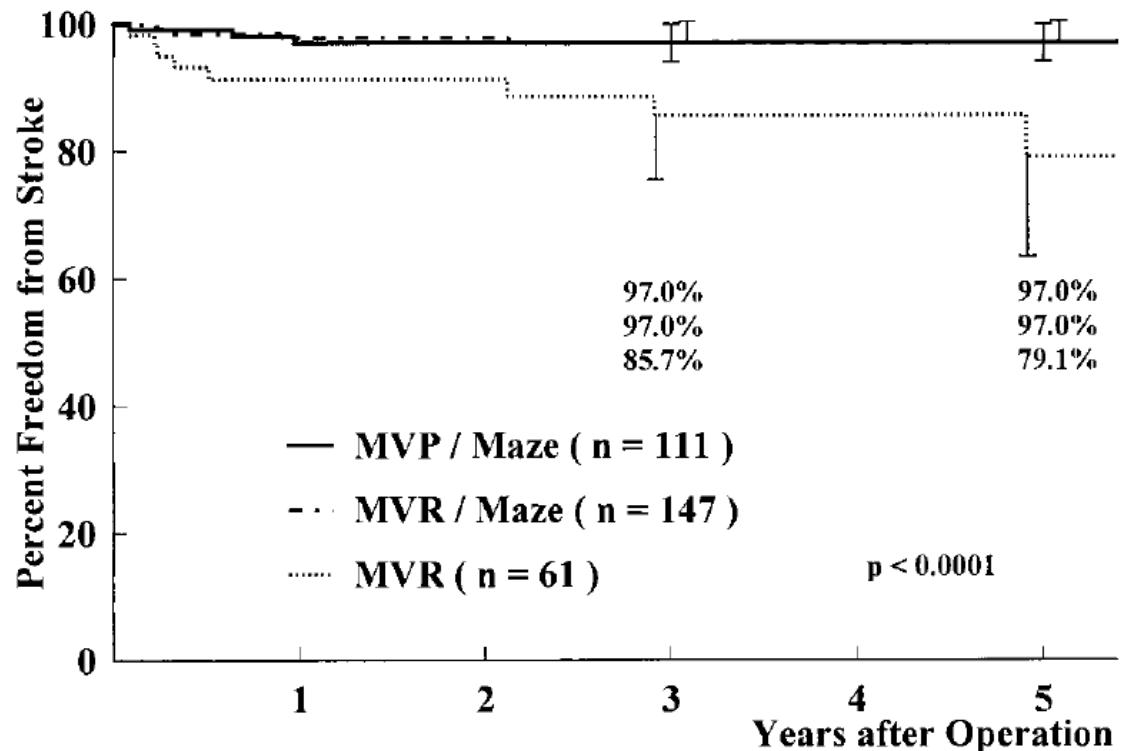
**Objective:** Since the late 1980s, surgical ablation of atrial fibrillation (AF) has been one of the most effective means of curing this arrhythmia. However, about 20% of patients who underwent maze procedures have shown recurrence of AF during the follow-up periods. The aim of this study is to evaluate our result of maze procedures in last decade and to analyze the risk factors of maze failure. **Methods:** Between July 1997 and July 2007, 560 consecutive patients underwent maze procedures for AF by a single surgeon. Demographics showed that average age of the patients is 51.3 years, with a slight female predominance (M:F = 248:312). Most of the maze procedures had been performed in conjunction with mitral valve ( $n = 494$ , 88.6%), while only six cases (1.1%) were performed with isolated maze procedure. The maze failure was defined as showing any rhythm besides normal sinus rhythm at the last follow-up. Univariate and multivariate analysis for the risk factors of maze failure were identified. The survival impact of maze failure was also evaluated. **Results:** The in-hospital mortality (1.6%) was acceptable. During the 29.7 months of median follow-up period, the late mortality rate was 3.8% and permanent pacemaker insertion was necessary in 2.3% ( $n = 13$ ) of the patients. The success rate of maze was 84.1% (471/560) and effective left atrial contraction was identified in 97.2% (458/471) of these patients. In multivariate analysis, the size of left atrium larger than 60 mm, cardiothoracic ratio over 60%, fine AF wave in preoperative ECG, no early normal sinus restoration and simplified surgical ablation were found as an independent predictor of maze failure. Furthermore, the patients with successful maze showed better long-term survival rates. **Conclusions:** The results of our maze procedure during the last decade showed an acceptable success rate and the patients who were restored to sinus rhythm after maze procedures showed better long-term survival rates. For the patients who have independent biological risk factors, more thorough ablation lesion set is recommended for better long-term results.

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# Impact of Cox maze procedure on outcome in patients with atrial fibrillation and mitral valve disease

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 Yoshio Kosakai, MD<sup>b</sup>  
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 Toshikatsu Yagihara, MD<sup>a</sup>  
 Soichiro Kitamura, MD<sup>a</sup>

J Thorac Cardiovasc Surg 2002;124:575-83

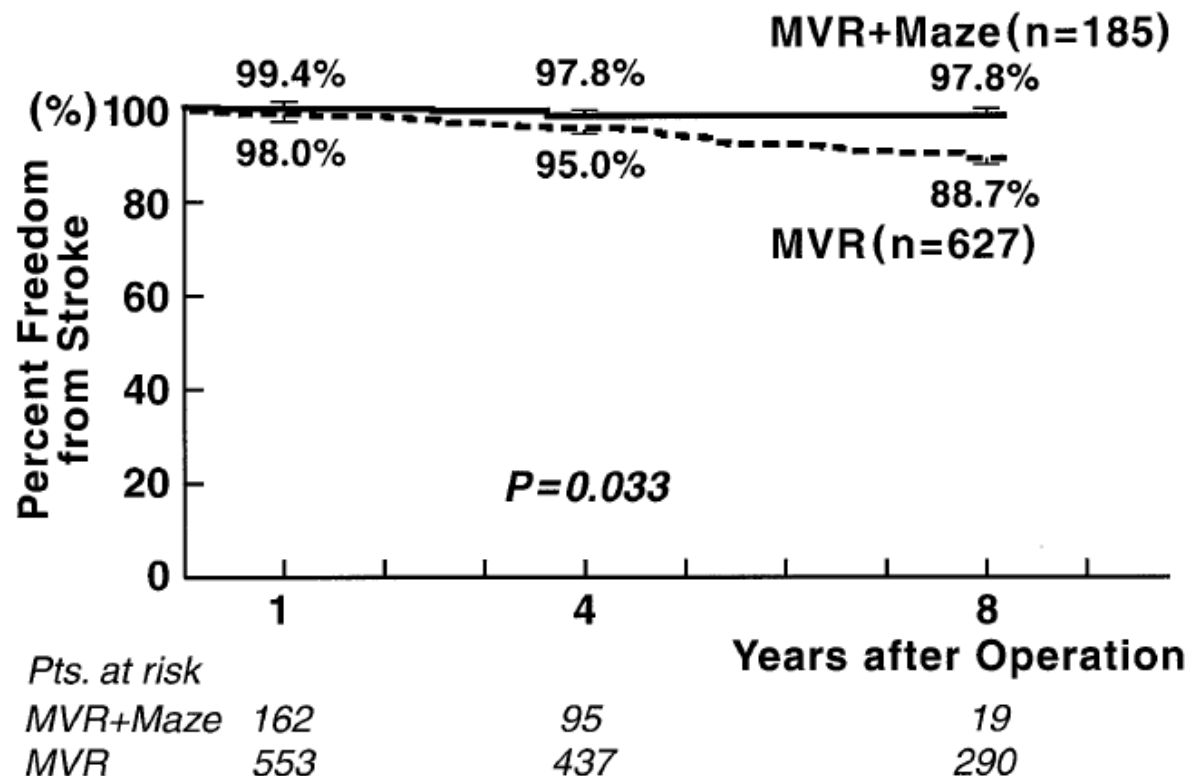


	0	1	2	3	4	5
Pts. at risk						
MVP+Maze	89	89	89	60	60	34
MVR+Maze	129	129	129	86	86	48
MVR	42	42	42	29	29	12

# Early and late stroke after mitral valve replacement with a mechanical prosthesis: Risk factor analysis of a 24-year experience

J Thorac Cardiovasc Surg 2003;126:358-64

Ko Bando, MD<sup>a</sup>  
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 Toshikatsu Yagihara, MD<sup>a</sup>  
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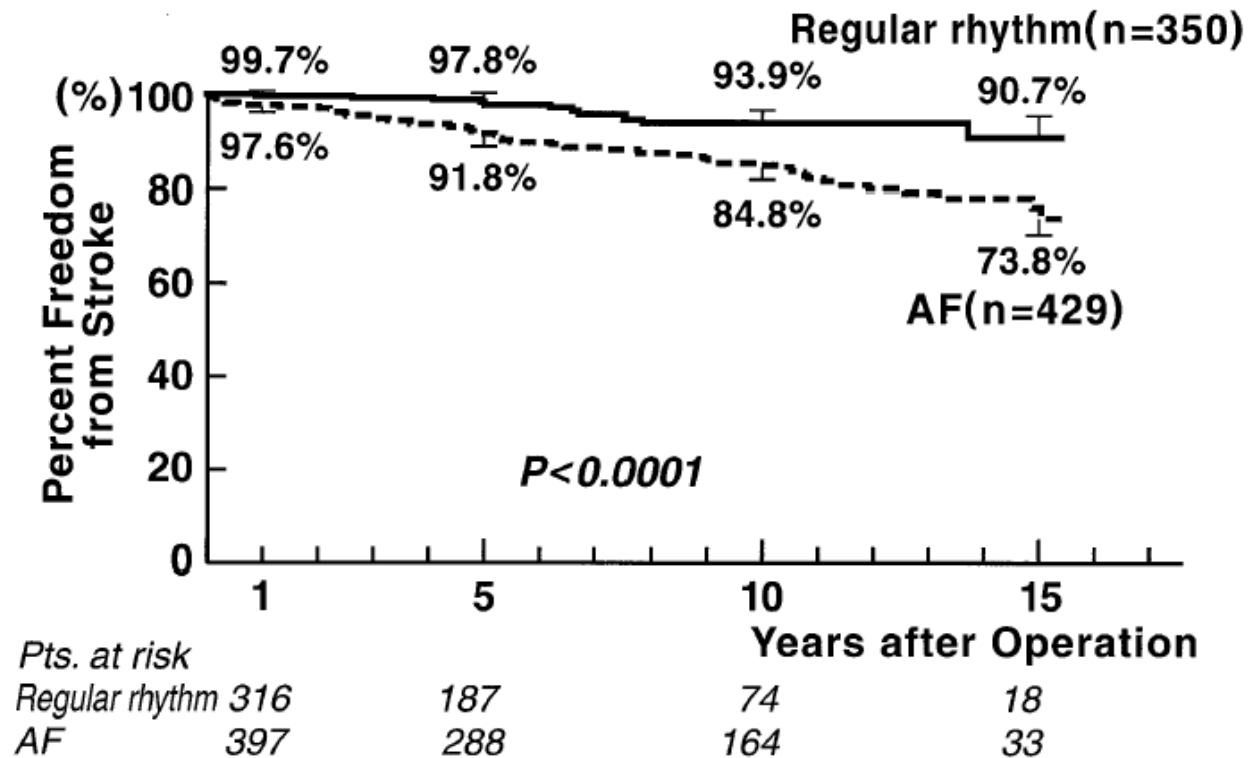




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Preoperative Left Ventricular  
dysfunction ?

# Left Ventricular Dysfunction in Atrial Fibrillation: Restoration of Sinus Rhythm by the Cox-Maze Procedure Significantly Improves Systolic Function and Functional Status

John M. Stulak, MD, Joseph A. Dearani, MD, Richard C. Daly, MD, Kenton J. Zehr, MD, Thoralf M. Sundt III, MD, and Hartzell V. Schaff, MD

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

Ann Thorac Surg 2006;82:494–501

Type of AF	Preoperative	Early Postoperative	Late Follow-up	<i>p</i> Value
Chronic (n = 23)	0.426 ± 0.031	0.548 ± 0.027 <sup>a</sup>	0.554 ± 0.028 <sup>b</sup>	0.00007 <sup>a</sup> 0.00006 <sup>b</sup>
Paroxysmal (n = 14)	0.46 ± 0.029	0.531 ± 0.073	0.507 ± 0.029	0.2
Total	0.439 ± 0.024	0.537 ± 0.029 <sup>a</sup>	0.535 ± 0.029 <sup>b</sup>	0.00006 <sup>a</sup>

Study	Patients (n)	Procedure	Preoperative	Postoperative	<i>p</i> Value
Kieny et al [34]	12	Cardioversion	0.32 ± 0.05	0.53 ± 0.10	<0.001
Van Gelder et al [35]	8	Cardioversion	0.36 ± 0.13	0.53 ± 0.08	<0.05
Twidale et al [36]	14	AV ablation/pacer	0.42 ± 0.03	0.47 ± 0.04	<0.05
<b>Current study</b>					
All patients	37	Cox/maze	0.46 ± 0.10	0.53 ± 0.03	<0.001
0.36–0.50 EF	8	Cox/maze	0.44 ± 0.02	0.53 ± 0.10	<0.05
≤ 0.35 EF	11	Cox/maze	0.31 ± 0.04	0.53 ± 0.07	<0.05

Surgical Ablation for Atrial Fibrillation in Cardiac Surgery  
*A Consensus Statement of the International Society of Minimally  
 Invasive Cardiothoracic Surgery (ISMICS) 2009*

**TABLE 4. Summary Consensus Recommendations**

**Class of  
 Recommendation  
 and Level of  
 Evidence**

**ISMICS Consensus Recommendations**

In patients with persistent and permanent atrial fibrillation undergoing cardiac surgery, concomitant surgical ablation is recommended:

Class 1, level A

To increase incidence of sinus rhythm at short- and long-term follow-up

Class 2a; level A

To improve ejection fraction and exercise tolerance

Class 2a; level B

To reduce the risk of stroke and thromboembolic events and to improve long-term survival

## Guidelines for the management of atrial fibrillation

### The Task Force for the Management of Atrial Fibrillation of the European Society of Cardiology (ESC)

Developed with the special contribution of the European Heart Rhythm Association (EHRA)<sup>†</sup>

Endorsed by the European Association for Cardio-Thoracic Surgery (EACTS)

### Recommendations for surgical ablation of AF

Recommendations	Class <sup>a</sup>	Level <sup>b</sup>	Ref. <sup>c</sup>
Surgical ablation of AF should be considered in patients with symptomatic AF undergoing cardiac surgery.	IIa	A	139, 141, 142
Surgical ablation of AF may be performed in patients with asymptomatic AF undergoing cardiac surgery if feasible with minimal risk.	IIb	C	
Minimally invasive surgical ablation of AF without concomitant cardiac surgery is feasible and may be performed in patients with symptomatic AF after failure of catheter ablation.	IIb	C	

# Do we increase the operative risk by adding the Cox Maze III procedure to aortic valve replacement and coronary artery bypass surgery?

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

**Objective:** Recent reports from Europe and the United States have suggested that patients presenting for open surgery with a significant history of atrial fibrillation (AF) have inferior early and late outcomes if AF is left untreated. On the other hand, there is reluctance among surgeons to treat AF surgically, especially when atriotomies may be required otherwise, which is the case with aortic valve replacement (AVR) or coronary artery bypass grafting (CABG). The objective of this study was to explore the potential impact of the addition of the Cox Maze III procedure on short- and long-term outcomes of patients when combined with AVR or CABG.

**Methods:** Since 2005, 485 patients have undergone the Cox Maze III procedure at Inova Heart and Vascular Institute, 95 of whom had a full Cox Maze III with an AVR or CABG (Cox Maze III/AVR = 30; Cox Maze III/CABG = 47; Cox Maze III/AVR/CABG = 18). In addition, 4255 patients with no history of AF underwent AVR or CABG without surgical ablation (AVR = 422; CABG = 3518; AVR/CABG = 315). Data from our CABG, valve, and AF registries were used for analyses. Patients with and without the Cox Maze III were propensity score matched using a 0.10 caliper to improve balance on clinical and demographic variables. Differences in perioperative and postoperative outcomes by group were evaluated using the Fisher exact test, and a Kaplan–Meier survival analysis was completed. Health-related quality of life (Short Form 12) was obtained at baseline and 6 months post-surgery (n = 72).

**Results:** All 95 patients who underwent the Cox Maze III were propensity score matched with patients who did not undergo the Cox Maze III. Mean age ( $t = 0.3$ ,  $P = .79$ ) and European System for Cardiac Operative Risk Evaluation score ( $t = -1.8$ ,  $P = .07$ ) were similar between the groups. There were no significant differences in major postoperative morbidities between the groups despite the Cox Maze III group being on bypass longer (164.4 vs 108.8 minutes;  $t = -9.8$ ,  $P < .001$ ). Pacemaker implantation was significantly higher in the Cox Maze III group ( $P = .03$ ). Survival during follow-up (mean = 35 months) was not different between patients who did and did not undergo the Cox Maze III procedure (log rank = 0.49,  $P = .48$ ). Improvement in physical health-related quality of life was similar for both groups ( $F = 0.01$ ,  $P = .94$ ). At 1 year, 94% of the patients (60/64) who underwent the Cox Maze III procedure were in sinus rhythm (81% off class I and III antiarrhythmic drugs).

**Conclusions:** The addition of the Cox Maze III procedure to AVR or CABG did not convey an increase in major morbidity and perioperative risk. Patients who underwent the Cox Maze III procedure demonstrated similar survival over time with improvement in health-related quality of life. The Cox Maze III should not be denied to patients in whom the cardiac surgical procedure does not include atriotomies because of the perceived increased operative risk. The Cox Maze III may significantly improve their outcome. (J Thorac Cardiovasc Surg 2012;143:936-44)

# **Cox Maze in concomitant heart surgery:**

- Improves mortality rates
- Lowers risk for stroke
- Improves atrial and LV function
- Improves health-related Quality of Life



**WHEN**



# Are there any limits for Cox Maze surgery?

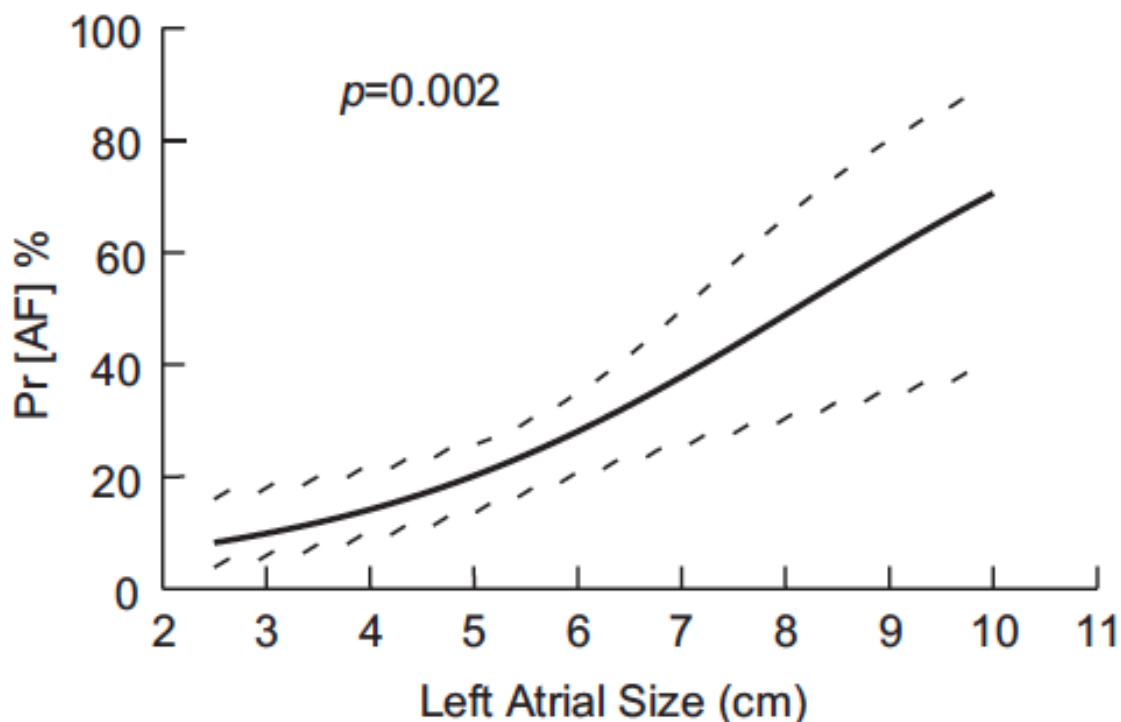
## Predictors of recurrence

- LA size
- Age of patient
- Duration AF
- Lower EF
- High creatinine levels

### The Cox maze IV procedure: Predictors of late recurrence

Ralph J. Damiano, Jr., Forrest H. Schwartz, Marci S. Bailey, Hersh S. Maniar, Nabil A. Munfakh, Marc R. Moon and Richard B. Schuessler

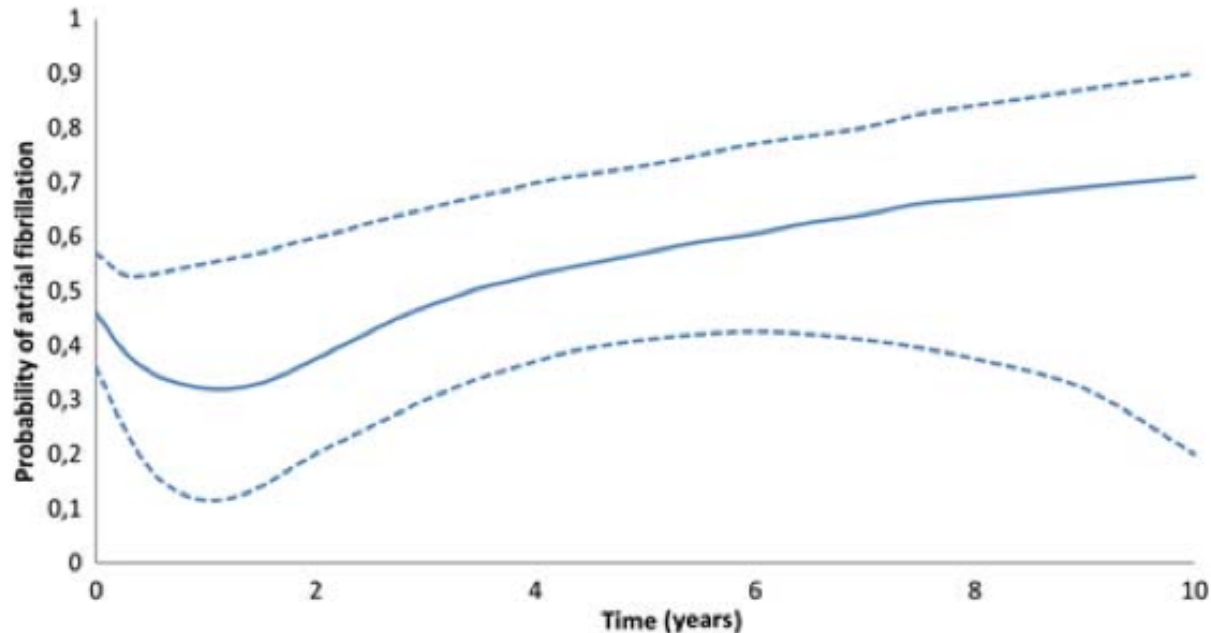
*J Thorac Cardiovasc Surg* 2011;141:113-121




**FIGURE 3.** Relationship between left atrial size and probability of atrial fibrillation (*Pr [AF]*) recurrence.

## Results of clinical application of the modified maze procedure as concomitant surgery

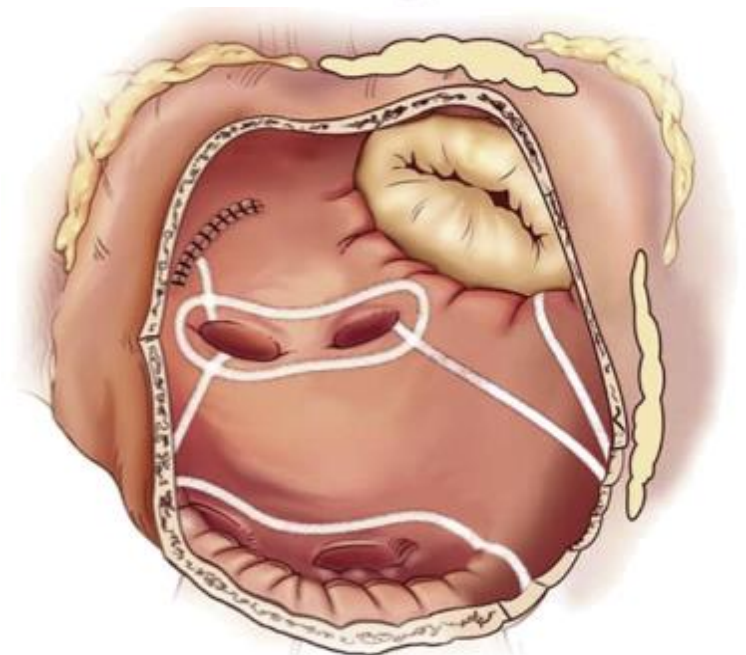
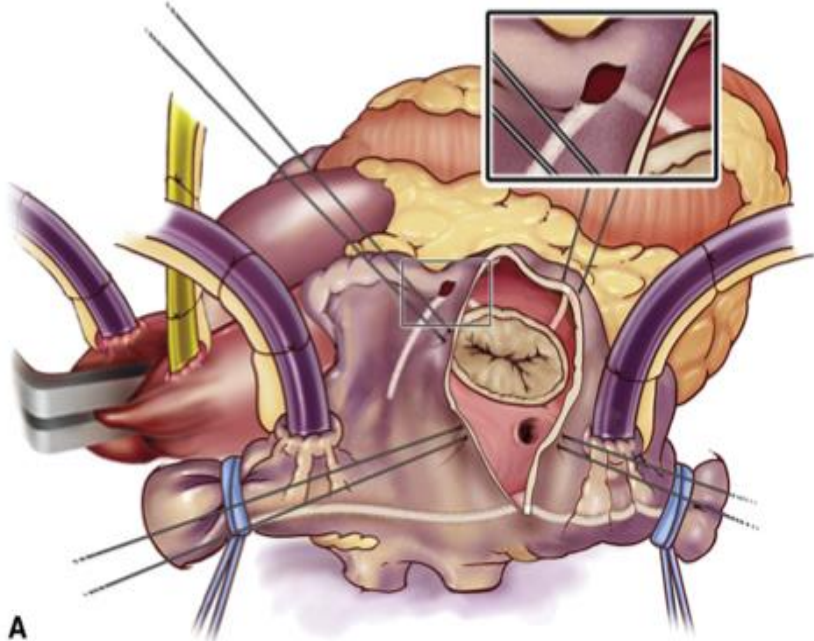
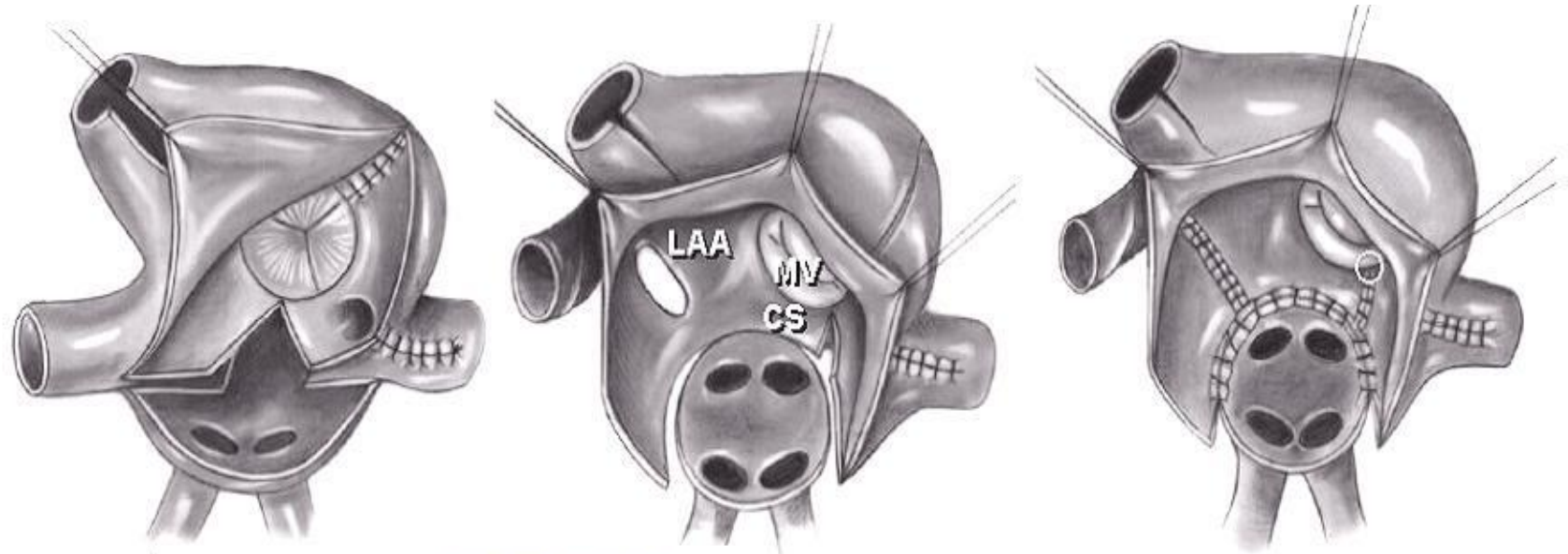
Robbert C. Bakker<sup>a</sup>, Sakir Akin<sup>b</sup>, Dimitris Rizopoulos<sup>c</sup>, Charles Kik<sup>a,\*</sup>, Johanna J.M. Takkenberg<sup>a</sup> and Ad J.J.C. Bogers<sup>a</sup>



**Figure 2:** Probability of AF over time (years) after surgery. Adjusted to age 62, mitral valve repair, male, long-standing AF, radiofrequency ablation, without diabetes mellitus and hyperlipidaemia, preoperative creatinine 91 mmol/l, good left ventricular function and bi-atrial ablation. The dashed lines denote 95% pointwise confidence intervals.



**HOW**



A

# Atrial reduction plasty Cox maze procedure: extended indications for atrial fibrillation surgery

Matthew A. Romano, David S. Bach, Francis D. Pagani, Richard L. Prager, G. Michael Deeb and Steven F. Bolling  
*Ann Thorac Surg* 2004;77:1282-1287

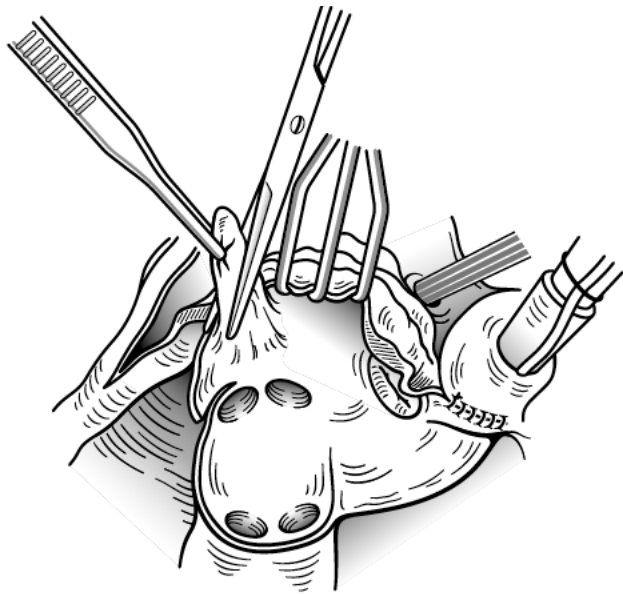


Fig 1. Inversion and excision of the left atrial appendage. The remaining left atrial appendage orifice is oversewn with 3-0 Prolene.

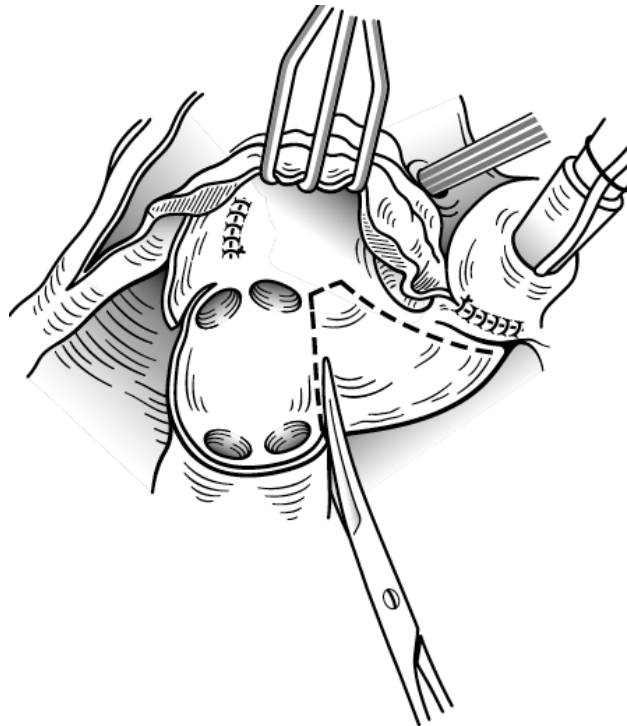


Fig 2. Left atrial reduction plasty. The left atrial posterior wall is excised by making an incision that courses along the os of the inferior pulmonary veins and a parallel incision from right to left that closely follows the mitral annulus.

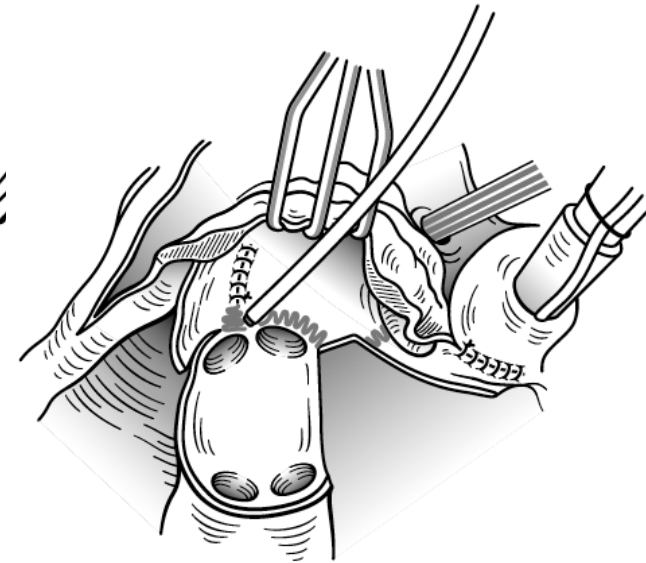
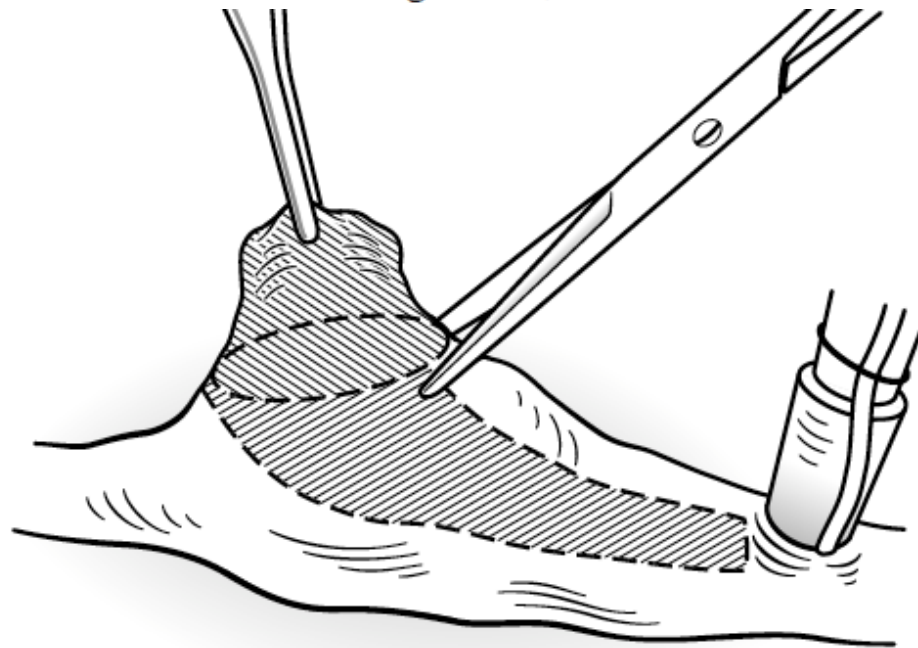


Fig 3. Endocardial ablation lesions are placed to complete the pulmonary vein isolation. A lesion is placed from the sewn orifice of the left atrial appendage to the left atriotomy incision.

## **Atrial reduction plasty Cox maze procedure: extended indications for atrial fibrillation surgery**

Matthew A. Romano, David S. Bach, Francis D. Pagani, Richard L. Prager, G. Michael Deeb and Steven F. Bolling

*Ann Thorac Surg* 2004;77:1282-1287



*Fig 4. Right atrial reduction plasty. The right atrial appendage is excised. An incision is then made from the right atrial stump parallel to the right atrioventricular groove toward the inferior vena cava. A second parallel posterior longitudinal incision is made from below the inferior vena cava orifice to above the superior vena cava orifice.*

Barnett, S. D., & Ad. Surgical ablation as treatment for the elimination of atrial fibrillation: A meta-analysis.

J Thorac Cardiovasc Surg. 2006; 131, 1029–1035.

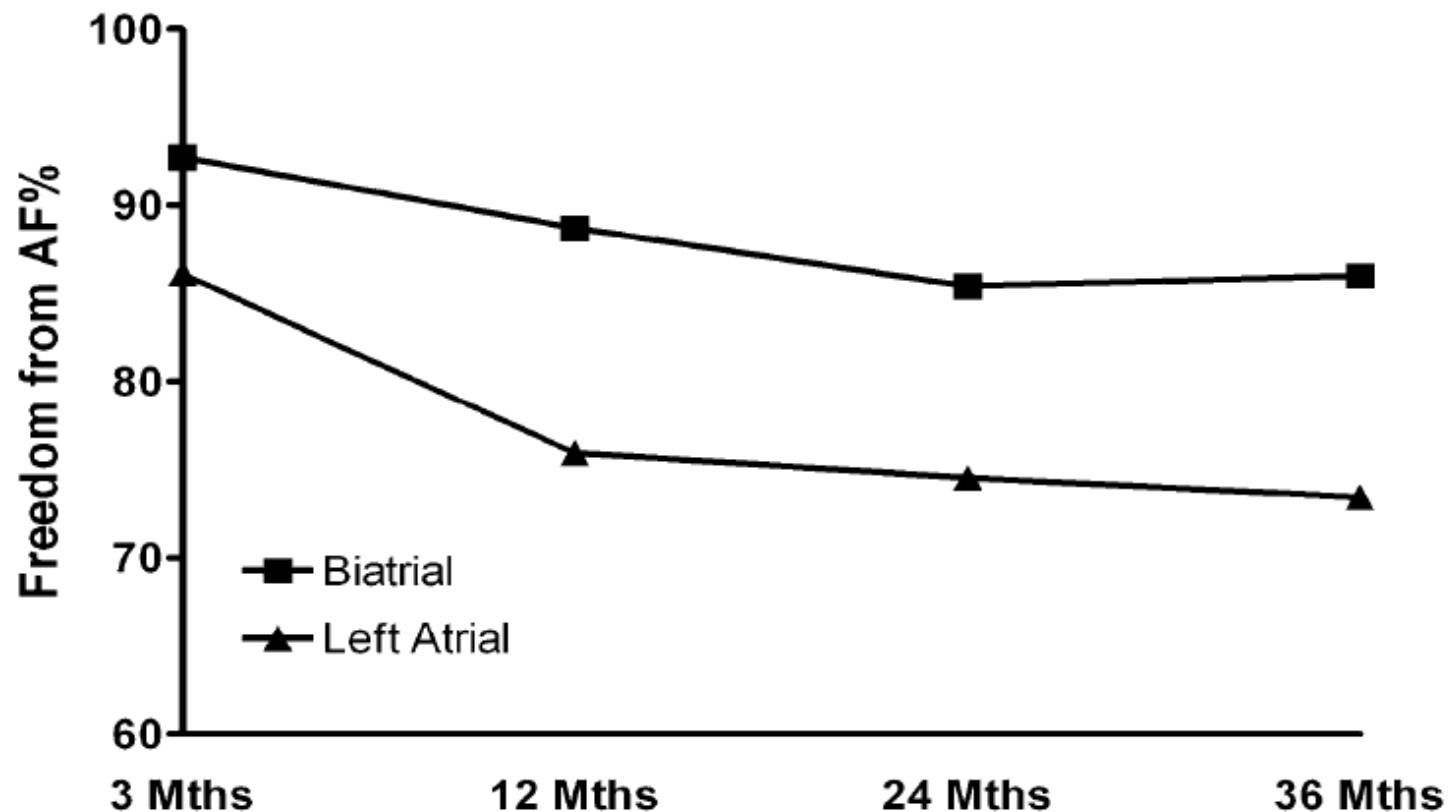


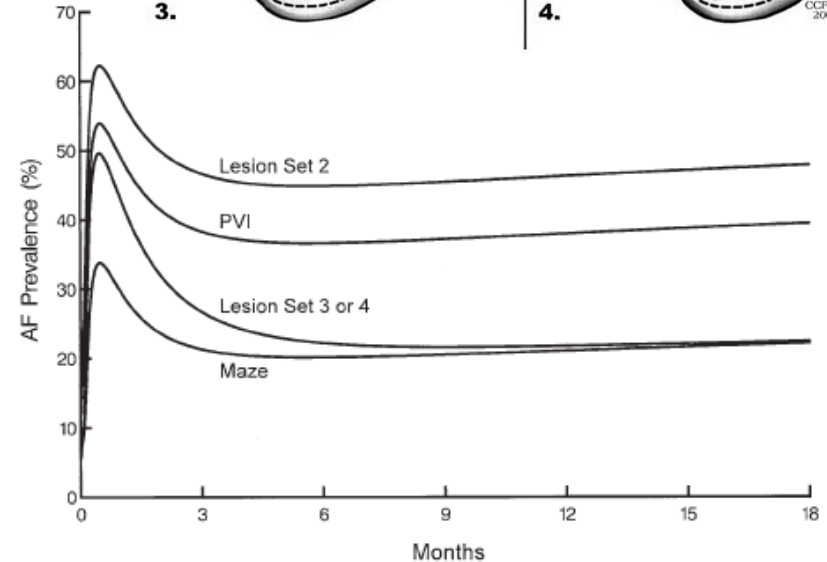
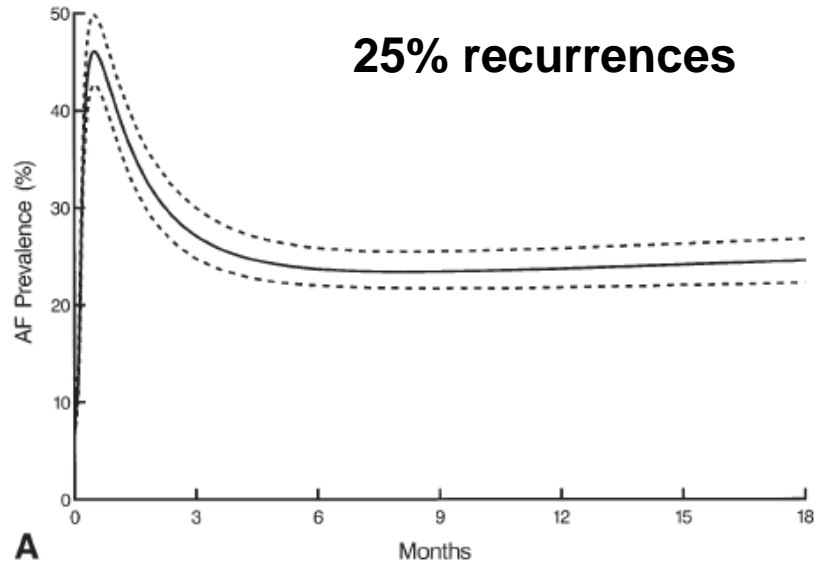
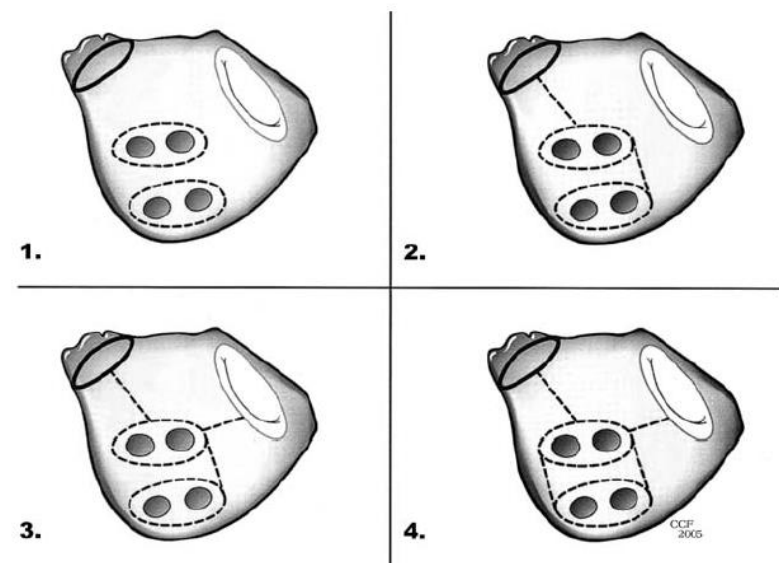
Fig. 2 Freedom from atrial fibrillation by lesions applied to the left atrium or to both right and left atria. *AF* atrial fibrillation, *Mths* months in follow-up [44]



# Surgery for Permanent Atrial Fibrillation: Impact of Patient Factors and Lesion Set

Ann Thorac Surg 2006;82:502-14

A. Marc Gillinov, MD, Sekar Bhavani, MD, Eugene H. Blackstone, MD, Jeevanantham Rajeswaran, MS, Lars G. Svensson, MD, PhD, Jose L. Navia, MD, B. Gösta Pettersson, MD, PhD, Joseph F. Sabik III, MD, Nicholas G. Smedira, MD, Tomislav Mihaljevic, MD, Patrick M. McCarthy, MD, Jeanne Shewchik, RN, and Andrea Natale, MD

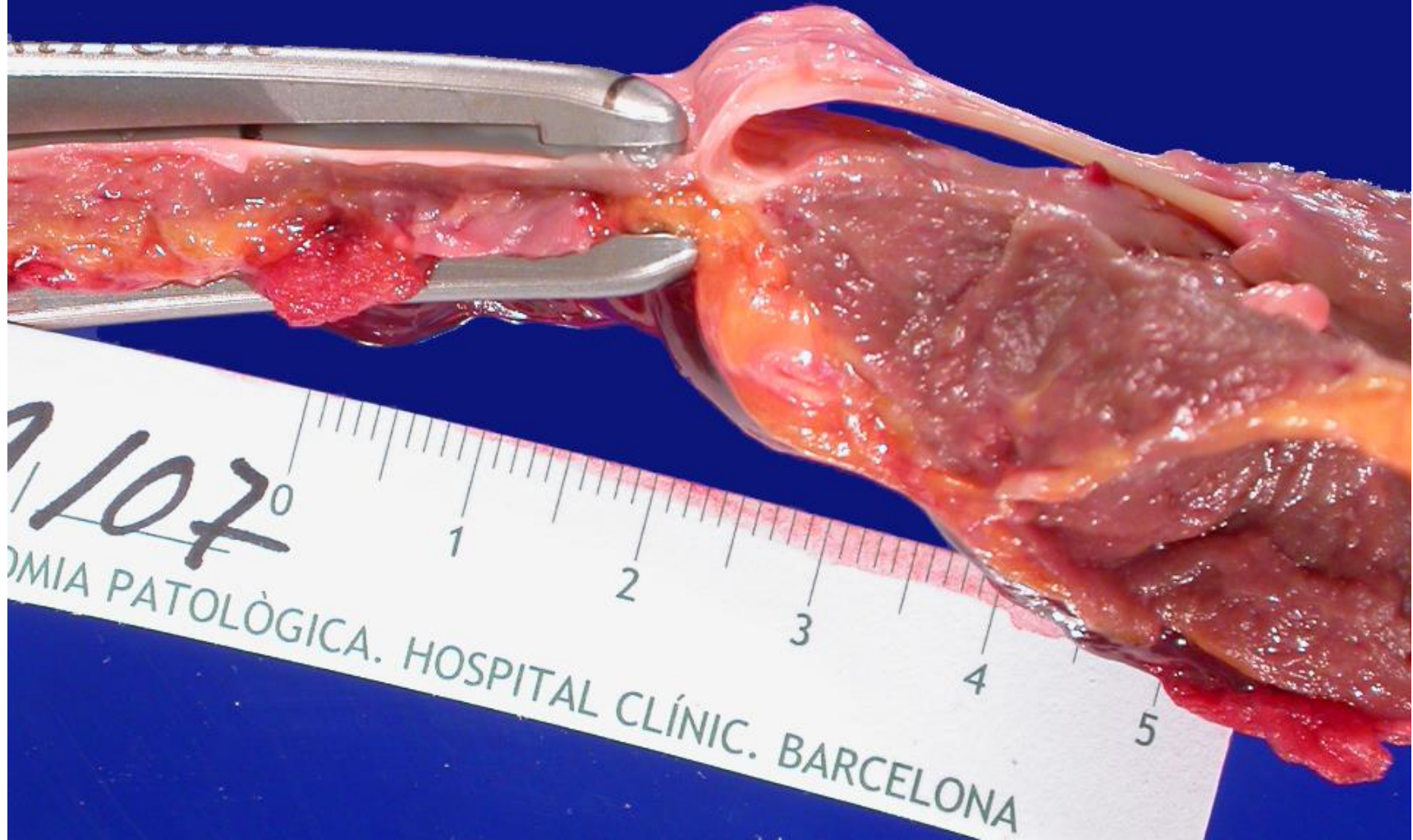


CCF 2005

# Anatomic aspects of the atrioventricular junction influencing radiofrequency Cox maze IV procedures

Manuel Castellá, MD, PhD,<sup>a,\*</sup> Antonio García-Valentín, MD,<sup>a</sup> Daniel Pereda, MD,<sup>a</sup> Andrea Colli, MD,<sup>a</sup>  
Antonio Martínez, MD,<sup>b</sup> Daniel Martínez, MD,<sup>b</sup> José Ramirez, MD,<sup>b</sup> and Jaime Mulet, MD, PhD<sup>a</sup>

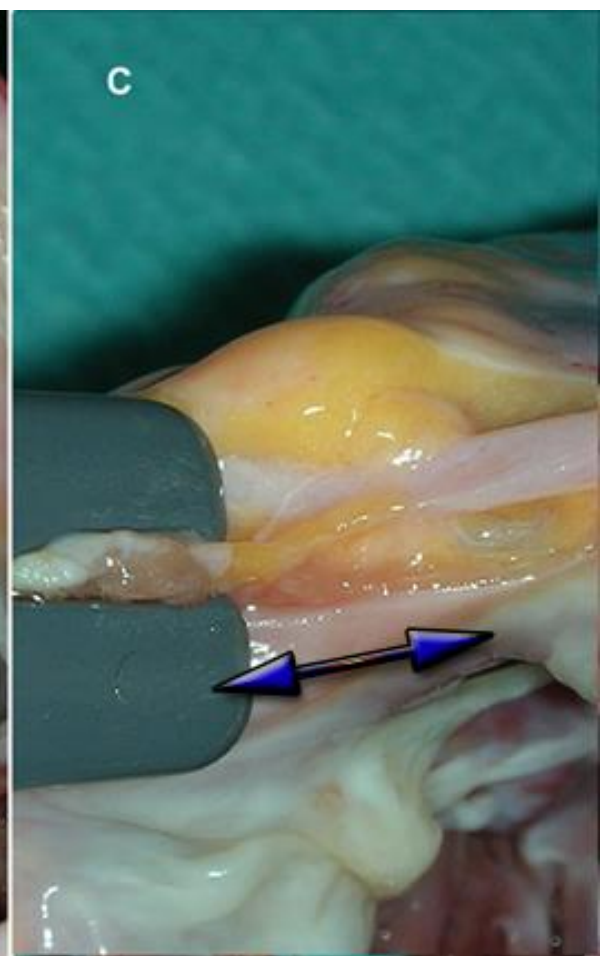
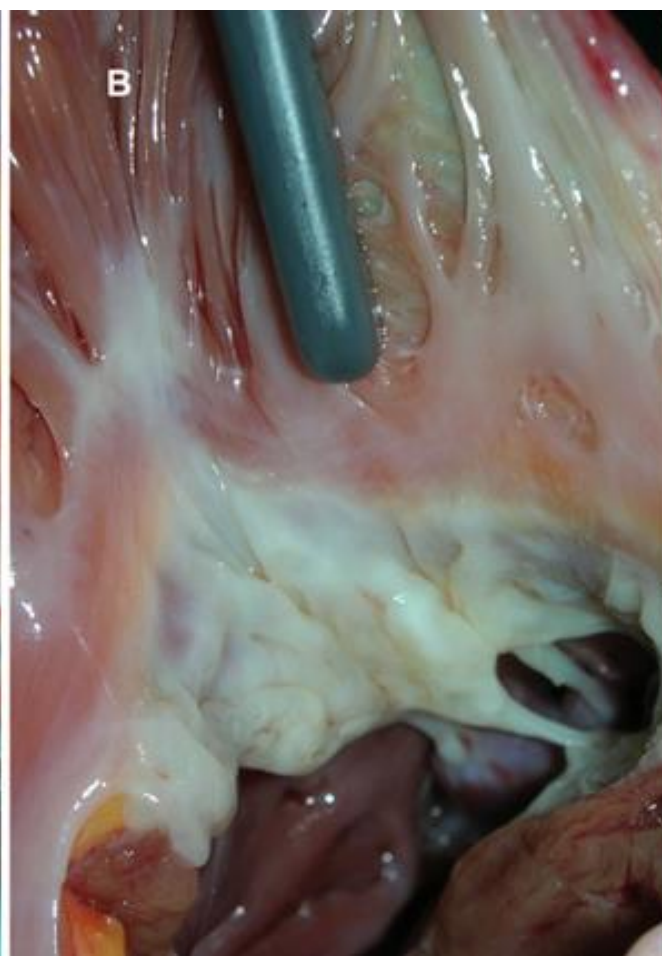
The Journal of Thoracic and Cardiovascular Surgery • Volume 136, Number 2 419

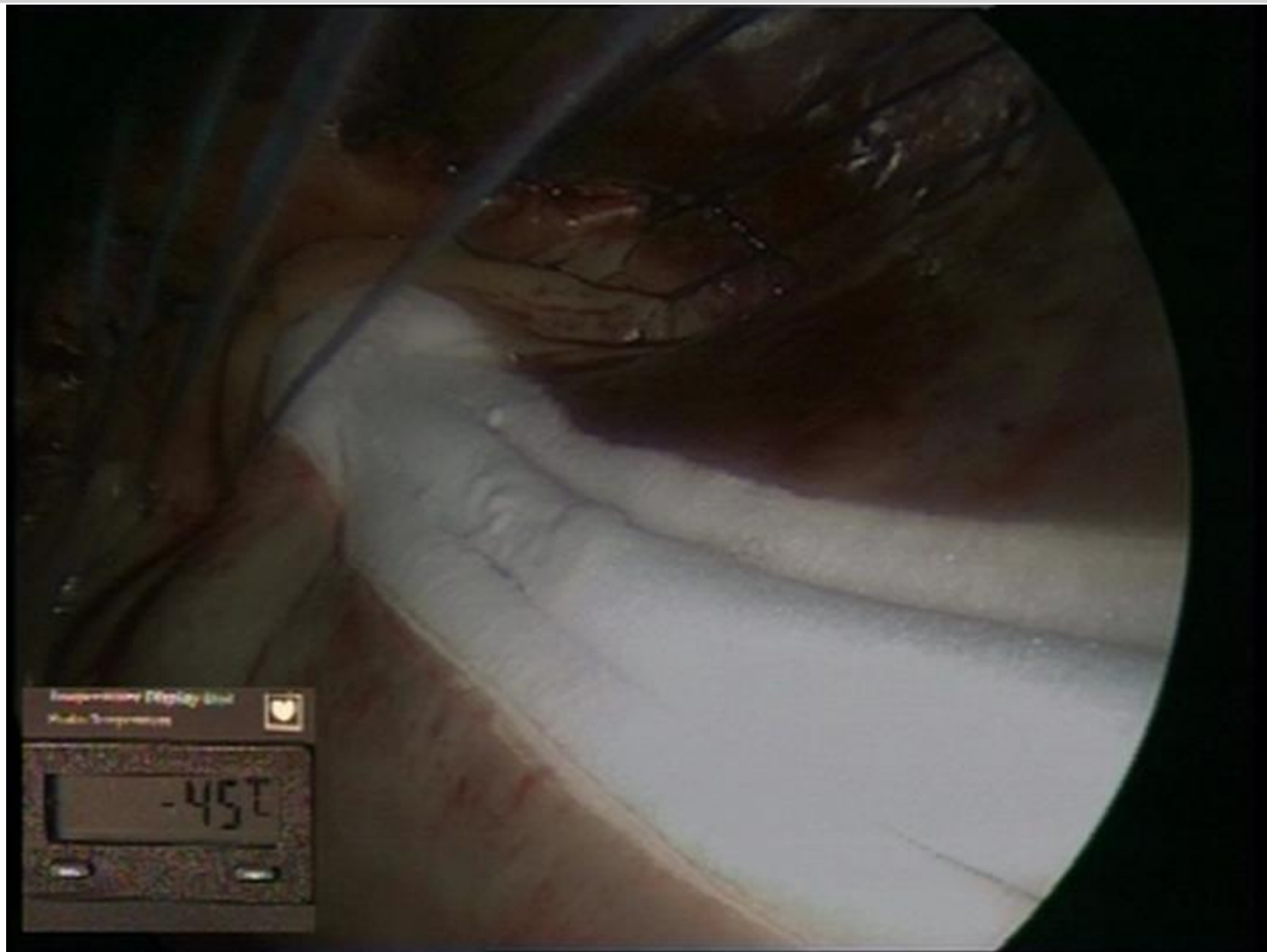


# Anatomic aspects of the atrioventricular junction influencing radiofrequency Cox maze IV procedures

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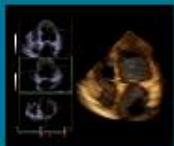
**The Journal of Thoracic and Cardiovascular Surgery • Volume 136, Number 2 419**





# Summary

- WHY: Surgical AF treatment reduce mortality, risk of stroke, improve atrial and LV function and health-related quality of life
- WHEN: Patient selection and limitation of the procedure depending of predictors of recurrences
- HOW:
  - Pulmonary vein isolation in paroxysmal, complete Cox Maze in persistent, long-standing AF
  - Importance of reaching the mitral and tricuspid annulus
  - Bipolar radiofrequency or cryotherapy



# EuroValve

