



Ten (almost twenty) years of atrial fibrillation transcatheter ablation: which results?



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**Scientific
advances**

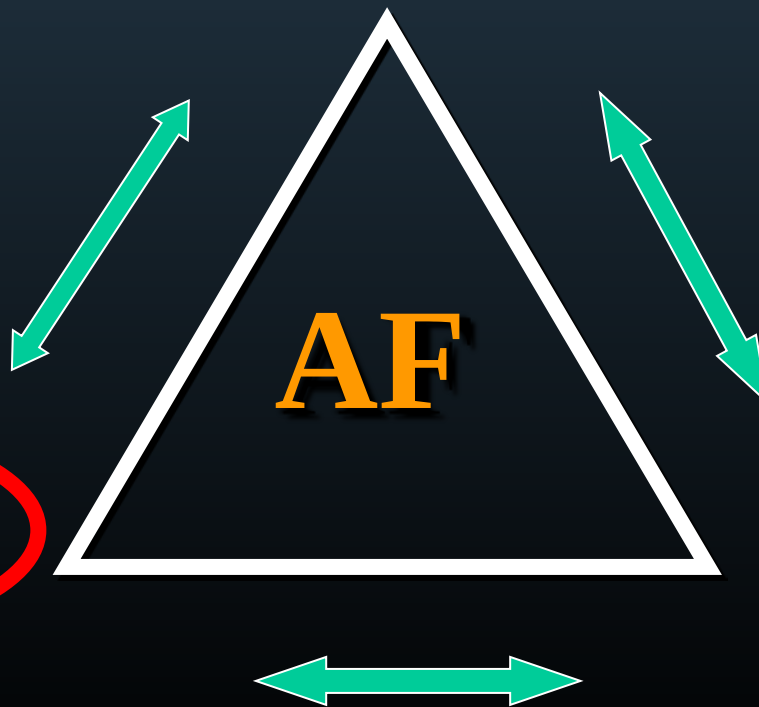
**Technical
innovations**

Trigger

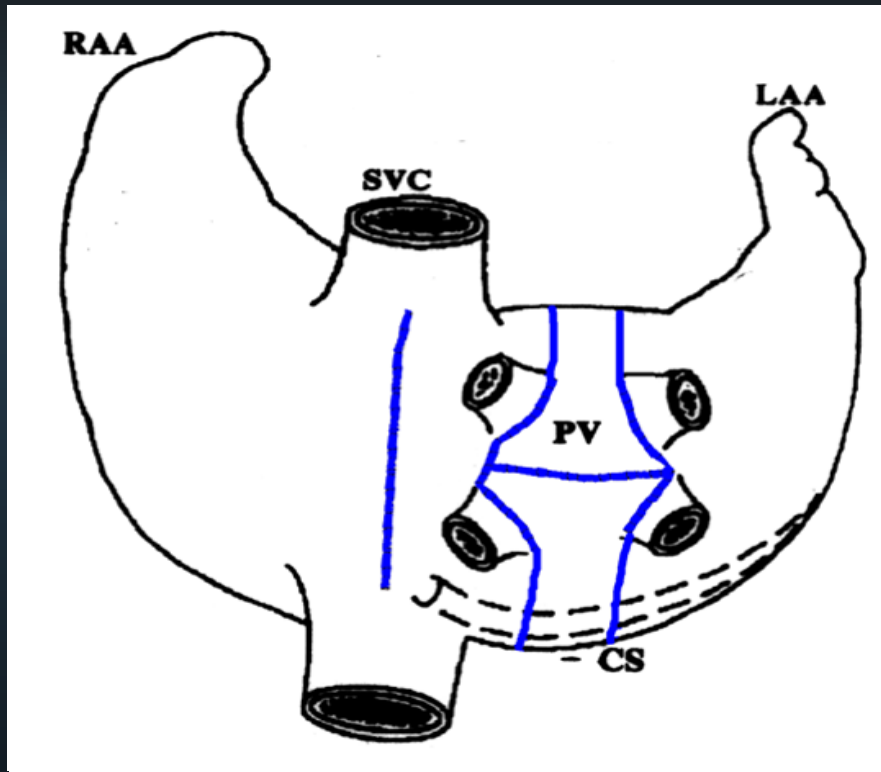
AF

Substrate

**Autonomic
Nervous
System**



1994: **RIGHT** AND **LEFT** LINEAR ABLATION



29 chronic AF patients

Success: 79%

Complication: 31%
(particularly cerebral vascular accidents)

Average procedure duration **10.50 h**

X-Ray exposure **118 min**

Swartz, NASPE '94 (Abstract)

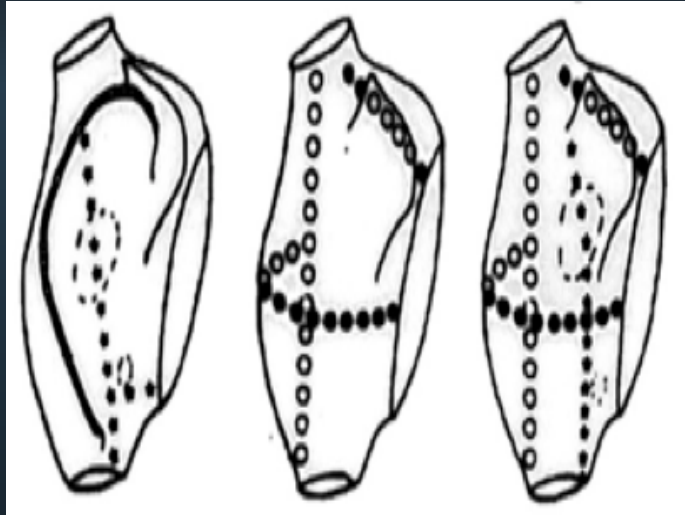
Technical limitation

Inappropriate tools and technologies:
**char formation with 1-mm tip catheter
and absence of temperature control**



Courtesy of Dr. Breithard and Prof. Borggreffe

1996: **RIGHT** LINEAR ABLATION



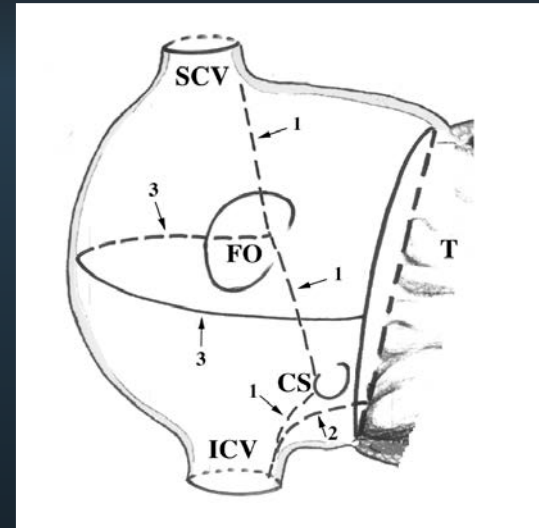
Jais – Haissaguerre 1996

45 pts

at 12 months f/up

33% success

no serious complications



F. Gaita 1996

16 pts

at 12 months f/up

31% success

no complications

1996

Λ

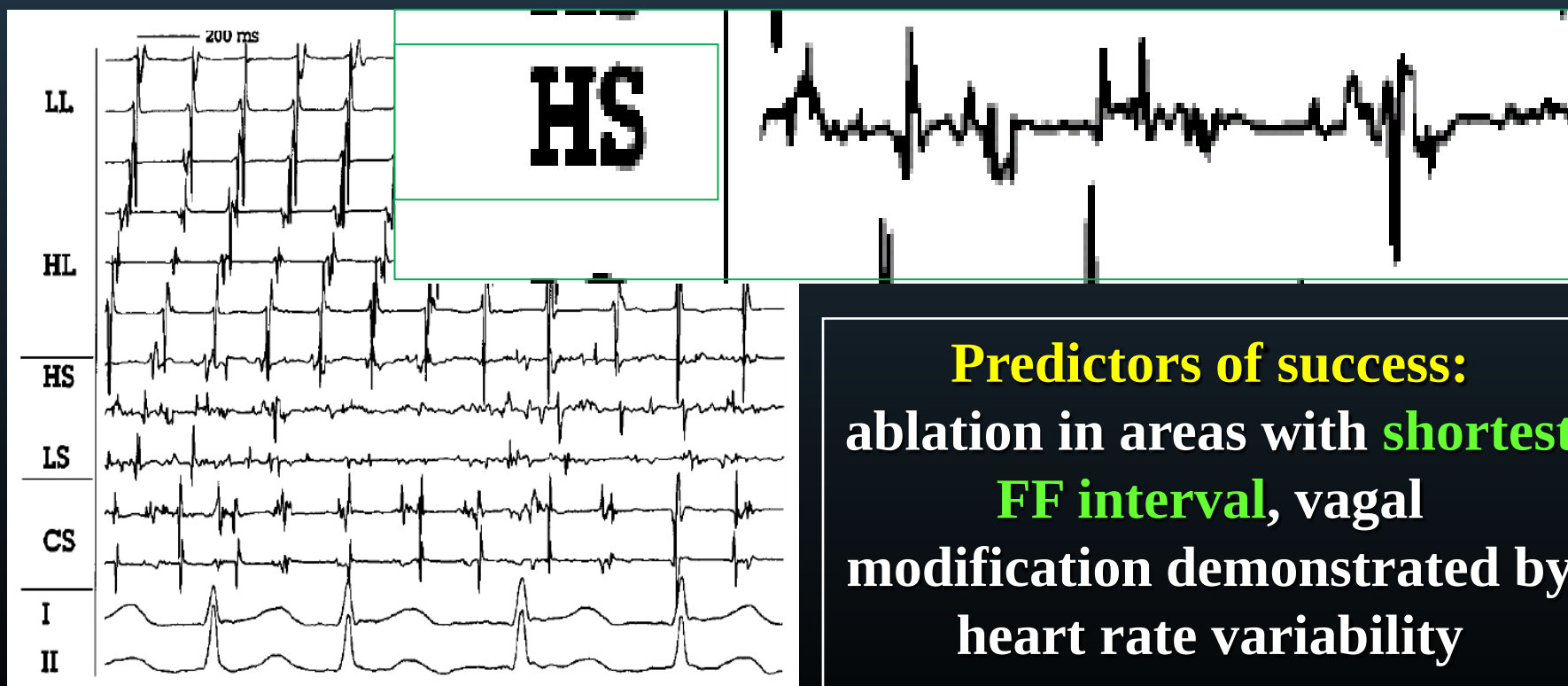
1994

2014

Atrial Mapping and Radiofrequency Catheter Ablation in Patients With Idiopathic Atrial Fibrillation

Electrophysiological Findings and Ablation Results

Fiorenzo Gaita, MD; Riccardo Riccardi, MD; Leonardo Calò, MD; Marco Scaglione, MD;
Lucia Garberoglio, MD; Renzo Antolini, PhD; Michele Kirchner, PhD;
Filippo Lamberti, MD; Elena Richiardi, MD

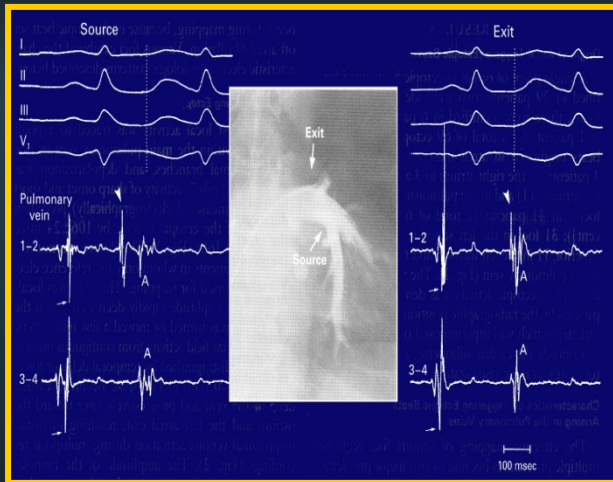


Predictors of success:
ablation in areas with **shortest**
FF interval, vagal
modification demonstrated by
heart rate variability

Circulation 1998;97;2136

**Scientific
advances**

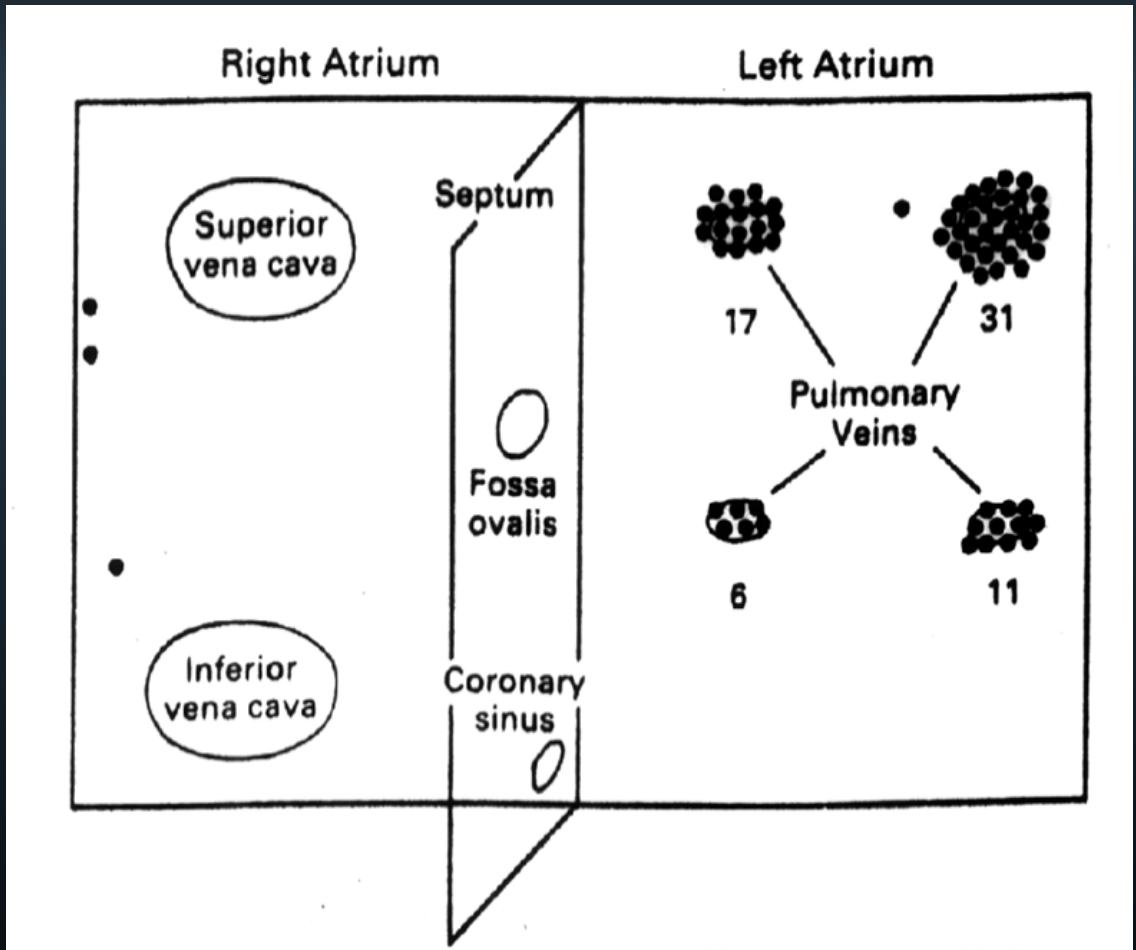
1998: **PULMONARY VEIN** FOCAL ABLATION



45 pts with
idiopathic PAF

Follow-up:
 8 ± 6 months

62% success w/o AAD



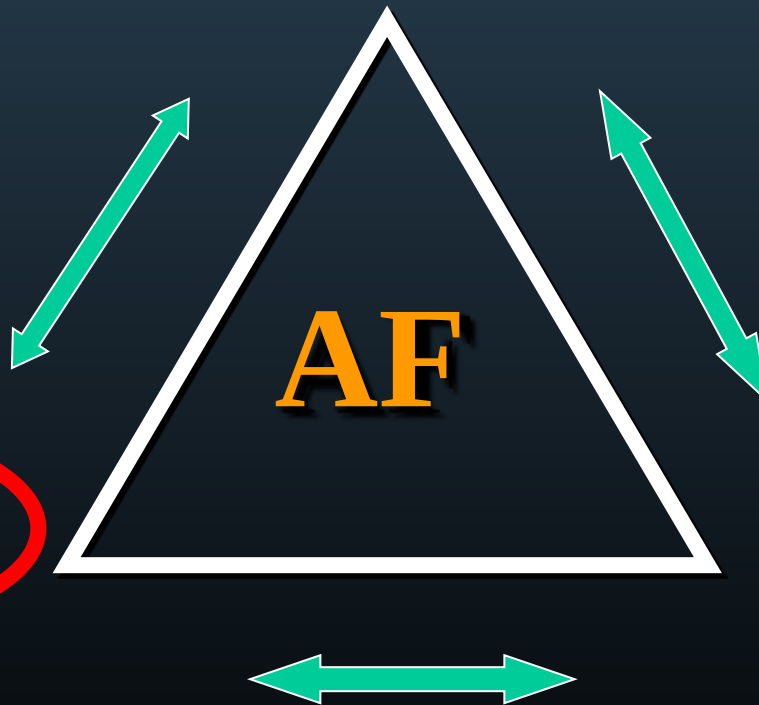
Haissaguerre et al. N Engl J Med 1998;339;659-66

Trigger

AF

Substrate

**Autonomic
Nervous
System**



Focal ablation: efficacy 62%,
concerns about vein stenosis

Technical innovations

Limited efficacy in
persistent/long lasting AF

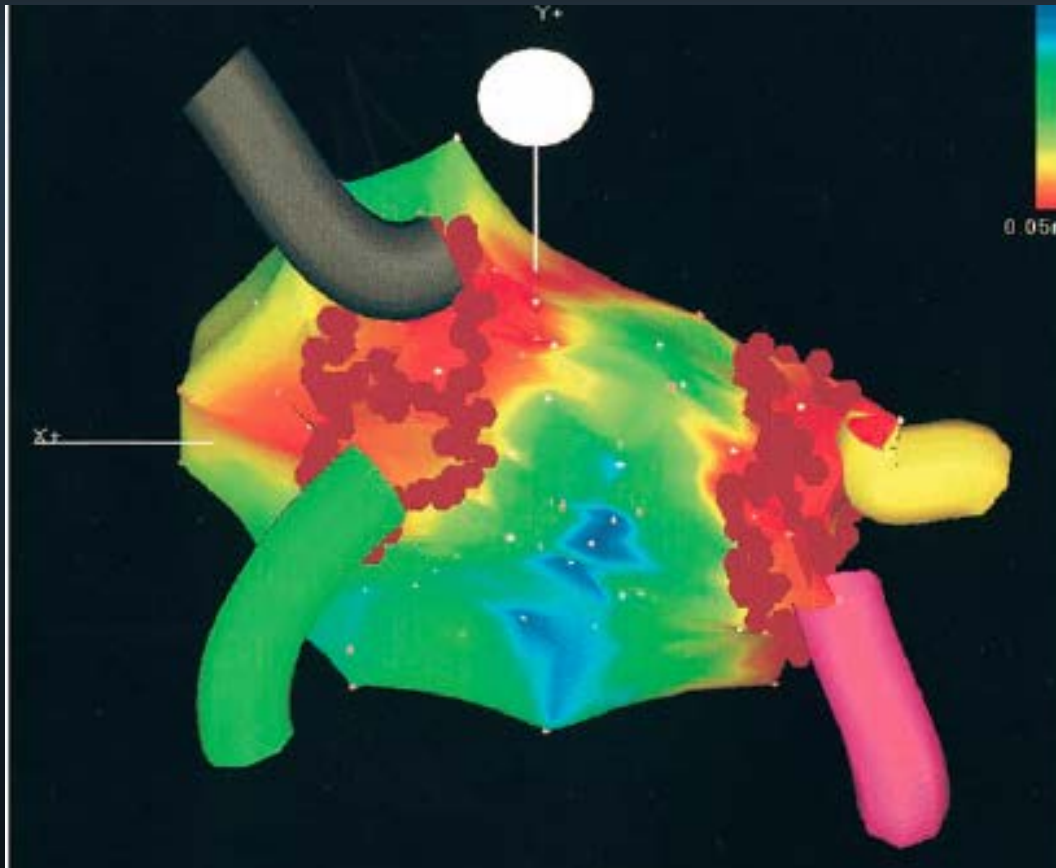
1999: NON FLUOROSCOPIC MAPPING



Precise catheter localisation
X-rays exposure reduction

Pappone, Circulation 1999

2001: ENCIRCLING



251 patients

10 month fup

Eff: 85% parox,
68% pers

complication 0,8%

Pappone, Circulation 2001

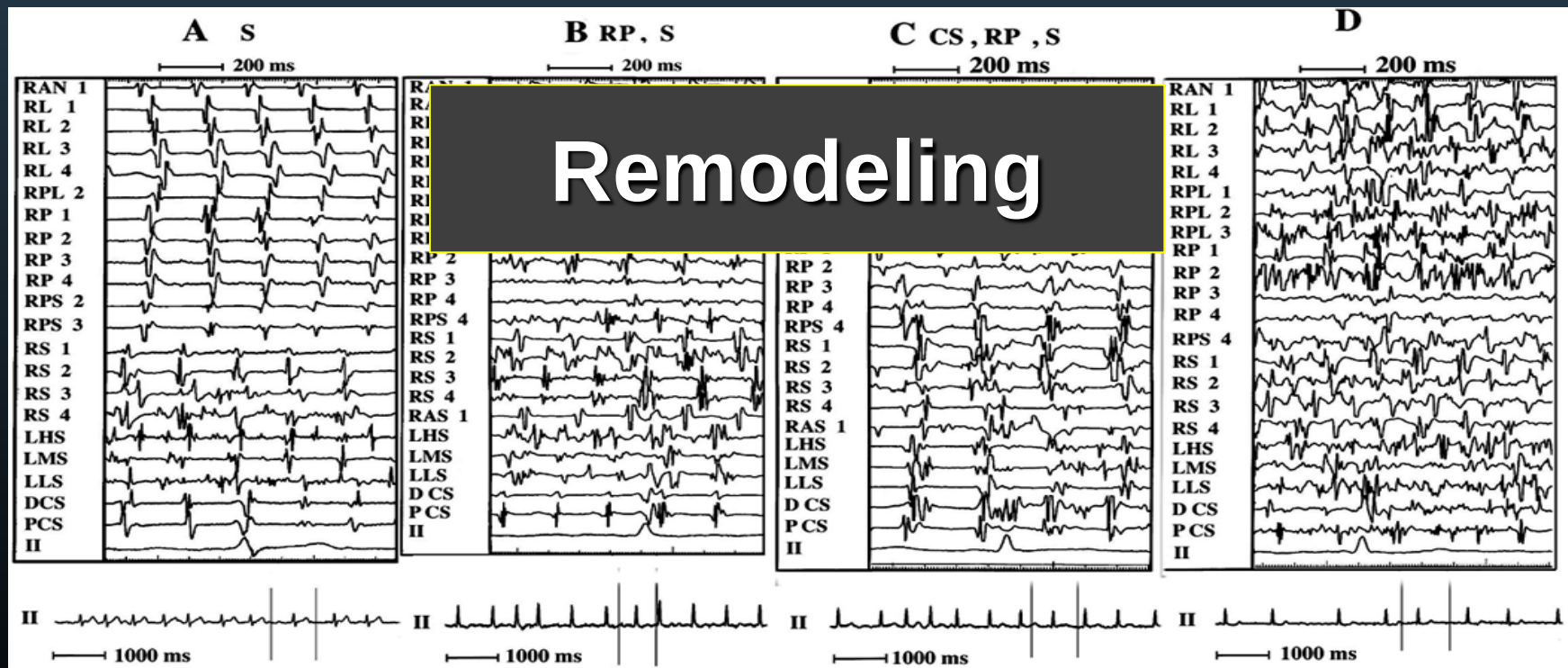
Focal ablation: efficacy 62%,
concerns about vein stenosis

Limited efficacy in
persistent/long lasting AF

Different Patterns of Atrial Activation in Idiopathic Atrial Fibrillation: Simultaneous Multisite Atrial Mapping in Patients With Paroxysmal and Chronic Atrial Fibrillation

JACC 2001

Fiorenzo Gaita, MD*, Leonardo Calò, MD*, Riccardo Riccardi, MD*, Lucia Garberoglio, MD*,
Marco Scaglione, MD*, Giovanni Licciardello, MD*, Luisella Coda, MD*, Paolo Di Donna, MD*,
Mario Bocchiardo, MD*, Domenico Caponi, MD*, Renzo Antolini, PhD,† Fulvio Orzan, MD,‡
GianPaolo Trevi, MD‡



Parox	22%	39%	39%	0%
Perm	0%	8%	33%	59%

Trigger

AF

Substrate

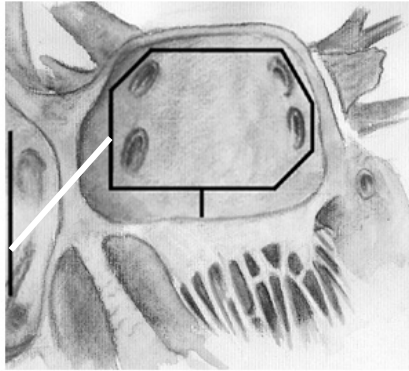
**Autonomic
Nervous
System**



**Scientific
knowledge**

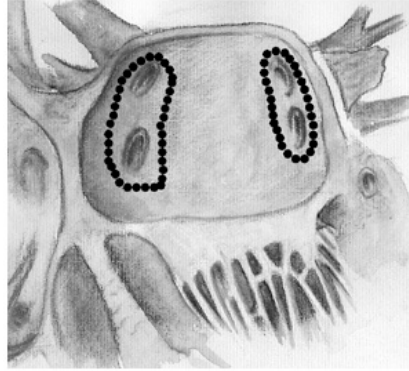
Surgical procedure

Scalpel



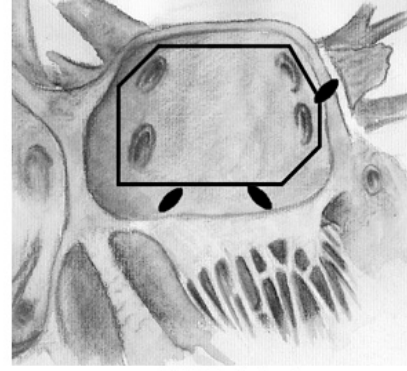
COX

RF



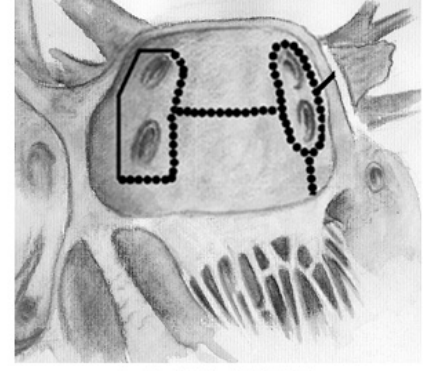
MELO

Scalpel + Cryo



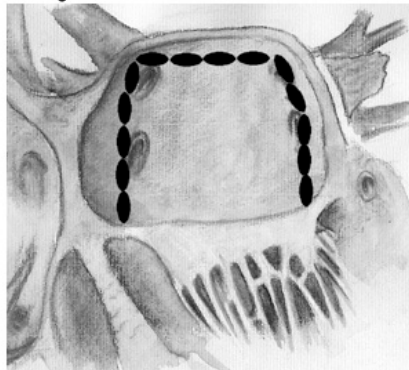
SUEDA

Scalpel + RF



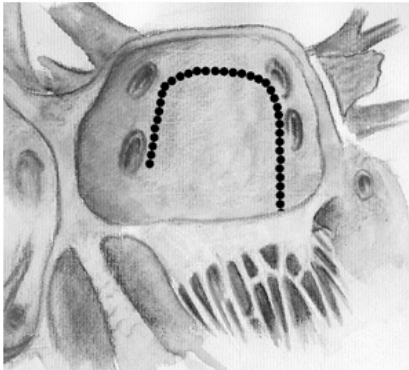
BENUSSI

Cryo



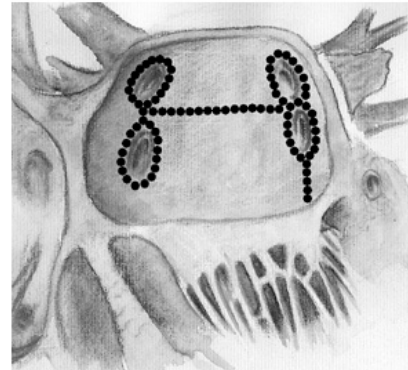
GAITA

RF



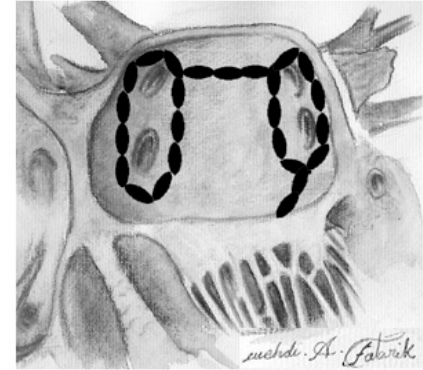
KOTTKAMP

Cooled RF



DENEKE

Cryo

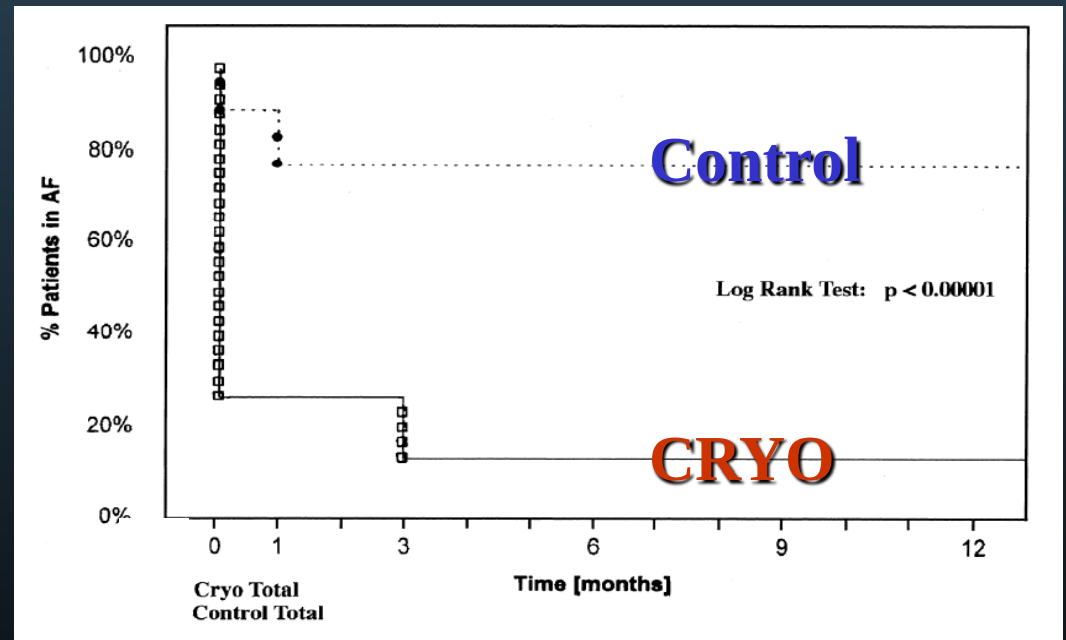
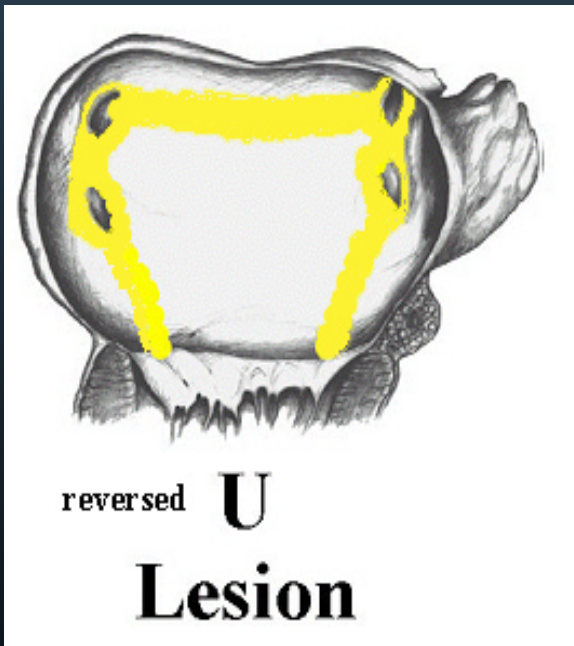


GAITA

- RF
- Cryo
- Scalpel

“7” scheme ablation for permanent AF and valvular heart disease (1996-98)

- Cryoablation in 32 pts with chronic AF and Valvular Heart Disease



Success w/o drugs **69%**

Success with RF and drugs **90%**

Gaita, Gallotti J Am Coll Cardiol 2000

Technical innovations

2002: **IRRIGATED TIP** ABLATION CATHETER

RF
ablation
catheter

4 mm



RF ablation
cooled
catheter

4 mm



larger and
safer lesions
(less charring)

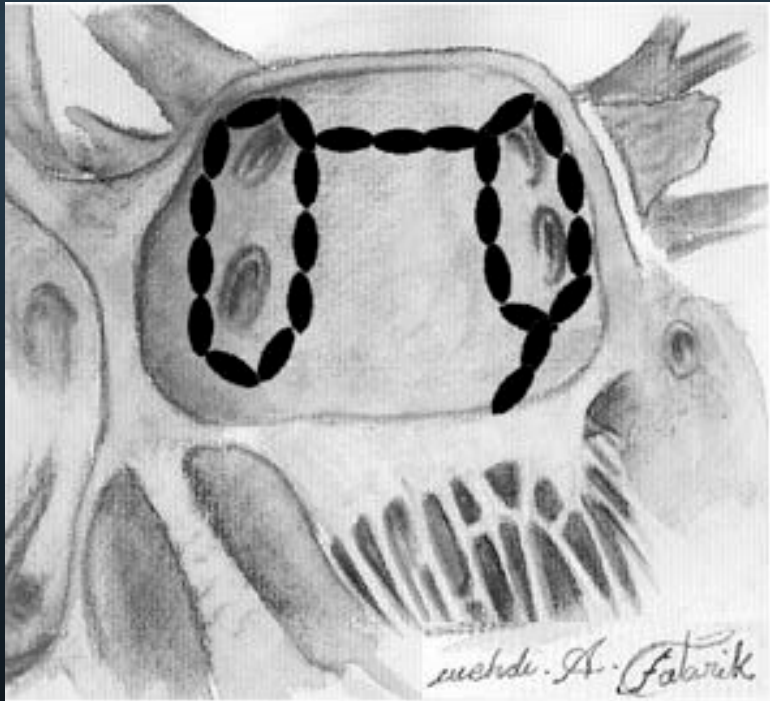
Schreieck JCE 2002

1994

2002



2014



GAITA

Pulmonary vein isolation

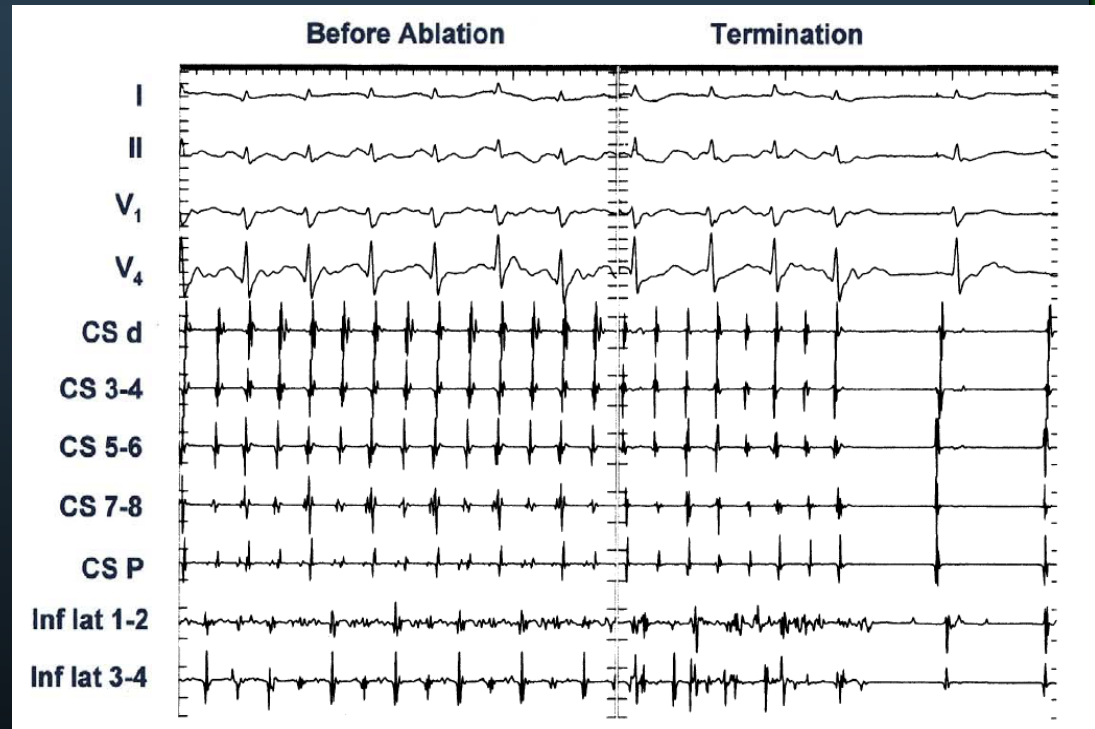
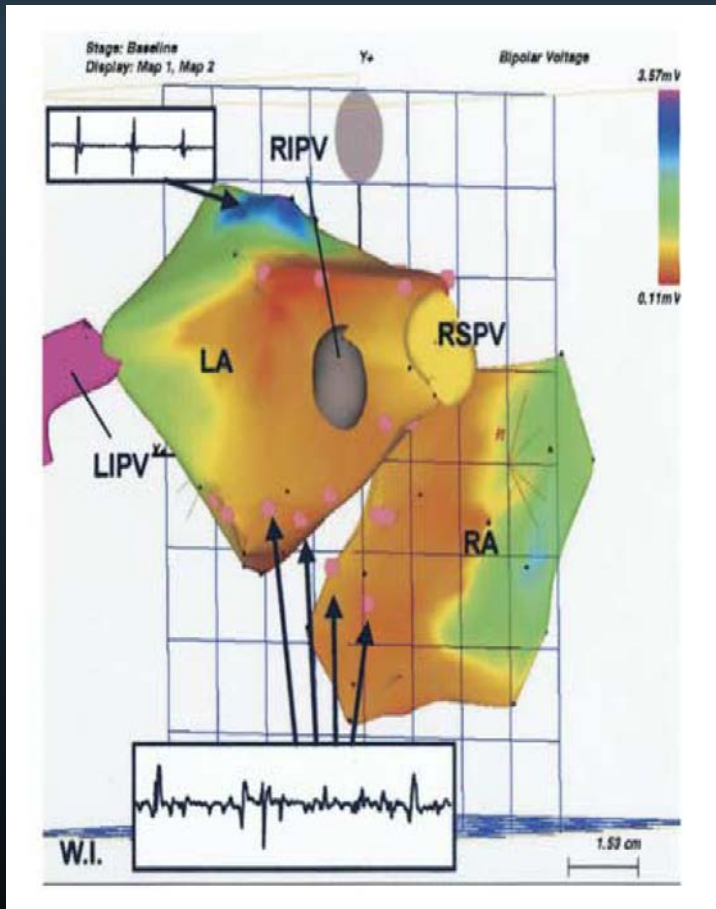
Left linear lesions

Ganglionated plexi ablation

**Complex fractionated
electrograms**

2004: CFAE ABLATION

121 pts with refractory AF (57 PAF, 64 chronic). **FU: 1 y**

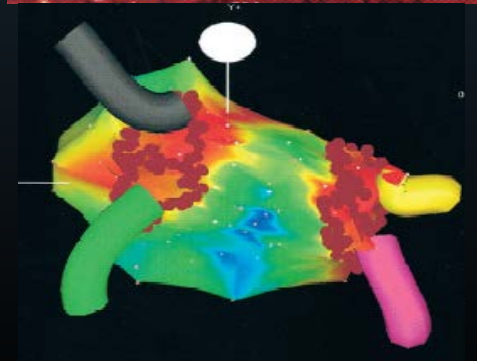
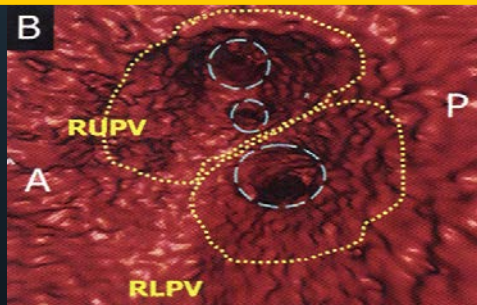
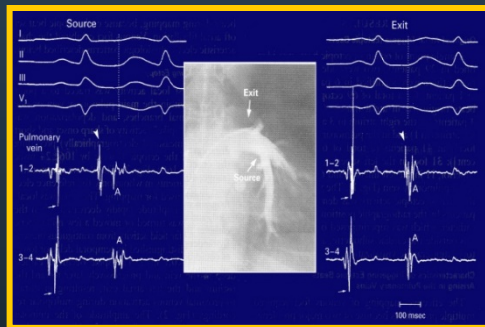


84% success rate w/out AAD (16% redo)

Nademanee et al. JACC 2004; 43:2044

STEPWISE APPROACH

PAROXYSMAL: PV Isolation

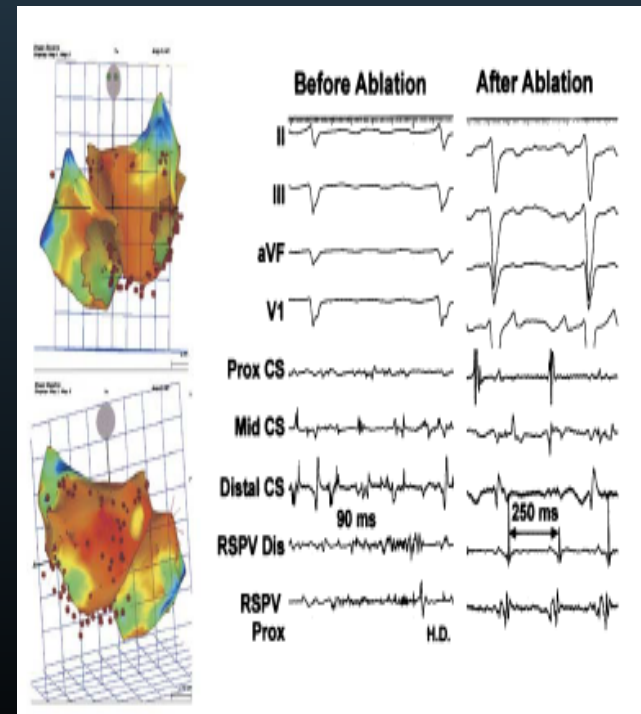
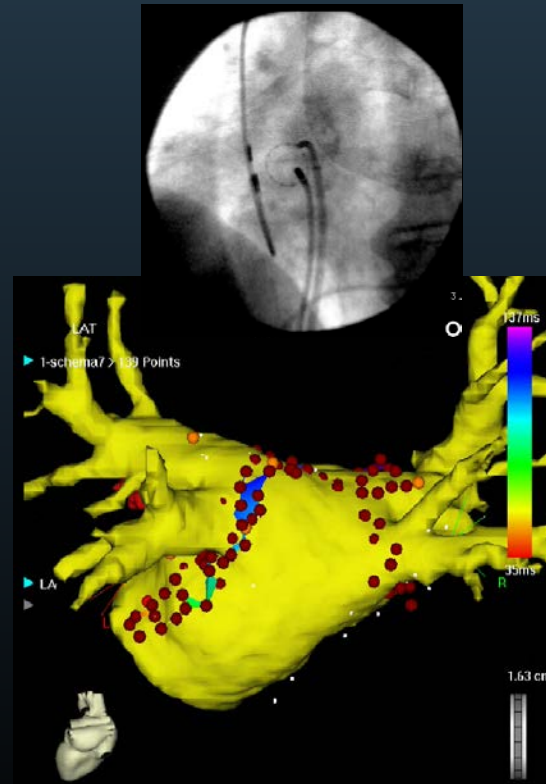


PERSISTENT and LONG-STANDING:

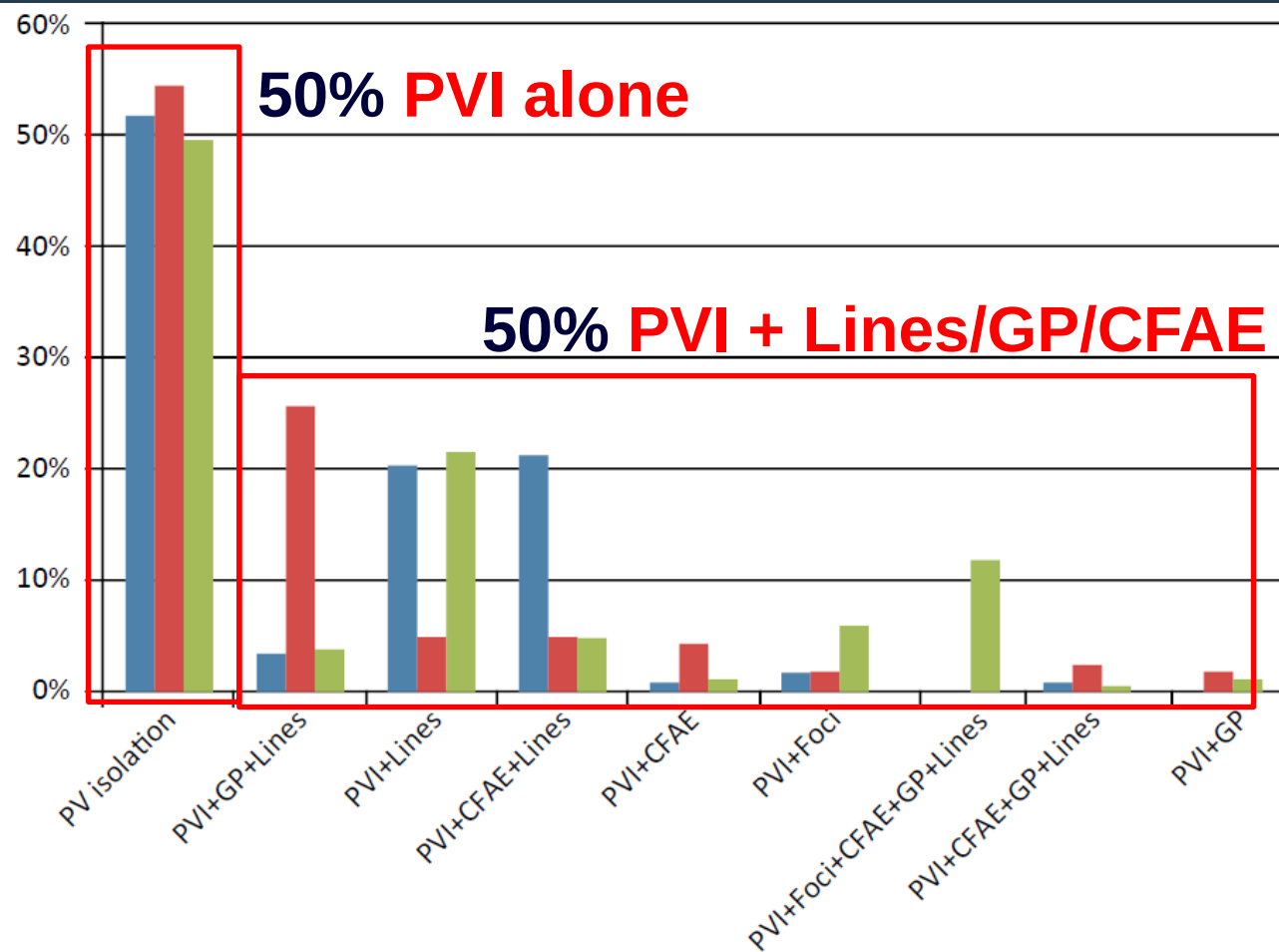
PVI + Linear Lesions

+

CFAE/GP



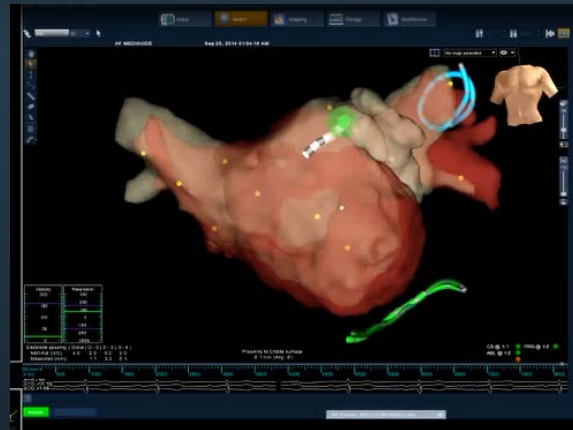
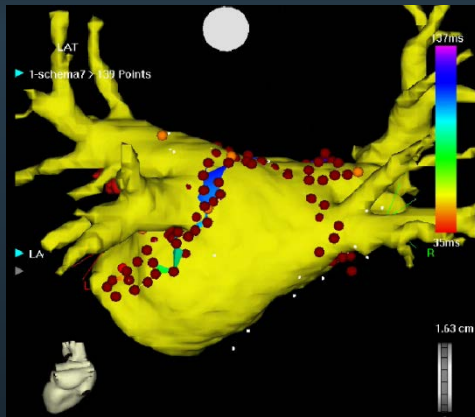
Prospective European Survey on Atrial Fibrillation Ablation: Clinical Characteristics of Patients and Ablation Strategies Used in Different Countries



2010-2011
35 centers,
12 countries,
940 patients

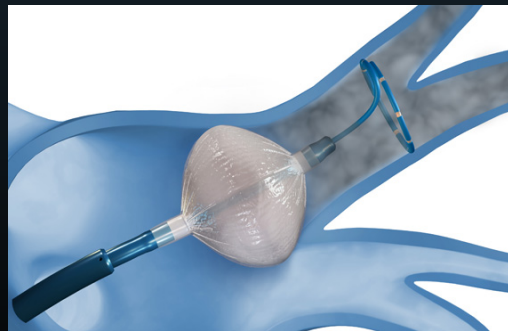
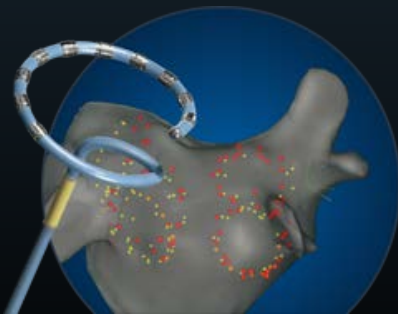
Parox 52.4%,
Pers 36%,
Long last 11.6%

Merging/Fusion with CT or MRI



**Technical
innovations**

“One shot”



1994

1996



1998



2000



2002



2004



2014

1994

1996

1998

2000

2002

2004

2014

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**Complication
Reduction**

The identification of problem (SCI) →
procedural tips → reduction of SCI's burden

PVAC

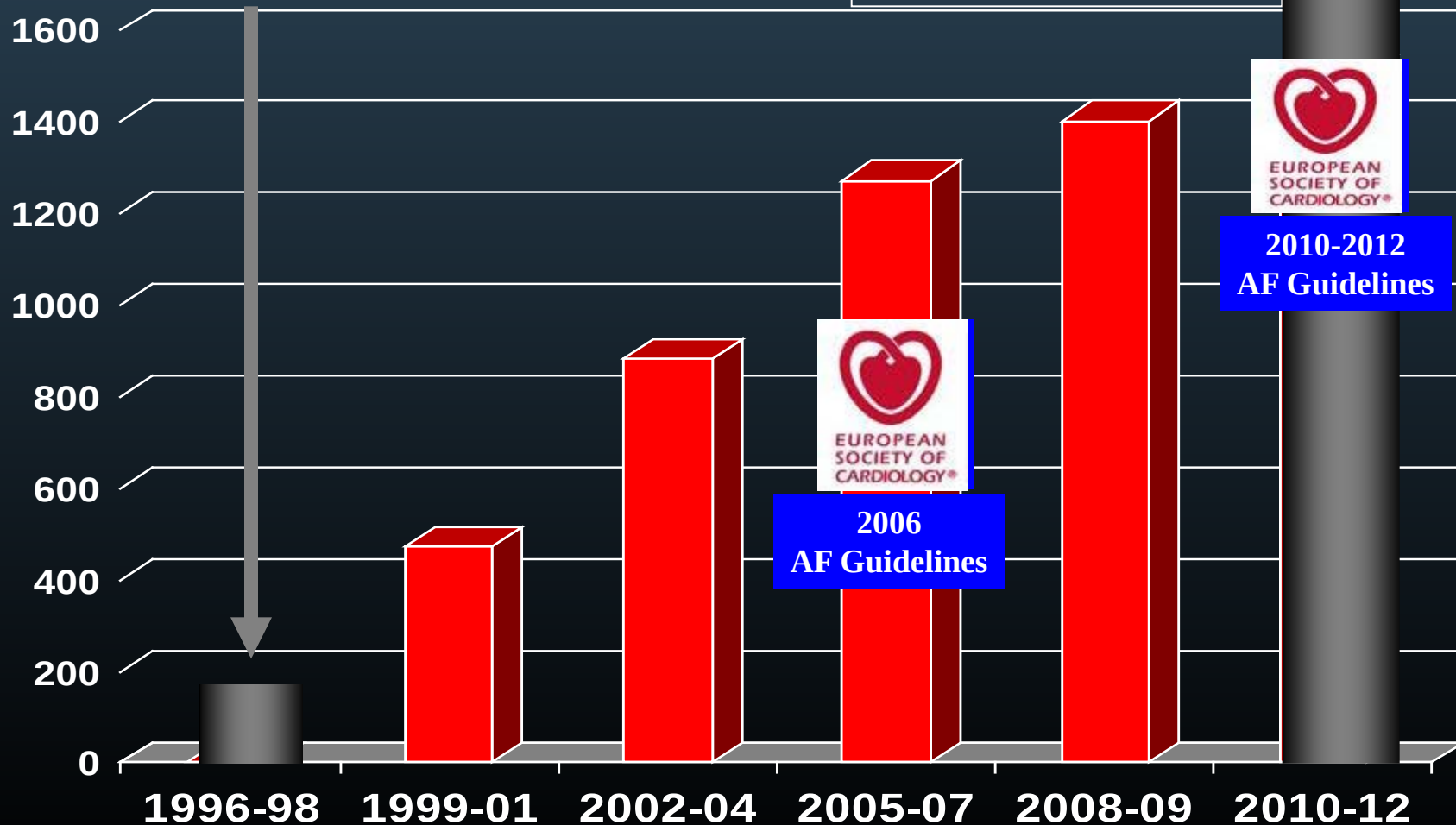
Widespread application of the technique



AF Ablation publications and procedures over time

*1996: 4 studies
268 patients*

*2012: 1500 studies
> 250000 ablations
performed*



Guidelines for the management of atrial fibrillation

2006

8.3. Maintenance of sinus rhythm

Recommendations

Class IIa

- (6) Catheter ablation is a reasonable alternative to pharmacological therapy to prevent recurrent AF in symptomatic patients with little or no LA enlargement. (Level of Evidence: C)

Guidelines for the management of atrial fibrillation

2010

		Catheter ablation of AF in patients with heart failure may be considered when antiarrhythmic medication, including amiodarone, fails to control symptoms.	IIb
Catheter ablation for paroxysmal AF should be considered in symptomatic patients who have previously failed a trial of antiarrhythmic medication.	IIa	Catheter ablation of AF may be considered prior to antiarrhythmic drug therapy in symptomatic patients despite adequate rate control with paroxysmal symptomatic AF and no significant underlying heart disease.	IIb
Ablation of persistent symptomatic AF that is refractory to antiarrhythmic therapy should be considered a treatment option.	IIa	Catheter ablation of AF may be considered in patients with symptomatic long-standing persistent AF refractory to antiarrhythmic drugs.	IIb

Guidelines for the management of atrial fibrillation

2012

Catheter ablation of symptomatic paroxysmal AF is recommended in patients who have symptomatic recurrences of AF on antiarrhythmic drug therapy (amiodarone, dronedarone, flecainide, propafenone, sotalol) and who prefer further rhythm control therapy, when performed by an electrophysiologist who has received appropriate training and is performing the procedure in an experienced centre.

I

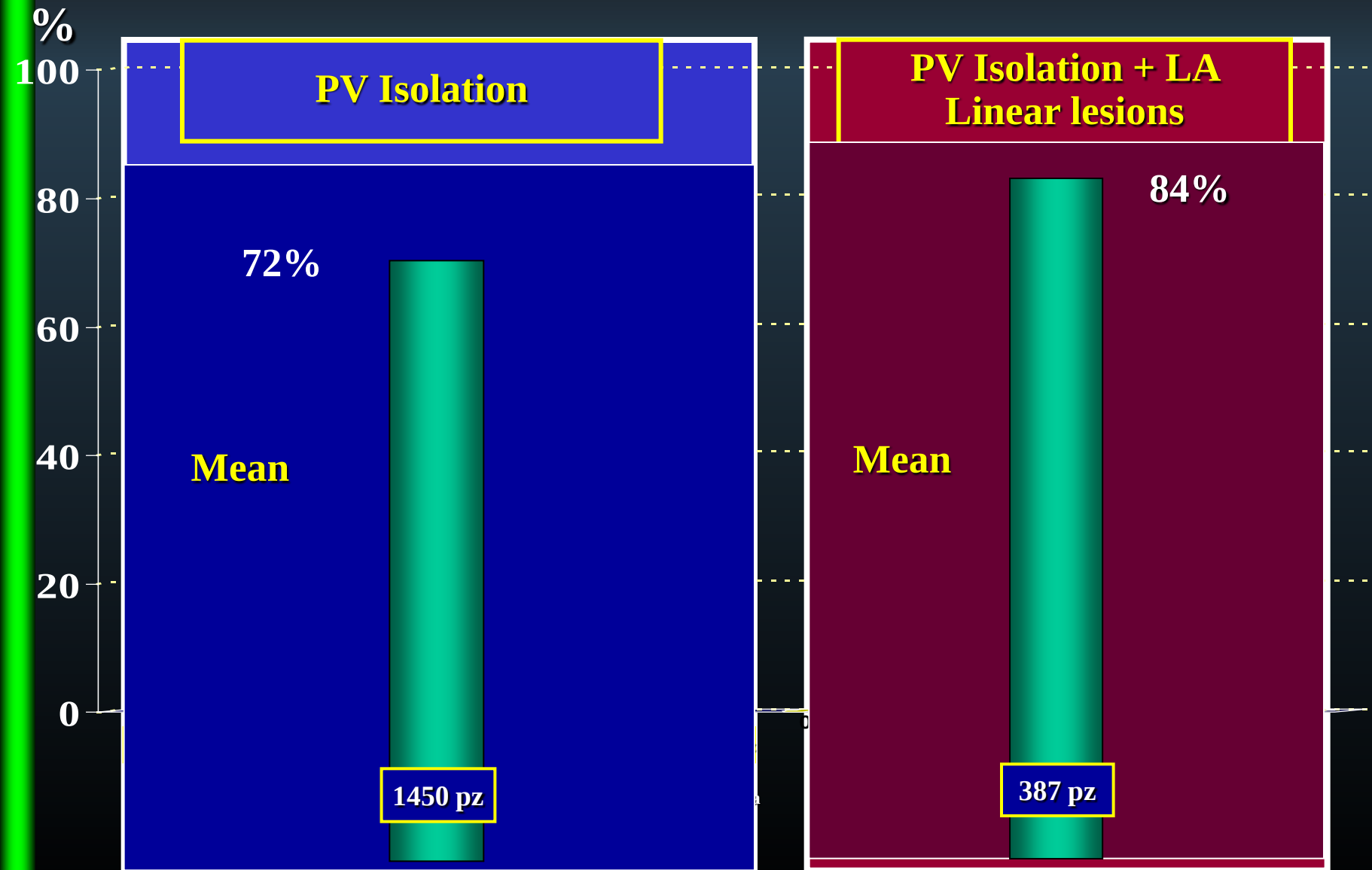
A

Catheter ablation of AF should be considered as first-line therapy in selected patients with symptomatic paroxysmal AF as an alternative to antiarrhythmic drug therapy, considering patient choice, benefit, and risk.

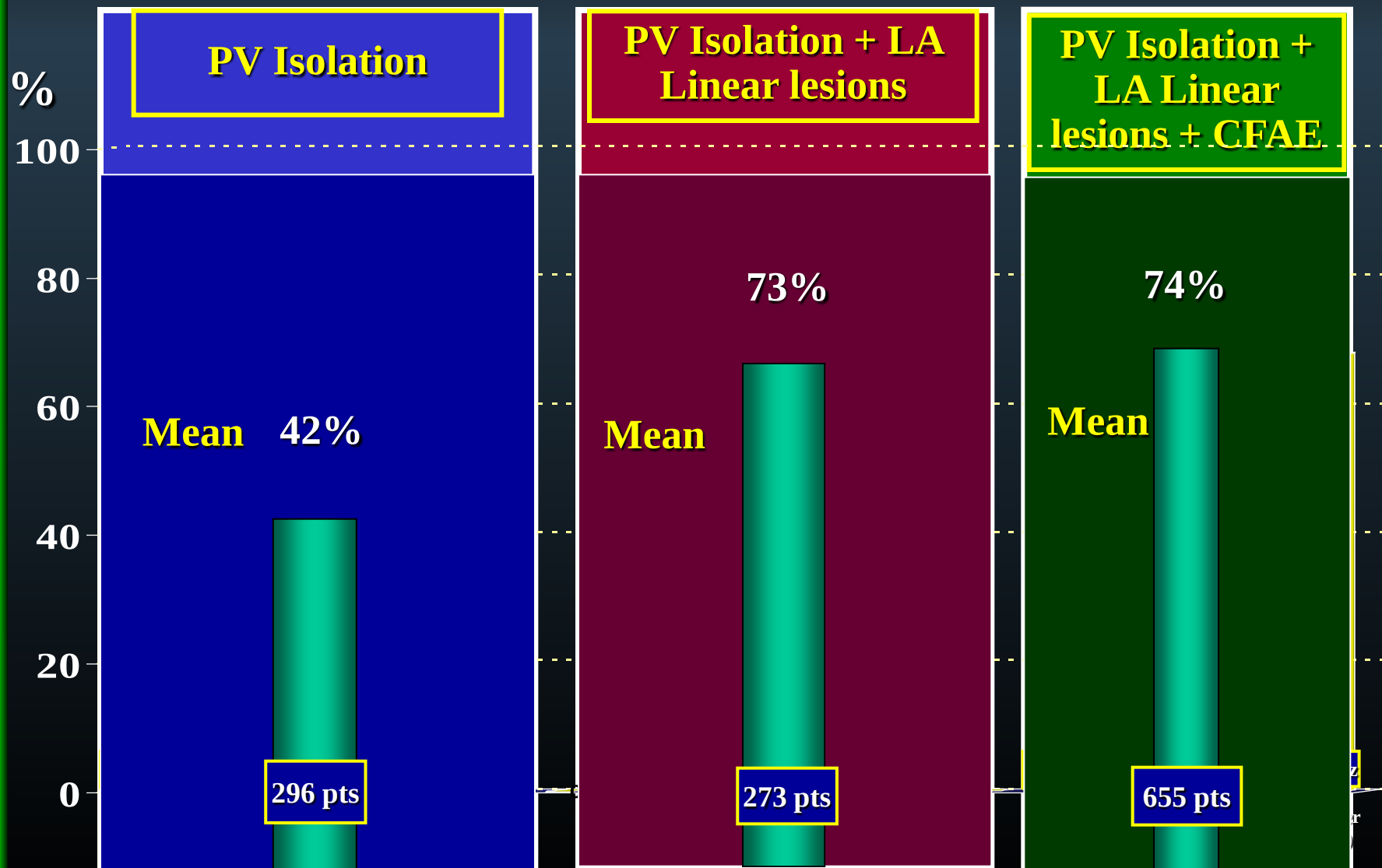
IIa

B

PAROXYSMAL AF: efficacy at 1 year



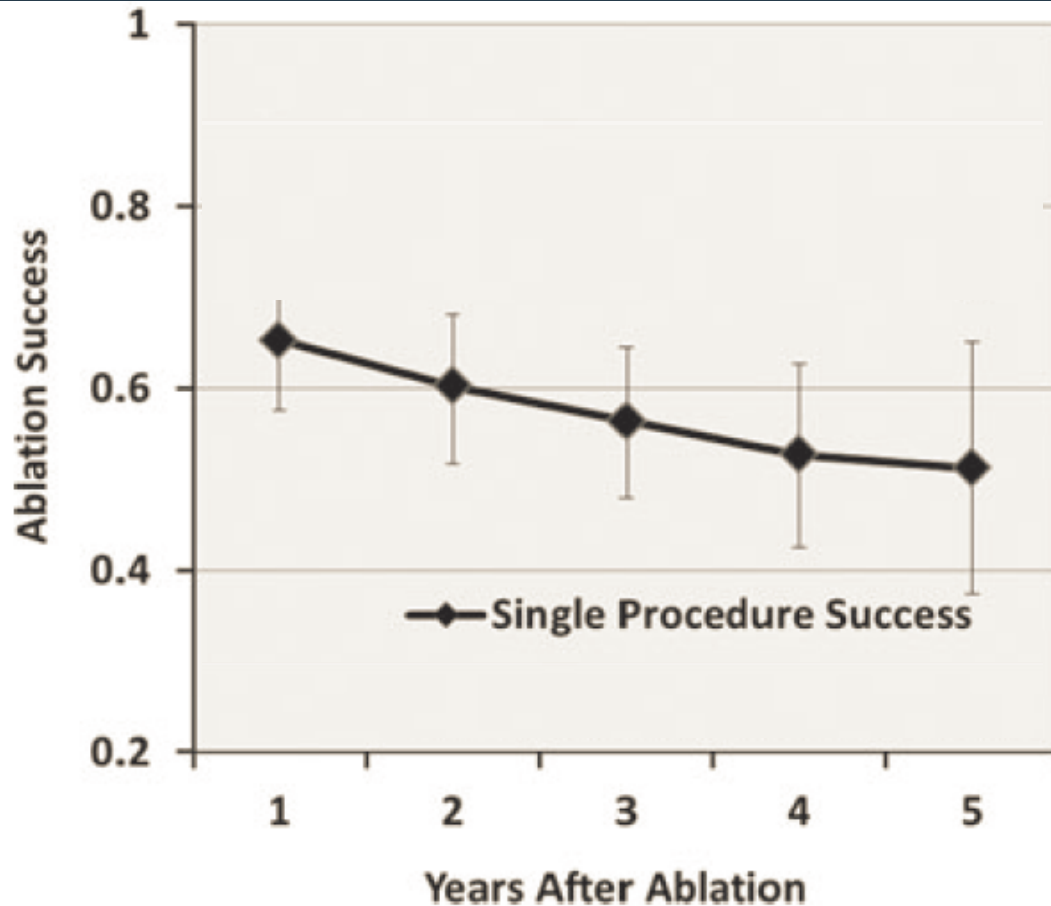
PERS/PERM AF: efficacy at 1 year



LONG TERM RESULT ?

Long-term Outcomes of Catheter Ablation of Atrial Fibrillation: A Systematic Review and Meta-analysis

Anand N. Ganesan, MBBS, PhD; Nicholas J. Shipp, PhD; Anthony G. Brooks, PhD; Pawel Kuklik, PhD; Dennis H. Lau, MBBS, PhD; Han S. Lim, MBBS, PhD; Thomas Sullivan, BMA, CompSc; Kurt C. Roberts-Thomson, MBBS, PhD; Prashanthan Sanders, MBBS, PhD



6167 patients

70% SR at 1 year

50% SR at 5 year

After multiple ABL

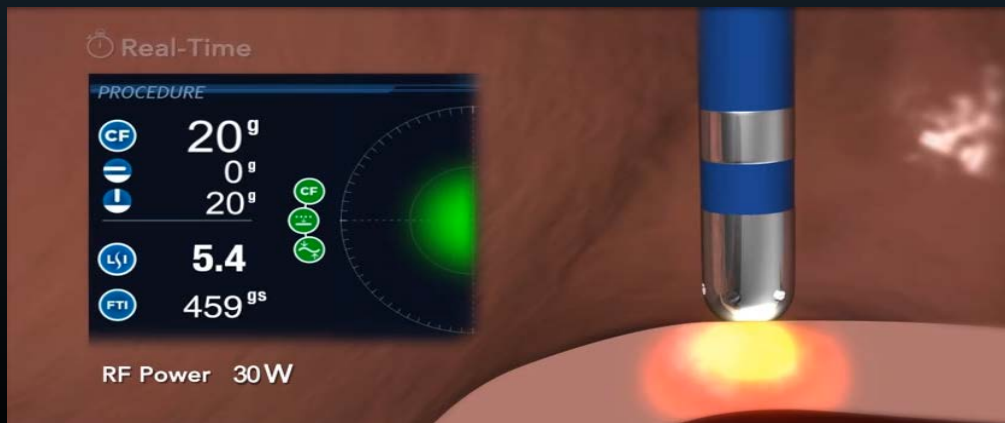
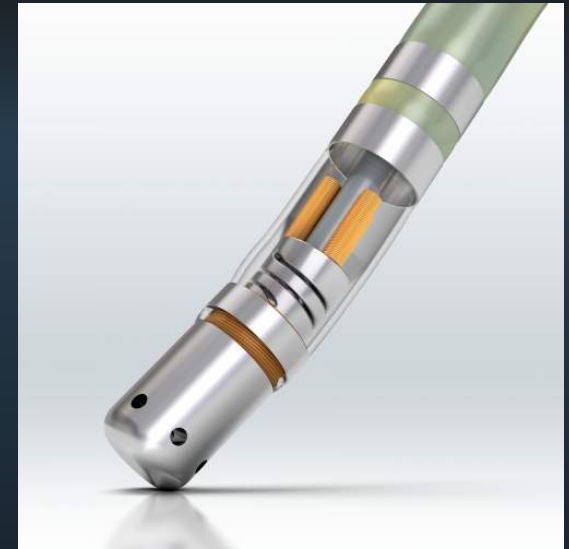
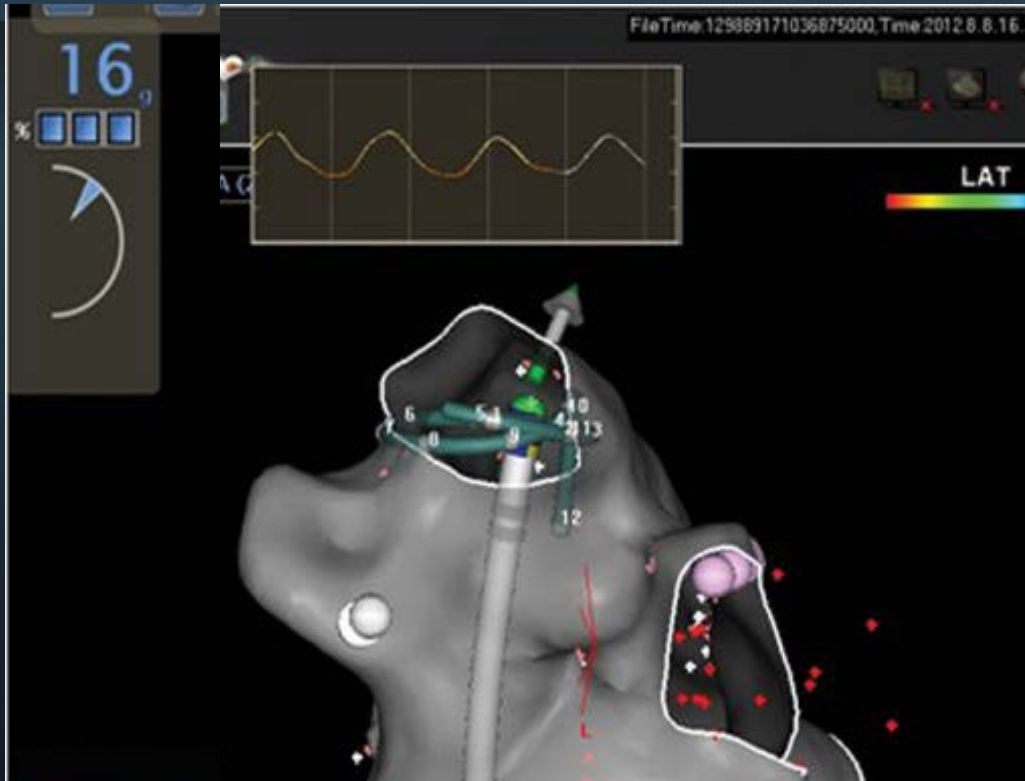
85% SR at 1 year

75% SR at 5 year

***PV conduction
recovery: need
for more durable
lesion***

**Technical
innovations**

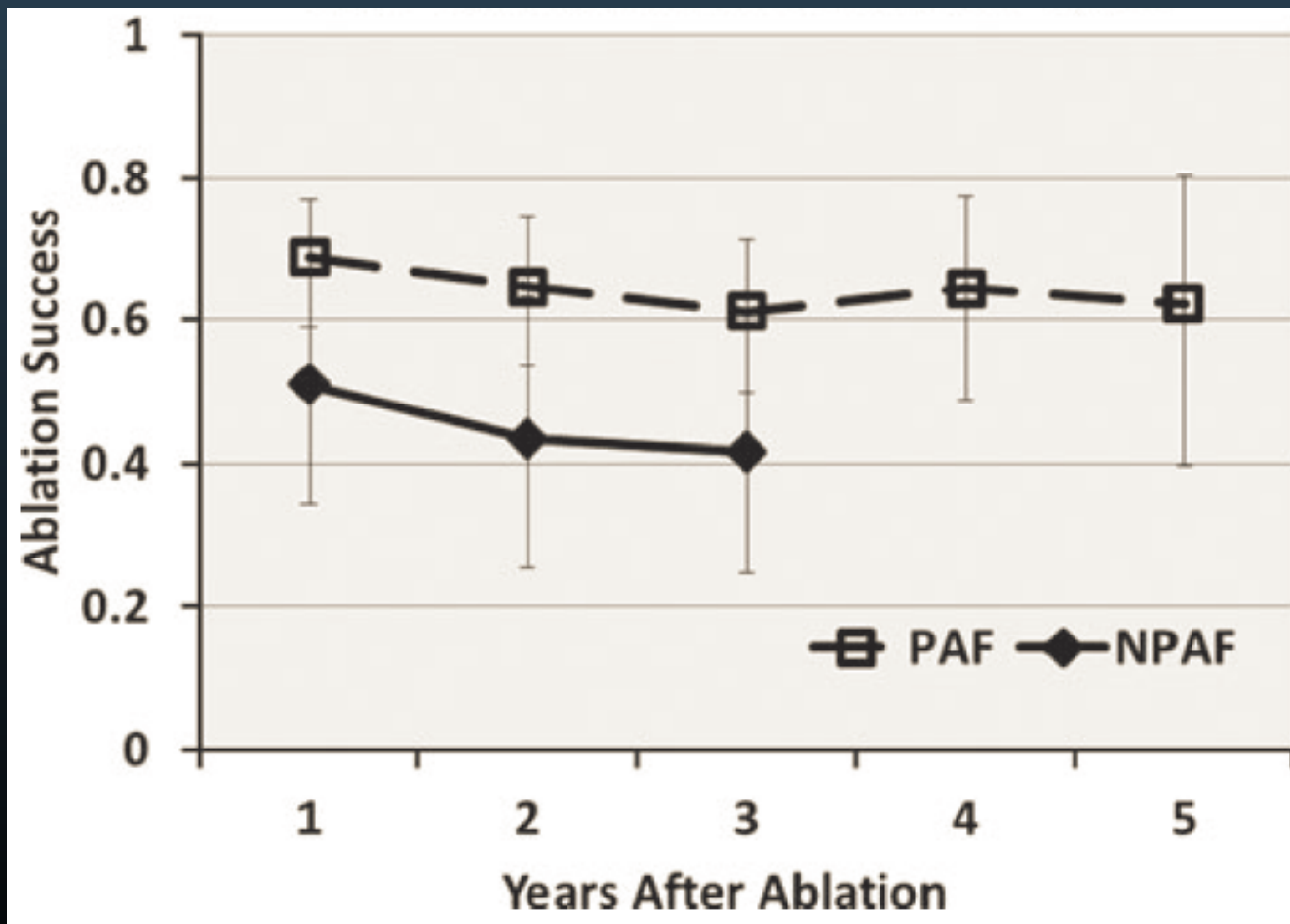
CONTACT FORCE CATHETER



Tip to endocardium:
more efficient and
secure

Long-term Outcomes of Catheter Ablation of Atrial Fibrillation: A Systematic Review and Meta-analysis

Anand N. Ganesan, MBBS, PhD; Nicholas J. Shipp, PhD; Anthony G. Brooks, PhD; Pawel Kuklik, PhD; Dennis H. Lau, MBBS, PhD; Han S. Lim, MBBS, PhD; Thomas Sullivan, BMa, CompSc; Kurt C. Roberts-Thomson, MBBS, PhD; Prashanthan Sanders, MBBS, PhD



PERSISTENT AF ABLATION: SUBSTRATE MODIFICATION

More lines?

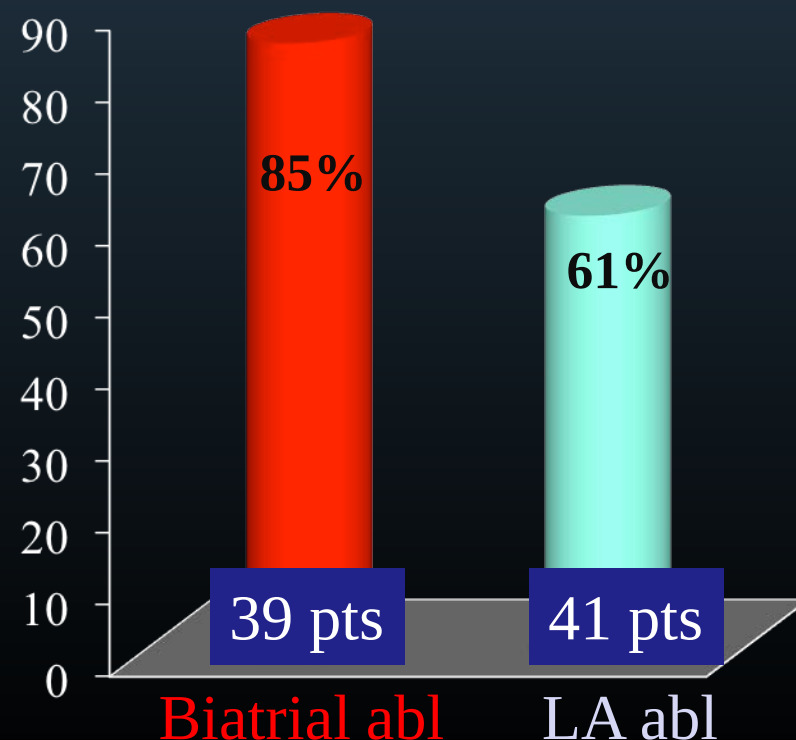
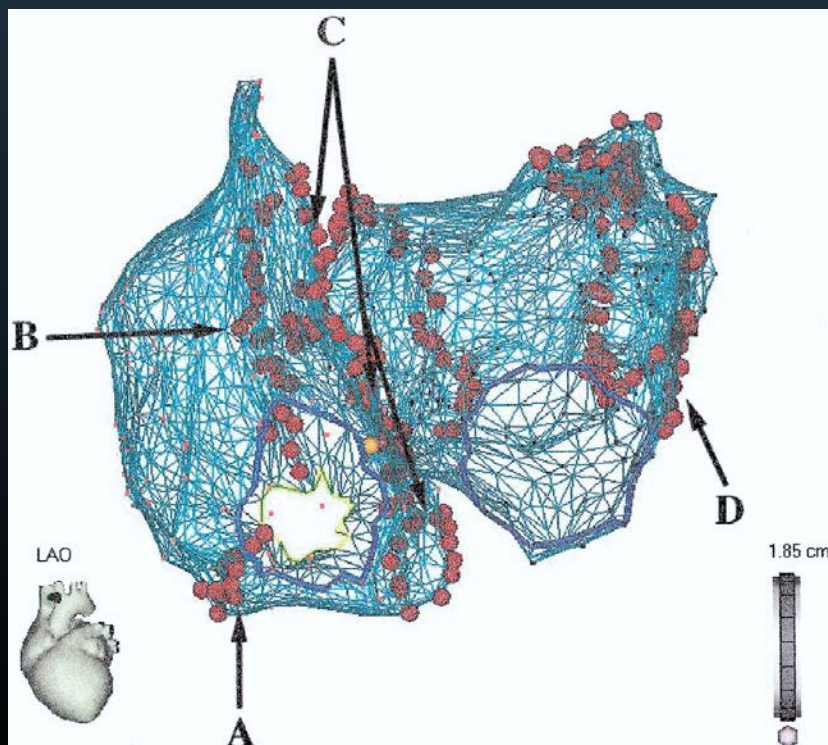
Left Atrial Ablation Versus Biatrial Ablation for Persistent and Permanent Atrial Fibrillation

A Prospective and Randomized Study

Leonardo Calò, MD, FESC,* Filippo Lamberti, MD,† Maria Luisa Loricchio, MD,‡
Ermenegildo De Ruvo, MD,* Furio Colivicchi, MD, FESC,§ Leopoldo Bianconi, MD,§
Claudio Pandozi, MD, FESC,§ Massimo Santini, MD, FESC, FACC§

Rome, Italy

Success at mean FU 14 months



PERSISTENT AF ABLATION: **SUBSTRATE MODIFICATION**

More lines?

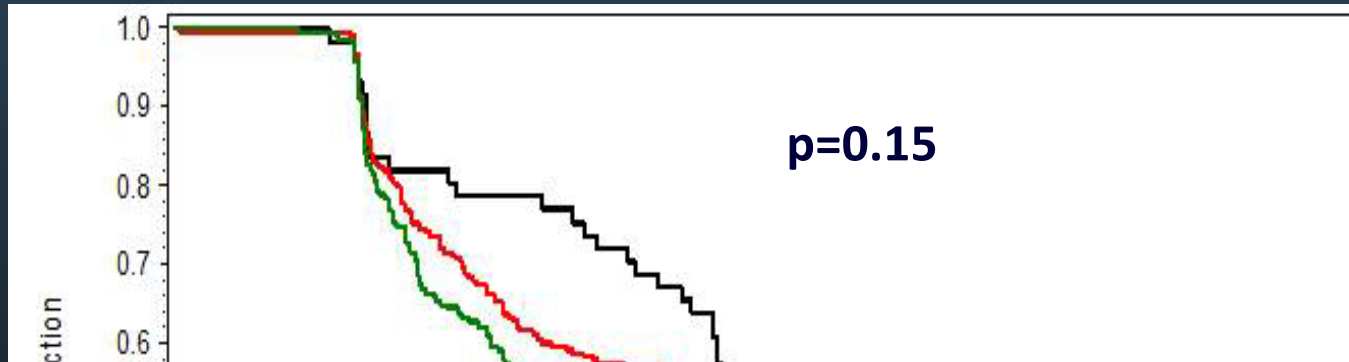
Less lines?



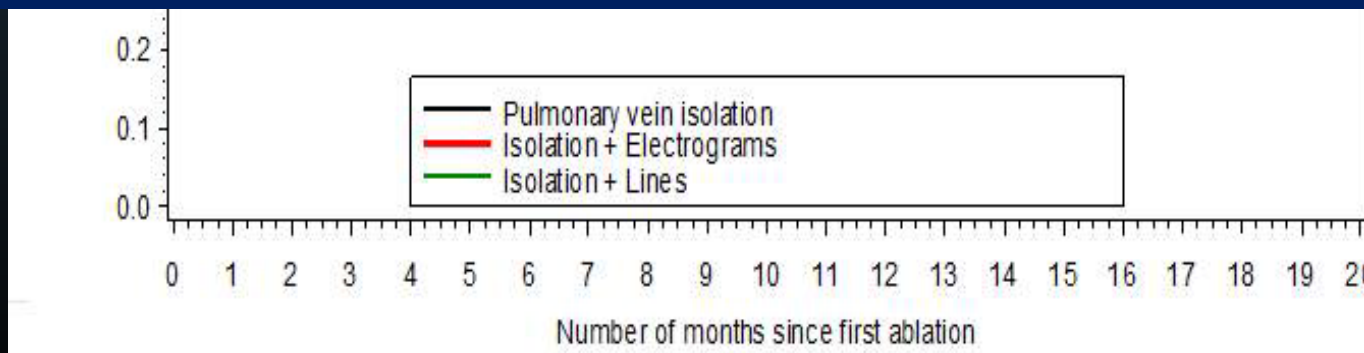
589 **persistent**
AF patients

Randomized to:

- 1) PV (**Antral isolation**)
- 2) PV+CFAE
- 3) PV+Lines



**Lines with block achieved in 74% of patients
(Roof 93% Mitral 75%)**



PERSISTENT AF ABLATION: **SUBSTRATE MODIFICATION**

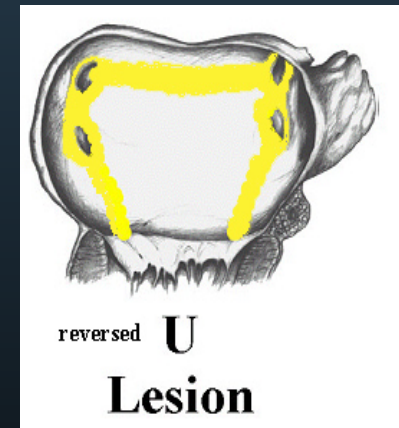
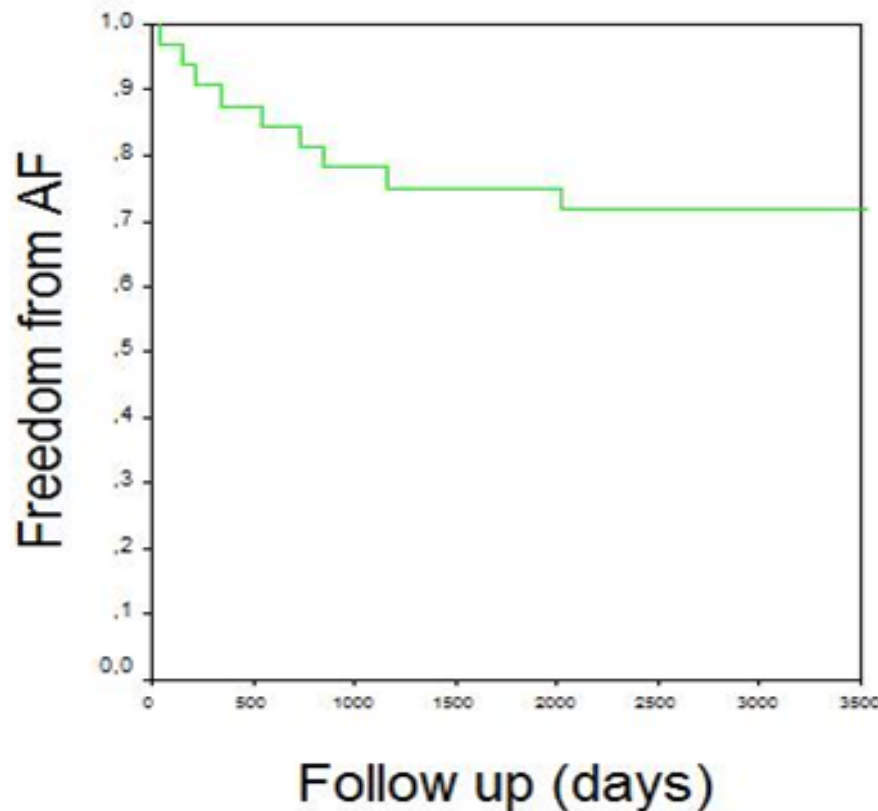
More lines?

Less lines?

Better lines?

Very Long-Term Results of Surgical and Transcatheter Ablation of Long-Standing Persistent Atrial Fibrillation

Fiorenzo Gaita, MD, Elisa Ebrille, MD, Marco Scaglione, MD, Domenico Caponi, MD, Lucia Garberoglio, MD, Laura Vivalda, MD, Alessandro Barbone, MD, PhD, and Roberto Gallotti, MD



Mean FU 10 ± 3 years

73% in SR

Ann Thorac Surg 2013

Conclusions:

- 1- **PVI** is surely highly effective
in **eliminating AF trigger**
- 2- **Substrate** and **ANS** modification
improve AF ablation outcome
in **persistent AF**, however
future research is still needed
to define the most effective approach

Su

nic