Ventricular Tachycardia: Therapy

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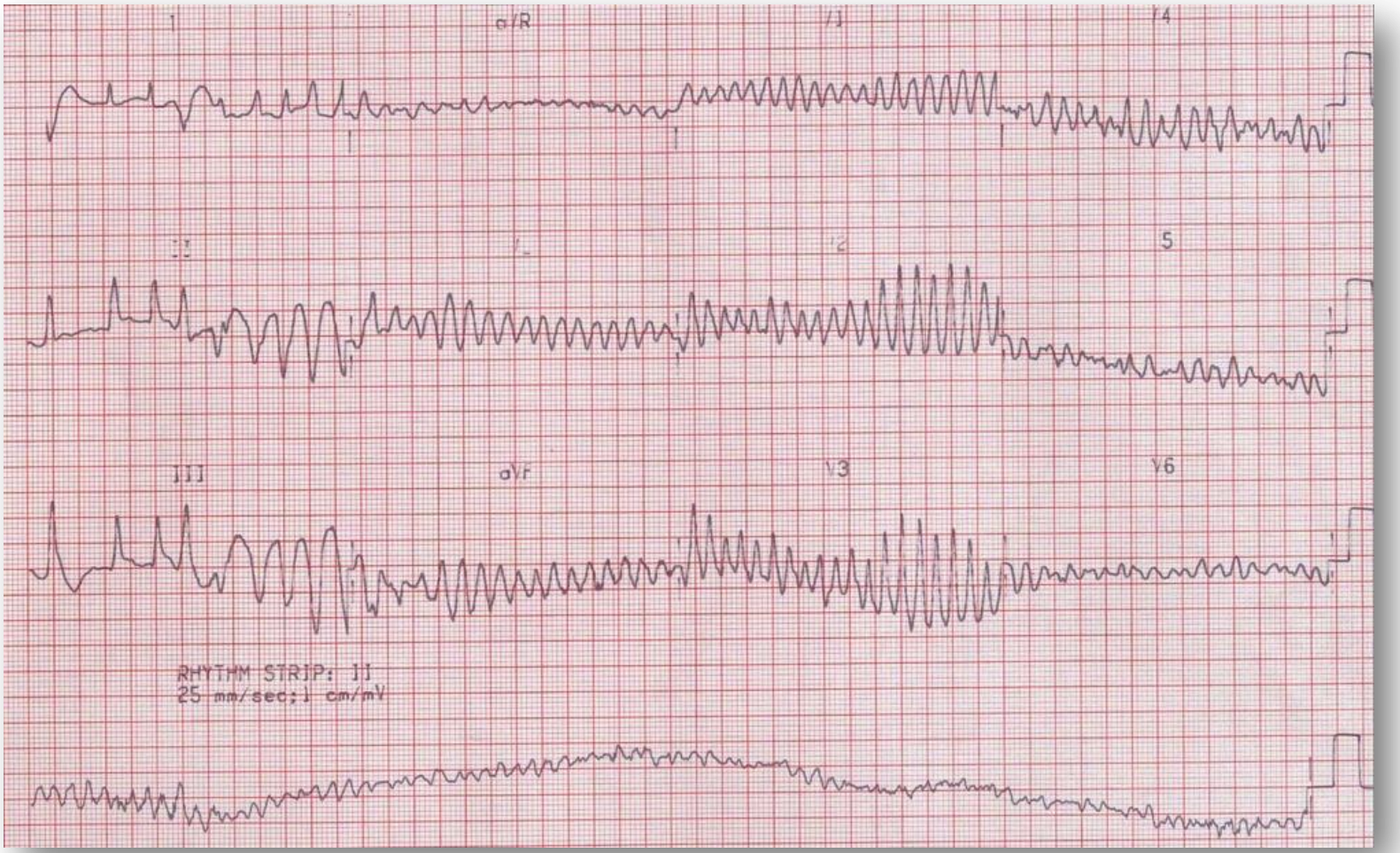
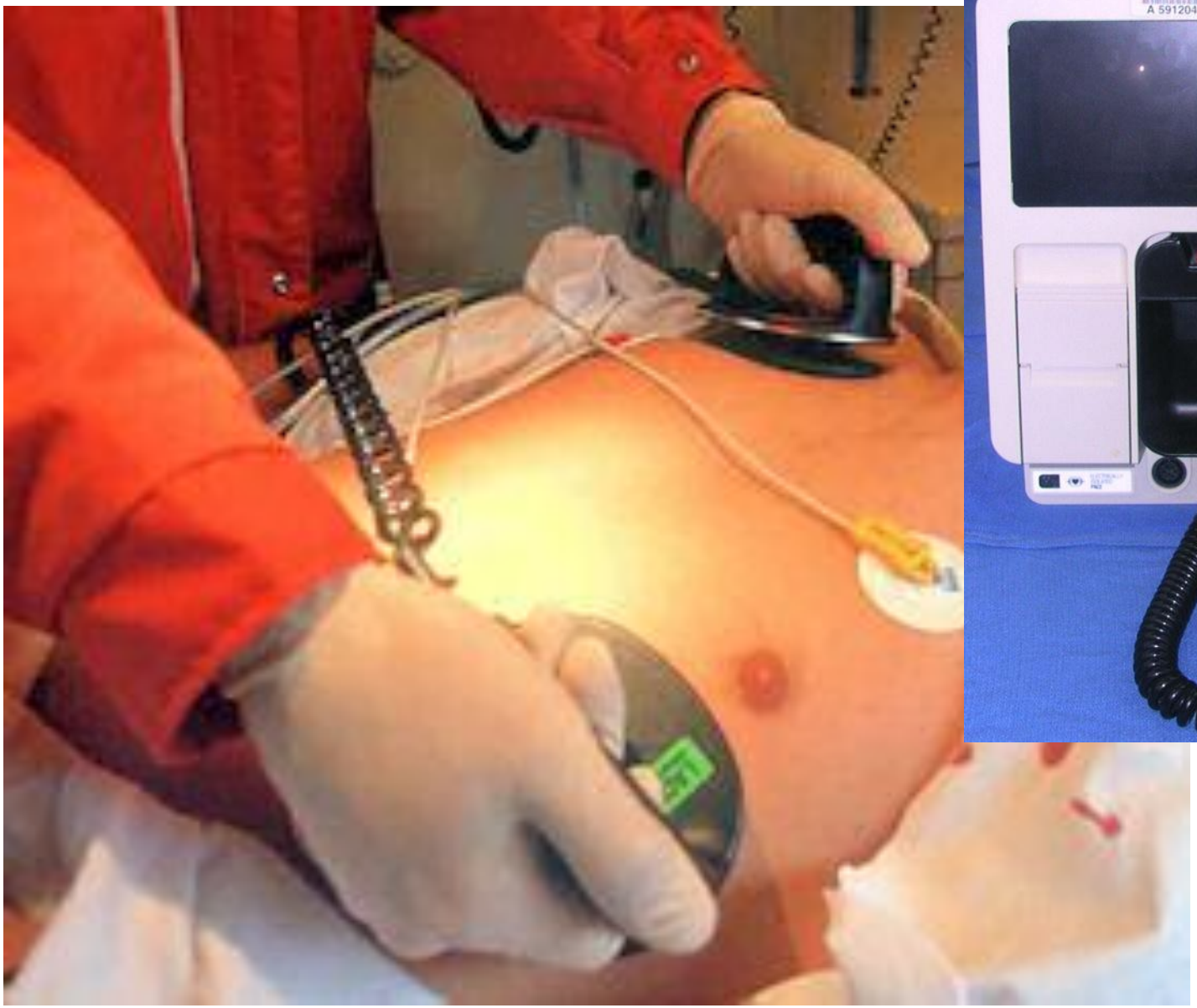
Ventricular Fibrillation – Sudden Cardiac Death

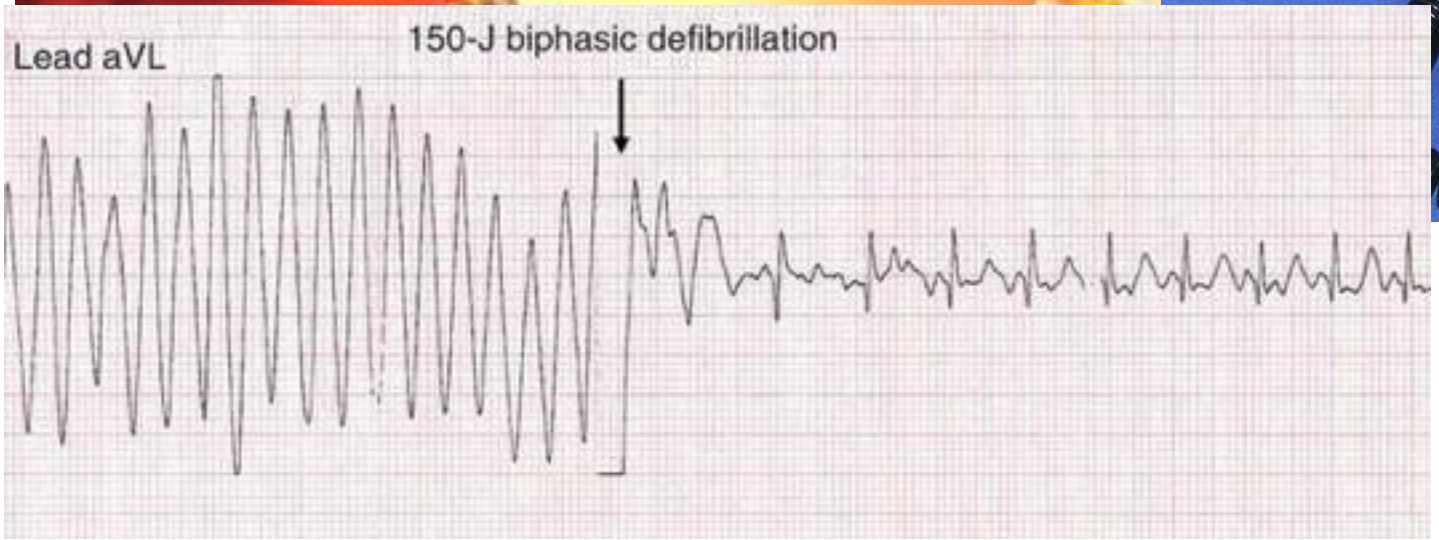


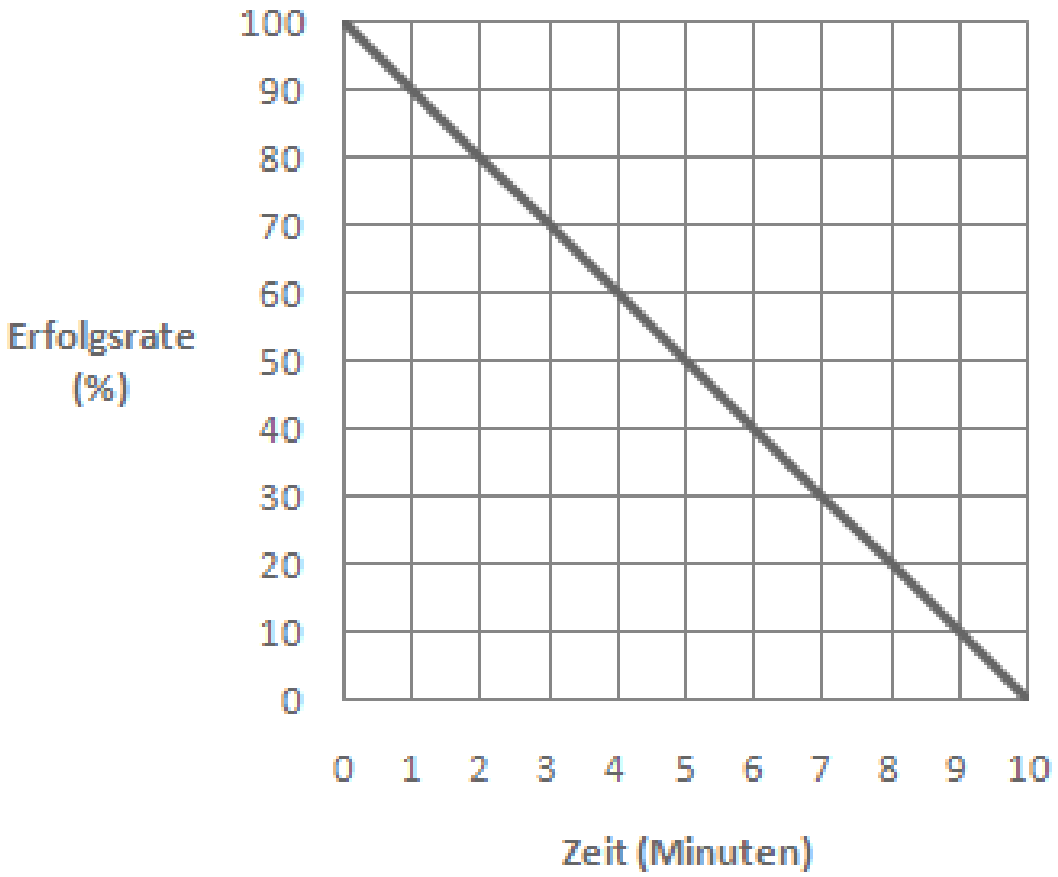

AMBULANCE




PHYSIO-CONTROL
LIFEPAK 9P
STERNUM
APEX


PHYSIO-CONTROL
LIFEPAK 9P
STERNUM
APEX

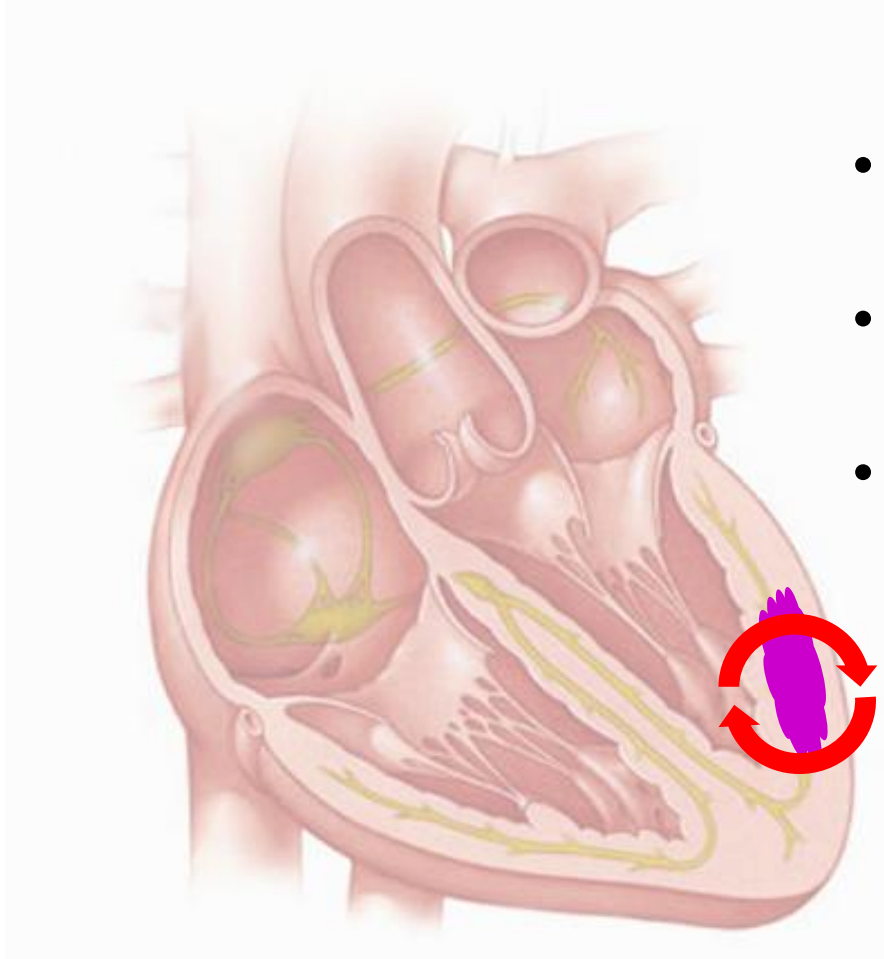

Lead aVL
150-J biphasic defibrillation


Erfolgsrate (%)
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10
Zeit (Minuten)

In Switzerland 10‘000 people die every year from sudden cardiac death

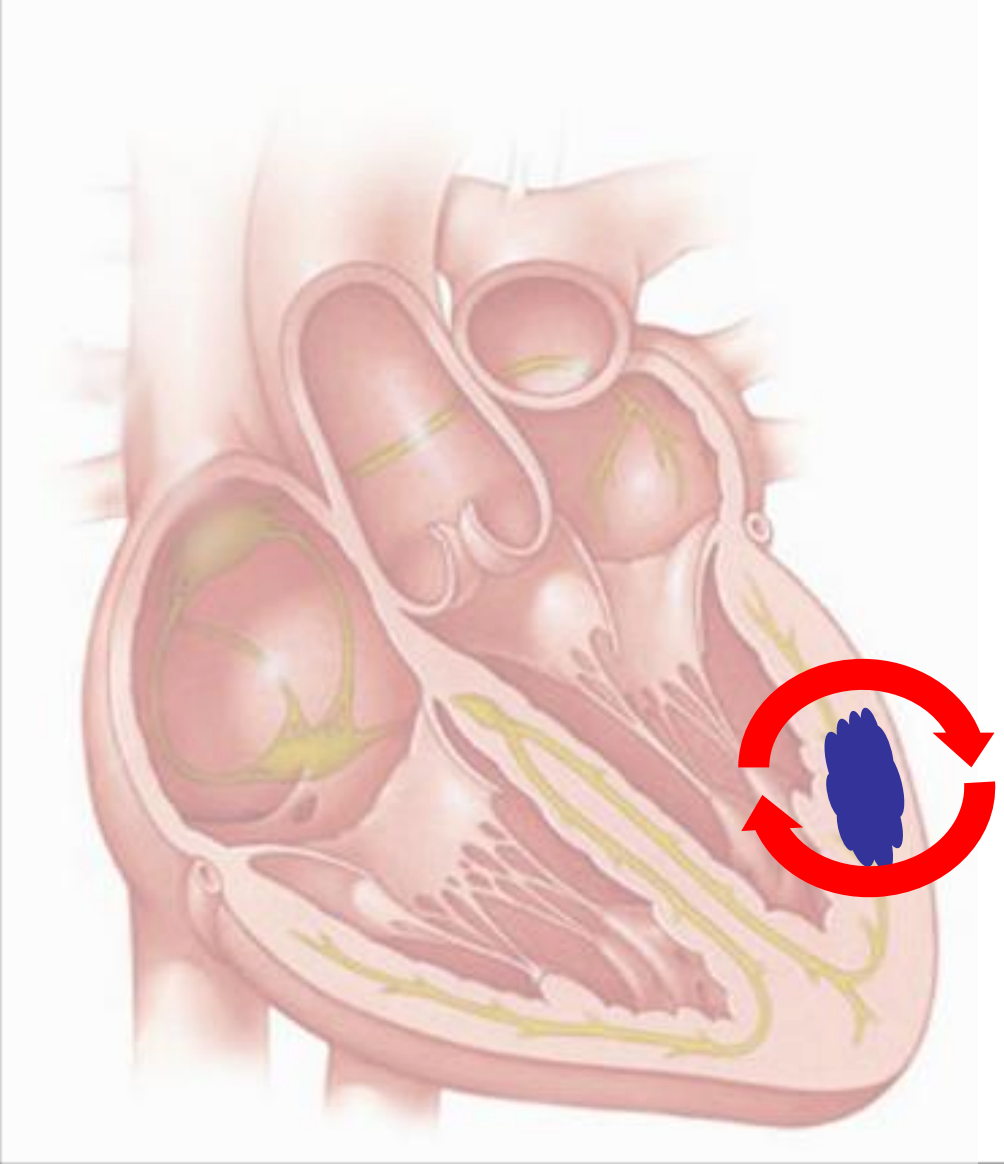
ICD = **I**mplantable **C**ardioverter - **D**efibrillator

Ventricular Tachycardia – Sudden Cardiac Death

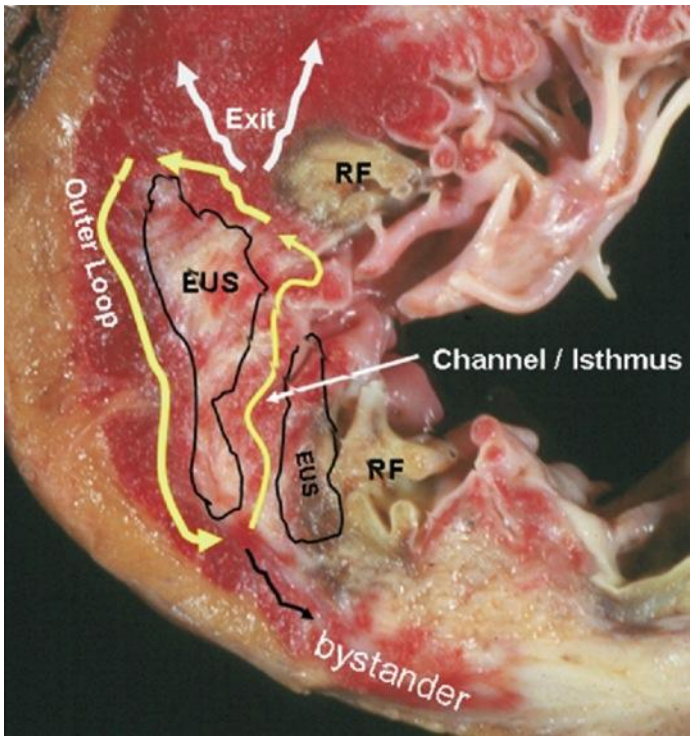


- Scar post MI
- Impaired systolic LV function
- Severe structural heart disease

Ventricular Tachycardia



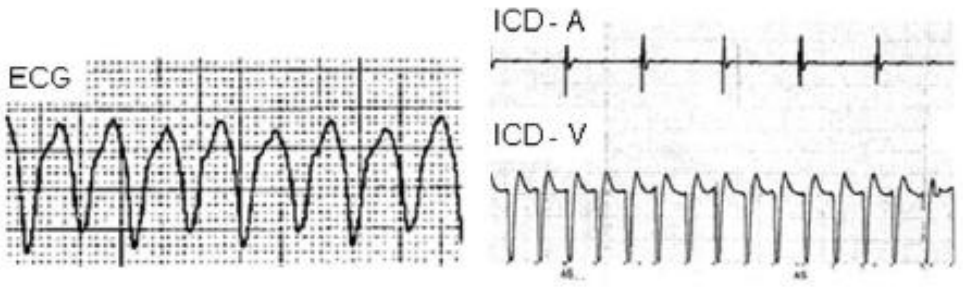
Scar-related electrical Reentry circuit



Monomorphic versus polymorphic VT

Monomorphic VT

- No Strucural Heart Disease / Idiopath
- Scar- related
- Purkinje - related



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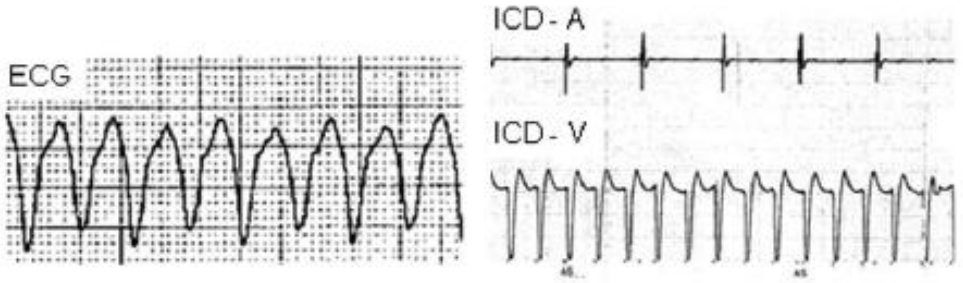
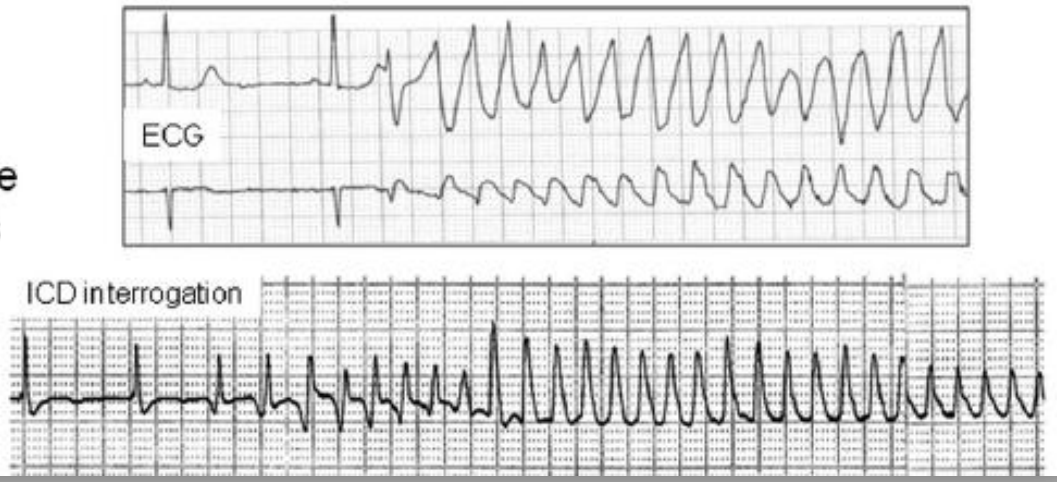
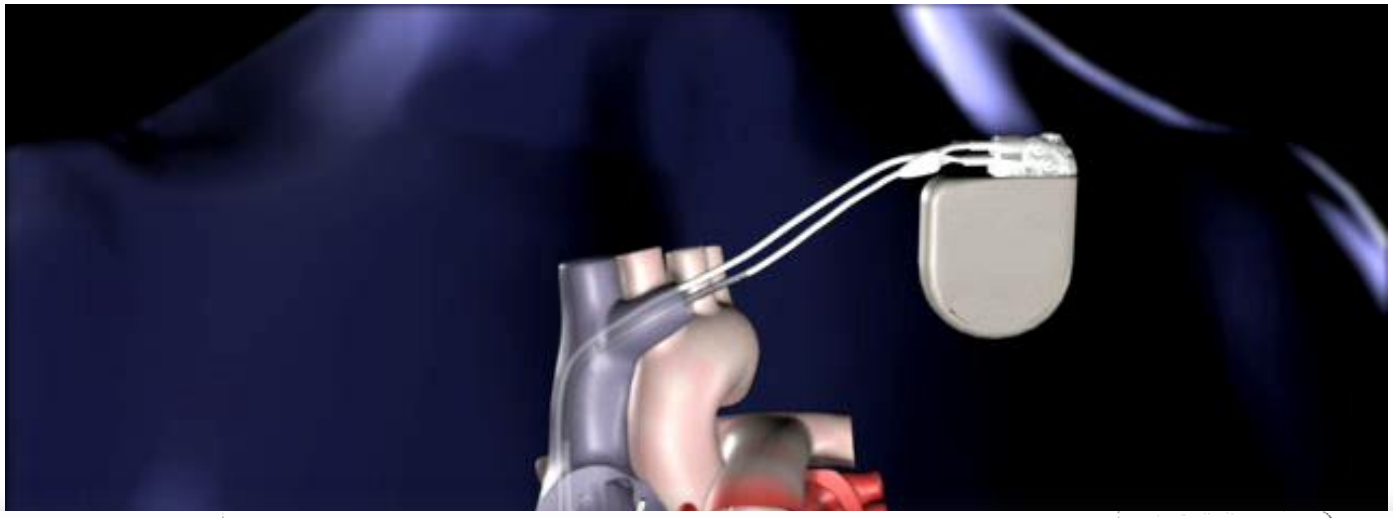


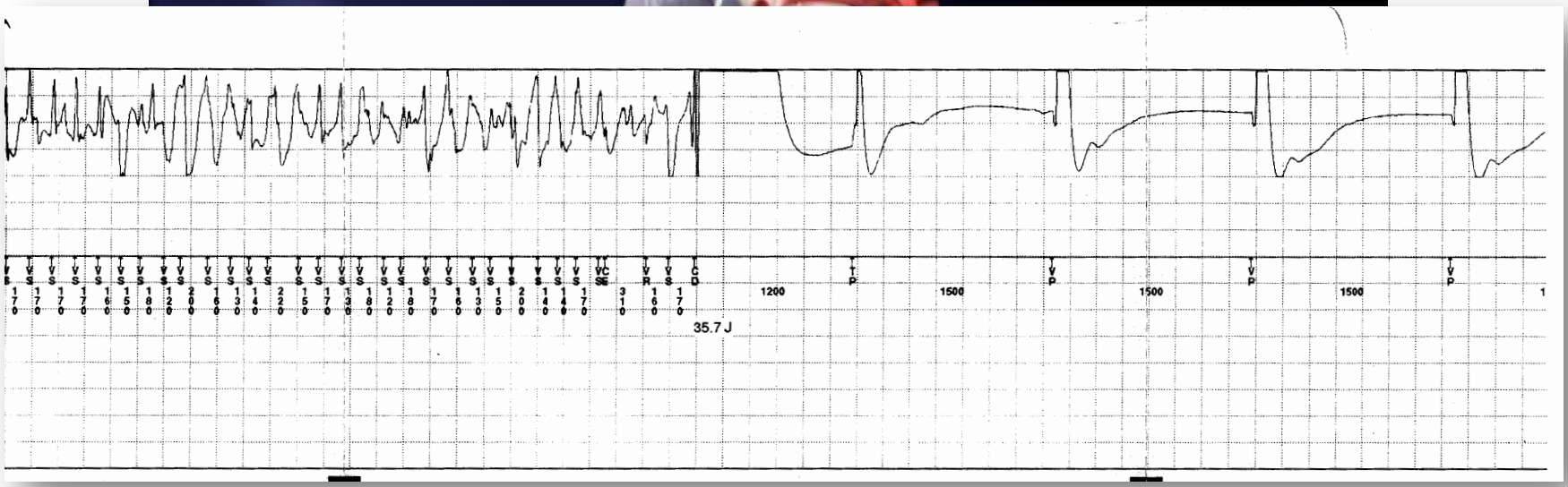
Polymorphic VT

- Acute myocardial ischemia
- Ventricular scar, hypertrophy, failure
- Genetic sudden death synddromes
  - Long QT, short QT
  - Brugada
  - CPVT



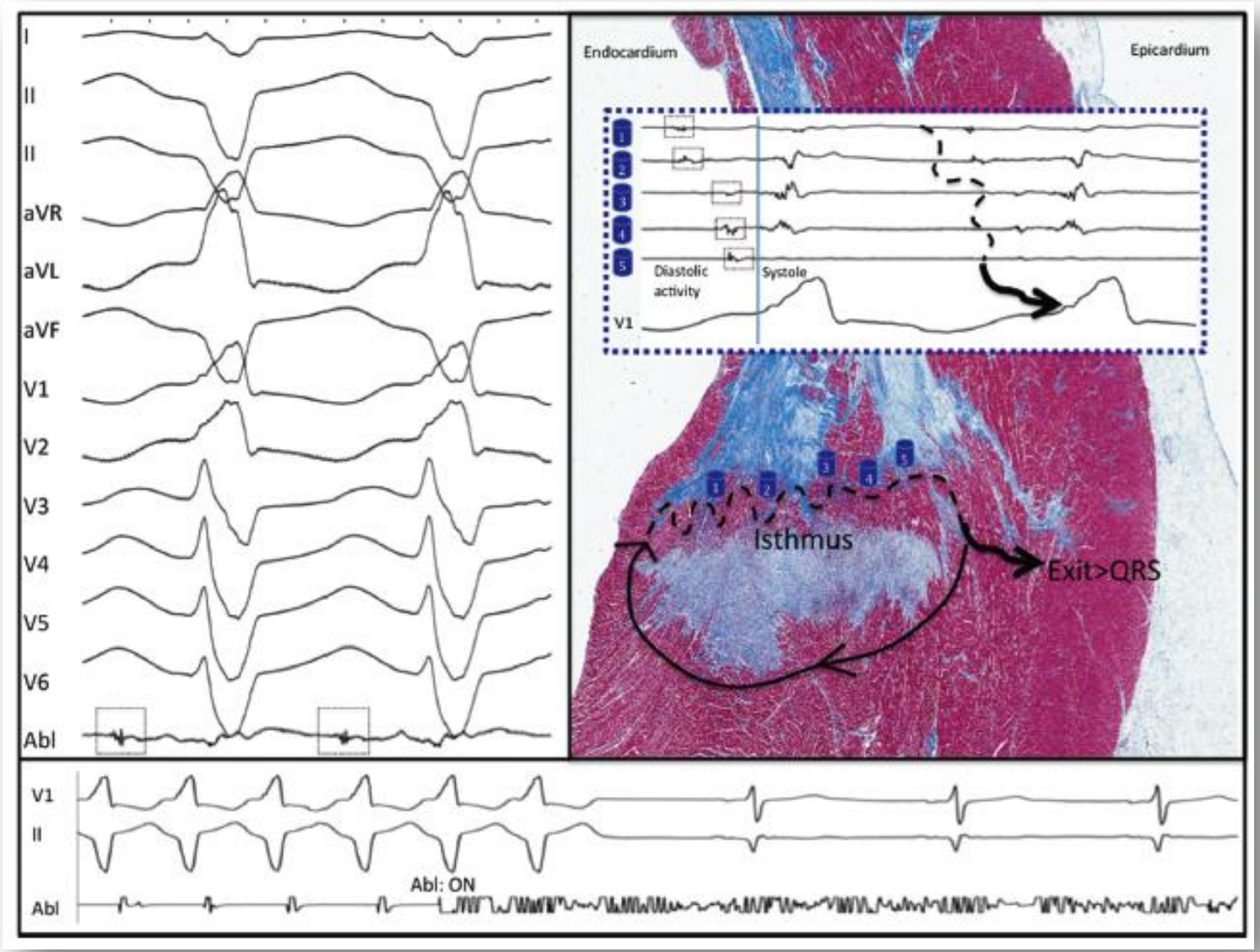
ICD = Implantable Cardioverter - Defibrillator





Amiodarone

UAW/Organ	Inzidenz	Empfohlene Überwachung	Anmerkungen
Herz Bradykardie QT-Zeit-Verlängerung Torsades de pointes	 5% > 90% < 1%	Ausgangs-EKG vor Therapiebeginn, mind. jährliche Kontrollen; bei vorbestehenden Überleitungsstörungen (AV-Block, Schenkelblock) häufiger	Geringere Loading-Dose bei älteren Patienten und bei vorbestehenden Überleitungsstörungen erwägen; Dosisreduktion oder Therapiestopp bei QT-Zeit > 550 msec
Leber	15%	SGOT (AST) und SGPT (ALT) vor Therapiebeginn bestimmen, Kontrollen alle sechs Monate	Nicht bei Patienten mit schwerer Lebererkrankung anwenden!
Schilddrüse Hyperthyreose Hypothyreose	 3% (Jodmangelgeb. 20%) 20%	Schilddrüsenfunktionstests vor Therapiebeginn, 2-3 Kontrollen jährlich	Nicht bei Patienten mit vorbestehenden Schilddrüsenknoten anwenden! Höhere Inzidenz von Funktionsstörungen bei Autoimmunerkrankungen der Schilddrüse
Lunge Lungenfibrose	 < 3%	Lungenfunktionstest vor Therapiebeginn und wenn Symptome auftreten. Rö-Thorax vor Therapiebeginn und jährliche Kontrollen	Sofortiges Absetzen, wenn der Verdacht auf pulmonale UAW besteht
Haut (Photosensibilität, Hautverfärbung)	25-75%	Keine besonderen Überwachungsempfehlungen	Sonnenschutz, Sun-Blocker mit hohem Lichtschutzfaktor
Nervensystem Ataxie, Tremor, Schlafstör., Polyneuropathie	3-30%	Keine besonderen Überwachungsempfehlungen	Bei verdächtigen Symptomen Dosisreduktion
Augen Hornhautablagerung Neuritis N. optici	 100% < 1%	Augenärztliche Untersuchung vor Therapiebeginn, Folgeuntersuchungen bei Symptomen	Nicht bei Pat. mit vorbestehender Neuritis N. optici


I
II
II
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
Abl
Endocardium
Epicardium
Diastolic
activity
Systole
V1
Isthmus
Exit>QRS
V1
II
Abl
Abl: ON

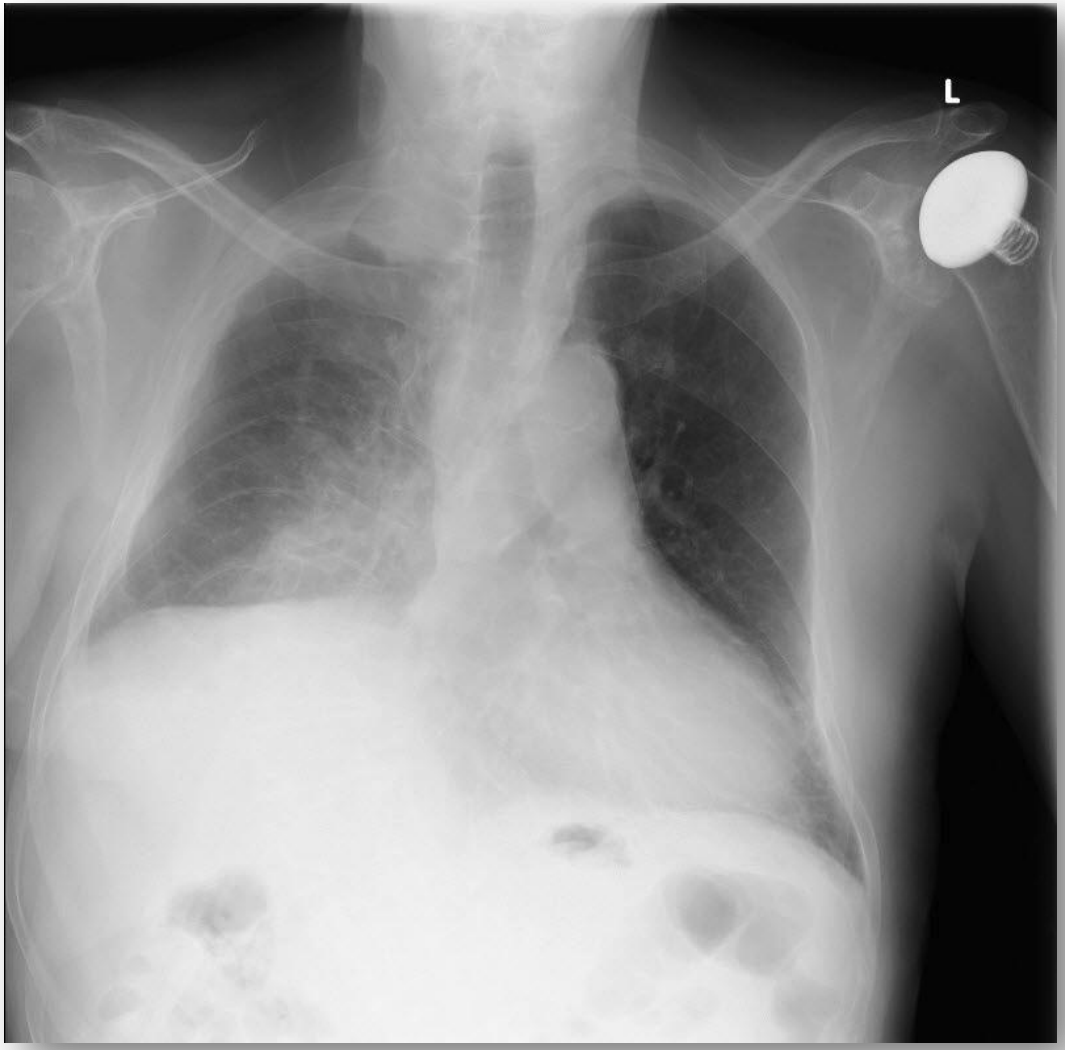
Patient 1

76-yo Male Patient

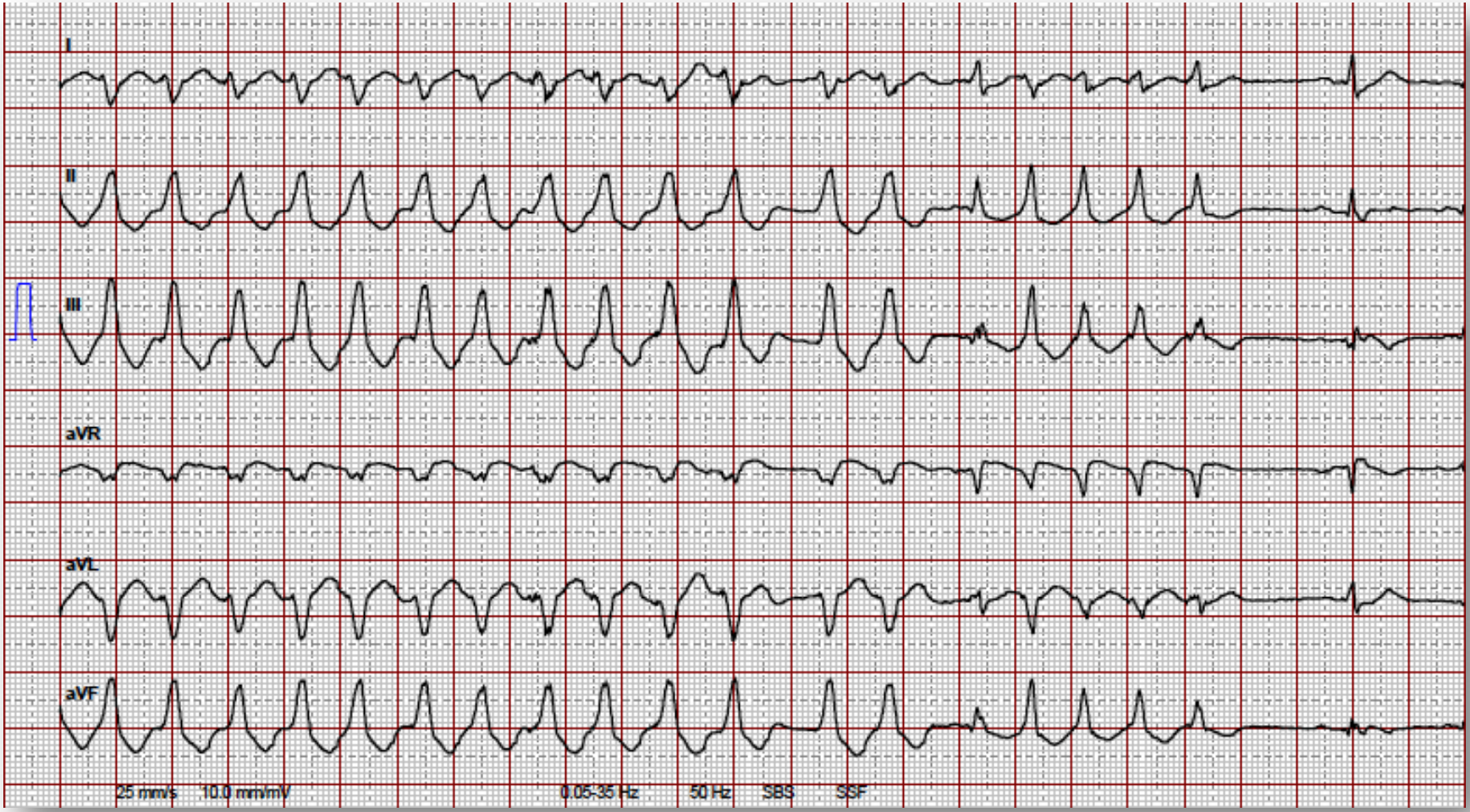
- Acute inferior MI and acute PCI of occluded RCA

- Hypertension
- Diabetes
- Severe lung disease post pleurectomy for pleural tuberculosis

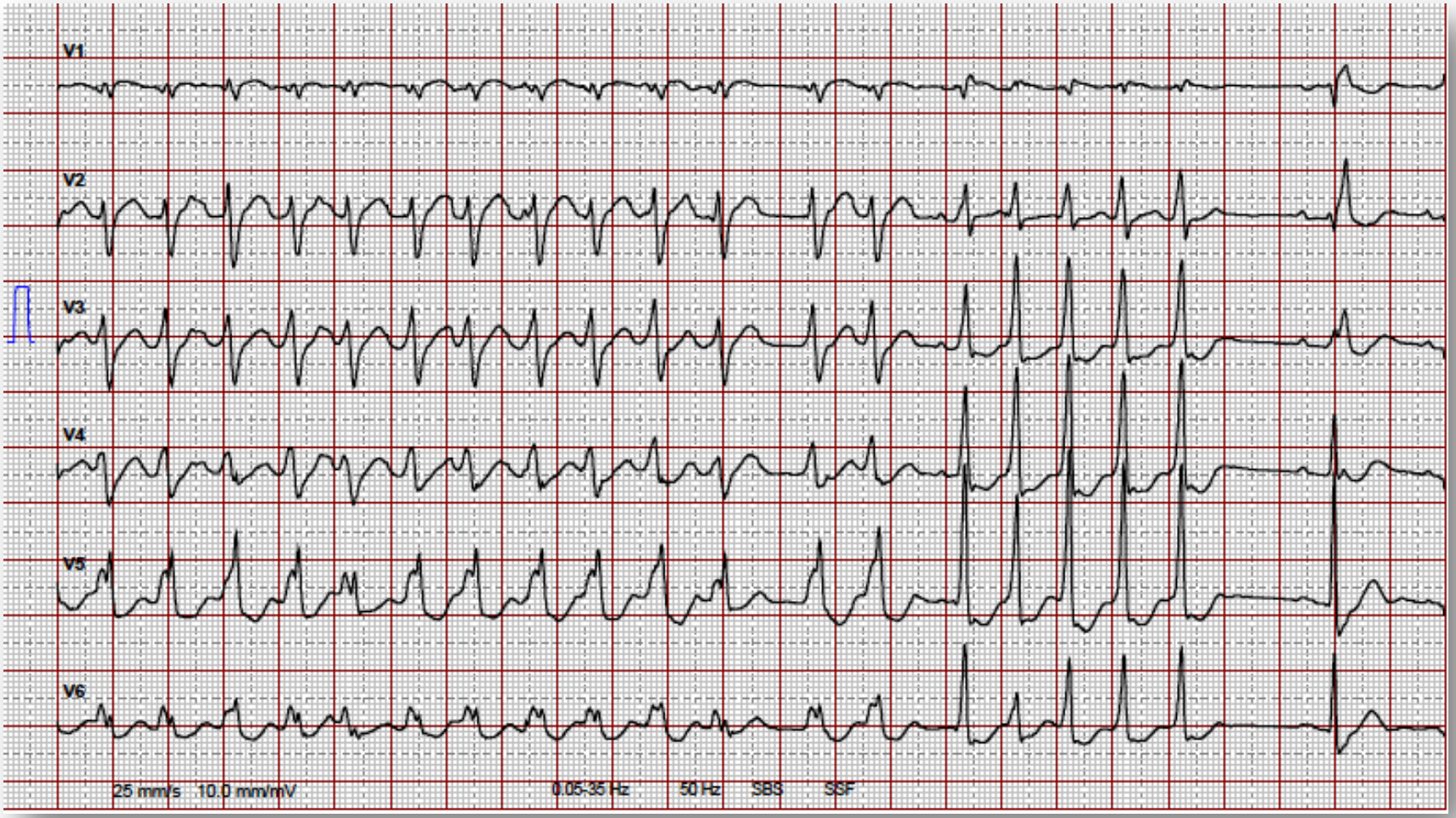
Severe Kyphoskoliosis



5 Days Later….



Recurrent symptomatic WCT


V1
V2
V3
V4
V5
V6
25 mm/s 10.0 mm/mV
0.05-35 Hz
50 Hz
SBS
SSF

Your ECG Diagnosis ?

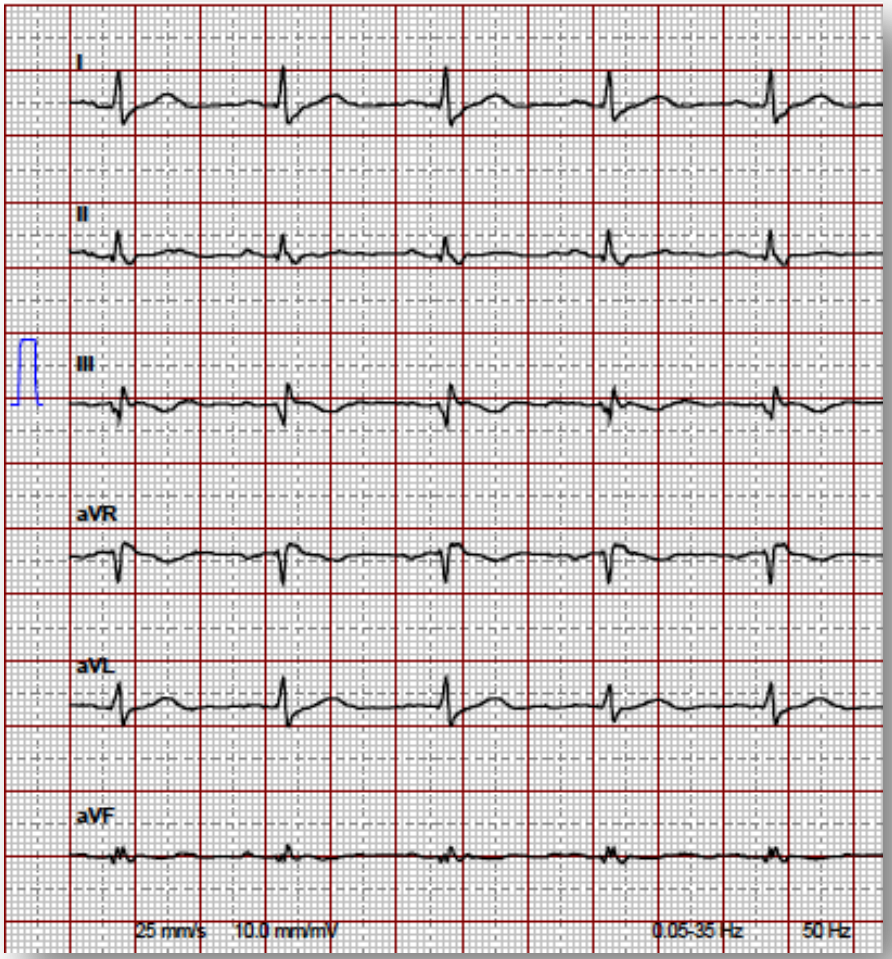
a) AF with aberrancy

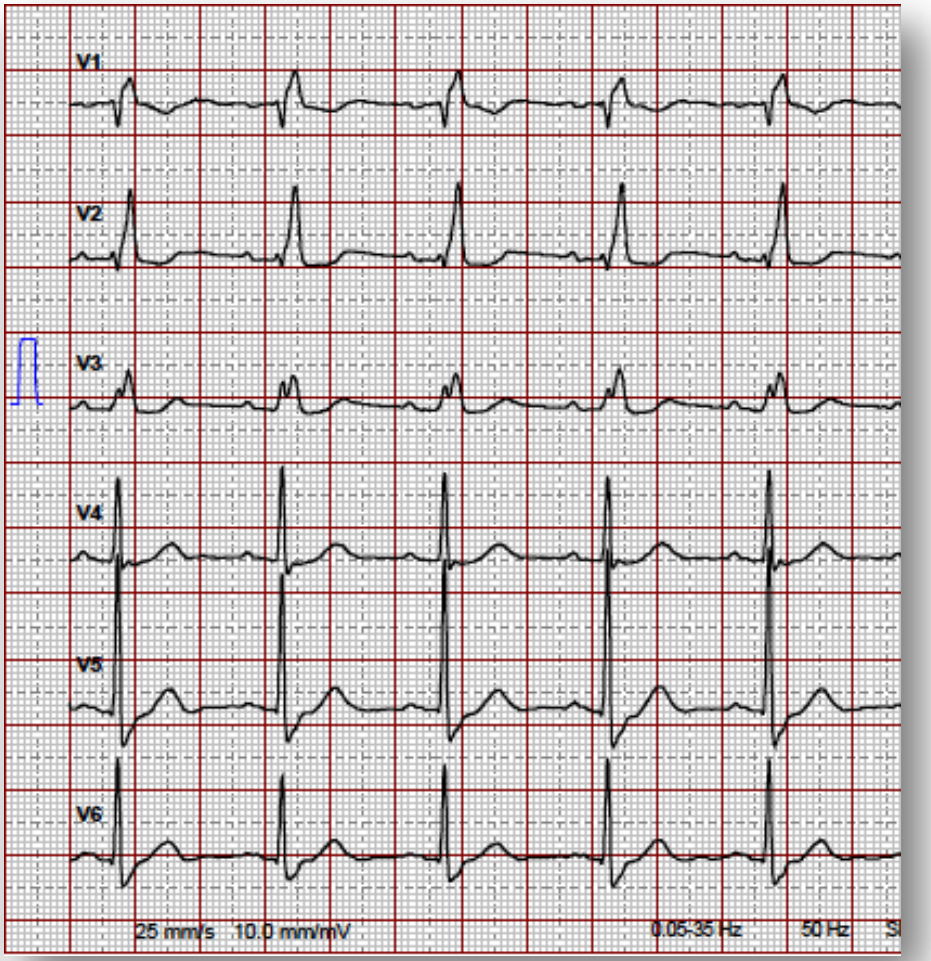
b) Atrial tachycardia

c) Ventricular tachycardia

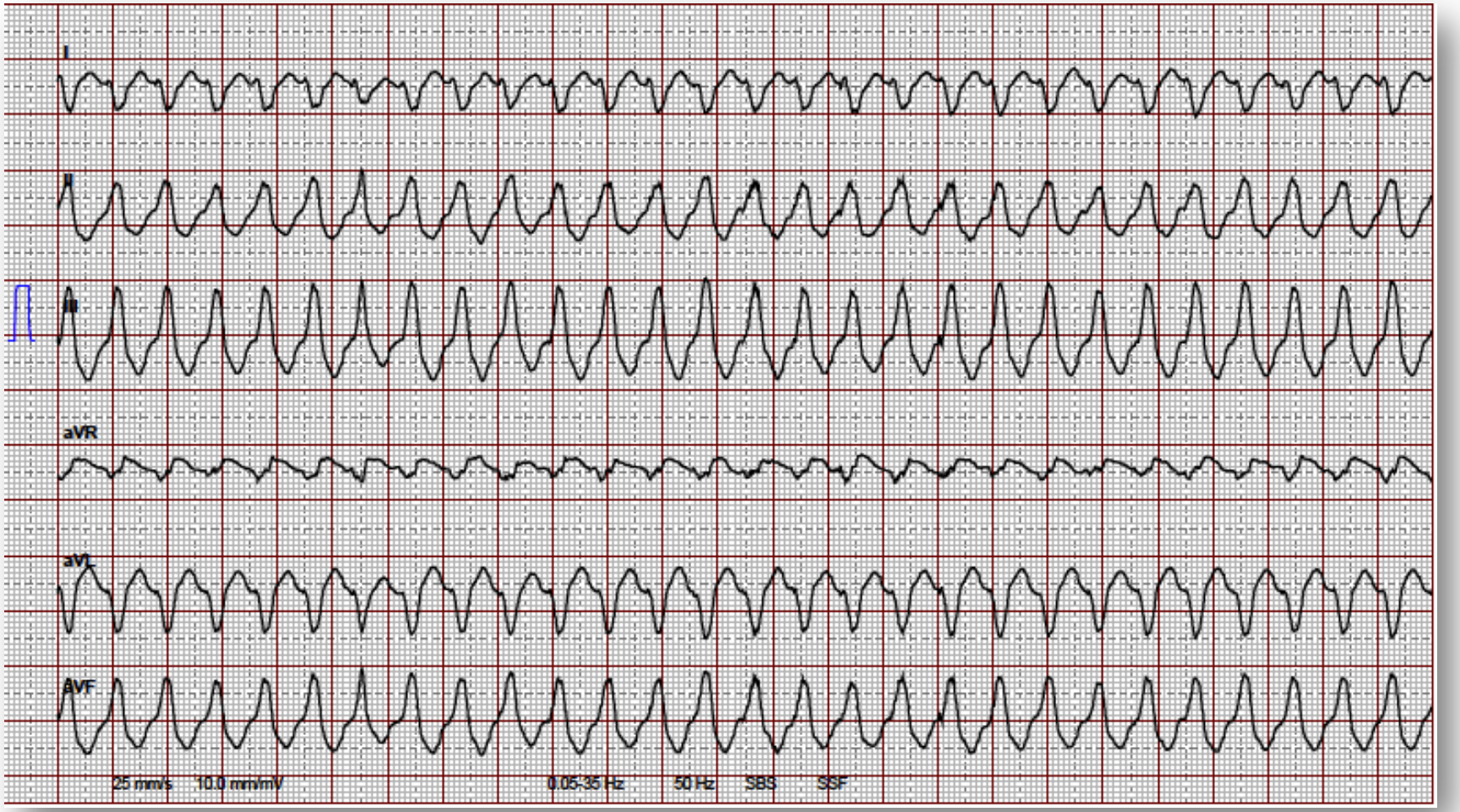
d) Dual tachycardia

ECG during normal SR

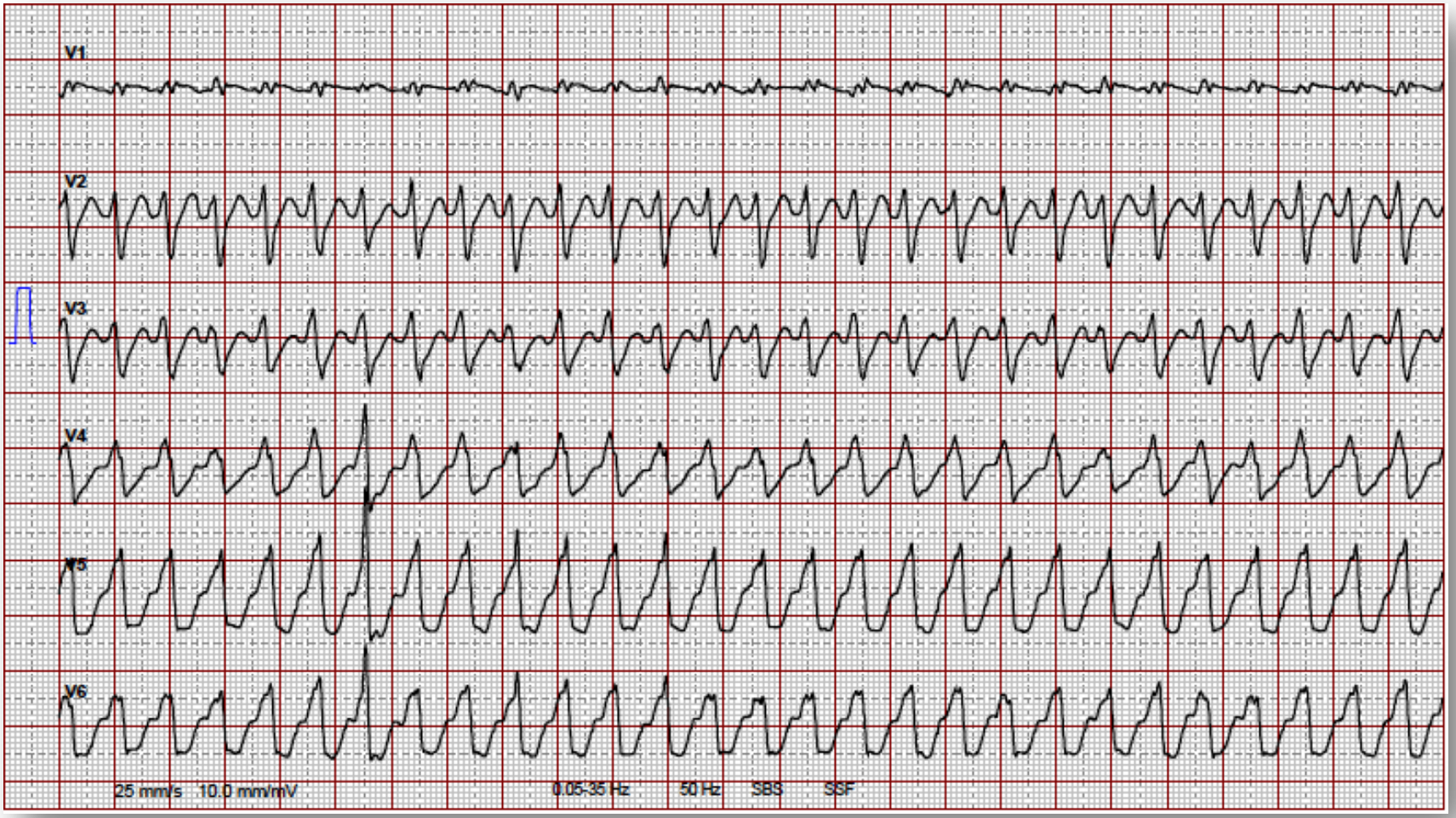




Sustained Tachycardias requiring DCCV



Sustained Tachycardias requiring DCCV



Problem

- Recurrent symptomatic sustained monomorphic VTs 180/min

What would you do next?

a) Echo

b) Coronary angiogram

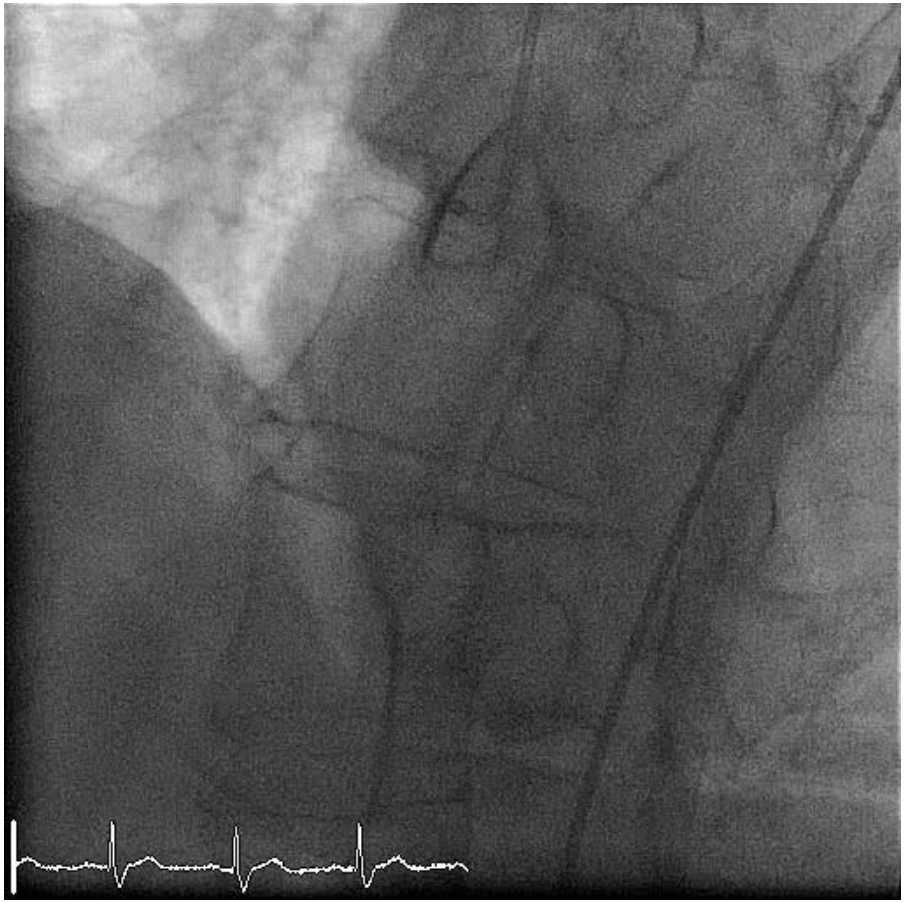
c) EP study

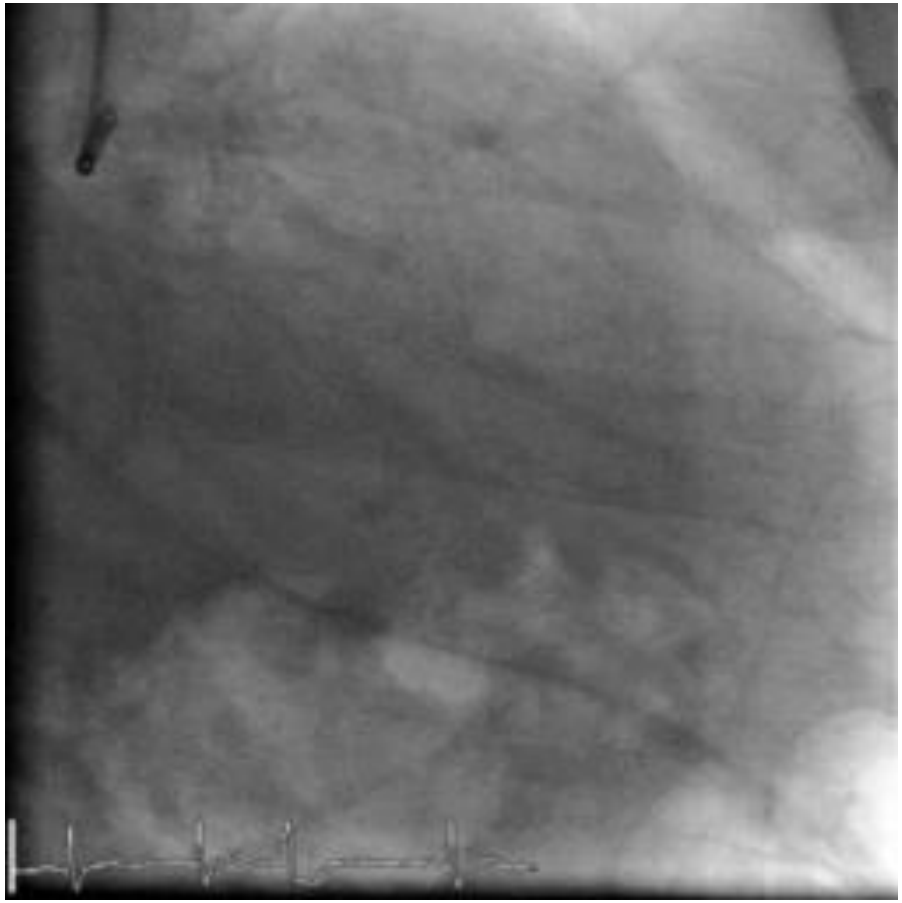
d) Functional ischemia test and which type

Diagnostics

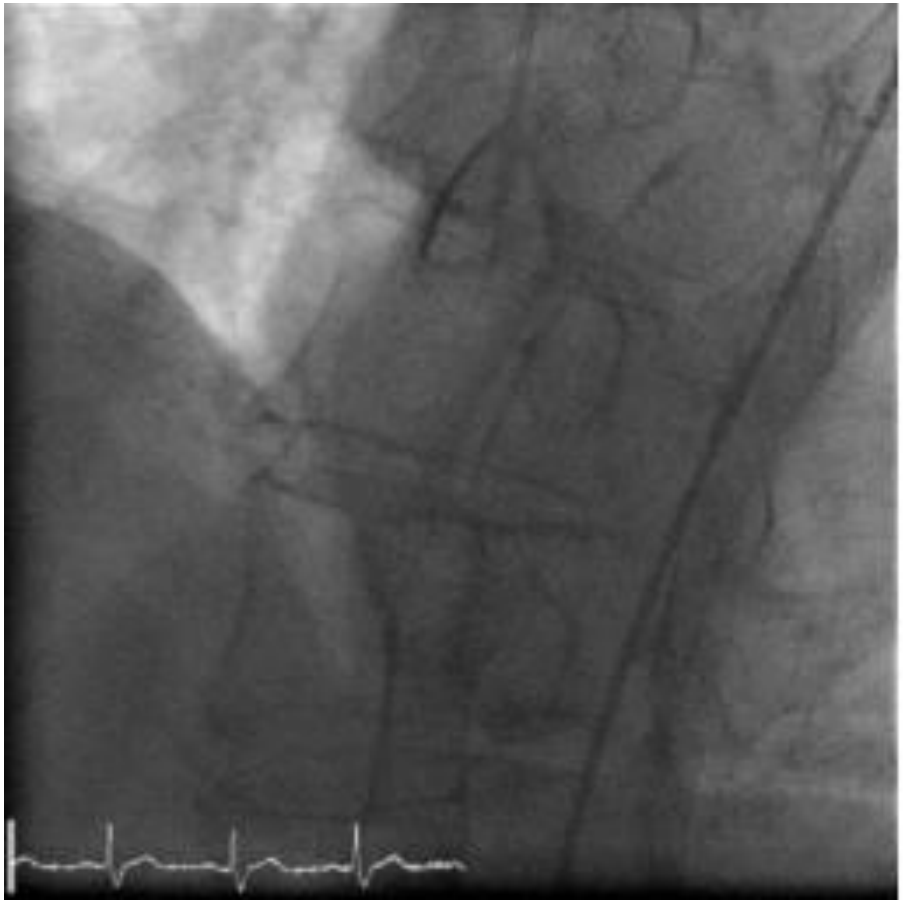
- Echo: EF 44%, hypo-/akinesia inferior, infero-lateral, infero-septal from basal to midventricular
- Repeated coronary angiogram and PCI of RCX
- Cardiac MRI: Infero-lateral scar from basal to apical, RVOT/LVOT normal

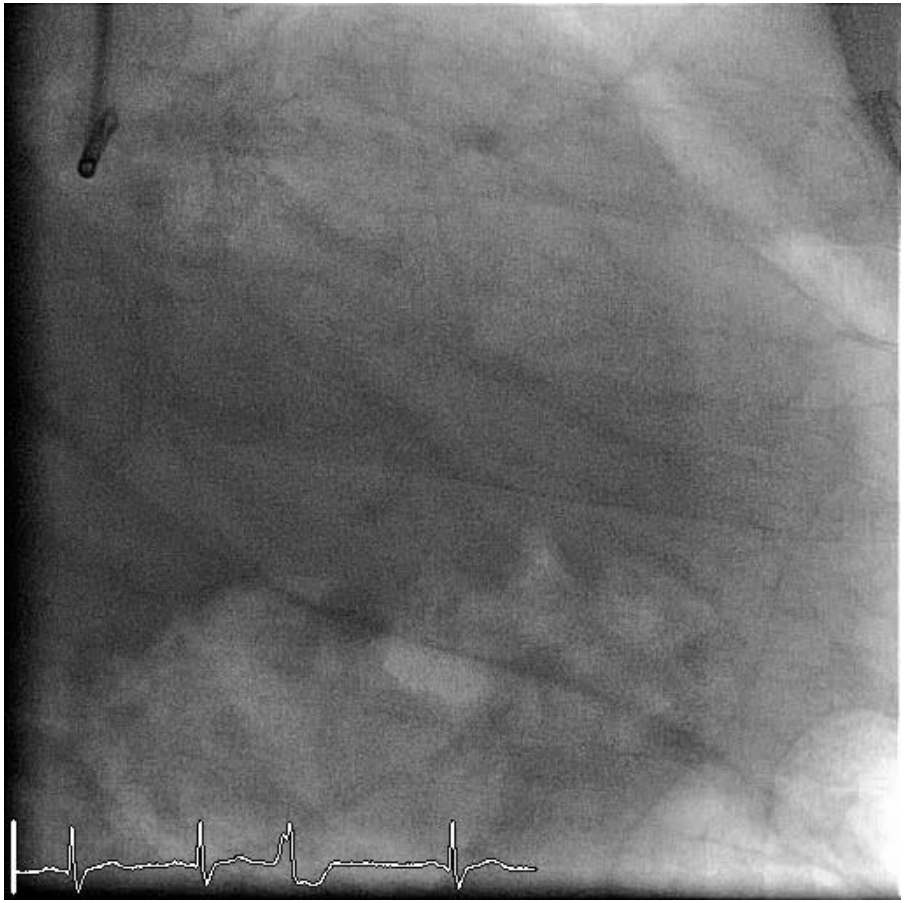
Coronary Angiography





Coronary Angiography





Treatments

- Betablocker
- Amiodarone

- Electrical cardioversions x3

Treatments

- Betablocker
- Amiodarone

- Electrical cardioversions x3

- In external hospital failed ablation for suspected „idiopathic“ RVOT VT

- Patient referred to our center

Myocardial Perfusion Scintigraphy

- No ischemia
- Large inferior and infero-lateral scar

Therapeutical Options in Refractory VT ?

a) Add Lidocain

a) Renal sympathetic denervation (neuraxial modulation)

b) ICD

c) Assist device

d) Ablation

Drug Treatment

- Betablocker
- **Amiodarone**
- **Lidocaine**

Electrical Storm

Electrical Storm - Definitions

VT storm

≥3 separate episodes of sustained VT within 24h

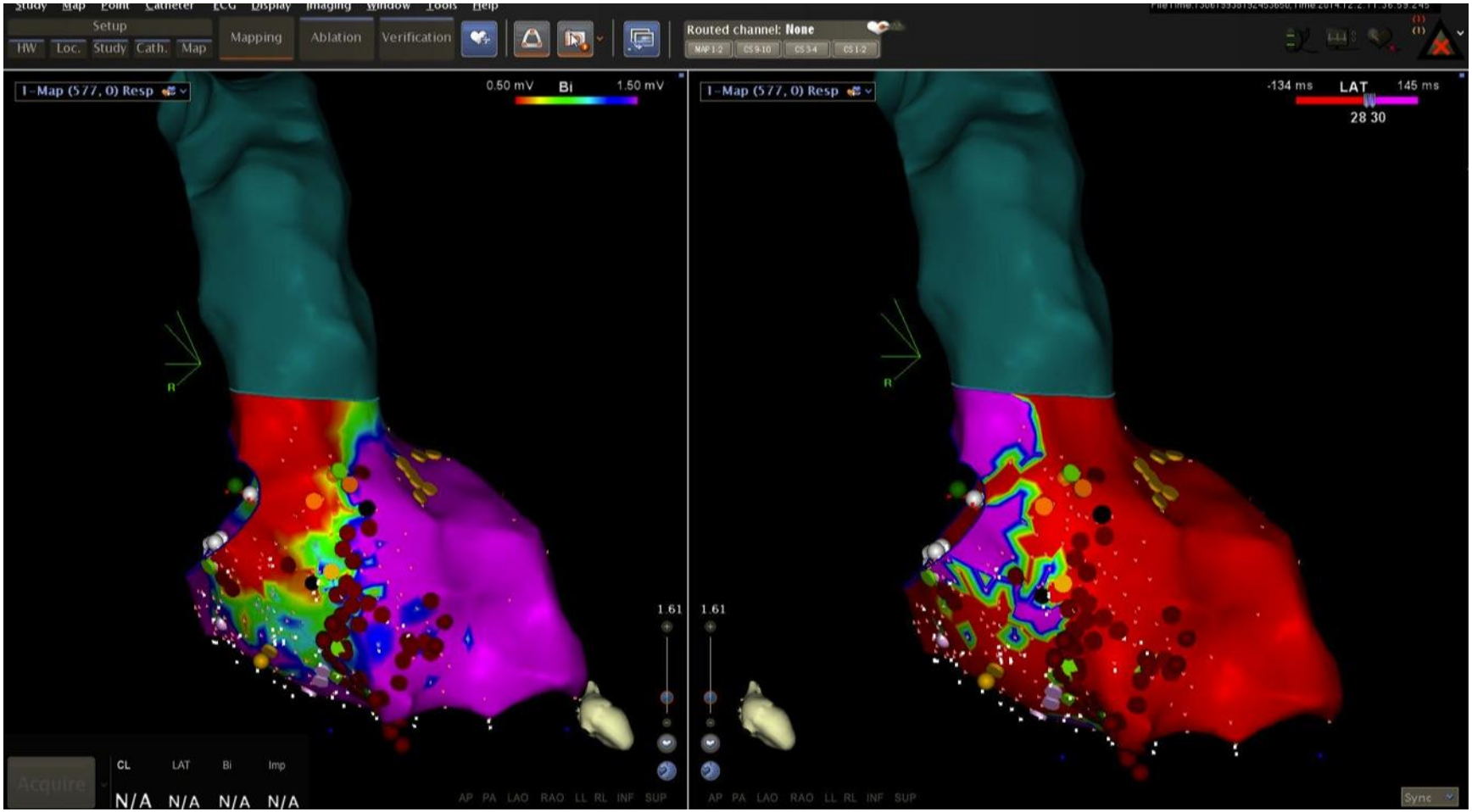
Incessant VT

continuous sustained VT that recurs promptly despite repeated intervention for termination

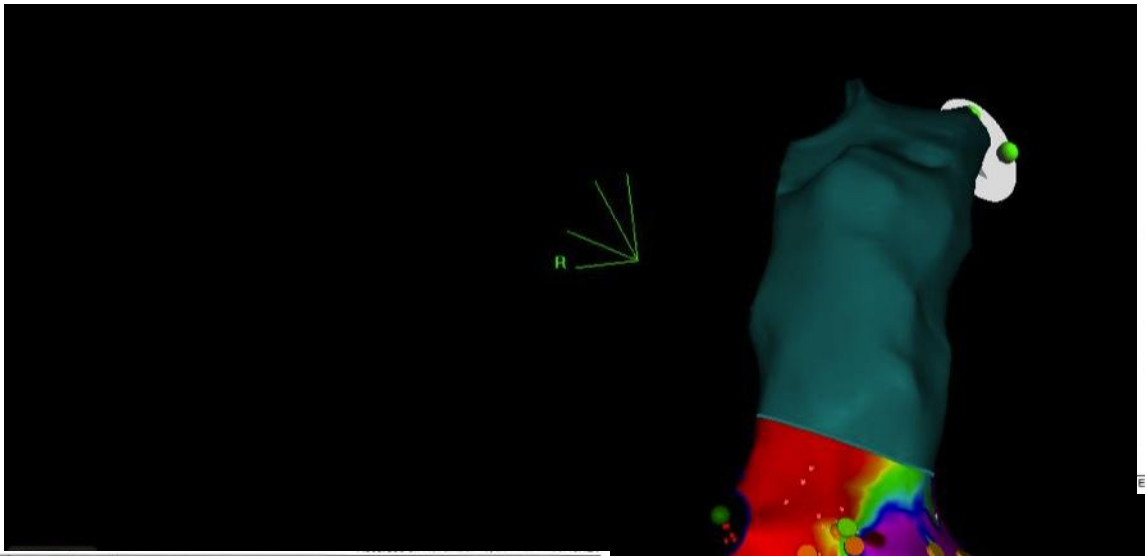
Management of VT Storm

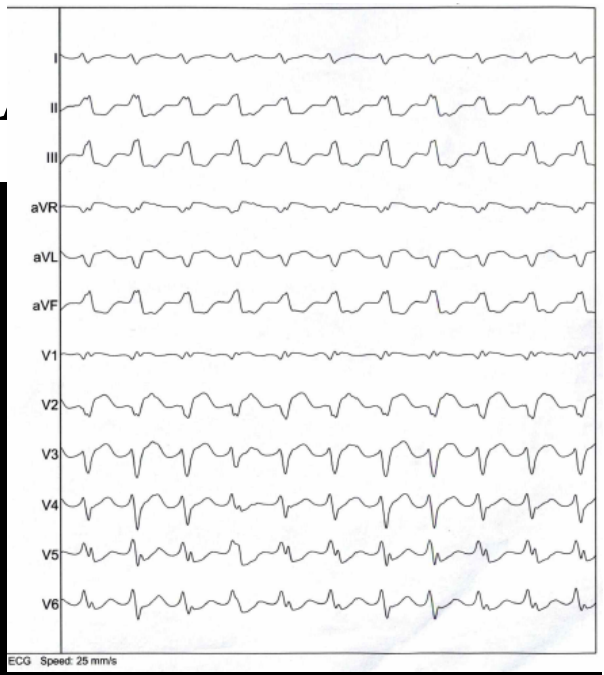
- β-blockade
- Antiarrhythmic drug therapy
- Intubation, deep sedation
- Mechanical hemodynamic support, ie, IABP, LVAD
- Neuraxial modulation: thoracic epidural anesthesia, left stellate ganglionectomy
- Catheter ablation

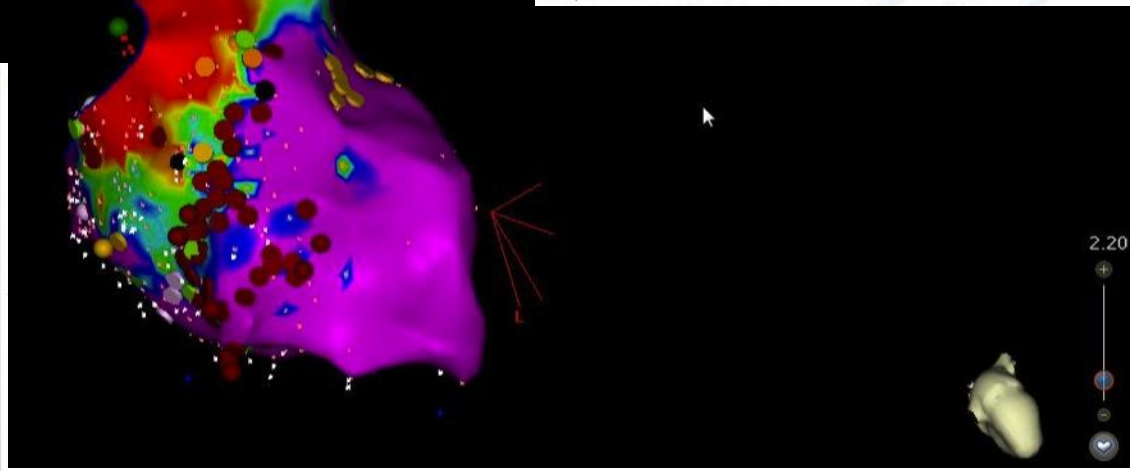
Catheter Mapping and Ablation



Catheter Mapping and A







Mapping Techniques for VT Ablation

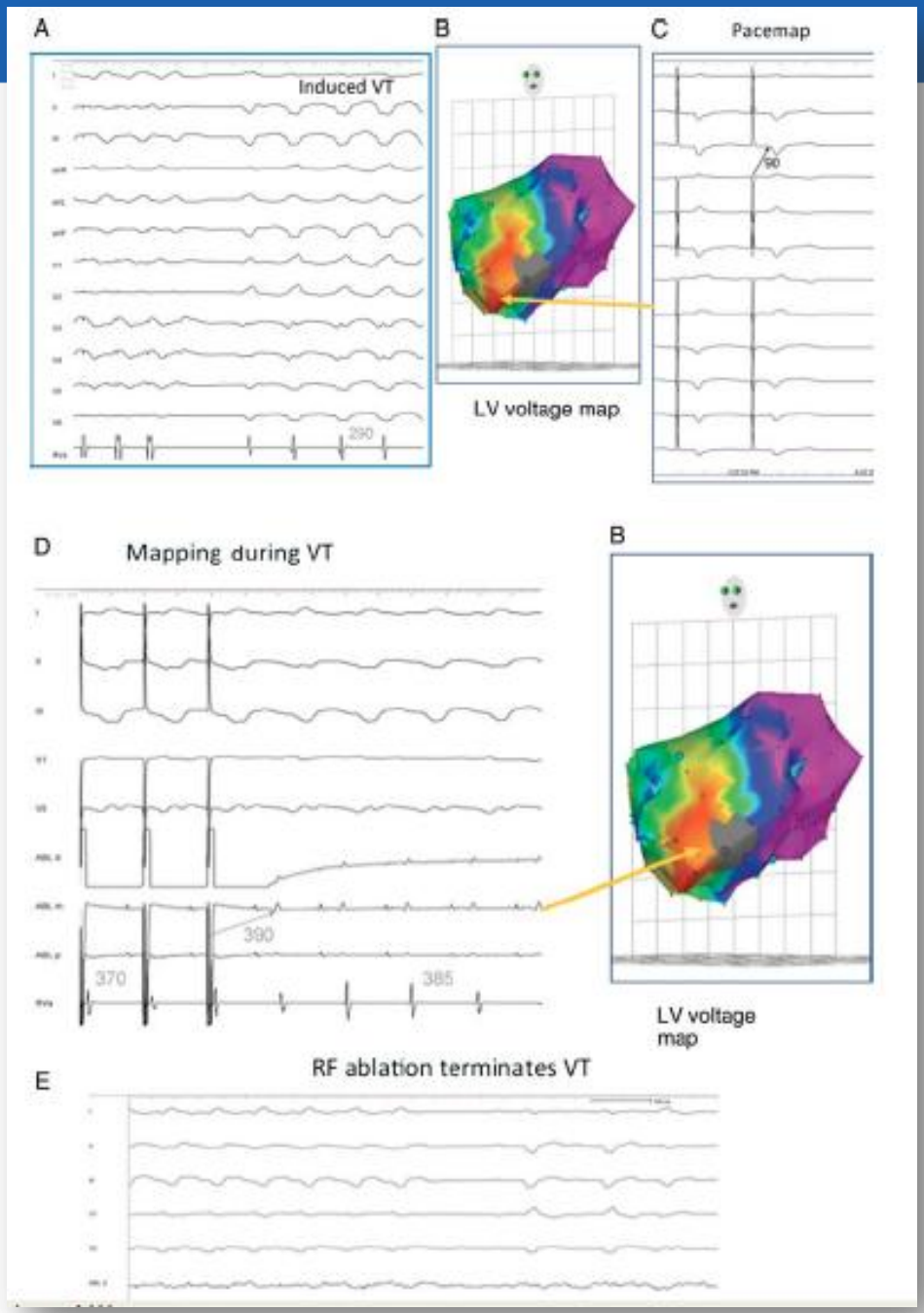
Hemodynamically stable VT

- Activation mapping
  - Idiopathic (triggered or automatic): earliest site of origin
  - Scar-mediated (reentry): diastolic activity
  - Presystolic (<30% TCL)=exit
  - Middiastolic (30%–70% TCL)=isthmus
  - Early diastolic (>70% TCL)=entrance
- Entrainment mapping of isthmus
  - Concealed fusion
  - PPI=TCL
  - S-QRS=EGM-QRS

Hemodynamically unstable VT

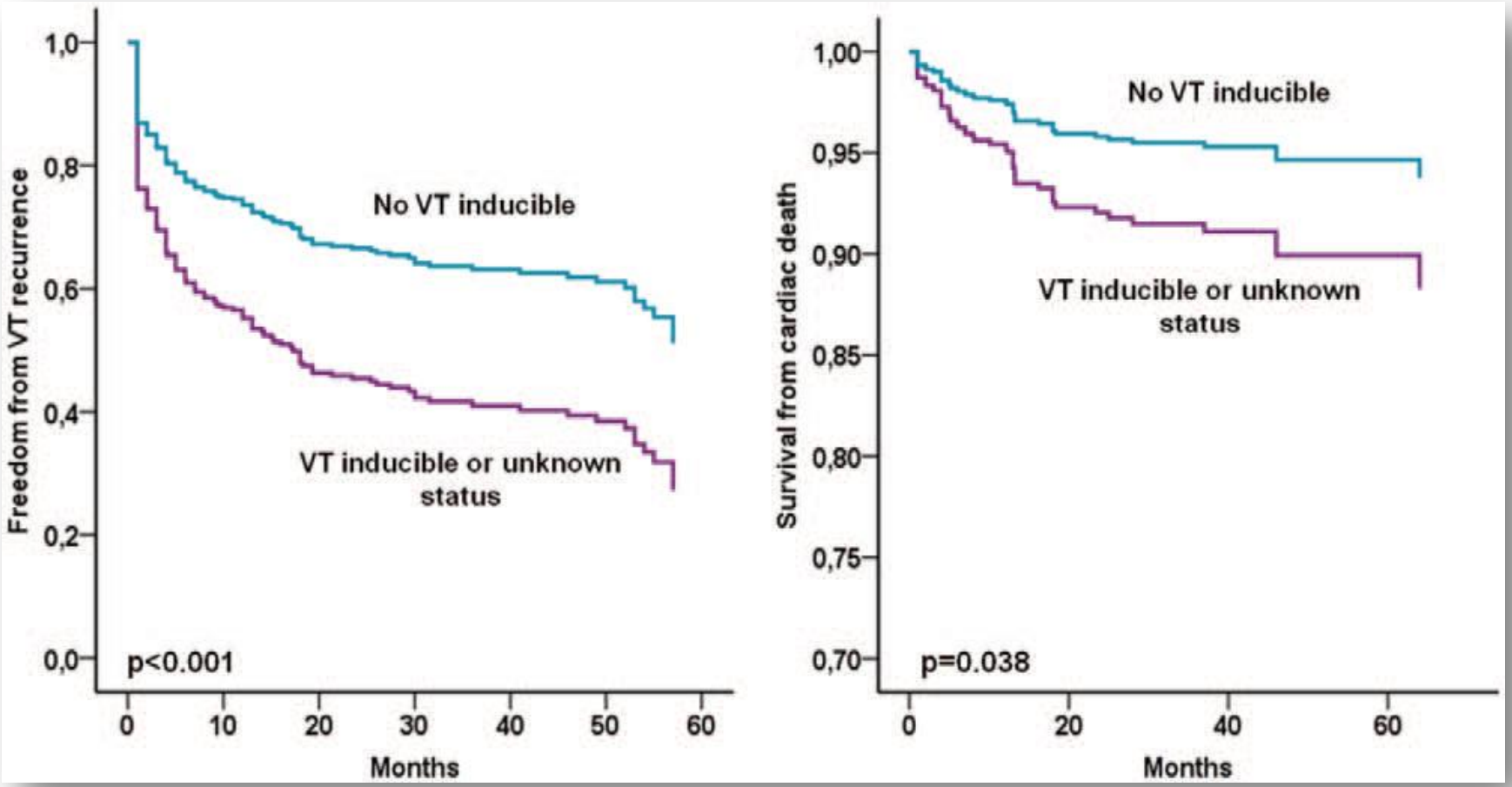
- Electroanatomic substrate mapping/scar delineation
- Pace mapping
- Targeting of late potentials
- Linear ablation lesions sets
  - Scar border zones
  - Scar transection
  - Connecting scars and anatomic boundaries, ie, annulus
- Mechanical hemodynamic support, ie, IABP, LVAD

Tung R et al. Circulation. 2011



Wissner E et al. Eur Heart J 2012

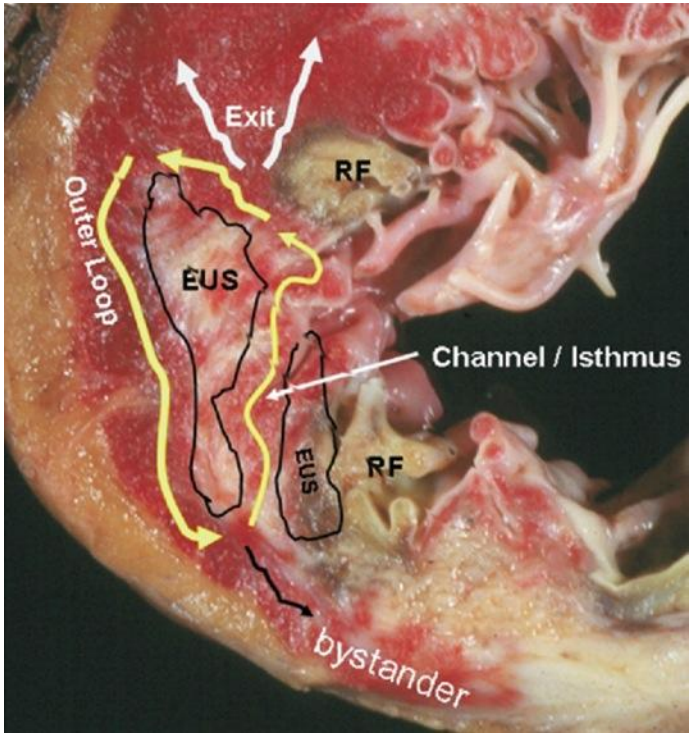
Success Rate of VT Ablation



Della Bella P et al. Circulation. 2013

Scar

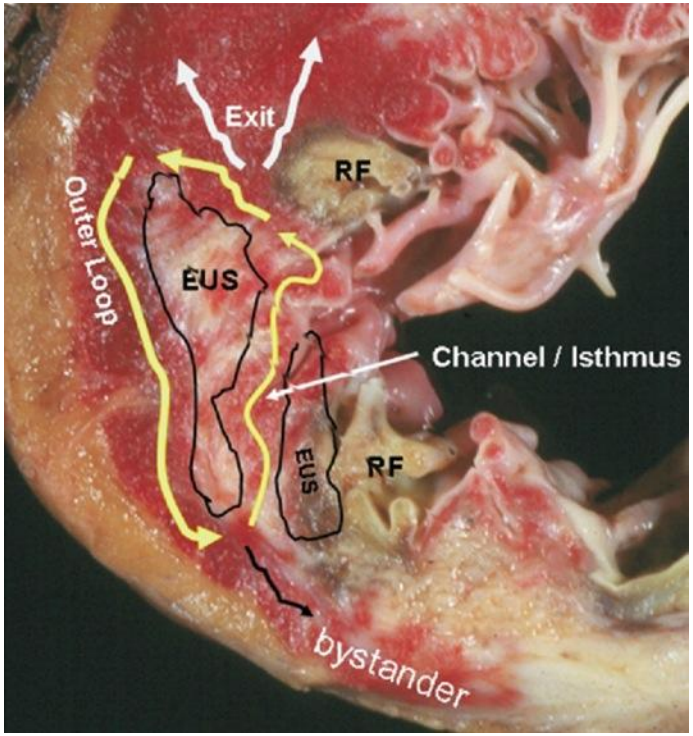
Subendocardial



Post myocardial infarction

Scar

Subendocardial



Post myocardial infarction

Epicardial

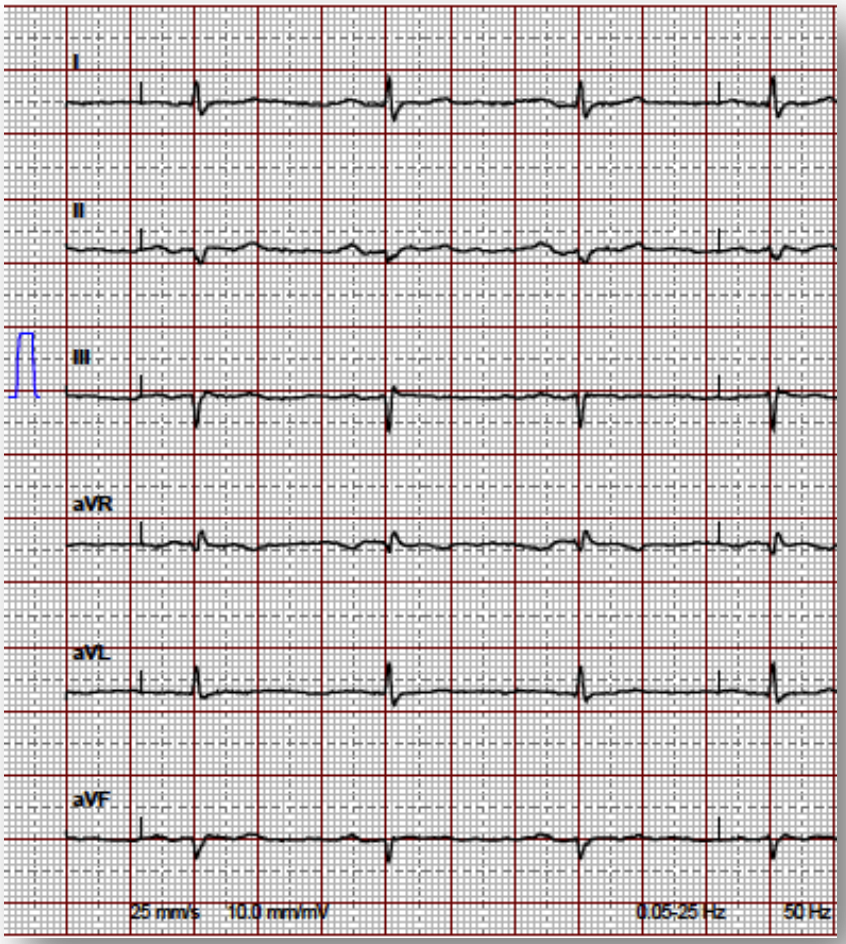
ARVC

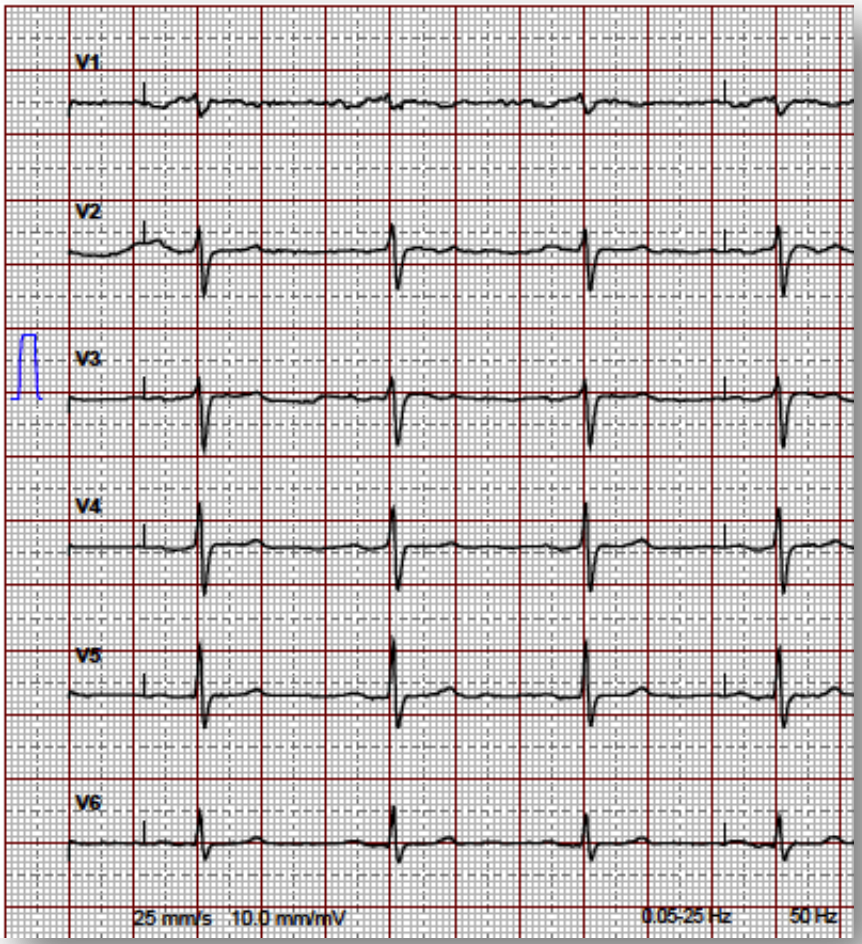
Dilatative cardiomyopathy

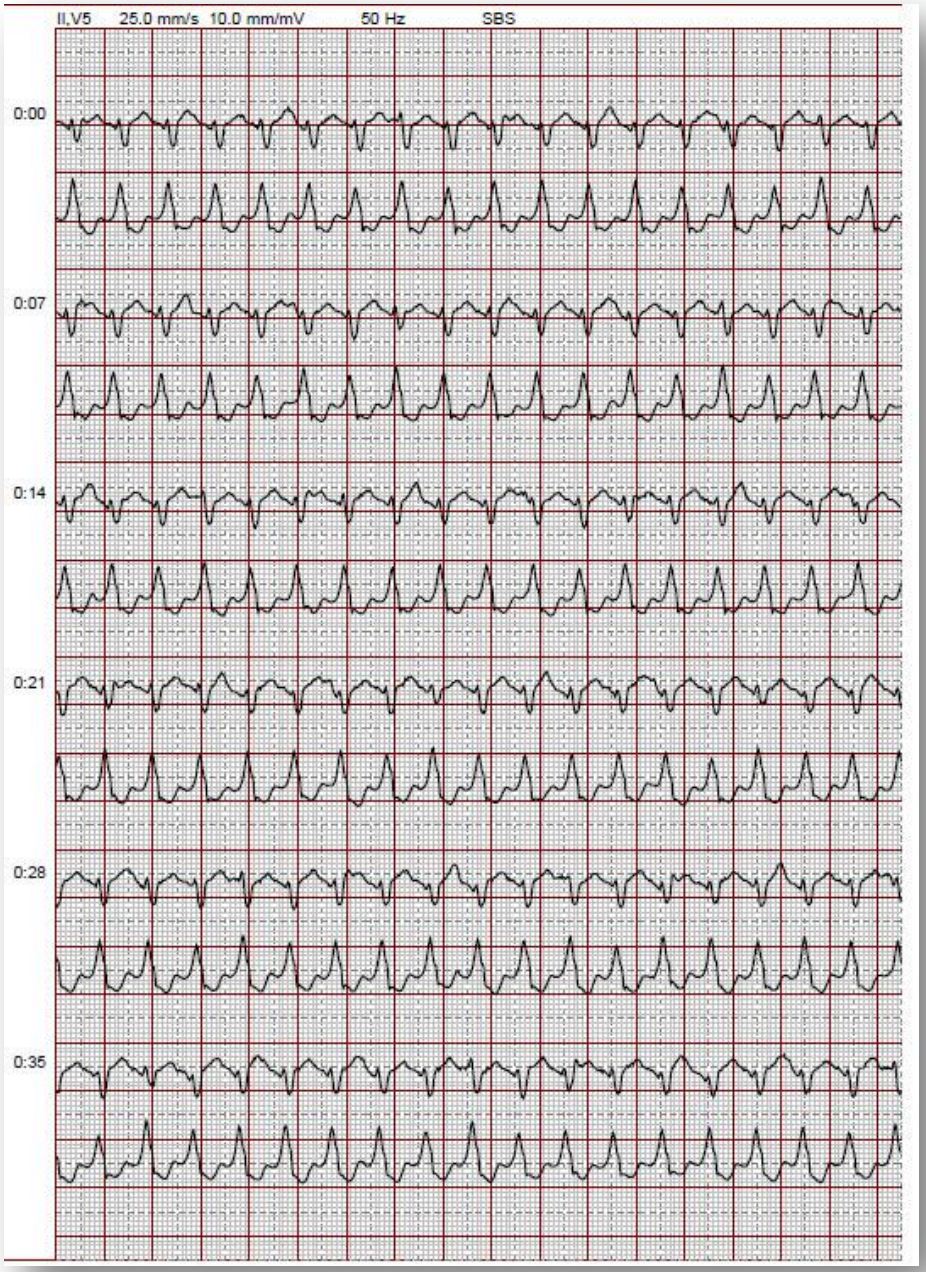
Post myokarditis

Patient 2

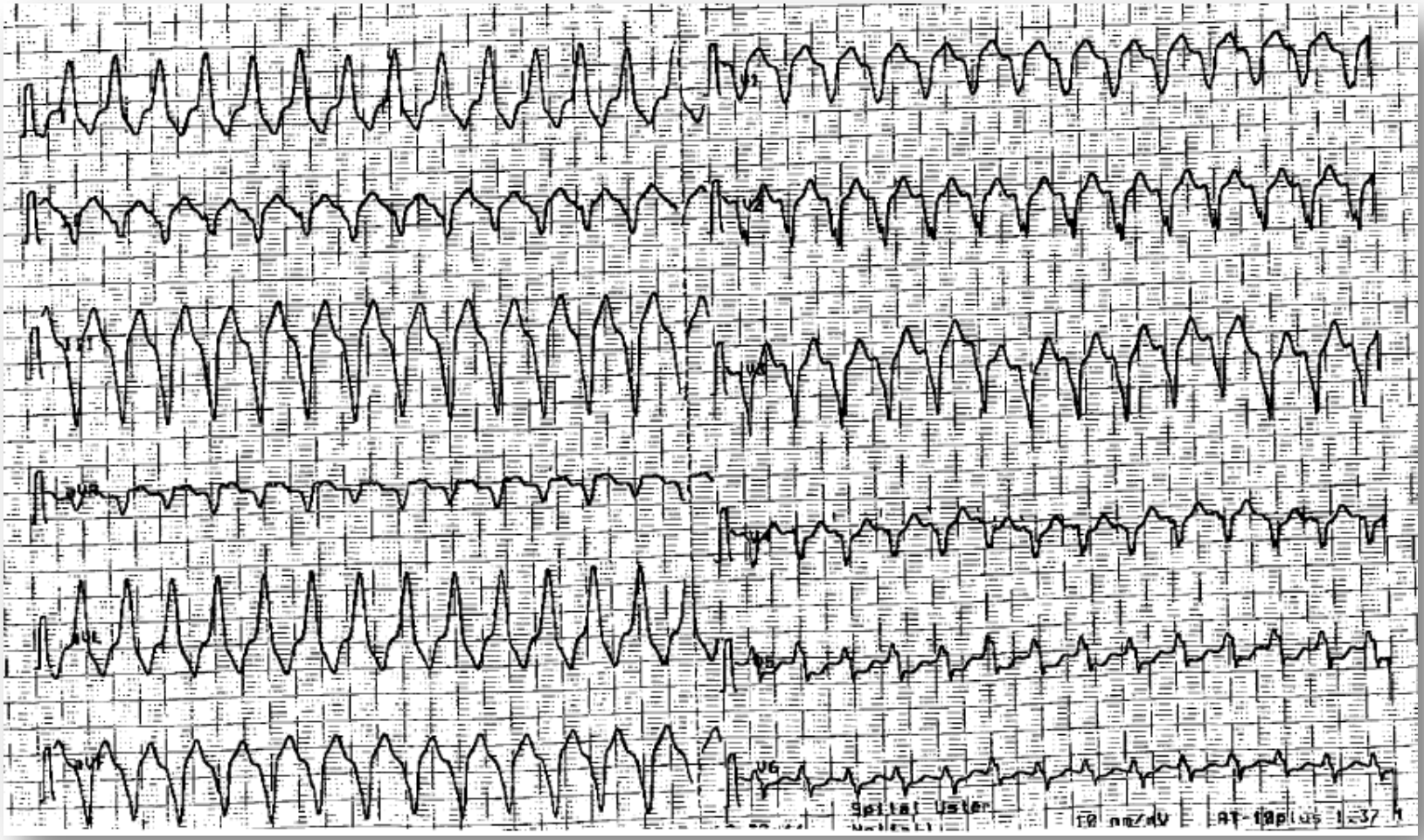
55-yo Male Patient with ARVC



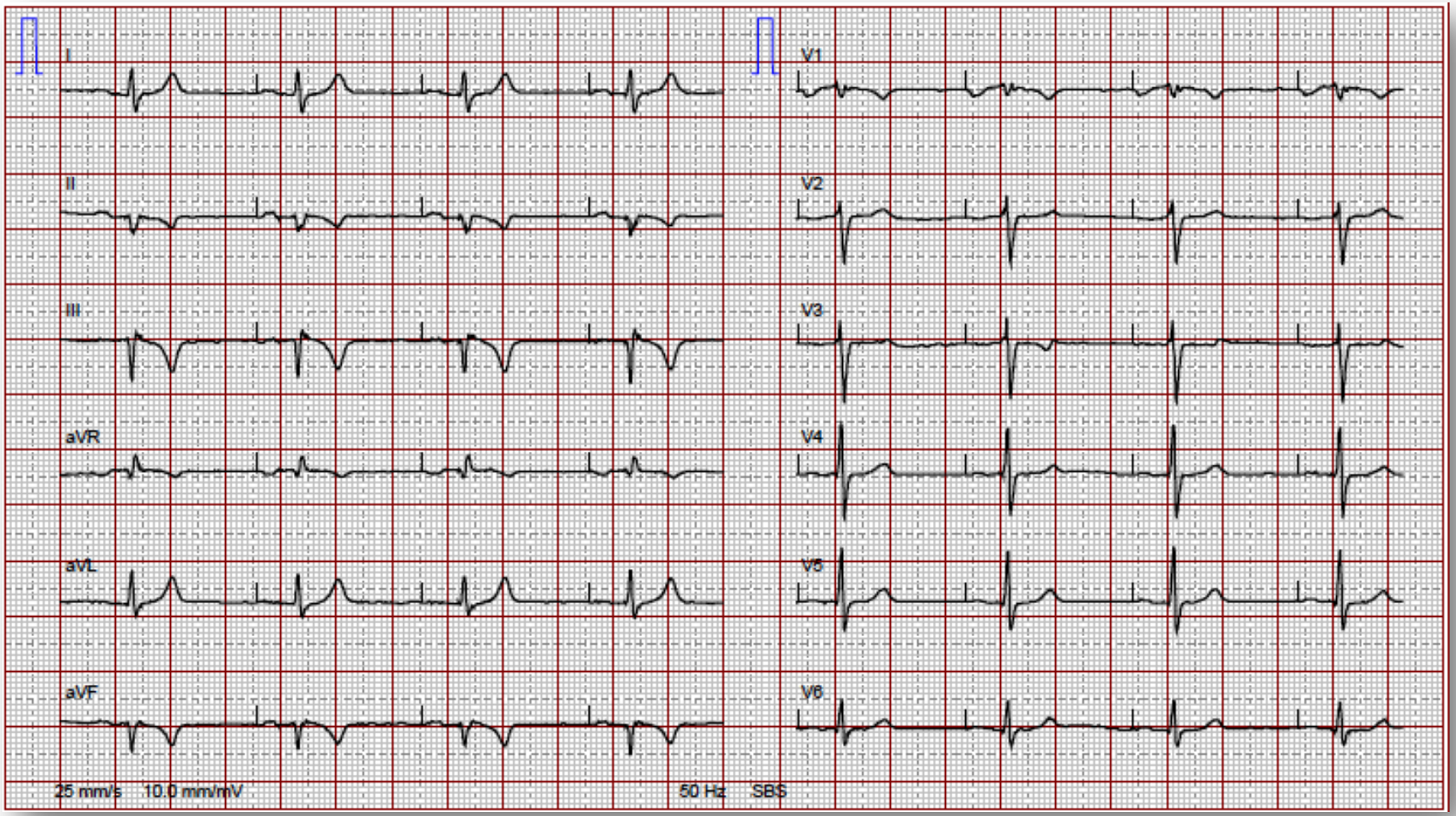



II,V5 25.0 mm/s 10.0 mm/mV 50 Hz SBS
0:00
0:07
0:14
0:21
0:28
0:35

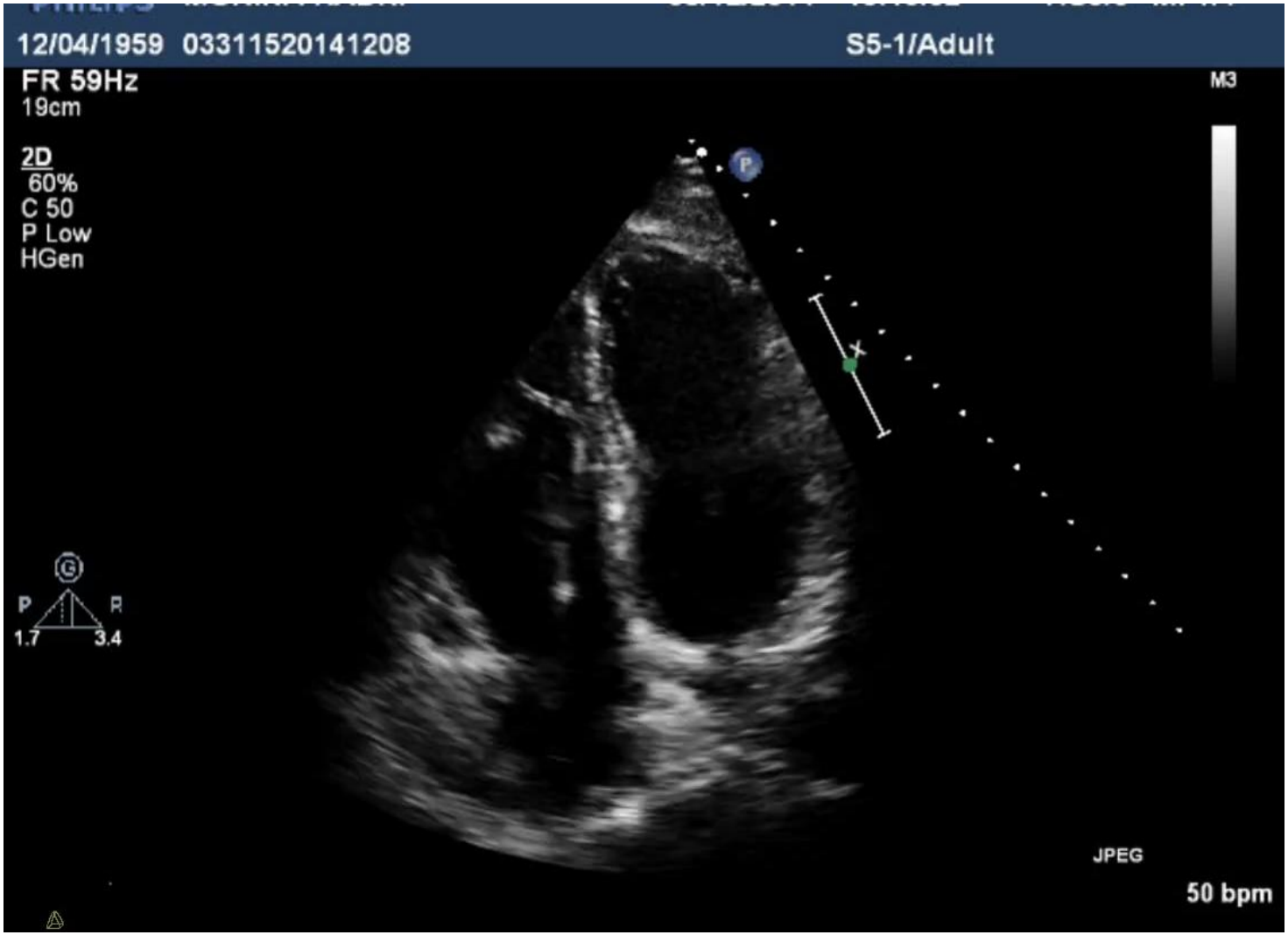
55-yo Male Patient with ARVC



55-yo Male Patient with ARVC



55-yo Male Patient with ARVC



Which Approach for VT Ablation?

a) Endocardial mapping / ablation first

a) Epicardial mapping / ablation only

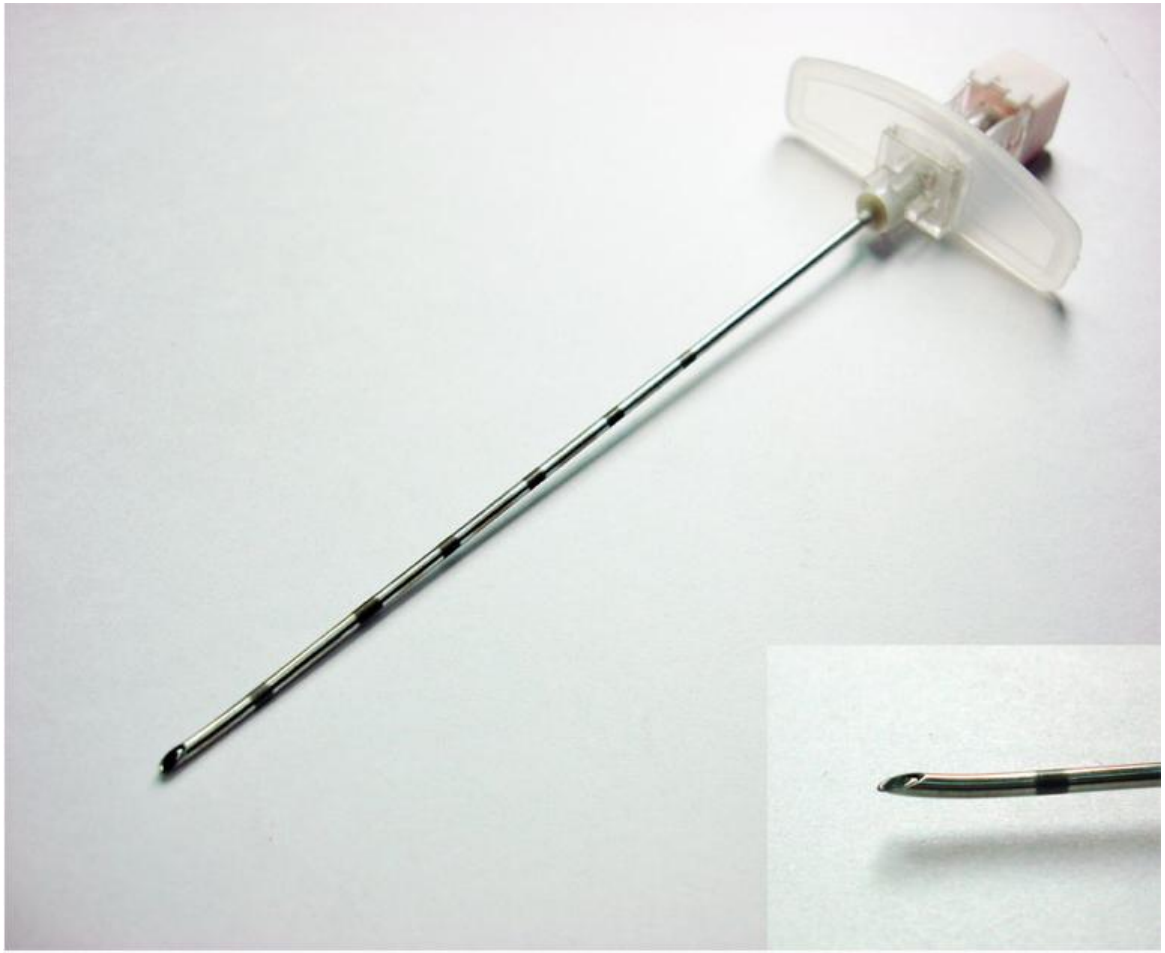
b) Combined endo- and epicardial mapping / ablation

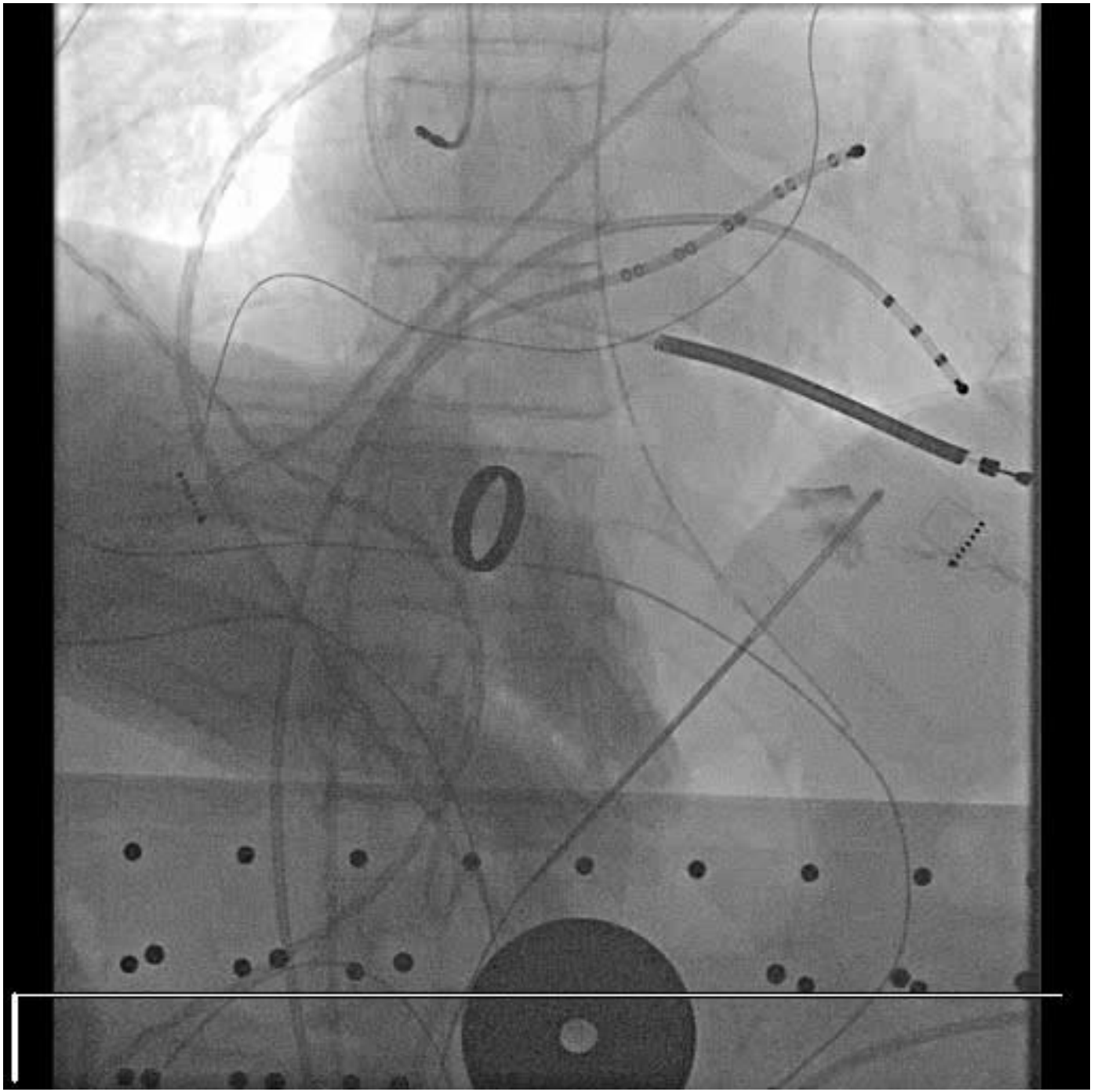
c) Don‘t know, perform coronary angiogram

How To Do “Dry Pericardial Puncture”?

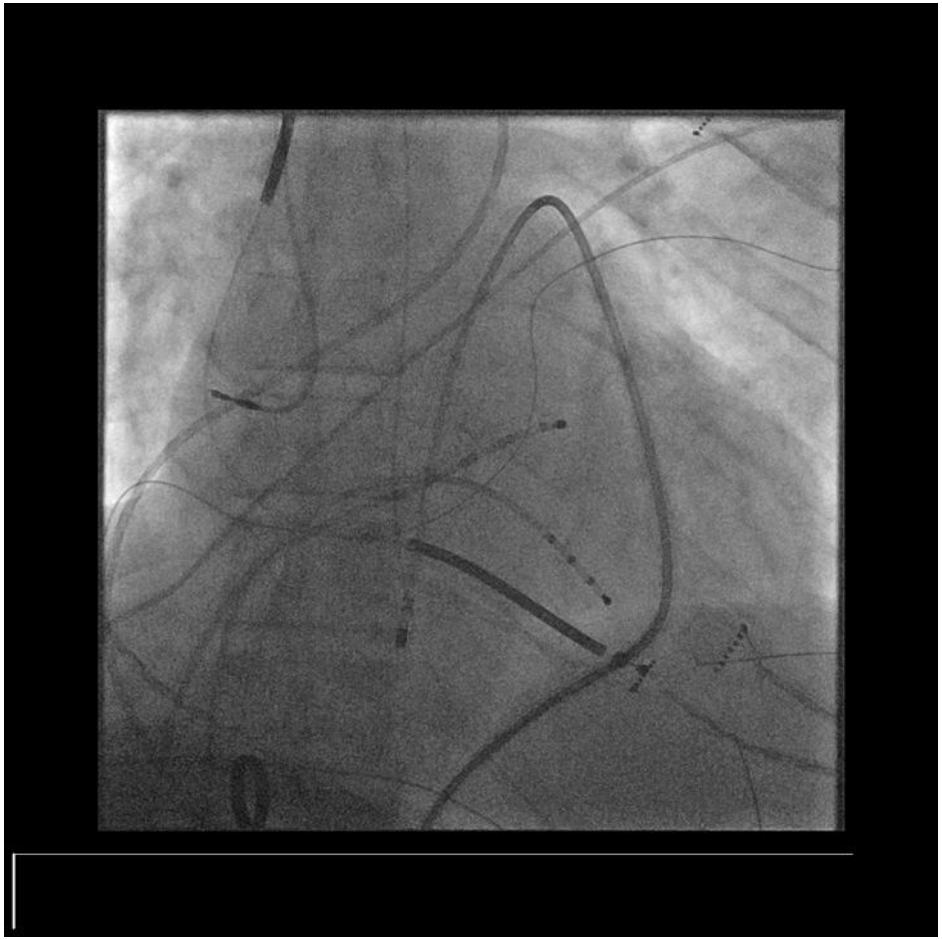
Subxyphoidal Puncture for Epicardial Access

Needle for Dry Pericardial Puncture

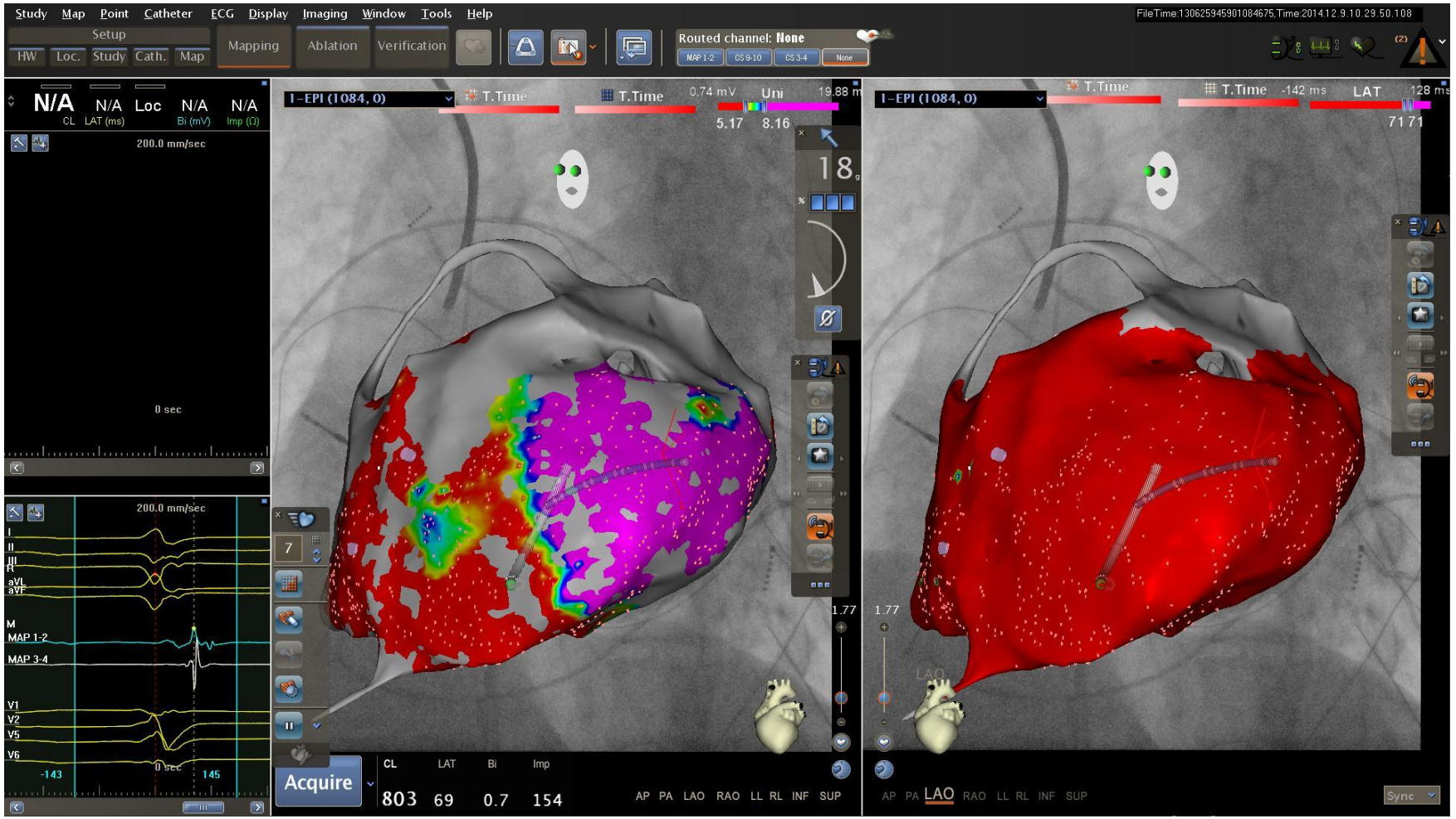




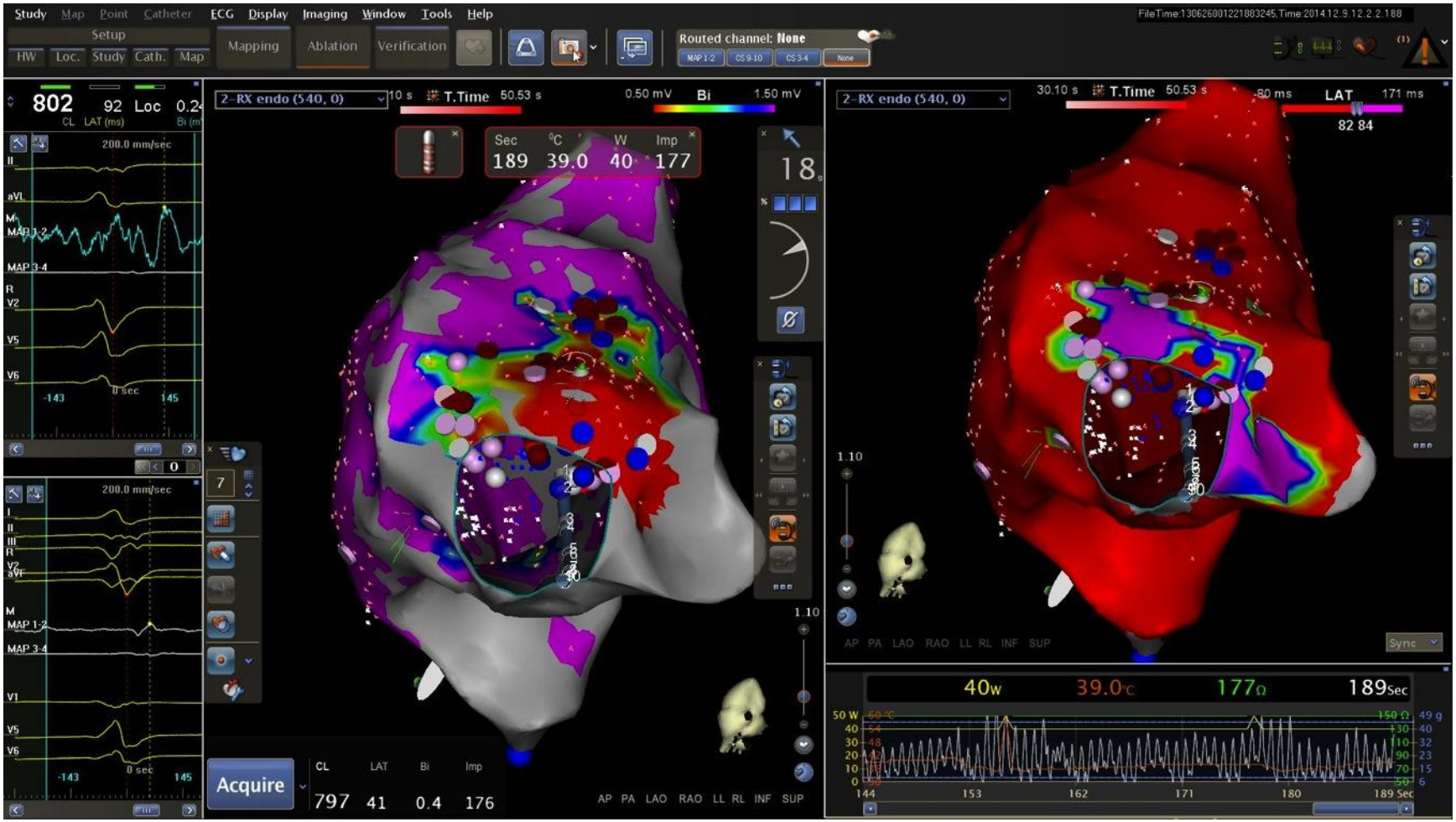
Ablation Catheter in Pericardium



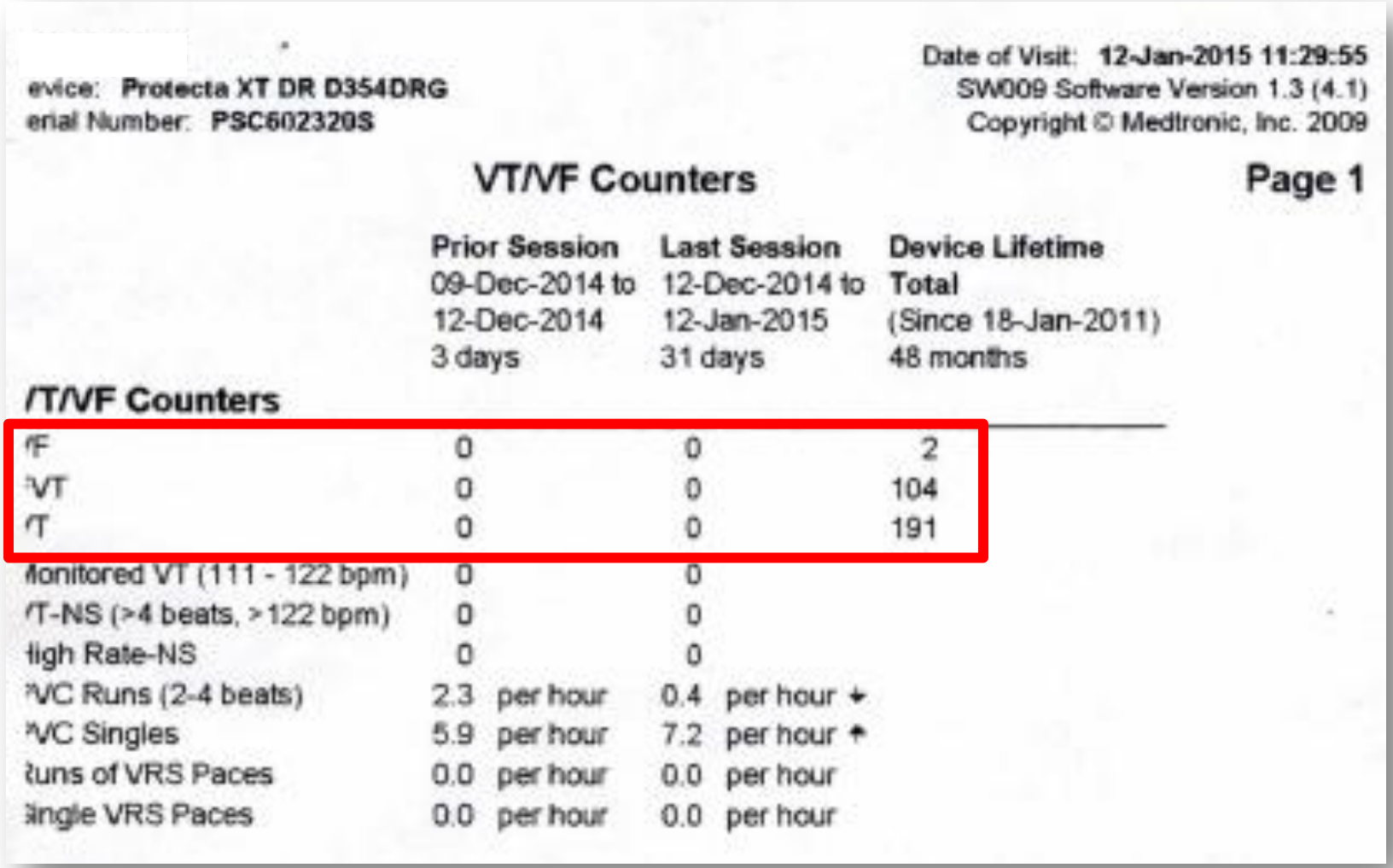
Epicardial Mapping



Ablation at Subtricuspidal Aneurysm (ARVC)



Device Interrogation at F/U (Sotalol off)



evice: **Protecta XT DR D354DRG**
erial Number: **PSC602320S**

Date of Visit: **12-Jan-2015 11:29:55**
SW009 Software Version 1.3 (4.1)
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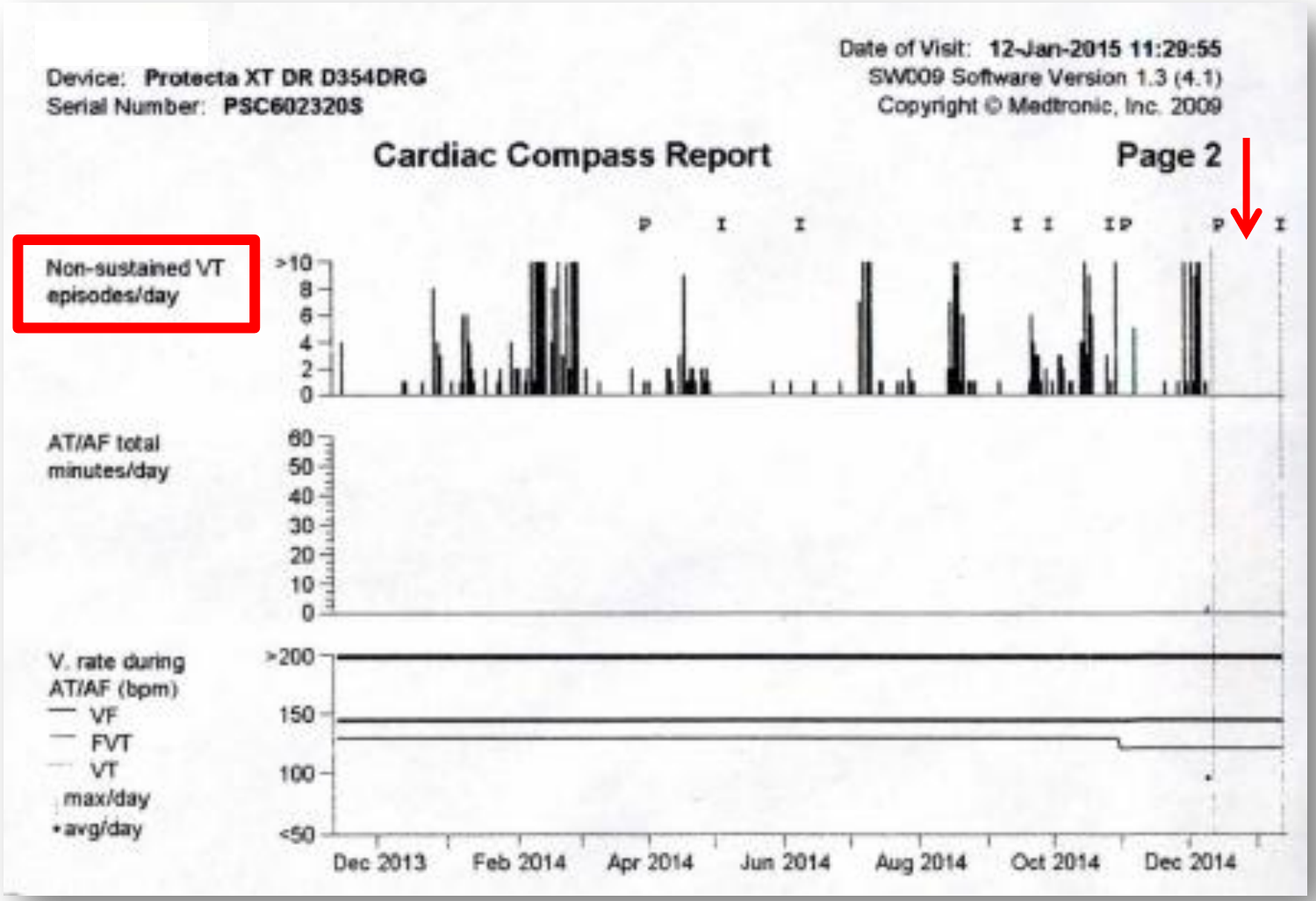
VT/VF Counters

Page 1

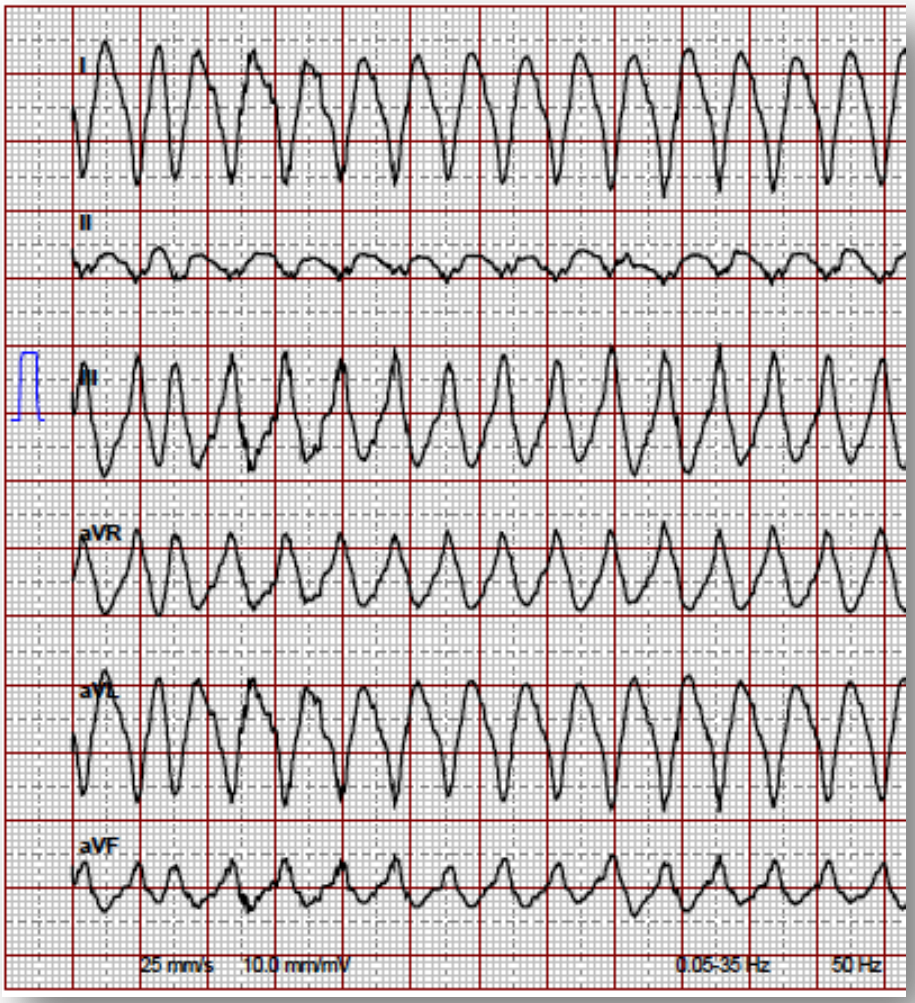
/T/VF Counters	Prior Session 09-Dec-2014 to 12-Dec-2014 3 days		Last Session 12-Dec-2014 to 12-Jan-2015 31 days		Device Lifetime Total (Since 18-Jan-2011) 48 months
⁄F	0		0		2
⁄VT	0		0		104
⁄T	0		0		191
⁄lonitored VT (111 - 122 bpm)	0		0		
⁄T-NS (>4 beats, >122 bpm)	0		0		
⁄ligh Rate-NS	0		0		
⁄VC Runs (2-4 beats)	2.3	per hour	0.4	per hour ↓	
⁄VC Singles	5.9	per hour	7.2	per hour ↑	
⁄uns of VRS Paces	0.0	per hour	0.0	per hour	
⁄ingle VRS Paces	0.0	per hour	0.0	per hour	

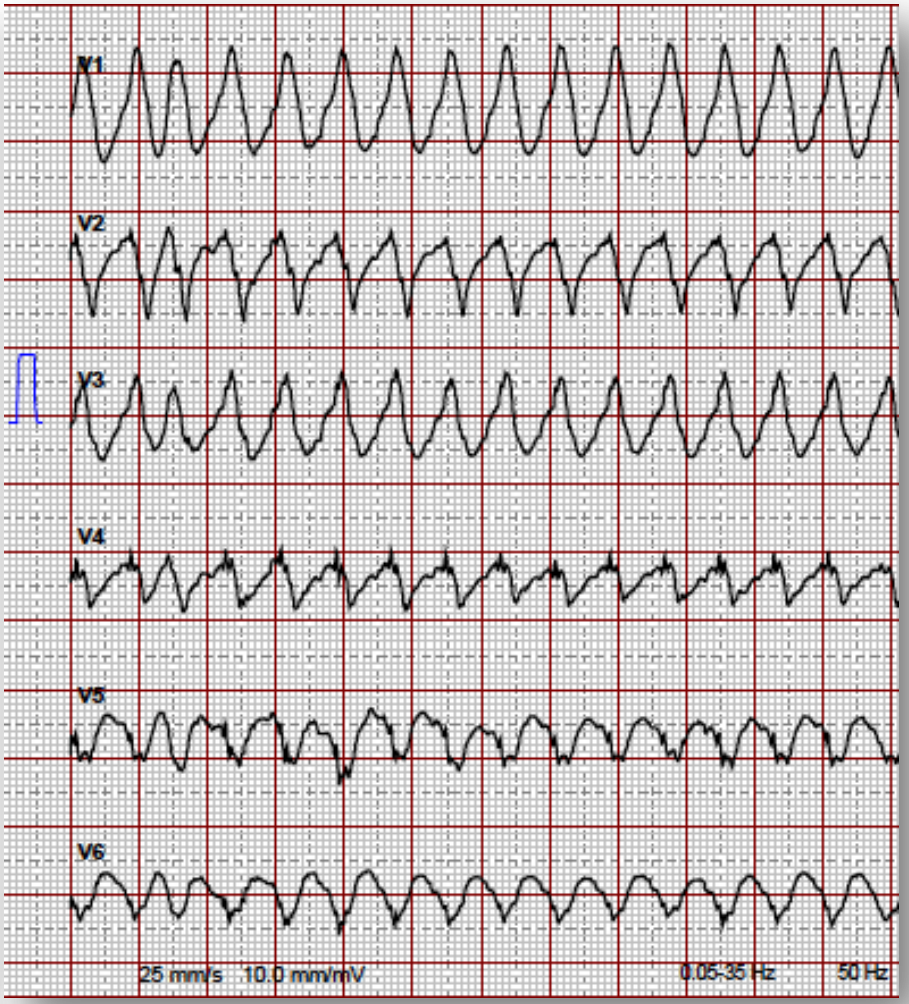
Device Interrogation at F/U (Sotalol off)



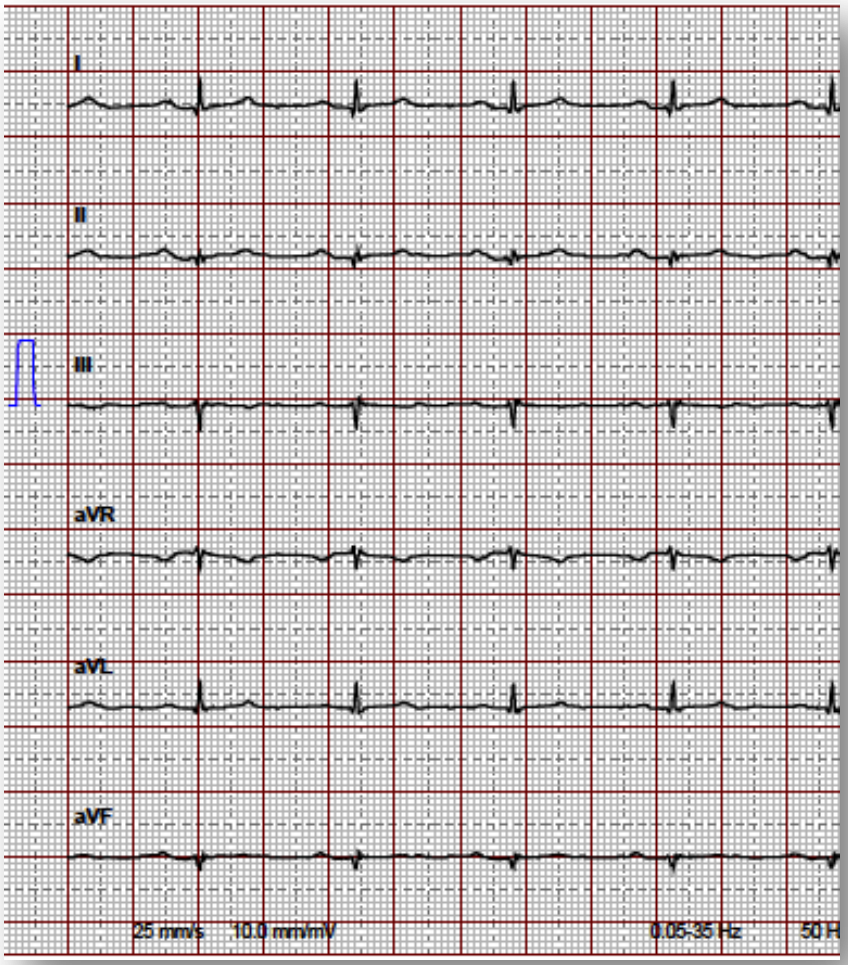
Patient 3

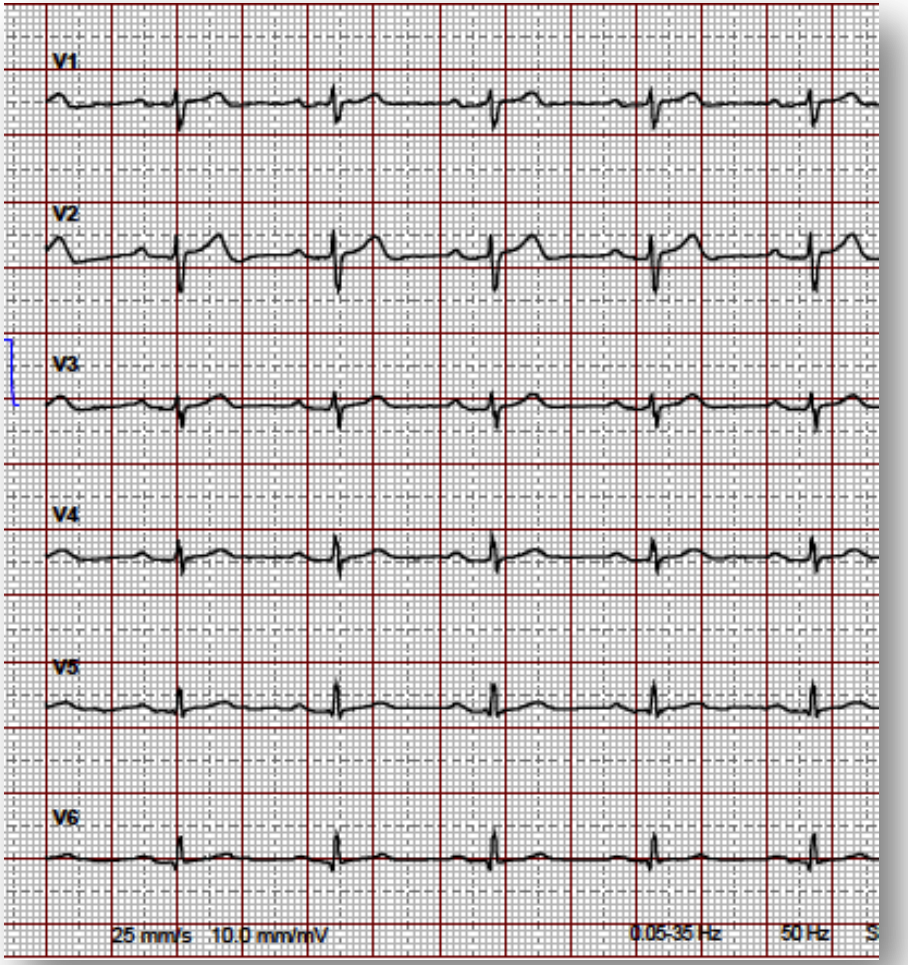
53-yo Male Patient with Non-Ischemic CMP



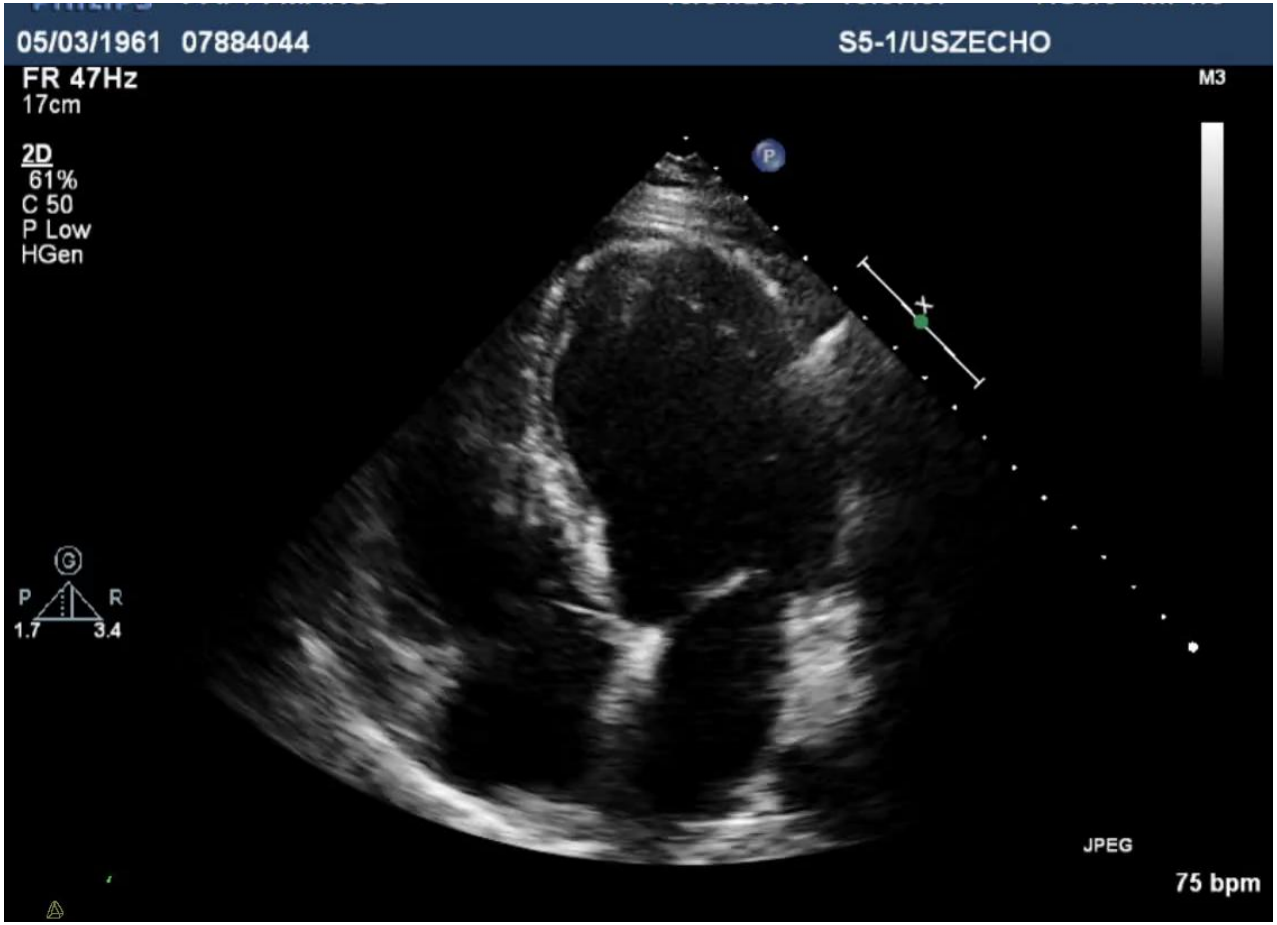


53-yo Male Patient with Non-Ischemic CMP

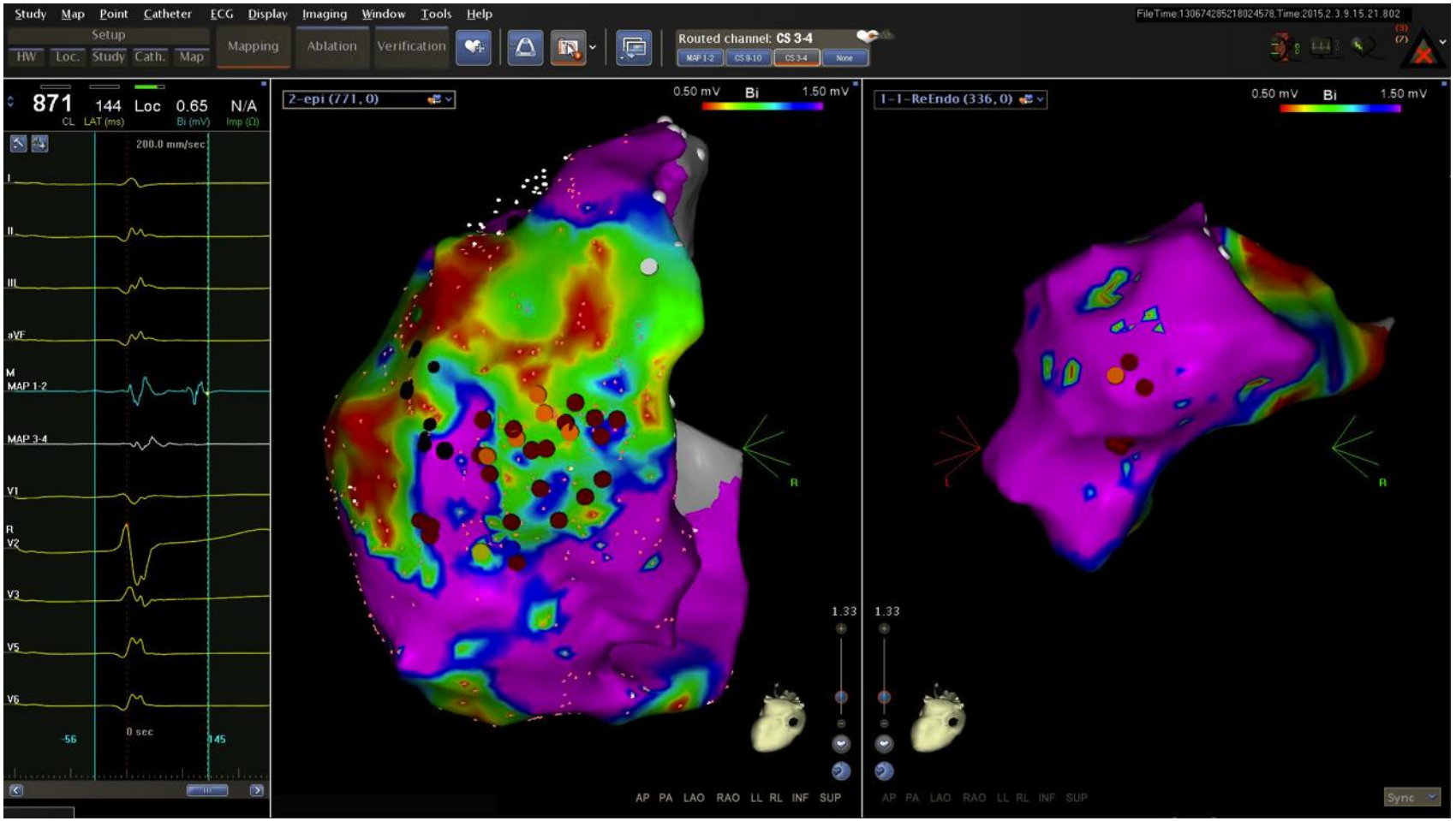




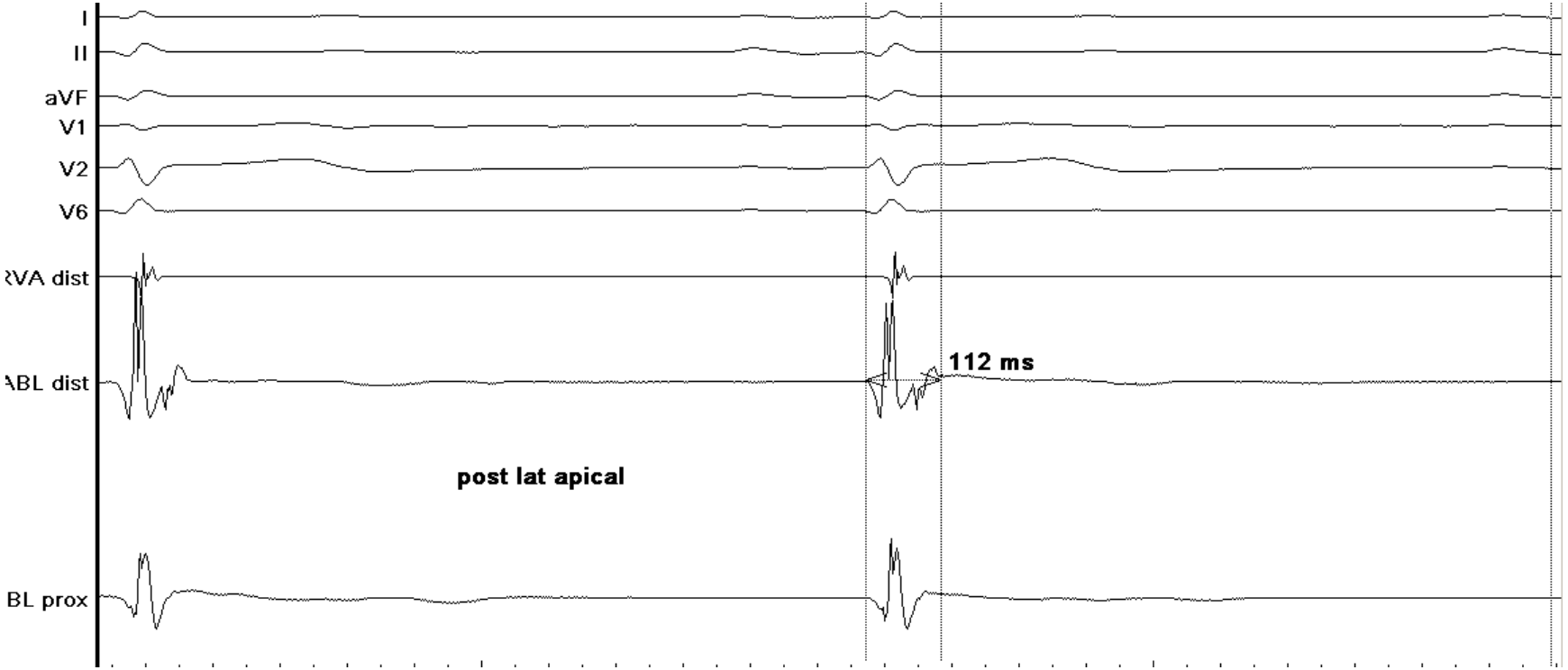
Echo


05/03/1961 07884044
S5-1/USZECHO
FR 47Hz
17cm
2D
61%
C 50
P Low
HGen
M3
P
R
1.7
3.4
JPEG
75 bpm

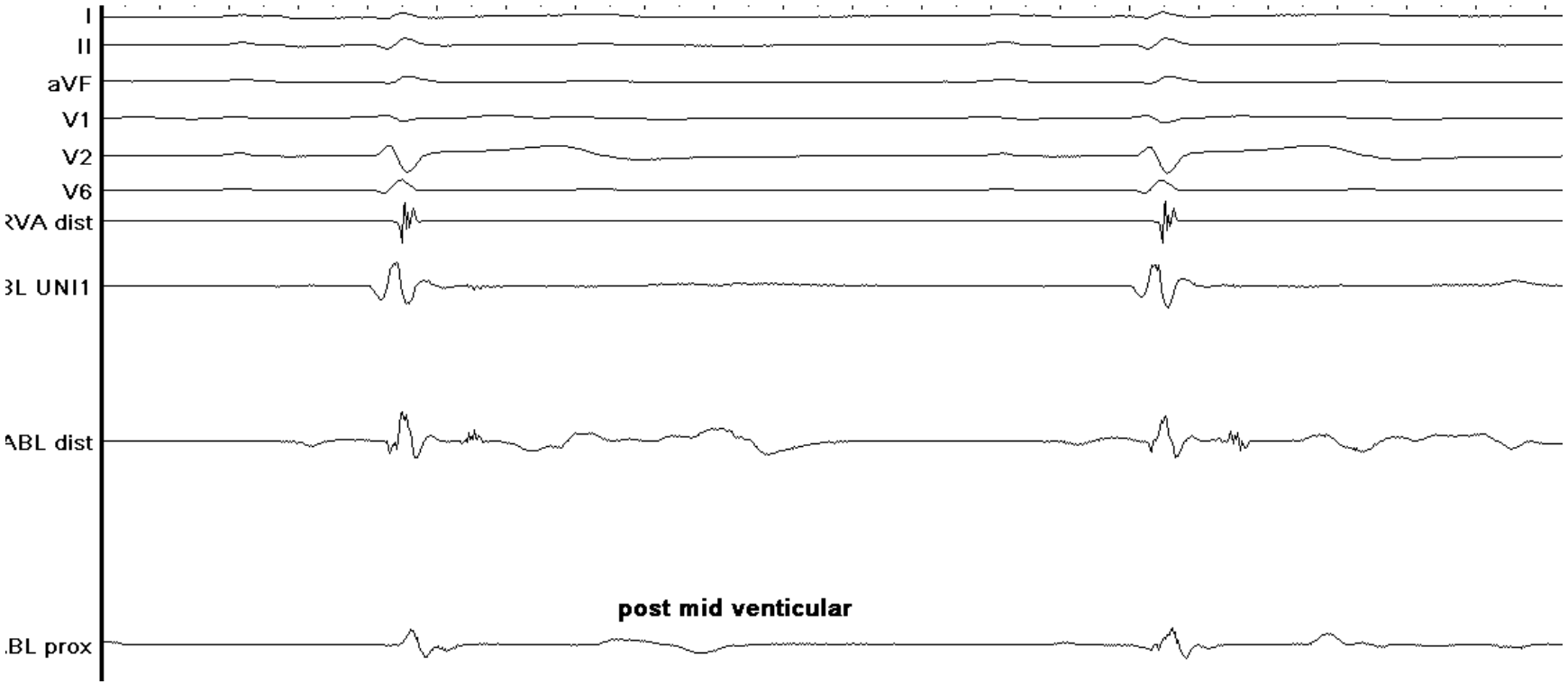
Epicardial and Endocardial Mapping of Voltage



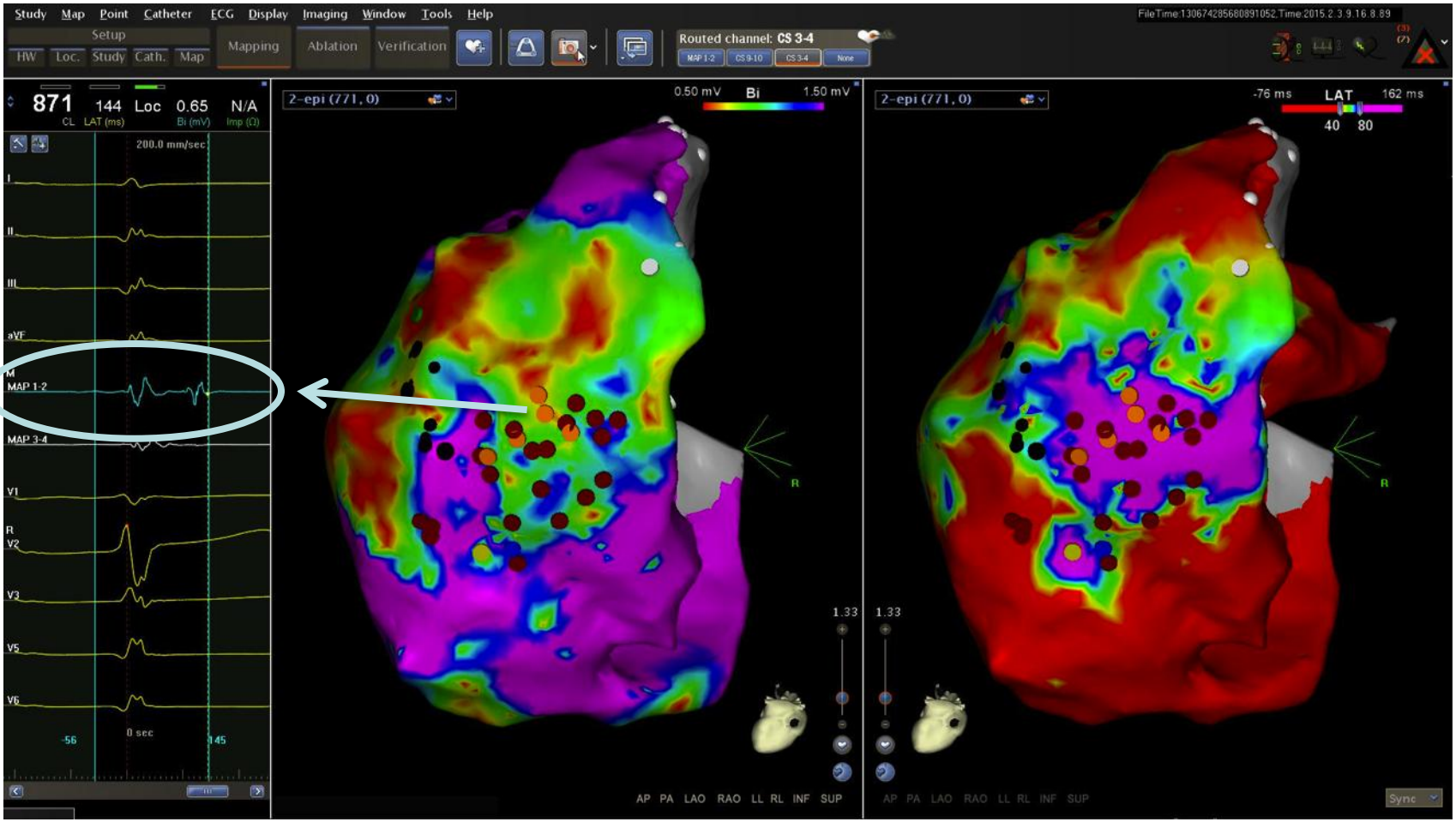
Late Potential in SR



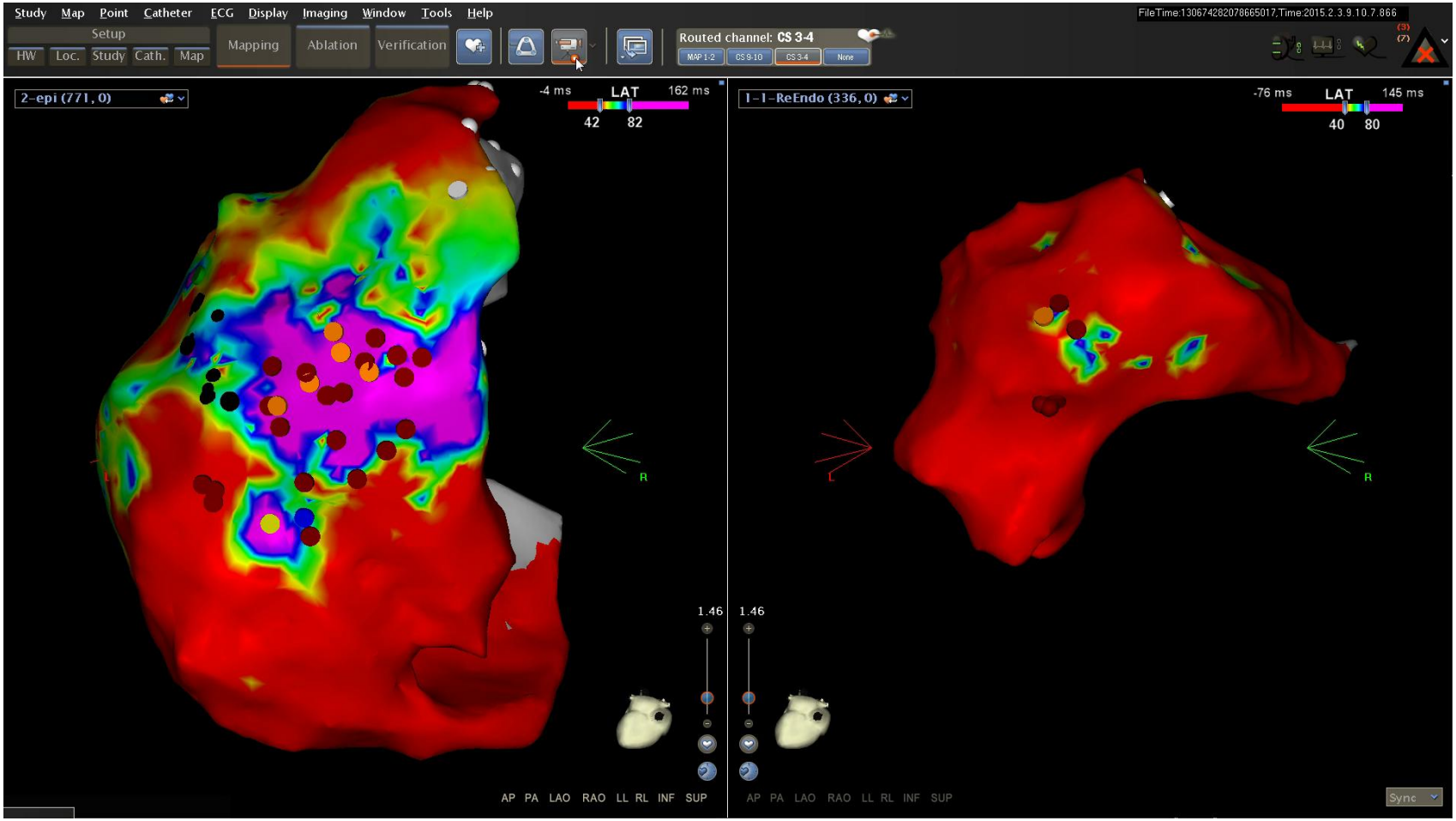
Late Potential in SR



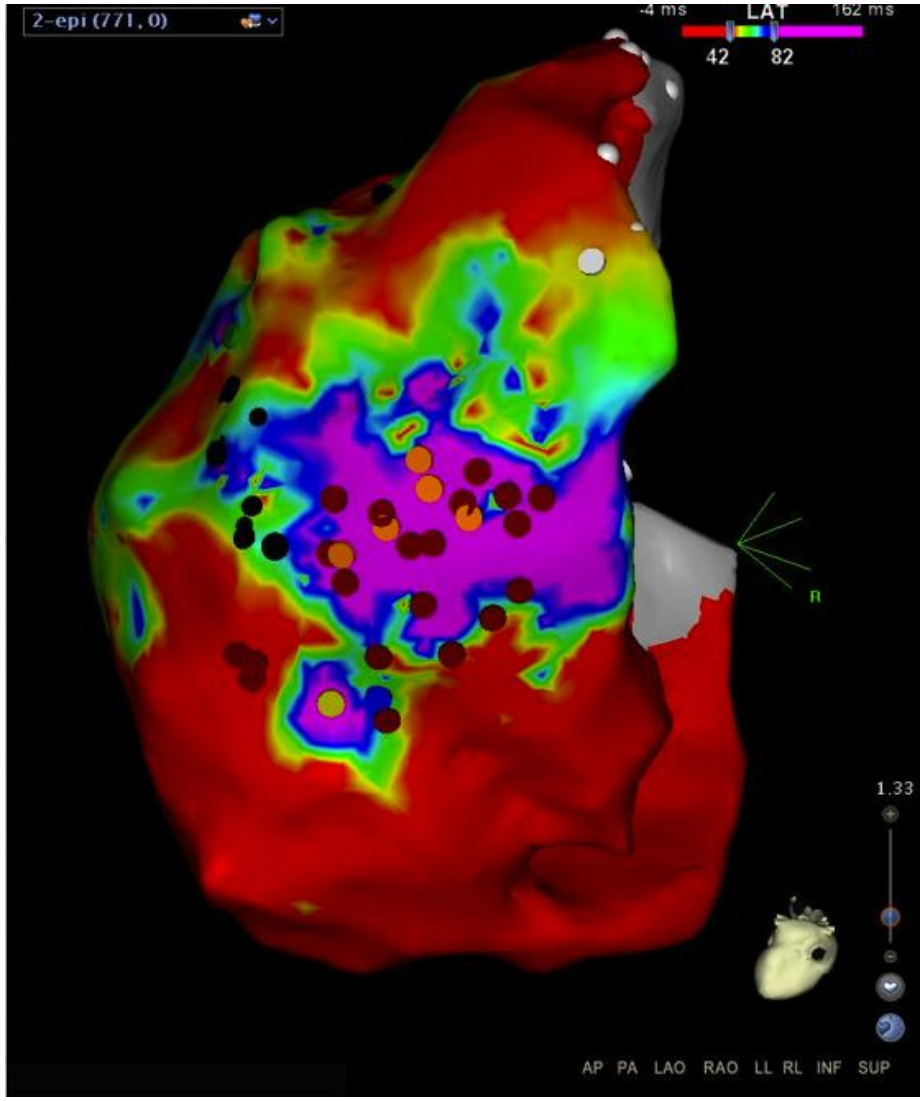
Substrate Mapping in SR of Voltage and LP



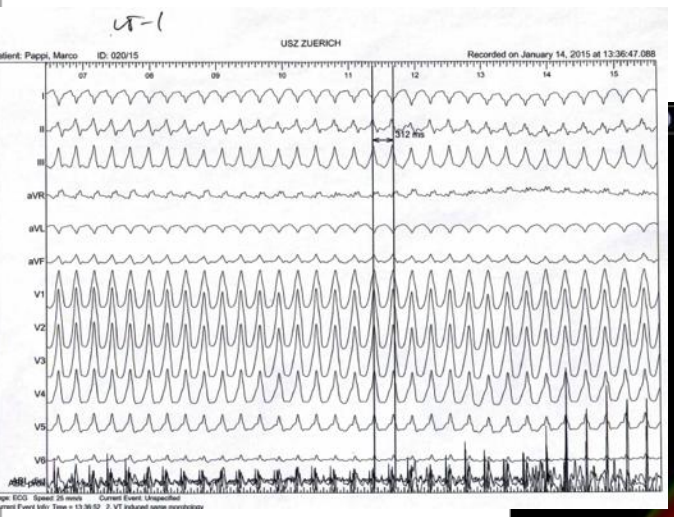
Epicardial and Endocardial Mapping of LP

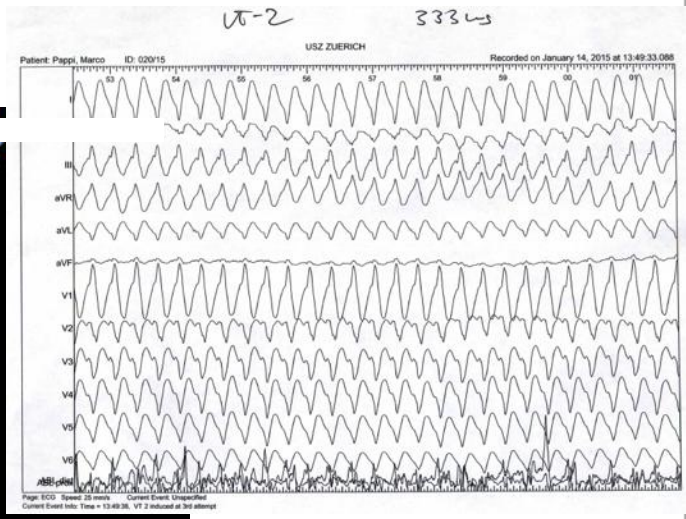


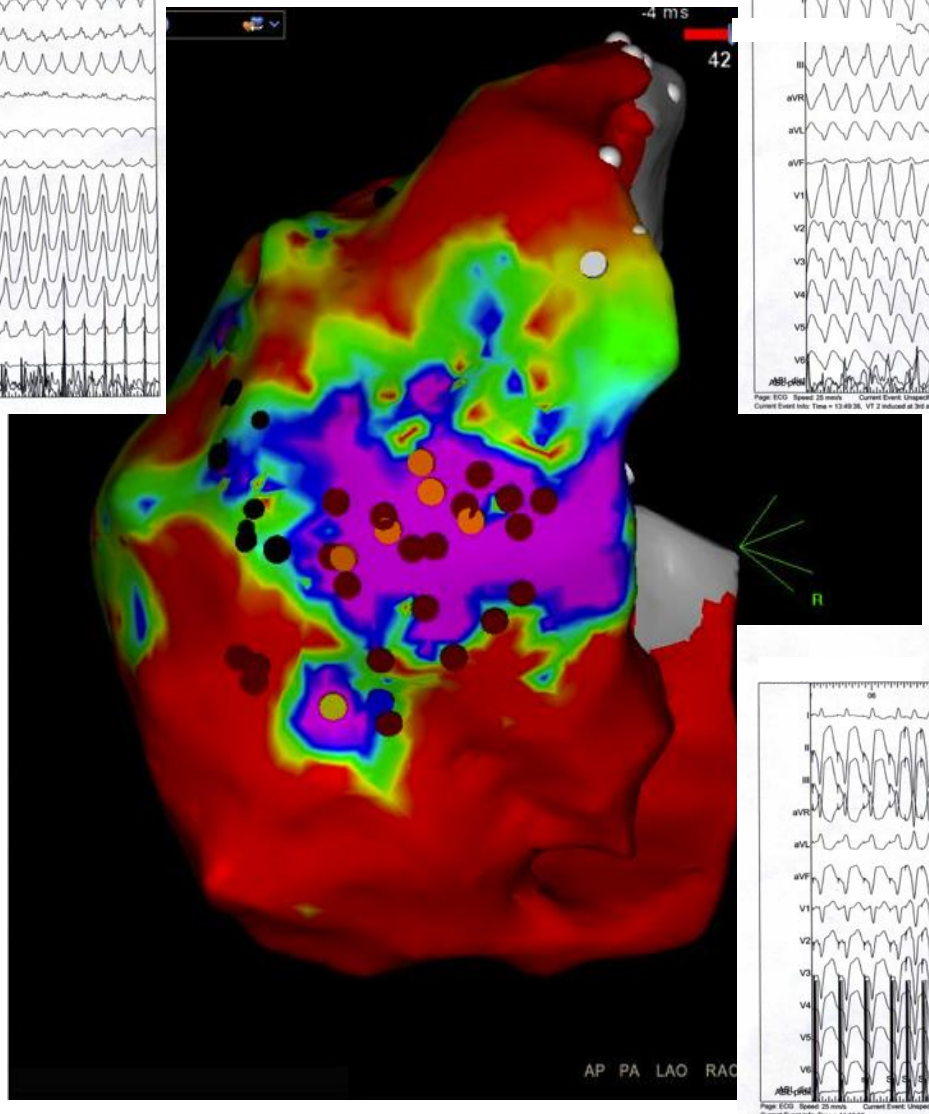
Epicardial Mapping

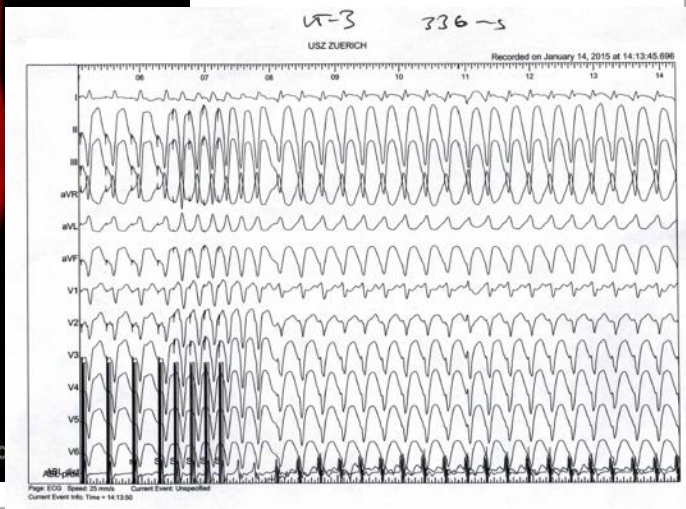


3 VT Circuits

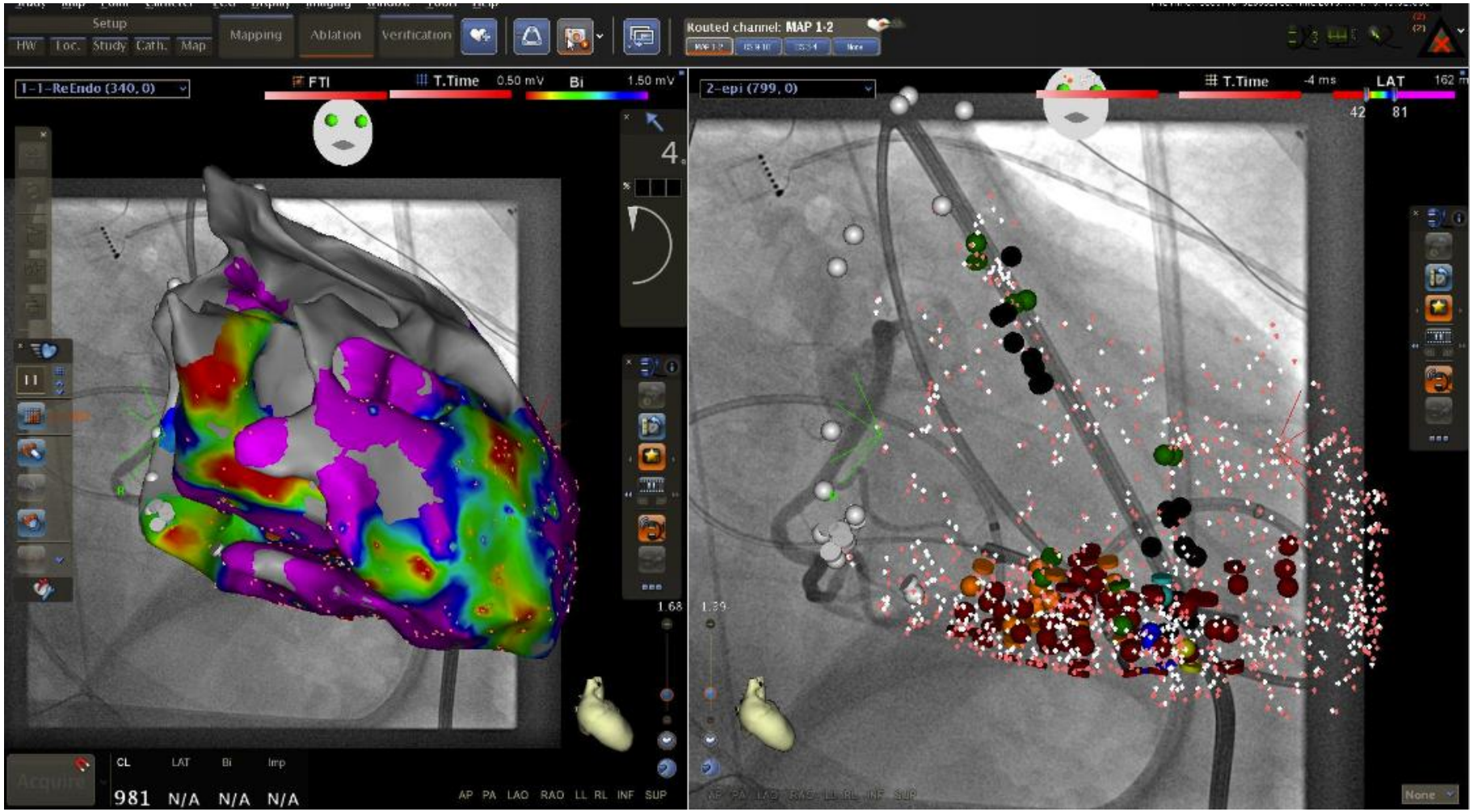




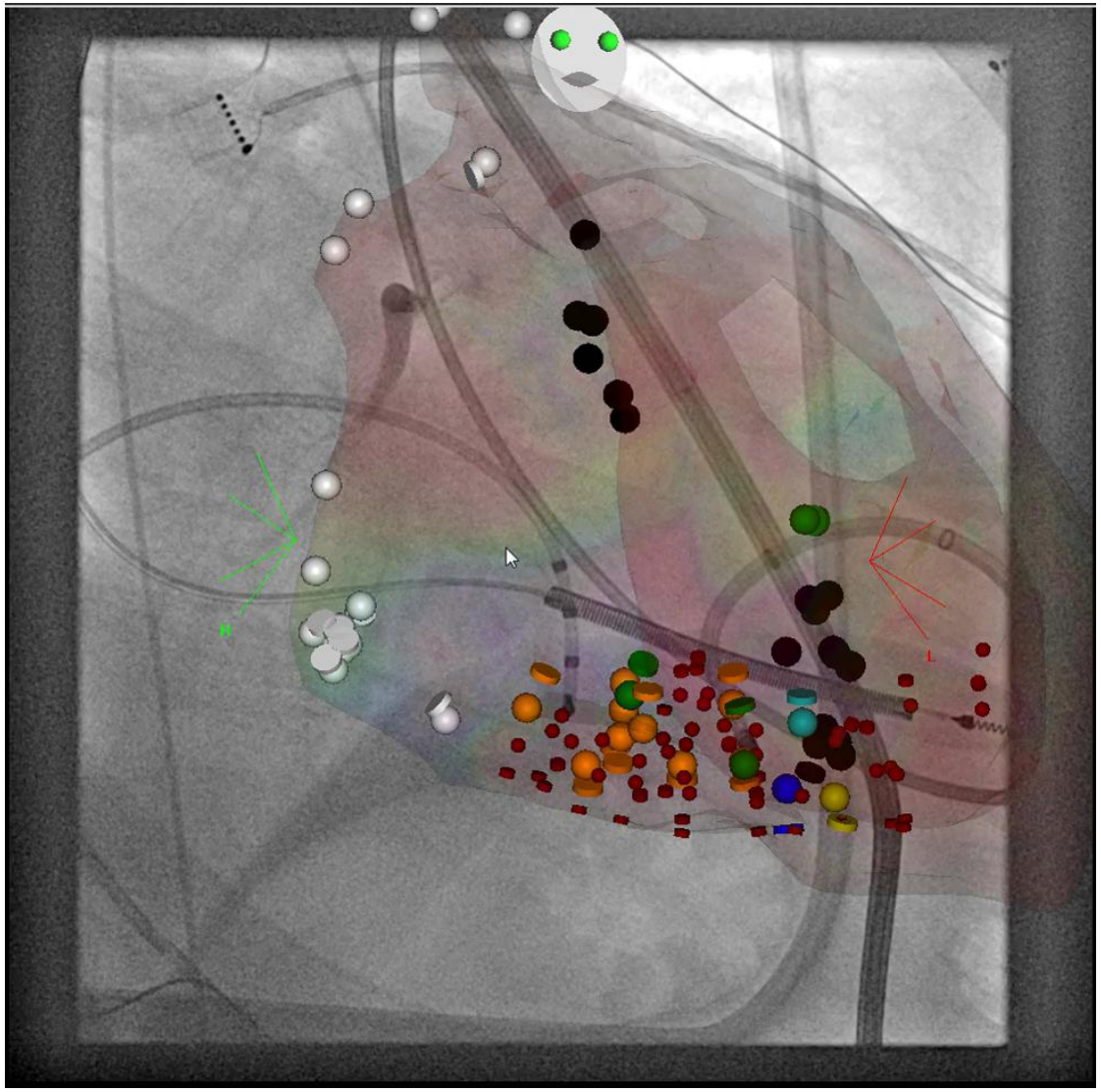




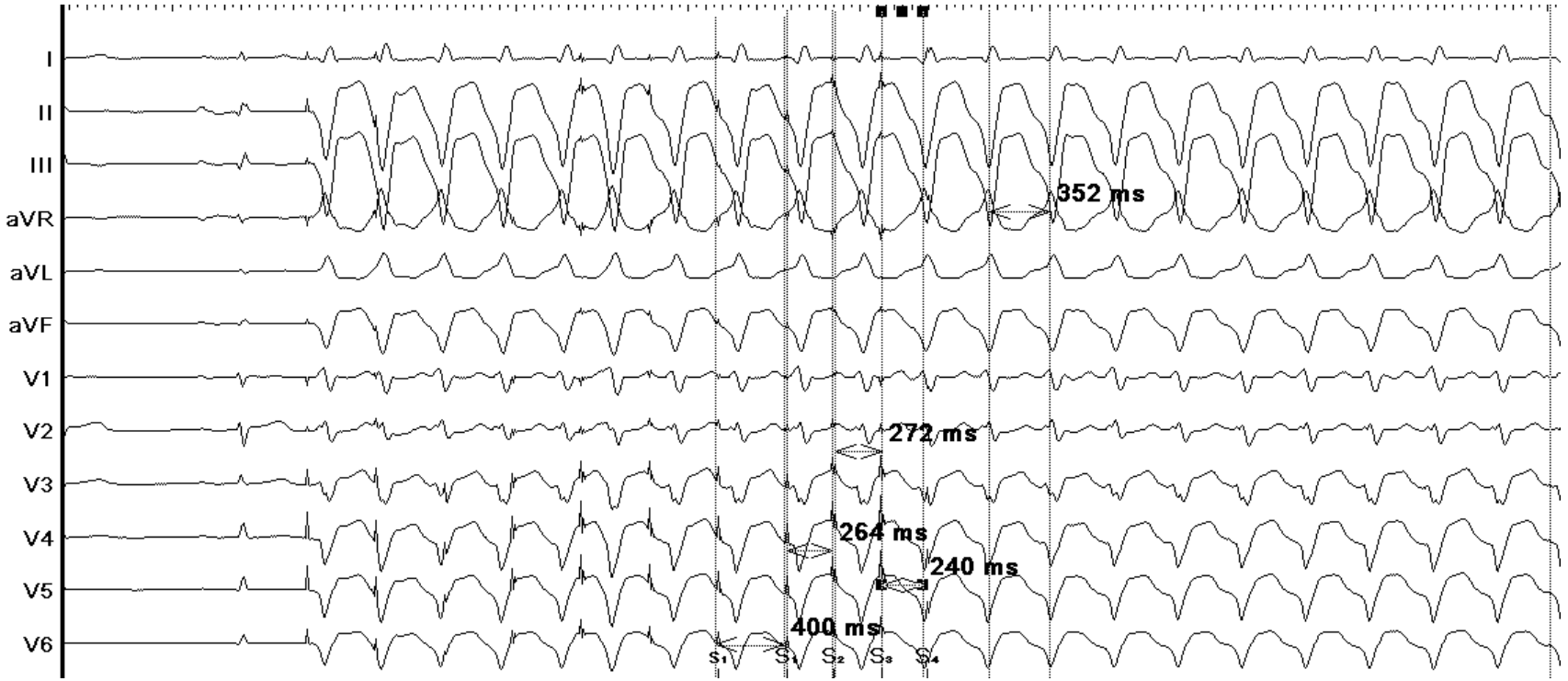
Avoid Coronary Arteries and Phrenic Nerve!



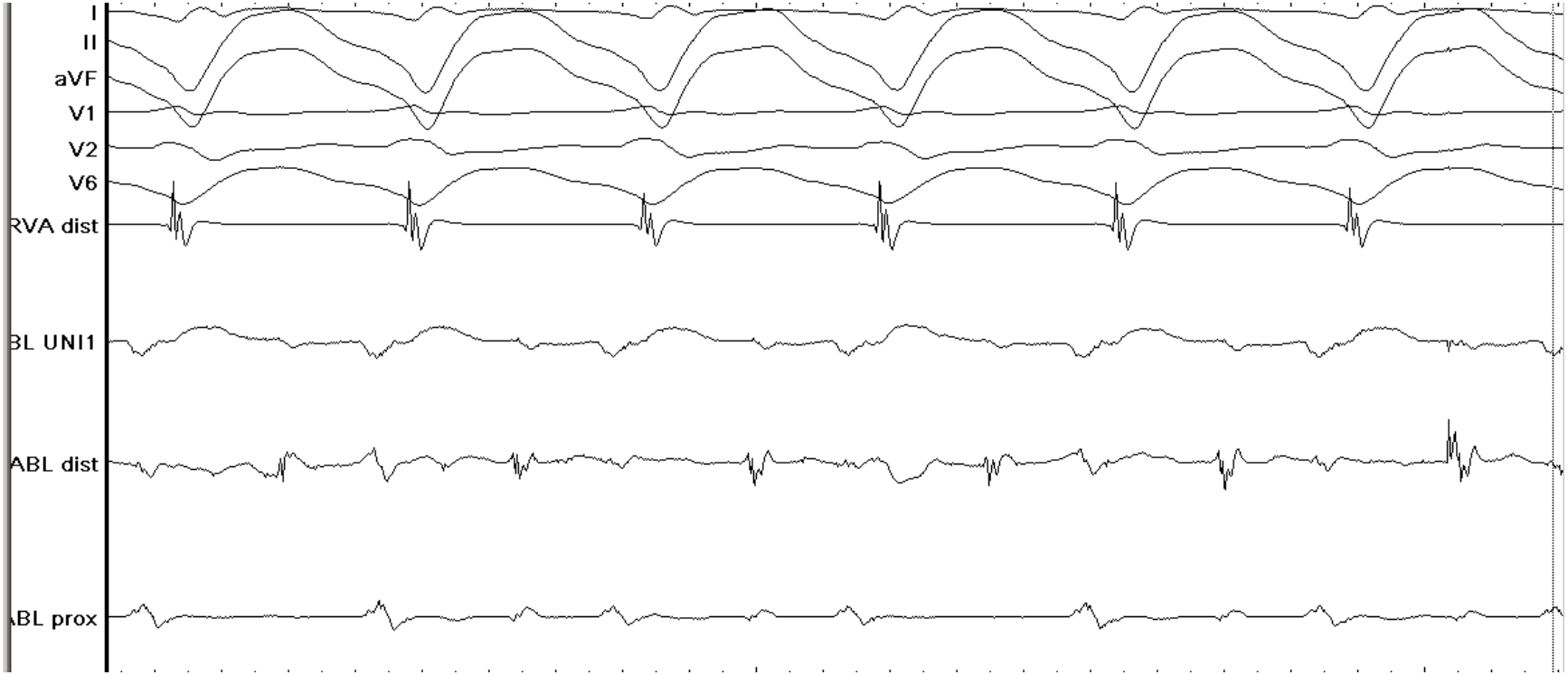
Avoid Coronary Arteries and Phrenic Nerve!



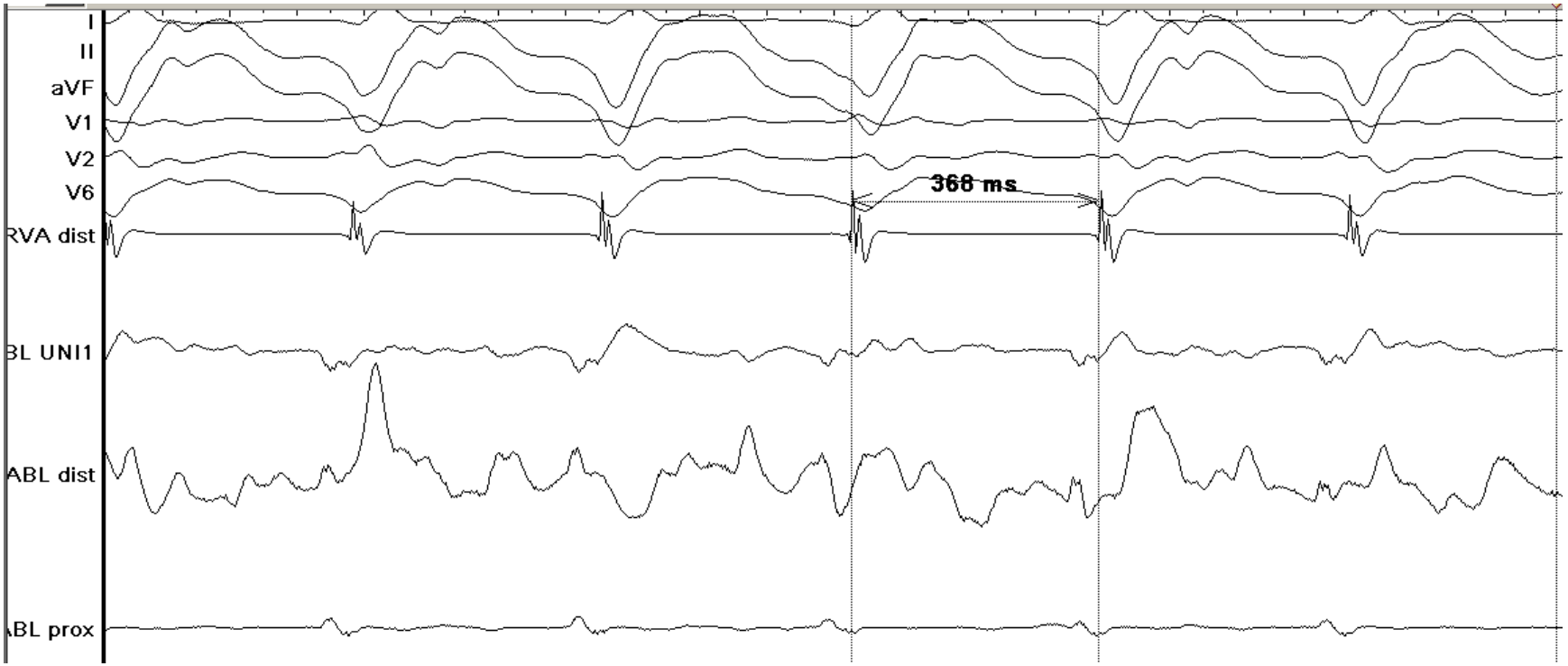
Perfect Pace Map induced VT 3



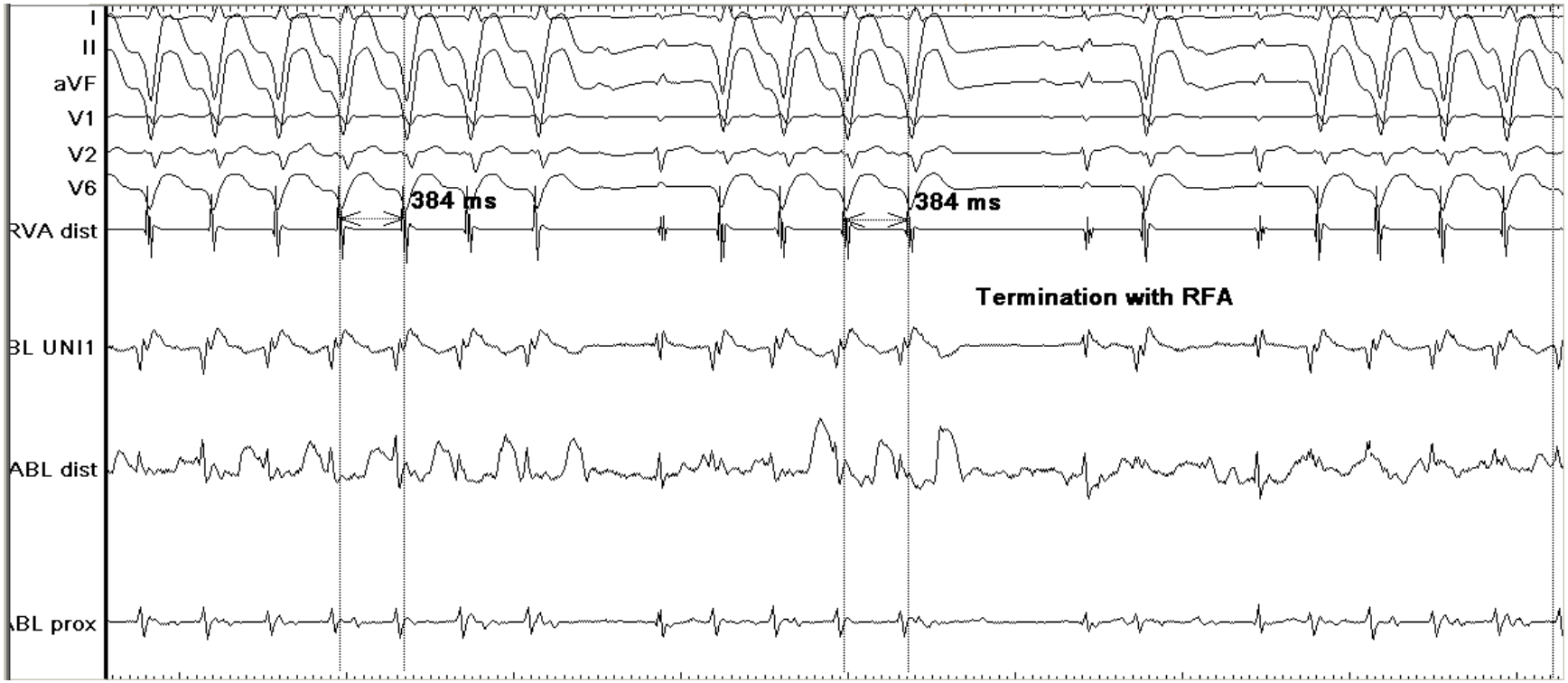
Ablation Site



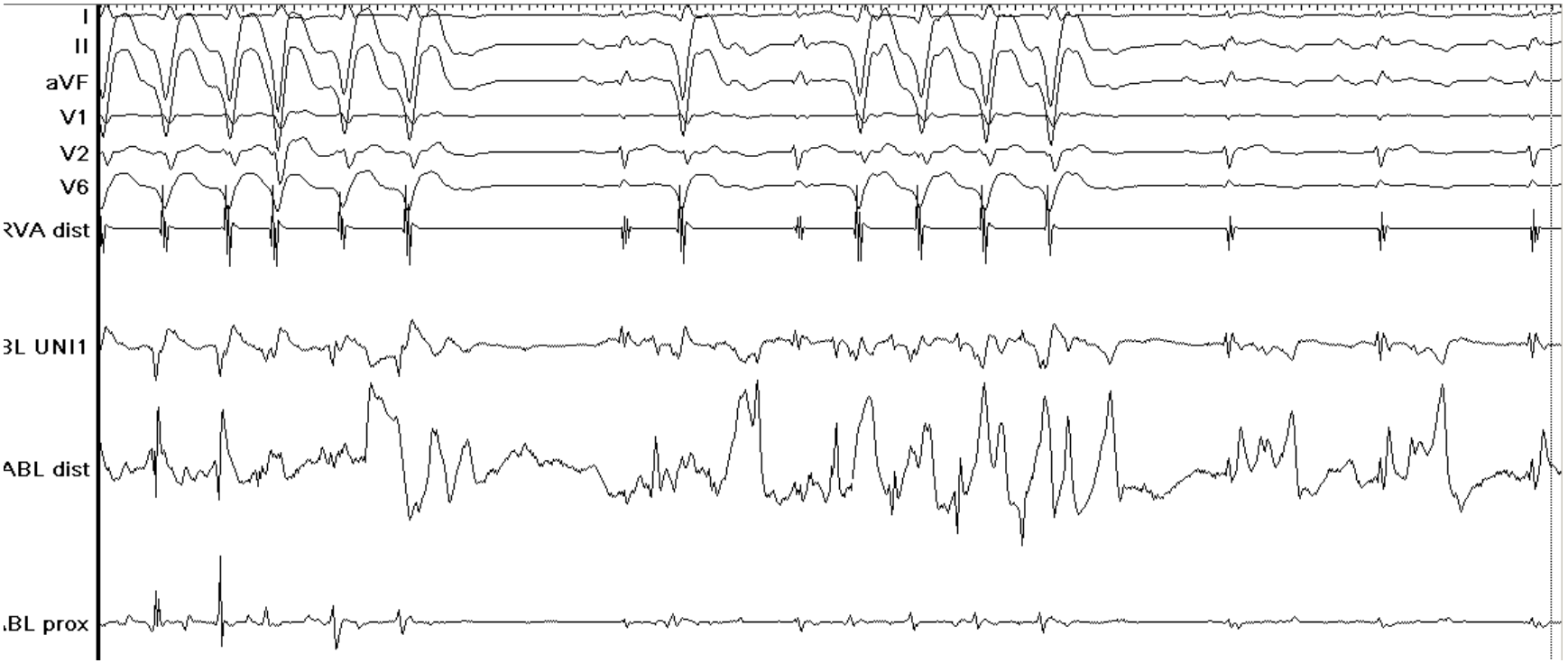
Slowing during Ablation



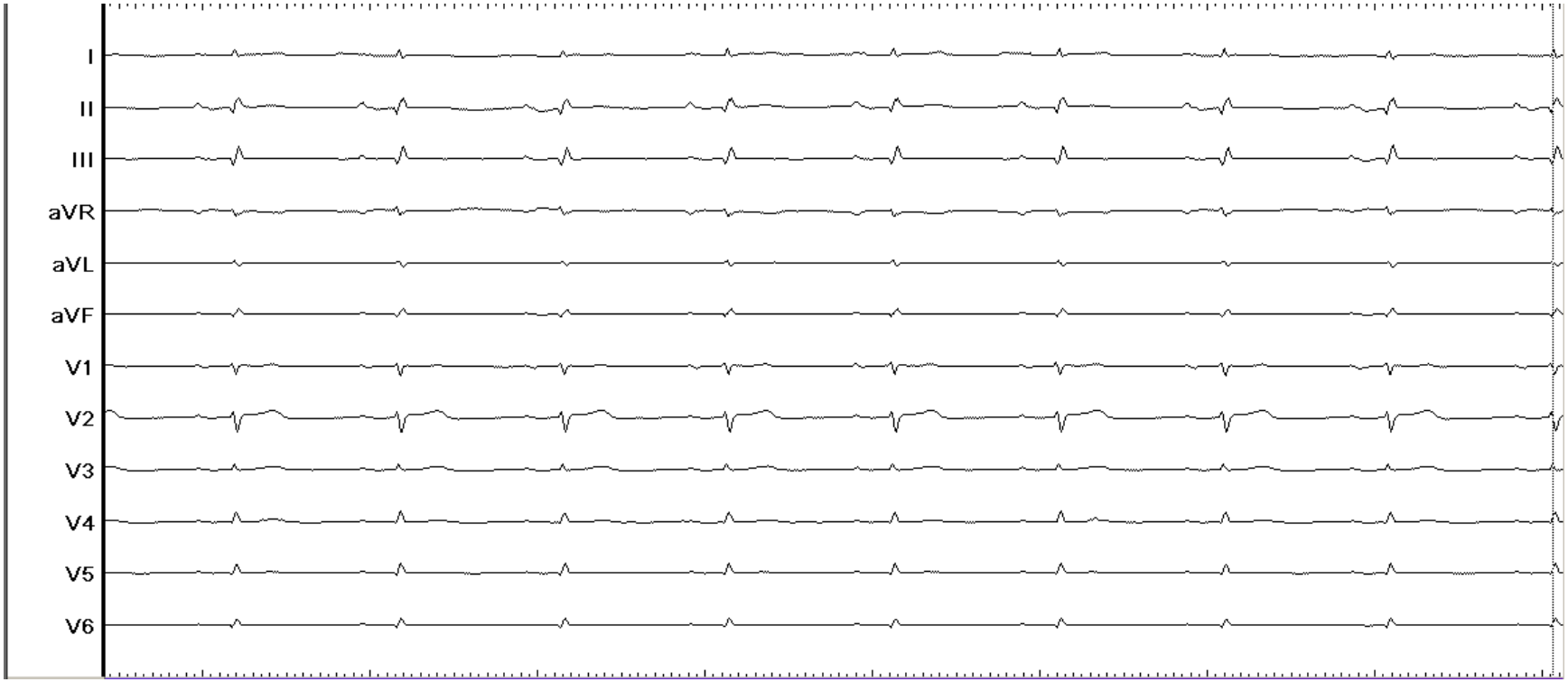
Terminates and Reinduces

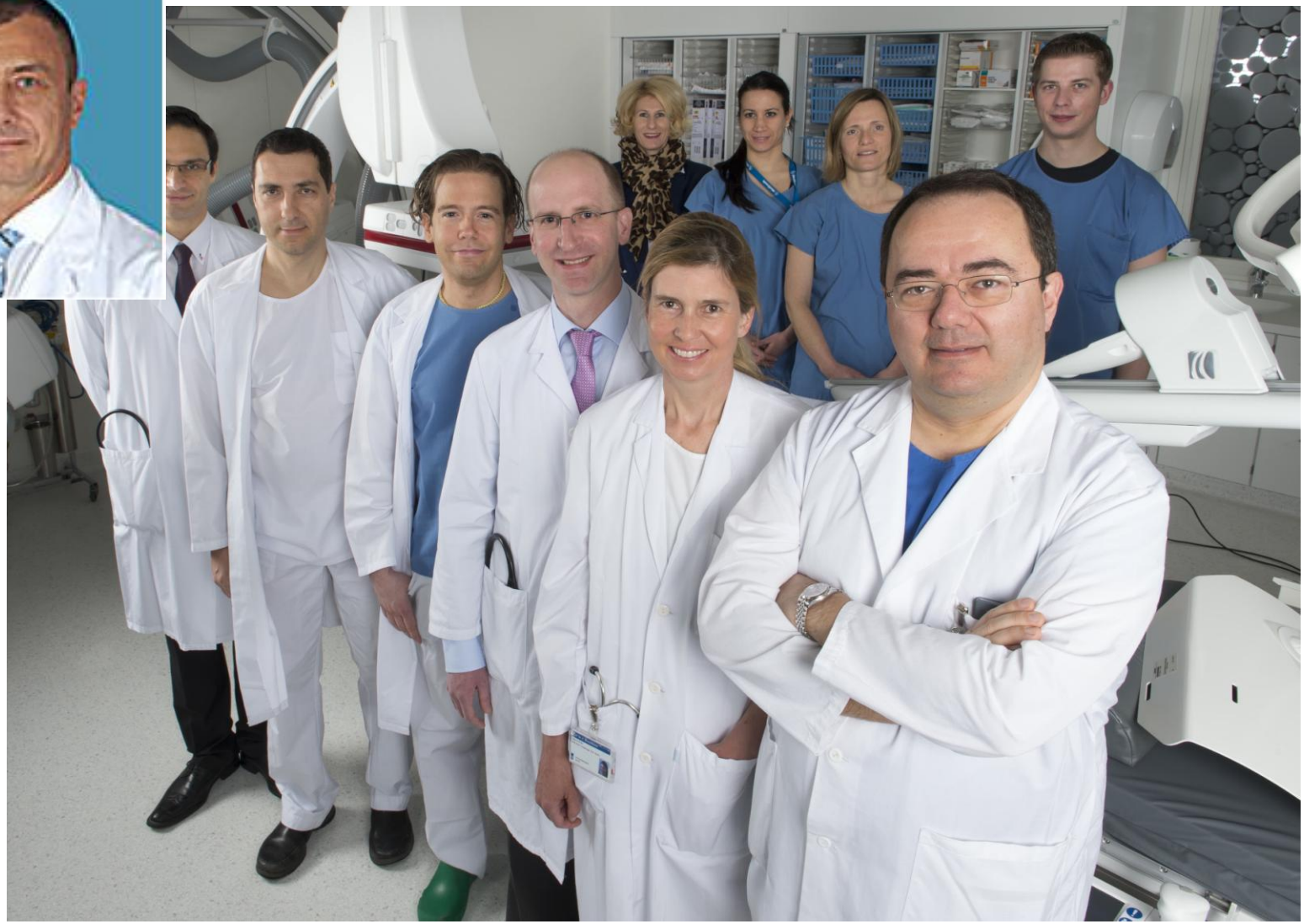


Definite Termination

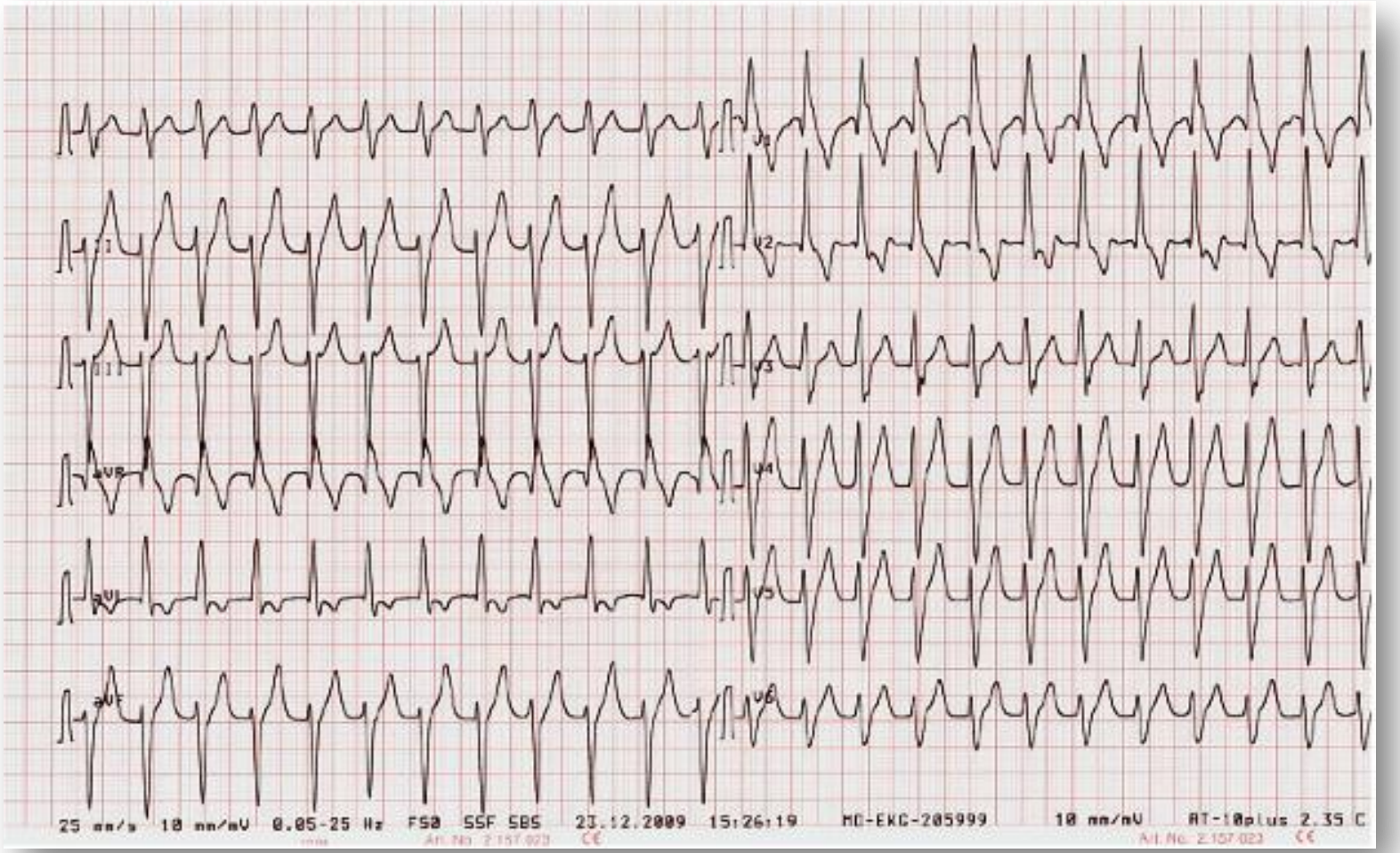


Sinus Rhythm!



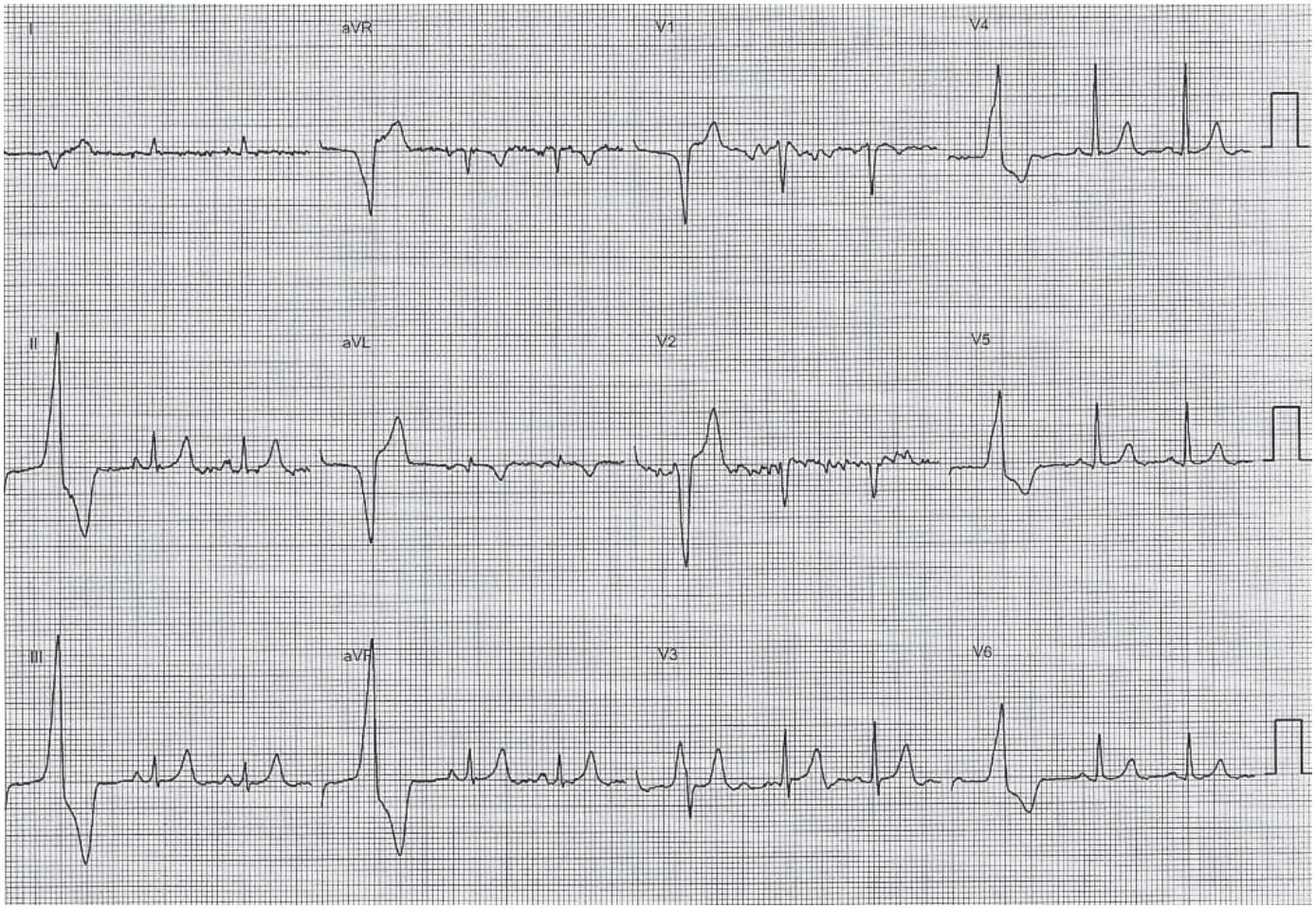


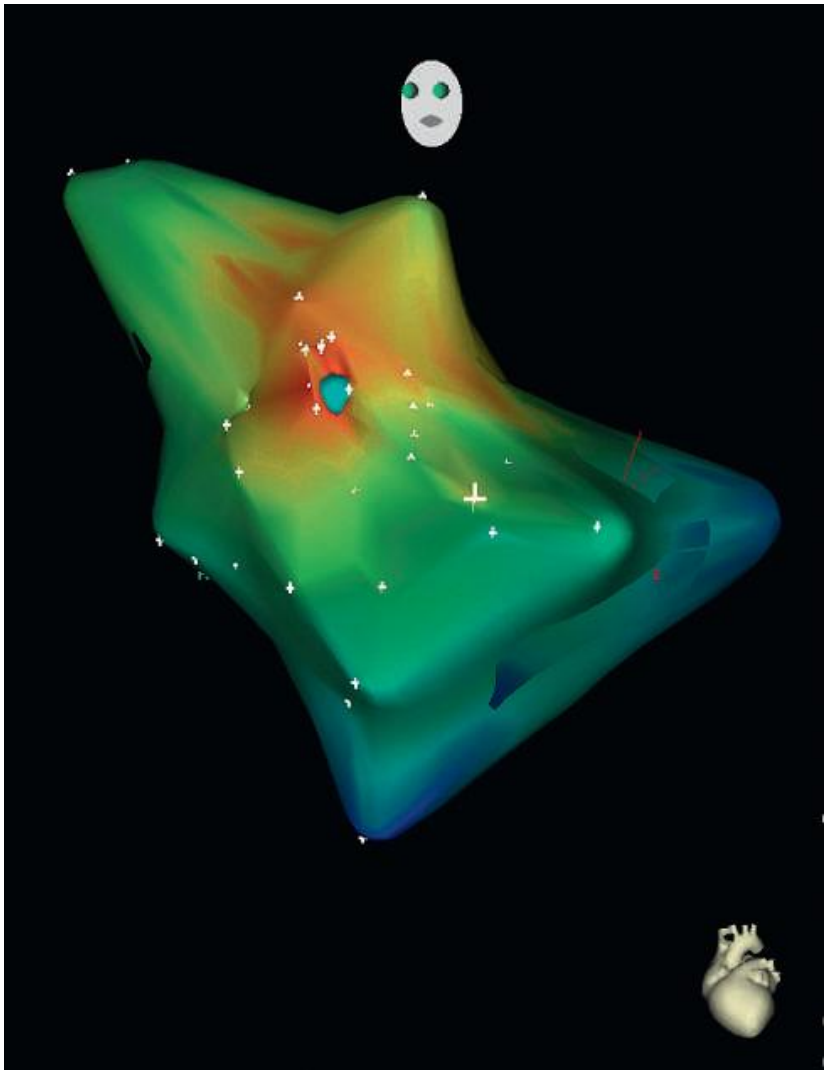
Thank you!


I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
25 mm/s 10 mm/mV 0.05-25 Hz FSO SSF SBS 21.12.2009 15:26:19 MC-EKG-205999 10 mm/mV AT-10plus 2.35 C


1 mV
II
1 mV
V


1 mV
II
1 mV
V


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6



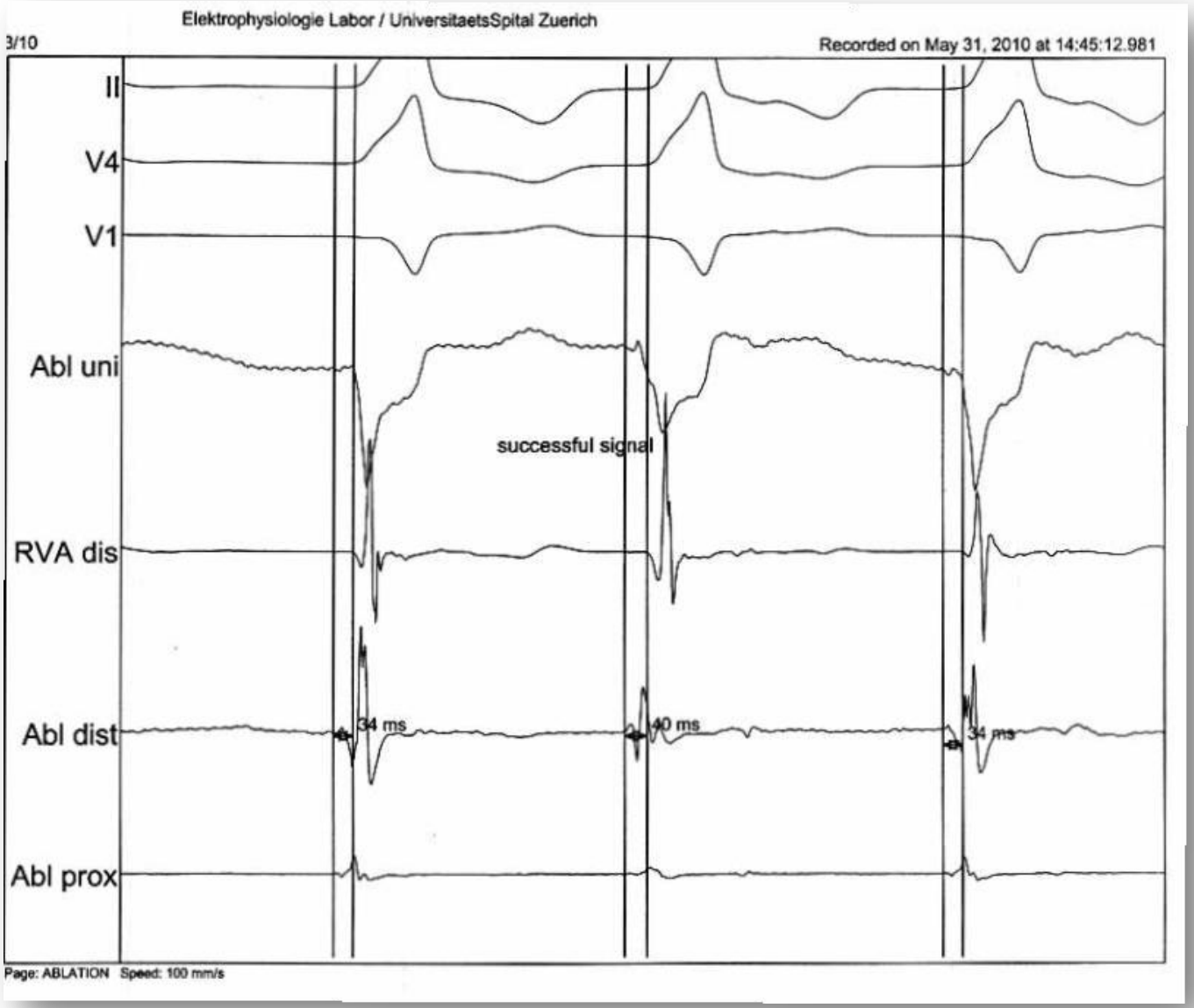

Elektrophysiologie Labor / UniversitaetsSpital Zuerich
3/10
Recorded on May 31, 2010 at 14:45:12.981
II
V4
V1
Abl uni
successful signal
RVA dis
Abl dist
34 ms
40 ms
34 ms
Abl prox
Page: ABLATION Speed: 100 mm/s

Table 2 Indications for catheter ablation of ventricular tachycardia

Patients with structural heart disease (including prior MI, dilated cardiomyopathy, ARVC/D)

Catheter ablation of VT is recommended

1. for symptomatic sustained monomorphic VT (SMVT), including VT terminated by an ICD, that recurs despite antiarrhythmic drug therapy or when antiarrhythmic drugs are not tolerated or not desired;*
2. for control of incessant SMVT or VT storm that is not due to a transient reversible cause;
3. for patients with frequent PVCs, NSVTs, or VT that is presumed to cause ventricular dysfunction;
4. for bundle branch reentrant or interfascicular VTs;
5. for recurrent sustained polymorphic VT and VF that is refractory to antiarrhythmic therapy when there is a suspected trigger that can be targeted for ablation.

Catheter ablation should be considered

1. in patients who have one or more episodes of SMVT despite therapy with one of more Class I or III antiarrhythmic drugs;*
2. in patients with recurrent SMVT due to prior MI who have LV ejection fraction >0.30 and expectation for 1 year of survival, and is an acceptable alternative to amiodarone therapy;*
3. in patients with haemodynamically tolerated SMVT due to prior MI who have reasonably preserved LV ejection fraction (>0.35) even if they have not failed antiarrhythmic drug therapy.*

Aliot EM and Stevenson WG et al. Heart Rhythm 2009

Patients without structural heart disease

Catheter ablation of VT is recommended for patients with idiopathic VT

1. for monomorphic VT that is causing severe symptoms.
2. for monomorphic VT when antiarrhythmic drugs are not effective, not tolerated, or not desired.
3. for recurrent sustained polymorphic VT and VF (electrical storm) that is refractory to antiarrhythmic therapy when there is a suspected trigger that can be targeted for ablation.

VT catheter ablation is contra-indicated

1. in the presence of a mobile ventricular thrombus (epicardial ablation may be considered);
2. for asymptomatic PVCs and/or NSVT that are not suspected of causing or contributing to ventricular dysfunction;
3. for VT due to transient, reversible causes, such as acute ischaemia, hyperkalaemia, or drug-induced torsade de pointes.

Aliot EM and Stevenson WG et al. Heart Rhythm 2009