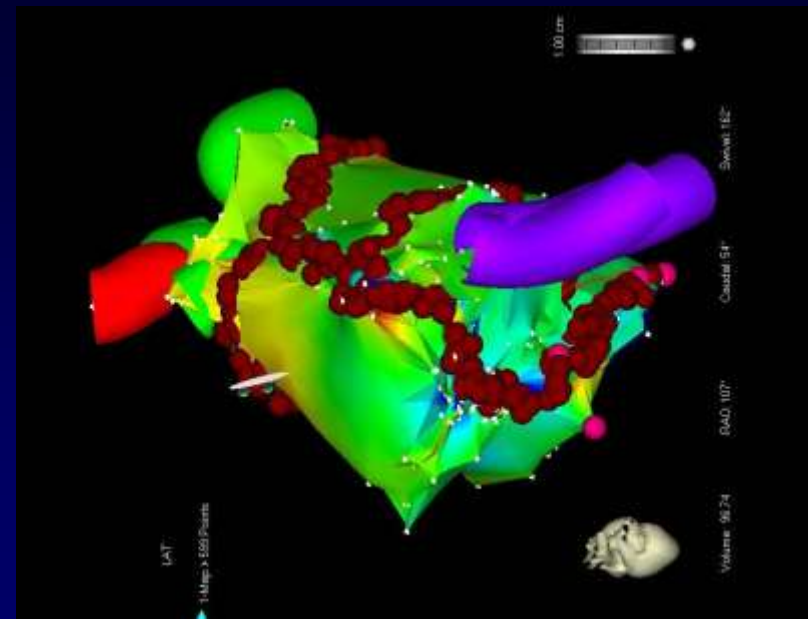


# The role of age, arrhythmia duration, left atrial size and concomitant cardiovascular disease in patient selection for AF ablation

Michalis Efremidis MD

Second Department of Cardiology

'' Evangelismos '' General Hospital





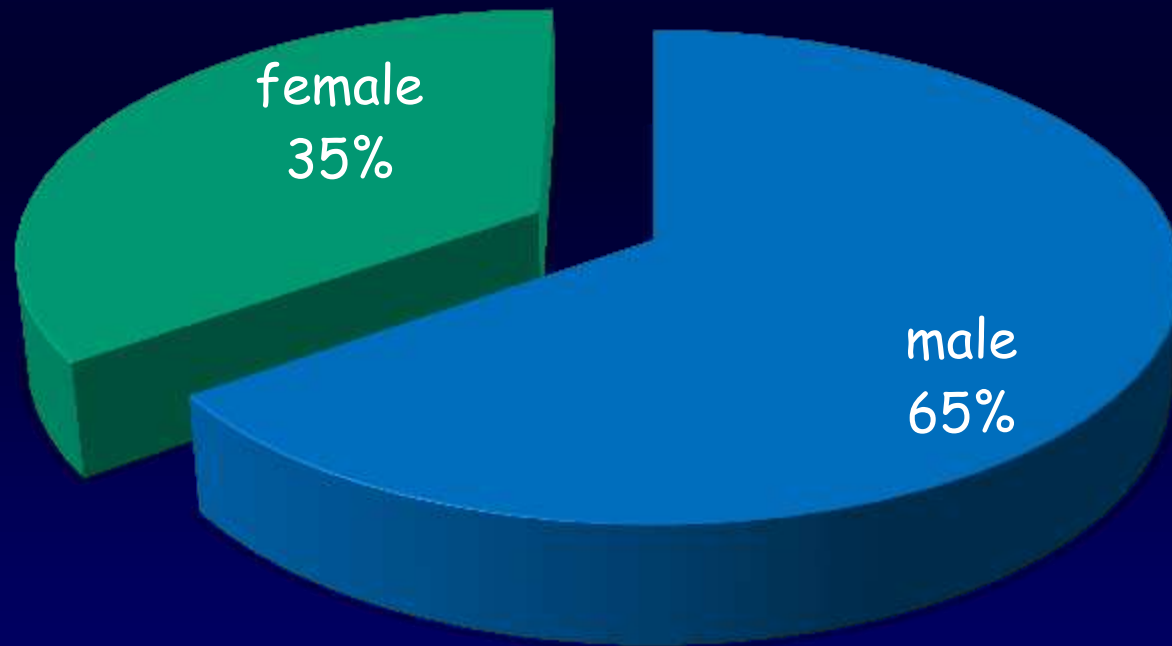
# Indications for Catheter AF Ablation

Catheter ablation is a reasonable alternative to pharmacological therapy to prevent recurrent AF (paroxysmal or persistent) in symptomatic patients. Symptomatic AF refractory or intolerant to at least one Class 1 or 3 AAD (Class IIa, level of evidence A and B respectively).



Evangelismos Registry: 141 pts  
with AF Ablation - Last 20  
months.

Patients Gender



Age predicts AF  
Recurrence?

# The Impact of Age on the Electroanatomical Characteristics and Outcome of Catheter Ablation in Patients with Atrial Fibrillation

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WEN-CHIN TSAI, M.D.,<sup>\*</sup> WEI-HUA TANG, M.D.,<sup>\*</sup> KAZUYOSHI SUENARI, M.D.,<sup>\*</sup>  
SHIH-YU HUANG, M.D.,<sup>\*</sup> PI-CHANGE LEE, M.D.,<sup>\*,†</sup> and SHIH-ANN CHEN, M.D.,<sup>\*,†</sup>

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**Age and Atrial Fibrillation.** *Background:* Previous studies have indicated that atrial fibrillation (AF) in patients over the age of 60 at diagnosis is a risk factor for a substantial increase in cardiovascular events. However, information about the impact of age on the atrial substrate and clinical outcome after catheter

## AGE impacts on LA substrate and outcome of AF ablation

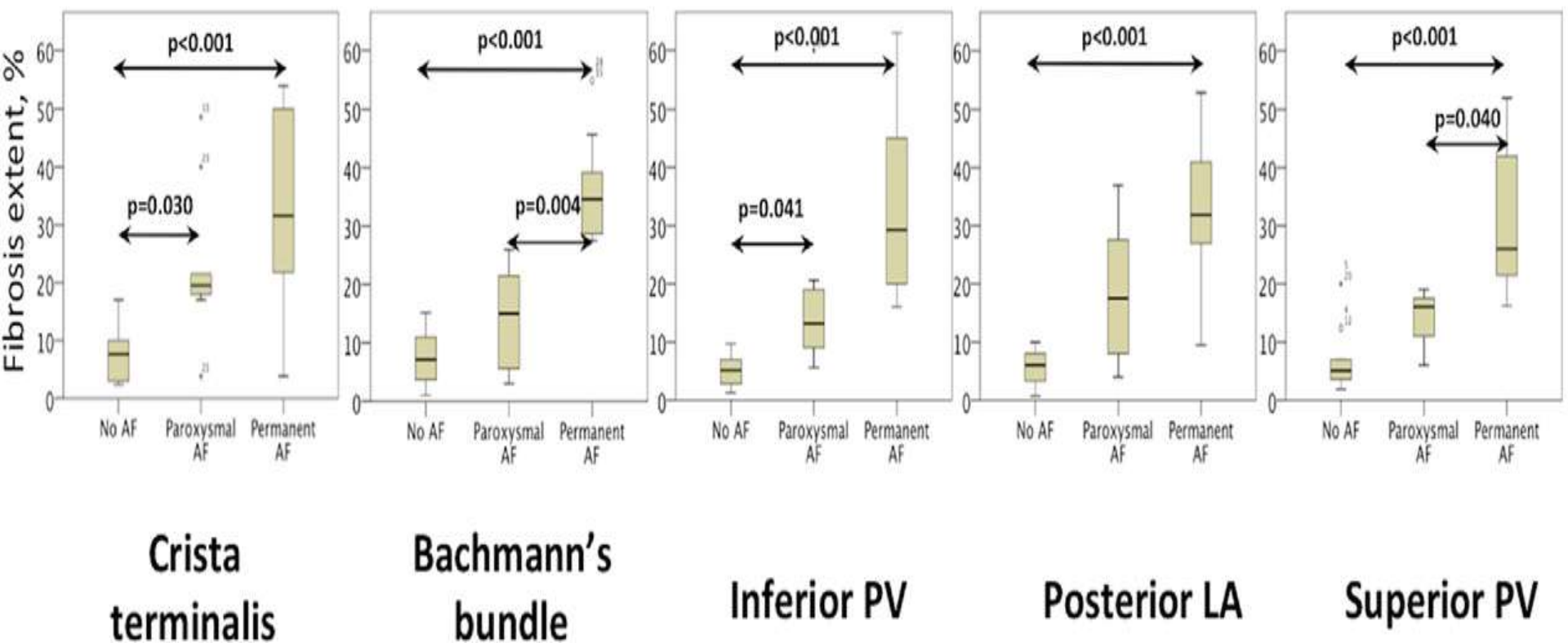
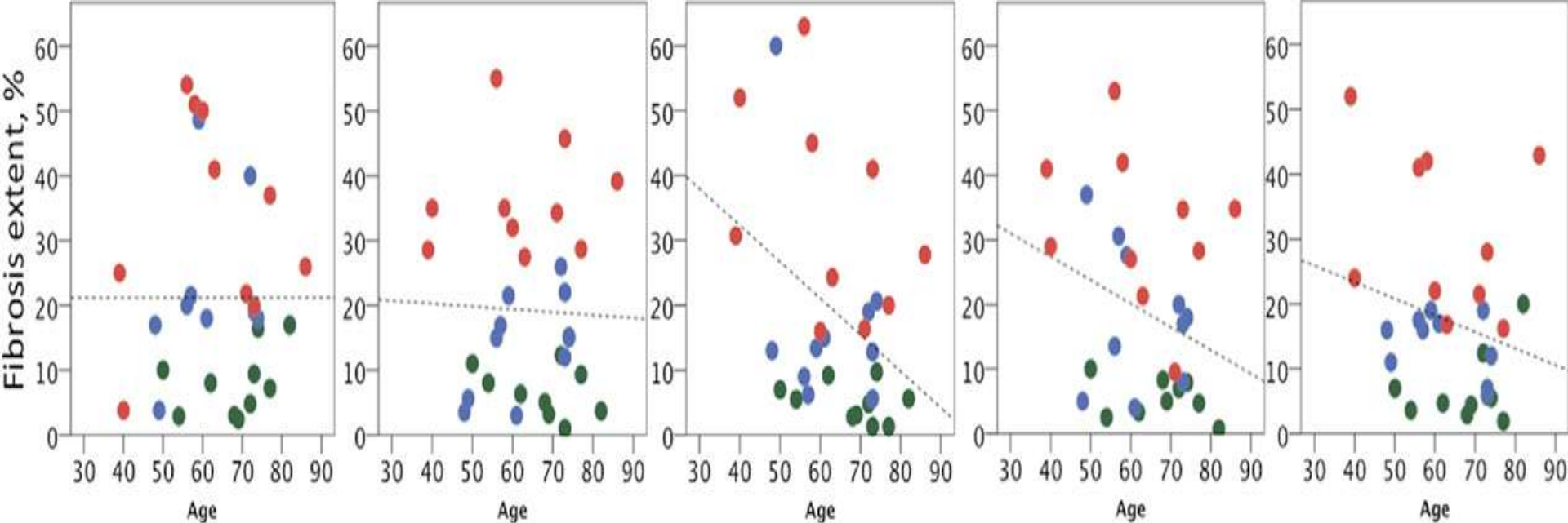
pulmonary vein isolation (CPVI) of AF, guided by a NavX mapping system. The subjects were divided into three groups according to their age, as follows: Group I: age  $\leq 50$  (n = 141), Group II: age = 51–64 (n = 149) and Group III: age  $\geq 65$  years old (n = 60). The mean voltage and total activation time of the individual atria were obtained by using a NavX mapping system before ablation. Several parameters, including the gender, AF duration, and left atrial (LA) diameter were analyzed.

*Results:* The younger age group had a significantly smaller LA diameter (Group I vs Group II vs Group III,  $36.89 \pm 7.11$  vs  $39.16 \pm 5.65$  vs  $40.77 \pm 4.95$  mm,  $P = 0.002$ ) and higher LA bipolar voltage ( $2.09 \pm 0.83$  vs  $1.73 \pm 0.73$  vs  $1.86 \pm 0.67$  mV, respectively,  $P = 0.024$ ), compared with the older AF patients. The LA bipolar voltage exhibited a significant reduction when the patients became older, however, that did not occur in the right atrium. The incidence of an AF recurrence was higher in the older age group than in the younger age groups. A subgroup of patients with lone AF was analyzed and age was found to be an independent predictor of the AF recurrence after receiving the first CPVI in the multivariable model ( $P < 0.05$ ).

*Conclusions:* Age has a significant impact on the LA substrate properties and outcome of the catheter ablation of AF. (*J Cardiovasc Electrophysiol*, Vol. 21, pp. 966-972, September 2010)

# Structural Abnormalities in Atrial Walls Are Associated With Presence and Persistency of Atrial Fibrillation But Not With Age

<b>Objectives</b>	The purpose of this study was to assess the association between structural changes in human atria, age, and history of atrial fibrillation (AF).
<b>Background</b>	Development of fibrosis in atrial walls is associated with deterioration of atrial conduction and predisposes to AF in experiment. Human data, however, are scarce, and whether fibrosis is a cause or consequence of AF is not known.
<b>Methods</b>	Medical records for consecutive autopsies were checked for AF history and duration. Atrial specimens from 30 patients (ages $64 \pm 12$ years) were collected in 3 equal age-matched groups as patients without AF history, with paroxysmal AF, or with permanent AF. Tissue samples were obtained at the level of superior pulmonary veins, inferior pulmonary veins, center of posterior left atrial wall, terminal crest, and Bachmann's bundle. Histology sections were assessed for extent of fibrosis, fatty tissues, and inflammatory infiltration at each location.
<b>Results</b>	No correlation was observed between age and fibrosis at any location. Fibrosis extent and fatty infiltration were twofold to threefold higher at all locations in patients with history of AF and correlated with lymphomononuclear infiltration. Patients with permanent AF had greater fibrosis extent than did patients with paroxysmal AF.
<b>Conclusions</b>	In post-mortem material, structural changes in the atria were not associated with age, but were significantly correlated with presence of AF and its severity. Our findings suggest that age-related changes per se are unlikely to be the sole cause of advanced fibrosis underlying AF. (J Am Coll Cardiol 2011;58:2225-32) © 2011 by the American College of Cardiology Foundation



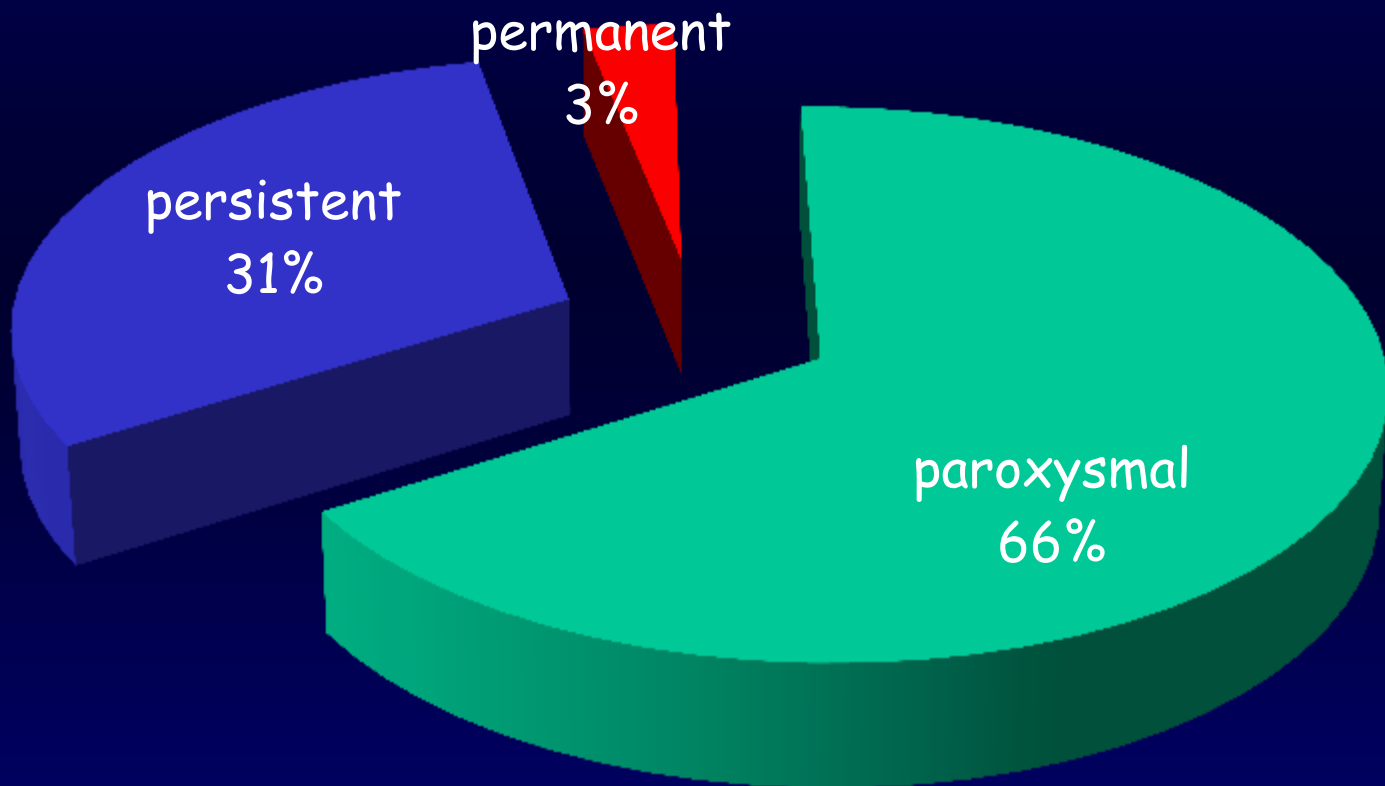
# Age predicts AF Recurrence?

In our analysis AGE is not a predictor of atrial fibrillation recurrence after AF ablation

- AF Duration



# Type of AF

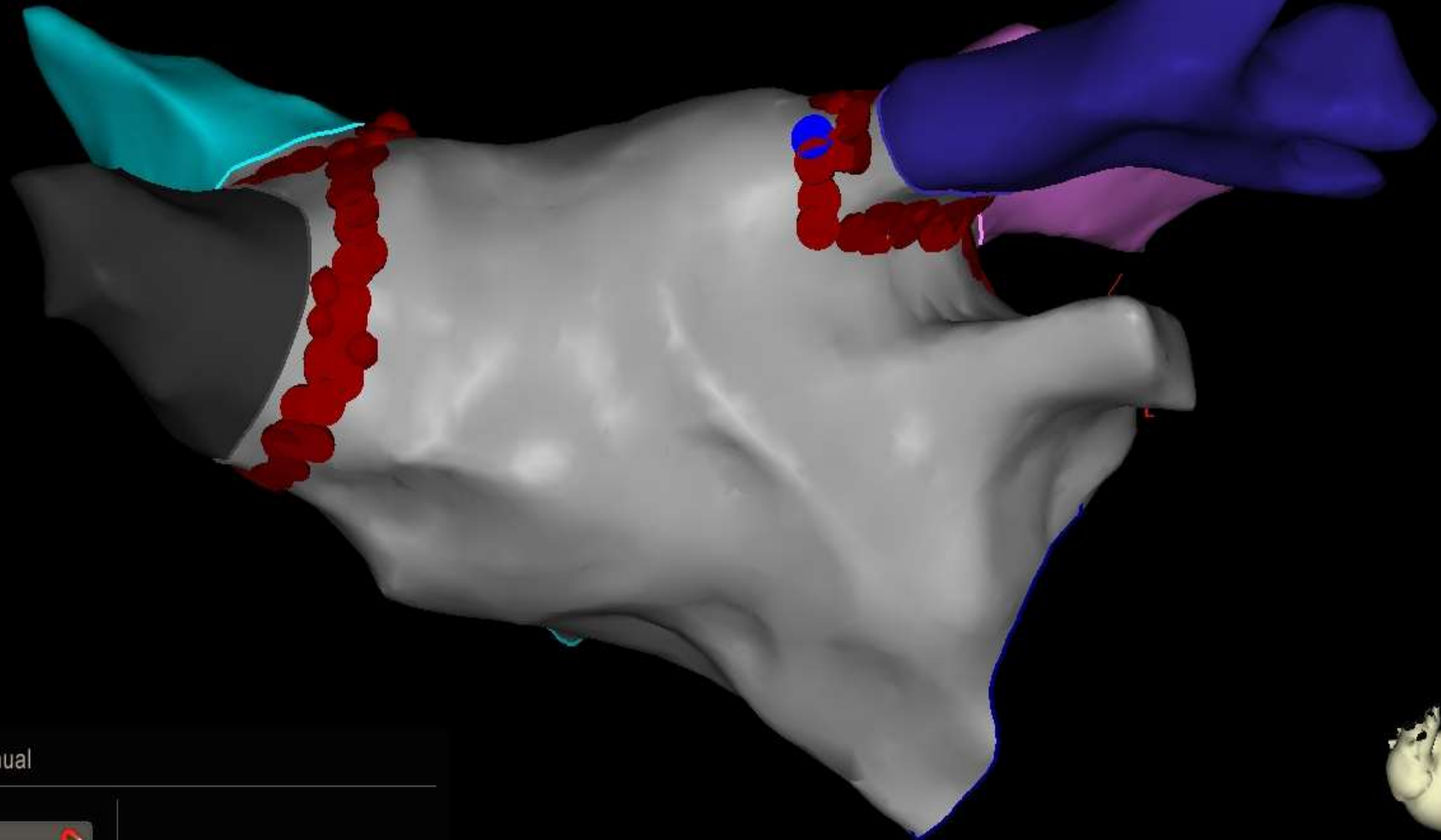


2-Map (213, 0) ▾

Navigation toolbar with icons for camera, rotation, zoom, and a slider set to 15.



LAT



Manual

Acquire

CL	LAT	Bi	Imp
831	-161	0.03	N/A

1.00



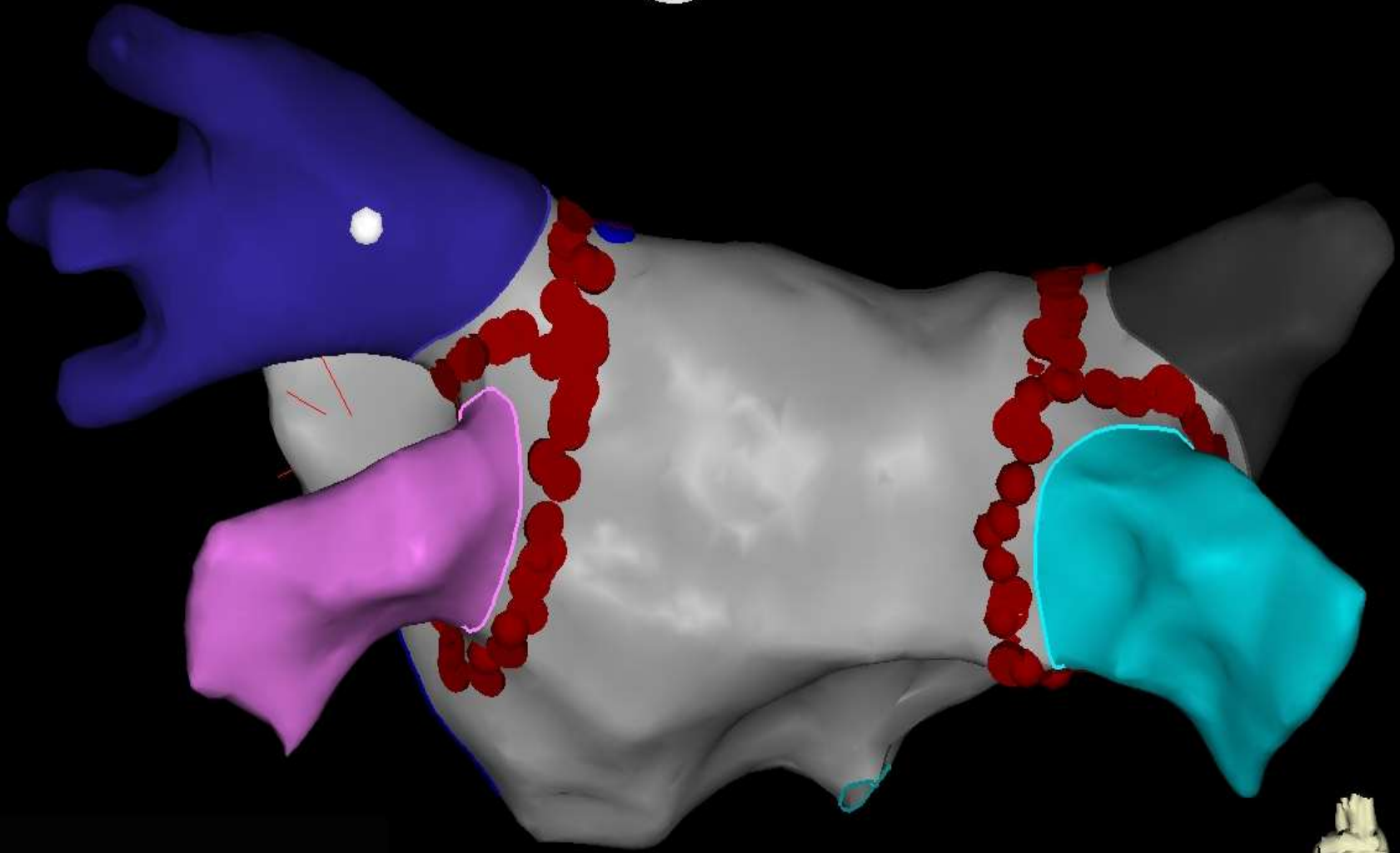
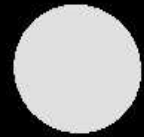
AP PA LAO RAO LL RL INF SUP

2-Map (213, 0) ▾



LAT

Navigation toolbar with icons for: Home, Rotate, Pan, Zoom, Grid, and a slider set to 15.



1.00

Vertical control panel with zoom in (+), zoom out (-), and orientation icons (heart, globe).

Manual

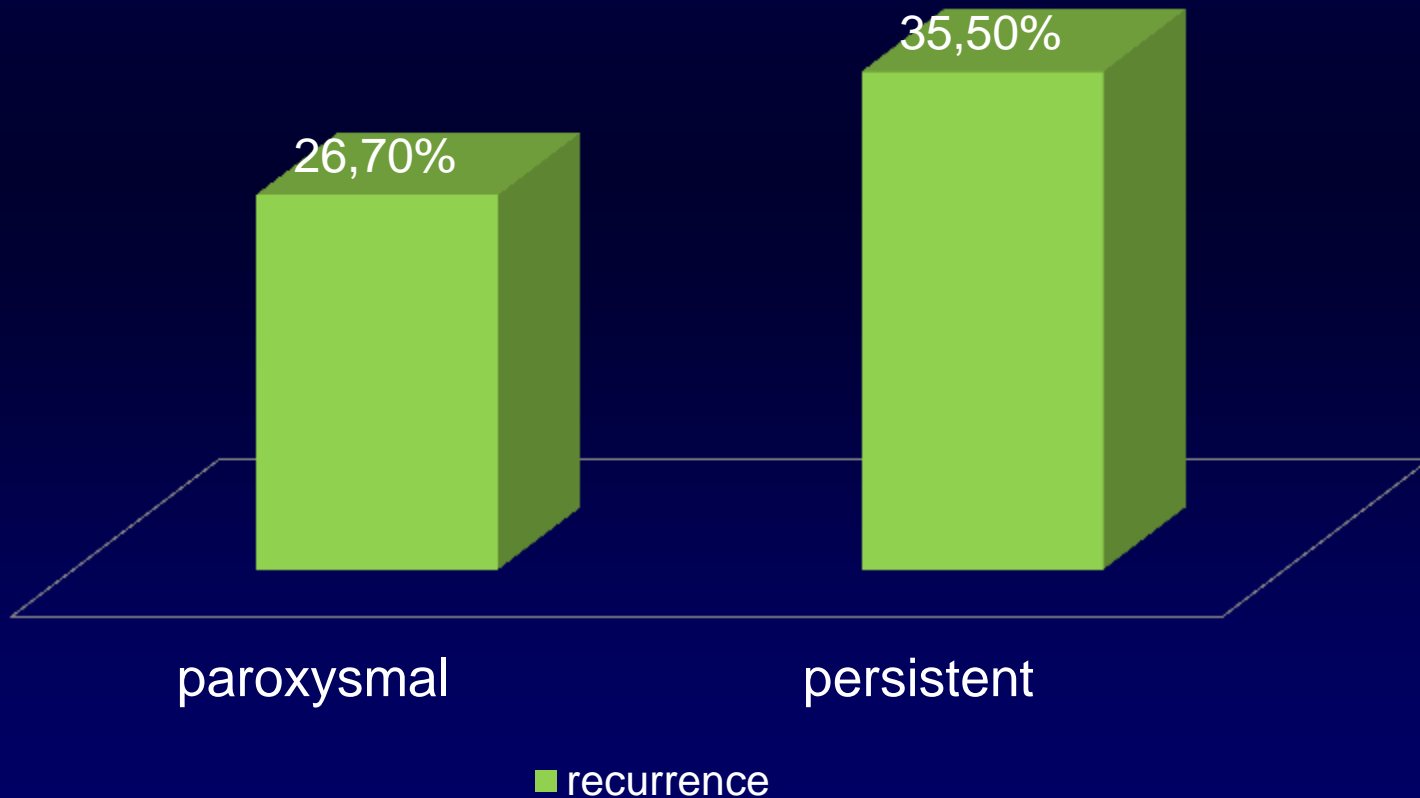
Acquire ▾

CL	LAT	Bi	Imp
831	-161	0.03	N/A

AP PA LAO RAO LL RL INF SUP



# Paroxysmal vs Persistent AF Recurrence



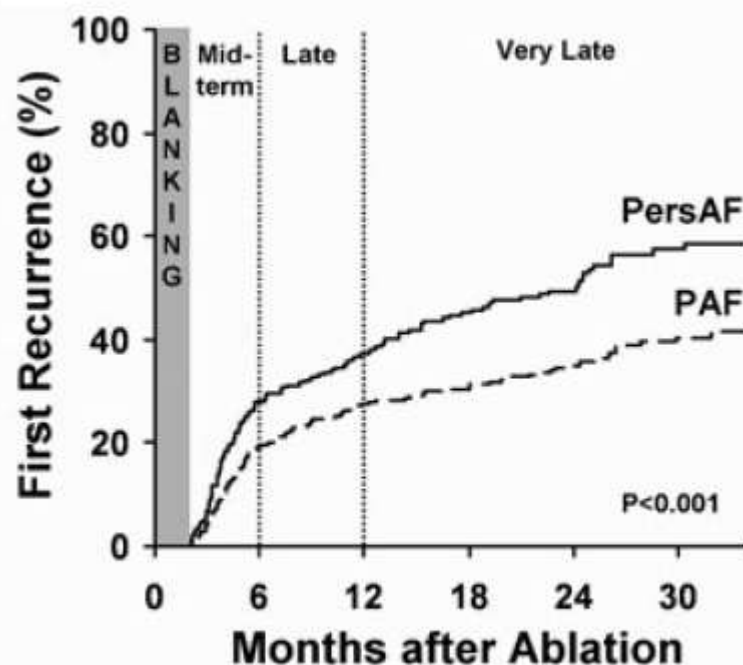
# Long-Term Outcome of Atrial Fibrillation Ablation: Impact and Predictors of Very Late Recurrence

ANITA WOKHLER  
SAMUEL J. ASIRVATHAN  
YONG-MEI CHEN  
CHRISTINE M. BLUHM

From the Division of Cardiac

**Long-Term Outcome** studies with 1 year follow-up cohort, we sought to describe

**Methods and Results:** 346 persistent or long-standing (WACA, 62%) or pulmonary patients and 142 in PersAF after last ablation and incidence rate of very late recurrence



	No. at risk	0	6	12	18	24	30
PAF	428	268	215	156	133	87	
PersAF	346	179	143	95	79	42	

recurrence rate increased by 20% (from 37% to 57%) in PersAF patients versus only 12% (from 27% to 39%) in PAF patients. Independent predictors

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THOMAS M. MUNGER, M.D.,  
TER A. BRADY, M.D.,  
STEPHEN C. HAMMILL, M.D.,

o Clinic, Rochester, Minnesota, USA

minates atrial fibrillation (AF) in se long-term efficacy. In a large r AF ablation.

[428 paroxysmal [PAF, 55%] and le area circumferential ablation ere were 135 recurrences in PAF of patients with PersAF at 2 years ng was related to a higher initial ce increased by 20% (from 37%

**Persistent AF and Diabetes were independent predictors of AF recurrence.**

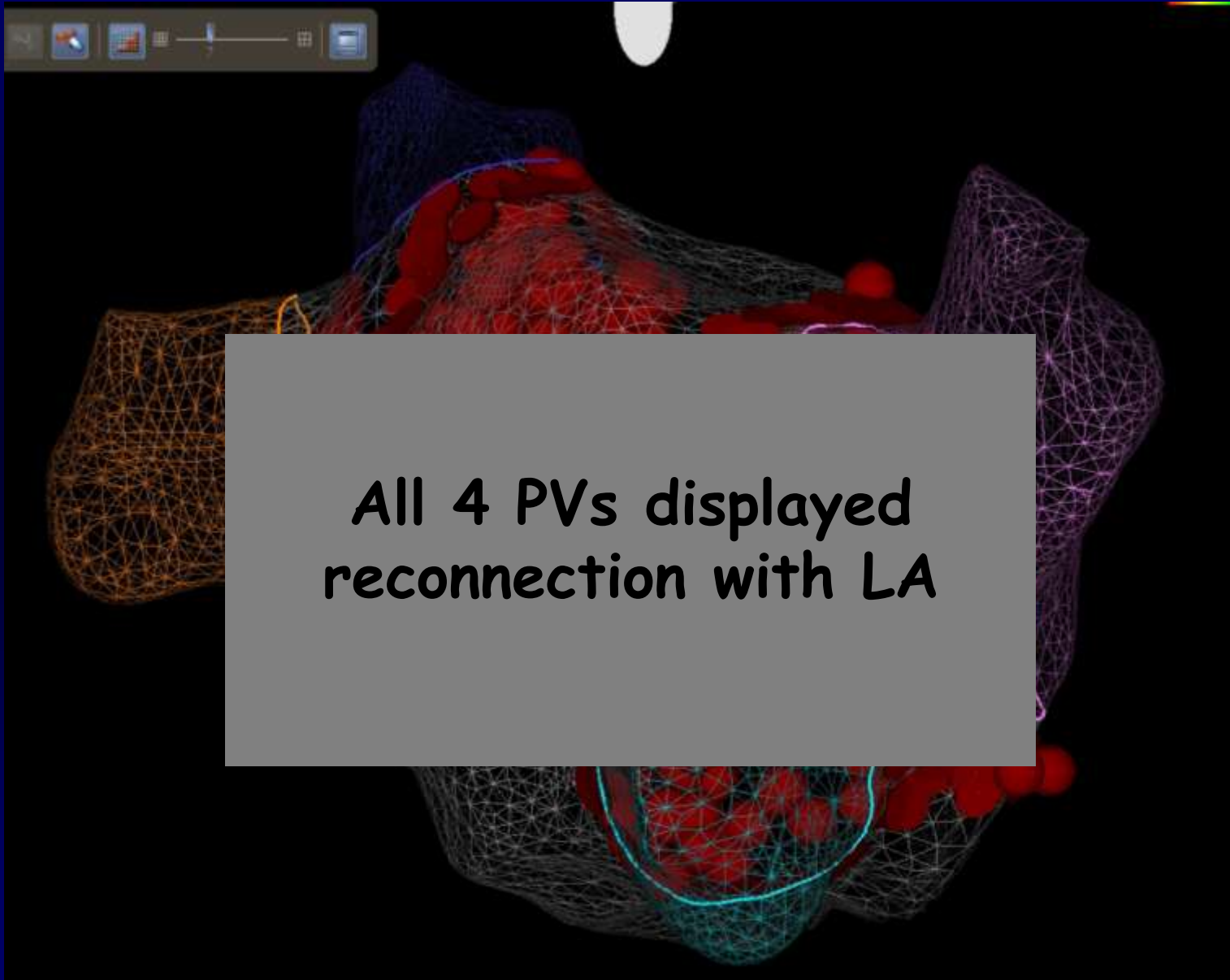
size >45 mm was identified as an AF-type specific predictor (HR 2.4 [1.3-4.7], P = 0.009), whereas in PersAF patients, no unique predictors were identified.

**Conclusion:** Late recurrences reduced the long-term efficacy of AF ablation, particularly in patients with PersAF and underlying cardiovascular diseases. (*J Cardiovasc Electrophysiol*, Vol. 21, pp. 1071-1078, October 2010)

- Left Ventricular Systolic Dysfunction
  - LAD



- 60 years-old man
- symptomatic persistent AF (4 months)
  - AF catheter ablation 2009 (PVAI)
    - worsening systolic heart failure (LVEF~ 40%) attributed to AF (tachy-induced cardiomyopathy)
      - LAD: 49mm
- coronary angiography without significant findings
- redo AF procedure scheduled in our lab (2010)



All 4 PVs displayed  
reconnection with LA



- AF termination during ablation
- one year following the index procedure the pt is in SR without any AAs
- LVEF significantly increased from 40 to 55%
- the pt is totally **ASYMPTOMATIC !!!**

# Ablation of Atrial Fibrillation in Patients with Heart Failure: Reversal of Atrial and Ventricular Remodelling

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**Results:** Eight patients (62%) remained in sinus rhythm at the end of the follow up and had achieved a statistically significant improvement in ejection fraction (from  $37.5 \pm 8.75\%$  to  $60.0 \pm 3.75\%$ ,  $p=0.011$ ), reduction of left ventricular end-diastolic diameter (from  $63.0 \pm 3.25$  mm to  $56.5 \pm 1.75$  mm,  $p=0.011$ ) and reduction of left atrial diameter (from  $45.0 \pm 2.5$  mm to  $40.0 \pm 1.5$  mm,  $p=0.011$ ). **Significant LVEF improvement from 37.5 to 60%** patients with relapse of AF had none of the above changes ( $p>0.05$ ). Prognostic indexes of AF recurrence appeared to be the failure to improve ejection fraction ( $p=0.003$ ), non-reversal of left ventricular ( $p=0.002$ ) and left atrial ( $p=0.006$ ) remodelling, a shorter energy application time ( $p=0.030$ ) and the presence of coronary artery disease ( $p=0.035$ ). None of the patients suffered any complication from the procedure.

# Meta-Analysis of the Effectiveness and Safety of Catheter Ablation of Atrial Fibrillation in Patients With Versus Without Left Ventricular Systolic Dysfunction

Stephen B. Wilton, MD<sup>a,b,\*</sup>, Adam Fundytus<sup>a</sup>, William A. Ghali, MD, MPH<sup>a,b</sup>, George D. Veenhuyzen, MD<sup>a</sup>, F. Russell Quinn, BM, BCh, PhD<sup>a</sup>, L. Brent Mitchell, MD<sup>a</sup>, Michael D. Hill, MD, MSc<sup>b</sup>, Peter Faris, PhD<sup>b</sup>, and Derek V. Exner, MD, MPH<sup>a,b</sup>

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Catheter ablation is a promising therapy for atrial fibrillation (AF), but its utility in patients with left ventricular systolic dysfunction (LVSD) is uncertain. The objectives of this study were to perform a systematic review and meta-analysis of randomized and observational studies comparing the rates of recurrent AF, atrial tachycardia (AT), and complications after AF catheter ablation in those with versus without LVSD and to summarize the impact of catheter ablation on the left ventricular ejection fraction. Seven observational studies and 1 randomized trial were included (total **n = 1,851**). Follow-up ranged from 6 to 27 months. In those with LVSD, 28% to 55% were free of AF or AT on follow-up after 1 AF catheter ablation, increasing to 64% to 96% after a mean of 1.4 procedures. The relative risk for recurrent AF or AT in those with versus without LVSD was 1.5 (95% confidence interval 1.2 to 1.8,  $p < 0.001$ ) after 1 procedure and 1.2 (95% confidence interval 0.9 to 1.5,  $p = 0.2$ ) after multiple procedures. No difference in complications was observed in patients with (3.5%) versus without (2.5%) heart failure ( $p = 0.55$ ). After catheter ablation, those with LVSD experienced a pooled absolute improvement in the left ventricular ejection fraction of 0.11 (95% confidence interval 0.07 to 0.14,  $p < 0.001$ ). In conclusion, patients with and without LVSD had similar risk for recurrent AF or AT after catheter ablation, but repeat procedures were required more often in those with LVSD. Significant improvements in left ventricular ejection fractions after ablation were observed in those with LVSD. Randomized trials are needed given the limitations of present data. © 2010 Elsevier Inc. All rights reserved. (Am J Cardiol 2010;106:1284–1291)

# Left ventricular systolic dysfunction by itself does not influence outcome of atrial fibrillation ablation

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Received 4 May 2009; accepted after revision 14 September 2009; online publish-ahead-of-print 31 October 2009

## Aims

The objective of the study was to analyse the influence of left ventricular (LV) ejection fraction (EF) on the outcomes

**LV systolic dysfunction is not a predictor of AF recurrence.  
LAD is an independent predictor of AF recurrence.**

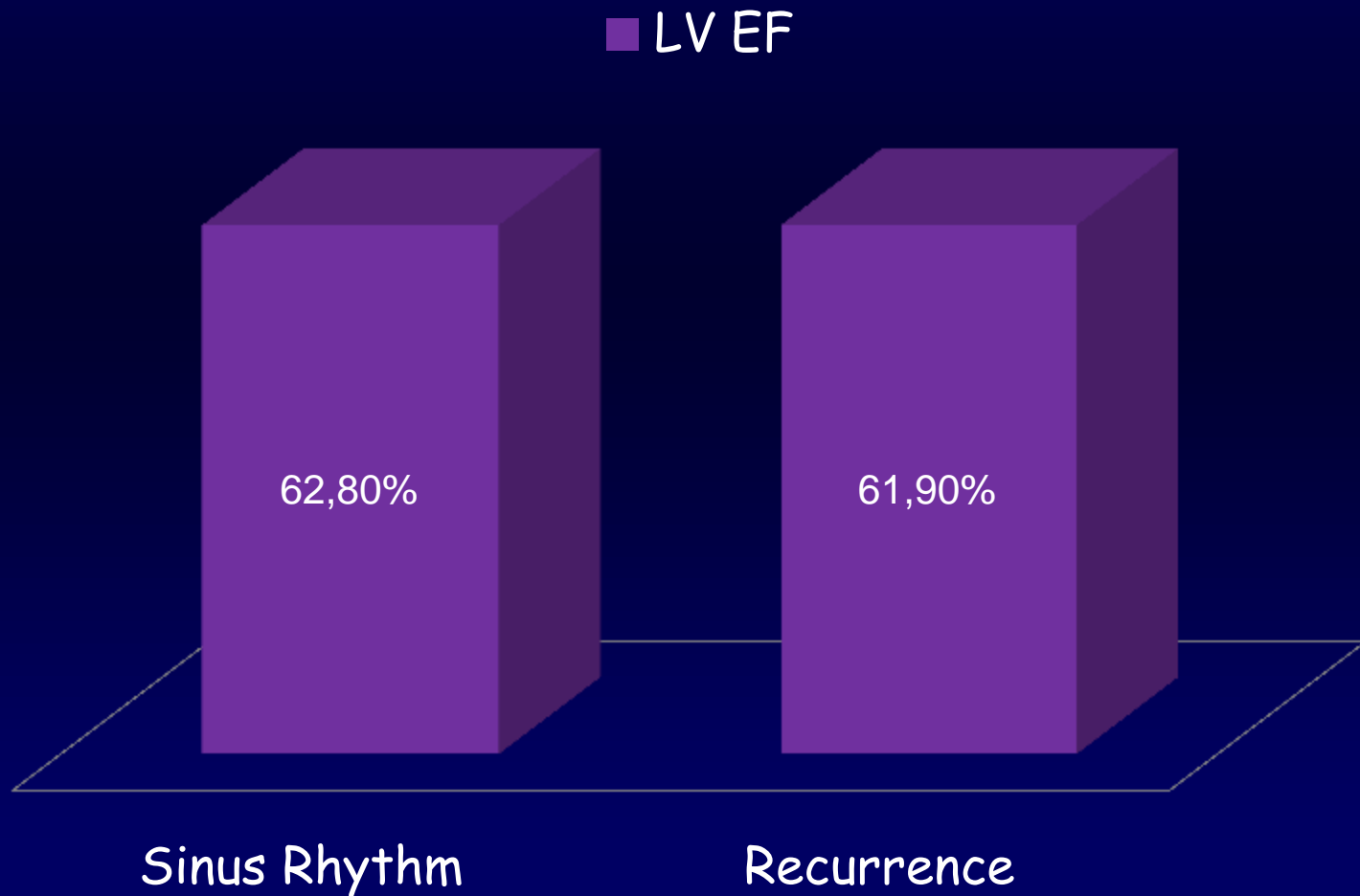
had higher LV end diastolic diameter ( $55.6 \pm 6.2$  vs.  $52.4 \pm 5.5$ ,  $P = 0.03$ ), higher LV end systolic diameter ( $40.3 \pm 6.9$  vs.  $32.6 \pm 4.3$ ,  $P < 0.001$ ), lower LVEF ( $41.4 \pm 8.0$  vs.  $63.1 \pm 5.5$ ,  $P < 0.001$ ) and were more likely to have structural heart disease. After a mean follow-up of  $16 \pm 13$  months, survival analysis for AF recurrences showed no differences between patients with depressed vs. normal LVEF (50.0 vs. 55.6%, log rank = 0.82). Cox regression analysis revealed LAD to be the only variable correlated to recurrence [OR 1.11 (1.01–1.22),  $P = 0.03$ ]. Analysis at 6 months showed a significant increase in LVEF ( $43.23 \pm 7.61$  to  $51.12 \pm 13.53\%$ ,  $P = 0.01$ ) for the case group.

## Conclusion

LV systolic dysfunction by itself is not a predictor of outcome after AF ablation. LAD independently correlates with outcome in patients with low or normal LVEF.

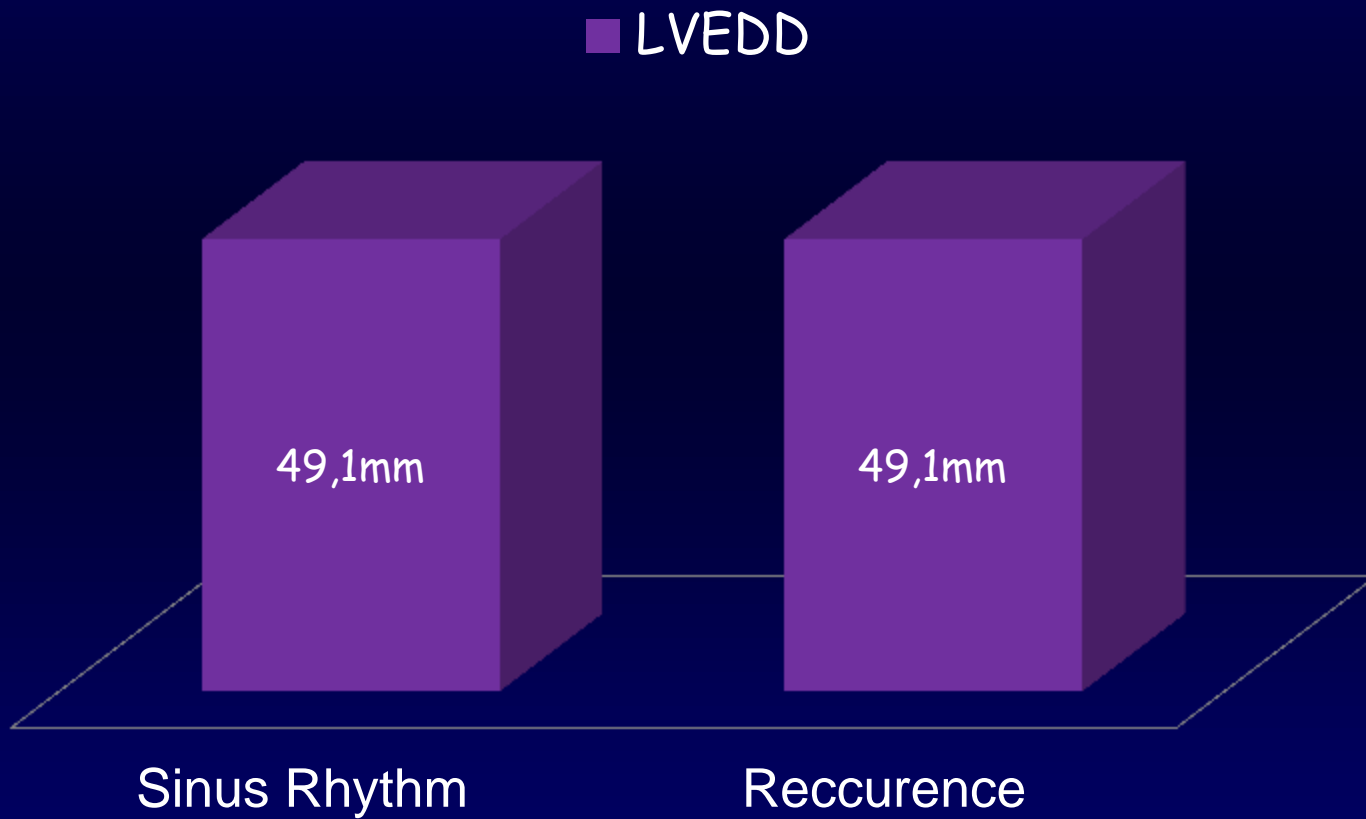


# EF as a Predictor of AF recurrence





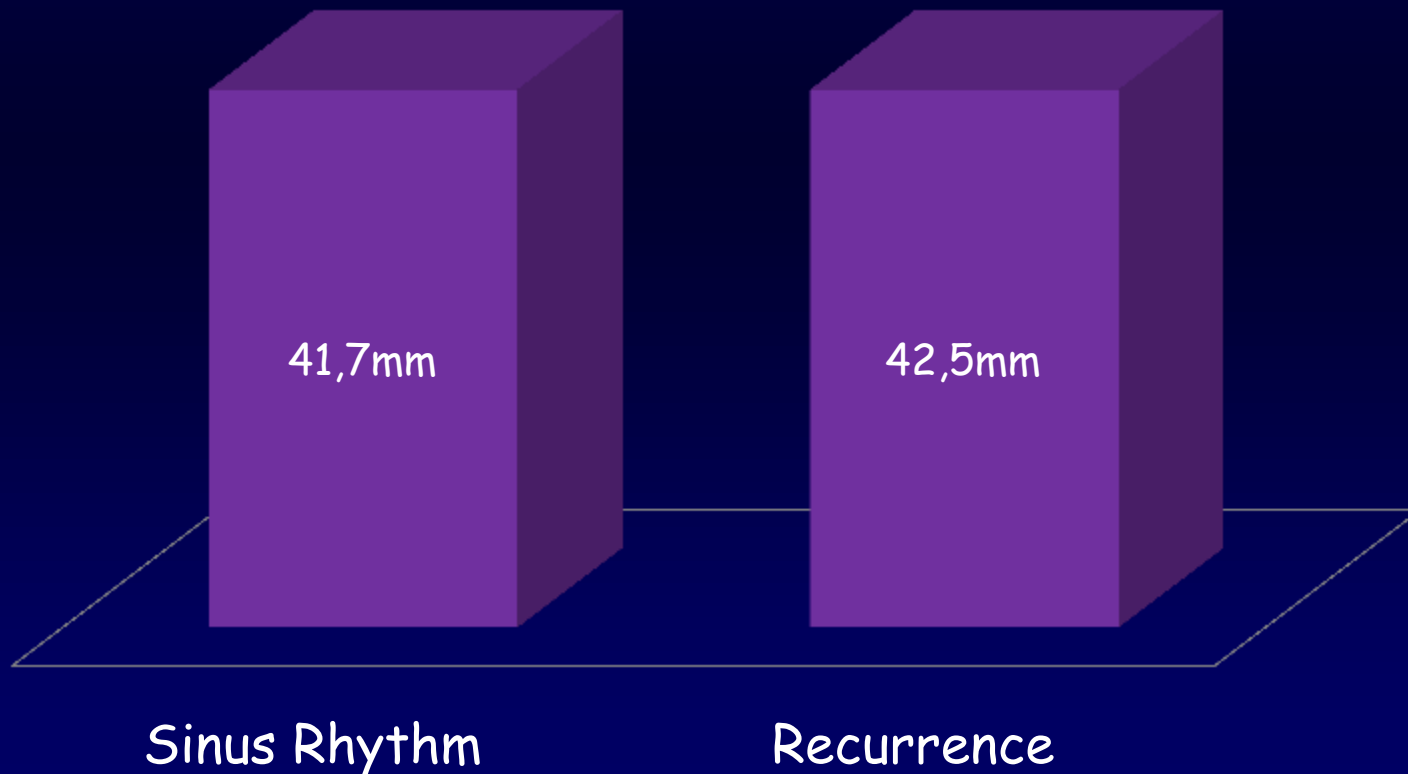
# LVEDD as a Predictor of AF Recurrence





# LAD as a Predictor of AF Recurrence

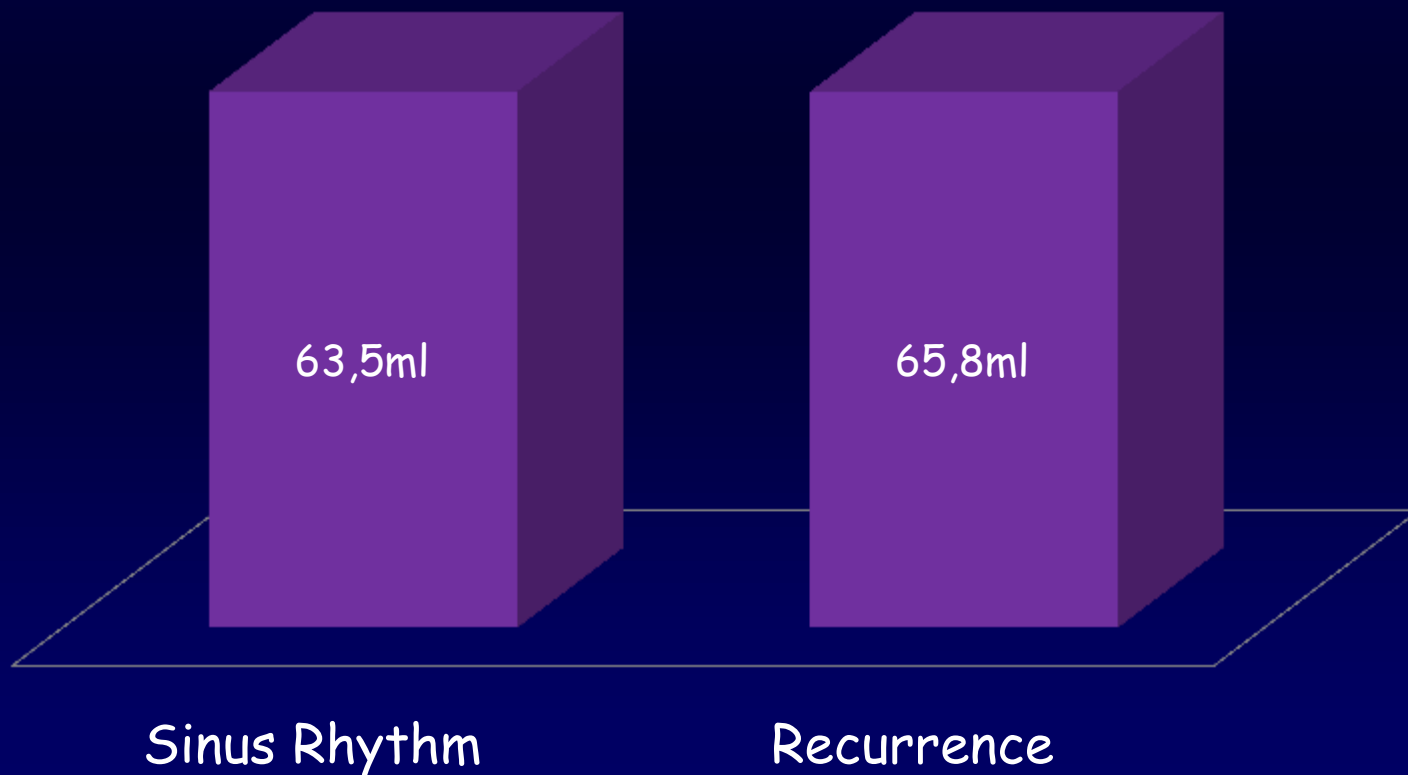
■ Left Atrium Diameter





# Left Atrium Volume as a Predictor of AF Recurrence

■ Left Atrium Volume



# Preprocedural Predictors of Atrial Fibrillation Recurrence Following Pulmonary Vein Antrum Isolation in Patients With Paroxysmal Atrial Fibrillation: Long-Term Follow-Up Results

SHINSUKE MIYA  
YOSHIHIDE  
MIT

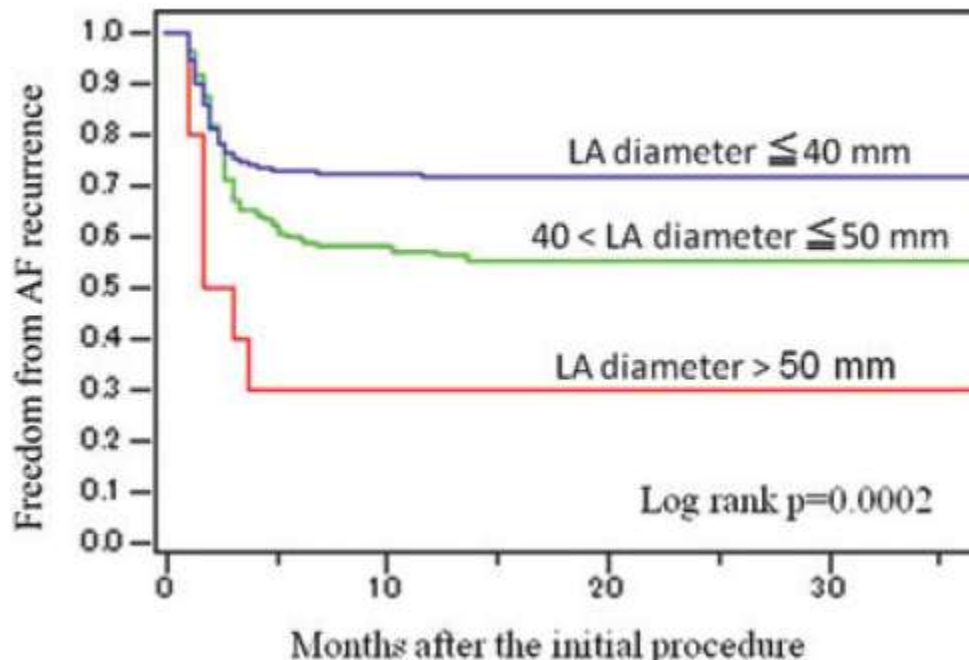
HI KOBORI, M.D.,\*  
SATO, M.D.,\*  
M.D.\*

From the \*Cardiovascular Cent  
Cardio

-ken, Japan; and †Department of  
70, Japan

**Predictors of Re**  
identify the simple pr  
procedure in patient:

*Methods and Resul*  
5.1 mm) with drug-  
vein antrum isolation  
elimination of all no  
13 months after sing



e of this study was to  
following single ablation

(LA) diameter  $37.6 \pm$   
analyzed. Pulmonary  
conduction block, and  
ean follow-up of  $30 \pm$   
at any antiarrhythmic

drugs. Multivariate analysis using Cox's proportional hazards model, including the age, gender, duration of AF, body mass index, LA size, left ventricular ejection fraction, and presence of hypertension and structural heart disease as variables, demonstrated that LA size was an independent predictor of AF recurrences after

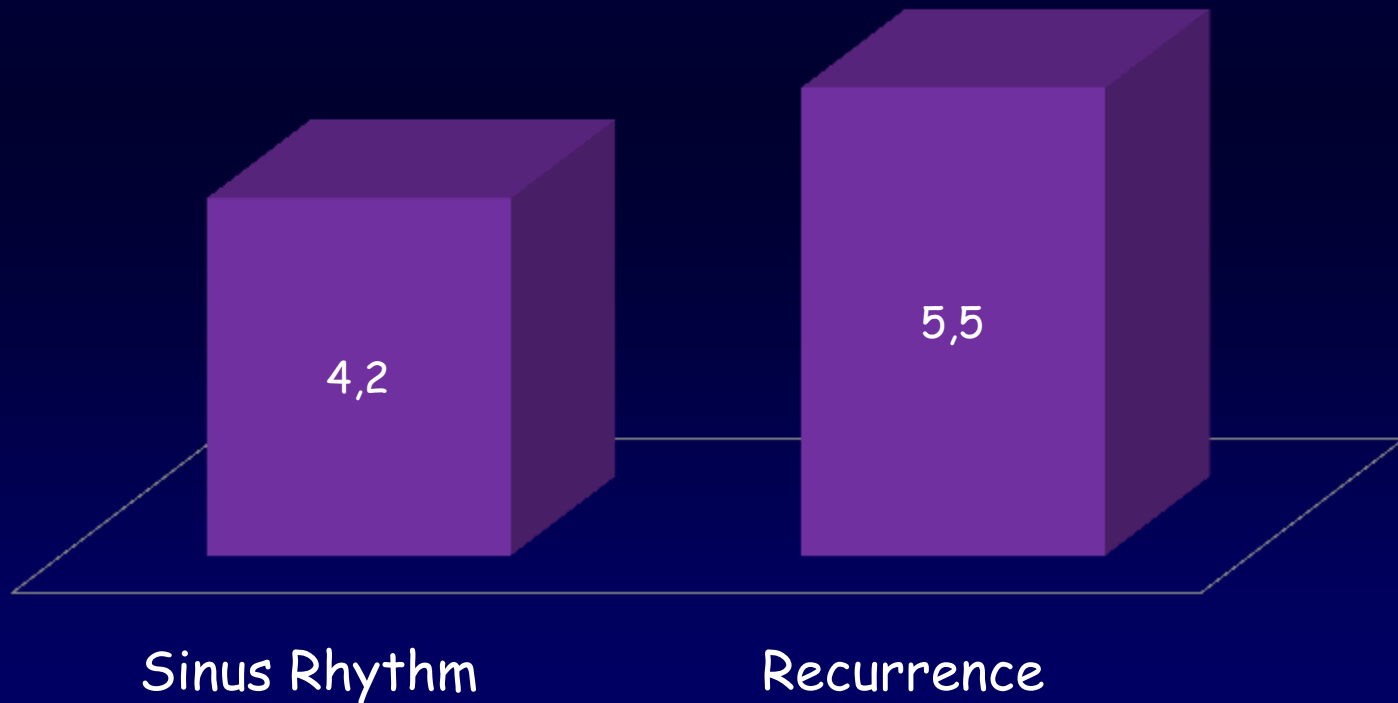
**AGE-GENDER-DURATION AF-BMI-EF-HYPERTENSION-  
STRUCTURAL HEART DISEASE, LAD the best  
preprocedural predictor**

recurrence following single ablation procedure in the patients with paroxysmal AF, even in the patients with a relatively small LA. (*J Cardiovasc Electrophysiol*, Vol. 22, pp. 621-625, June 2011)



# AF Duration as a Predictor of AF Recurrence

■ AF duration (years)





Μ. Εφραιμίδης  
Κ. Λέτσας  
Δ. Μανωλάτος  
Σ. Ξυδώνας  
Π. Σκουφογιάννη  
Α. Σιδέρης

