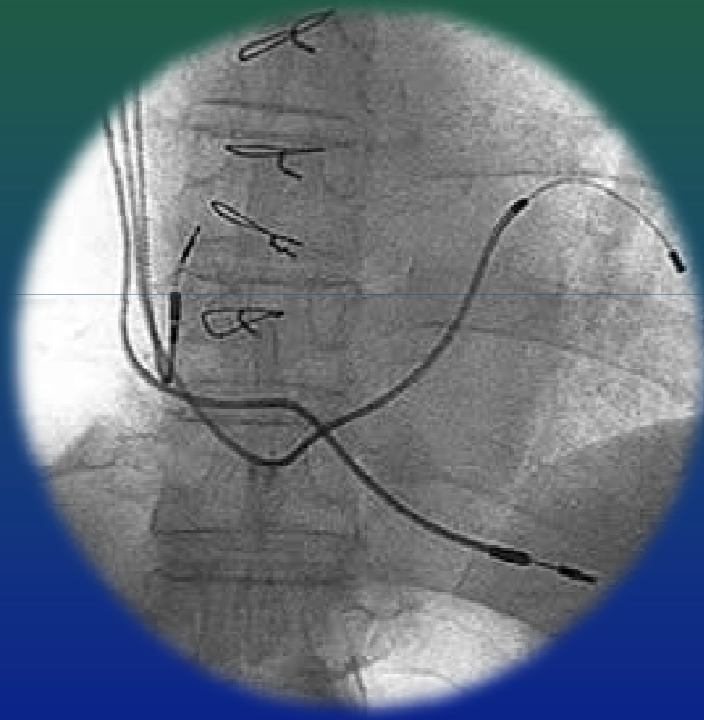


Catheter Ablation to Improve ICD Performance



Natasja M.S de Groot

Erasmus Medical Center, Rotterdam, the Netherlands

Implantable cardioverter defibrillator therapy in heart failure patients

- ✓ primary prevention of arrhythmic death
- ✓ secondary prevention of arrhythmic death
- ✓ cardiac resynchronization therapy

Recommendation in patients with heart failure in New York Heart Association function class II

Recommendation	Patient population	Class ^a	Level ^b	Ref. ^c
CRT preferentially by CRT-D is recommended to reduce morbidity or to prevent disease progression ^d	NYHA function class II LVEF $\leq 35\%$, QRS ≥ 150 ms, SR Optimal medical therapy	I	A	9, 20–22

Recommendation in patients with heart failure in New York Heart Association function class III/IV

Recommendation	Patient population	Class ^a	Level ^b	Ref. ^c
CRT-P/CRT-D is recommended to reduce morbidity and mortality ^d	NYHA function class III/IV LVEF $\leq 35\%$, QRS ≥ 120 ms, SR Optimal medical therapy Class IV patients should be ambulatory ^e	I	A	5–19

Device Therapy in Heart Failure Patients

Performance

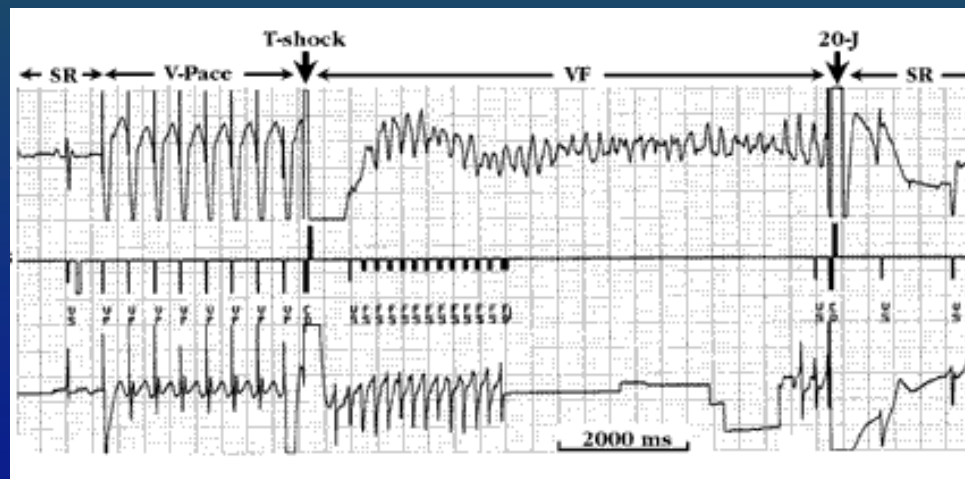
- ✓ continuous surveillance for ventricular arrhythmia
 - anti-tachycardia pacing
 - shock therapy
 - ✓ cardiac resynchronization therapy
 - continuous delivery of ventricular pacing
- 95% bi-ventricular pacing

The Paradox of ICD therapy

Observation

HF patients experiencing **shocks** have a **higher mortality rate** than those who do not

? Merely a marker of disease severity ?



Mortality : ATP \neq Shocks

The Paradox of ICD therapy

- ✓ ICD therapy is immediately life saving
 - does **not alter** arrhythmic **risk**
 - shocks **impact** on **quality of life**

THUS:

decreasing the frequency of
both **inappropriate** and **appropriate** shocks

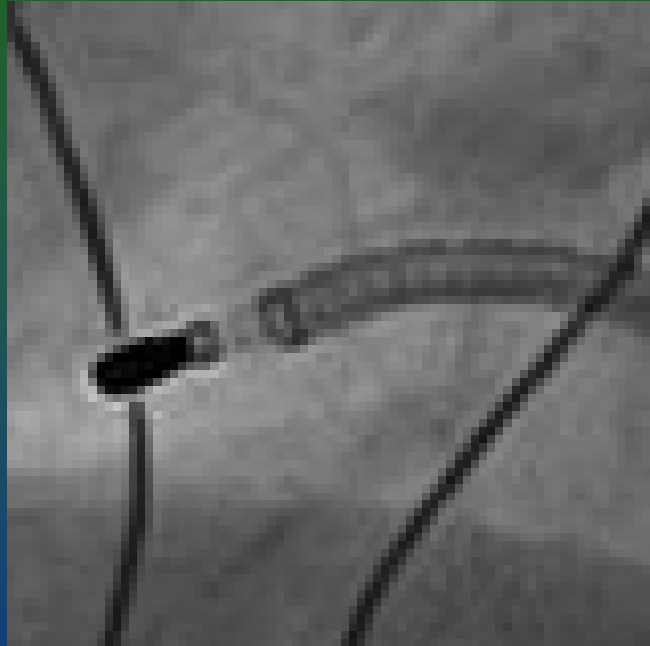


atrial tachyarrhythmias

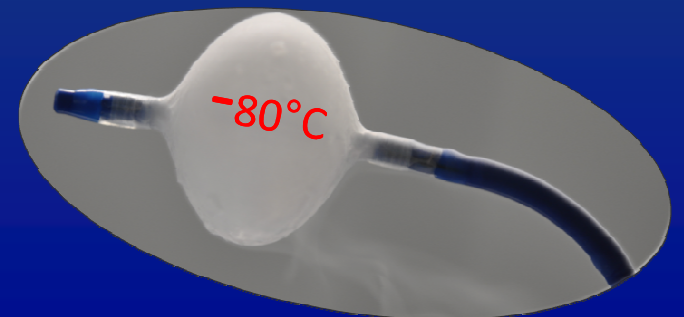


ventricular tachyarrhythmias

Catheter Ablation



“Fire” or “ICE”



Catheter Ablation

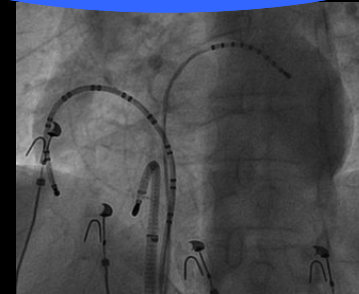
- ✓ **only curative** treatment modality for both AT/VT
- ✓ **localization** of the arrhythmogenic **substrate difficult**
(distortion of cardiac anatomy)
- ✓ **extensive mapping** prior to ablation is therefore essential
- ✓ **innovation** mapping/navigation technology
- ✓ **recurrences** of VT/AT after ablation
(progressive cardiomyopathy)

Mapping and Ablation Technologies

Epicardial Mapping



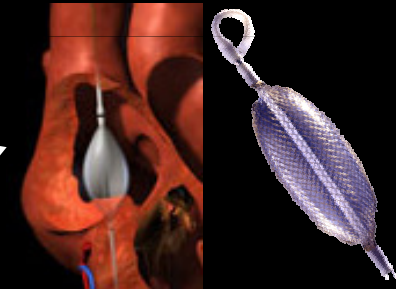
Endocardial Mapping



Contact Mapping



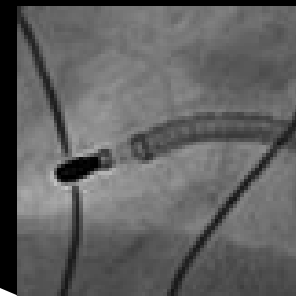
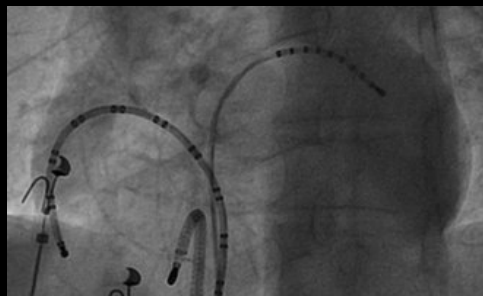
Non-Contact Mapping



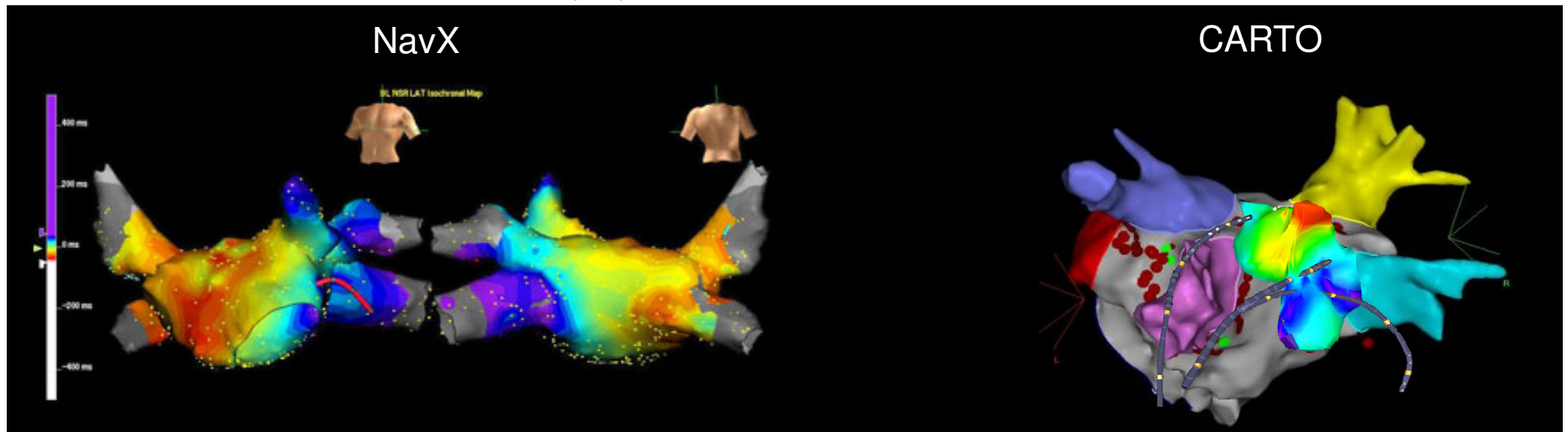
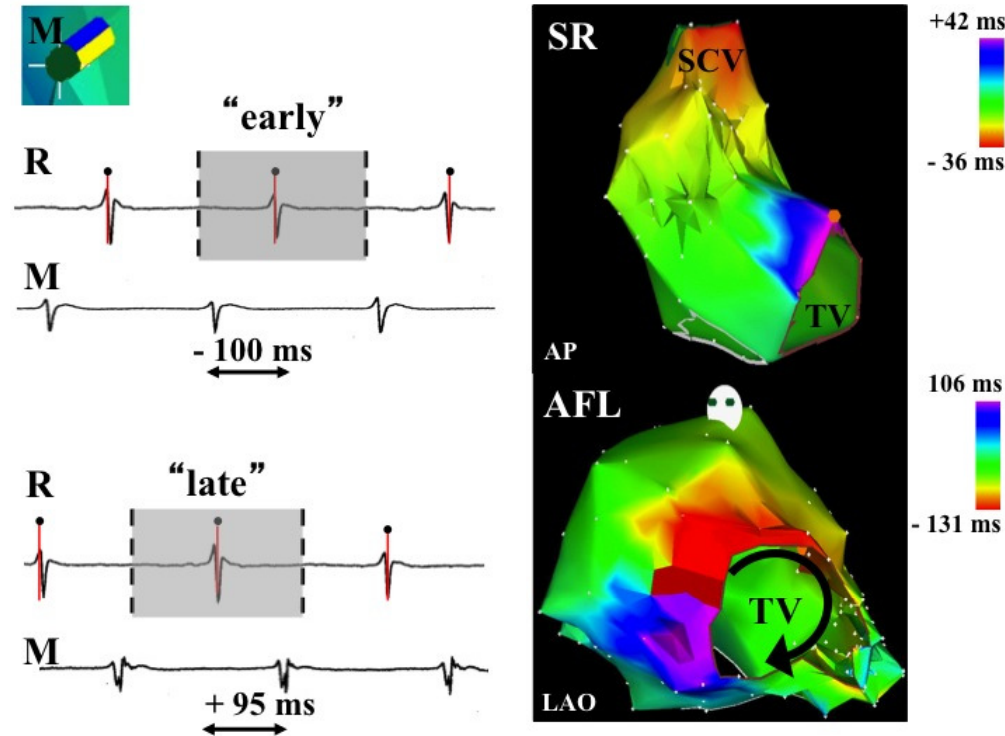
Multi-Site Mapping

simultaneous

sequential



3-Dimensional Electro-Anatomical Mapping Technologies



Catheter Navigation

Manual Navigation



Remote Navigation



magnetic navigation

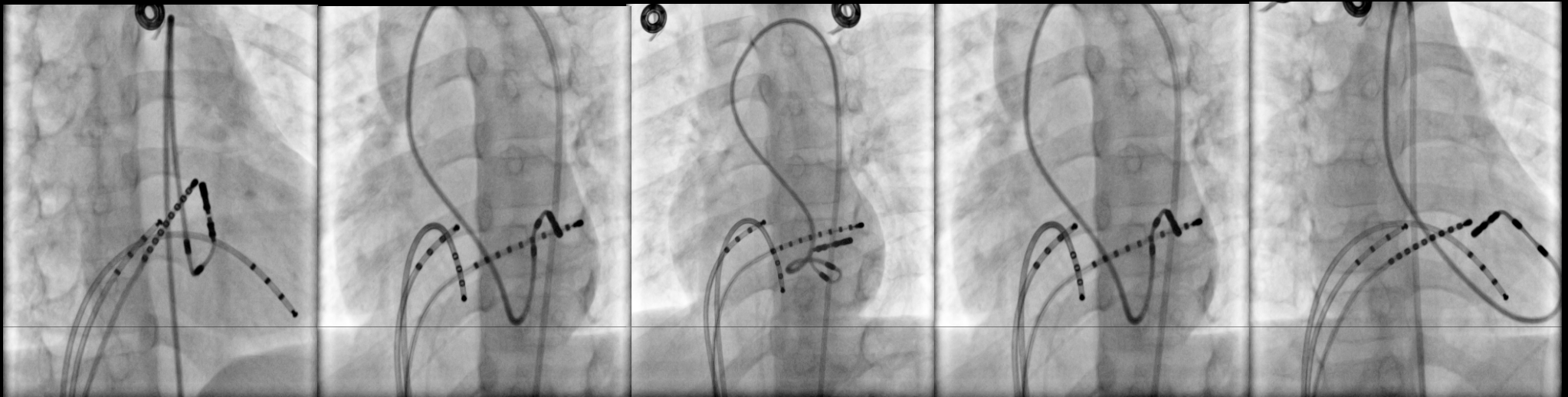


robotic navigation



Magnetic Navigation System

Stereotaxis NIOBE®



“Floppy” Catheter Design

- Less harmful
- No curve



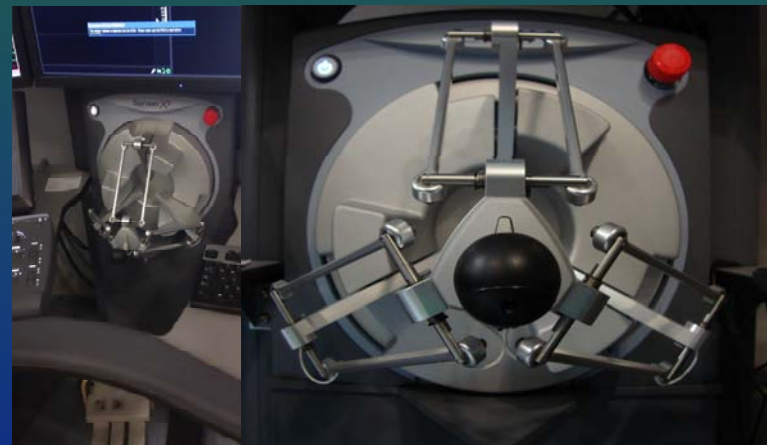
Effective enough ?

By courtesy of Dr. T. Szili-Torok



Remote Catheter Navigation

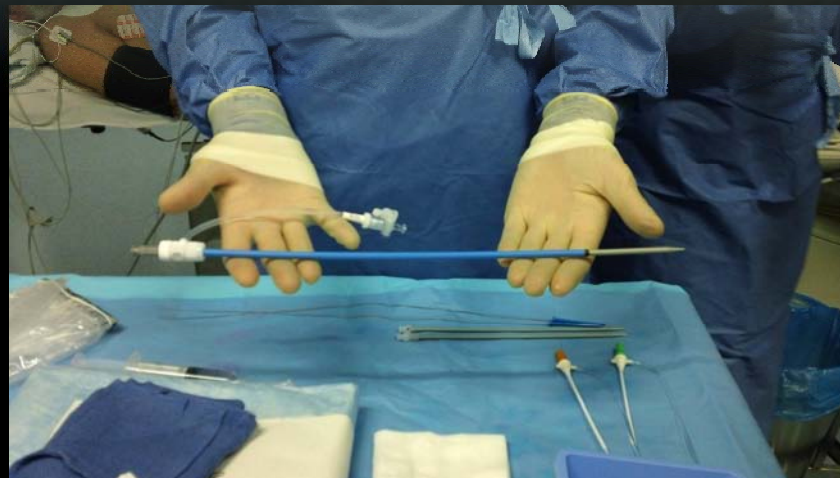
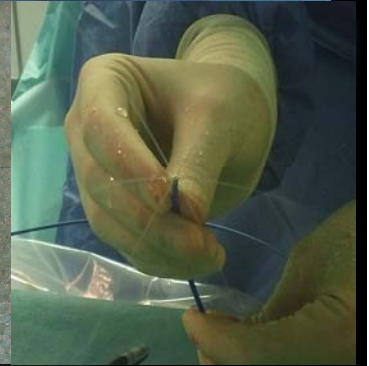
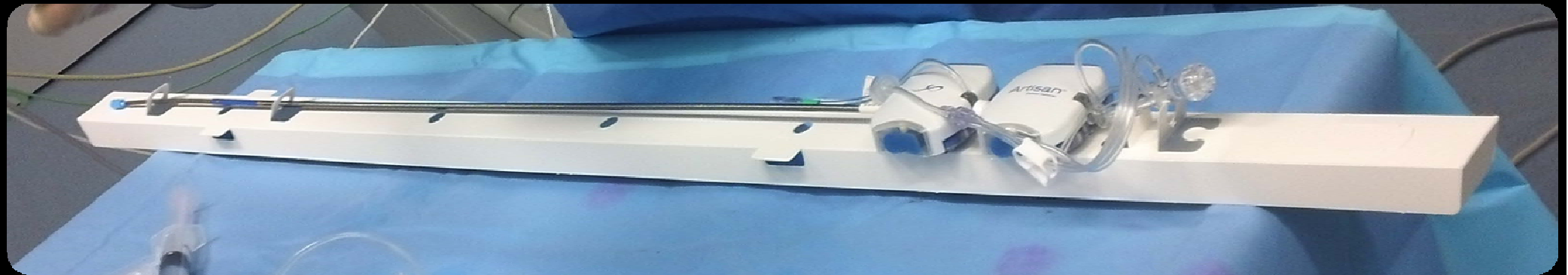
Robotic Navigation System (Sensei Hansen Medical)

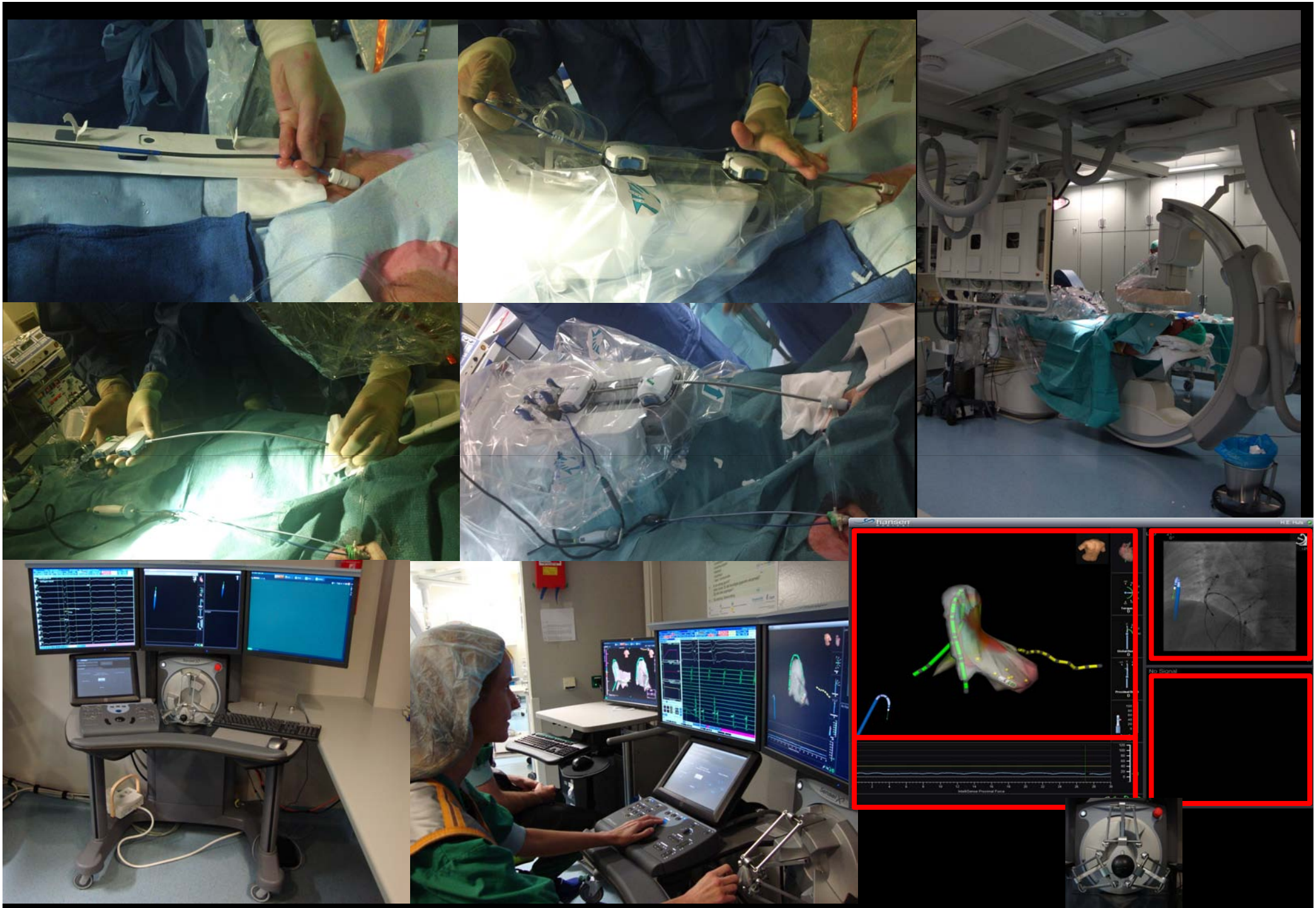


Robotic Arm



Artisan Sheath





Reduction Appropriate ICD shocks

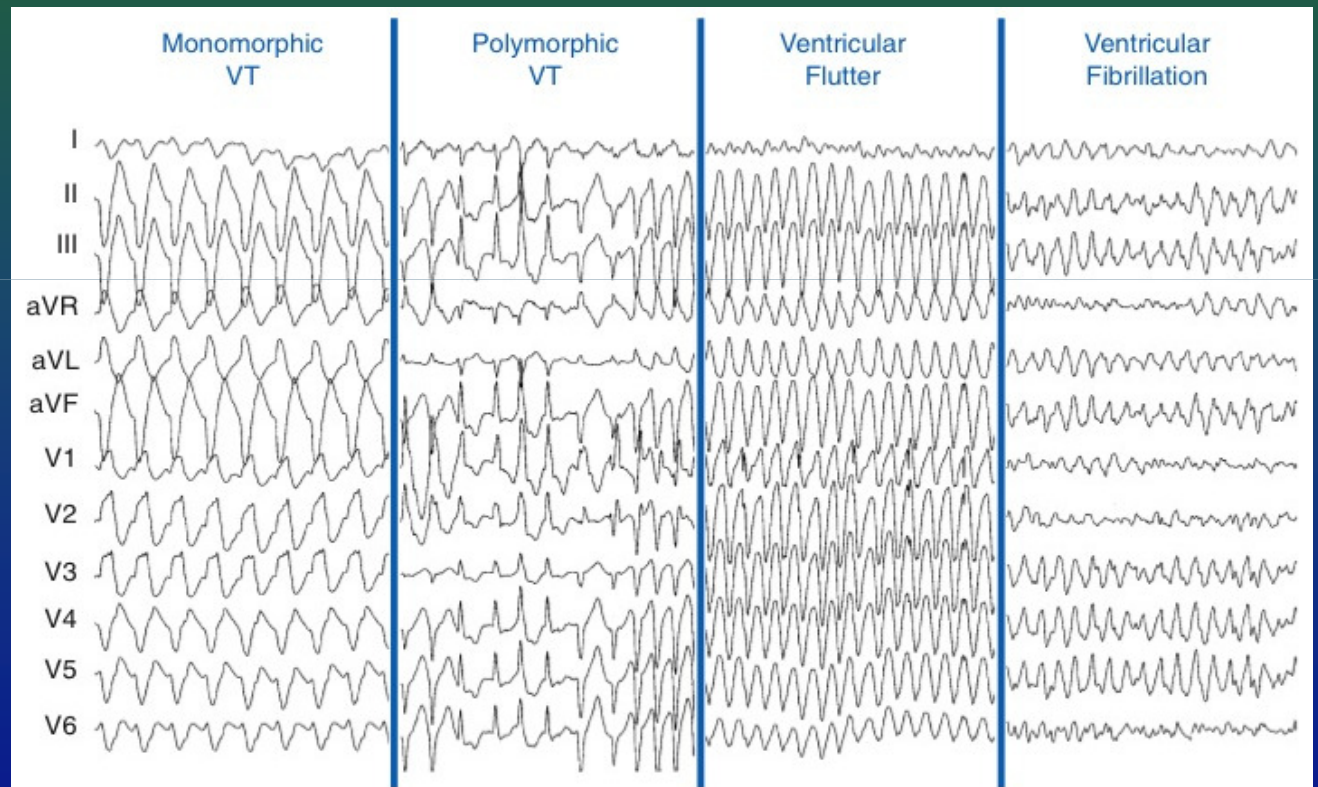
Ventricular Tachycardia



Ventricular Tachycardia and Heart Failure

- ✓ sudden **cardiac death**
40% of deaths in HF patients !

- ✓ VTs in HF patients
 - PVCs
 - non-sustained VTs



present in up to 70 % of HF patients with systolic heart failure !

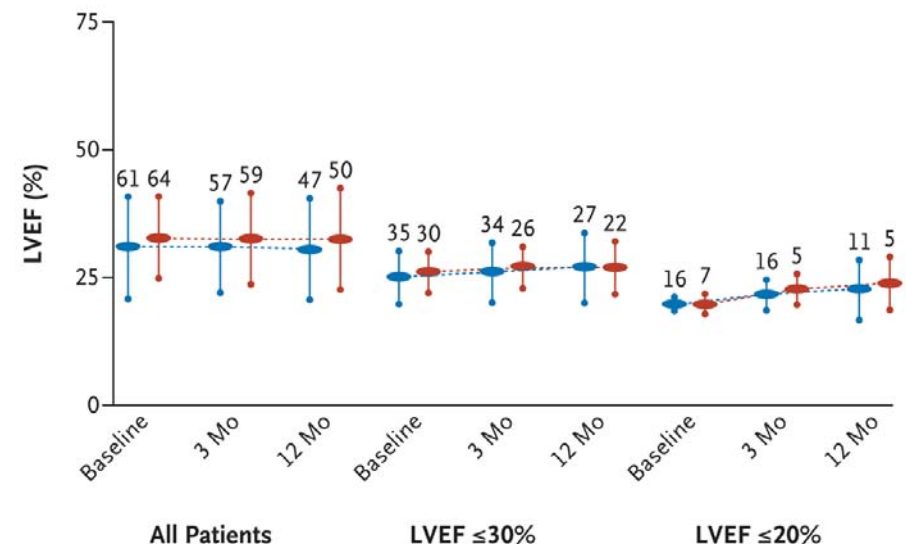
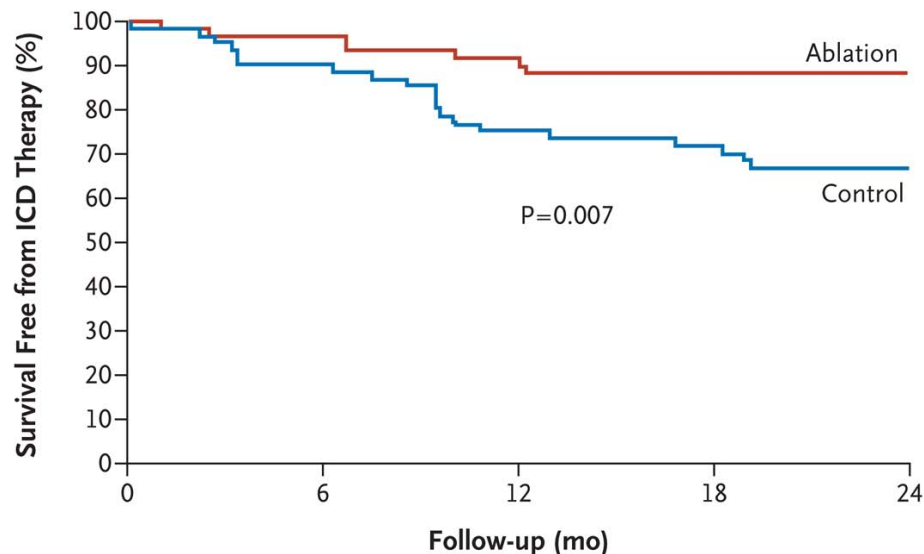
Therapeutic Catheter Ablation

Adjunctive therapy

Prophylactic Catheter Ablation for the Prevention of Defibrillator Therapy

Vivek Y. Reddy, M.D., Matthew R. Reynolds, M.D., Petr Neuzil, M.D.Ph.D., Allison W. Richardson, M.D., Milos Taborsky, M.D., Ph.D., Krit Jongnarangsin, M.D., Stepan Kralovec, Lucie Sediva, M.D., Jeremy N. Ruskin, M.D., and Mark E. Josephson, M.D.

From the Cardiac Arrhythmia Service, Massachusetts General Hospital, Boston (V.Y.R., K.J., J.N.R.); the Harvard-Thorn-dike Electrophysiology Institute and Arrhythmia Service, Beth Israel Deaconess Medical Center, Boston (M.R.R., A.W.R., M.E.J.); and the Cardiac Arrhythmia Service, Homolka Hospital, Prague, Czech Republic (P.N., M.T., S.K., L.S.)



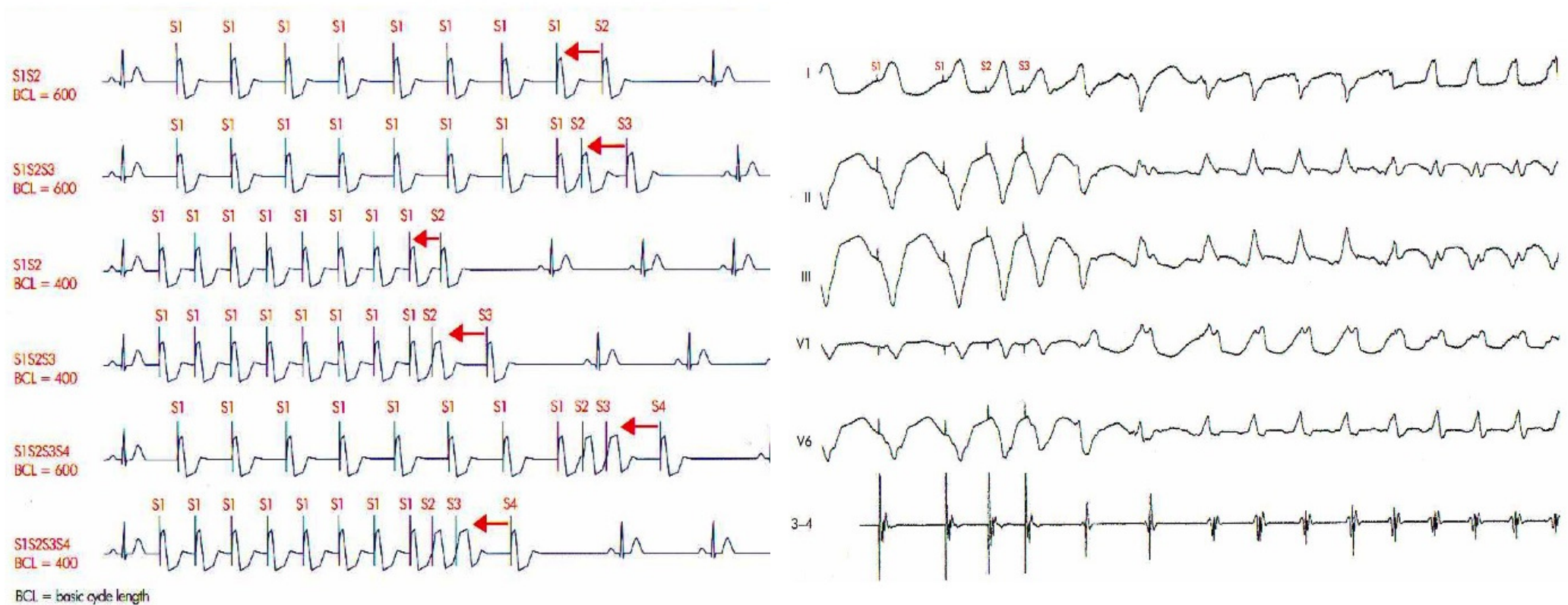
Mechanism of Ventricular TachyArrhythmias

- ✓ reentrant arrhythmias around a scar border
- ✓ focal activity



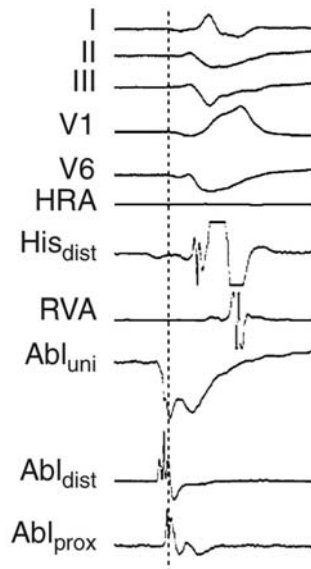
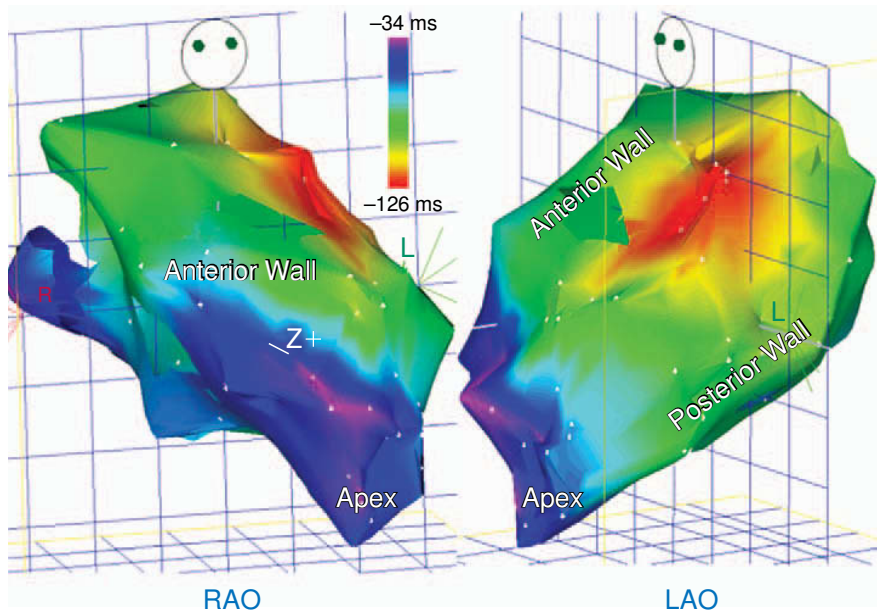
Catheter Ablation of Ventricular Tachycardias

- ✓ documentation of the clinical VT
- ✓ hemodynamically, stable VT

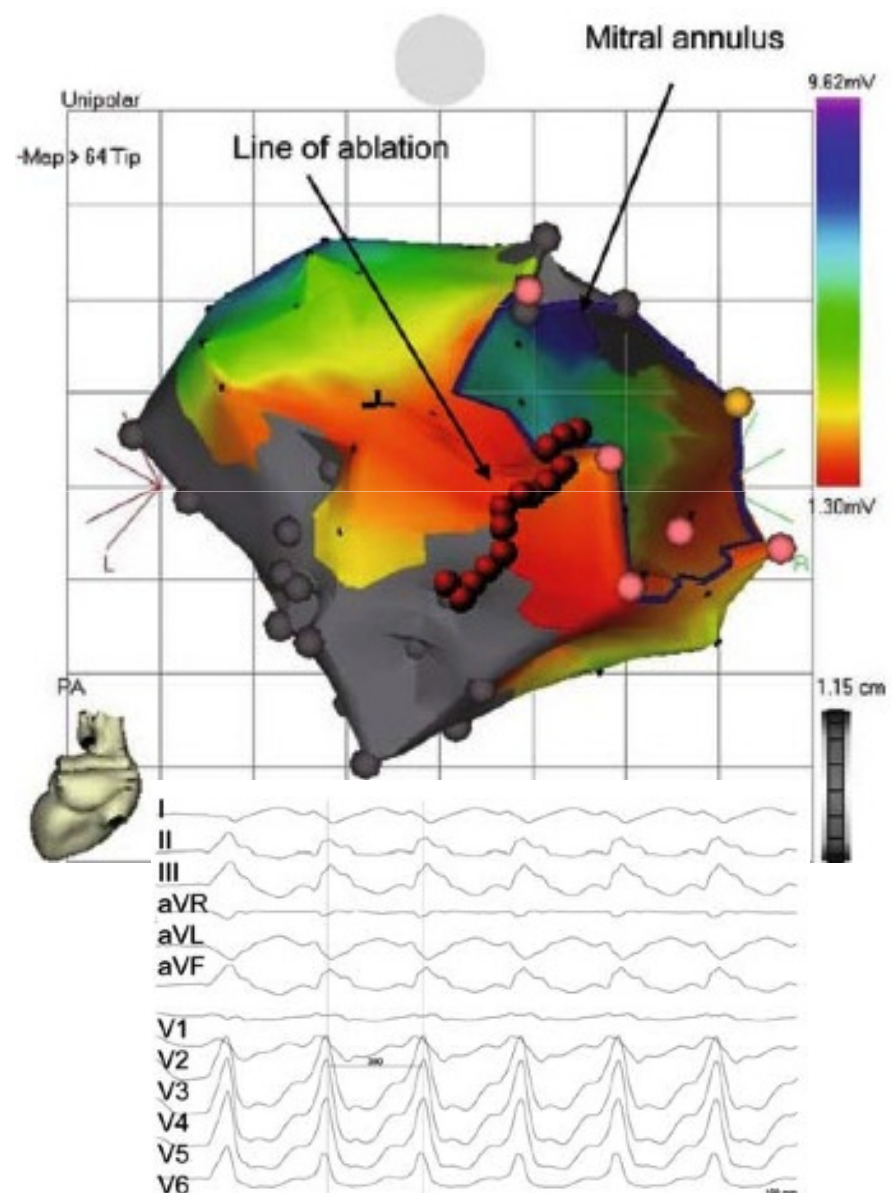


Mapping of Ventricular Tachycardias

Focal VT

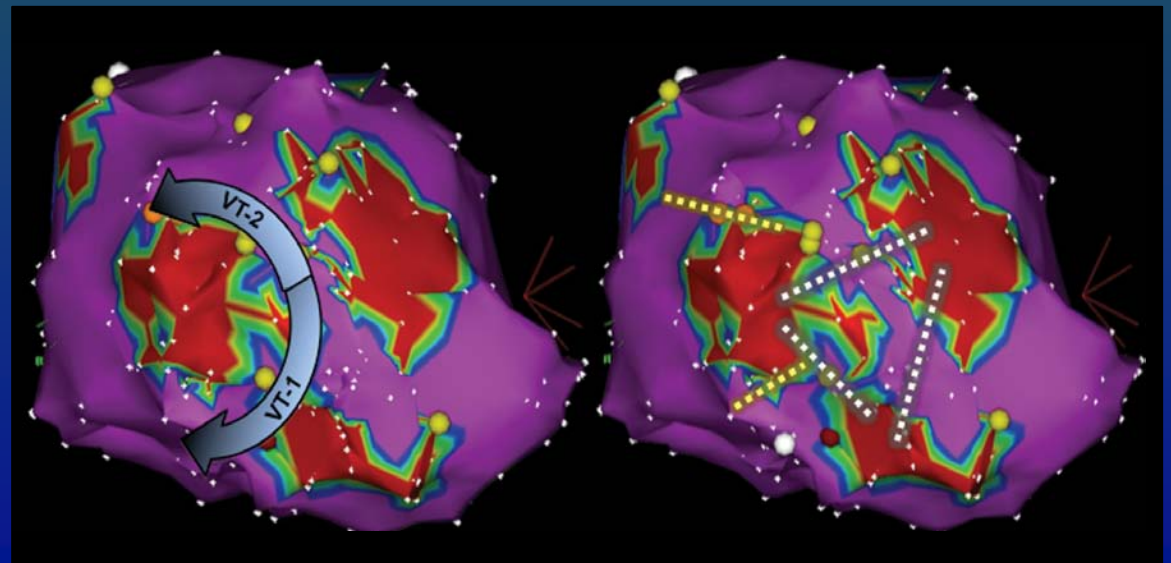
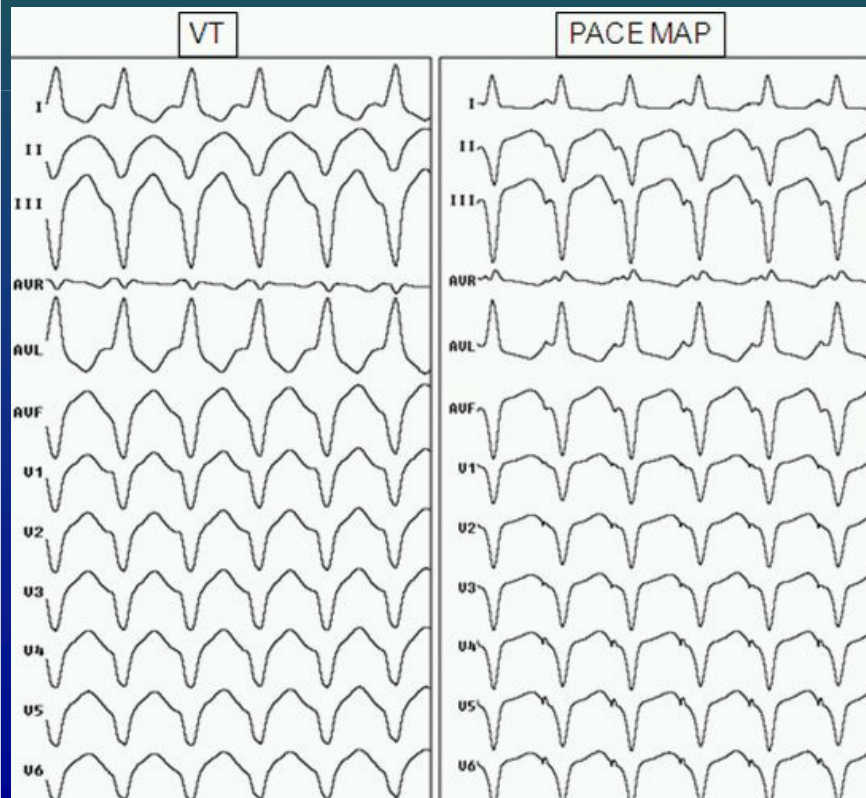


Reentrant VT



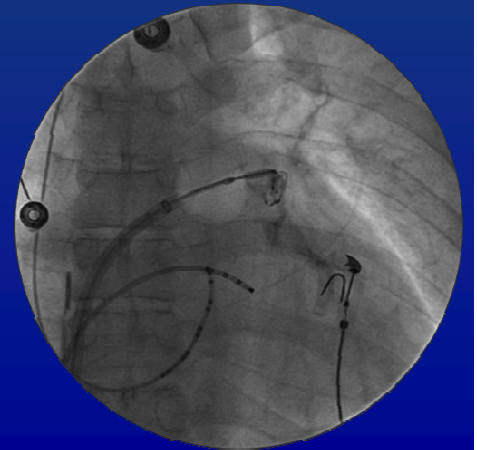
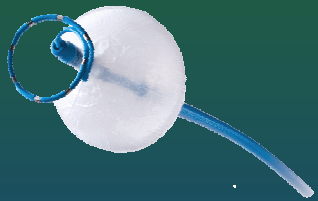
Catheter ablation of Ventricular Tachycardias

- ✓ hemodynamically **unstable** VTs
- ✓ voltage mapping during **SR/pacing**
- ✓ selection **target site** for ablation



Reduction InAppropriate ICD shocks

Atrial Fibrillation



CRT and Atrial Fibrillation

- ✓ 20% of the patients receiving CRT have permanent AF

- ✓ prevalence AF related with severity heart failure

NYHA class I: 5%

NYHA class III-IV: 25-50%

- ✓ death from HF AF patients > SR patients
(13.5% vs 4%, $P < 0.001$)



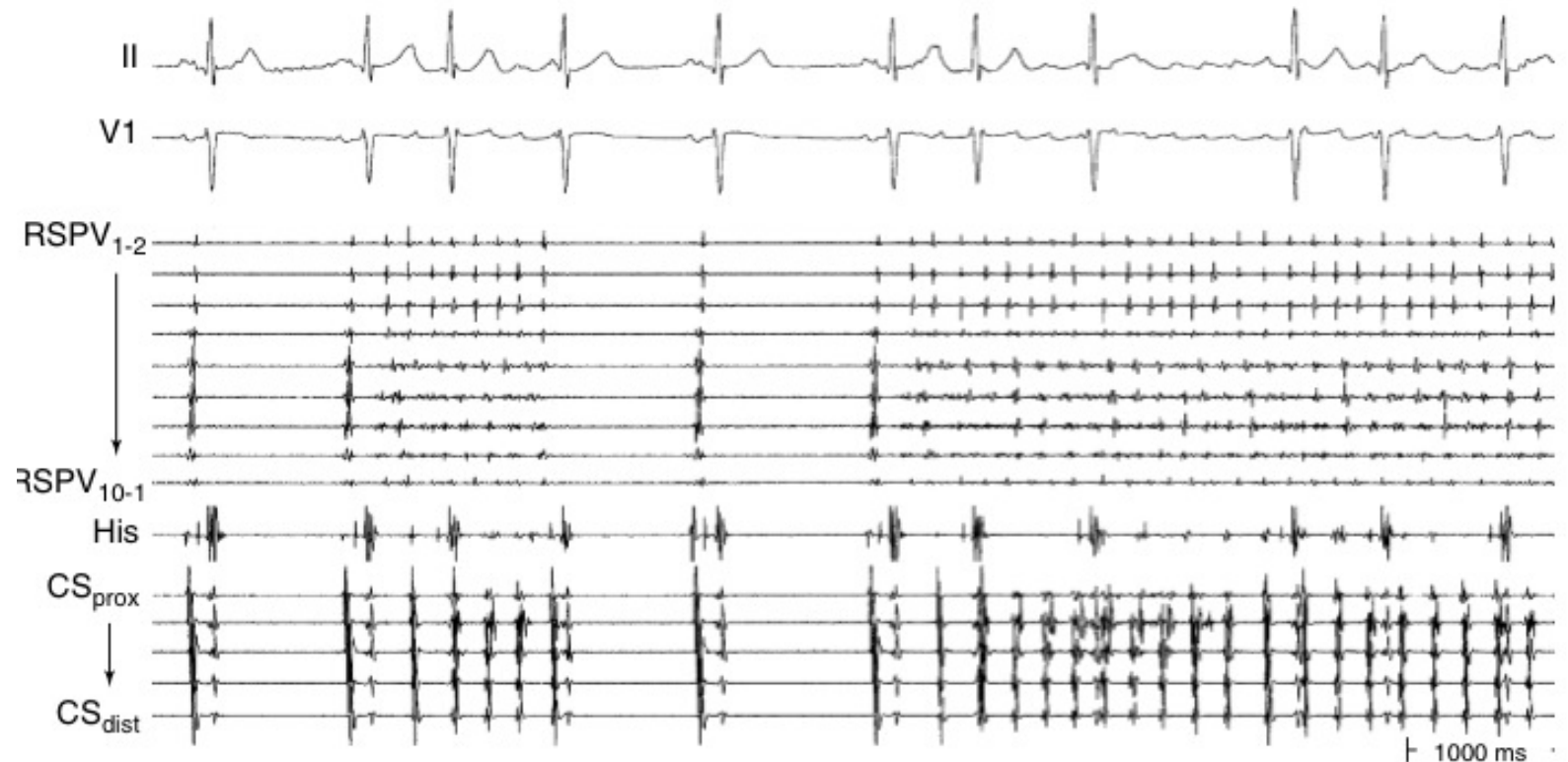
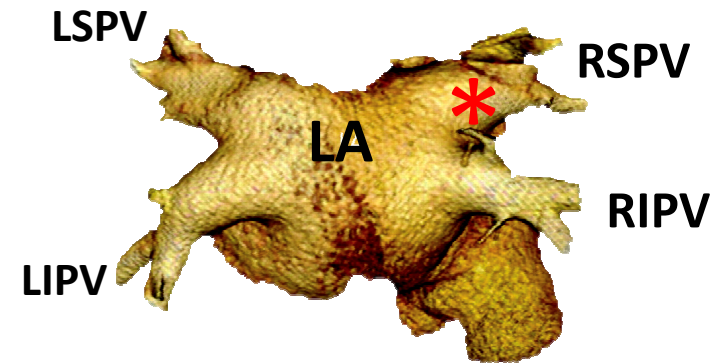
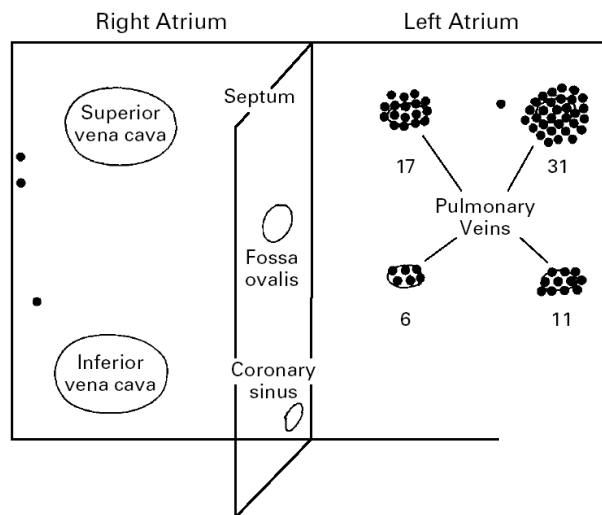
✓ increased
✓ high

By courtesy of Dr

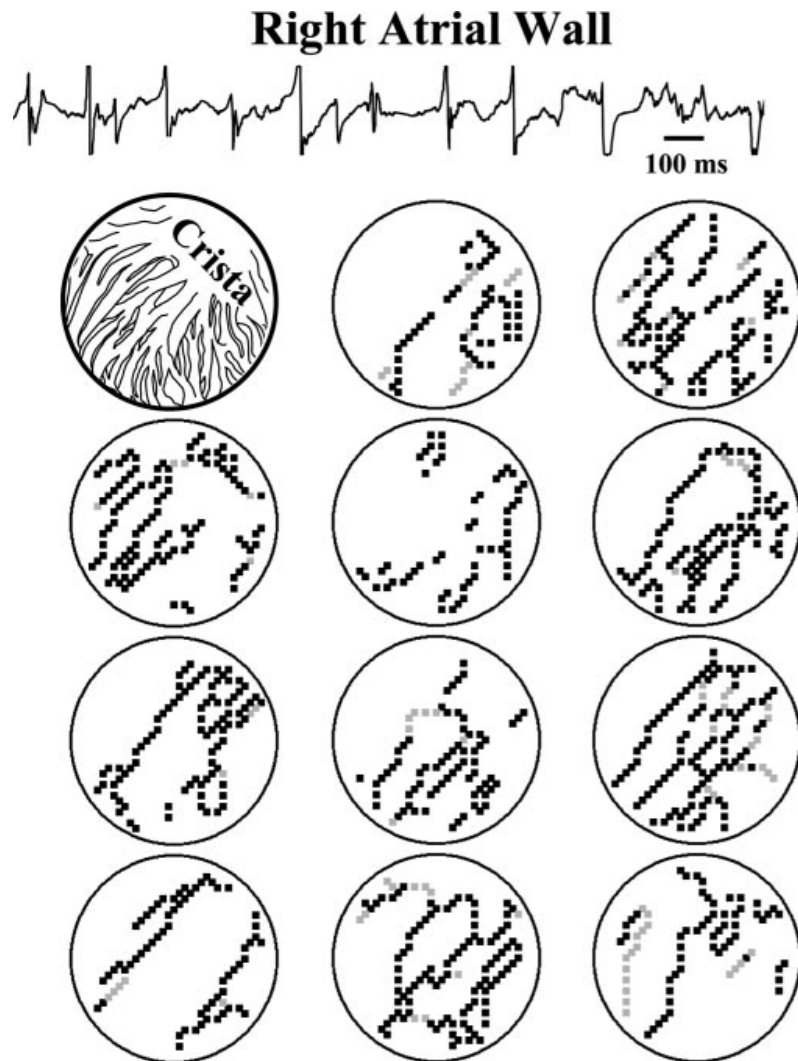
- spontaneous beats/pseudo-fusion beats/fusion beats

- ## reduction bi-ventricular pacing

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

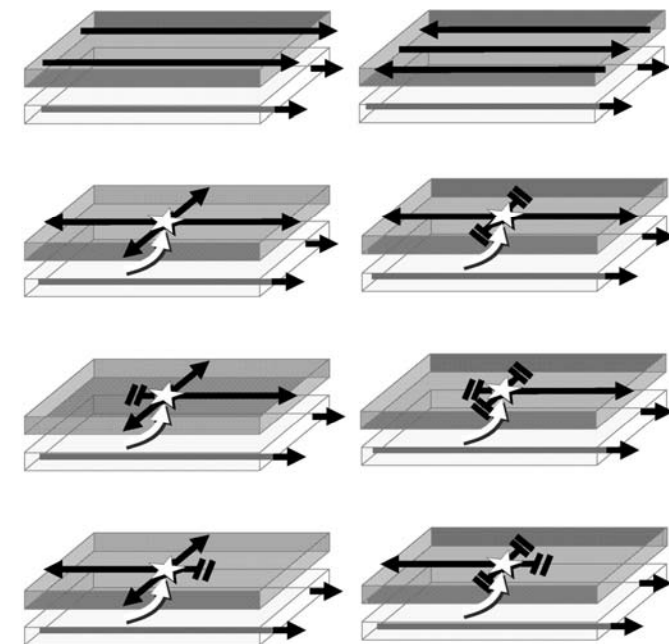


Electropathological Substrate of Long-Standing Persistent Atrial Fibrillation in Patients With Structural Heart Disease Longitudinal Dissociation



Allessie & de Groot Circulation AE 2010;3:606-615

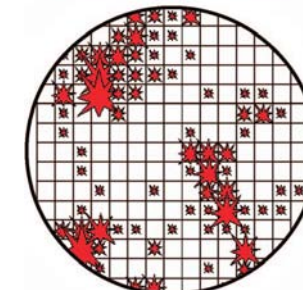
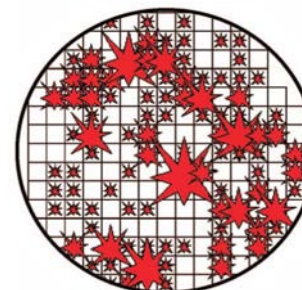
Electropathological Substrate of Longstanding Persistent Atrial Fibrillation in Patients With Structural Heart Disease, Part 2 Epicardial Breakthrough



**Persistent AF
Right Atrium**

**Persistent AF
Left Lateral Wall**


**Persistent AF
Left Posterior Wall**



De Groot & Allessie Circulation 2010;122:1674-82

Cardiac resynchronization therapy and Atrial Fibrillation

2010 Focused Update of ESC Guidelines on device therapy in heart failure

considered to reduce morbidity	LVEF $\leq 35\%$, QRS ≥ 130 ms Pacemaker dependency induced by AV nodal ablation			
CRT-P/CRT-D ^d should be considered to reduce morbidity	NYHA function class III/IV LVEF $\leq 35\%$, QRS ≥ 130 ms Slow ventricular rate and frequent pacing ^e	IIa	C	—

^aClass of recommendation.

^bLevel of evidence.

^cReferences.

^dReasonable expectation of survival with good functional status for >1 year for CRT-D. Patients with a secondary prevention indication for an ICD should receive a CRT-D.

^eFrequent pacing is defined as $\geq 95\%$ pacemaker dependence.

CRT = cardiac resynchronization therapy; CRT-P = CRT with pacemaker function; CRT-D = CRT with defibrillator function; LVEF = left ventricular ejection fraction; NYHA = New York Heart Association; SR = sinus rhythm.



Cardiac resynchronization therapy and Atrial Fibrillation

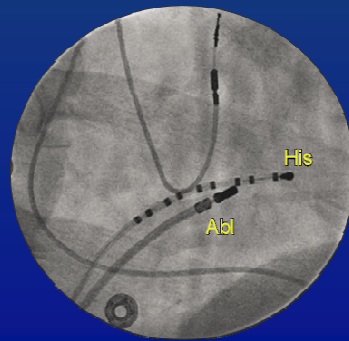
2010 Focused Update of ESC Guidelines on
device therapy in heart failure

4. Cardiac resynchronization therapy with pacemaker/ defibrillator function in patients with heart failure and permanent atrial fibrillation

However, there is consensus that essentially complete ventricular capture is mandatory in order to maximize clinical benefit and improve the prognosis of patients with permanent AF.³⁶ This often requires creation of complete heart block by ablation of the AV junction given the frequently inadequate efficacy of pharmacological treatment of ventricular rate control at rest and during exercise. Frequent pacing is defined as $\geq 95\%$ pacemaker dependency.³⁷

CRT and Atrial Fibrillation

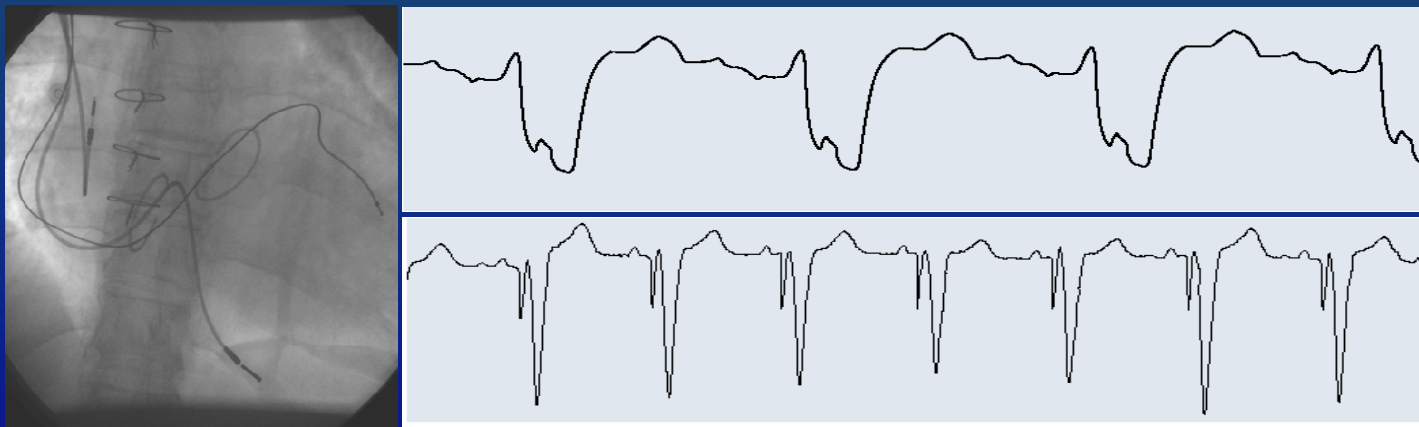
AV junction ablation is the **only** tool that allows
complete heart rate control
favoring a **constant delivery of CRT**



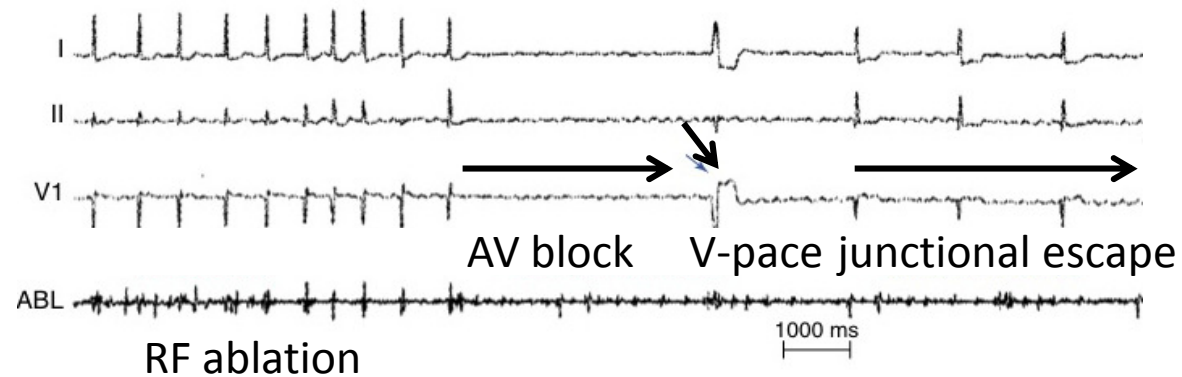
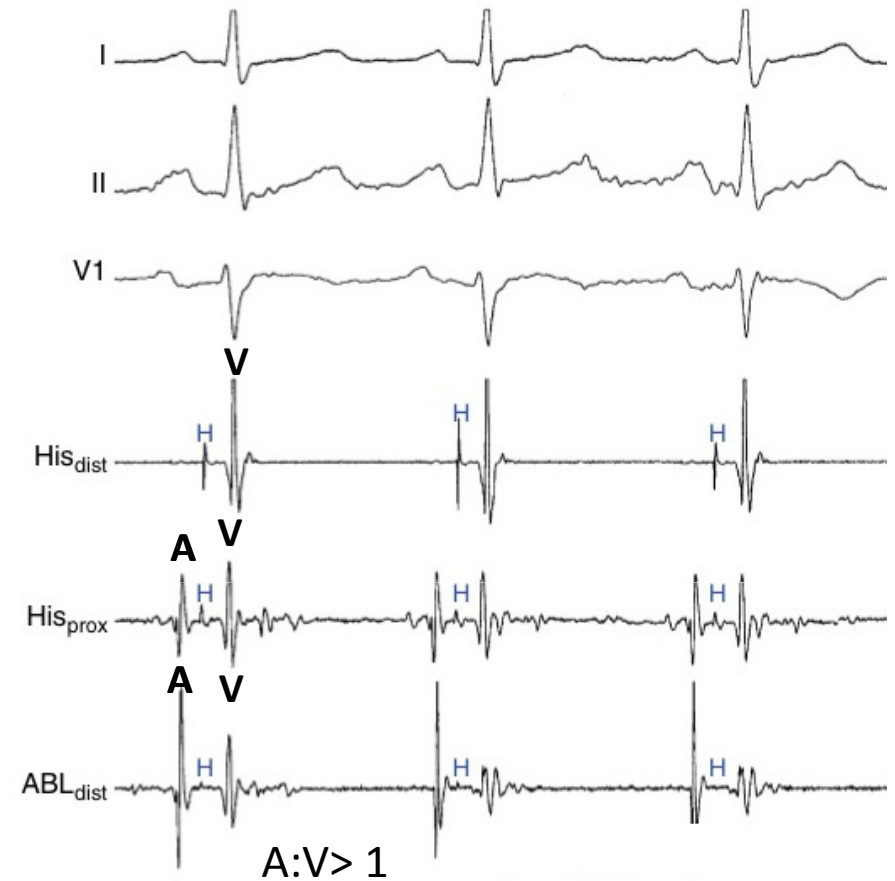
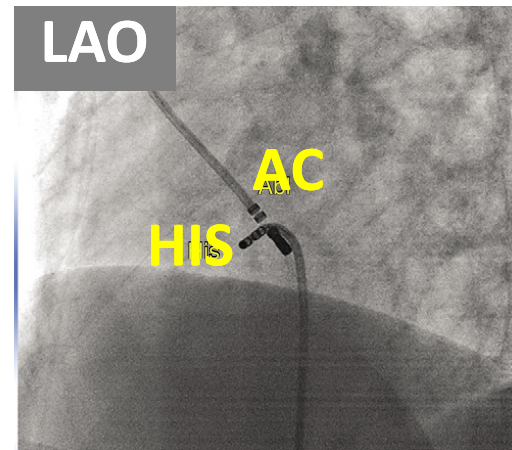
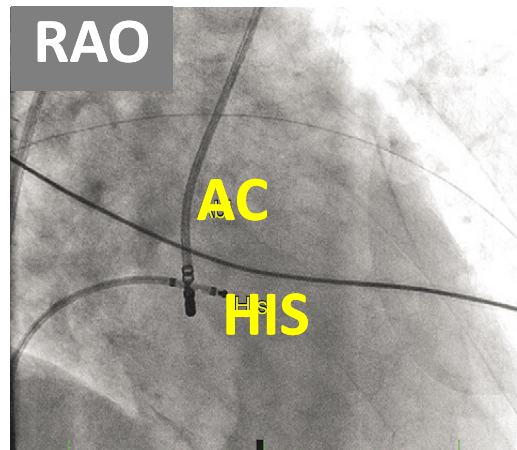
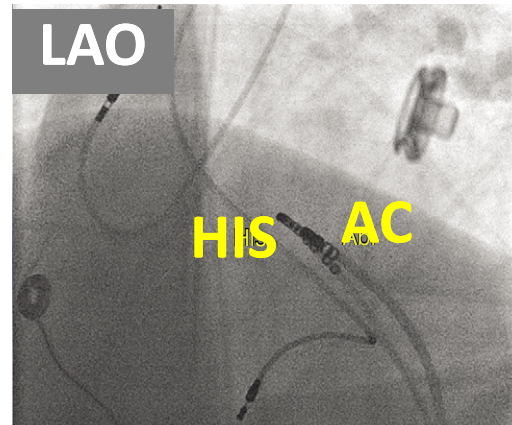
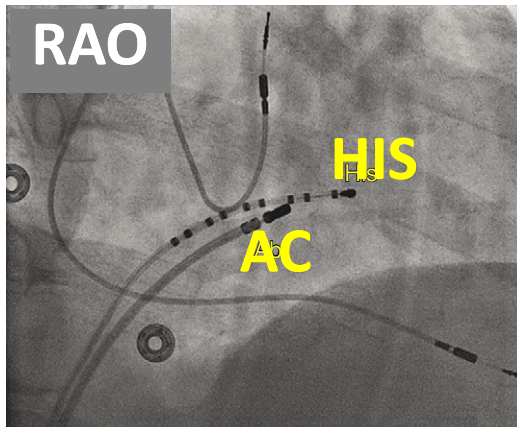
'Ablate and Pace' Approach

Positive effect of AV junction ablation

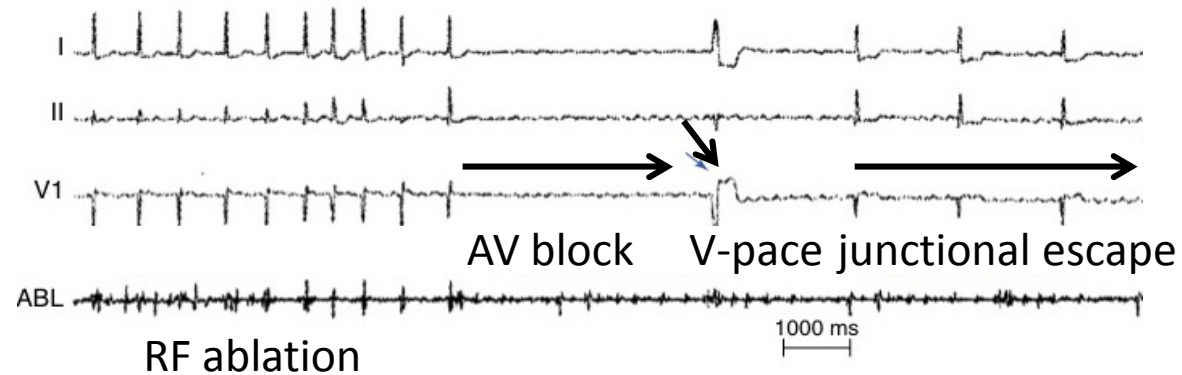
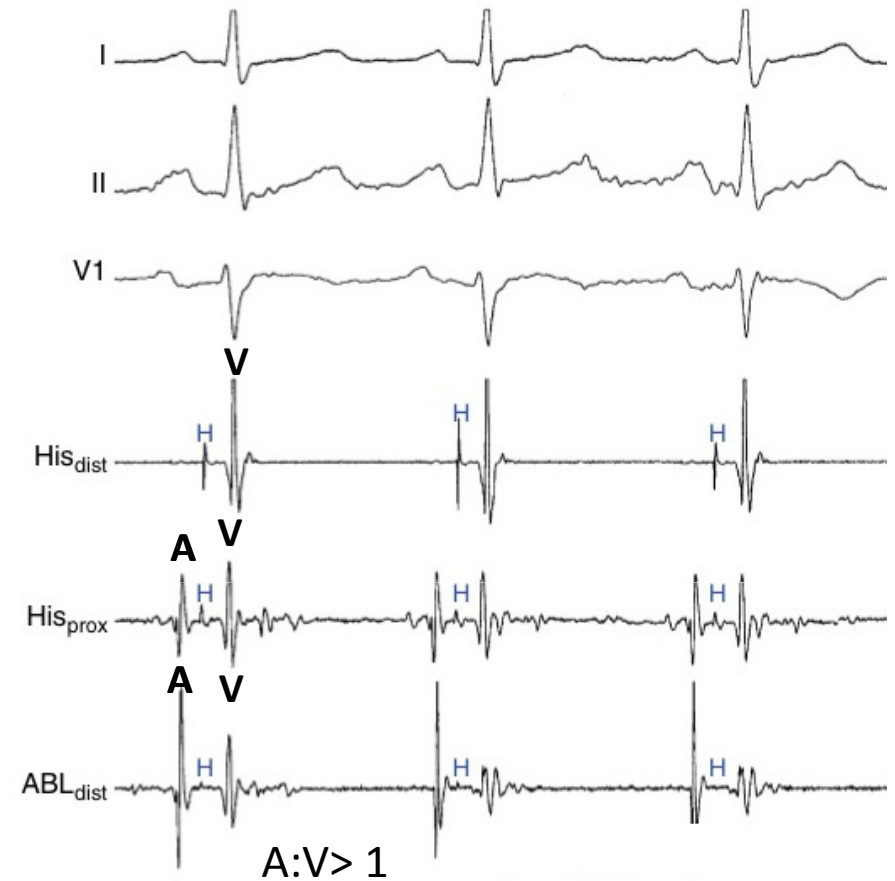
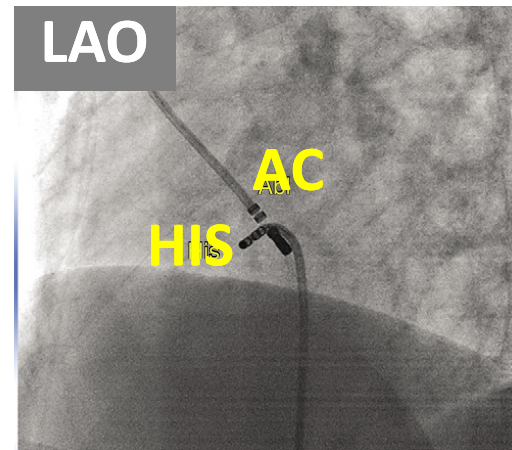
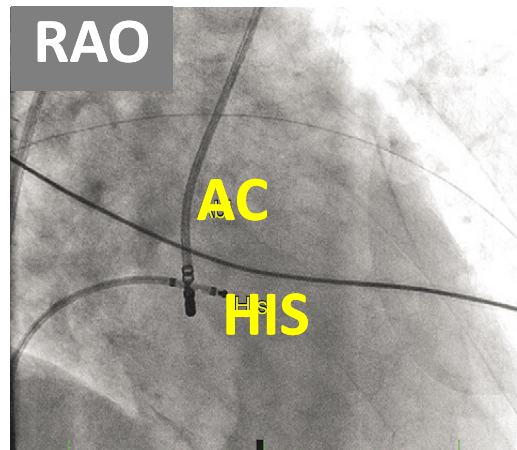
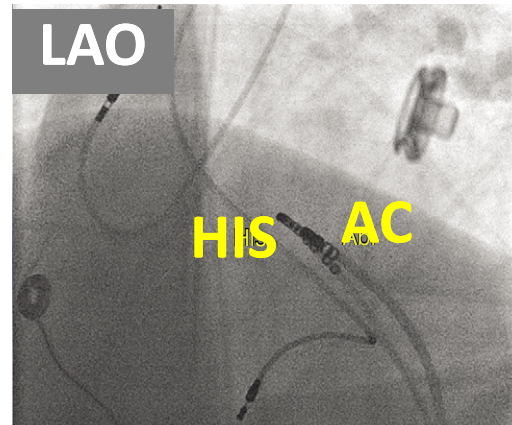
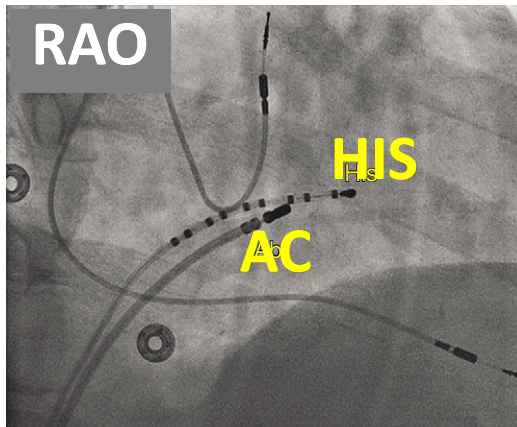
- ✓ Improvements in NYHA functional class
- ✓ Left ventricular ejection fraction
- ✓ Exercise capacity
- ✓ Reduction of cardiovascular mortality



AV junction ablation



AV junction ablation

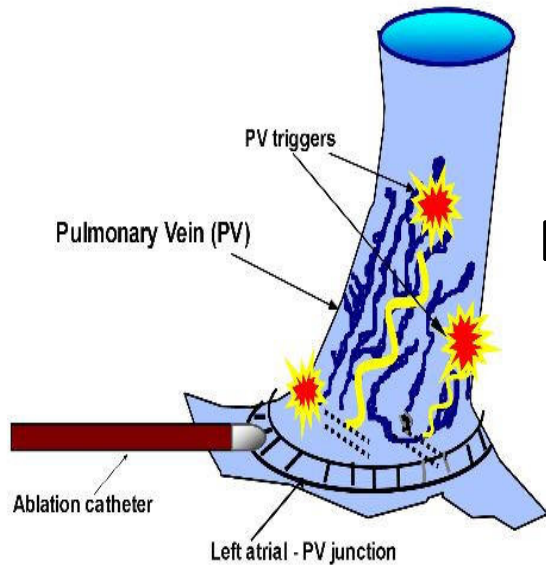


CRT and Atrial Fibrillation



Catheter Ablation versus Standard
conventional Treatment in patients with
Left ventricular dysfunction and Atrial
Fibrillation

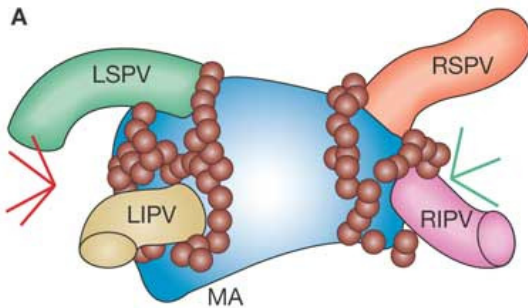
Pulmonary Veins Isolation



ECG

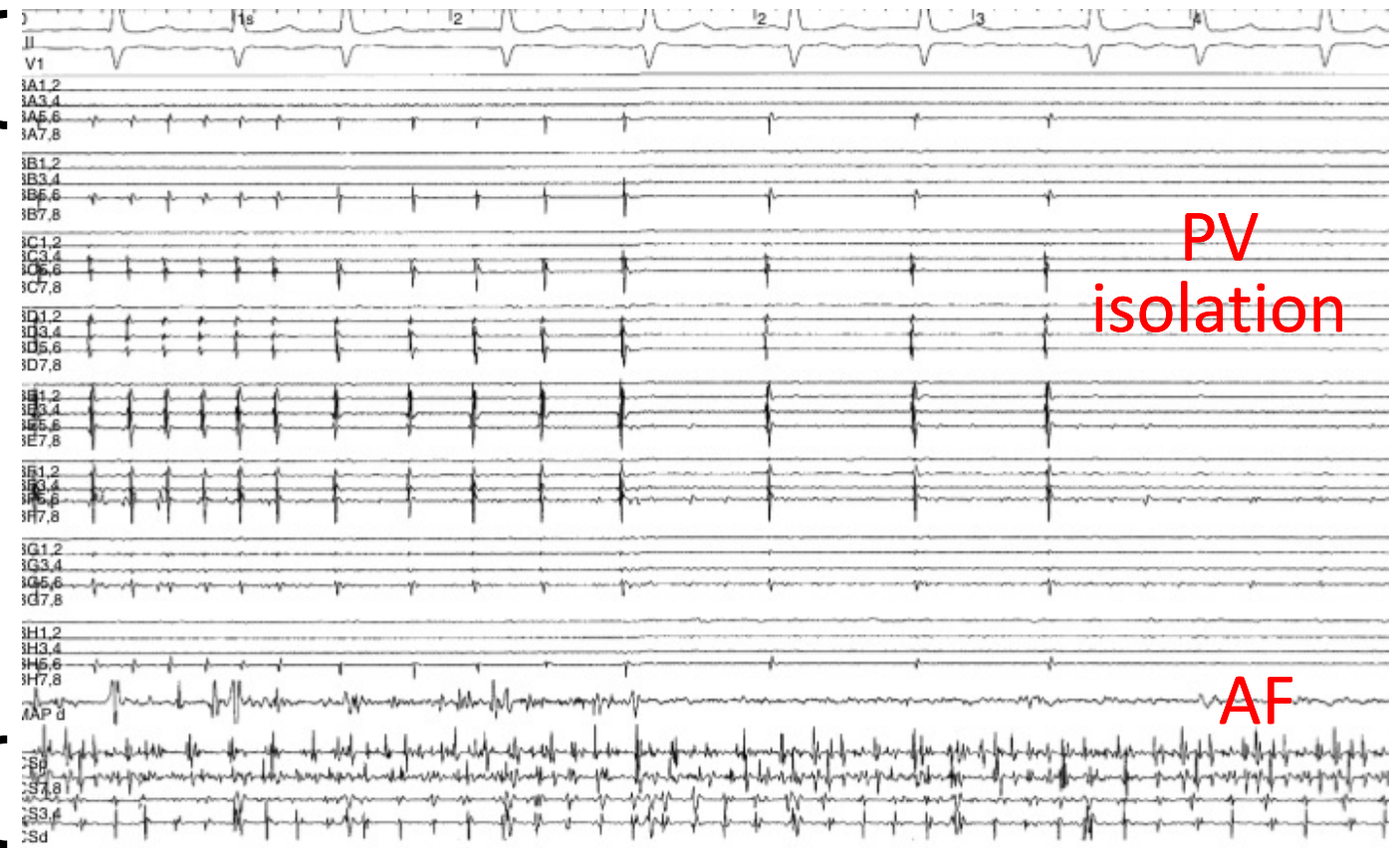
PVs

PV
isolation

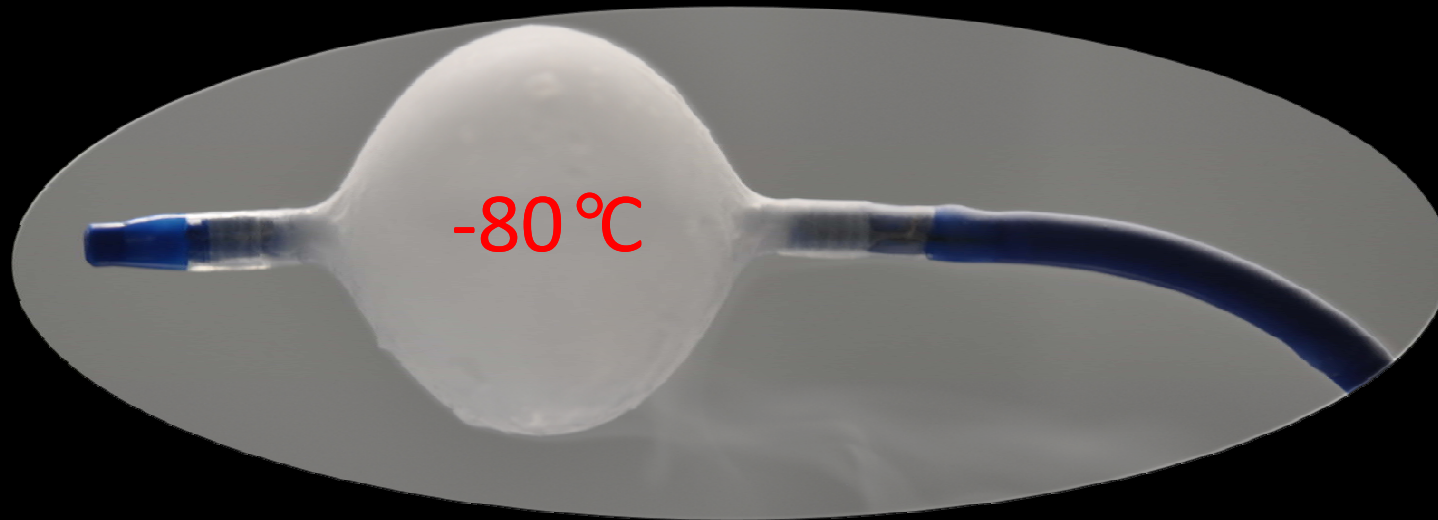


CS

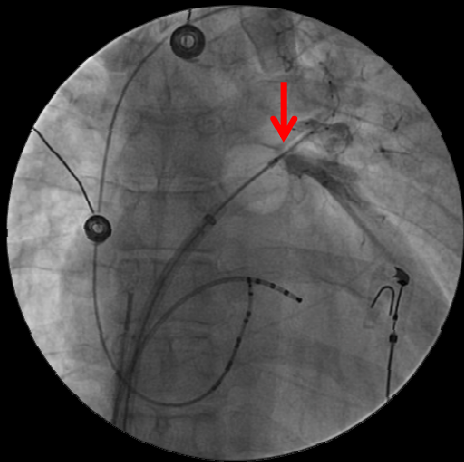
AF



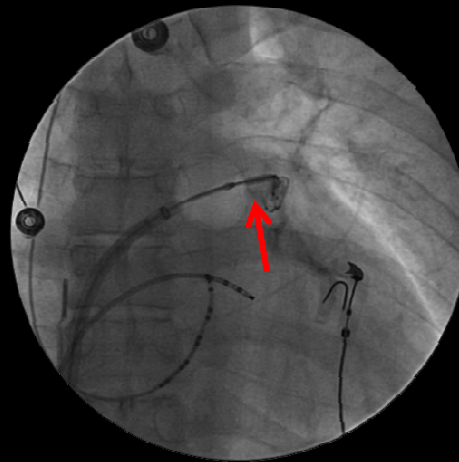
Cryothermal energy ablation



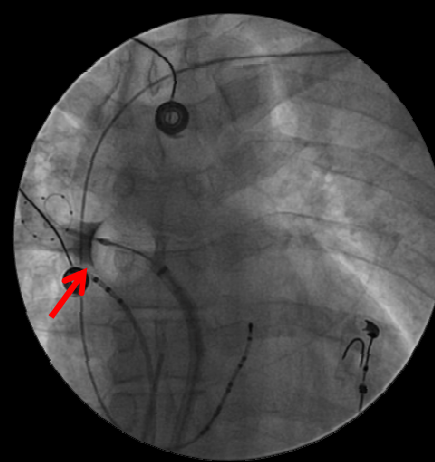
LSPV



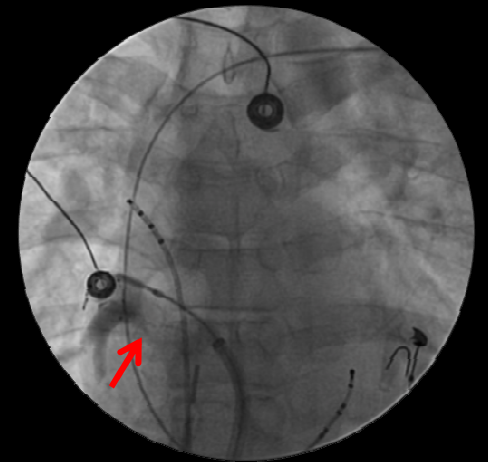
LIPV



RSPV



RIPV



5 minutes per vein

By courtesy of Dr. R. Bhagwandien

Update CRT, AF and Ablative Therapy

Heart Failure Patients

- ✓ ICDs : prevention sudden cardiac death
paradox of ICD therapy !!
- ✓ Effective CRT is mandatory: improve survival
- ✓ Reduction (in) appropriate shocks
- ✓ Ablative therapy : curative treatment modality

Update CRT, AF and Ablative Therapy

Heart Failure Patients

- ✓ Advances in mapping/ablation technology have improved **success rate** and extended indications
- ✓ Catheter **ablation** : important **adjunctive therapy** to medical and ICD therapy
- ✓ Ablative therapy: unstable and stable VT
- ✓ AVJ ablation is a fundamental step in CRT

Questions ?

