

# STS/EACTS Latin America Cardiovascular Surgery Conference

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## Hybrid Surgical Ablation in South America: Lesson Learned

Joao R. Breda



The Society  
of Thoracic  
Surgeons



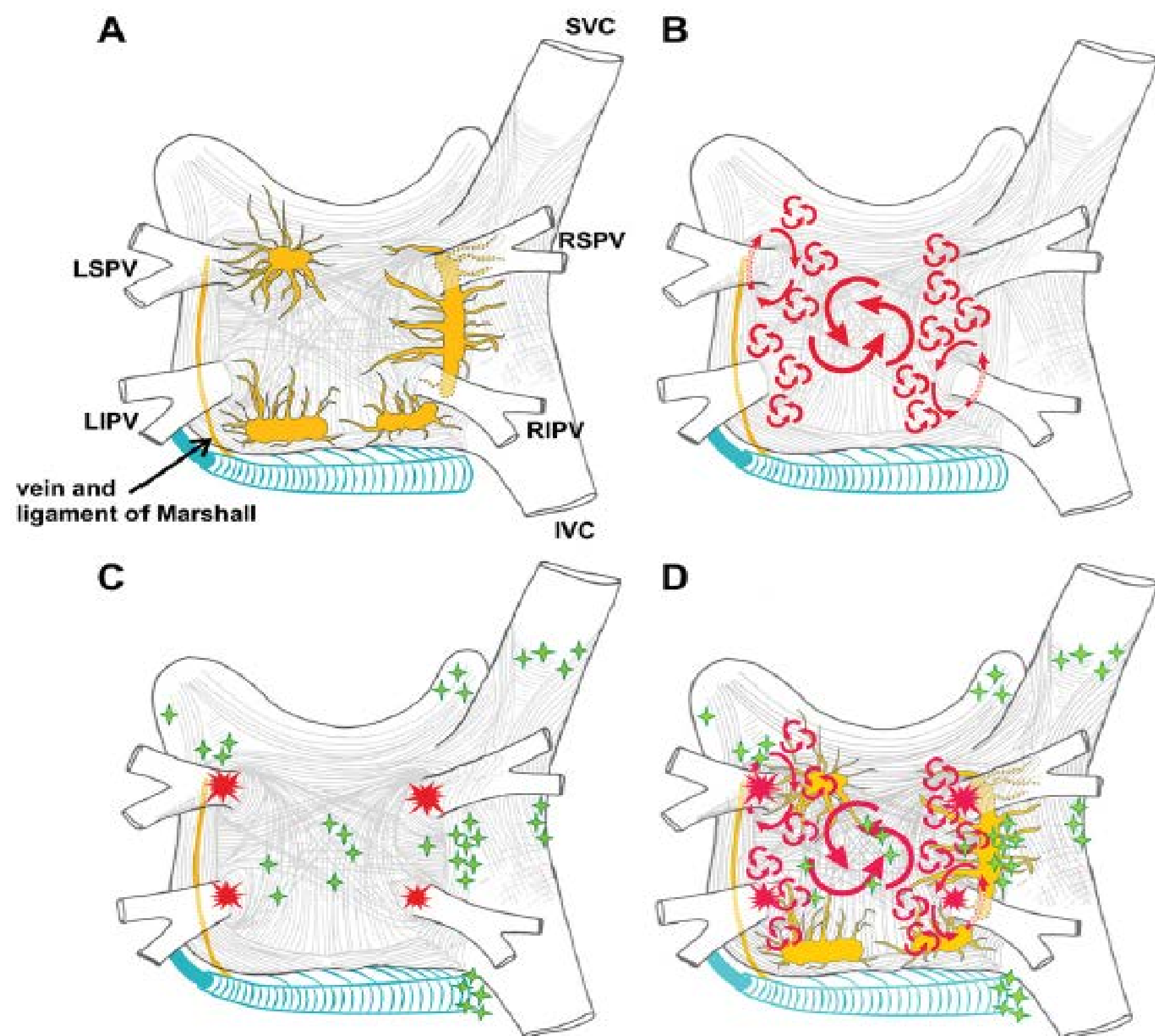
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# DISCLOSURES

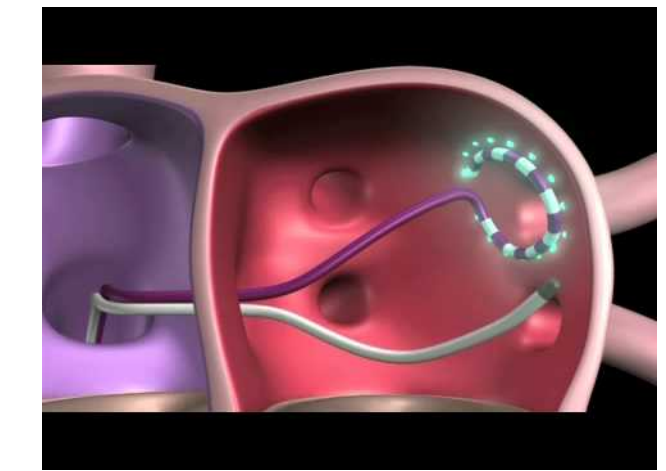
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# How to treat Atrial Fibrillation (AF)



- Understanding of pathophysiology mechanisms
- Ablation approach
- Choice of lesion set
- Choice of energy source
- Interaction between EP and Cardiac Surgeon

# Catheter Ablation in Long-Standing AF



Heart Rhythm Disorders

## Catheter Ablation of Long-Standing Persistent Atrial Fibrillation

### 5-Year Outcomes of the Hamburg Sequential Ablation Strategy

Roland Richard Tilz, MD, Andreas Rillig, MD, Anna-Maria Thum, Anita Arya, MD, Peter Wohlmuth, Andreas Metzner, MD, Shibu Mathew, MD, Yasuhiro Yoshiga, MD, Erik Wissner, MD, Karl-Heinz Kuck, MD, Feifan Ouyang, MD

Hamburg, Germany

**Objectives** This study describes the 5-year efficacy of catheter ablation for long-standing persistent atrial fibrillation (LS-AF).

**Background** Long-term outcome data after catheter ablation for LS-AF are limited.

**Methods** Long-term follow-up of 56 months (range 49 to 67 months) was performed in 202 patients (age  $61 \pm 9$  years) who underwent the sequential ablation strategy for symptomatic LS-AF. Initial ablation strategy was circumferential pulmonary vein isolation (PVI). Additional ablation was performed only in acute PVI nonresponder, if direct current cardioversion failed after PVI.

**Results** After the first ablation procedure, sinus rhythm was documented in 41 of 202 (20.3%) patients. After multiple procedures, sinus rhythm was maintained in 91 of 202 (45.0%) patients, including 24 patients receiving antiarrhythmic drugs. In 105 patients, PVI was the sole ablative therapy, 49 (46.7%) of those patients remained in sinus rhythm during follow-up. Patients with a total AF duration of  $<2$  years had a significantly higher ablation success rate than patients whose AF duration was  $>2$  years (76.5% vs. 42.2%, respectively;  $p = 0.033$ ). Persistent AF duration (hazard ratio: 1.09 [95% confidence interval: 1.04 to 1.13];  $p < 0.001$ ) independently predicted arrhythmia recurrences, and acute PVI responders had a reduced risk of relapse (hazard ratio: 0.57 [95% confidence interval: 0.41 to 0.78];  $p < 0.001$ ) after the first ablation.

**Conclusions** During 5-year follow-up, single- and multiple ablation procedure success was 20% and 45%, respectively, for patients with LS-AF. For patients with a total AF duration of  $<2$  years, the outcomes were favorable. (J Am Coll Cardiol 2012;60:1921-9) © 2012 by the American College of Cardiology Foundation

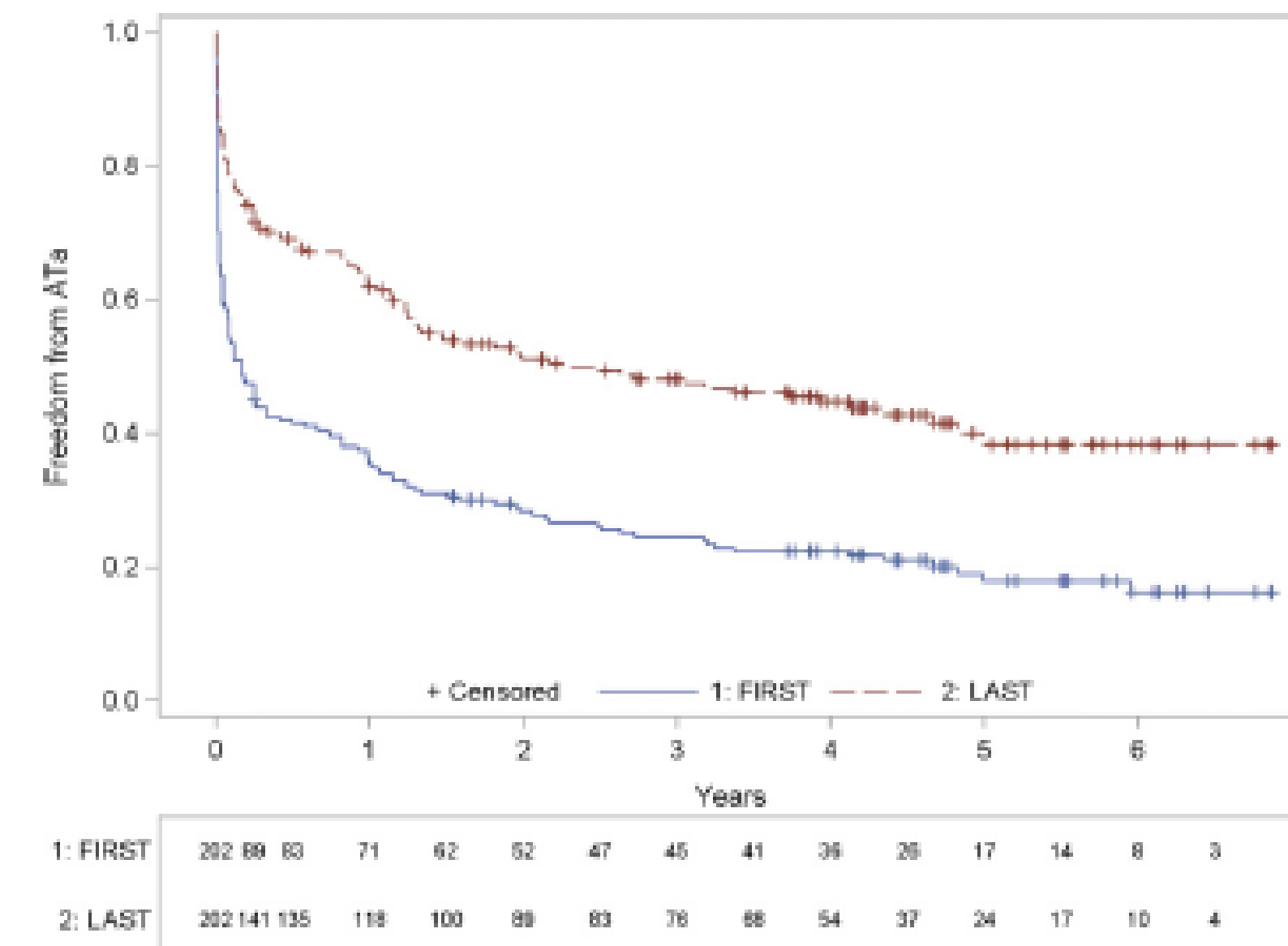
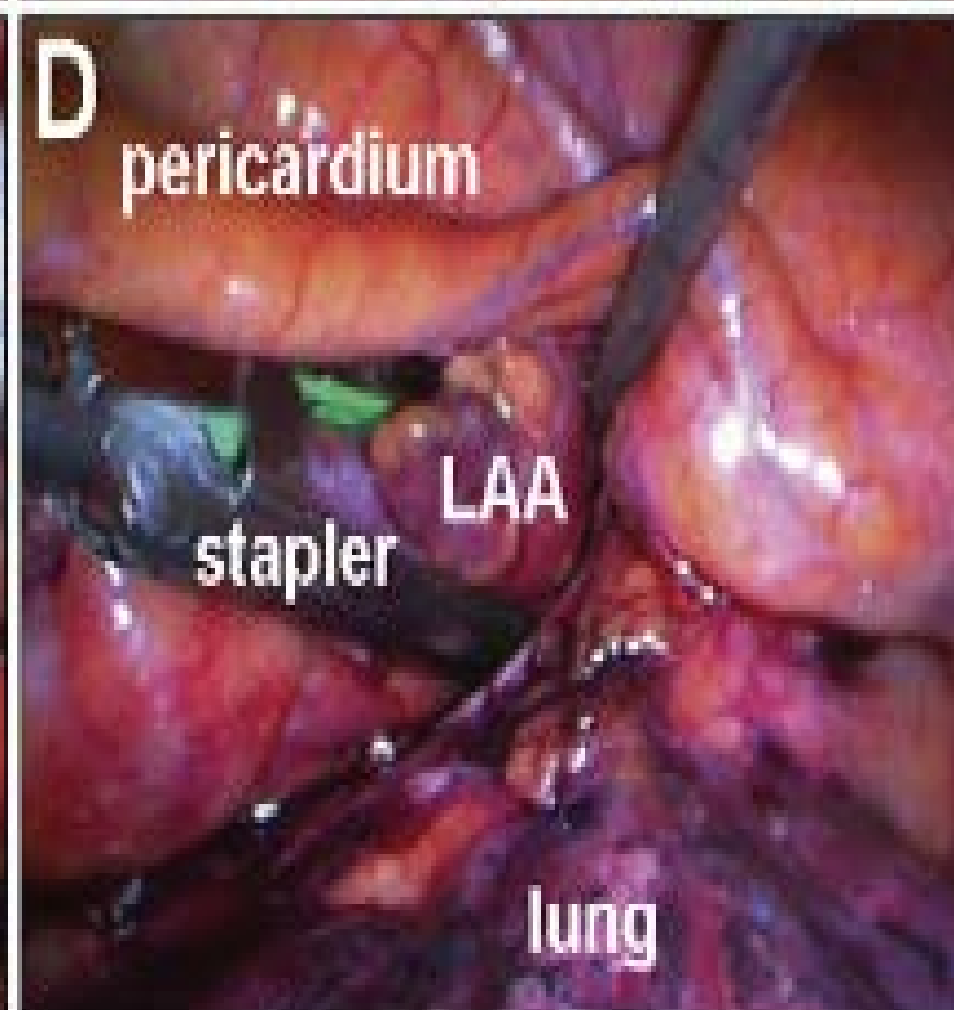
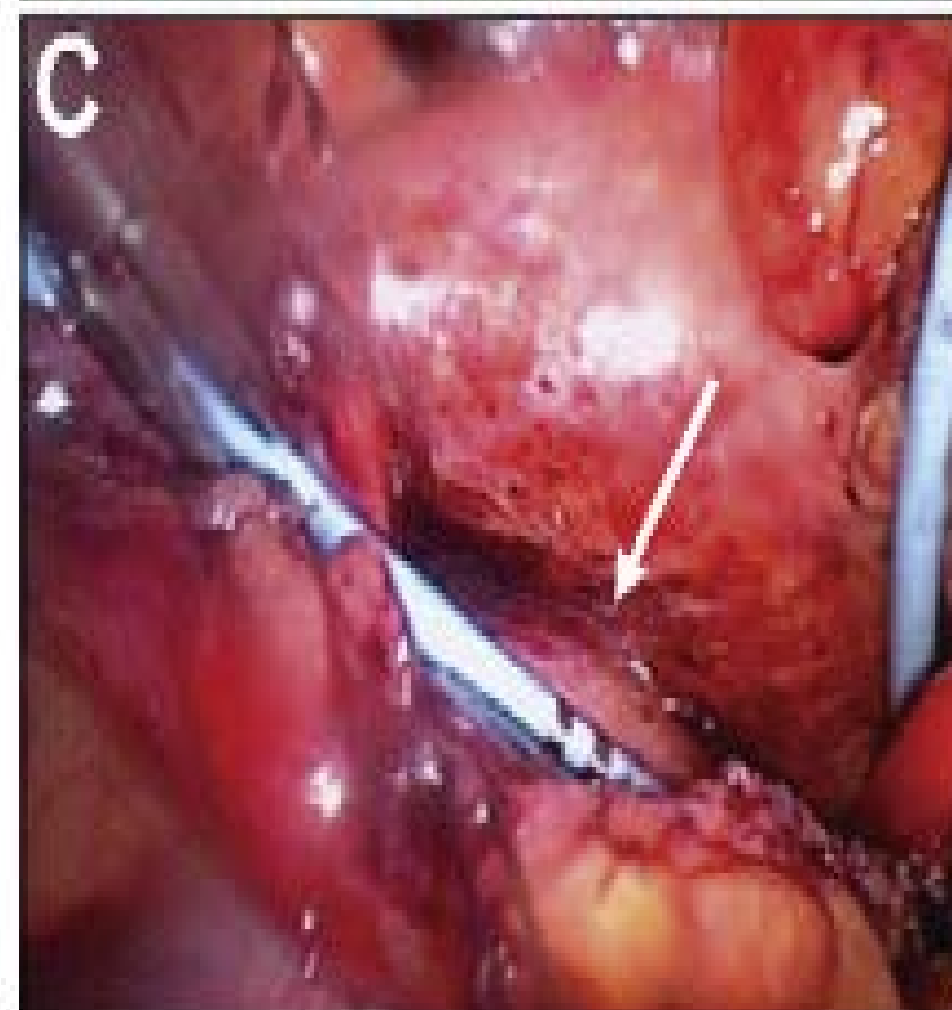
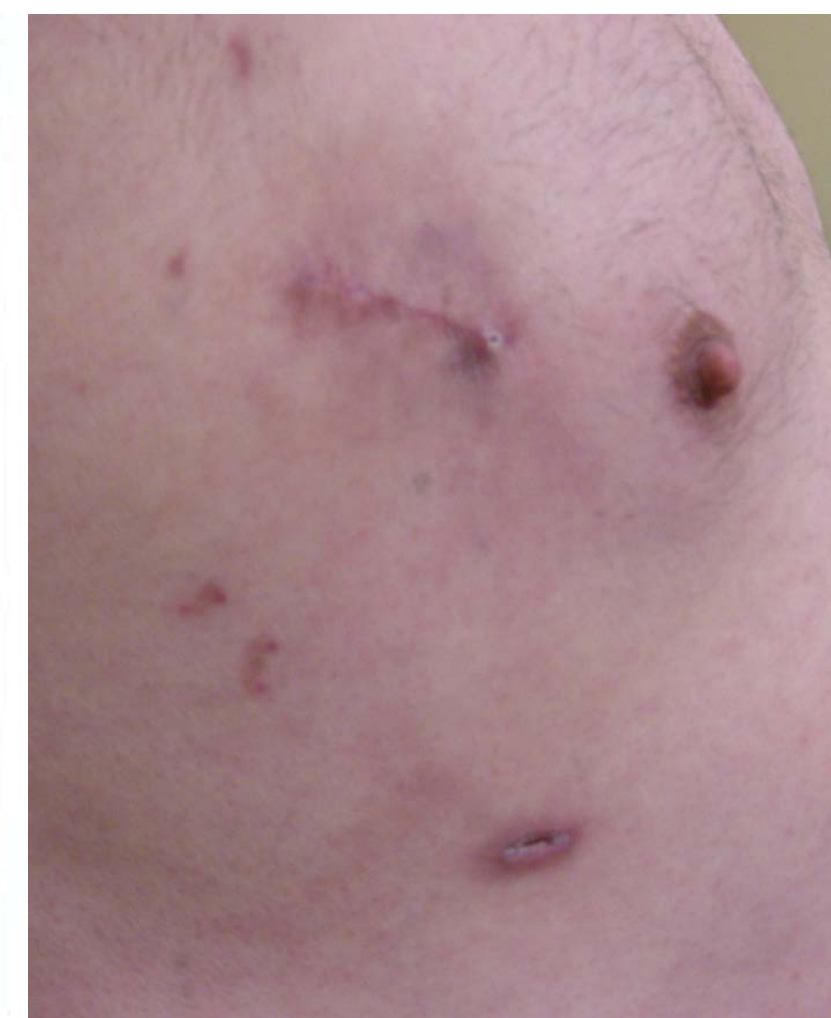
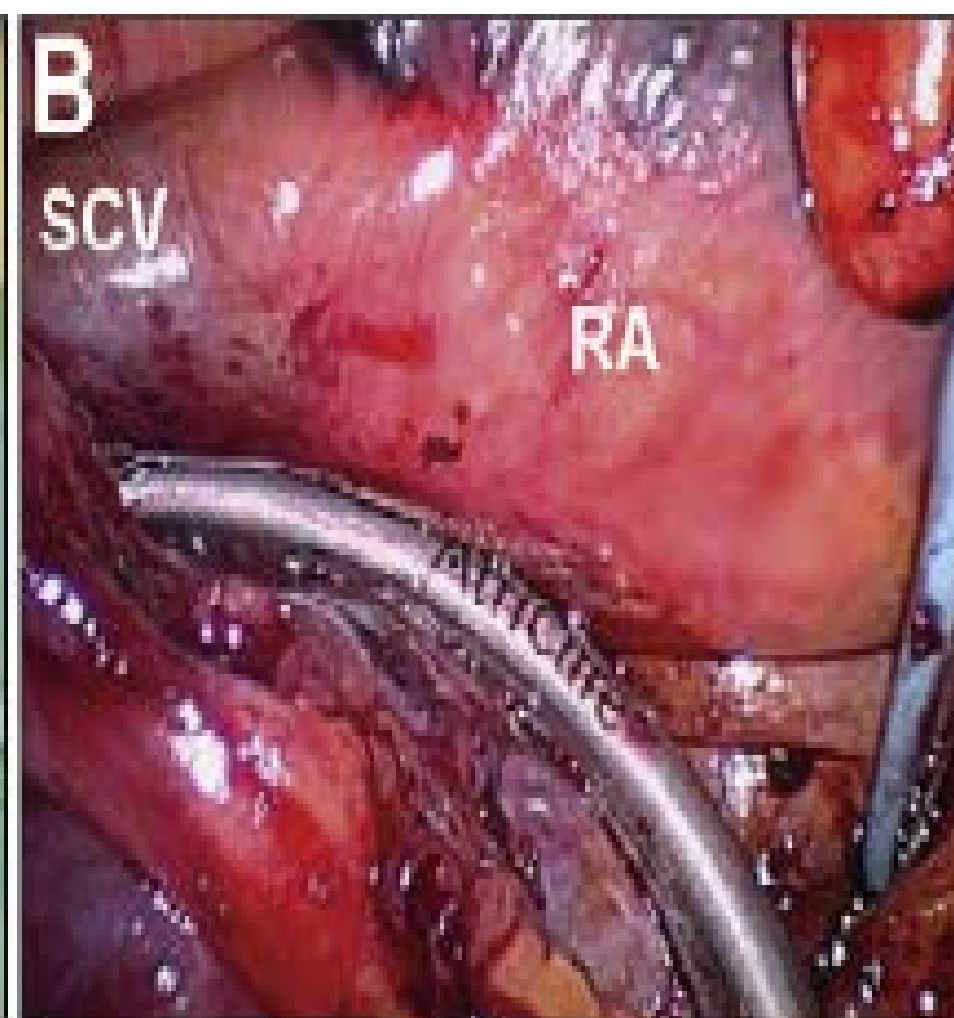
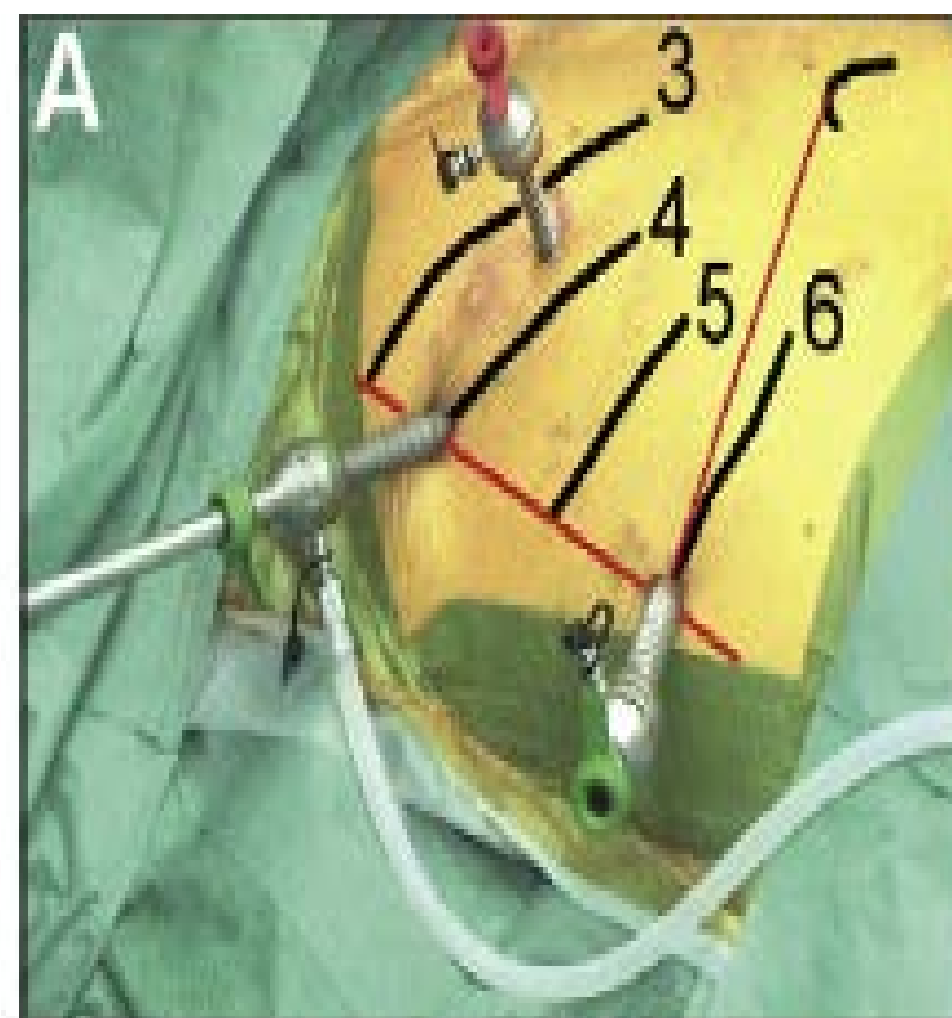


Figure 3 Single and Multiple Procedure Outcomes

Kaplan-Meier event-free survival curve after the first procedure (blue line) and after the last procedure (red line). Plus sign (+) indicates censored. Numbers at bottom indicate patients at risk. ATa = atrial tachyarrhythmia.

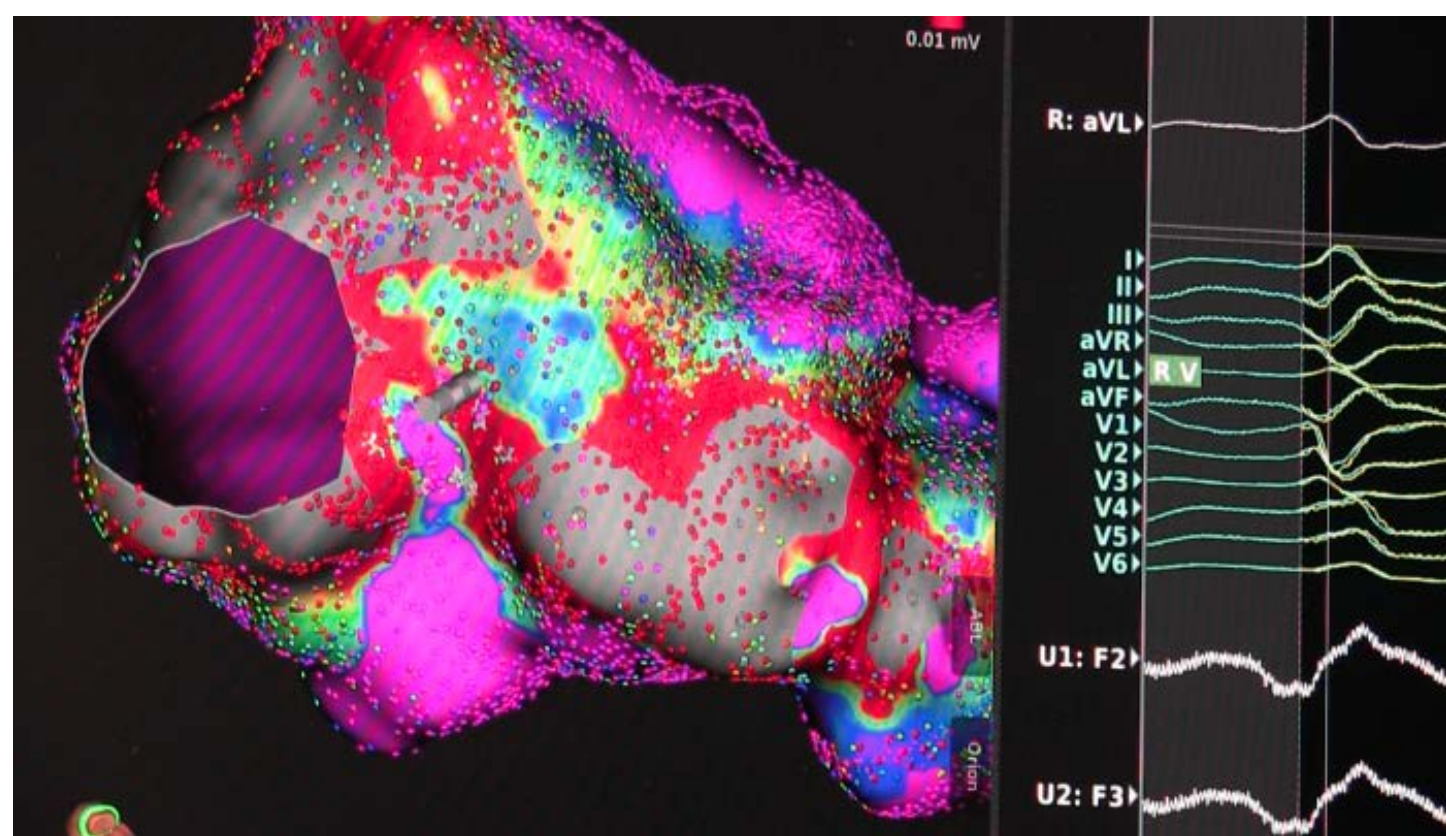


# Minimally Invasive Ablation of AF

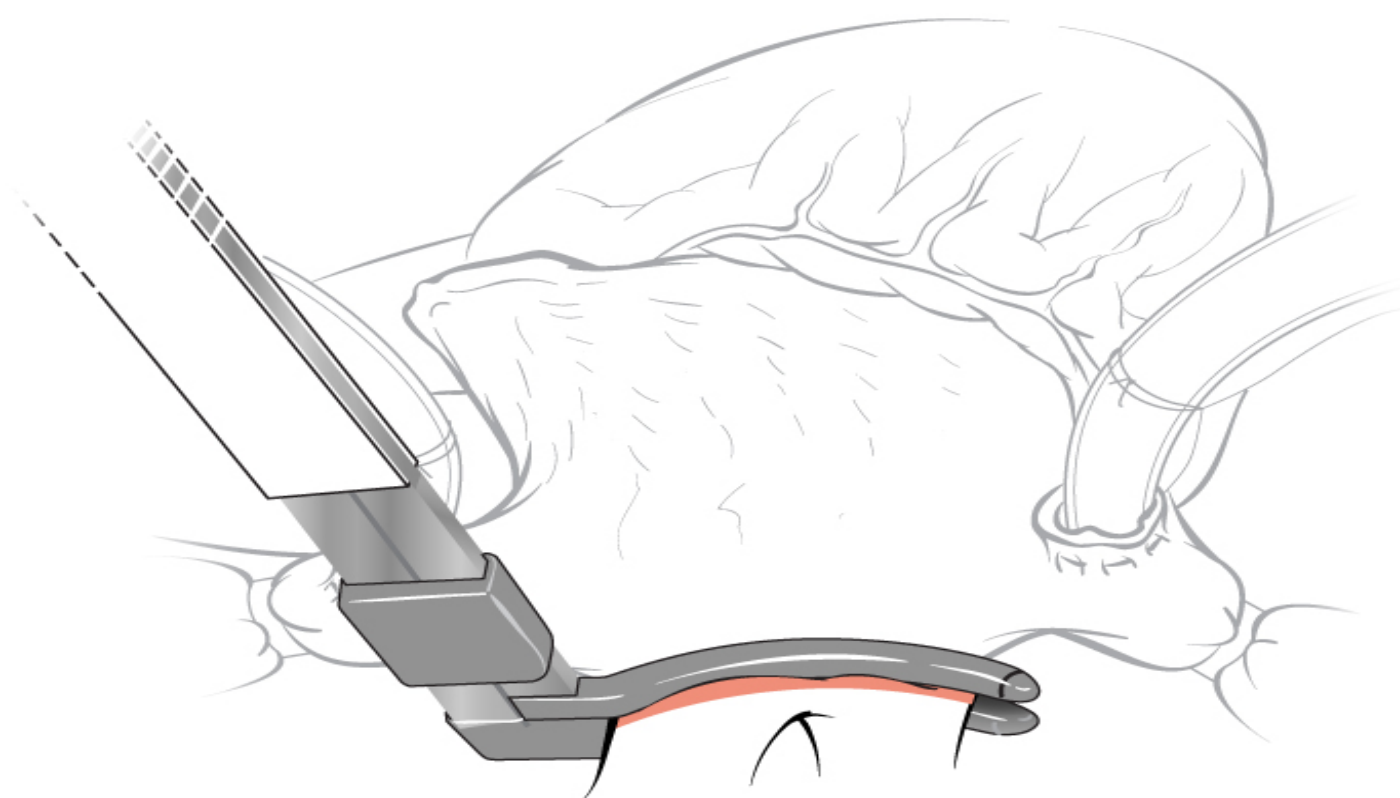


- Connecting lesions
- Line to the mitral annulus
- Isolation of the coronary sininus
- Lesions in the right atrial

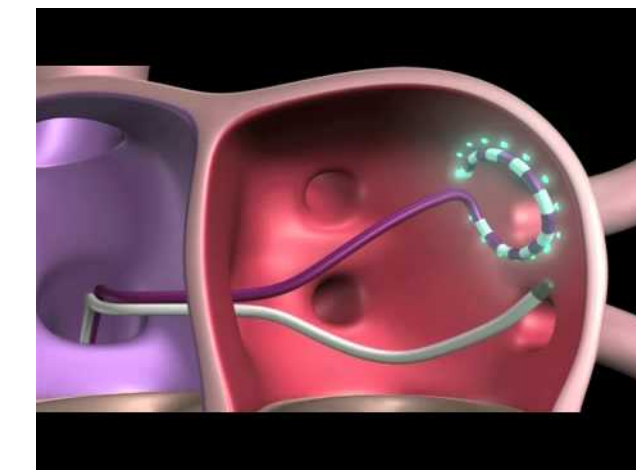
# HYBRID SURGICAL ABLATION



- Hybrid ablation procedures consist of epicardial surgical ablation combined with percutaneous endocardial ablation
- The hybrid ablation can be a part of single joint procedure or two preplanned ablation procedures (by no more than 6 months)
- The indication must be evaluated in the context of safety and efficacy



# The Hybrid Ablation Procedure



## Epicardial approach

- **Pro**

- Minimal invasive
- Fast procedure
- Exclusion LAA

- **Con**

- Transmurality
- Limited lesion set
- Limited endpoints

## Endocardial approach

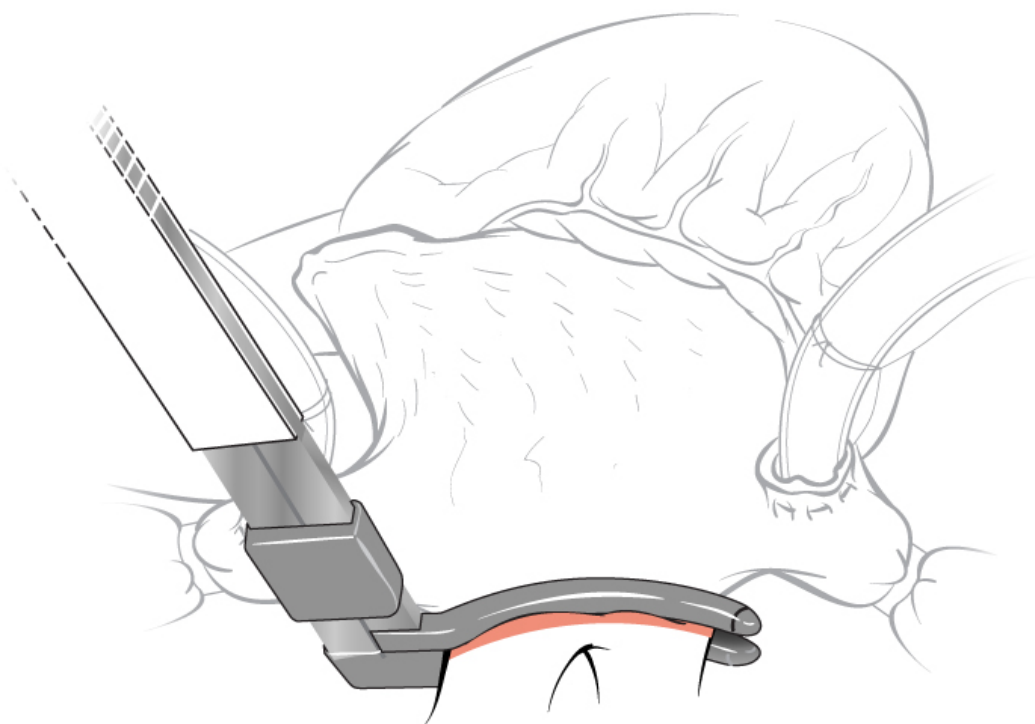
- **Pro**

- Mapping
- Electrophysiological endpoints
- Collaboration with EP

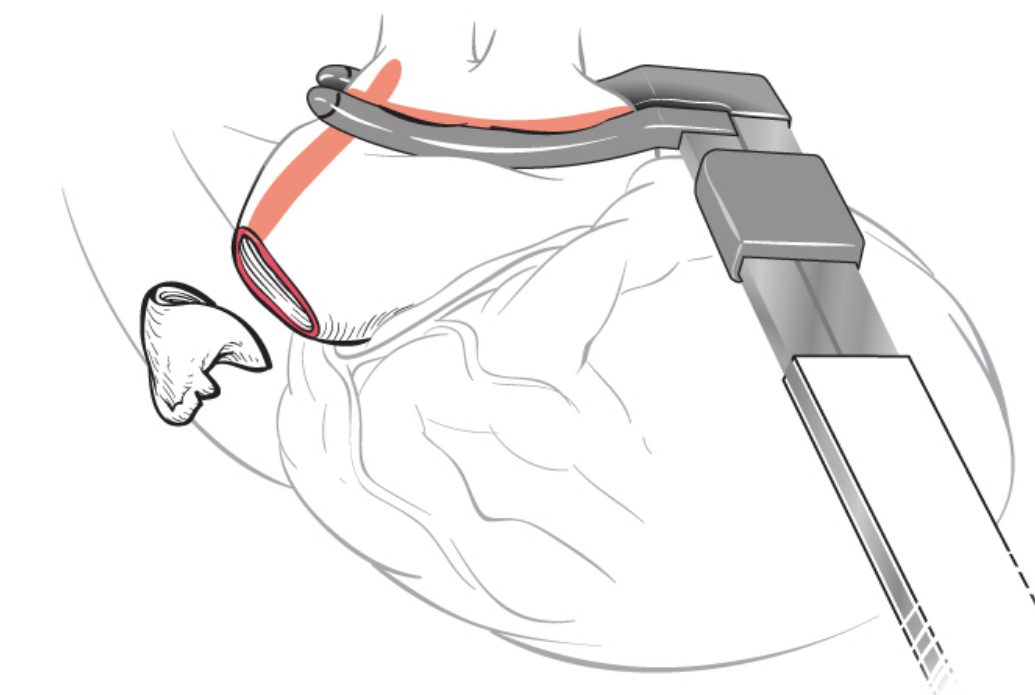
- **Con**

- Long procedures
- Injury phrenic nerve/esophagus
- Fluoroscopy

# The Hybrid Ablation Procedure - Techniques



- Bilateral PVI with left atrial appendage (LAA) management (bilateral thoracoscopy or thoracotomy approach)



- Unilateral thoracoscopic PVI posterior encircling box lesion without LAA management
- Alternative approaches to posterior left wall epicardial ablation (“convergent procedure) without LAA management



# Hybrid thoracoscopic and transvenous catheter ablation of atrial fibrillation

Sandro Gelsomino<sup>a,\*</sup>, Henrica N.A.M. Van Breugel<sup>a,†</sup>, Laurant Pison<sup>a</sup>, Orlando Parise<sup>a</sup>, Harry J.G.M. Crijns<sup>a</sup>, Francis Wellens<sup>b</sup>, Jos G. Maessen<sup>a</sup> and Mark La Meir<sup>b</sup>

- Minimally Invasive Hybrid Approach 335 patients
- Long Standing Persistent AF 162 patients

**Table 1:** Baseline characteristics

First author	Year	Patients	Age	AF duration	LA diameter (mm)	PCA	PX	PR	LSP
Mahapatra <i>et al.</i> [17]	2011	15	59.5 ± 2.4	5.4 ± 0.6 y	52.3 ± 10.3	15	-	9	6
Krul <i>et al.</i> [18]	2011	31	57 (43-77)	8 [1-25] y	47.0 ± 7.0	14	16	13	2
La Meir <i>et al.</i> [19]	2012	35	57.1 ± 9.5	5 [4.2-9.0] y	52.0 ± 5.0	21	16	8	11
Pison <i>et al.</i> [20]	2012	26	56.8 ± 8.6	67.2 ± 47.6 m	43.1 ± 5.5	11	15	10	1
La Meir <i>et al.</i> [21]	2012	19	61.2 ± 8.6	5 [3-8.5] y	49 ± 20	9	5	4	10
Zembala <i>et al.</i> [22]	2012	27	55.2 ± 11	3.5 ± 2.5 y	45.5 ± 4.7	8	-	5	22
Munieretto <i>et al.</i> [23]	2012	36	62.3 ± 10	72.8 (7-240) m	50.3 ± 5.5	-	-	8	28
Gehi <i>et al.</i> [24]	2013	101	62.9 ± 9.6	5.9 ± 5.5 y	51 ± 10	36	17	47	37
Bisleri <i>et al.</i> [25]	2013	45	62.3 ± 9.8	83.8 ± 69.1 m	51.3 ± 9.7	-	-	-	45

Studies are presented by the year of publication. Age is expressed as mean ± SD or (range); AF duration expressed as mean ± SD or (range) or median (interquartile range).

y: years; m: months; LA: left atrial diameter expressed as mean ± SD; PCA: (previous) percutaneous catheter ablation; PX: paroxysmal atrial fibrillation; PR: persistent atrial fibrillation; LSP: long-standing persistent atrial fibrillation.

# Hybrid thoracoscopic and transvenous catheter ablation of atrial fibrillation

Sandro Gelsomino<sup>a,\*</sup>, Henrica N.A.M. Van Breugel<sup>a,†</sup>, Laurant Pison<sup>a</sup>, Orlando Parise<sup>a</sup>, Henry J.G.M. Crijns<sup>a</sup>, Francis Wellens<sup>b</sup>, Jos G. Maessen<sup>a</sup> and Mark La Meir<sup>b</sup>

- Energy source: RF Monopolar and Bipolar

Table 2: Surgery

First author	Source	Method	Access	Roof line	Inferior line	A-LA	IL	RA	LAA	GP	CTL	CSL
Mahapatra <i>et al.</i> [17]	RF (b)I	VATS	B-Thor	Y	-	Y	-	Y	14/15	Y	Y	Y
Krul <i>et al.</i> [18]	RF(b) I	VATS	B-Thor	13/31	8/31	13/31	-	-	29/31	Y	ns	-
La Meir <i>et al.</i> [19]	RF (b)I	VATS	B-Thor	31/35	32/35	Y	7/35	23/35	15/35	Y	3/35	-
Pison <i>et al.</i> [20]	RF(b) I	VATS	B-Thor	23/26	22/26	Y	3/26	8/26	Y	Y	2/26	-
La Meir <i>et al.</i> [21]	RF(u) I	VATS	R-Thor	-	Y	3/19	-	-	-	Y	2/19	-
Zembala <i>et al.</i> [22]	RF(u) I	VALS	LAP	Y	Y	-	-	-	Y	-	Y	-
Muneretto <i>et al.</i> [23]	RF(u)	VATS	R-Thor	Y	Y	-	-	-	-	Y	ns	-
Gehi <i>et al.</i> [24]	RF(u) I	VATS	SubX	90/101	97/101	Y	84/101	-	-	-	99/101	73/101
Bisleri <i>et al.</i> [25]	RF(u)	VATS	R-Thor	Y	Y	-	-	-	-	-	ns	-

Studies are presented by the year of publication.

RF: radiofrequency; b: bipolar; u: unipolar; I: irrigated; VATS: video-assisted thoracoscopic surgery; VALS: video-assisted laparoscopy; R-Thor: right thoracoscopy; B-Thor: bilateral thoracoscopy; LAP: laparoscopy; SubX: subxiphoid; A-LA: additional left atrial lines; IL: isthmus line; RA: right atrial and caval lines; LAA: left atrial appendage excision/closure; GP: ganglionated plexi ablation; CTL: cavotricuspid line; CSL: coronary sinus line; Y: yes; ns: not specified.

# Hybrid thoracoscopic and transvenous catheter ablation of atrial fibrillation

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- Freedom from AF: 85.7% to 92% with Bipolar RF and 36.8% to 88.9% with Monopolar RF

**Table 4.** Results according to HRS/EHRA/ECAS consensus<sup>\*</sup>

First author	All			Paroxysmal			Persistent			LS-persistent		
	n	AF	AF-AAD (%)	n	AF	AF-AAD	n	AF	AF-AAD (%)	n	AF	AF-AAD (%)
Mahapatra <i>et al.</i> [17]	2	93.3%	86.7	-	-	-	ns	ns	ns	ns	ns	ns
Krul <i>et al.</i> [18]	3	ns	86	1	ns	91.6%	2	ns	77.7	0	ns	100
La Meir <i>et al.</i> [19]	5	ns	85.7	2	ns	87.5%	1	ns	87.5	2	ns	81.8
Pison <i>et al.</i> [20]	2	ns	92	1	ns	93%	1	ns	90	0	ns	100
La Meir <i>et al.</i> [21]	12	63.1%	36.8	2	ns	60%	2	ns	50	8	ns	20
Zembala <i>et al.</i> [22] <sup>*</sup>	5	72.2%	66.5	-	-	-	ns	ns	ns	ns	ns	ns
Muneretto <i>et al.</i> [23]	8	91.6%	77.7	-	-	-	ns	ns	ns	ns	ns	ns
Gehi <i>et al.</i> [24]	34	73.3%	60.7	ns	ns	ns	ns	ns	ns	ns	ns	ns
Bisleri <i>et al.</i> [25]	5	ns	88.9	-	-	-	-	-	-	5	ns	88.9

Studies are presented by the year of publication.

HRS: heart rhythm society; EHRA: European Heart Rhythm Association; ECAS: European Cardiac Arrhythmia Society; AF: (patients free of) atrial fibrillation; AF-AAD: (patients free of) atrial fibrillation and antiarrhythmia; ns: not specified.

<sup>\*</sup>Freedom from AF-off antiarrhythmic drugs (AAD) at 6 months (see text).

# Hybrid thoracoscopic and transvenous catheter ablation of atrial fibrillation

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- Mortality 0.8%, Complications Rate 4.1%, Conversion to Sternotomy 0.8%, Tromboembolic Events 0%

**Table 5.** Early and late outcomes

First author	Early death	Conversion*	Complications	Late death	Repeated ablation	ECV	TEs
Mahapatra <i>et al.</i> [17]	0	0	T	0	0	2	0
Krul <i>et al.</i> [18]	0	3	B(3) HeTX PNX PN	0	0	0	0
La Meir <i>et al.</i> [19]	0	0	0	0	0	2	0
Pison <i>et al.</i> [20]	0	0	PLE	0	0	0	0
La Meir <i>et al.</i> [21]	0	0	0	0	0	0	0
Zembala <i>et al.</i> [22]	1	0	T B	0	0	0	0
Muneretto <i>et al.</i> [23]	0	0	0	0	0	0	0
Gehi <i>et al.</i> [24]	2	0	B(2) T(2)	0	0	0	0
Bisleri <i>et al.</i> [25]	0	0	0	0	0	0	0

Studies are presented by the year of publication.

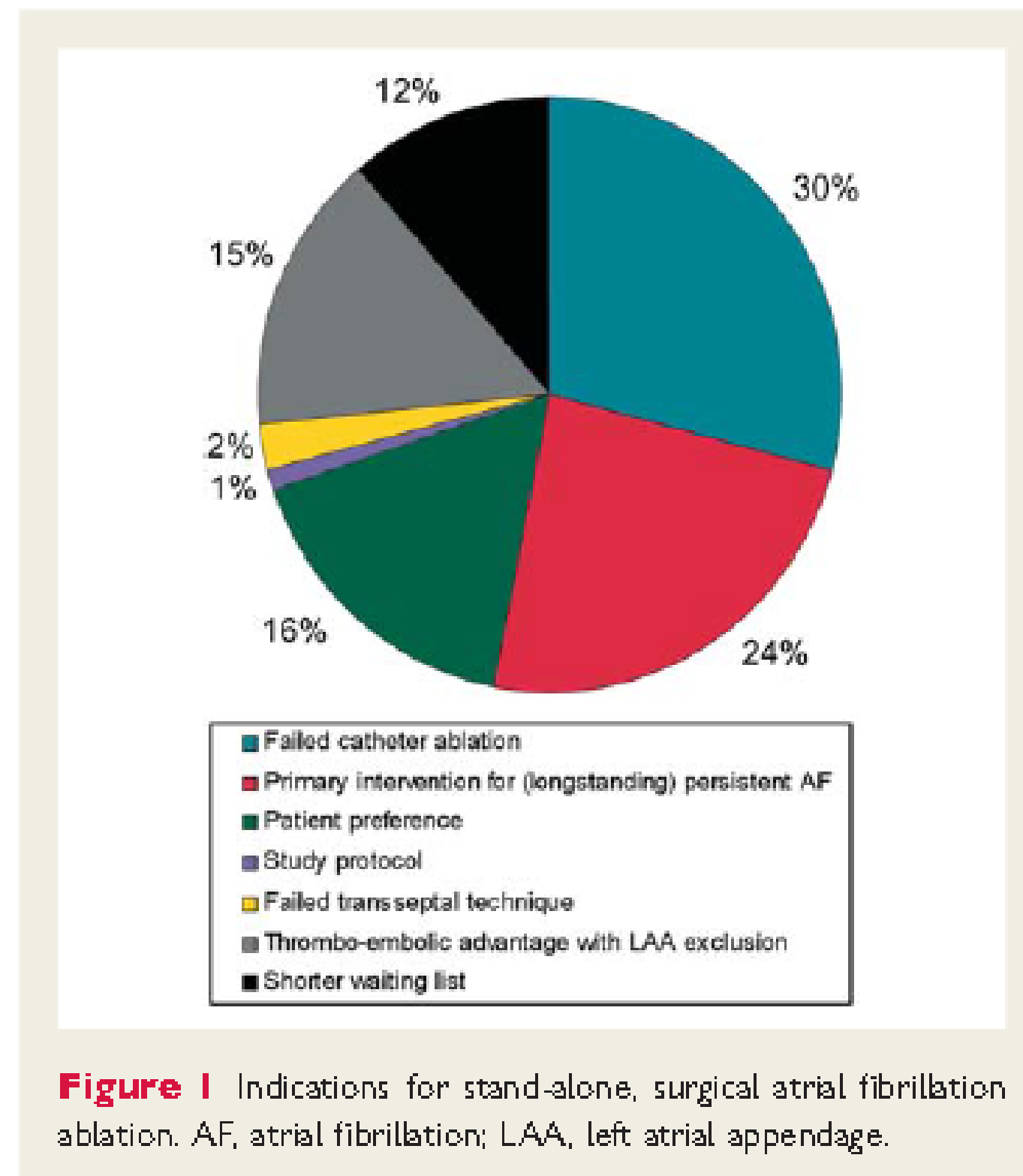
ECV: electric cardioversion; TEs: thromboembolic events; T: tamponade; B: bleeding; HeTX: haemothorax; PNX: pneumothorax; PN: pneumonia; PLE: pleural effusion; B: bleeding.

\*Conversion to sternotomy and cardiopulmonary bypass.

# Surgical and hybrid atrial fibrillation ablation procedures

Laurent Pison<sup>1\*</sup>, Nikolaos Dagres<sup>2</sup>, Thorsten Lewalter<sup>3</sup>, Alessandro Proclemer<sup>4</sup>, Germanas Marinakis<sup>5</sup>, and Carina Blomström-Lundqvist<sup>6</sup>, conducted by the Scientific Initiative Committee, European Heart Rhythm Association

Why would a cardiologist or EP refer a patient with lone AF for a surgical approach?

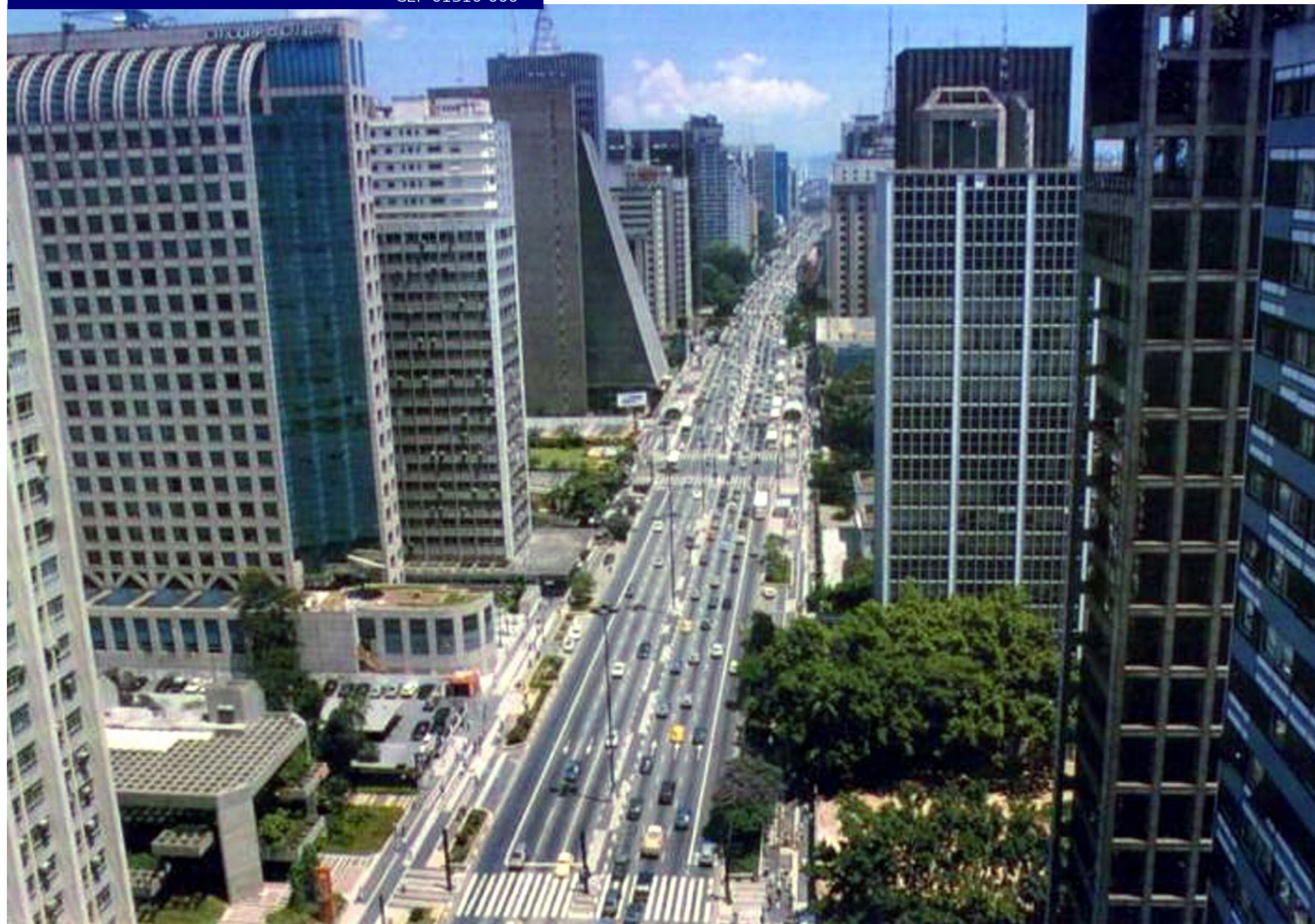


- **30% failed catheter ablation**
- **24% longstanding persistent AF**
- **15% wish to exclude LAA**
- **16% preference of the patient**
- **12% shorter waiting list**



Avenida Paulista

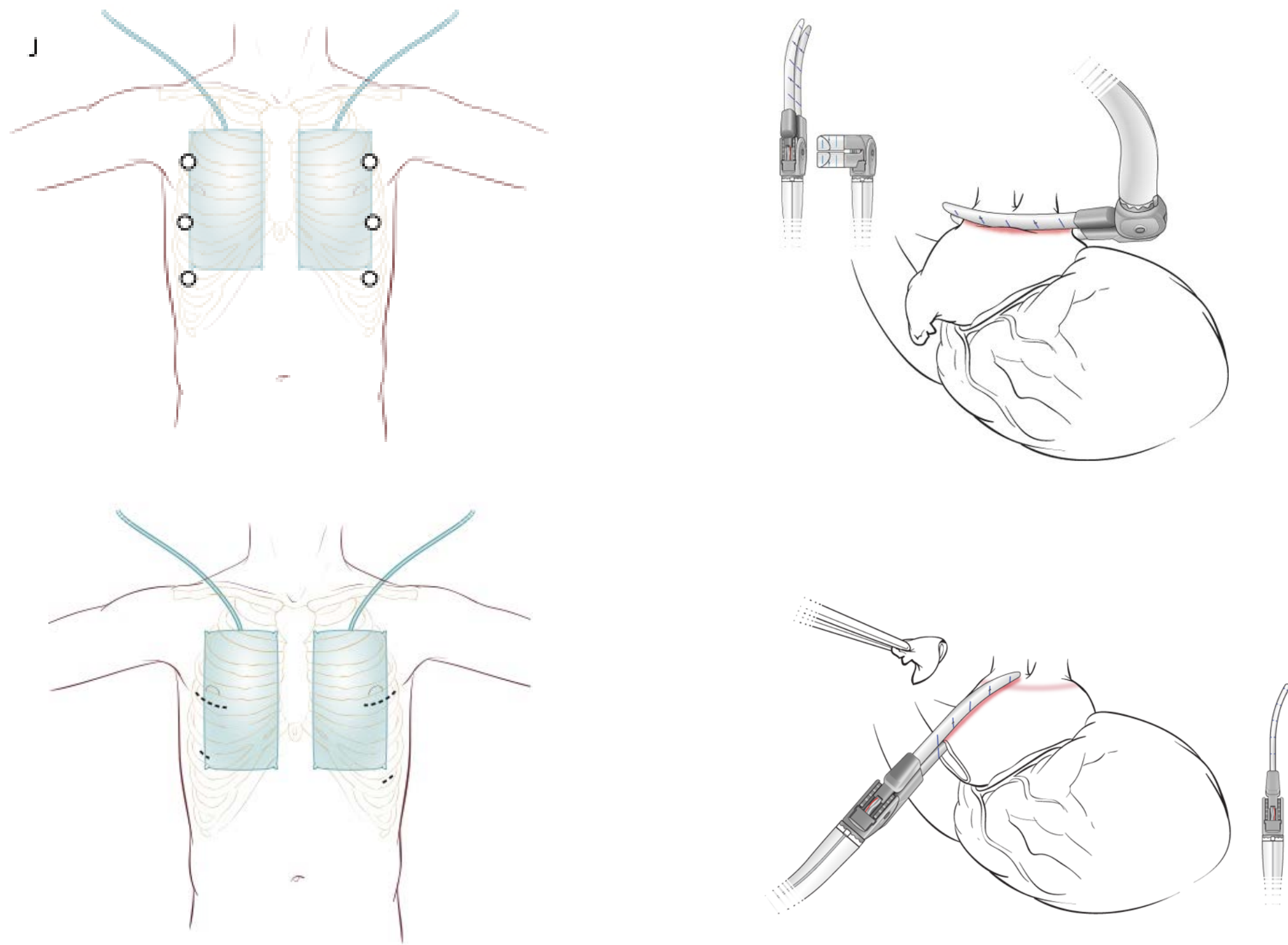
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# Operative Technique

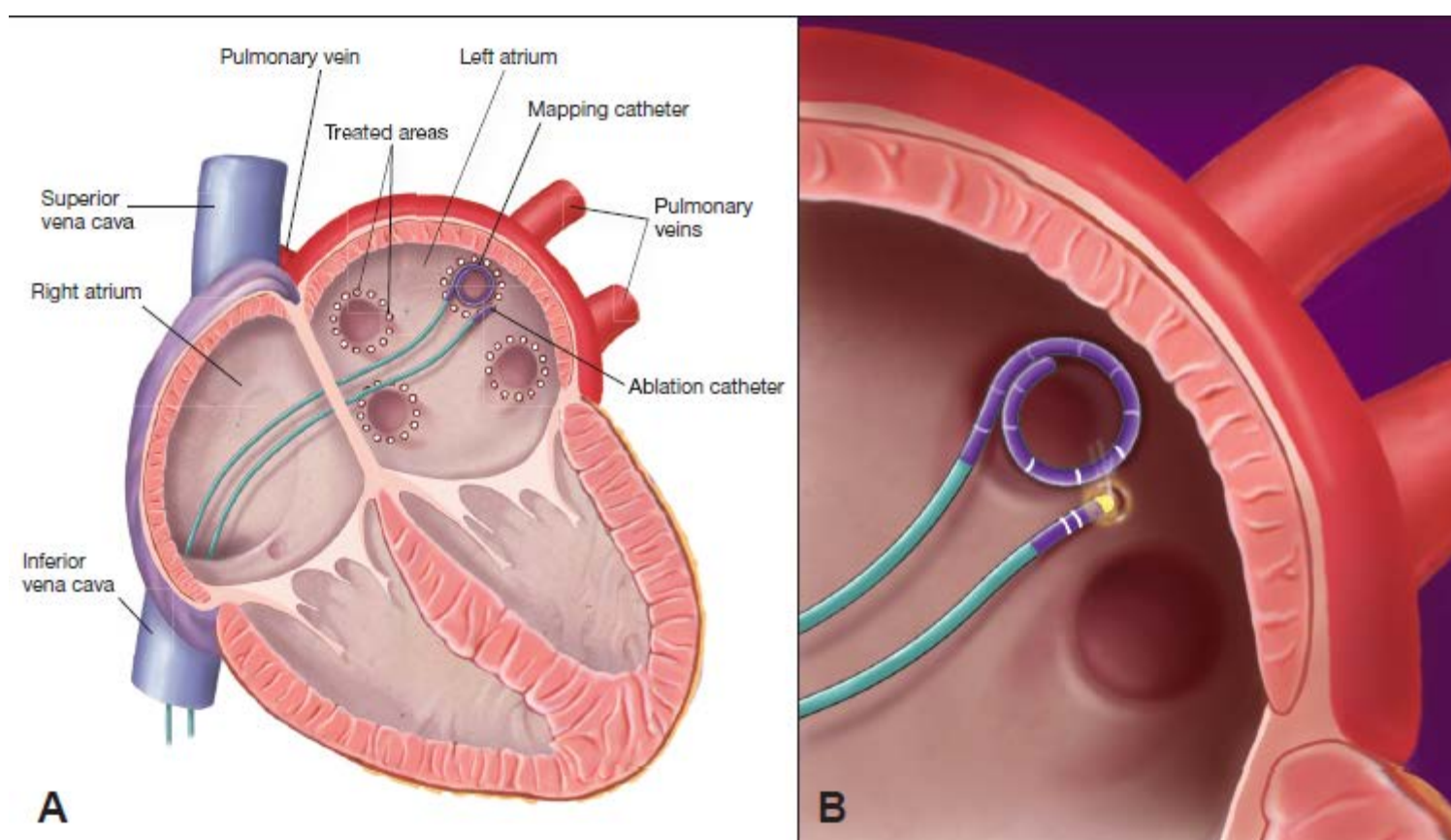
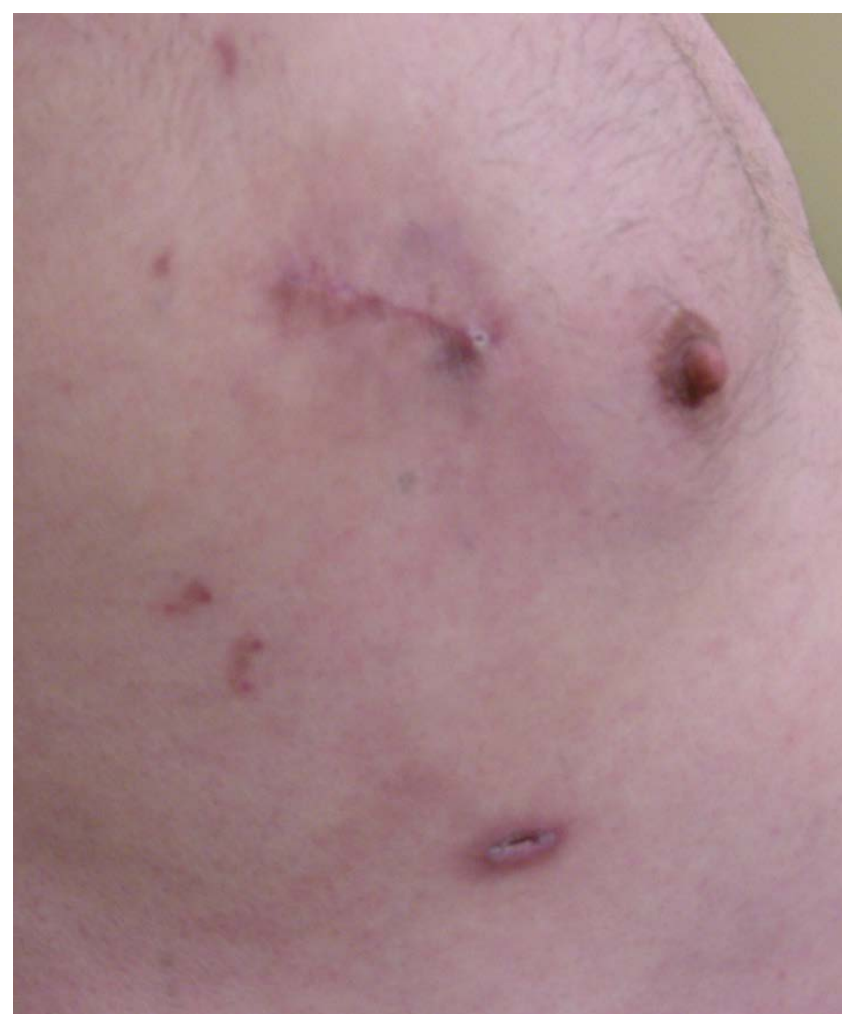


- Small bilateral thoracotomies (8-10cm)
- More lateral is preferred, especially on left side
- Right side 4th interspace
- Left side 3rd interspace



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# Operative Technique - Rationale

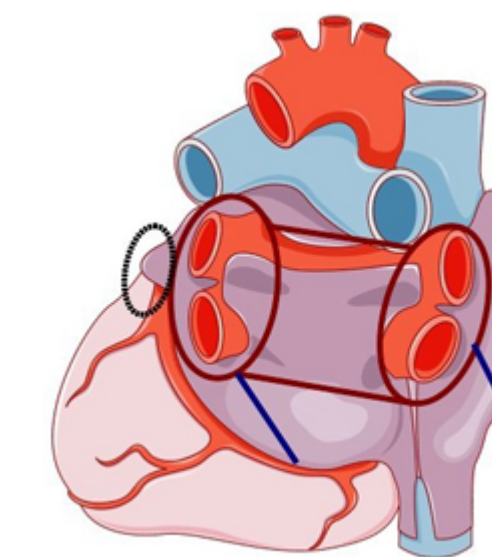


- Minimally invasive operations should not sacrifice efficacy for cosmetics
- Use established principles of surgery and electrophysiology
  - Most effective lesion patterns for ablation
  - Identification and destruction of autonomic ganglia
  - Intraoperative confirmation of arrhythmia control
- Development and adaptation of technology to perform truly effective, minimally invasive surgery



## Expert consensus guidelines: Examining surgical ablation for atrial fibrillation

Niv Ad, MD,<sup>a,b</sup> Ralph J. Damiano, Jr, MD,<sup>c</sup> Vinay Badhwar, MD,<sup>a</sup> Hugh Calkins, MD,<sup>d</sup> Mark La Meir, MD,<sup>e</sup> Takashi Nitta, MD, PhD,<sup>f</sup> Nicolas Doll, MD,<sup>g</sup> Sari D. Holmes, PhD,<sup>h</sup> Ali A. Weinstein, PhD,<sup>i</sup> and Marc Gillinov, MD<sup>j</sup>



### Research Question 5: What are the indications for a hybrid ablation or stand-alone off-pump epicardial ablation in patients with AF?

**Recommendation #7.** Overall, hybrid procedures have shown promising results compared with percutaneous catheter ablation in a subgroup of symptomatic patients with AF in whom medical treatment or percutaneous catheter ablation have failed.

*Class IIb:* Hybrid procedures may be considered as a stand-alone procedure in patients with appropriate indications and by an experienced heart team.

*Level of Evidence: Level B-NR*

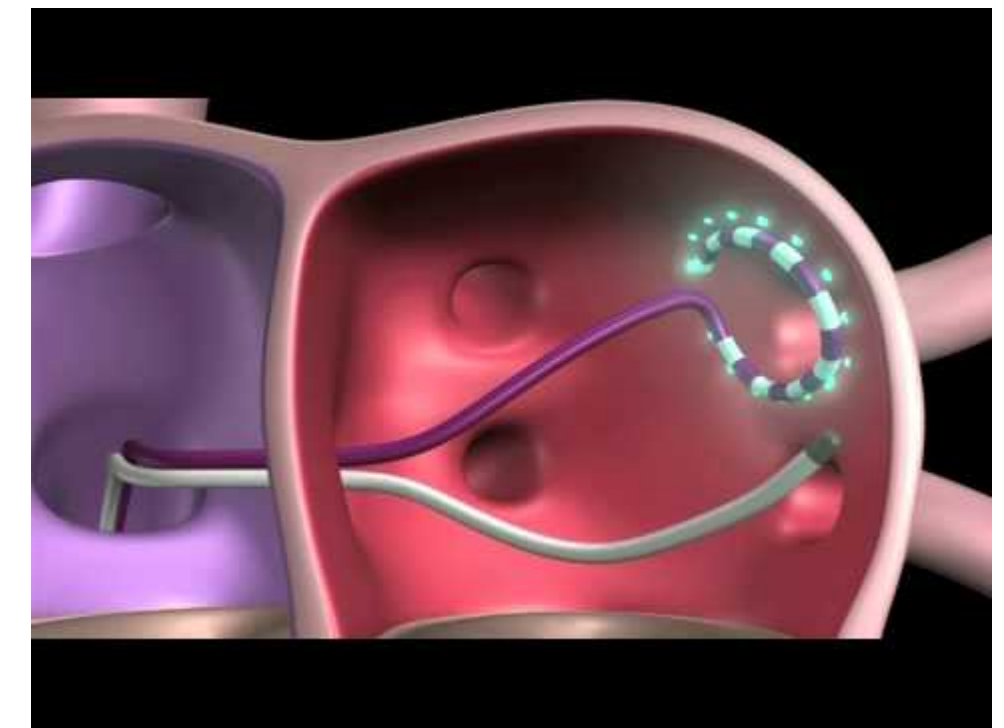
**Recommendation #8.** Overall, minimally invasive approaches to isolate the pulmonary veins bilaterally have shown promising results compared with percutaneous catheter ablation in a subgroup of symptomatic patients with paroxysmal AF and a small left atrium in whom medical treatment or percutaneous catheter ablation has failed.

*Class IIa:* It is reasonable to perform stand-alone surgical ablation for pulmonary vein isolation in patients with symptomatic paroxysmal AF and small left atria.

*Level of Evidence: Level B-R*

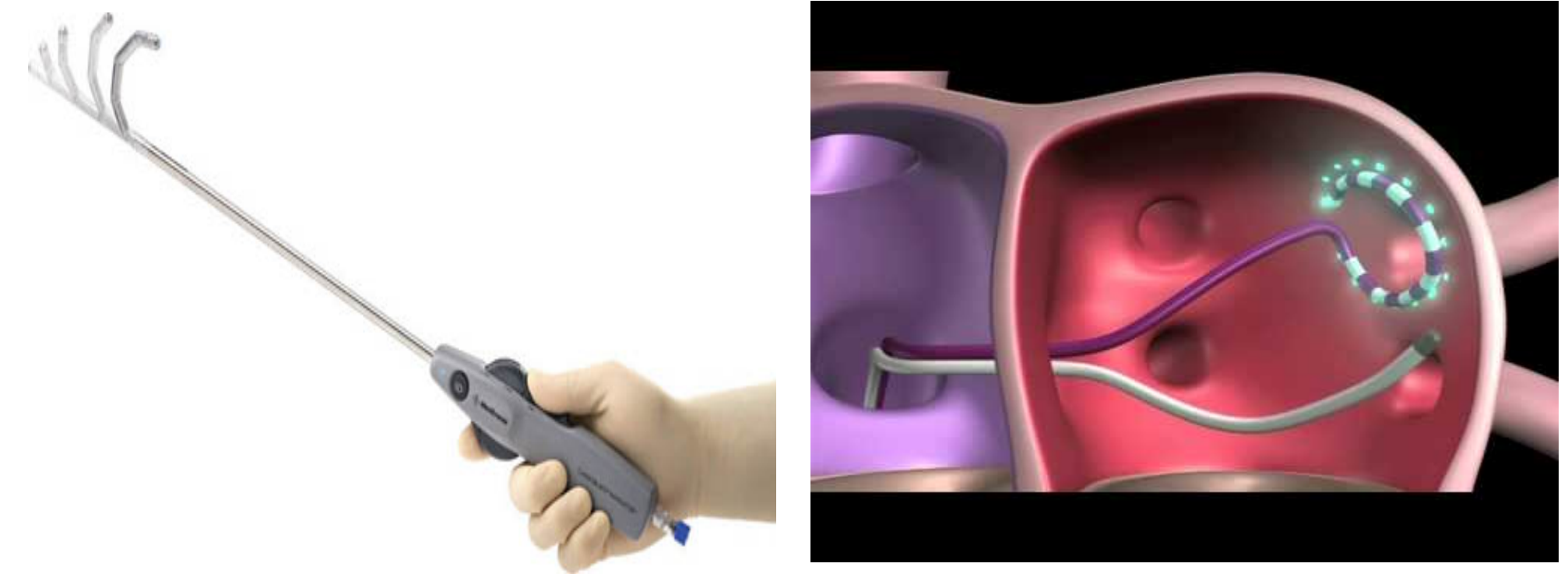
# CONCLUSIONS

- AF is a serious condition
- Surgical ablation is a safe and effective strategy
- Bipolar RF or Cryoprobes are the best ablation devices
- It is important to carefully consider the indications for hybrid procedures
- Training protocols need to be create to ensure patient safety and beneficial outcomes



# CONCLUSIONS

- Multicenter randomized trials
- It is necessary to establish whether hybrid procedures may become a standard treatment for lone AF
- Determine solid endpoints to improve the long term success rate
- Reduce complications
- Single procedures will lead to a higher cost efficacy



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**Thank You !  
Gracias !  
Obrigado!**



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