

ABLATION TECHNIQUES FOR ATRIAL FIBRILLATION

Demosthenes G. Katritsis, MD, PhD_(Lon), FRCP

Athens Euroclinic

Ablation for AF

- Cox JL, et al. Surgery for atrial fibrillation. Semin Thorac Cardiovasc Surg. 1989;1:67-73.
- Swartz JF, et al. Circulation 1994; 90:I-335 AHA Sessions 1994
- Katritsis D, et al. Linear left atrial ablation for the treatment of atrial fibrillation. Eur Heart J 1996; Suppl:I-45 ESC 1996

AF ABLATION

Athens Euroclinic

<i>1998-2000</i>	<i>CS/LA (ligament of Marshall)</i>
<i>2001-2004</i>	<i>PV disconnection</i>
<i>2004-2006</i> <i>- 2005-2006</i>	<i>Circumferential ablation (CARTO)</i> <i>Non-inducibility</i>
<i>2006-2007</i>	<i>Ganglionated Plexi Ablation</i>
<i>2008-</i>	<i>Combined Techniques</i>

Ablation for AF

Complication rates following PV and circumferential ablation

Complication	Rate (%)	
	Worldwide Survey Circulation 2005; 111: 1199	Reynolds et al. HRS 07 HCA Casemix Database 51 Hosps, 2028 pts
Death	0.05	0.69
Stroke	0.28	0.28
Transient ischemic attack	0.66	
Tamponade	1.22	1.97
PV stenosis	0.0	1.31

Oesophageal damage?

Thirty-two deaths (**0.98 per 1,000 patients**) were reported during 45,115 procedures in 32,569 patients.

Cappato et al. JACC 2009;53:1798–803

Ablation for Paroxysmal AF

PV Isolation With Circumferential Ablation

- Circumferential PV ablation even when performed with a clear end-point of delivering coalescent lesions that produce a voltage reduction to <0.1 mV and delayed local conduction (>30 ms) between contiguous points across the line, **cannot achieve complete electrical isolation of PVs in 25 to 45% of patients.**
 - Hocini et al. Eur Heart J. 2005;26:696-704.
 - Ouyang et al. Circulation. 2004;110:2090-6.
 - Pappone et al. Circulation. 2001;104:2539-44.
-
- When such clear end-points are not necessarily achieved, complete isolation of all PVs is present **in less than 20% of patients, and does not predict freedom from AF in the long-term.**
 - Lemola et al. J Am Coll Cardiol. 2005;46:1060-6.
 - Kottkamp et al. J Am Coll Cardiol. 2004;44:869-77.

Ablation for AF

Katritys, Ellenbogen, Camm. Europace. 2004;6:425-32.



Ablation for AF

- **AF recurrence is associated with PV-LA conduction recurrence**
 - Ouyang et al. Circulation. 2005;111:127-35.
 - Cappato et al. 2003;108:1599-604.
 - Hocini et al. Eur Heart J. 2005;26:696-704.
- **PV isolation may not be necessary for a successful clinical outcome**
 - Cappato et al. Circulation. 2003;108:1599-604.
 - Stabile et al. Circulation. 2003;108:657-60.
 - Lemola et al. Heart Rhythm. 2004;1:197-202 (up to 98% recurrence).
 - Katritsis et al. Europace 2004;6:425-32.
 - Lemola K, et al. J Am Coll Cardiol. 2005;46:1060-6.
 - van Brakel et al. Eur Heart J. 2005;26:1321-6.
 - Pratola et al. Circulation 2008; 117:136

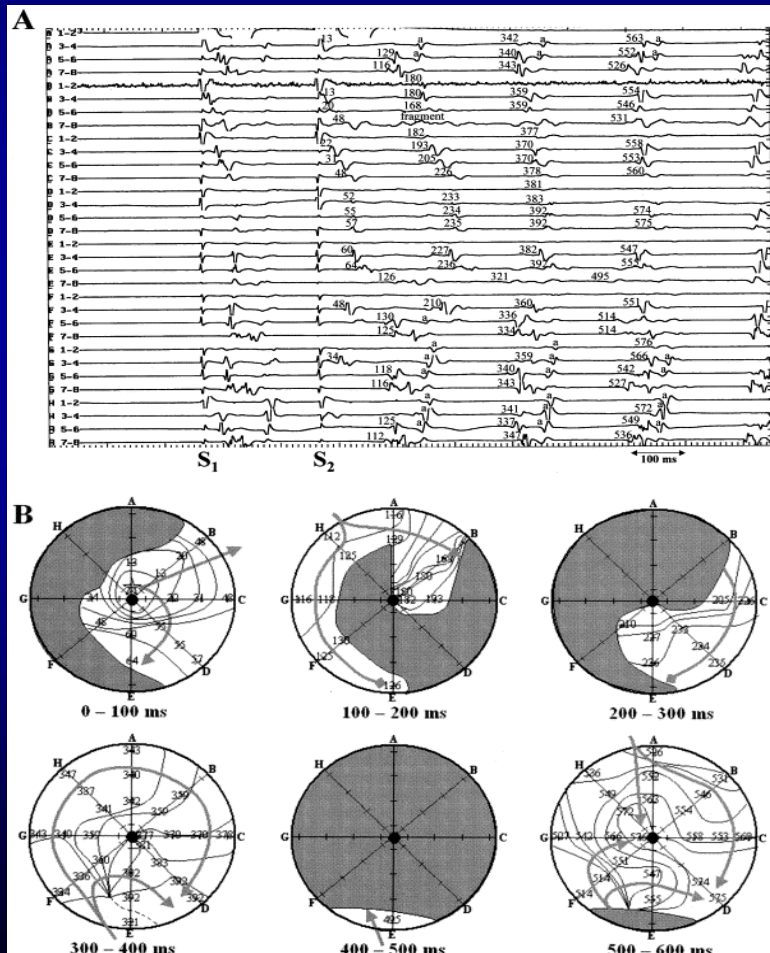
Ablation for AF

Antral Ablation

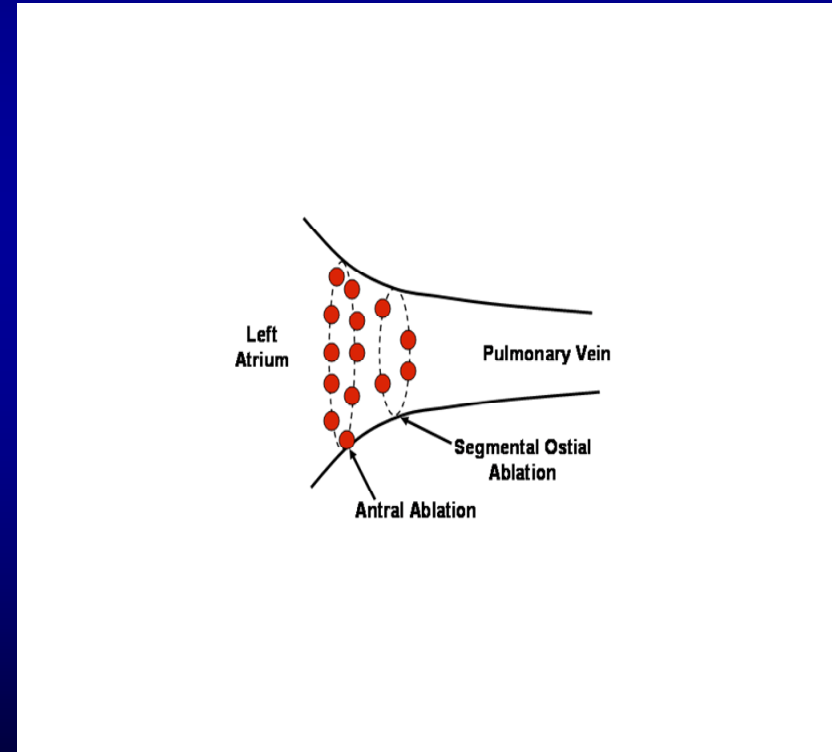
PV-LA junction reentry

Multi-electrode basket catheter

Kumagai et al. JACC 2004; 43:2281



Antral isolation



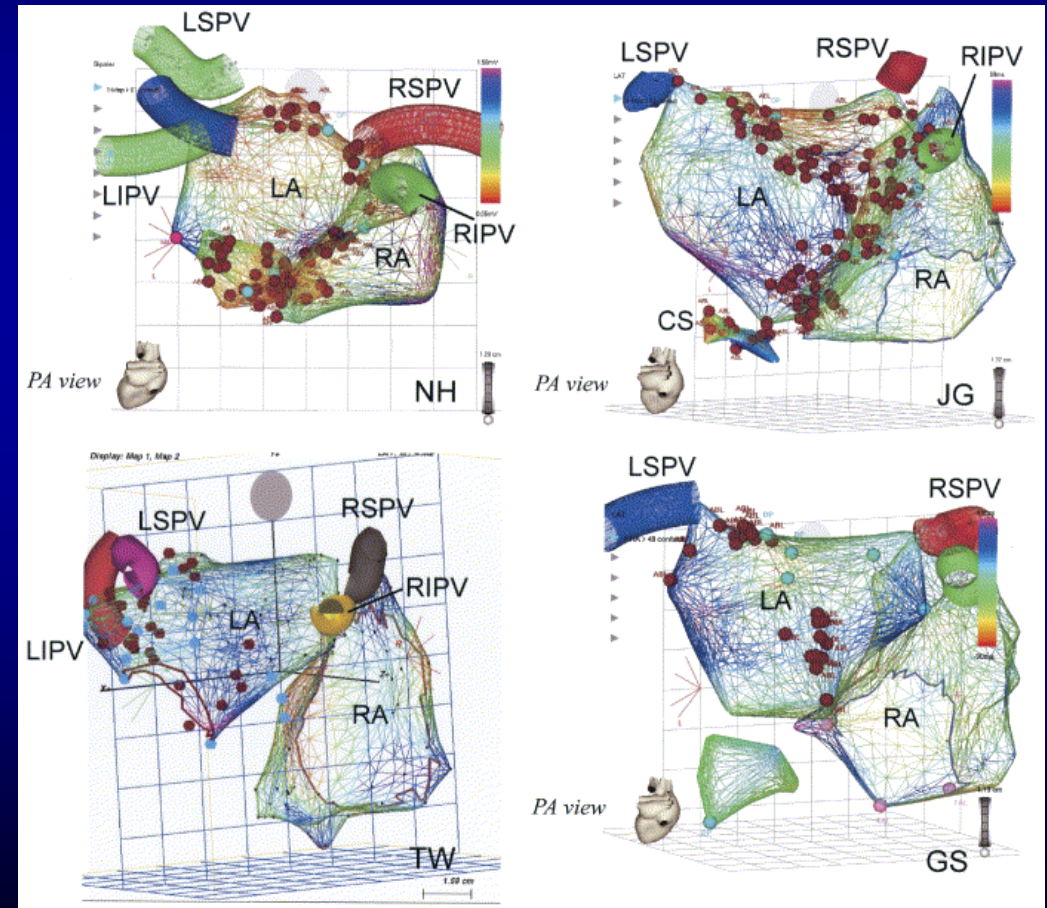
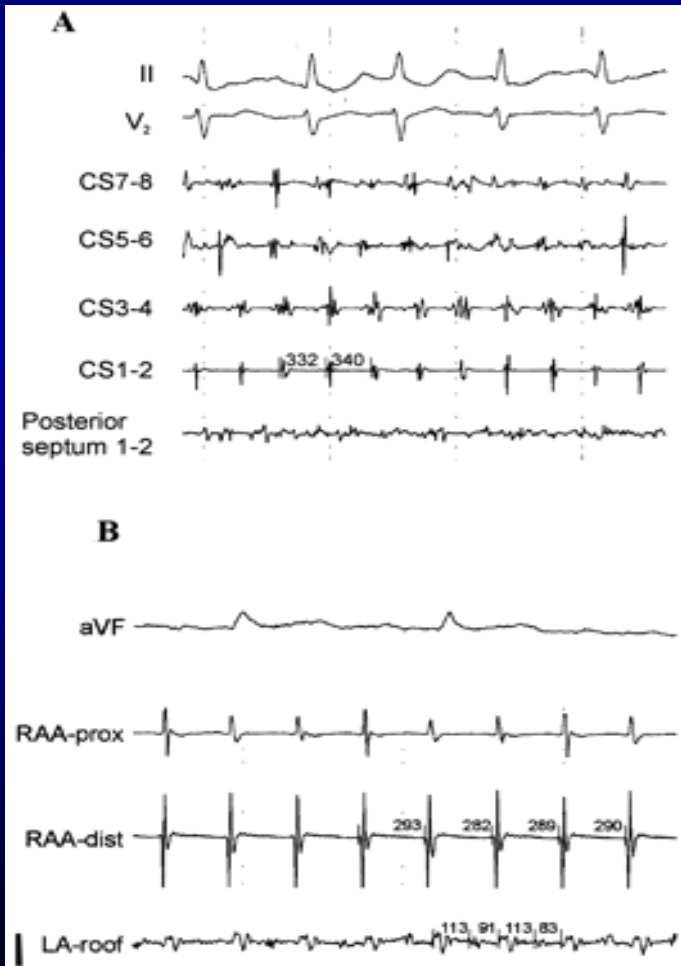
Ablation for AF

Substrate Mapping (Fractionated potentials)

Nademanee JACC 2004; 43:2044

CFAE

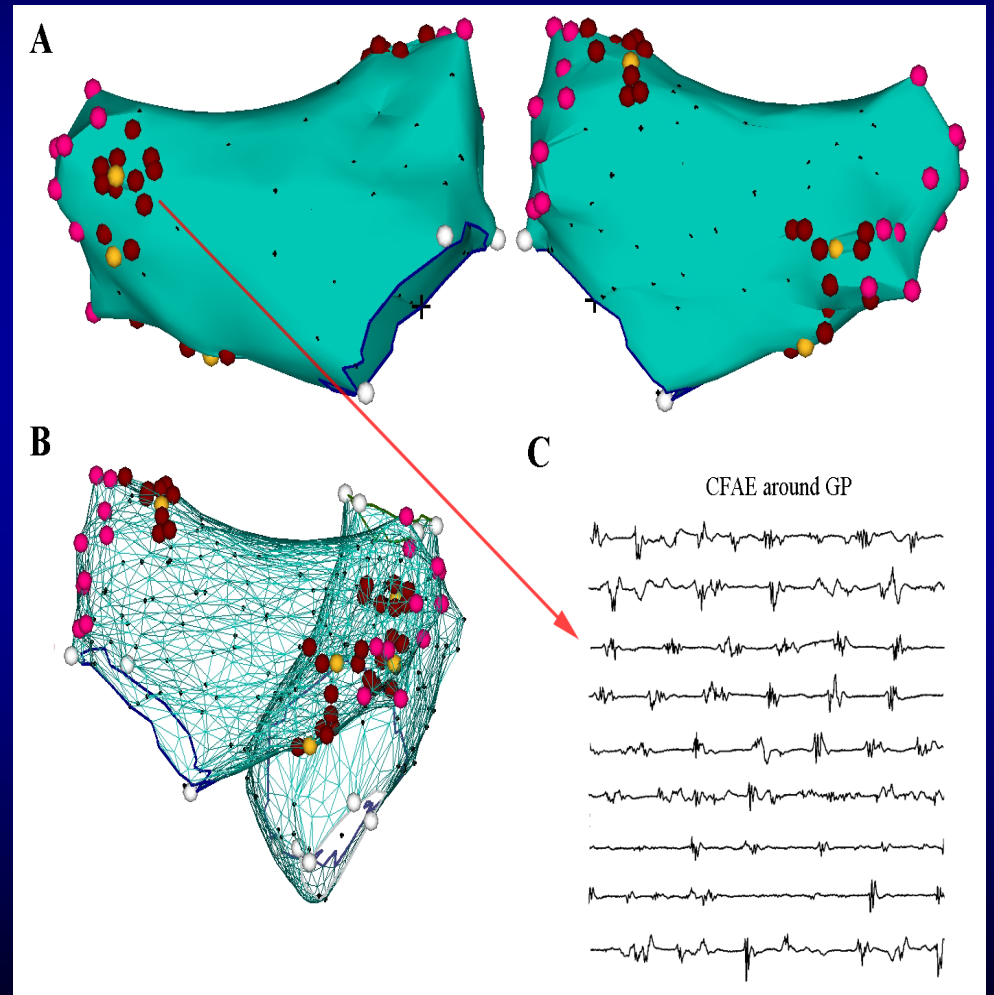
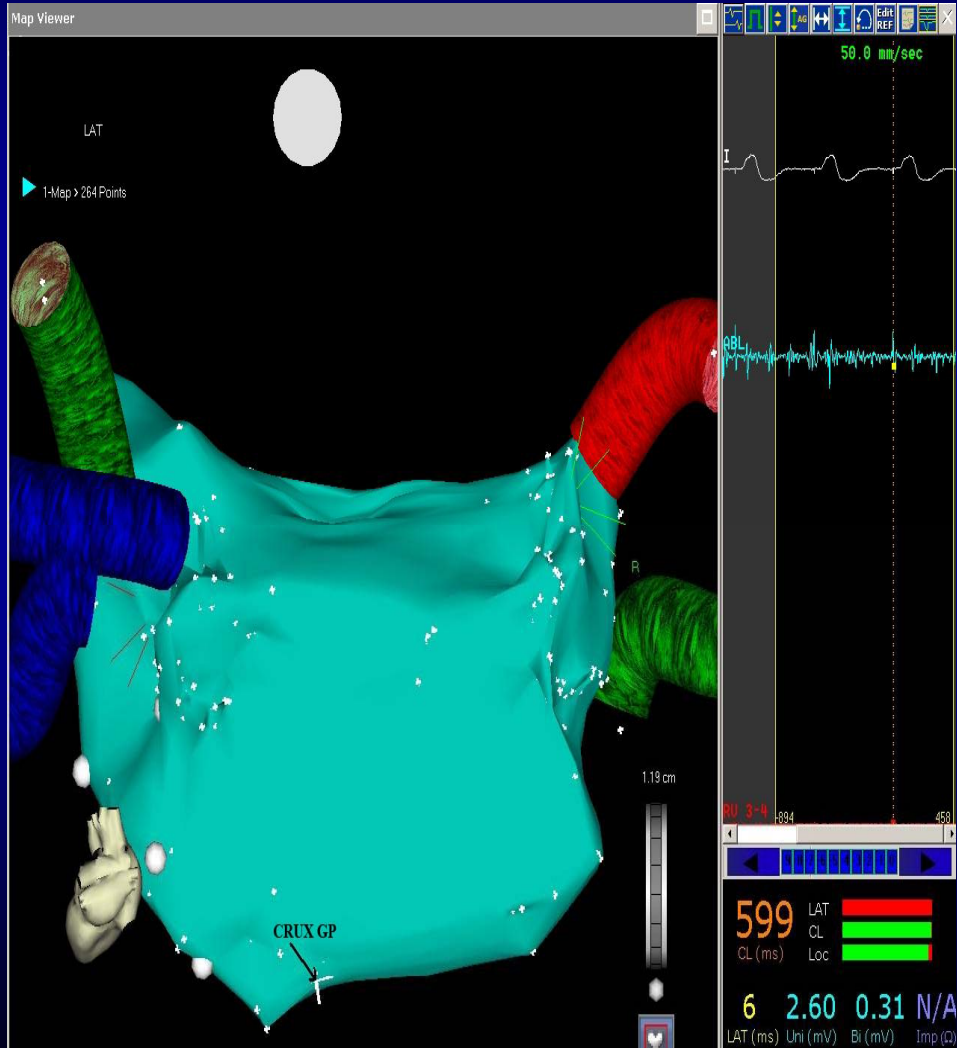
121 pts, 1 yr F-U, 76% Success at 1st attempt



Ablation for AF

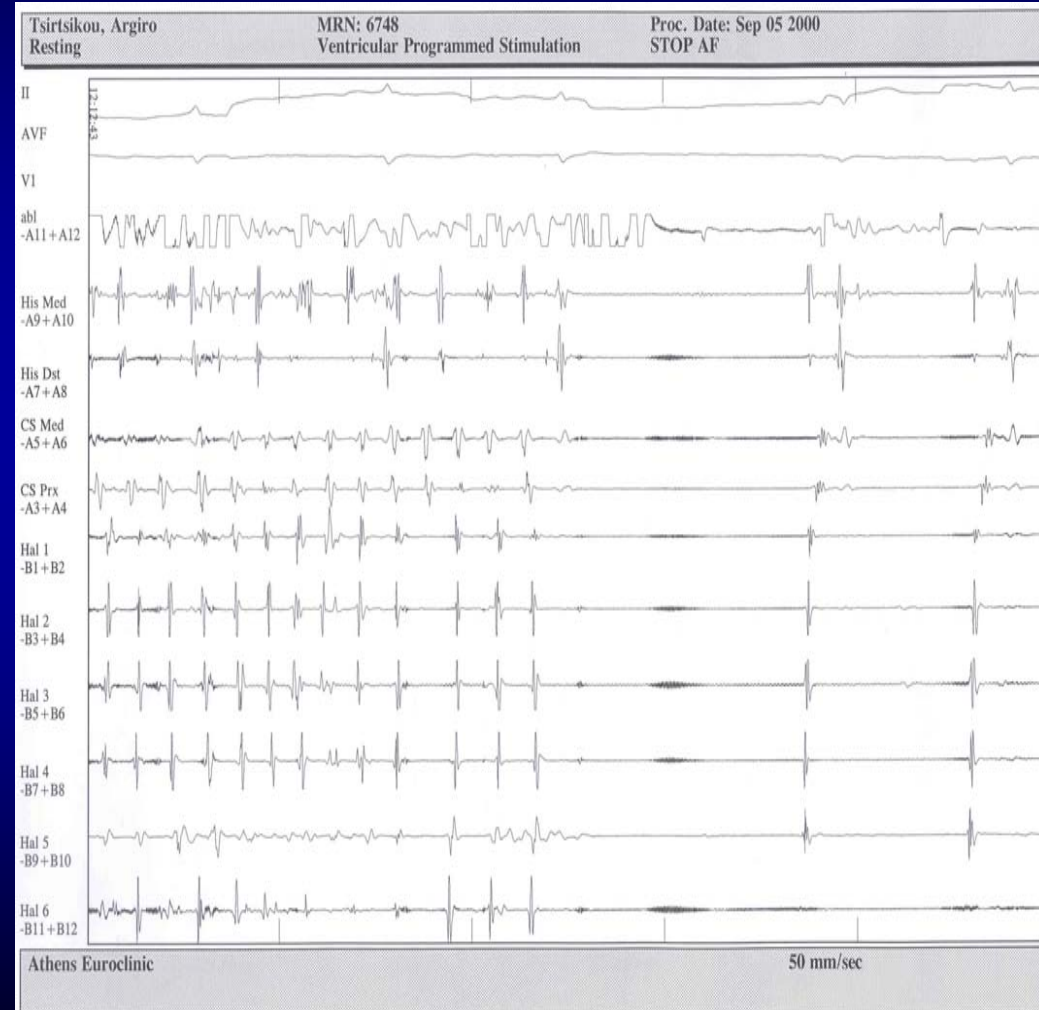
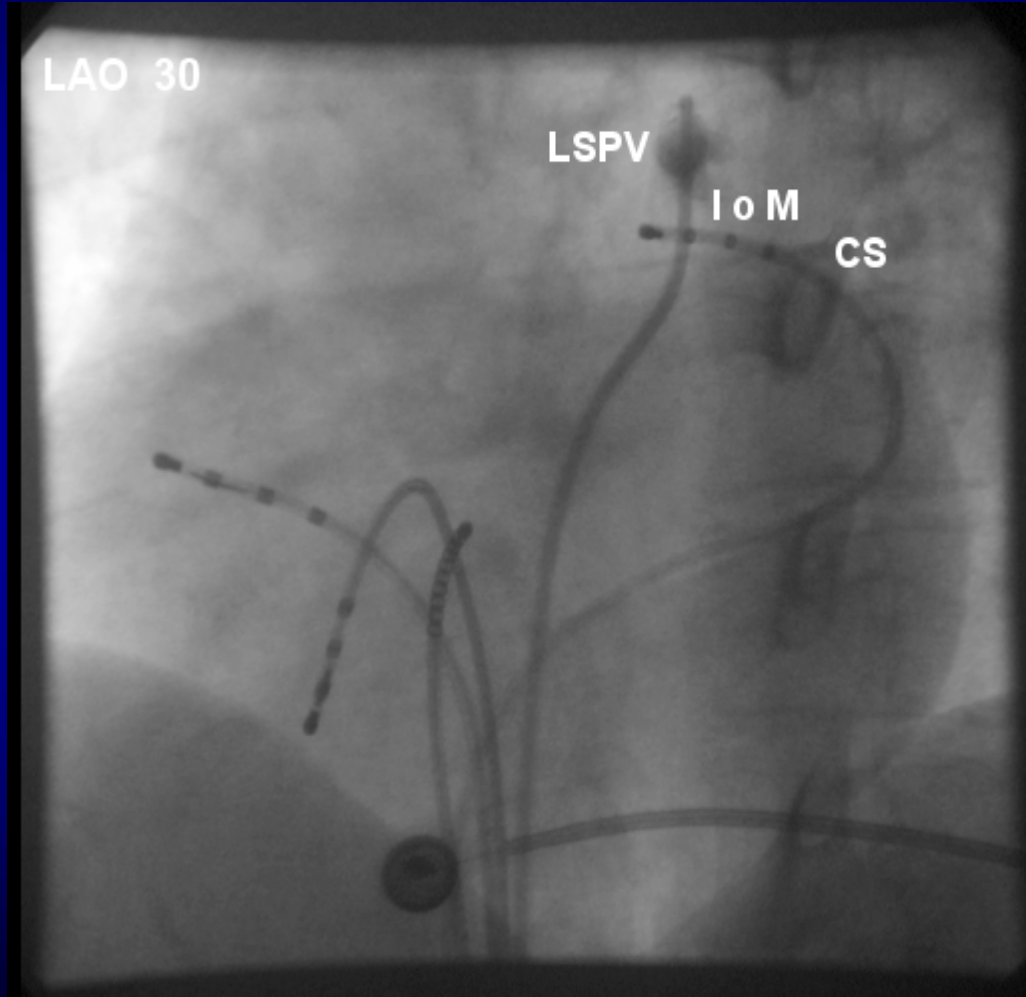
CFAEs and GP

Katrtsis et al. Europace 2009;11:308-315



Ablation for AF

Katrtsis et al. *J Cardiovasc Electrophysiol* 2001;12:750-8.

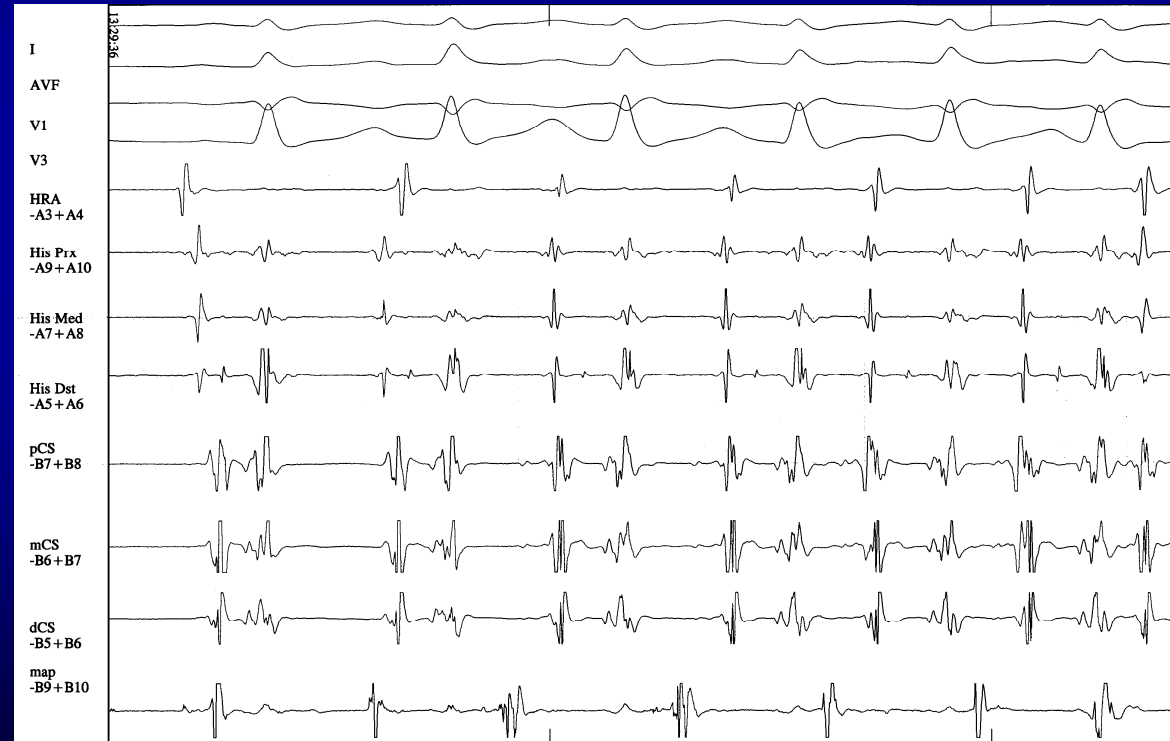
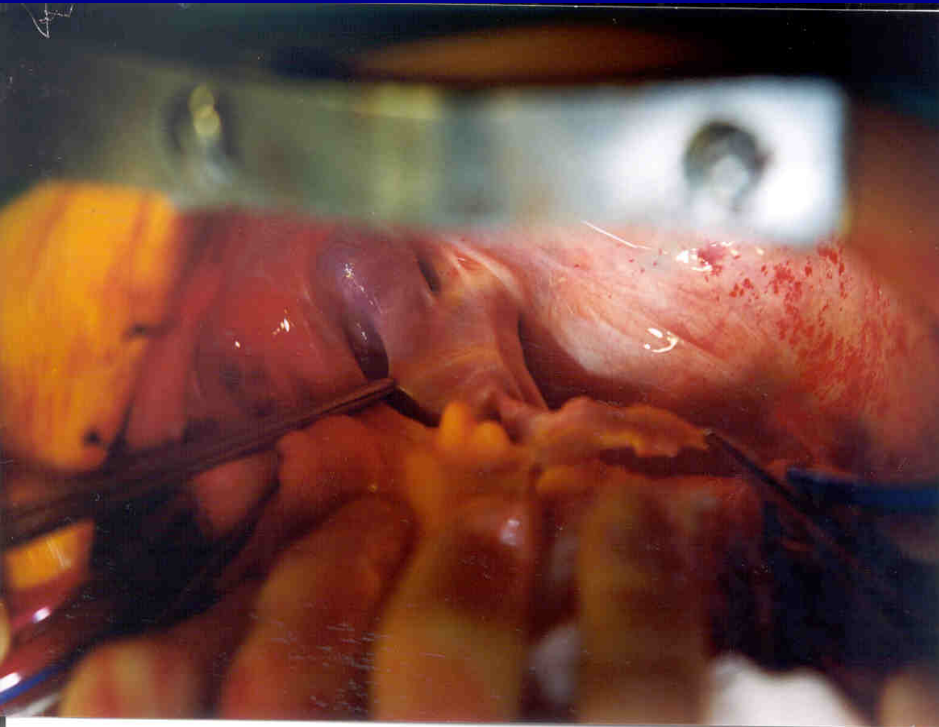


Ablation for AF

Sympathetic Denervation

Ligament of Marshall Ablation

Katritsis et al. *J Cardiovasc Electrophysiol* 2001;12:750-8.



Ablation for AF

Vagal denervation

Partial vagal denervation prevents AF

Scherlag. JICE 2005; 13 (S1): 37

Scanavacca. Circulation 2006; 114:876

Schauerte. Circulation 2000; 102:2774

Lemola. Circulation 2008; 117:470

Partial vagal denervation (fat pad) increases or does not affect vulnerability to AF

Hirose. JCE 2002; 13:1272

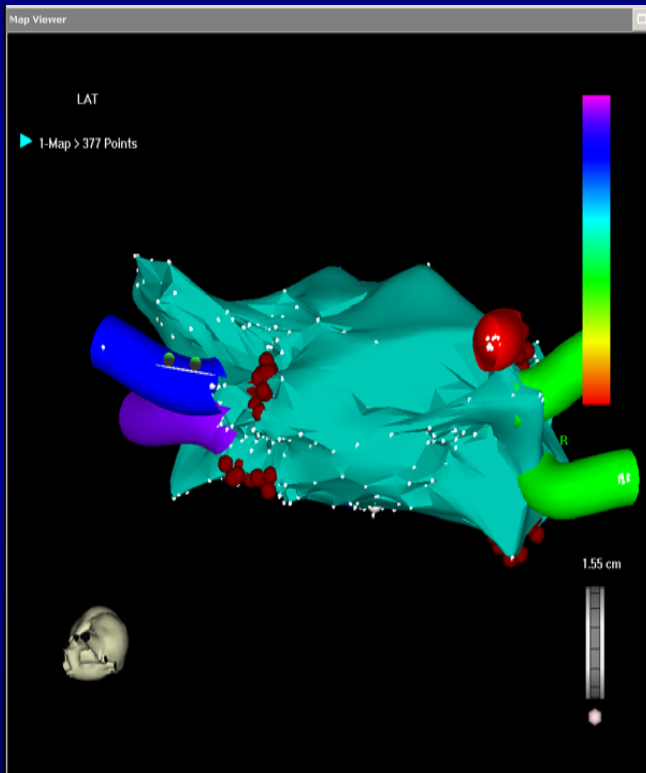
Oh. HeartRhythm 2006; 3:701

Ablation for AF

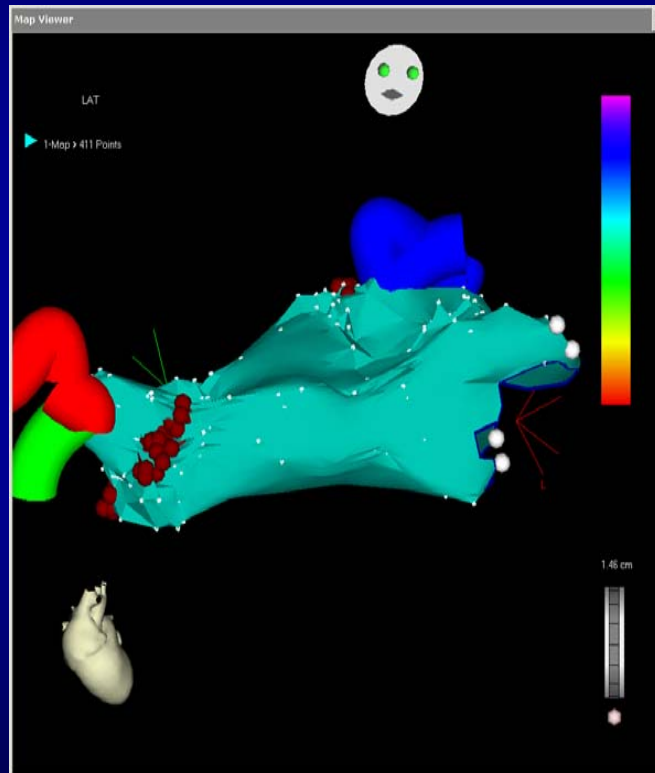
Anatomic Ganglionic Plexi Ablation: 19 pts with PAF

Katritsis et al. Am J Cardiol 2008;102:330

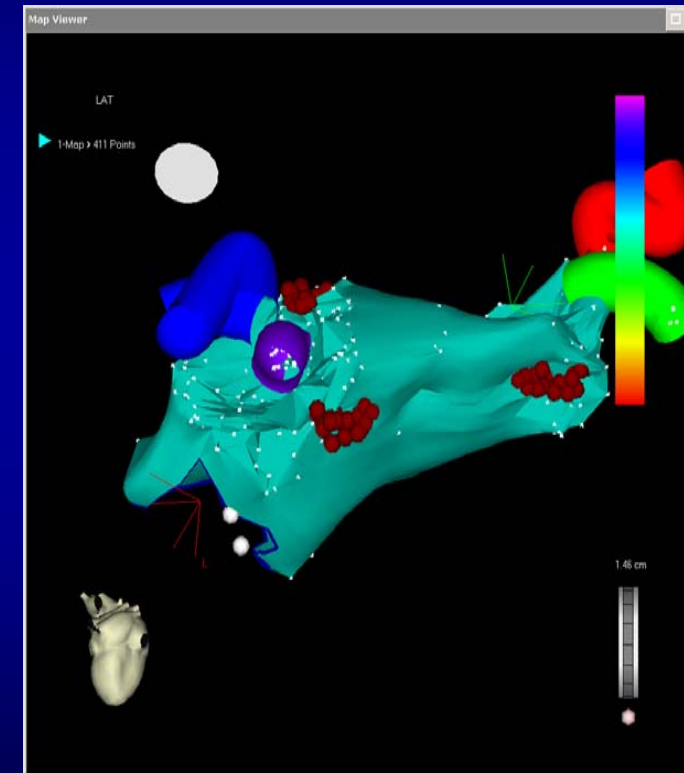
Left Superior GP



Right Anterior GP



Left and Right Inferiorr GP

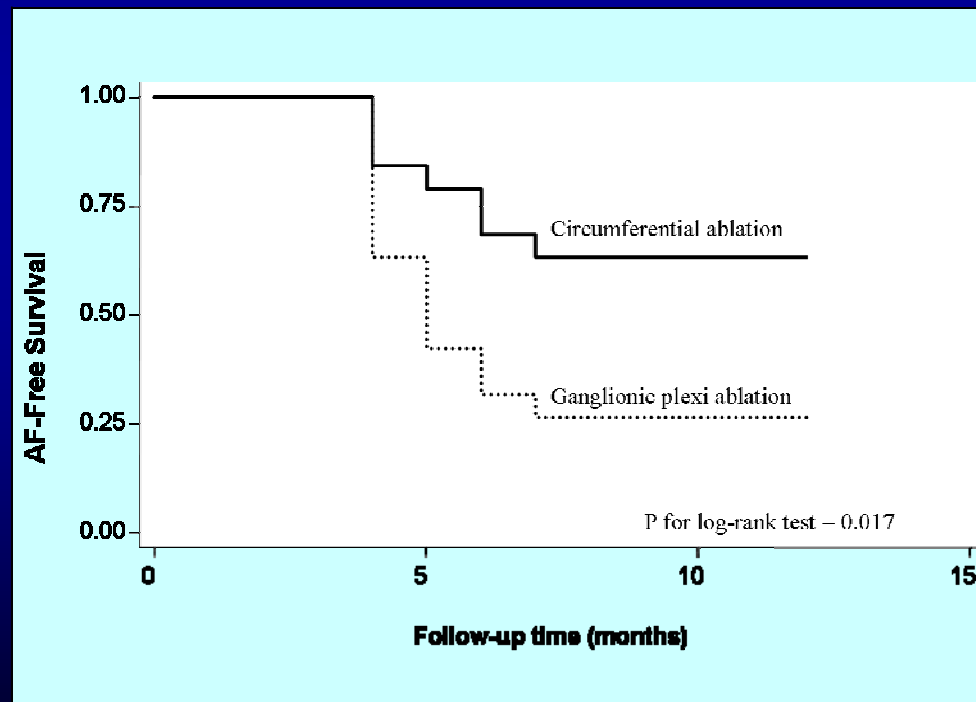


Ablation for AF

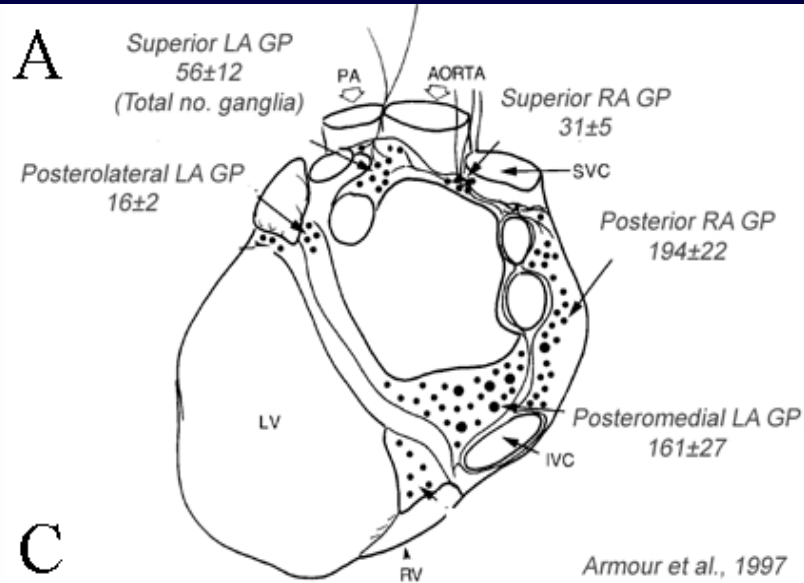
Anatomic Ganglionic Plexi Ablation for Parasympathetic Denervation

Katristsis et al. Am J Cardiol 2008;102:330

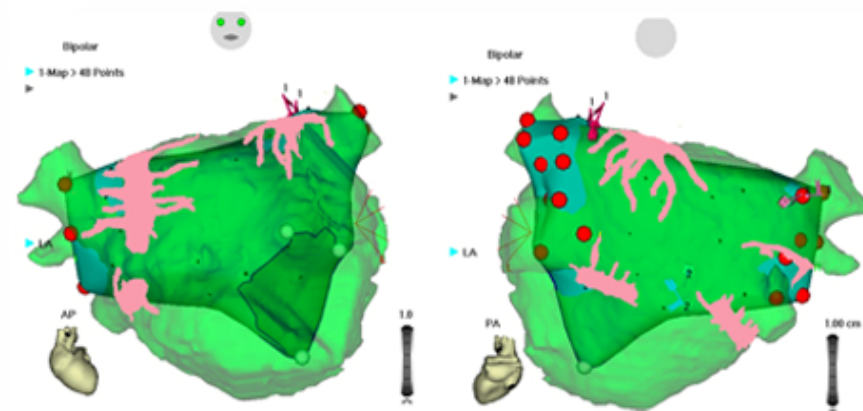
19 pts with CP anatomic ablation
compared to 19 age- and sex-matched controls
with circumferential ablation



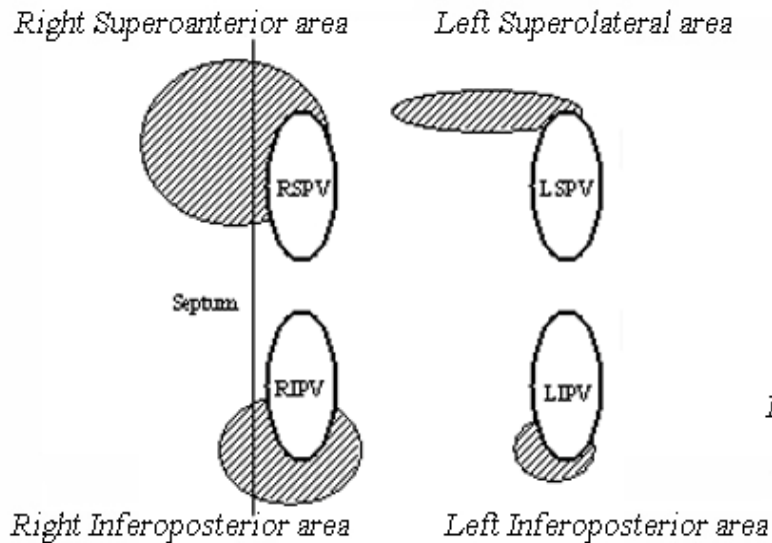
Ablation for AF



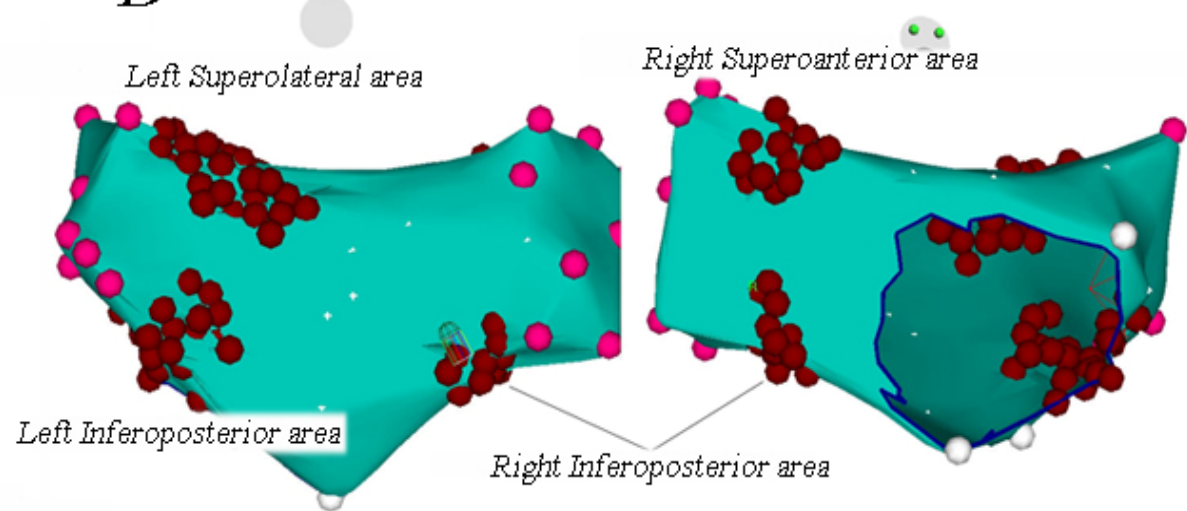
B



C



D



AF ABLATION

Athens Euroclinic

State Research Institute of Circulation Pathology, Novosibirsk

Pokushalov and Katritsis. EUROPACE (In press)

Extensive GP ablation (Reveal)

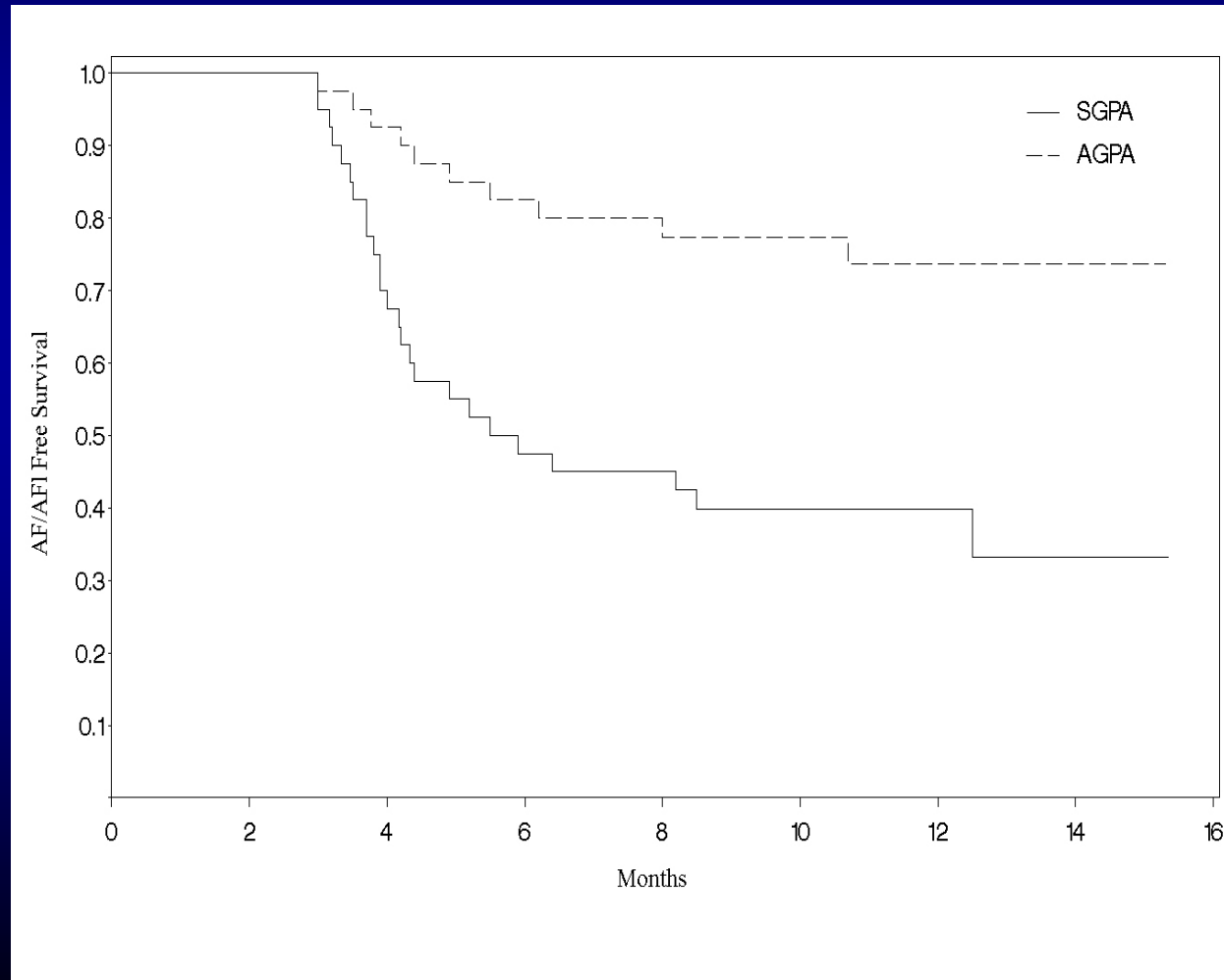
<i>Pts No</i>	<i>F-U (months)</i>	<i>AF-free</i>
56 (PAF)	6	73 %
19 (Persistent AF)	6	68%

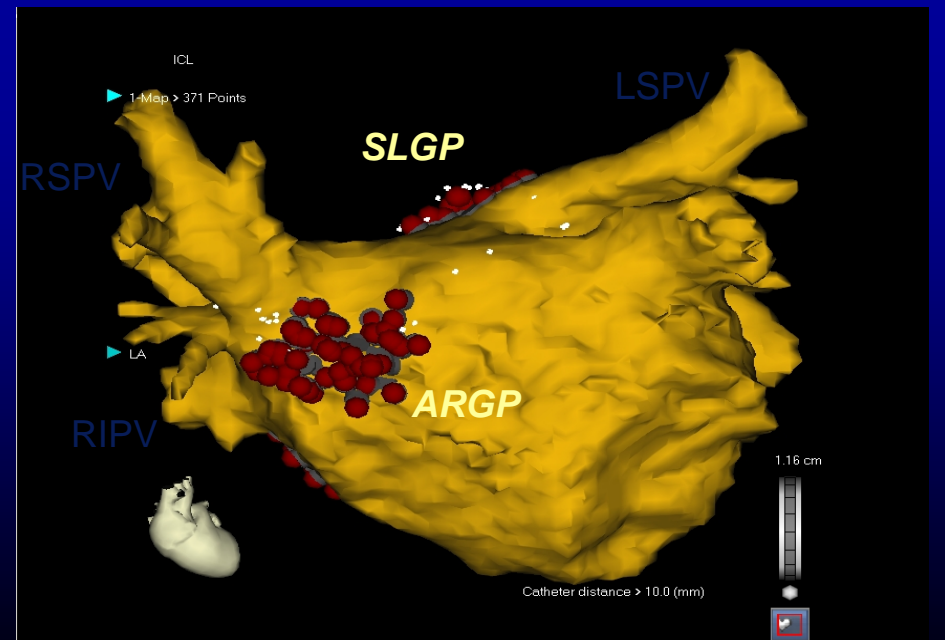
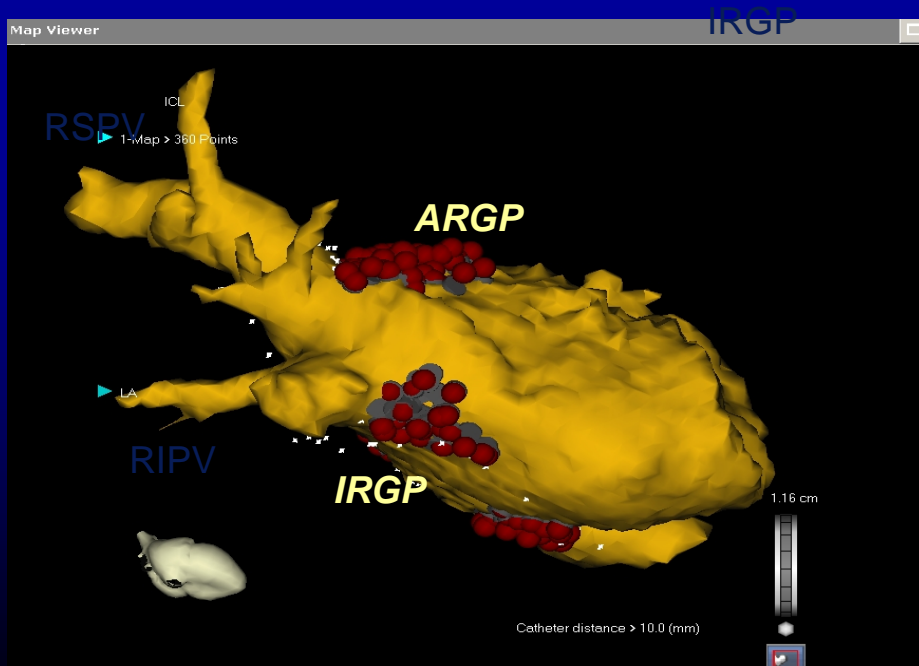
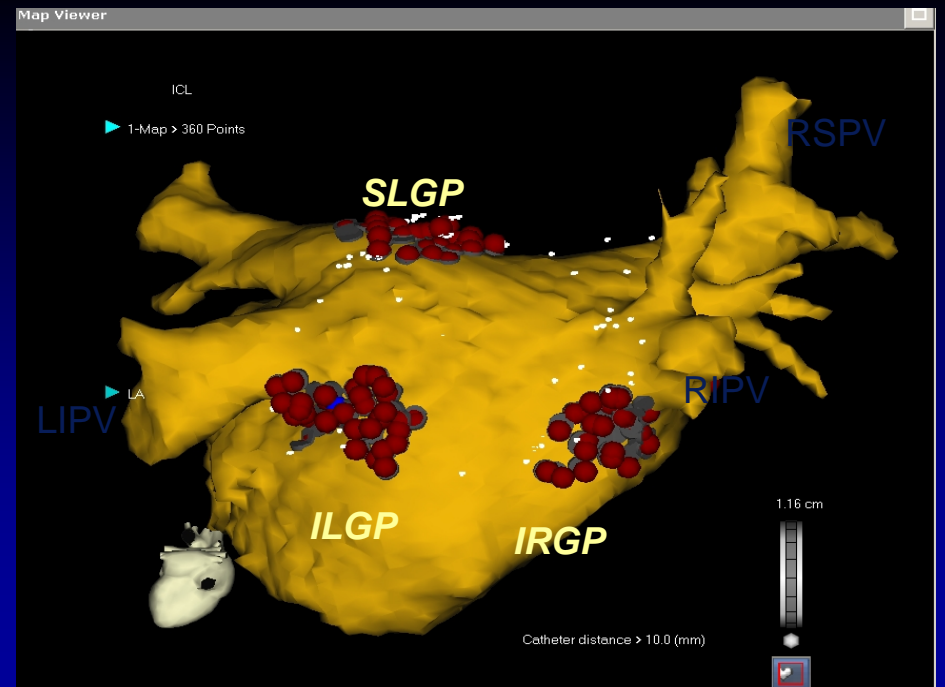
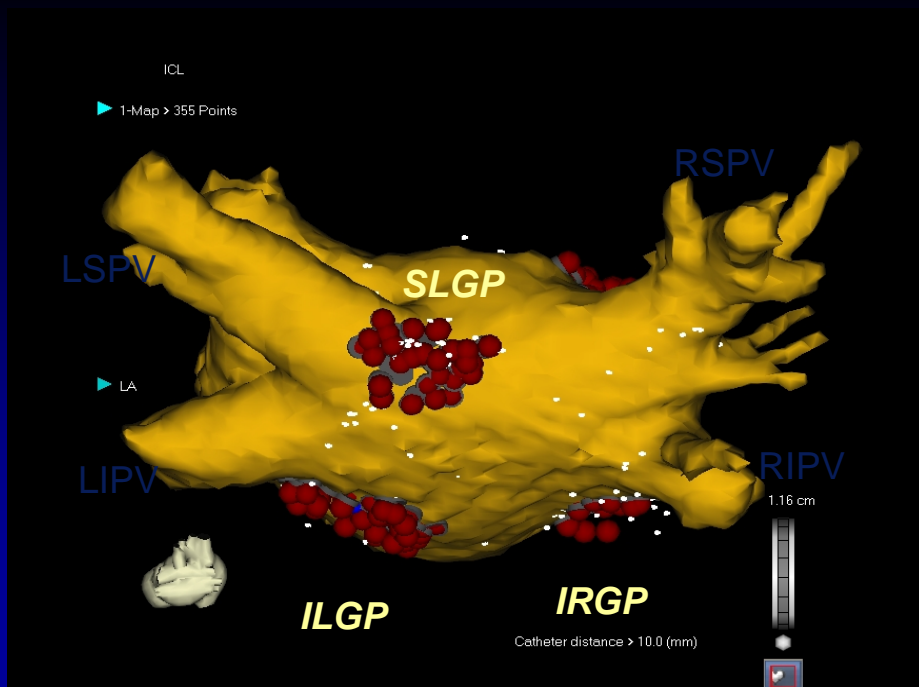
AF ABLATION

Selective vs Anatomic GP Ablation

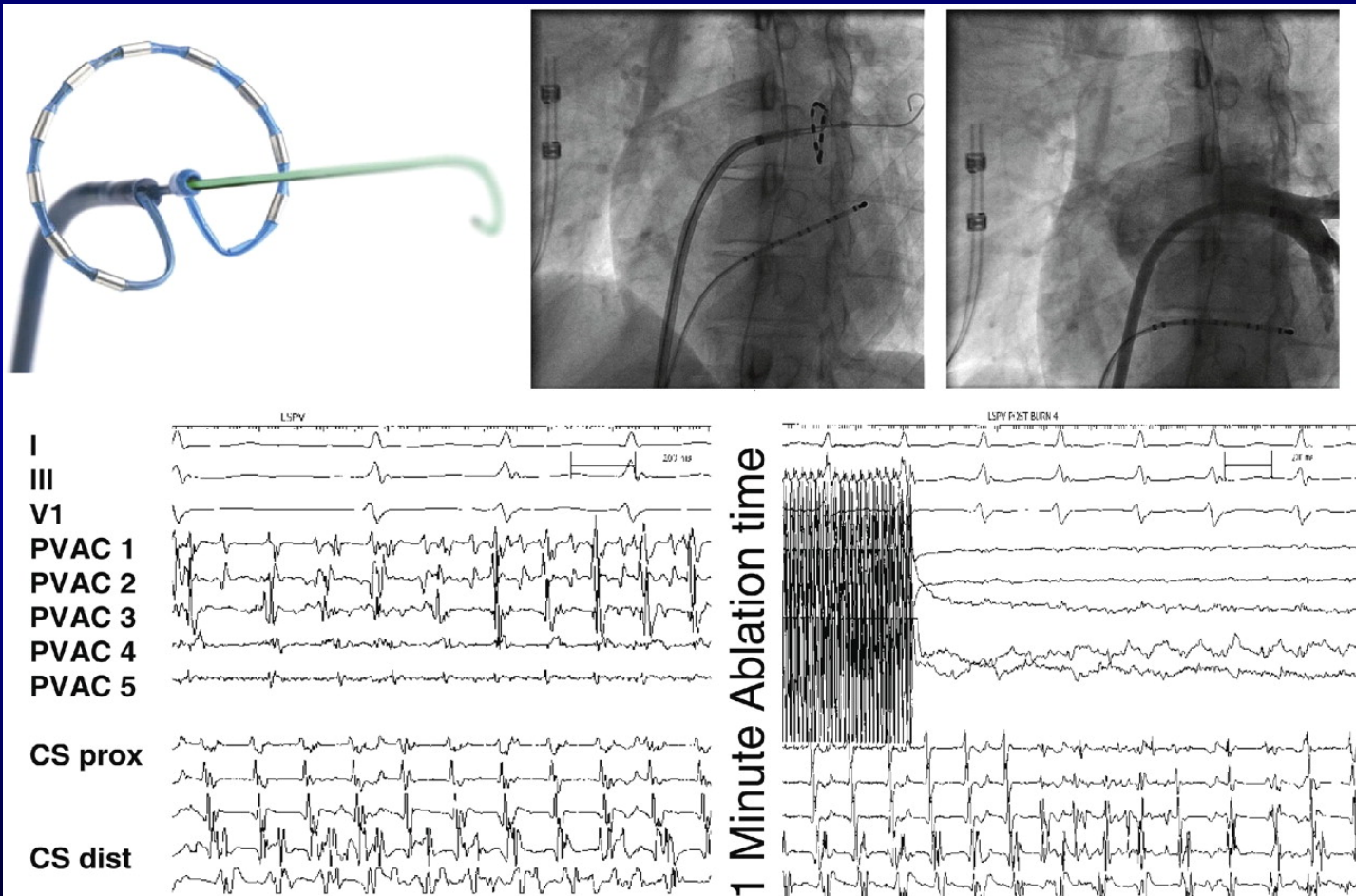
A Randomised Comparison (80 pts)

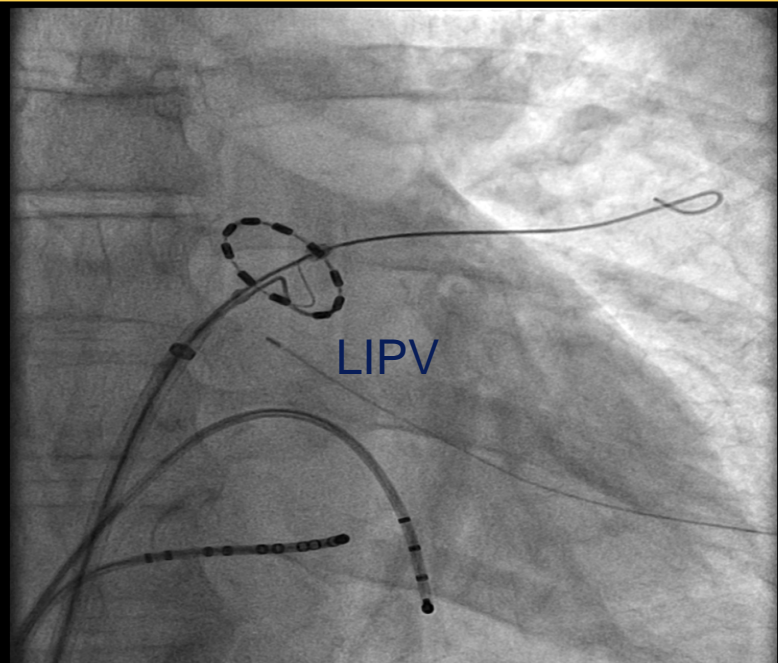
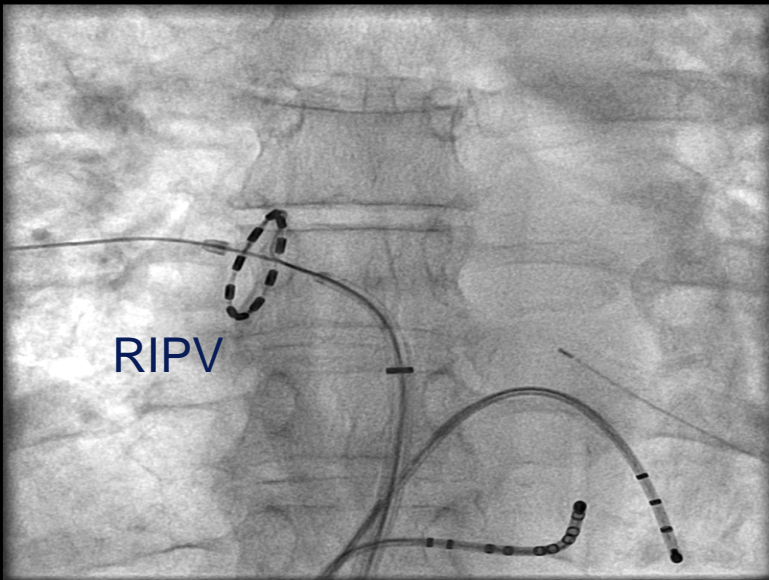
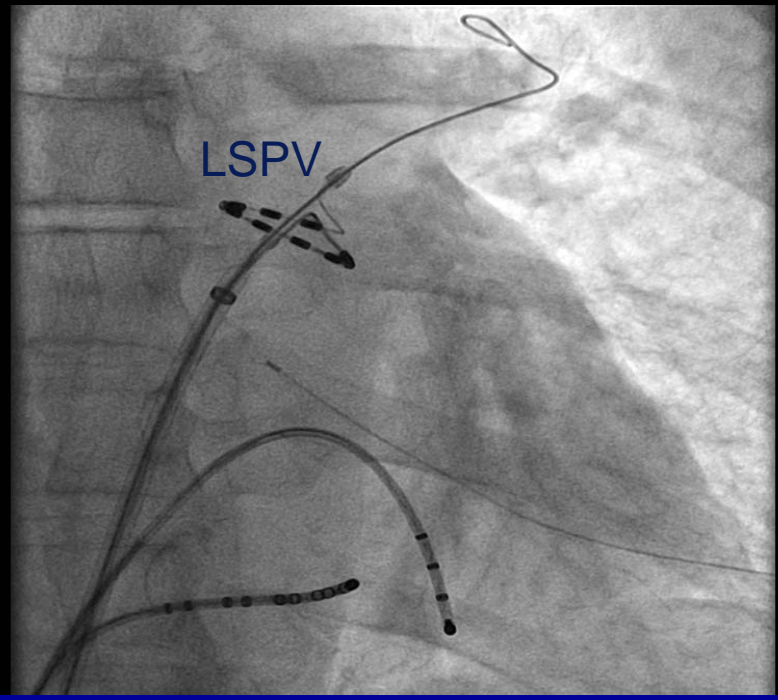
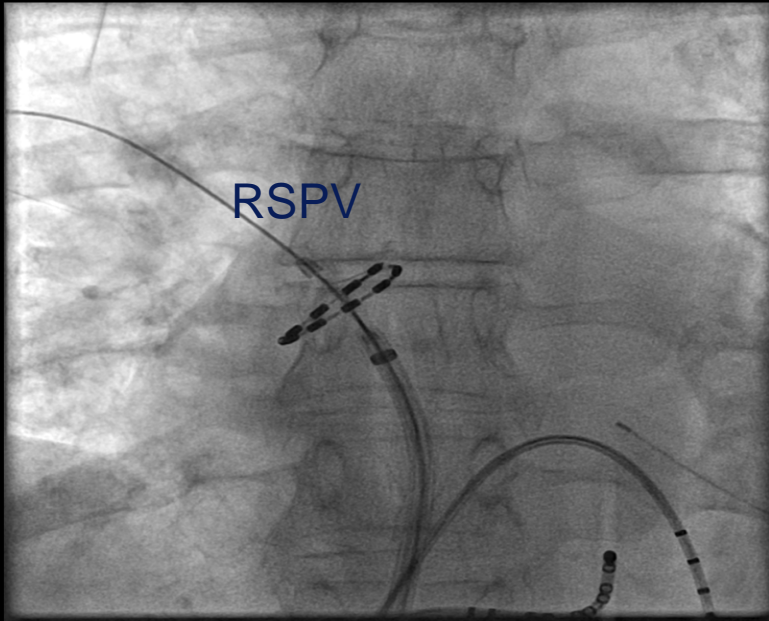
Pokushalev and Katritsis. HeartRhythm 2009;6:1257-64





AF ABLATION PVAC

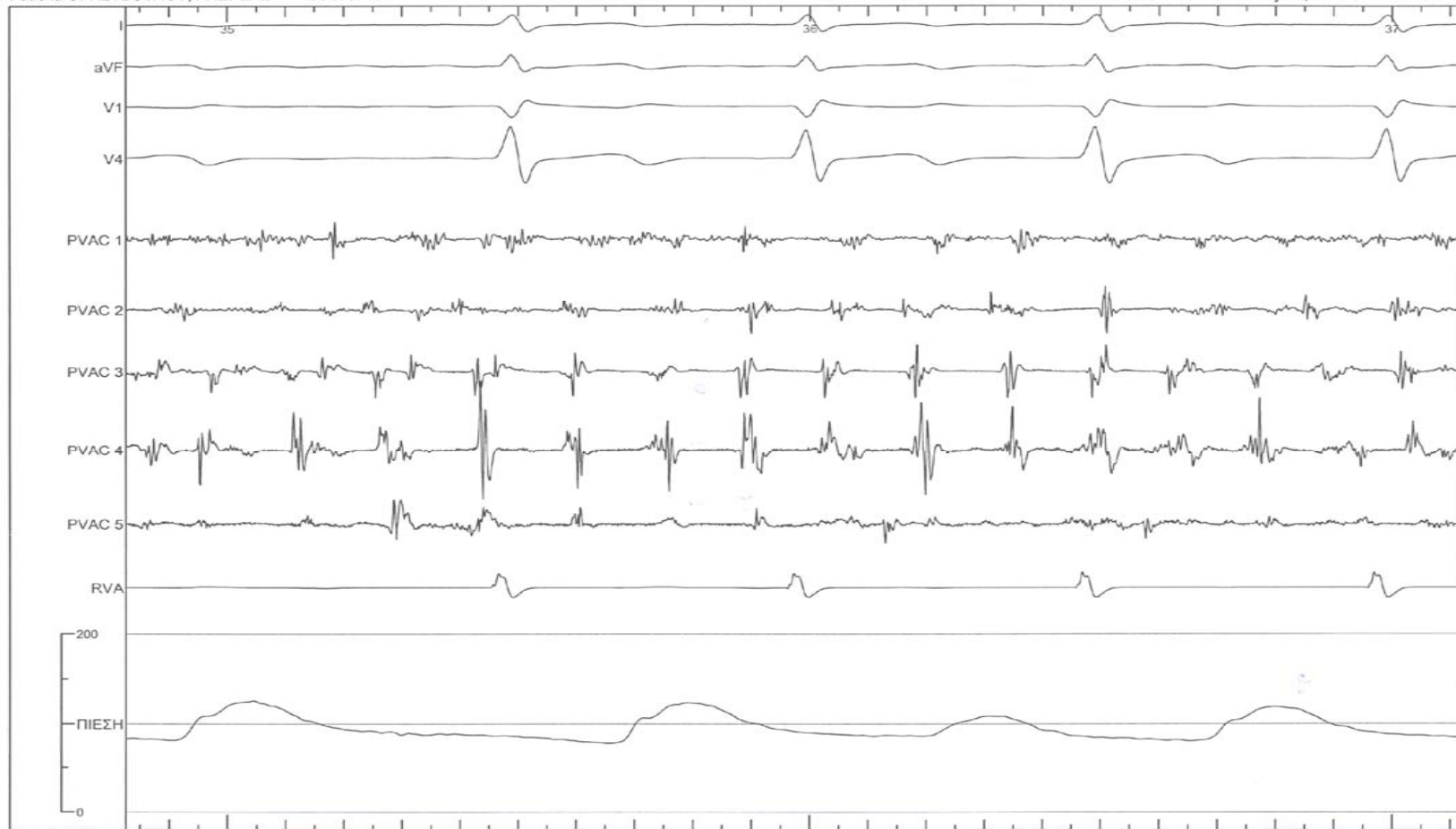




ΕΥΡΩΚΛΙΝΙΚΗ ΑΘΗΝΩΝ

Patient: ΘΡΑΣΥΒΟΥΛΟΥ, ΑΝΔΡΕΑΣ ID: 175749

Recorded on February 01, 2010 at 11:22:23.029

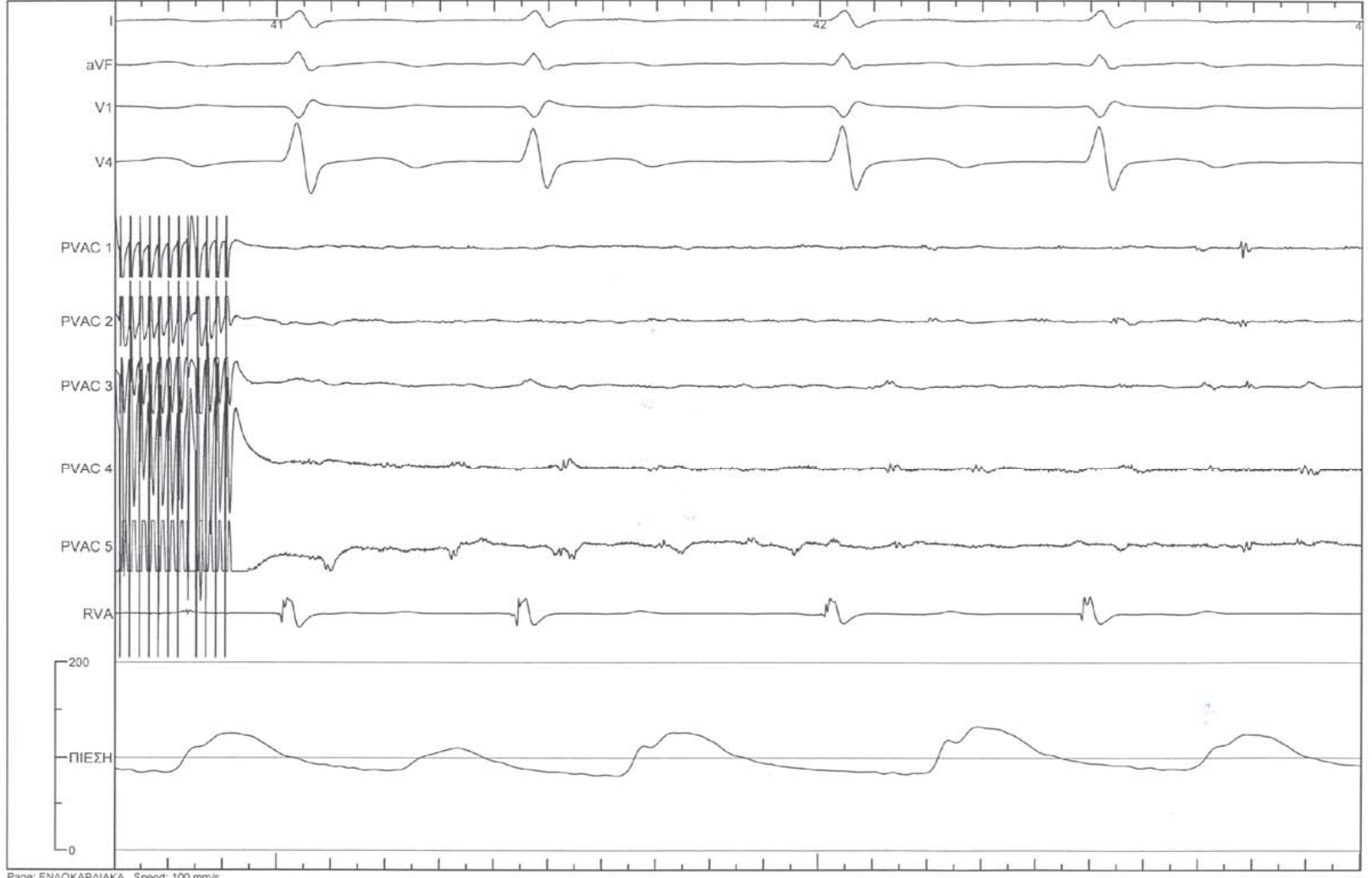


ΕΥΡΩΚΛΙΝΙΚΗ ΑΘΗΝΩΝ

Patient: ΟΡΑΣΕΥΒΟΥΛΟΥ, ΑΝΔΡΕΑΣ

ID: 175749

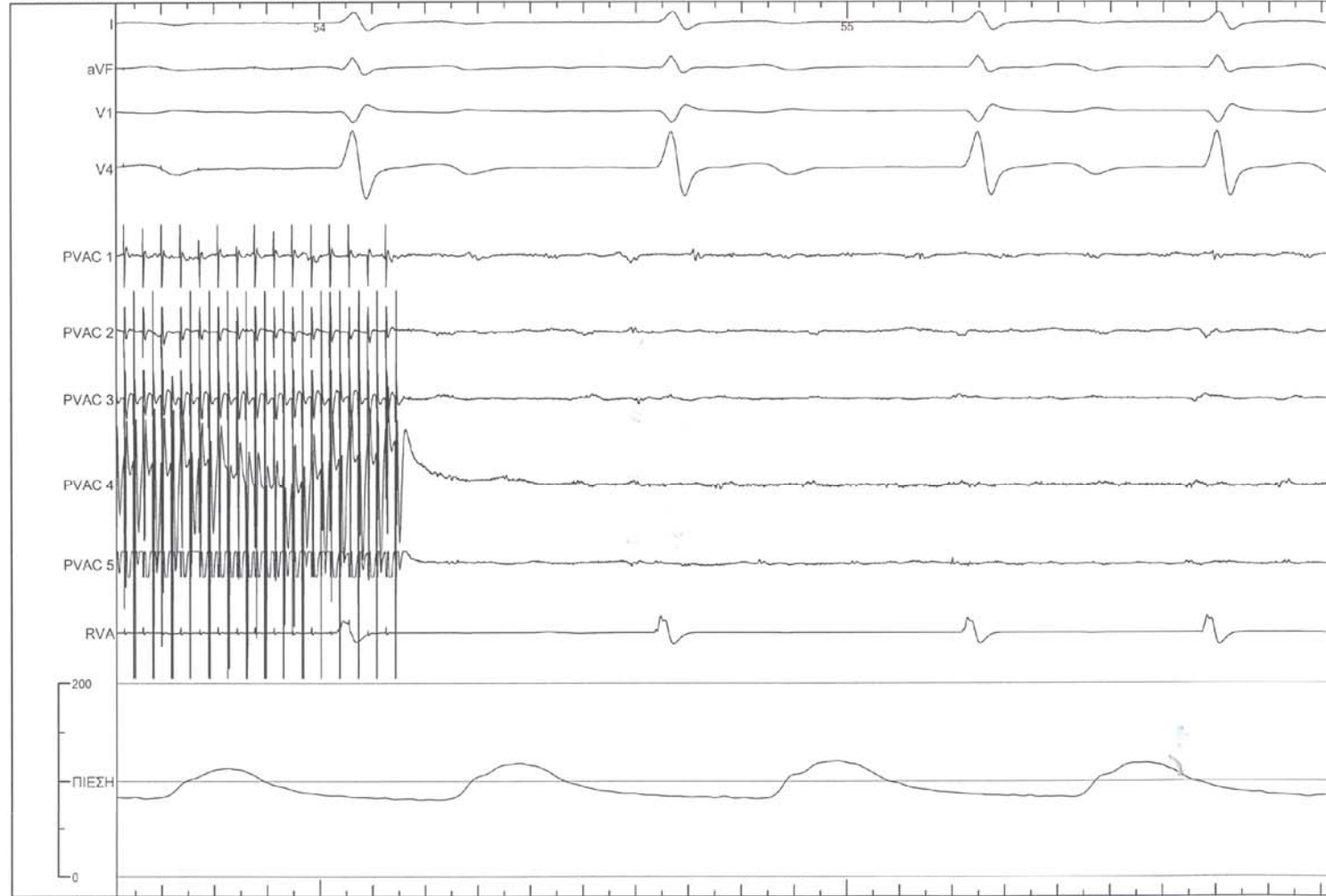
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ΕΥΡΩΚΛΙΝΙΚΗ ΑΘΗΝΩΝ

Patient: ΘΡΑΣΥΒΟΥΛΟΥ, ΑΝΔΡΕΑΣ ID: 175749

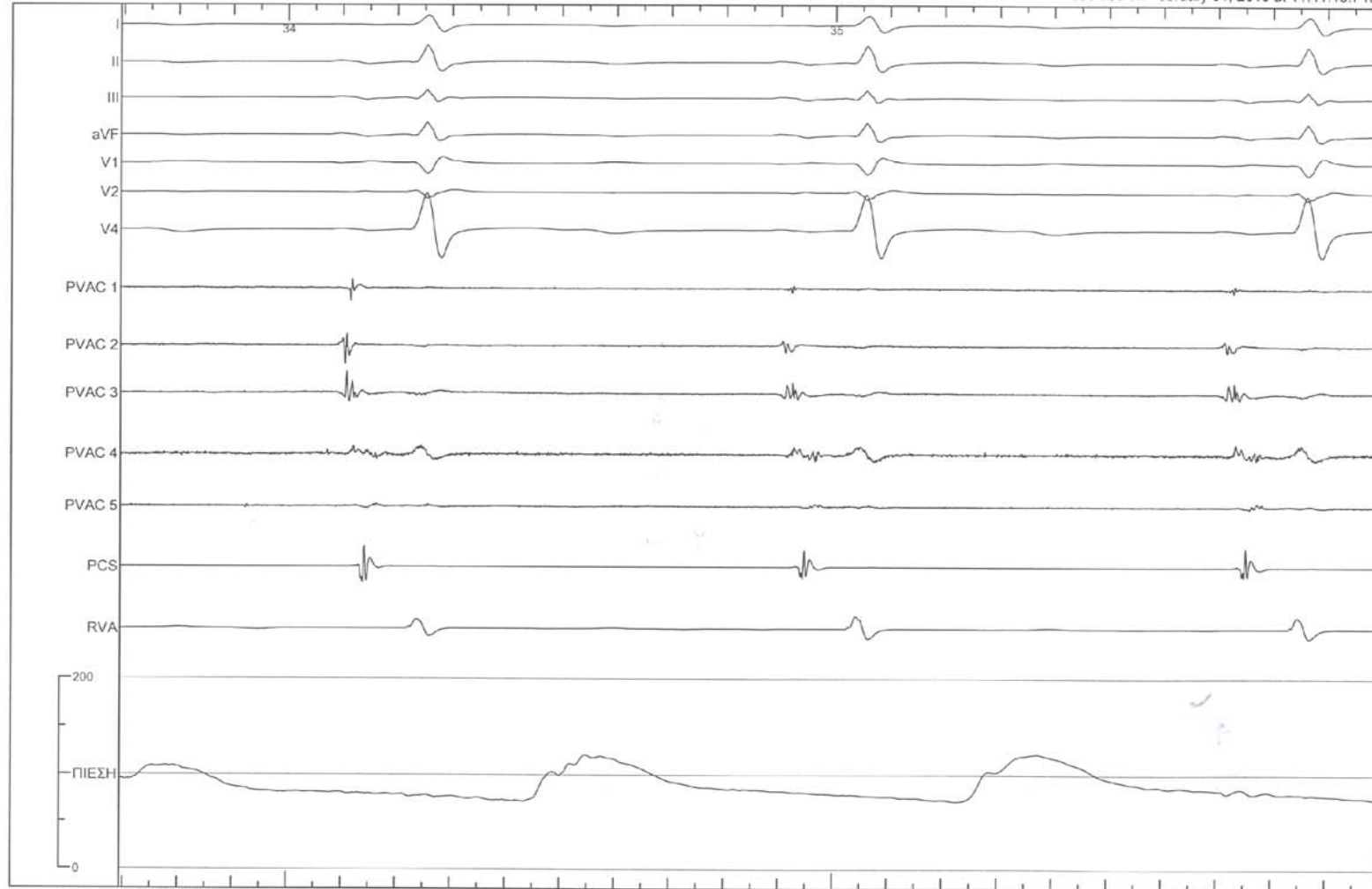
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ΕΥΡΩΚΛΙΝΙΚΗ ΑΘΗΝΩΝ

Patient: ΘΡΑΣΥΒΟΥΛΟΥ, ΑΝΔΡΕΑΣ ID: 175749

Recorded on February 01, 2010 at 11:41:13.740

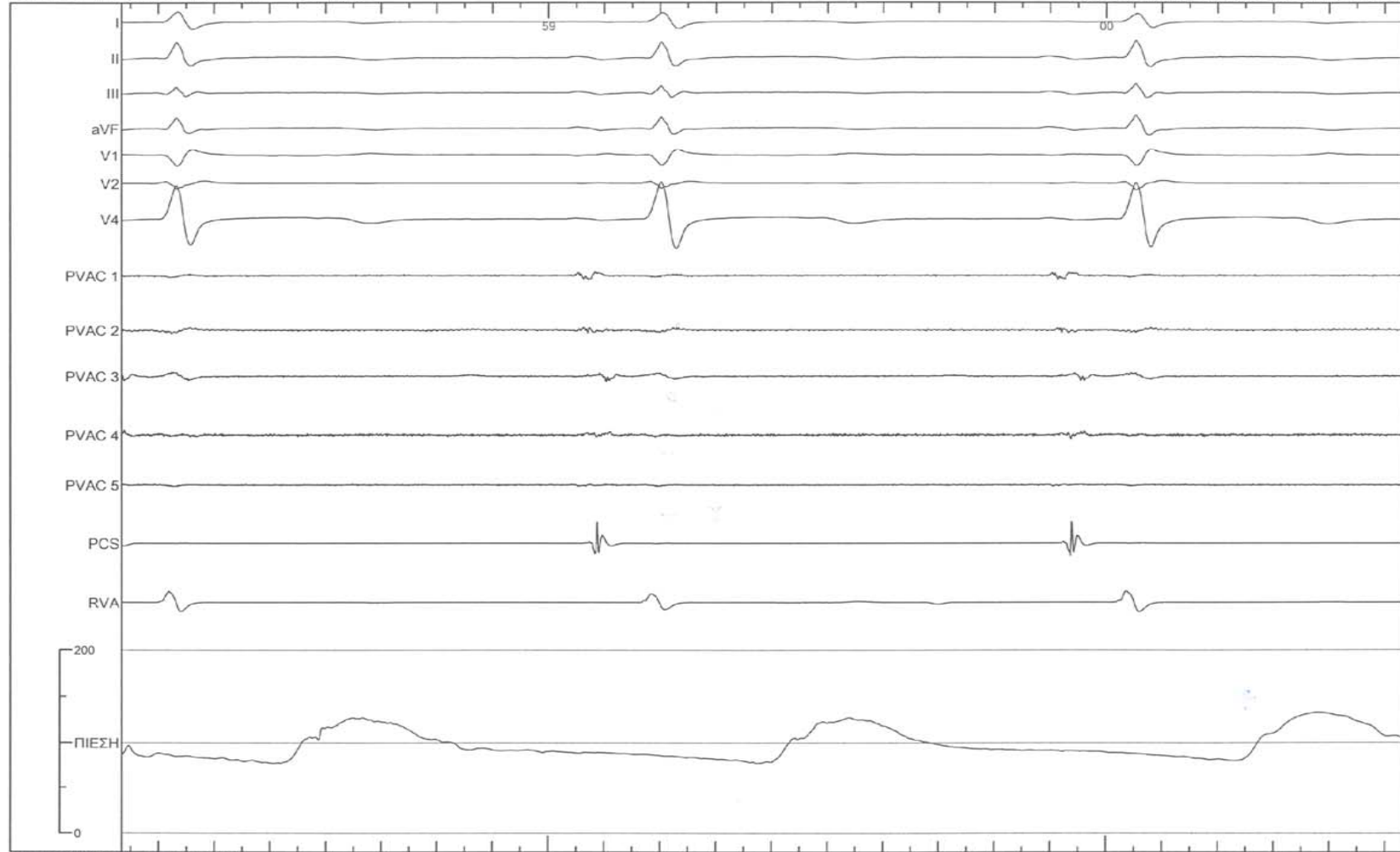


ΕΥΡΩΚΛΙΝΙΚΗ ΑΘΗΝΩΝ

Patient: ΟΡΑΣΥΒΟΥΛΟΥ, ΑΝΔΡΕΑΣ

ID: 175749

Recorded on February 01, 2010 at 11:51:38.280



ΕΥΡΩΚΛΙΝΙΚΗ ΑΘΗΝΩΝ

Patient: ΘΡΑΣΥΒΟΥΛΟΥ, ΑΝΔΡΕΑΣ ID: 175749

Recorded on February 01, 2010 at 11:52:10.994



ΕΥΡΩΚΛΙΝΙΚΗ ΑΘΗΝΩΝ

Patient: ΘΡΑΣΥΒΟΥΛΟΥ, ΑΝΔΡΕΑΣ ID: 175749

Recorded on February 01, 2010 at 11:40:17.396

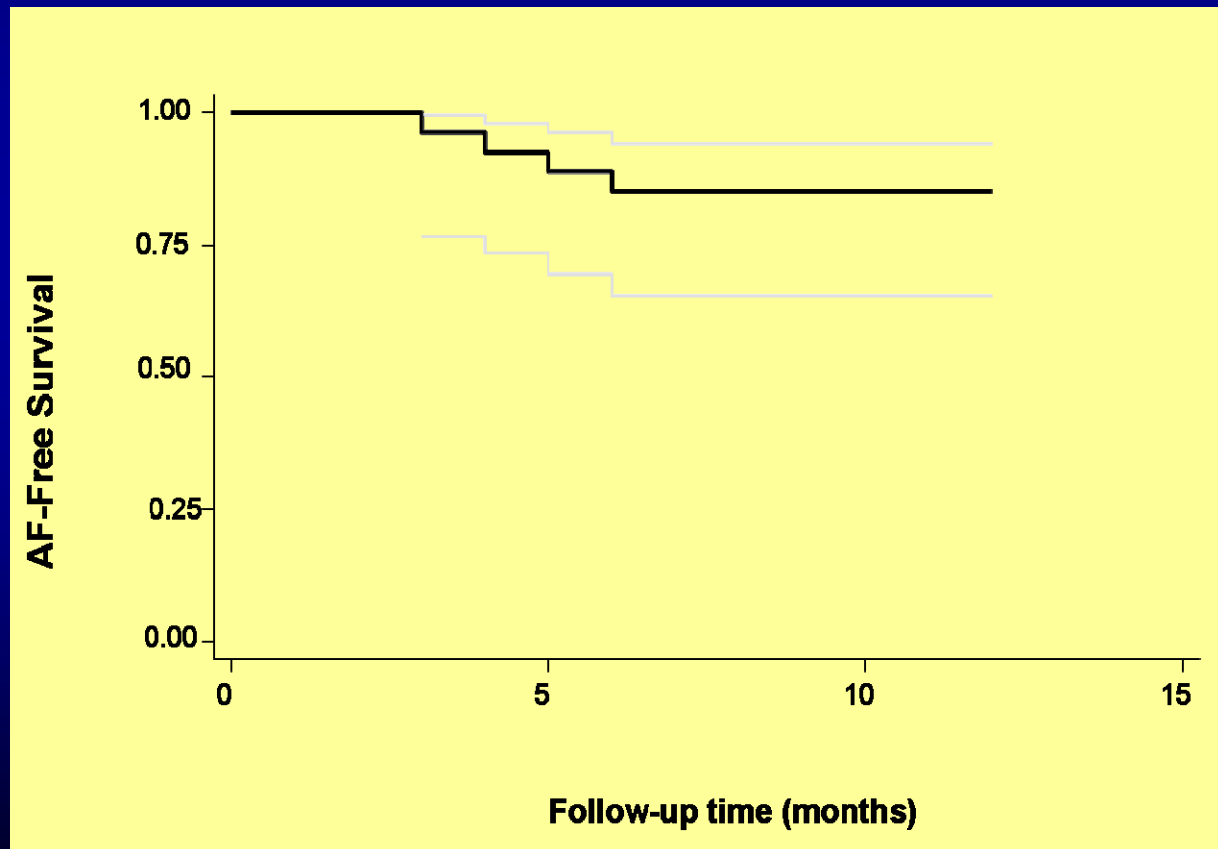


Ablation for AF

The Euroclinic Experience: 27 PAF pts

PV isolation and GP ablation

Katritsis et al. Europace (In press)



RSPV

RIPV

AF ABLATION
Athens Euroclinic
2008-2009

PVAC+GP

<i>Pts No</i>	<i>F-U (months)</i>	<i>AF-free</i>	<i>LA flutter</i>
40	1-18	36 (90%)	2

AF ABLATION

PVAC experience

Boersma et al. Heart Rhythm. 2008;5:1635-42. 98 pts

Scharf et al. J Am Coll Cardiol. 2009;54:1450-6. 50 pts

Fredersdorf et al. J Cardiovasc Electrophysiol. 2009;20:1097-101 21 pts

Duytschaever et al. Pacing Clin Electrophysiol. 2009 Nov 18. [Epub ahead of print] 27 pts

Wieczorek et al. J Interv Card Electrophysiol. 2009 Nov 24. [Epub ahead of print] 73 pts

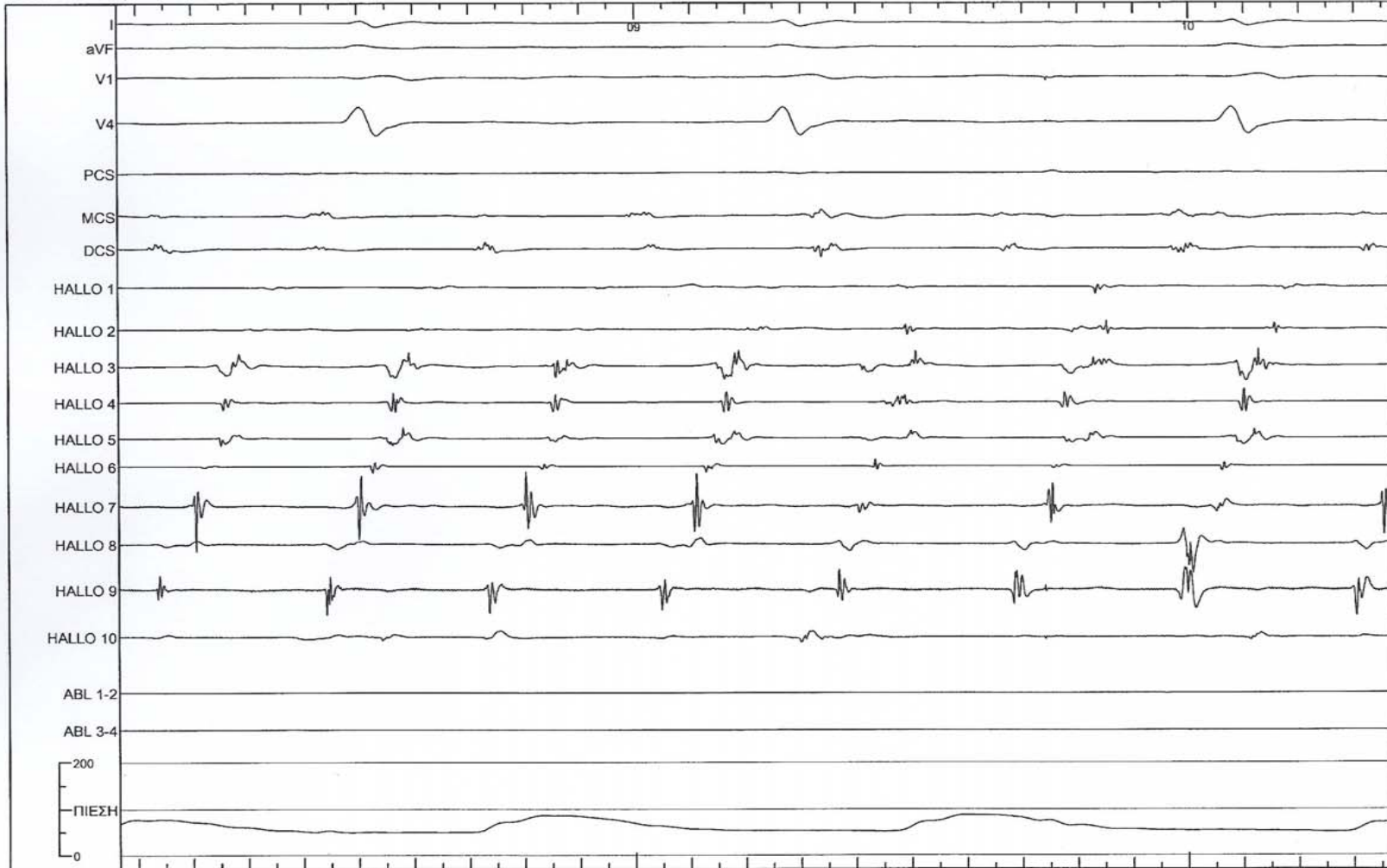
Wieczorek et al. J Cardiovasc Electrophysiol. 2009 Nov 10. [Epub ahead of print] 88

ΕΥΡΩΚΛΙΝΙΚΗ ΑΘΗΝΩΝ

Patient: ΨΑΡΡΟΣ, ΓΕΩΡΓΙΟΣ ID: 171916

Recorded on February 17, 2010 at 12:19:27.963



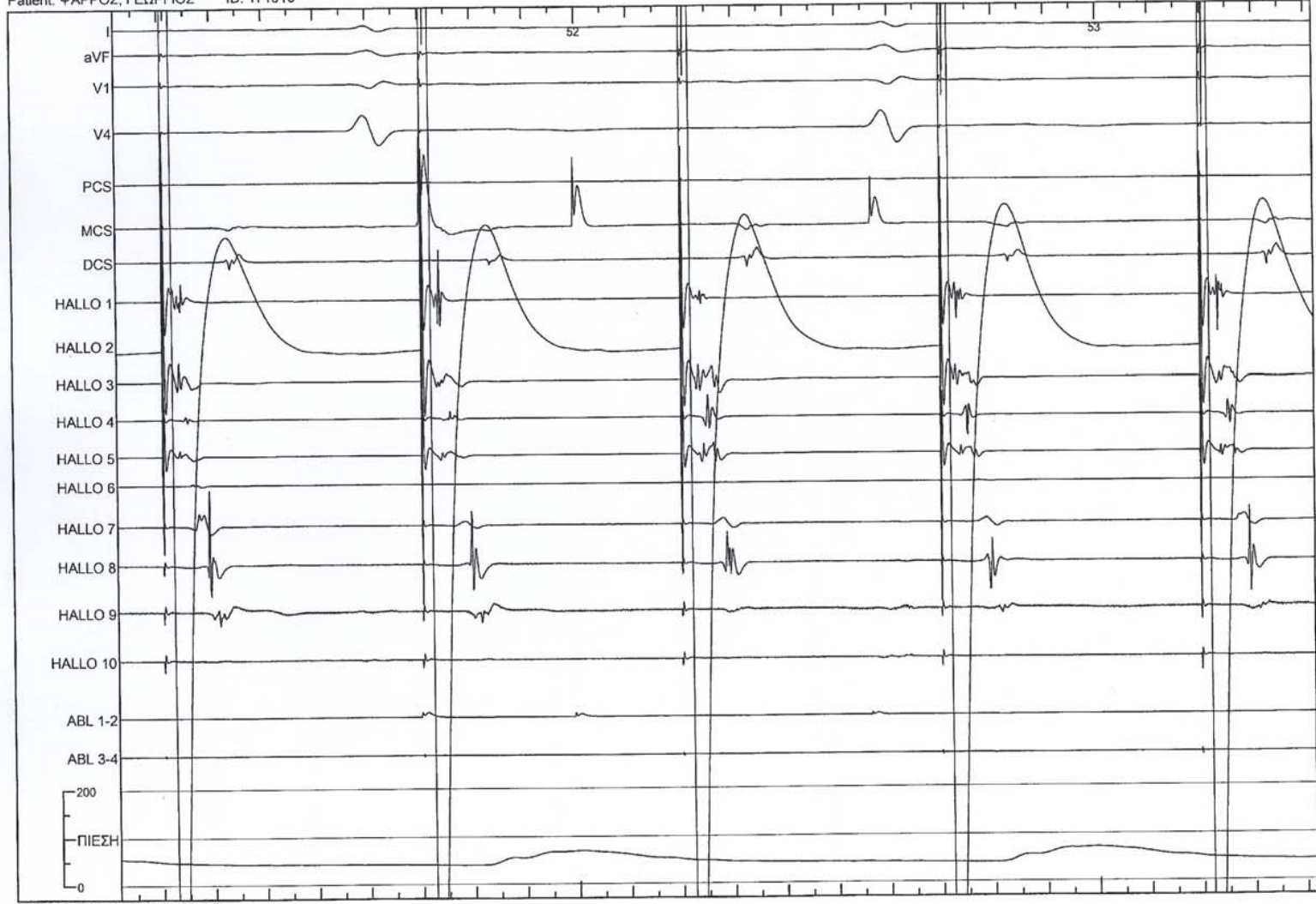


ΕΥΡΩΚΛΙΝΙΚΗ ΑΘΗΝΩΝ

Patient: ΨΑΡΡΟΣ, ΓΕΩΡΓΙΟΣ ID: 171916

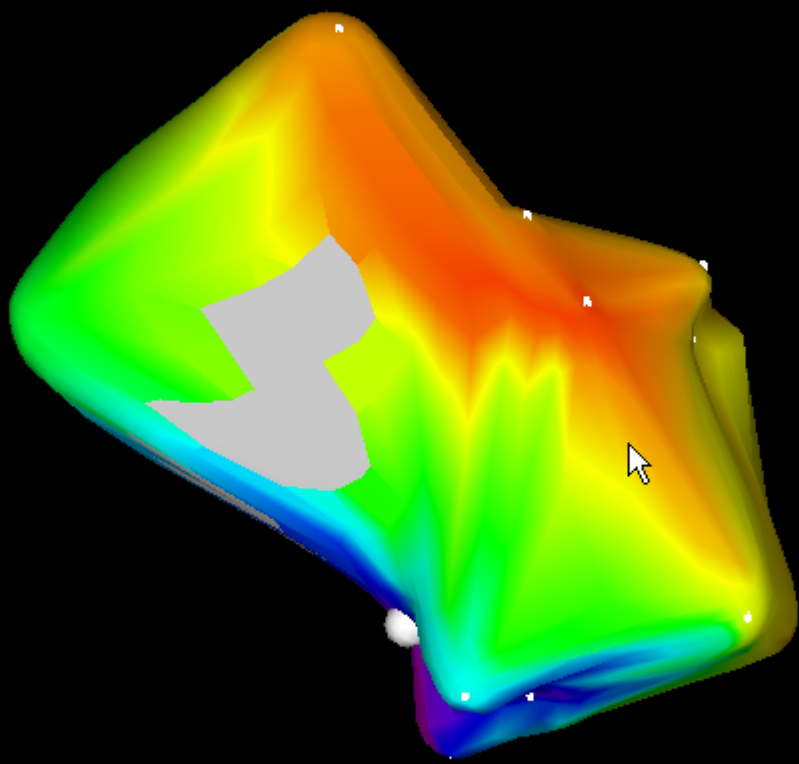
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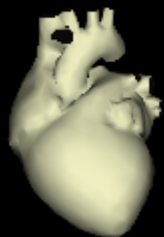
LAT

4-Map > 19 Points



173ms

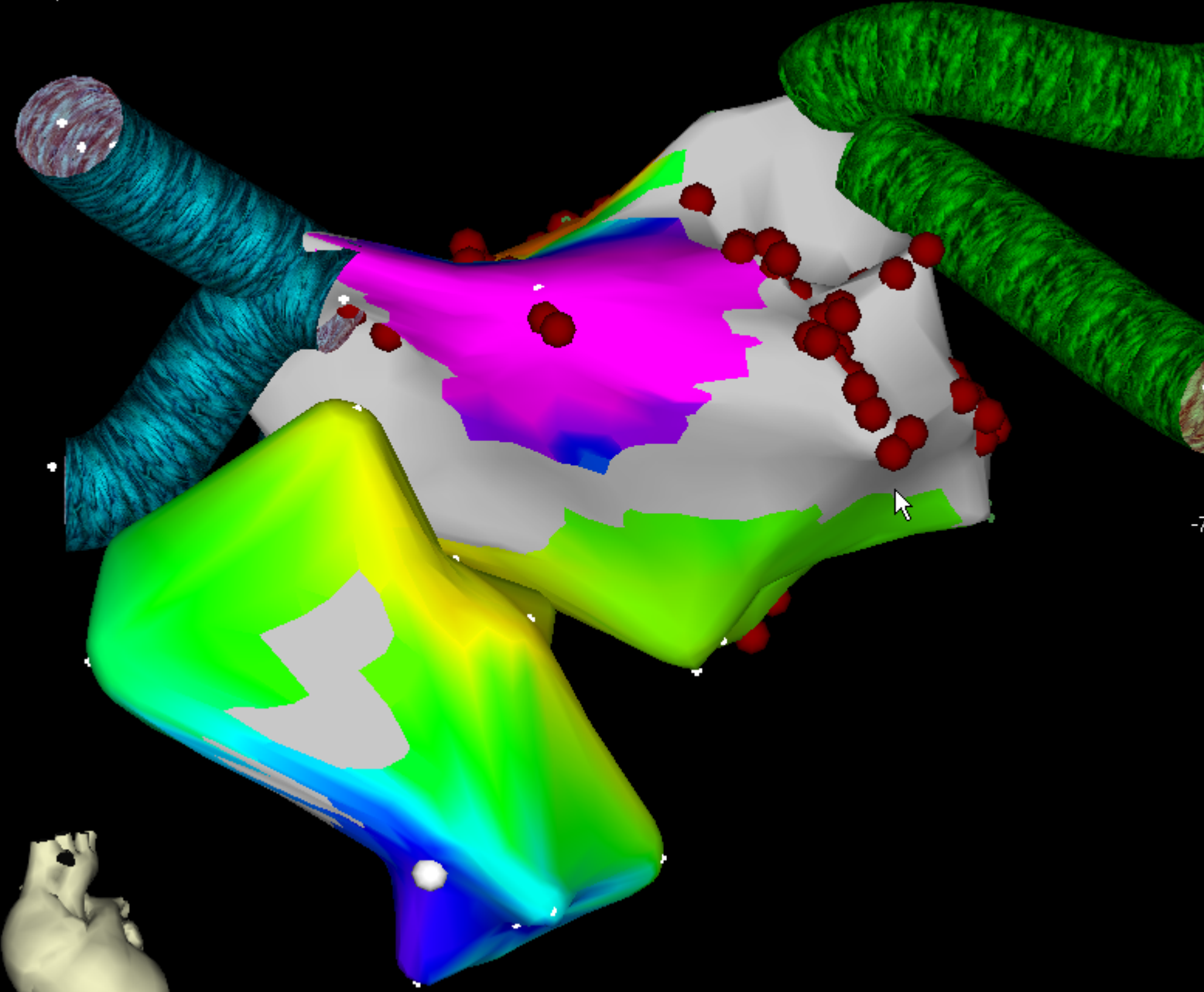
-41ms



1.15 cm

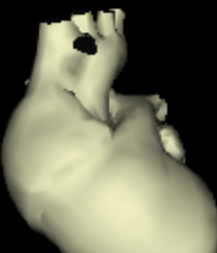


▶ 1-1-ReMap > 229 Points



-79ms

1.50 cm



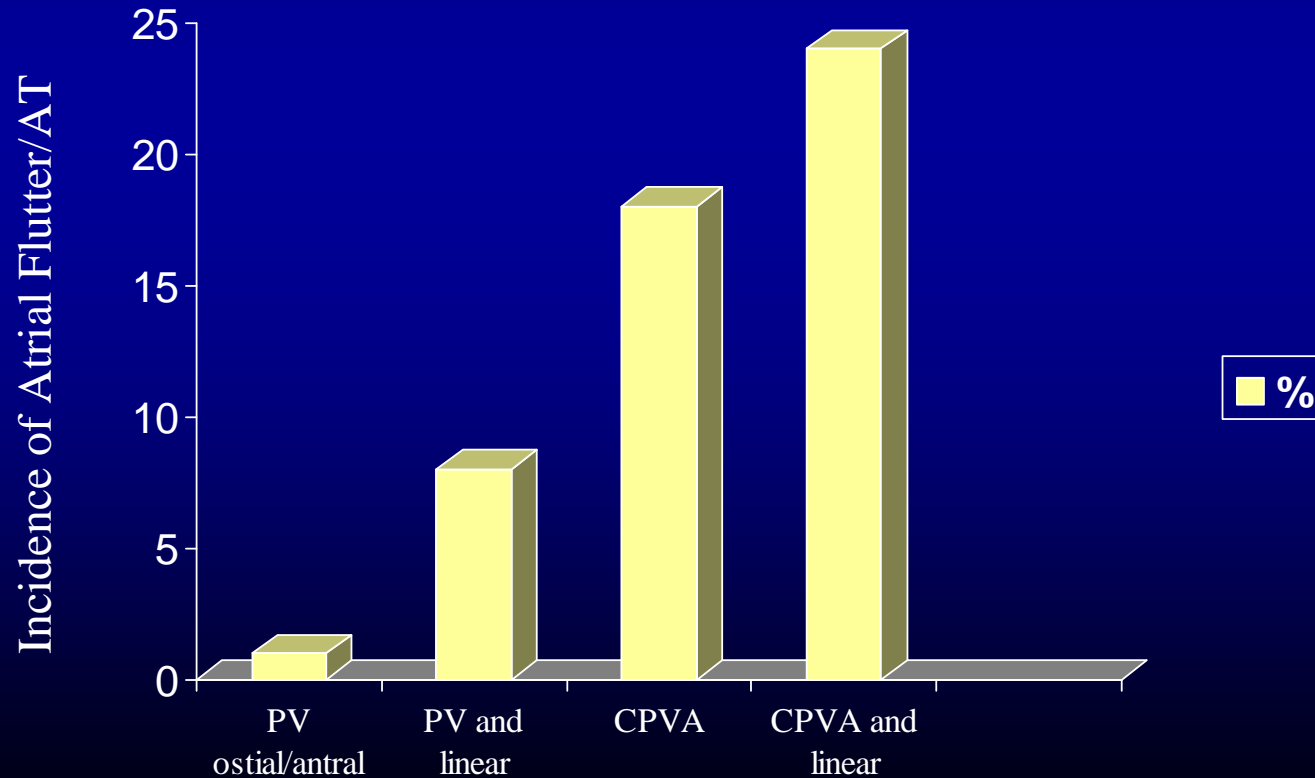
Ablation for AF

Incidence of Ablation-Induced Tachycardias

Athens Euroclinic, Athens, Greece

Medical College of Virginia, Richmond, VA, USA

544 patients Katritsis et al. JICE 2006;16:123

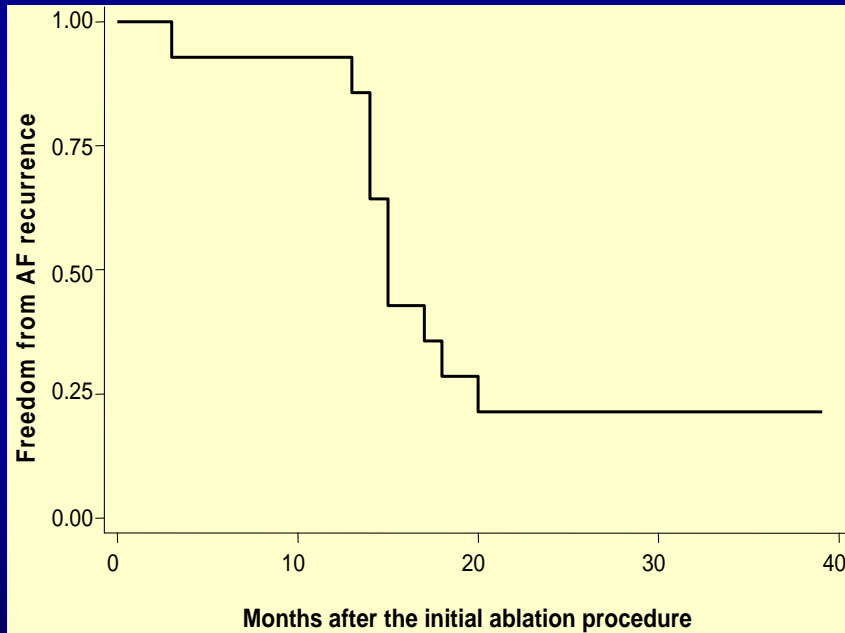


AF Ablation

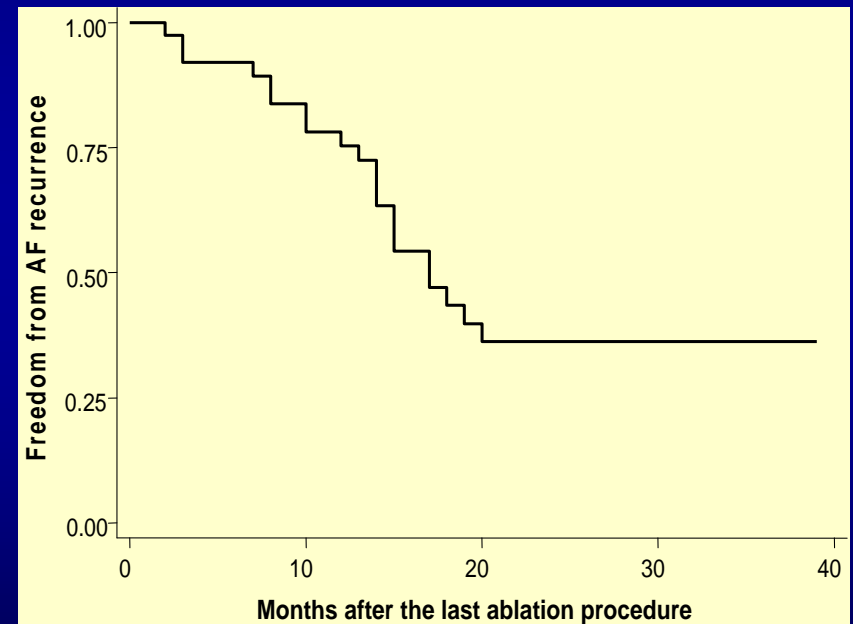
Long-term Results

(Athens Euroclinic and Medical College of Virginia Hospital)

Katritsis et al. *Europace*. 2008;10:419-24



Freedom from AF recurrence after the initial procedure for patients subjected to a single procedure.



Freedom from AF recurrence after the last procedure among all patients.

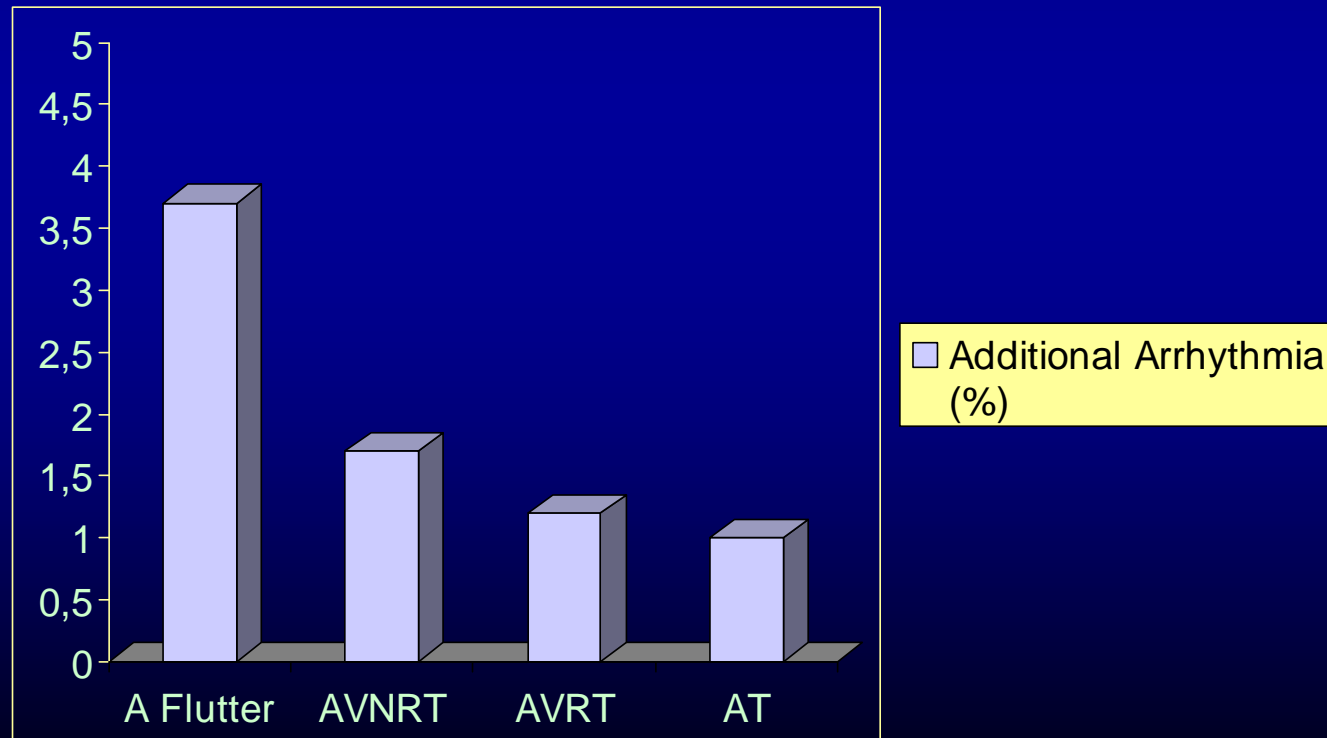
Ablation for AF

Katristsis et al. Europace 2007;9:785-9

EPS is mandatory

409 pts referred for AF ablation

6.7% additional inducible arrhythmia



Ablation for AF

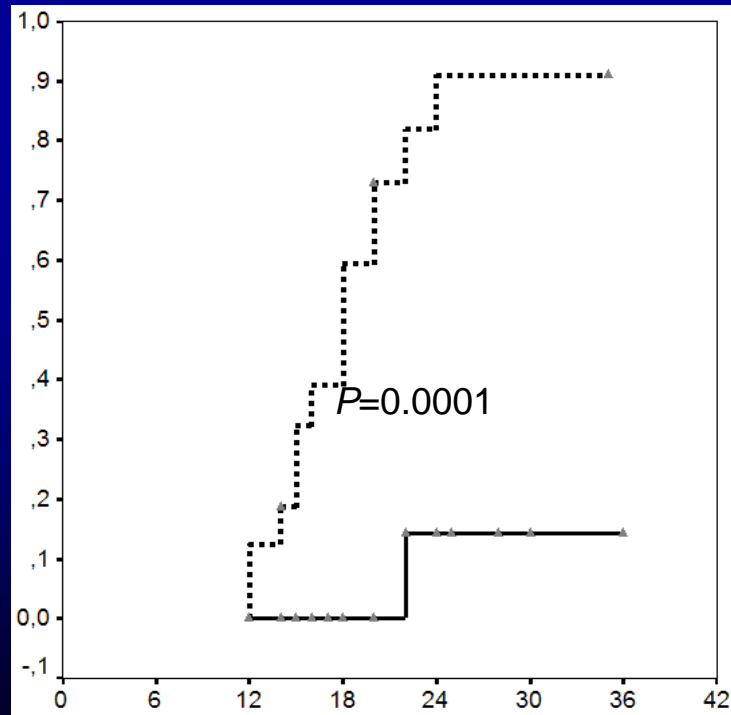
Treat hypertension

292 pts with AF, 32 pts with lone AF
13 out of 14 pts with latent HT: AF
recurrence

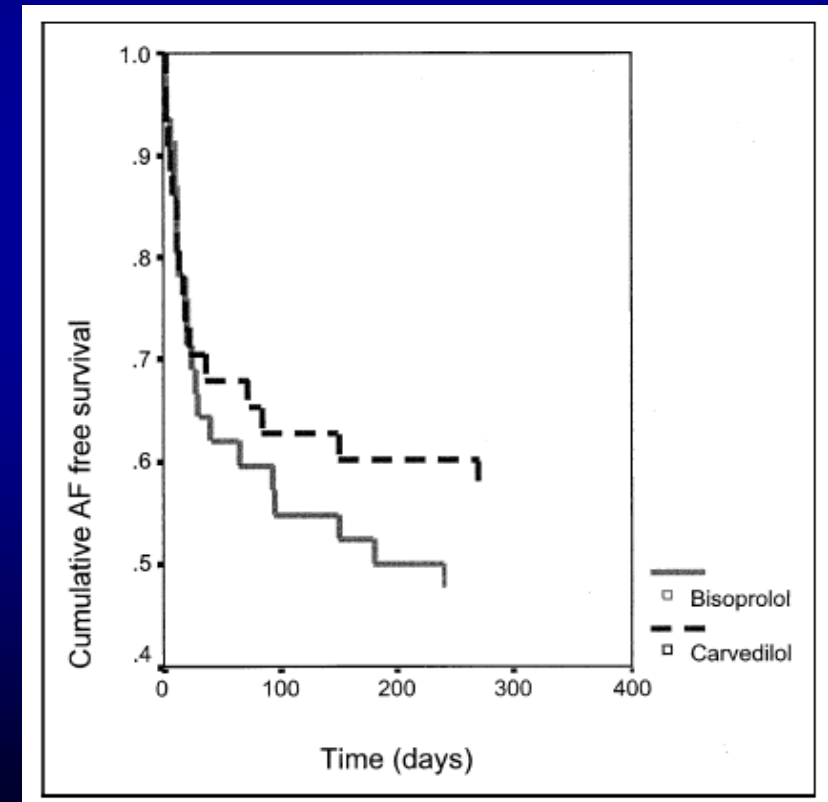
Katrtsis et al. JICE 2005;13:203

Comparison of bisoprolol vs carvedilol for SR
maintenance after cardioversion of persistent AF
Katrtsis et al. Am J Cardiol 2003;92:1116

————— Response / partial response
..... No response



Follow-up in months



Ablation for AF

Impact of LA Size

Predictors of PV reconnection

Sauer et al. Heart Rhythm. 2006;3:1024

	Relative risk	P-value
HTN	1.45 (1.21, 2.43)	0.02
LA size >4.5 cm	1.69 (1.12, 2.5)	0.01
Age (years)	1.05 (1.03, 1.09)	<0.01
Sleep apnea	2.16 (1.32, 3.94)	0.01
Persistent	1.34 (1.09, 1.87)	<0.01

PV isolation

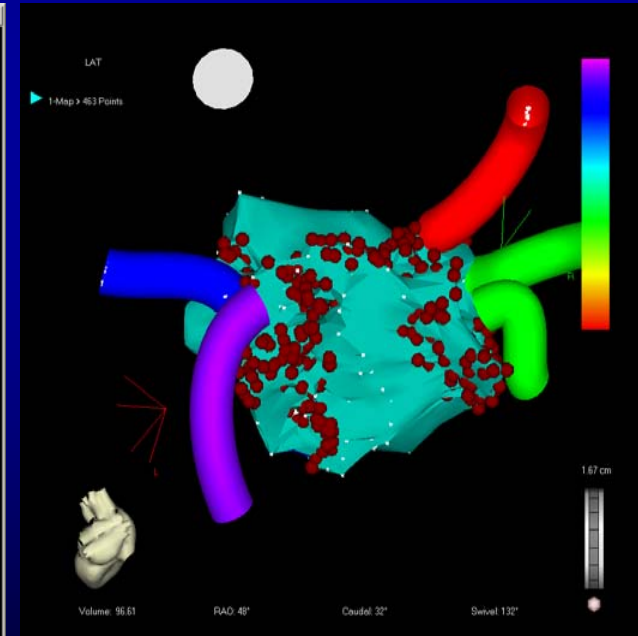
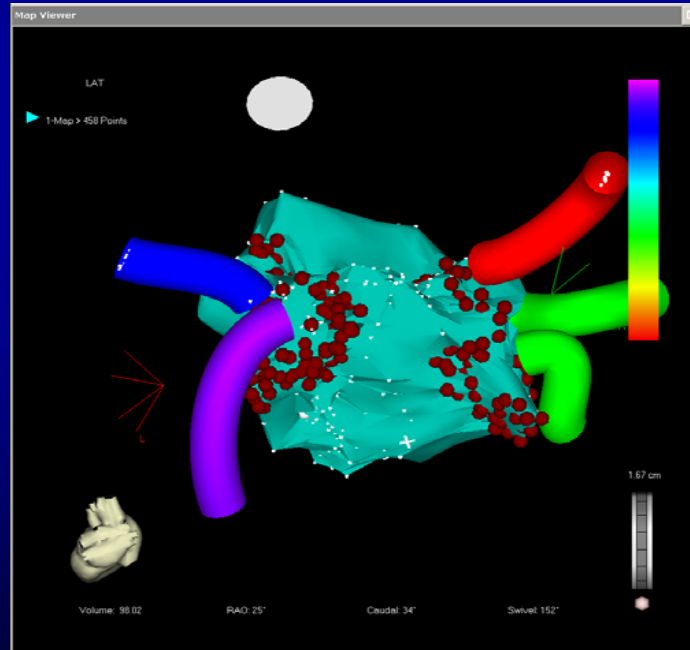
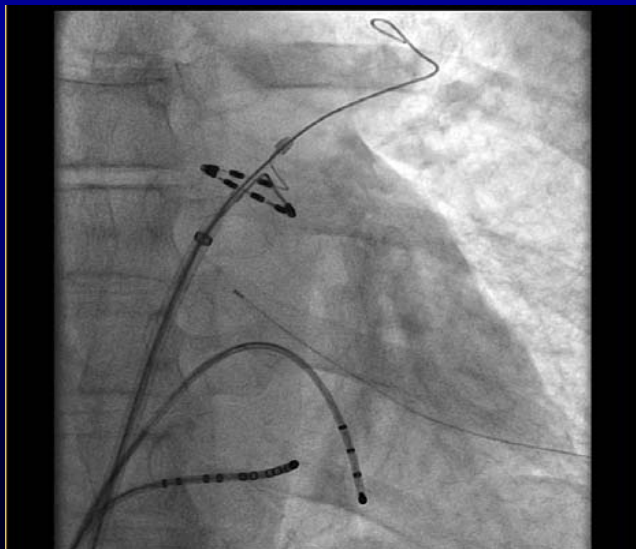
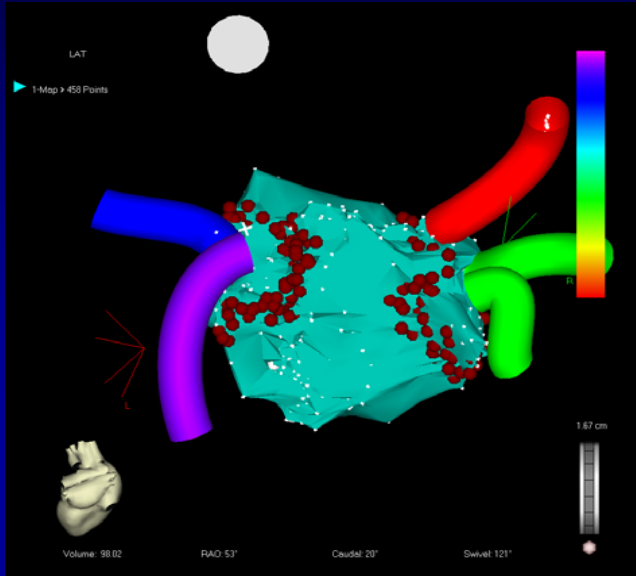
Ablation for Persistent AF

Tailored Procedures

Katritsis et al. PACE 2007;30:102

CFAE/Voltage abatement
near the PV (GP)

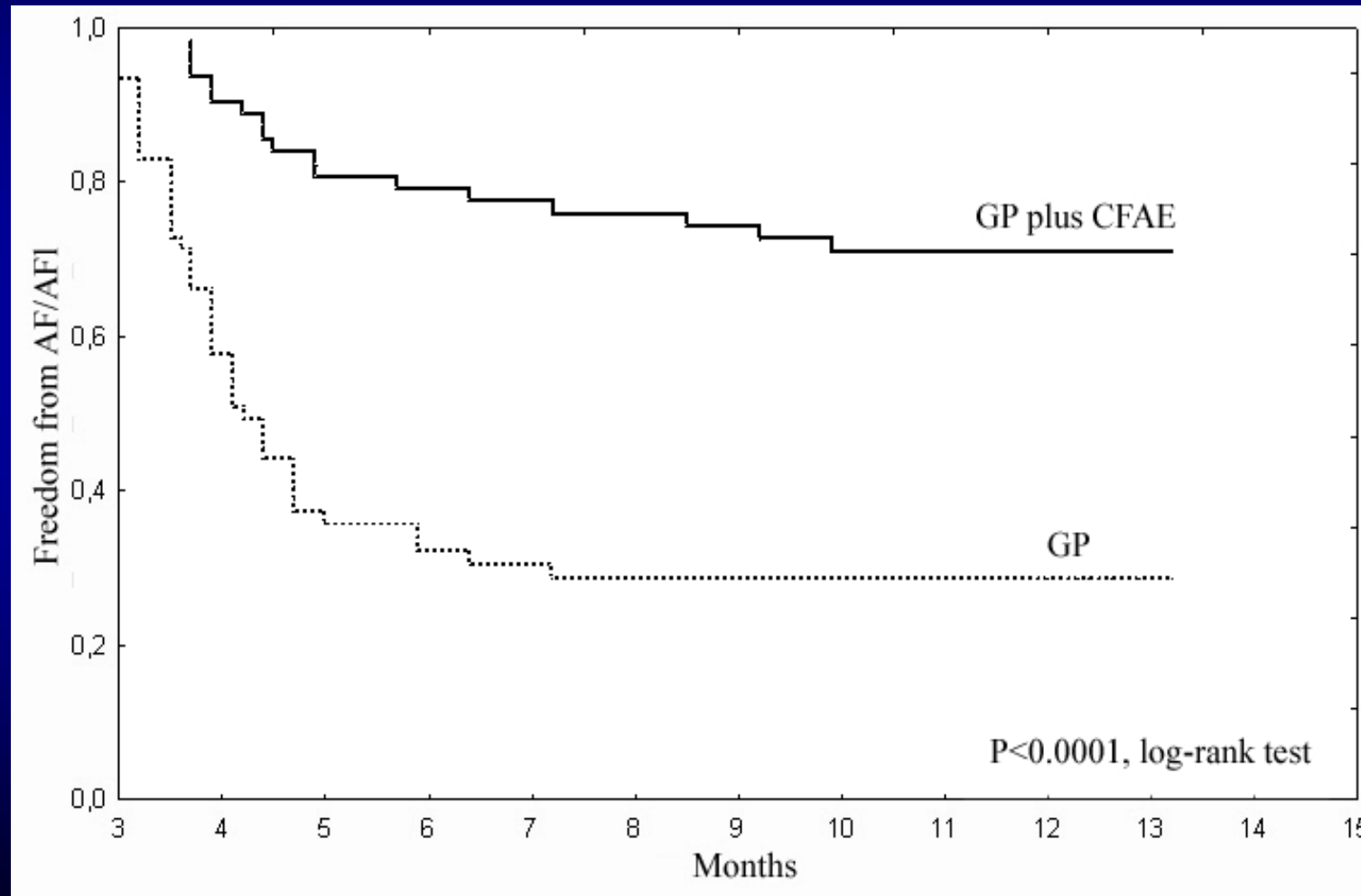
Lines (LS-RS/MV isthmus)



Ablation for AF: *Euroclinic Practice*

Pokushalov and Katritsis: 101 pts selective GP vs GP and CFAE

HeartRhythm (In Press)



AF ABLATION

Athens Euroclinic

2001-2010

Persistent AF

PV isolation

Pts No

F-U (months)

AF-free

27

24

29%

Combined

Pts No

F-U (months)

AF-free

37

24

54%

AF Ablation

ΕΥΡΩΚΛΙΝΙΚΗ ΑΘΗΝΩΝ

2000-2009

- 267 ασθενείς
 - 14 LoM
 - 92 PV isolation (Lasso)
 - 65 circumferential (CARTO)
 - 59 GP ablation (40 PVAC)
 - 37 combined procedure

 - 1 CVA (full recovery)
 - 4 επιπλωματισμοί (1.4%)
 - » 2 χειρουργική αντιμετώπιση

Ablation for AF

THE FUTURE









1. **PVAC** or **Cryo** for PV

2. **CARTO** or **NAVEX** for GP ablation or CFAE
ablation (near the PV)

3. **New electrodes**

AF ABLATION

PVAC, MASC, MAAC

	4mm Tip	PVAC	MASC	MAAC
				
Electrode Shape			 	
Electrode Surface Area	33.7 mm ²	13.64 mm ²	9.09 mm ²	
Power Input	30 W	Max 10W	Max 10W	
Current Density	0.016 A/mm ²	0.015 A/mm ²	0.018 A/mm ²	

Catheter Ablation for AF: *Euroclinic Practice*

Conclusions

1. Treatment of hypertension (Bb, ACE/ARB, statins) and comprehensive EPS
2. Paroxysmal AF: Anatomic GP ablation (CARTO)
+ PV isolation (PVAC)
3. Persistent AF: Pt <75 years, LA<5, No VHD
PV isolation (PVAC) or Circumferential ablation (CARTO)
+ anatomic GP ablation (CARTO)
+ additional within the lesion voltage abatement (CARTO) or CFAE near the PV ablation
4. Recurrence of persistent AF: LSPV to RSPV and mitral isthmus lines