Κατάλυση της κοιλιακών αρρυθμιών σε ασθενή με καρδιακή και νεφρική ανεπάρκεια

Πότε και πως

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Διευθυντής Α Καρδιολογικής Κλινικής /
Τμήματος Ηλεκτροφυσιολογίας/Βηματοδότησης
«Ερρίκος Ντυνάν» Hospital Center

Presenter Disclosure Information

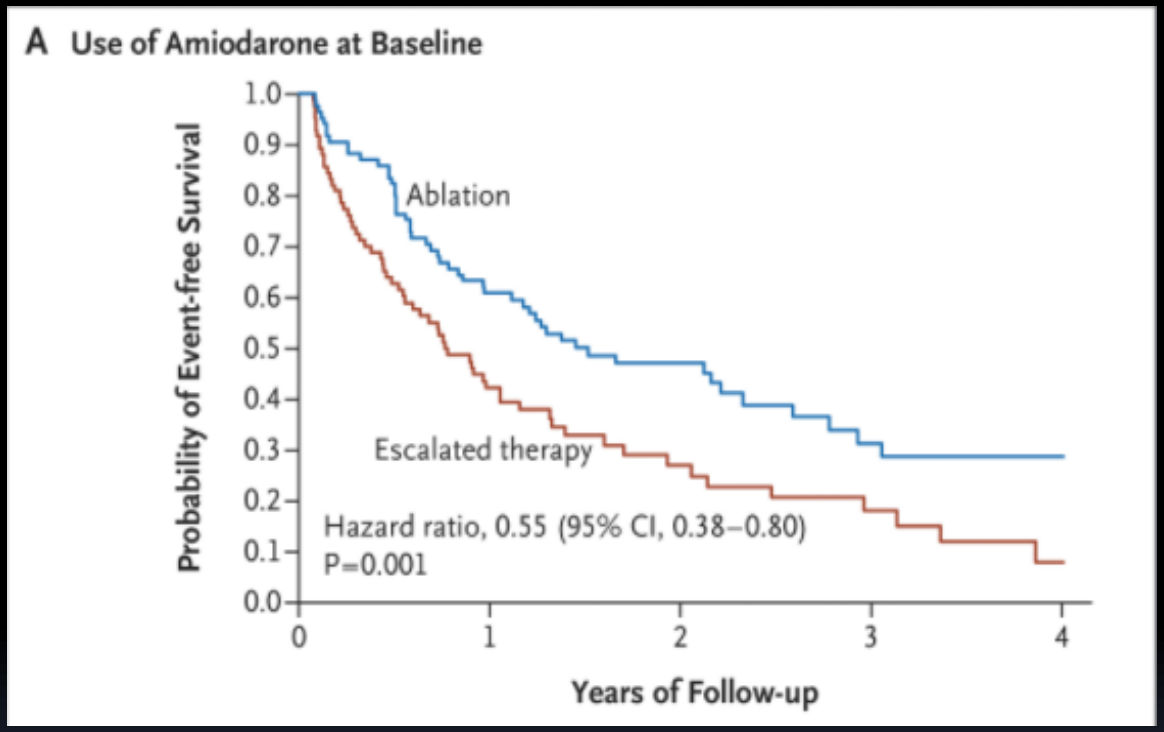
The presenter has received honoraria for participation in lectures and advisory boards from the following pharmaceutical and biotechnology companies:

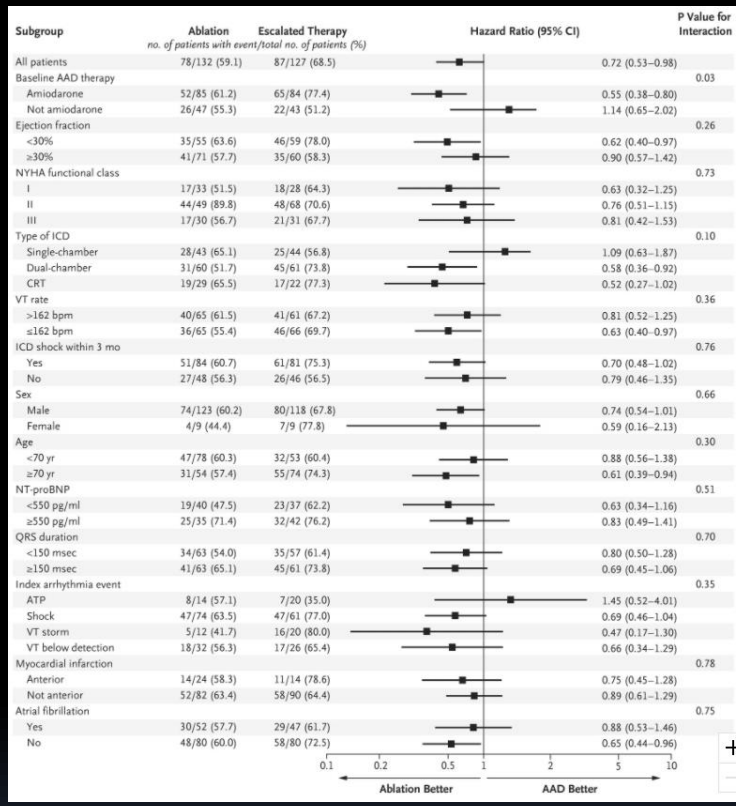
- *Abbot*
- *AstraZeneca,*
- *Bard,*
- *Bayer Healthcare,*
- *Boehringer Ingelheim,*
- *Boston Scientific,*
- *Bristol-Myers Squibb,*
- *ELPEN,*
- *Galenica,*
- *Lilly*
- *Medtronic,*
- *Menarini,*
- *MSD,*
- *Pfizer,*
- *Sanofi,*
- *Servier,*
- *Unifarma,*
- *Vianex.*

Ventricular Tachycardia Ablation versus Escalation of Antiarrhythmic Drugs

John L. Sapp, M.D., George A. Wells, Ph.D., Ratika Parkash, M.D., William G. Stevenson, M.D., Louis Blier, M.D., Jean-Francois Sarrazin, M.D., Bernard Thibault, M.D., Lena Rivard, M.D., Lorne Gula, M.D., Peter Leong-Sit, M.D., Vidal Essebag, M.D., Ph.D., Pablo B. Nery, M.D., et al.

The VANISH study. N Engl J Med 2016; 375:111-121





Subgroup	Ablation (no. of patients with event/total no. of patients (%))	Escalated Therapy (no. of patients with event/total no. of patients (%))	Hazard Ratio (95% CI)	P Value for Interaction
All patients	78/132 (59.1)	87/127 (68.5)	0.72 (0.53–0.98)	
Baseline AAD therapy				0.03
Amiodarone	52/85 (61.2)	65/84 (77.4)	0.55 (0.38–0.80)	
Not amiodarone	26/47 (55.3)	22/43 (51.2)	1.14 (0.65–2.02)	
Ejection fraction				0.26
<30%	35/55 (63.6)	46/59 (78.0)	0.62 (0.40–0.97)	
≥30%	41/71 (57.7)	35/60 (58.3)	0.90 (0.57–1.42)	
NYHA functional class				0.73
I	17/33 (51.5)	18/28 (64.3)	0.63 (0.32–1.25)	
II	44/49 (89.8)	48/68 (70.6)	0.76 (0.51–1.15)	
III	17/30 (56.7)	21/31 (67.7)	0.81 (0.42–1.53)	
Type of ICD				0.10
Single-chamber	28/43 (65.1)	25/44 (56.8)	1.09 (0.63–1.87)	
Dual-chamber	31/60 (51.7)	45/61 (73.8)	0.58 (0.36–0.92)	
CRT	19/29 (65.5)	17/22 (77.3)	0.52 (0.27–1.02)	
VT rate				0.36
>162 bpm	40/65 (61.5)	41/61 (67.2)	0.81 (0.52–1.25)	
≤162 bpm	36/65 (55.4)	46/66 (69.7)	0.63 (0.40–0.97)	
ICD shock within 3 mo				0.76
Yes	51/84 (60.7)	61/81 (75.3)	0.70 (0.48–1.02)	
No	27/48 (56.3)	26/46 (56.5)	0.79 (0.46–1.35)	
Sex				0.66
Male	74/123 (60.2)	80/118 (67.8)	0.74 (0.54–1.01)	
Female	4/9 (44.4)	7/9 (77.8)	0.59 (0.16–2.13)	
Age				0.30
<70 yr	47/78 (60.3)	32/53 (60.4)	0.88 (0.56–1.38)	
≥70 yr	31/54 (57.4)	55/74 (74.3)	0.61 (0.39–0.94)	
NT-proBNP				0.51
<550 pg/ml	19/40 (47.5)	23/37 (62.2)	0.63 (0.34–1.16)	
≥550 pg/ml	25/35 (71.4)	32/42 (76.2)	0.83 (0.49–1.41)	
QRS duration				0.70
<150 msec	34/63 (54.0)	35/57 (61.4)	0.80 (0.50–1.28)	
≥150 msec	41/63 (65.1)	45/61 (73.8)	0.69 (0.45–1.06)	
Index arrhythmia event				0.35
ATP	8/14 (57.1)	7/20 (35.0)	1.45 (0.52–4.01)	
Shock	47/74 (63.5)	47/61 (77.0)	0.69 (0.46–1.04)	
VT storm	5/12 (41.7)	16/20 (80.0)	0.47 (0.17–1.30)	
VT below detection	18/32 (56.3)	17/26 (65.4)	0.66 (0.34–1.29)	
Myocardial infarction				0.78
Anterior	14/24 (58.3)	11/14 (78.6)	0.75 (0.45–1.28)	
Not anterior	52/82 (63.4)	58/90 (64.4)	0.89 (0.61–1.29)	
Atrial fibrillation				0.75
Yes	30/52 (57.7)	29/47 (61.7)	0.88 (0.53–1.46)	
No	48/80 (60.0)	58/80 (72.5)	0.65 (0.44–0.96)	

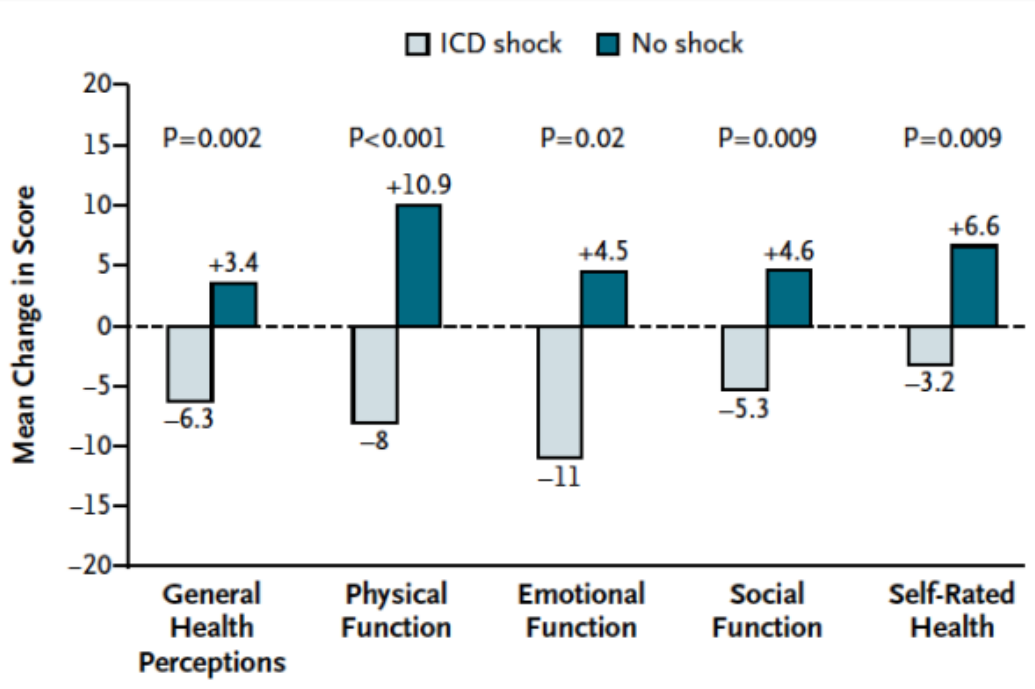
CONCLUSIONS

In patients with ischemic cardiomyopathy and an ICD who had ventricular tachycardia despite antiarrhythmic drug therapy, there was a significantly lower rate of the composite primary outcome of death, ventricular tachycardia storm, or appropriate ICD shock among patients undergoing catheter ablation than among those receiving an escalation in antiarrhythmic drug therapy. (Funded by the Canadian Institutes of Health Research and others; VANISH ClinicalTrials.gov number, NCT00905853.)

VT ABLATION IMPROVES PROGNOSIS

SCD HeFT-Trial – Impact of ICD shock

Shock Type	Hazard Ratio for Death (95% CI)	P Value
≥1 App vs. no App	5.68 (3.97–8.12)	<0.001
≥1 Inapp vs. no Inapp	1.98 (1.29–3.05)	0.002
Both shock types vs. no shock	11.27 (6.70–18.94)	<0.001



Marc D, NEJM 2008;359:999-1008

PARTITA VT Study

Primary objective:

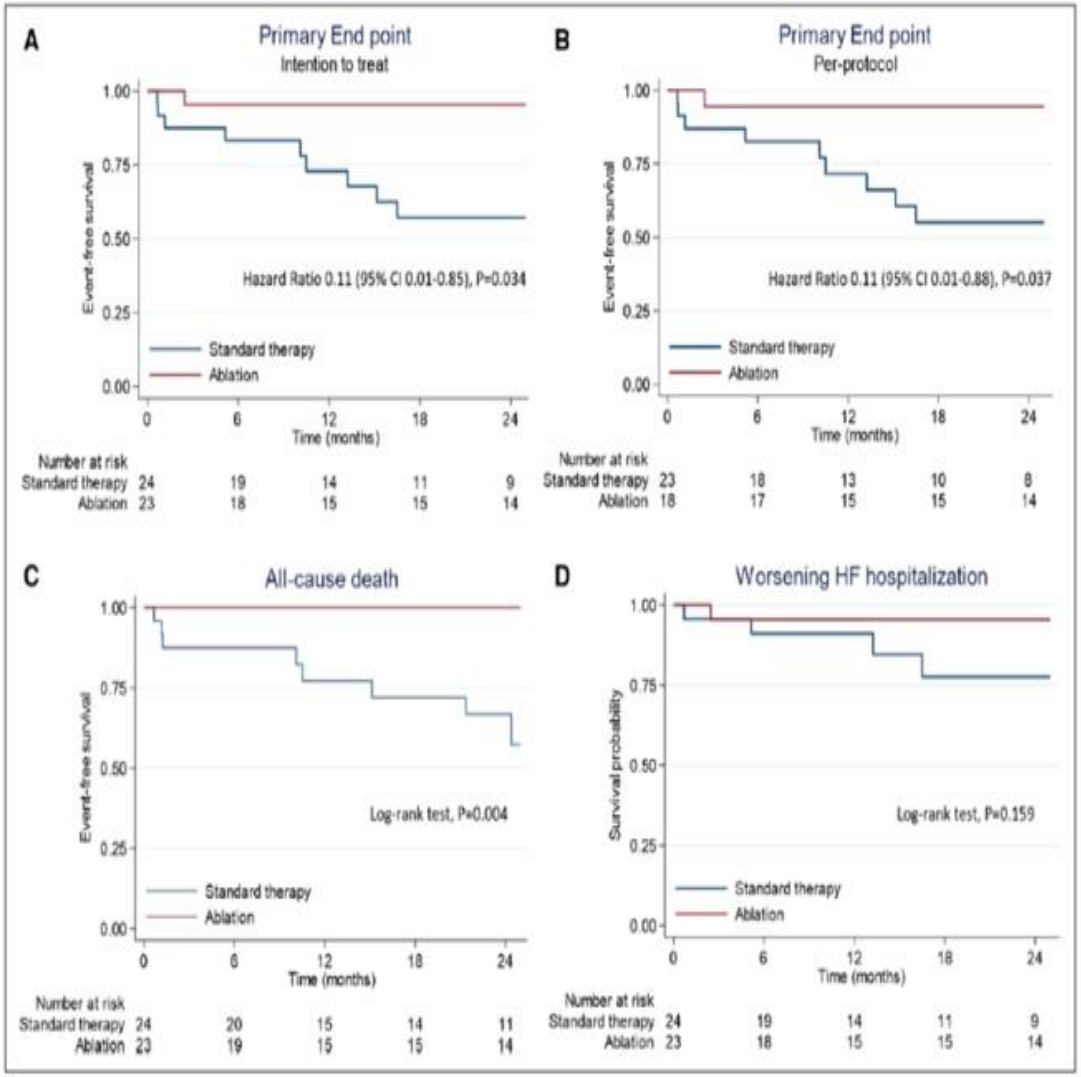
- Impact of VT Ablation after first appropriate shock

Methods:

- 2 Phase study. 1:1 random. after first shock -> immediate VT ablation or std tx.
- Primary outcome: composite of death, hosp. for CHF

Results:

- N = 517 (47) ICM or Non-ICM (22%)
- Stop after 1. interim analysis
- sign. red. of primary endpoint
- No deaths in ablation group



De La Bella et al. Circulation 2022;145:1829-1838.

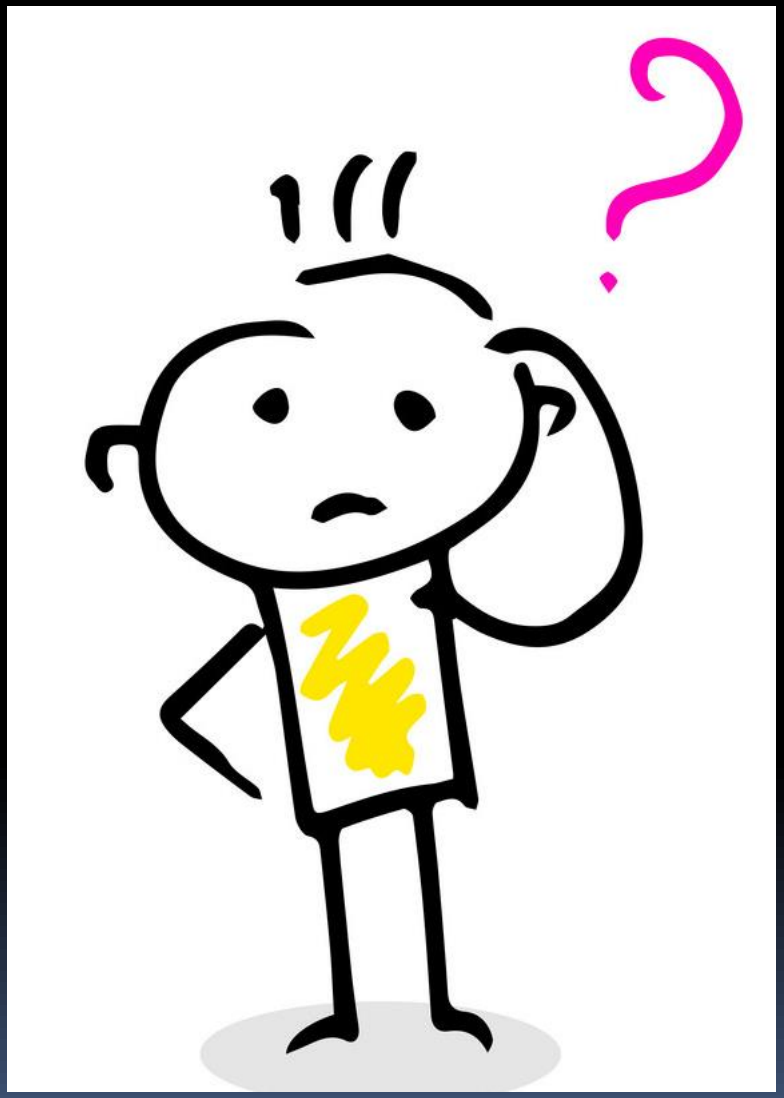
Clinical Outcomes in Patients with Dilated Cardiomyopathy and Ventricular Tachycardia DCM-VT Study

Zeppenfeld et al J Am Coll Cardiology 2022

- **Prospective follow-up of patients with DCM undergoing VT abation at 9 international centers**
- **Intention to treat** – patients included if the entered the EP laboratory for ablation but no ablation was performed
- **281 consecutive patients** were enrolled between 9/2013 and 1/2017.
- **Exclusions:** myocardial infarction, significant coronary artery disease, right dominant CM, hypertrophic CM, LV non-compaction CM, restrictive CM, prior myocarditis, cardiac sarcoidosis, Chagas disease, tachycardia-induced CM, primary significant valvular heart disease, congenital heart disease.

VT Ablation Procedural Complications

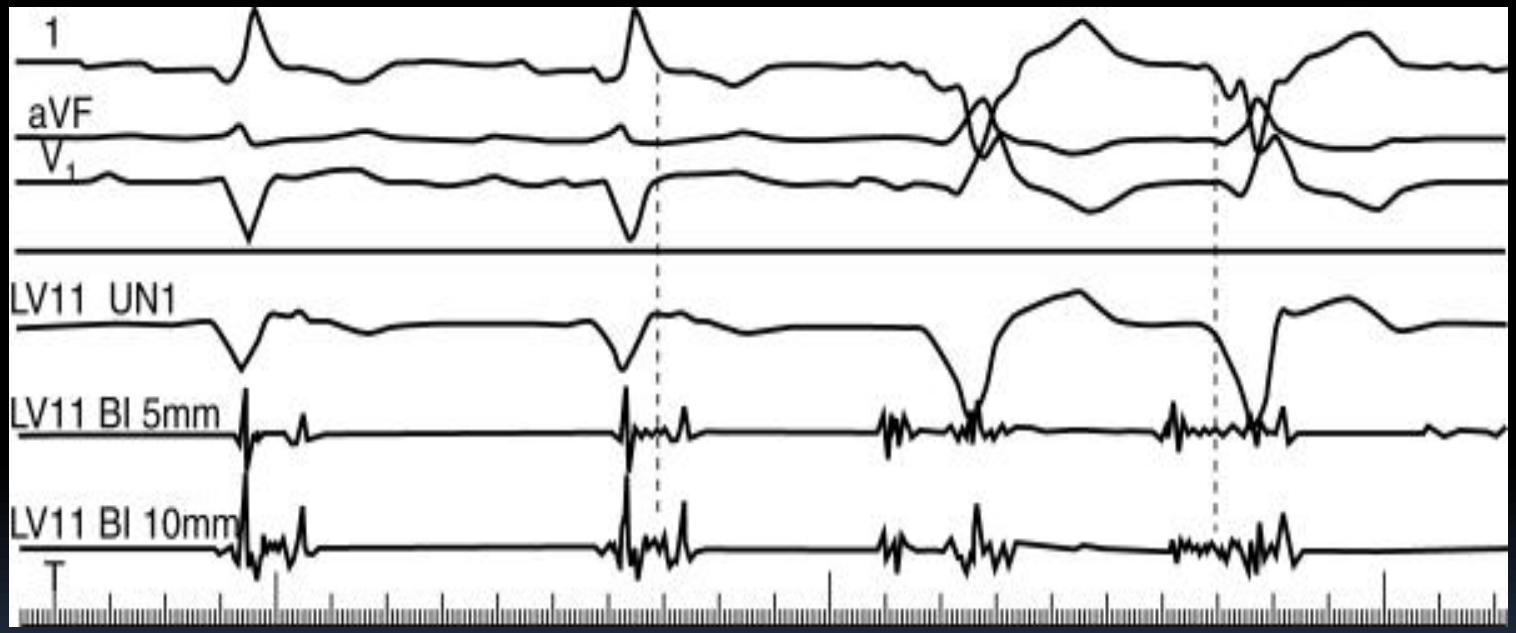
	N=281
Complications	32 (11%)
Procedural-related death	2 (1%)
Pericardial bleeding/ tamponade	5/2 (2%)
AV block	7 (2%)
Vascular complications	10 (3%)



ΠΩΣ;

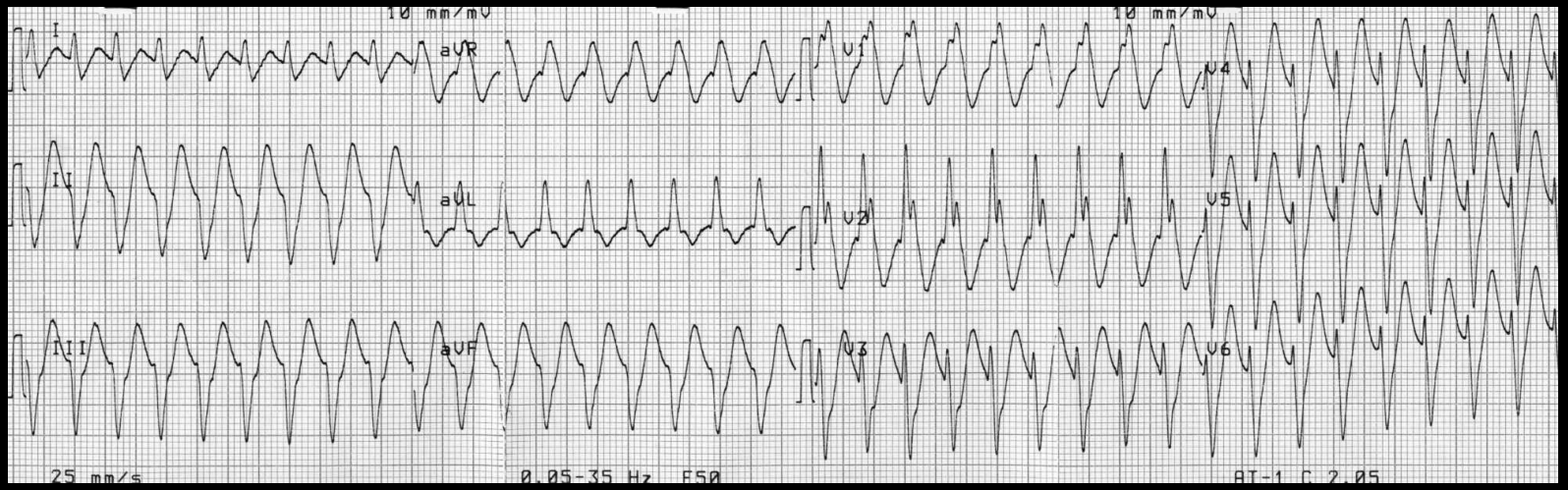
Electrogram recording from a ventricular tachycardia (VT) site of origin

During sinus rhythm, a fractionated, multicomponent signal is recorded; the final component of this electrogram is recorded after the end of the surface QRS.
During VT (final two beats of the tracing), isolated diastolic potentials are observed, preceding the QRS by 90msec. BI, bipolar; LV, left ventricle; UN, unipolar



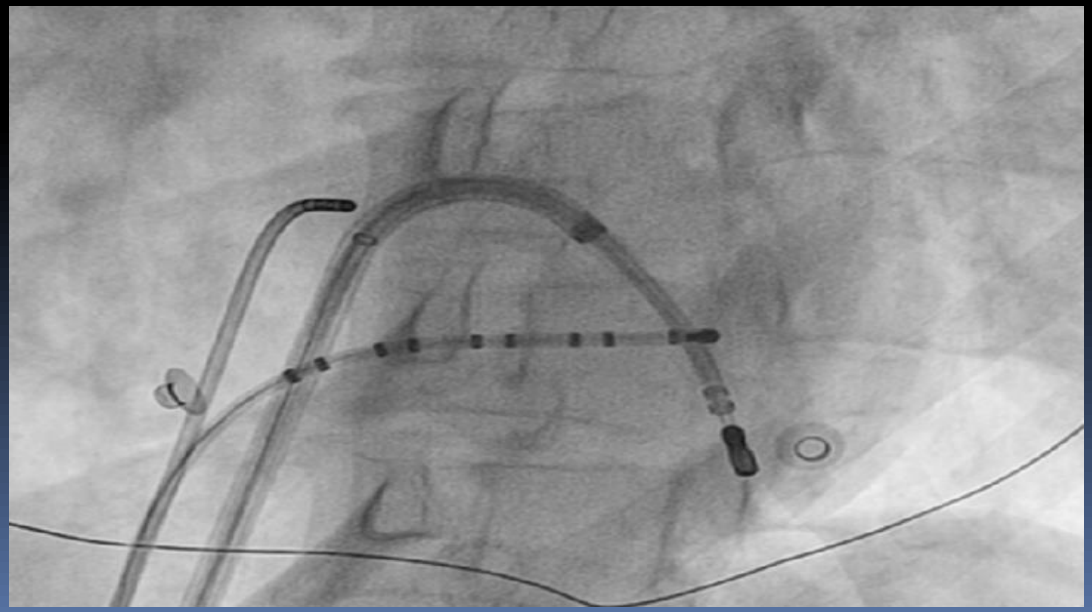
From Josephson ME. Clinical Cardiac Electrophysiology: Techniques and Interpretations, 3rd ed. Philadelphia: Lippincott Williams & Wilkins; 2002

Συμβατική κατάλυση με δεξιά προσπέλαση και διαφραγματοστομία



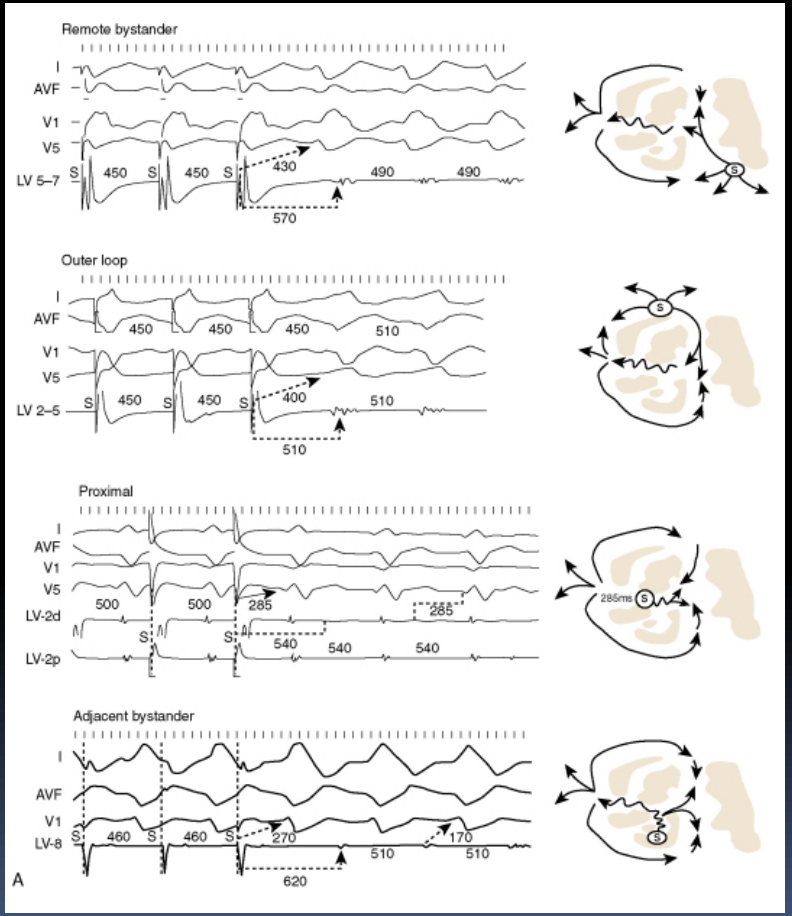
Left posterior fascicular VT

•Οι ευαίσθητες στη βεραπαμίλη δεσμιδικές κοιλιακές ταχυκαρδίες (verapamil-sensitive fascicular VTs) είναι η πιο συχνή μορφή αριστερής ιδιοπαθούς κοιλιακής ταχυκαρδίας (Zipes et al. Am J Cardiol 1979).



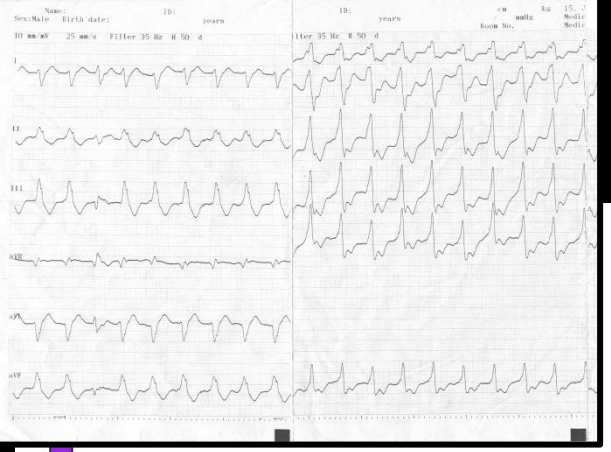
Αρχείο Γ.Ανδρικόπουλου, Ερρίκος Ντυνάν Hospital Center

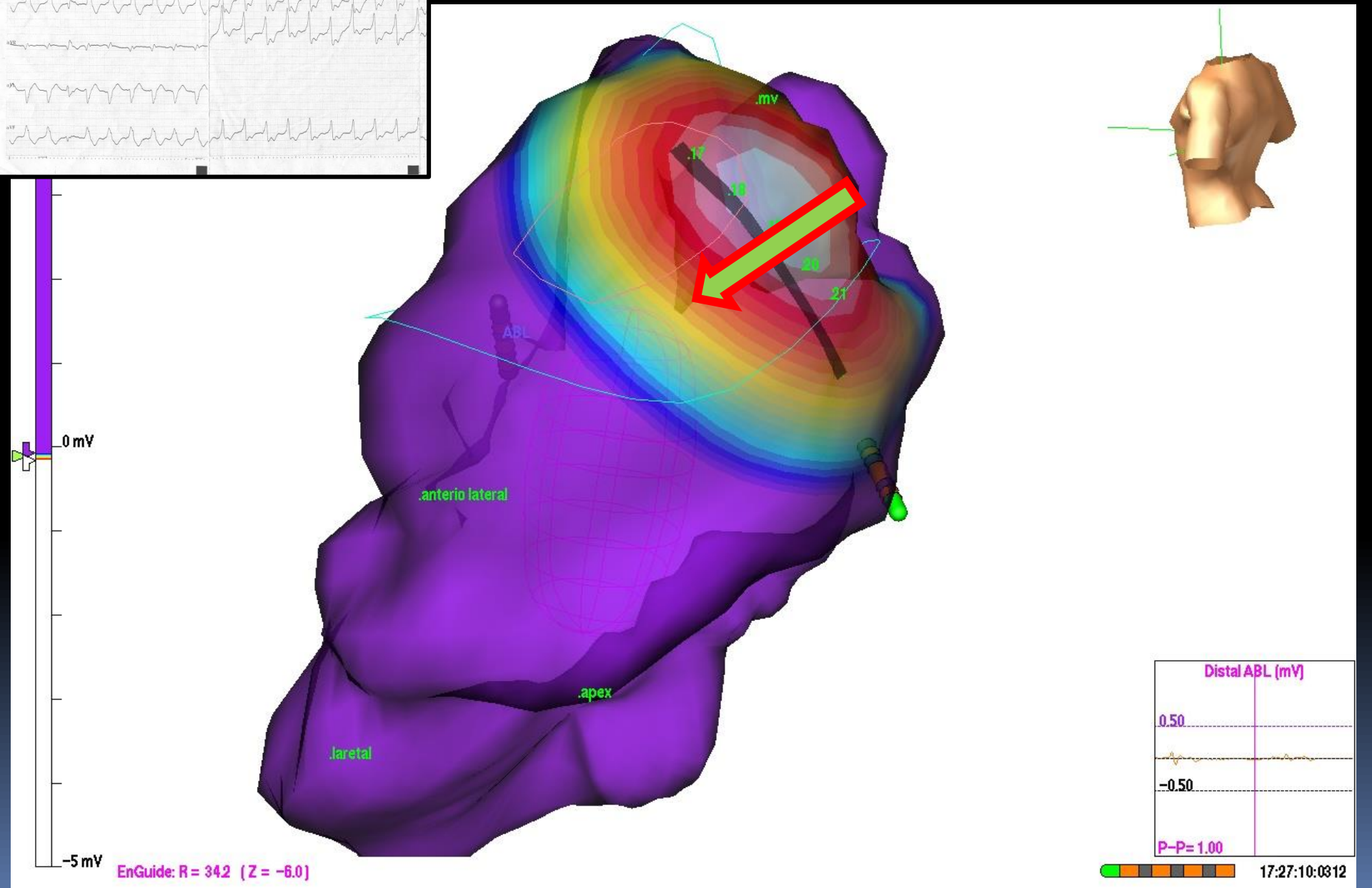
Όταν ο ασθενής το επιτρέπει η χαρτογράφηση της ταχυκαρδίας με παράσυρση δίνει πολύτιμες πληροφορίες αλλά έχει μικρή ειδικότητα και μπορεί να είναι θετική σε ευρεία περιοχή

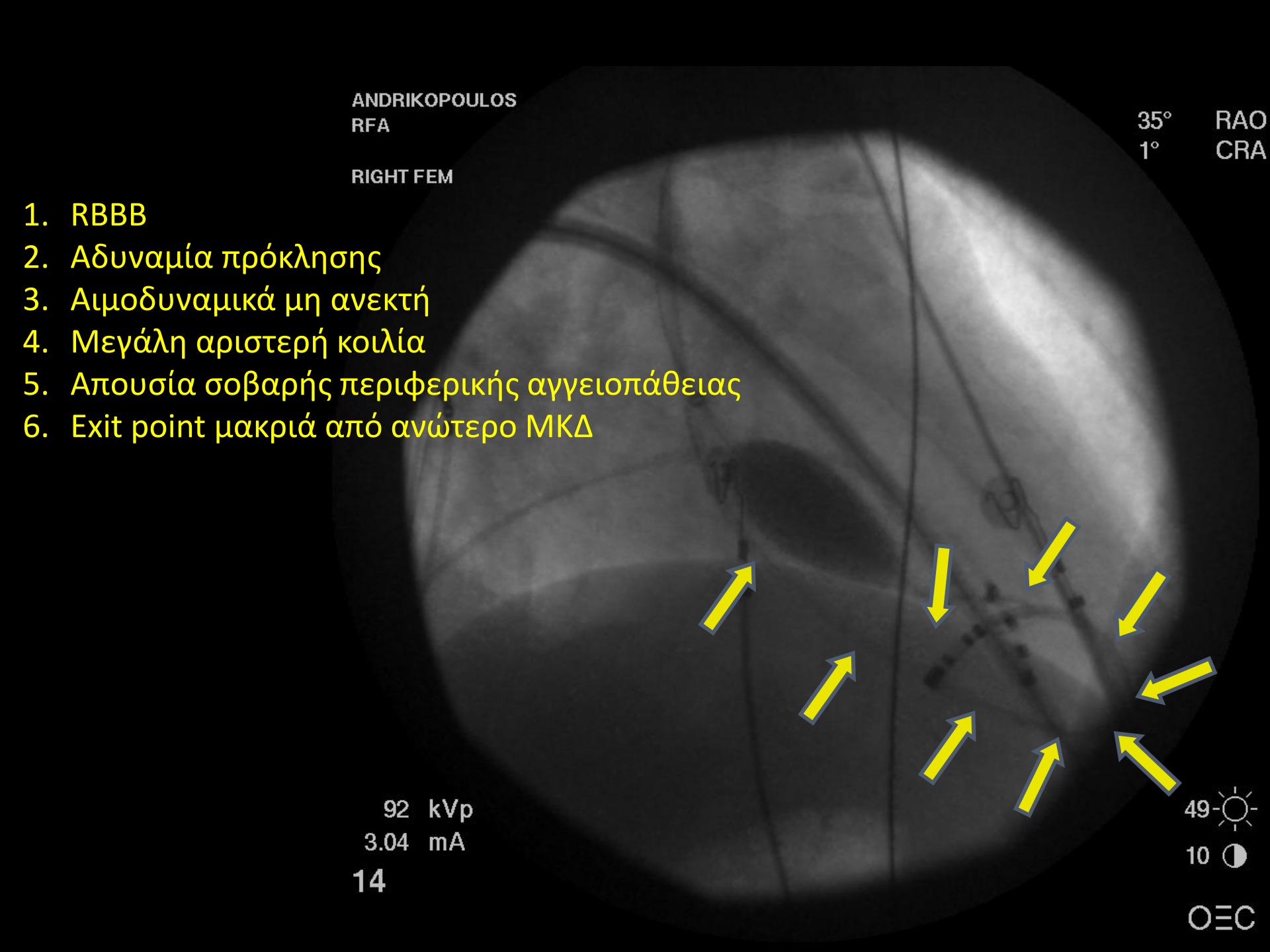


Αρχείο Γ.Ανδρικόπουλου, ΓΝΑ «Ερρίκος Ντυνάν» 2009

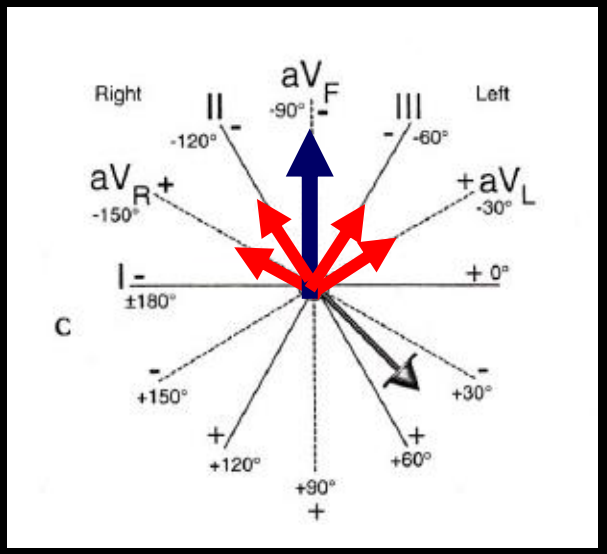
Ηλεκτροανατομική χαρτογράφηση χωρίς επαφή (ENSITE)







1. RBBB
2. Αδυναμία πρόκλησης
3. Αιμοδυναμικά μη ανεκτή
4. Μεγάλη αριστερή κοιλία
5. Απουσία σοβαρής περιφερικής αγγειοπάθειας
6. Exit point μακριά από ανώτερο ΜΚΔ


Right
Left
aVF
II
III
aVR
aVL
I
-120°
-90°
-60°
-150°
-30°
±180°
+ 0°
+150°
+30°
+120°
+60°
+90°
C


ΝΟΣΟΚΟΜΕΙΟ "ΕΡΡΙΚΟΣ ΝΤΥΝΑΝ" Εργαστήριο Ηλεκτροφυσιολογίας
ID: 335085
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6


ΝΟΣΟΚΟΜΕΙΟ "ΕΡΡΙΚΟΣ ΝΤΥΝΑΝ" Εργαστήριο Ηλεκτροφυσιολογίας
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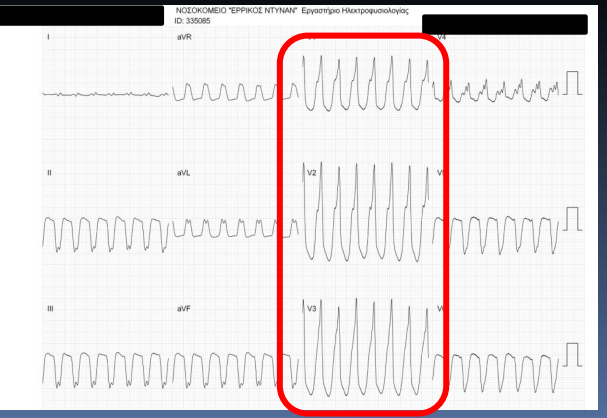
ΝΟΣΟΚΟΜΕΙΟ "ΕΡΡΙΚΟΣ ΝΤΥΝΑΝ" Εργαστήριο Ηλεκτροφυσιολογίας
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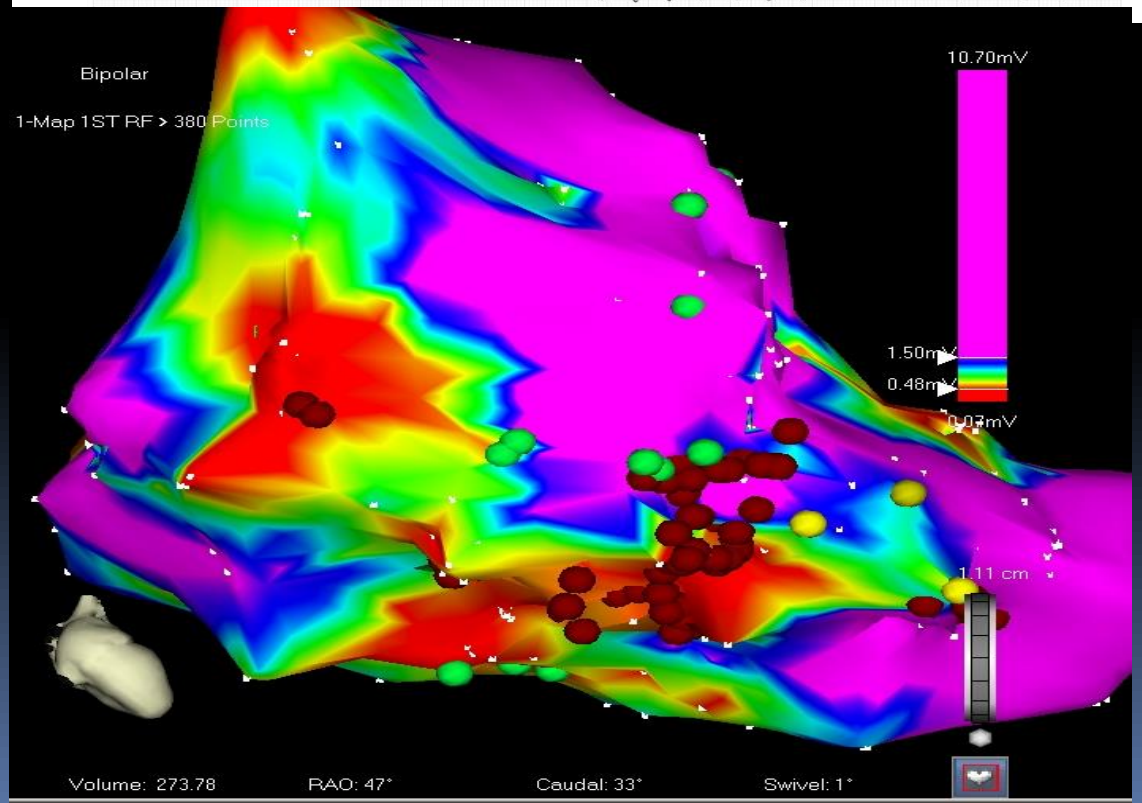
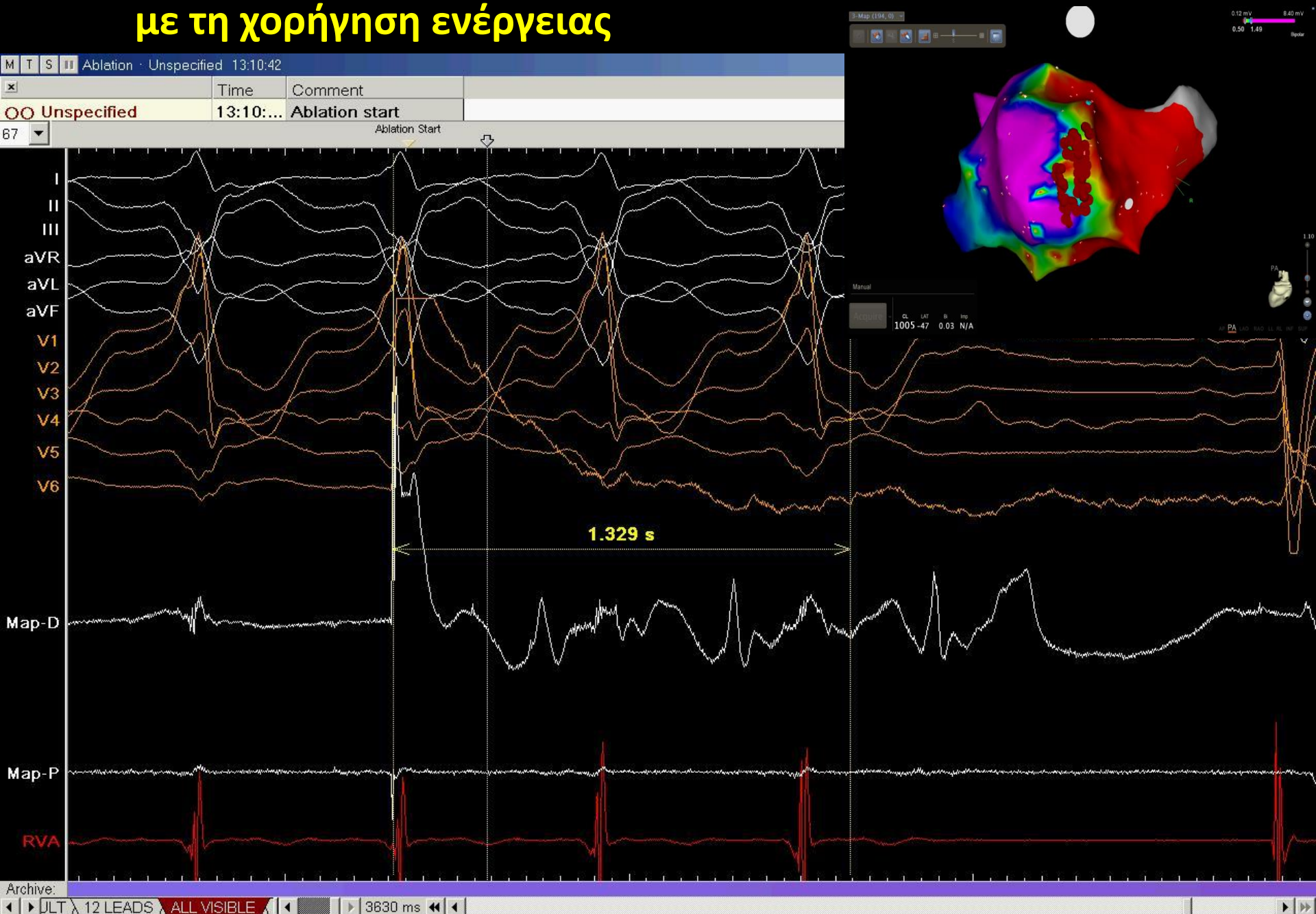
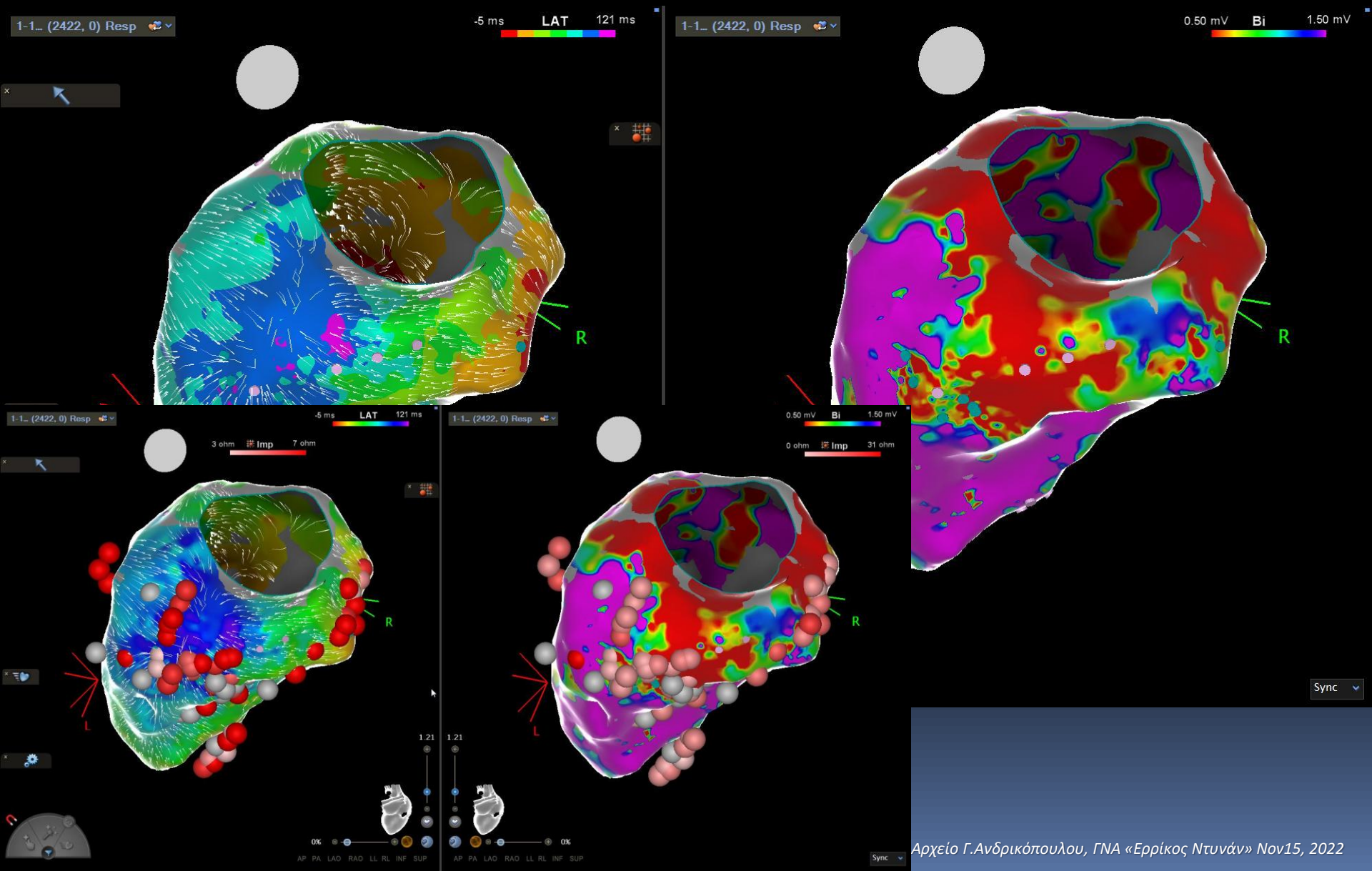

Bipolar
1-Map 1ST RF > 380 Points
10.70mV
1.50mV
0.48mV
0.07mV
1.11 cm
Volume: 273.78
RAO: 47°
Caudal: 33°
Swivel: 1°

Άμεσος τερματισμός της ταχυκαρδίας με τη χορήγηση ενέργειας

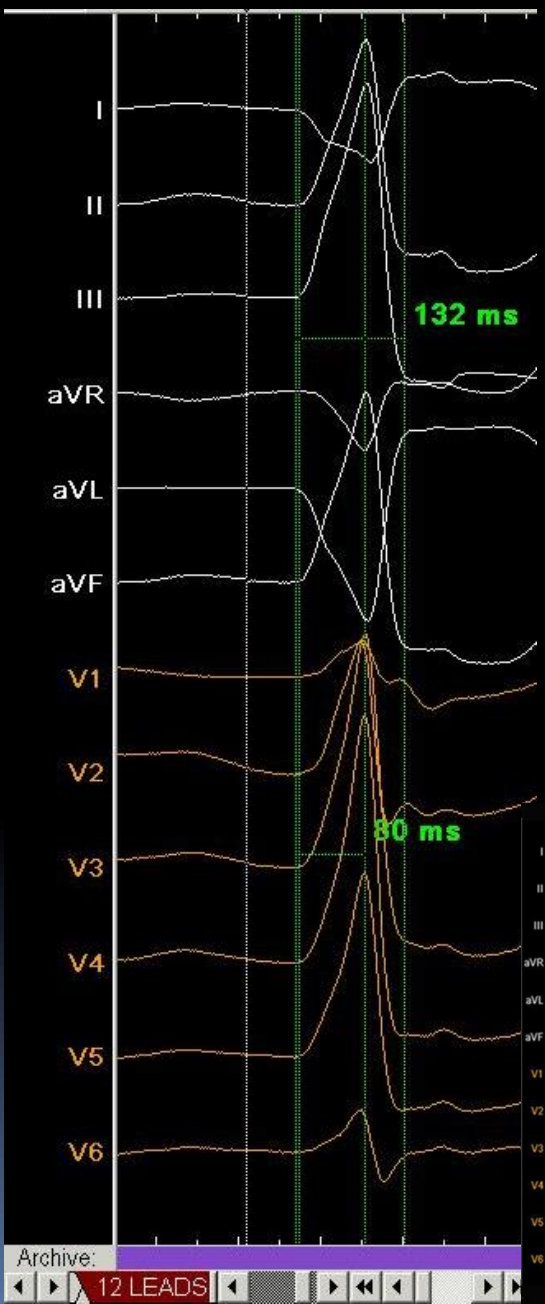


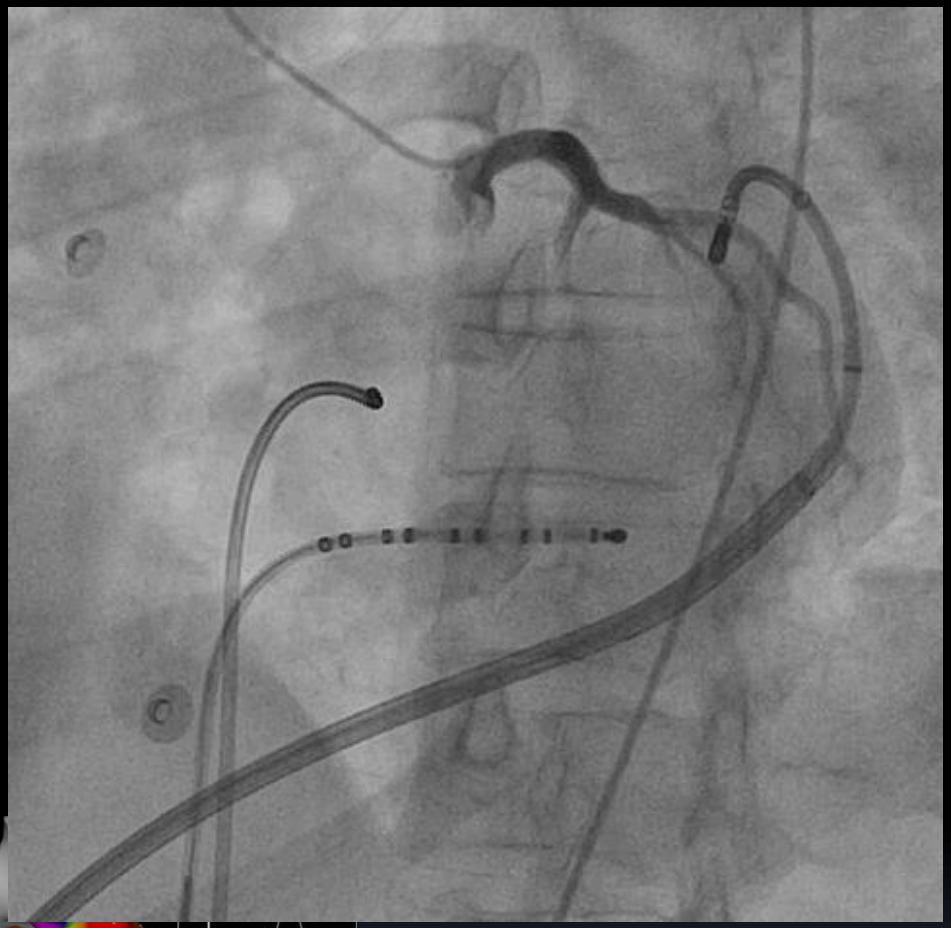
ΕΠΕΜΒΑΣΗ ΚΑΤΑΛΥΣΗΣ ΚΟΙΛΙΑΚΗΣ ΤΑΧΥΚΑΡΔΙΑΣ ΣΕ ΑΣΘΕΝΗ ΜΕ ΣΝ

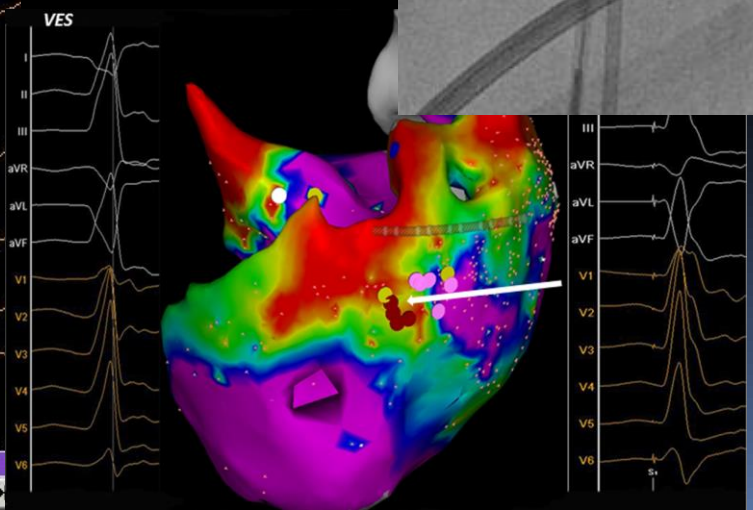


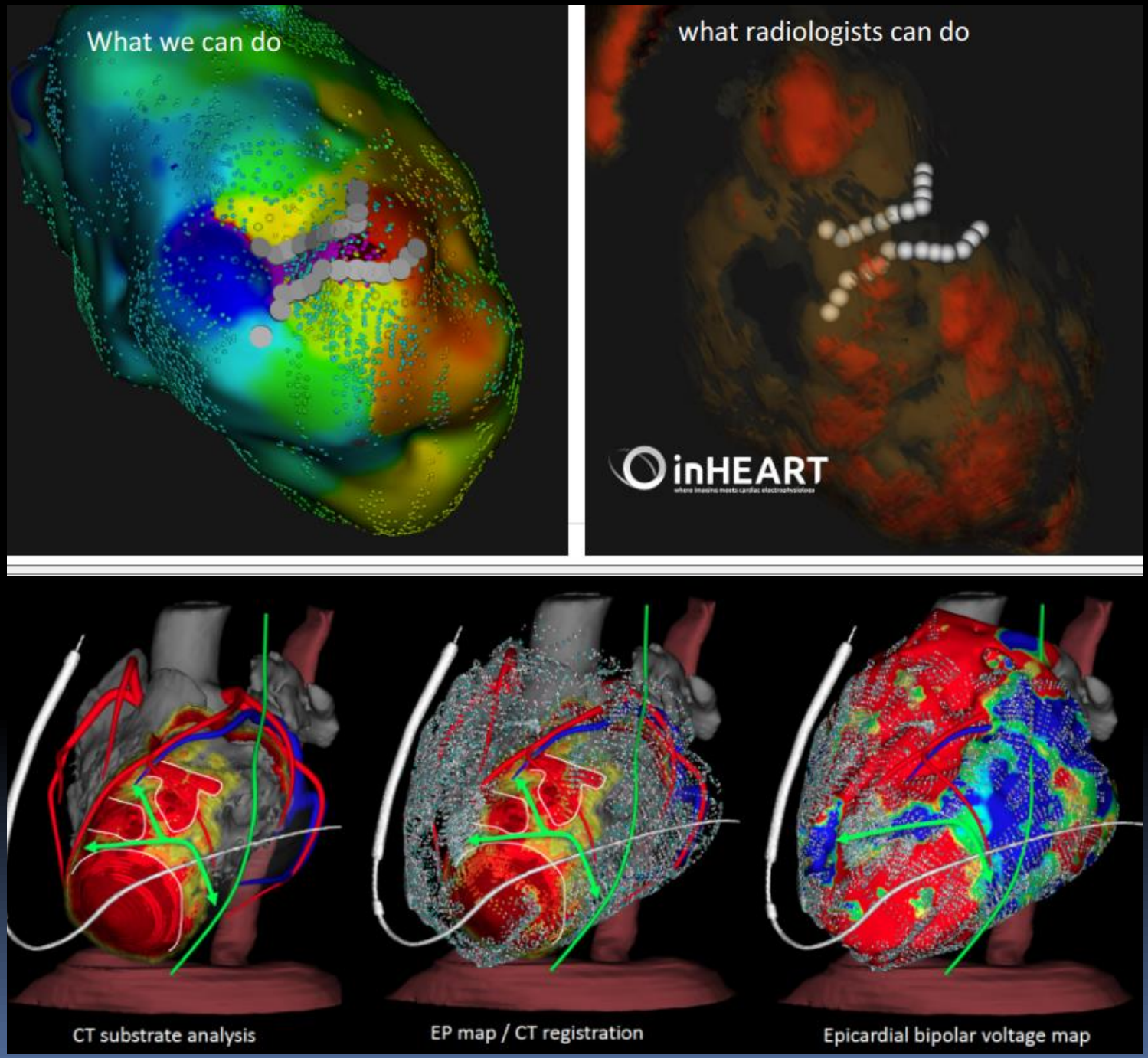
Αρχείο Γ.Ανδρικόπουλου, ΓΝΑ «Ερρίκος Ντυνάν» Νοv15, 2022

Έλεγχος της θέσης των στεφανιαίων αγγείων κατά την επικαρδιακή κατάλυση



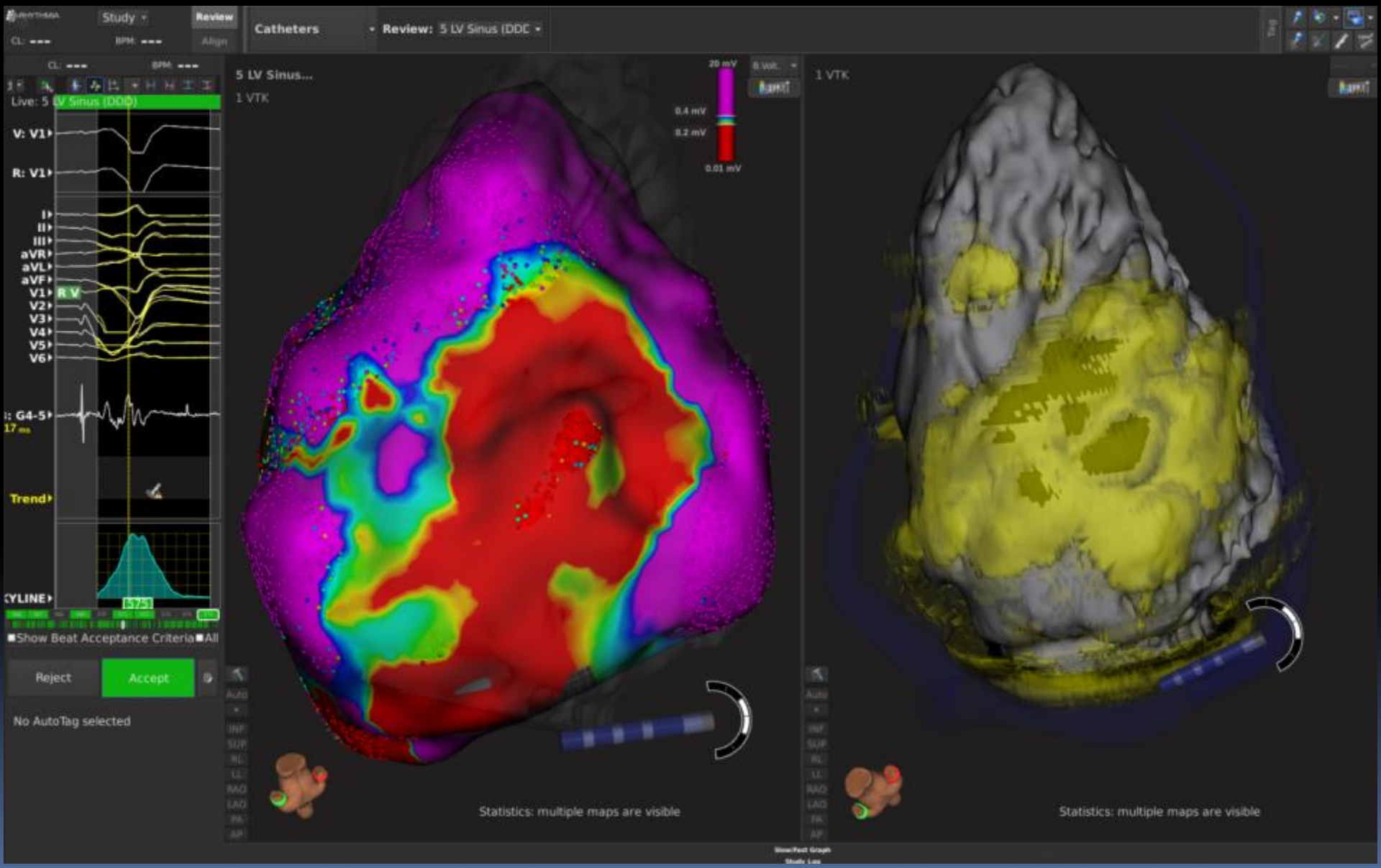






As presented by P Jais, EHRA 2022

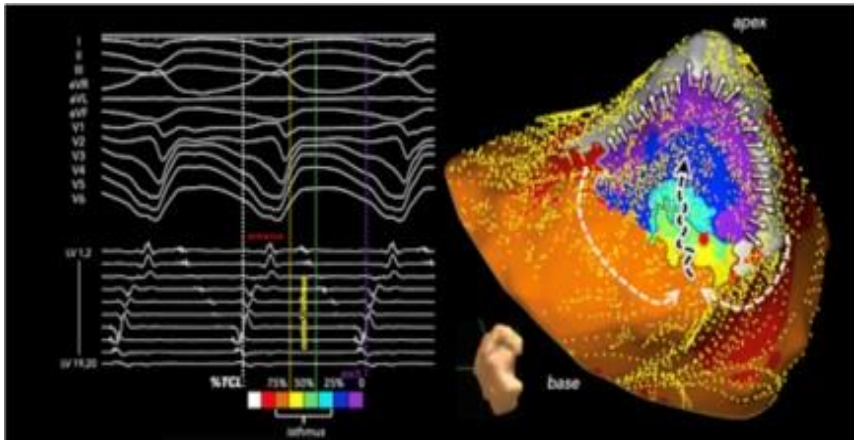
Electroanatomic mapping combined with CT scan or MRI imaging



As presented by P Jais, EHRA 2022

High Density Mapping: Simultaneous endocardial and epicardial delineation of 3D Reentrant VT

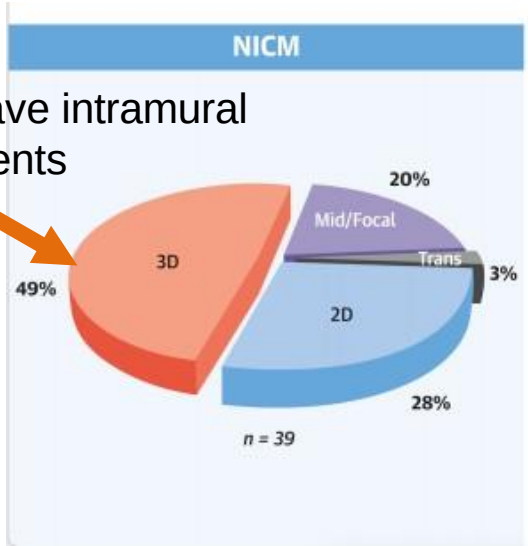
Tung et al JACC 2020

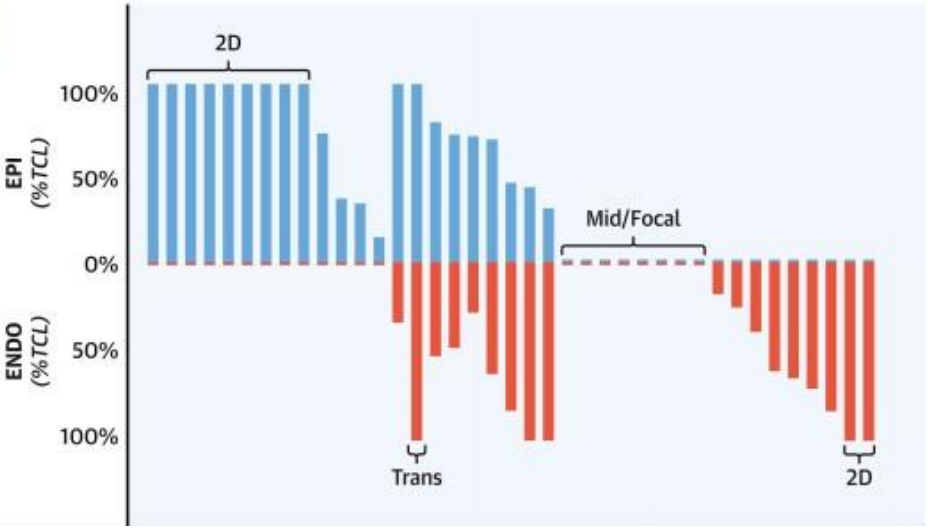


Defining activation throughout the VT cycle length

"Gaps" in the map can indicate intramural portions of the circuit

49% of circuits have intramural components

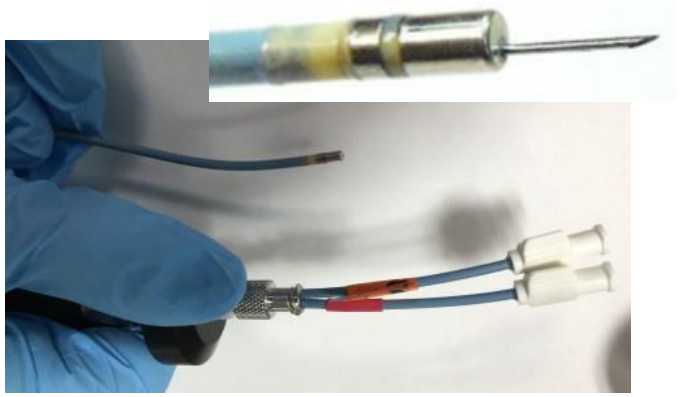




As presented by William Stevenson at EHRA 2023

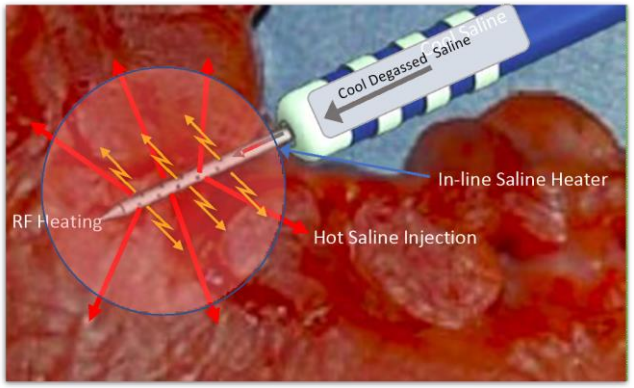
Irrigated Needle RF ablation

Single end hole irrigation
Biosense Webster



Sapp et al J Cardiovasc Electrophys 2006;17:657-61

Heated saline multiple pore irrigation
Saline Enhanced RF (SERF) Ablation
Thermedical



1 week old SERF lesions in canine heart

Suzuki, Packer et al. Heart Rhythm 2021;18:443–452

First two MRI Guided Stereotactic Body Radiation Therapy of Recurrent Sustained Ventricular Tachycardia

B. Kovacs[1], M. Mayinger[2], S. Tanadini-Lang[2], S. Ehrbar[2], L. Wilke[2], M. Chamberlain[2], A. Moreira[2], N. Weitkamp[2], C. Brunckhorst[1], F. Duru[1], J. Steffel[1], A. Breitenstein[1], H. Alkadhi[3], H. Garcia Schueler[2], R. Manka[1,3], F. Ruschitzka[1], M. Guckenberger[2], N. Andratschke[2], A.M. Saguner[1]

[1]Department of Cardiology, [2]Department of Radiation Oncology, [3]Institute of Diagnostic and Interventional Radiology, University Hospital Zurich, Zürich, Switzerland

Purpose: We report the worldwide first cases of real-time magnetic resonance image guided SBRT (MR-SBRT) in recurrent sustained ventricular tachycardia (VT) due to structural heart disease.

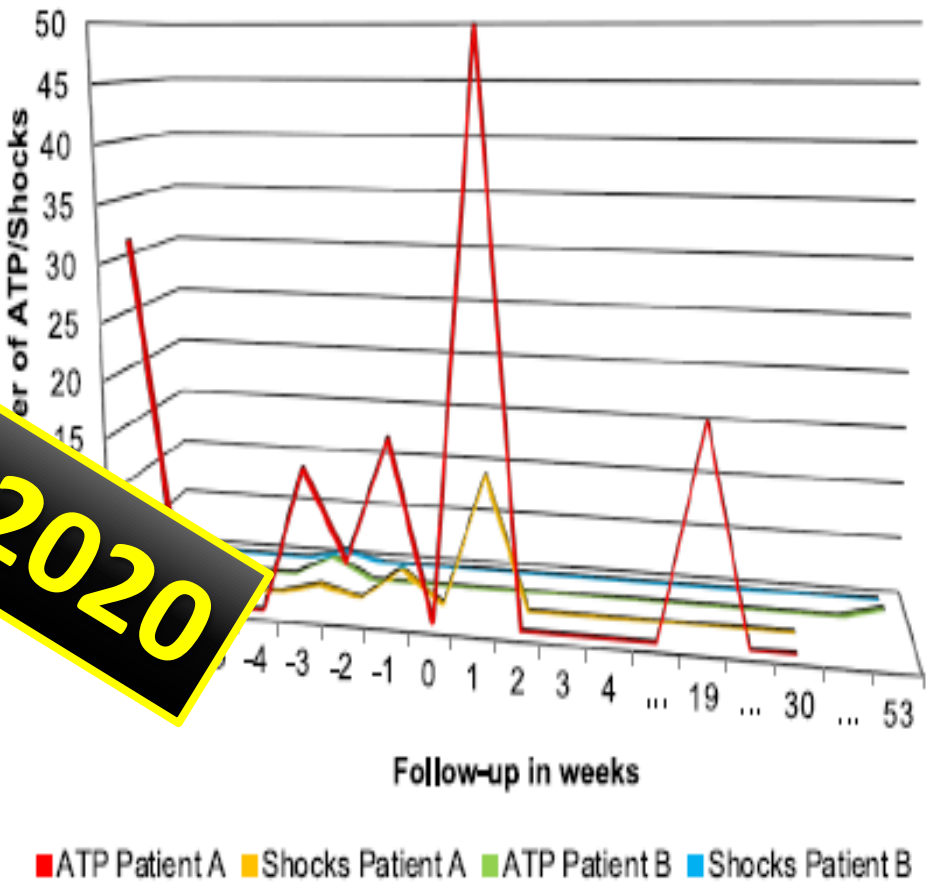
Methods: MR-SBRT was performed on in two therapy refractory patients in palliative intent to minimize repetitive ICD shocks after an interdisciplinary decision was made.

	Patient A	Patient B
Age (years)	71	74
Gender	male	male
Heart disease	DCM	DCM
LVEF (%)	32	23
Prior catheter ablations	3	1
Indication for SBRT	Electrical storm	Recurrent ICD-shocks for sustained VT
PTV (ml)	269	74
Dose (Gy)	25 (85% isodose)	25 (80% isodose)
Adverse events	Post-radiation electrical storm	Pericardial effusion
Follow-up (days)	222	320

DCM, dilated cardiomyopathy; LVEF, left ventricular ejection fraction; PTV, planned target volume; SBRT, stereotactic body radiotherapy

ESC 2020

Results:



Conclusions: In these first two cases, we demonstrate feasibility, safety and short-term efficacy of MR-SBRT.

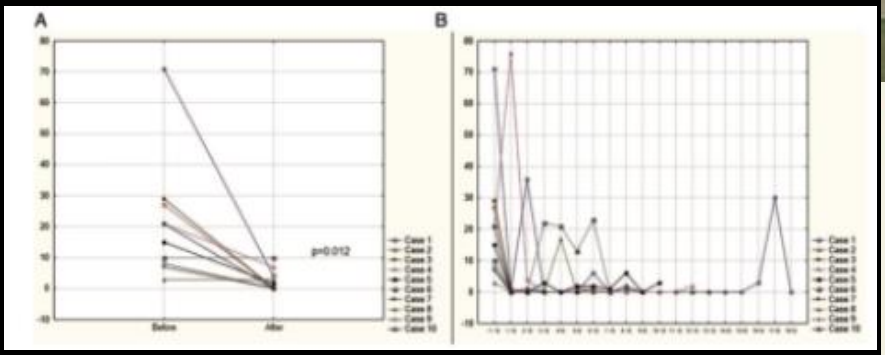
USZ Universitäts Spital Zürich

Open Access Case Report

DOI: 10.7759/cureus.*90

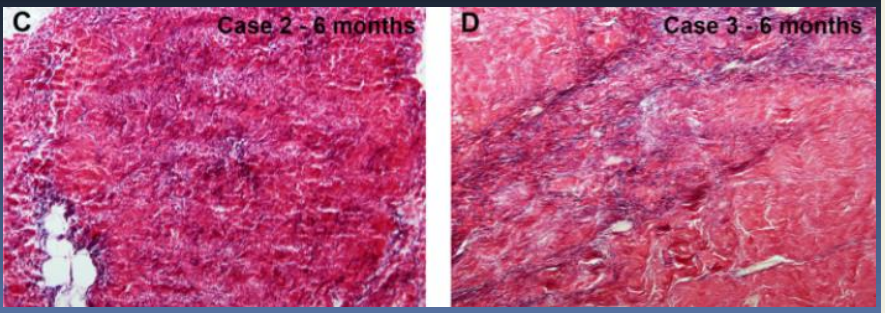
Cardiac Radiosurgery for Malignant Ventricular Tachycardia

2014



Stereotactic radiosurgery for ablation of ventricular tachycardia

Radek Neuwirth[1], Jakub Cvek[2*], Lukas Knybel[2], Otakar Jiravsky[3], Lukas Molenda[2], Michal Kodaj[3], Martin Fiala[1], Petr Peichl[4], David Feltl[5], Jaroslav Januska[3], Jan Hecko[3], and Josef Kautzner[4]



EP CASE EXPRESS

doi:10.1093/europace/euab326

Oesophagopericardial fistula as a late complication of stereotactic radiotherapy for recurrent ventricular tachycardia

Jana Haskova[1*], Kristina Jedlickova[2], Jakub Cvek[3], Lukas Knybel[3], Radek Neuwirth[4], and Josef Kautzner[1]

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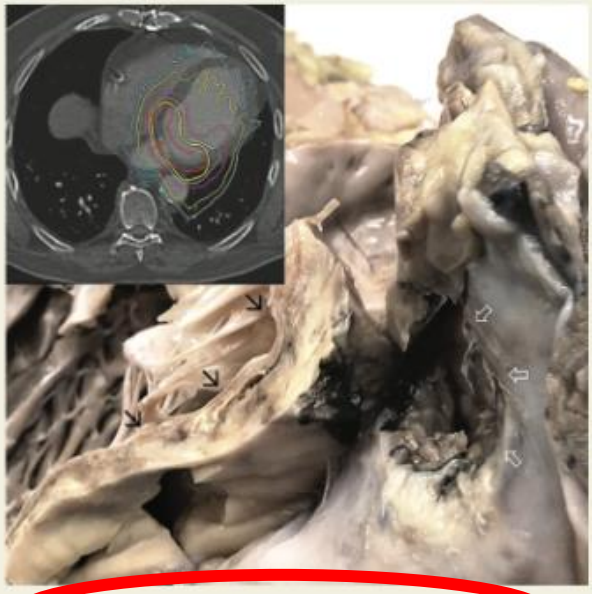
Severe adverse effects of stereotactic body radiotherapy (SBRT) for recurrent ventricular tachycardias (VTs) have not been reported. We describe the late complication of SBRT (25 Gy, CyberKnife, Accuray) in a 67-year-old patient with previous arterial coronary revascularization, including gastroepiploic artery, and subsequent recurrent VTs despite catheter ablation. He developed radiation oesophagitis 18 days after SBRT, which resolved on antiulcer therapy, and 6 months later was admitted for severe symptomatic ulcer. Despite intensive treatment, he died because of bleeding oesophagopericardial fistula. Post-mortem macroscopic picture shows the myocardial substrate in the inferior wall (black arrows) and adjacent oesophagopericardial fistula through the parietal pericardium (open arrows). Inset depicts radiosurgical treatment plan with coloured isodose lines.

Our case illustrates that SBRT may be complicated even in a long-term course, and oesophagopericardial fistula could be one of the potential complications. Therefore, the risk/benefit of SBRT for VT should be always carefully considered, and long-term follow-up is advisable.

The full-length version of this report can be viewed at: https://www.escardio.org/Education/E-Learning/Clinical-cases/Electrophysiology.



(Europace. 2022 Jul 15;24(6):969)

ESC European Society of Cardiology

European Heart Journal - Case Reports (2023) **7**, 1–3
https://doi.org/10.1093/ehjcr/ytad093

CARDIOVASCULAR FLASHLIGHT

Adult congenital heart disease

Flowerpower: p ventricular tach Ebstein's anoma

Ulrich Krause [1]*†, **Leonar and Thomas Paul**[1]

[1]Department of Pediatric Cardiology, Intensive Care Medi 099 Göttingen, Germany; and [2]Department of Cardiology and Pneumology, Heart Center, University Medical Center, Georg-August-University Göttingen, Robert-Koch-Str. 40, 37099 Göttingen, Germany

Received 15 December 2022; first decision 24 January 2023; accepted 16 February 2023; online publish-ahead-of-print 18 February 2023

Case Reports > J Cardiovasc Electrophysiol. 2023 Aug;34(8):1772-1775. doi: 10.1111/jce.16002. Epub 2023 Jul 11.

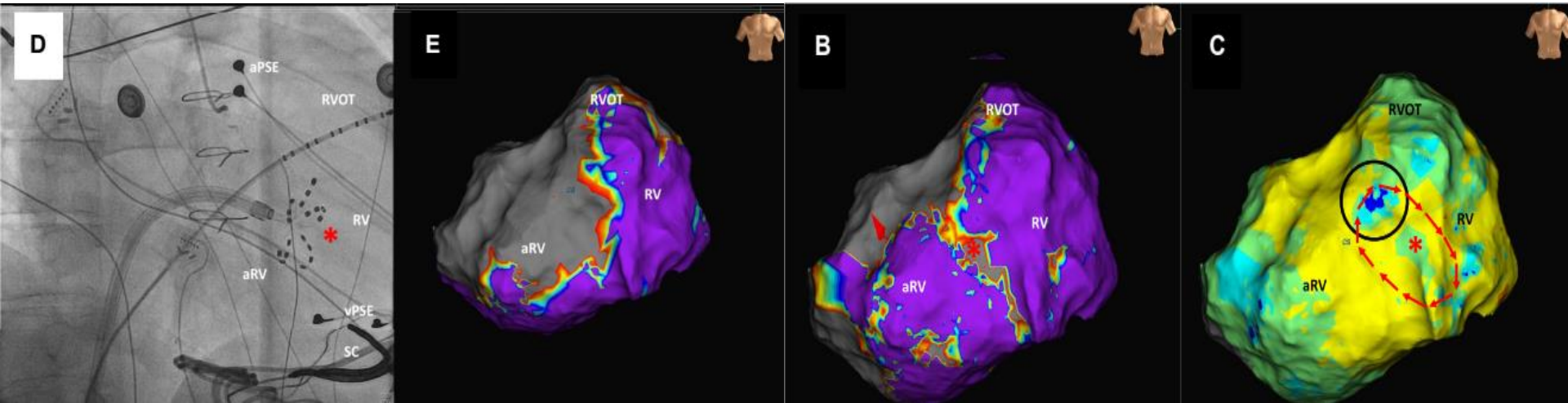
First worldwide use of pulsed-field ablation for ventricular tachycardia ablation via a retrograde approach

Claire A Martin [1 2], Myo Thant Zaw [1], Nicola Jackson [3], Dave Morris [3], Pierluigi Costanzo [1]

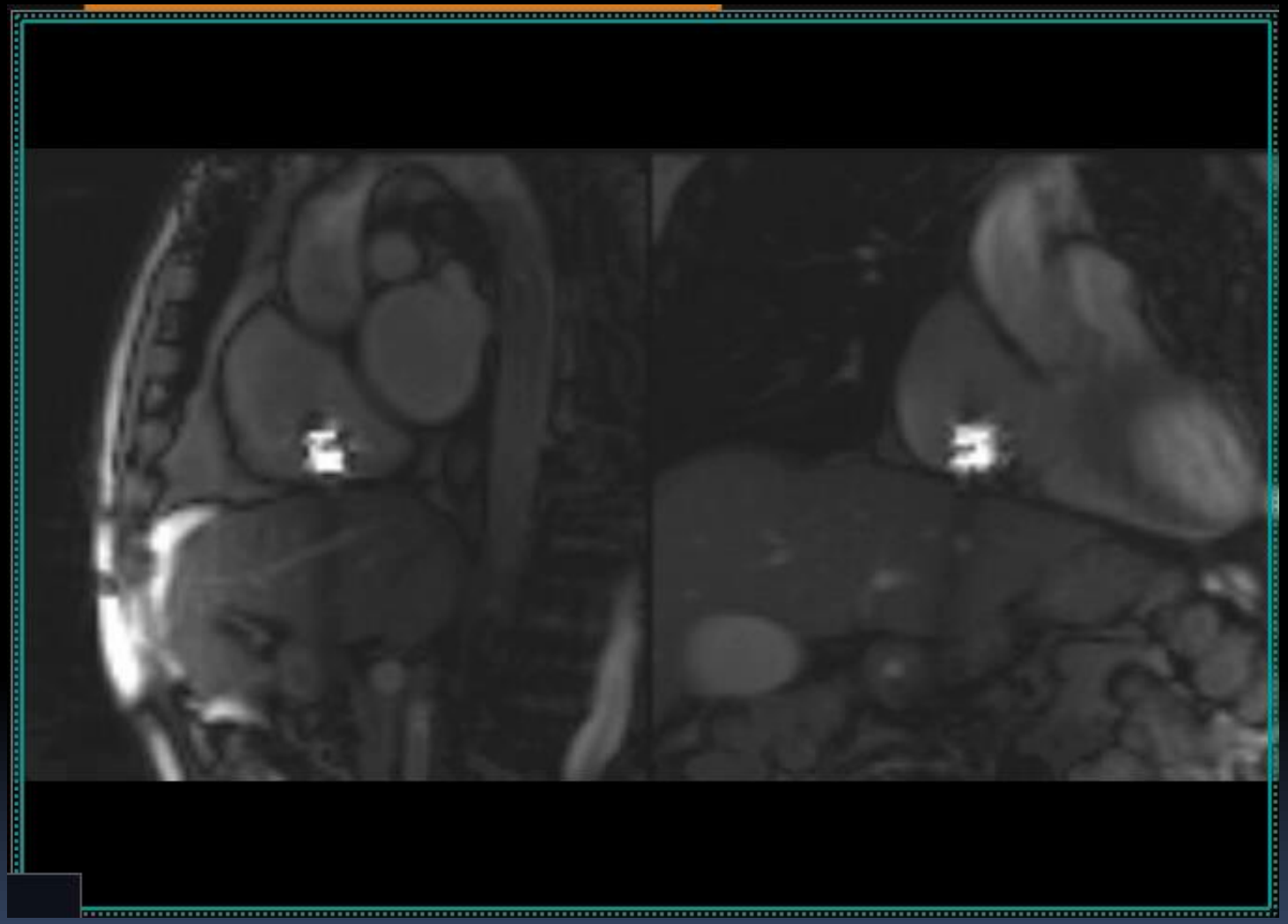
Affiliations – collapse

Affiliations

1 Royal Papworth Hospital, Cambridge, UK.
2 University of Cambridge, Cambridge, UK.
3 Boston Scientific, Marlborough, USA.



78-year old male with common atrial flutter



Henry Dunant Hospital Center, Sep 2022

Impact of chronic kidney disease on in-hospital mortality and clinical outcomes of catheter ablation of ventricular tachycardia: Insights from the national readmission database

Data from 7212 patients who underwent VT ablation in high-volume USA based EP centers

	NO CKD pts	CKD pts	
Length of stay	8,73	5,69	P<0.01
In-hospital mortality	6.7%	2.2%	P<0.01
Acute kidney injury	43%	11.3%	P<0.01

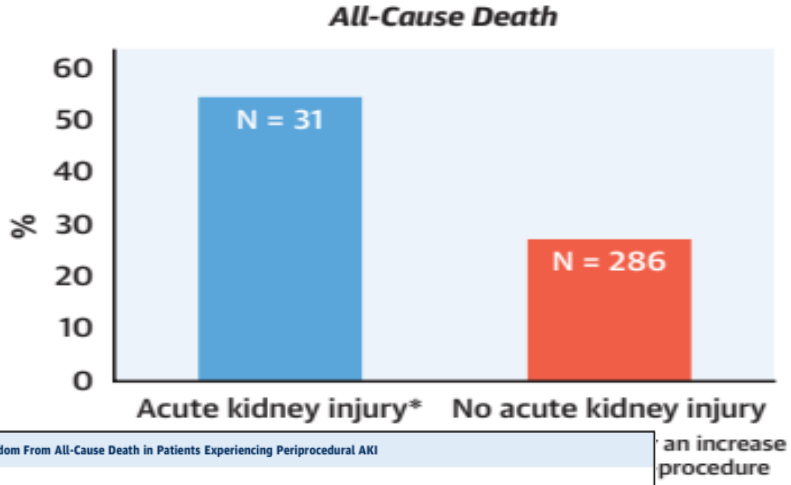
Conclusion: In patients with CKD, VT ablation is associated with worse clinical outcomes in-hospital mortality, acute kidney injury, mean length of stay, and total hospital charge. This significantly influences the decision-making prior to performing this procedure.

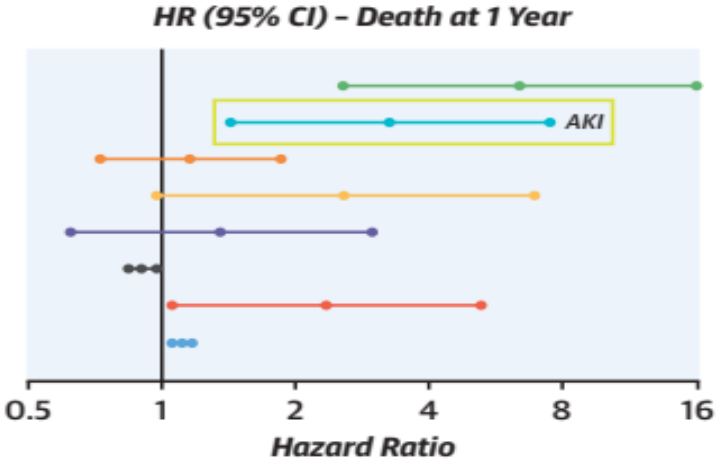
Khalil M., et al. J Interv Card Ielectrophysiol 2023;66(2):323-331. doi: 10.1007/s10840-022-01187-z

Periprocedural Acute Kidney Injury in Patients With Structural Heart Disease Undergoing Catheter Ablation of VT

CENTRAL ILLUSTRATION **Prognostic Impact of Periprocedural AKI In Patients With Structural Heart Disease Undergoing VT Ablation**

317 Consecutive Patients Undergoing Radiofrequency Catheter Ablation of Scar-Related VT With Longitudinal Assessment of Renal Function – *Median follow-up 39 (6-65) Months*

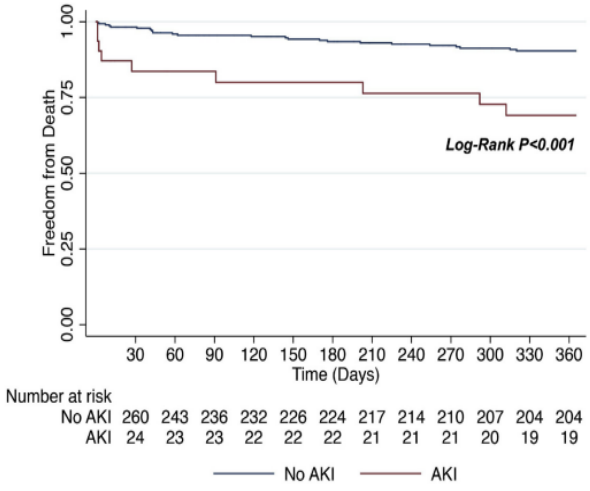




an increase
procedure

Chronic Obstructive Pulmonary Disease, Age, Ischemic Cardiomyopathy, New York Heart Association Functional Class, Ejection Fraction, Ventricular Tachycardia Storm, Diabetes
Body Mass Index
Hemodynamic Decompensation
AKI
Chronic Kidney Disease
Atrial Fibrillation
N. Inotropes/Vasopressors
Ventricular Tachycardia Recurrence

FIGURE 2 Freedom From All-Cause Death in Patients Experiencing Periprocedural AKI



Kaplan-Meier survival curve showing freedom from all-cause death in patients experiencing periprocedural acute kidney injury (AKI) compared with all-cause death in the rest of the population.

n risk of post-procedural death in patients with scar-related ventricular tachycardia (VT) undergoing
k; CI = confidence interval; HR = hazard ratio; PAINESD = Chronic Obstructive Pulmonary Disease, Age,
al Class, Ejection Fraction, Ventricular Tachycardia Storm, Diabetes.

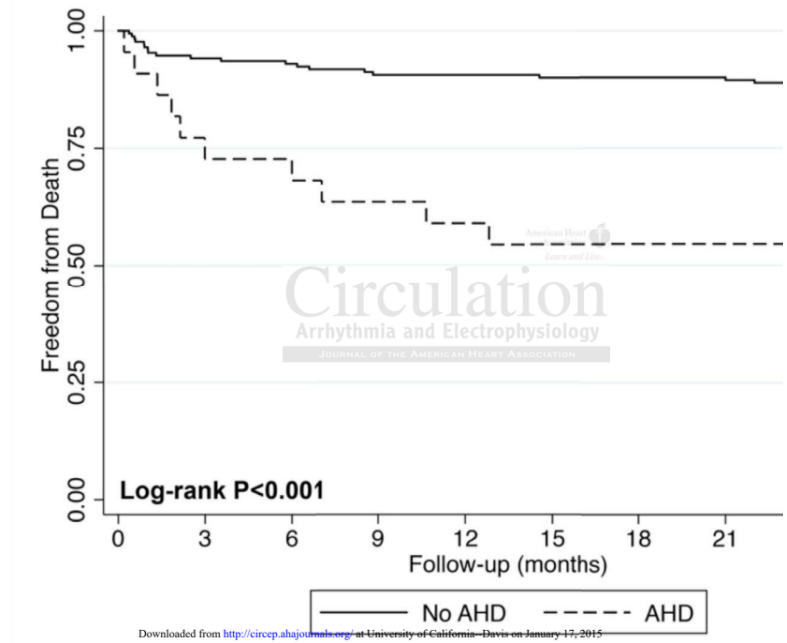
JACC EP 2021

Circulation
Arrhythmia and Electrophysiology

American Heart Association

Acute Hemodynamic Decompensation during Catheter Ablation of Scar-Related VT: Incidence, Predictors and Impact on Mortality

Pasquale Santangeli, Daniele Muser, Erica S. Zado, Silvia Magnani, Sumun Khetpal, Mathew D. Hutchinson, Gregory Supple, David S. Frankel, Fermin C. Garcia, Rupa Bala, Michael P. Riley, David Lin, J. Eduardo Rame, Robert Schaller, Sanjay Dixit, Francis E. Marchlinski and David J. Callans



PAAINESD PILOT RISK SCORE	
VARIABLE	SCORE
Pulmonary disease [chronic obstructive] – COPD	5
Age >60 years	3
Anesthesia [general]	4
Ischemic cardiomyopathy	6
NYHA class III or IV	6
Ejection fraction <25%	3
Storm [VT]	5
Diabetes mellitus	3

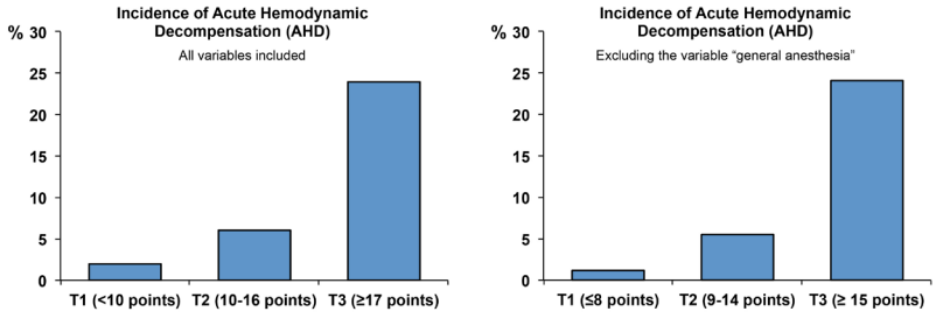
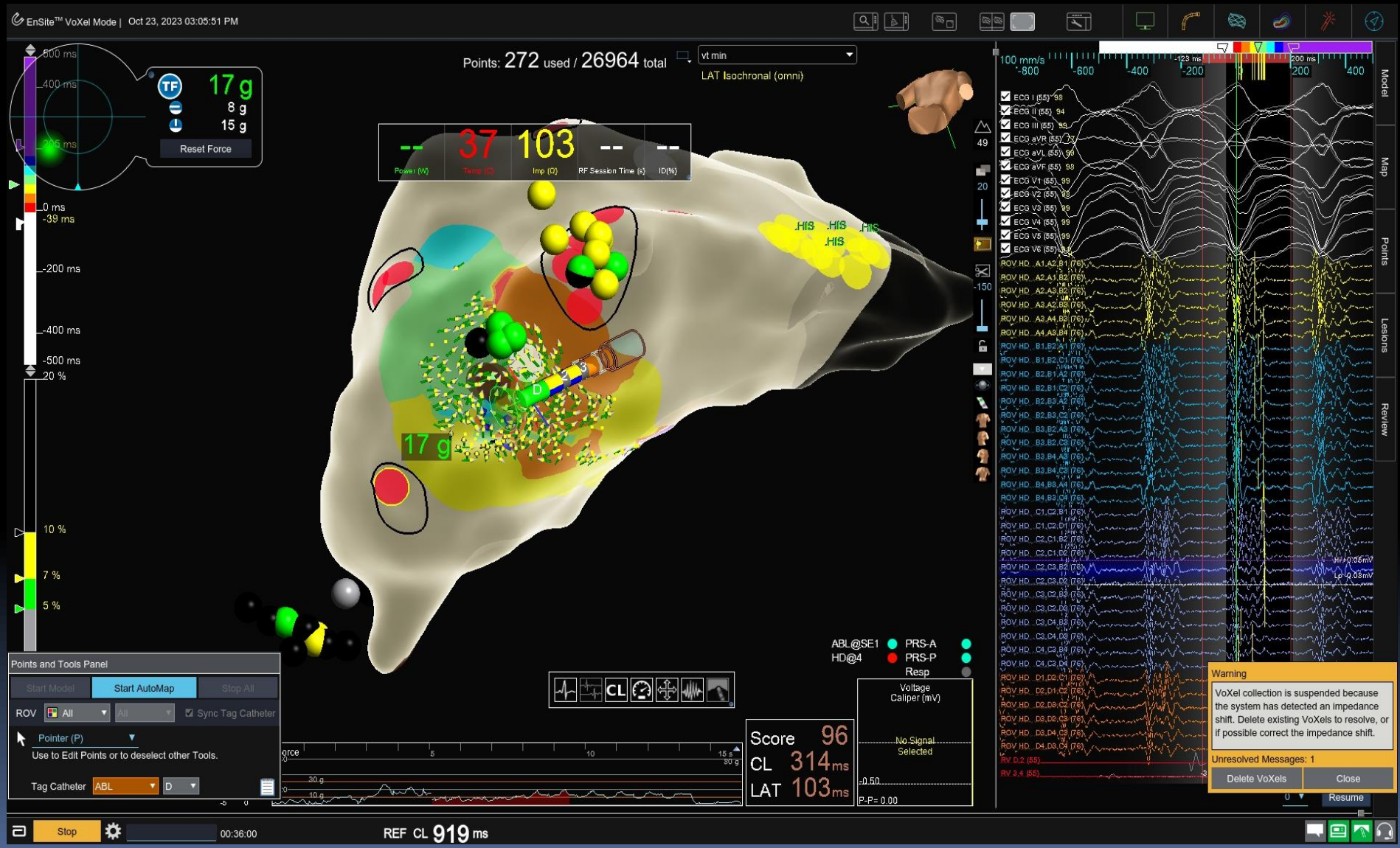


Figure: *Upper panel*: Clinical variables included in the PAAINESD risk score. Note: variables are derived from univariate logistic regression analysis. *Lower left panel*: risk of periprocedural acute hemodynamic decompensation (AHD) according to tertiles (T) of risk score including all the predictors at univariate analysis. *Lower right panel*: risk of periprocedural AHD according to tertiles (T) of risk score

Conclusions **-** AHD occurs in 11% of patients undergoing RFCA of scar-related VT and is associated with increased risk of mortality over follow-up. AHD may be predicted by clinical factors including advanced age, ischemic cardiomyopathy, more severe heart failure status (NYHA class III/IV, lower EF), associated comorbidities (diabetes, COPD), presentation with VT storm and use of general anesthesia.

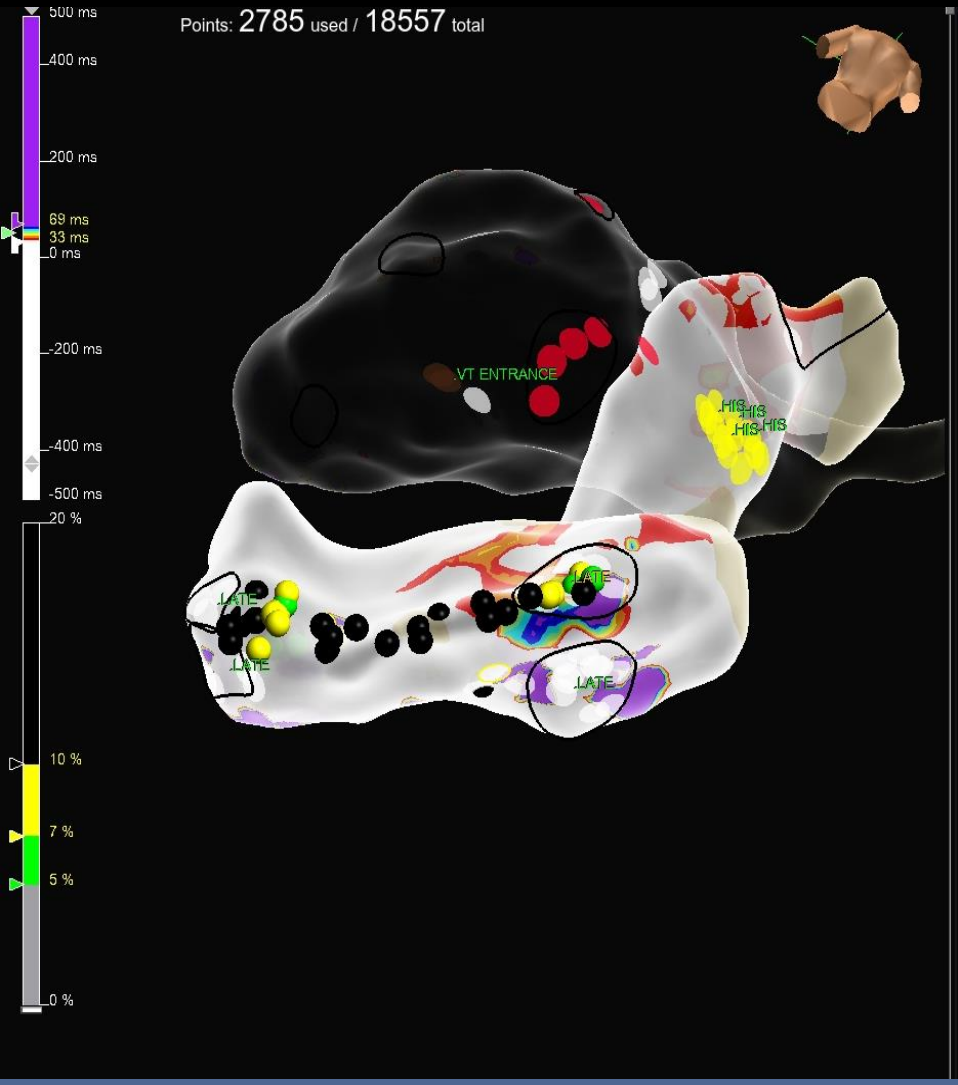
Santangeli P., et al. Circ Arrhythm Electrophysiol2015 Feb;8(1):68-75

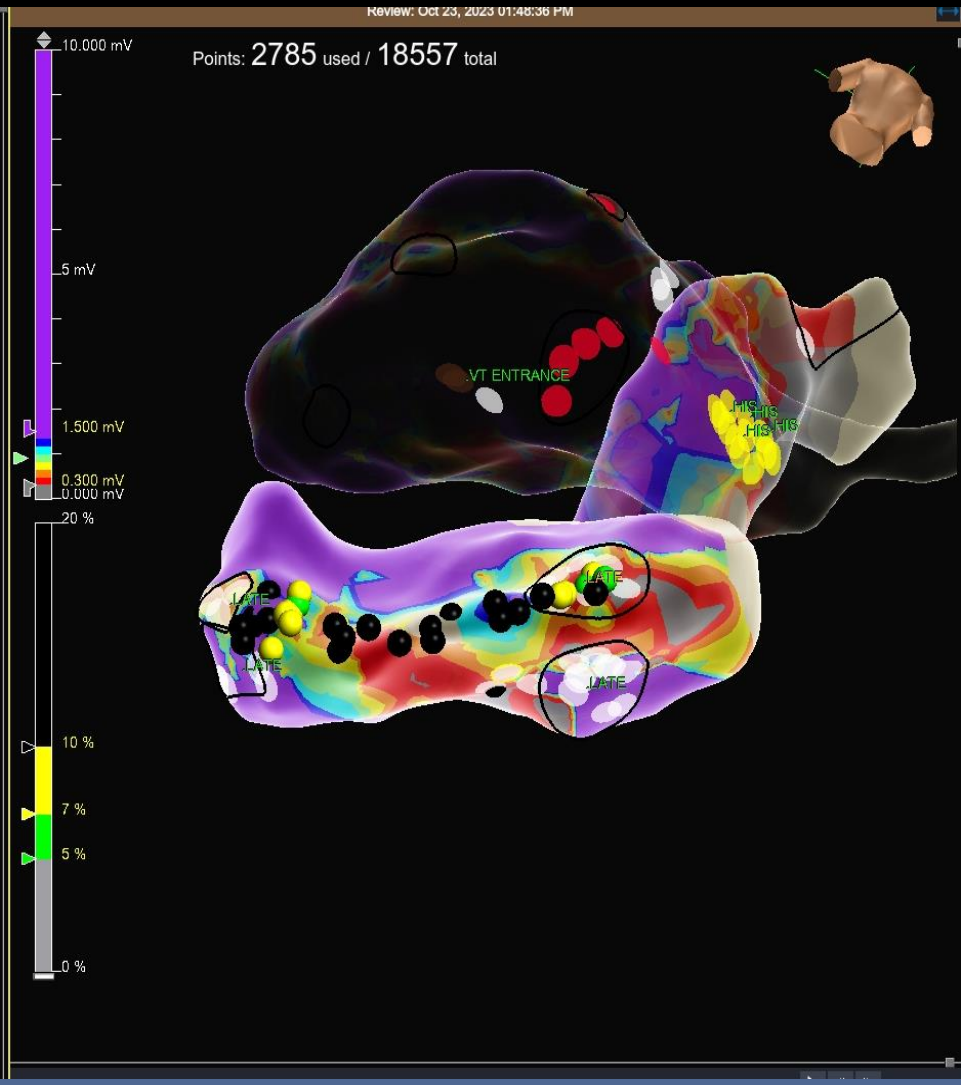
Ασθενής 52 ετών με αρρυθμιογόνο μυοκαρδιοπάθεια και προσβολή ΔΕ και ΑΡ κοιλίας (ΚΕΑΚ=25%), ICD από 10/2022 παρουσιάζει ήπια ΧΝΑ και αυξανόμενο φορτίο κοιλιακών αρρυθμιών (8 δόκιμες εκφορτίσεις του ICD κατά την τελευταία εβδομάδα)



Αρχείο Γ.Ανδρικόπουλου, ΓΝΑ «Ερρίκος Ντυνάν» 2023

Ασθενής 52 ετών με αρρυθμιογόνο μυοκαρδιοπάθεια και προσβολή ΔΕ και ΑΡ κοιλίας (ΚΕΑΚ=25%), ICD από 10/2022 παρουσιάζει ήπια ΧΝΑ και αυξανόμενο φορτίο κοιλιακών αρρυθμιών (8 δόκιμες εκφορτίσεις του ICD κατά την τελευταία εβδομάδα)





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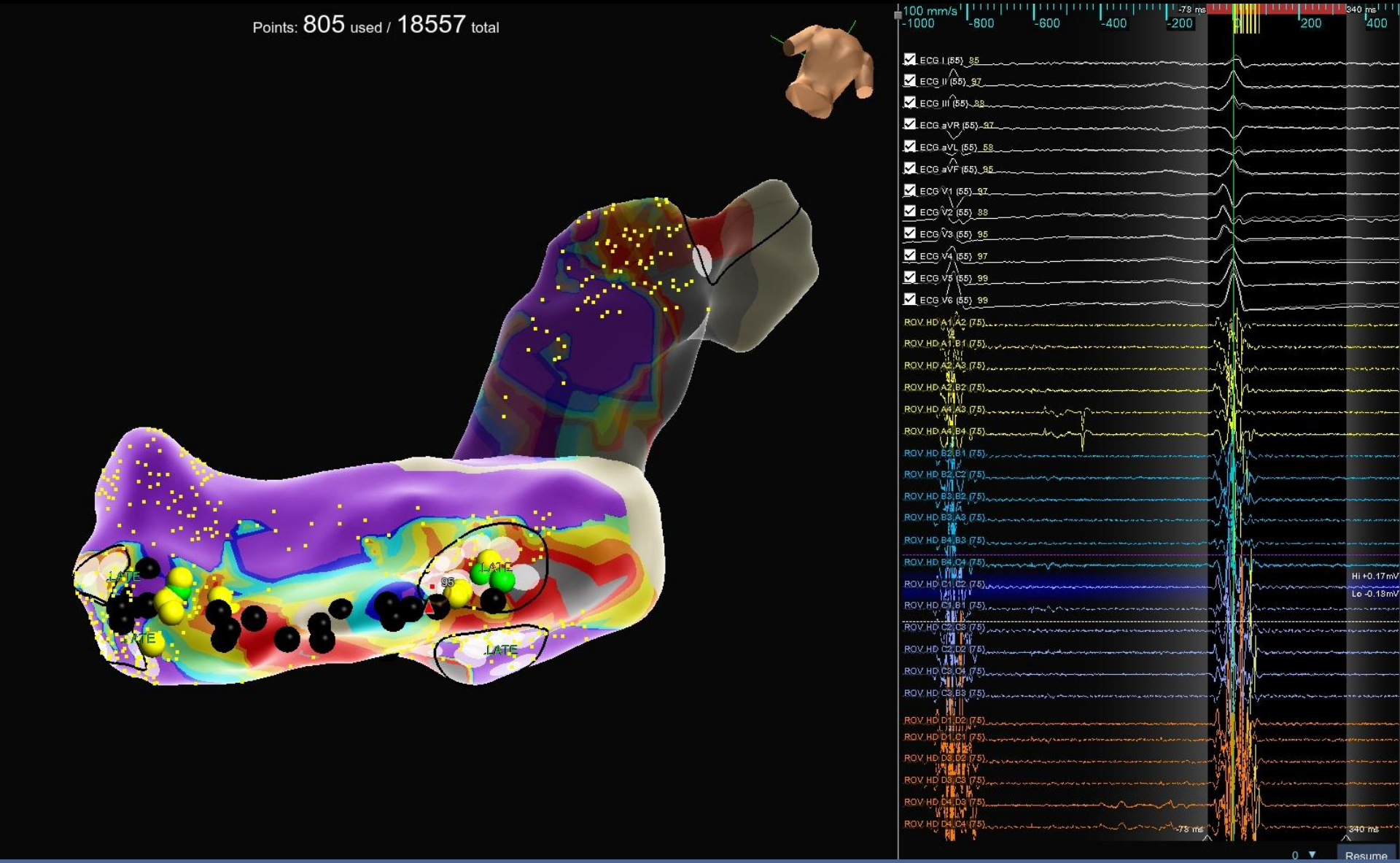
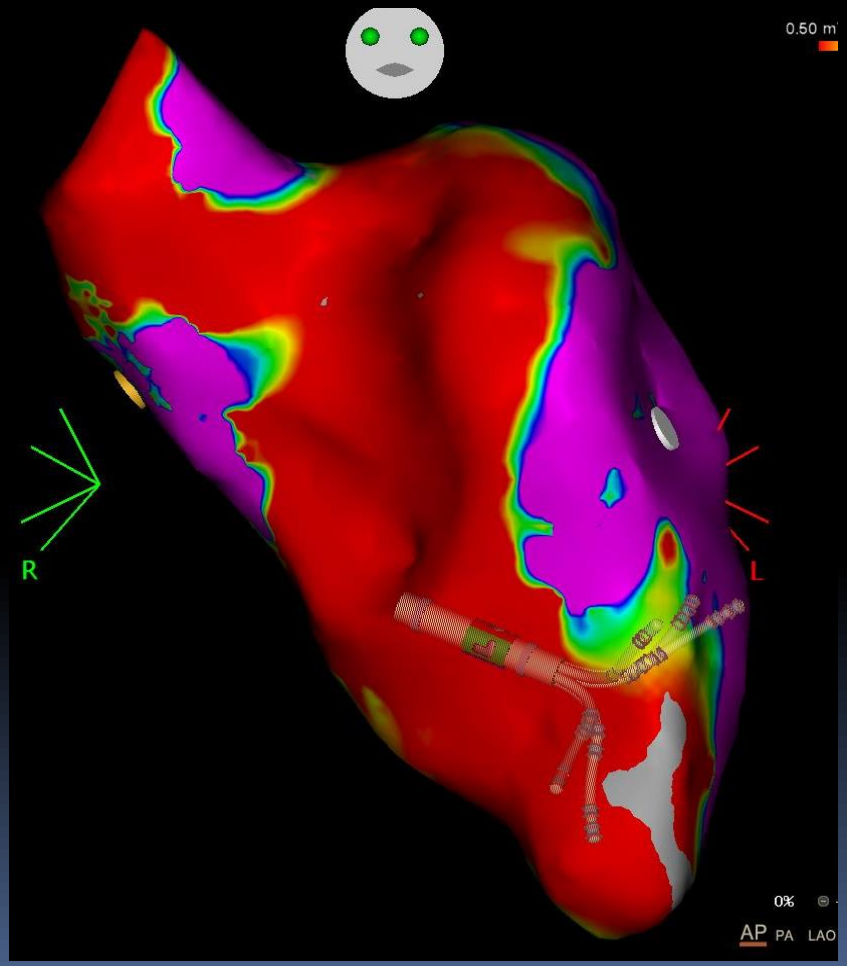
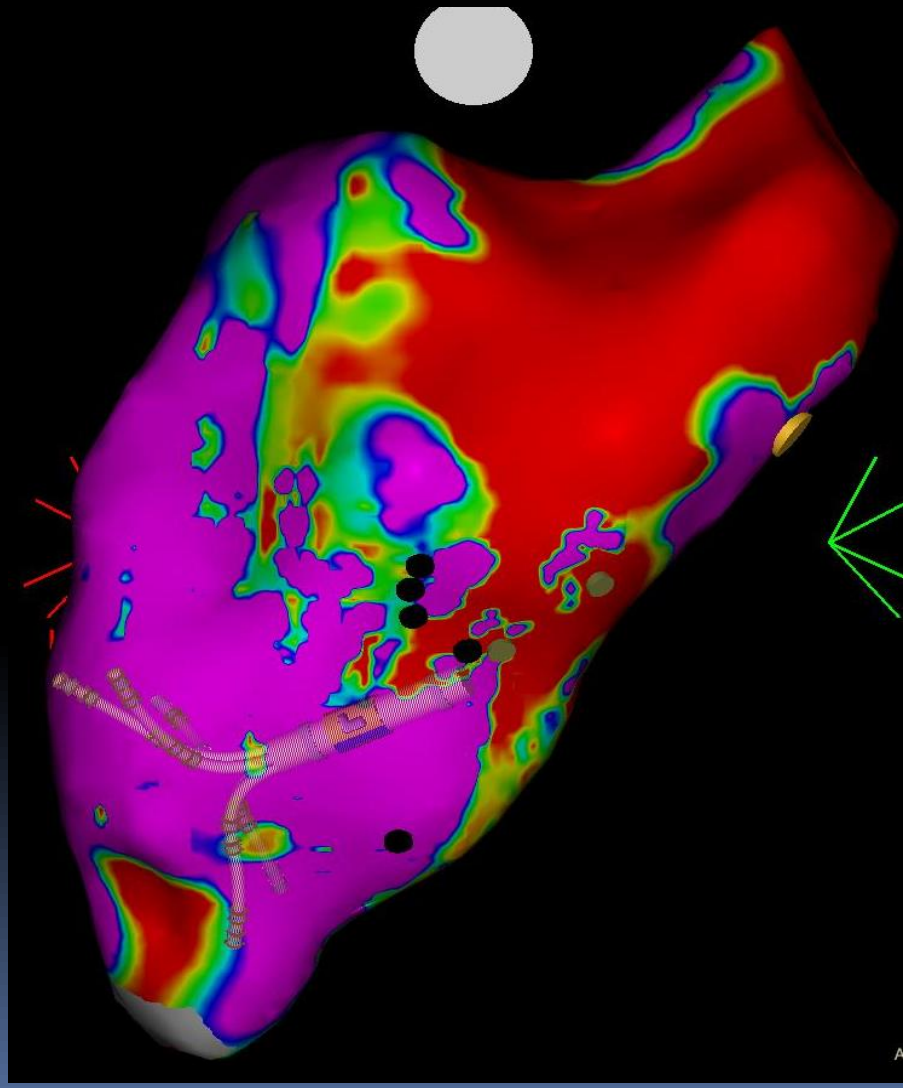


Νοσηλεία στη ΜΕΘ (διασωληνωμένη υπό καταστολή)
Υποξύ ΕΜ (ΚΕΑΚ=15%) – ΟΝΑ (Κρεατινίνη 2 ως 3 mg/dl)
Πλήρης επαναιμάτωση (PCI) κι επιβεβαιωτική στεφανιογραφία l;ogv ast;aueiaw
Πολλαπλές απινιδώσεις με VT/VF υπό πλήρη αγωγή (amio+mexiletine+bblockers+ranolazine)





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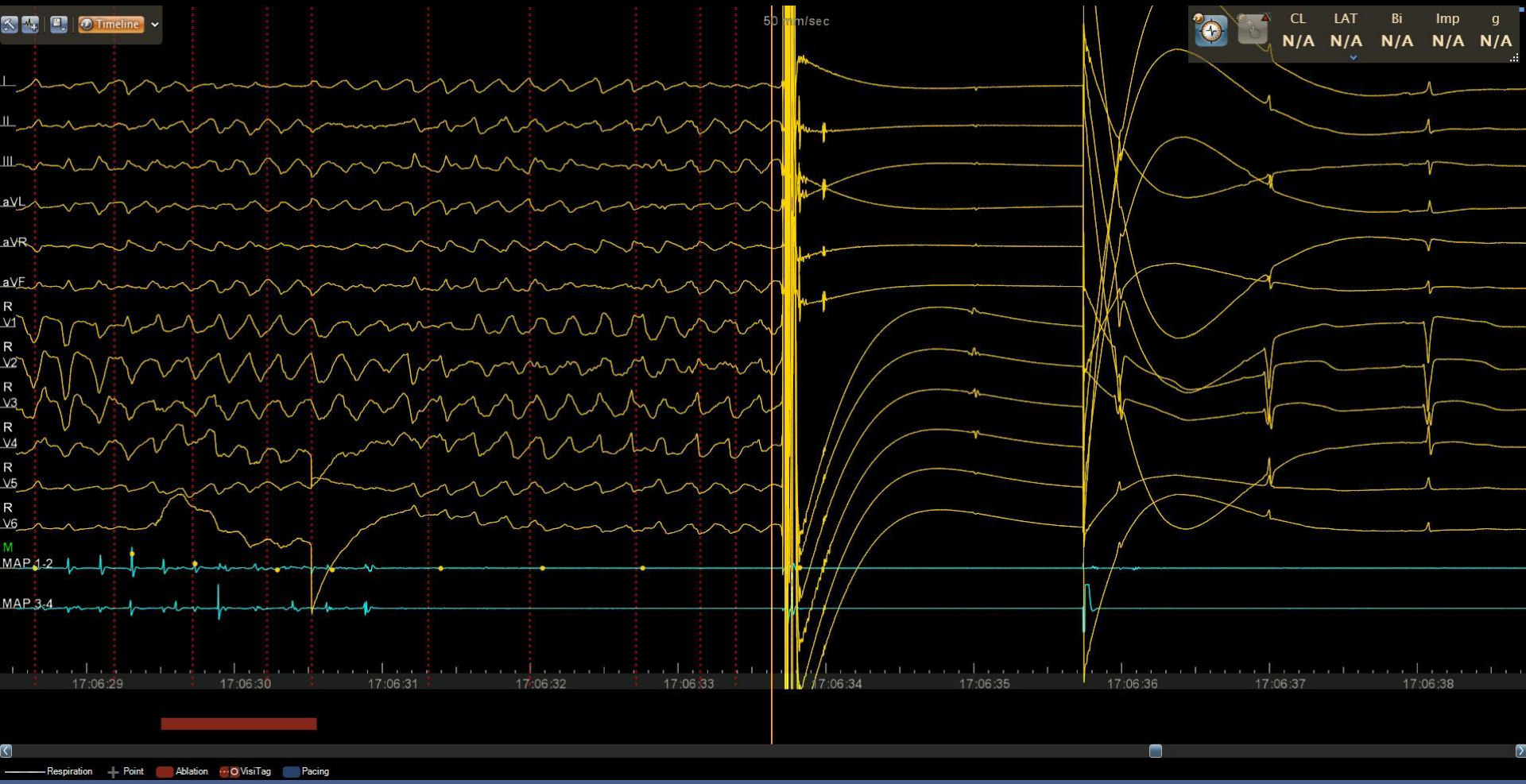

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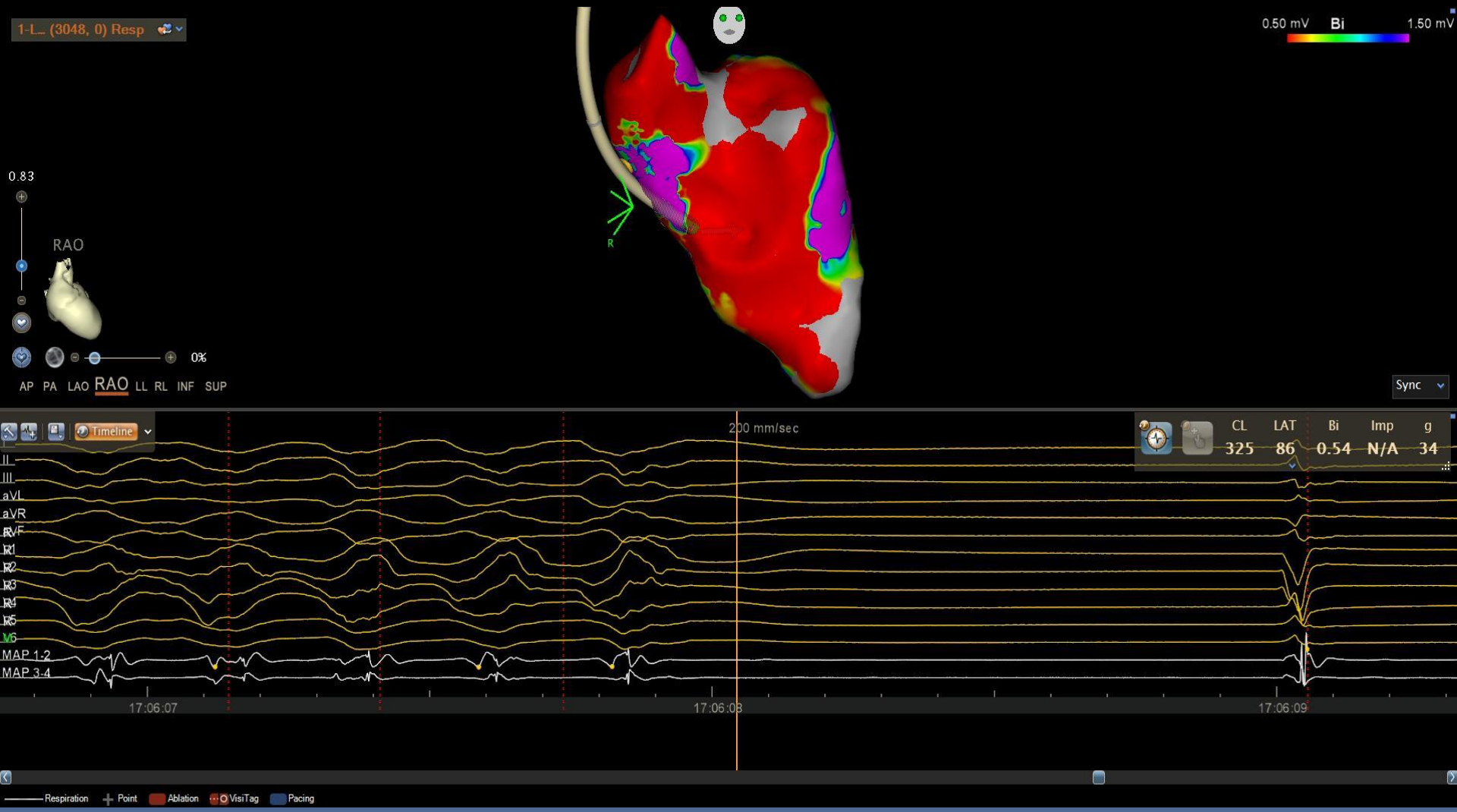

Κατάλυση της κοιλιακής ταχυκαρδίας σε καρδιακή και νεφρική ανεπάρκεια

- Δυνατότητα αιμοδυναμικής υποστήριξης

Circulation
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Acute Hemodynamic Decompensation during Catheter Ablation of Scar-Related VT: Incidence, Predictors and Impact on Mortality

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Circ Arrhythm Electrophysiol. published online December 9, 2014;
Circulation: Arrhythmia and Electrophysiology is published by the American Heart Association, 7272 Gre
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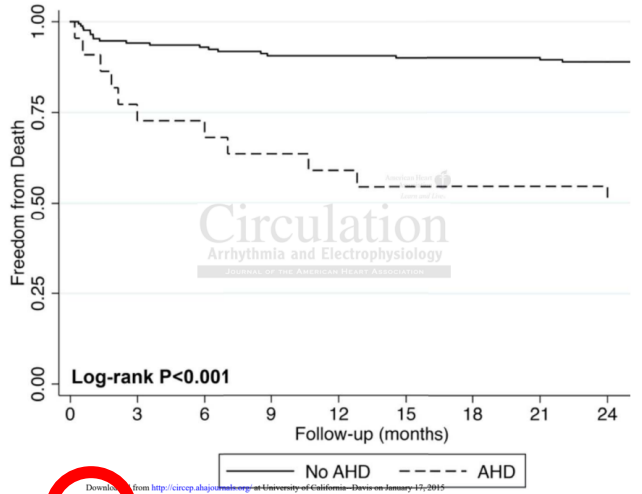
Print ISSN: 1941-3149. Online ISSN: 1941-3084



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Heart, Lung and Circulation (2018) xx, 1–12
1443-9506/04/$36.00
https://doi.org/10.1016/j.hlc.2018.10.006

Mechanical Circulatory Support During Catheter Ablation of Ventricular Tachycardia: Indications and Options

Sohaib A. Virk, MD [a], Arieh Keren, MBBS [b], Adam Eslick, MBBS [c], Saurabh Kumar, MBBS, PhD [d*]

«Available options for haemodynamic support include an intra-aortic balloon pump (IABP), TandemHeart left atrial to femoral artery bypass system, Impella left ventricle (LV) to aorta flow- assist system and extracorporeal membrane oxygenation (ECMO)»

Κατάλυση της κοιλιακής ταχυκαρδίας σε καρδιακή και νεφρική ανεπάρκεια

- Δυνατότητα αιμοδυναμικής υποστήριξης
- Επέμβαση υπό πλήρη νάρκωση ΜΕ αναισθησιολόγο
- Δυνατότητα μετεπεμβατικής νεφρικής κάθαρσης
- Δυνατότητα άμεσης χειρουργικής αντιμετώπισης επιπλοκών
- Δυνατότητα ένδο/έπικαρδιακής κατάλυσης
- Στρατηγική τροποποίησης υποστρώματος
- ΤΑΧΥΤΗΤΑ
- ΣΟΦΡΩΣΥΝΗ

Ευχαριστώ