Katétrová ablácia komorovej ektopie– zmysluplná terapia alebo "high-tech hrátky"?

Catheter ablation o ventricular ectopy – meaningful therapy or another high-tech toy?

ROBERT HATALA

NATIONAL CARDIOVASCULAR INSTITUTE AND SLOVAK MEDICAL UNIVERSITY

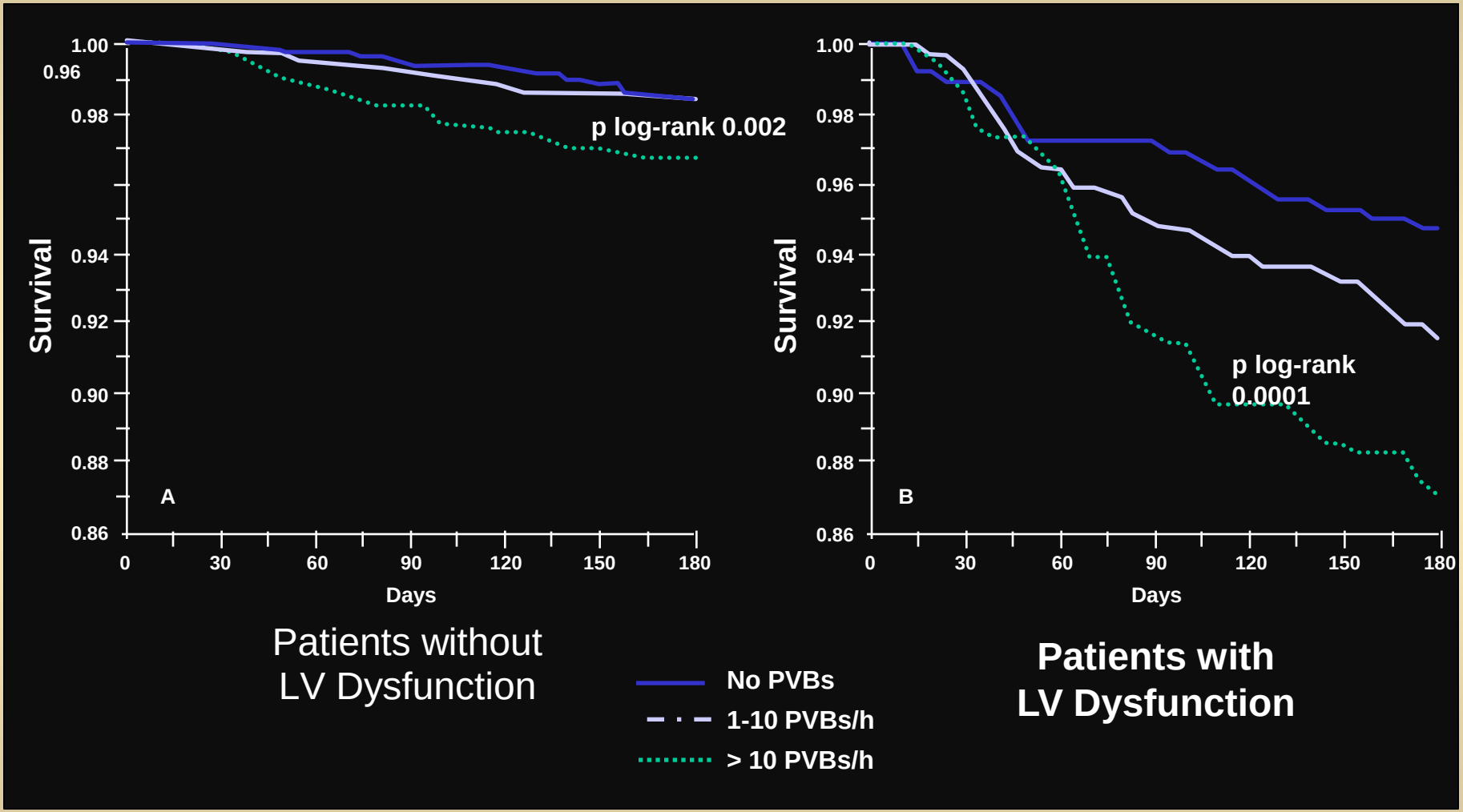
BRATISLAVA, SLOVAKIA

Ventricular ectopic activity is ubiqitous

- **1% of adult population has VEA on standard ECG, 40-75% with ECG monitoring**
- Frequent VES >1/min occur in 1-4% of the general population
- **„We conclude that the long-term prognosis in asymptomatic healthy subjects with frequent and complex ventricular ectopy is similar to that of the healthy U.S. population and suggests no increased risk of death“**

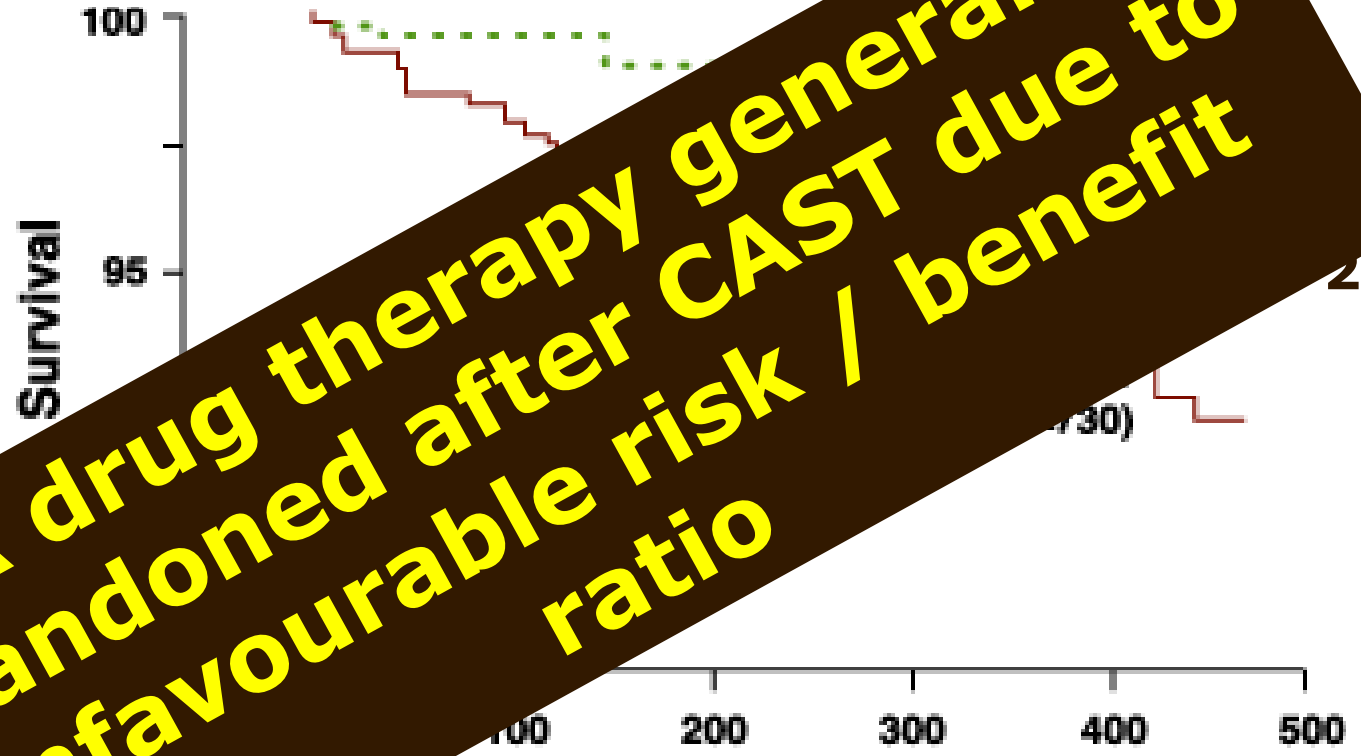
HL Kennedy, TA Buckingham et al.: Long-term follow-up of asymptomatic healthy subjects with frequent and complex ventricular ectopy. NEJM 1985, 312:193-197

Risk of Sudden Death: Data from GISSI-2



Maggioni AP. Circulation. 1993;87:312-322.

CAST : increased mortality in post-MI patients treated with class IC AA drugs (10 months F-



AA drug therapy generally abandoned after CAST due to unfavourable risk / benefit ratio

Open-La
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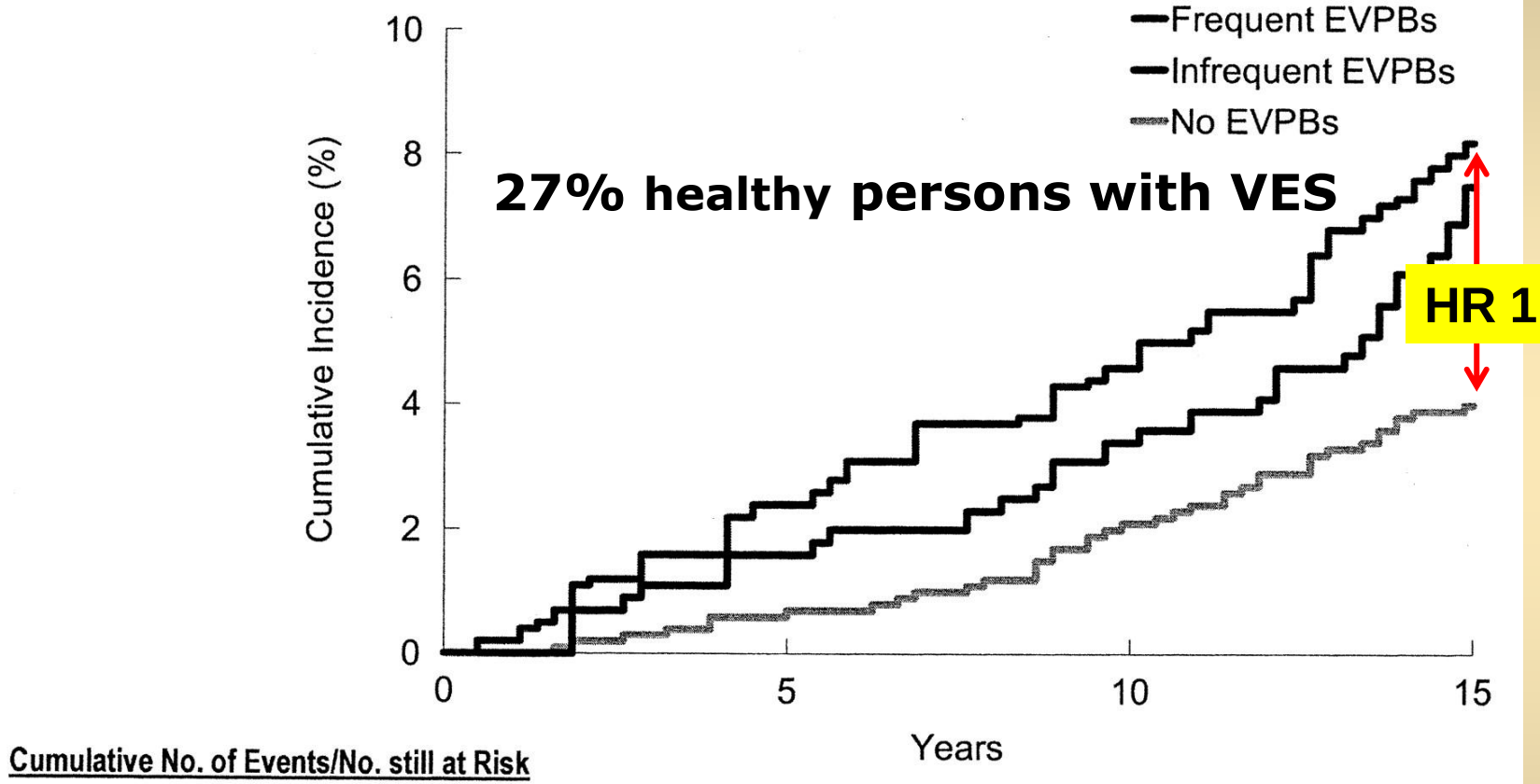
PVCs

Echt DS et al., NEJM 1991

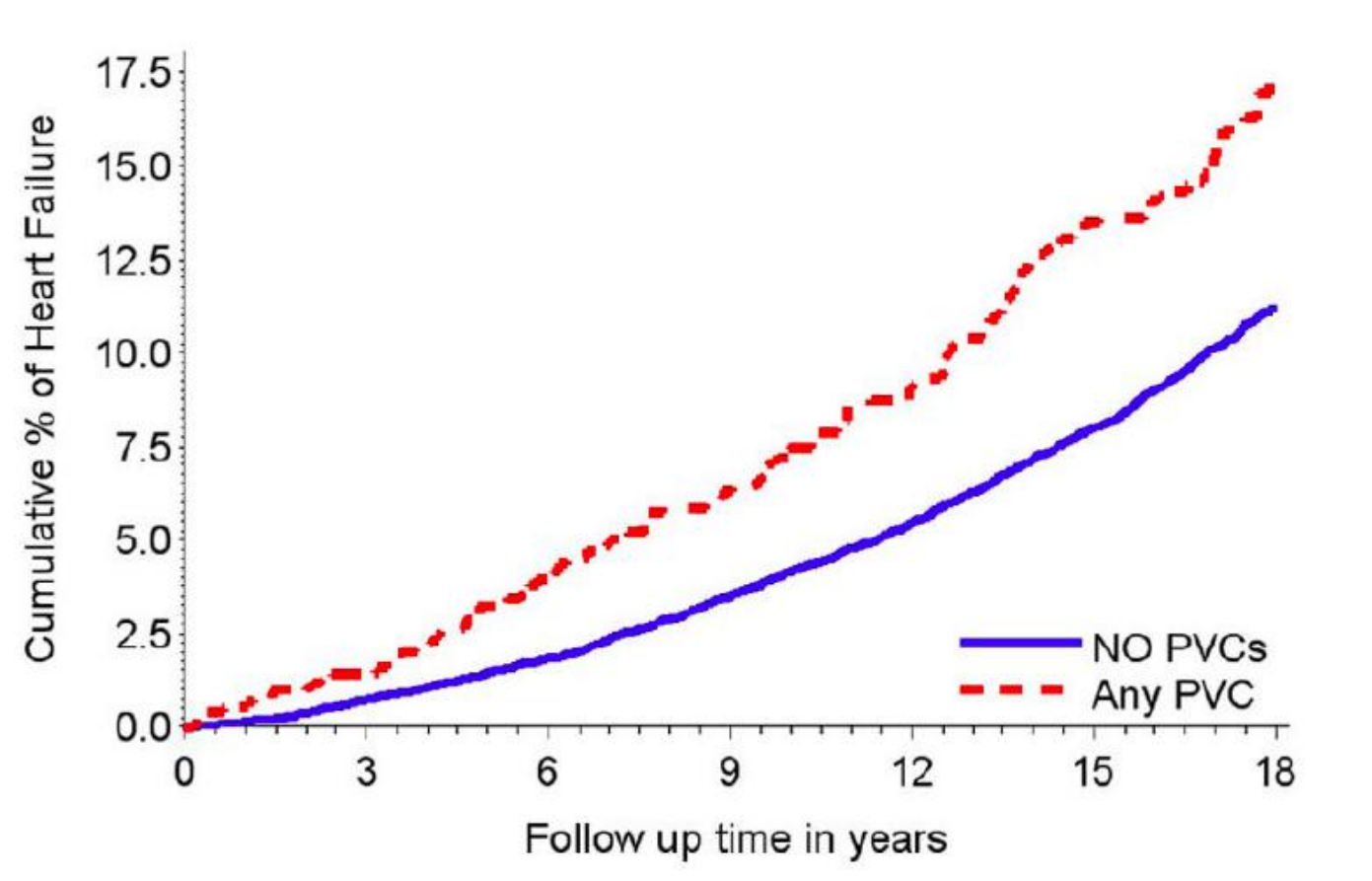
Exercise-induced PVCs and incidence of death
Framingham offspring 2885 pers., 1397 men, age 43



Cumulative No. of Events/No. still at Risk				
No EVPBs	0/2093	12/2080	41/2033	82/1690
Infrequent EVPBs (≤median)	0/399	7/392	15/383	29/307
Frequent EVPBs (>median)	0/393	11/382	22/370	39/300

Morshedi-Meibodi, A. et al. Circulation 2004;109:2417-2422

Multivariable adjusted cumulative heart failure events during follow up by the presence any VPCs in a 2- minute ECG strip among ARIC cohort participants free of heart failure and CHD at baseline (13 486 persons)



Agarwal et al., Am J Cardiol 2010

Ventricular Premature Contractions: A Randomized Non-drug Intervention Trial in Normal Men

R.

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of them, and little "contamination" occurred in the control group.

VPCs were analyzed according to VPC/min, VPC/man and VPC/total number of heart beats. Moderate changes in VPC rates occurred in both experimental and control groups but no significant group differences were found at rest or during any induction test. This 6-week, multiple-factor "hygienic" intervention program had no significant influence on the frequency or occurrence of VPCs in apparently normal men with persistent and frequent VPCs.

Because the mechanisms and the significance of VPCs are different in patients with ischemic heart disease, our approach and methods may be useful for similar trials among cardiac patients of adjunct or non-drug therapy for ectopic rhythms.

Original Article

Suppression of Frequent Premature Ventricular Contractions and Improvement of Left Ventricular Function in Patients With Presumed Idiopathic Dilated Cardiomyopathy

DOUGLAS F. DUFFEE, M.D.,* WIN-KUANG SHEN, M.D., AND HUGH C. SMITH, M.D.

• *Objective*: To examine the hypothesis that suppression of frequent premature ventricular contractions may be associated with improvement in left ventricular function in patients with presumed idiopathic dilated cardiomyopathy.

• *Design*: We conducted a retrospective case study and statistical analysis of the effect of cardiac medical therapy on outcome.

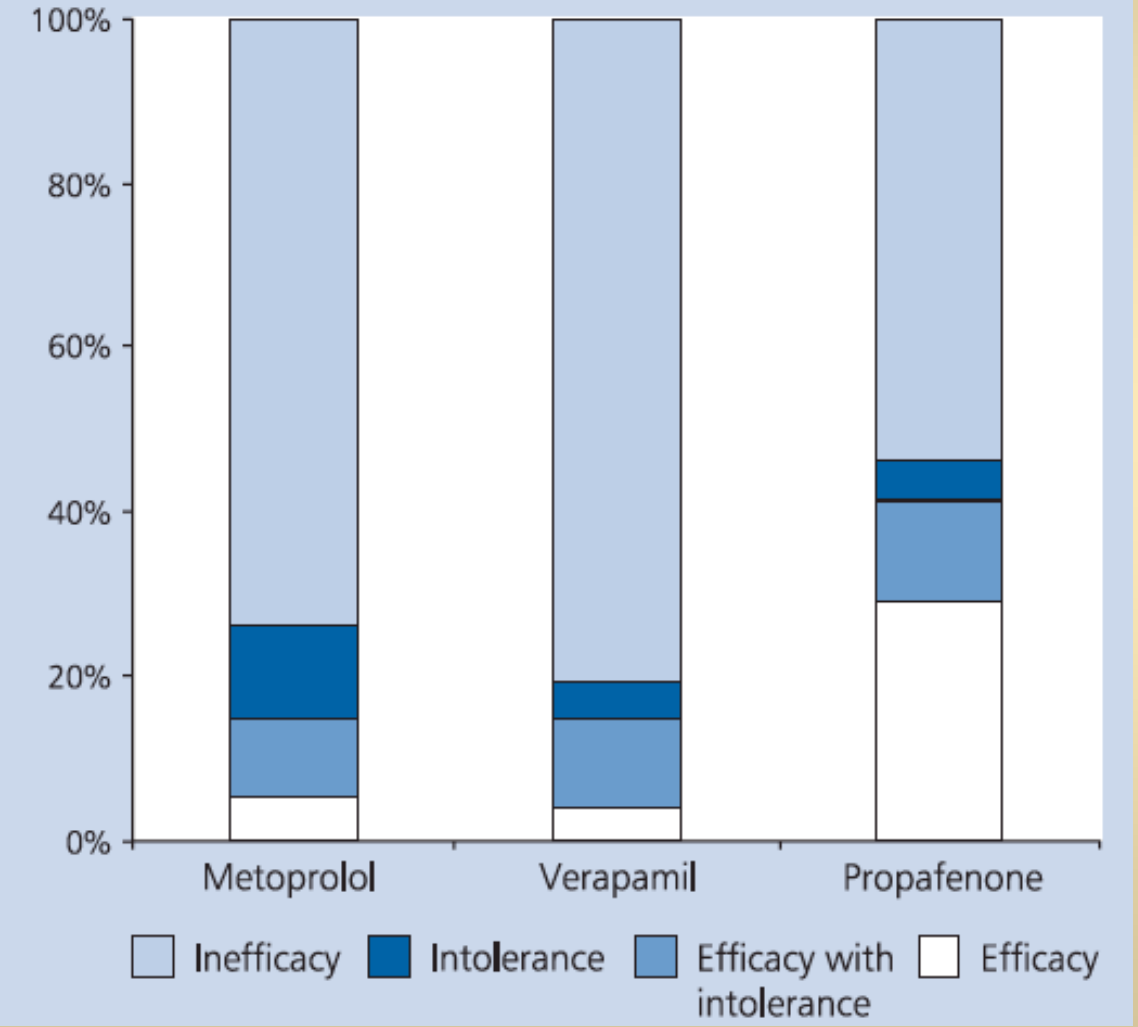
• *Material and Methods*: The study population consisted of 14 patients with more than 20,000 premature ventricular contractions in 24 hours recorded by Holter monitoring and associated left ventricular dysfunction (ejection fraction, 40% or less). Clinical characteristics, number of premature ventricular contractions per hour on 24-hour ambulatory Holter monitoring, and ejection fraction based on transthoracic echocardiography were compared before and after cardiac therapeutic intervention.

• *Results*: Of the 14 patients, 10 had presumed idiopathic dilated cardiomyopathy, and 4 had ischemic heart disease. Of the overall study group, seven had received additional cardiac medical therapy after the index evaluation, including four patients who had amiodarone therapy. A significant reduction (75% or more from baseline) in premature ventricular contractions after medical therapeutic intervention was observed in five patients at the first follow-up examination. The mean interval to the first follow-up examination was 6 ± 3 months. Of the five patients, four had significant improvement in clinical functional status and the ejection fraction. The mean ejection fraction of these five patients increased from $27 \pm 10\%$ at baseline to $49 \pm 17\%$ after medical therapy ($P = 0.04$).

• *Conclusion*: The suppression of frequent premature ventricular contractions may be associated with improvement of left ventricular function in patients with presumed idiopathic dilated cardiomyopathy.

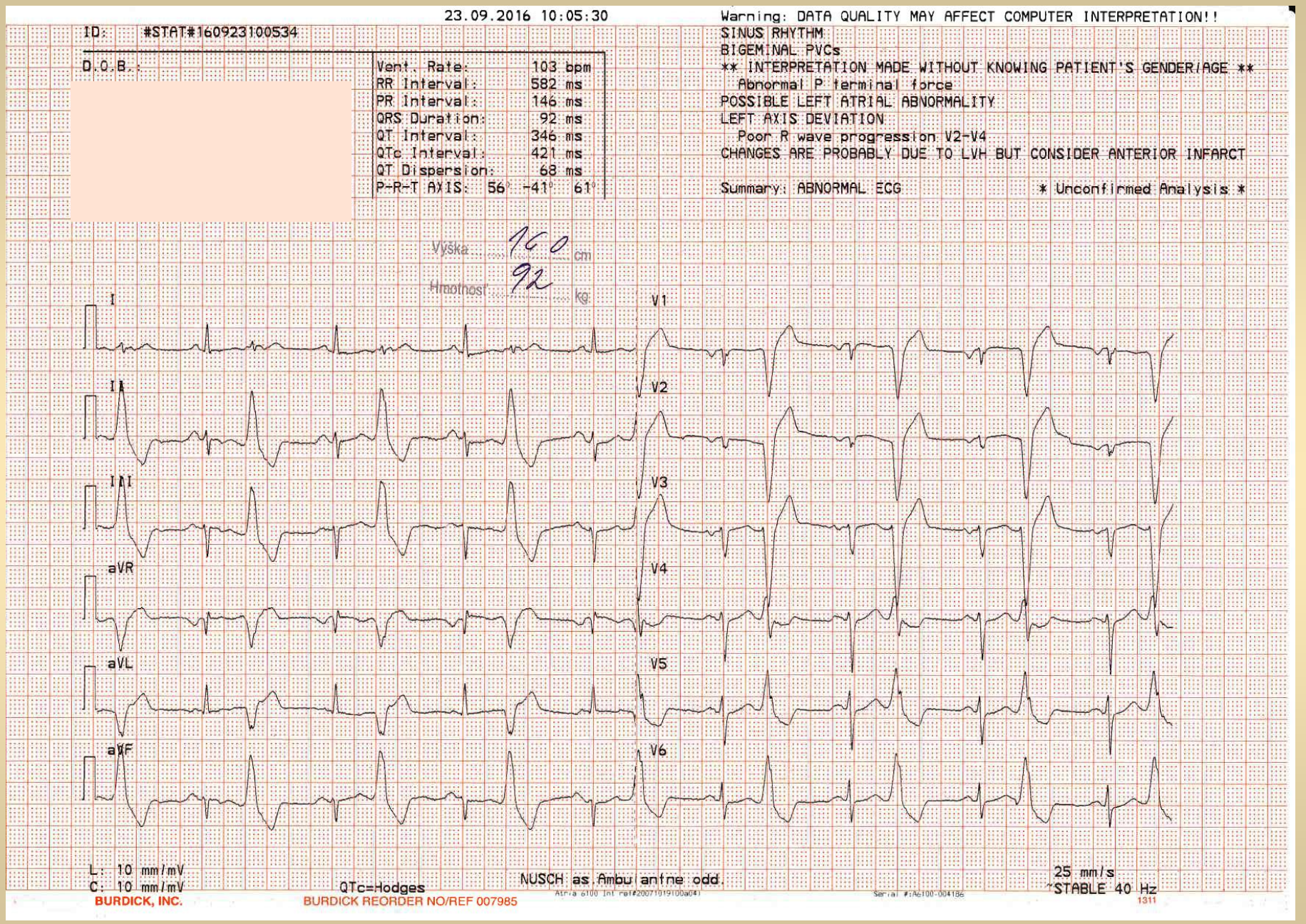
Mayo Clin Proc 1998;73:430-433

AA drugs for PVC



84 pts
median age 47
50 underwent RFCA
44 success (8 re-do)

Stec S et al, Kardiol Pol 2012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PR Interval: 146 ms
QRS Duration: 92 ms
QT Interval: 346 ms
QTc Interval: 421 ms
QT Dispersion: 68 ms
P-R-T AXIS: 56° -41° 61°
SINUS RHYTHM
BIGEMINAL PVCs
** INTERPRETATION MADE WITHOUT KNOWING PATIENT'S GENDER/AGE **
Abnormal P terminal force
POSSIBLE LEFT ATRIAL ABNORMALITY
LEFT AXIS DEVIATION
Poor R wave progression V2-V4
CHANGES ARE PROBABLY DUE TO LVH BUT CONSIDER ANTERIOR INFARCT
Summary: ABNORMAL ECG
* Unconfirmed Analysis *
Výška 160 cm
Hmotnost 92 kg
I
II
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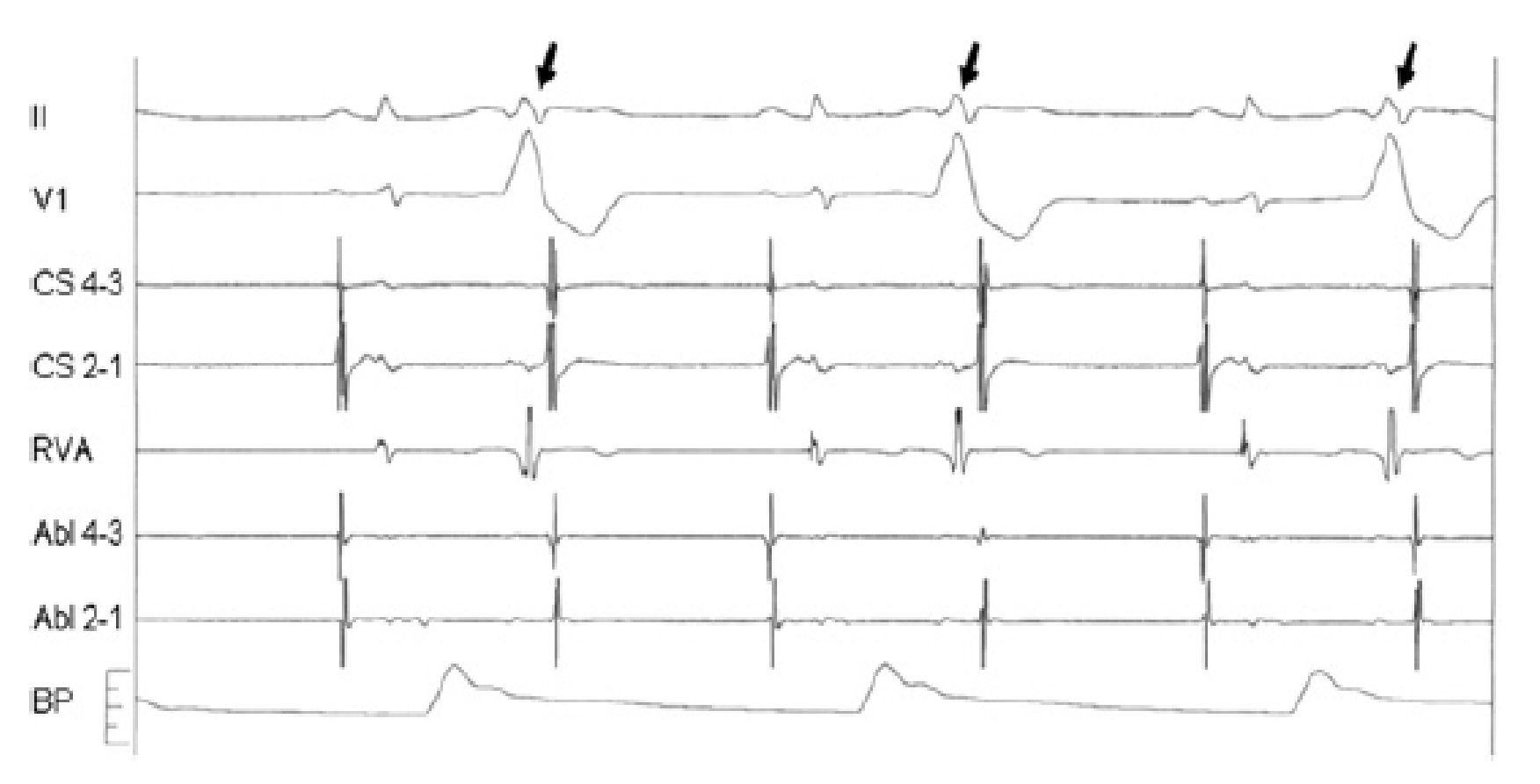
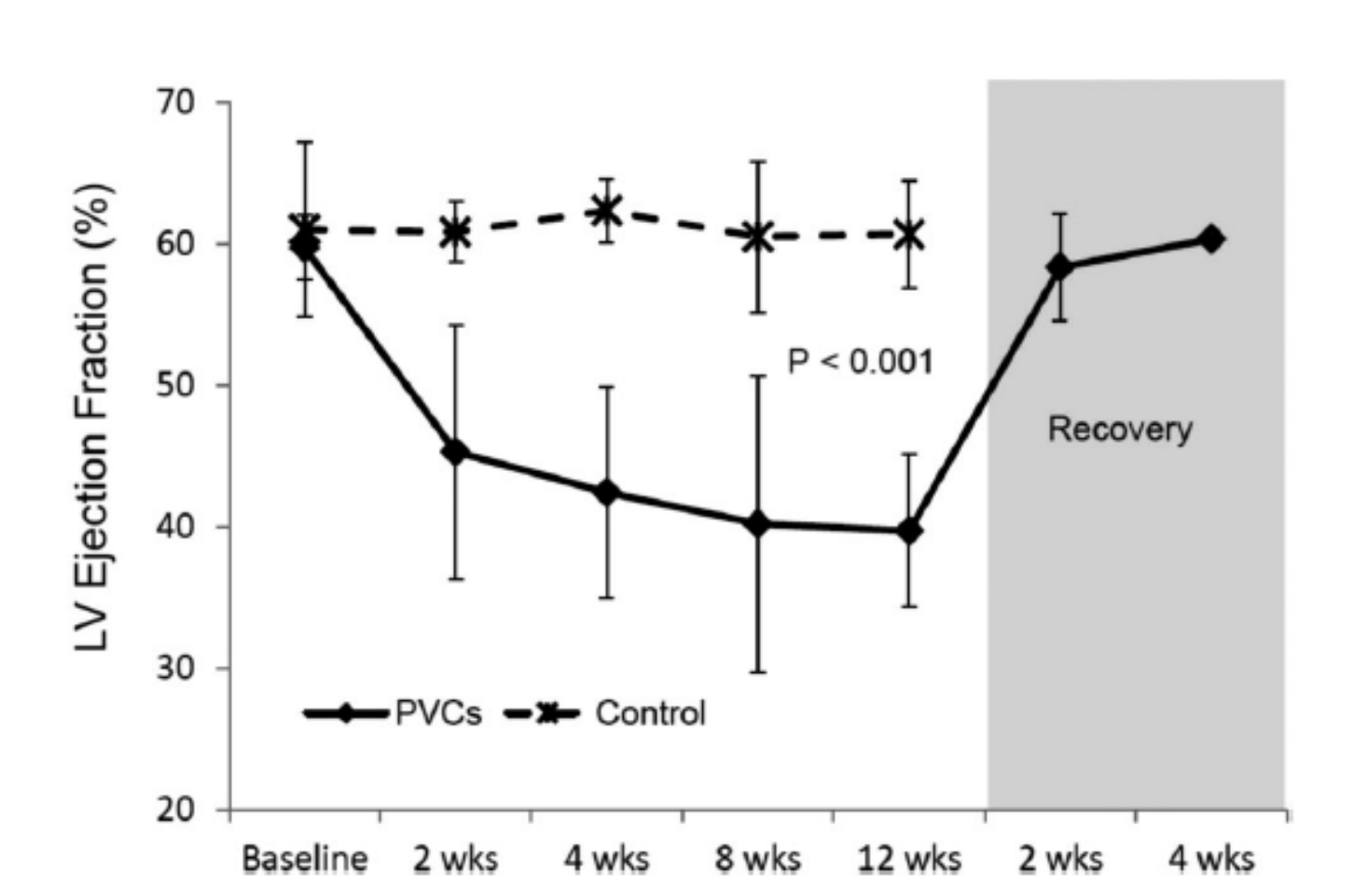
BURDICK, INC.
BURDICK REORDER NO/REF 007985
1311

Recordings of arterial BP in a 52-year-old male patient with frequent PVCs without structural heart disease

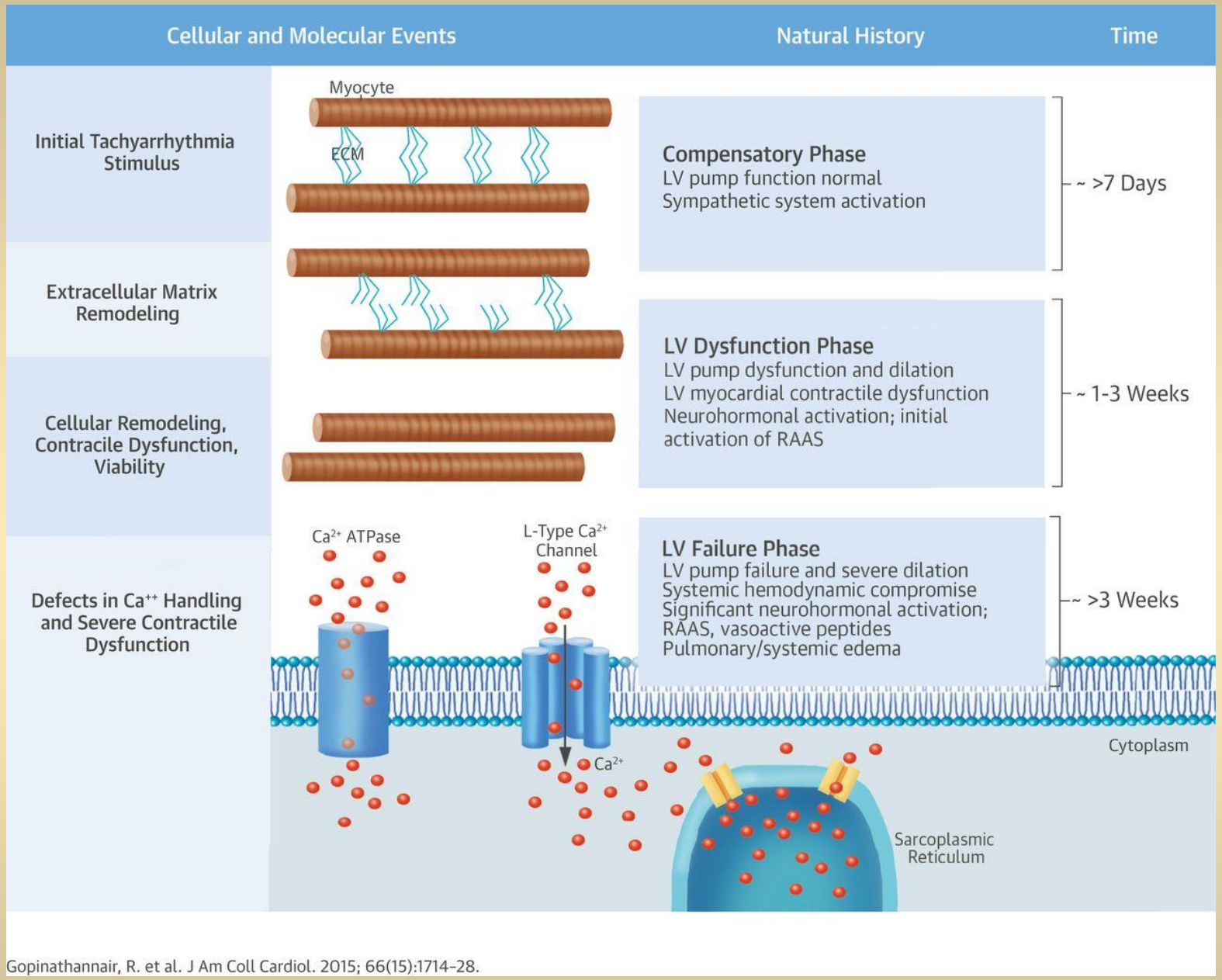


Chen T el al., J Cardiac Fail 2013;19:40-49

Left Ventricular Systolic Dysfunction Induced by Ventricular Ectopy
A Novel Model for Premature Ventricular Contraction-Induced Cardiomyopathy



Huizar J et al., Circ Arrhythm Electrophysiol. 2011;4:543-549



Gopinathannair, R. et al. J Am Coll Cardiol. 2015; 66(15):1714–28.

Rakesh Gopinathannair et al. JACC 2015;66:1714-1728

JACC Vol. 26, No. 4
October 1995:843–9

CLINICAL STUDIES — ELECTROPHYSIOLOGY

Radiofrequency Catheter Ablation for Management of Symptomatic Ventricular Ectopic Activity

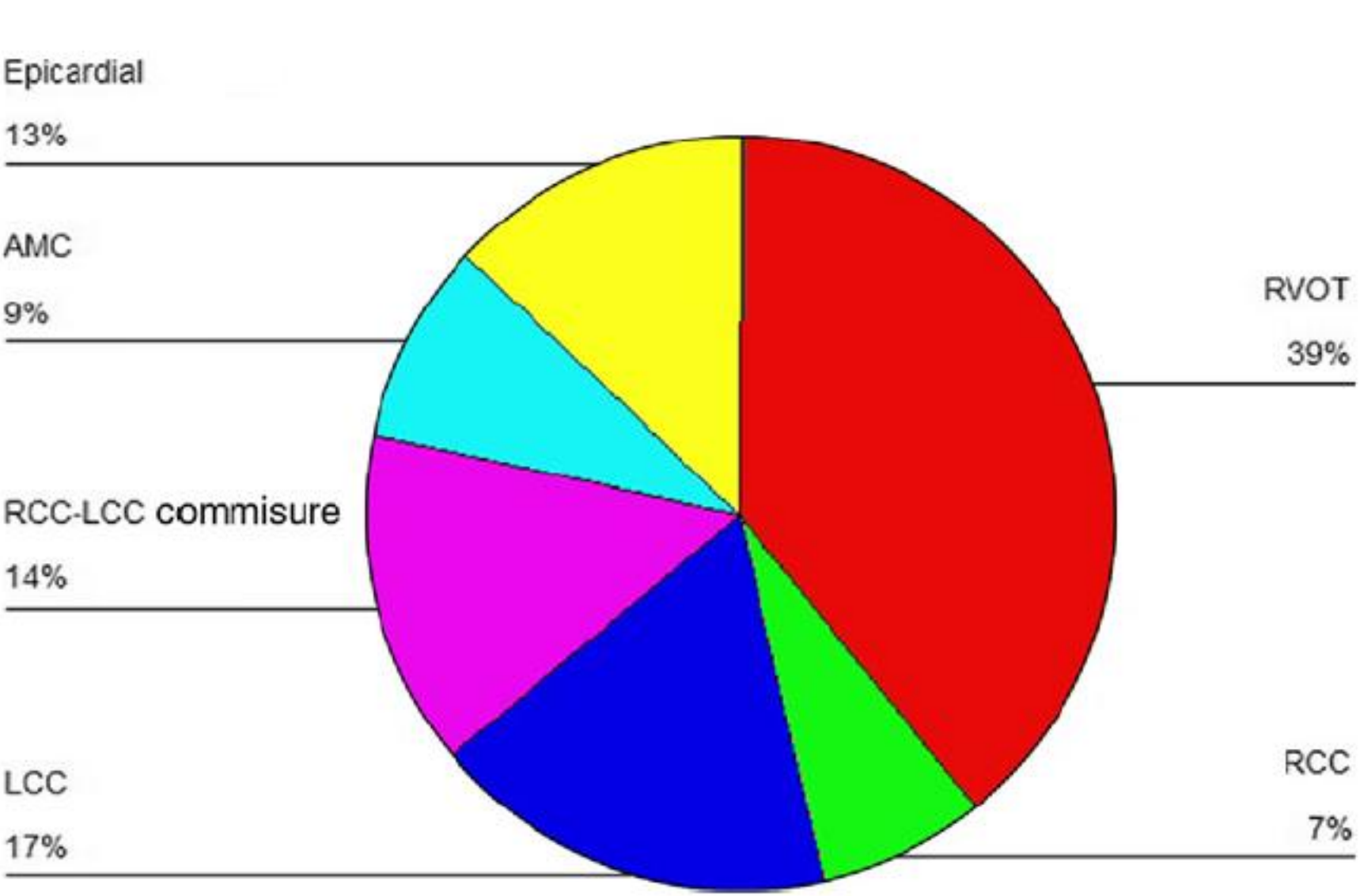
DENNIS WEI-XI ZHU, MD, FACC, JAMES D. MALONEY, MD, FACC,
TONY W. SIMMONS, MD, FACC,* JUNICHI NITTA, MD, PHD, DAVID M. FITZGERALD, MD, FACC,*
RICHARD G. TROHMAN MD, FACC,† DIRAR S. KHOURY, PHD, WALID SALIBA, MD,
KAREN M. BELCO, RN, CARLOS RIZO-PATRON, MD, FACC, SERGIO L. PINSKI, MD†

Houston, Texas; Winston-Salem, North Carolina; and Cleveland, Ohio

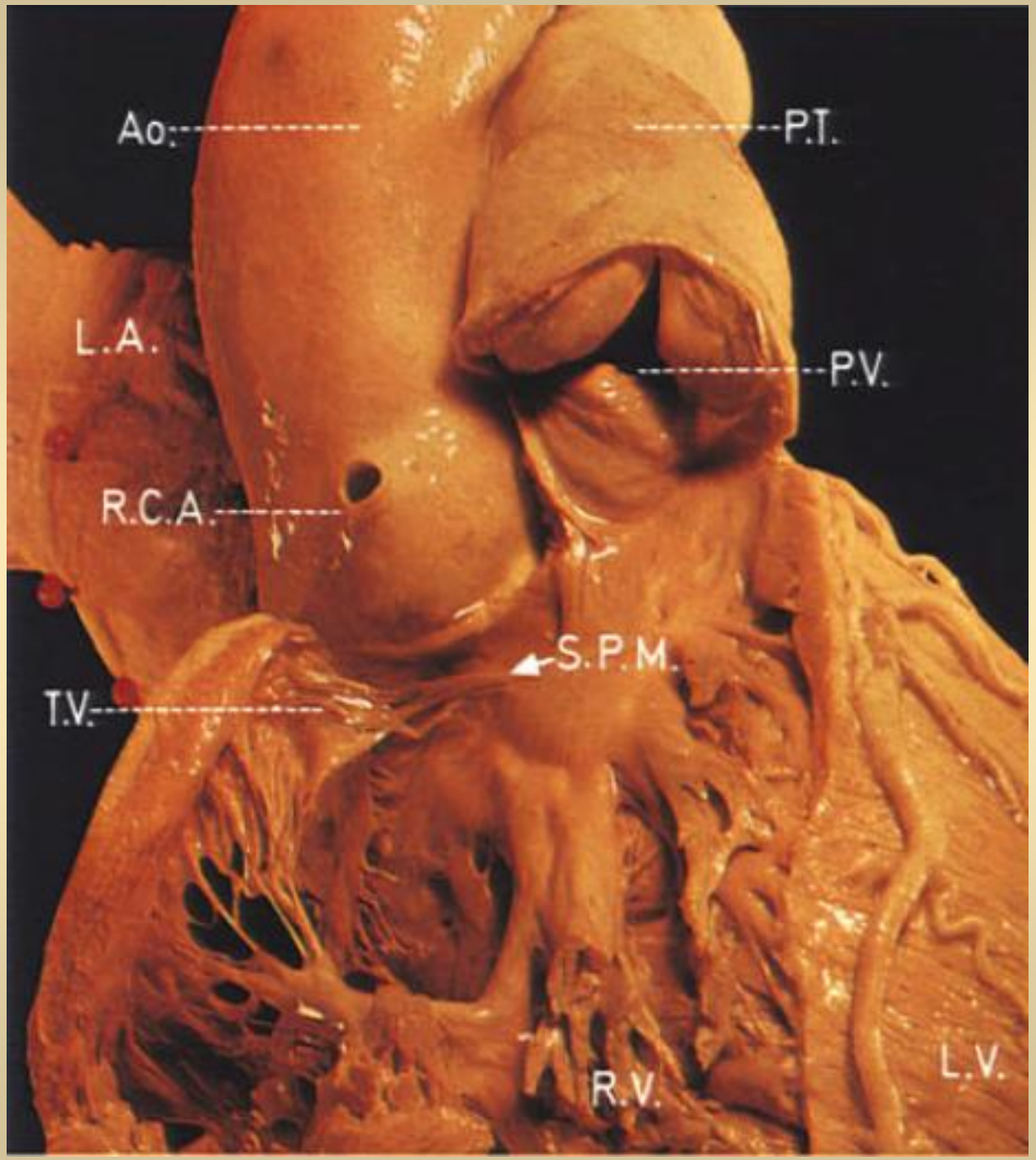
Conclusions. **Radiofrequency catheter ablation can be successfully used to eliminate monomorphic ventricular ectopic activity. It may therefore be a reasonable alternative for the treatment of severely symptomatic, drug-resistant monomorphic ventricular ectopic activity in patients without significant structural heart disease.**

(J Am Coll Cardiol 1995;26:843–9)

Distribution of outflow tract PVC origin associated with left ventricular dysfunction



Mountantonakis SE et al. Heart Rhythm. 2011 Oct;8(10):1608-14,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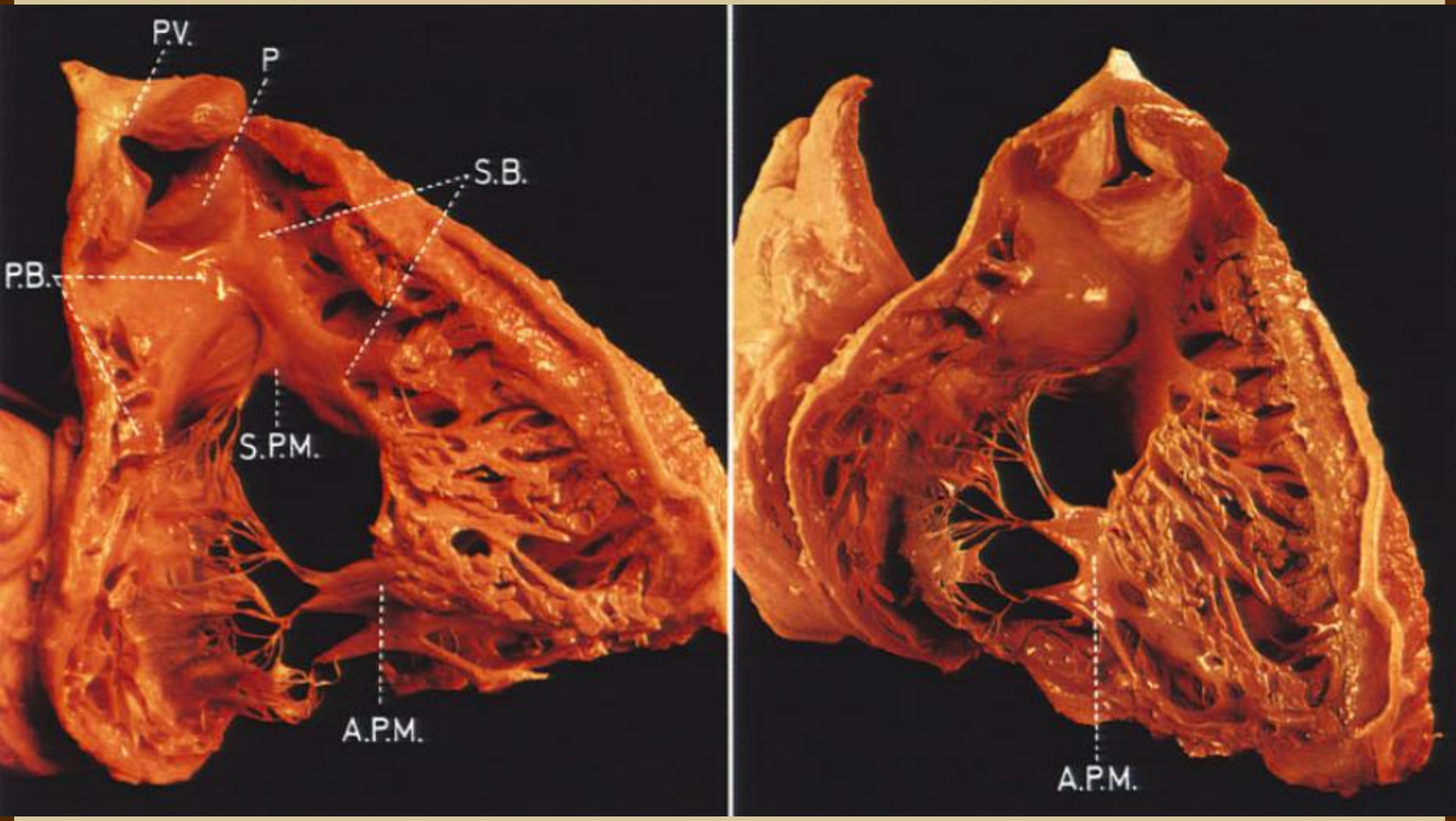
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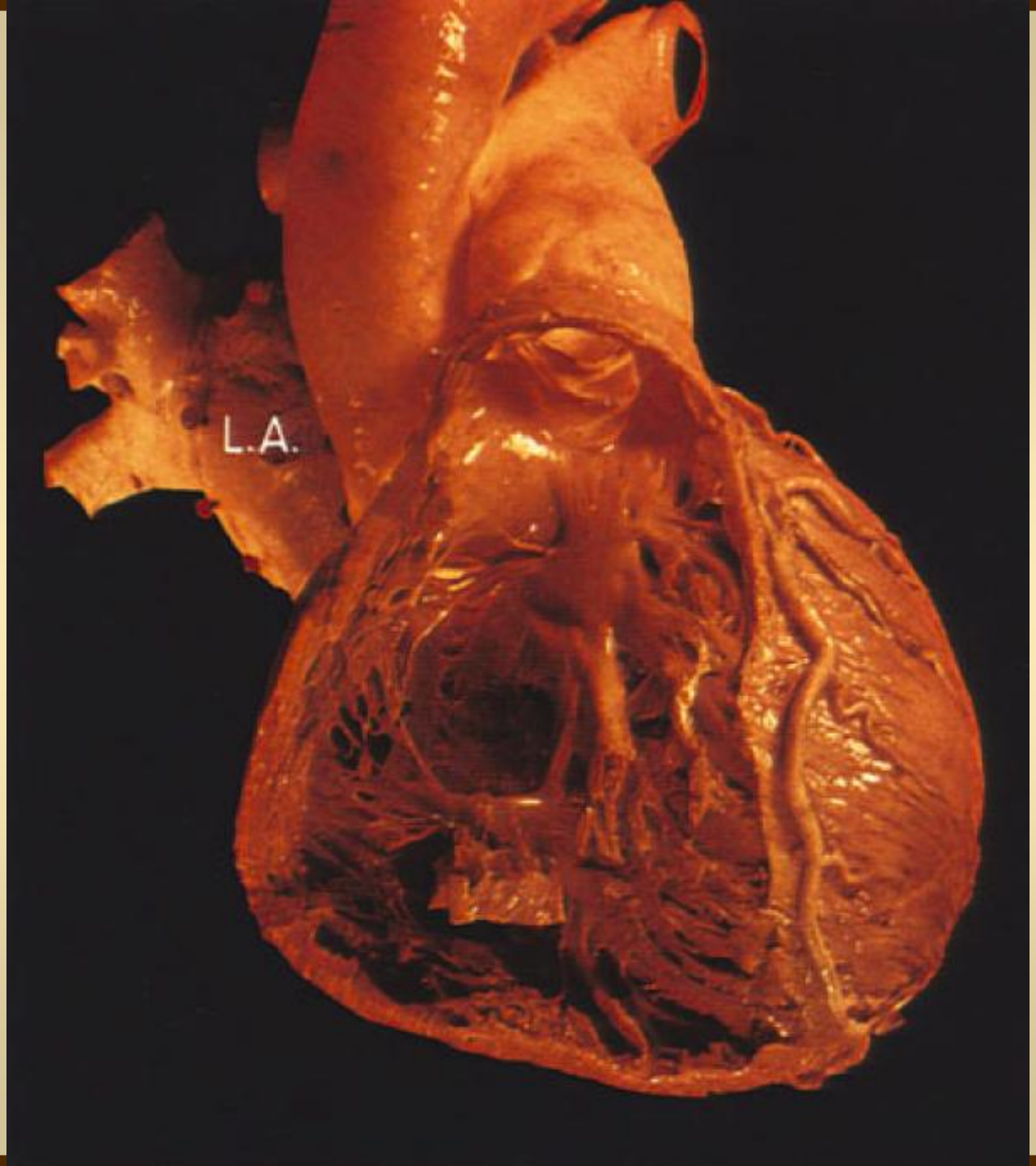
A.P.M.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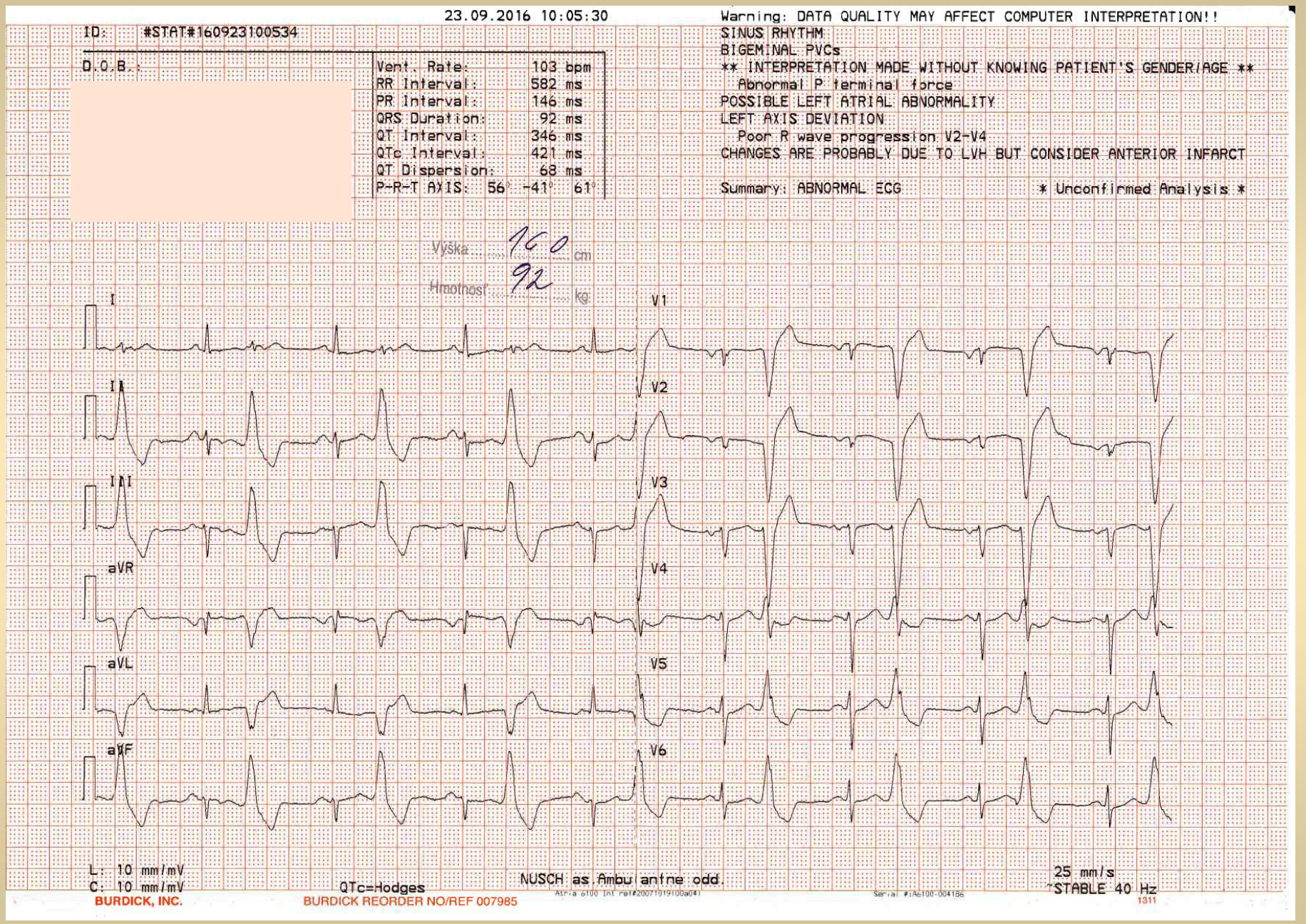
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L: 10 mm/mV
C: 10 mm/mV
QTc=Hodges
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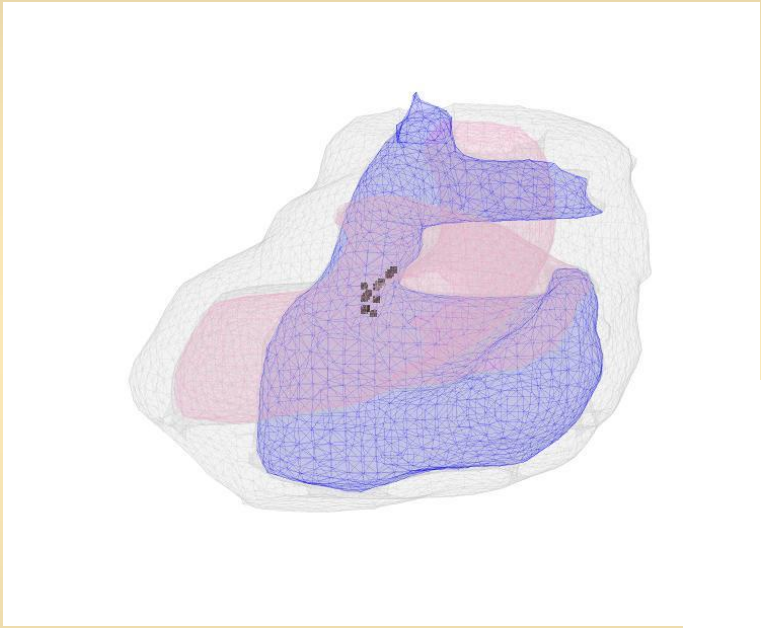
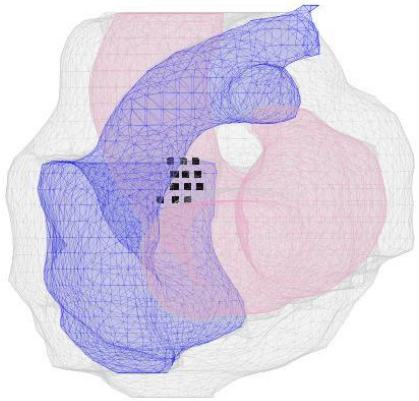
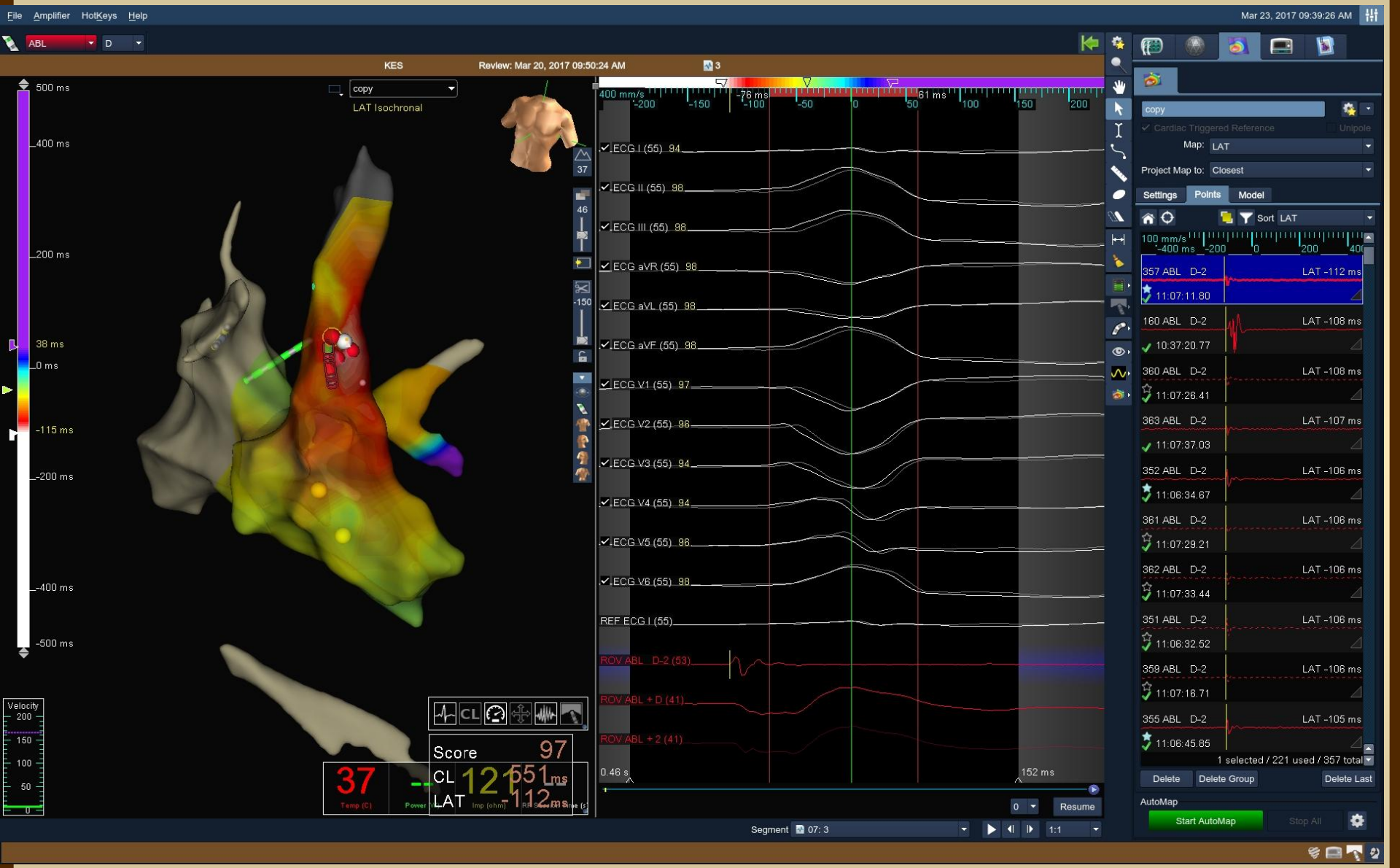
25 mm/s
STABLE 40 Hz
BURDICK, INC.
BURDICK REORDER NO/REF 007985
1311

High-density body surface potential mapping – localization of ectopic focus



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Mar 23, 2017 09:39:26 AM
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LAT Isochronal
500 ms
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ECG I (55) 94
ECG II (55) 98
ECG III (55) 98
ECG aVR (55) 98
ECG aVL (55) 98
ECG aVF (55) 98
ECG V1 (55) 97
ECG V2 (55) 96
ECG V3 (55) 94
ECG V4 (55) 94
ECG V5 (55) 96
ECG V6 (55) 98
REF ECG I (55)
ROV ABL D-2 (53)
ROV ABL + D (41)
ROV ABL + 2 (41)
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CL 121 ms
LAT -112 ms
copy
Cardiac Triggered Reference
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357 ABL D-2 LAT -112 ms
11:07:11.80
160 ABL D-2 LAT -108 ms
10:37:20.77
380 ABL D-2 LAT -108 ms
11:07:26.41
363 ABL D-2 LAT -107 ms
11:07:37.03
352 ABL D-2 LAT -106 ms
11:06:34.67
361 ABL D-2 LAT -106 ms
11:07:29.21
362 ABL D-2 LAT -106 ms
11:07:33.44
351 ABL D-2 LAT -106 ms
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359 ABL D-2 LAT -106 ms
11:07:16.71
355 ABL D-2 LAT -105 ms
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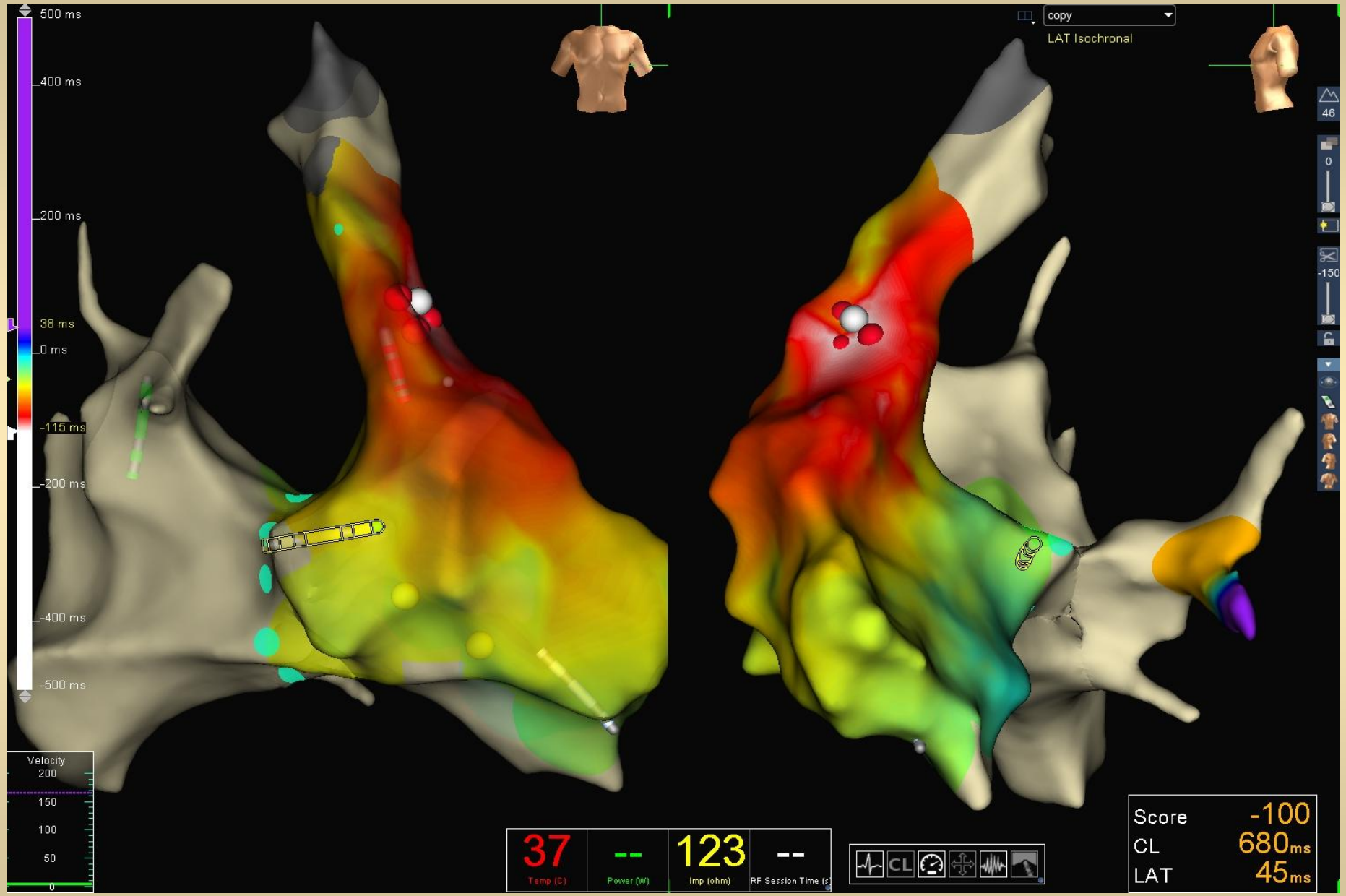
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LAT 45ms


Patient Applications Edit View Acquire Input Tools Options Help
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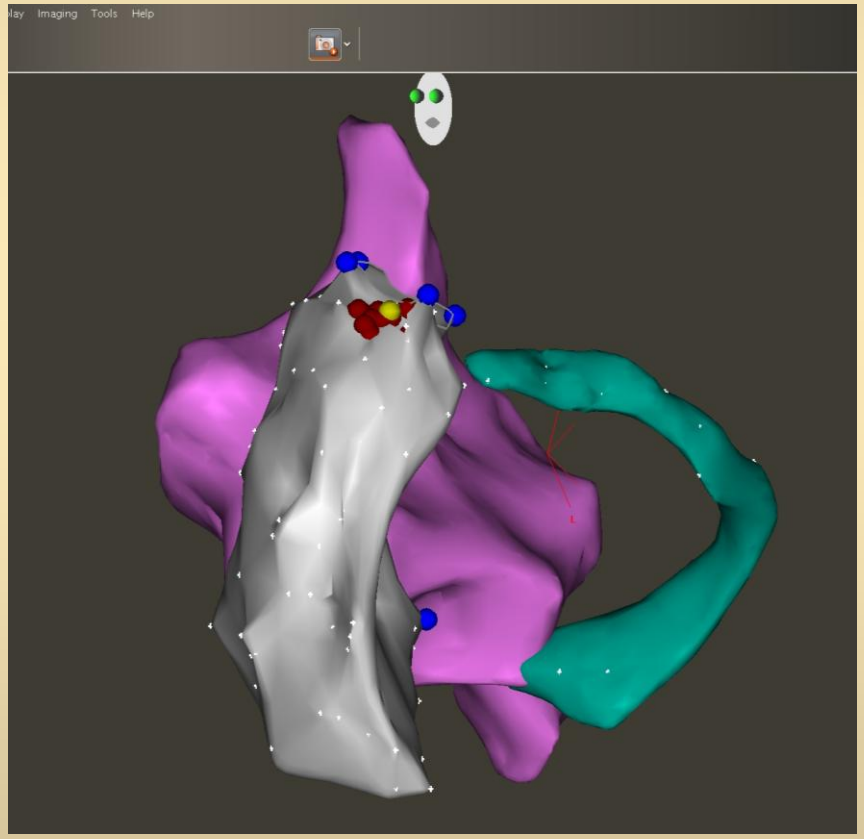
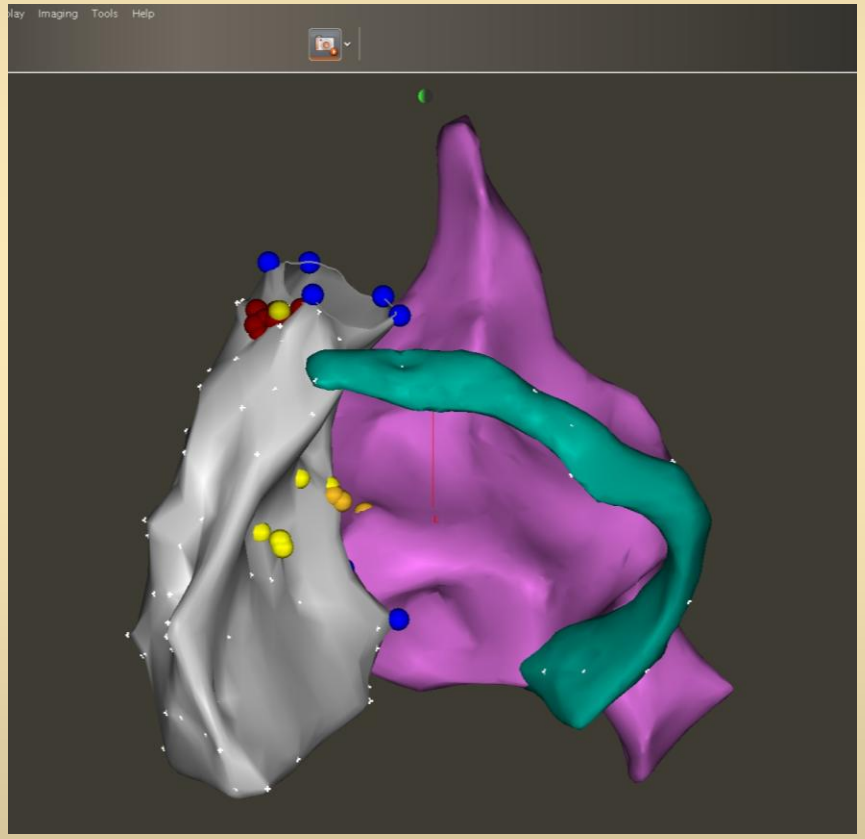
Frequent asymptomatic VES (21%) with symptomatic depressed LVEF

Complete elimination of VPB pre RFCA and normalization of LVEF

RAO view



LAO view




Patient Applications Edit View Acquire Input Tools Options Help
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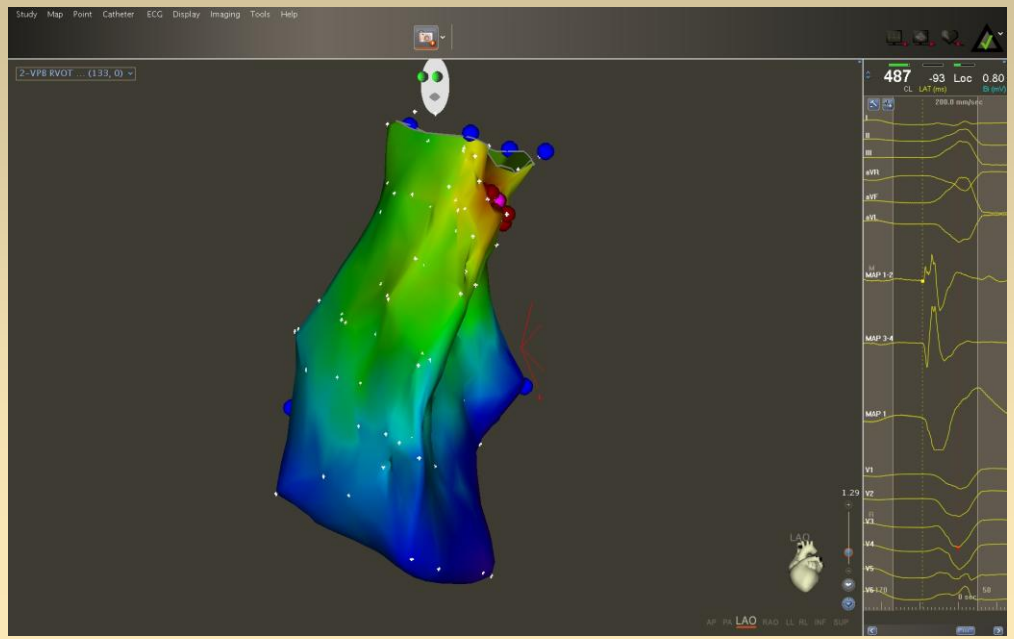
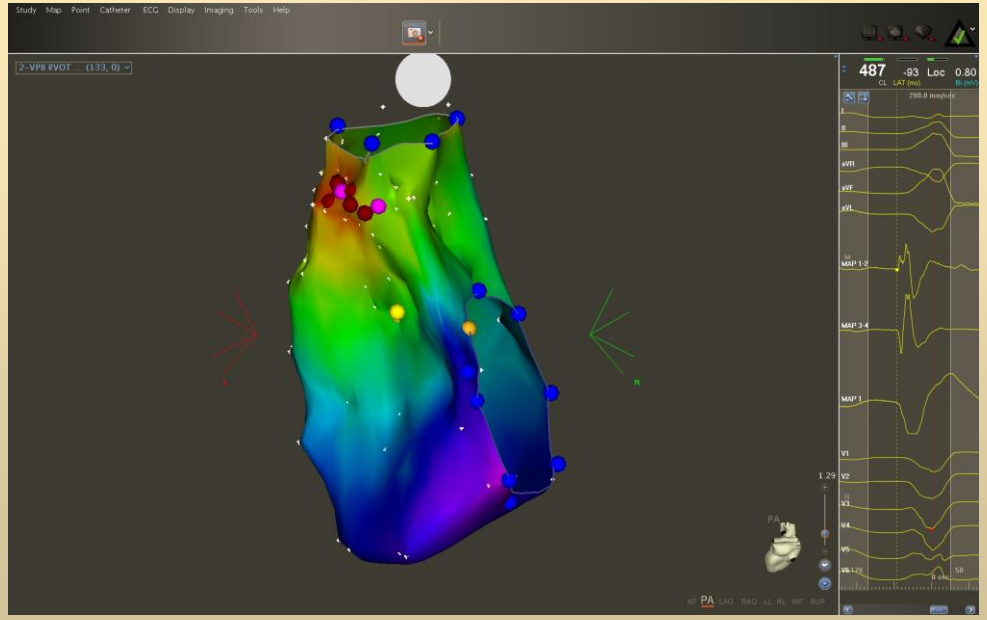
Storage: 28:18
14:15:28 - predcasnost 30ms
15:37:22

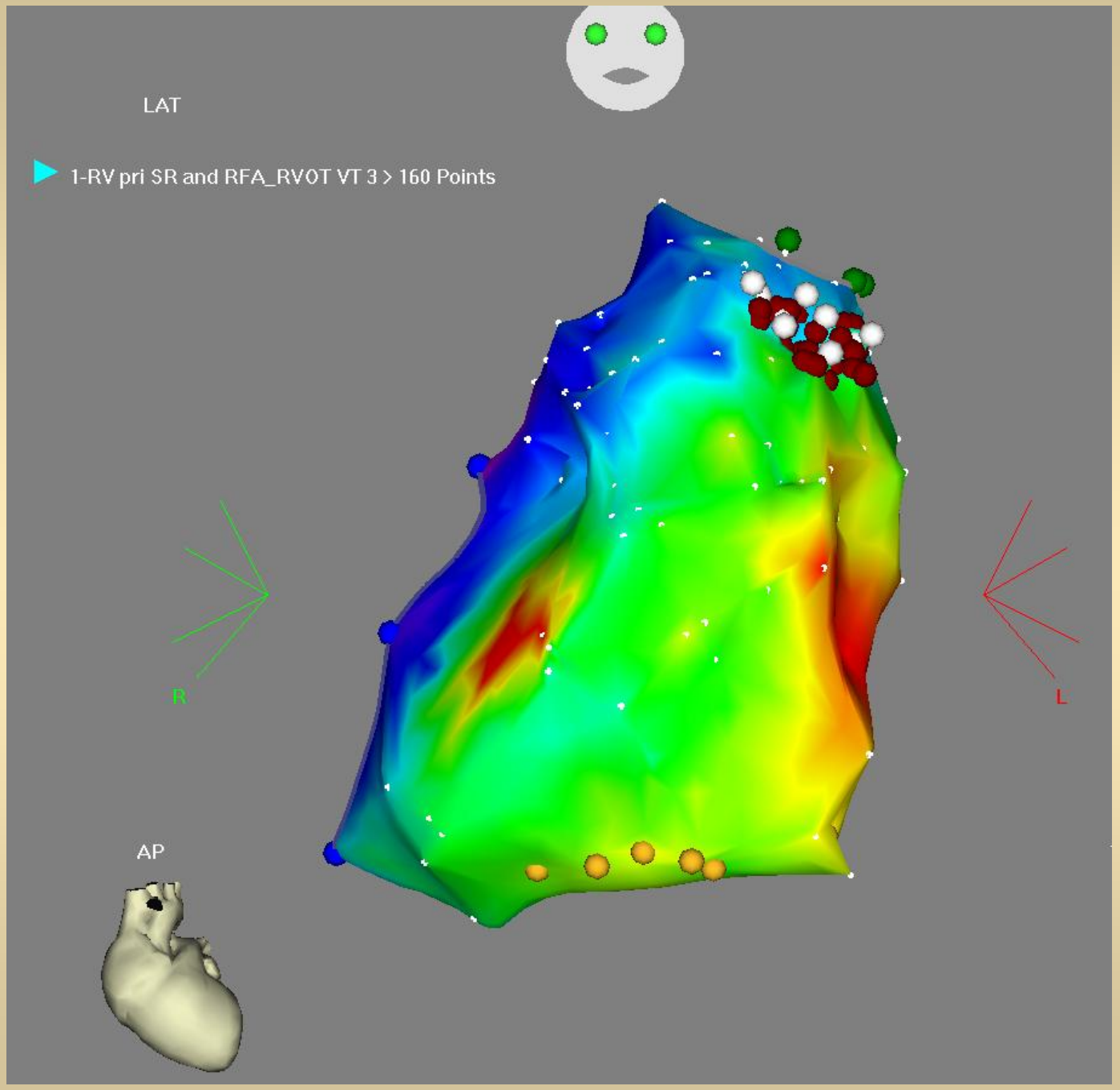
Clinical VEB and pace-mapping



Electro-anatomical mapp of RVOT – elimination of VEB



Pace-mapping based procedure
12/12 - RVOT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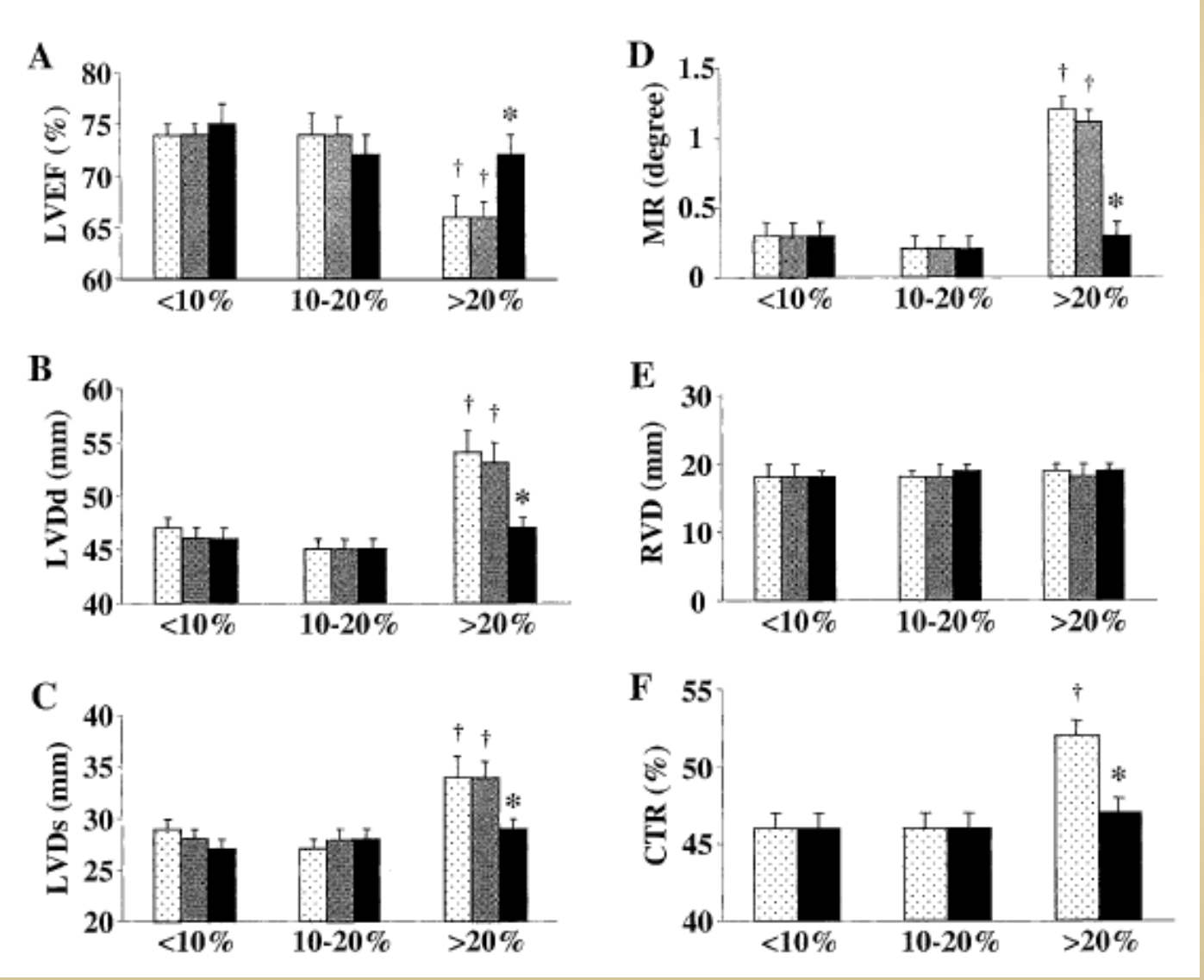
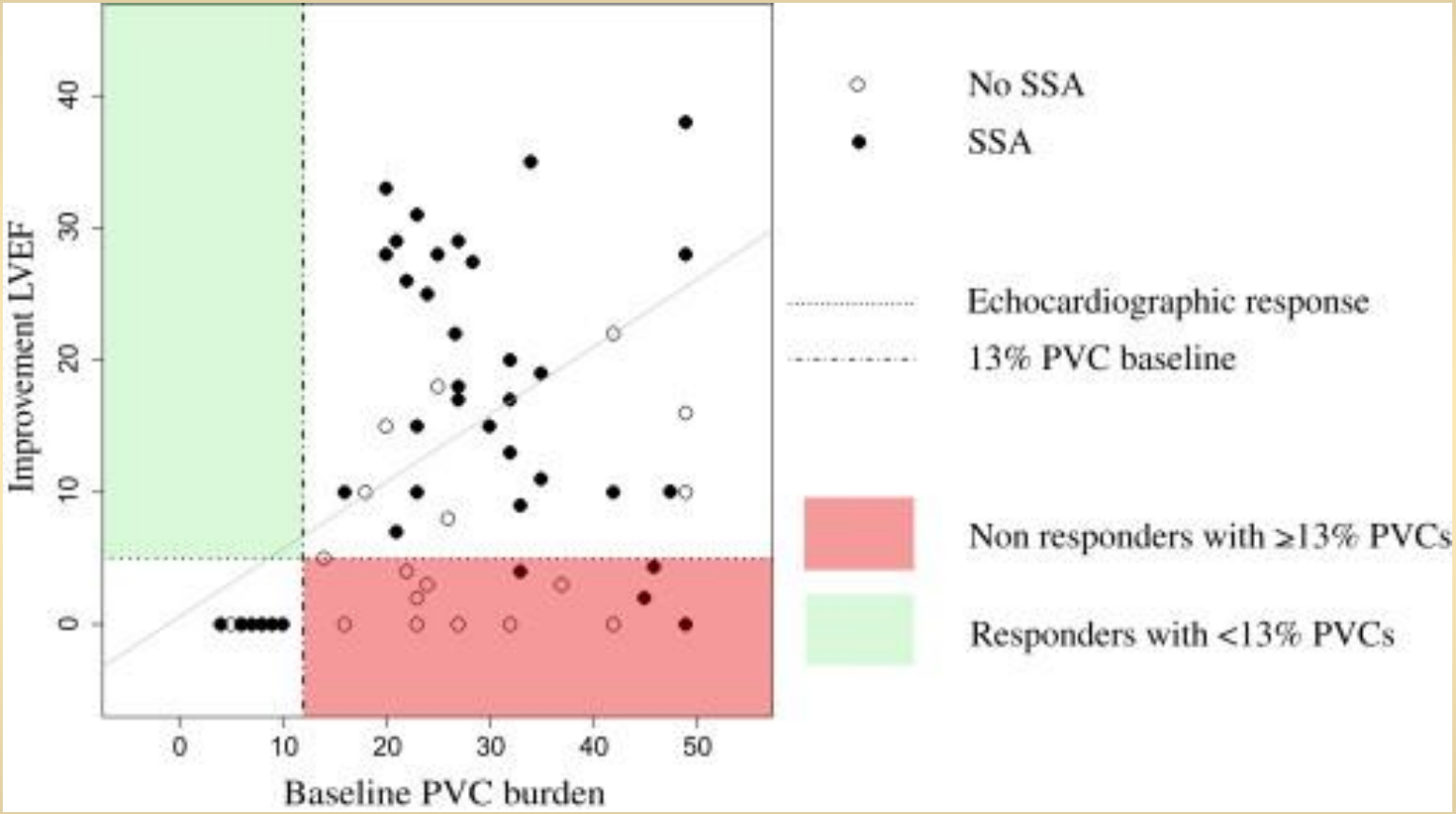
RFCA of PVC From RVOT Improves Left Ventricular Dilatation and Clinical Status in Patients Without SHD



Takemoto M et al., J Am Coll Cardiol 2005;45:1259–65

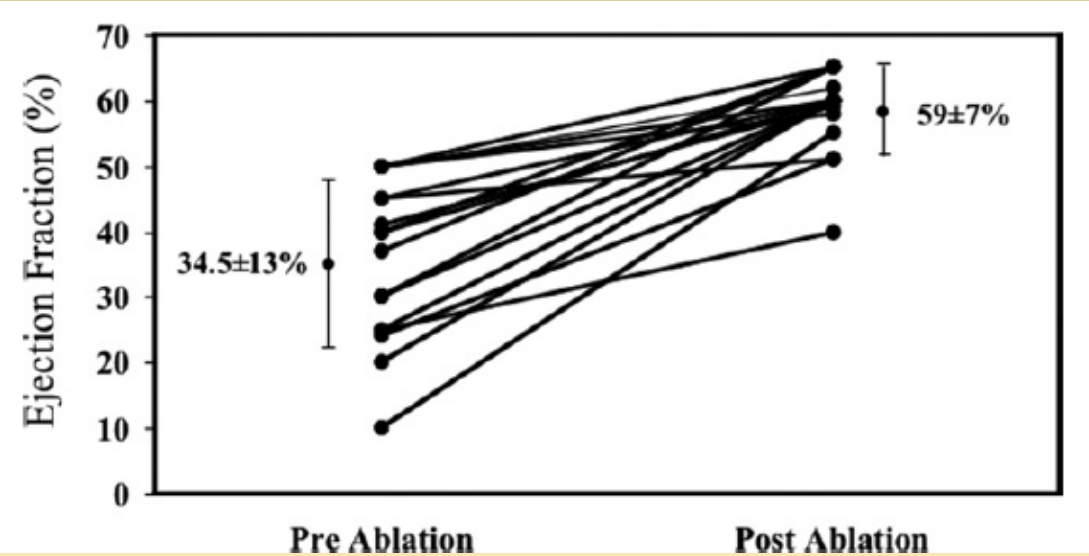
Neurohormonal, Structural, and Functional Recovery Pattern After Premature Ventricular Complex Ablation Is Independent of Structural Heart Disease Status in Patients With Depressed Left Ventricular Ejection Fraction : A Prospective Multicenter Study

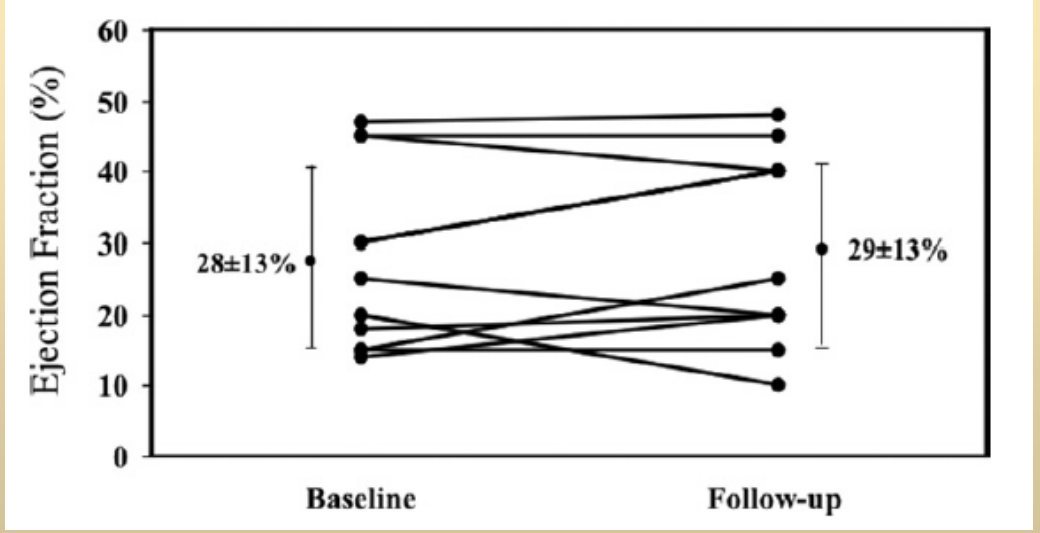


EchocardiographicResponseThe relationship between the baseline PVC percentage during Holter monitoring and the LVEF improvement during follow-up.

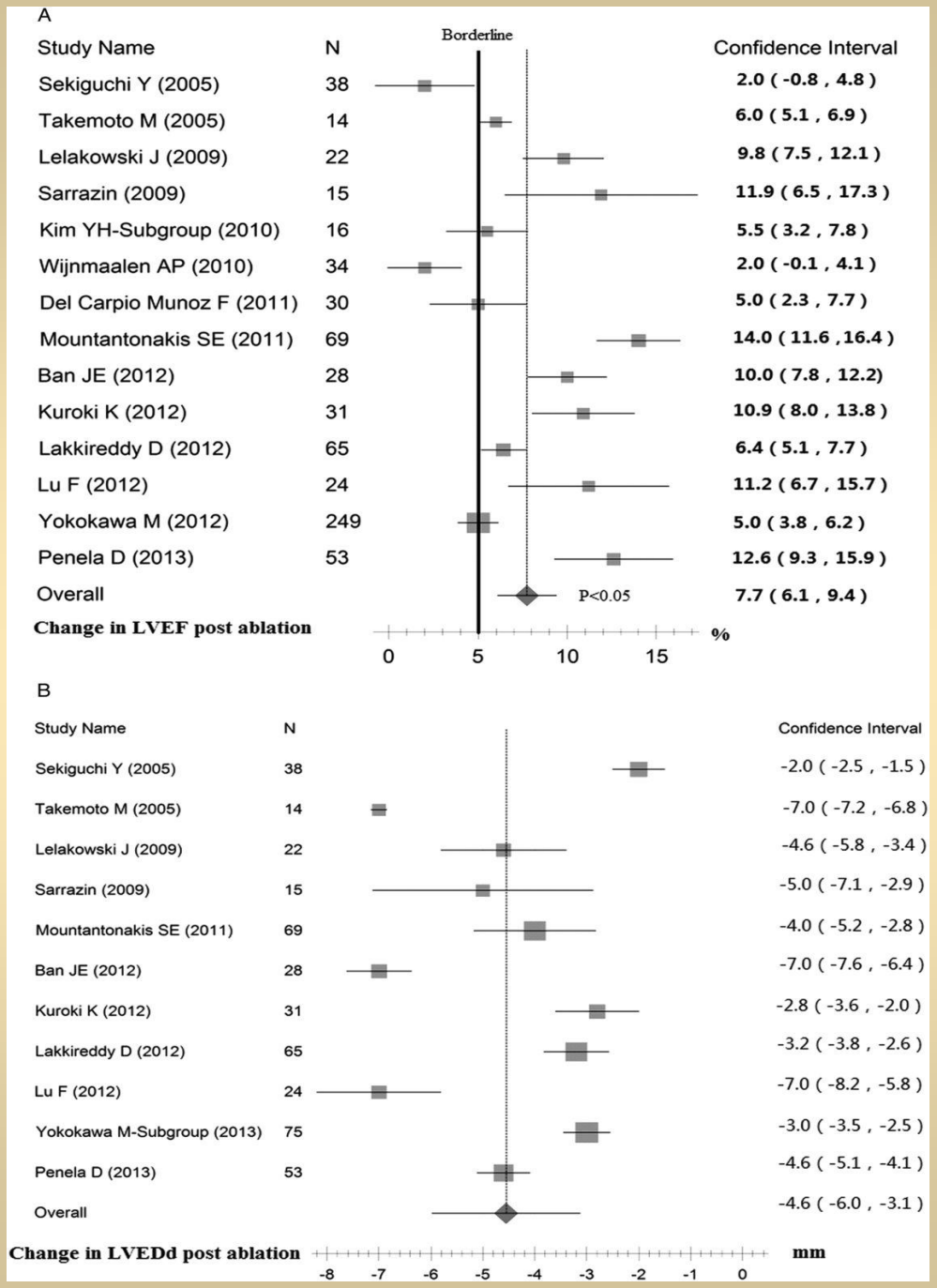
Diego Penela et al., JACC 2013, http://dx.doi.org/10.1016/j.jacc.2013.06.012

RFCA of frequent, idiopathic premature ventricular complexes: Comparison with a control group without intervention



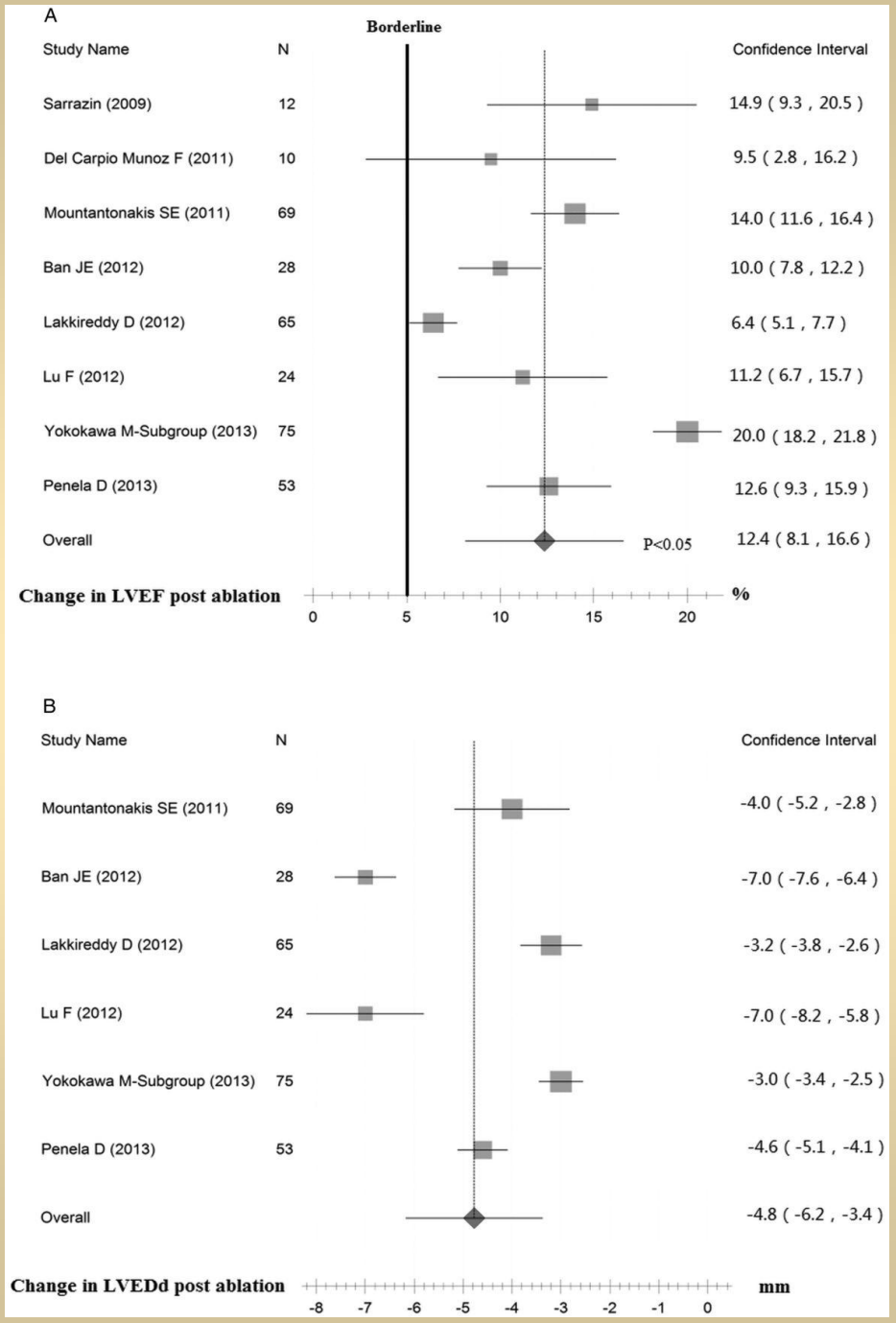


Bogun F et al, Heart Rhythm 2007;4:863– 867



RFCA of PVC – impact on LV function

Zang M et al. Heart 2014;100:787-793



RFCA of PVC – impact on LV function in pts presenting already with LV dysfunction

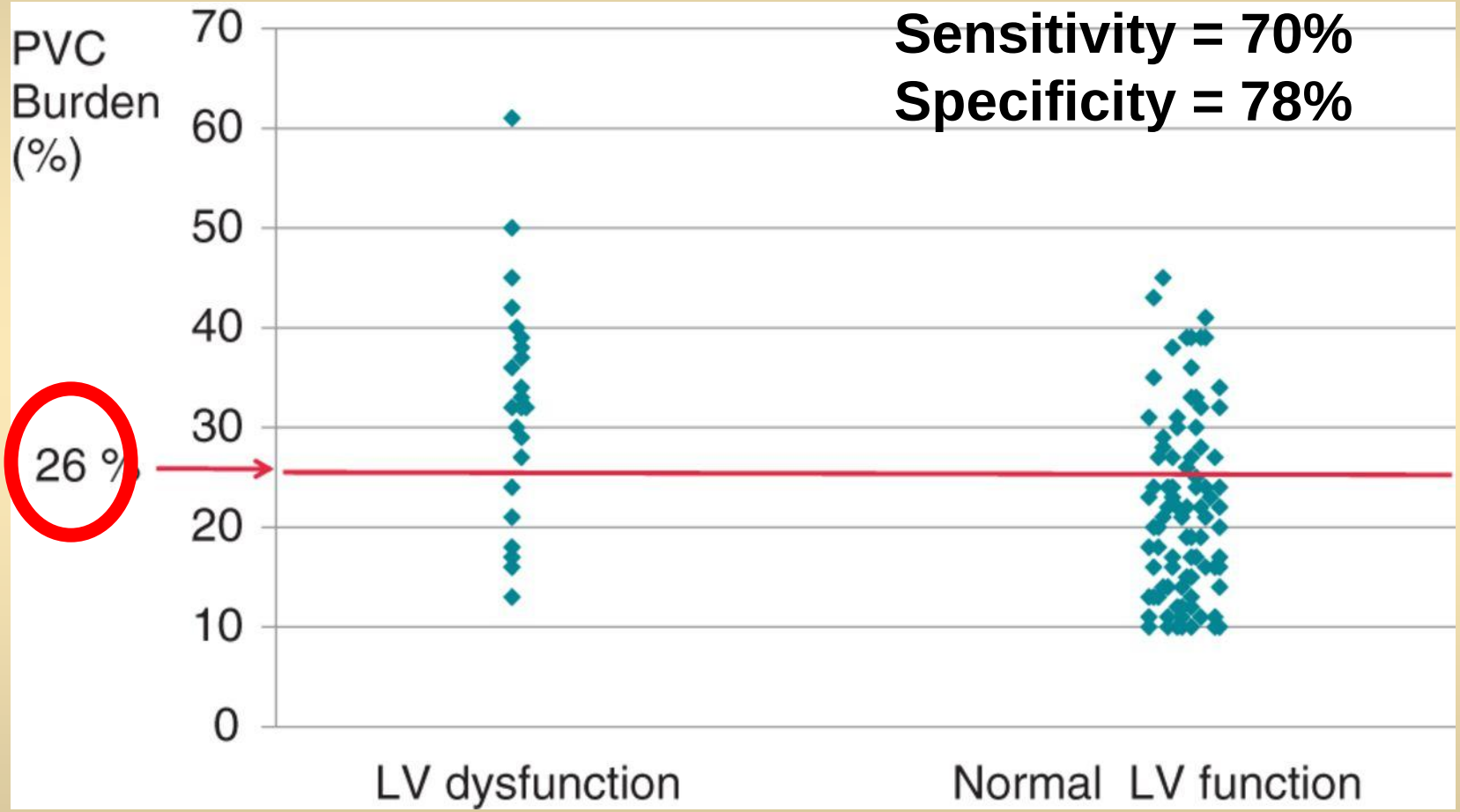
Zang M et al. Heart 2014;100:787-793

PVC burden associated with LV dysfunction

	n	%LVd	%VEs LVd	%VEs normal LV	*P*	Predictive PVC burden
Ban *et al.*[21]	127 (28 LVd)	22%	31 ± 11%	22 ± 10%	0.001	26%
Deyell *et al.*[25]	90 (24 LVd)	27%	32 ± 12%	27 ± 12%	0.077	–
Munoz *et al.*[26]	70 (LVd 17)	24%	29 ± 15%	17 ± 14%	0.004	10% RV; 20% LV
Olgun *et al.*[27]	51 (21 LVd)	41%	30 ± 11%	14 ± 15%	0.0001	–
Hasdemir *et al.*[28]	249 (17 LVd)	7%	29 ± 9%	8 ± 7%	0.001	16%
Baman *et al.*[29]	174 (57 LVd)	33%	33 ± 13%	13 ± 12%	0.0001	24%
Kanei *et al.*[30]	108 (21 LVd)	19%	13 ± 11%[a]	7 ± 9%[a]	0.004	–

EHRA / HRS / APHRS Consensus Europace (2014) 16, 1257–1283

The correlation between the PVC burden and LV function:
A higher PVC burden is independently associated with PVC-mediated LV dysfunction

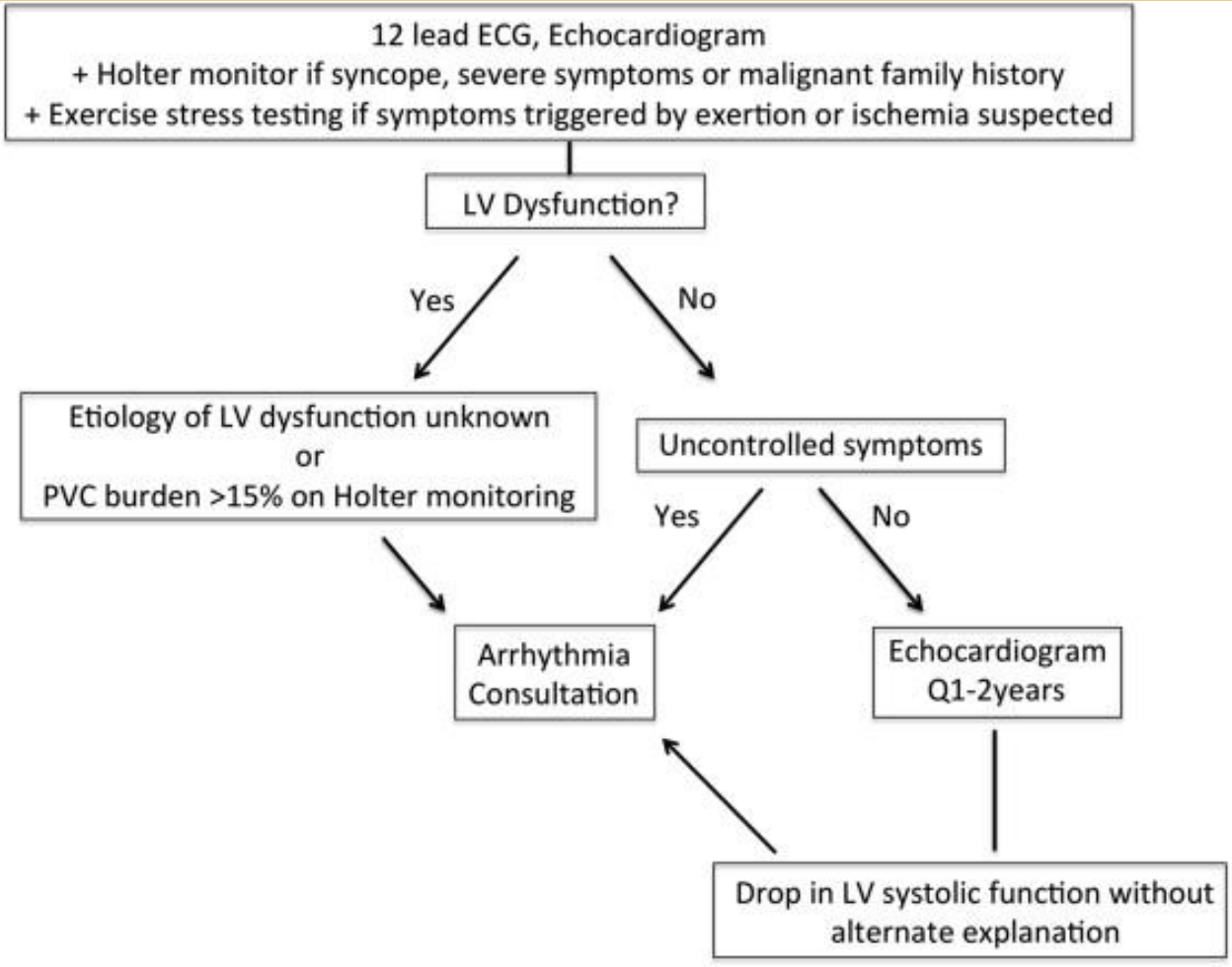


Ban J et al. Europace 2013;15:735-741

PVC – not so benign !

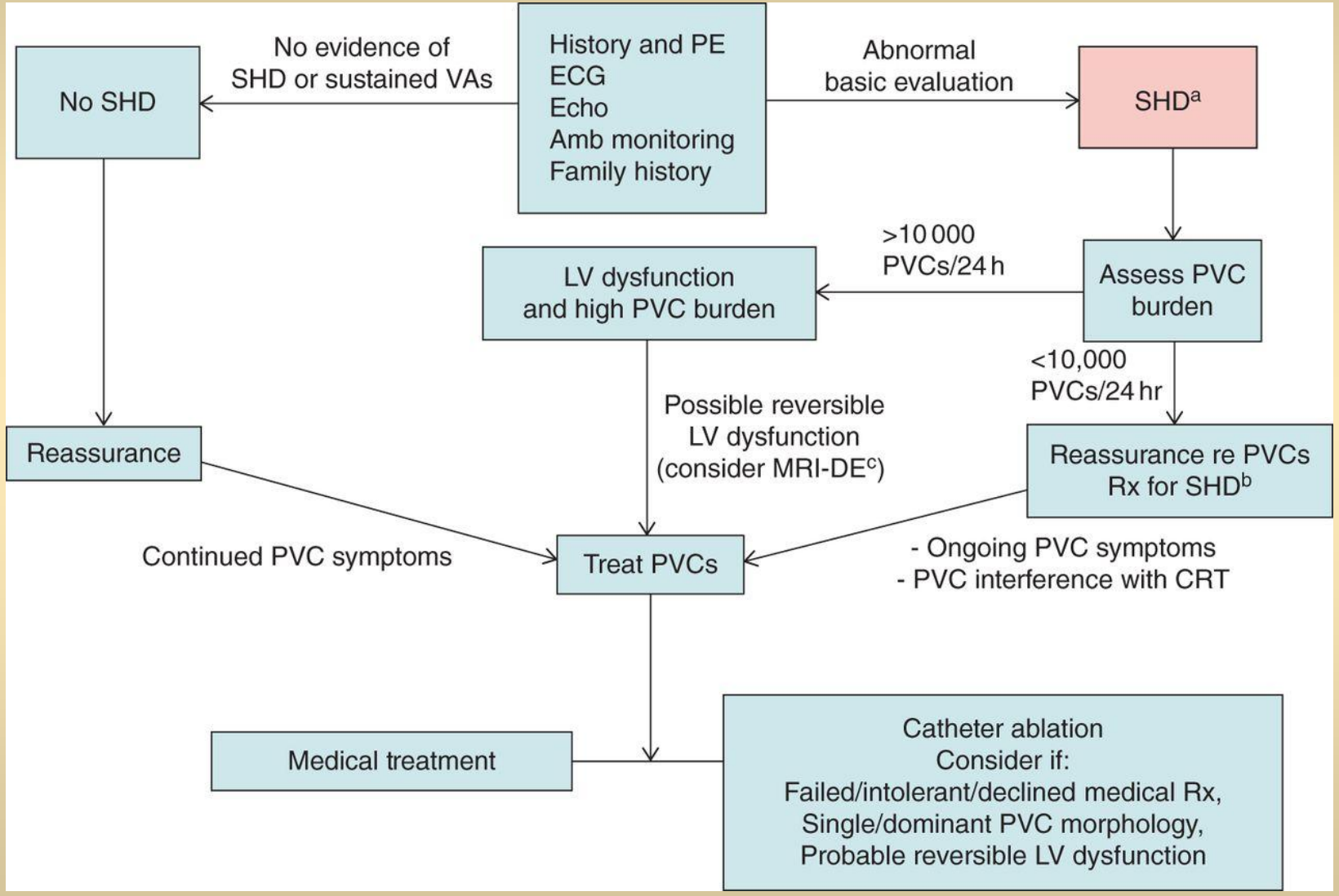
- In spite of their „omnipresence“, PVCs are not necessarily a benign epiphenomenon
- Their occurence in the context of SHD with depressed LV function
  - may signify non-negligable arrhythmogenic risk
  - reflect the severity of SHD / presence of „subtle“ subclinical substrate
- **In selected cases VEB have a clear malignant potential**
- **BB and RFCA are the therapy of choice in most cases with prognostic relevance**

Clinical pathway for workup of patients with frequent PVCs



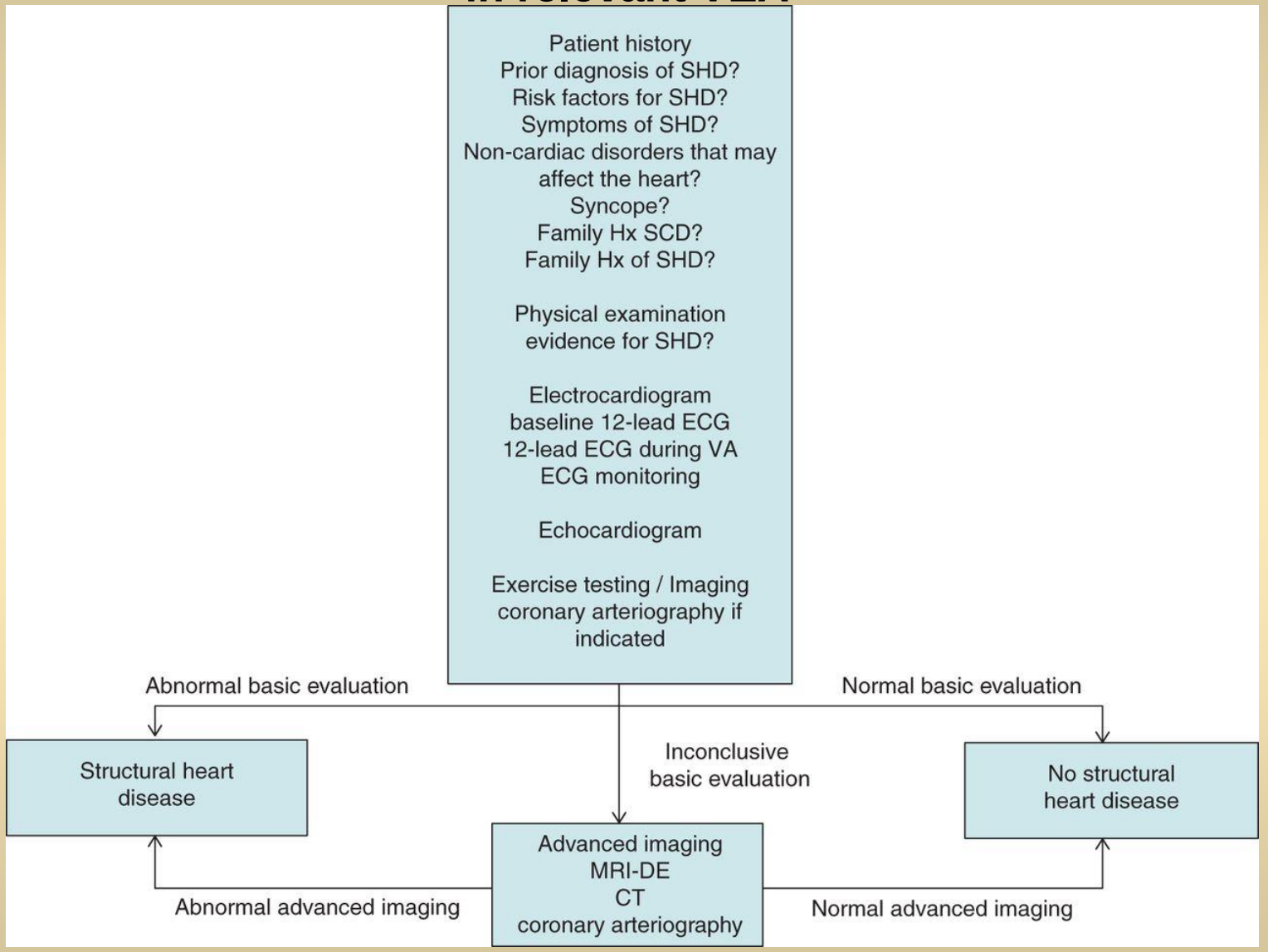
Katie Giles , Martin S. Green: Canadian Journal of Cardiology, Volume 29, Issue 11, 2013, 1512 - 1515

Management of PVCs – expert consensus 2014



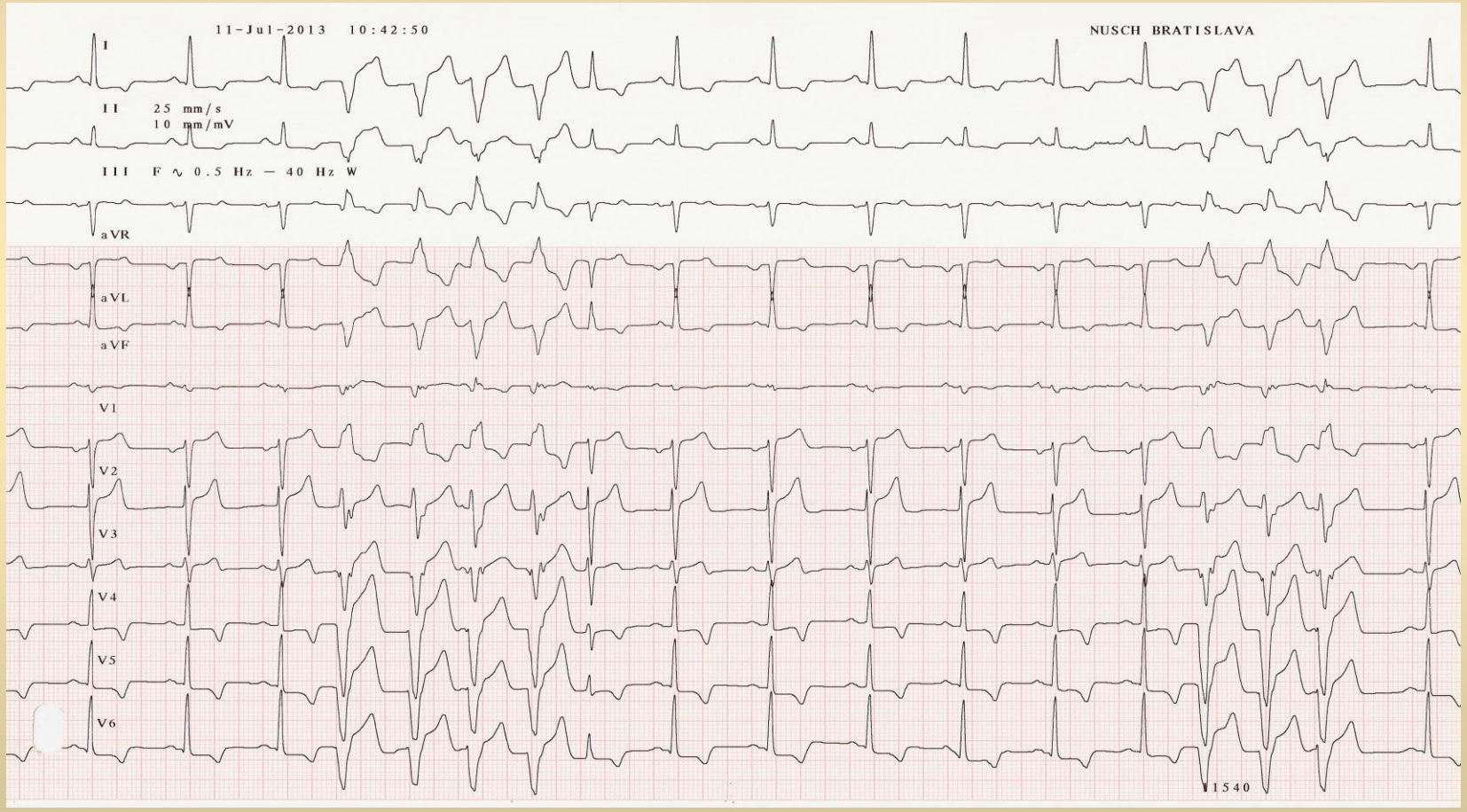
Pedersen C T et al. Europace 2014;16:1257-1283

Evaluation for the presence or absence of structural heart disease in relevant VEA

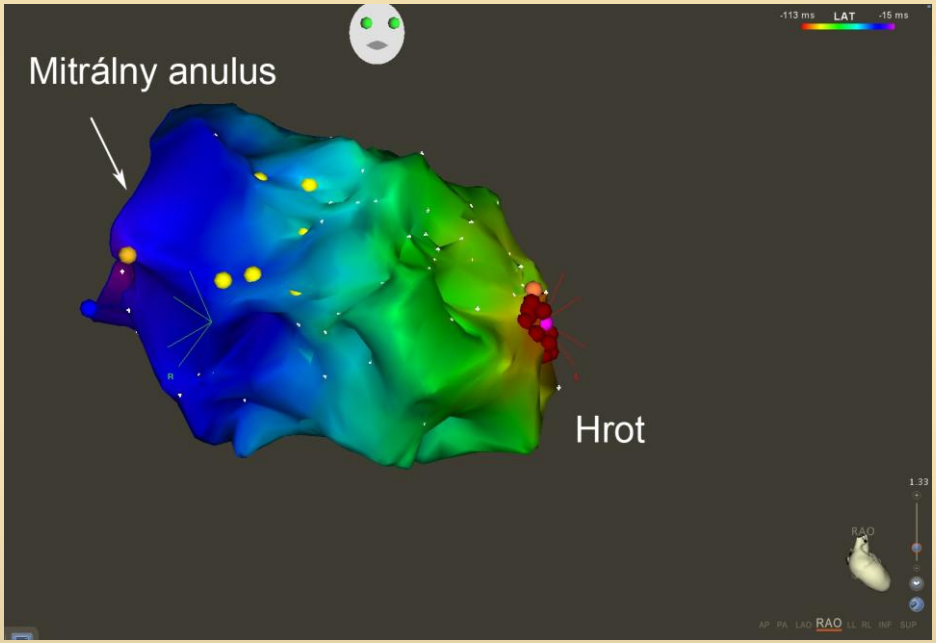


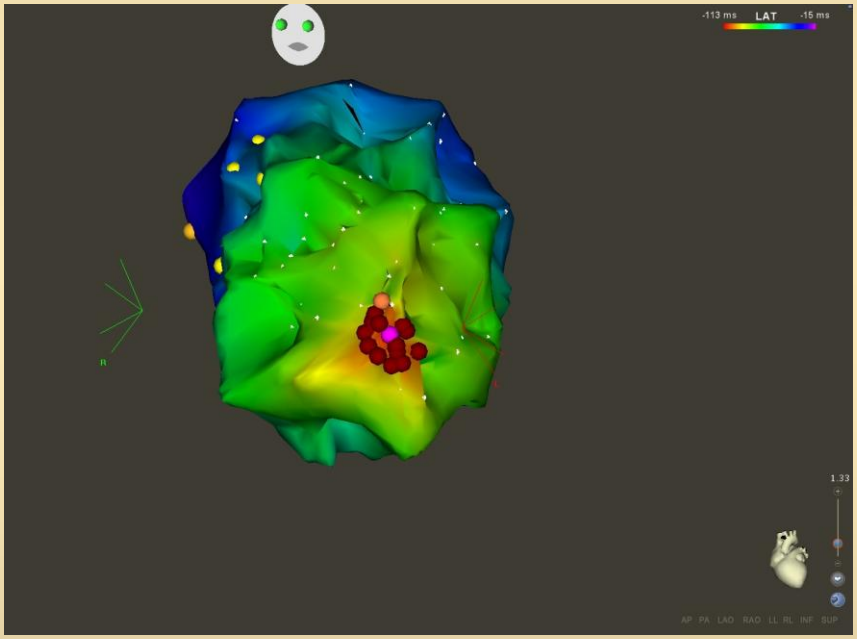
Pedersen C T et al. Europace 2014;16:1257-1283

Tachycardiomyopathy due to long-lasting VEA
ECG before RF

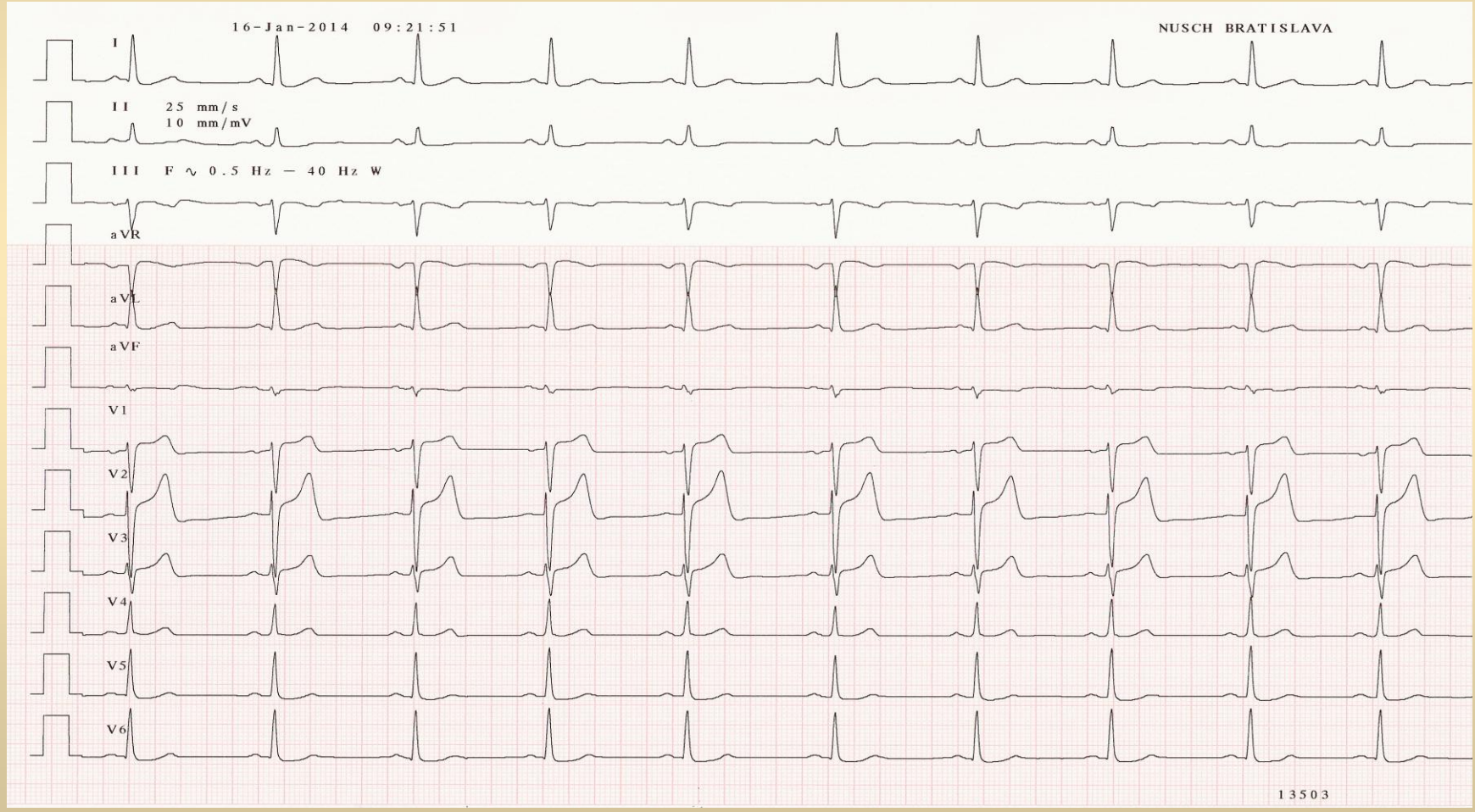


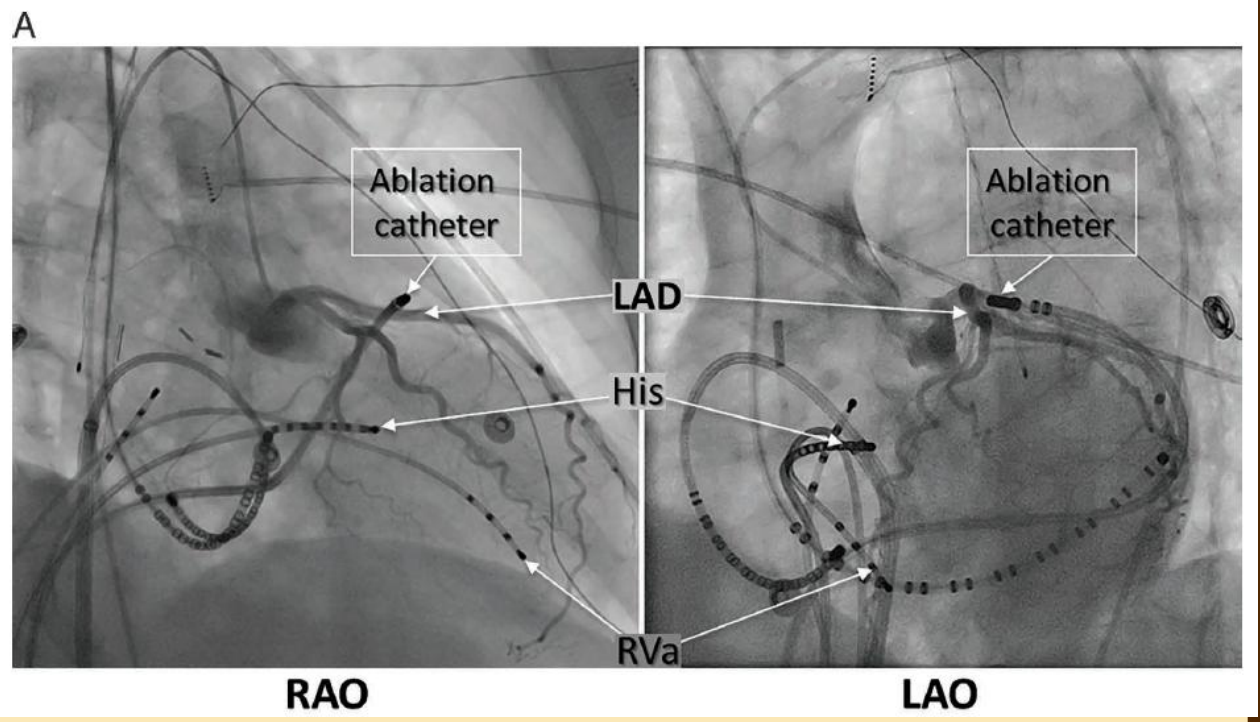
- **Asymptomatic VPC and ns-VT since 14 y of age, with 32-y - HF with LVEF=20%, HTx candidate**
- **Electro-anatomic mapping based RFCA with acute success performed**





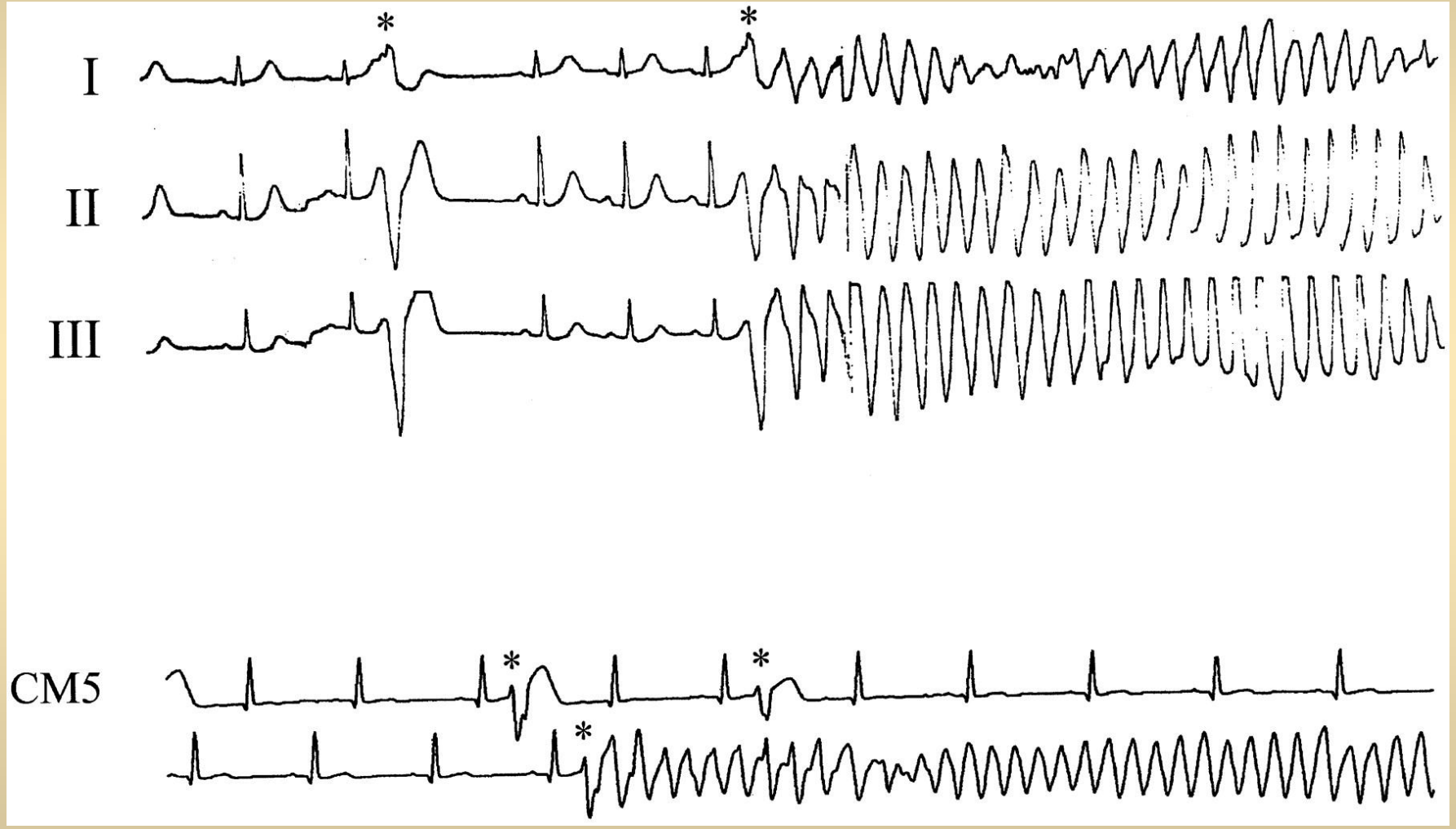
ECG post RFCA
LVEF=60%, 3 months post RFCA, complete recovery





Epicardial ectopic focus of PVC

VF initiation by PVB later found to originate from the right (top) or left (bottom) ventricle



Haissaguerre, M. et al. Circulation 2002;106:962-967

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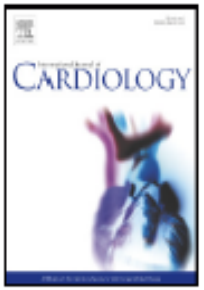

Short communication

Catheter ablation to prevent sudden cardiac death

Josef Kautzner *, Petr Peichl

Department of Cardiology, Institute for Clinical and Experimental Medicine – IKEM, Prague, Czech Republic

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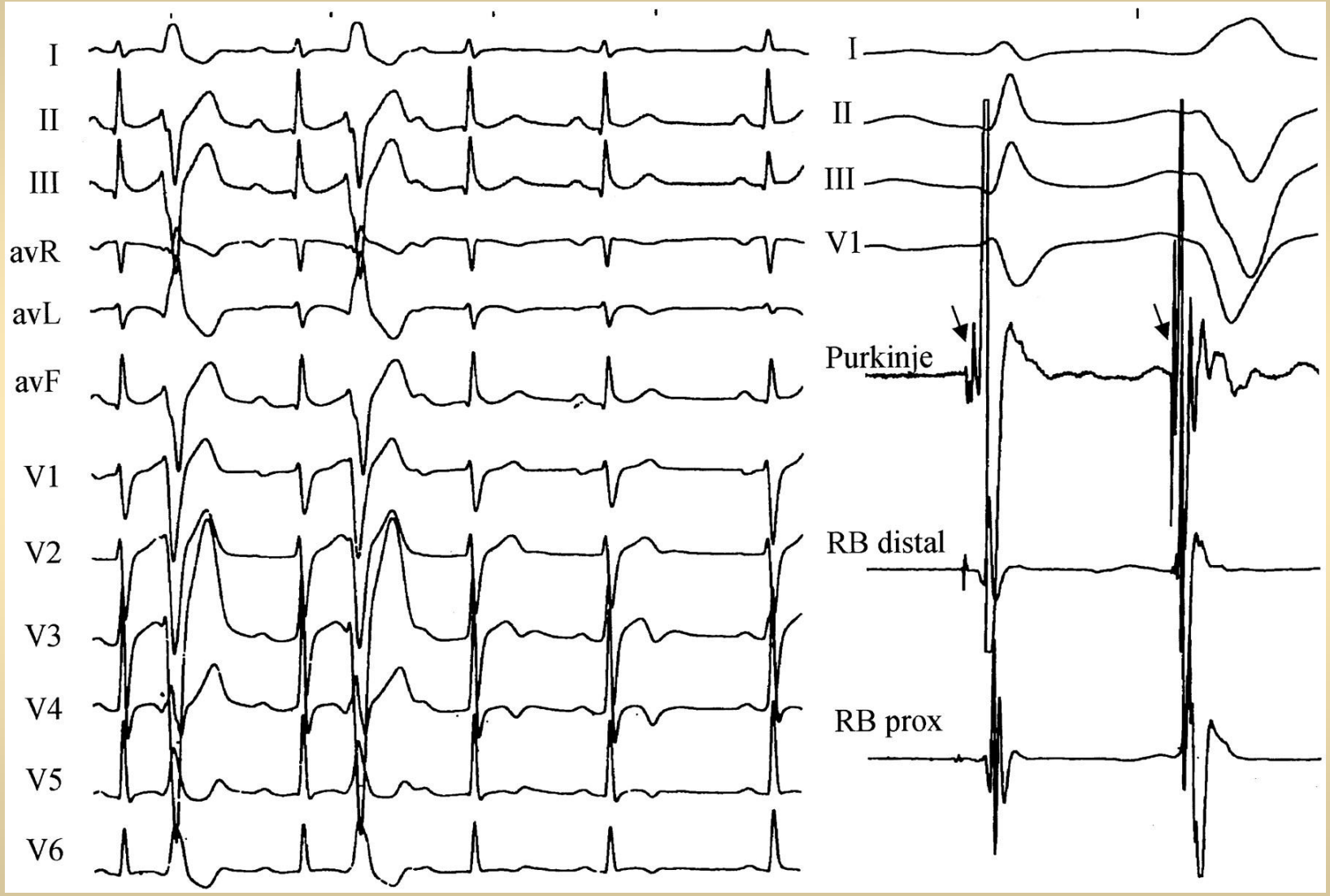
ABSTRACT

Since ventricular arrhythmias are a common cause of sudden cardiac death (SCD), treatment for ventricular arrhythmias is the target area of interest in research field. Among different means to prevent ventricular arrhythmias, catheter ablation (CA) has emerged as an effective therapeutic method. CA can decrease the likelihood of SCD in the following arrhythmia categories: 1) idiopathic ventricular fibrillation (VF) that is usually triggered by premature ventricular beats originating in the Purkinje fibres; 2) VF in subjects with structural heart disease, especially after myocardial infarction, that is triggered by premature ventricular beats from surviving Purkinje fibres; 3) Brugada syndrome in which modification of an epicardial substrate in the right ventricular outflow tract might be the most promising strategy; 4) recurrent monomorphic ventricular tachycardias in the setting of structural heart disease; 5) ventricular preexcitation in which CA appears to be a method of choice in high risk patients, regardless of the presence or absence of symptoms.

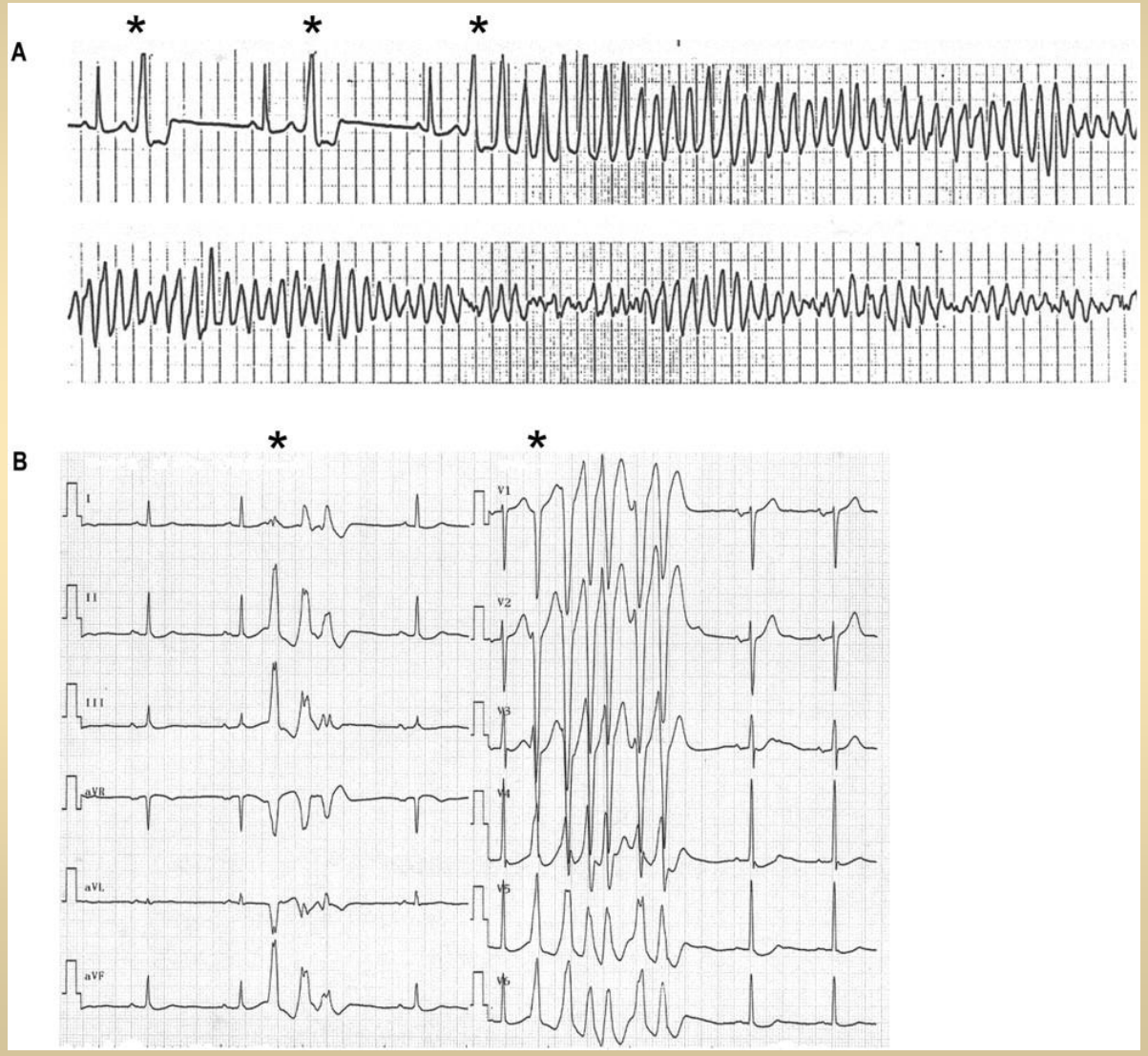
In conclusion, CA is a therapeutic method that may prevent SCD in different subsets of patients. Better understanding of mechanisms and substrates may further improve the rate of success and/or broaden such prophylactic indications.

ECG morphology and endocardial mappingVEB originating from the RV anterior wall



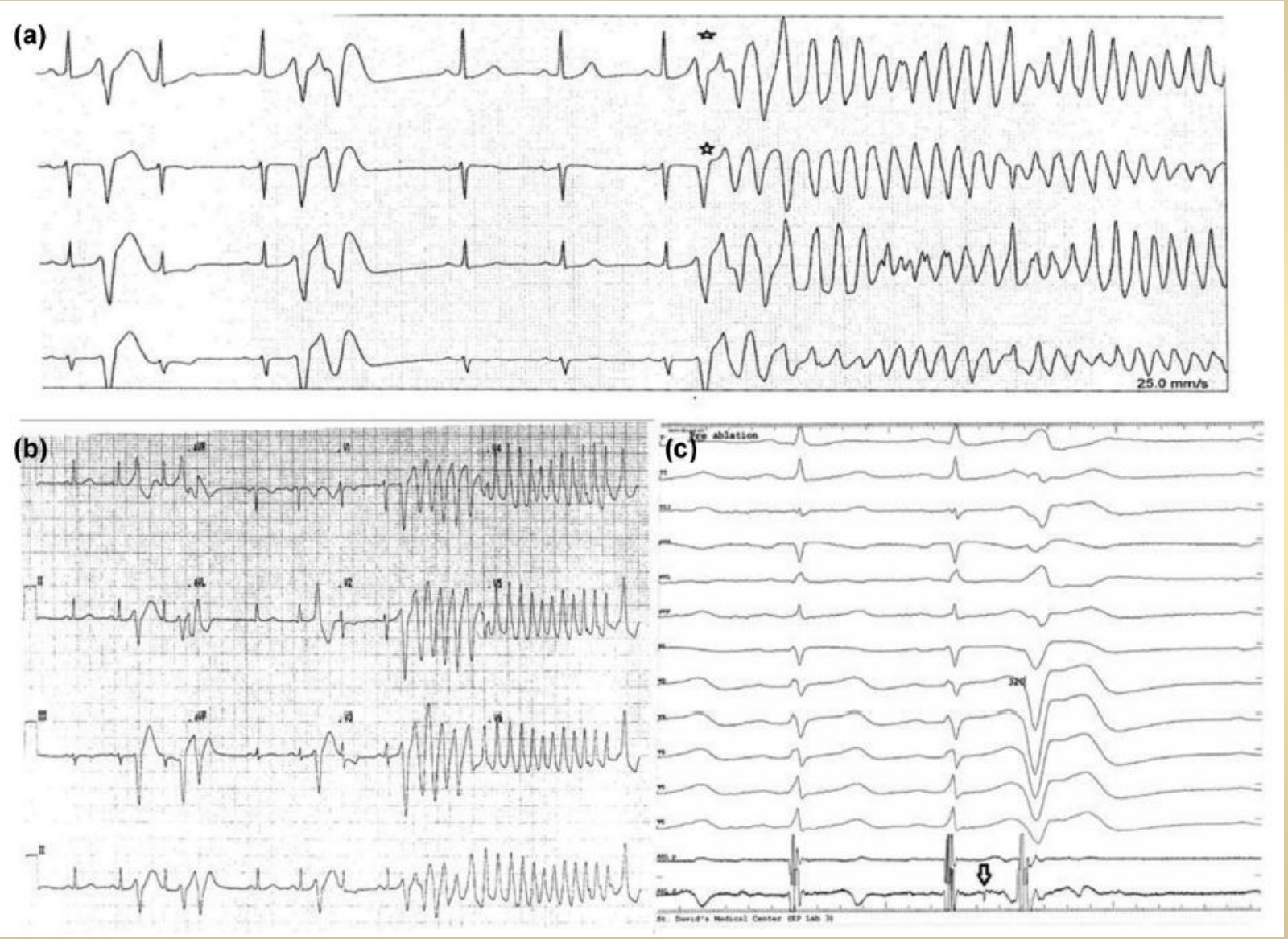
Haissaguerre, M. et al. Circulation 2002;106:962-967

Initiation of VF by VES from RVOT (16/108 pts with RVOT)

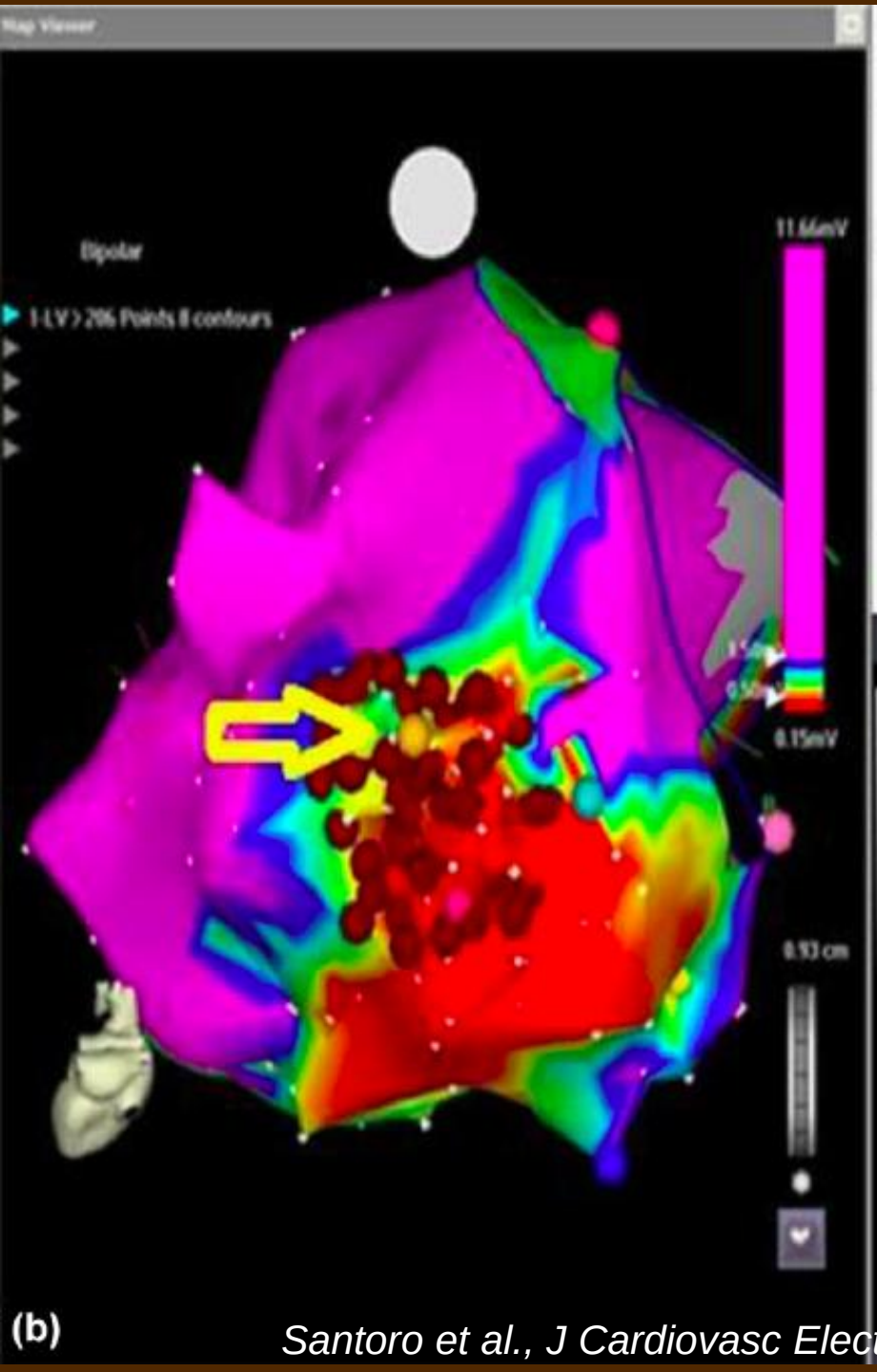


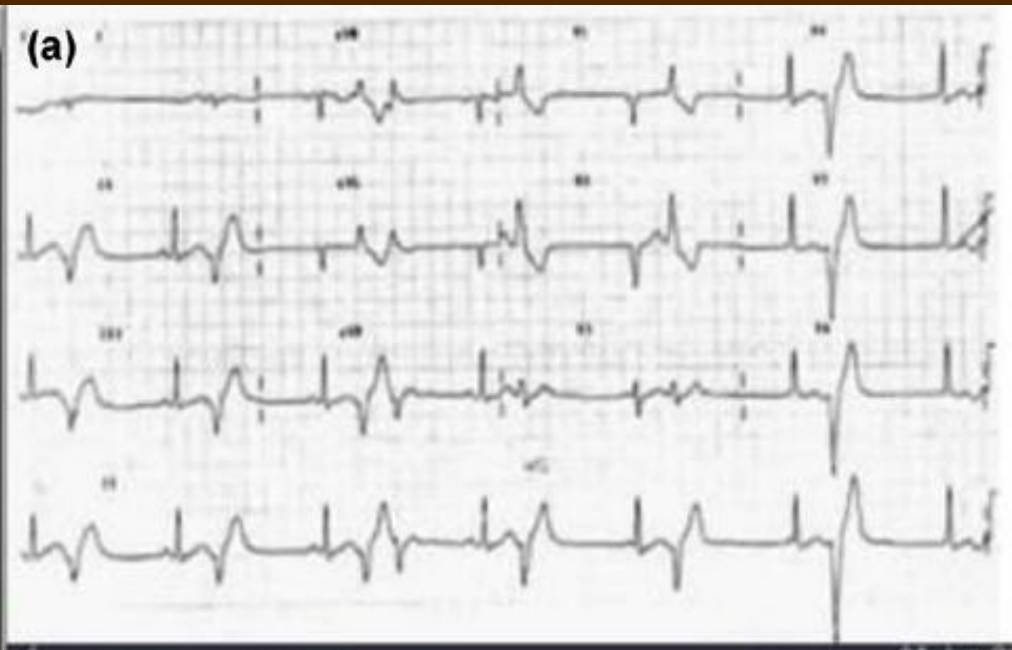
Noda, T. et al. J Am Coll Cardiol 2005;46:1288-1294

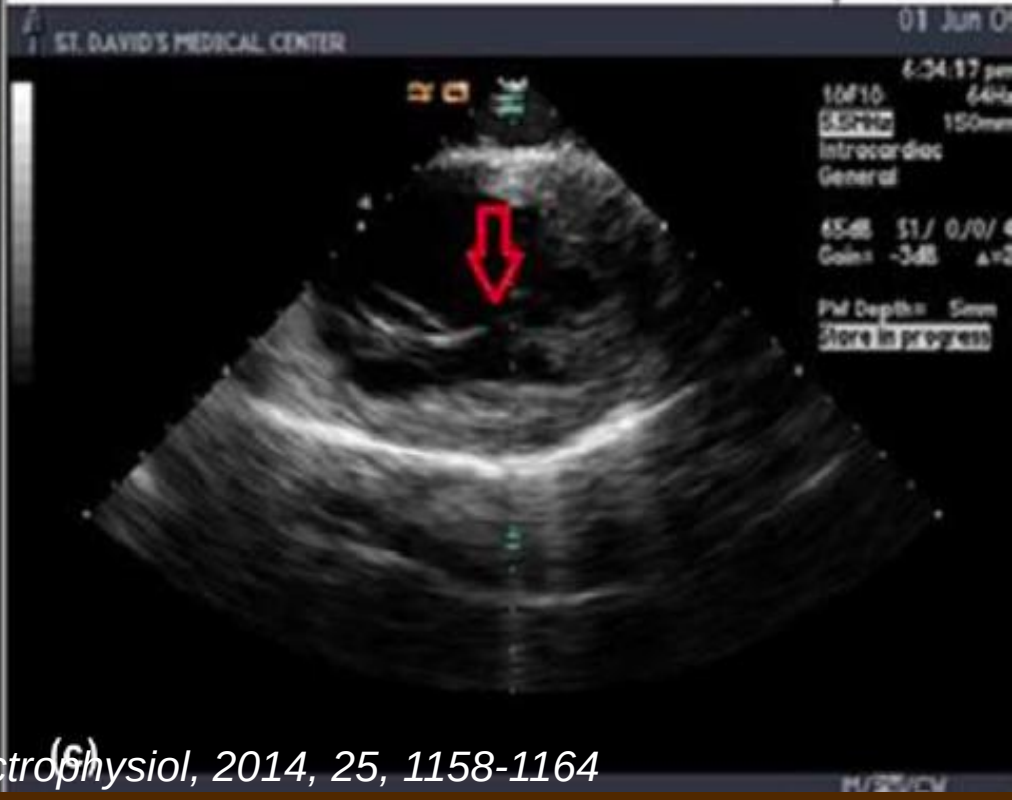
Ventricular Fibrillation Triggered by PVCs from Papillary Muscles: Clinical Features and Ablation



Santoro F. J Cardiovasc Electrophysiol, 2014, 25, 1158-1164)

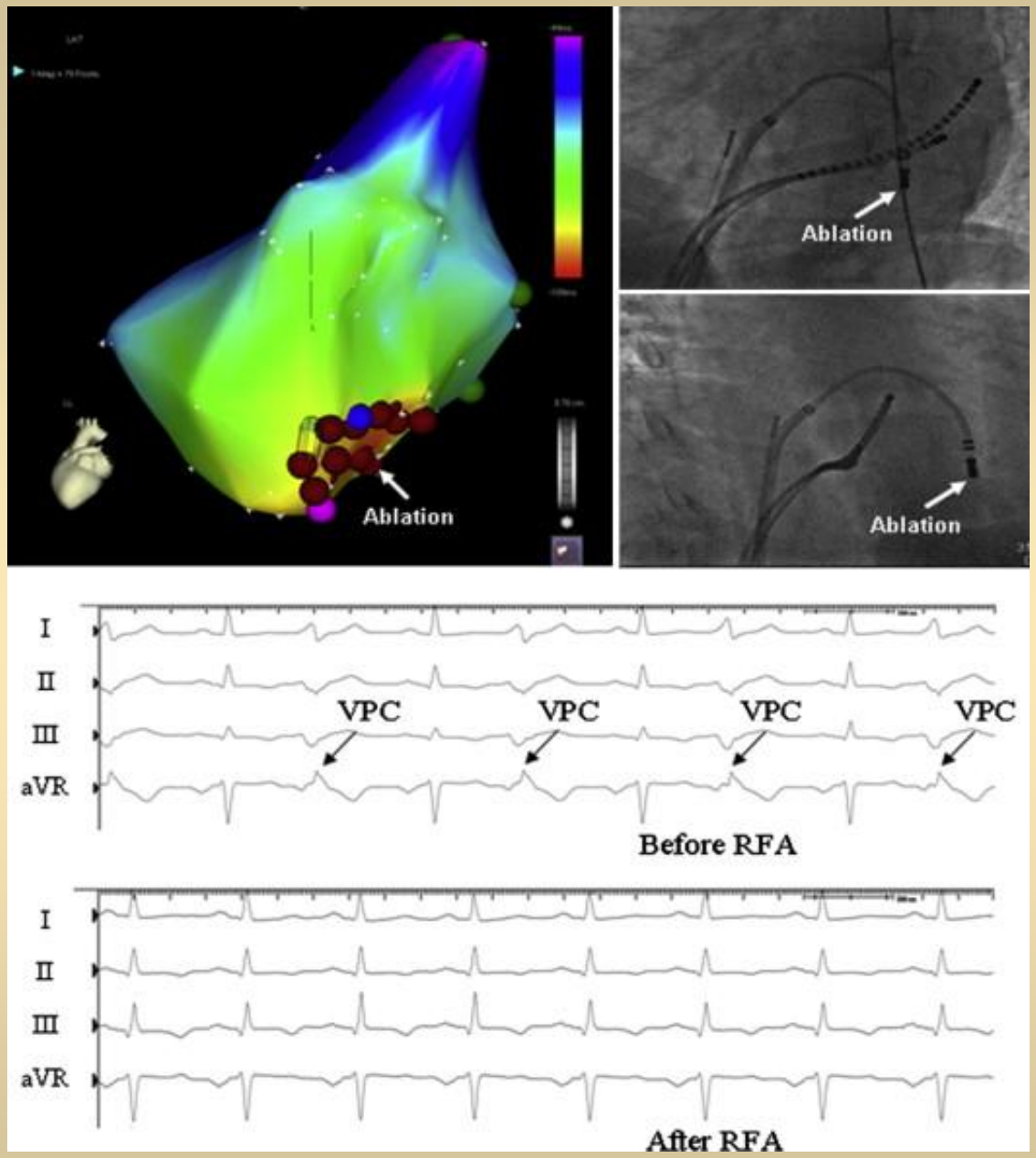






Santoro et al., J Cardiovasc Electrophysiol, 2014, 25, 1158-1164


I
II
III
V1
HIS p
HIS m
HIS d
ABL
ABL d
CS p
CS m
CS d
24 msec
24 msec
6:10:20 PM
6:10:21 PM

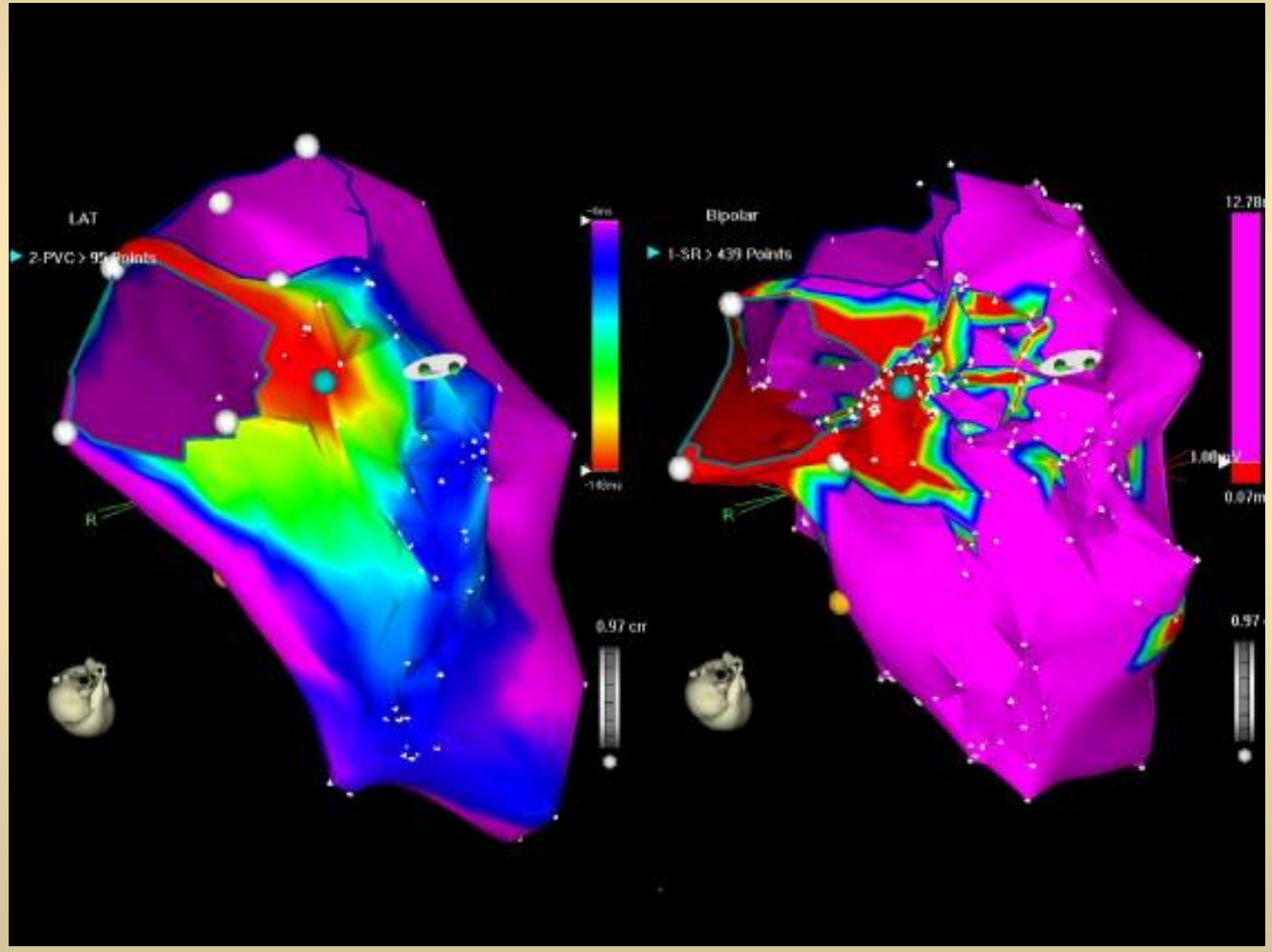


Mapping and ablation (RFA) of ventricular ectopy near the base of the posterior papillary muscle in LV with the use of a 3-dimensional electroanatomic map

Chen T et al., Journal of Cardiac Failure, Volume 19, Issue 1, 2013, 40 – 49

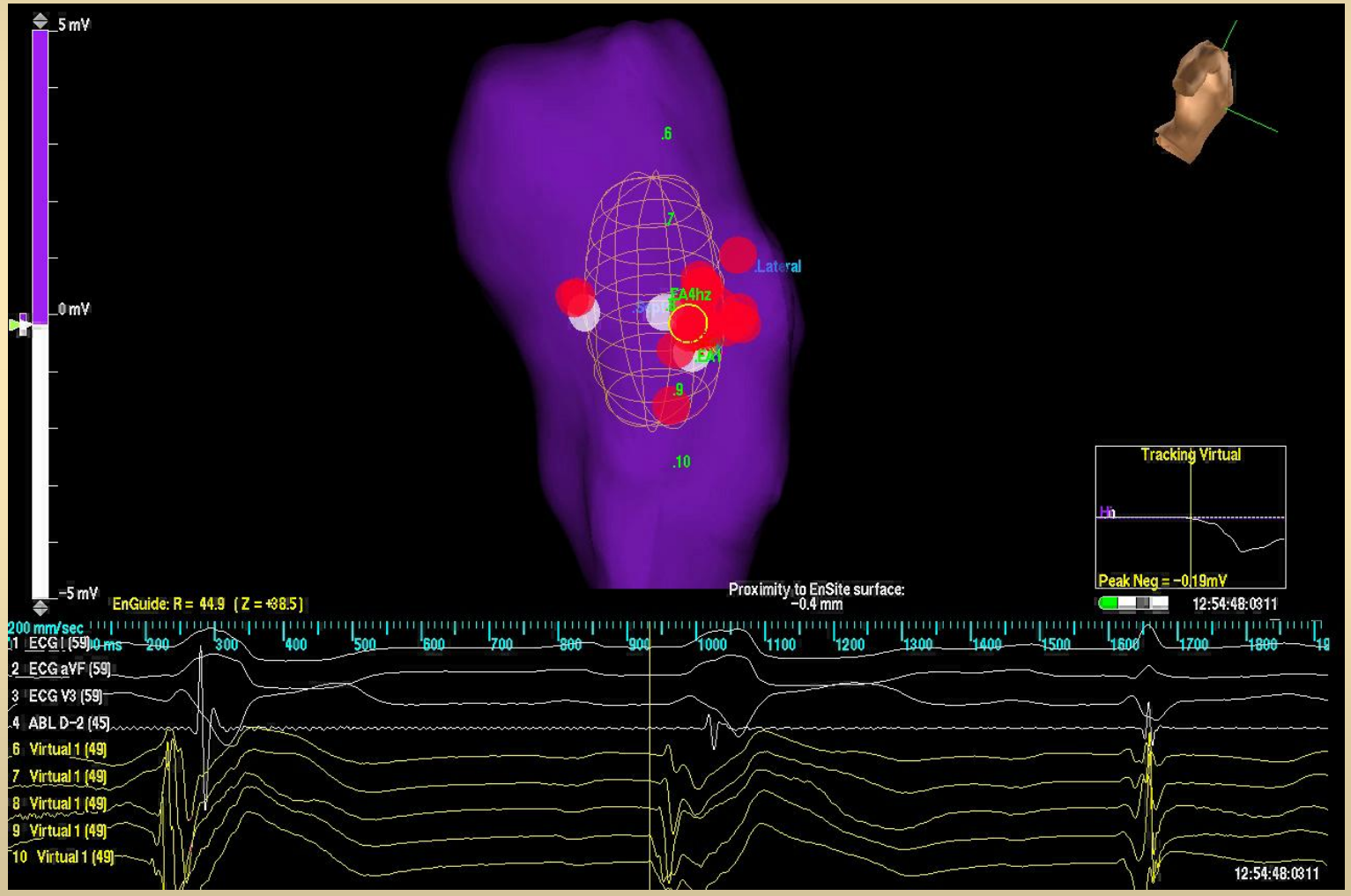
PVC origin in MI scar

PVC as RFCA targets to eliminate VT



Bogun F et al., HR 2008

Single-beat non-contact mapping for VES origin location



Frequent PVCs – not necessarily benign !

- Frequent PVCs have been associated with the **development of CMP with systolic dysfunction. In patients with PVC burden of ≥ 20,000 PVCs/24h**, CMP may develop in up to 20% of patients on long-term follow up.
- **PVC-induced CMP** is most commonly observed in patients with a PVC burden of ≥10% or ≥ 10,000 PVCs/24h.
- **High PVC burden, long PVC QRS duration, and epicardial origin of PVCs** have been associated with increased risk of cardiomyopathy.

Frequent PVCs – not necessarily benign !

- Catheter ablation has been associated with a **higher degree of suppression of PVCs and is associated with complete resolution of cardiomyopathy in more than 70%** of patients.
- Case series and retrospective studies suggest that **catheter ablation may be more efficacious** in treating PVC-induced cardiomyopathy.
- Future well-designed randomized studies are needed to establish evidence-based recommendation in the treatment of patients with PVC-induced cardiomyopathy
- .

Frequent PVC's: Is there a place for ablation?

. CERTAINLY YES AND IT IS EXPANDING! However:

- In-depth exclusion of other etiologies of LV function decline
- Allow for sufficient time to evaluate dynamics of PVCs / LV function
- "Favorable electric millieu" – single / dominat ECG morphology
- Decision shared with patient, drugs not an option
- **Experienced** center / operator – excellent results, low complication rate

PVCs in the real life – how to approach the patient ?

- For **asymptomatic** patients with preserved cardiac function and no high-risk features for SCD - **careful follow-up** - **monitor LV EF annually!**
- **In patients showing a clear association between:**
  - **PVCs and symptoms**
  - **PVC-induced ventricular tachyarrhythmia (VT/VF)**
  - **PVC mediated cardiomyopathy**

  Catheter ablation should always be considered individually (characteristics of patient and his/her PVCs)