Ventricular Arrhythmias

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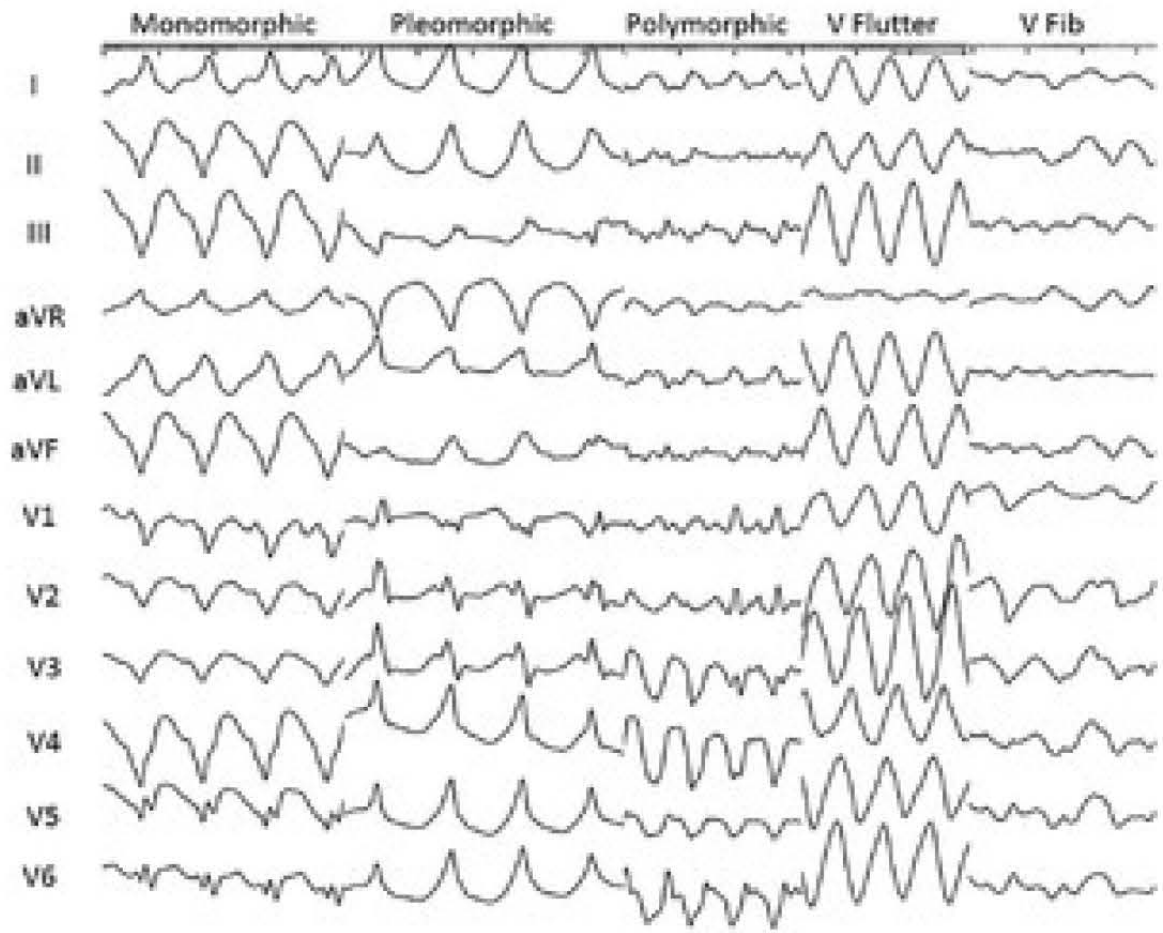

From the ESC textbook

Figure 42.1.1

Morphologies of ventricular arrhythmias. The 12-lead ECGs for the common forms of ventricular arrhythmias are shown from most organized to least. V, ventricular; V fib, ventricular fibrillation.

General consideration

- Ventricular tachycardias due to genetic arrhythmia syndromes (usually caused by disorders of ion-channel function) tend to be polymorphic on ECG (not originating from a single discrete focus) and are typically not amenable to catheter ablation

Ventricular arrhythmias

- Idiopathic VA - **Only 10% of cases of VT occur in the absence of structural heart disease, termed** *idiopathic* **VT.**
  - **Focal VT – most common origin –outflow tract (70%)**
  - **Fascicular VT (Belhassen VT)**
- Scar related VT
  - Ischemic
  - Nonischemic CMP
  - Sarcoidosis
  - Arrhythmic CMP
- Bundle branch reentry VT

Recent Clinical Case

- 47 year old
- EF ~ 40-45%
- No IHD
- Treated with beta blockers and ACE inh
- Holter- 40% PVC’s
- MRI from 2016 no evidence for scar
- HOW SHOULD WE MANAGE THIS PATIENT?


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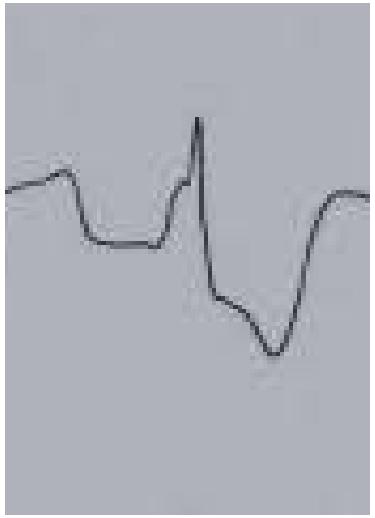
V1



Idiopathic ventricular arrhythmias

- Idiopathic ventricular arrhythmias (VAs) occur in patients with structurally normal hearts.
- Spectrum of clinical presentation
  - isolated premature ventricular contractions (PVCs),
  - Repetitive nonsustained or sustained ventricular tachycardia (VT)
  - PVC-triggered ventricular fibrillation.
- Majority originate from the outflow tract of the right ventricle (RV) and left ventricle (LV), but they may arise from anywhere in the heart.

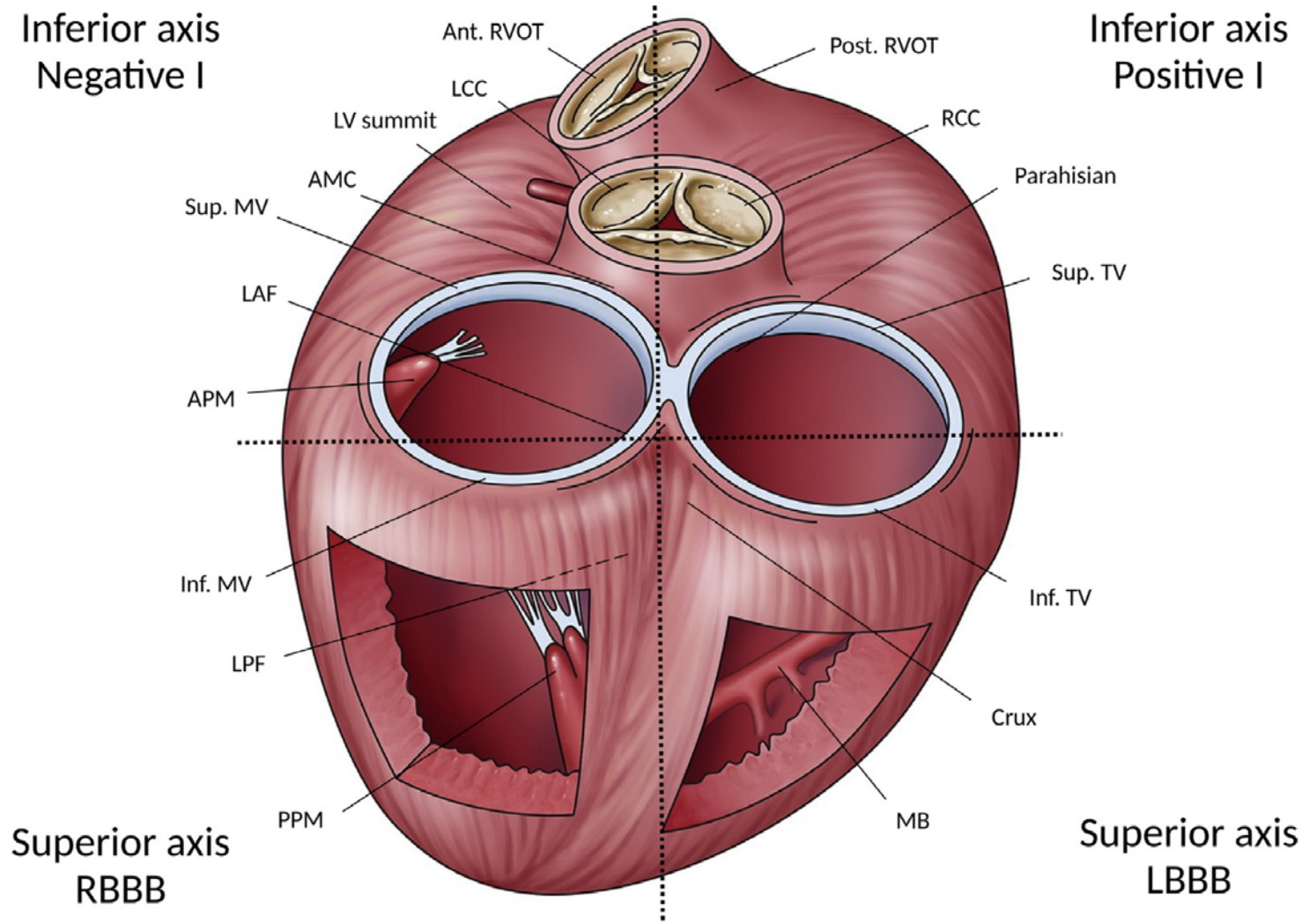


Figure 1 Anatomic approach for the regionalization of the VA site of origin based on frontal plane axis and bundle branch block pattern. AMC = aortomitral continuity; APM = anterolateral papillary muscle; Inf. = inferior; LAF = left anterior fascicle; LBBB = left bundle branch block; LCC = left coronary cusp; LPF = left posterior fascicle; LV = left ventricular; MB = moderator band; MV = mitral valve; PPM = posteromedial papillary muscle; RBBB = right bundle branch block; RCC = right coronary cusp; RVOT = right ventricular outflow tract; Sup. = superior; TV = tricuspid valve; VA = ventricular arrhythmia.

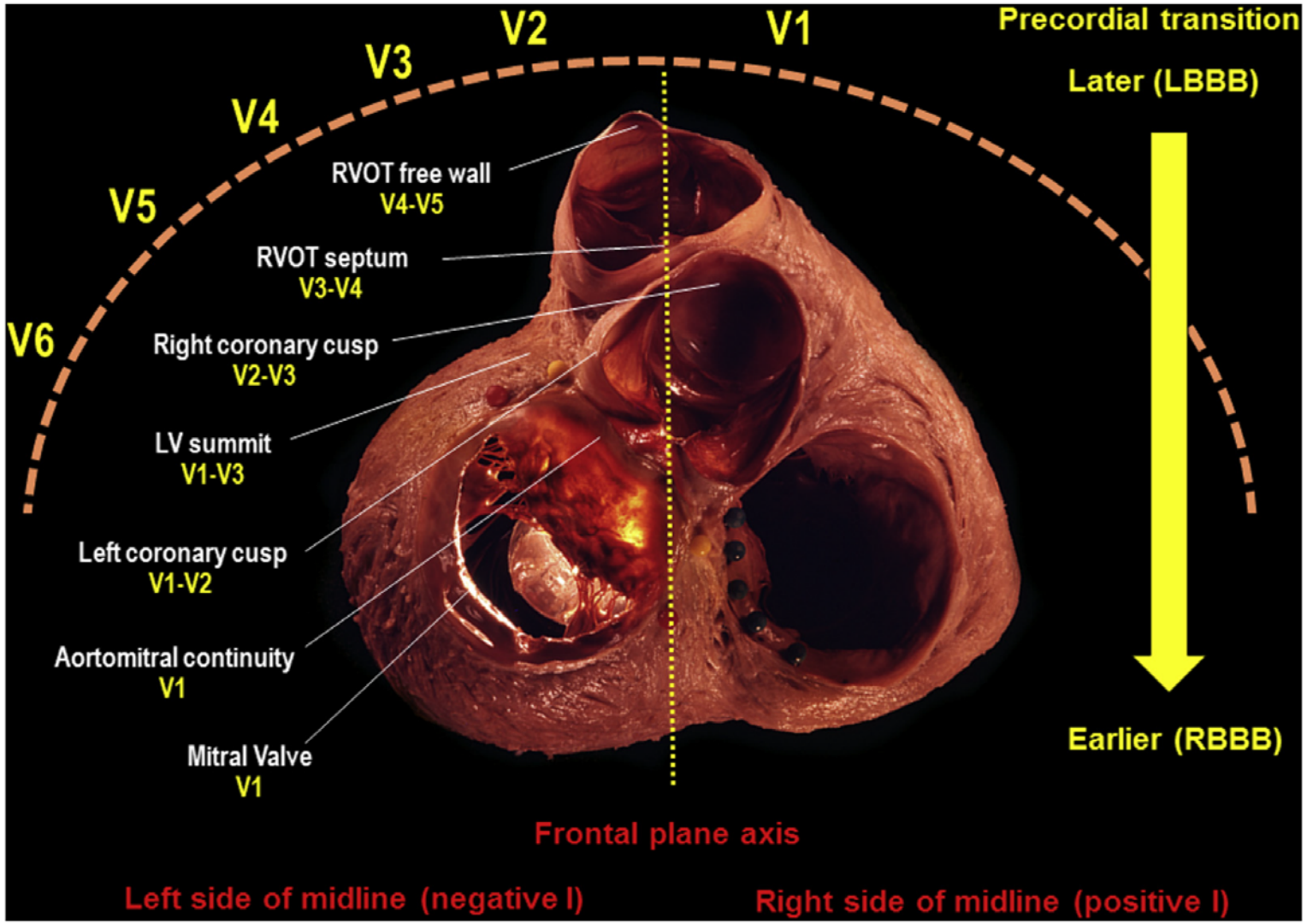
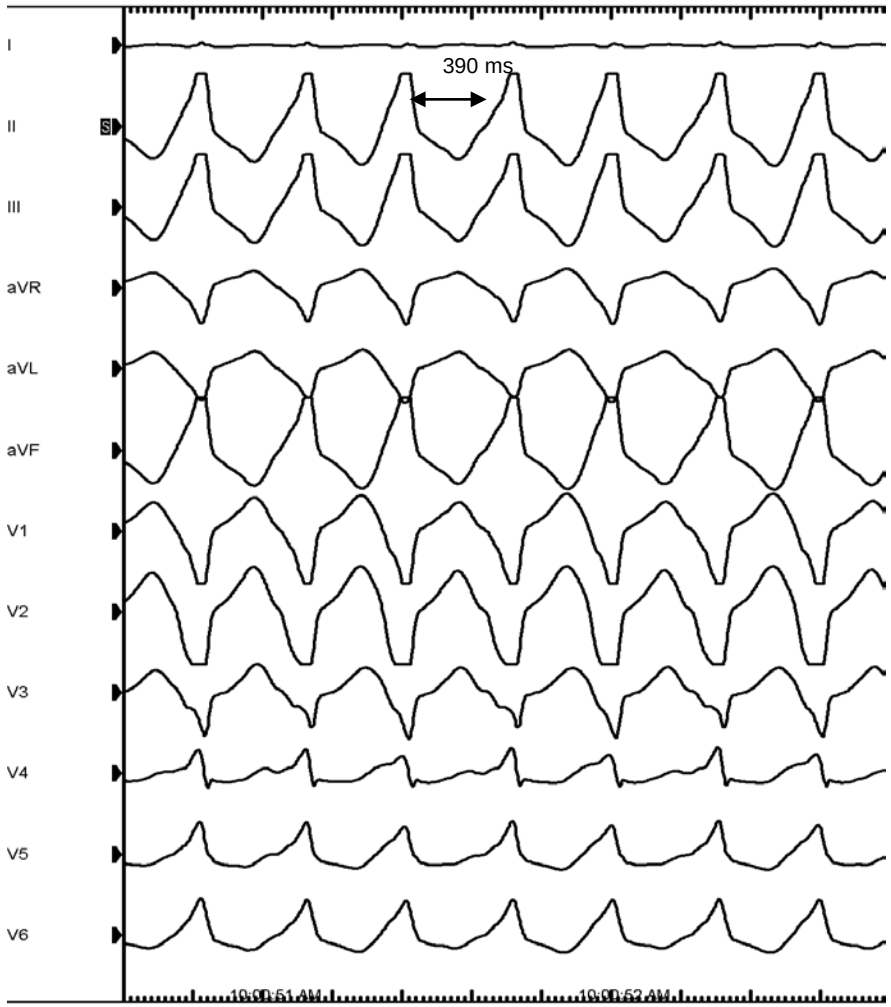
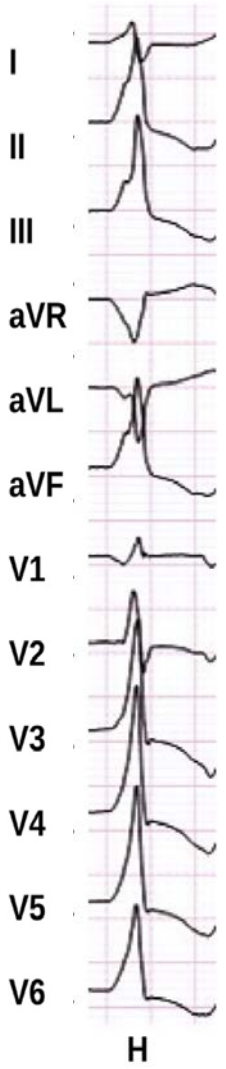


Figure 2 Anatomical schema to understand the electrocardiographic patterns of outflow tract VAs, showing the value of precordial transition and frontal plane axis. The free wall of the RVOT is the most anterior structure, and the precordial transition occurs progressively earlier as we move toward the anterolateral mitral annulus. Lead I polarity allows one to discriminate structures located leftward from the midline from those located on the right side. Note that the anterior aspect of the RVOT is actually a leftward structure while the right coronary cusp of the aortic valve is a rightward structure. Abbreviations as in Figure 1. Reproduced from Dr K. Shivkumar with permission. Copyright UCLA Cardiac Arrhythmia Center, McAlpine Collection.

RVOT VT



LVOT PVC (AMC)



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The V_2 Transition Ratio

A New Electrocardiographic Criterion for Distinguishing Left From Right Ventricular Outflow Tract Tachycardia Origin

Brian P. Betensky, MD, Robert E. Park, Francis E. Marchlinski, MD, Matthew D. Hutchinson, MD, Fermin C. Garcia, MD, Sanjay Dixit, MD, David J. Callans, MD, Joshua M. Cooper, MD, Rupa Bala, MD, David Lin, MD, Michael P. Riley, MD, PHD, Edward P. Gerstenfeld, MD

Philadelphia, Pennsylvania

- Several ECG criteria have been proposed for differentiating left from right OTVT origin; ventricular tachycardias (VTs) with left bundle branch block and V(3) transition remain a challenge.

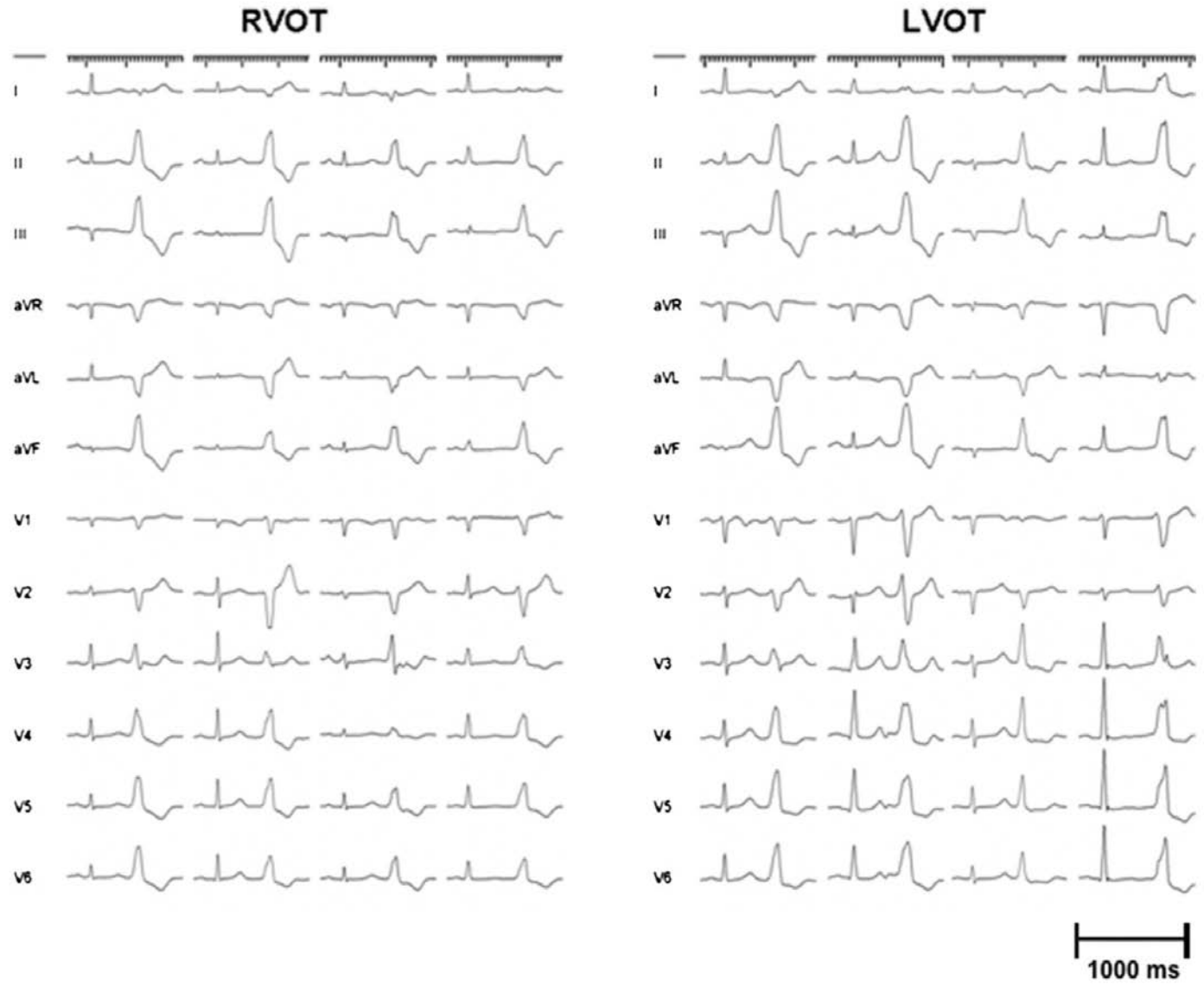


Figure 6 **Representative Outflow Tract PVC Surface ECG Recordings**

The SR QRS and PVC morphologies from the retrospective cohort demonstrating the relatively earlier SR precordial transition in RVOT **(left)** compared with patients with LVOT PVC origin **(right)**. The ECG speed: 25 mm/s. Lead gain standardized to 1/16. Abbreviations as in Figures 3 and 4.

Indication for treatment

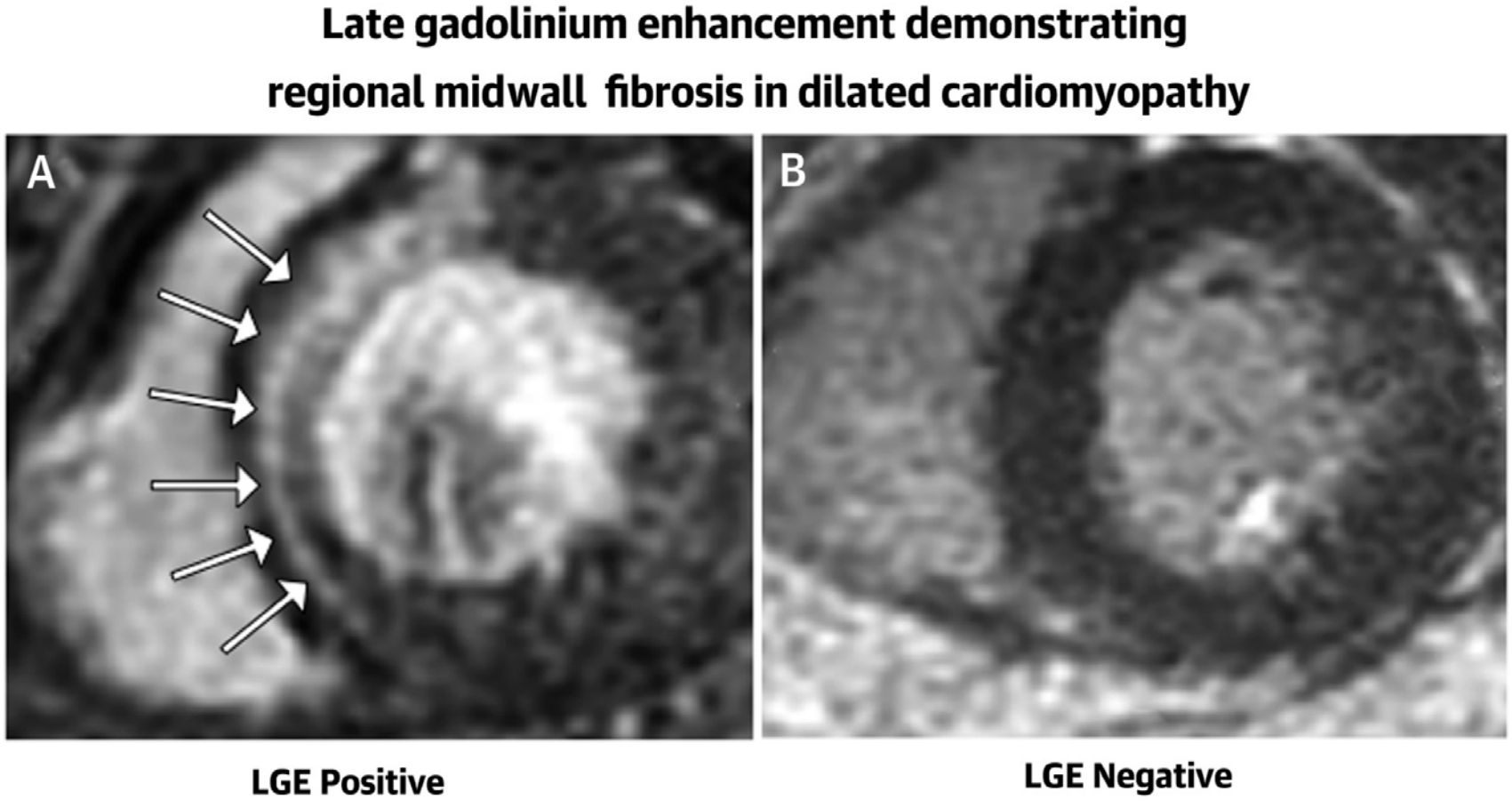
- Symptomatic
- Tachy ind CMP (usually with PVC burden > 15%)
- Drugs
  - BB, Ca blockers
  - Ic
  - Amiodarone
- Ablation-Idiopathic ventricular tachycardias can be ablated with limited delivery of radiofrequency energy to the site of origin of the arrhythmia.

Arrhythmia-induced cardiomyopathy (AiCM)

- Tachycardia-induced cardiomyopathy
- AF-CM
- PVC-CM

Scar burden < 10% predicts reversibility of AF-CM

FIGURE 2 MRI-Detected Midwall Ventricular Fibrosis in Idiopathic Cardiomyopathy



An example of midwall fibrosis as detected by the presence of late gadolinium enhancement (LGE) on CMR. **Panel A** shows a short-axis view demonstrating midwall fibrosis highlighted in **white** along the inter-ventricular septum **(arrows)**. **Panel B** shows a patient with no detectable LGE. Abbreviations as in Figure 1.

PVC-CARDIOMYOPATHY

- LV dysfunction caused solely by frequent PVCs
- Superimposed PVC-CM is defined as worsening of LVEF by at least 10% due to frequent PVCs in a previously known CM
- PVC burden > 10% is significant enough to trigger PVC-CM.
- Diagnosis of exclusion,
  - suspected when PVCs burden >10%
  - nonischemic CM.
- Challenge is to identify when PVCs are the etiology of a CM or just “innocent bystander”

TABLE 5 Clinical and PVC Features to Identify PVC-CM

	CM Resulting in PVCs	PVCs Causing CM
Patient characteristics	Older with known heart disease	Healthy otherwise
Comorbidities	CAD, myocarditis, RV dysplasia	No prior cardiac hx
Echocardiogram	Segmental hypokinesis, LVEF <25%	Global hypokinesis, LVEF 37 ± 10%
Cardiac magnetic resonance imaging (late-gadolinium enhancement)	Significant scar	Absence or minimal scar burden (≤9 g)
PVC frequency	<5,000/24 h (<5%)	≥10,000/24 h (≥10%)
PVC pattern	Multifocal	Monomorphic
QRS morphology	Nonspecific	RVOT/LVOT/epicardial
Response to PVC suppression	No change in LV function	Improvement of LV function

CAD = coronary artery disease; RV = right ventricular; RVOT = right ventricular outflow tract; other abbreviations as in Table 4.

Echo

- PVC-CM is characterized by mild to moderate LV systolic dysfunction
- LV dilatation
- Mild mitral regurgitation
- Mild LA enlargement
- Resolves within 2 to 12 weeks after elimination of PVC’s

MRI

- Scar burden may predict the response to PVC suppression

Risk factors

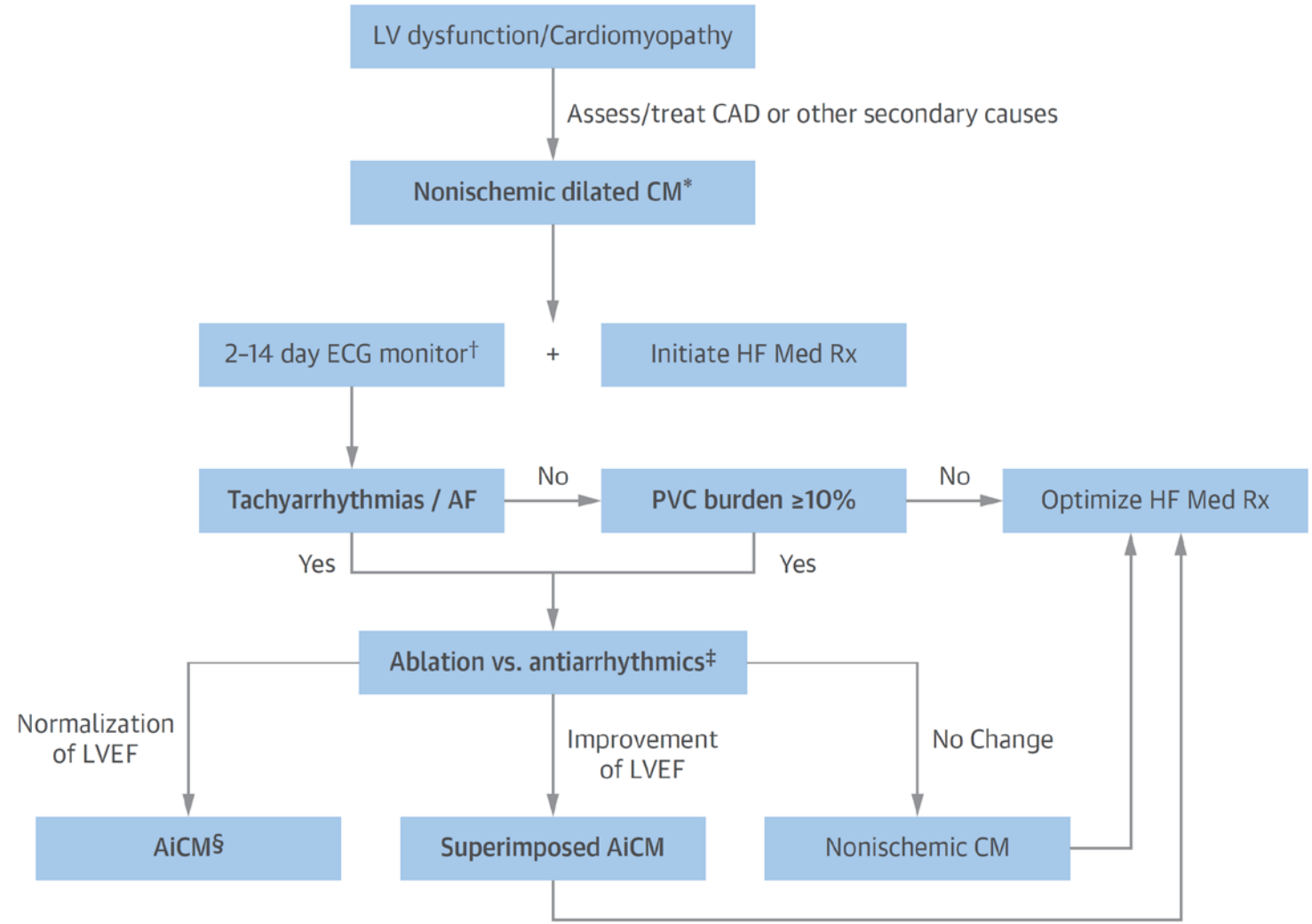
- Males> Females
- High PVC burden (16-24% best identifies patients with PVC-CM)
  - PVC burden may vary
  - 6 days holter may be required to define maximal PVC burden
- Lack of symptoms
- PVC QRS duration > 150 ms
- Epicardial origin

Treatment

- RFA or AAD similar long term suppression effect of 70-80%
- Areas with lower ablation success include – papillary muscle, epicardium, near coronary arteries or the conduction system.
- Ablation complications ~ 5-8%
- ~ 10% need to stop AAD due to side effects.
- No randomized trial compared AAD to RFA
- Retrospective study – RFA higher efficacy.

- PVC suppression > improve LV function, LV dilatation, MR and BNP levels
- ~ 67% of patients show improvement in EF
- MRI with late-gadolinium enhancement predict responders versus nonresponders
- However, if PVC burden reduction (>20%) is achieved, the presence of myocardial scar seems to be less relevant to predict response

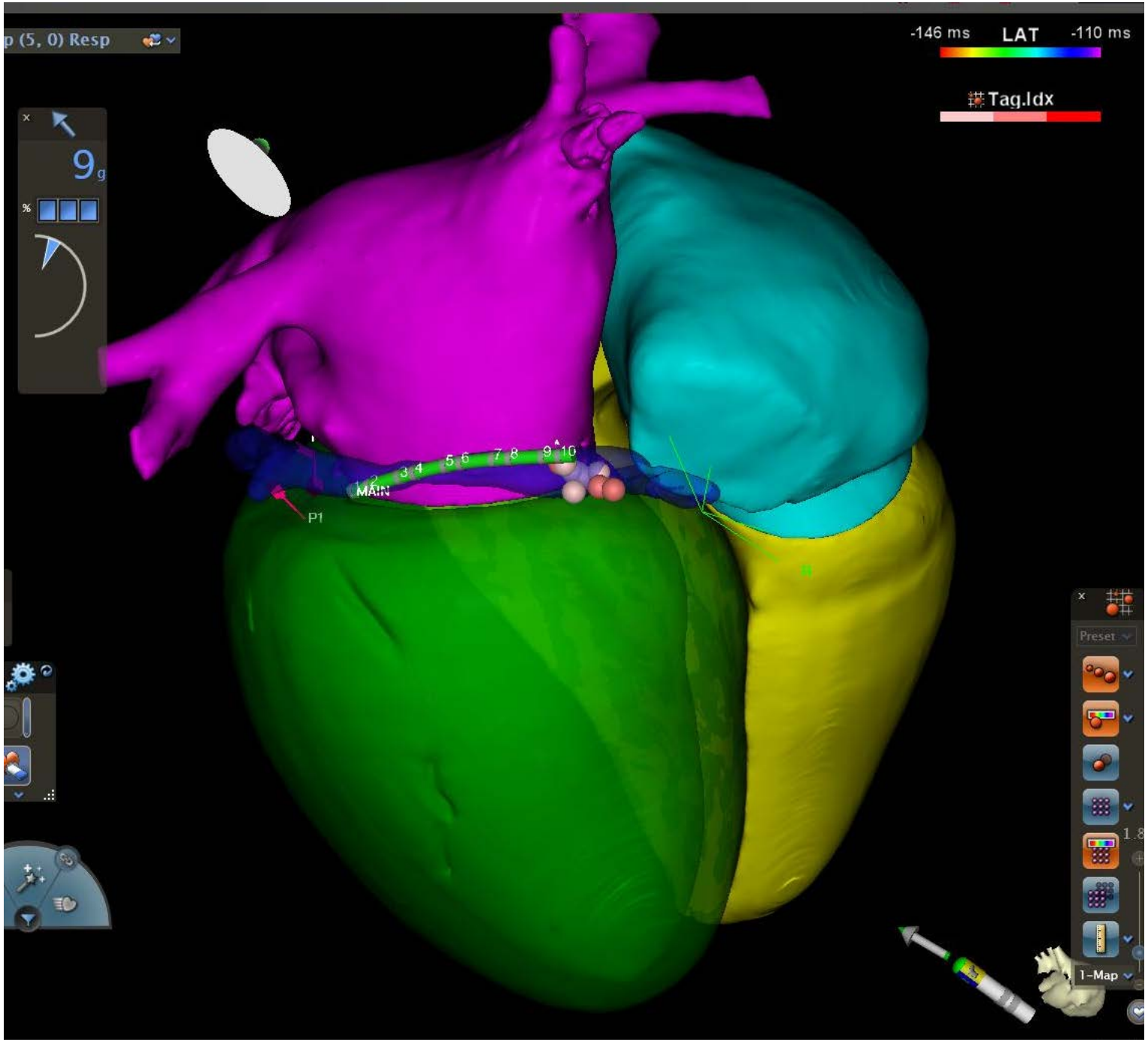
FIGURE 5 Proposed Management of Potential Arrhythmia-Induced CM



*Consider following the algorithm even if coronary artery disease (CAD) is documented or worsening of prior CM is noted (superimposed arrhythmia-induced cardiomyopathy [AiCM]). †Two-week ambulatory Holter is preferred as it increases the diagnosis yield of high PVC burden (≥10%). ‡Consider cardiac magnetic resonance to assess scar burden and predict response to PVC suppression. Short-term observation is reasonable for PVC-CM as 15% of cases may improve without PVC suppression strategy (49). §Continue close surveillance and HF med Rx in those with abnormal LV dimensions and presence of scar (cardiac magnetic resonance imaging). Abbreviations as in **Figures 1 and 2**.

Back to our patient-

- 1st ablation- Several RF lesions delivered at the lower septal mitral annulus as well as from the TA side.
- Procedure was stopped due to patient discomfort
- Follow up visit PVC burden now is 20%
- MRI – no scar except for the ablated area.
- 2nd ablation successful (ablated at the crux).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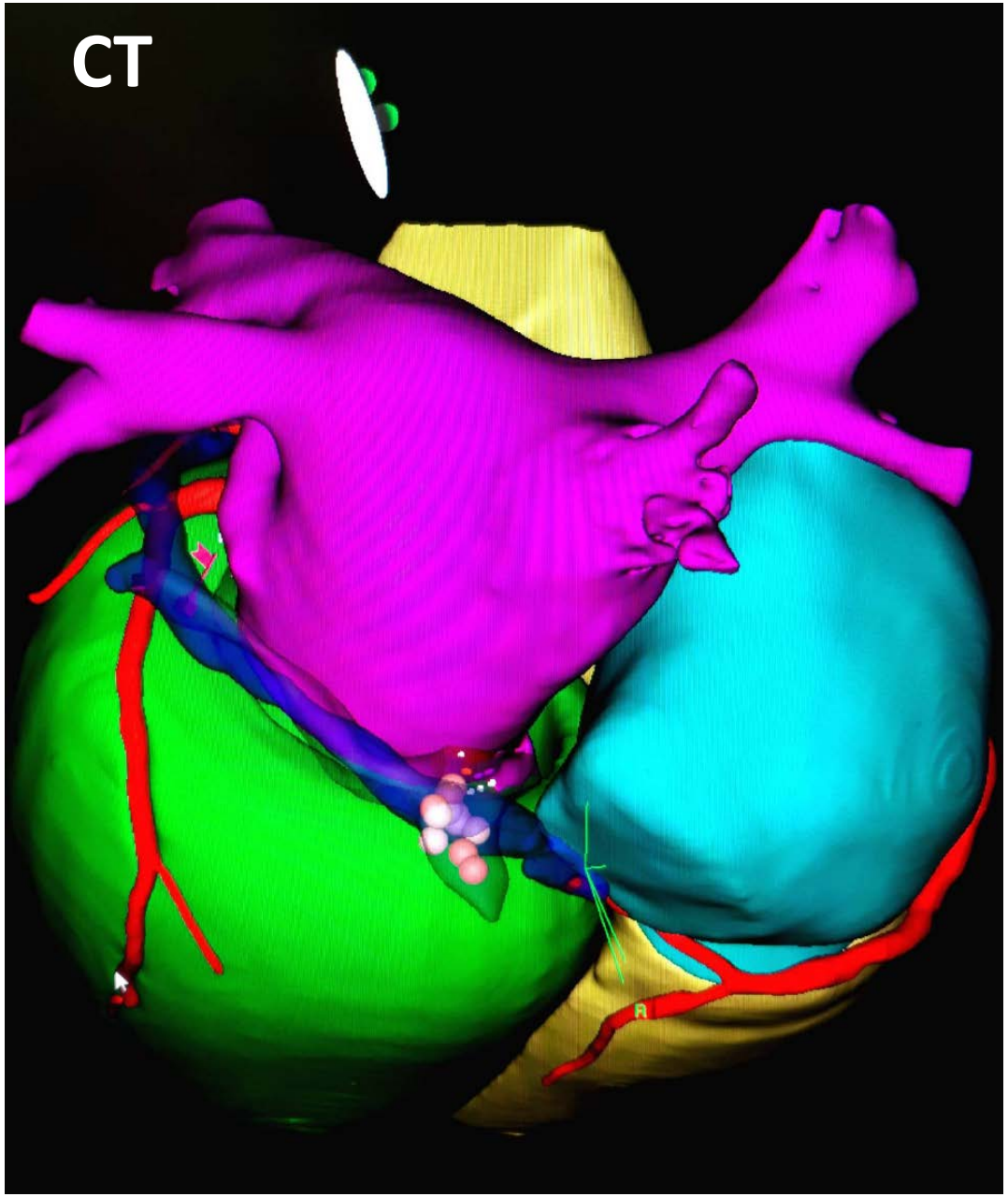
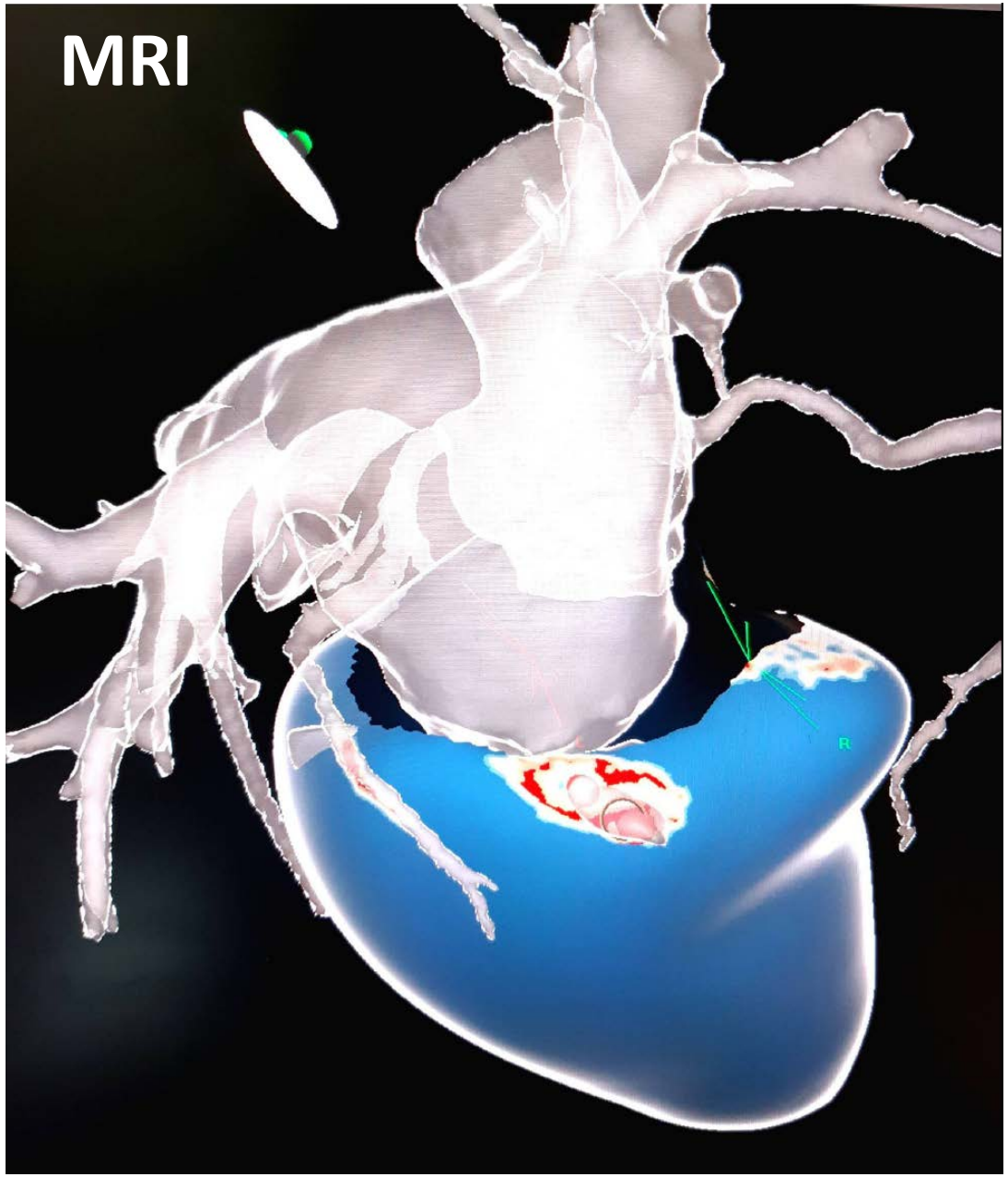
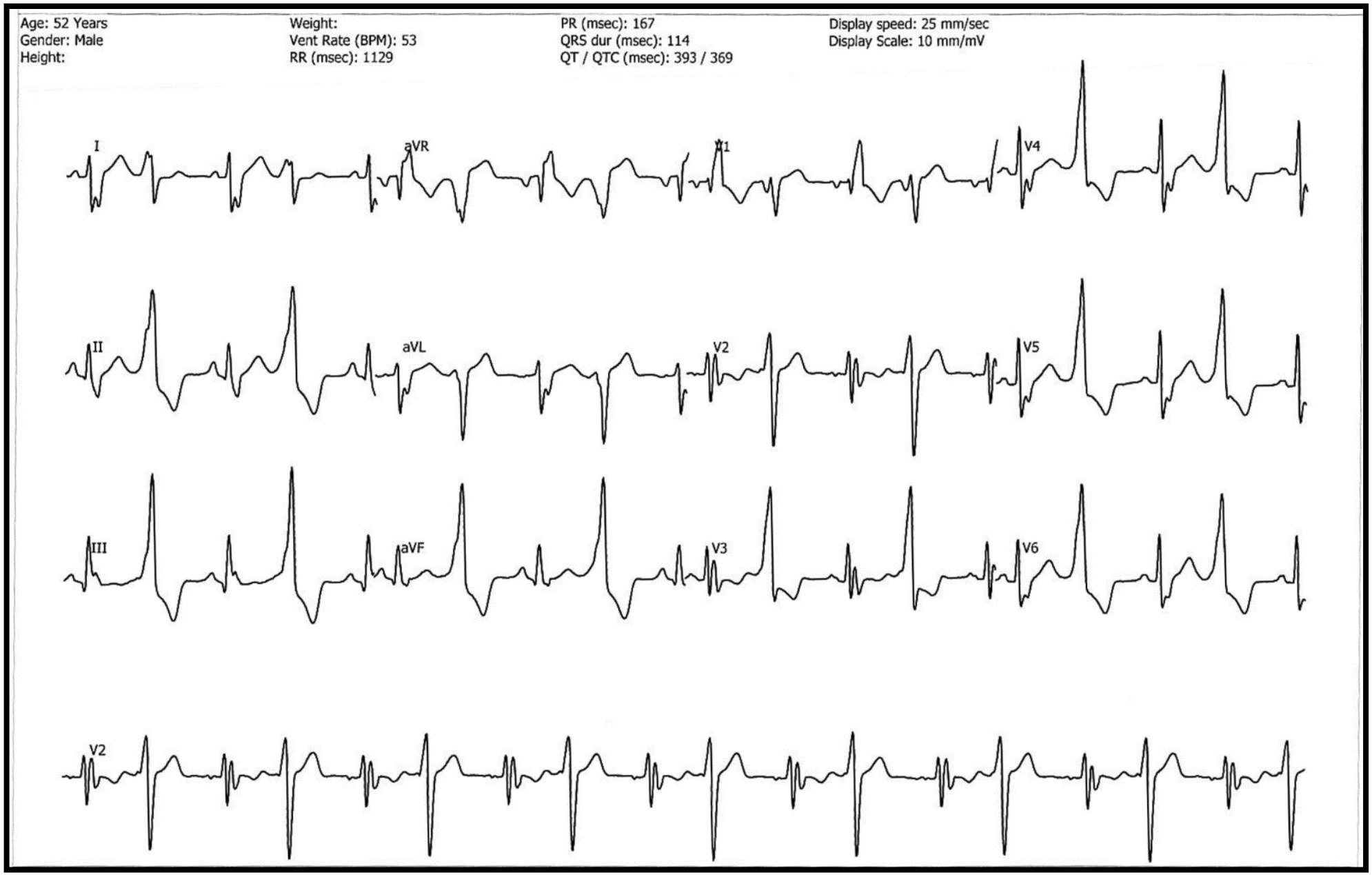

CT


MRI

Summary

- Male gender, asymptomatic
- Non ischemic CMP
- Very high PVC burden
- Epicardial origin

Second case


Age: 52 Years
Gender: Male
Height:
Weight:
Vent Rate (BPM): 53
RR (msec): 1129
PR (msec): 167
QRS dur (msec): 114
QT / QTC (msec): 393 / 369
Display speed: 25 mm/sec
Display Scale: 10 mm/mV
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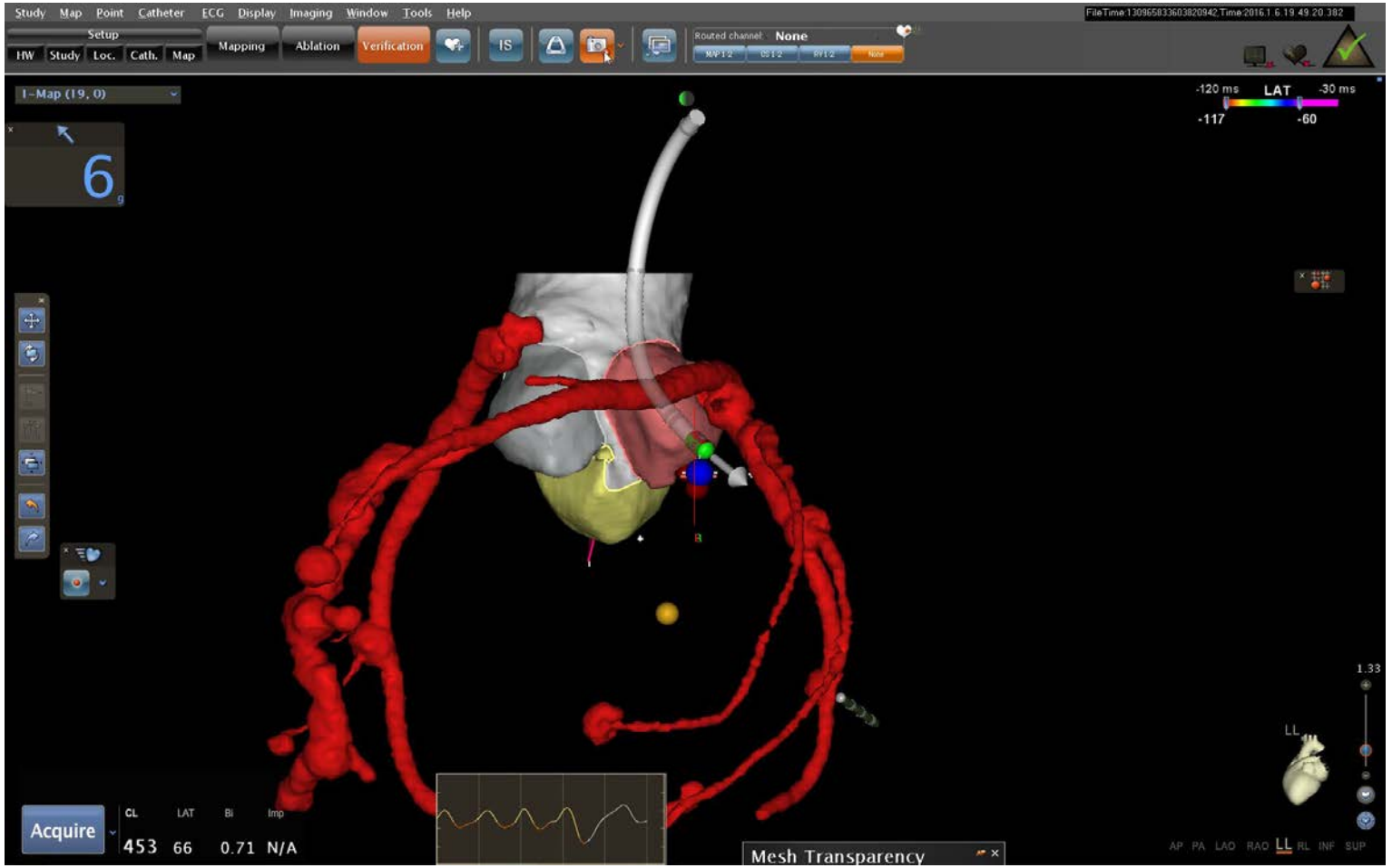
CARTO RF1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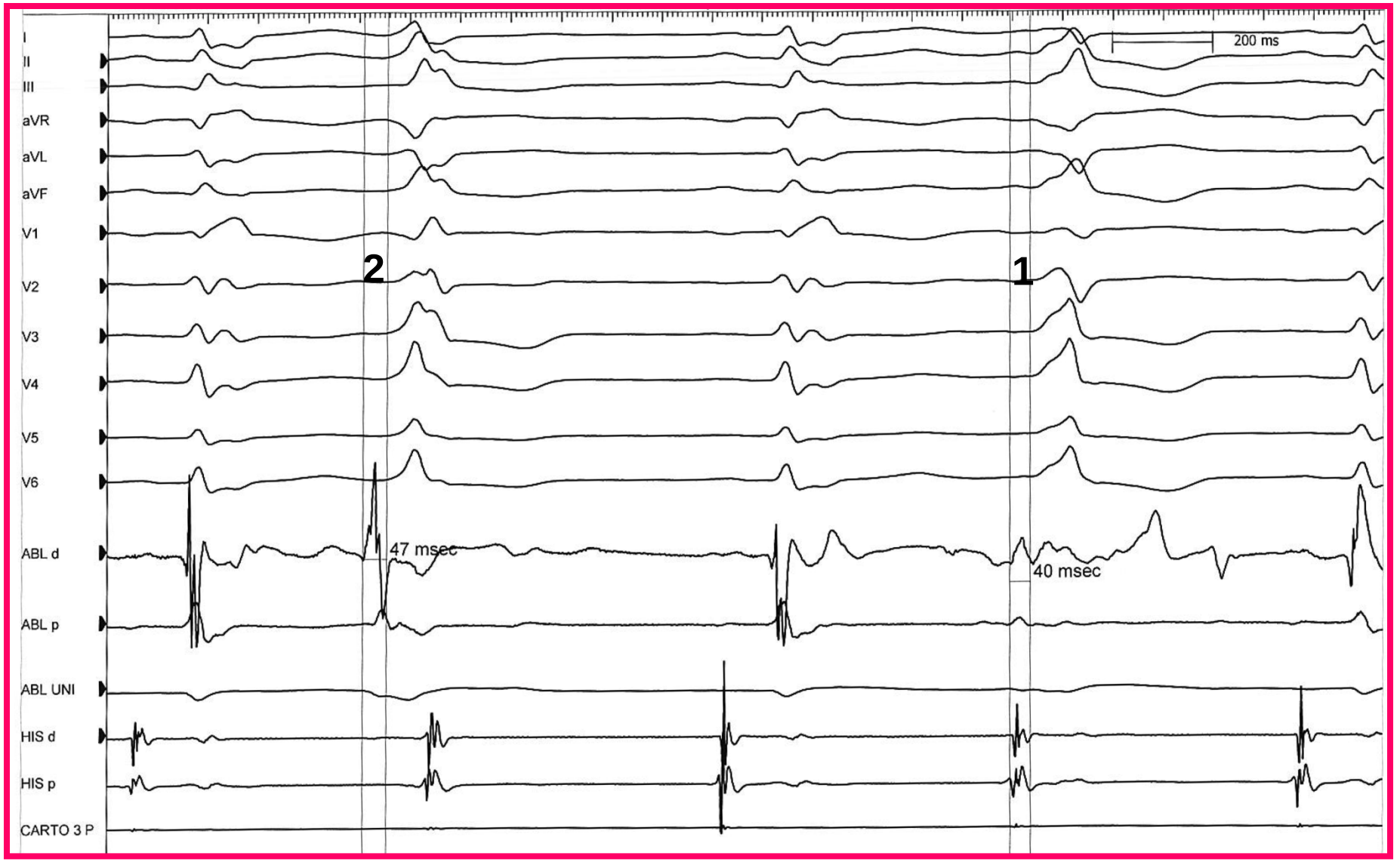
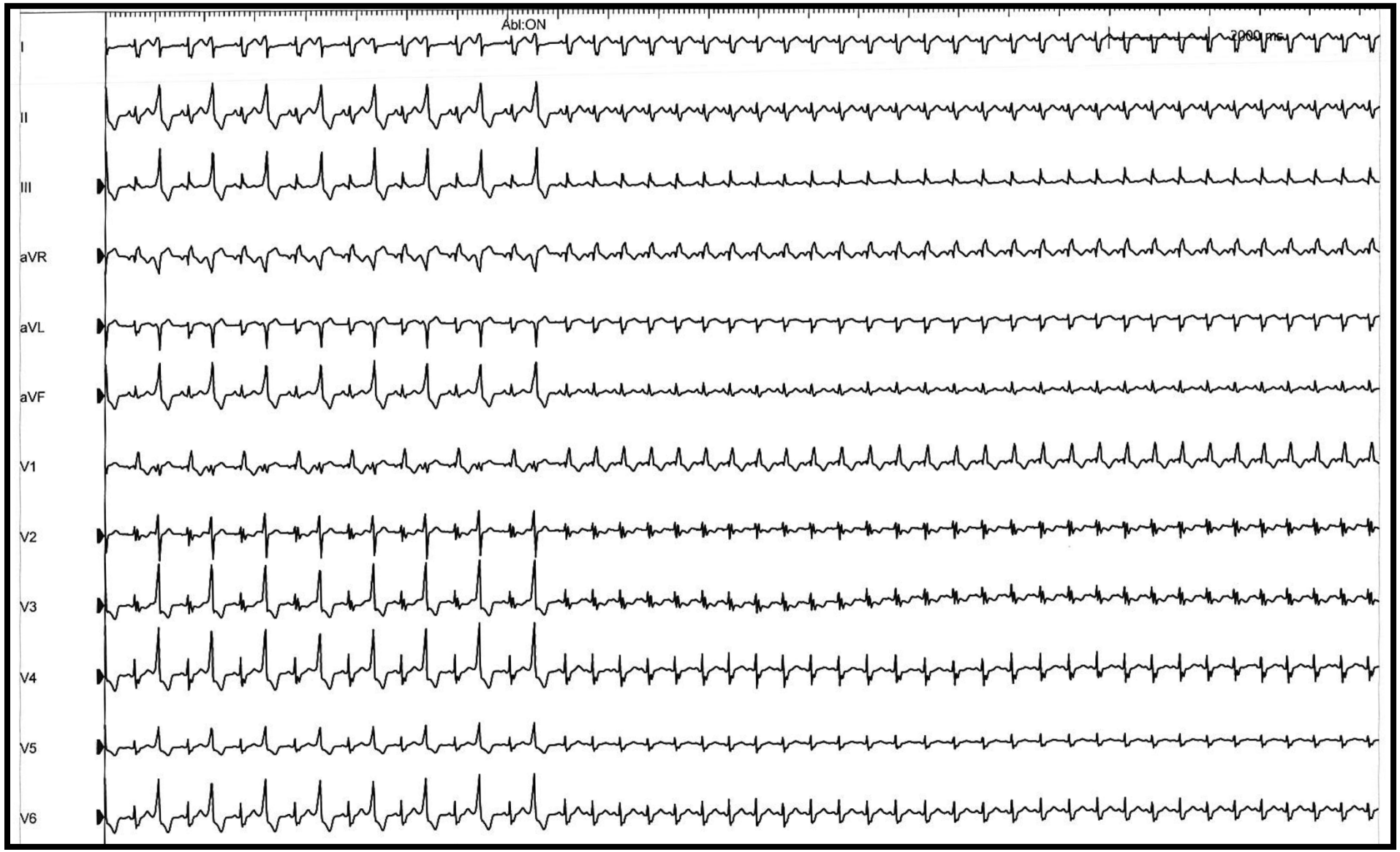
LL
AP PA LAO RAO LL RL INF SUP

Mapping of VPC’s #1 and #2



RF#3, 50Wts, LCC-RCC commissure



Br Heart J 1981; **46**: 679–82

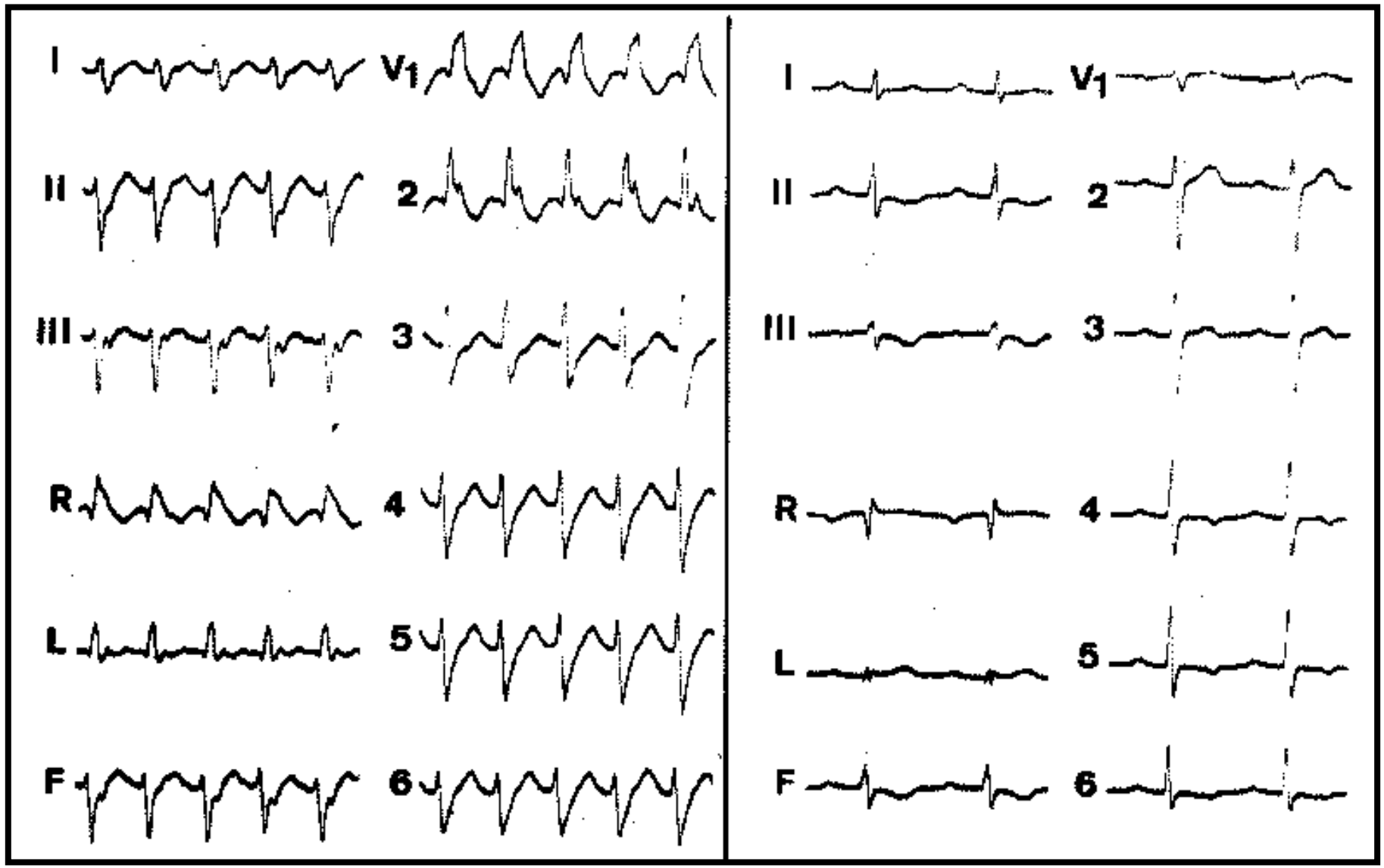
Response of recurrent sustained ventricular tachycardia to verapamil

BERNARD BELHASSEN, HESCHI H ROTMENSCH, SHLOMO LANIADO

From the Department of Cardiology, Municipal Governmental Medical Center, Ichilov Hospital, Tel-Aviv, Israel

SUMMARY A 28-year-old man is described with no demonstrable organic heart disease and recurrent paroxysmal attacks of sustained ventricular tachycardia. Lignocaine and ajmaline failed to terminate the first attack but a bolus injection of verapamil succeeded. This drug was subsequently successful on six more occasions. During electrophysiological study of the eighth attack, slow intravenous administration of verapamil significantly reduced the rate of the tachycardia and prevented its subsequent reinitiation by pacing.

Two mechanisms are postulated to explain both the arrhythmia and the beneficial effects of verapamil in this case.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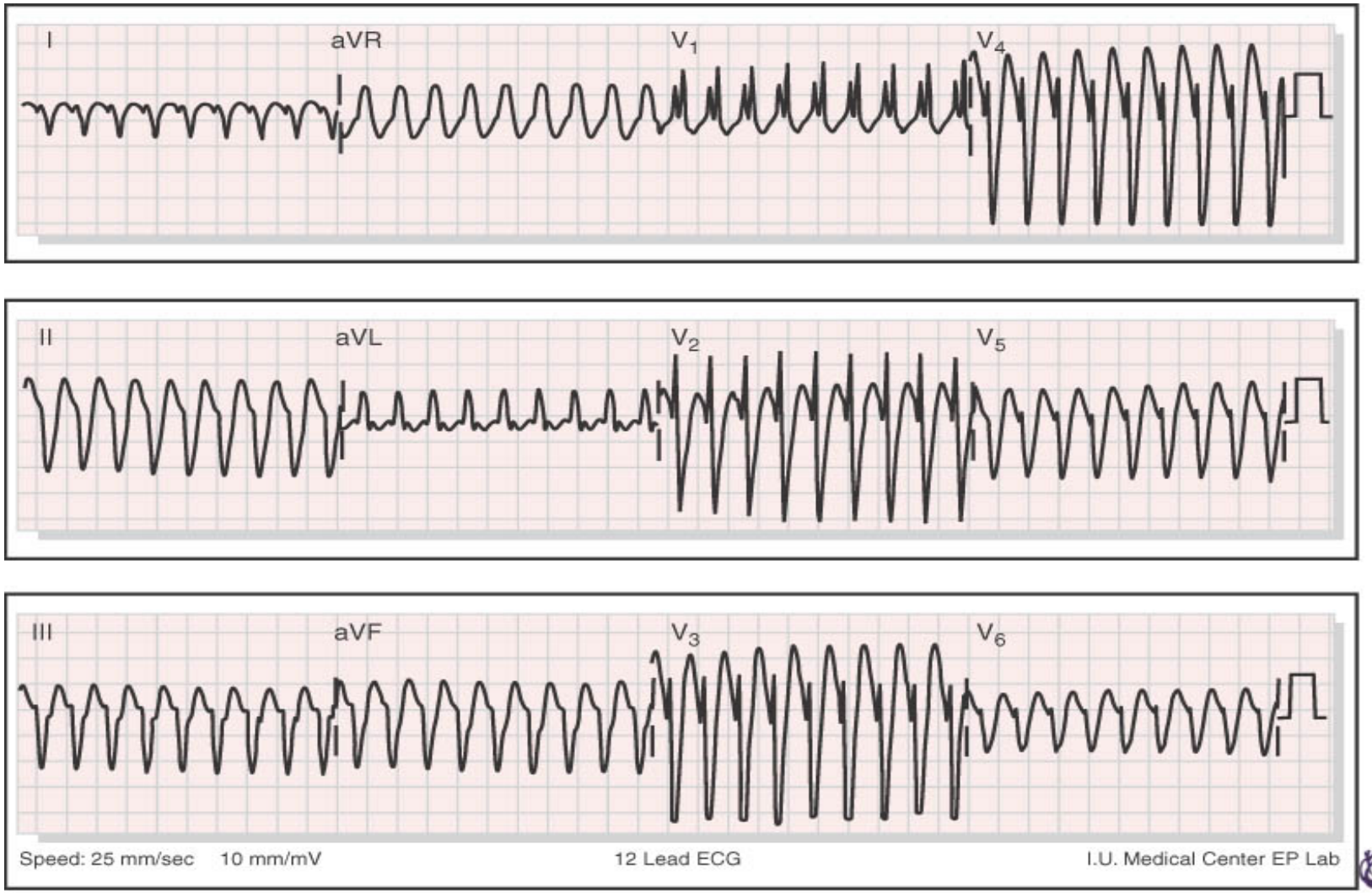
Idiopathic Left VT



Idiopathic Left Ventricular Tachycardia (ILVT): Clinical Features

- Symptoms:
  - Palpitations and presyncope.
  - Syncope is uncommon.

- Prognosis:
  - Generally excellent
  - Cardiac arrest is rare.

Idiopathic Left Ventricular Tachycardia (ILVT): Treatment

- Acute Therapy:
  - IV Verapamil is very effective.
  - Vegal maneuvers, adenosine, beta blockers, and lidocaine are usually ineffective.

- Chronic Therapy:
  - Verapamil for mild cases
  - Ablation for severe symptoms (success rate: 80-90%)

CLASSIFICATION OF IDIOPATHIC FASCICULAR VT

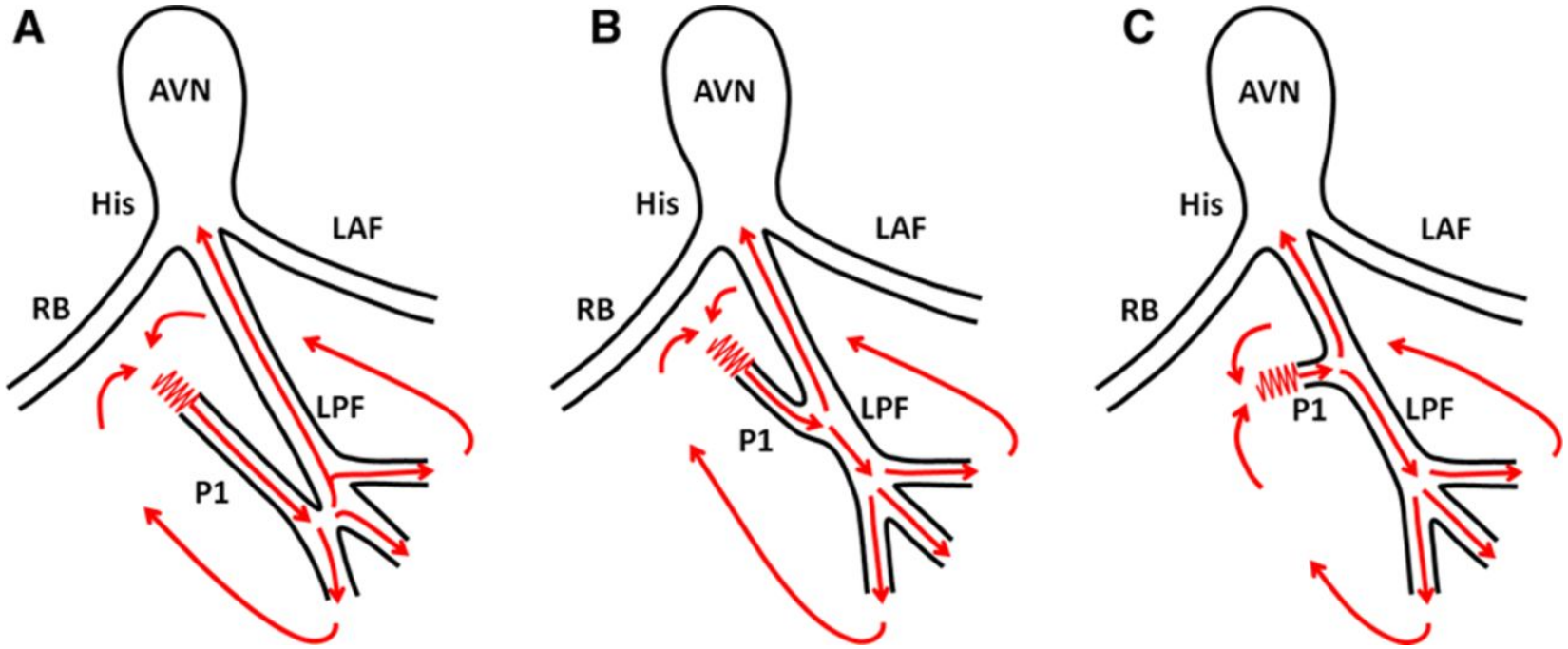
- **Posterior fascicular VT (90-95%): RBBB morphology + left axis deviation; arises close to the left posterior fascicle (Belhassen VT, 1981).**

- **Anterior fascicular VT (5-10%): RBBB morphology + right axis deviation cases): arises close to the left anterior fascicle (Ohe et al., 1988).**

- **Upper septal fascicular VT (rare #1%): atypical morphology – usually RBBB but may resemble LBBB instead; cases with narrow QRS and normal QRS axis have also been reported. Arises from the region of the upper septum (Shimoike et al., 2000).**

Figure 2

Schematic diagram of the left posterior fascicular ventricular tachycardia (LPF-VT) reentry circuit.



Liu et al. Circ Arrhythm Electrophysiol. 2016;9:e004272

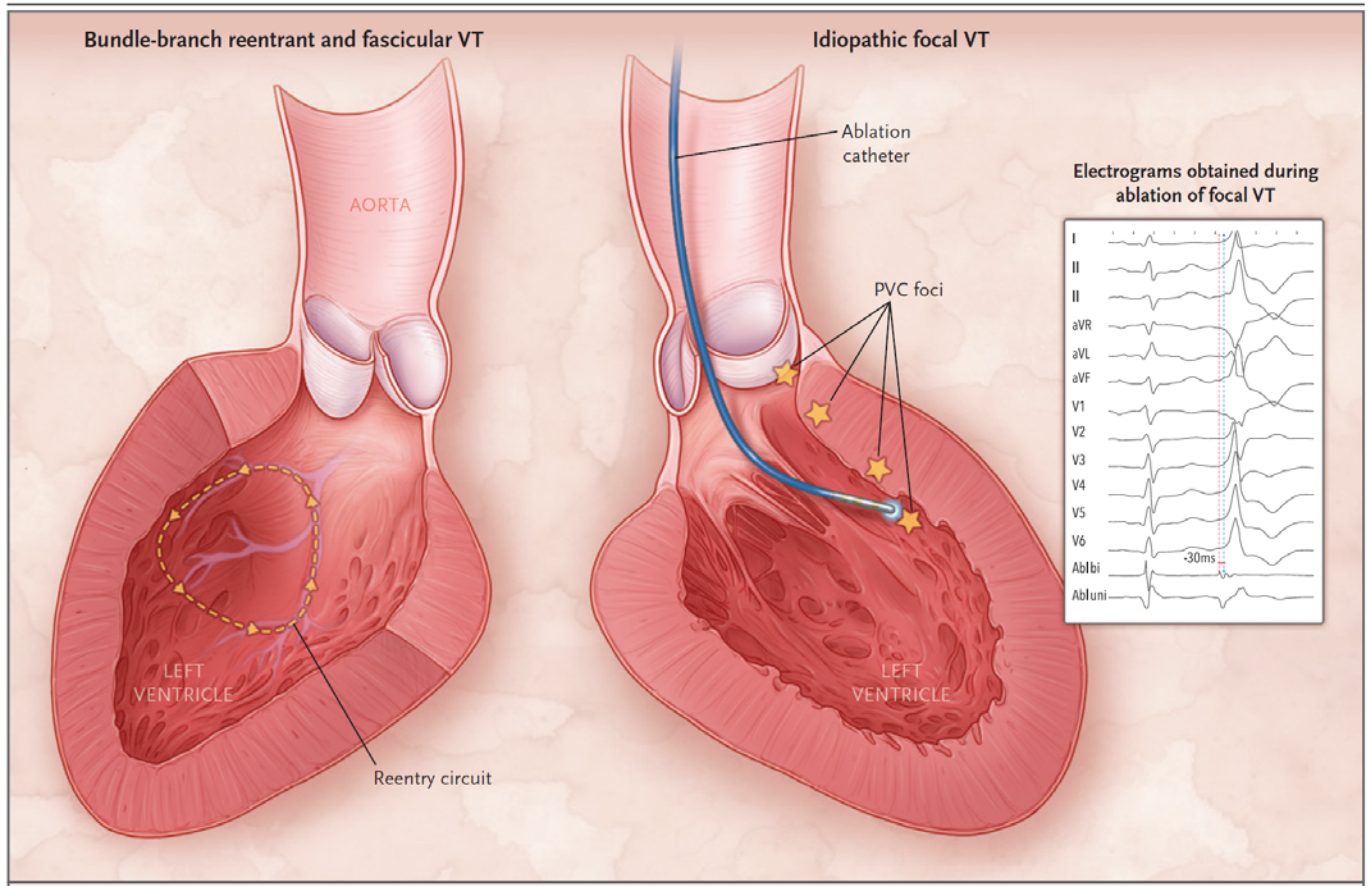


Figure 1. Mechanisms and Catheter Ablation of Ventricular Tachycardia (VT) in the Absence of Structural Heart Disease.

Shown are two views of the left ventricle and common mechanisms of VT in patients who do not have structural heart disease. In bundle-branch reentrant and fascicular VT, a reentry circuit incorporating the cardiac conduction system is present (arrows show the direction of movement of the depolarization wave). In idiopathic VT, the tachyarrhythmia typically arises from a discrete myocardial focus. At this focus, abnormal impulse formation occurs either during or after the normal cardiac action potential (i.e., the abnormal impulse triggers arrhythmia). In this example, an ablation catheter is passed in a retrograde fashion through the aortic valve into the left ventricle. During the ablation procedure, electrograms are obtained with the use of the body-surface electrocardiographic (ECG) leads, as well as recordings from the ablation catheter itself. Shown are a bipolar recording from the ablation catheter (Abl bi), in which two electrodes, positioned proximally and distally on the catheter, are used to obtain a very localized signal, and a unipolar recording (Abl uni), in which the distal electrode is used to obtain a signal between the catheter tip and a remote electrode. The electrograms document one sinus beat followed by a premature ventricular complex (PVC); the catheter recordings document an abnormal electrical potential occurring 30 msec before the body-surface complex, indicating that the catheter tip is close to the focus of initiation of the PVC.

The NEW ENGLAND JOURNAL of MEDICINE

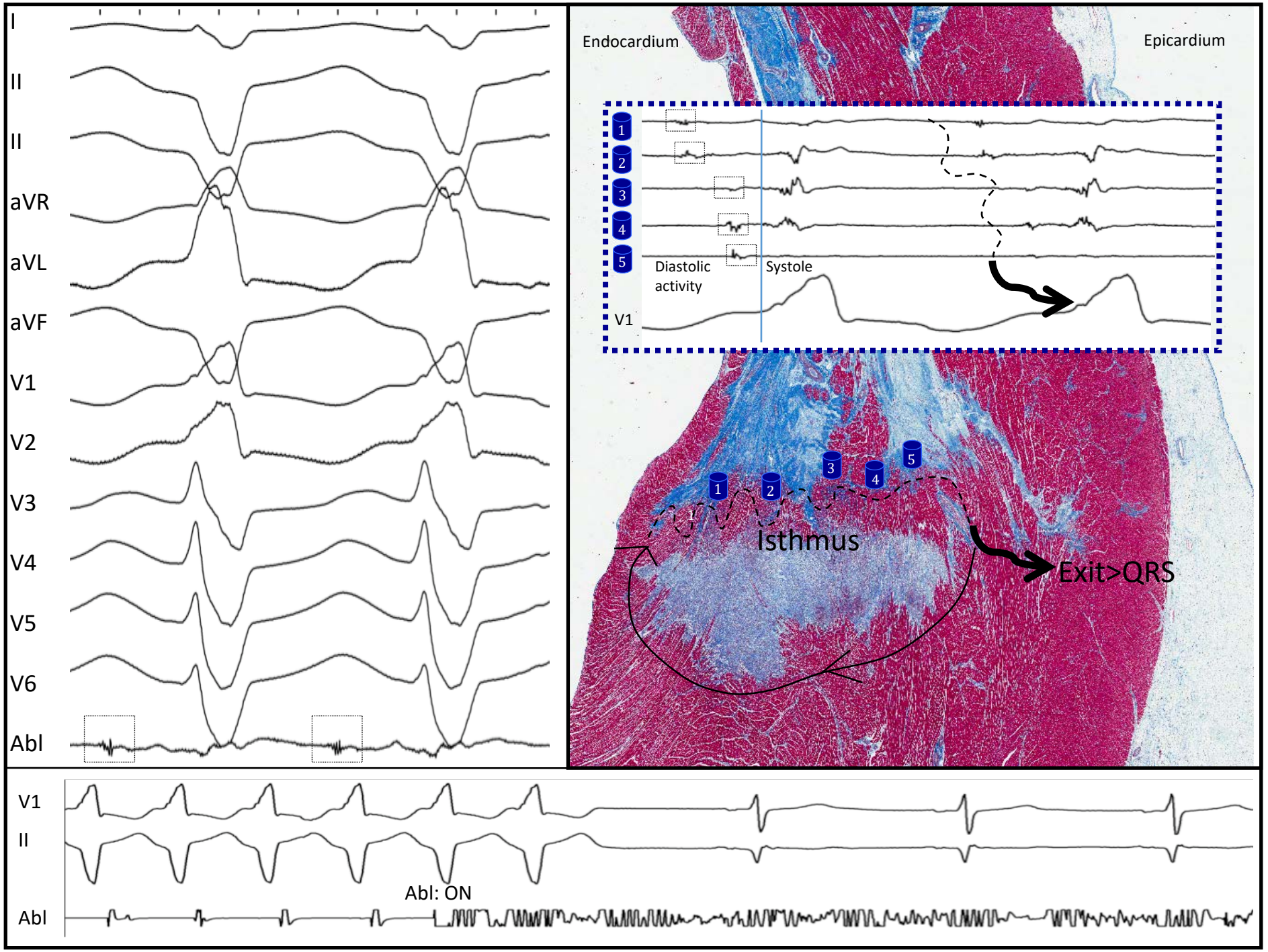
REVIEW ARTICLE

John A. Jarcho, M.D., *Editor*

Catheter Ablation of Ventricular Arrhythmias

Kalyanam Shivkumar, M.D., Ph.D.

Scar related VT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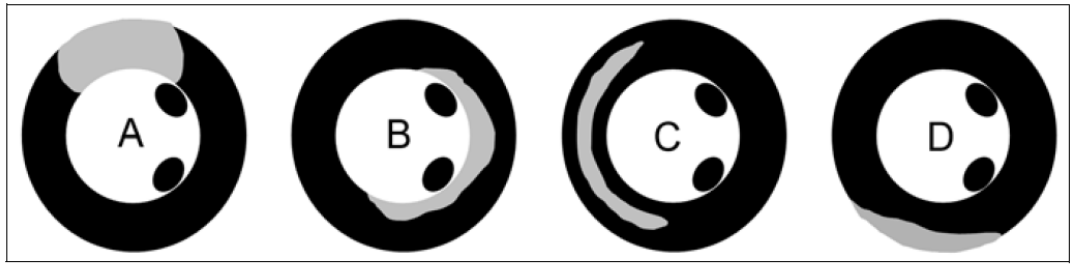
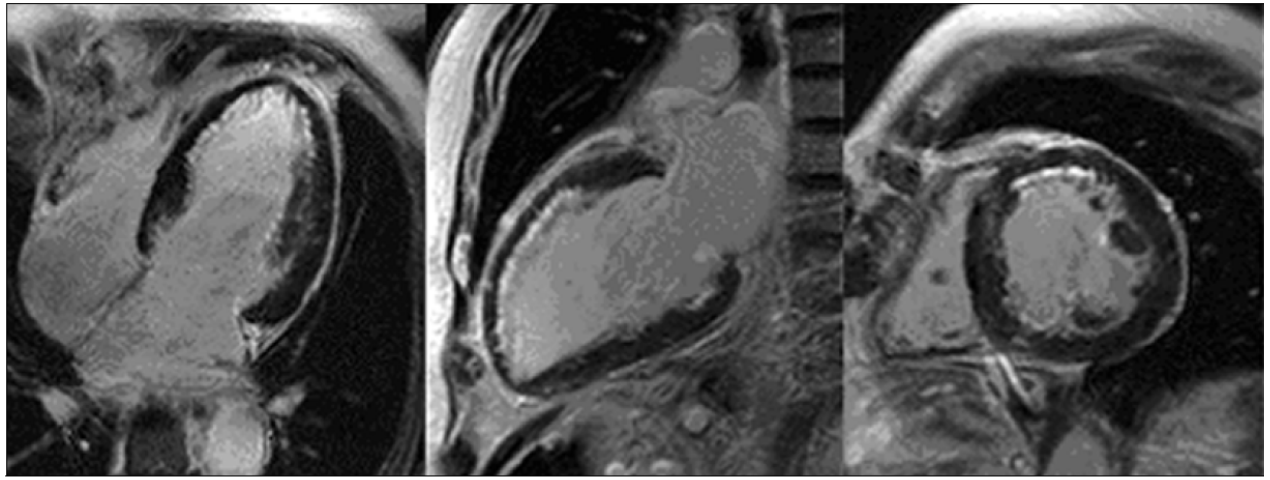
PATTERNS OF MYOCARDIAL SCAR

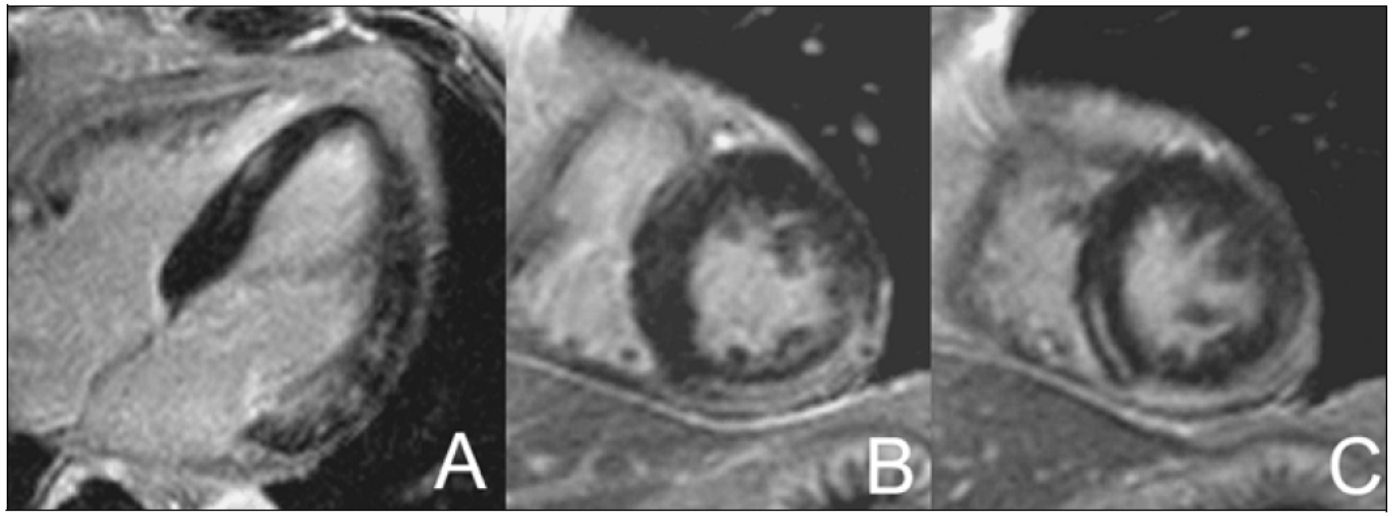


Well defined Endocardial scar

ICM



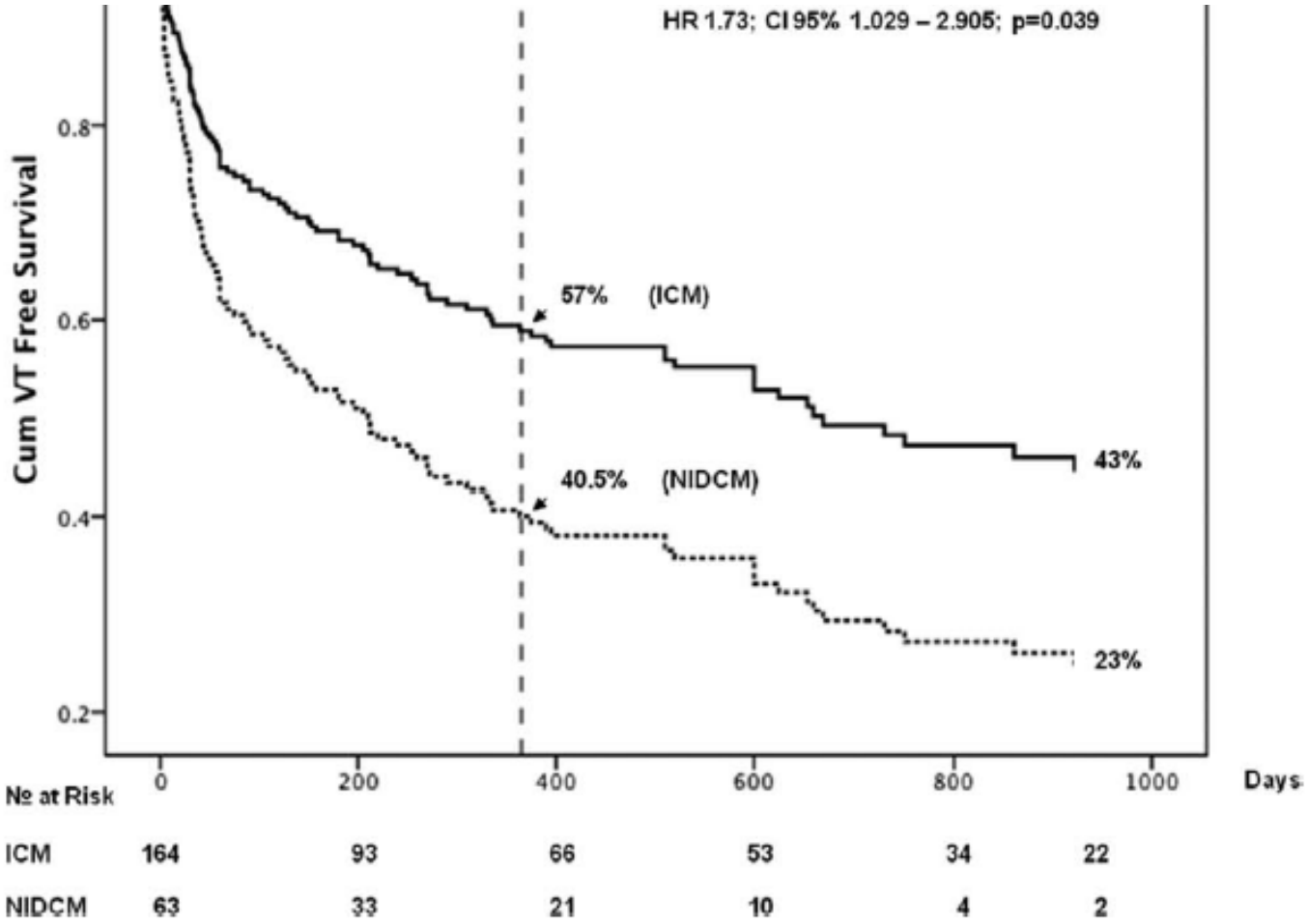
NICM



Hunold P, et al. AJR Am J Roentgenol. 2005;184(5):1420-6.

Outcomes in Catheter Ablation of Ventricular Tachycardia in Dilated Nonischemic Cardiomyopathy Compared With Ischemic Cardiomyopathy

Results From the Prospective Heart Centre of Leipzig VT (HELP-VT) Study



Ablation results are better compared no NICMP

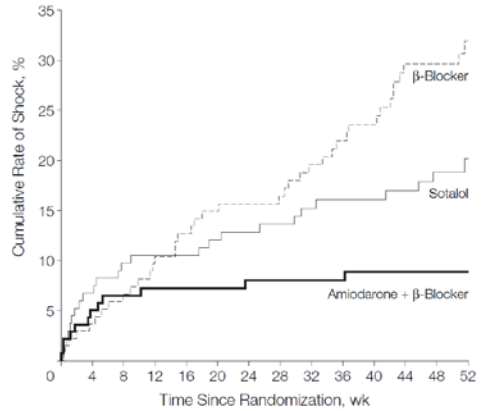
Dinov et al Circulation 2014

Studies on drug therapy

- OPTIC study (JAMA 2006) – 412 with VT randomized to
  - Beta blockers – 38.5% - ICD shocks
  - Sotalol – 24.3% shocks
  - Amiodarone + BB – 10.3% shocks
- Amiodarone better, Sotalol trend.
- Adverse events on Amiodarone –

Pulmonary 5%, hyperthyroid 1.4%

Figure 2. Cumulative Rate of Shock for the 3 Treatment Groups by Time Since Randomization



No. at Risk					
β-Blocker	138	119	109	91	42
Sotalol	134	118	108	94	35
Amiodarone + β-Blocker	140	124	115	106	56

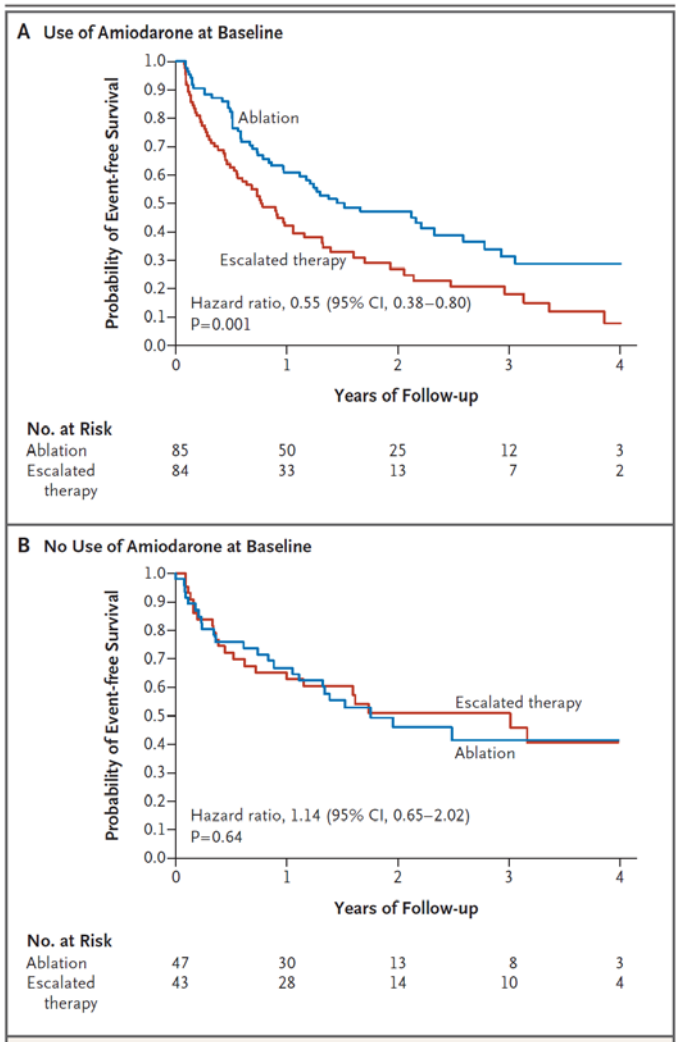
Log-rank $P<.001$ for amiodarone plus β-blocker vs β-blocker alone, log-rank $P=.02$ for amiodarone plus β-blocker vs sotalol alone, and log-rank $P=.055$ for sotalol vs β-blocker.

Studies on drug therapy- *VANISH NEJM 2016*

- Patients with VT despite antiarrhythmics.
- Randomized to Ablation (n=132) vs. Escalation drug therapy (n=127)
  - Start Amiodarone,
  - Increase the dose to 300 mg.
  - Add Mexiletine.
- Primary outcome (death, VT storm, ICD shock) – 59% vs. 68%, p=0.04.
- Adverse events-
  - Ablation

    2 perforations, 3 bleedings, 1 AVB (4.5%)
  - Amiodarone

    3 deaths (2.3%) pulmonary or hepatic toxicity



- In patients with IHD and VT - Ablation is better than escalation drug therapy
- Amiodarone and ablation are superior to Sotalol and beta-blockers. Severe complications may occur with both, however in *VANISH* mortality was seen only with Amiodarone.

Activation and substrate ablation

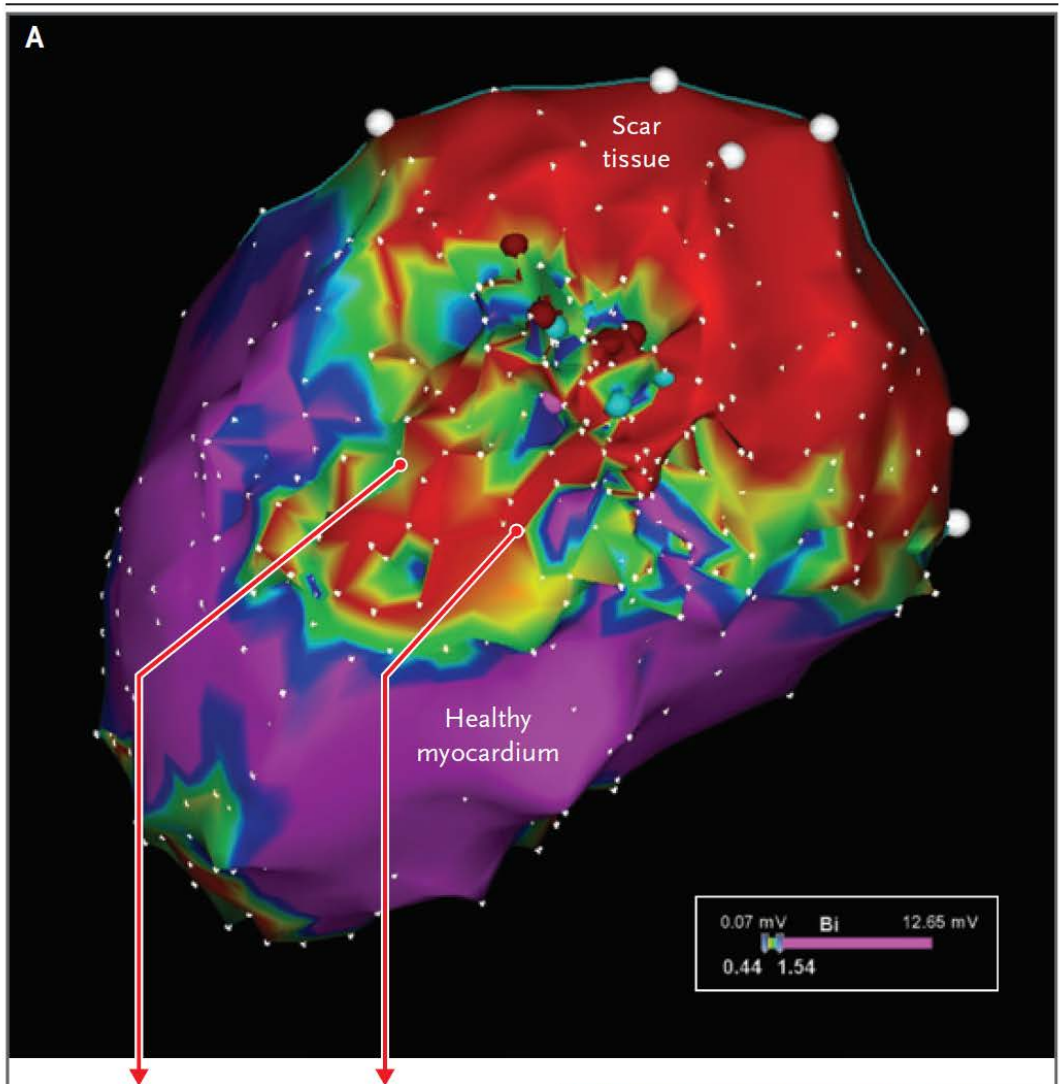
The NEW ENGLAND JOURNAL of MEDICINE

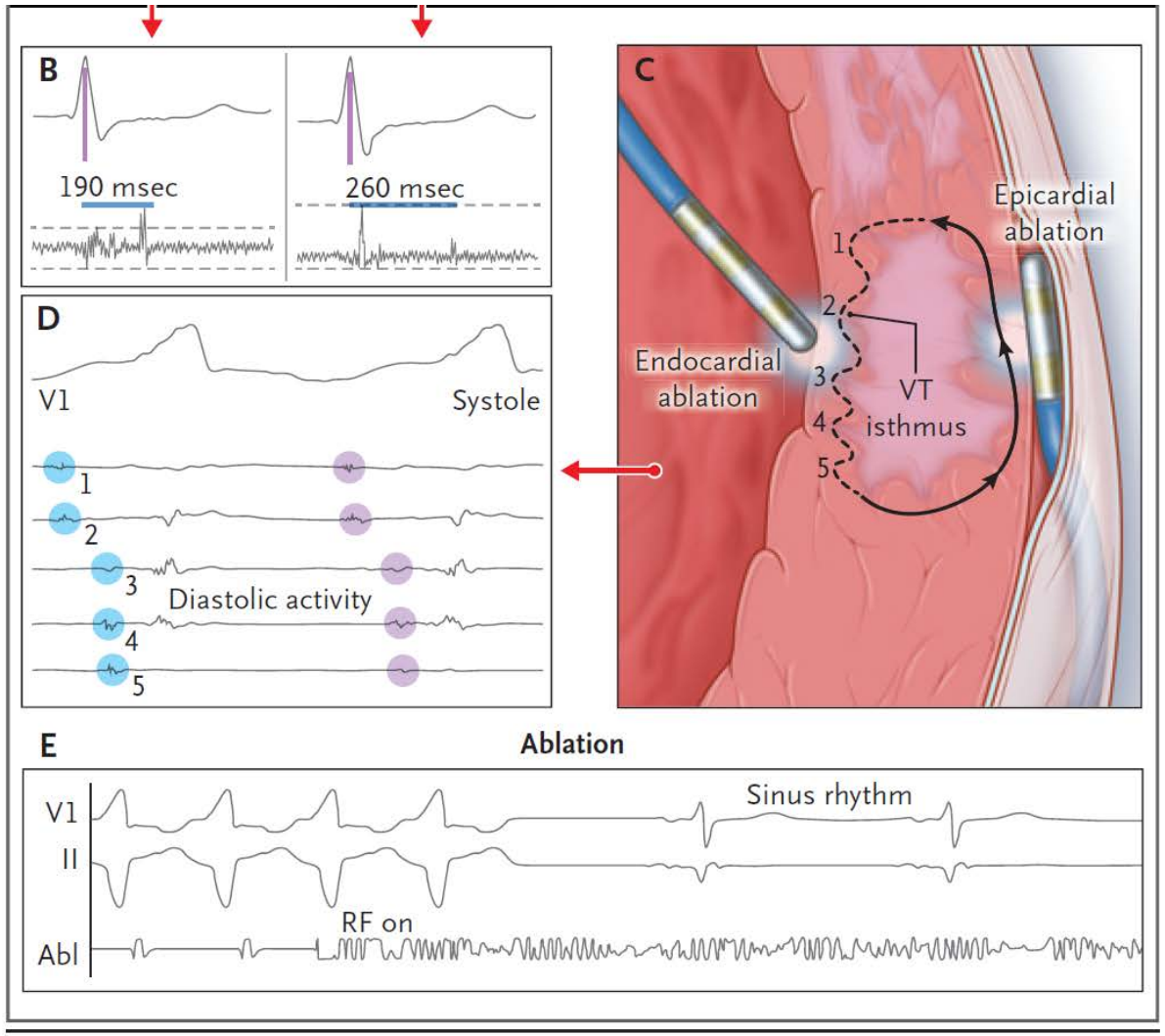
REVIEW ARTICLE

John A. Jarcho, M.D., Editor

Catheter Ablation of Ventricular Arrhythmias

Kalyanam Shivkumar, M.D., Ph.D.





Scar homogenization

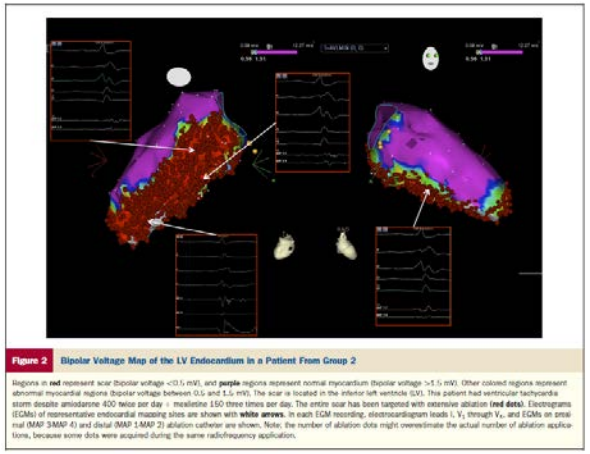
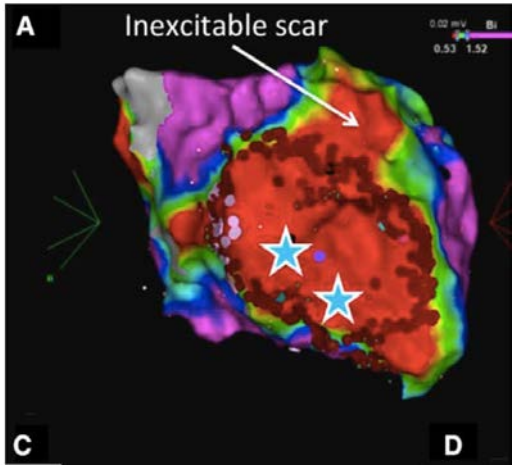


Figure 2 Bipolar Voltage Map of the LV Endocardium in a Patient From Group 2

Regions in **red** represent scar (bipolar voltage <0.5 mV), and **purple** regions represent normal myocardium (bipolar voltage >1.5 mV). Other colored regions represent abnormal myocardial regions (bipolar voltage between 0.5 and 1.5 mV). The scar is located in the inferior left ventricle (LV). This patient had ventricular tachycardia storm despite amiodarone 400 twice per day + mexiletine 150 three times per day. The entire scar has been targeted with extensive ablation (**red dots**). Electrograms (EGMs) of representative endocardial mapping sites are shown with **white arrows**. In each EGM recording, electrocardiogram leads I, V_1 through V_6, and EGMs on proximal (MAP 3/MAP 4) and distal (MAP 1/MAP 2) ablation catheter are shown. Note: the number of ablation dots might overestimate the actual number of ablation applications, because some dots were acquired during the same radiofrequency application.

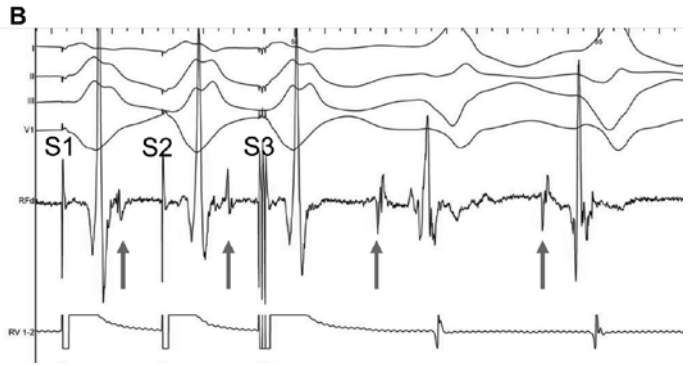
Di Biase and Natale, JACC 2012

Core isolation



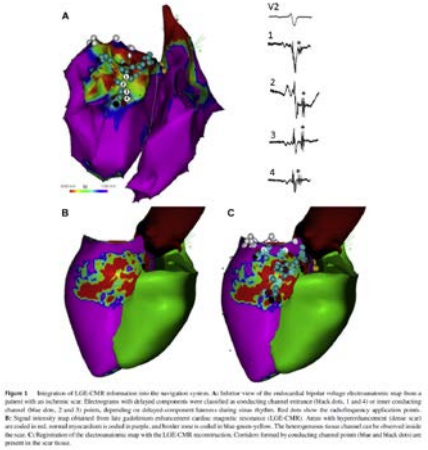
Tsou and Marchlinski, Circ Arrhyth 2014

LAVA elimination



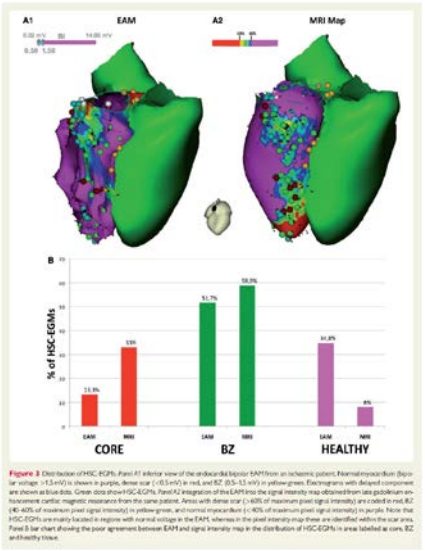
Jais and Haissaguerre, Circulation 2012

Scar de-channeling



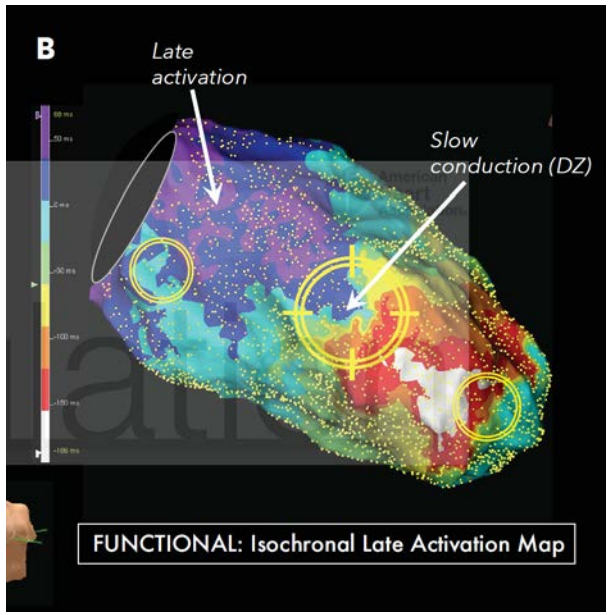
Andreu and Berruezo, Heart Rhythm 2017

Hidden slow conduction



Acosta and Berruezo, Europace 2018

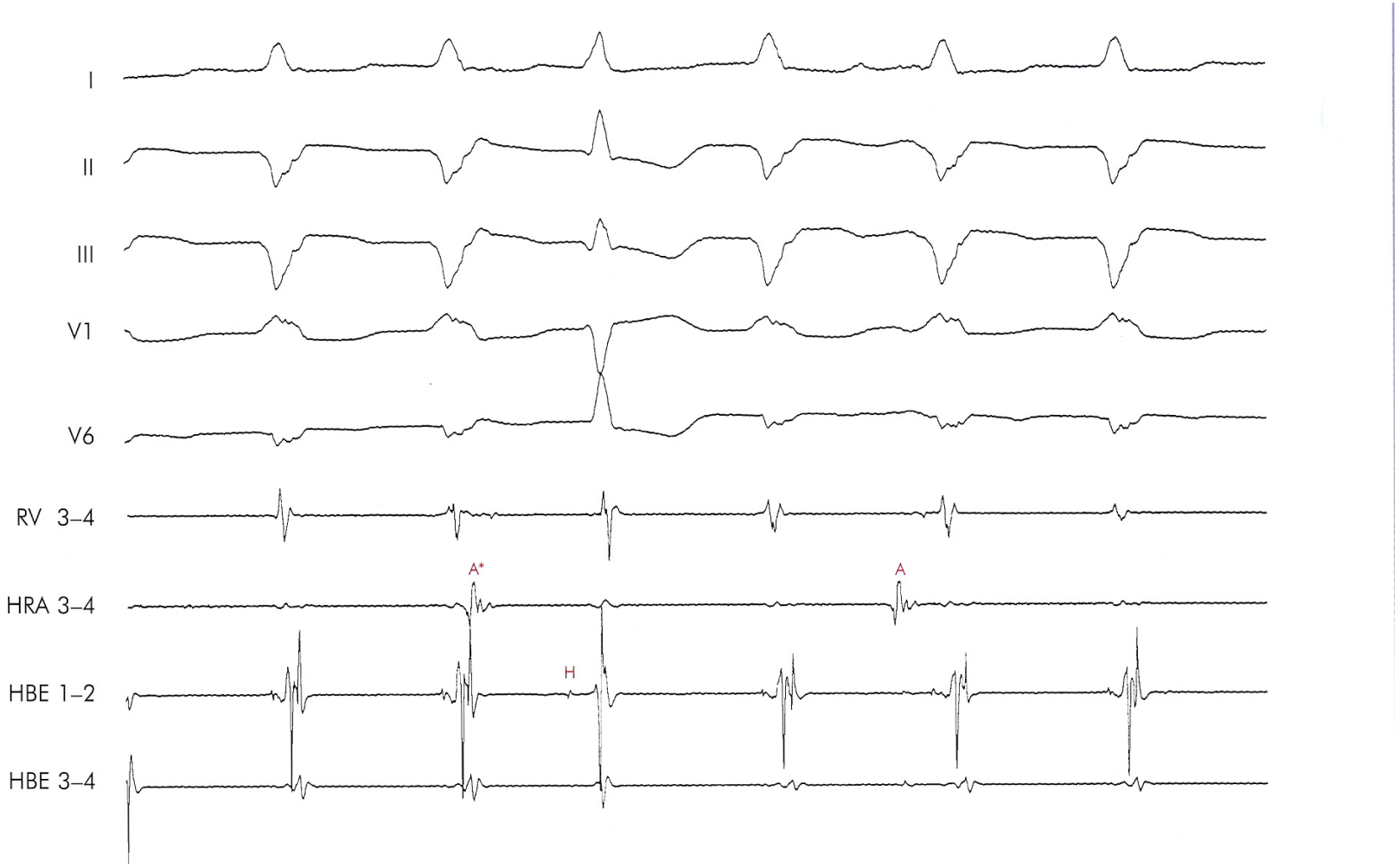
Deceleration zone ablation



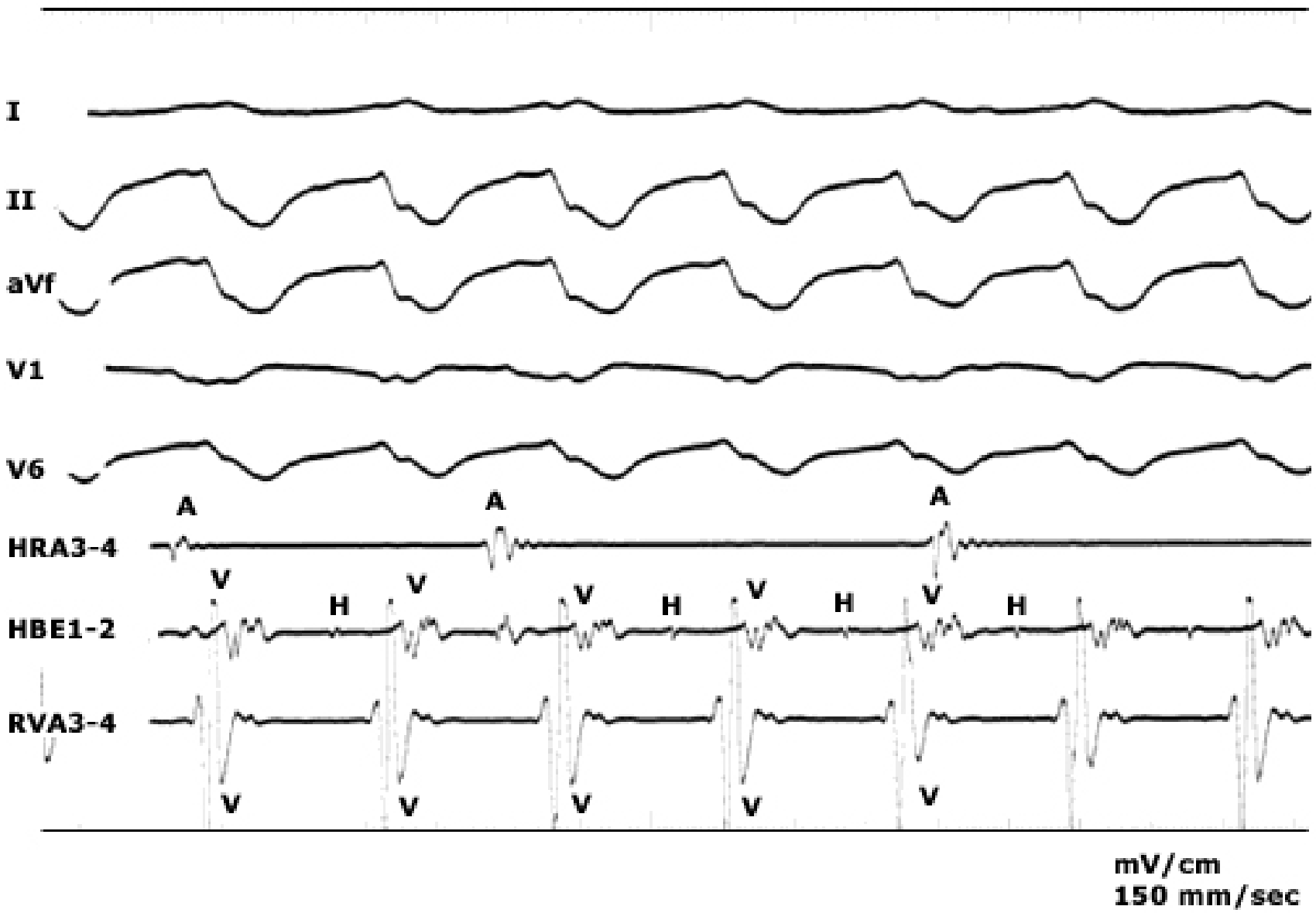
Aziz and Tung, Circulation 2019

1 Year VT free survival ~ 80%

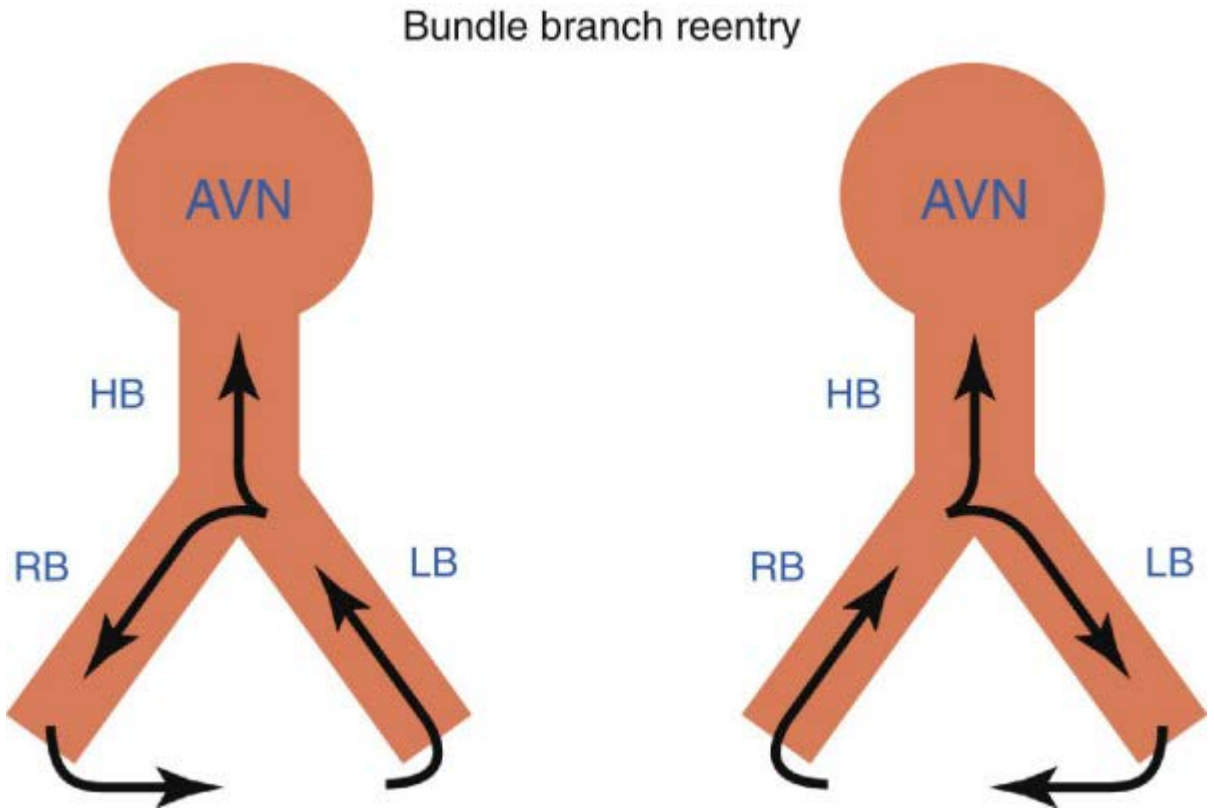
Monomorphic VT



What's this


I
II
aVf
V1
V6
A
A
A
HRA3-4
V
H
V
V
H
V
H
V
H
HBE1-2
RVA3-4
V
V
V
V
V
mV/cm
150 mm/sec

Bundle Branch Reentry VT

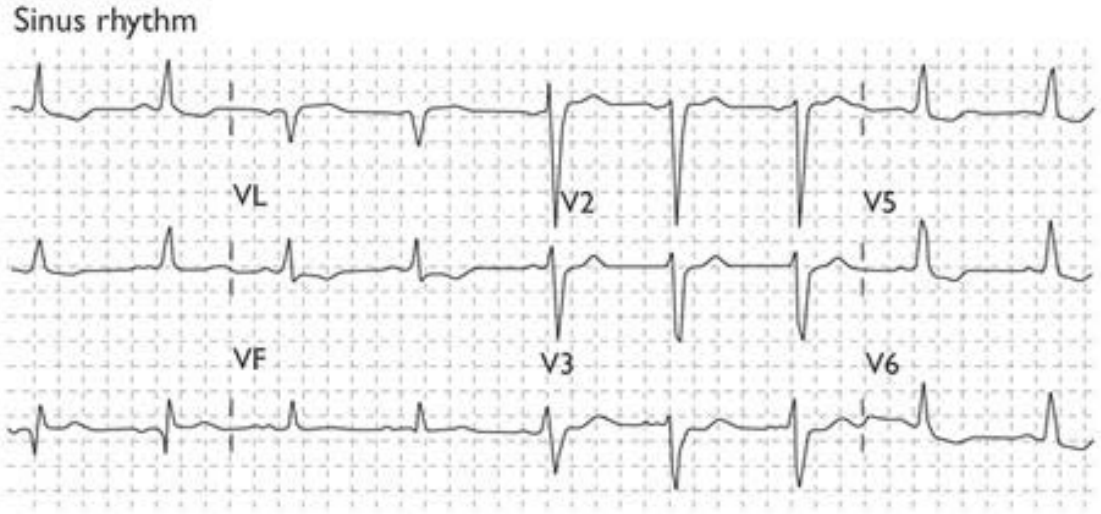


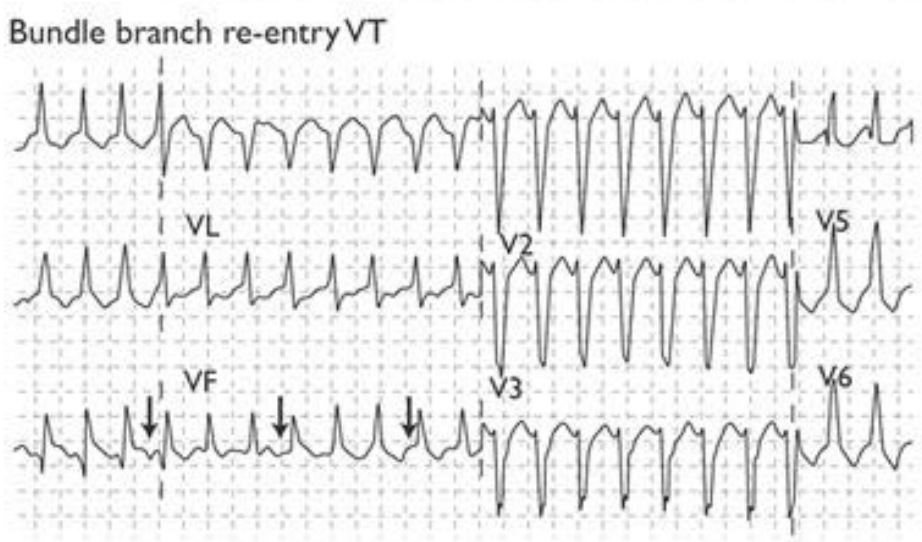
LBBB (90%)

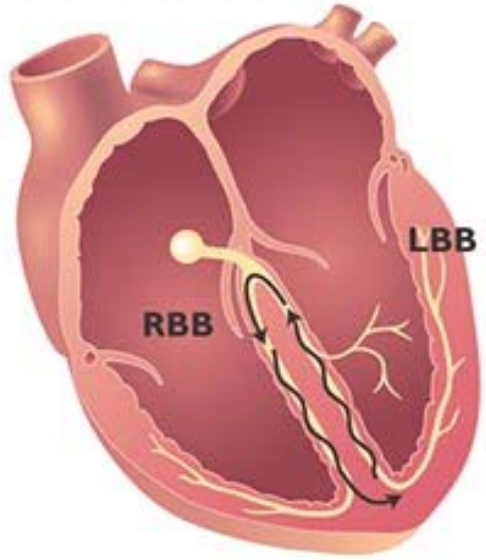
RBBB (10%)

Bundle Branch Reentry: ECG Features

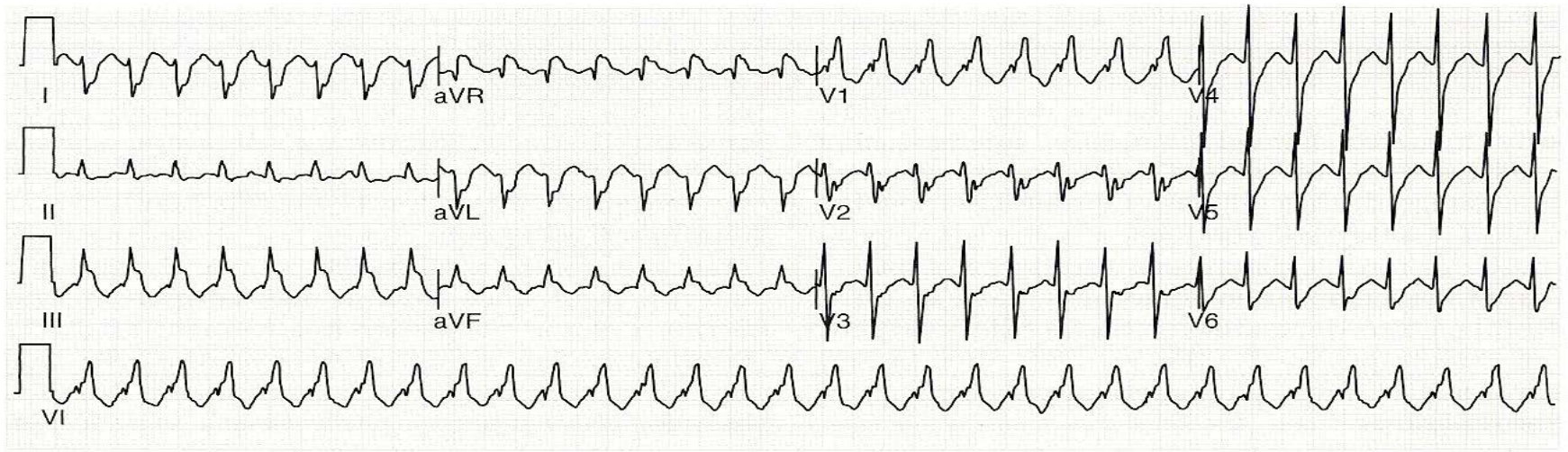
Bundle Branch Reentry: LBBB Type



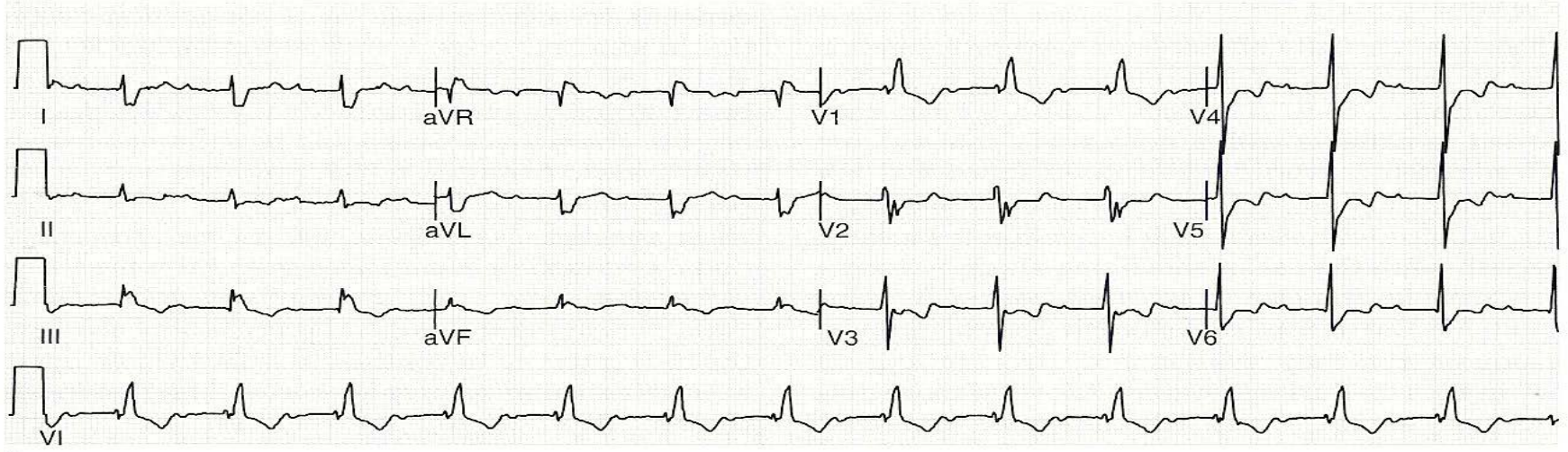




Bundle Branch Reentry: RBBB Type



A



B

Epidemiology

- Structural heart disease, especially DCM (45%).
- Ischemic cardiomyopathy: 4-5% of inducible VT
- Non-ischemic cardiomyopathy: 15-40% of inducible VT.
- Associated myocardial VT is also noted in 25%.

Management

- Drug therapy is usually ineffective.
- RF catheter ablation of a bundle branch (typically the RB) can cure BBR.
- ICD is needed since myocardial VT often occurs.

The NEW ENGLAND JOURNAL of MEDICINE

REVIEW ARTICLE

John A. Jarcho, M.D., *Editor*

Catheter Ablation of Ventricular Arrhythmias

Kalyanam Shivkumar, M.D., Ph.D.

Table 1. Evaluation and Management of Ventricular Tachycardia (VT).*

Preprocedure evaluation
Review of 12-lead ECG
Transthoracic echocardiogram
ICD interrogation and programming
Use of a Holter monitor or other event recorder (to assess PVC burden)
Management of myocardial ischemia
Management of heart failure
Imaging (MRI) to locate scars
FDG-PET to rule out inflammation (in appropriate cases)
Treatment of coexisting disorders (electrolyte abnormalities, renal failure)
Management of VT storm
Care in the ICU, beta-blockade, antiarrhythmic drug therapy (amiodarone)
Intubation, deep sedation
Mechanical hemodynamic support (intraaortic balloon pump, LVAD)
Neuraxial modulation: thoracic epidural anesthesia, stellate ganglion blockade
Radiofrequency catheter ablation

* ECG denotes electrocardiogram, FDG-PET ^{18}F-fluorodeoxyglucose–positron-emission tomography, ICD implantable cardioverter–defibrillator, ICU intensive care unit, LVAD left ventricular assist device, and PVC premature ventricular complex.

European Heart Journal (2015) **36**, 2793–2867
doi:10.1093/eurheartj/ehv316

2015 ESC Guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death

Recommendations	Class[a]	Level[b]	Ref.[c]
Catheter ablation of RVOT VT/PVC is recommended in symptomatic patients and/or in patients with a failure of anti-arrhythmic drug therapy (e.g. beta-blocker) or in patients with a decline in LV function due to RVOT-PVC burden.	I	B	525–528
Treatment with sodium channel blockers (class IC agents) is recommended in LVOT/aortic cusp/epicardial VT/PVC symptomatic patients.	I	C	529–531
Catheter ablation of LVOT/aortic cusp/epicardial VT/PVC by experienced operators after failure of one or more sodium channel blockers (class IC agents) or in patients not wanting long-term anti-arrhythmic drug therapy should be considered in symptomatic patients.	IIa	B	195, 531–533

2019 HRS/EHRA/APHRS/LAHRS expert consensus statement on catheter ablation of ventricular arrhythmias

4.1. Idiopathic Outflow Tract Ventricular Arrhythmia

Recommendations for catheter ablation of idiopathic OT VA

COR	LOE	Recommendations	References
I	B-R	1. In patients with frequent and symptomatic PVCs originating from the RVOT in an otherwise normal heart, catheter ablation is recommended in preference to metoprolol or propafenone.	S4.1.1
I	B-NR	2. In patients with symptomatic VAs from the RVOT in an otherwise normal heart for whom antiarrhythmic medications are ineffective, not tolerated, or not the patient's preference, catheter ablation is useful.	S4.1.2–S4.1.12
I	B-NR	3. In patients with symptomatic idiopathic sustained monomorphic VT, catheter ablation is useful.	S4.1.13–S4.1.17
IIa	B-NR	4. In patients with symptomatic VAs from the endocardial LVOT, including the SV, in an otherwise normal heart for whom antiarrhythmic medications are ineffective, not tolerated, or not the patient's preference, catheter ablation can be useful.	S4.1.18–S4.1.27
IIa	B-NR	5. In patients with symptomatic VAs from the epicardial OT or LV summit in an otherwise normal heart for whom antiarrhythmic medications are ineffective, not tolerated, or not the patient's preference, catheter ablation can be useful.	S4.1.28–S4.1.32

Recommendations for catheter ablation of PVCs in patients with or without LV dysfunction

COR	LOE	Recommendations	References
I	B-NR	1. In patients with cardiomyopathy suspected to be caused by frequent and predominately monomorphic PVCs and for whom AADs are ineffective, not tolerated, or not preferred for long-term therapy, catheter ablation is recommended.	S4.3.1–S4.3.10
IIa	B-NR	2. In patients with SHD in whom frequent PVCs are suspected to be contributing to a cardiomyopathy and for whom AADs are ineffective, not tolerated, or not preferred for long-term therapy, catheter ablation can be useful.	S4.3.3,S4.3.11,S4.3.12
IIa	B-NR	3. In patients with focally triggered VF refractory to AADs and triggered by a similar PVC, catheter ablation can be useful.	S4.3.13–S4.3.17
IIa	C-LD	4. In nonresponders to cardiac resynchronization therapy (CRT) with very frequent unifocal PVCs limiting optimal biventricular pacing despite pharmacological therapy, catheter ablation can be useful.	S4.3.18

Recommendations for catheter ablation of VAs in patients with IHD

COR	LOE	Recommendations	References
I	B-R	1. In patients with IHD who experience recurrent monomorphic VT despite chronic amiodarone therapy, catheter ablation is recommended in preference to escalating AAD therapy.	S4.4.1
I	B-NR	2. In patients with IHD and recurrent symptomatic monomorphic VT despite AAD therapy, or when AAD therapy is contraindicated or not tolerated, catheter ablation is recommended to reduce recurrent VT.	S4.4.2–S4.4.4
I	B-NR	3. In patients with IHD and VT storm refractory to AAD therapy, catheter ablation is recommended.	S4.4.5–S4.4.9
IIa	C-EO	4. In patients with IHD and recurrent monomorphic VT, in whom AADs are not desired, catheter ablation can be useful.	
IIb	A	5. In patients with IHD and an ICD who experience a first episode of monomorphic VT, catheter ablation may be considered to reduce the risk of recurrent VT or ICD therapies.	S4.4.10–S4.4.14
IIb	C-LD	6. In patients with prior MI and recurrent episodes of symptomatic sustained VT for whom prior endocardial catheter ablation has not been successful and who have ECG, endocardial mapping, or imaging evidence of a subepicardial VT substrate, epicardial ablation may be considered.	S4.4.15–S4.4.19


Thank you