

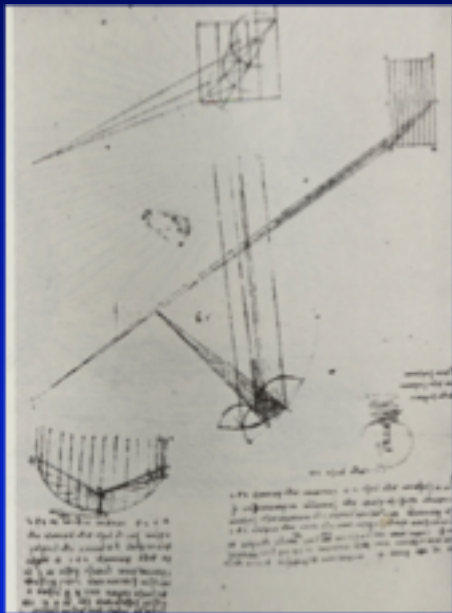
Storia dell'ablazione della fibrillazione atriale:

da dove siamo partiti, dove siamo, dove andremo

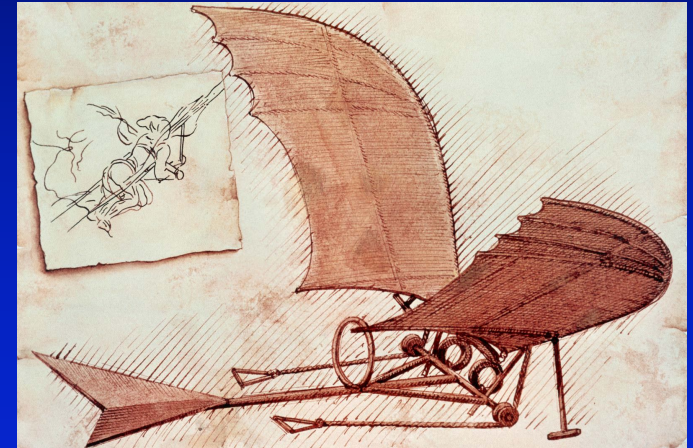
Prof. Fiorenzo Gaita



Knowledge



Idea



Serendipity

Technology

(right tools)



Serendipity - discovery of a new method

ARCHIVES DES MALADIES DU CŒUR ET DES VAISSEAUX

Tome 72, N° 1, janvier 1979

FAITS CLINIQUES

Arch Mal Coeur Vaiss. 1979 Jan;72(1):107-12.

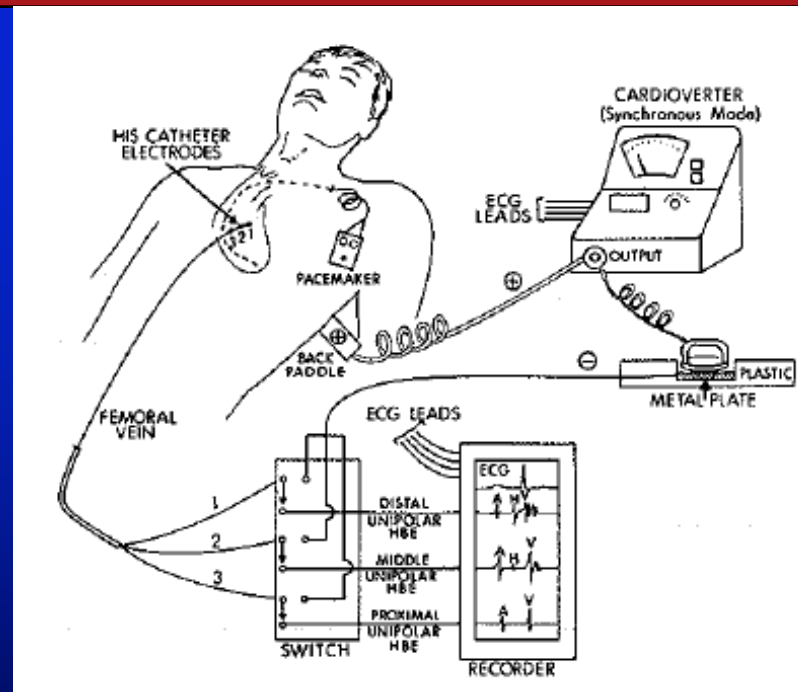
**Bloc auriculo-ventriculaire intra-hisien définitif induit
au cours d'une exploration endoventriculaire droite**

par J. VEDEL, R. FRANK, G. FONTAINE, J.F. FOURNIAL et Y. GROSGOGEAT

**Permanent intra-hisian atrioventricular block induced
during right intraventricular exploration.**

Vedel J, Frank R, Fontaine G, Fournial JF, Grosogoeat Y.

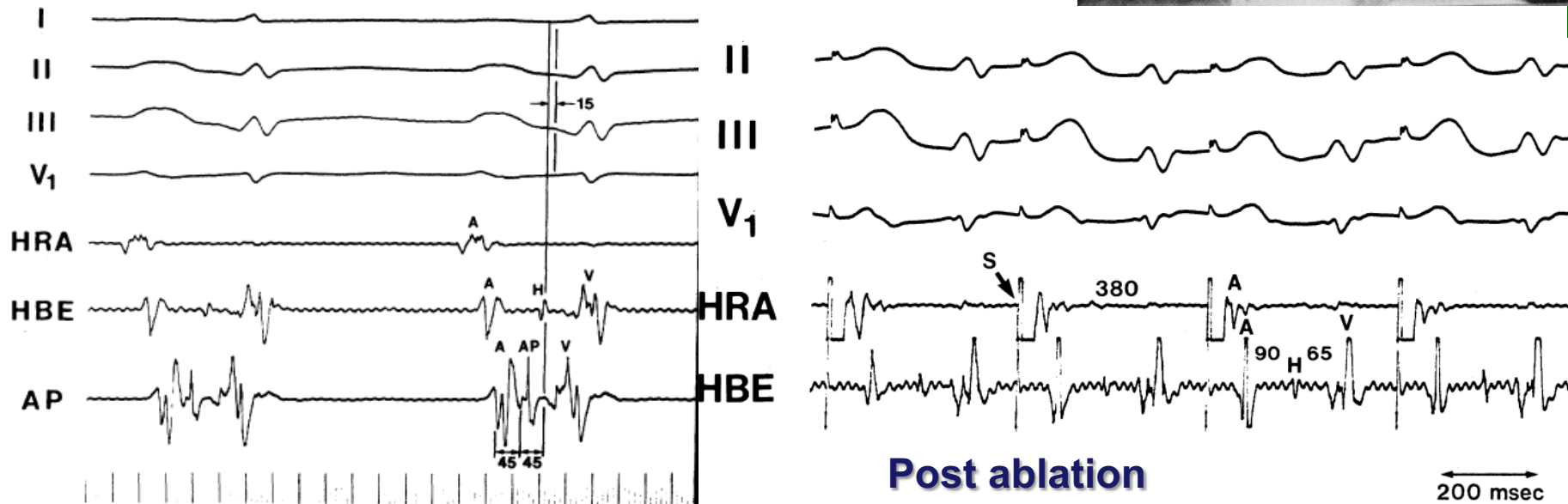
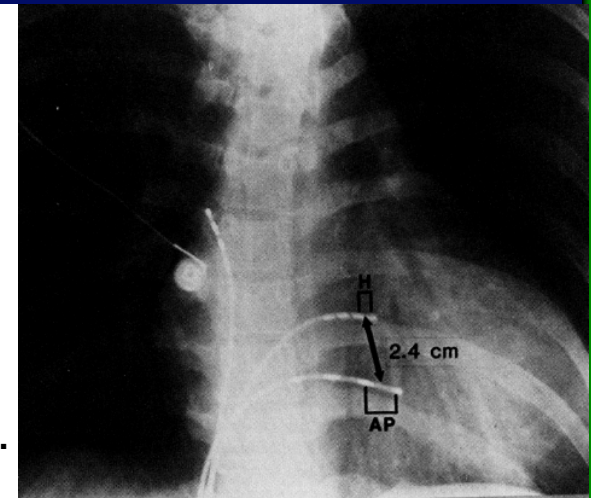
History of transcatheter ablation technique started in the '80s using DC shock (Fulguration)



Direct endocardial recording from an accessory atrioventricular pathway: localization of the site of block, effect of antiarrhythmic drugs, and attempt at nonsurgical ablation

WARREN M. JACKMAN, M.D., KAREN J. FRIDAY, M.D., BENJAMIN J. SCHERLAG, PH.D.,
MICHAEL M. DEHNING, M.D., ELIOT SCHECHTER, M.D., DWIGHT W. REYNOLDS, M.D.,
EDWIN G. OLSON, M.D., EDWARD J. BERBARI, PH.D., LURA A. HARRISON, PH.D.,
AND RALPH LAZZARA, M.D.

Circulation 1983(68) 5: 906-916.



R-wave synchronous shocks of **160 and 320 W-sec**
delivered between the catheter electrode recording
the largest AP potential and a skin electrode

First direct access to **left sided** accessory pathway

Catheter Ablation of Accessory Pathways With a Direct Approach

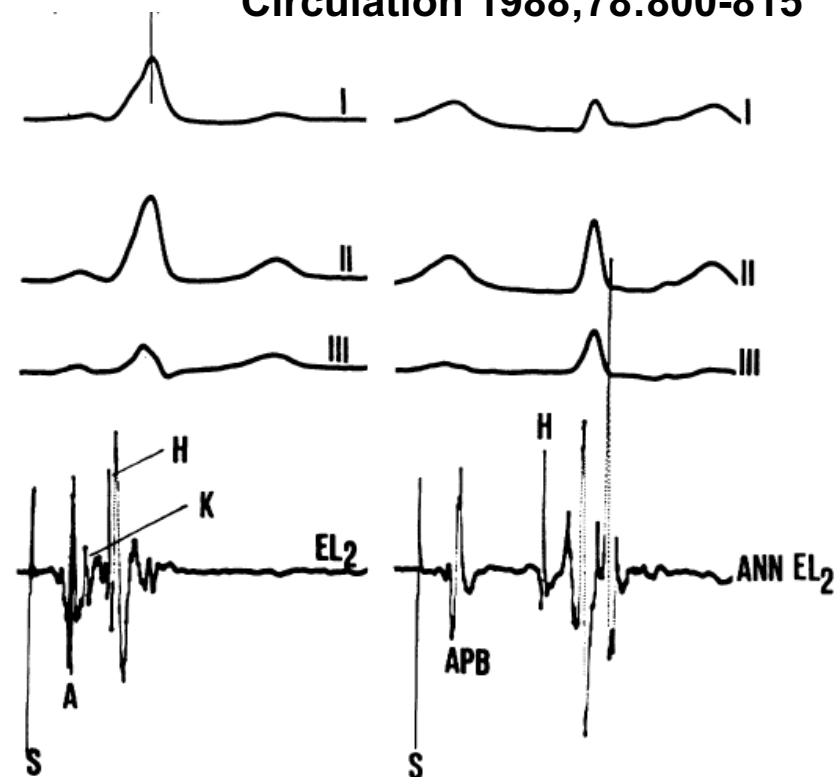
Results in 35 Patients

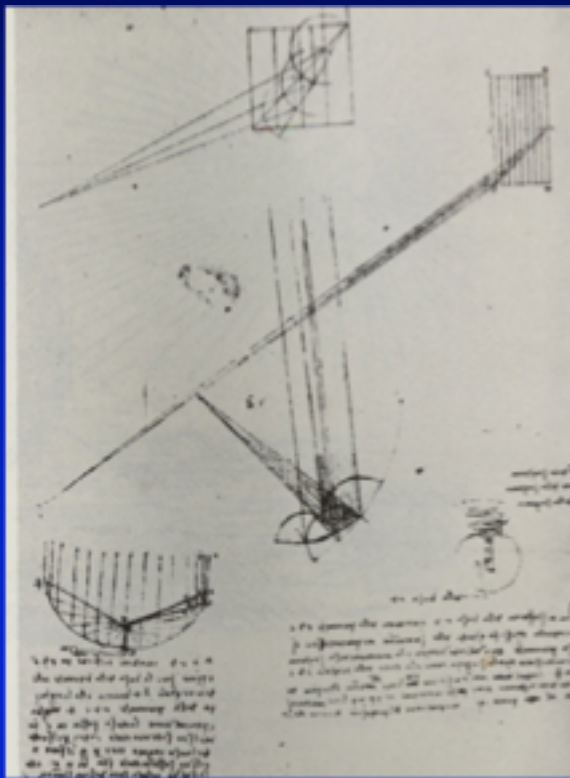
Jean-François Warin, MD, Michel Haissaguerre, MD, Philippe Lemetayer, MD,
Jean-Pierre Guillem, MD, and Pierre Blanchot, MD



35 patients (**6 left sided AP**)
Left atrium was accessed
through a **transseptal puncture**.
Ablation efficacy 32 pts (91,4%)

Circulation 1988;78:800-815





***10 years of
DC shock ablation
increased our
knowledge on the
substrate of
arrhythmia***

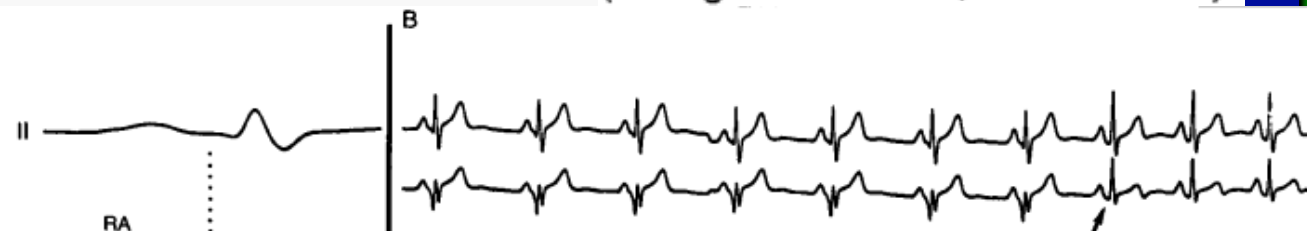
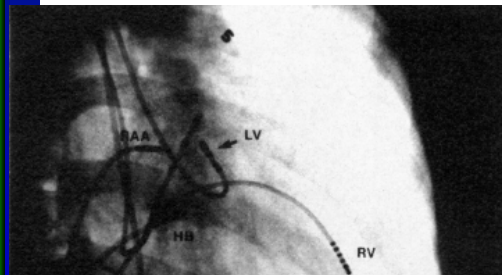
Technology
“The right tools”



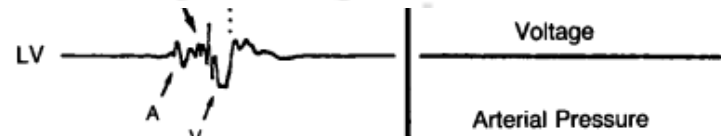
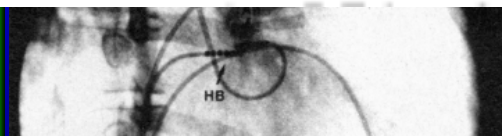
CATHETER ABLATION OF ACCESSORY ATRIOVENTRICULAR PATHWAYS (WOLFF-PARKINSON-WHITE SYNDROME) BY RADIOFREQUENCY CURRENT

WARREN M. JACKMAN, M.D., XUNZHANG WANG, M.D., KAREN J. FRIDAY, M.D., CARLOS A. ROMAN, M.D.,
KRIEGH P. MOULTON, M.D., KAREN J. BECKMAN, M.D., JAMES H. MCCLELLAND, M.D.,
NICHOLAS TWIDALE, M.D., H. ANDREW HAZLITT, M.D., MICHAEL I. PRIOR, M.D.,
P. DAVID MARGOLIS, M.D., JAMES D. CALAME, R.N., EDWARD D. OVERHOLT, M.D.,
AND RALPH LAZZARA, M.D.

(N Engl J Med 1991; 324:1605-11.)



Results. Accessory-pathway conduction was eliminated in 164 of 166 patients (99 percent) by a median of three applications of radiofrequency current.



Complications of radiofrequency-current application occurred in three patients (1.8 percent): atrio-ventricular block (one patient), pericarditis (one), and cardiac tamponade (one) after radiofrequency current was

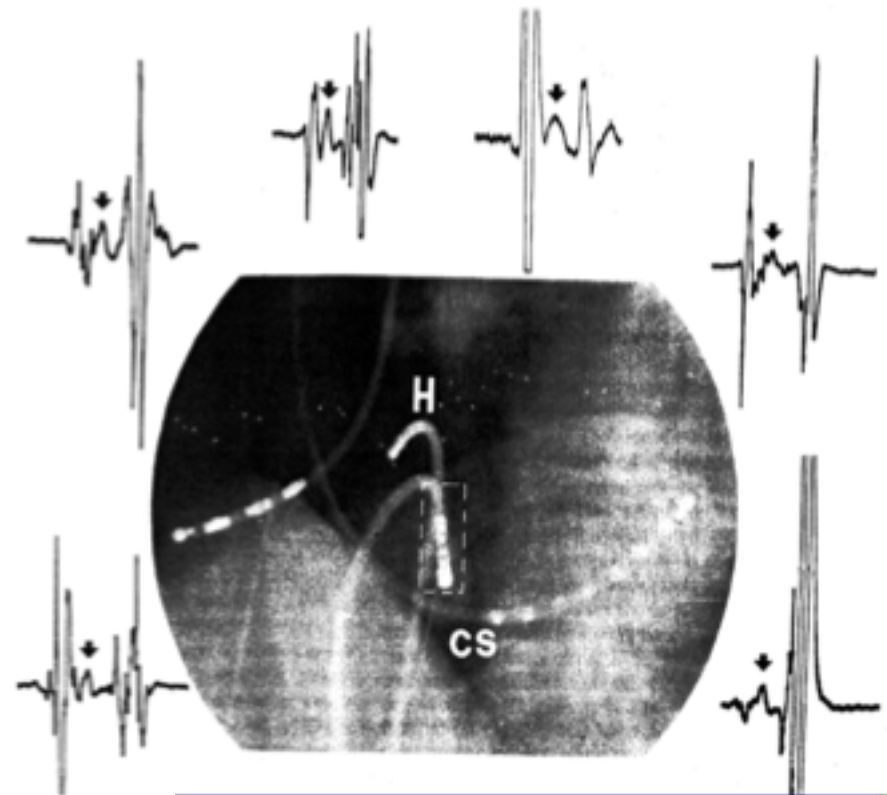
Elimination of Atrioventricular Nodal Reentrant Tachycardia Using Discrete Slow Potentials to Guide Application of Radiofrequency Energy

Circulation 1992;85:2162

Michel Haissaguerre, MD; Fiorenzo Gaita, MD; Bruno Fischer, MD;
Daniel Commenges, PhD; Paul Montserrat, MD; Christophe d'Ivernois, MD;
Philippe Lemetayer, MD; and Jean-François Warin, MD

Slow potentials were recorded along a vertical band at the mid or posterior part of the septum near the tricuspid annulus.

Radiofrequency energy applied at the slow potential site resulted in interruption of induced tachycardia within a few seconds and rendered tachycardia noninducible in all patients.

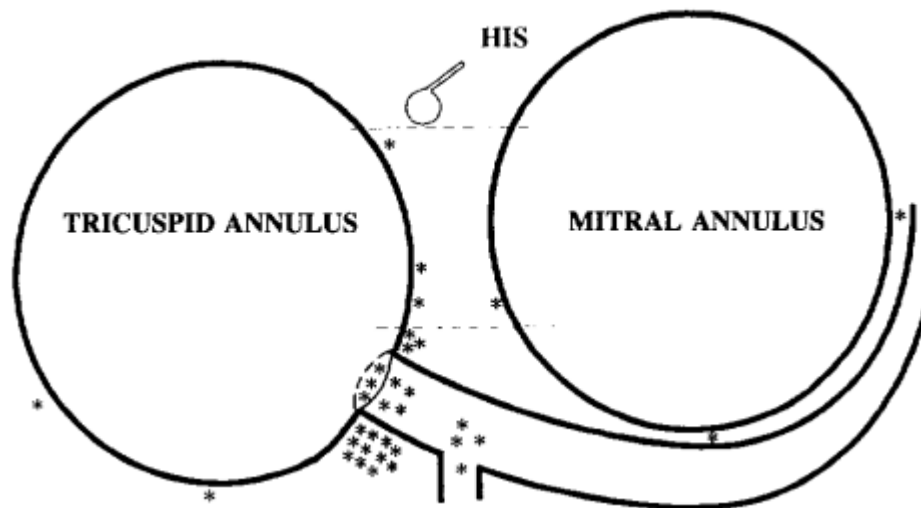


Catheter Ablation of Permanent Junctional Reciprocating Tachycardia With Radiofrequency Current

JACC Vol. 25, No. 3
March 1, 1995:648-54

FIORENZA GAITA, MD, MICHEL HAISSAGUERRE, MD,* CARLA GIUSTETTO, MD,†
BRUNO FISCHER, MD,* RICCARDO RICCARDI, MD, ELENA RICHIARDI, MD,†
MARCO SCAGLIONE, MD, FILIPPO LAMBERTI, MD, JEAN-FRANÇOIS WARIN, MD*

Asti and Turin, Italy and Bordeaux, France



32 patients

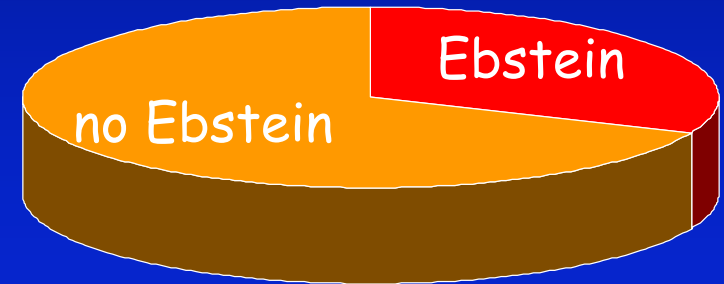
31 (97%) asymptomatic

**Patients with depressed LVEF
showed normalization**



“Pseudo-Mahaim” location and association with right-sided Kent bundles and Ebstein disease

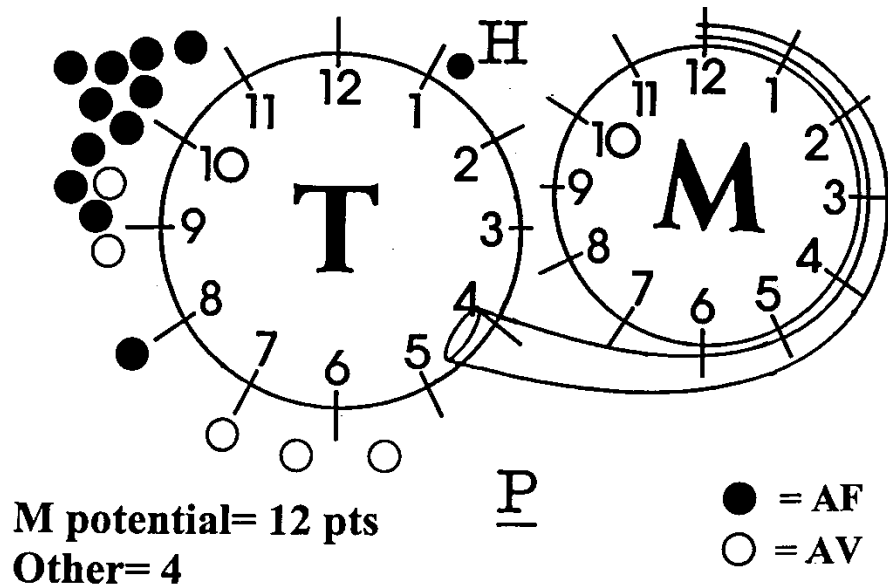
Pts with “pseudo-Mahaim” fibers



Location of M-AP

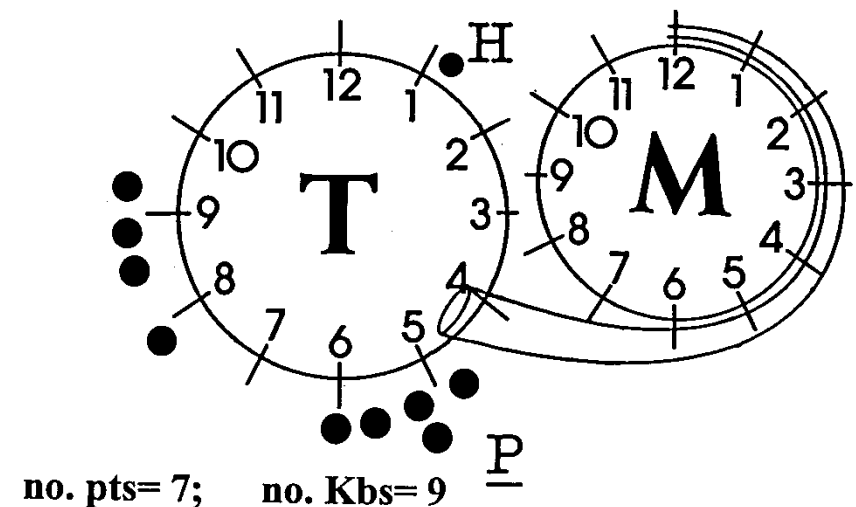
no. pts= 16

A



Location of Concomitant Kbs

A



De Ponti et al., Eur Heart J 1997

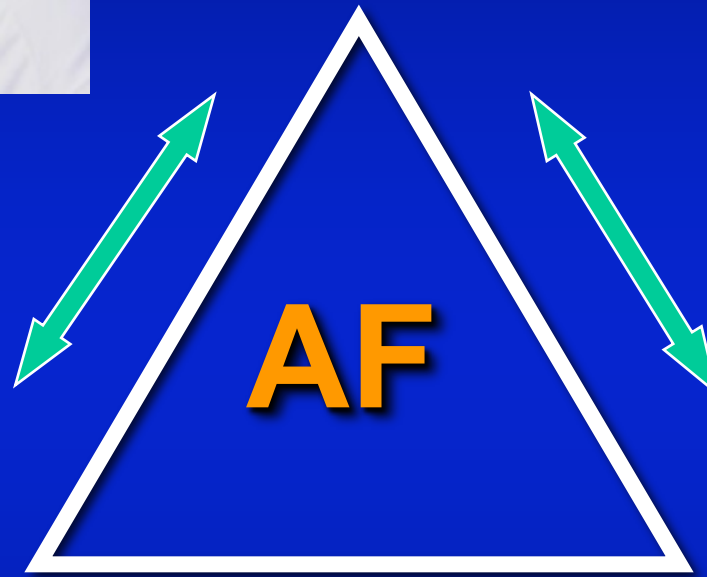
Late 90s

The last frontier of TC ablation

Atrial fibrillation



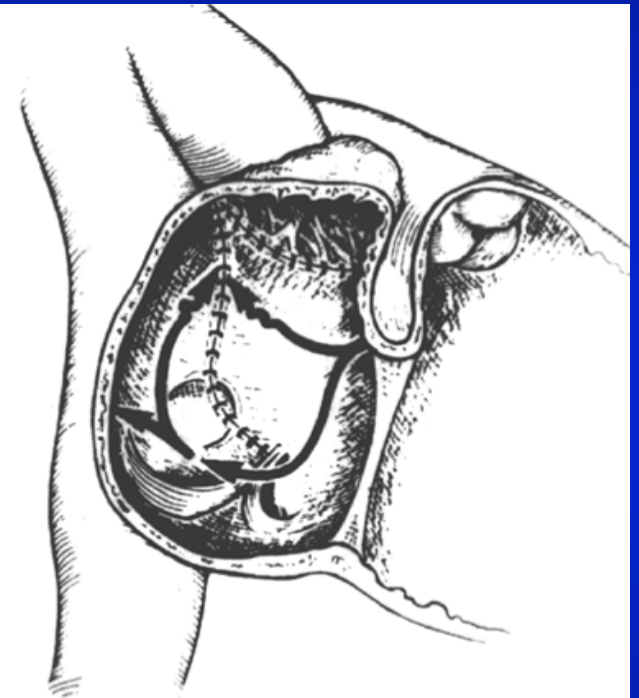
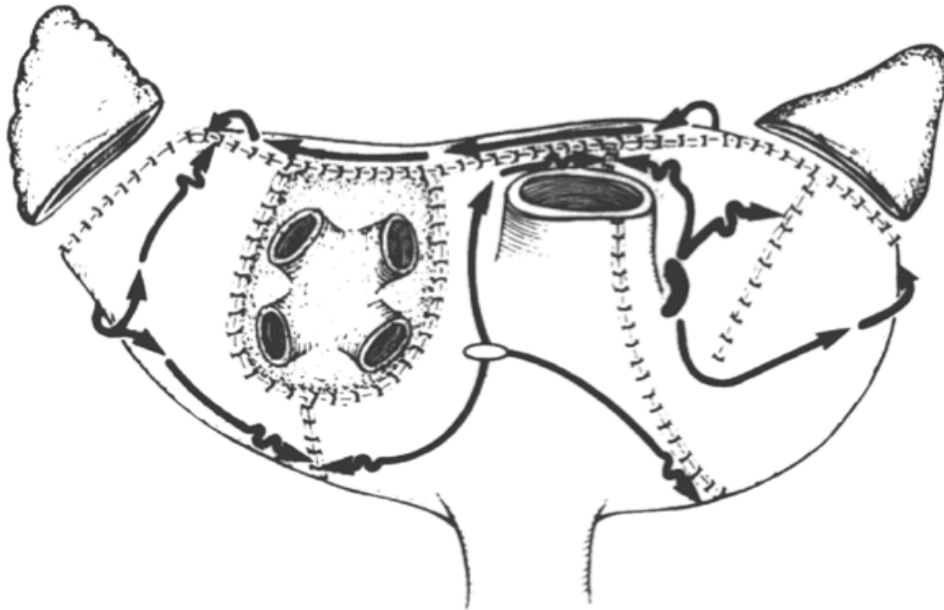
Substrate
(Critical mass)



Trigger
(extrasystoles)

**Autonomic
Nervous
System**

Substrate modification: **linear lesions**



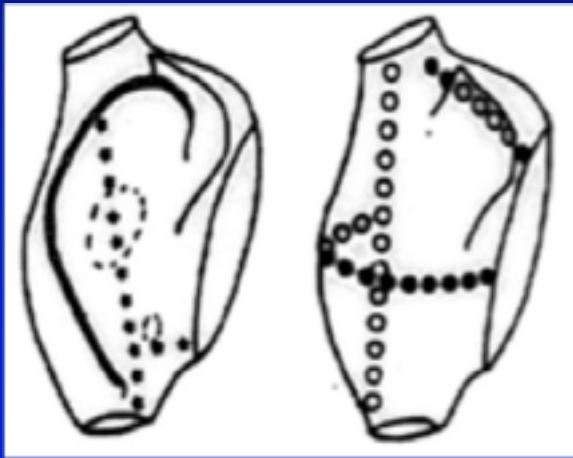
178 pts (103 paroxysmal, 75 chronic)

Follow-up : 3 - 102 months

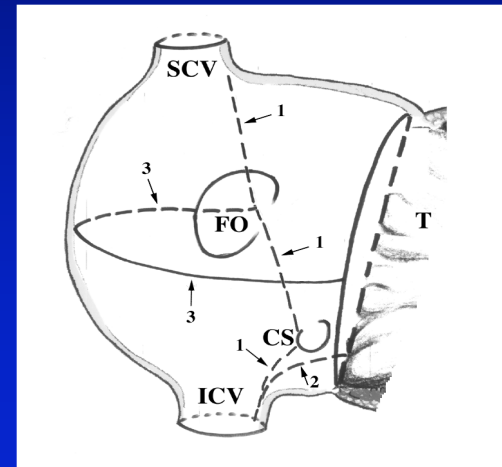
Success rate: **93%**

Complications: PM implant 30 pts, 1 stroke, 2 MI
4 deaths

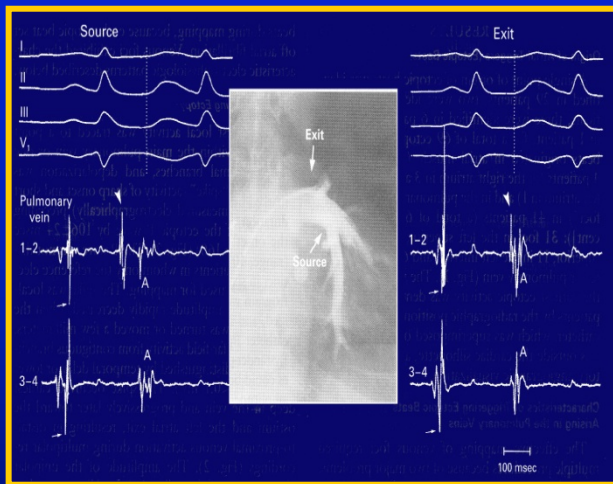
Beginning of the era of TC AF ablation



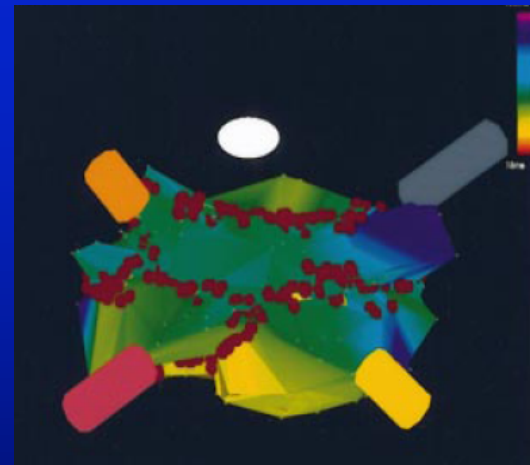
Haissaguerre '96-98



F. Gaita '96-98



Haissaguerre '98



Pappone '99

“The Right Tools” for left atrial ablation

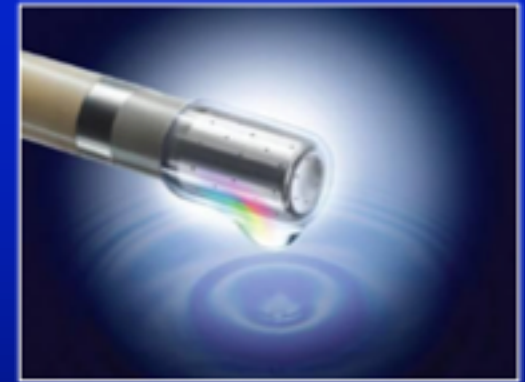
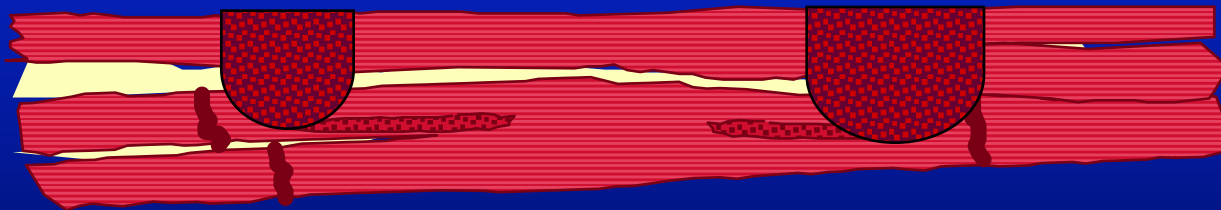
4 mm irrigated/cooled catheter produces larger and safer lesions,
decreasing the risk of cerebral vascular accidents

RF
ablation
catheter

RF ablation
cooled
catheter

4 mm

4 mm



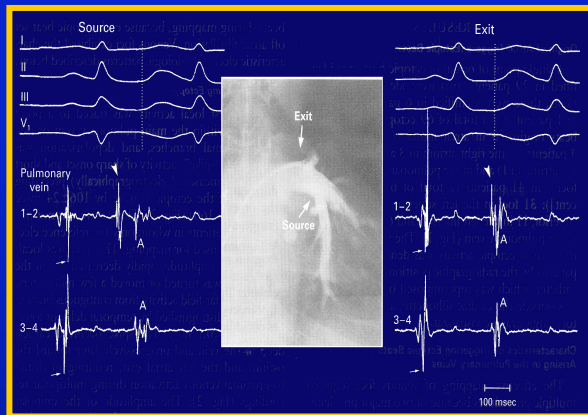
The right idea: PV ablation

Interest moves from *substrate* to *triggers*

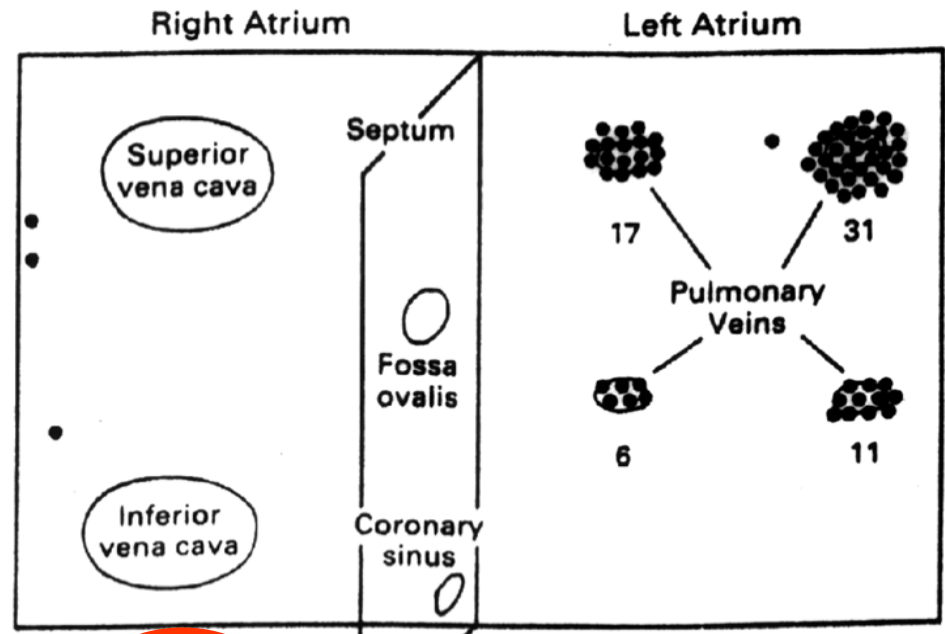
SPONTANEOUS INITIATION OF ATRIAL FIBRILLATION BY ECTOPIC BEATS ORIGINATING IN THE PULMONARY VEINS

MICHEL HAÏSSAGUERRE, M.D., PIERRE JAÏS, M.D., DIPEN C. SHAH, M.D., ATSUSHI TAKAHASHI, M.D., MÉLÈZE HOCINI, M.D.,
GILLES QUINIOU, M.D., STÉPHANE GARRIGUE, M.D., ALAIN LE MOUROUX, M.D., PHILIPPE LE MÉTAYER, M.D.,
AND JACQUES CLÉMENTY, M.D.

NEJM 1998;339:659-666



45 pts with
idiopathic PAF
Follow-up:
8±6 months

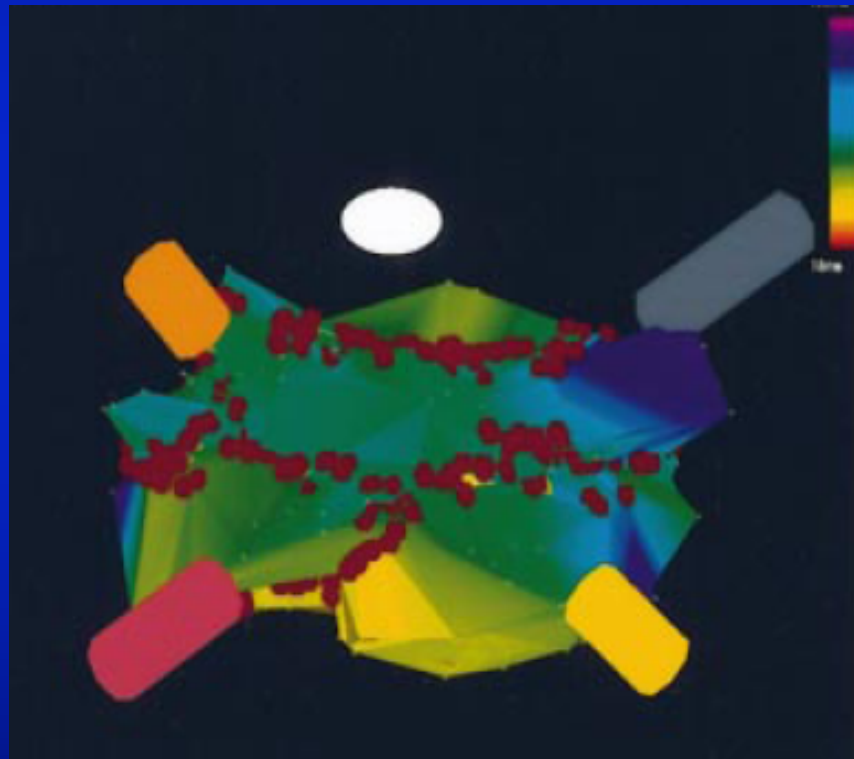


62% success rate w/oAAD

Electroanatomic mapping systems

Catheter Ablation of Paroxysmal Atrial Fibrillation Using a 3D Mapping System

Carlo Papone, MD; Giuseppe Oreto, MD; Filippo Lamberti, MD; Gabriele Vicedomini, MD; Maria Luisa Loricchio, MD; Shlomo Shpun, DSc; Mariano Rillo, MD; Maria Pia Calabrò, MD; Andrea Conversano, MD; Shlomo A. Ben-Haim, MD, DSc; Riccardo Cappato, MD; Sergio Chierchia, MD
(*Circulation*. 1999;100:1203-1208.)

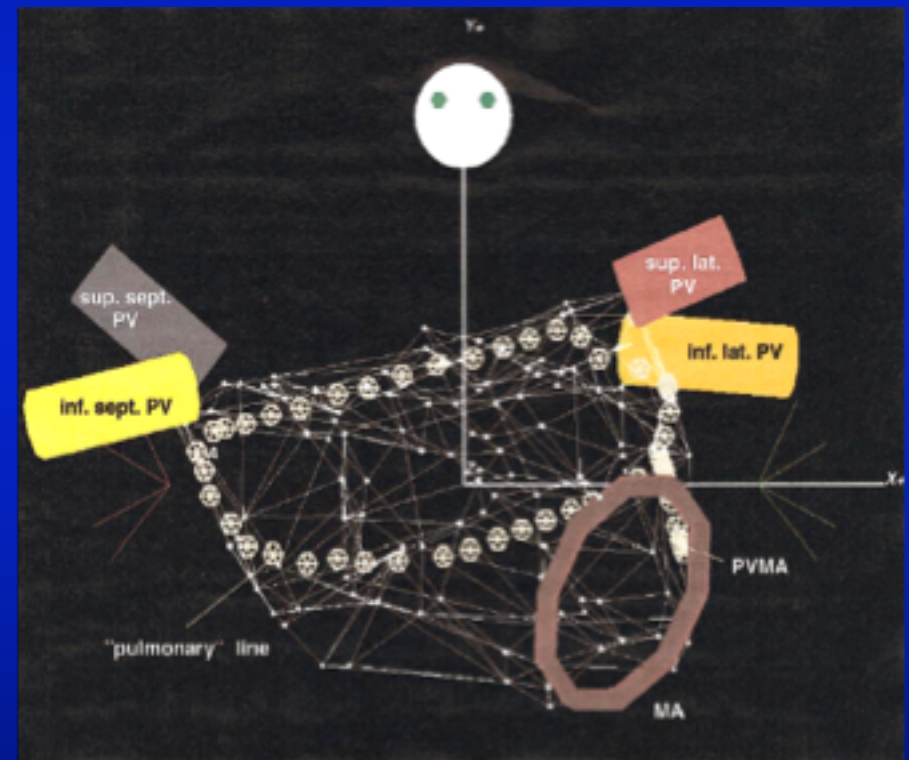


27 pts: success in 16 pts (59%)

Modification of the Substrate for Maintenance of Idiopathic Human Atrial Fibrillation

Efficacy of Radiofrequency Ablation Using Nonfluoroscopic Catheter Guidance

Sabine Ernst, MD; Michael Schlüter, PhD; Feifan Ouyang, MD; Afsaneh Khanedani, MD; Riccardo Cappato, MD; Joachim Hebe, MD; Marius Volkmer, MD; Matthias Antz, MD; Karl-Heinz Kuck, MD
(*Circulation*. 1999;100:2085-2092.)

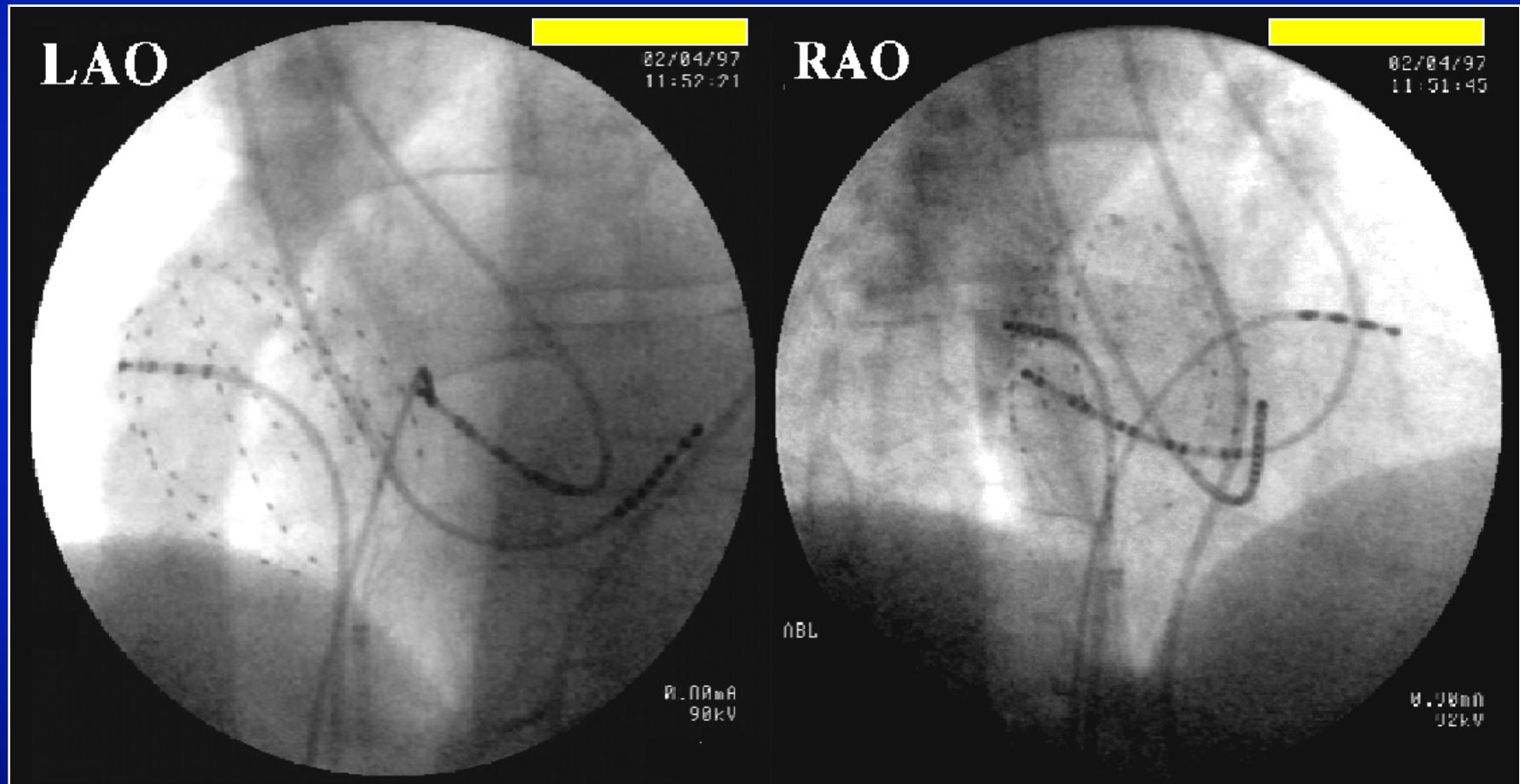


32 pts: success in 2 pts (6%)

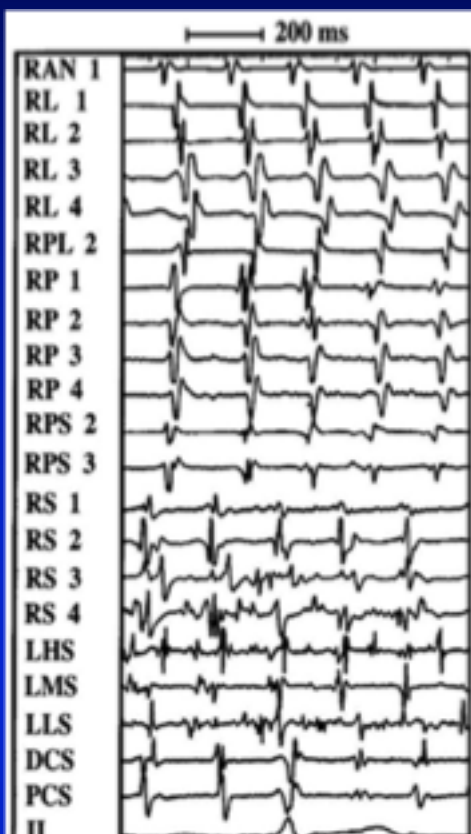
The question in 2000

Can pulmonary vein isolation
effectively treat also patients
with **persistent AF** and
structural heart disease?

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

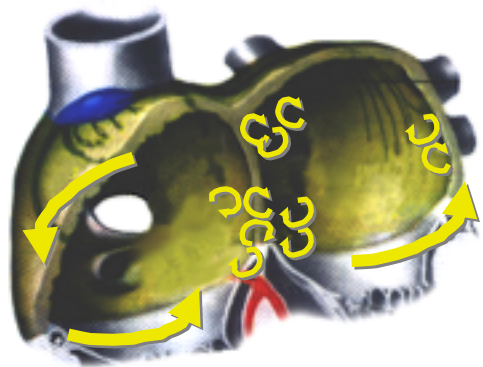
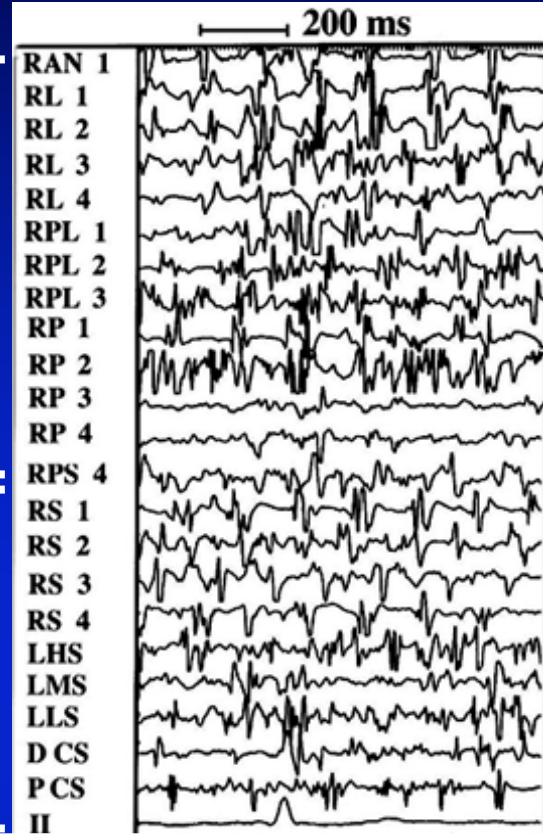


Gaita F. Scaglione M. Calo L. Riccardi R. JACC 2001

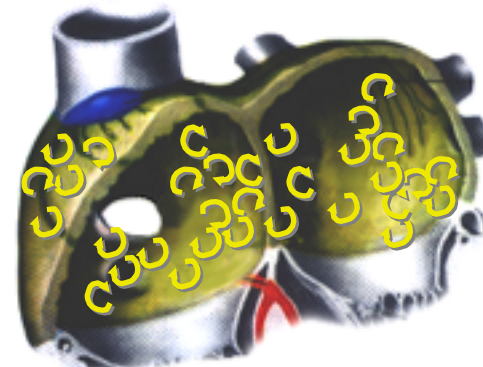
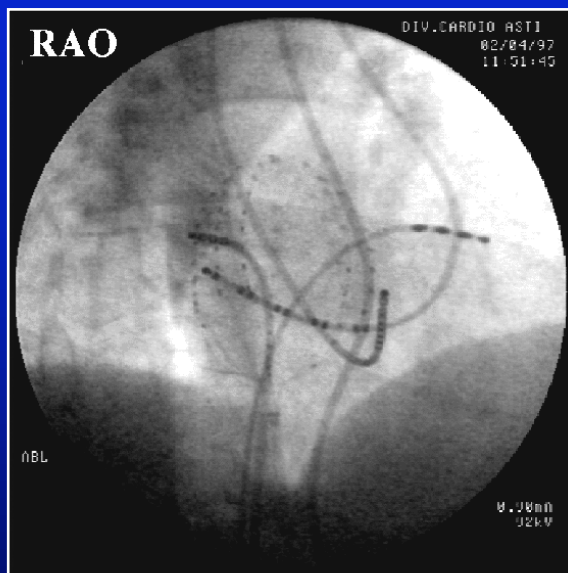


RIGHT ATRIUM

LEFT ATRIUM



Paroxysmal AF



Persistent AF

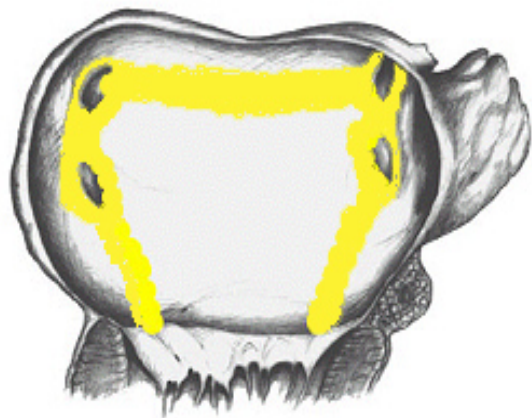
Linear Cryoablation of the Left Atrium Versus Pulmonary Vein Cryoisolation in Patients With Permanent Atrial Fibrillation and Valvular Heart Disease

Correlation of Electroanatomic Mapping and Long-Term Clinical Results

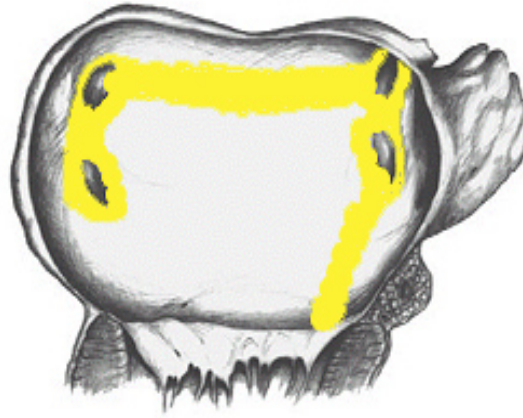
Fiorenzo Gaita, MD; Riccardo Riccardi, MD; Domenico Caponi, MD; Dipen Shah, MD; Lucia Garberoglio, MD; Laura Vivalda, MD; Alessandro Dulio, BS; Andrea Chiecchio, PhD; Eric Manasse, MD; Roberto Gallotti, MD

Circulation 2005;111:136-42
JOURNAL OF THE AMERICAN HEART ASSOCIATION

105 pts, Permanent AF and Valvular Heart Disease



reversed U
Lesion



7
Lesion



VP
Isolation

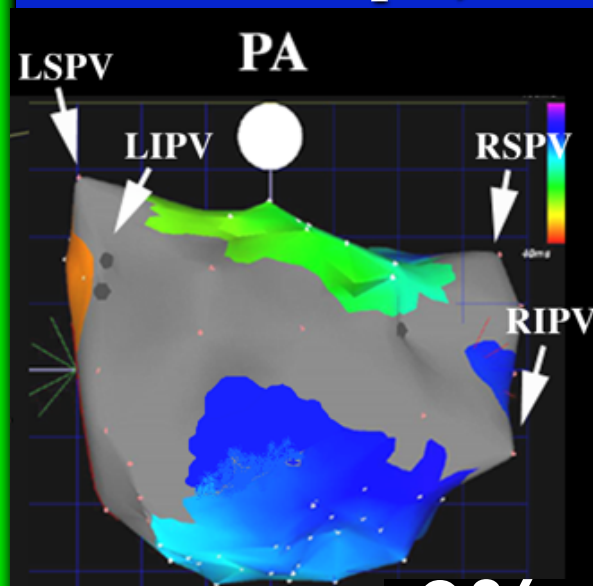
Linear Cryoablation of the Left Atrium Versus Pulmonary Vein Cryoisolation in Patients With Permanent Atrial Fibrillation and Valvular Heart Disease

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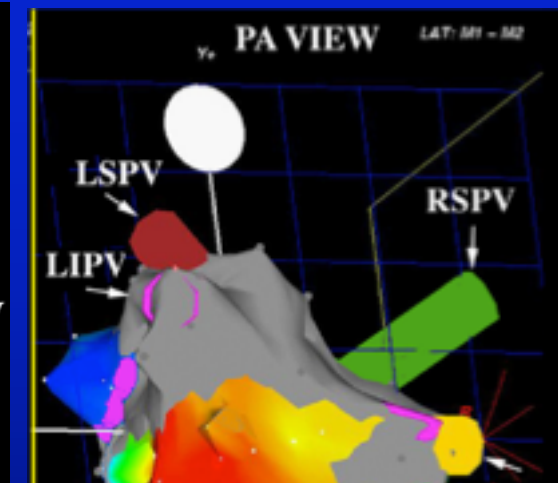
Fiorenzo Gaita, MD; Riccardo Riccardi, MD; Domenico Caponi, MD; Dipen Shah, MD; Lucia Garberoglio, MD; Laura Vivalda, MD; Alessandro Dulio, BS; Andrea Chiecchio, PhD; Eric Manasse, MD; Roberto Gallotti, MD

3D left atrial mapping 3 months after procedure

105 pts, Permanent AF and Valvular Heart Disease

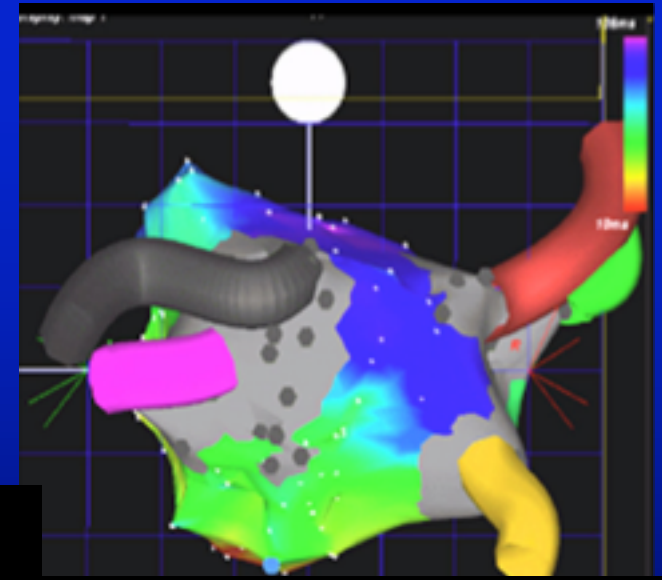


"U" lesion 0%



Complete Lesions

7 scheme 65%



PVI isolation 81%

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

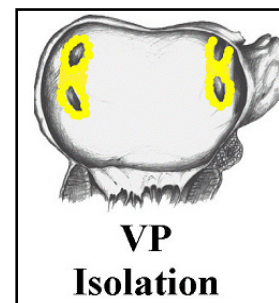
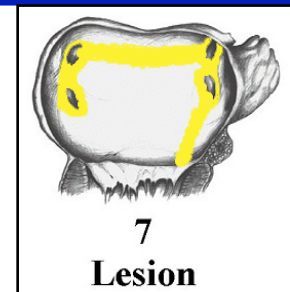
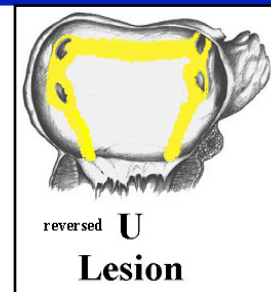
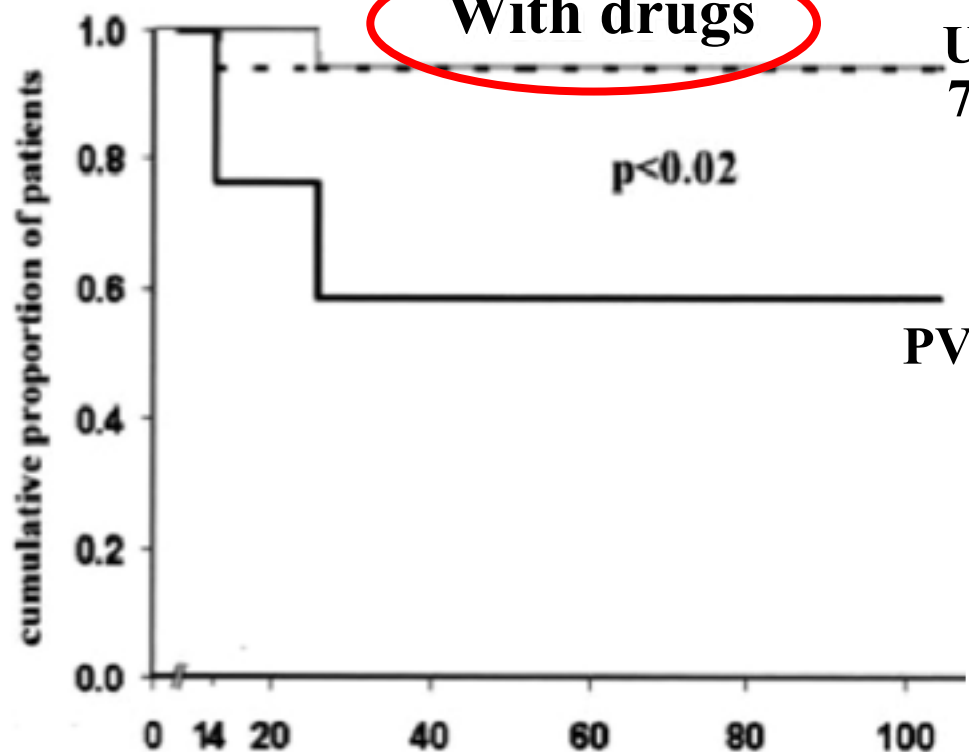
Fiorenzo Gaita, MD; Riccardo Ricciardi, MD; Domenico Caponi, MD; Dipen Shah, MD;
Lucia Garberoglio, MD; Laura Vivalda, MD; Alessandro Dulio, BS; Andrea Chiecchio, PhD;
Eric Manasse, MD; Roberto Gallotti, MD

Circulation

2005;111:136-42

**Permanent AF
and Valvular
Heart Disease**

Pts in SR with drugs



U pts	17	17	17	17	17	17
7 pts	17	17	17	17	17	17
PVI pts	17	17	17	17	17	17

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

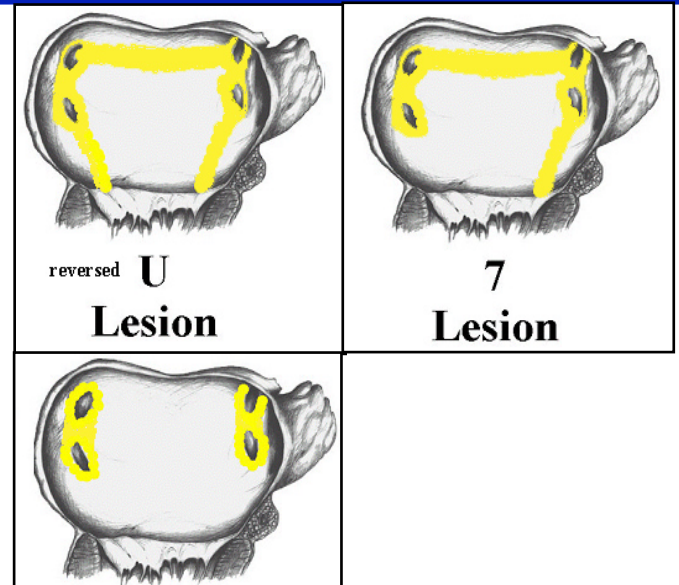
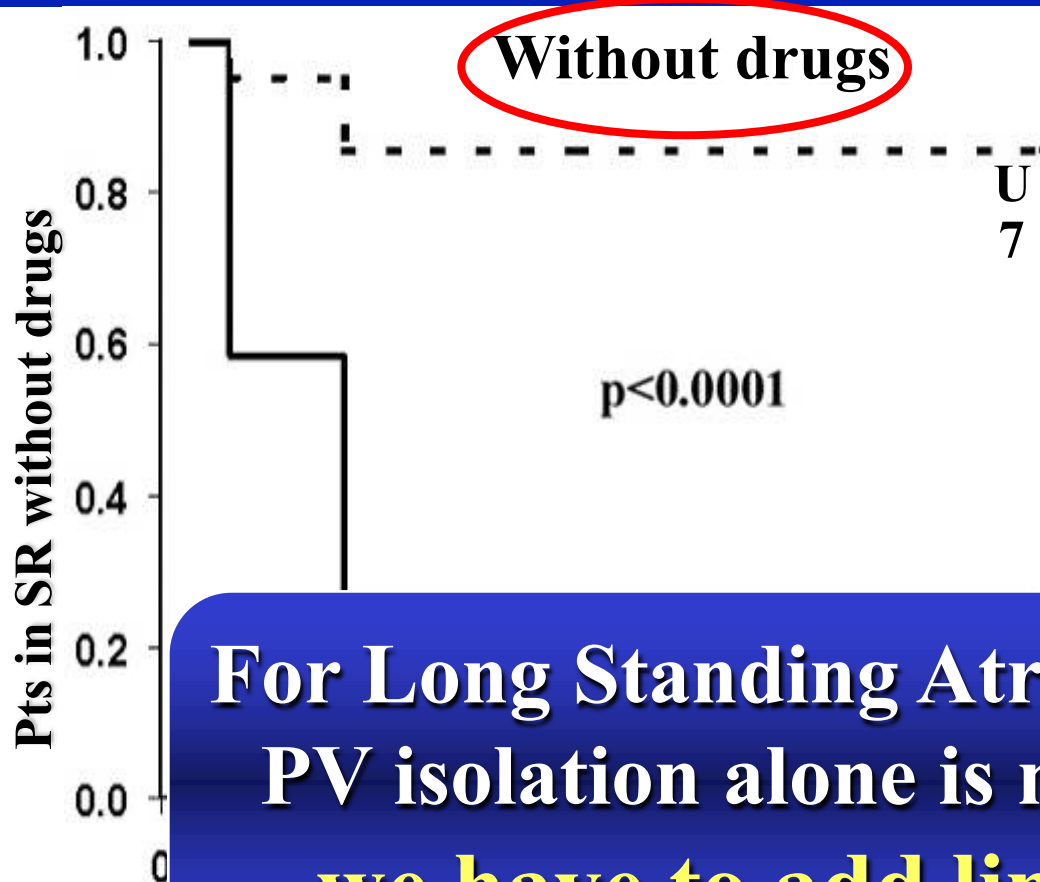
Correlation of Electroanatomic Mapping and Long-Term Clinical Results

Fiorenzo Gaita, MD; Riccardo Ricciardi, 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

Circulation

2005;111:136-42

**Permanent AF
and Valvular
Heart Disease**

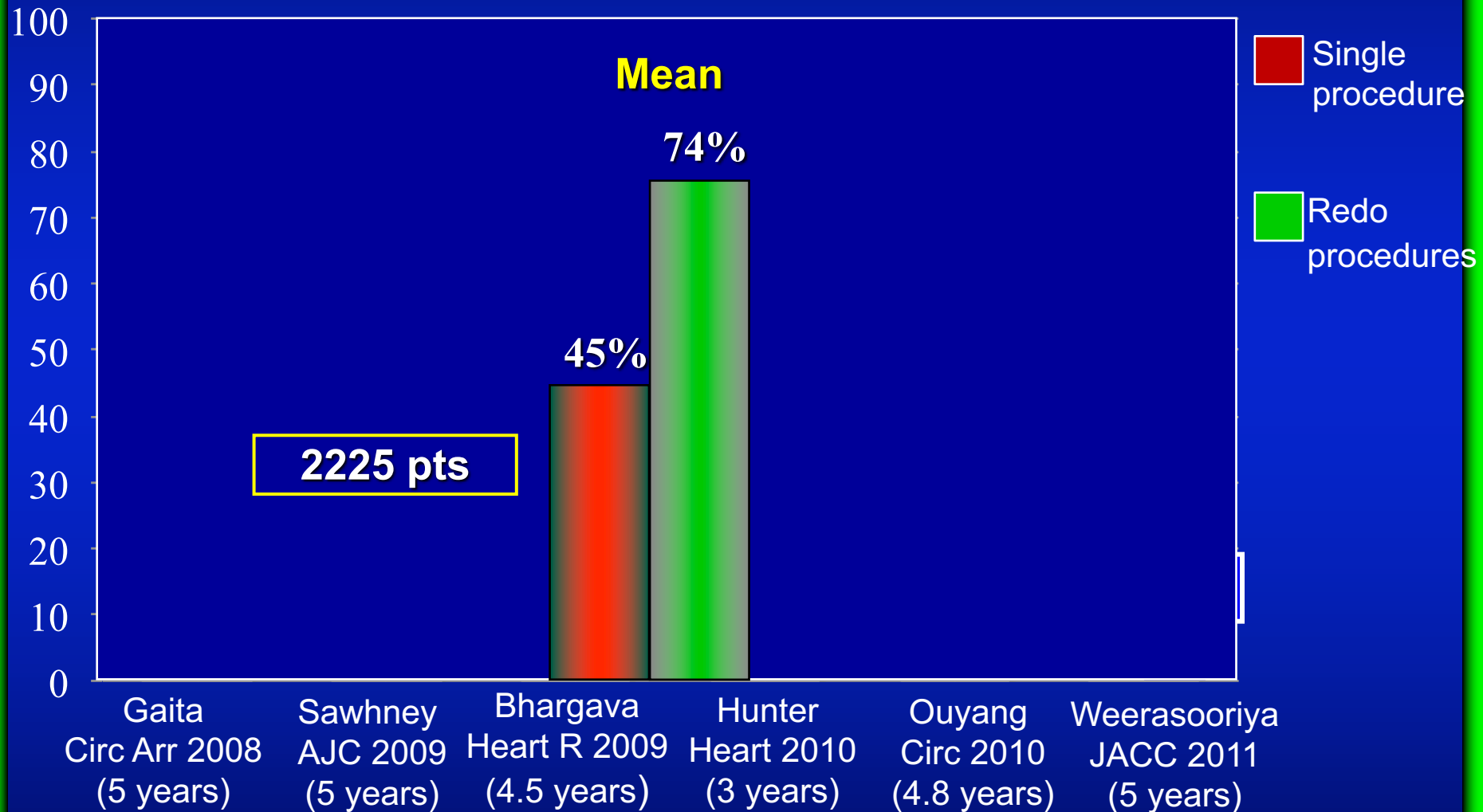


**For Long Standing Atrial Fibrillation
PV isolation alone is not sufficient:
we have to add linear lesions**

LONG-TERM EFFICACY
5 years

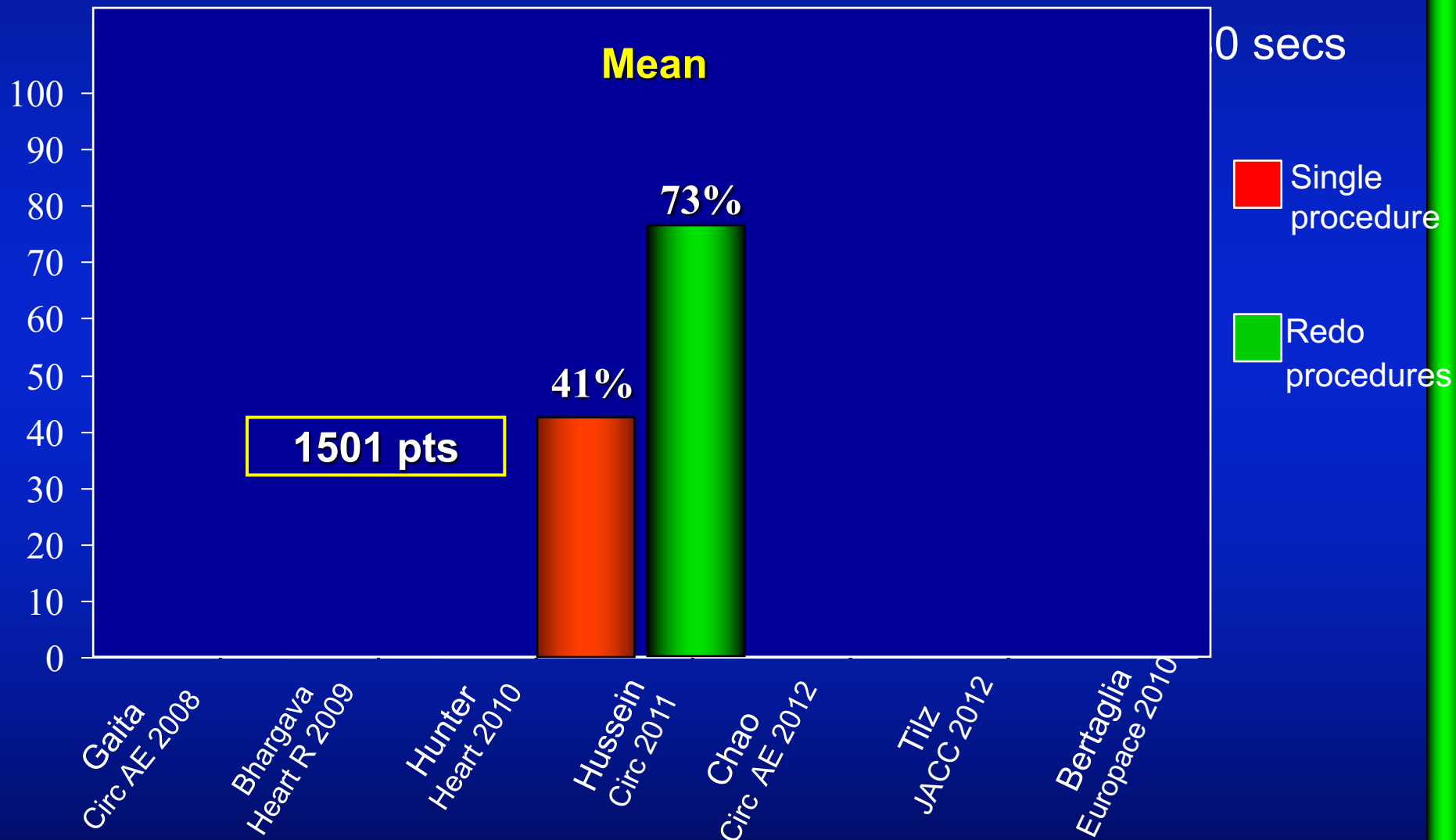
Paroxysmal AF transcatheter ablation

Long term results (5 years) from studies involving more than 50 pts



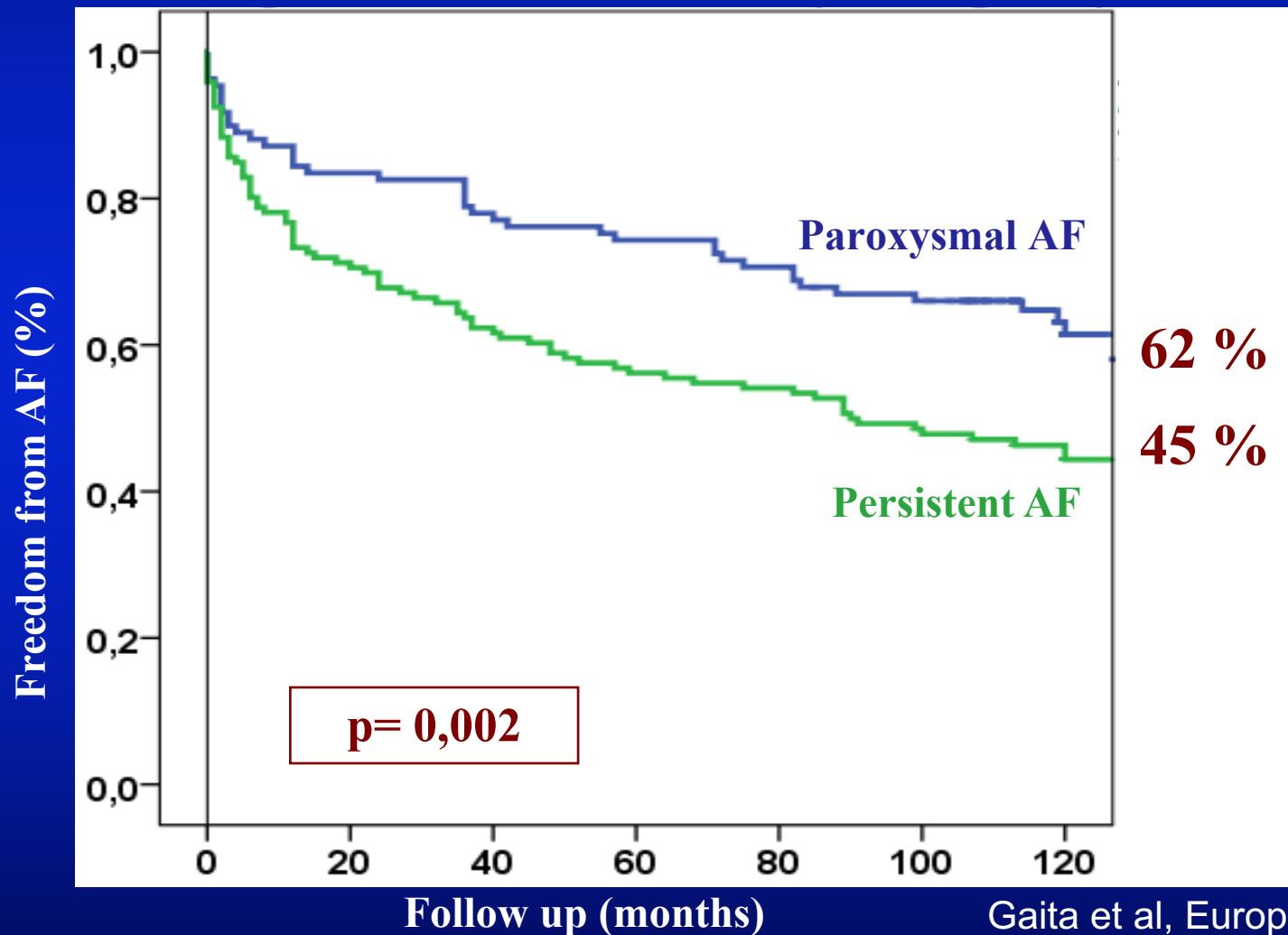
Persistent AF transcatheter ablation

Long term results (3 years) from studies involving more than 50 pts



Results at 10 years follow-up

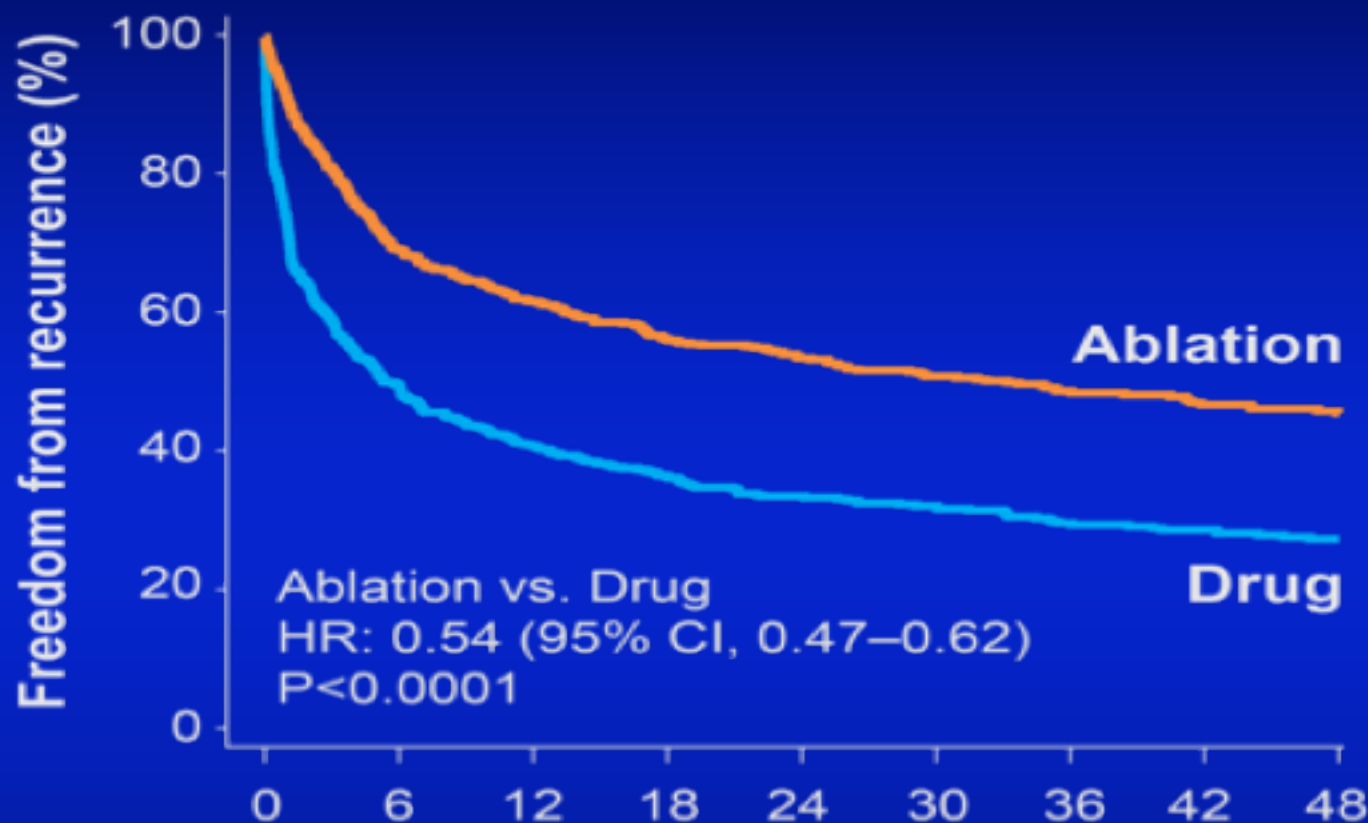
Paroxysmal / Persistent AF ablation



Recurrence of Atrial Arrhythmias in the Catheter Ablation Versus Antiarrhythmic Drug Therapy for Atrial Fibrillation (CABANA) Trial

- CABANA randomized 2204 symptomatic patients with paroxysmal or persistent atrial fibrillation (AF) 1:1 to percutaneous left atrial catheter ablation versus medical therapy
 - Patients were ≥ 65 years or < 65 years with ≥ 1 risk factor for stroke
- Primary endpoint - Composite of death, disabling stroke, serious bleeding, or cardiac arrest

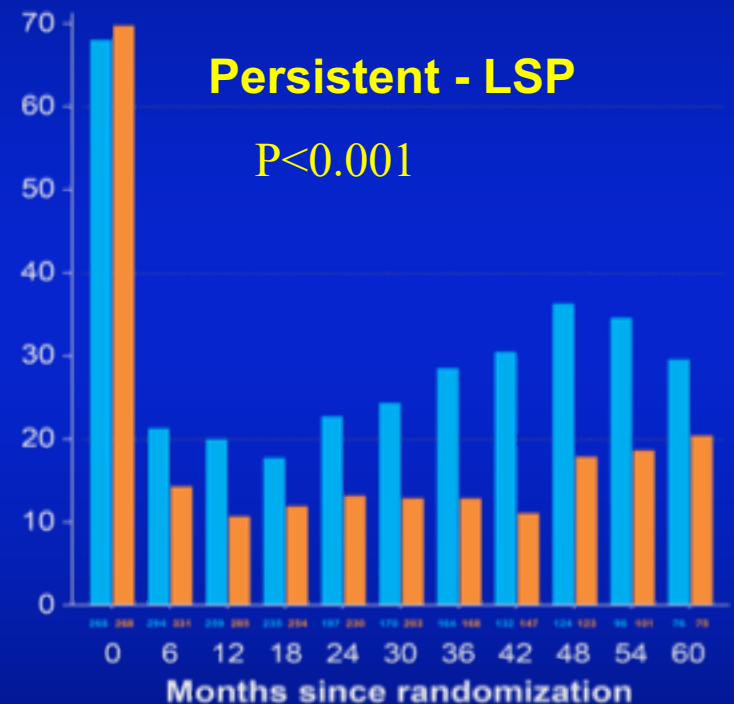
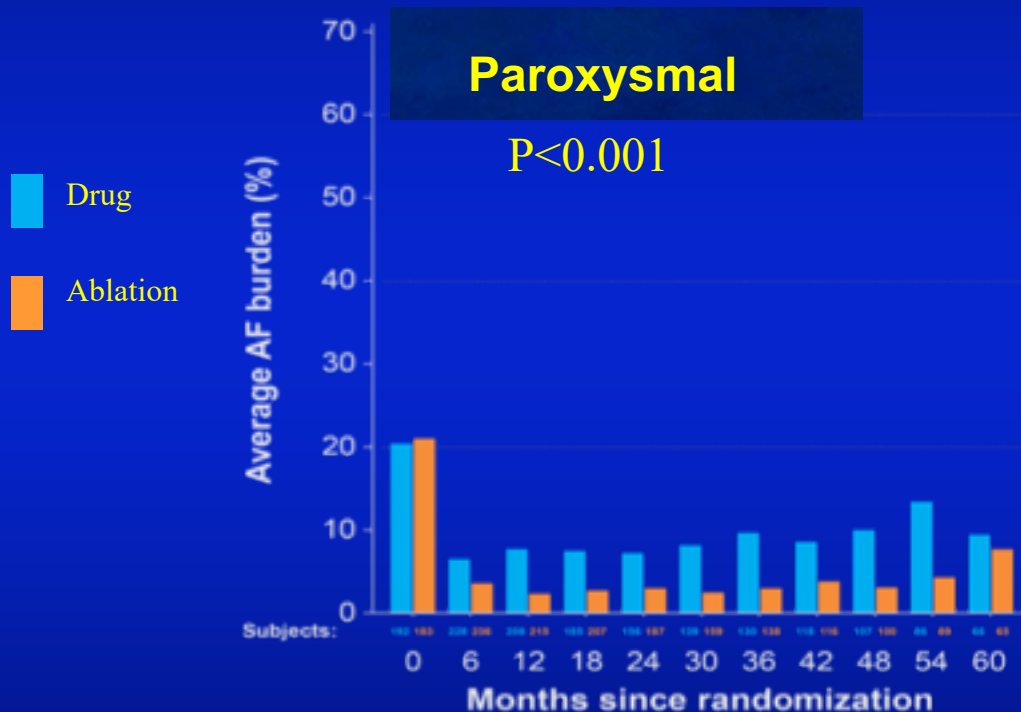
Atrial Fibrillation/Flutter



Number
at risk:

Drug	629	311	255	210	178	155	127	112	92
Ablation	611	422	373	322	287	239	198	161	132

Percent AF Burden Holter Analysis by Baseline Pattern of AF



*Cabana study recording system only

CABANA : MORTALITY

15% reduction of all cause mortality with ablation was observed (ITT).

(HR 0.85; 95% CI 0.60-1.21; $p=0.377$) non stat significant

Analyses by *treatment received* showed significant benefits of ablation for both the primary endpoint and for mortality

**So what is the
state of the art of Ablation
in 2018 ?**

Ablation per year today



25.000

93% RF

6% cryo

1% other



213.000

91% RF

7% cryo

2% other



250.000

92% RF

6% cryo

2% other



800.000

92% RF

6% cryo

2% other



**Where are we going
in the future?**

High resolution non invasive mapping

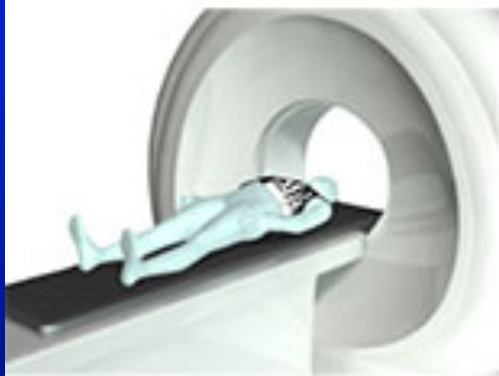
252 ELECTRODE VEST



ECM* ALGORITHMS SOLVES
"INVERSE PROBLEM"



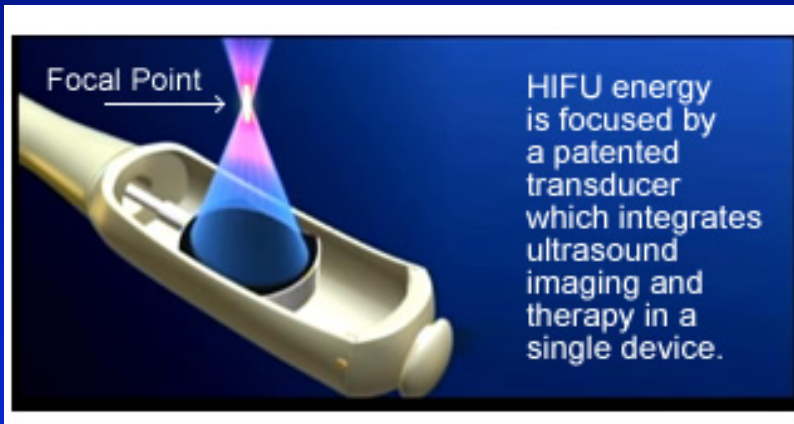
HEART-TORSO
GEOMETRY (CT)



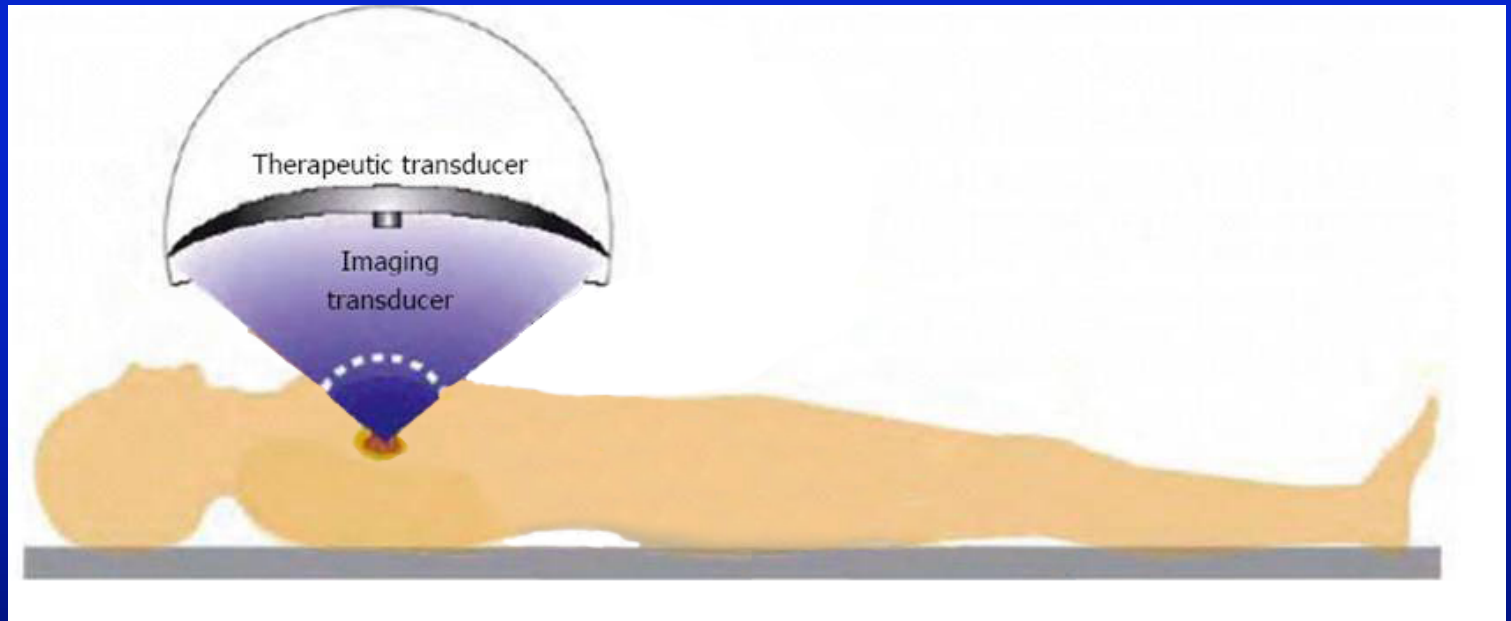
ECM MAPS



External ablation for AF?



Focused ultrasound therapy?



Adapted from World J Gastroenterol. Jul 28, 2014; 20(28): 9570-9577

Thank you for your attention



Waiting for the future...

**What can we do today to
improve our results?**

The New York Times 30 Jan, 2014

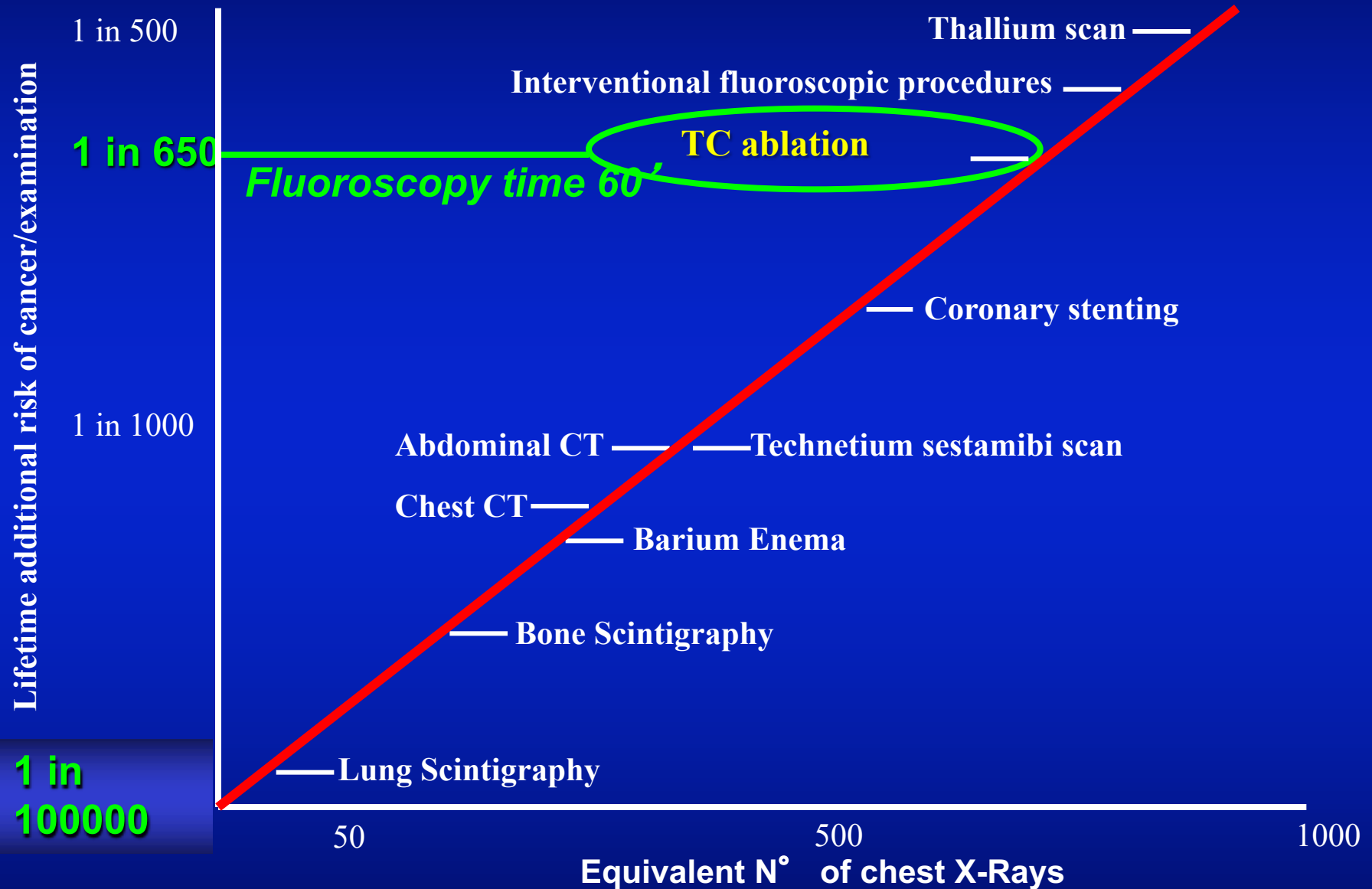
We Are Giving Ourselves Cancer

By RITA F. REDBERG 30, 2014



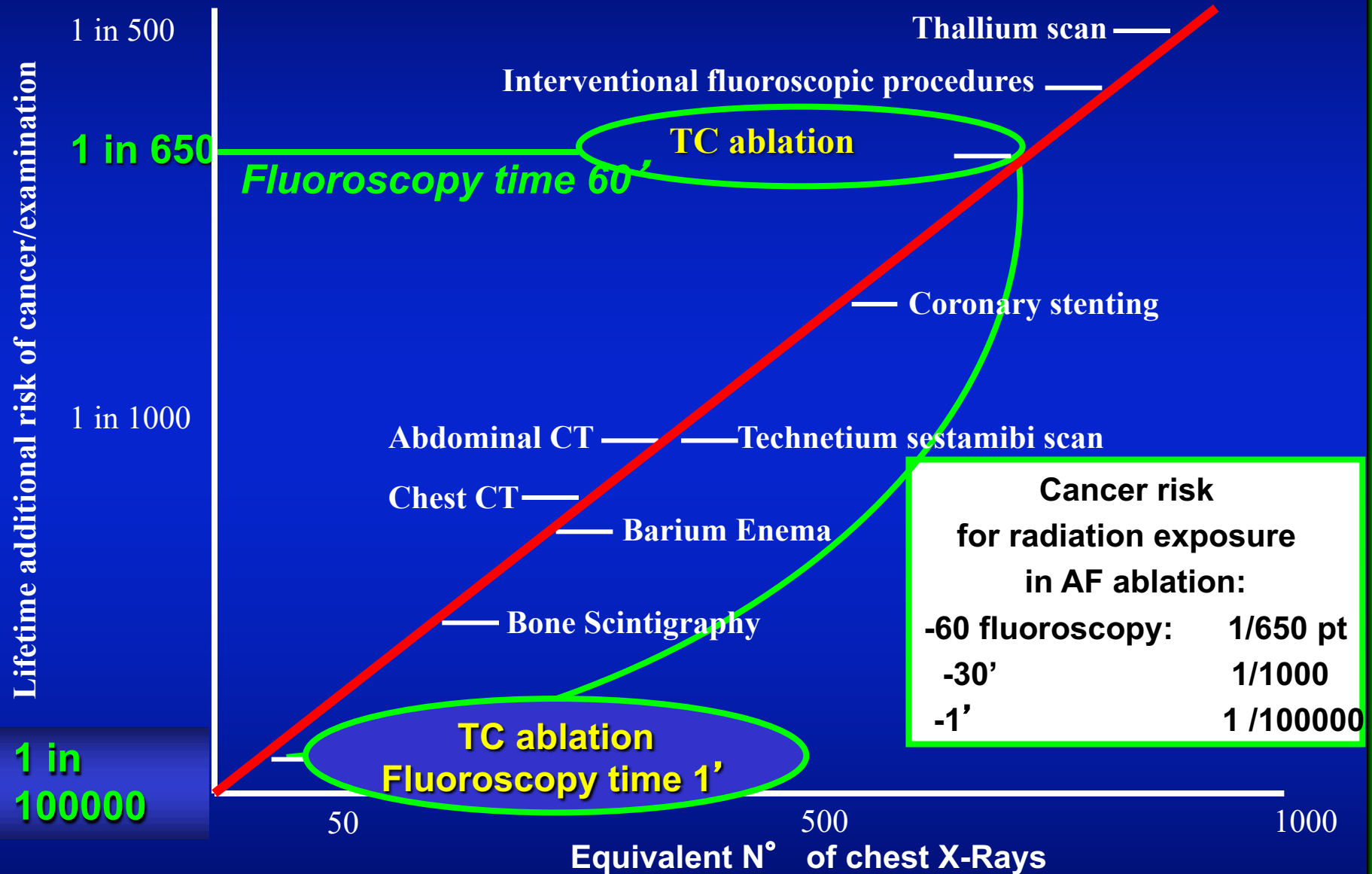
Ben Jones

Radiation exposure: additional cancer risk for patients



Modified from Picano BMJ 2004

Radiation exposure: additional cancer risk for patients



Modified from Picano BMJ 2004

2016

AF guidelines ESC

Initiation of long term rhythm control therapy to improve symptoms in AF

