Imaging in AF (ablation)

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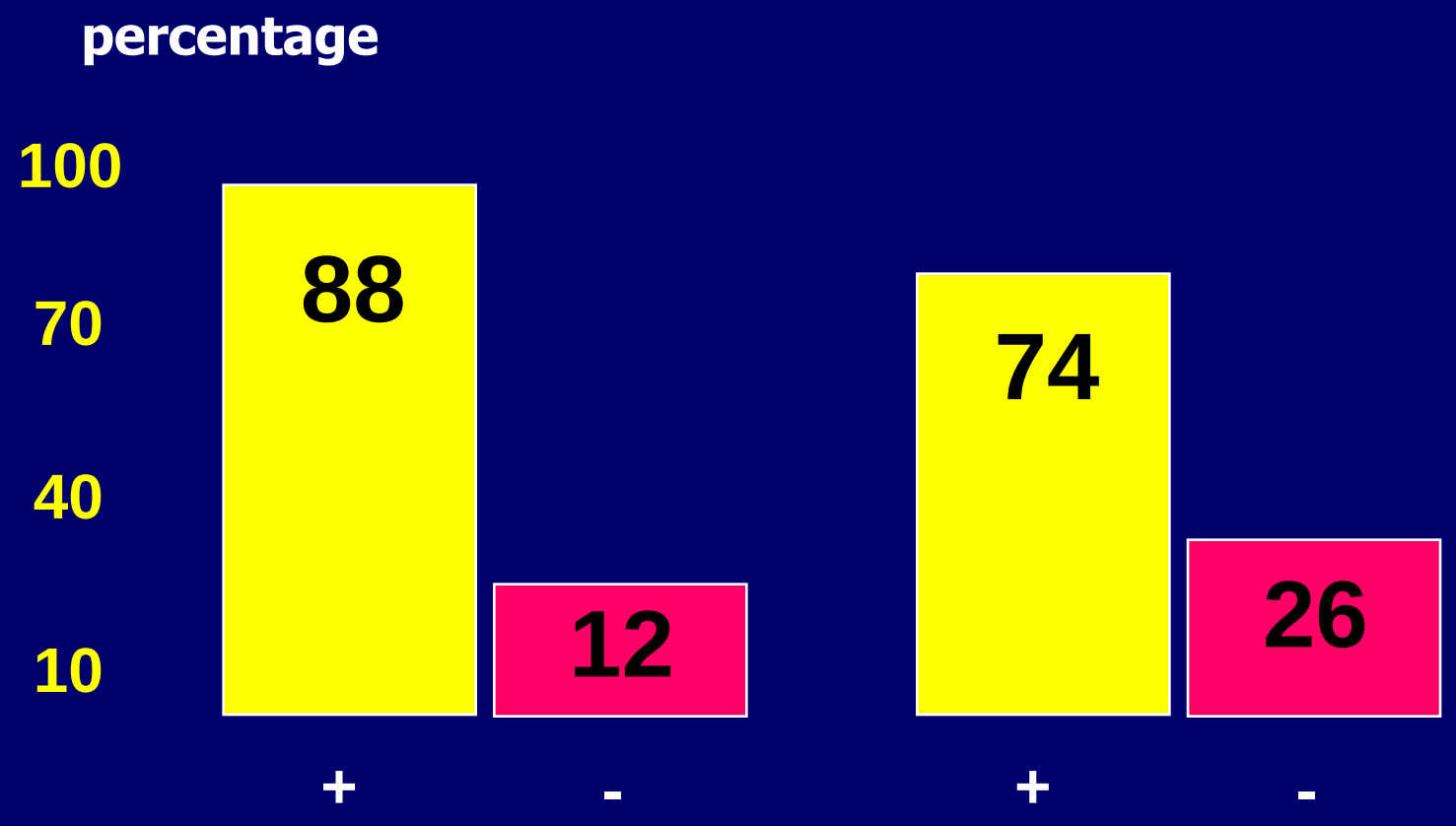
HongKong, july 2020

Research grants: Medtronic, Biotronik, Boston Scientific, St Jude, BMS imaging, GE Healthcare, Edwards Lifescience

AF ablation: success and failure

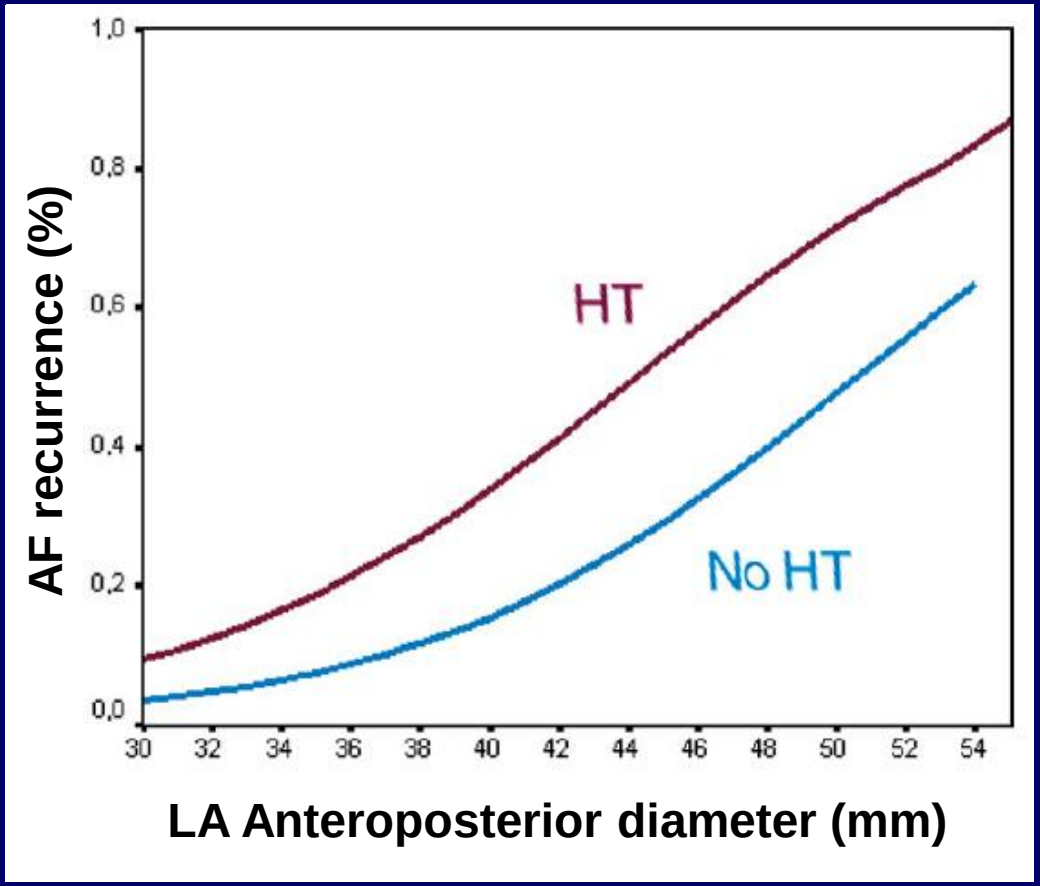


Oral H et al. NEJM 2006; Khan et al. NEJM 2008

Assessment of substrates for AF
Prediction of successful RFCA

Independent predictors of AF recurrences after RFCA:

- Age
- Hypertension
- Permanent AF
- LA dimensions
- LV dimensions

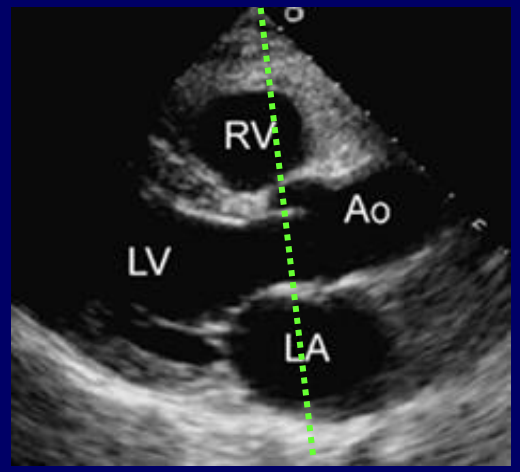


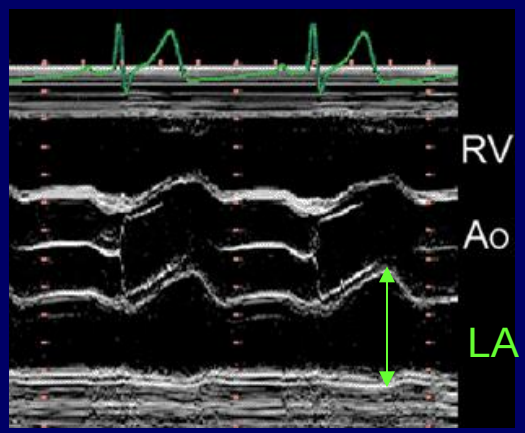
Berruezo et al. EHJ 2007

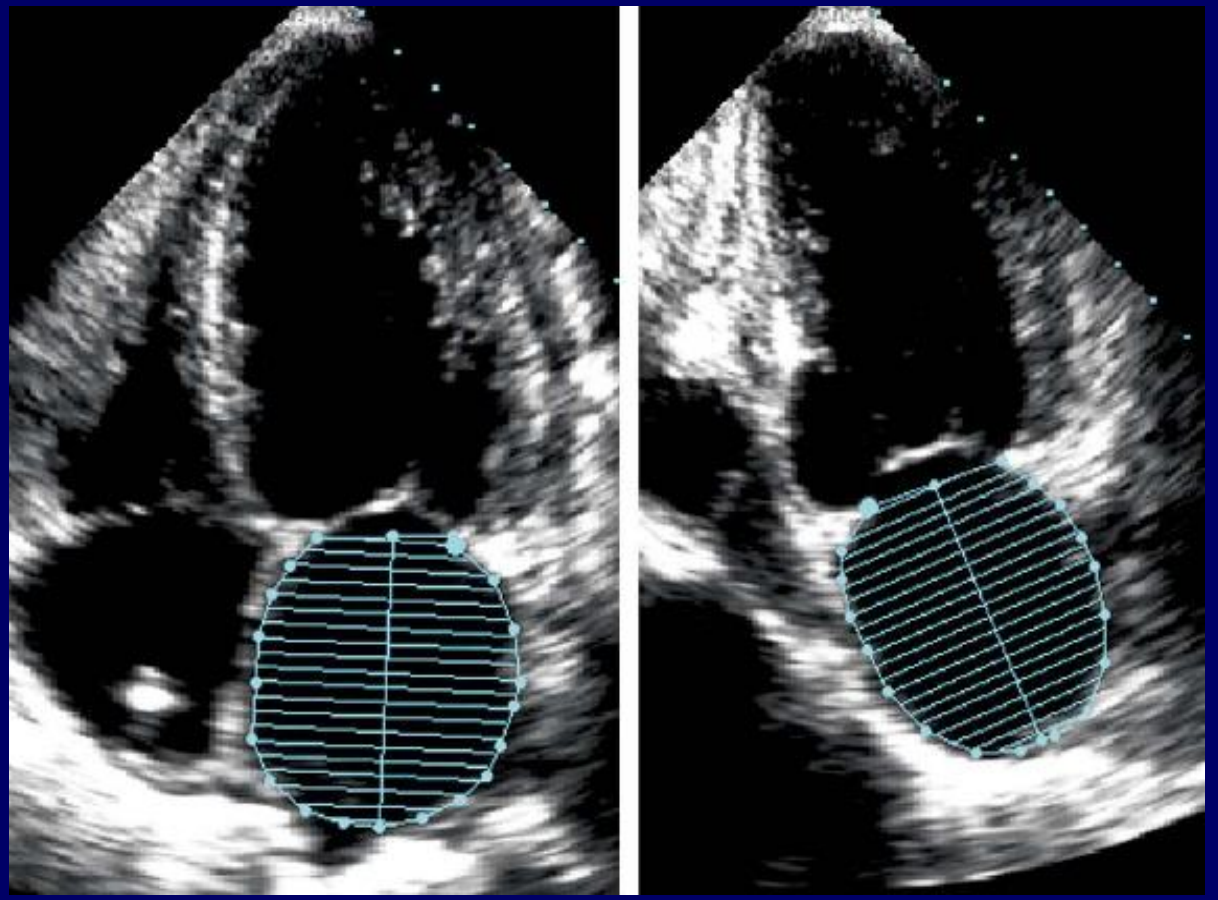
1. Assessment of substrate for AF ☞Prediction of successful RFCA
    - LA enlargement
    - LA fibrosis:
        - Mechanical consequences
        - Electrical conduction heterogeneities
2. Evaluation of successful RFCA on LA and LV performance

Left atrial dimensions

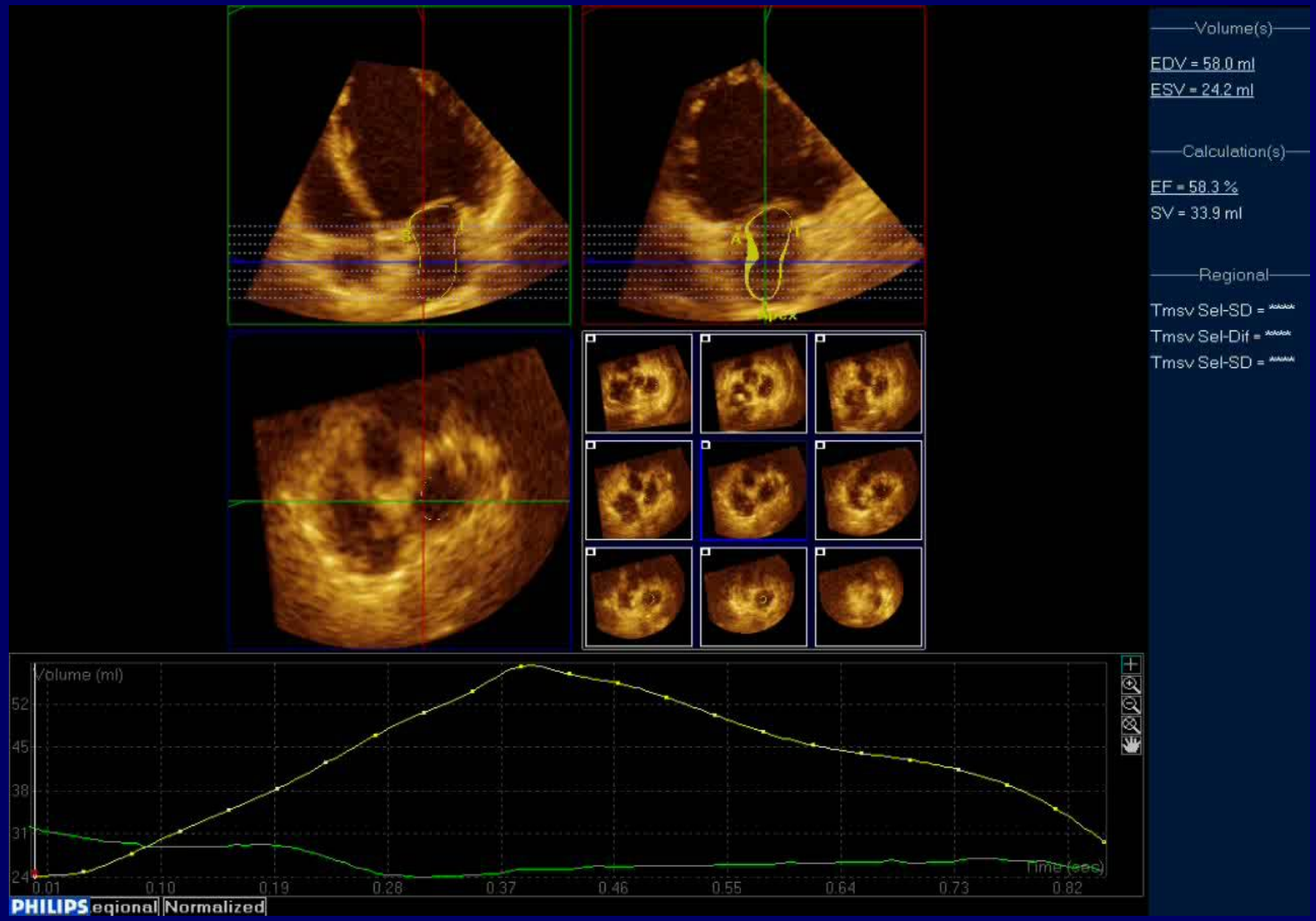
Linear dimensions AP diameter	LA volume Modified Simpson's rule







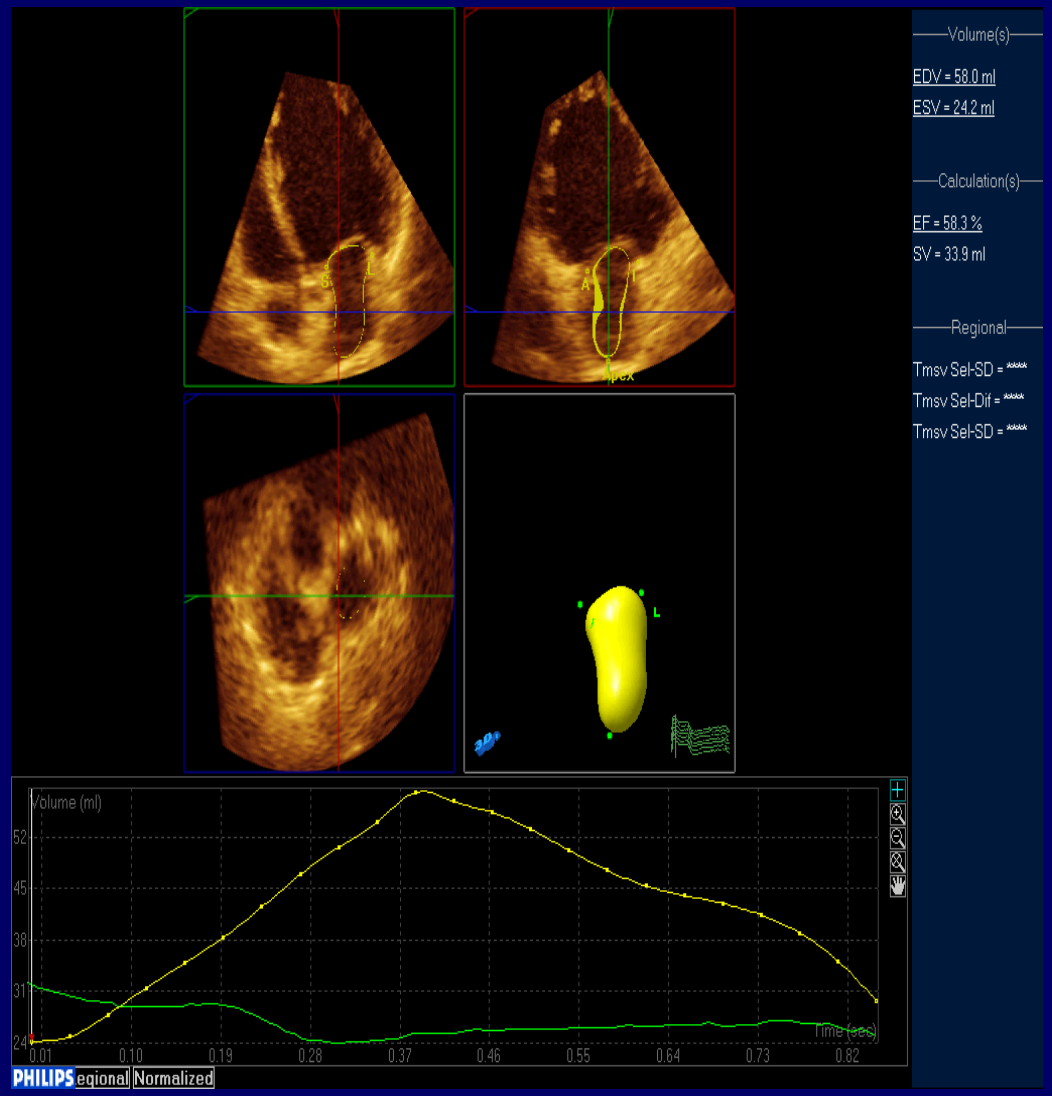
Real-time 3D echocardiography



Real-time 3D echocardiography

LA volumes:

- LA_{max}
  - just before mitral valve opening
- LA_{min}
  - just before mitral valve closure
- LA_{preA}
  - last frame before mitral valve reopening



Ajmone Marsan et al. AJC2008

N = 57

77% male

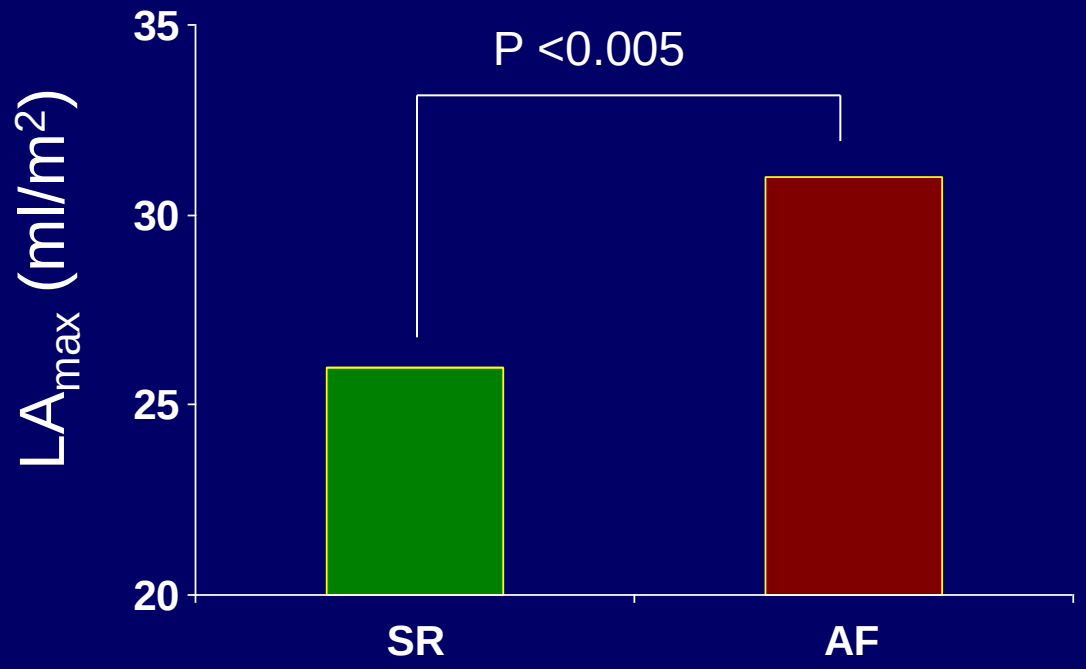
79% Paroxysmal AF

RFCA

SR
N = 38

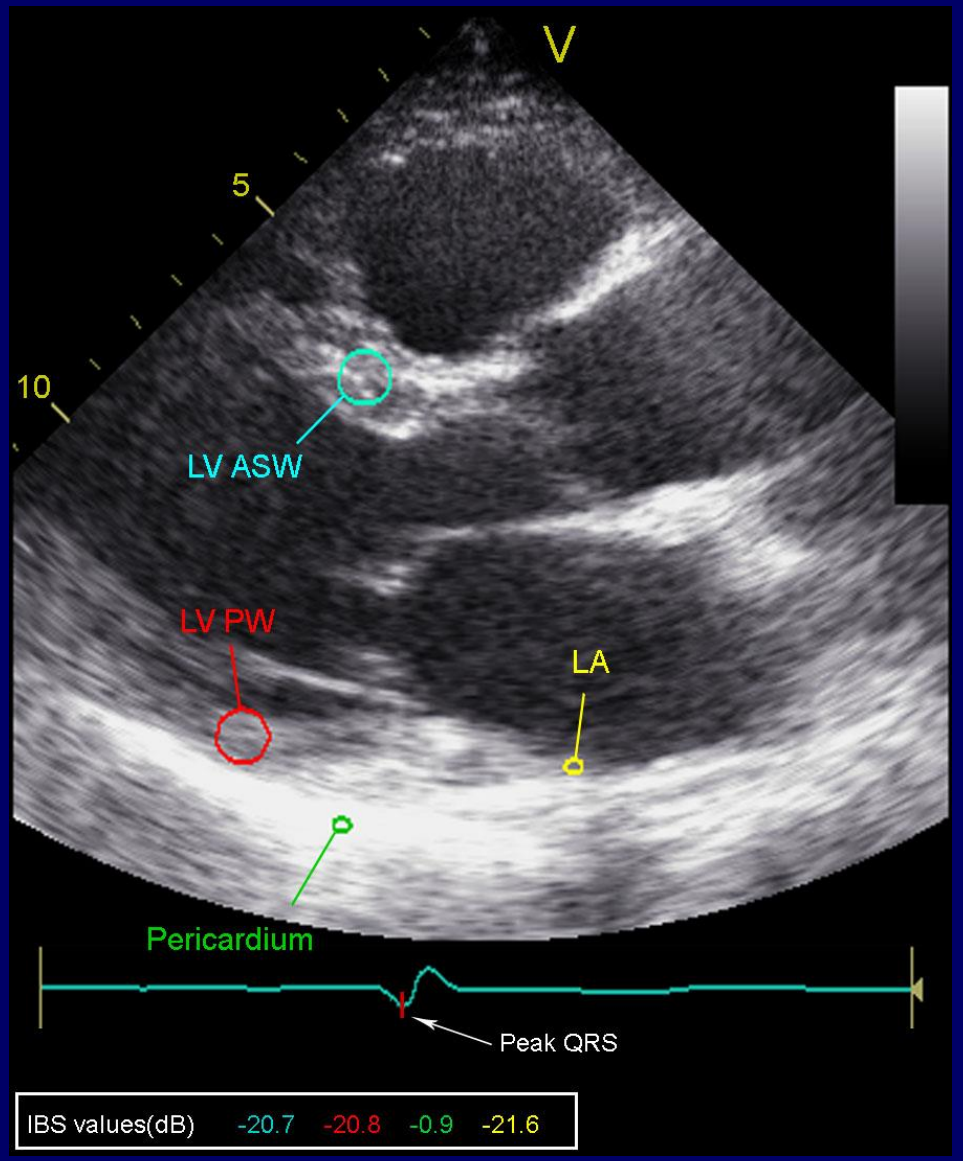
AF
N = 19

Baseline RT3DE LA volumes



Ajmone Marsan et al. AJC2008

Left atrial tissue characterization



Calibrated integrated backscatter

↓

Tissue ultrasound reflectivity measurement

↓

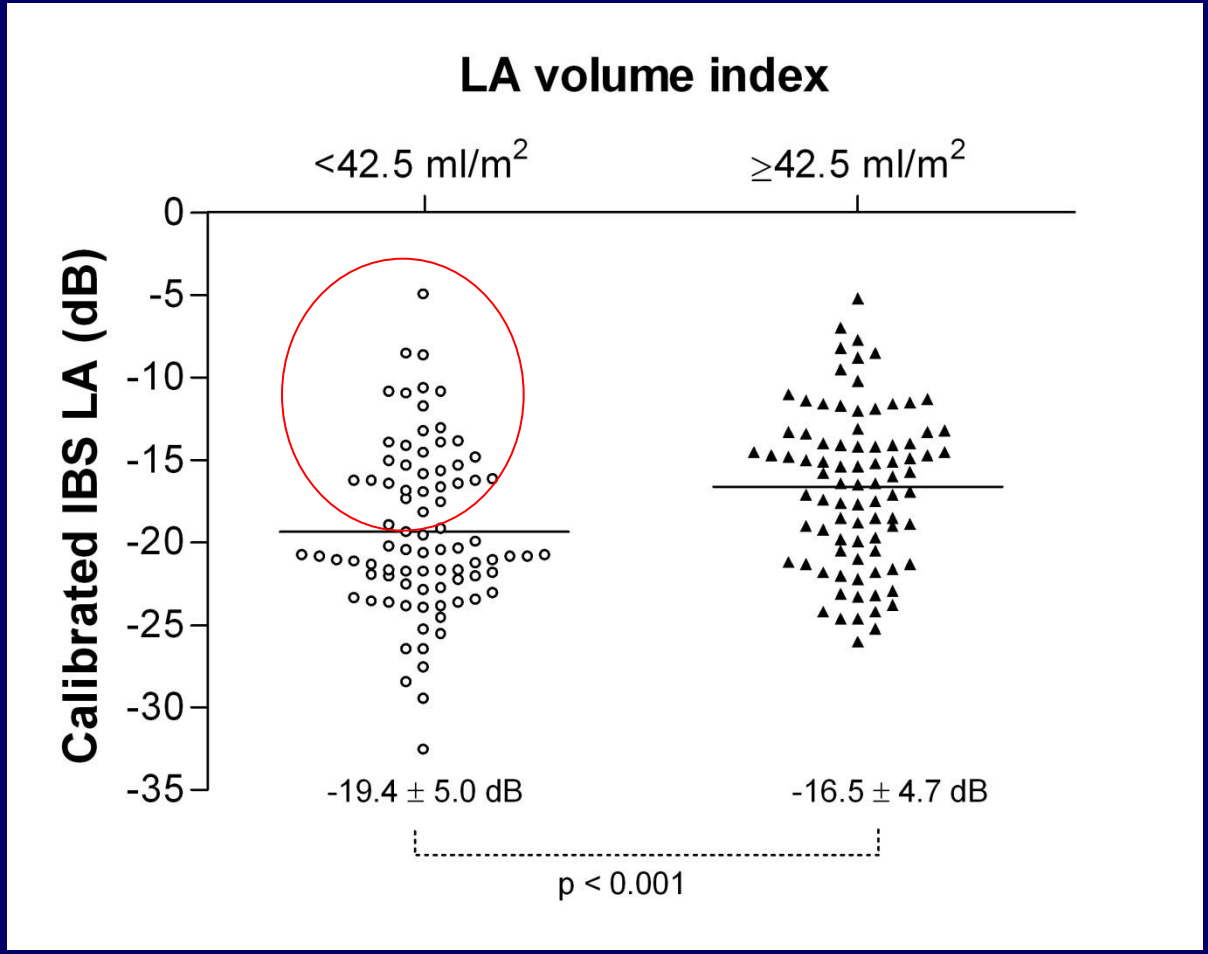
LA fibrosis

N = 170

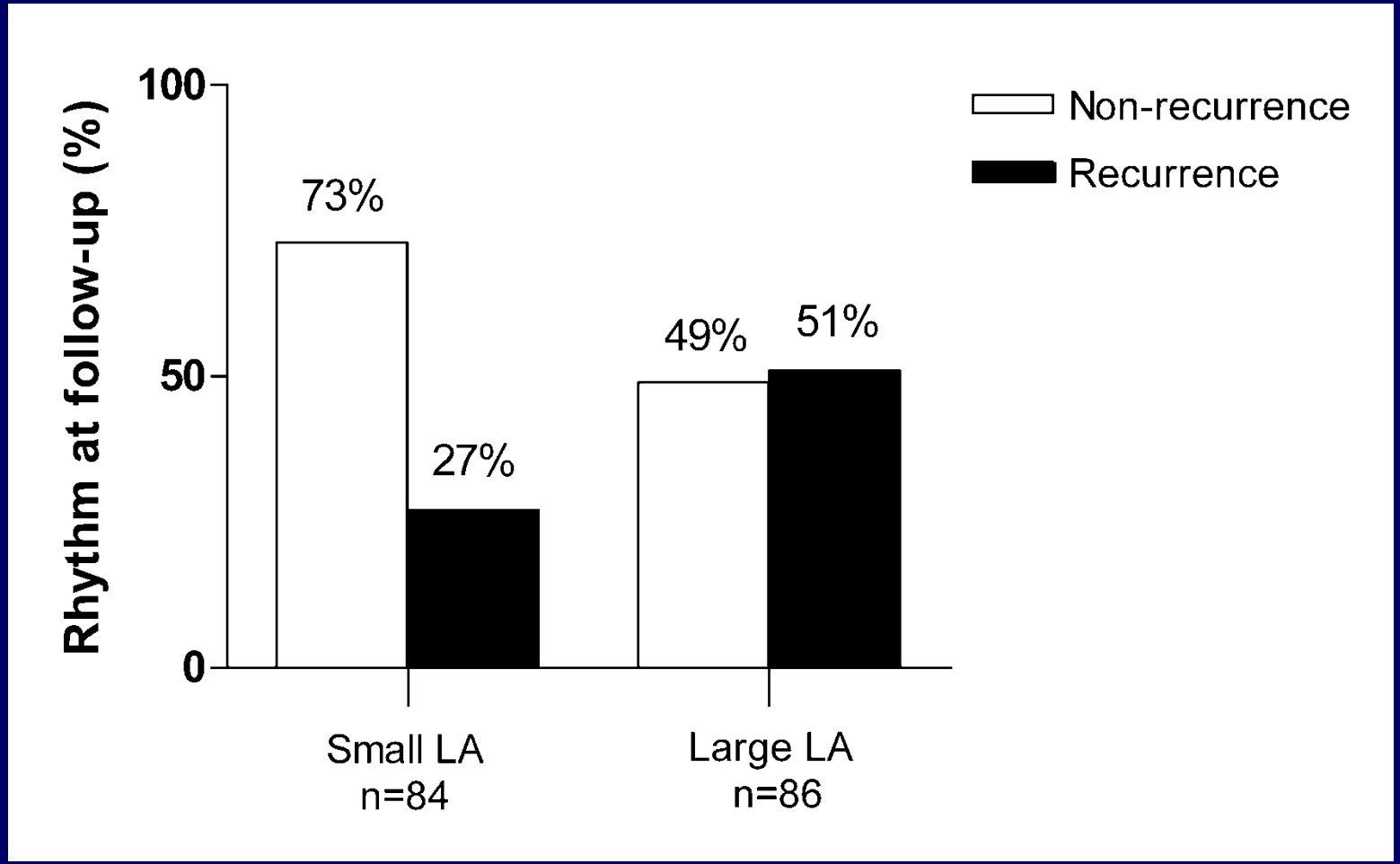
77% male

71% Paroxysmal AF

RFCA

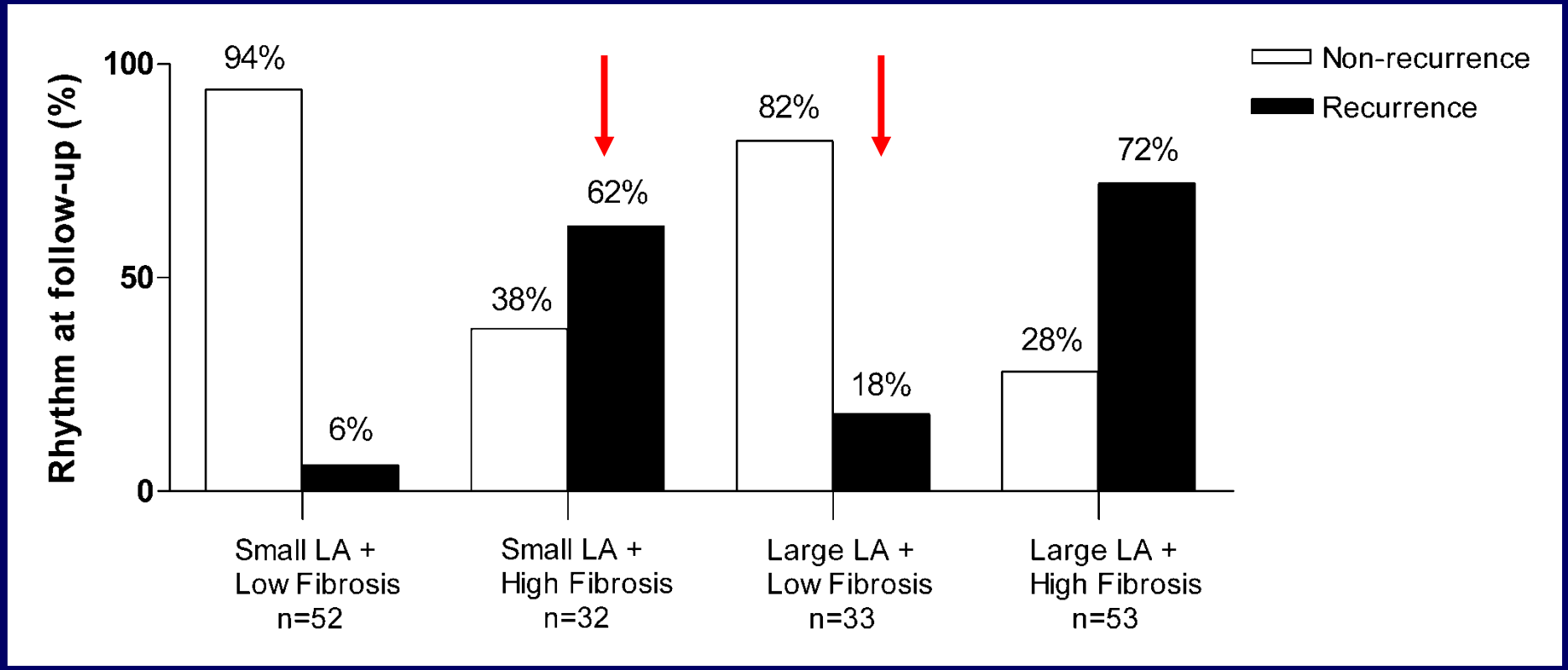


"Small LA" can show high fibrosis content



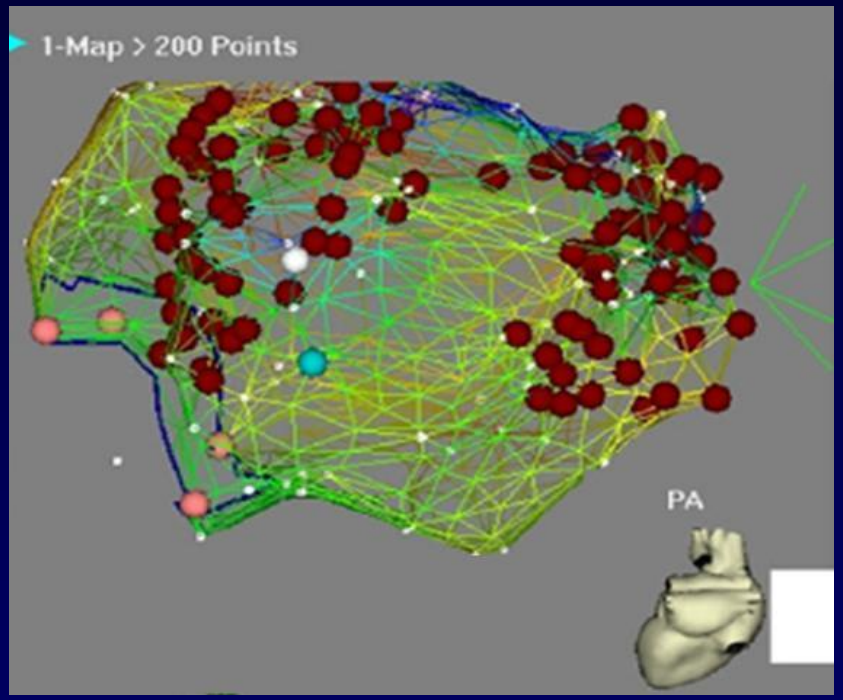
Outcome according to indexed LA volume

- Patients with “large LA” had more recurrences than patients with “small LA”.
- 27% of patients with “small LA” have also AF recurrences…why?



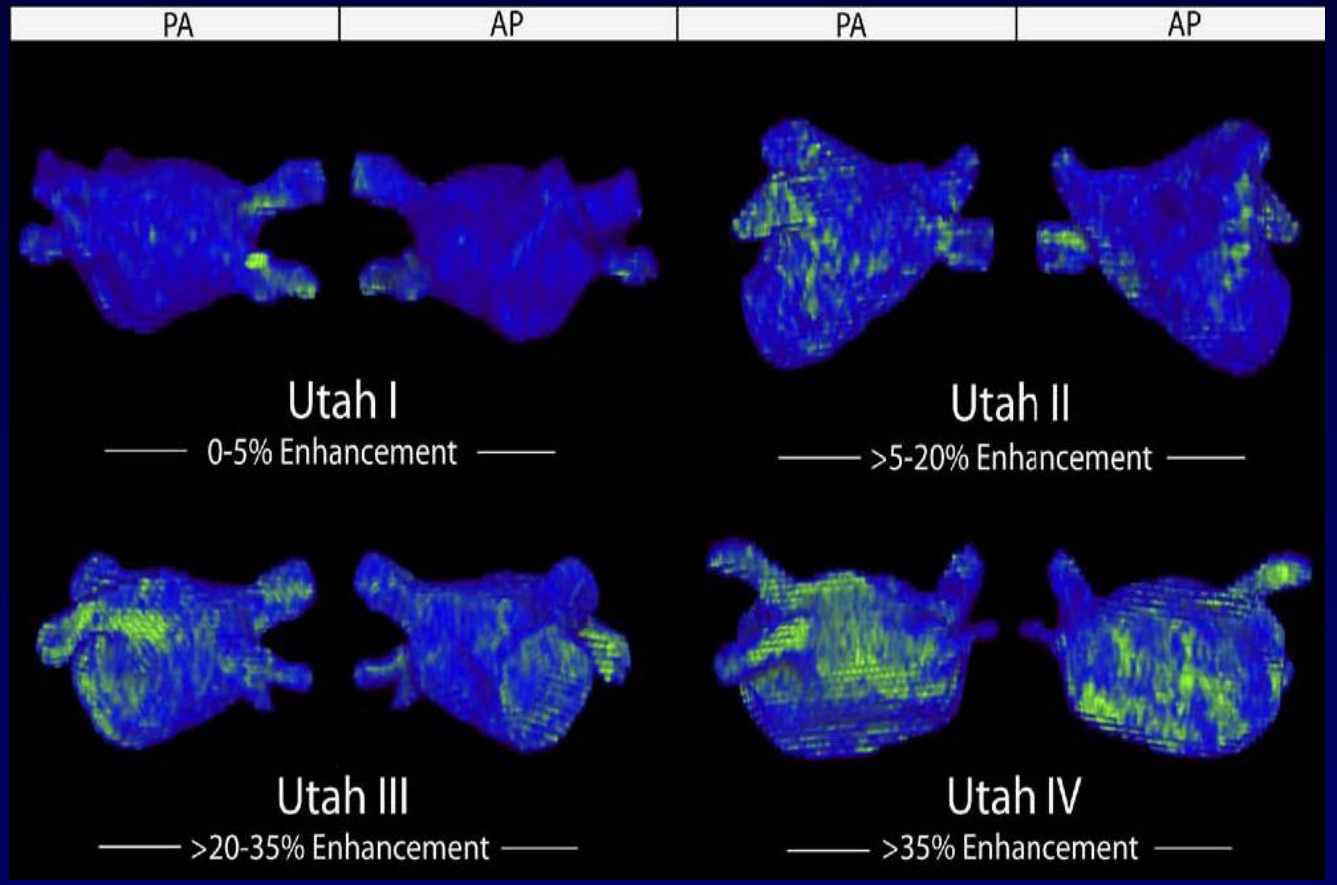
LA fibrosis content evaluation provides additional information in stratification of AF patients undergoing RFCA

Left atrial tissue characterization - MRI



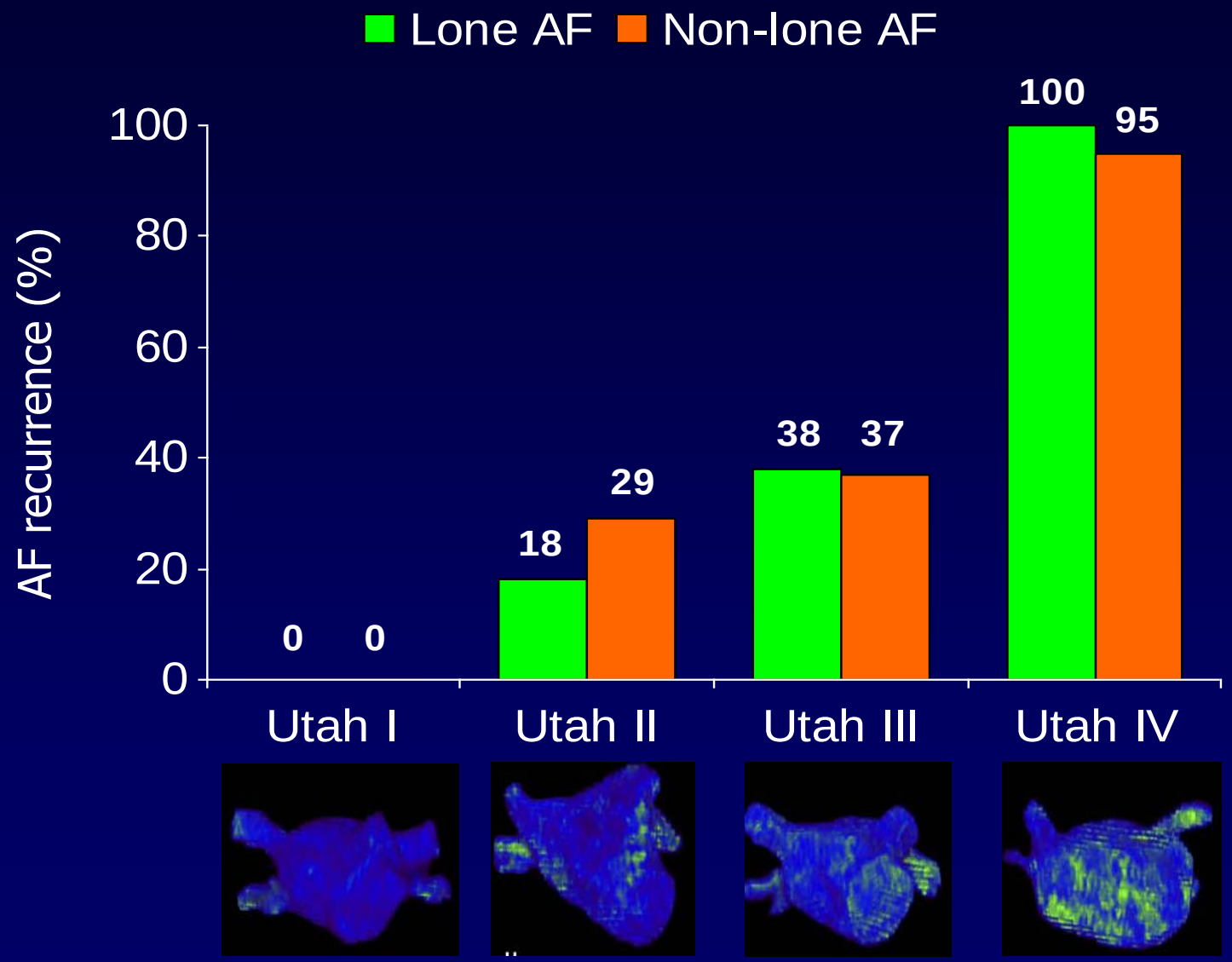
Taclas et al. Heart Rhythm 2010

- **N = 333 AF patients**
- **LA fibrosis before RFCA: DE-MRI**

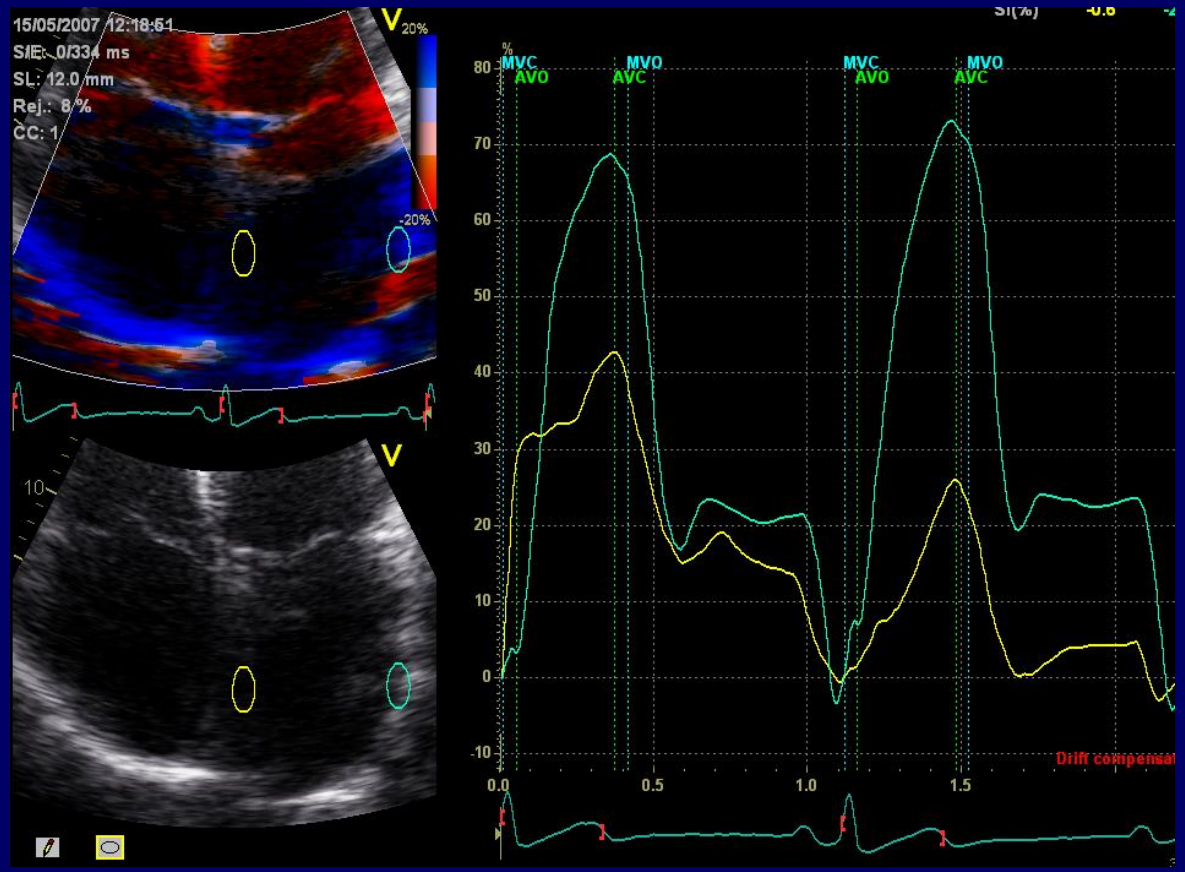


Mahnkopf et al. Heart Rhythm 2010

LA fibrosis vs. RFCA outcome



Left atrial mechanical properties

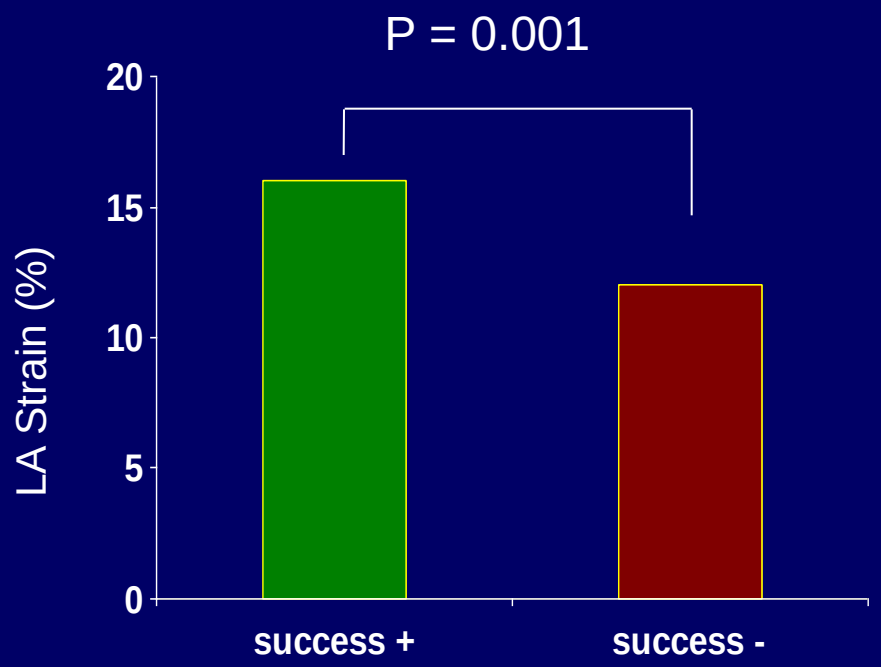


Strain imaging

↓

Active deformation of the LA

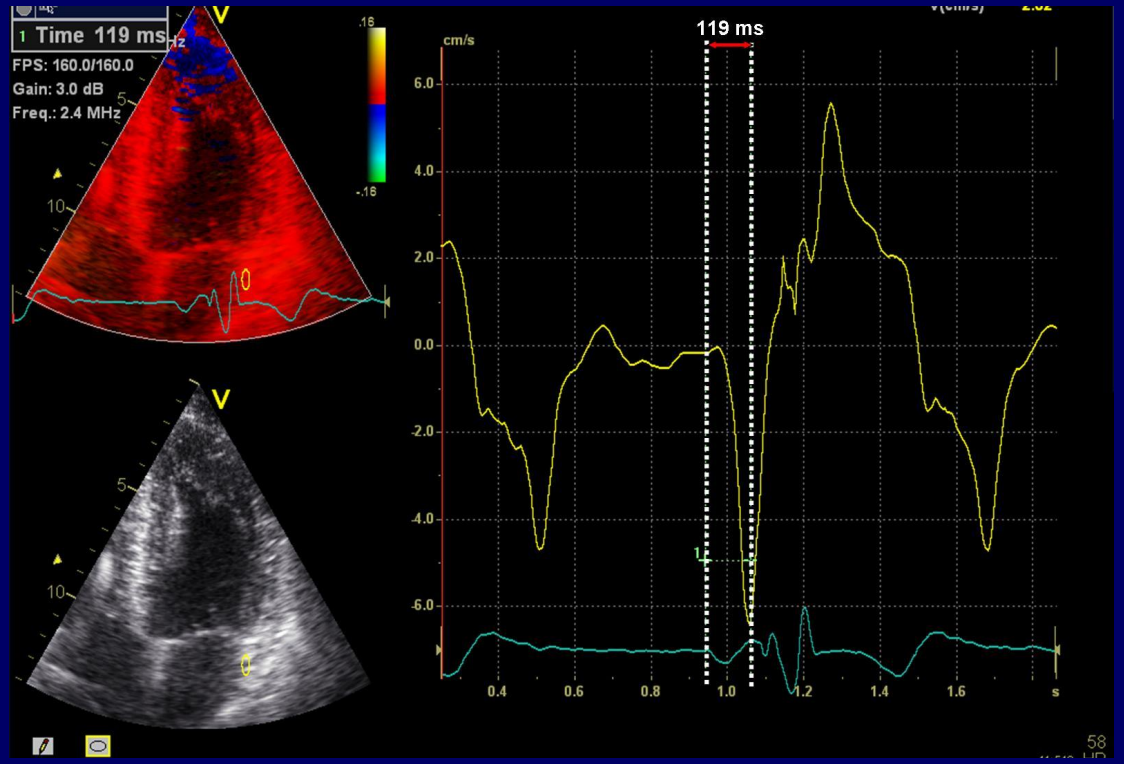
LA strain at baseline



Remodeler
↓LA_{max} ≥15%

Non-remodeler
↓LA_{max} <15%

Left atrial electro-mechanical properties



TDI

↓

Total atrial conduction time (PA-TDI)

↓

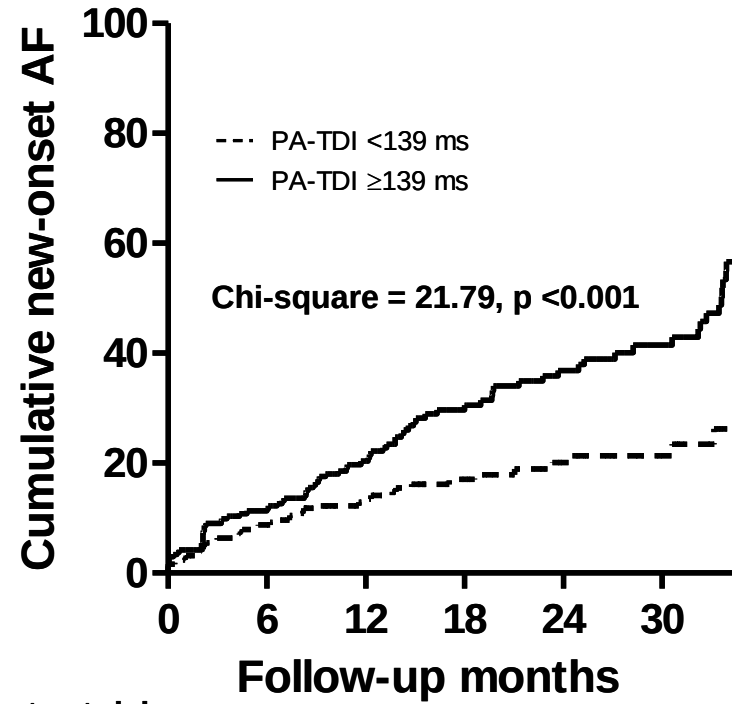
Time interval from the onset of the P-wave to the A'-wave peak

- PA-TDI as predictor of new onset AF in heart failure patients

N = 495

79% male

21% previous paroxysmal AF



Number of patients at risk:

PA-TDI duration <139 ms	253	226	140	94	66	38
PA-TDI duration ≥139 ms	242	193	133	83	64	43

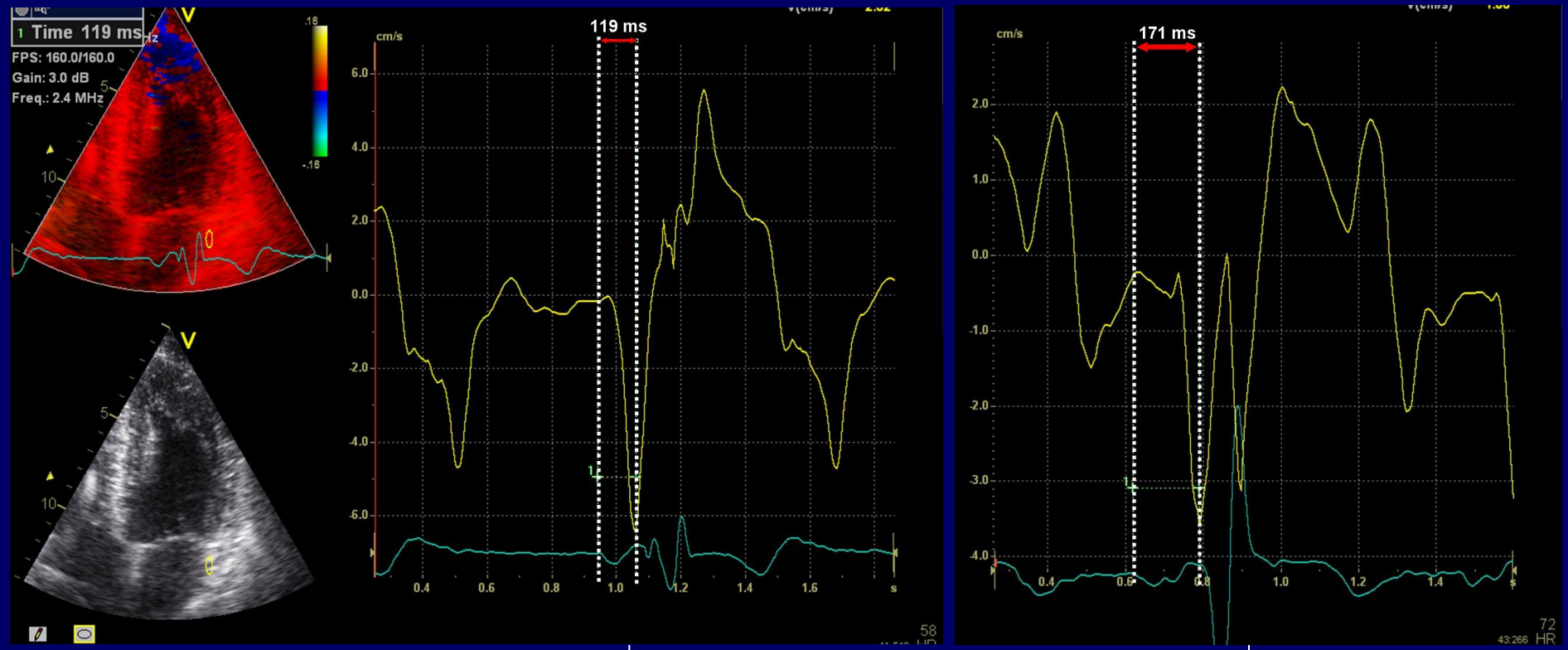
PA-TDI

HR: 1.01 (1.01-1.02)

P<0.001

Patient 1

Patient 2

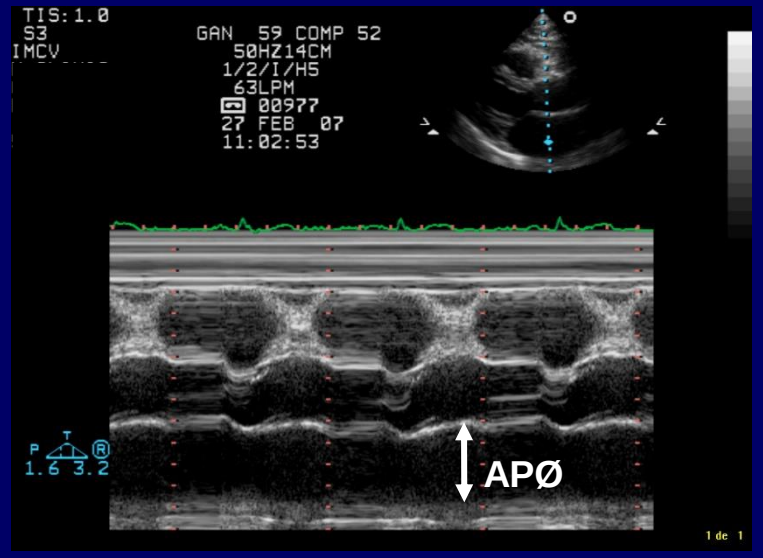


No AF

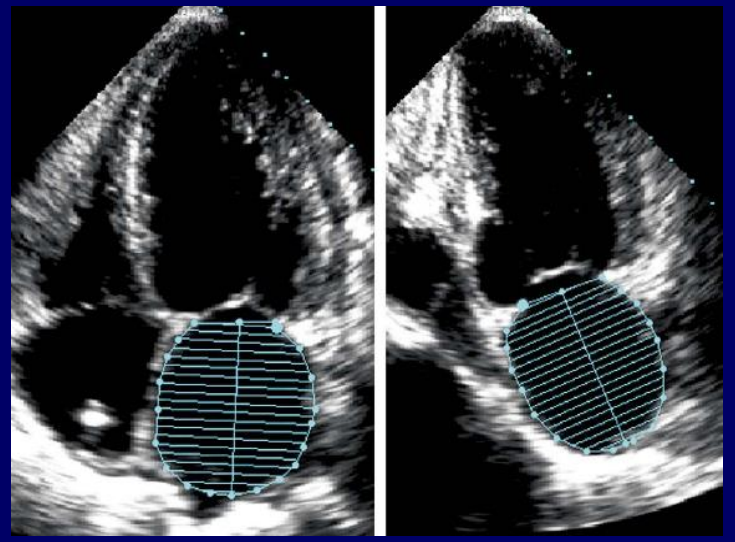
New onset AF

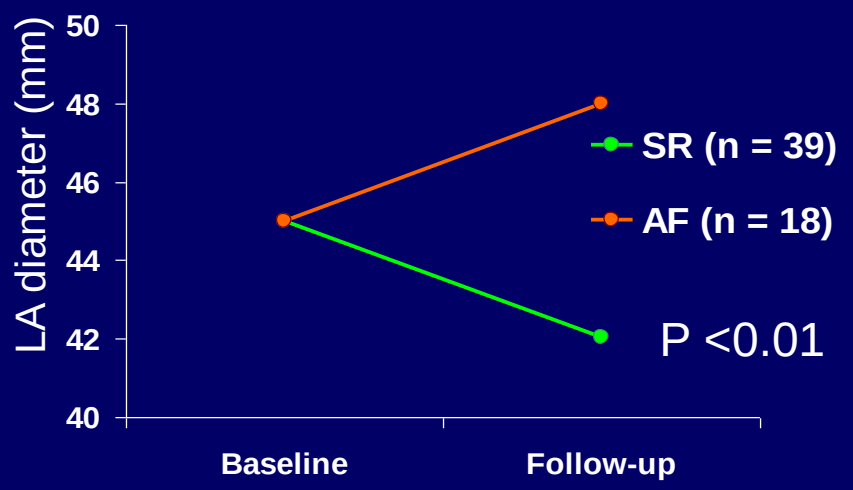
1. Assessment of substrate for AF ☞Prediction of successful RFCA
    - LA enlargement
    - LA fibrosis:
        - Mechanical consequences
        - Electrical conduction heterogeneities
2. Evaluation of successful RFCA on LA and LV performance

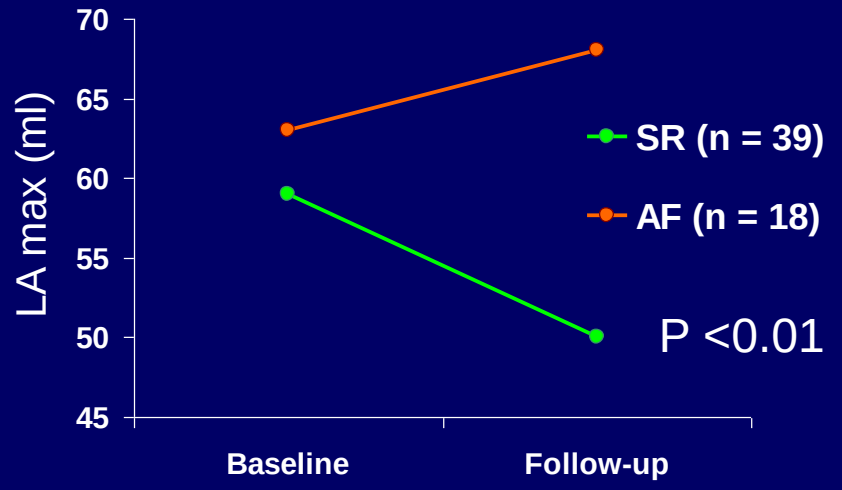
LA linear dimensions



LA volumes



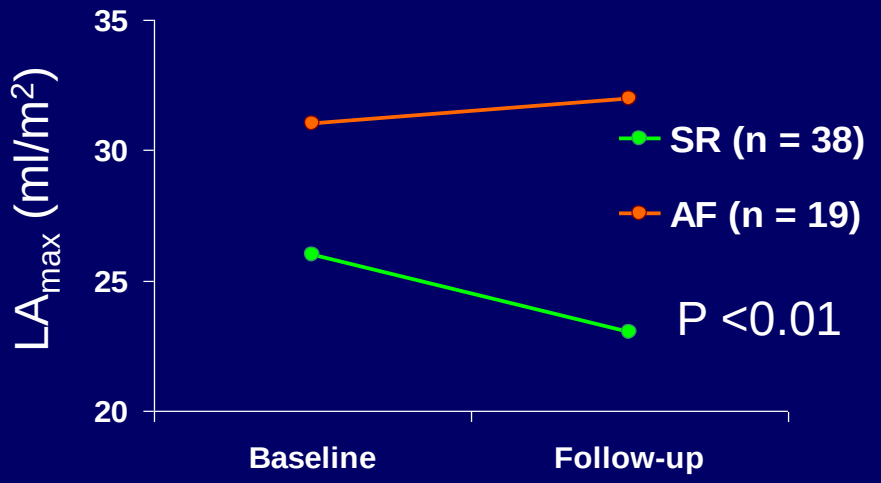


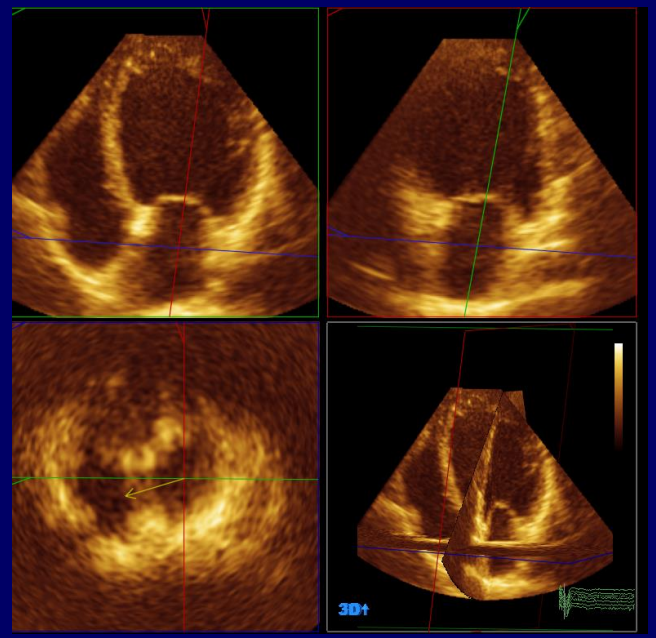


Tops et al. AJC2005

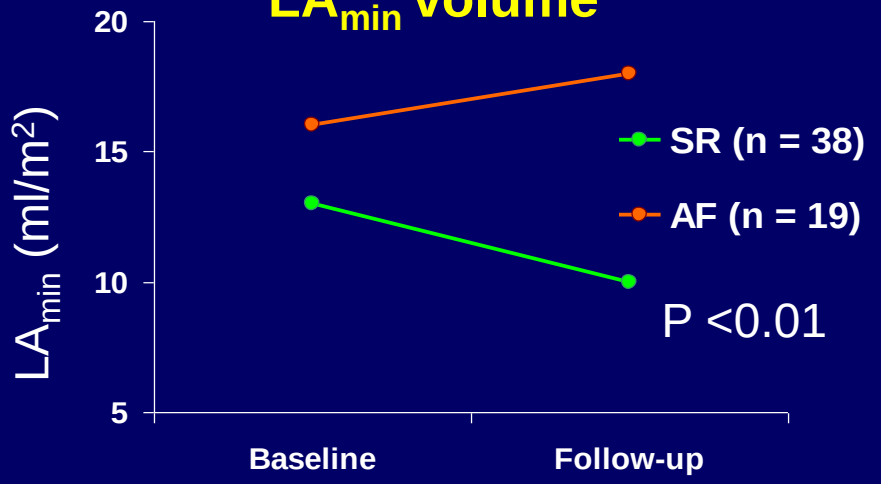
Real-time 3D Echocardiography

LA_{max} volume

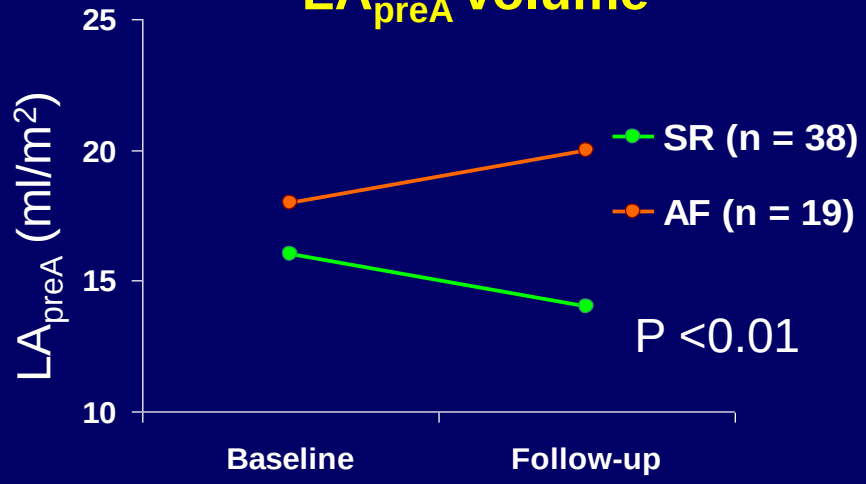




LA_{min} volume

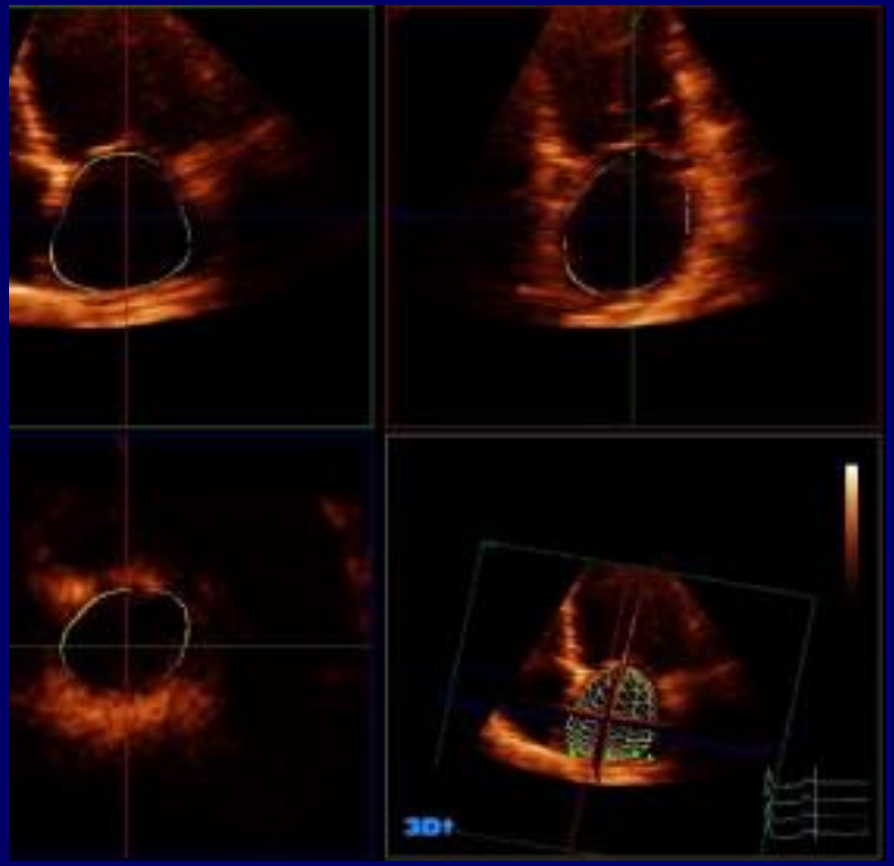


LA_{preA} volume



Ajmone Marsan et al. AJC2008

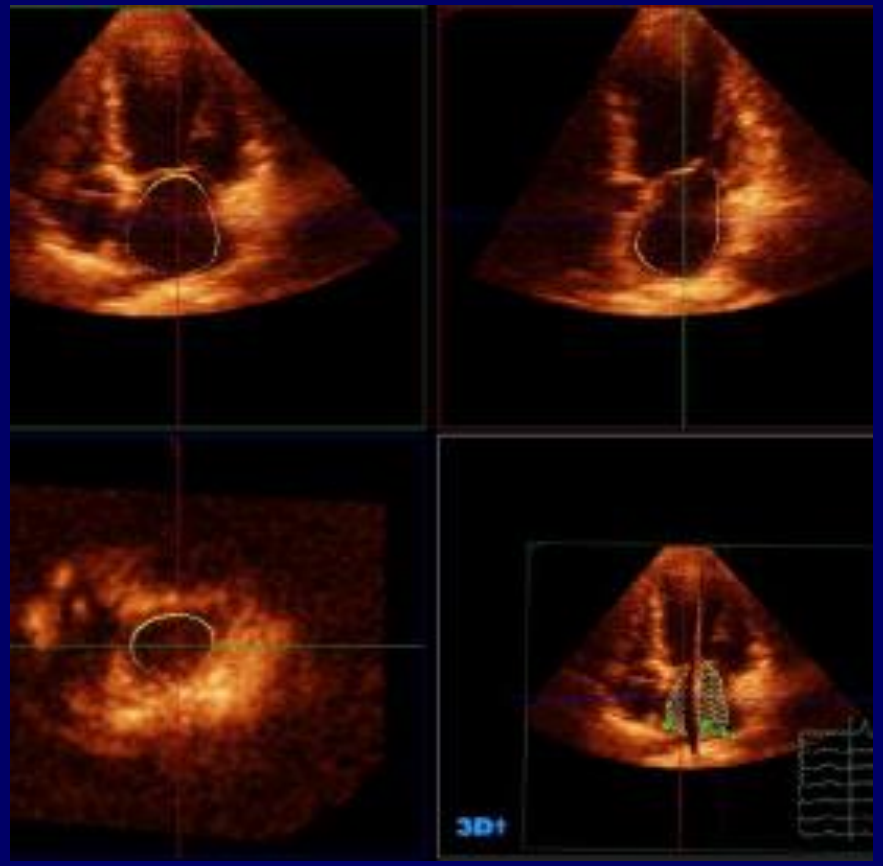
Baseline



LA maximum volume: 51 ml

LA minimum volume: 35 ml

3 months after RFCA



LA maximum volume: 42 ml

LA minimum volume: 25 ml

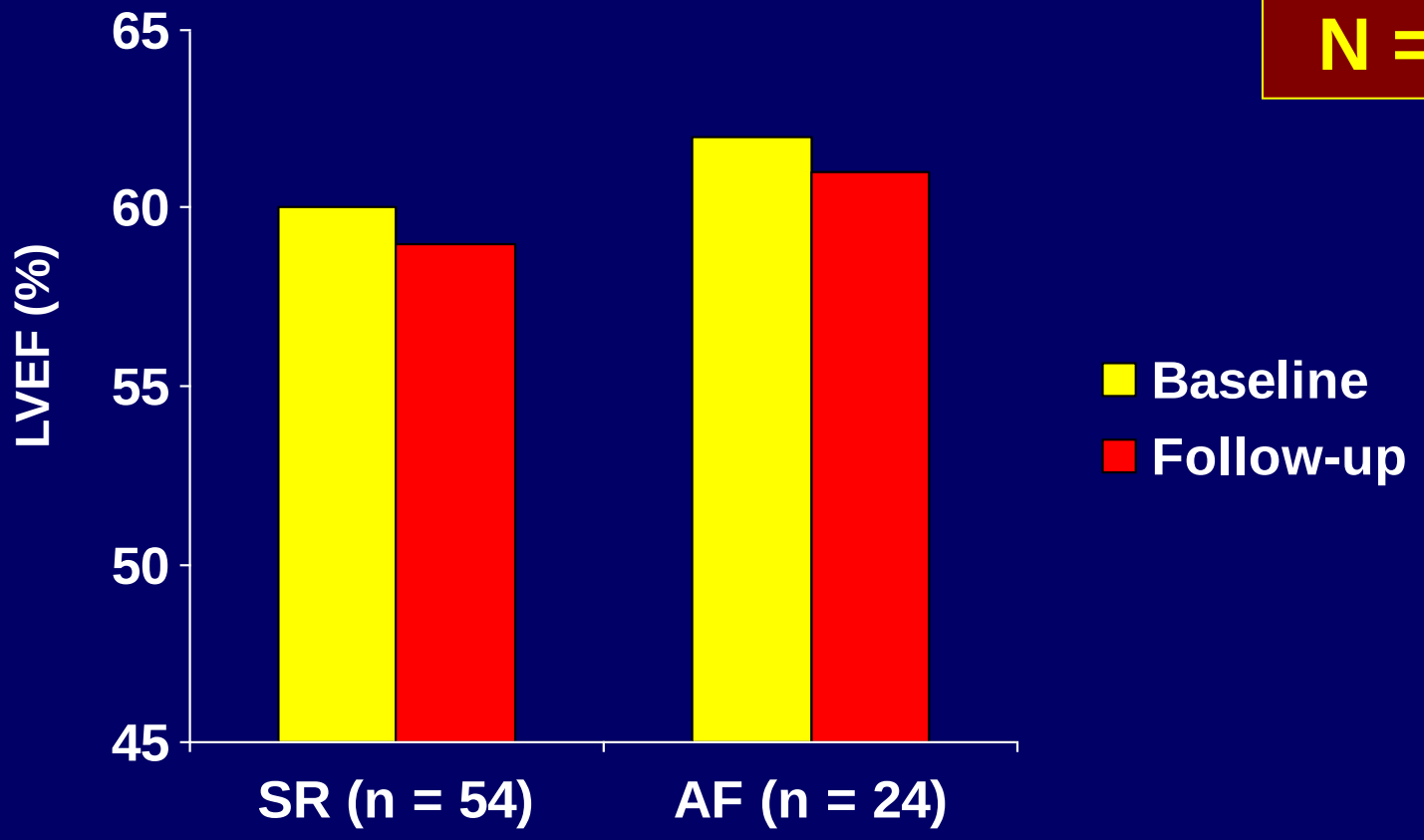
LV mechanics

N = 78
80% male

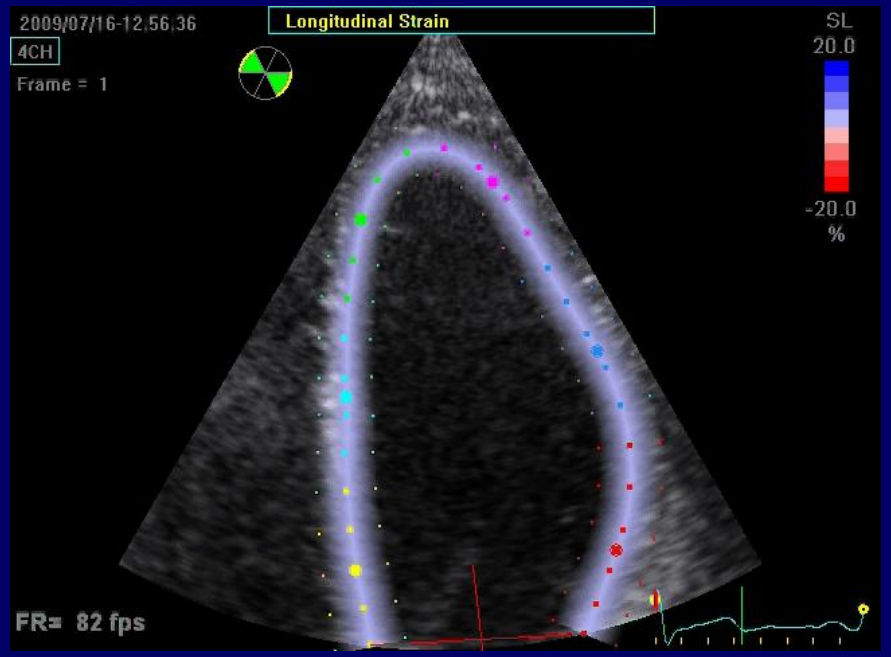
RFCA

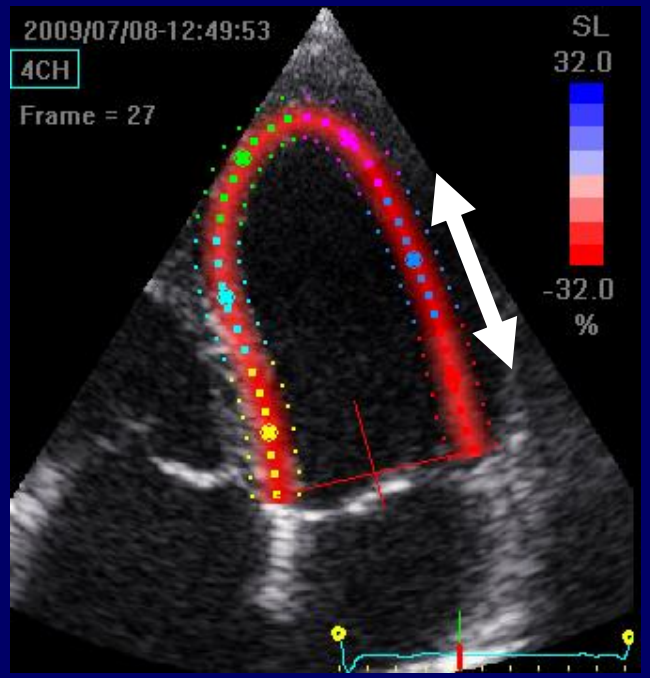
SR
N = 54

AF
N = 24



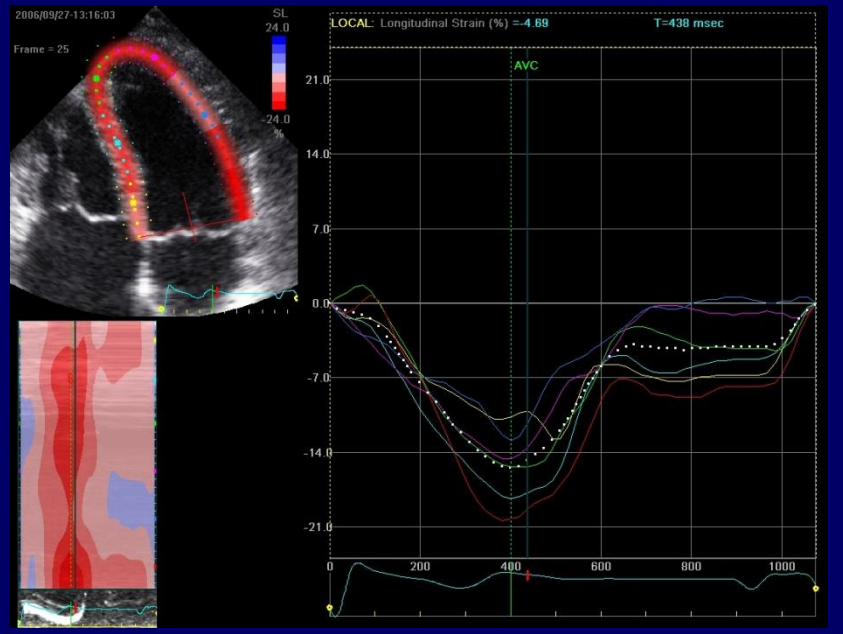
Tops et al. Circ A&E 2009

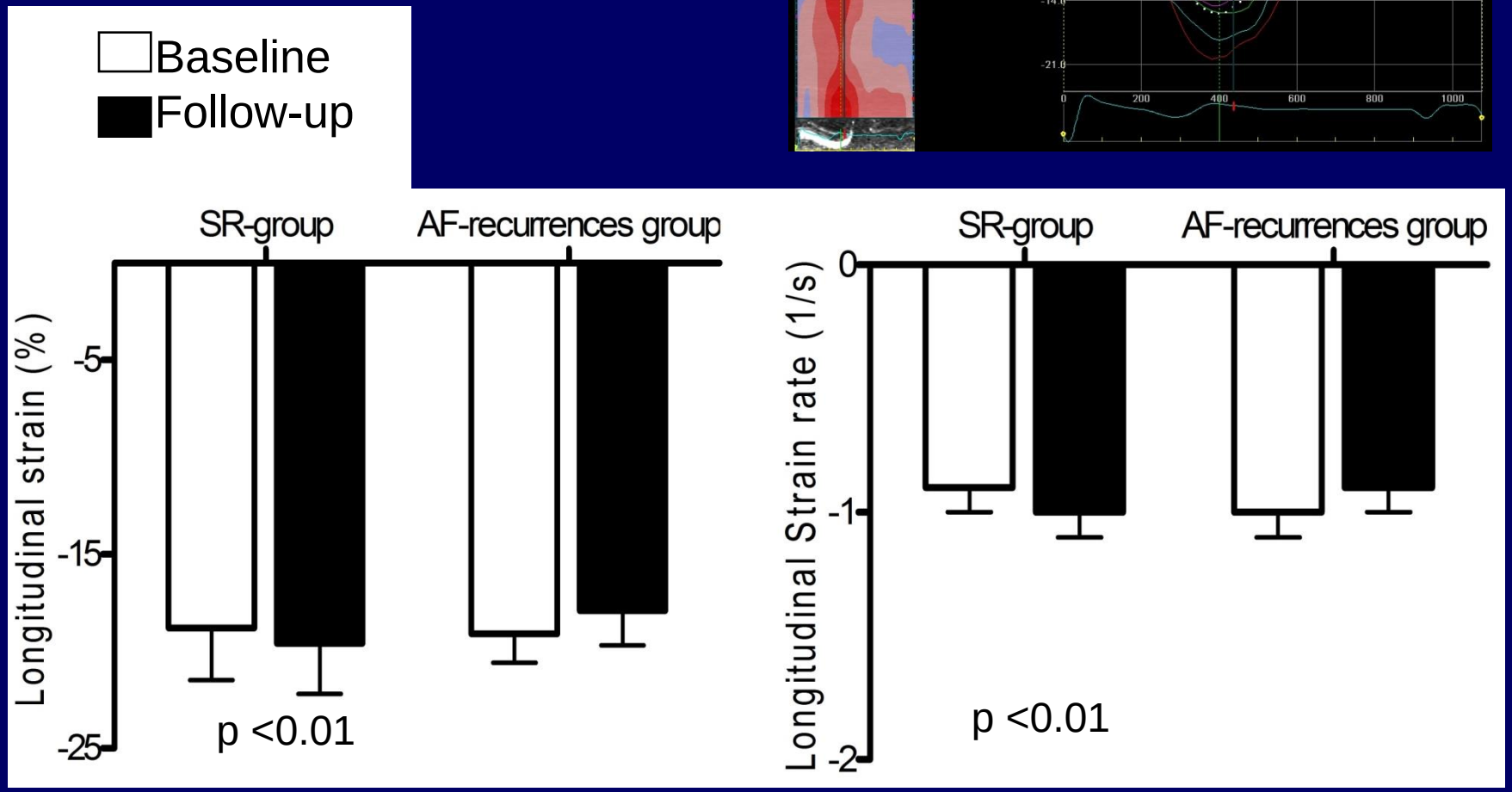




Longitudinal strain

Changes in Longitudinal strain/Sr according to the response to RFCA

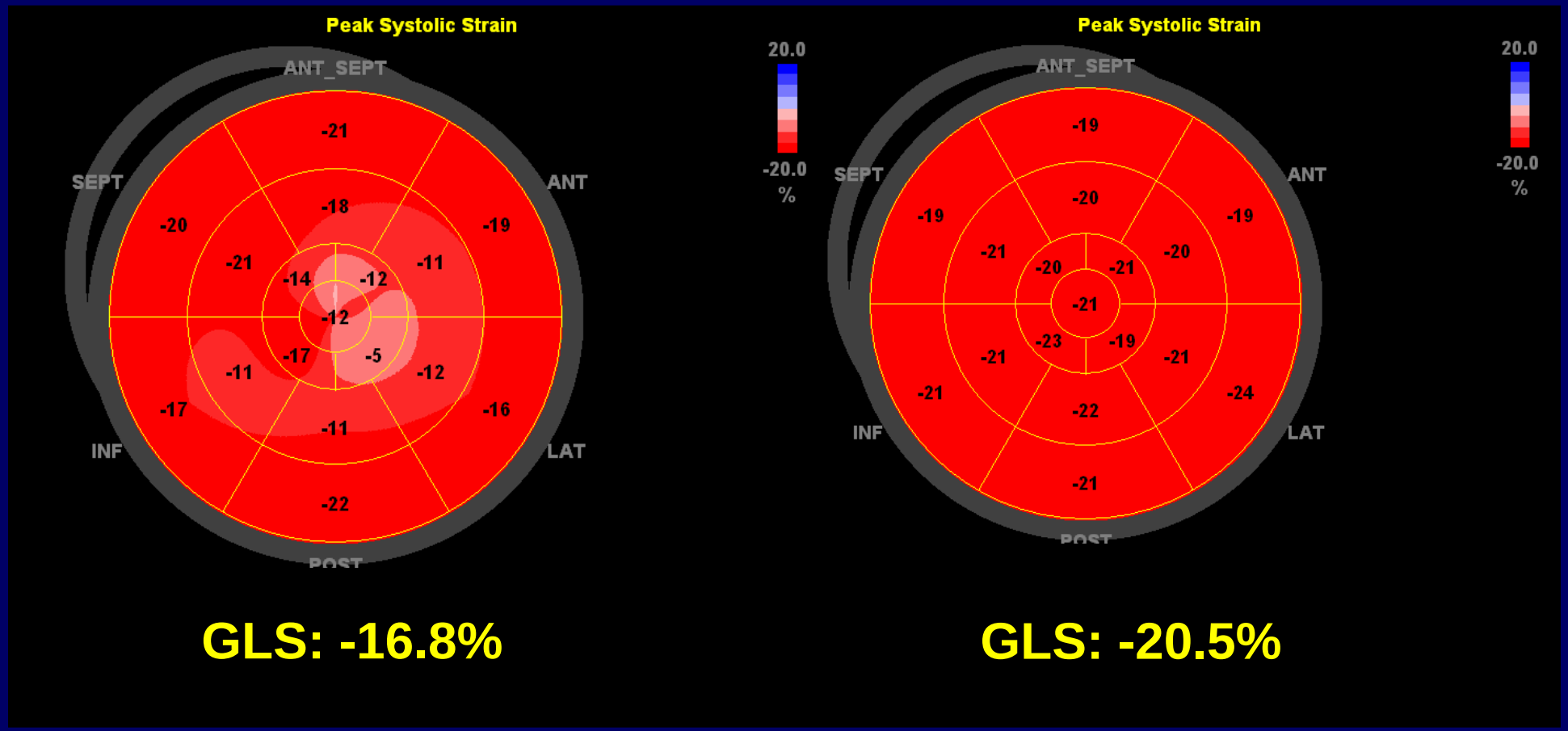




Baseline **Follow-up**

Comparable LV performance?

Baseline



GLS: -16.8%

Follow-up

GLS: -20.5%

Imaging in AF

1. LA size, function and fibrosis important for predicting successful RFCA
2. Evaluation of LA and LV performance after RFCA

We need anatomic and functional imaging