

Catheter Ablation of Atrial Fibrillation



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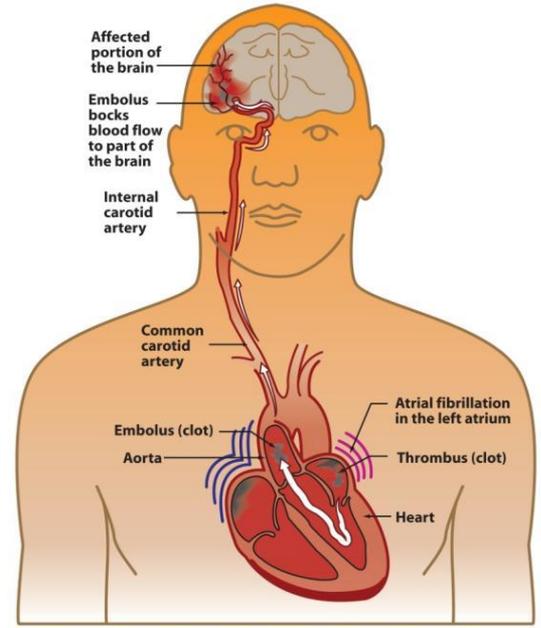
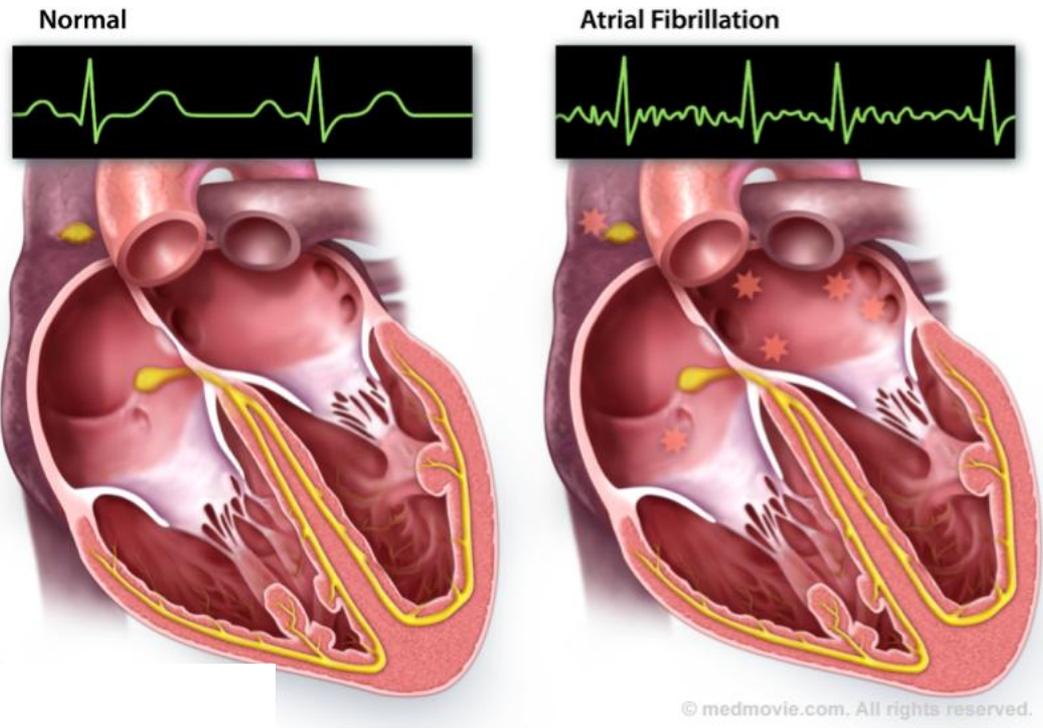
February 13, 2013



UniversitätsSpital
Zürich



Atrial Fibrillation



- **5-6% of population \geq 60 y**
- **5x increased risk for thrombo-embolism (stroke)**
- **Antiarrhythmic drug therapy often not successful**

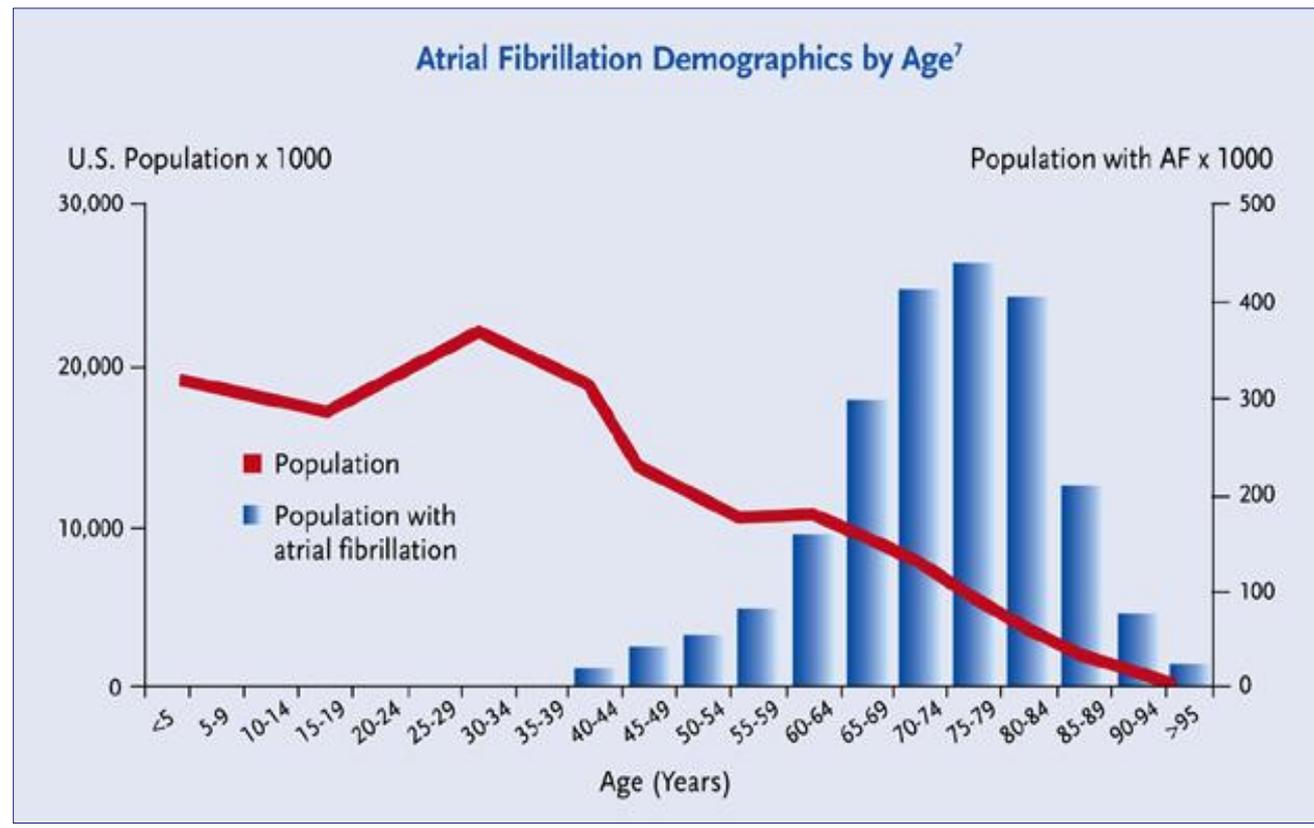
Feinberg WM et al. Arch Intern Med 1995

Wolf et al. Stroke 1991

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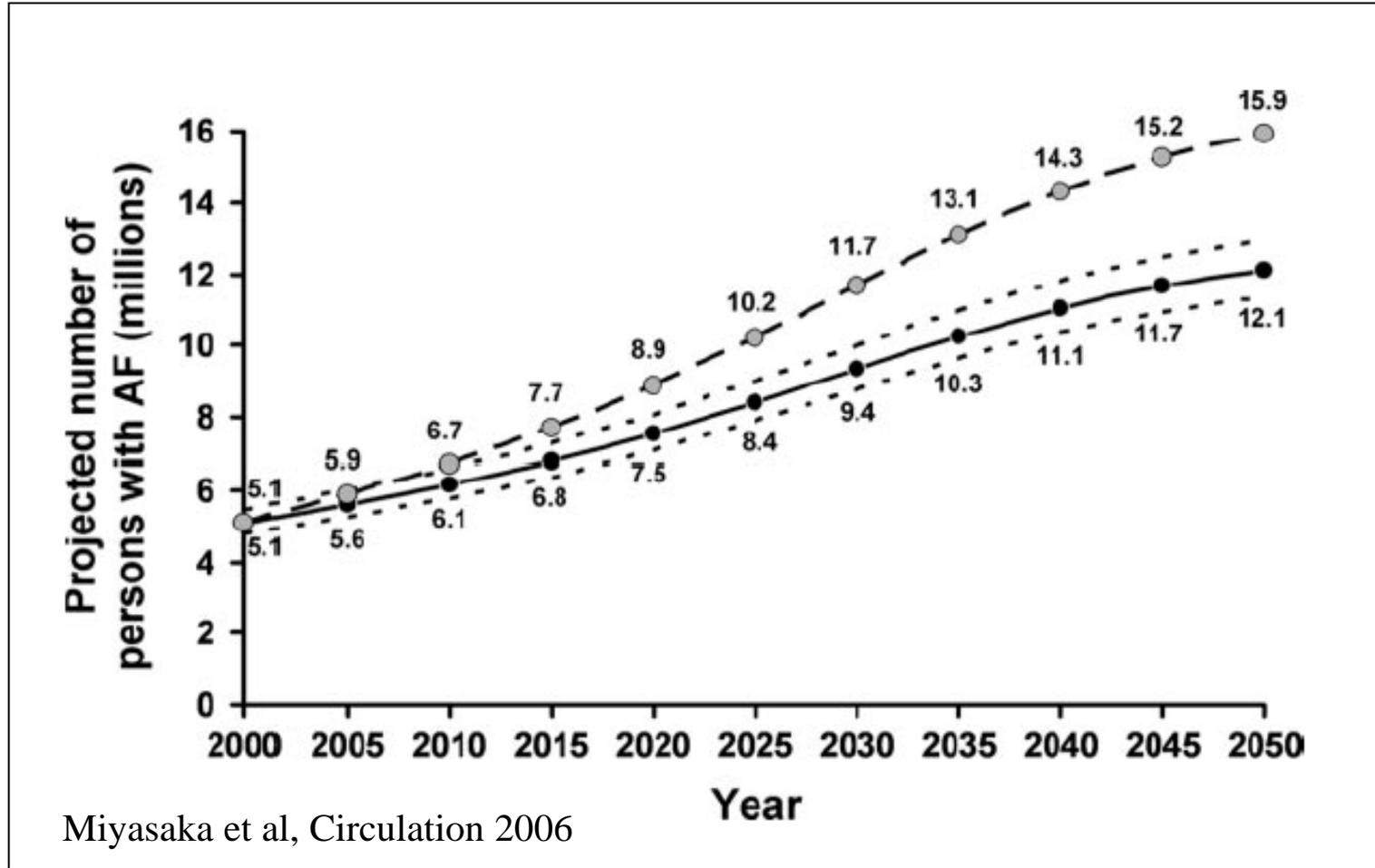
Atrial Fibrillation

Increased prevalence in the elderly



Feinberg WM, Blackshear JL, Laupacis A. Arch Intern Med. 1995;155:469-473

Growing Epidemic of Atrial Fibrillation



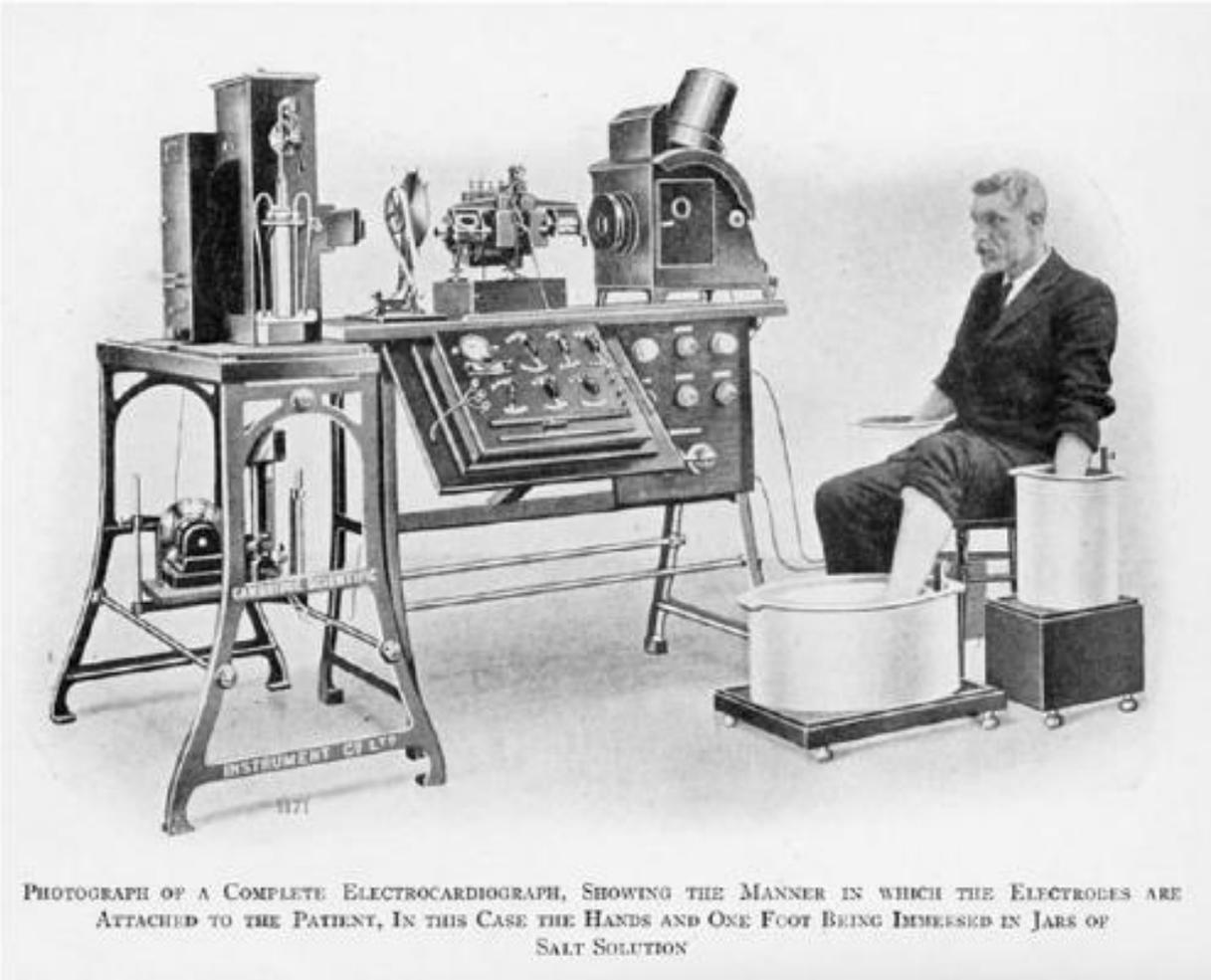
Miyasaka et al, Circulation 2006

Willem Einthoven and Sir Thomas Lewis

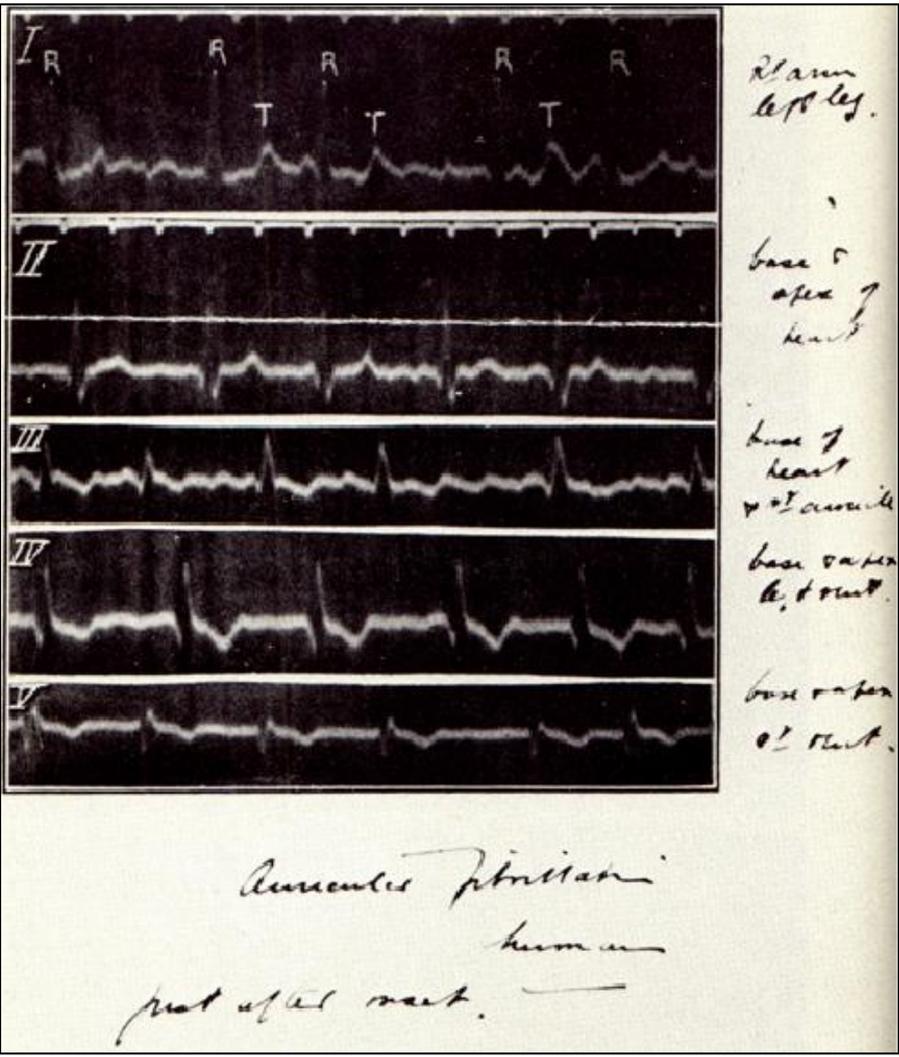


The first ECG in 1903

Willem Einthoven (Leiden/NL)



First ECG Documentation of „Auricular“ Fibrillation



*“Dear Professor Einthoven,
By this post I am sending you some
curves, experimental and clinical.
Please treat the curves I send as if they
were your own.”*

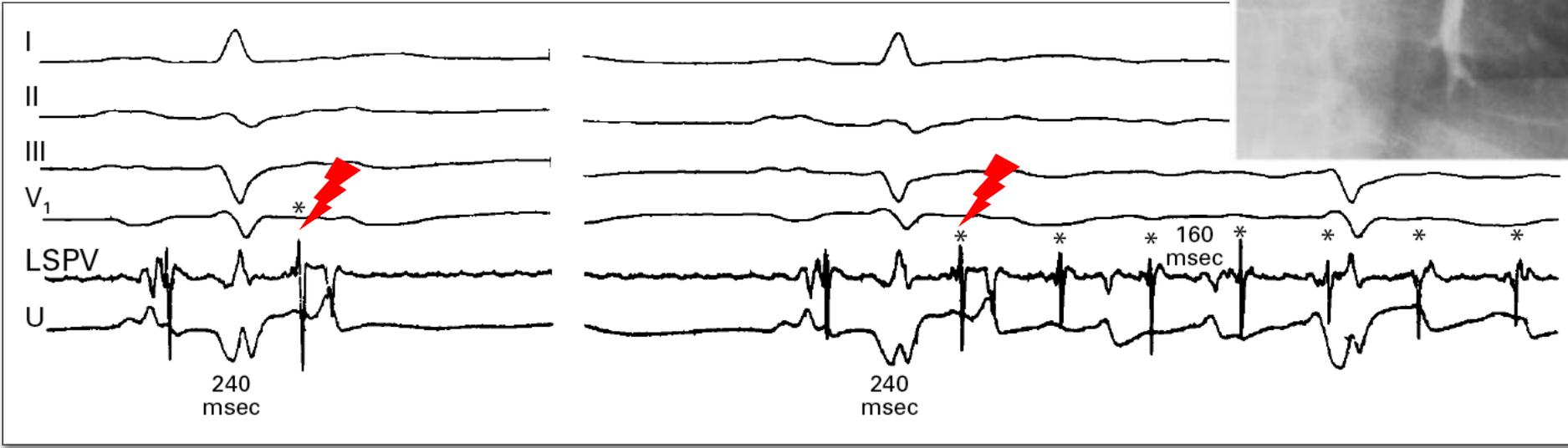
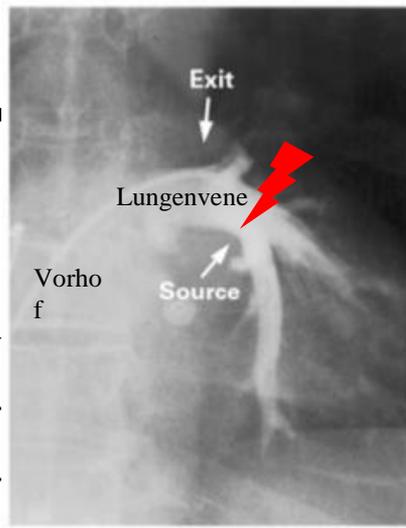
*Sir Thomas Lewis,
London, January 30, 1910*

The Nature of Auricular Fibrillation

Definition:

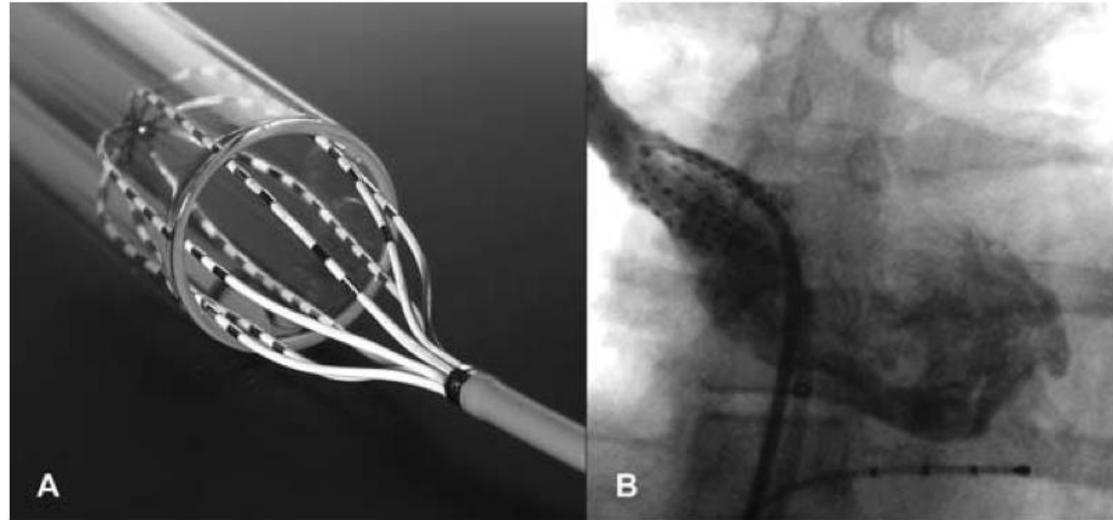
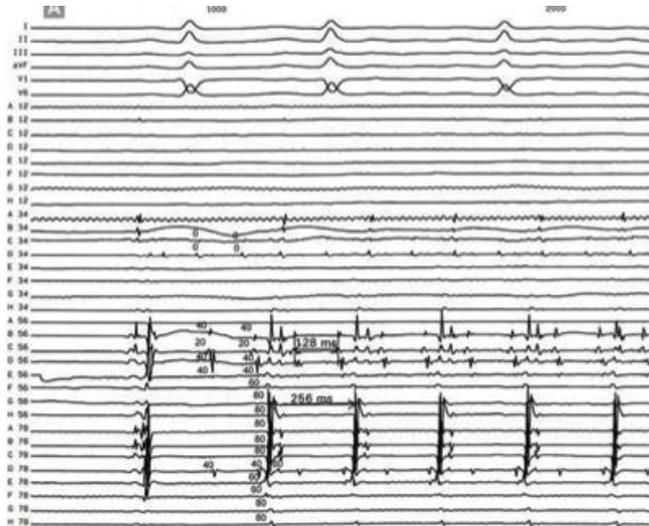
“conspicuous and continuous oscillations of varying form and dimensions, and of auricular origin, in ECG leads from the limbs.”

Pulmonary Vein = Trigger



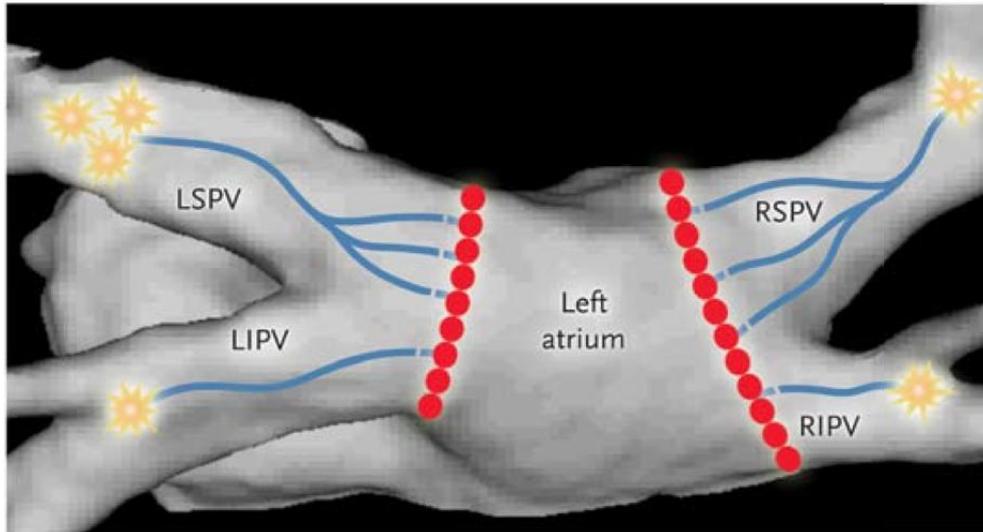
Extrasystole from pulmonary vein → Initiation of atrial fibrillation

High-Density Mapping of Pulmonary Veins



- Intracardiac registration with 64-poles **Basket-Catheter** (35 Pts)
- **Short coupling interval** of extrasystole from pulmonary vein induces **atrial fibrillation**

Goal of AF Ablation: Electrical Isolation of Pulmonary Veins



Posterior view
Left atrium and pulmonary veins

Muscle fibers = electrical connection between left atrium and pulmonary veins



Catheter ablation of muscle fibers with radiofrequency energy



Electrical isolation of pulmonary veins

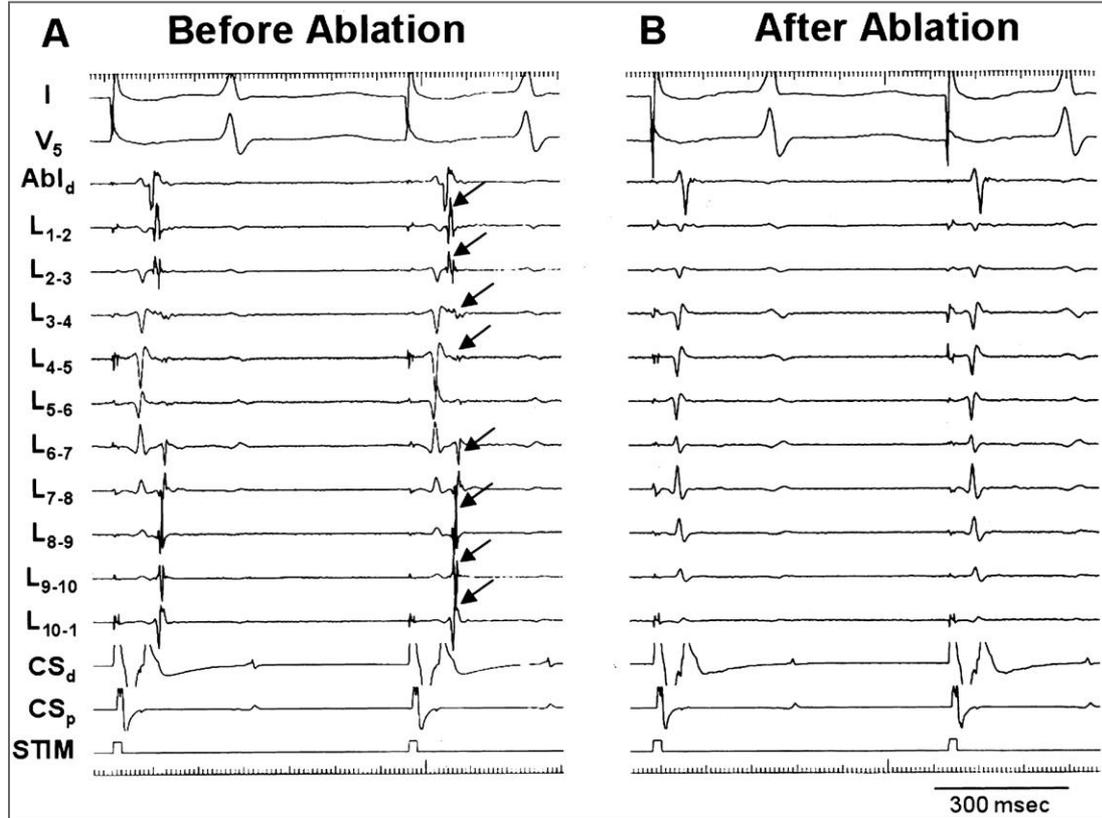
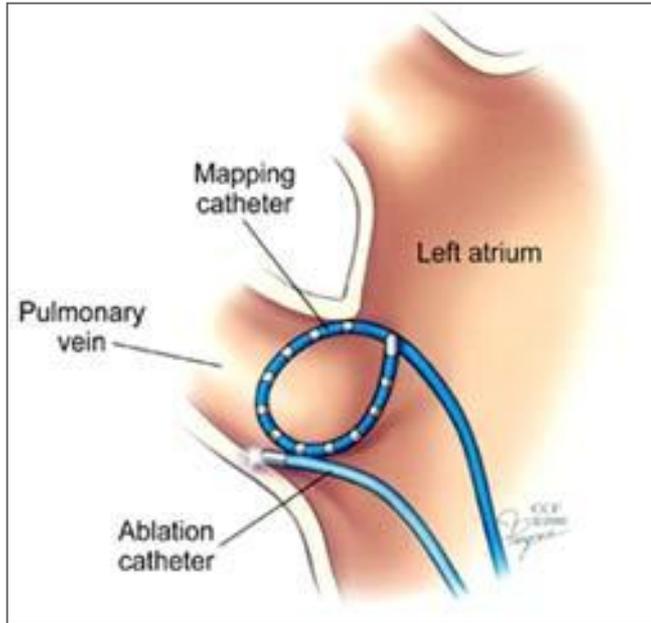
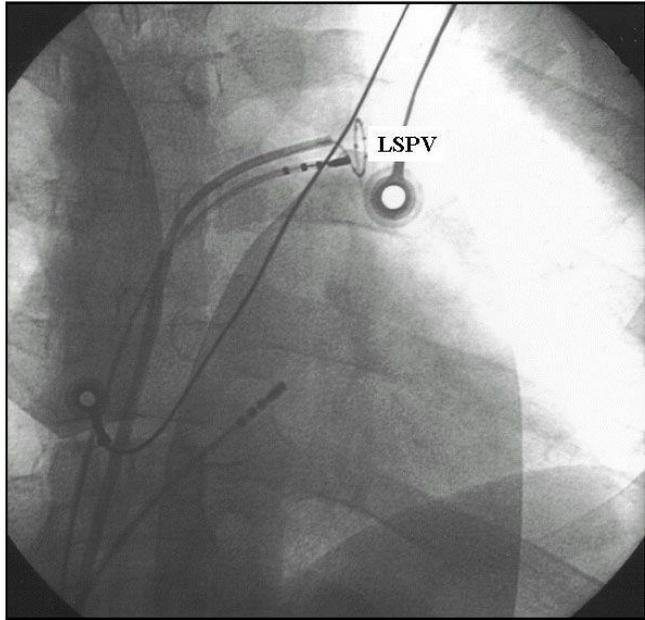
Steerable Ablation Catheter (uni-/bi-directional)



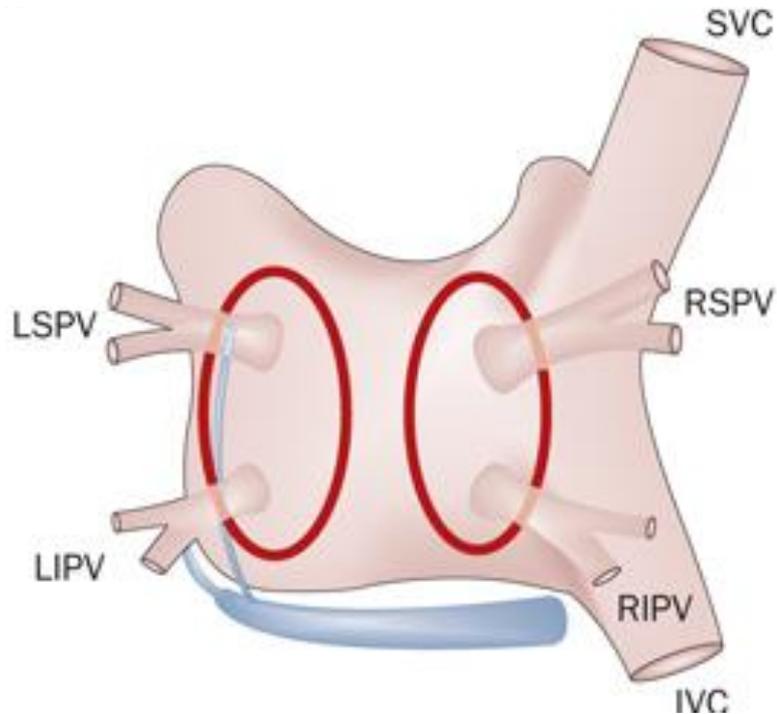
Circular Mapping Catheter



Procedural Endpoint: Pulmonary Vein Isolation



Pulmonary Vein Isolation: Cornerstone of AF Ablation



- Point-by-point RF lesions
- Encircling 2 left and 2 right PVs
- Irrigated RF ablation catheter
- Circular mapping catheter
- 3-dimensional mapping system
- Integration of pre-acquired MRI/CT image of left atrium/PVs

Calkins H et al. HRS/EHRA/ECAS expert consensus statement on catheter ablation and surgical ablation of atrial fibrillation. Heart Rhythm 2012.

Targeted Myocardial Injury by Ablation

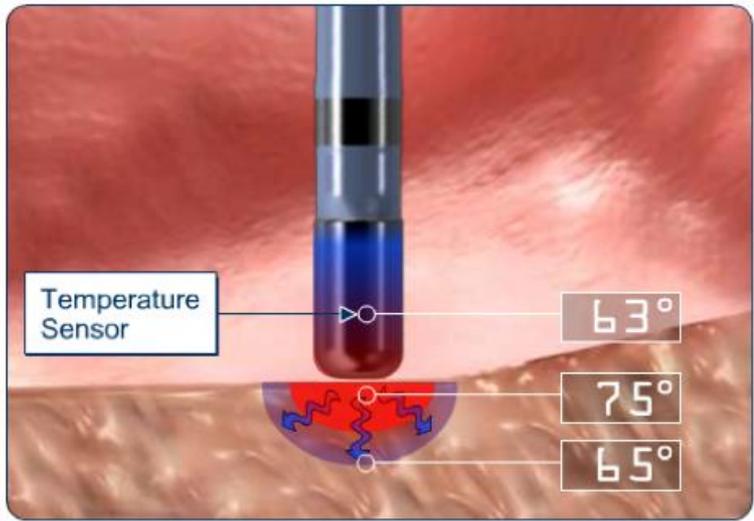


Table 1 Troponin T elevation in all patients vs. patients receiving a direct current cardioversion

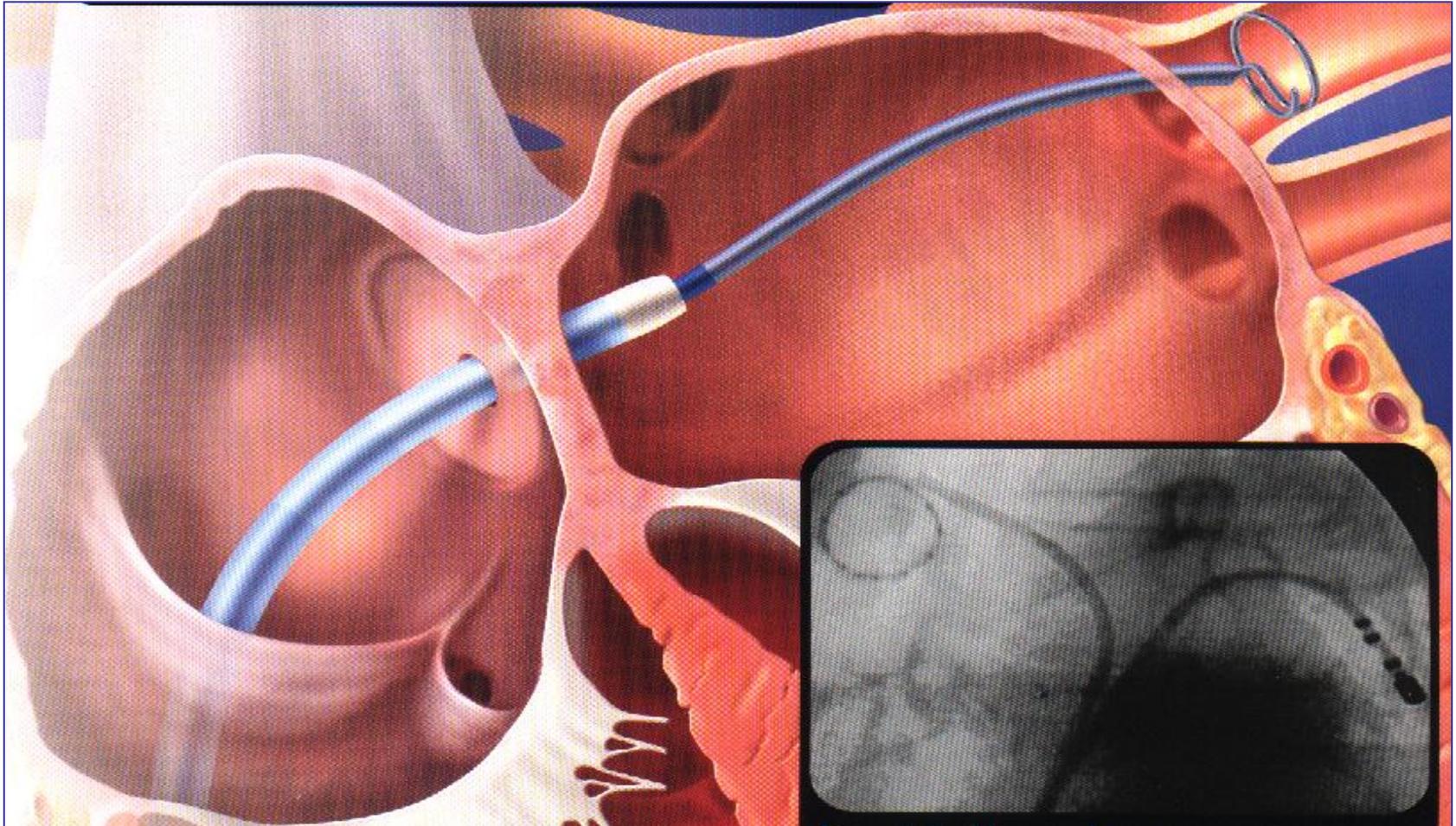
	Number patients	Mean troponin T (μg/L)	
		Pre-procedure (n = 30)	Post-procedure (n = 60)
All patients	60	<0.01	0.85 ± 0.34
Patients with DCCV	12	<0.01	0.67 ± 0.28*

DCCV, direct current cardioversion.
 *P > 0.05 (patients with DCCV vs. all patients)

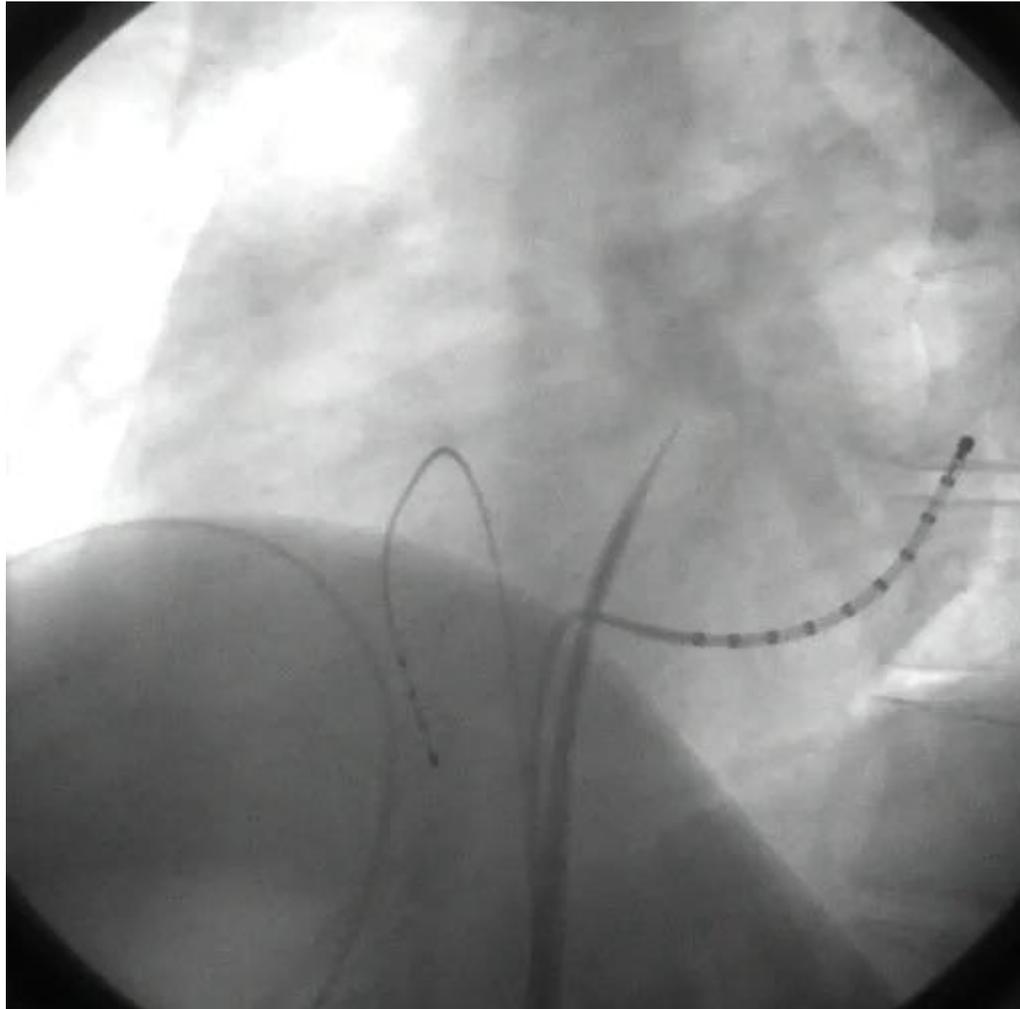
20x increased troponin T after AF ablation

Transseptal Puncture

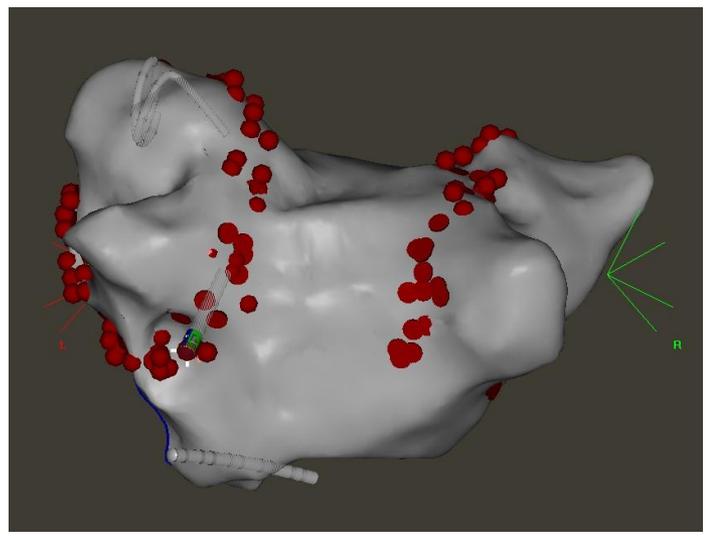
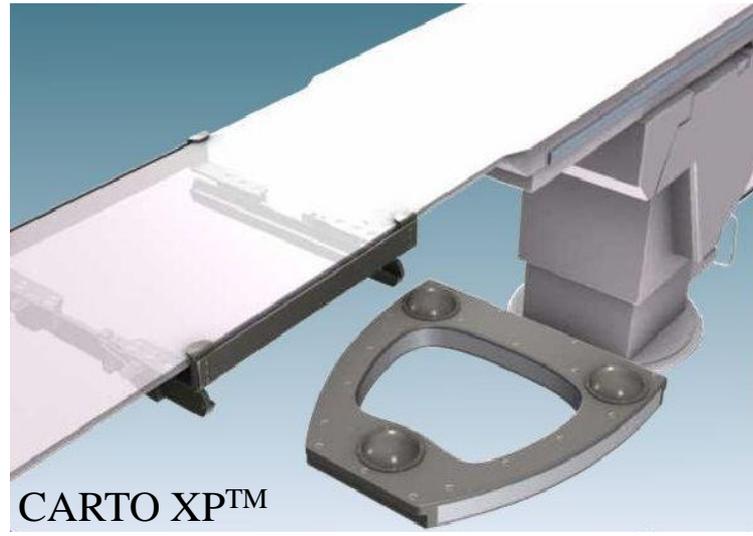
„Door“ to the left atrium and the pulmonary veins



Transseptal Puncture

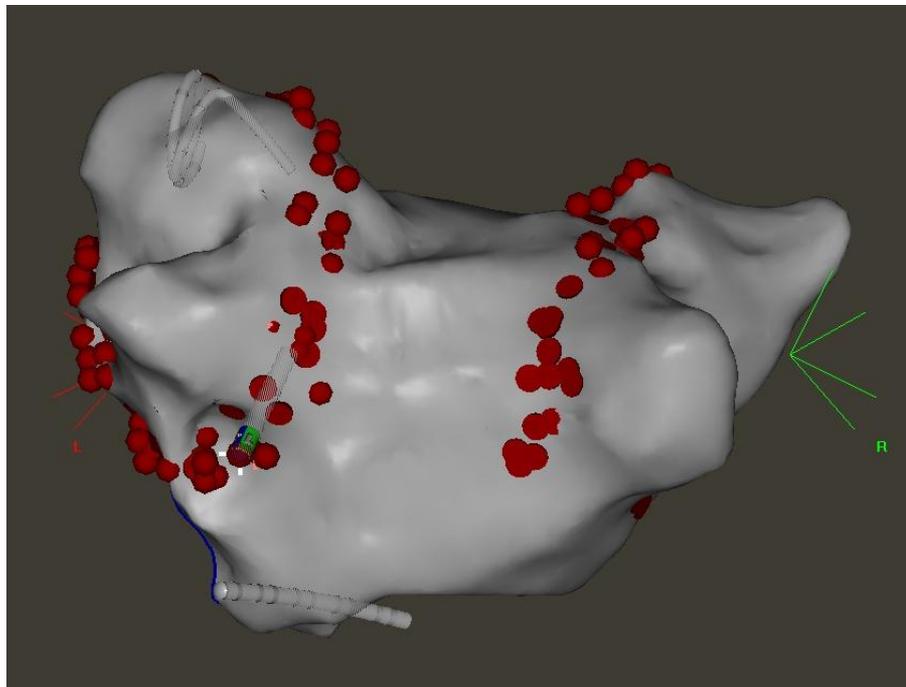


Electro-Anatomical Mapping System *„GPS Navigation System in the Heart“*

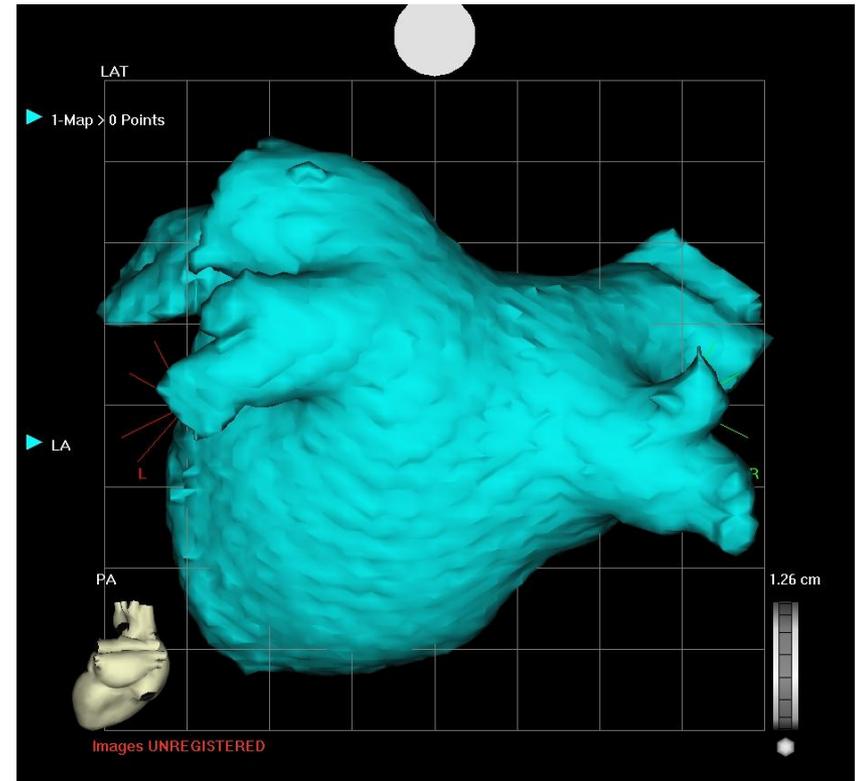


3D-Mapping and Image Integration

CARTO™

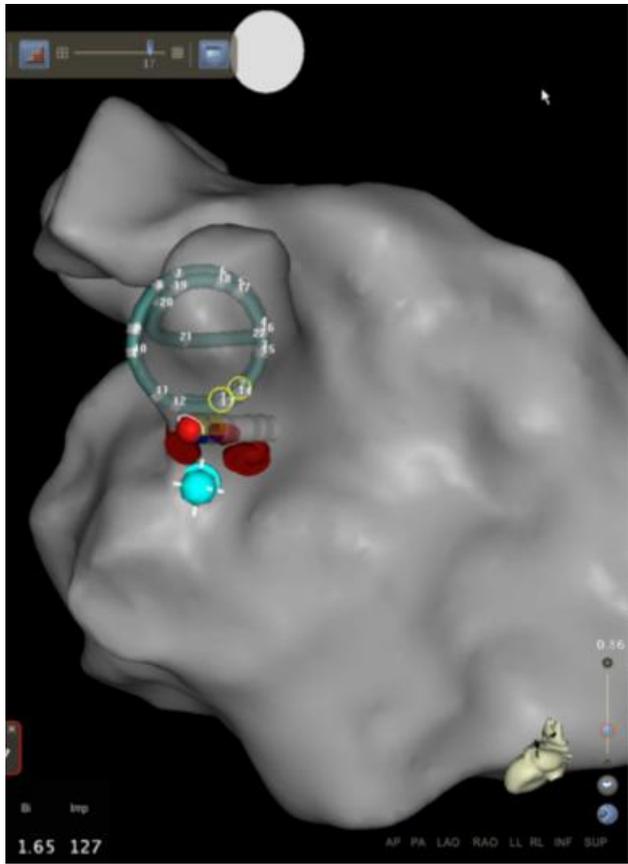
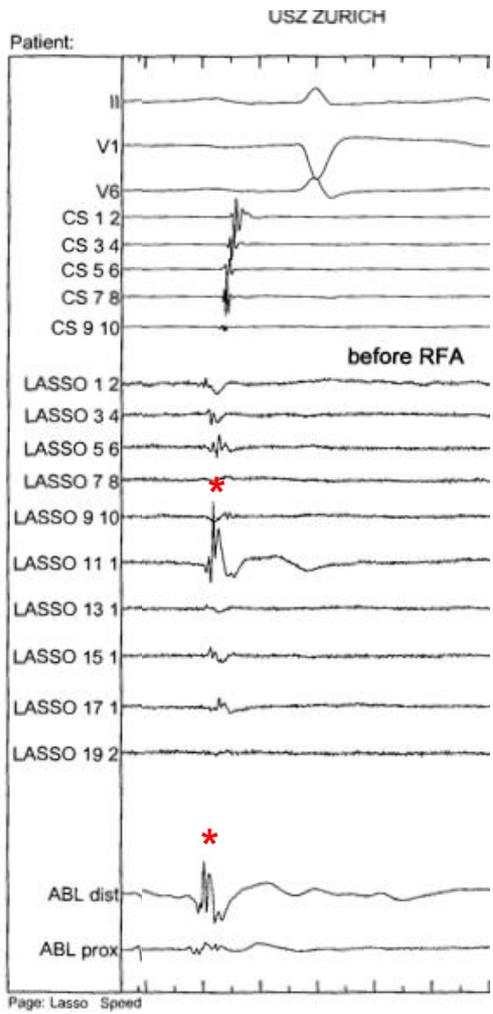


Posterior view



MRI/CT

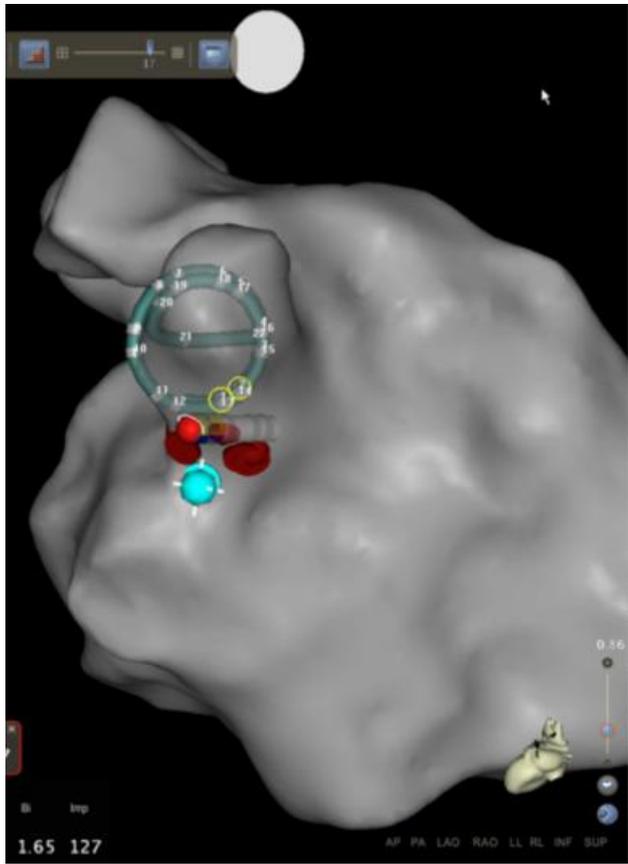
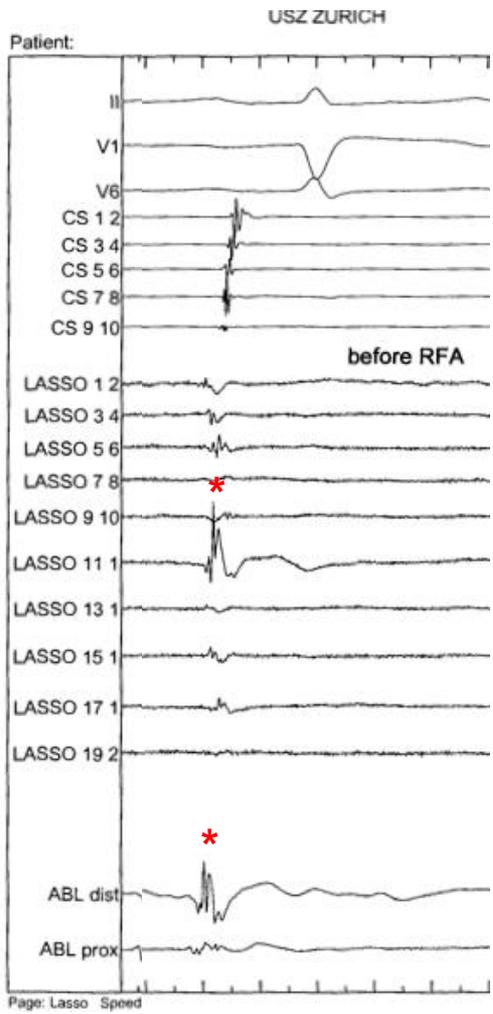
Electrical Isolation of Pulmonary Veins



Posterior View

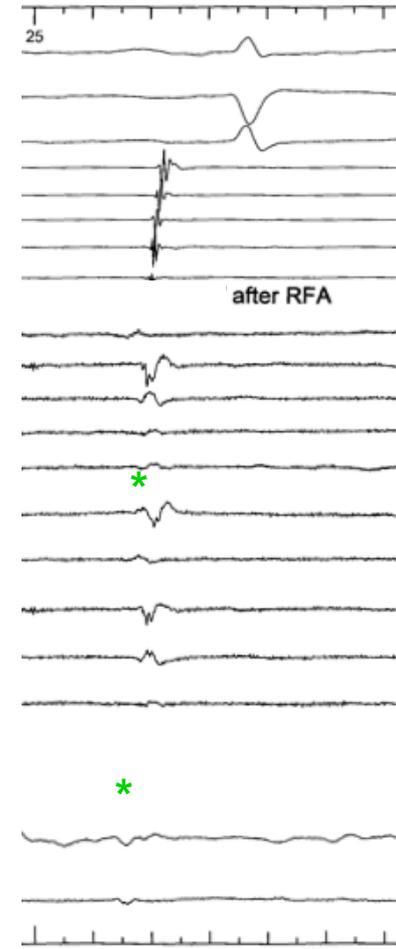
Left lower pulmonary vein

Electrical Isolation of Pulmonary Veins



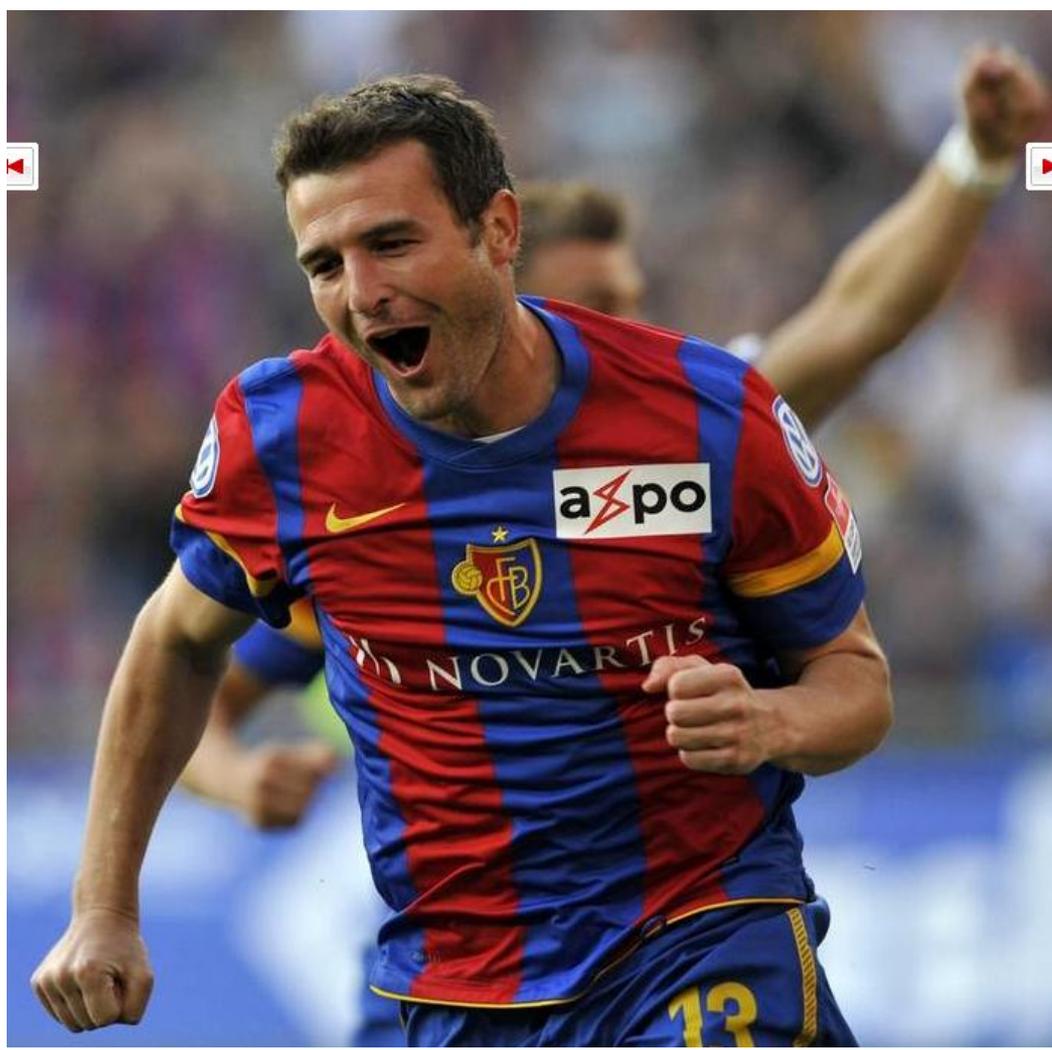
Posterior View

Left lower pulmonary vein

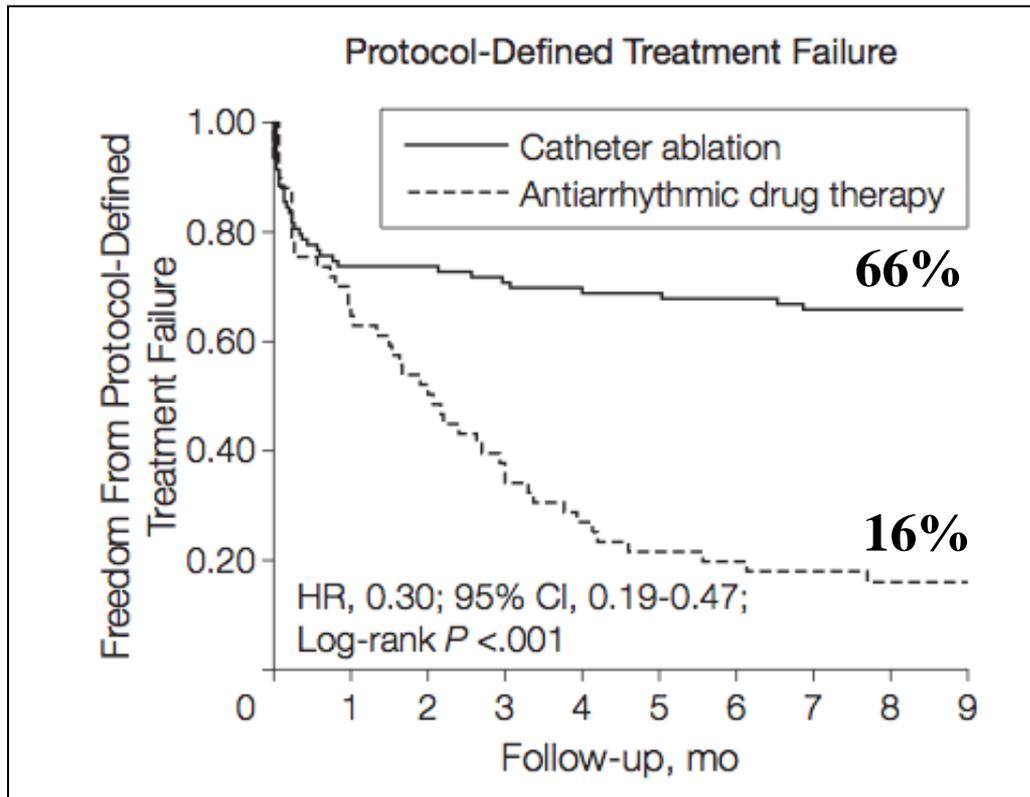




Success Rates ?



RF Ablation versus AAD



- n=167
- 19 hospitals
- Paroxysmal AF
- ≥ 1 AAD failed

- After 9 months: no AF

- 66% in ablation arm**
- 16% in AAD arm**

- 1 pericardial effusion
- 1 pulmonary oedema
- 1 pneumonia

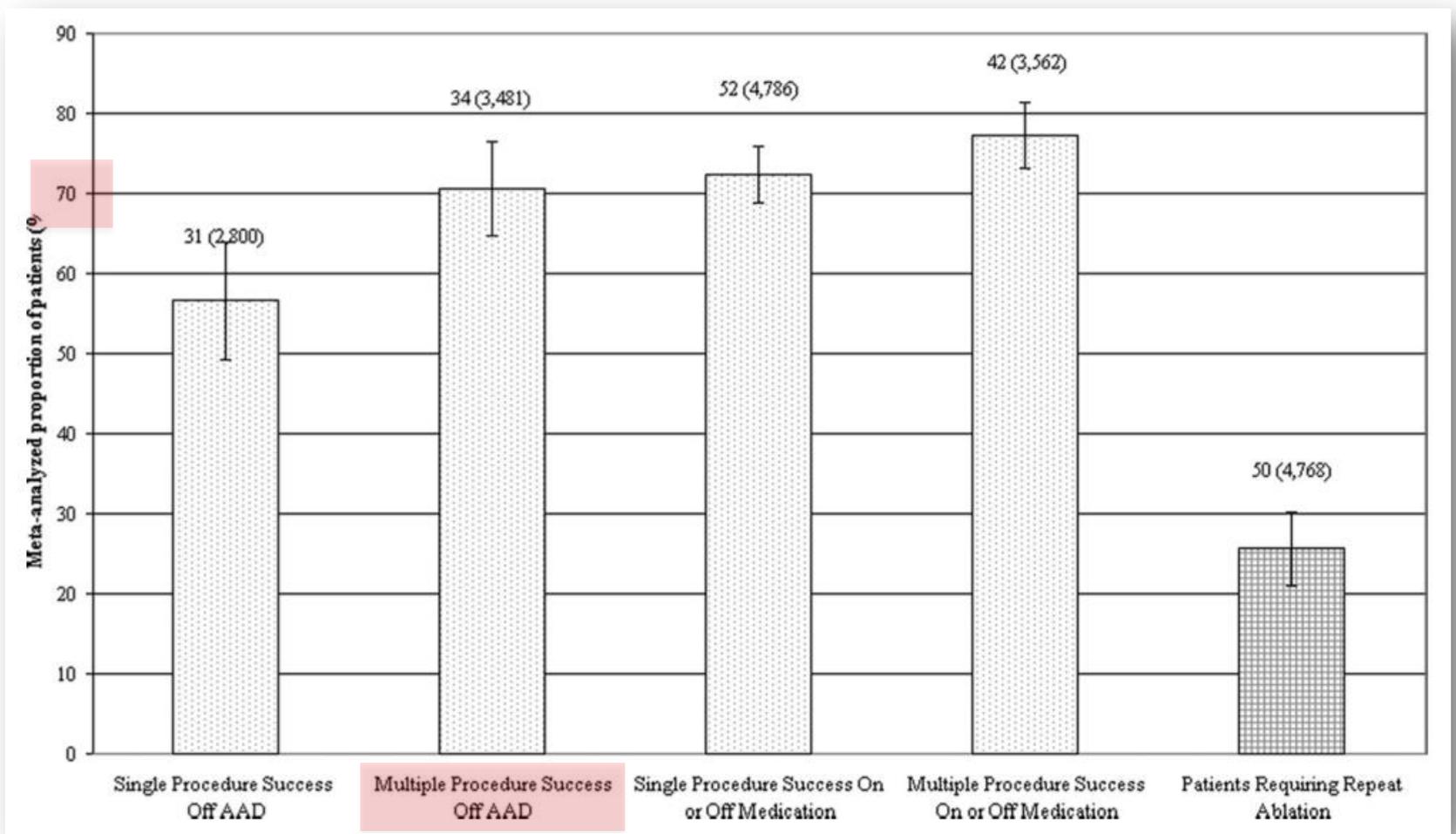
- 2 life-threatening arrhythmia

Wilber DJ et al. Comparison of antiarrhythmic drug therapy and radiofrequency catheter ablation in patients with paroxysmal atrial fibrillation. JAMA 2010; 333-340.

Success Rate of AF Ablation

- **206 patients** (230 procedures, 89% outpatients)
 - 56 years old, 74% male
 - 171 paroxysmal / 35 persistent AF
 - Duration 7.6 years
- **86% with significant reduction (>90%)** of symptomatic AF
- **Complication rate 3%** (1 TIA and 6 pericardial tamponade)

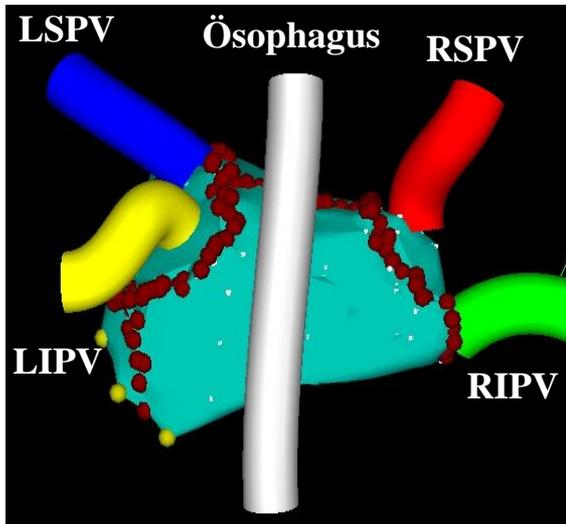
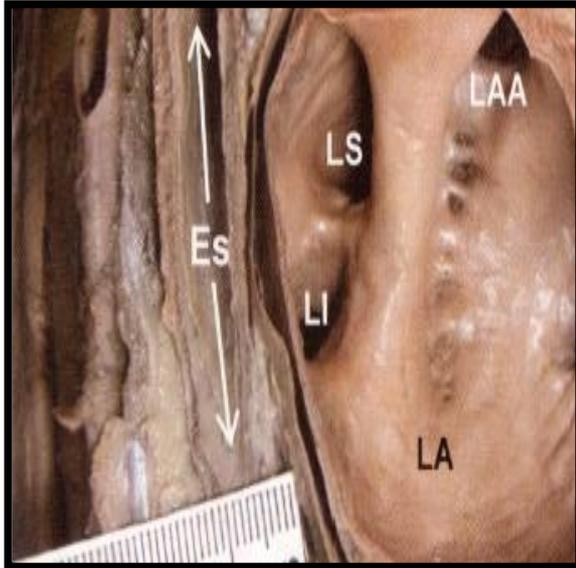
Metaanalysis: Efficacy of AF Ablation



Calkins H et al. Treatment of Atrial Fibrillation With Antiarrhythmic Drugs or Radiofrequency Ablation: Two Systematic Literature Reviews and Meta-Analyses. *Circ Arrhythm Electrophysiol* 2009;;2;349-361



Risks of AF Catheter Ablation



Pericardial tamponade (1-2%)

Percutaneous drainage

Thromboembolism (1%)

TEE beforehand, anticoagulation during and after procedure

Pulmonary vein stenosis (<1%)

Avoidance of ablation inside of PV

Atrio-esophageal fistula (<1:10.000)

Esophageal monitoring during procedure, energy reduction, PPI

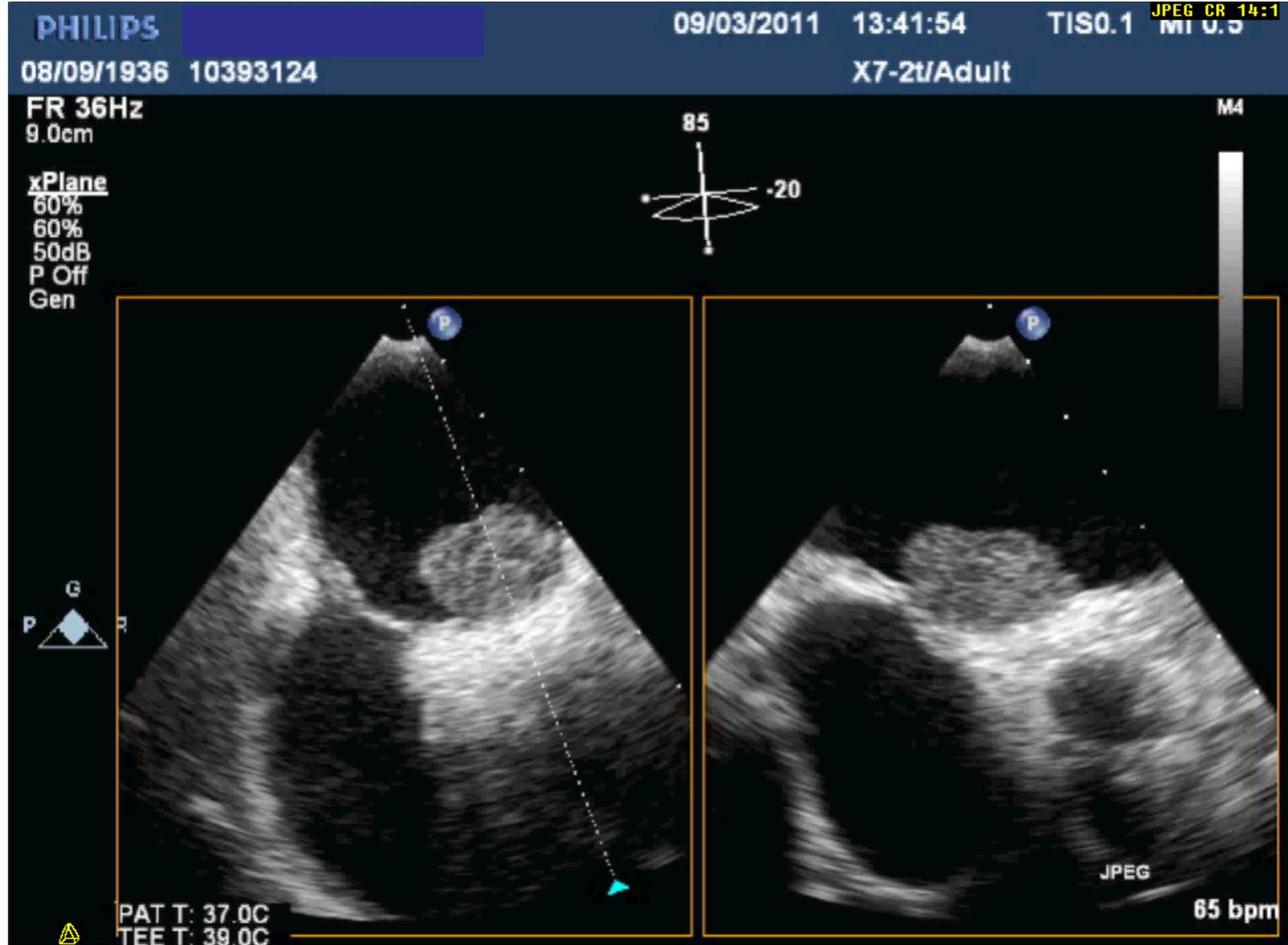
Vascular access complication

Left-atrial flutter (Pro-arrythmia)

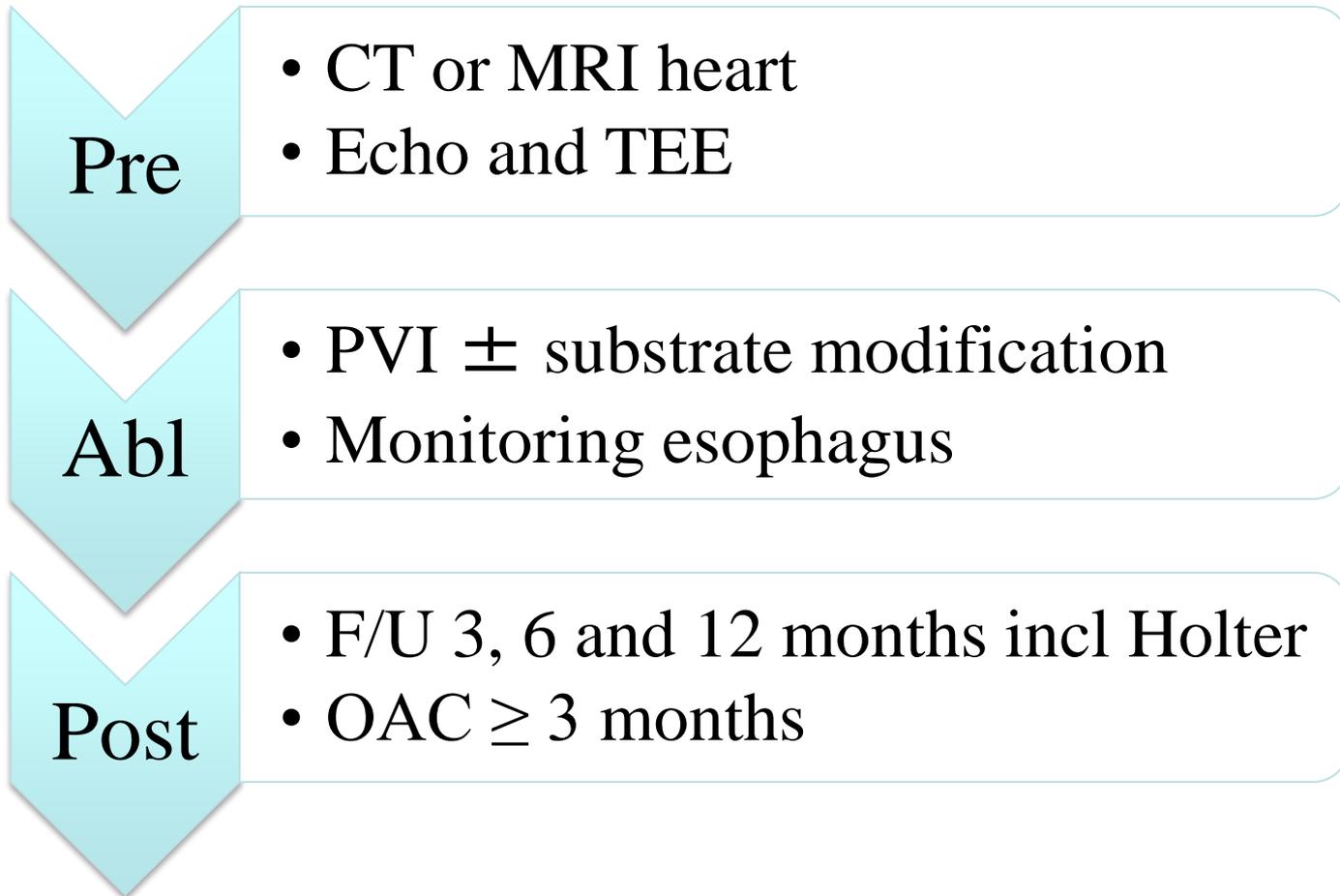
Redo procedure

→ Total = 2-4 %

TEE before Ablation



USZ Clinical Care Track for AF



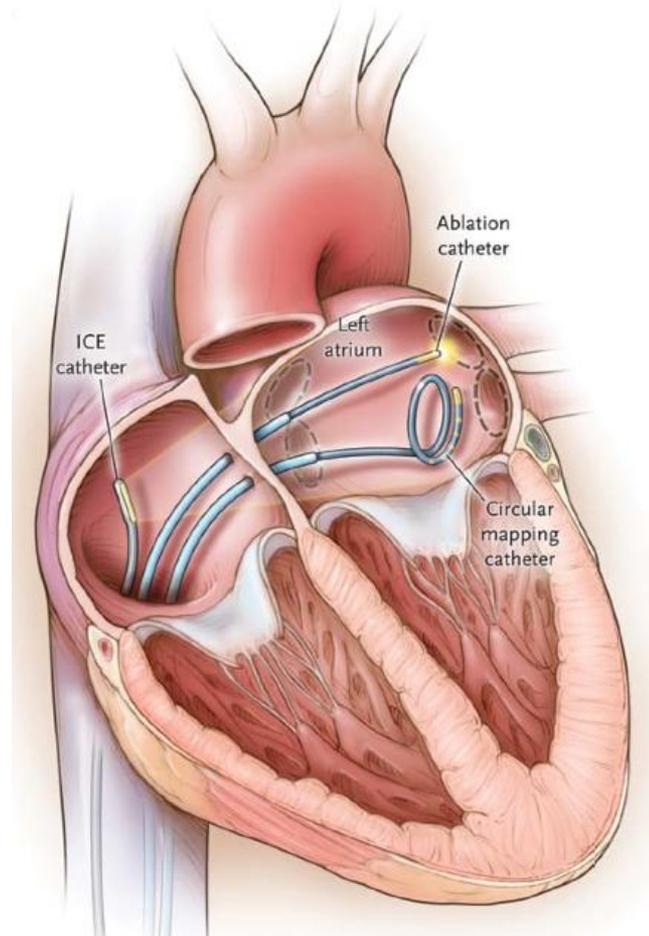
Double Transseptal Puncture

TABLE 1

Patient characteristics	<i>n</i> = 243
Age (years)	56.6 ± 9.3
Sex (male)	183 (75%)
Type of AF	
Paroxysmal AF	195 (80.3%)
Persistent AF	45 (18.5%)
Permanent AF	3 (1.2%)
Duration of AF (years)	7.4 ± 6.2
Left ventricular ejection fraction (%)	57.9 ± 7.1
Left atrial diameter (mm)	43.3 ± 5.4

TABLE 2

Procedural statistics	<i>n</i> = 269
Average procedure time (min)	201 ± 31
Fluoroscopy time (min)	41.3 ± 13.0
Major complications	
(i) Thromboembolic event and stroke	1 (0.4%)
(ii) Pericardial tamponade	7 (2.6%)
(iii) Major vascular access complication (requiring surgery or blood transfusion)	none
Minor complications	
(i) Reversible air embolism	1 (0.4%)
(ii) Bazold-Jarish-like reflex	1 (0.4%)



Good Candidates for AF Ablation ?

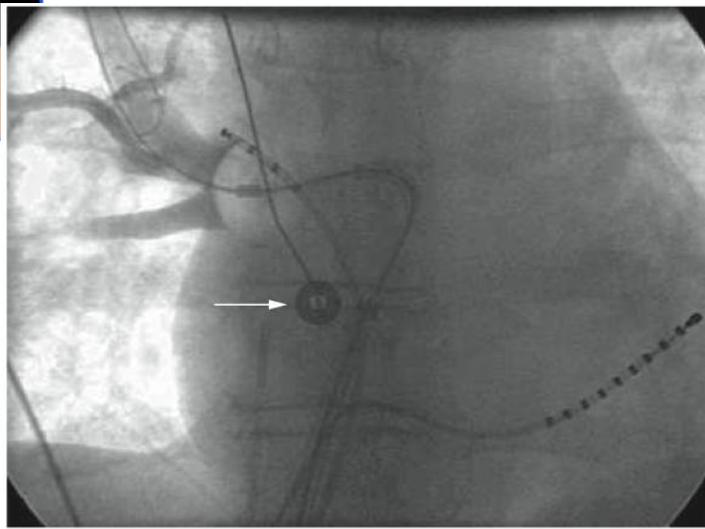
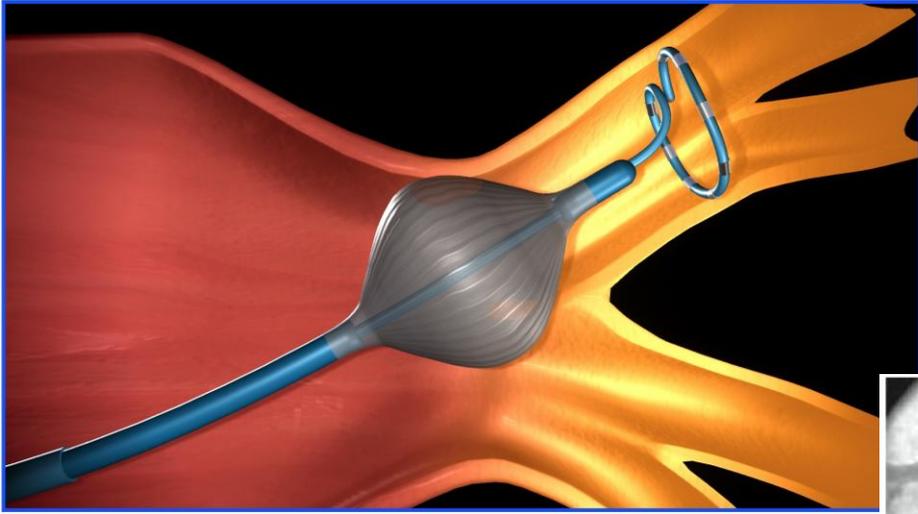


AF Ablation for Patients > 65 y

Table 3. Catheter ablation of atrial fibrillation in the elderly.

Inclusion and results	Haegeli <i>et al.</i>	Bunch <i>et al.</i>	Tan <i>et al.</i>	Zado <i>et al.</i>
Inclusion age (years)	≥65	≥80	≥80 70–79 60–69	65–74 ≥75
Mean age (years)	69 ± 3.5	82 ± 2	84 ± 5 75 ± 4 66 ± 4	68 ± 3 77 ± 2
Patients (n)	45	35	49 151 177	185 32
Procedures (n)	53	35	53 174 209	228 34
Paroxysmal AF (%)	87	46	55 53 51	62 53
Ablation strategy	PVI ± linear lesions	PVI ± linear lesions	PVI	PVI
Mean F/U (months)	6	12	18	27
Periprocedural complication rate (%)				
– Pericardial tamponade	1.9	2.8	0.2	0.4
– Deep venous thrombosis	0	2.8	0.9	0
– CVA/TIA	0	0	0.7	0.8
– Retroperitoneal bleeding	0	0	0.7	0.4
– Pseudoaneurysm/AV fistula	0	0	0.5	2.7
Freedom of AF (%)	74	78	70	84

Cryoballoon Catheter



Arctic Front® (Medtronic CryoCath LP Ltd.)

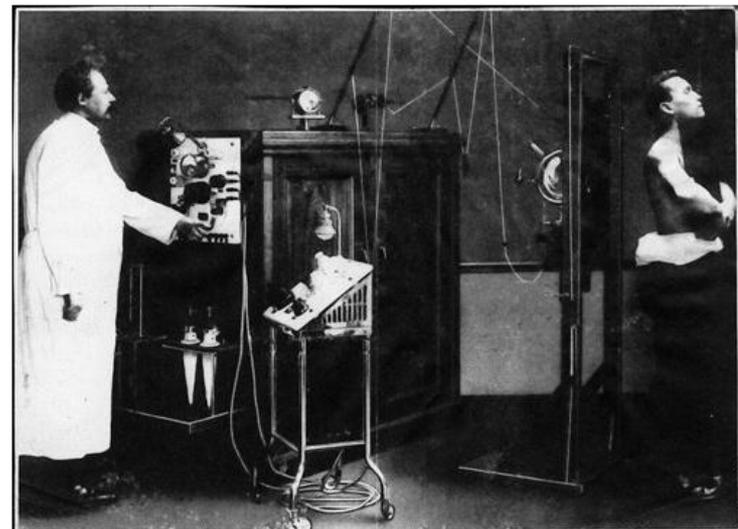


Risk of X-Ray for Patient and Staff



Risk of X-Ray for Patient and Staff

- **Single AF ablation** confers an additional lifetime risk for **fatal cancer of 0.2%** for **patient** ¹
- Lifetime risk for fatal cancer following a 15-year X-ray exposure is **0.5%** for **operator** ²
- Birth defects
- Cataracts



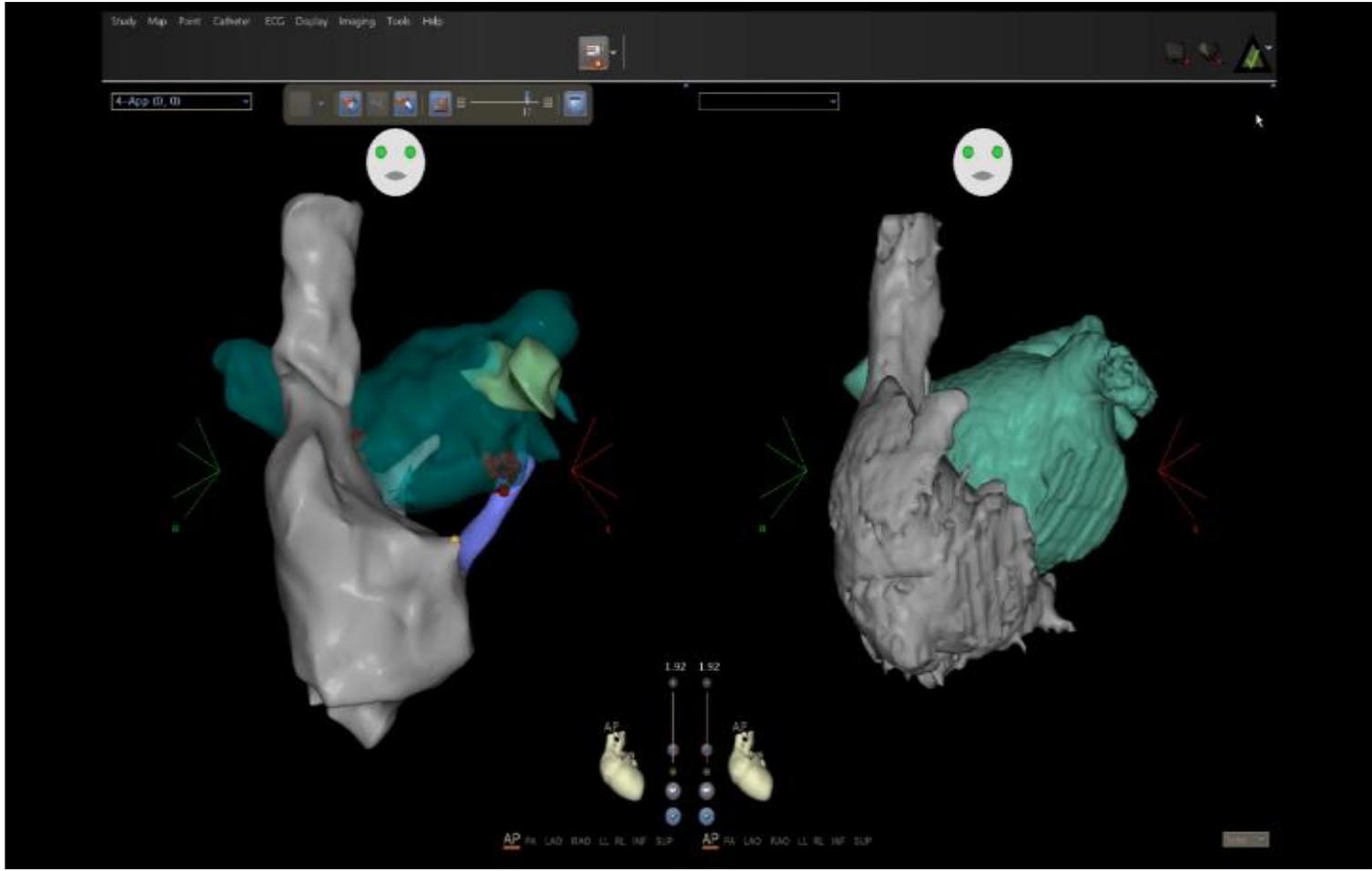
¹ Lickfett L et al. Circulation 2004

² Bedetti G et al. Br J Radiol 2008

Minimize Radiation Exposure !

- **Complex** procedure (double TSP, extensive RF application)
- Often **CT scan** beforehand (alternatively MRI !)
- Sometimes invasive **coronary angiograms**
- **Repeated procedures** (cumulative dose !)

The USZ Zero-Fluoroscopy AF Ablation



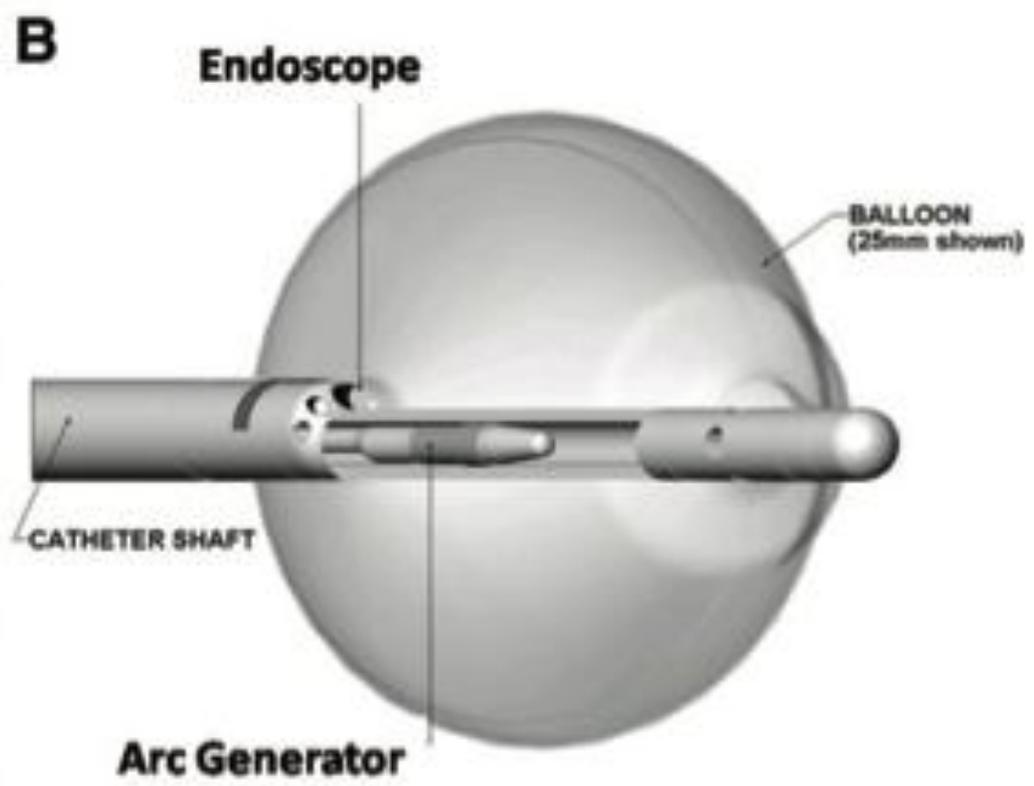
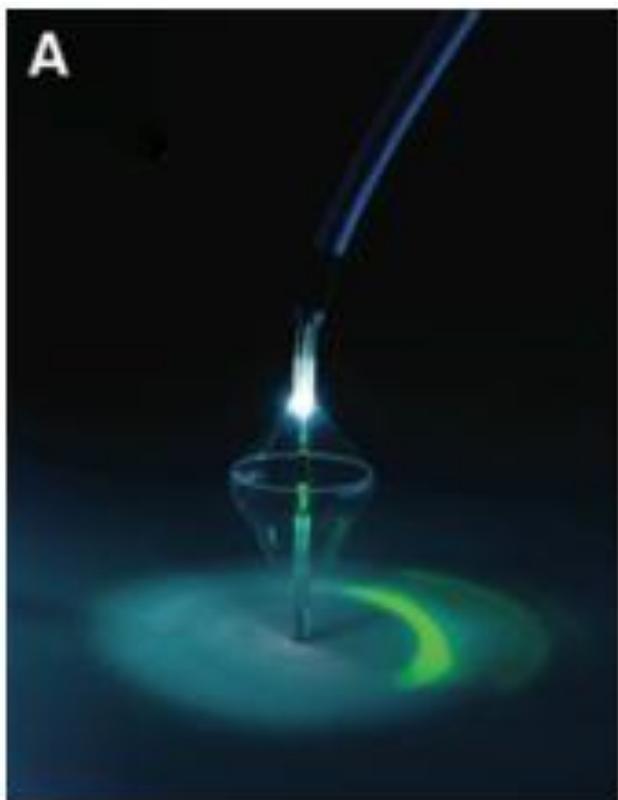
University Hospital Zurich

The USZ Zero-Fluoroscopy AF Ablation



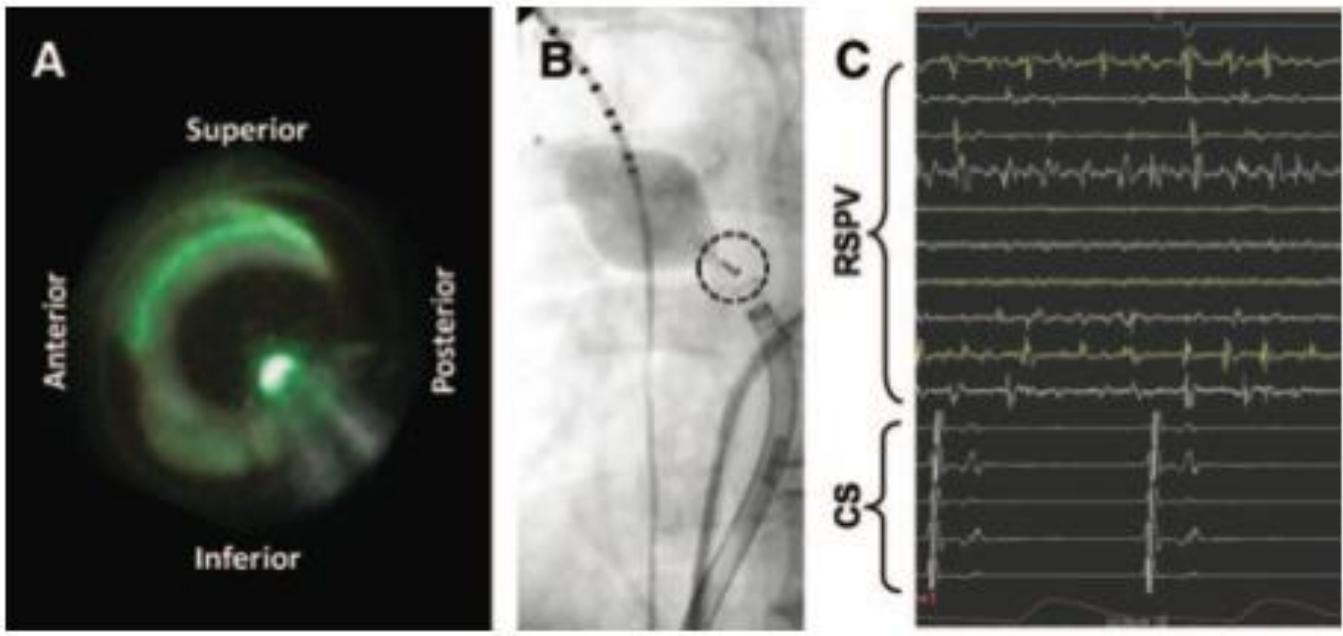
Intra-cardiac echo

Laser Energy



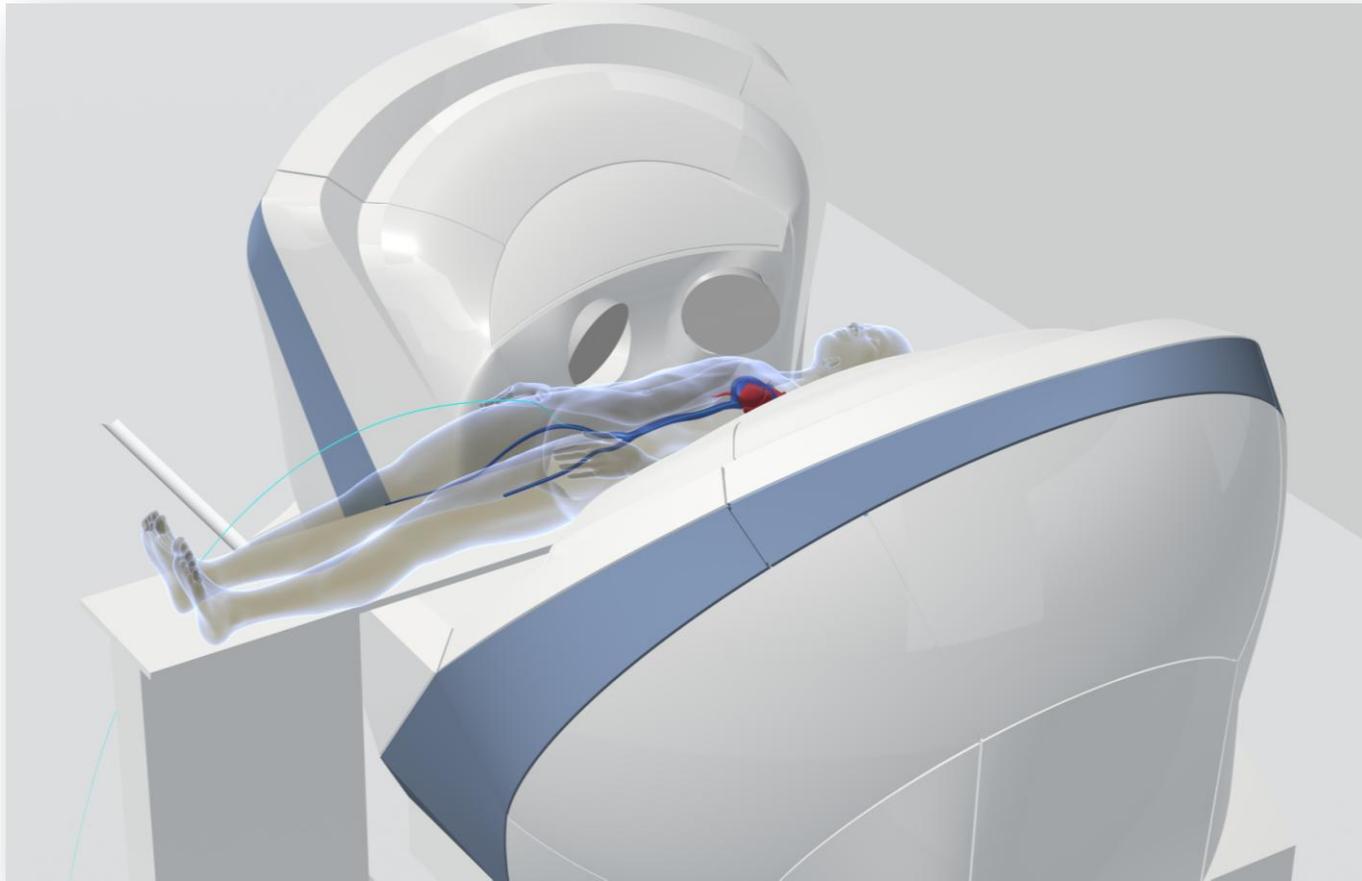
Reddy VY et al. Visually-guided balloon catheter ablation of atrial fibrillation: experimental feasibility and first-in-human multicenter clinical outcome. *Circulation* 2009; 120:12-20.

Visually Guided Energy Delivery

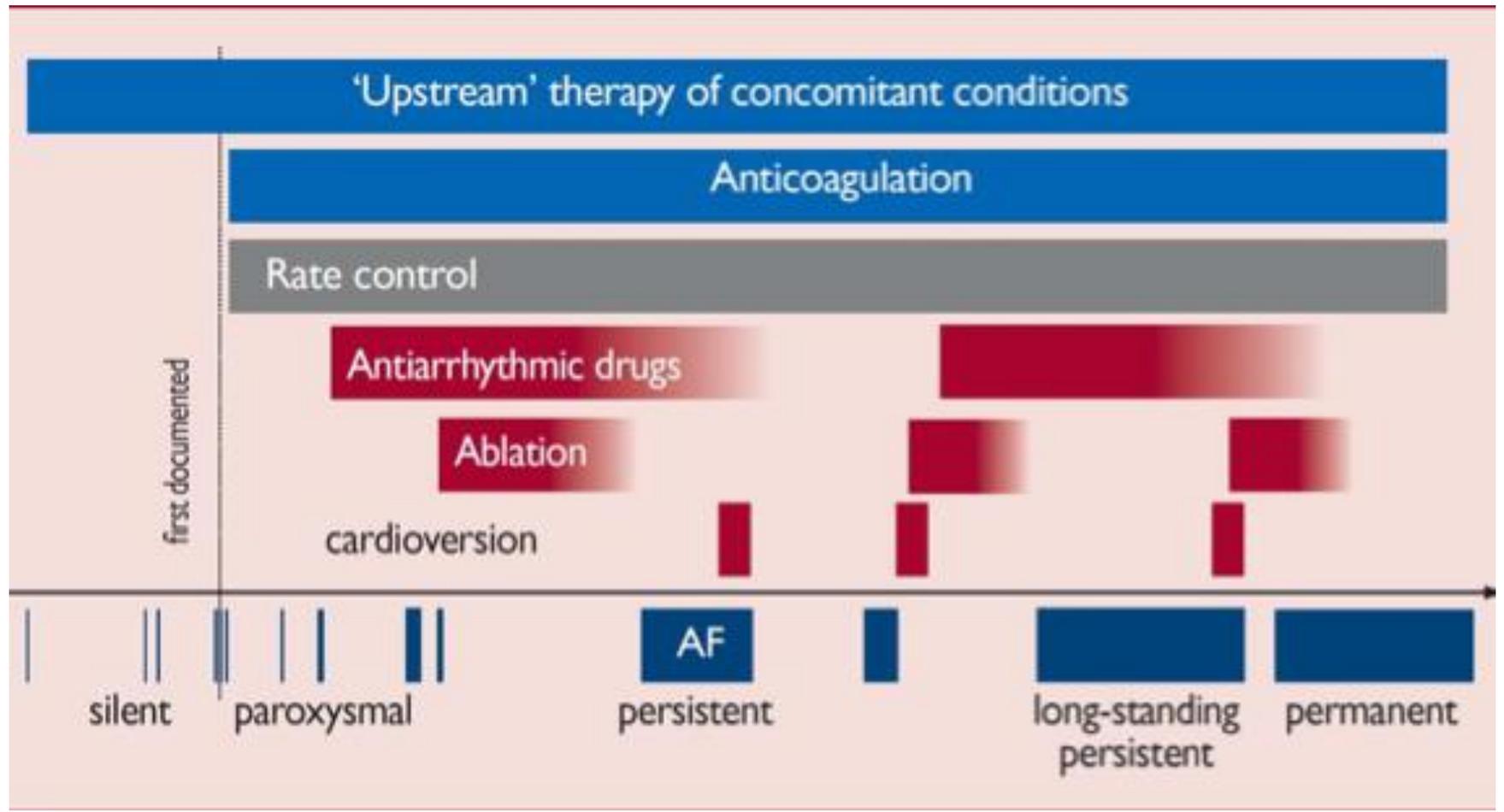


Reddy VY et al. Visually-guided balloon catheter ablation of atrial fibrillation: experimental feasibility and first-in-human multicenter clinical outcome. *Circulation* 2009; 120:12-20.

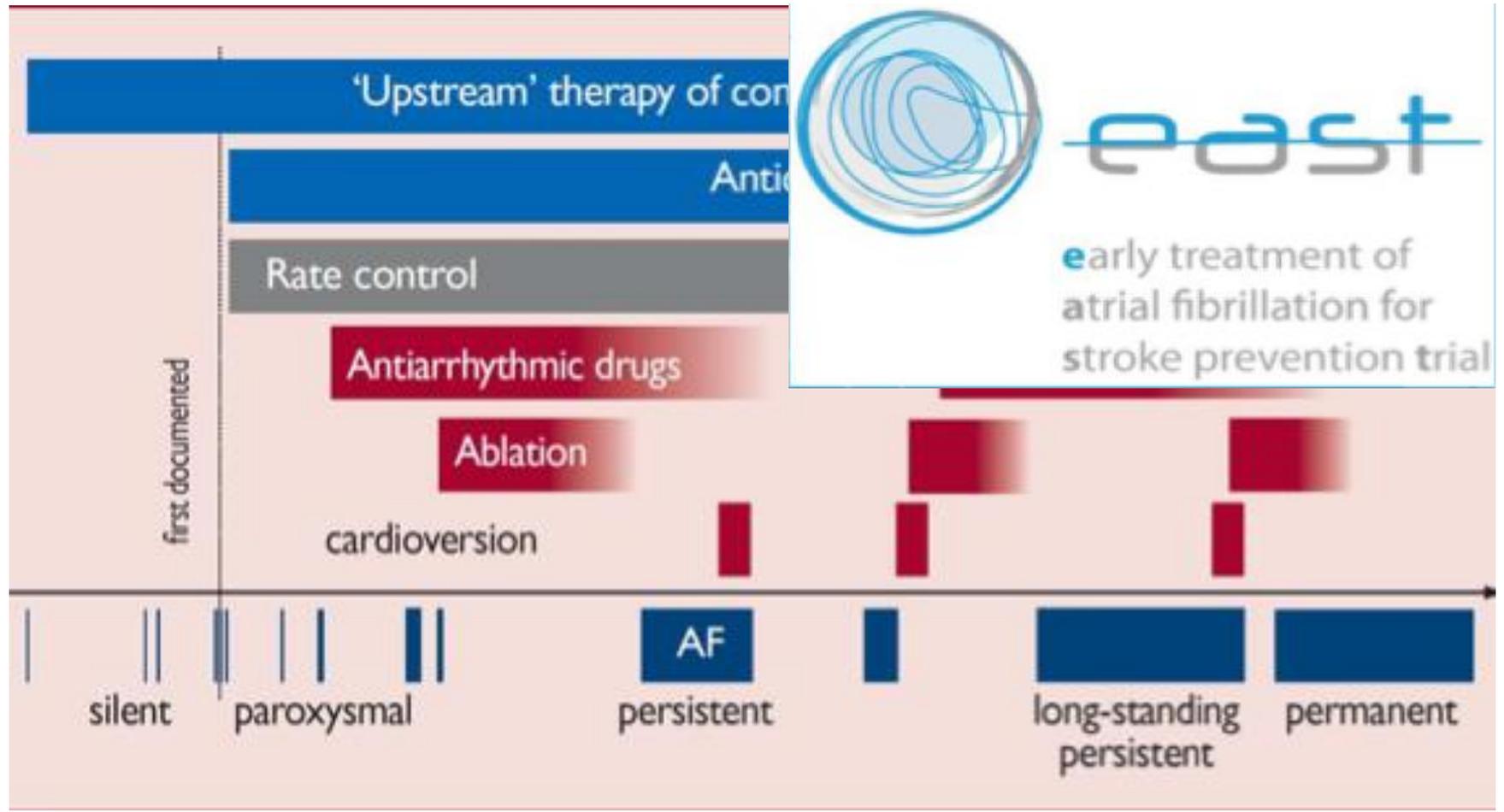
Magnetic Catheter Steering System







Early Care in AF



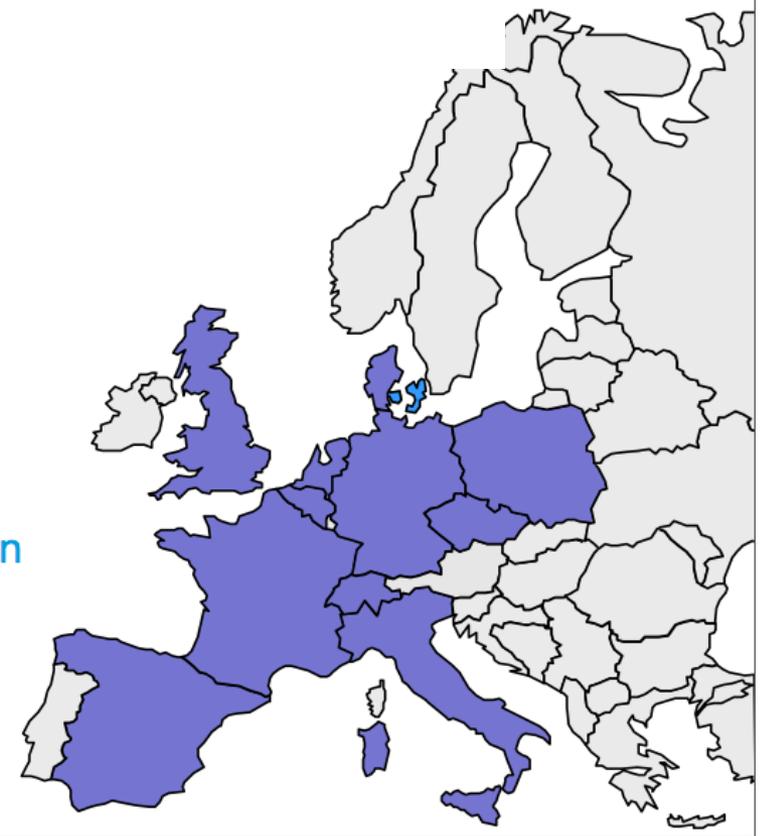


EAST Trial



- 3000 patients
- 200 European centers
- Follow-up 4 years

Switzerland	Laurent Haegeli, Zurich
Belgium	Hein Heidbuchel, Leuven
Czech Republic	Josef Kautzner, Prague
Denmark	Axel Brandes, Odense
France	Etienne Aliot, Nancy
Germany	Stephan Willems, Hamburg
Great Britain	John Morgan, Southampton
Italy	Michele Gulizia, Catania Sakis Themistoclakis, Venice
Netherlands	Isabelle van Gelder, Groningen
Poland	Lukasz Szumowski, Warsaw
Spain	Lluis Mont, Barcelona



Indications for Catheter Ablation of AF

- **Symptomatic patients** with paroxysmal and persistent atrial fibrillation !

Indications for Catheter Ablation of AF

- **Symptomatic patients** with paroxysmal and persistent atrial fibrillation !
- After **one** antiarrhythmic drug failure
- **No** indications are:
 - *asymptomatic patients with AF*
 - *patient wish to discontinue anticoagulation*

AF Ablation Therapy

- **Success rates** for paroxysmal atrial fibrillation are **70-90%** (with 1-2 procedures)
- Major complications occur in 2-3 %

Thank you !



Questions ?

