Behandlung von ablationsrefraktären VTs

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HERZZENTRUM
LEIPZIG

Helios

Conflict of Interests

NONE

When is a VT refractory to ablation?

It is important to emphasize that after an initial failed endocardial or epicardial ablation, a repeat standard ablation can often be successful, suggesting that the most common reason for initial failure is **failure of mapping** or **inadequate lesion creation**.

In structural heart disease–related VT, ablation fails to abolish the clinical VTs in 5% to 10% in ischemic cardiomyopathy and 11% to 24% in NICM. *

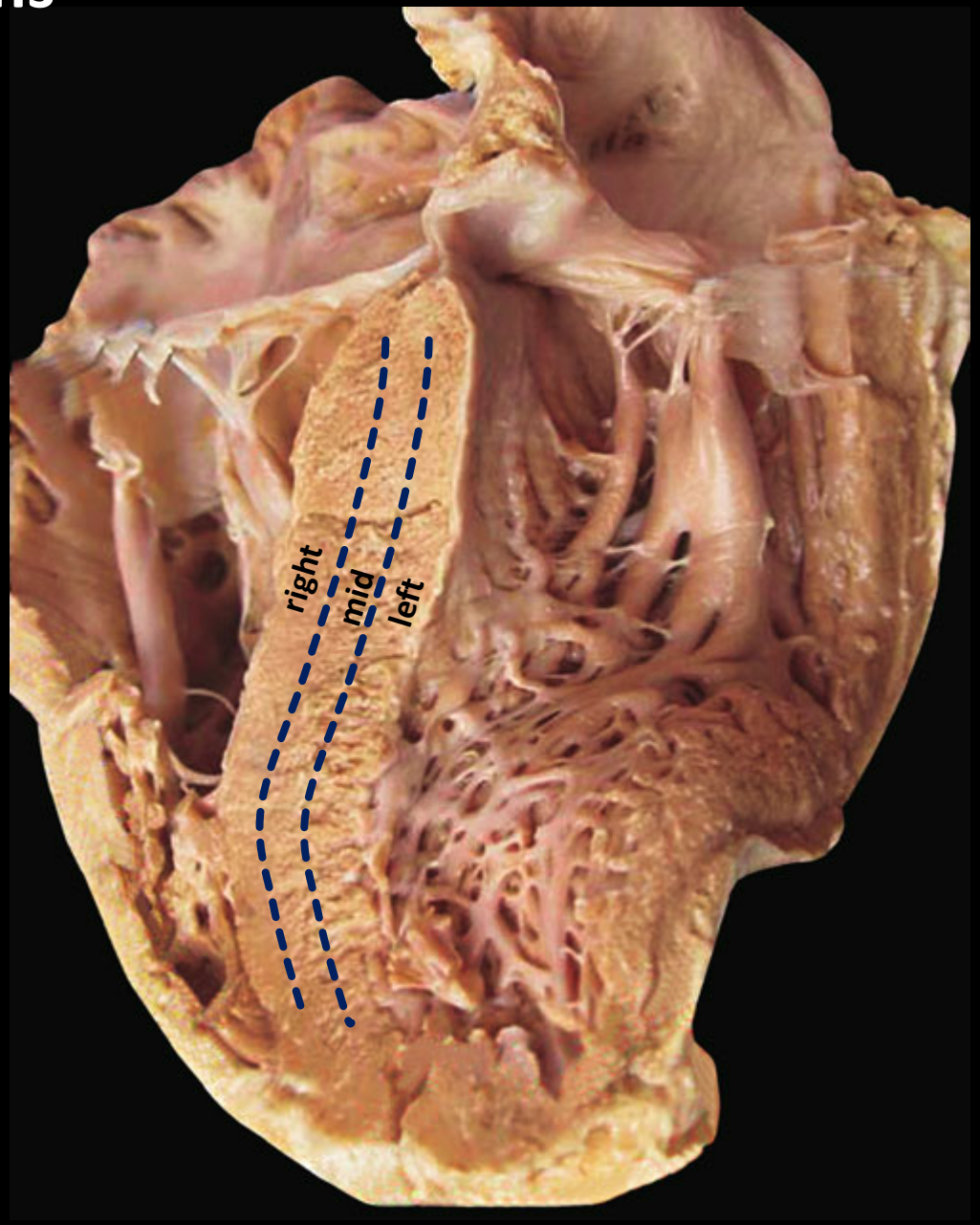
* Circ Arrhythm Electrophysiol. 2017;10:e003676

Table 1. Reasons for Acute Failure With Contemporary Catheter Ablation Techniques

Reasons for Acute Failure
Suboptimal previous endocardial or epicardial ablation
Nonendocardial VA origin but inaccessible epicardium
Previous cardiac surgery
Previous pericarditis
Failed attempt at epicardial access
Intramural substrate
Septal
Free wall
VA origin in close proximity to critical structures
Endocardial: His bundle
Epicardial: phrenic nerve, coronary arteries
Inability to deliver adequate energy to VA target site
Great cardiac vein or anterior interventricular vein
Anatomic barriers prohibiting lesion formation
Prominent trabeculations (eg, right ventricle)
Epicardial fat (eg, LV summit)
Suspected nonendocardial VA origin, but epicardial access not undertaken because of anticipated cardiac surgery for other conditions, such as valve replacement or LVAD insertion, where VA surgery will also be performed
Acute complications
Ventricular perforation and tamponade
Other catastrophic complications (eg, refractory cardiogenic shock, stroke, electromechanical dissociation)

Circ Arrhythm Electrophysiol. 2017;10:e003676.

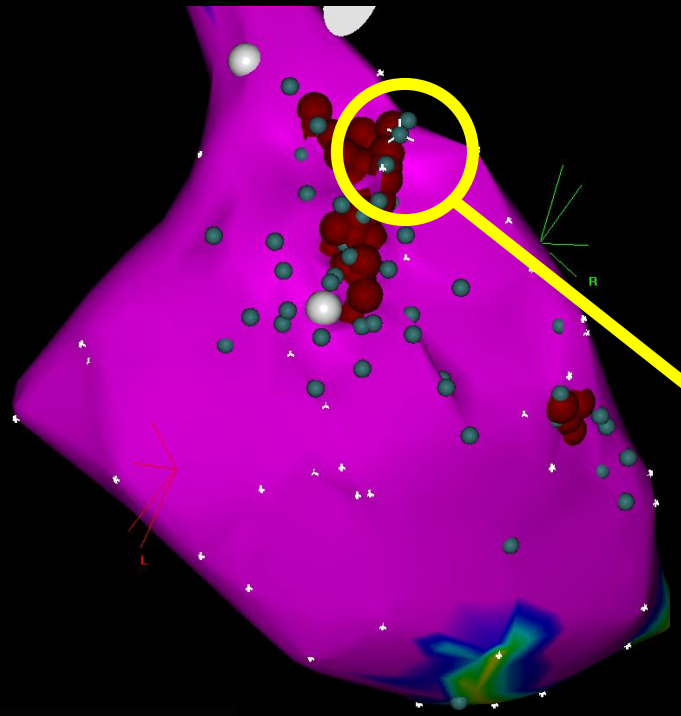
Anatomical Considerations

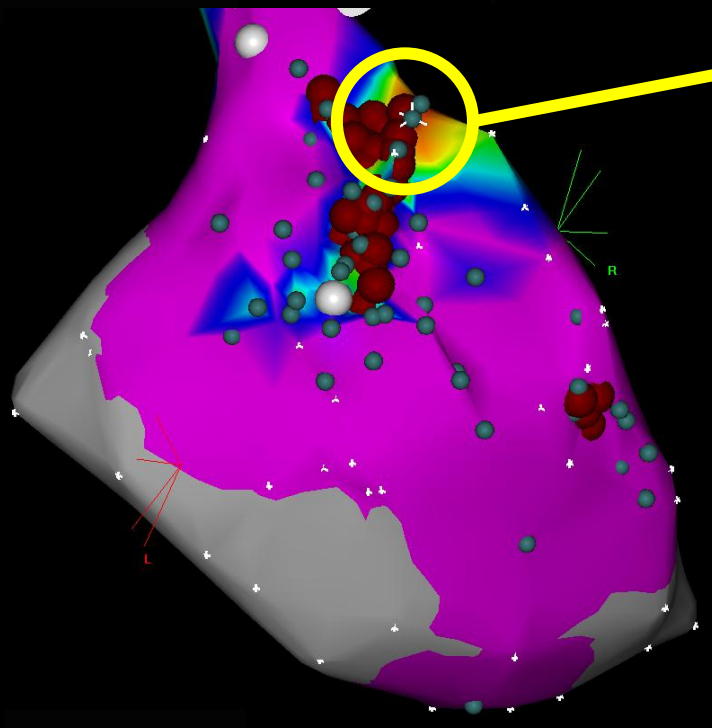


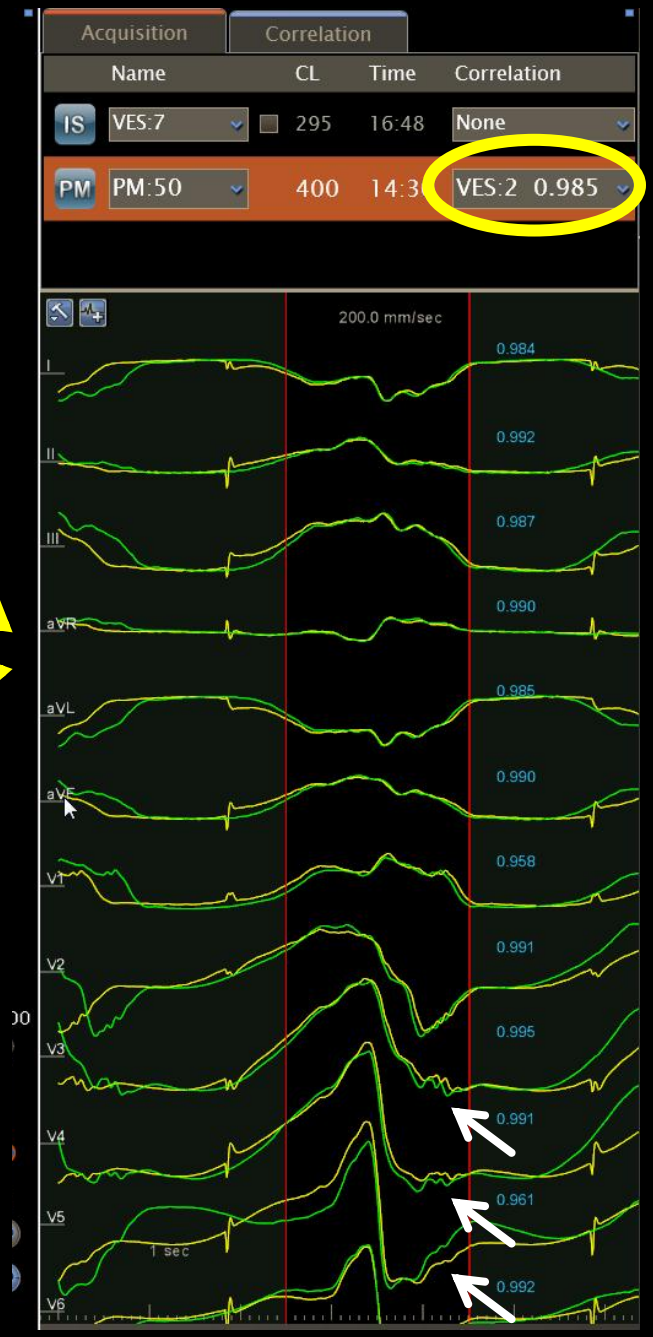
Zhu X. Surgical Atlas of Cardiac Anatomy 2015
 ISBN 978-94-017-9408-4

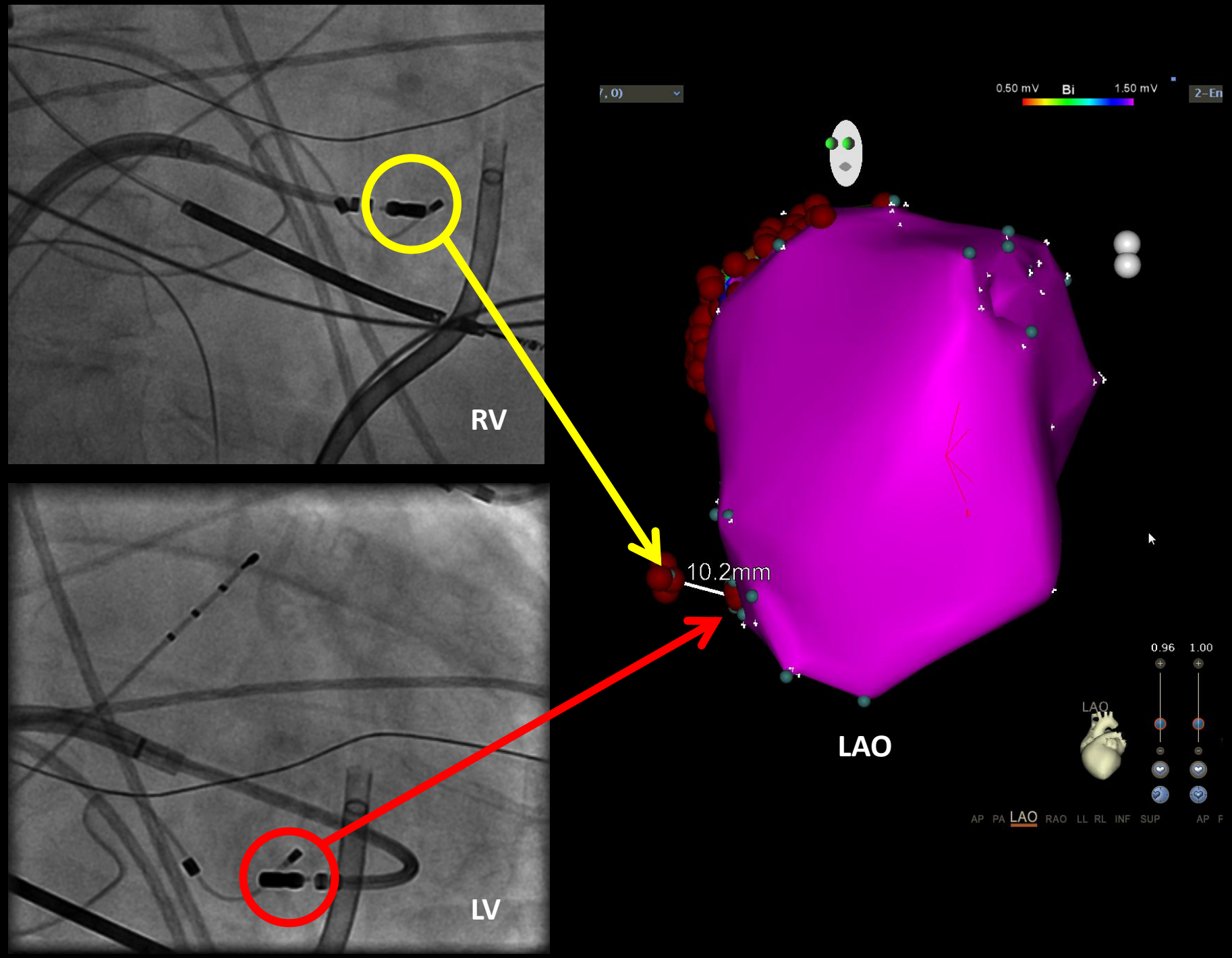
Substrate Mapping

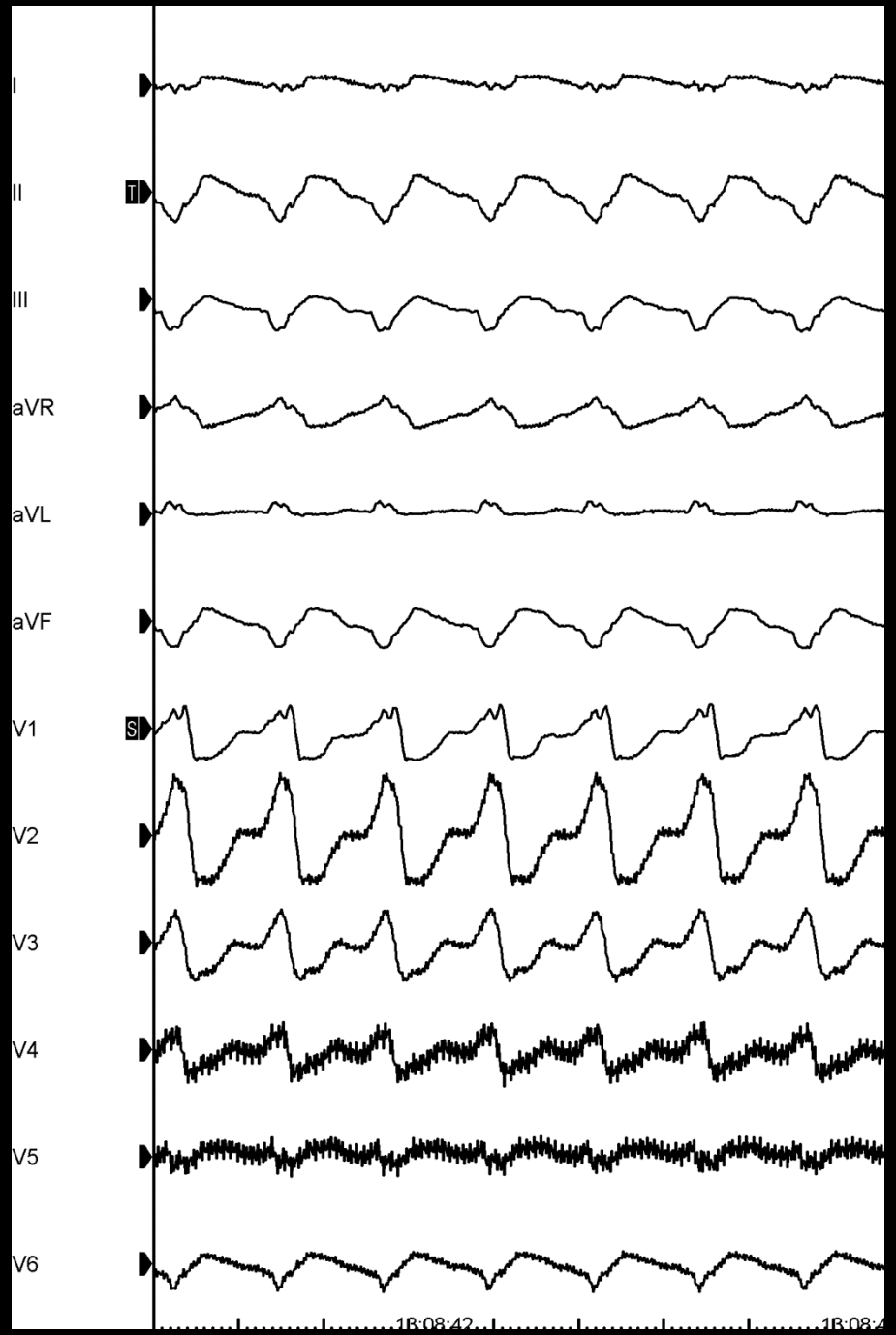
PM Correlation Mapping

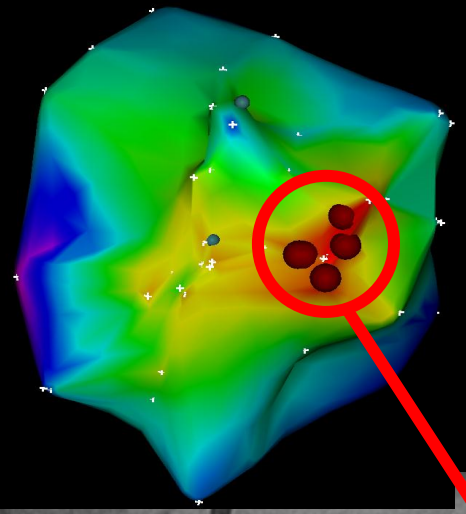






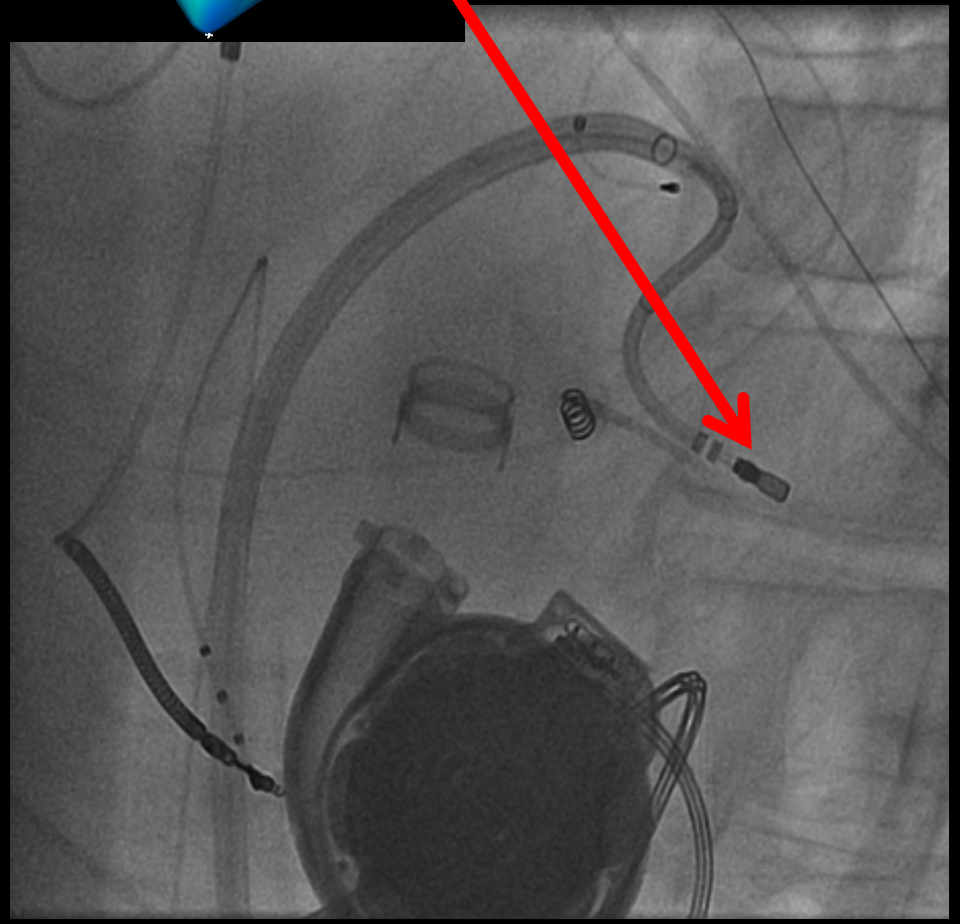

RV
LV
0.50 mV
Bi
1.50 mV
10.2mm
LAO
0.96
1.00
AP PA LAO RAO LL RL INF SUP





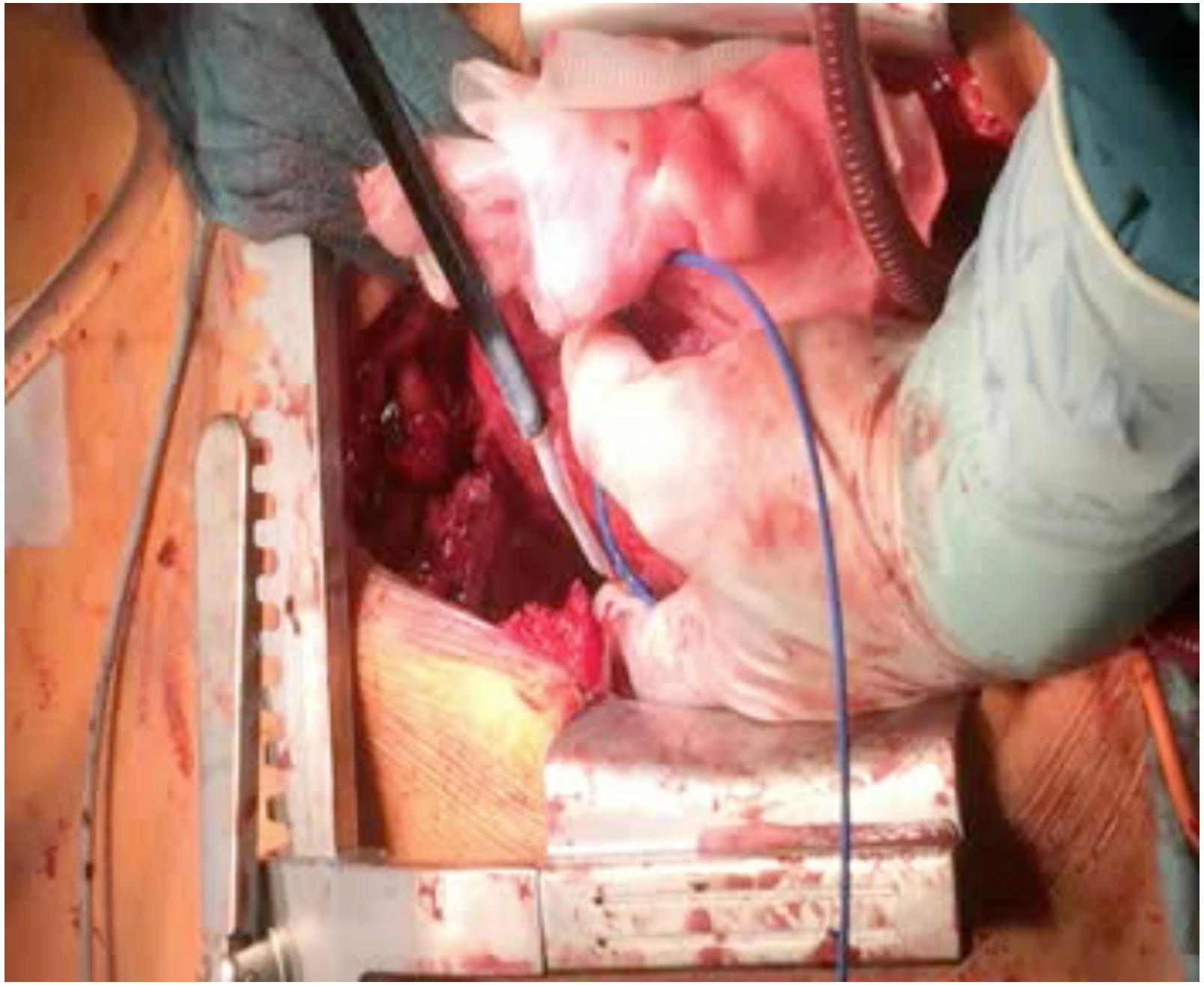
Epicardial VT
LVAD

LV Left Lateral



Surgical approaches[7,35,36]				
Epicardial window	When epicardial target suspected but percutaneous pericardial access not possible	Allows access to LV inferior wall and apex, but access may be limited	Risk of bleeding because of lysis of adhesions if necessary	Careful preprocedural planning with imaging, 3D mapping needed to determine optimal approach
			Difficult to access anterior or lateral LV from subxiphoid approach if adhesions present	
Thoractomy/median sternotomy	Usually a last resort therapy or "no access" ventricles; or when other cardiac surgical indication exists	Preferred for anterior or lateral LV targets	Complications in 17% to 36% in a high-risk population	
		May allow access to entire heart to address more complex substrates or when mobilization of phrenic or coronaries needed to target VA	Noninducibility or nonsustainability of ventricular tachycardia can limit operative mapping	
		Can address other surgical needs (eg, revascularization, valve replacement, LVAD replacement)	Usually limited intraoperative 3D mapping options	
		49% to 67% VA-free survival when used as a last resort in contemporary series		
		Significant ↓ VA burden		

Circ Arrhythm Electrophysiol. 2017;10:e003676.



Interventional Options:

Half-Saline Irrigation

Bipolar Ablation

Needle Ablation

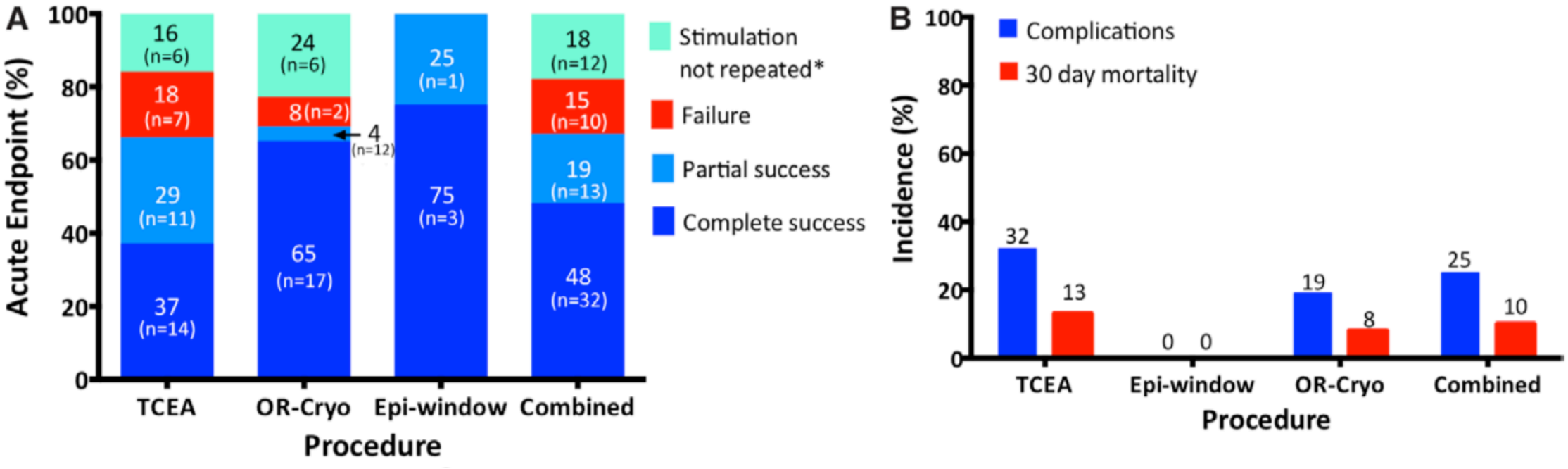
Alcohol Ablation

Surgical Cardiac Sympathetic Denervation/RSD

New catheter design (HPSD)/ energy sources (HIFU)

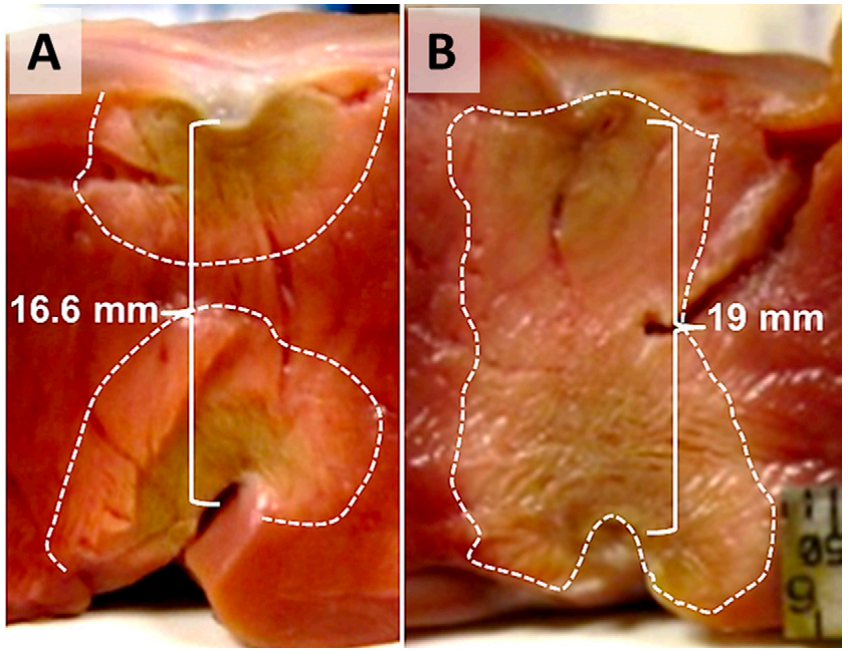
Radioablation

In the absence of any randomized data, the **choice** and **sequence of alternative** interventional techniques are heavily influenced by institutional experience and preferences.

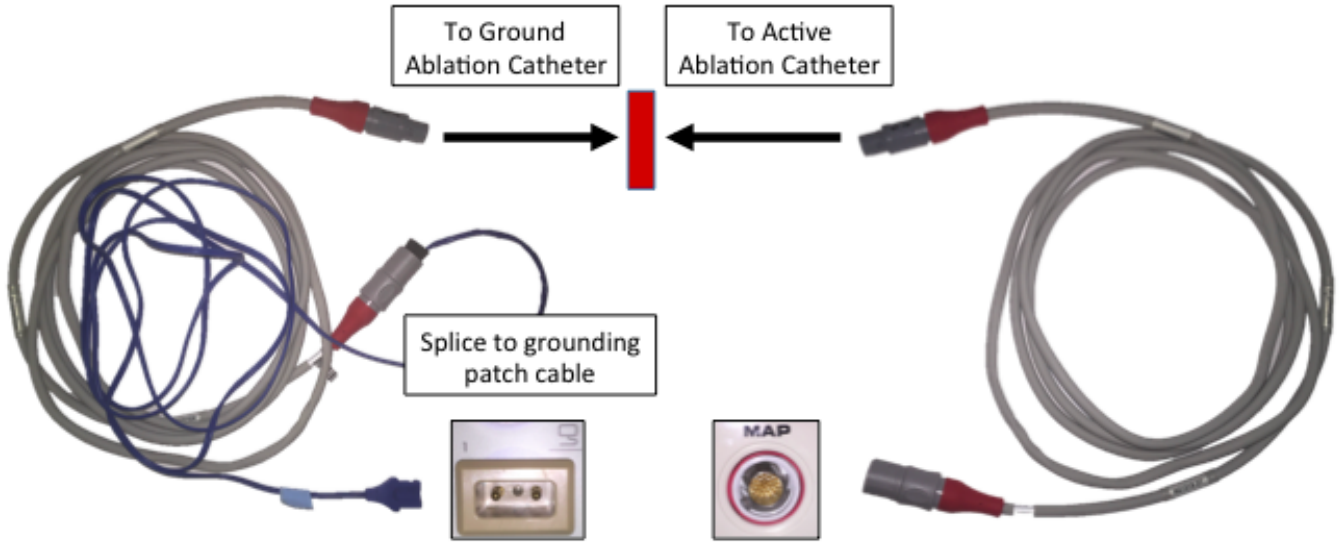


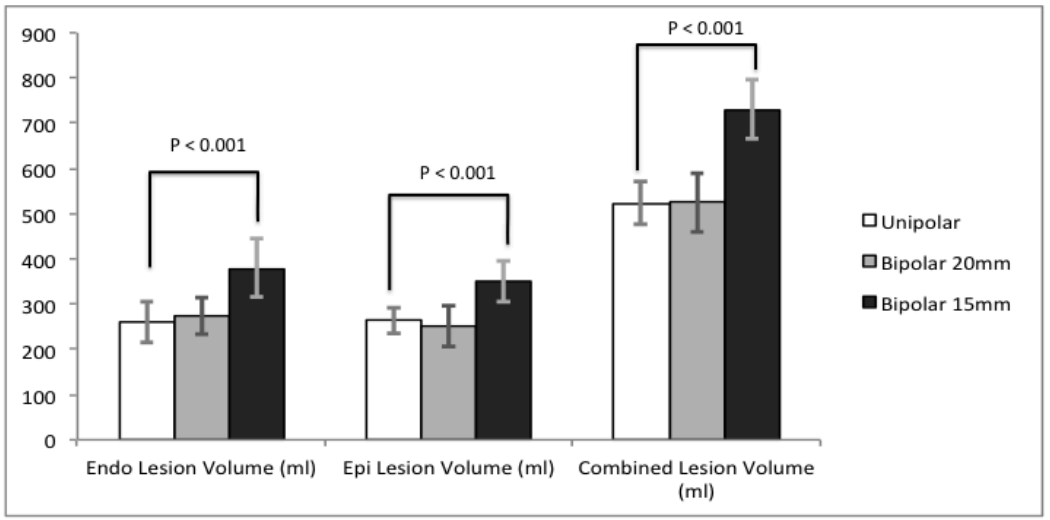
Circ Arrhythm Electrophysiol. 2015;8:606-615.

Bipolar Ablation:



Heart Rhythm 2012;9:1932–1941

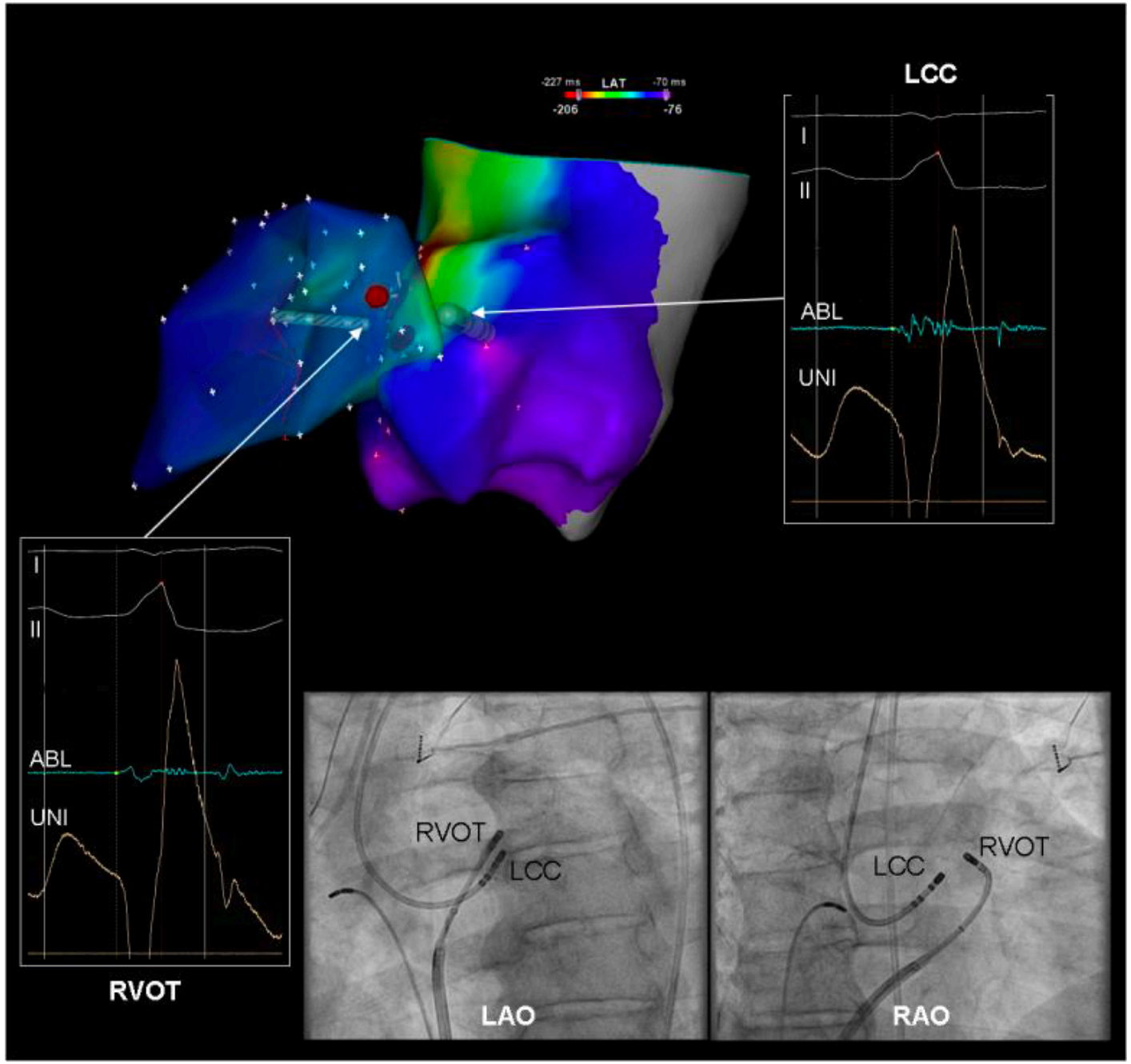




	Endo Lesion Volume (ml)	Epi Lesion Volume (ml)	Combined Lesion Volume (ml)
Unipolar	260.7±46.5	263.0±27.7	523.7±47.8
Bipolar 20mm	274.0±40.5	250.9±46.4	524.9±65.3
Bipolar 15mm	379.4±63.4	350.2±45.4	729.6±64.9
20mm vs. Unipolar	p = 0.242	p = 0.227	p = 0.934
15mm vs. Unipolar	**p < 0.001**	**p < 0.001**	**p < 0.001**

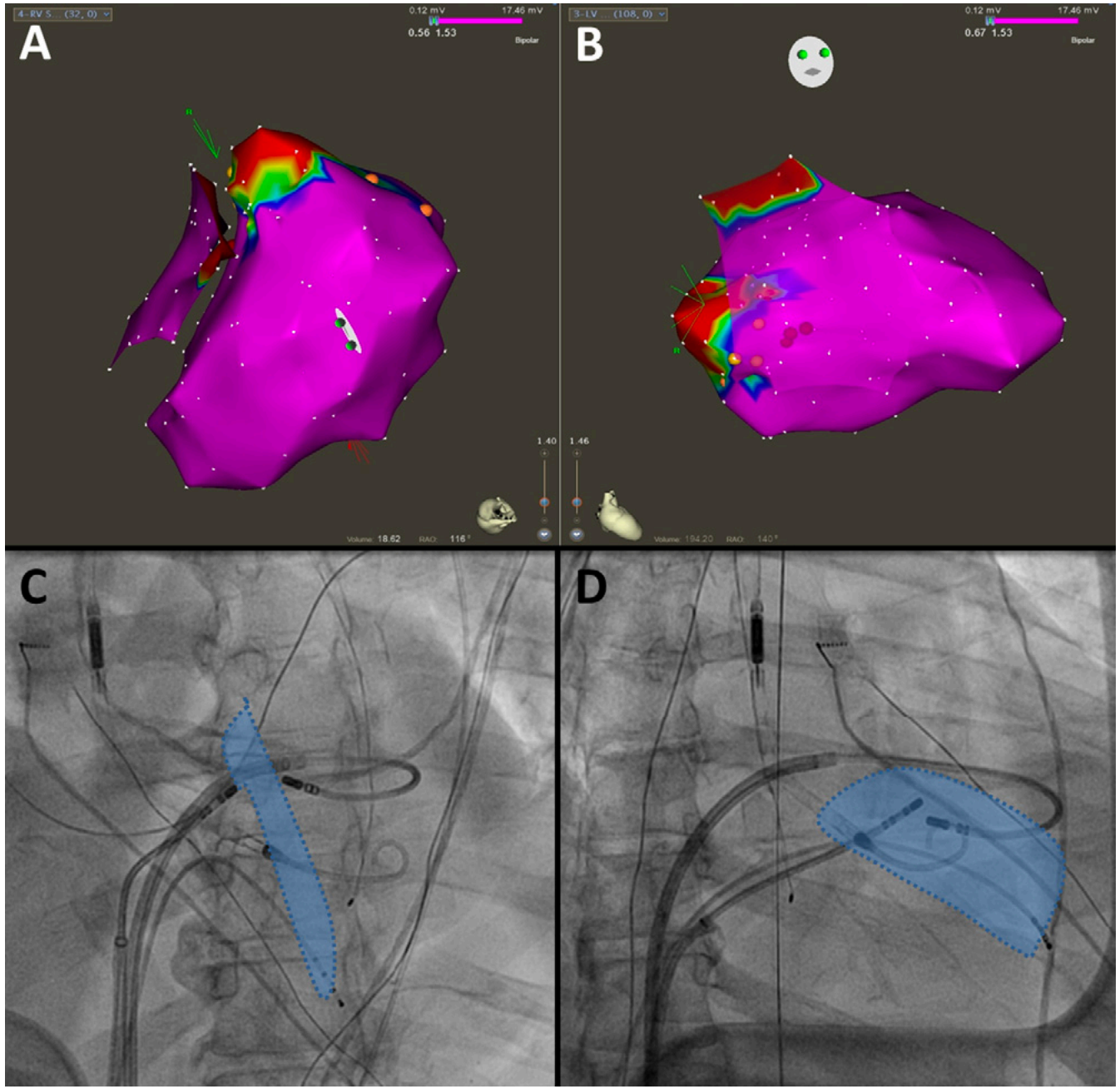
Heart Rhythm. 2016 Nov;13(11):2161-2171

Bipolar Ablation:



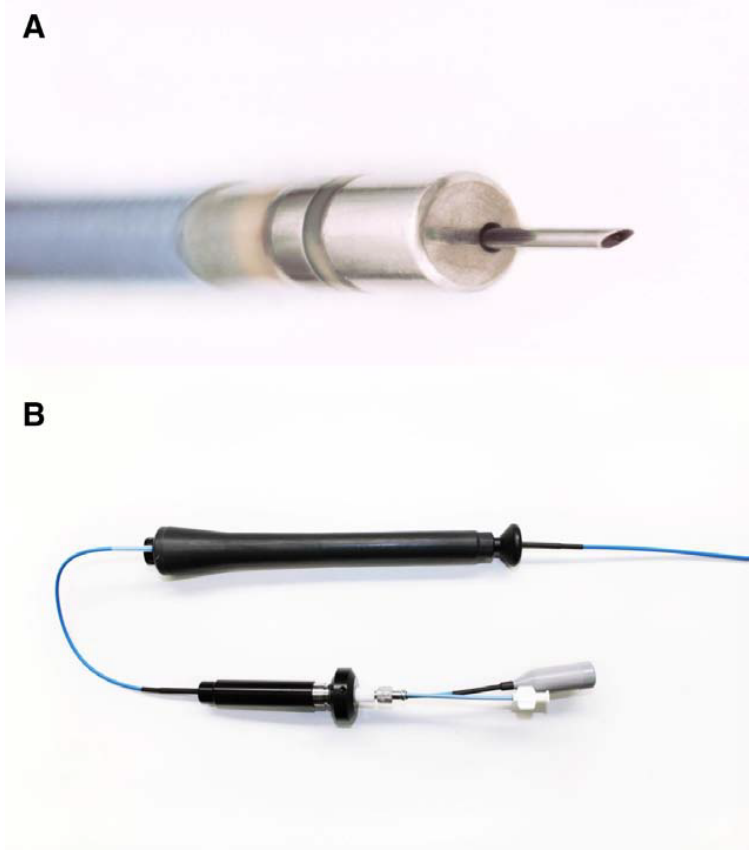
J Cardiovasc Electrophysiol. 2014 Oct;25(10):1093-9

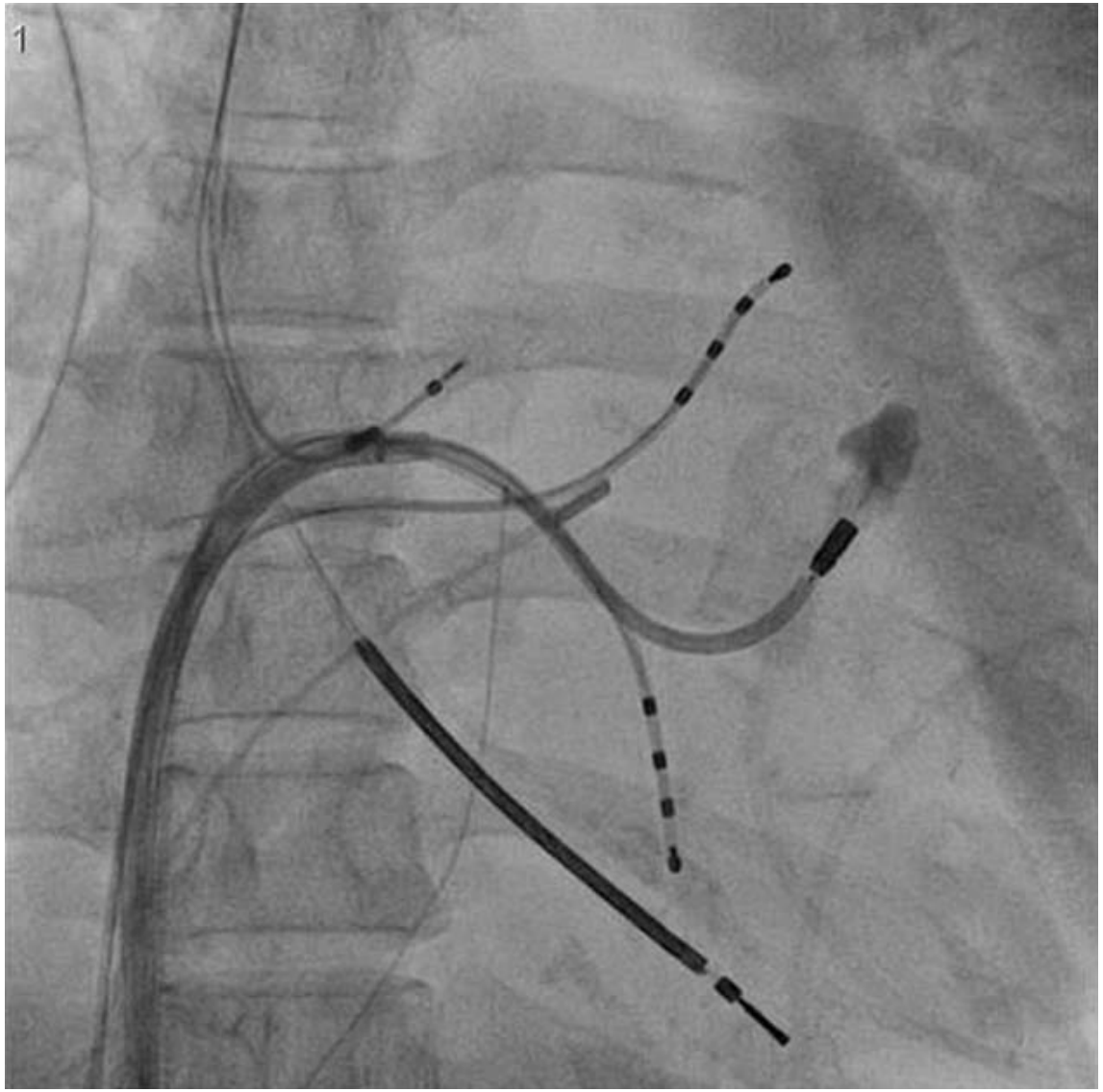
Bipolar Ablation:



Heart Rhythm 2012;9:1932–1941

Needle Ablation:

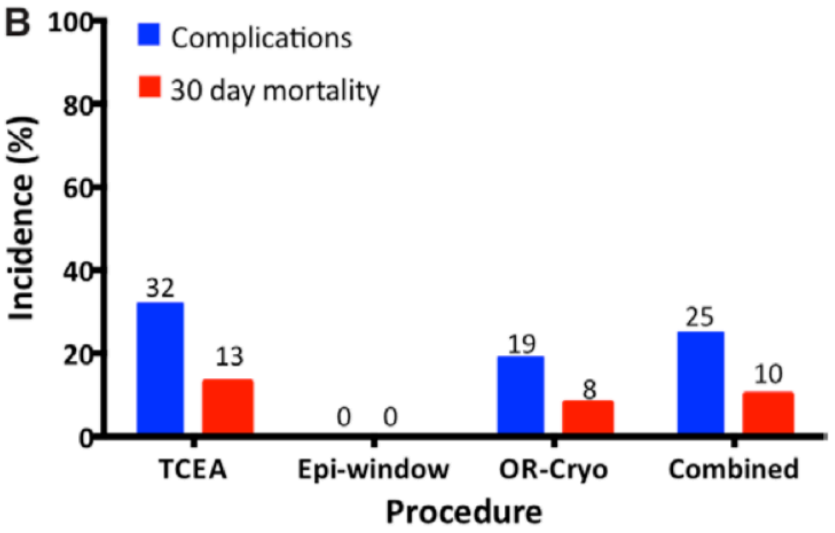


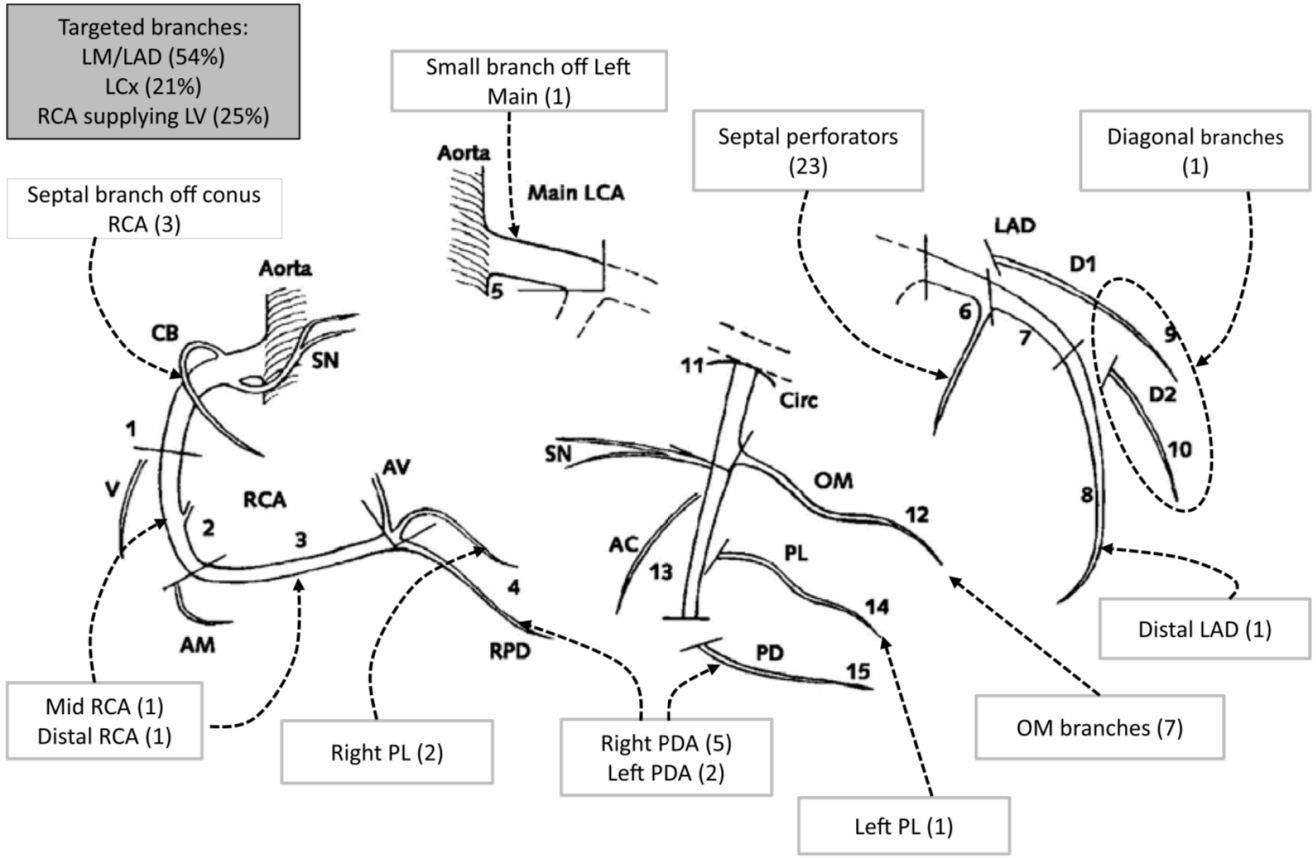


Circulation. 2013;128:2289–2295

Transcoronary Ethanol Ablation:

In a series of 42 patients (19 with ischemic, 22 with nonischemic, and 1 with no structural heart disease) target sites were septal in 74%, aortic-mitral continuity or the outflow tracts in 9% and other non-septal sites in 23% of patients.





Circ Arrhythm Electrophysiol. 2015;8:606-615.

Table 1
Cases series on ventricular tachycardia alcohol ablation

Author, Year	N	Age (y)	ICM	Acute Success	Complications	Follow-up	Recurrence
Brugada et al,[5] 1989	3	56 ± 10	100%	100%	33% (CHB)	1–6 mo	33%
Dailey et al,[6] 1992	4	NA	100%	100%	25% (CHB)	4–25 mo	50%
Kay et al,[7] 1992	10	62 ± 12	100%	90% any VT	40% (CHB)	372 d	50%
Nellens et al,[8] 1992	10	NA	100%	100%	NA	2–44 mo	14%
Segal et al,[2] 2007	5	70 ± 4	80%	100%	0%	19 ± 17 mo	0%
Sacher et al,[9] 2008	9	55 ± 9	67%	56% any VT 89% clinical VT	33% (1 severe hypotension; 2 groin hematoma)	29 ± 23 mo	33%
Steven et al,[10] 2009[a]	3	NA	NA	100%	0%	NA	NA
Tokuda et al,[11] 2011	22	63 ± 13	52%	46% any VT 82% clinical VT	38% (CHB)	16 d	64%
Baher et al,[3] 2012[b]	2	~67	0%	100% clinical VT	50% (pericarditis)	5 mo	0%

Abbreviations: CHB, complete heart block; ICM, ischemic cardiomyopathy; N, number; NA, not available.

[a] Part of a case series on VT originating from the aortomitral continuity in structural heart disease.

[b] Retrograde TCEA.

Card Electrophysiol Clin. 2017 Mar;9(1):93-98.

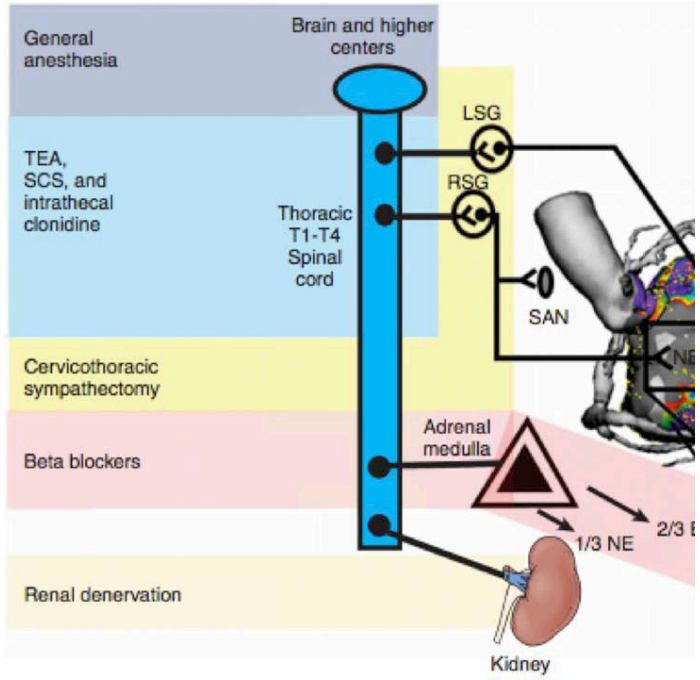
Surgical Cardiac Sympathetic Denervation:

Cardiac sympathetic denervation in patients with refractory ventricular arrhythmias or electrical storm: Intermediate and long-term follow-up

Heart Rhythm2014;11:360–366

41 Patients: 14 LSCD, 27 BSCD

Freedom from ICD shocks: 48% (BSCD)
Significant ↓ ICD shocks: 90%
BSCD (48%) >> LSCD (30%)

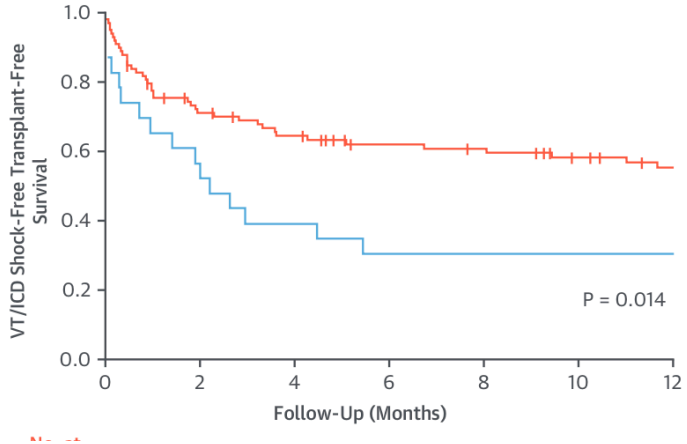


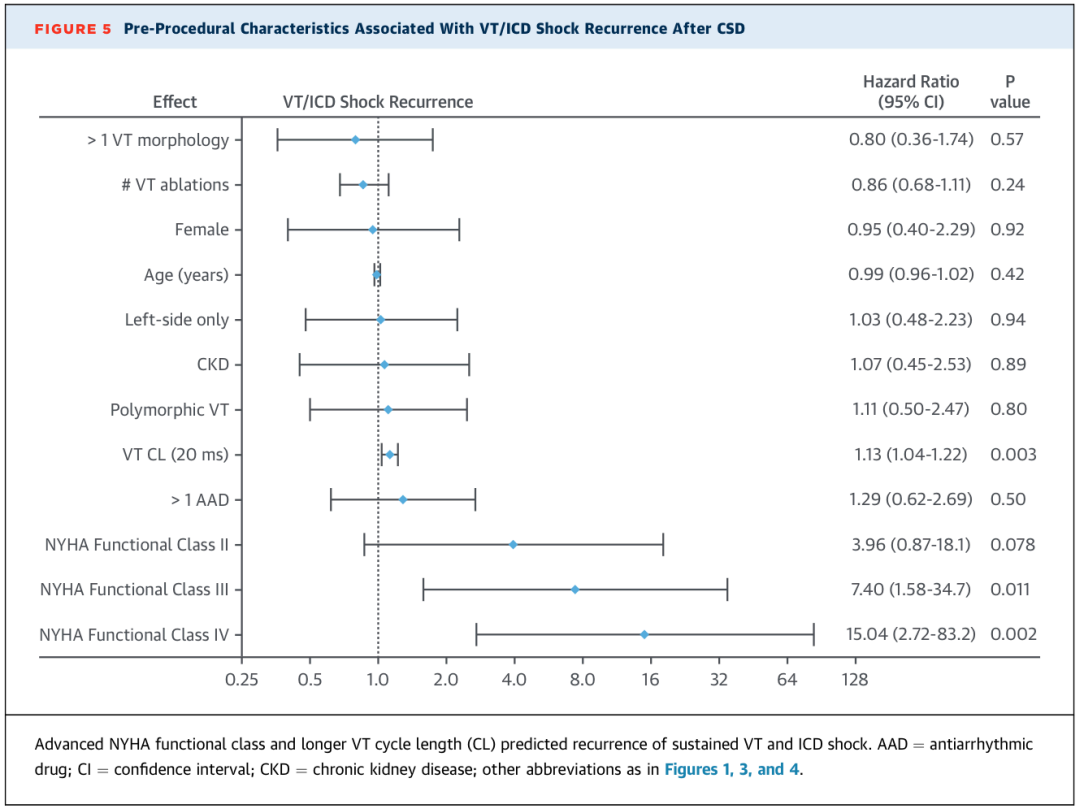
Usually works for faster VTs

Cardiac Sympathetic Denervation for Refractory Ventricular Arrhythmias

Between 2009 and 2016, 121 patients (age 55±13 years, 26% female, mean ejection fraction of 30±13%) underwent left or bilateral CSD.

One-year freedom from sustained VT/ICD shock and ICD shock, transplant, and death were 58% and 50%, respectively.

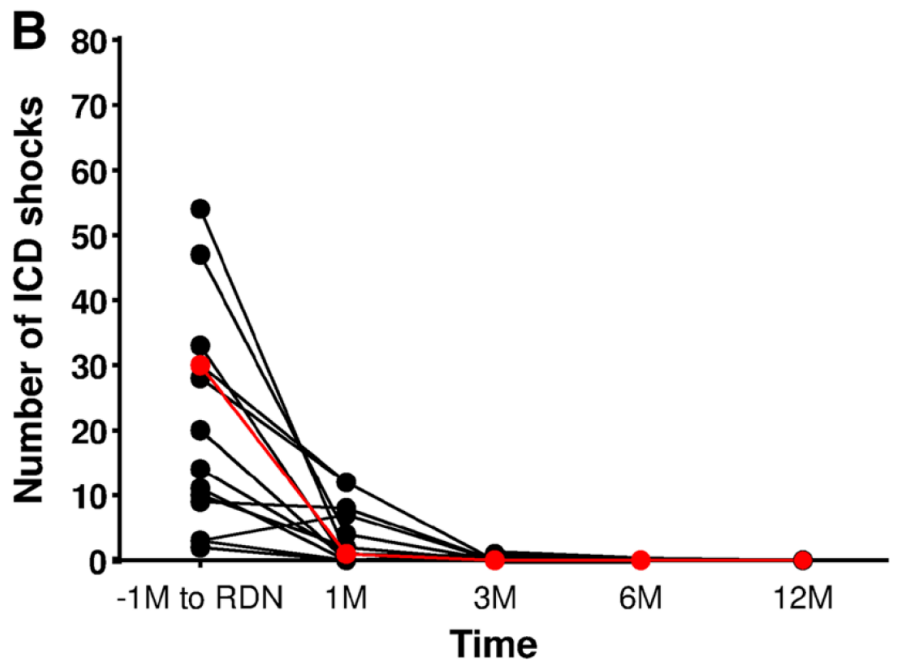




J Am Coll Cardiol 2017;69:3070–80

Renal denervation for treatment of ventricular arrhythmias: data from an International Multicenter Registry

Clin Res Cardiol (2016) 105:873–879



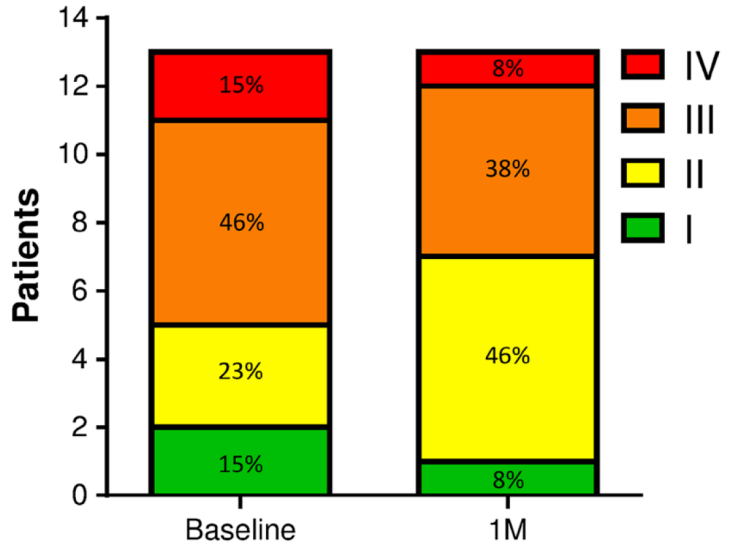


Fig. 3 Proportion of NYHA-class at baseline and after 1 month after renal denervation. *1M* 1-month follow-up

13 Patients. Four (31 %) and 11 (85 %) patients of these 13 patients were free from VA at 1 and 3 months.

Stereotactic Ablative Radiotherapy for the Treatment of Refractory Cardiac Ventricular Arrhythmia

Billy W. Loo, Jr, MD, PhD*; Scott G. Soltys, MD*; Lei Wang, PhD; Anthony Lo, MS;
Benjamin P. Fahimian, PhD; Andrei Iagaru, MD; Linda Norton, RN, MSN;
Xin Shan, BS, BAH; Edward Gardner, PhD; Thomas Fogarty, MD;
Patrick Maguire, MD, PhD; Amin Al-Ahmad, MD; Paul Zei, MD, PhD

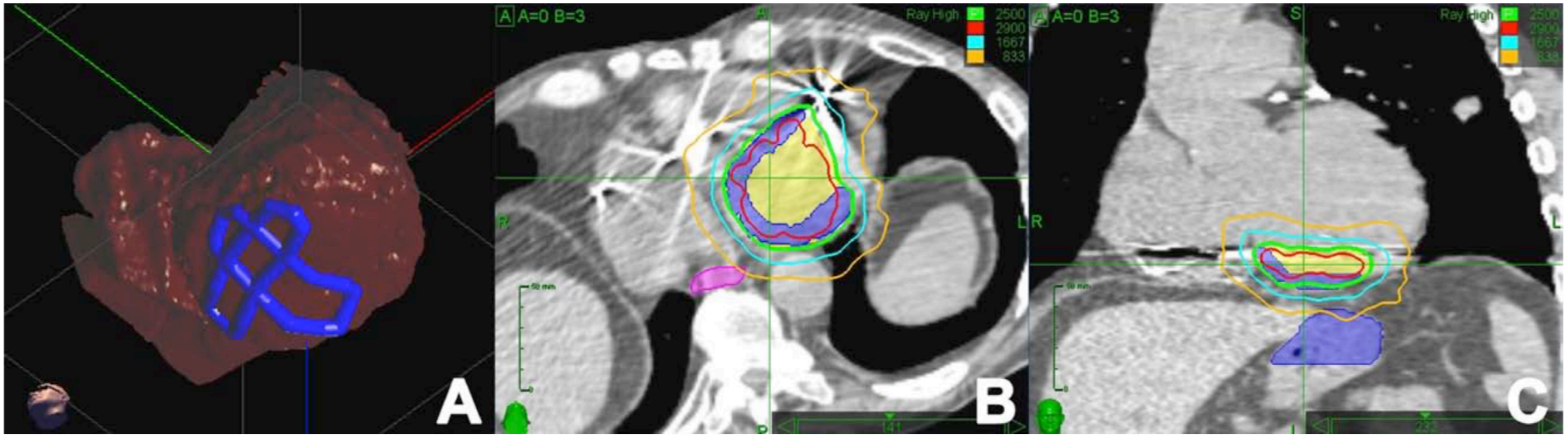


Figure 1. Stereotactic arrhythmia radioablation (STAR) treatment plan. **A**, Simulated cardiac ablation contours (dark blue); **B** and **C**, Final target volume (blue/yellow) treated with 25 Gy (Green isodose line) with higher dose (Red 29 Gy isodose line) centered within the mid-myocardial layer.

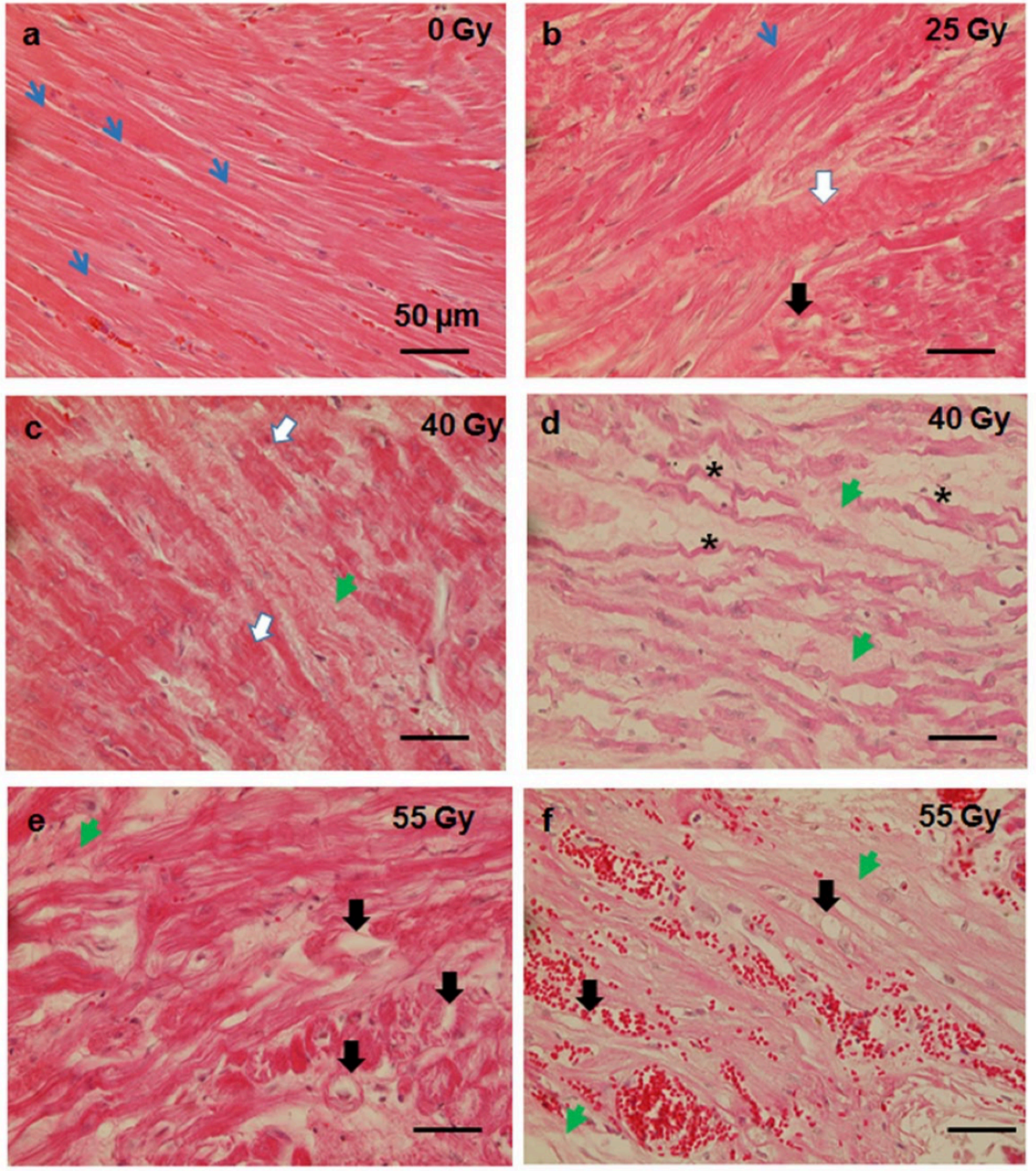
A STAR treatment plan of 25 Gy in a single outpatient treatment over 90 minutes to the 75% isodose line was designed, encompassing the inferoseptal, inferior, and inferolateral walls from base to apex.

Circ Arrhythm Electrophysiol. 2015;8:748-750.

High-energy heavy ions can deliver high radiation doses in small targets with reduced damage to the normal tissue compared to conventional X-rays.

Mechanism of action:

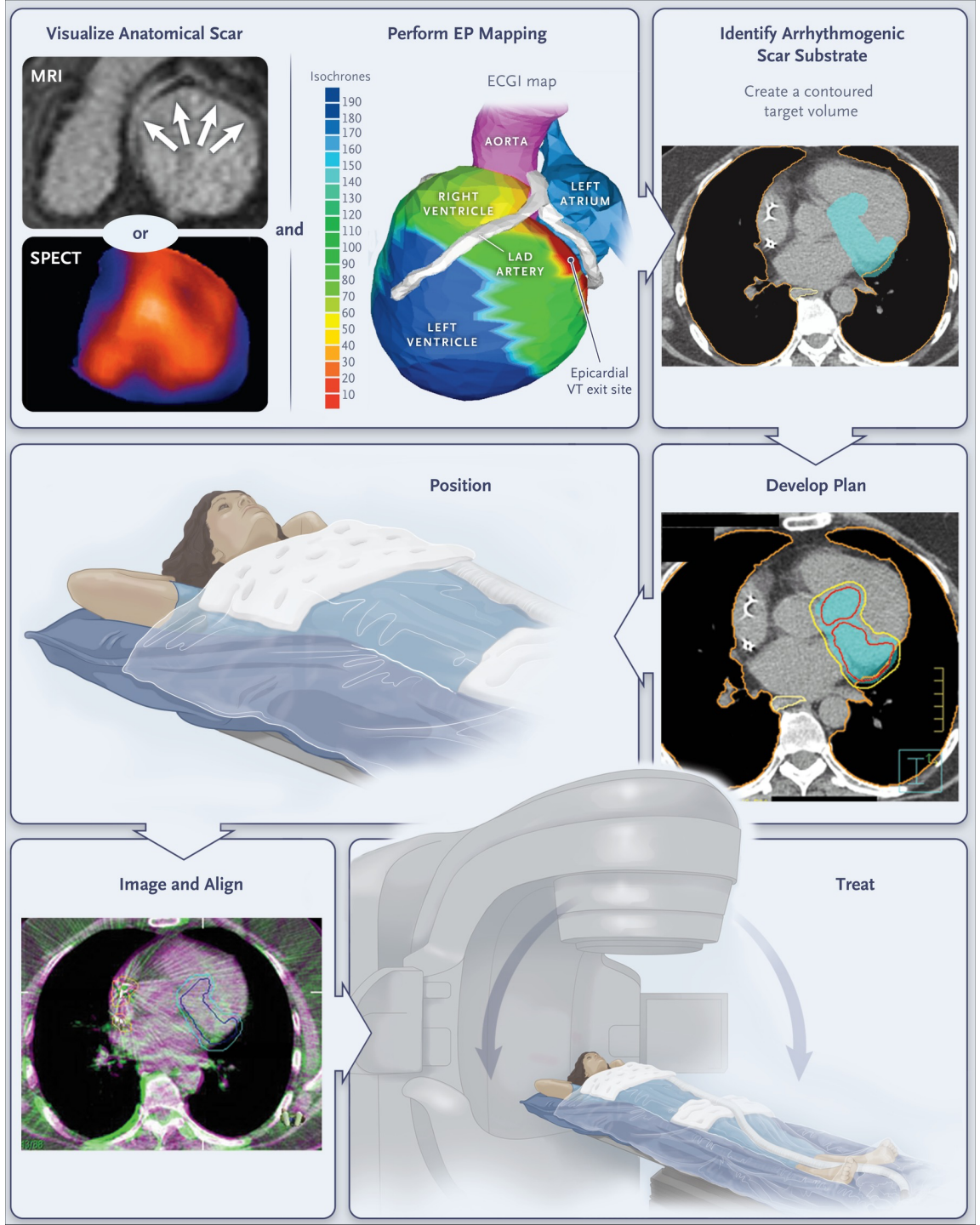
(1) long-lasting vascular damage
(2) fibrosis and
(3) loss of polarity of targeted cardiomyocytes and wavy fibers with vacuolization.

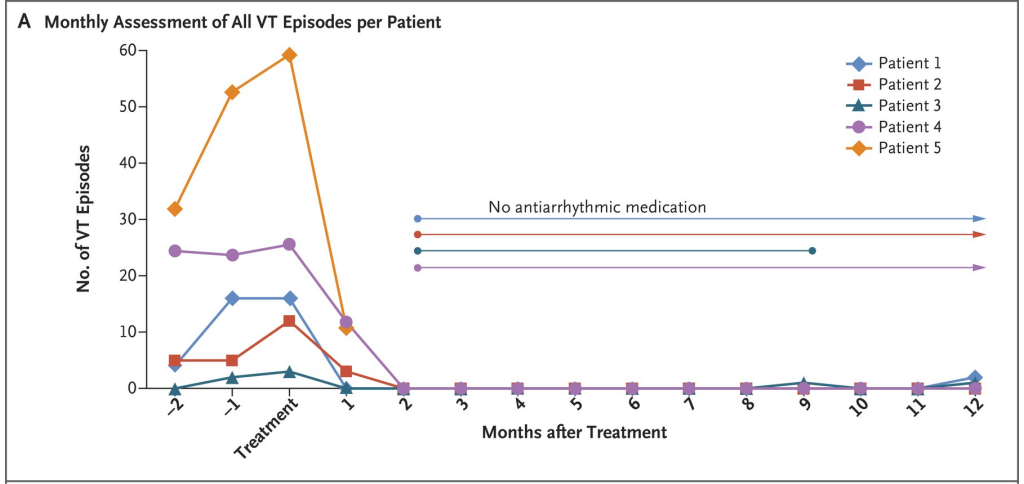


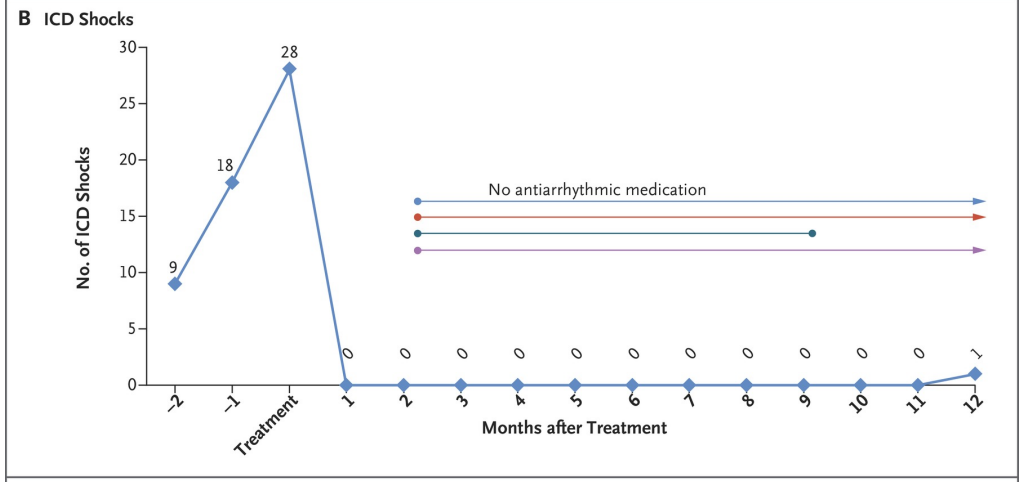
Scientific Report 2019 Mar 21;9(1):5000. doi: 10.1038/s41598-019-41314-x.

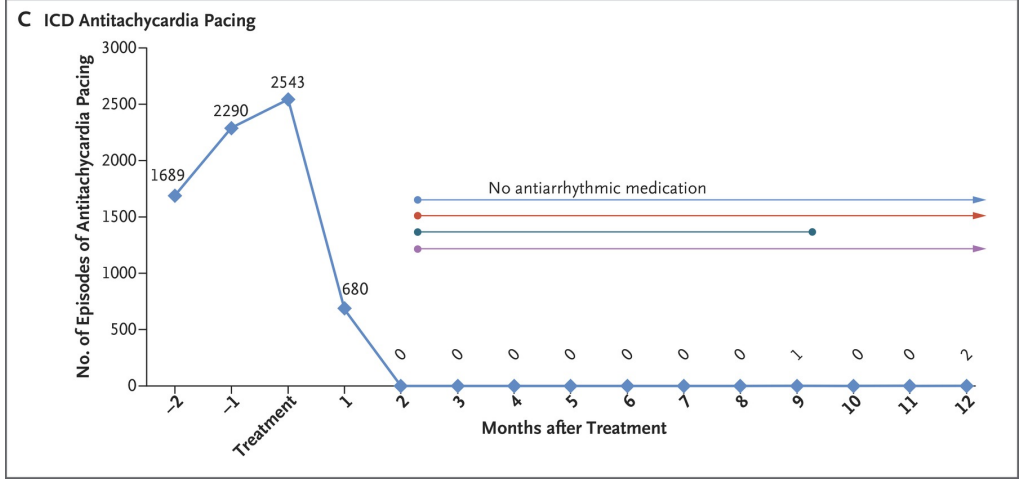
Noninvasive Cardiac Radiation for Ablation of VT

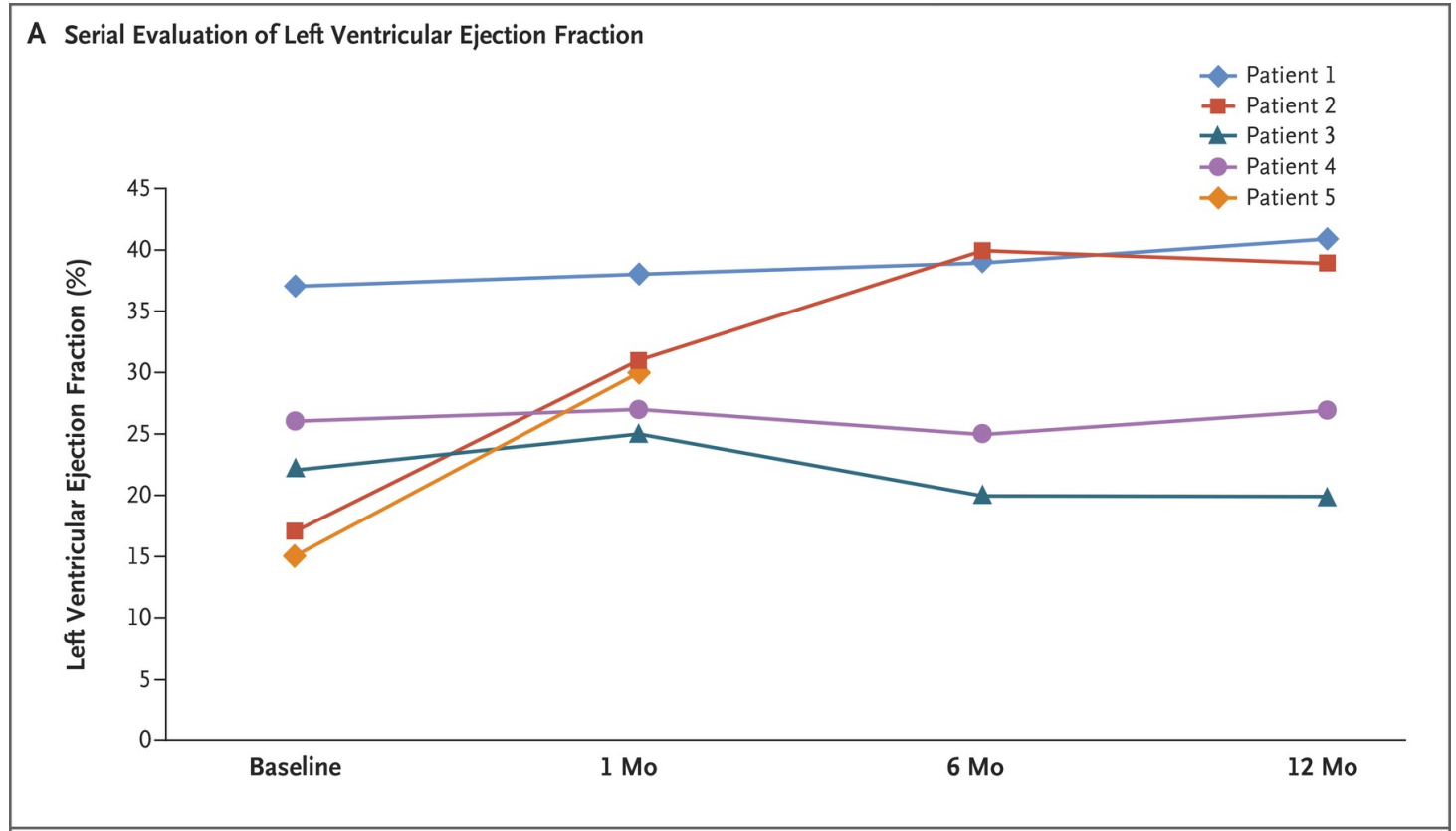
N Engl J Med 2017; 377:2325-2336

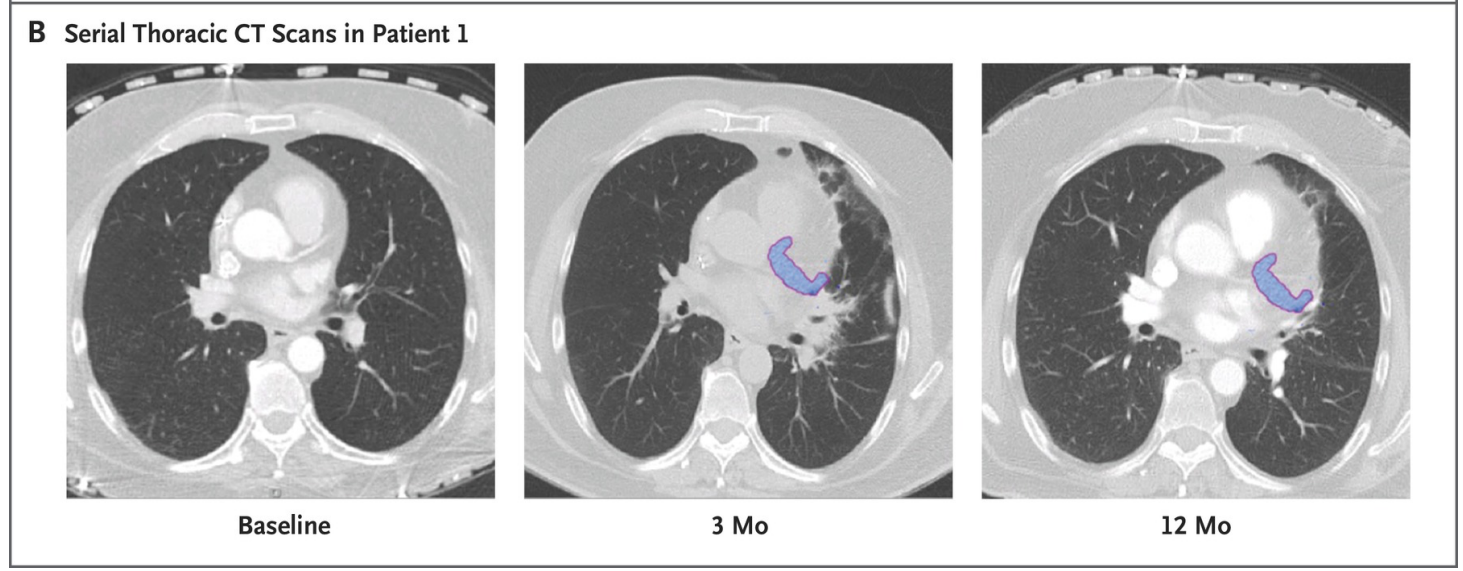



A Monthly Assessment of All VT Episodes per Patient
No. of VT Episodes
Patient 1
Patient 2
Patient 3
Patient 4
Patient 5
No antiarrhythmic medication
Treatment
Months after Treatment

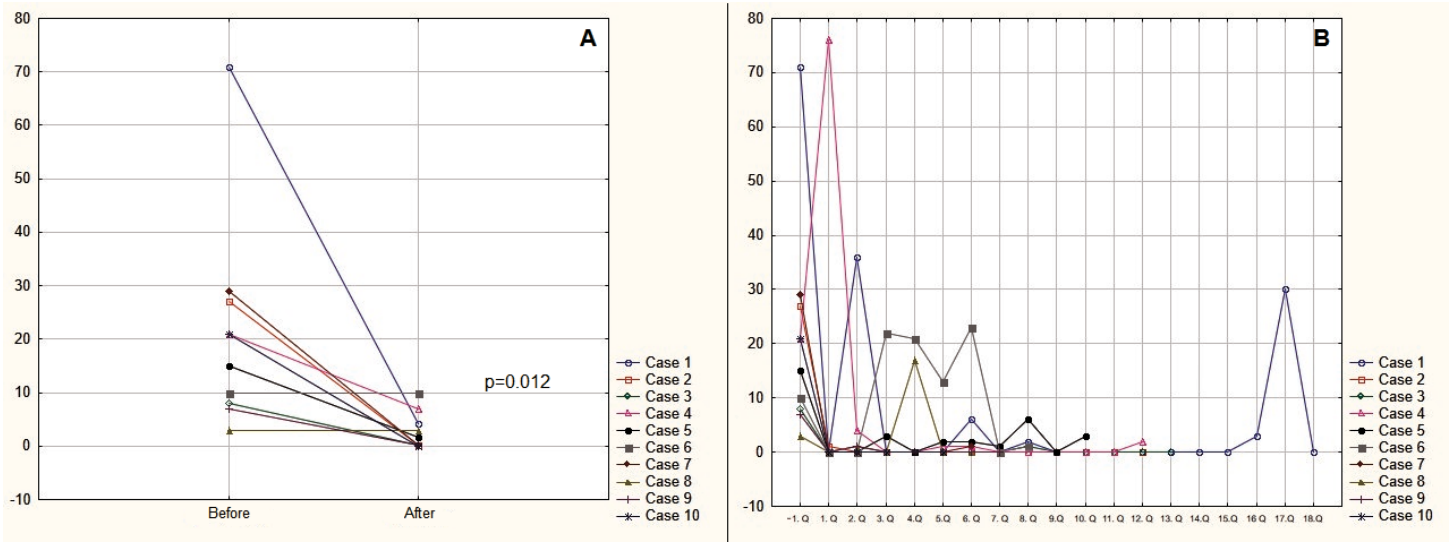

B ICD Shocks
No. of ICD Shocks
No antiarrhythmic medication
Treatment
Months after Treatment


C ICD Antitachycardia Pacing
No. of Episodes of Antitachycardia Pacing
No antiarrhythmic medication
Treatment
Months after Treatment


A Serial Evaluation of Left Ventricular Ejection Fraction
Patient 1
Patient 2
Patient 3
Patient 4
Patient 5
Left Ventricular Ejection Fraction (%)
Baseline
1 Mo
6 Mo
12 Mo

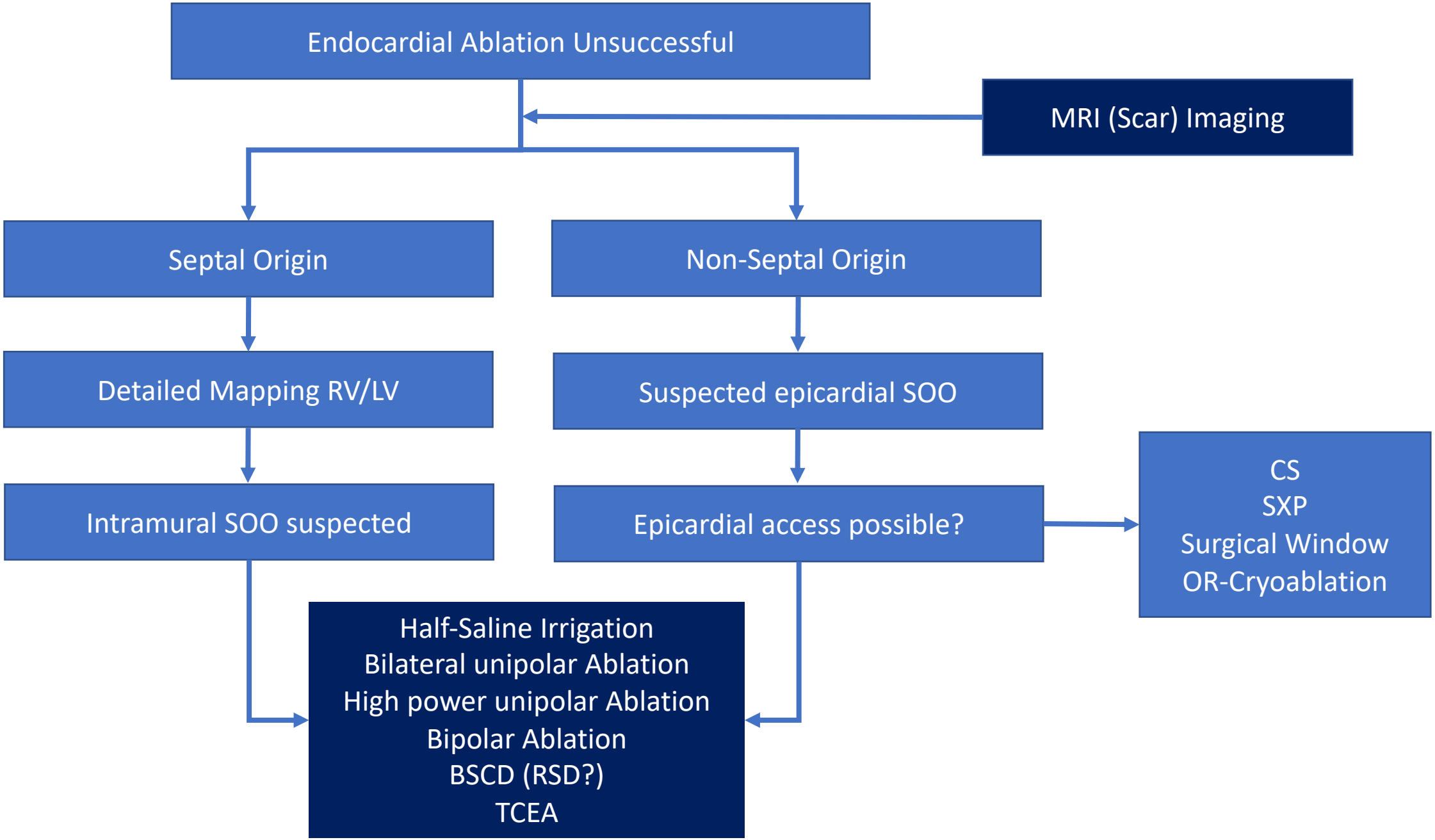

B Serial Thoracic CT Scans in Patient 1
Baseline
3 Mo
12 Mo

Stereotactic Radiosurgery for Ablation of Ventricular Tachycardia



Ten patients underwent radiosurgical ablation (mean PTV, 22.15 ml; treatment duration, 68 min). After radiosurgery, four patients experienced nausea and one patient presented gradual progression of mitral regurgitation. During the follow-up (median 28 months), VT burden was reduced by 87.5% compared to baseline (P=0.012) and three patients suffered non-arrhythmic deaths. After the blanking period, VT recurred in eight of ten patients.

EP 2019: accepted manuscript


Endocardial Ablation Unsuccessful
MRI (Scar) Imaging
Septal Origin
Non-Septal Origin
Detailed Mapping RV/LV
Suspected epicardial SOO
Intramural SOO suspected
Epicardial access possible?
CS
SXP
Surgical Window
OR-Cryoablation
Half-Saline Irrigation
Bilateral unipolar Ablation
High power unipolar Ablation
Bipolar Ablation
BSCD (RSD?)
TCEA

Presentation available at:
https://www.arasharya.de/resources/