Surgical AF Treatment: Surgical Trials

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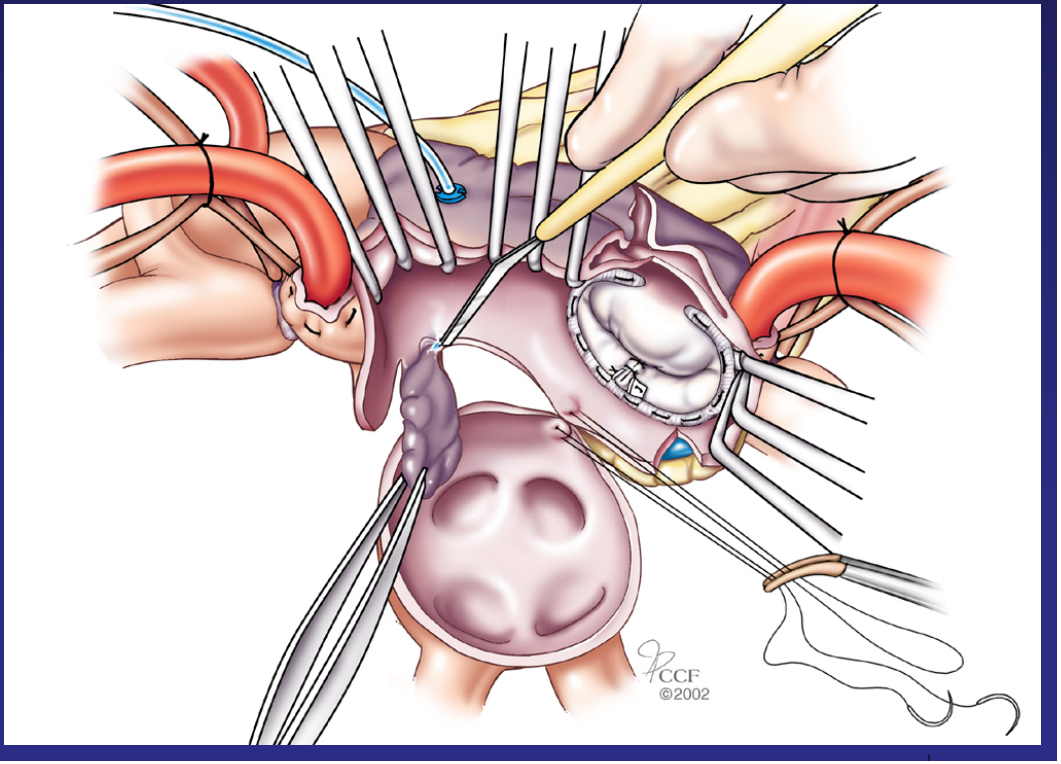
Chair: STS/AATS New Technology
Chair: STS AF Writing Committee

Consultant: Medtronic
Advisory Board: Medical CV
Boston Scientific

- Brief History
- Prior Randomized Trials
- Stand Alone AF Trials

Cox Maze Procedure

- Pulmonary Vein "Box" Lesion
- MV Annulus to Box Lesion
- SVC-IVC
- TV Annulus flutter lines X2
- Excision of LAA



The Cox maze III procedure for atrial fibrillation: Long-term efficacy in patients undergoing lone versus concomitant procedures

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Cindy J. Camillo, RN
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John P. Boineau, MD
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James L. Cox, MD
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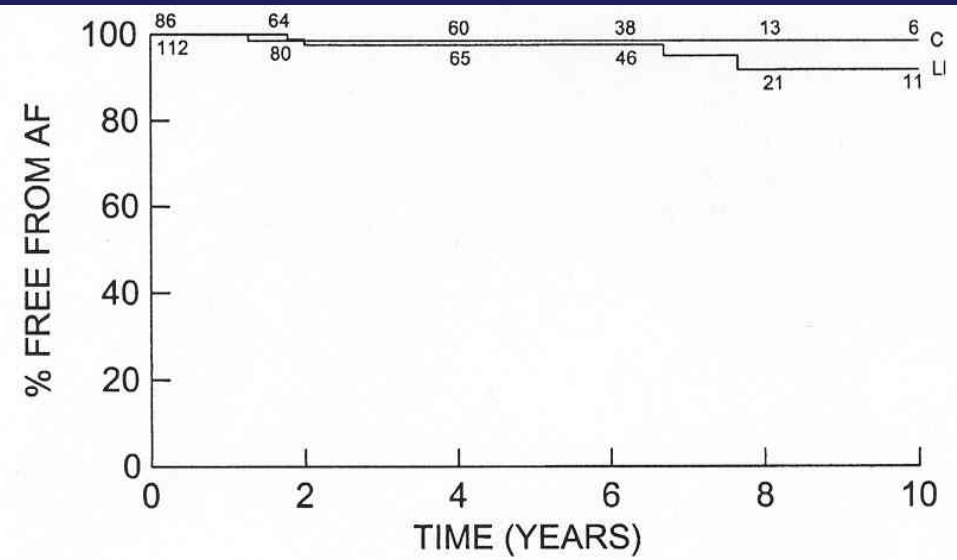
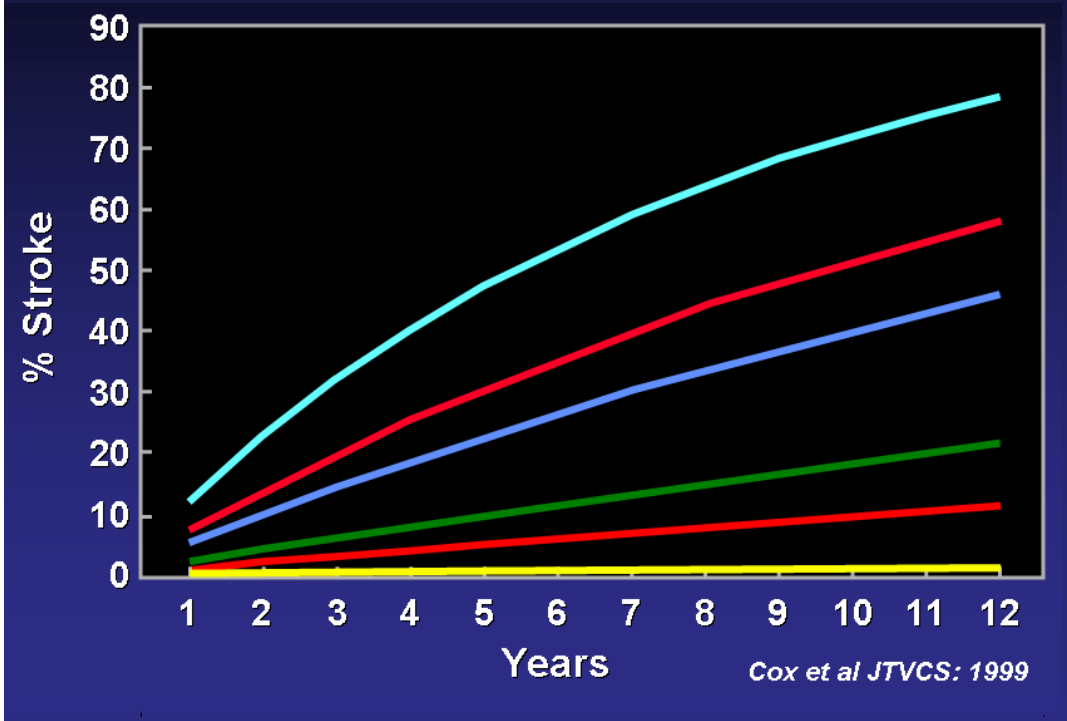
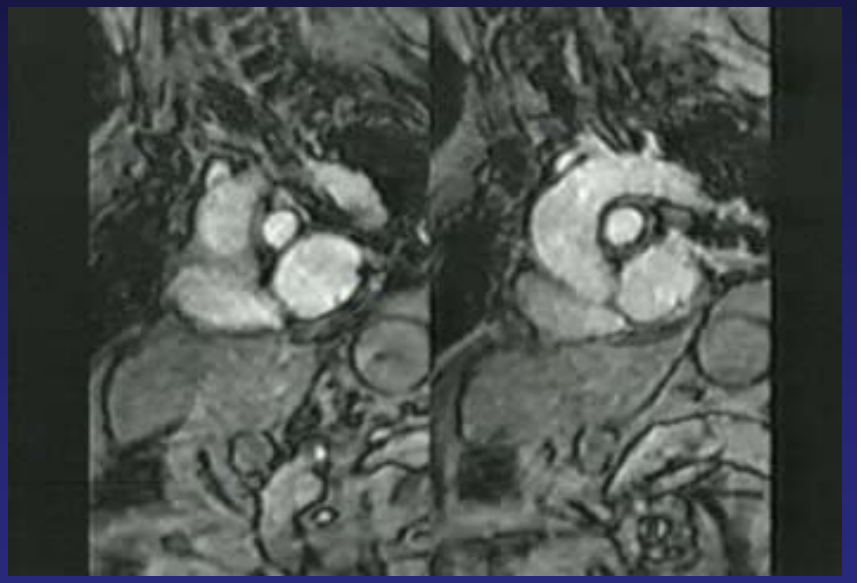


Figure 1. Kaplan-Meier survival analysis of freedom from recurrent AF. The numbers on each line indicate the number of patients at risk. There was no difference in the long-term estimate of freedom from AF between the lone maze group *(L)* and the concomitant group (*C*; $P = .64$).

J Thorac and Cardiovasc Surg 2005;126:1822-27

Stroke Reduction



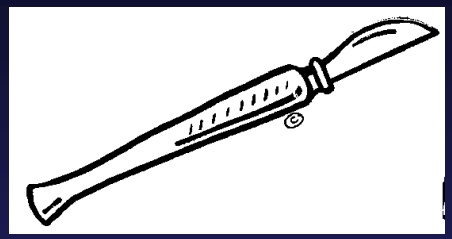
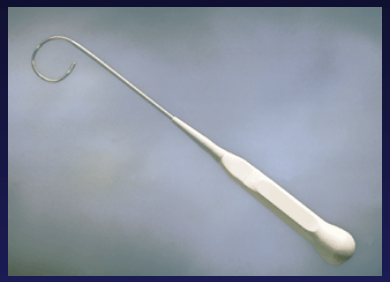
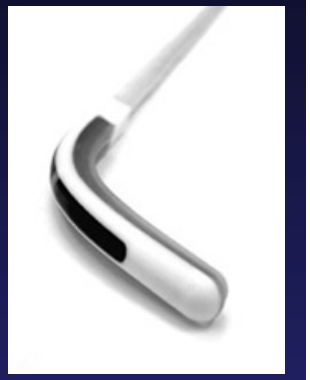


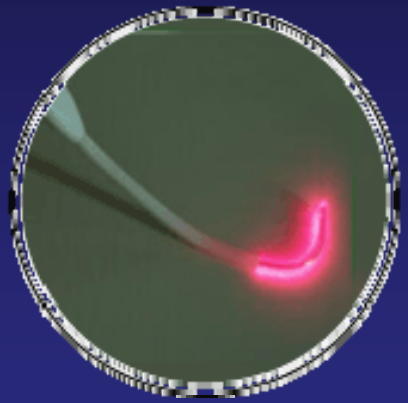
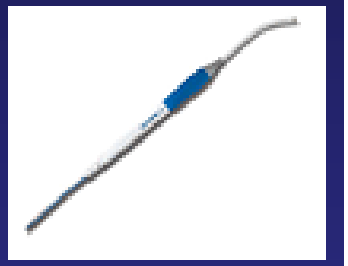
Cox-Maze Summary

- Symptomatic AF Rare (about 5%)
- CVA Risk Very Low (1 % at 10 years)
- Atrial Transport Difficult to Quantify (60-90%)
- Effective With Large LA; Low EF (TCM); Structural Heart Disease
- But, Too Complex (US: 100 pts / year)

“Technologies” for Ablation

- Cut and Sew
- Cryoablation
- Unipolar RF
- Bipolar RF
- Microwave
- HIFU
- Laser

Two FDA Trials for RF Ablation Devices Are On-going in MV Surgery Patients

Prospective Randomized Trials of Permanent AF Ablation with Mitral Valve Surgery

Trials, Year	Number of Pts	Technology	Control 12 Month * NSR	Treated 12 Month NSR
Deneke et al., 2002	30	Unipolar Cooled RF	26.7%	80% ($p < 0.01$)
Schuetz et al., 2003	43	Microwave	33.3%	80% ($p = 0.036$)
Akpinar et al., 2003	67	Unipolar RF	9.4%	93.6% ($p = 0.0001$)
Abreu Filho et al., 2005	70	Unipolar Cooled RF	26.9%	79.4% ($p = 0.001$)
Doukas et al., 2005	101	Unipolar RF	4.5%	44.4% ($p = 0.001$)

5 RCT Permanent AF/MVR

- All $p < 0.001$ in favor of NSR if AF treated
- No Peri-op AF Treatment Complications
- None powered or followed for late survival
- Heterogenous NSR rates (44-94%)

HRS / STS Guidelines

"It is advisable that all pts with documented AF referred for other cardiac surgeries undergo a left or biatrial procedure for AF at an experienced center, unless it…will add significant risk…"

Stand Alone AF Therapy and Trials

STS Data '04 – '06

- 67,389 pts: 11.47% had pre-op AF
- Ablation: 28.1% '04 to 40.2% in '06
- 52% of MVR; 24% of CAB 28% AVR
- "Stand–Alone" N = 1184

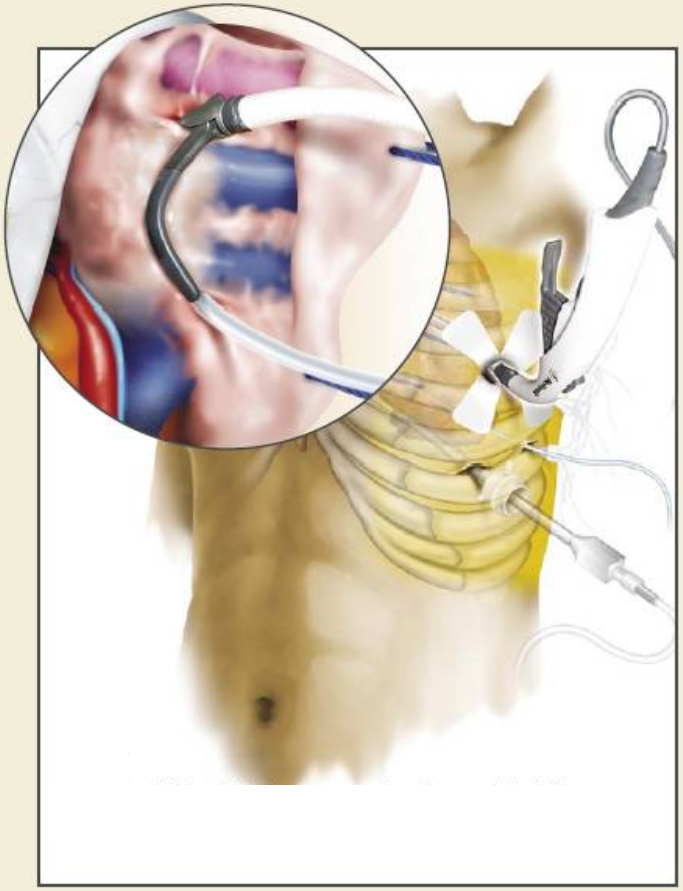
"After adjusting for differences in preoperative characteristics, mitral valve surgery patients with a surgical AF correction procedure did not have a significantly higher risk of mortality (adjusted OR 1.00, CI 0.83-1.20) or major morbidity."

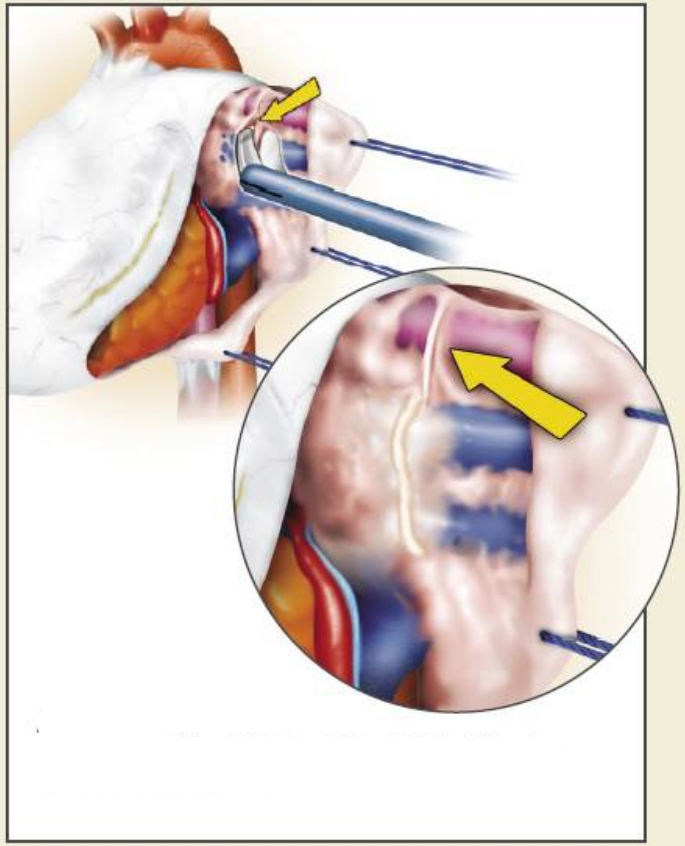
Gammie JS, Haddad M, Milford-Beland S, et al. Trends in the utilization and risk of atrial fibrillation correction surgery in patients undergoing cardiac surgery. Analysis of 67,389 cases from the Society of Thoracic Surgeons National Cardiac Database. *Submitted for publication 2007.*

Stand Alone Therapy Goals

- "Off-Pump" Mini-invasive Approach
- Epicardial Ablation
- High Effectiveness and Safety
- CVA Reduction
- Possible LAA Closure?
- Possible GP Ablation?
- Hybrid Approach with Catheter Ablation?

Bilateral Mini-Thoracotomy





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Right Thoracotomy Port AccessAblation

What Should The FDA Expect From Stand Alone AF Surgical Trials?

Technology (Labeling) Issue

If A Device is Approved For AF Concomitant Ablation Will it Be Approved For Stand Alone Surgery?

Similar To Catheter Ablation Trials

- Multi-Center Outcome Trials
- Industry-Sponsored Device Approval
- STS and Other Registries

Similar to Catheter Ablation Trials

- Endpoints: Primary and Secondary
- QOL Studies
- Monitoring for AF
- Standardized Reporting of Outcomes
- AE and SAE Definitions

Differences from Catheter Ablation

- LA Appendage Management
- Ganglionic Plexus Ablation?
- Epicardial Ablation and Transmurality
- Hybrid? Mapping and MV,TV Line
- Procedure Risks

Patient Inclusion Criteria

- Symptomatic AF
- Failed Catheter Ablation
- Not Candidates for Catheter Ablation

Summary

- AF Surgery has a long history
- New Technologies have led to expanded use
- Experience in Stand-alone operations is still early
- Trials will leverage technology proven in concomitant cases
- Data collection/reporting will be standardized

Case 1

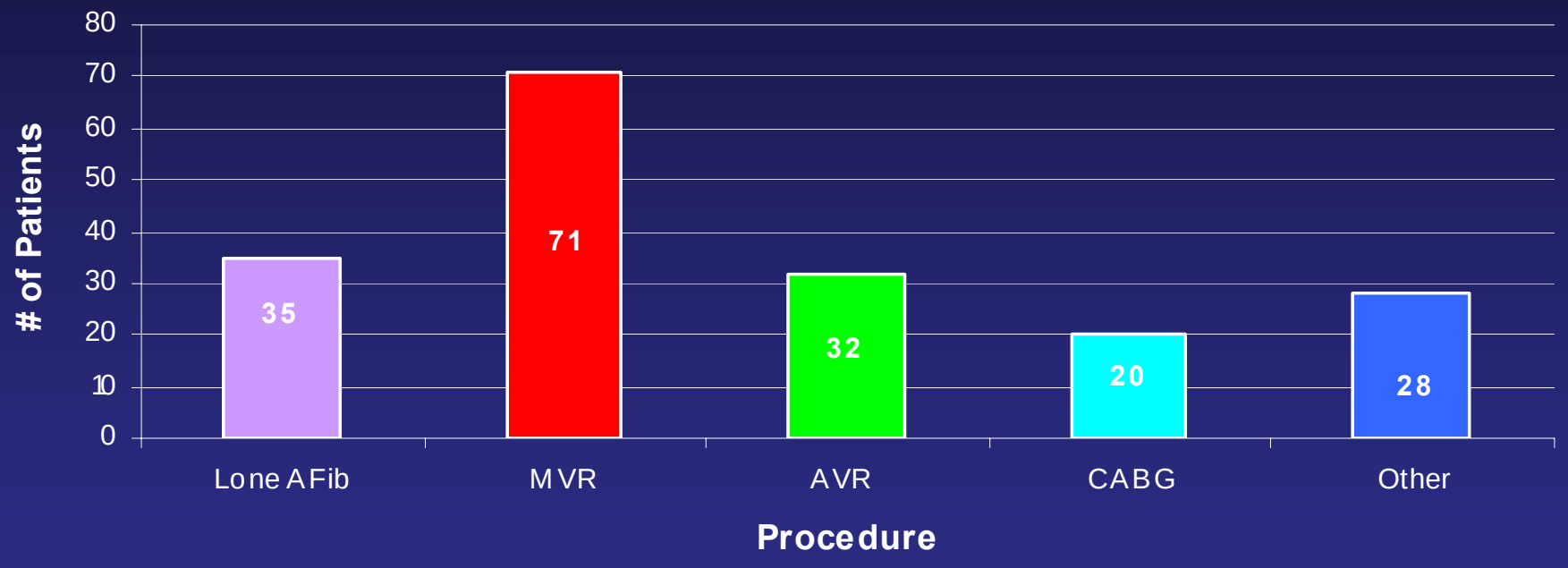
- 68 yo woman Starr-Edwards MV ’79; AF Since ’79; CVA ’95; mild residual: Now FC III CHF
- 1 – 2+ MR/ mild MS; LA 6.5 cm
- Severe AS; 2+ AI
- 3+ TR
- LVEF 55%

Options:

- 1) AVR; TVA only
- 2) AVR; MVR; TVA; Maze (AF ablation)
- 3) AVR minimally invasive
- 4) Percutaneous AVR

NMH AF Surgery *(Apr '04 - Jun '06)*

86% of AF Patients were Treated

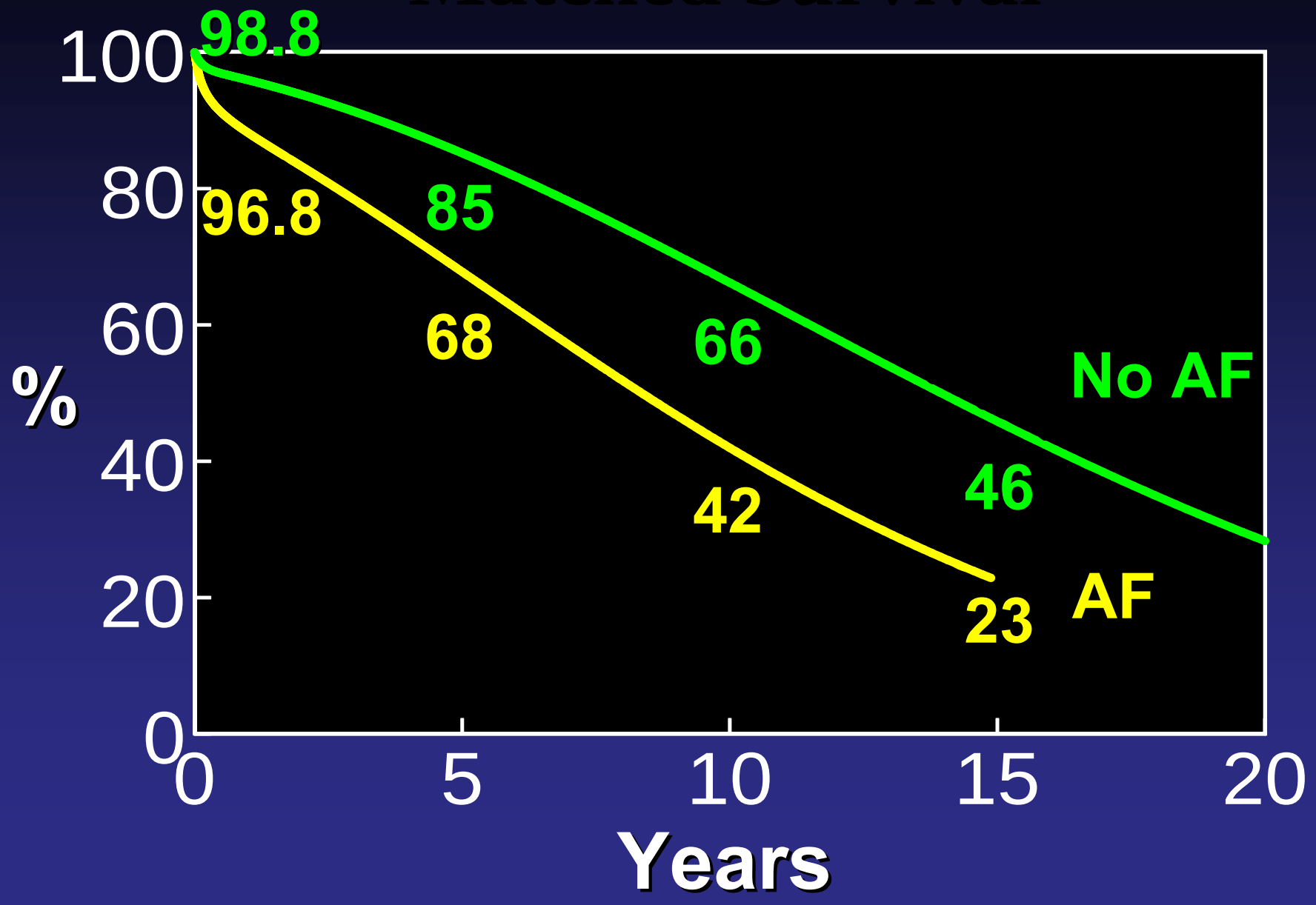


Does Preoperative Atrial Fibrillation Reduce Long-Term Survival After Coronary Artery Bypass Grafting?

M. A. Quader, MD, Patrick M. McCarthy, MD, A. Marc Gillinov, MD, Joan M. Alster, MS, Delos M. Cosgrove III, MD, Bruce W. Lytle, MD, Eugene H. Blackstone, MD

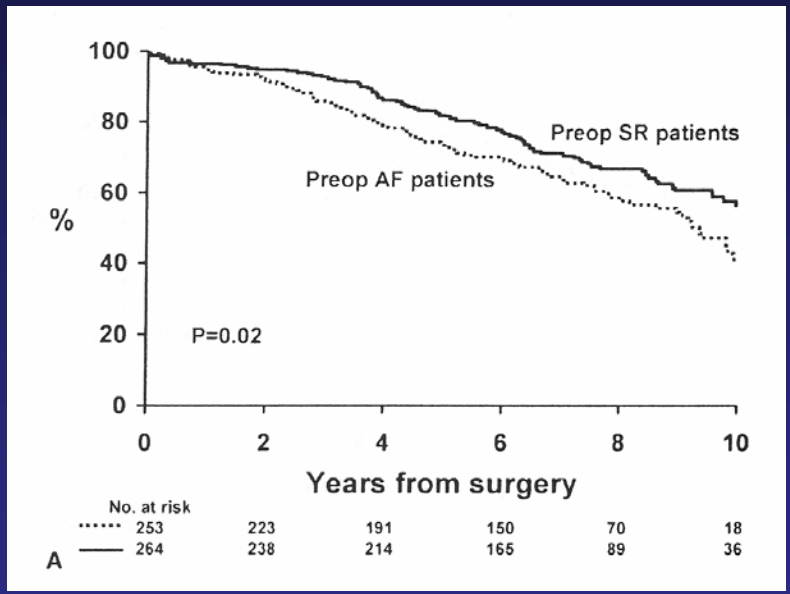
THE CLEVELAND CLINIC FOUNDATION

Matched Survival



Does preoperative atrial fibrillation influence early and late outcomes of coronary artery bypass grafting?

Dumbor L. Ngaage, MB, BS,[a] Hartzell V. Schaff, MD,[a] Charles J. Mullany, MB, MS,[a] Thoralf M. Sundt III, MD,[a] Joseph A. Dearani, MD,[a] Sunni Barnes, PhD,[b] Richard C. Daly, MD,[a] and Thomas A. Orszulak, MD[a]



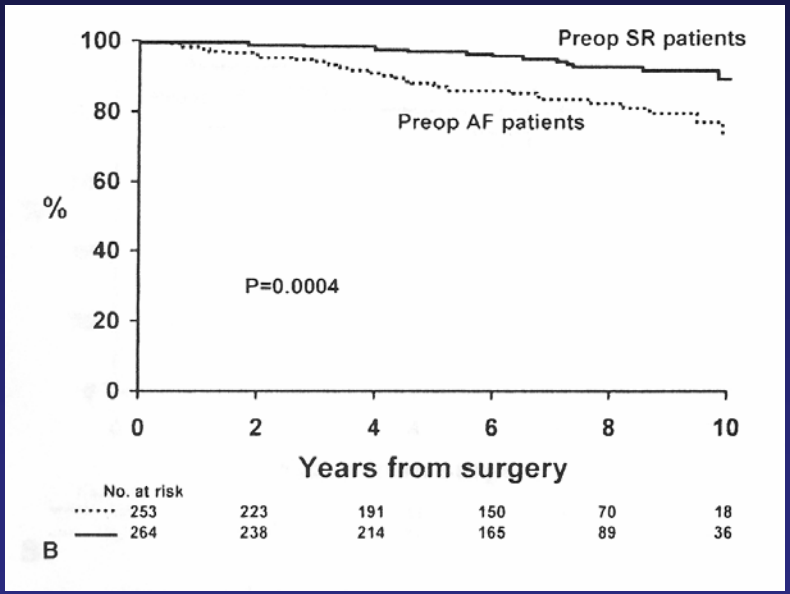


Figure 1. Kaplan–Meier survival curves for patients after CABG. A, Overall survival. B, Freedom from cardiac death. *AF*, Atrial fibrillation; *SR*, sinus rhythm.

J Thorac Cardiovasc Surg 2007;133:182-9

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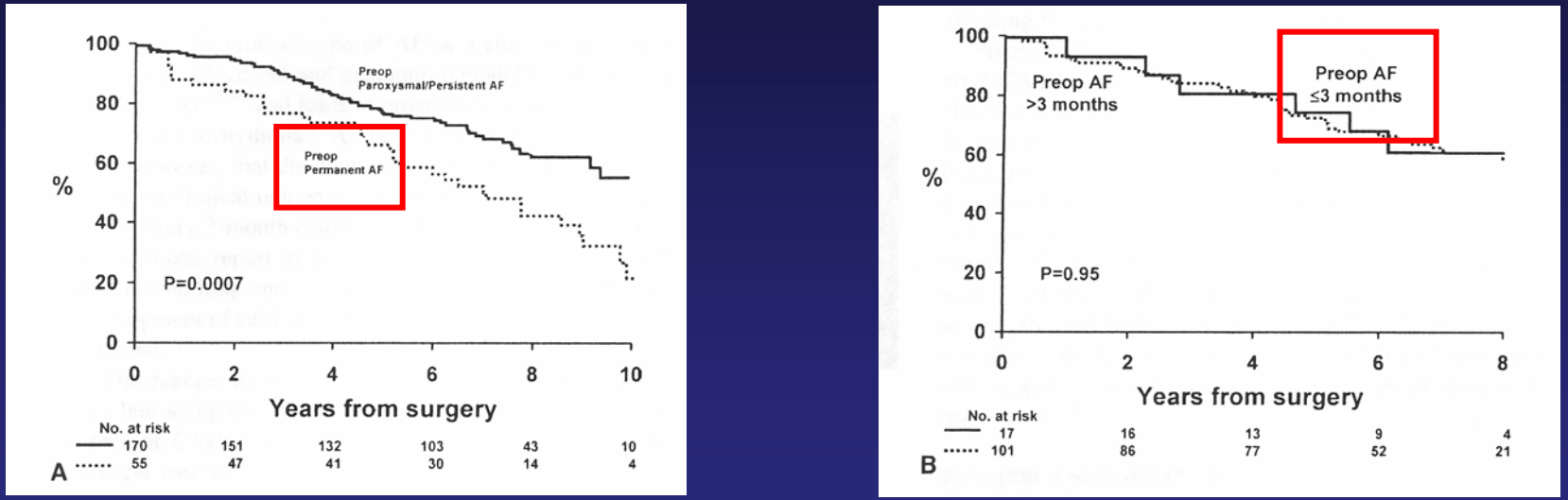

Figure 3. Kaplan–Meier survival curves for patients with different subclasses of preoperative AF after CABG. A, Survival of patients with the 2 patterns of AF. B, Comparison of survival on the basis of AF duration. *AF,* Atrial fibrillation.

J Thorac Cardiovasc Surg 2007;133:182-9

Does preoperative atrial fibrillation influence early and late outcomes of coronary artery bypass grafting?

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Results:

Risk of late mortality (all causes) in patients with atrial fibrillation was increased by 40% compared with patients in sinus rhythm ($P = 0.02$), and the late cardiac death rate in the atrial fibrillation group was 2.8 times that of the sinus rhythm group ($P = .0004$). Major adverse cardiac events occurred in 70% of patients with preoperative atrial fibrillation compared with 52% of patients in preoperative sinus rhythm ($P < .0001$).

J Thorac Cardiovasc Surg 2007;133:182-9

Prognostic Implications of Preoperative Atrial Fibrillation in Patients Undergoing Aortic Valve Replacement: Is There an Argument for Concomitant Arrhythmia Surgery?

Dumbor L. Ngaage, MD, Hartzell V. Schaff, MD, Sunni A Barnes, PhD, Thoralf M. Sundt III, MD, Charles J. Mullany, MB, Joseph A. Dearani, MD, Richard C. Daly, MD, and Thomas A. Orszulak, MD

Division of Cardiovascular Surgery and Department of Biostatistics, Mayo Medical Center, Rochester, Minnesota

Results:

They also had worse late survival (risk ratio [RR] for death =1.5, $p = 0.03$) with 1-, 5-, and 7-year survival rates substantially reduced at 94%, 87%, and 50%, respectively, for those in AF versus 98%, 90%, and 61% for patients in sinus rhythm preoperatively. Individuals in AF had a greater probability of subsequent rhythm-related intervention (RR = 4.7, $p = 0.0002$), and more frequently developed congestive heart failure (25% vs 10%, $p = 0.005$) and stroke (16% vs 5%, $p = 0.005$). By multivariable analysis, preoperative AF was an independent predictor of late adverse cardiac and cerebrovascular events, but not late death.

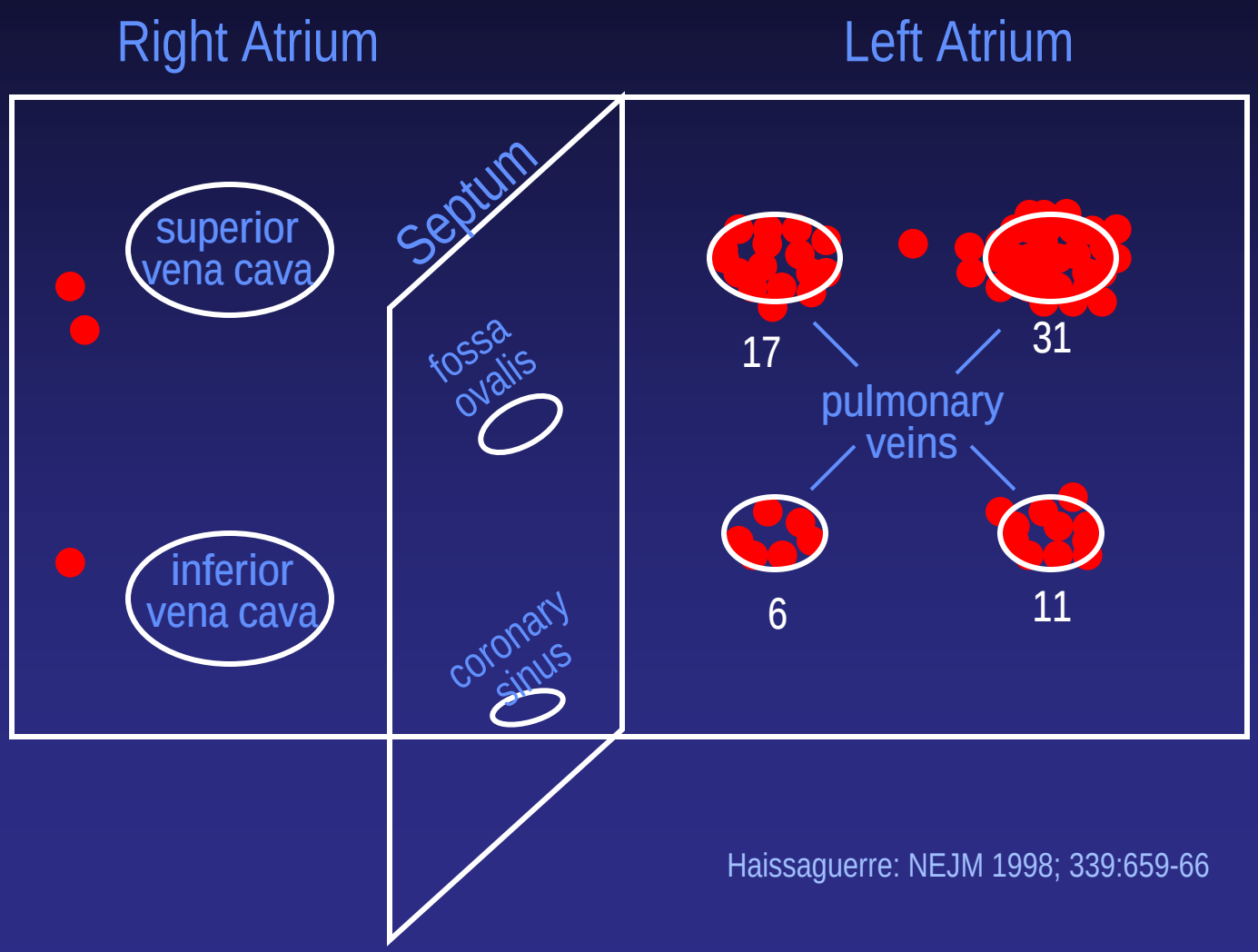
Ann Thorac Surg 2006;1392-9

Permanent Pre-op AFib CAUSES Increased

- Mortality
- MACE
- Stroke
- Rhythm Related Intervention

How?

Pulmonary Vein Triggers
Paroxysmal AF



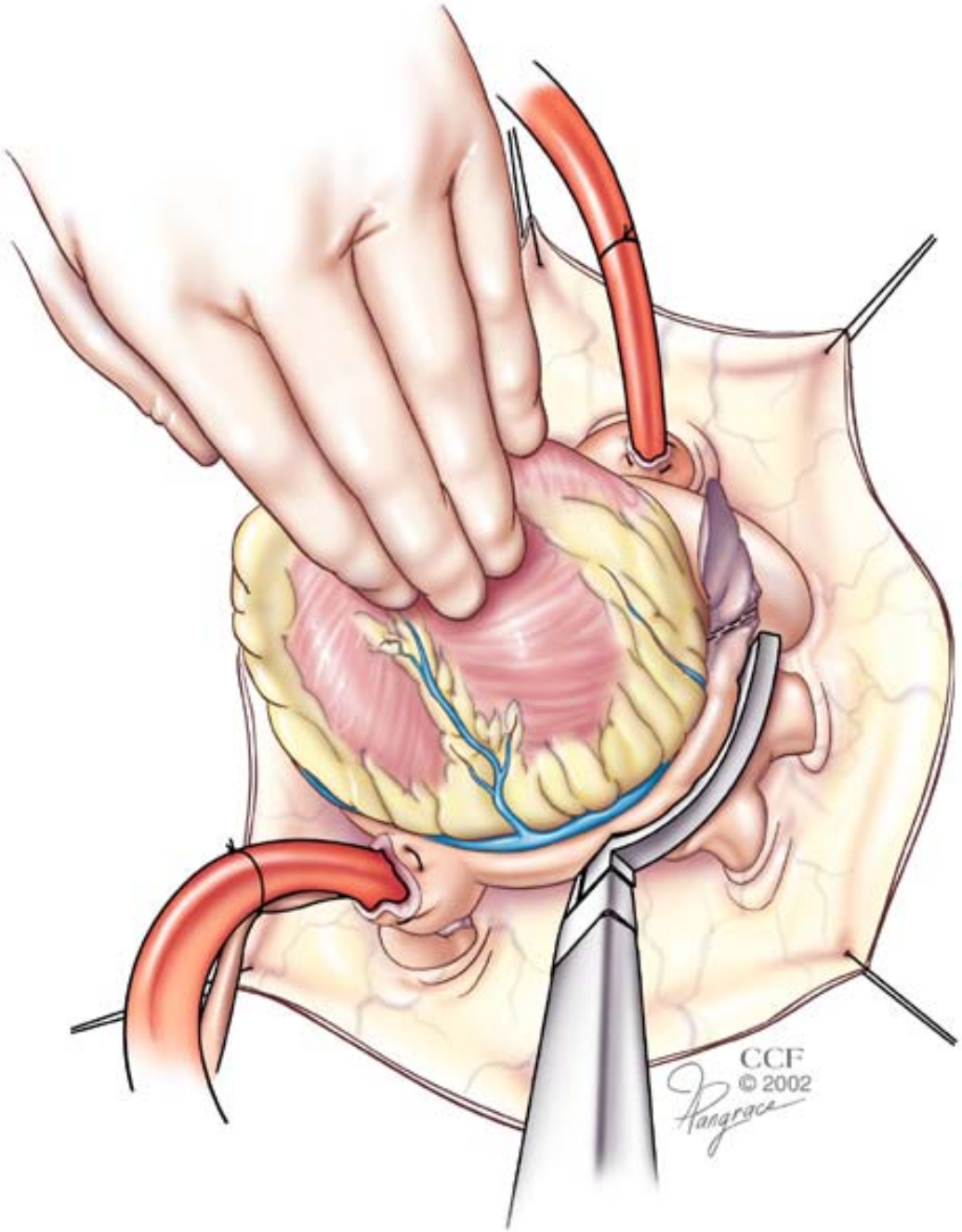
Haissaguerre: NEJM 1998; 339:659-66

Cut and Sew Maze Advantages

- Late Stroke Risk
- Reduce LA Size
- Remove LAA
- “All” Lesion Sets
- Transmural!
- Track Record

Pulm Vein Isolation:

PAF
Short Duration A Fib
“Wolf” Procedure
CAB, AVR, Aneurysm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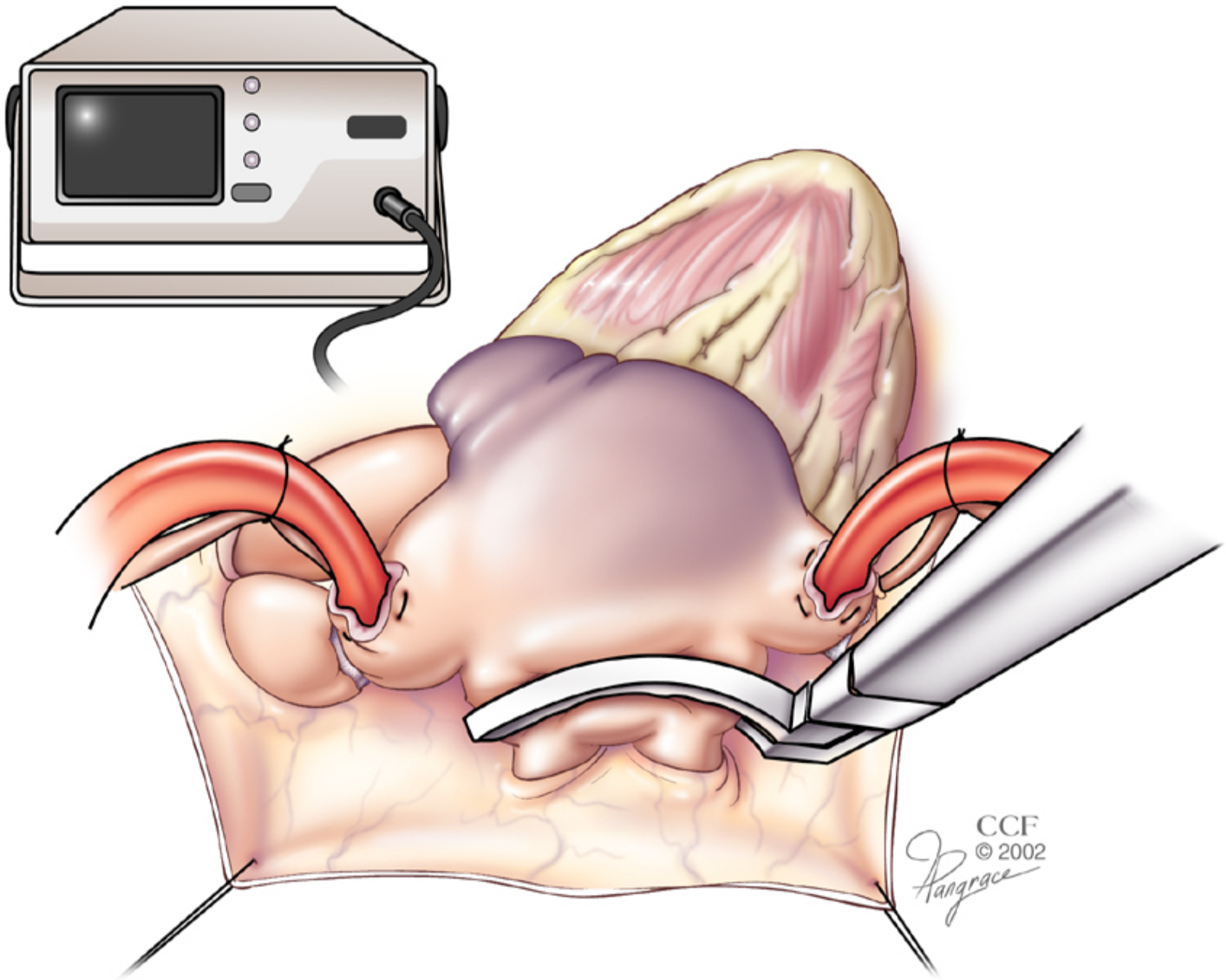
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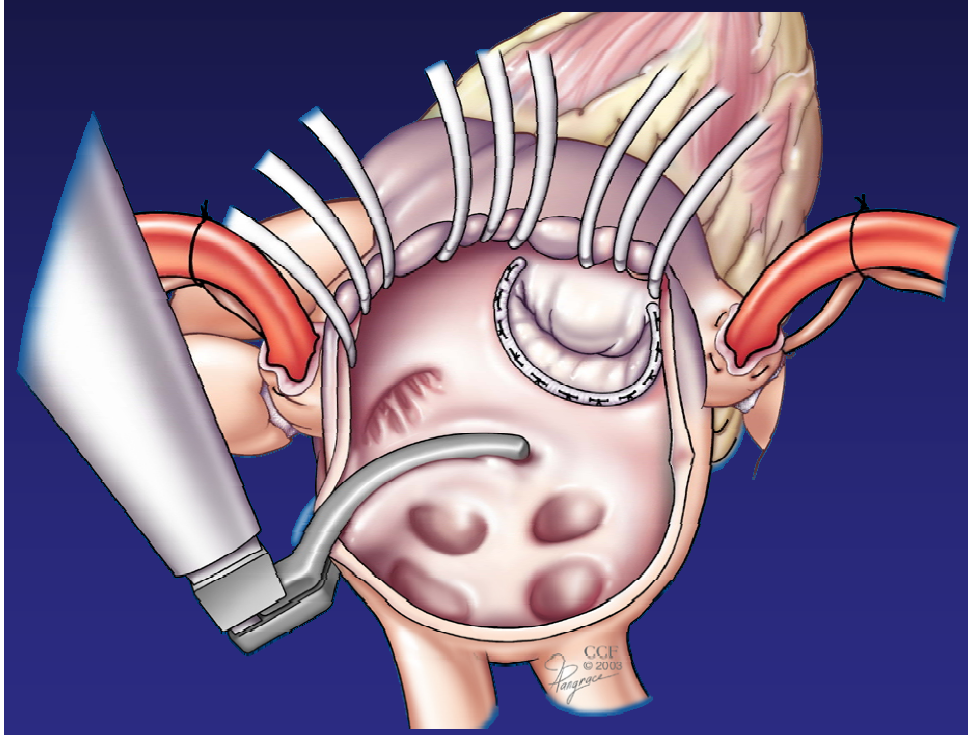
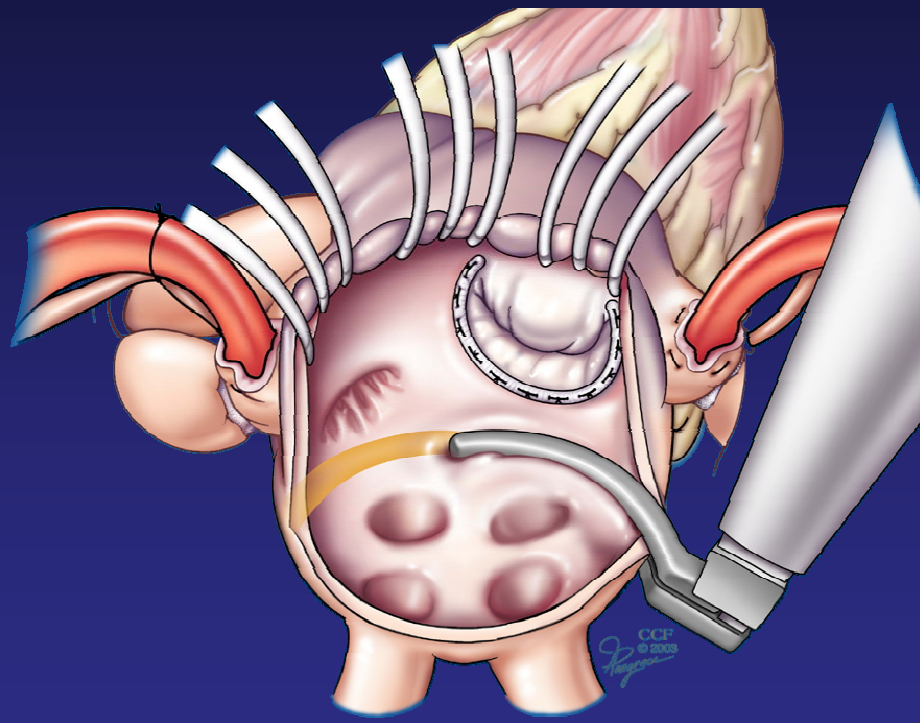
Extended Lesions:

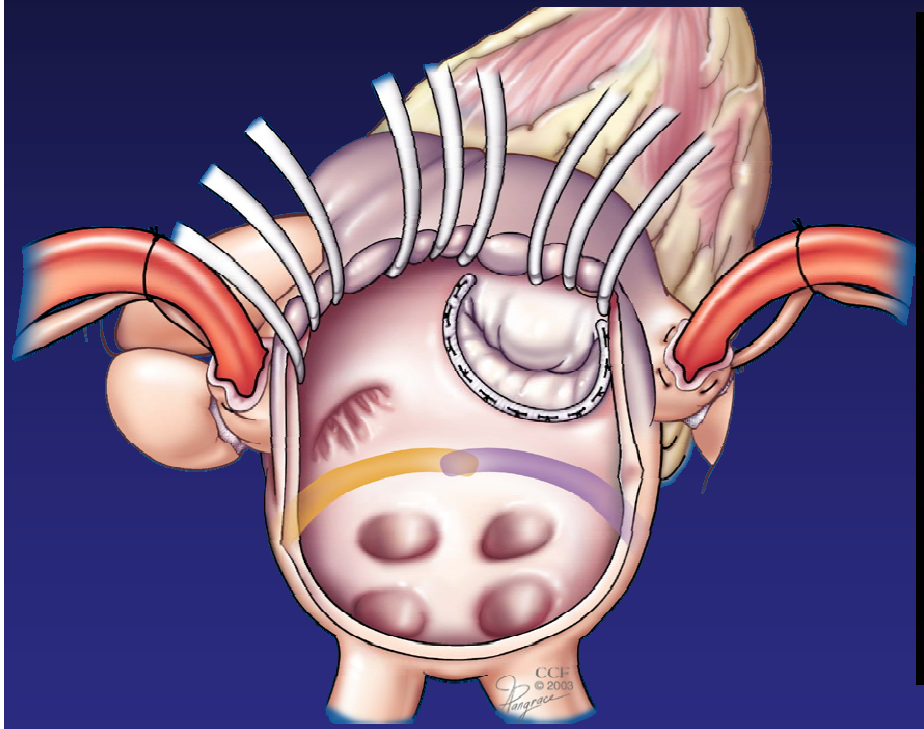
If the LA is Open (MV)
Or Permanent Afib
Or Symptomatic AFib

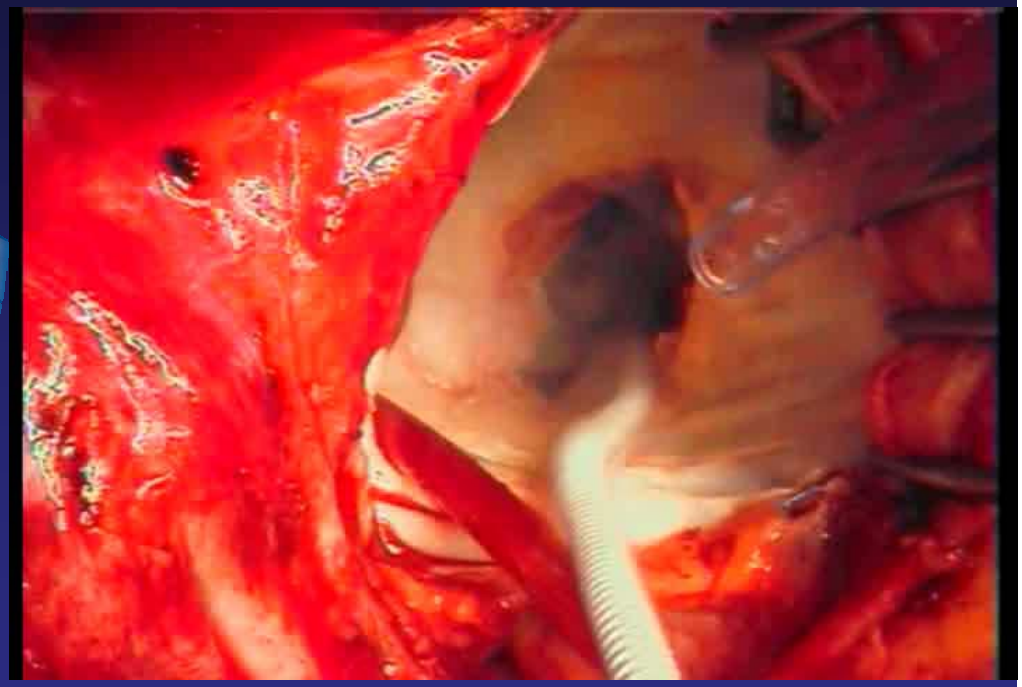
“Box Lesion”





MV Annulus Lesion

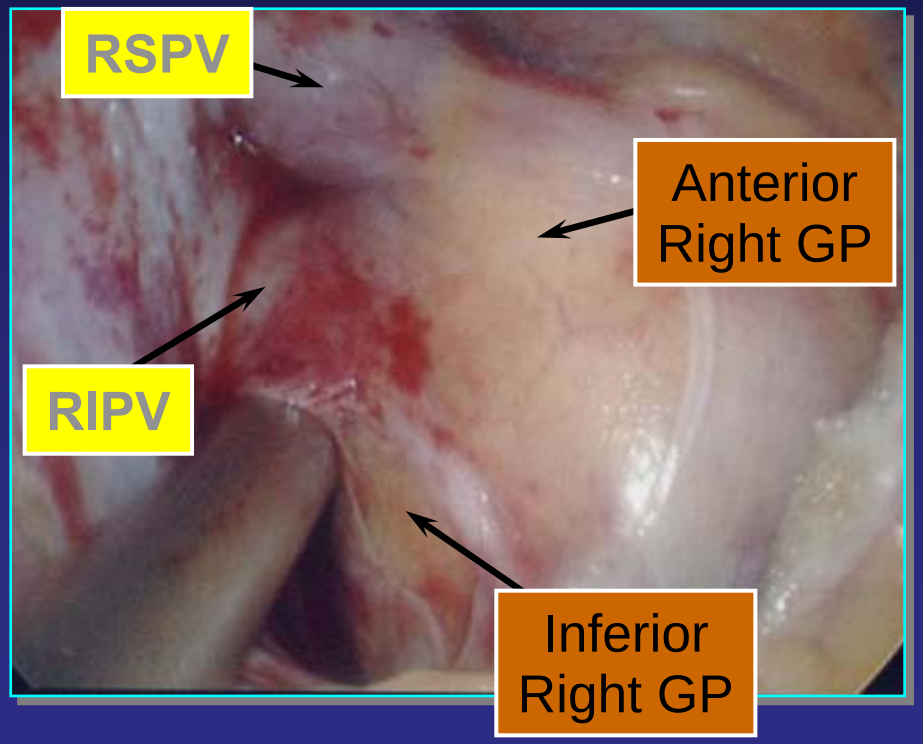




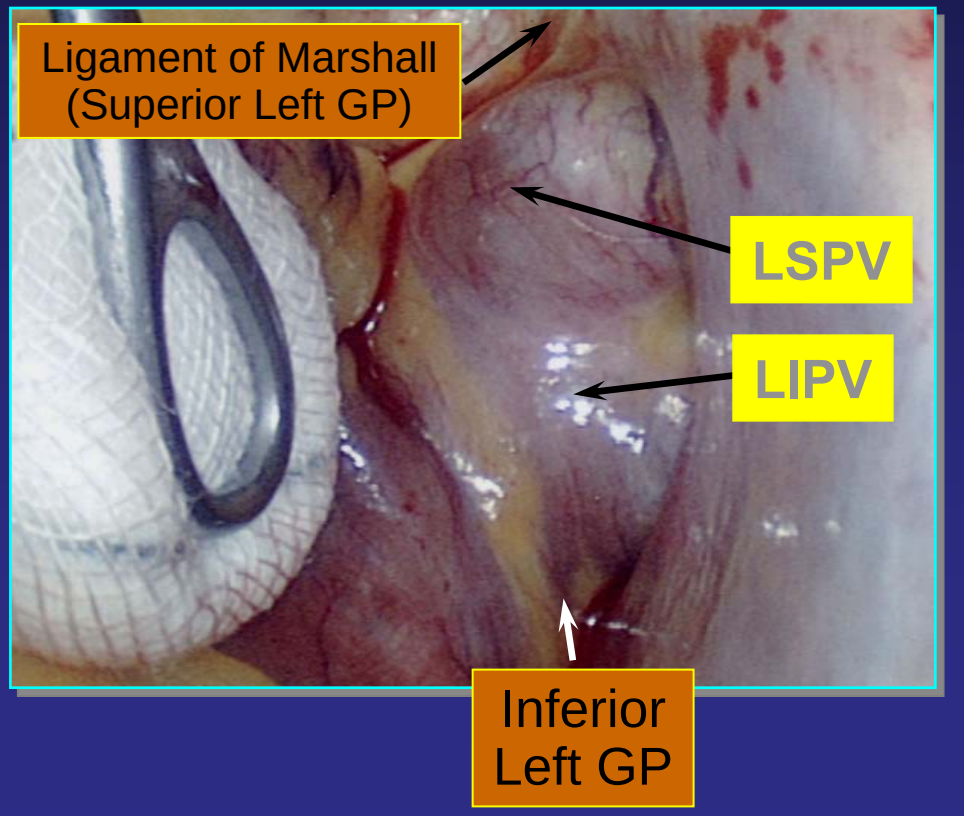
C.S. – TV Annulus Lesion

Epicardial GP Mapping and Ablation

Right PV and Ganglionated Plexi



Left PV and Ganglionated Plexi



Summary

- AF is Common in CV Surgery Pts … and Dangerous
- Concomitant AF Ablation is Safe and Effective
- "Mini-Invasive" Surgery can Ablate for AF, Close LAA, and Ablate GP
- Transmural Epicardial Lesions are Challenging
- Hybrid Procedures?

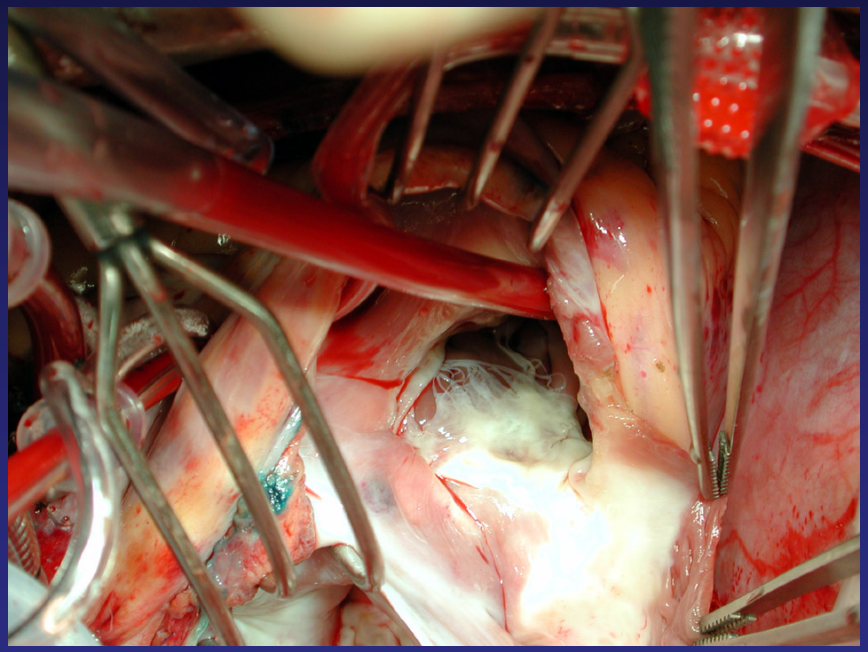
Guidelines

"It is advisable that all pts w documented AF referred for other cardiac surgeries undergo a left or biatrial procedure for AF at an experienced center, unless it…will add significant risk…"

Guidelines: Stand-Alone

- Failed cath ablation and symptoms
- Symptoms & not candidate, or prefer surgery
- Failed med therapy and have LA thrombus
- Risk for stroke and cannot take coumadin

Prior Catheter Ablation



Left Atrial Radiofrequency Ablation During Mitral Valve Surgery for Continuous Atrial Fibrillation

A Randomized Controlled Trial

George Doukas, FRCSI
Nilesh J. Samani, MD, FRCP
Christos Alexiou, FRCS, PhD
Mehmet Oc, MD
Derek T. Chin, MD
Peter G. Stafford, MD
Leong L. Ng, MD
Tomasz J. Spyt, FRCS, MD

Results At 12 months, sinus rhythm was present in 20 (44.4%) of 45 RFA patients and in 2 (4.5%) of 44 controls (rate ratio, 9.8; 95% CI, 2.4-86.3; $P<.001$).

JAMA 2005;294:2323-9

Why Not 100%?

Exceptions: recent examples

- 85 yo, 6.5 cm LA, 15 yr history AF, 35% EF : needs mini-AVR
- Third time redo CAB; L-Cx
- Rheumatic redo triple valve
- We Didn't Know!

NMH Valve Outcomes

4/19/2004 – 6/30/2006

	NMH Observed Mortality	STS Calculated Risk	EuroSCORE Predicted Risk	Ambler Predicted Risk	Obs/Exp
Isolated AV Replacement n=97	1.0%	3.6%	8.3%	3.6%	0.20
AVR with CAB n=61	0%	5.6%	12.9%	7.4%	0
Mitral Valve Repair n=64	1.6%	*	4%	2.1%	0.52
MV Repair with CAB n=35	2.9%	*	12.1%	9.7%	0.27
Mitral Valve with AF Ablation n=75	1.3%	*	14.5%	10.9%	0.10
Isolated CAB n=360	0%	1.5%	10.6%	N/A	0

**STS does not calculate predicted risk for MV Repair as yet*

Prospective Randomized Trials of Permanent AF Ablation with Mitral Valve Surgery

Trials, Year	Number of Pts	Technology	Control 12 Month * NSR	Treated 12 Month NSR
Doukas et al., 2005	101	Unipolar RF	4.5%	44.4% (p = 0.001)
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5 RCT Permanent AF/MVR

- All $p < 0.001$ in favor of NSR if AF treated
- No Peri-op AF Treatment Complications
- None powered or followed for late survival
- Heterogenous NSR rates (44-86%)

Linear Cryoablation of the Left Atrium Versus Pulmonary Vein Cryoisolation in Patients With Permanent Atrial Fibrillation and Valvular Heart Disease

Correlation of Electroanatomic Mapping and Long-Term Clinical Results

Fiorenzo Gaita, MD; Riccardo Riccardi, MD; Domenico Caponi, MD; Dipen Shah, MD; Lucia Garberoglio, MD; Laura Vivalda, MD; Alessandro Dulio, BS; Andrea Chiecchio, PhD; Eric Manasse, MD; Roberto Gallotti, MD

Discussion

The major findings deriving from the study are as follows.

1. The maintenance of SR off AADs during a long-term follow-up in patients with permanent AF associated with valvular heart disease was achieved in more than 85% of the patients when a complete linear lesion connecting the 4 pulmonary veins and the LIPV with the MA (7 scheme) was obtained.
2. Complete electrical isolation of the pulmonary veins alone is infrequently effective (25% success rate) in the same patient population.
3. An electrophysiological study to show what the surgeon really achieved in the operating room is essential to interpret correctly the clinical results in either a short- or a long-term follow-up, because a complete linear lesion or complete electrical pulmonary vein isolation is obtained in approximately 65% of patients with cryoenergy.

Circulation 2005;111:136-142

Three years experience with monopolar and bipolar radiofrequency ablation surgery in patients with permanent atrial fibrillation☆

Stephan Geidel[a,*], Jörg Ostermeyer[a], Michael Lass[a], Matthias Betzold[a], Anh Duong[a], Folke Jensen[a], Sigrid Boczor[b], Karl-Heinz Kuck[b]

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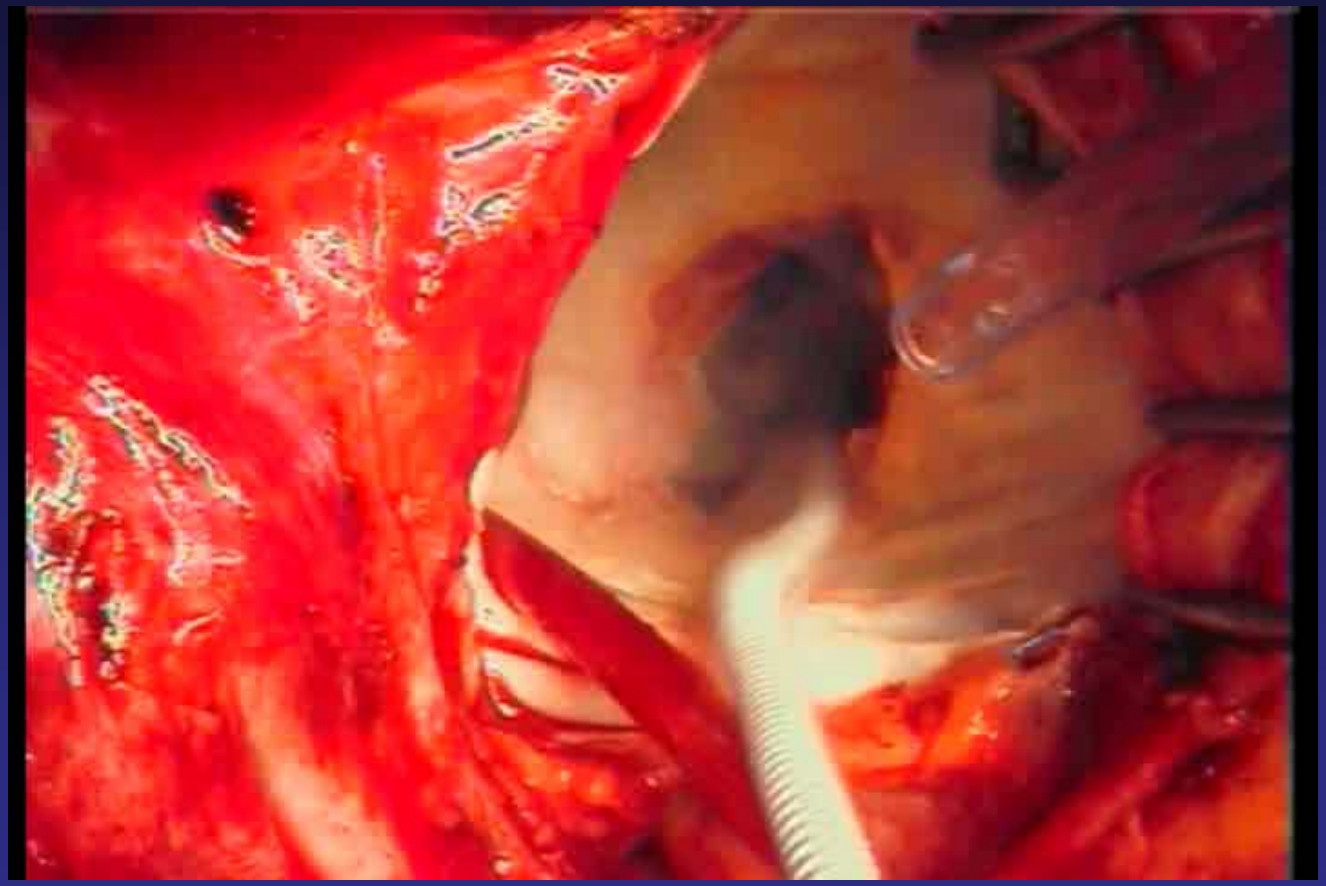
Received 31 August 2004; received in revised form 15 October 2004; accepted 18 October 2004; Available online 15 December 2004

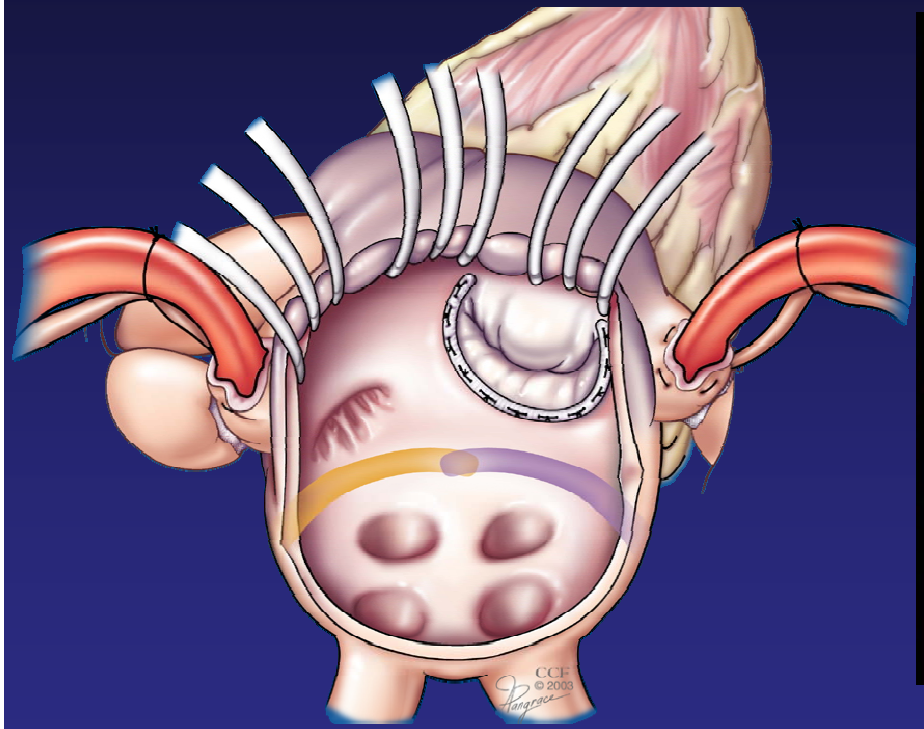
Objective: Whereas patients with *small* left atrial size (LA-diameters<56 mm; *n* = 59) had SR in almost 90% at follow-up, LA enlargement (LA-diameter ≥ 56 mm; *n* = 47) was associated with significant risk of persisting pAF after surgery (*P* = 0.033, 0.002 and 0.006 at 3, 6, and 9 months follow-up).

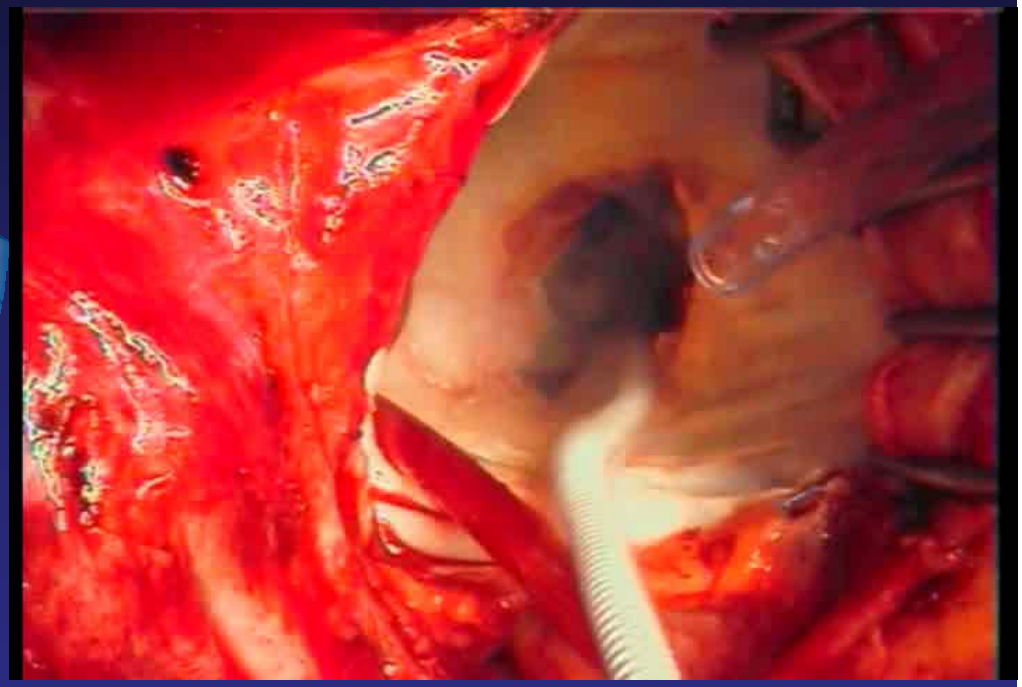
Eur J Cardiothorac Surg 2005;27:243-49

Cryoablation to MV Annulus

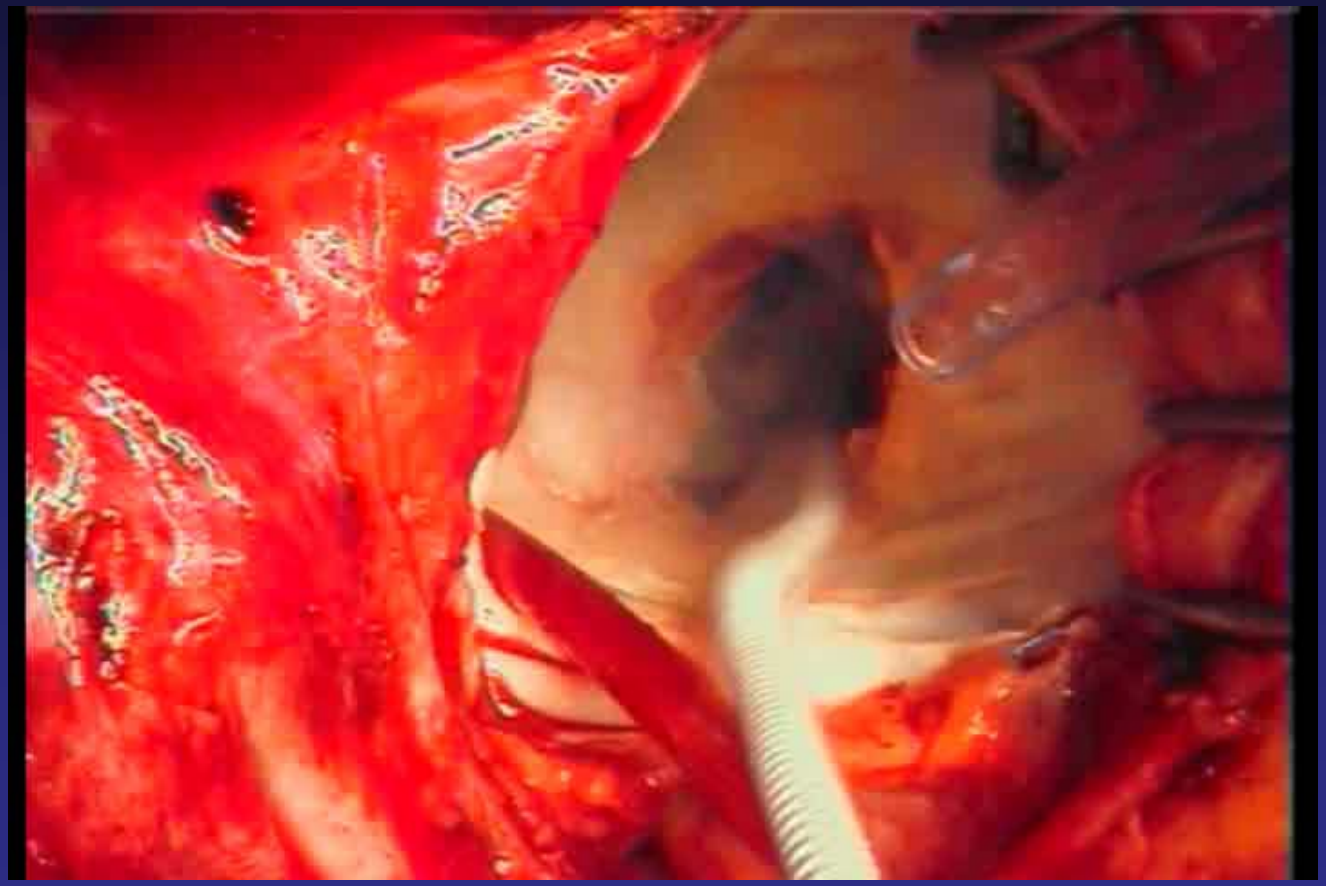


MV Annulus Lesion



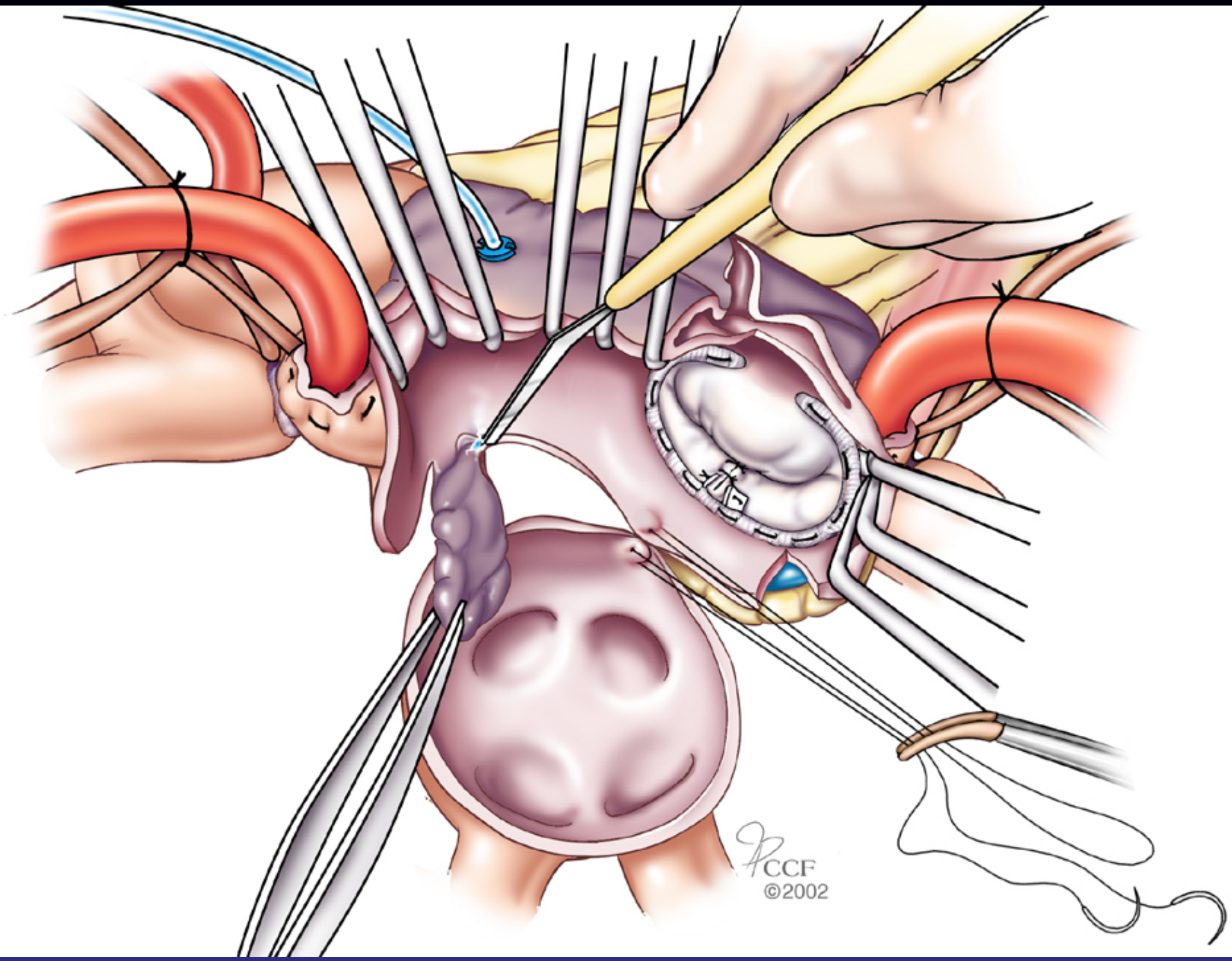


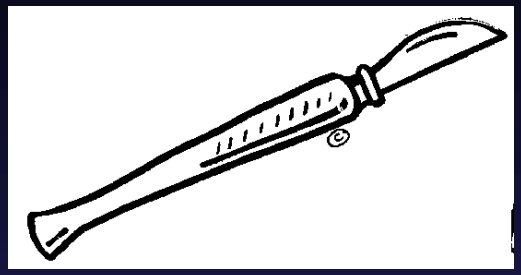
Cryoablation to MV Annulus

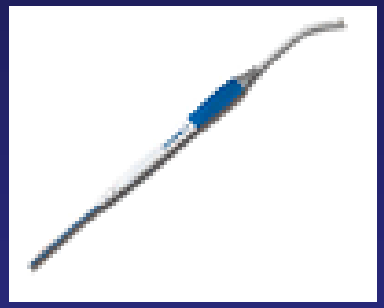


WHY?

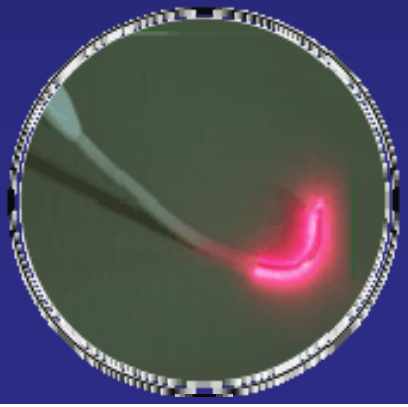
Stroke Reduction


CCF
©2002



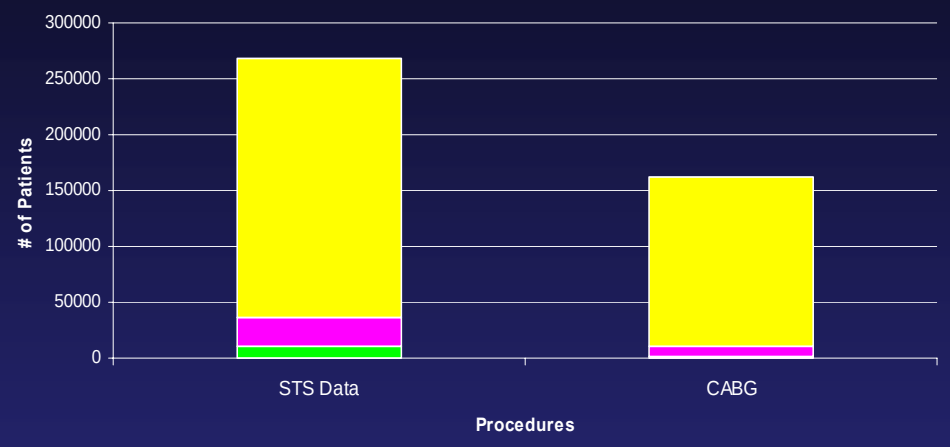


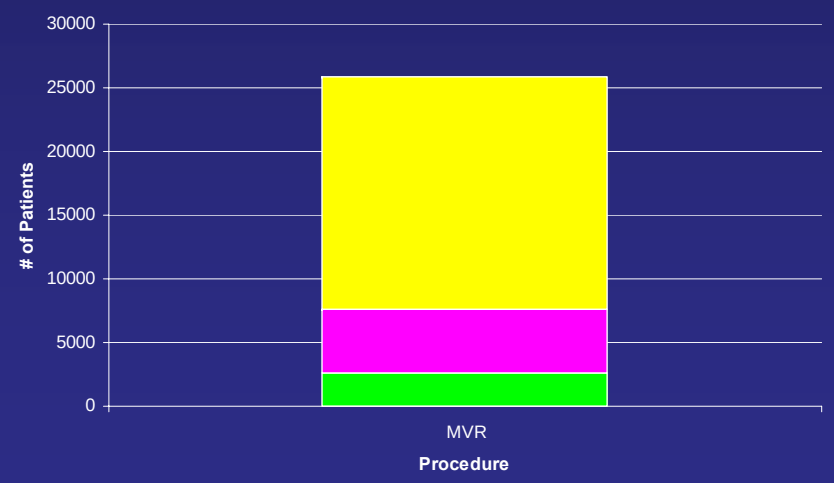
Medtronic



STS 2005 Data

- Total 38% Treated
- CAB 24%
- MVR 51%
- "Isolated" AF N=466
- 10,000 Treated pts





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