Bipolar ablation in ventricular arrhythmias

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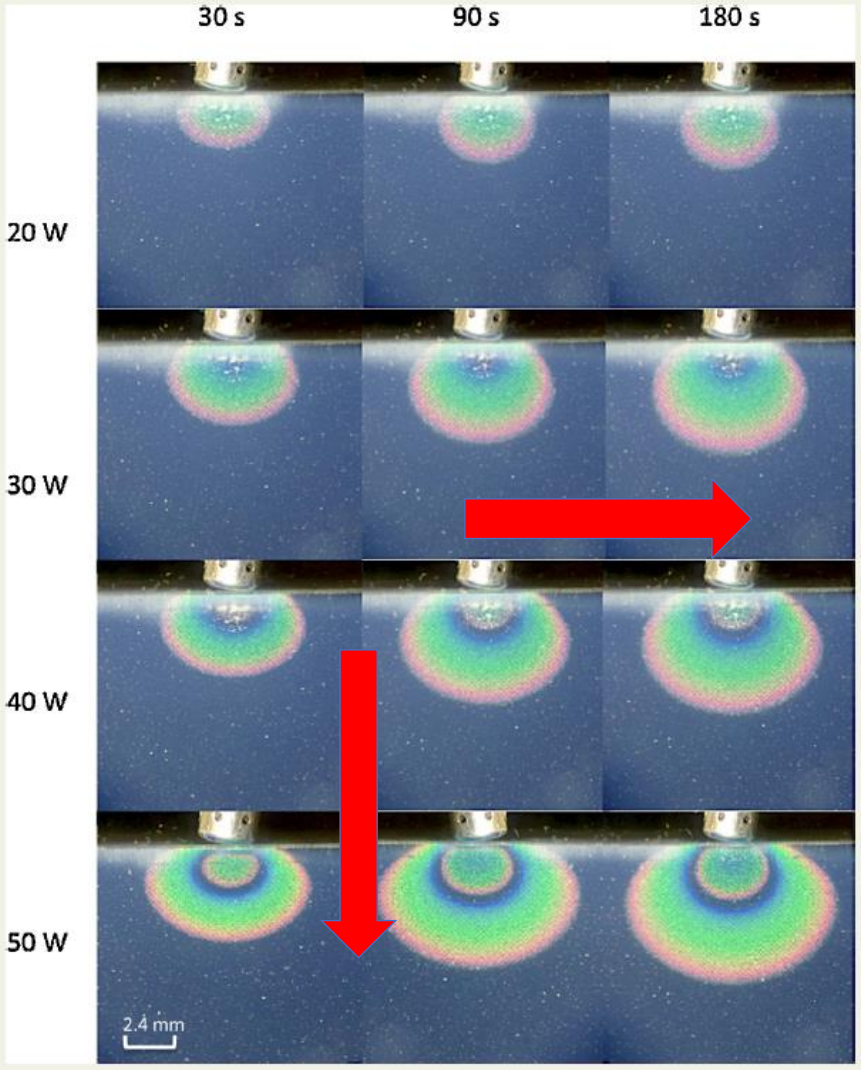
23rd Prague Workshop on Catheter Ablation, April 18 - 20, 2021

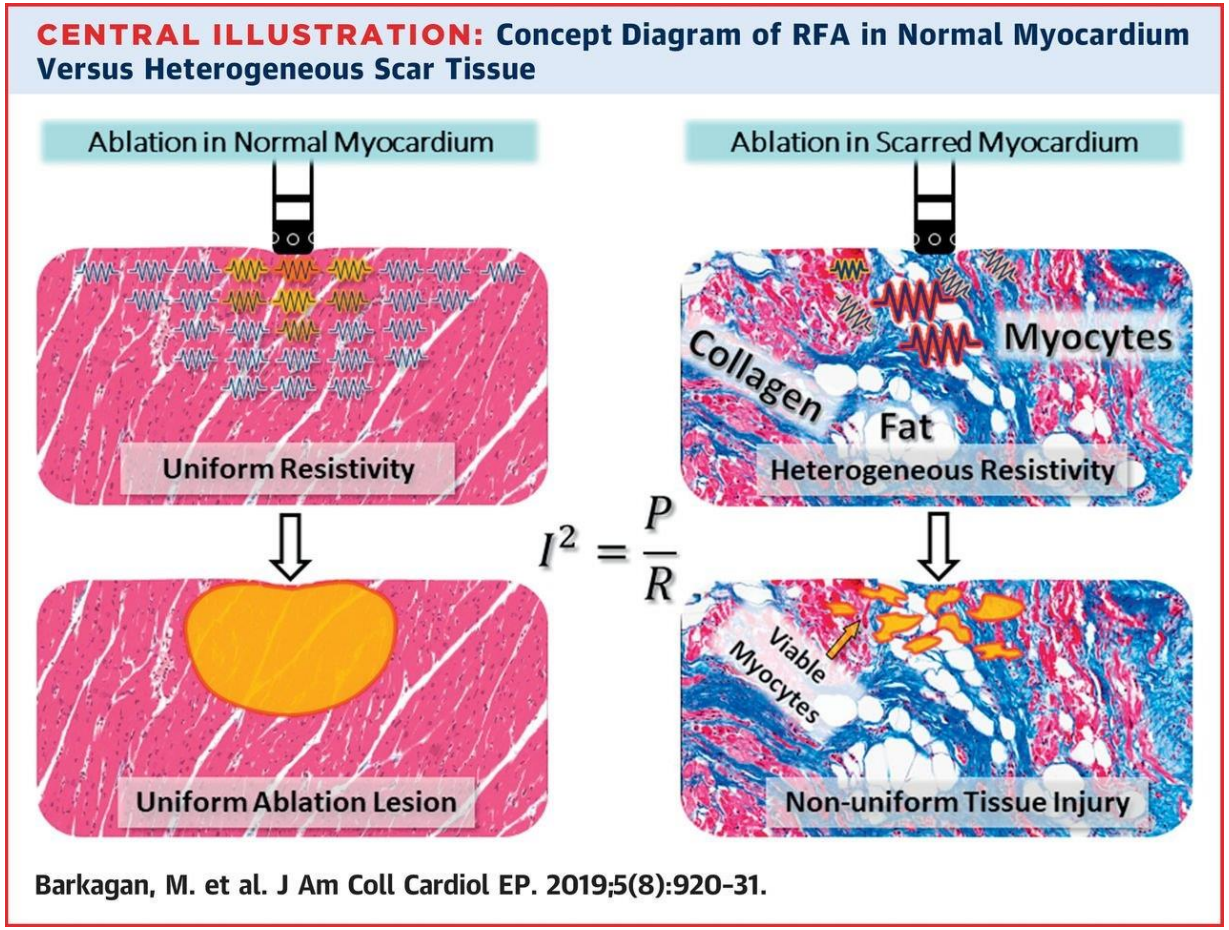
COI

- Bipolar radiofrequency and high-voltage ablation tools – patent applications
- Equity in CorSystem
- APT – consultations

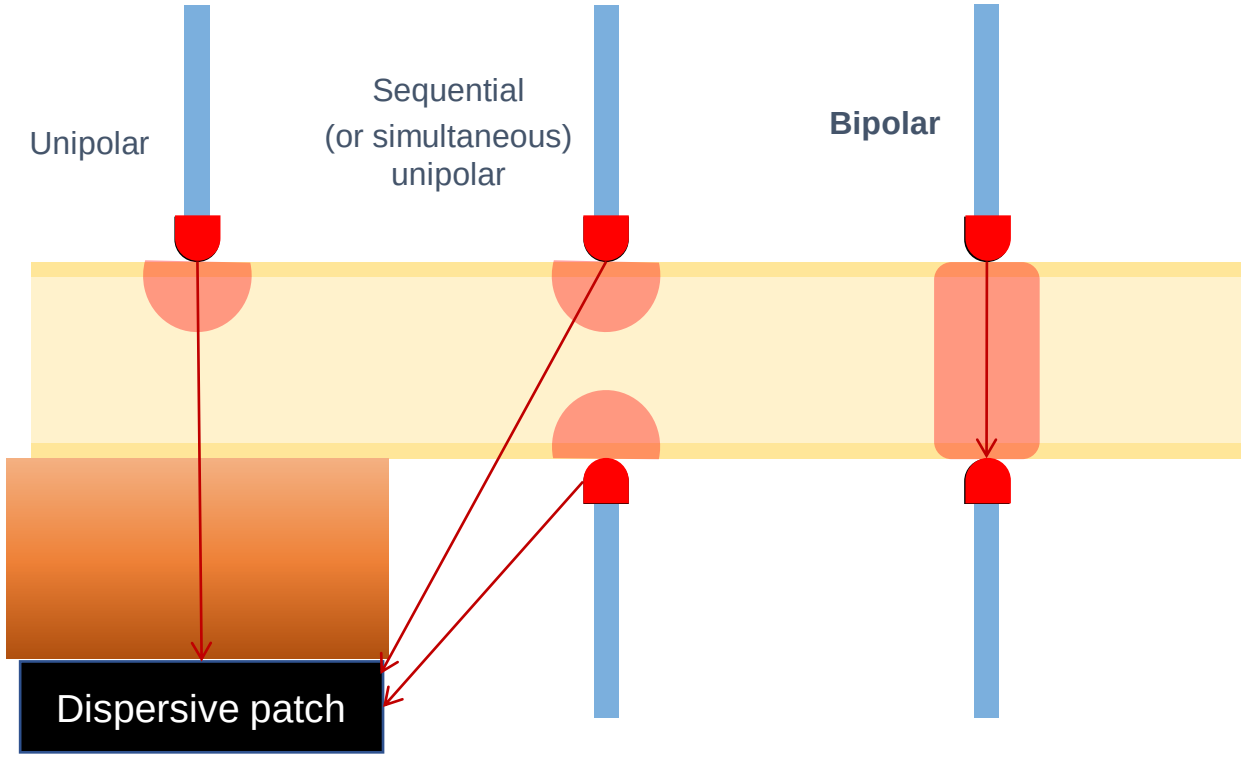
Unipolar ablation – limitations



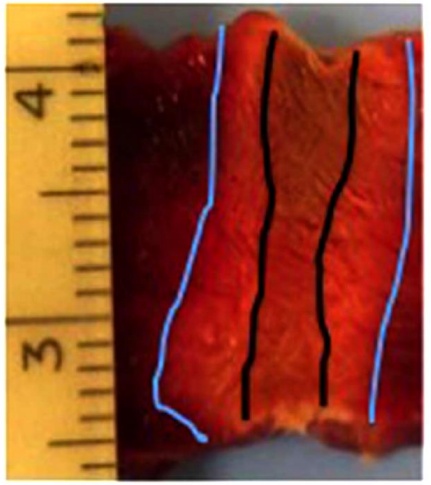
Bhaskaran et al. Heart Lung Circ. 2017



Bipolar ablation – lesion core



Simultaneous Unipolar RFA



Bipolar RFA

Nguyen et al. JCE 2019

When NOT to think about bipolar ablation

- No consent
- No symptoms

- Mapping error
- Recurrence of another arrhythmia

- SOO too close to crucial structures (coronaries, His)
- Intraelectrode distance <5mm (?)
- Intraelectrode distance >20mm

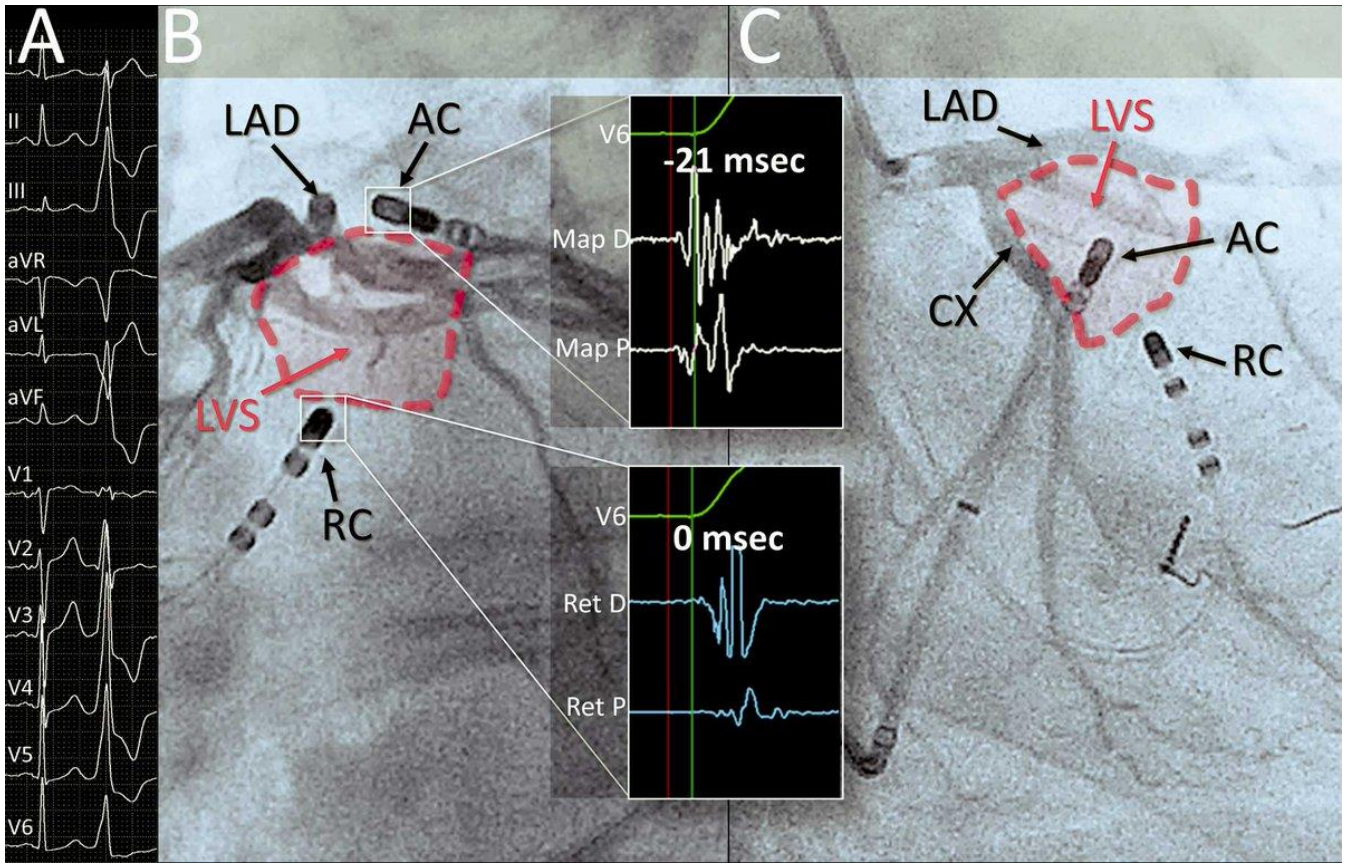
When to think about bipolar ablation

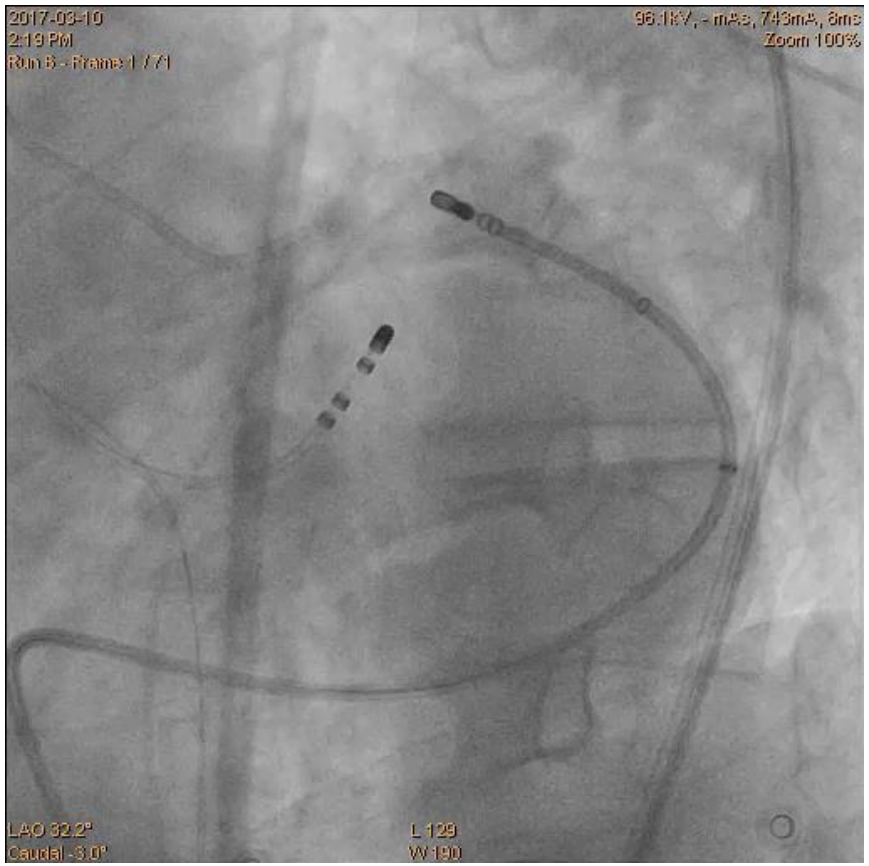
- Symptoms
- Multiple failed ablations
- Activation nowhere perfect
- Pacemap nowhere perfect
- Similar activation times at different (or opposite) spots
- Broad area of similar activation

- Evidence of suppression without complete elimination (!) after unipolar RF
- Morphology shift without complete elimination after unipolar RF

Bipolar Endo-Epicardial Radiofrequency Ablation of Arrhythmia Originating From the Left Ventricular Summit

Piotr Futyma, MD; Agnieszka Wysokińska, MD; Jarosław Sander, MD;
Marian Futyma, MD, PhD; Piotr Kułakowski, MD, PhD

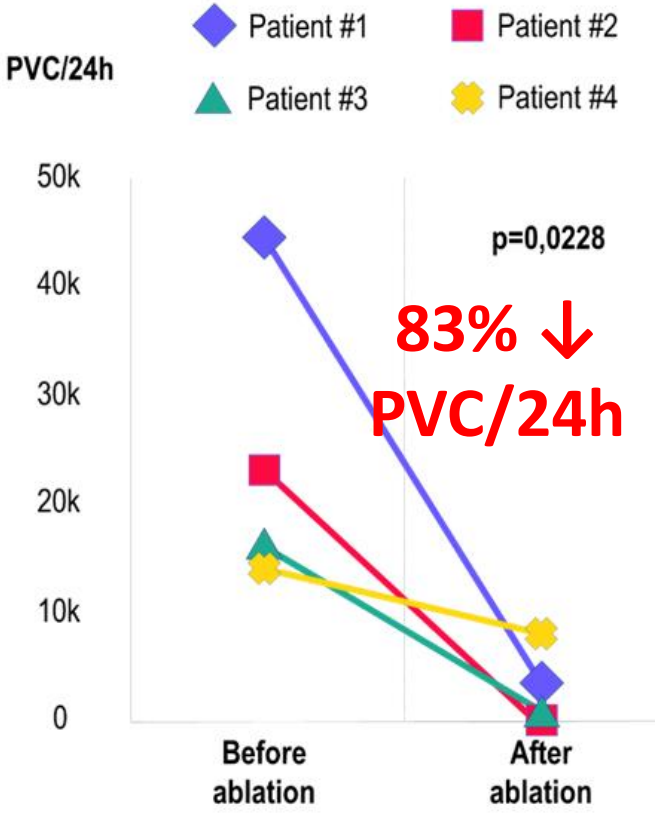


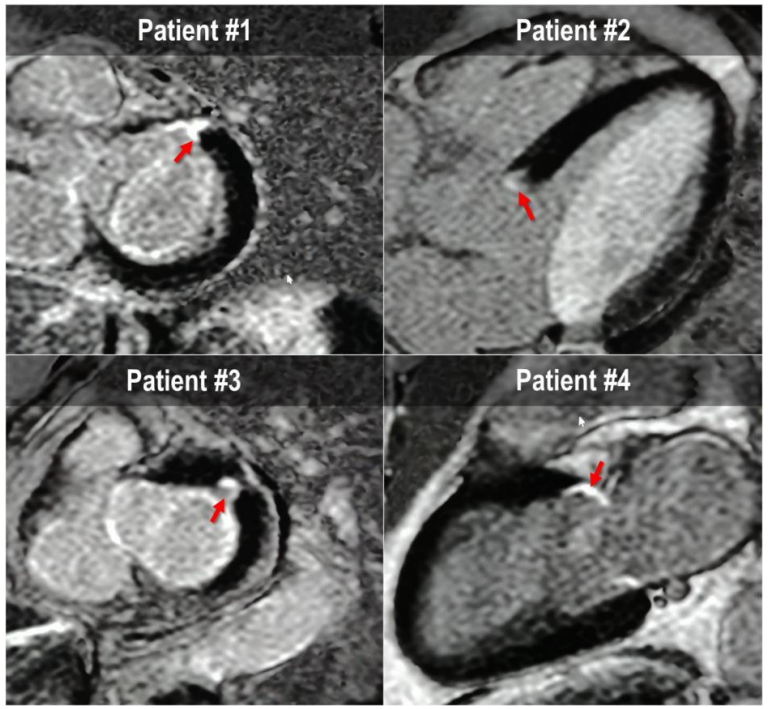


Circulation J 2018

Bipolar radiofrequency ablation delivered from coronary veins and adjacent endocardium for treatment of refractory left ventricular summit arrhythmias

Piotr Futyma [1] · Jarosław Sander [1] · Kamil Ciąpała [1] · Ryszard Głuszczyk [1] · Agnieszka Wysokińska [1] · Marian Futyma [1] Piotr Kułakowski [1,2]

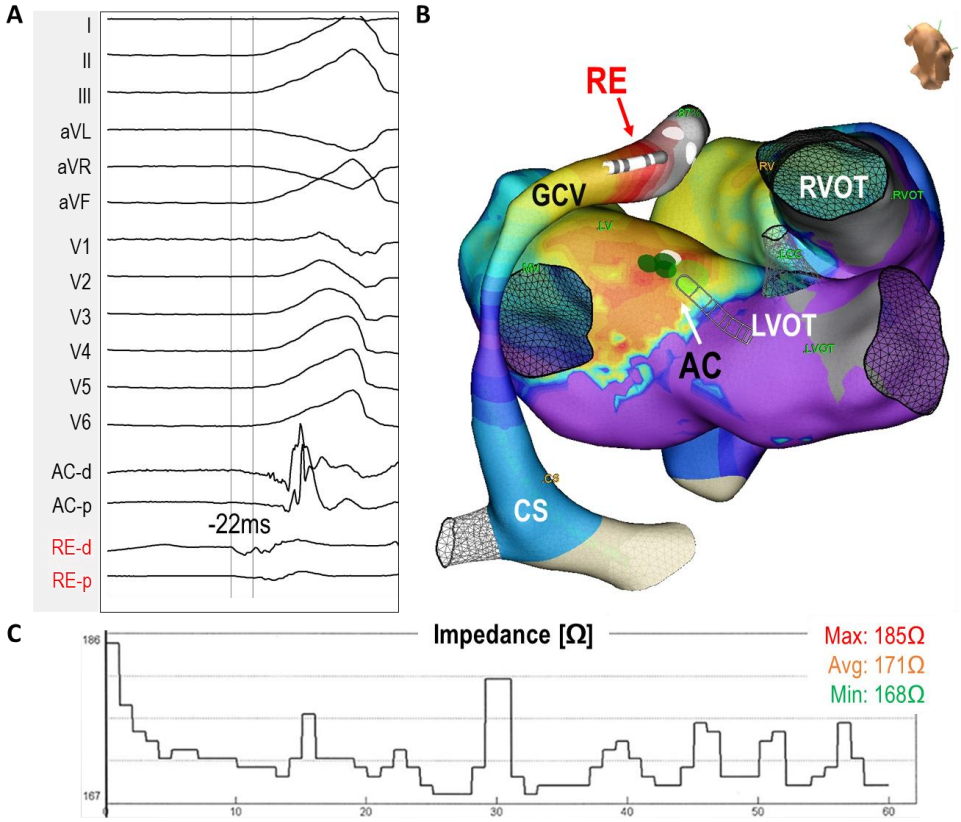




JICE 2019

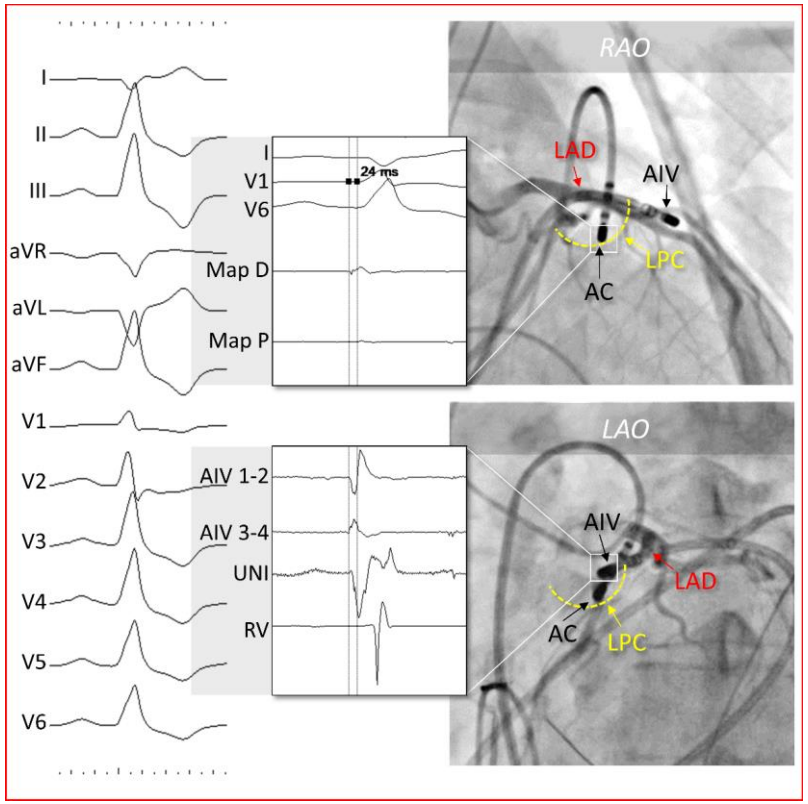
Requirements: GCV mapping, >5mm LAD distance, target >20W, time >60s, impedance <300

Multicenter experience, extended follow-up n=15

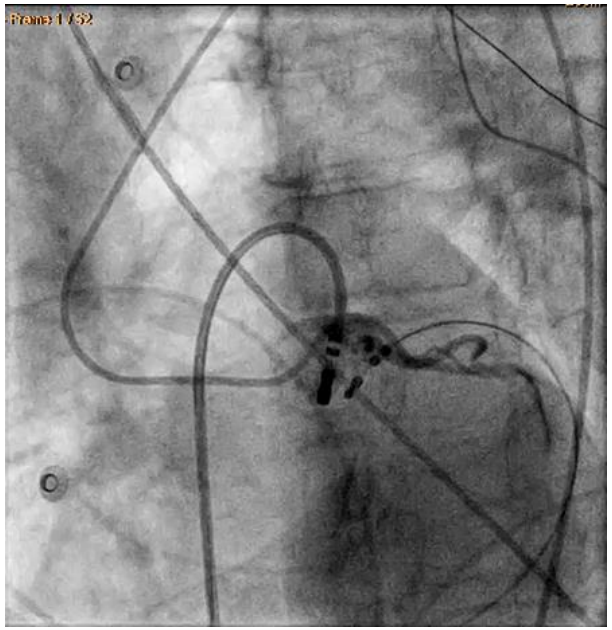


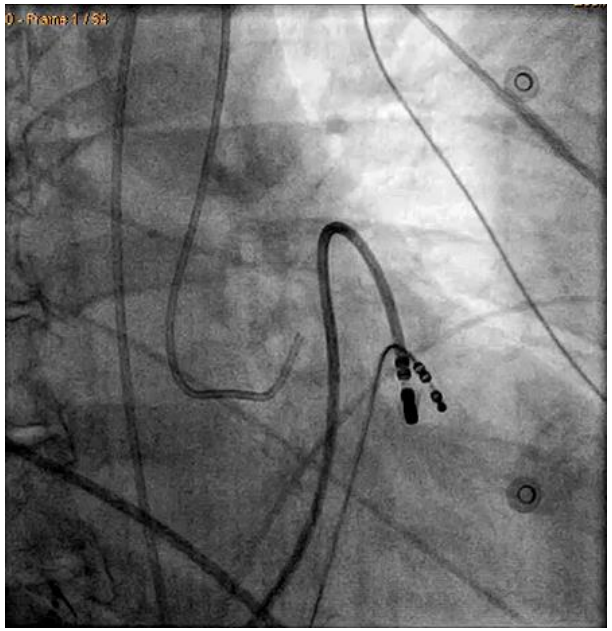
Futyma P, Santangeli P, Enriquez A, Cano Ó, Nazer B, Gibson D, Tokioka S, Tzou W et al. In draft

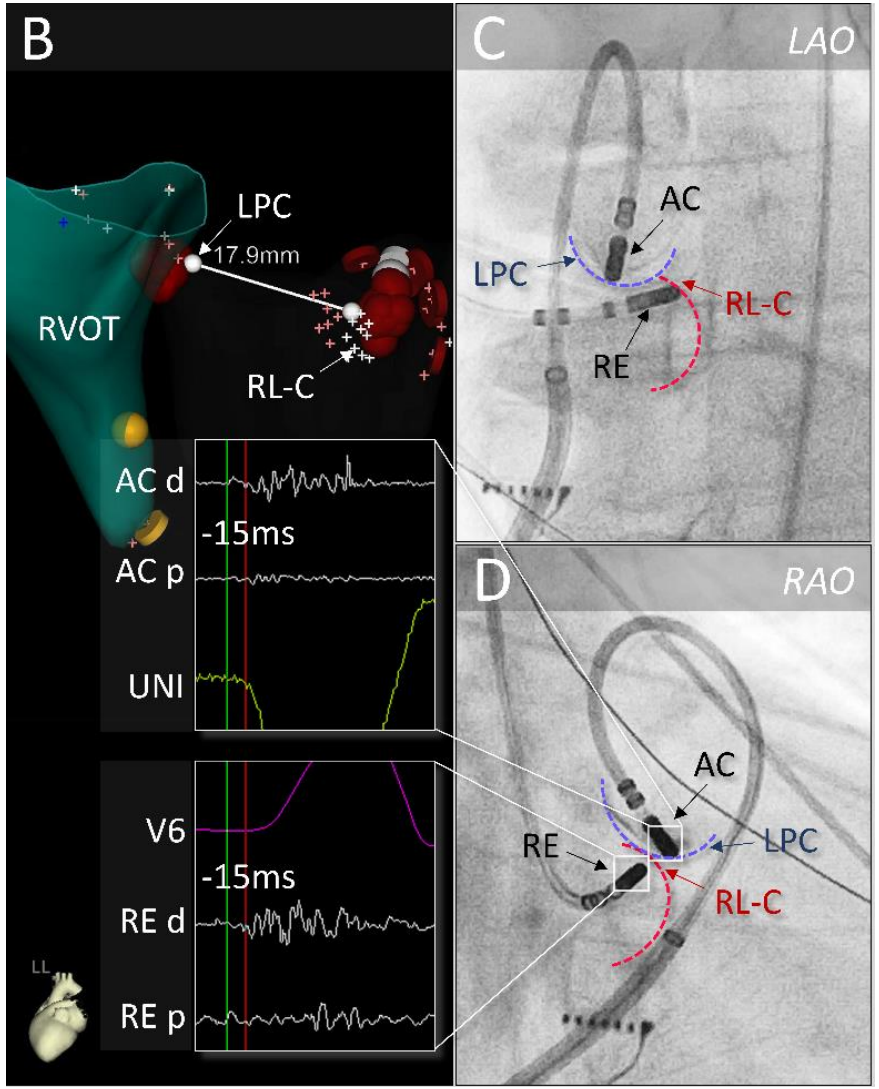
Left pulmonic cusp



Futyma P et al., Europace 2019







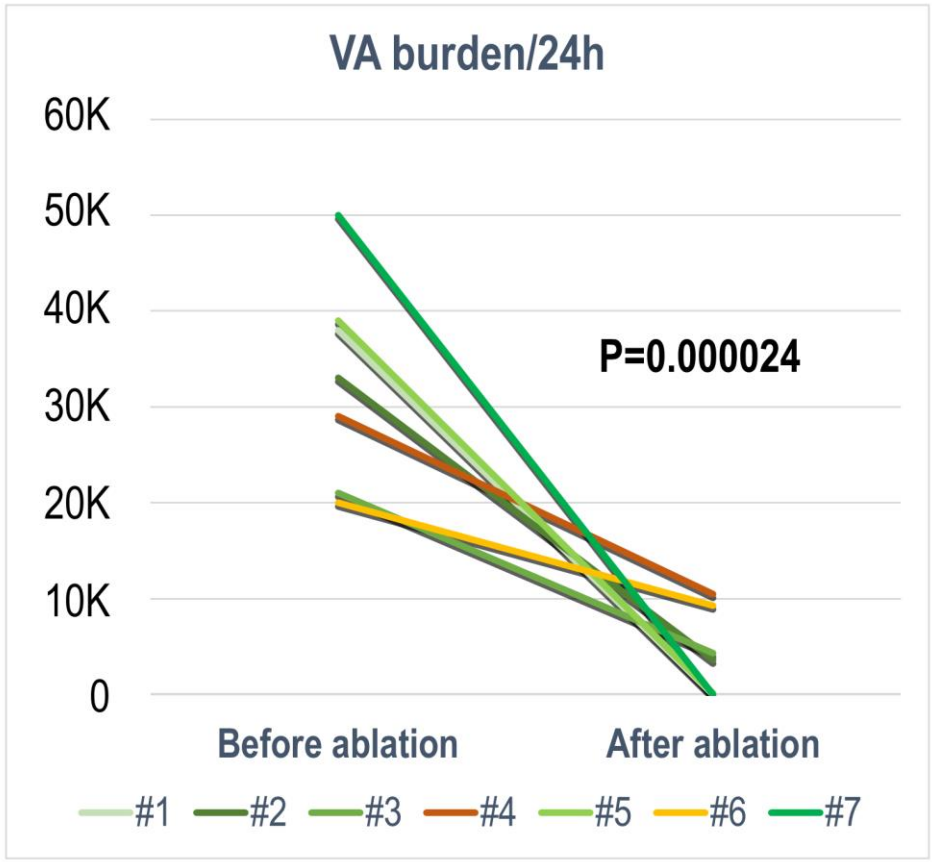
Futyma P, Kułakowski P. Rev Esp Cardiol 2019

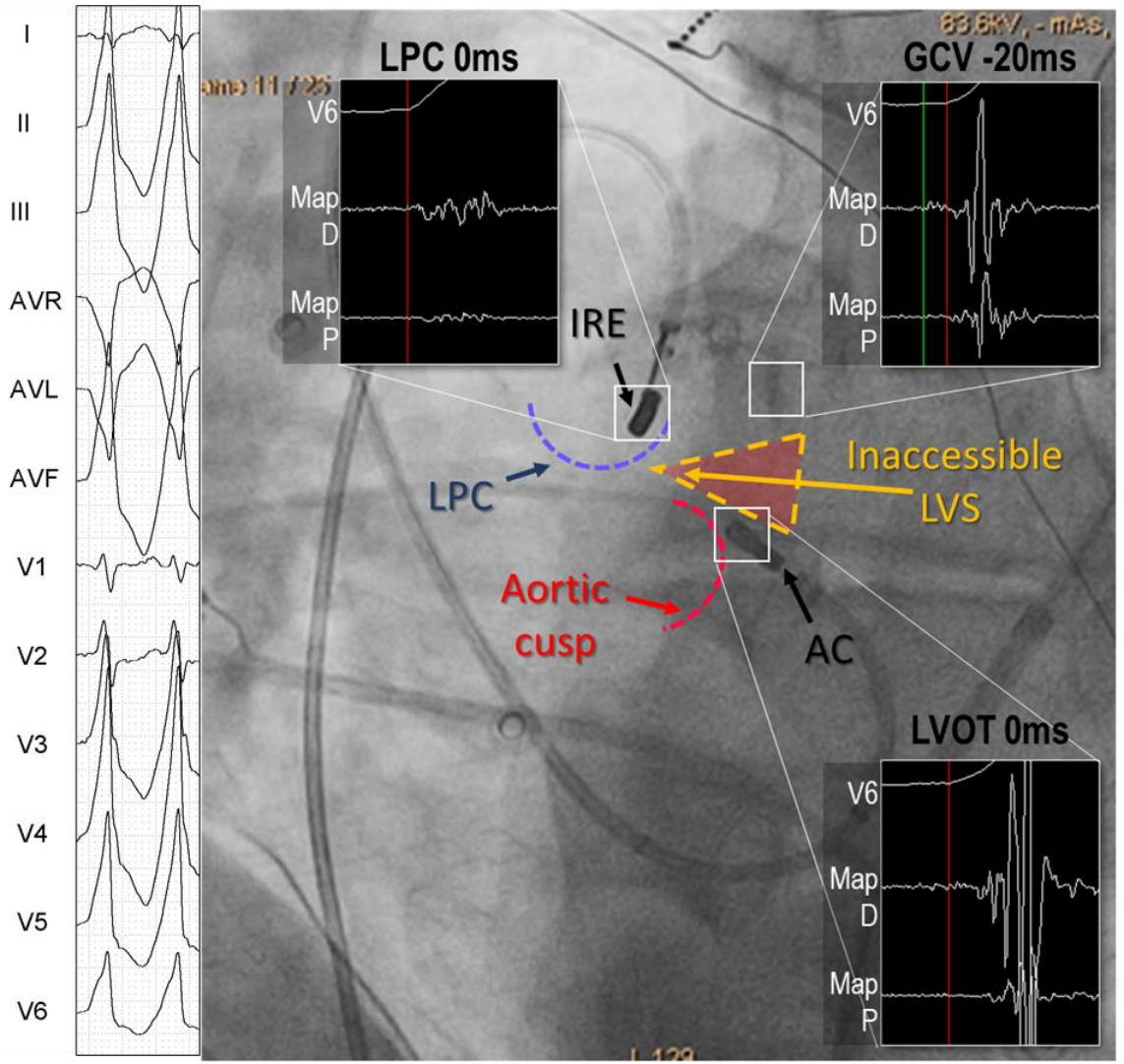
HeartRhythm Heart Rhythm Society

CLINICAL VENTRICULAR TACHYCARDIA | VOLUME 17, ISSUE 9, P1519-1527, SEPTEMBER 01, 2020

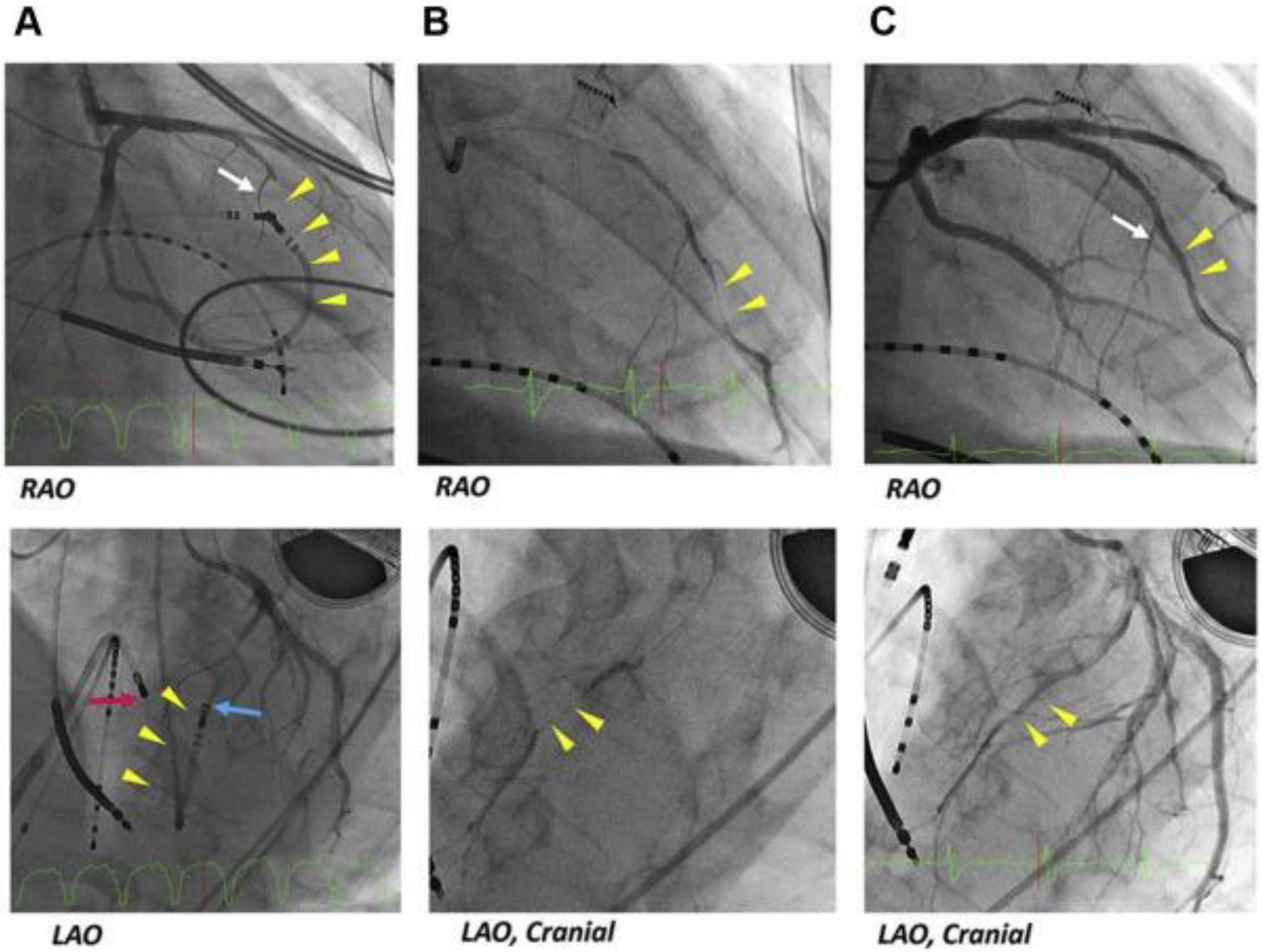
Anatomic approach with bipolar ablation between the left pulmonic cusp and left ventricular outflow tract for left ventricular summit arrhythmias

Piotr Futyma, MD • Pasquale Santangeli, MD • Helmut Pürerfellner, MD, FHRS • ...
Marian Futyma, MD • Francis E. Marchlinski, MD, FHRS • Piotr Kułakowski, MD • Show all authors





Bipolar ablation near coronary arteries – precautions



Igarashi M et al. Heart Rhythm 2020

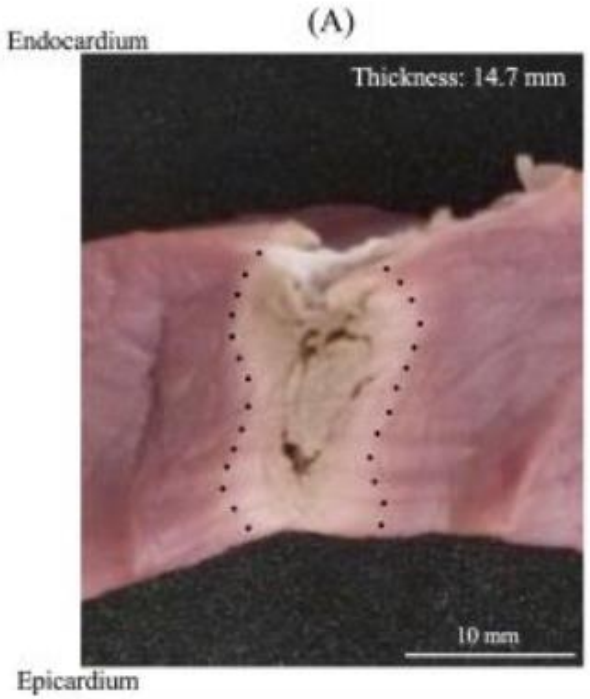
Bipolar ablation in healthy myocardium – precautions

Impedance decrement indexes for avoiding steam-pop during bipolar radiofrequency ablation: an experimental study using a dual-bath preparation

Osamu Saitoh PhD, Ayaka Oikawa MT, Ayari Sugai MT,

Masaomi Chinushi MD

- 50W
- Low minimum impedance



Methods and Results. Using a newly designed dual-bath experimental model, contact-force-controlled (20-g) BIP ablation (50 W, 60-sec) was attempted for porcine left ventricle (17.0±2.7 mm thickness). BIP ablation was successfully accomplished for 60-sec in 75 of the 89 RF applications (84.3%), whereas audible steam-pop occurred in the other 14 RF applications (15.7%). Receiver operating characteristic analysis demonstrated the optimal predictive values regarding the occurrence of steam-pop as follows; thinner myocardial wall (≤ 14.8 mm), low minimum impedance (≤ 89 ohm), greater total impedance decrement (TID) (≤ -25 ohm) and %-TID (≤ -22.5%). Greater impedance decrement was not observed immediately preceding the occurrence of steam-pop but appeared around 15-sec prior to. Four steam-pops happened before reaching the optimal predictive values of minimum impedance, whereas all 14 steam-pops developed 11.5±9.2 and 8.1±8.1 sec after reaching the optimal predictive values of TID and %-TID, respectively. Total lesion depth (endocardial plus epicardial) was 10.7±1.2 mm on

JCE 2020

Journal of Cardiovascular Electrophysiology
THE OFFICIAL JOURNAL OF THE WORLD SOCIETY OF ARRHYTHMIAS
World Society of Arrhythmias
Editor-in-Chief Bradley P. Knight

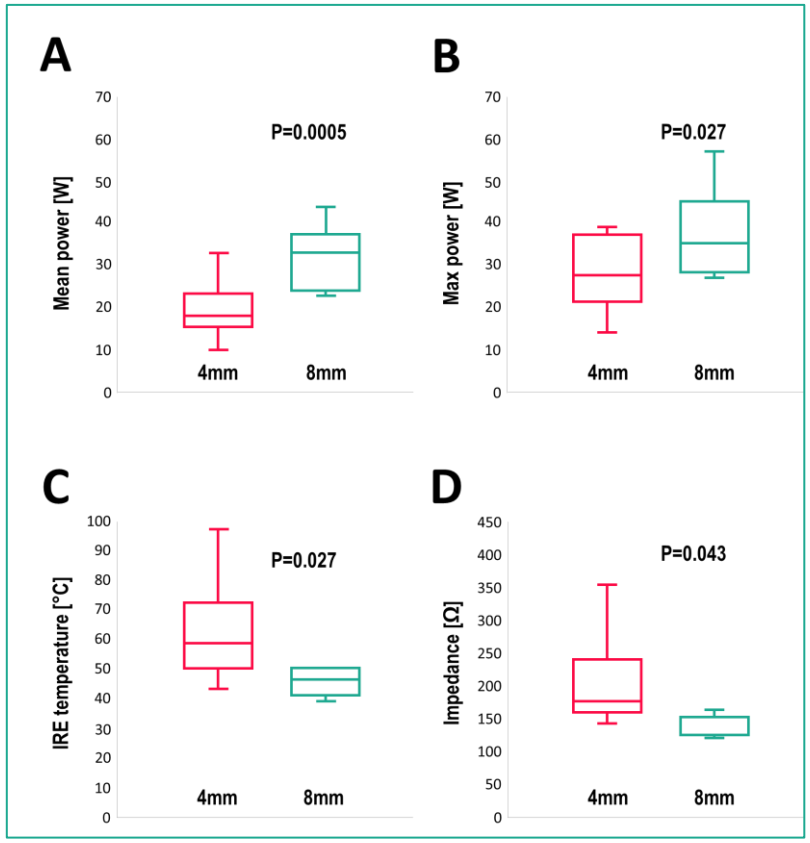
INNOVATIVE TECHNIQUES

Bipolar ablation of refractory atrial and ventricular arrhythmias: Importance of temperature values of intracardiac return electrodes

Piotr Futyma, Kamil Ciąpała, Ryszard Głuszczyk, Jarosław Sander, Marian Futyma, Piotr Kułakowski

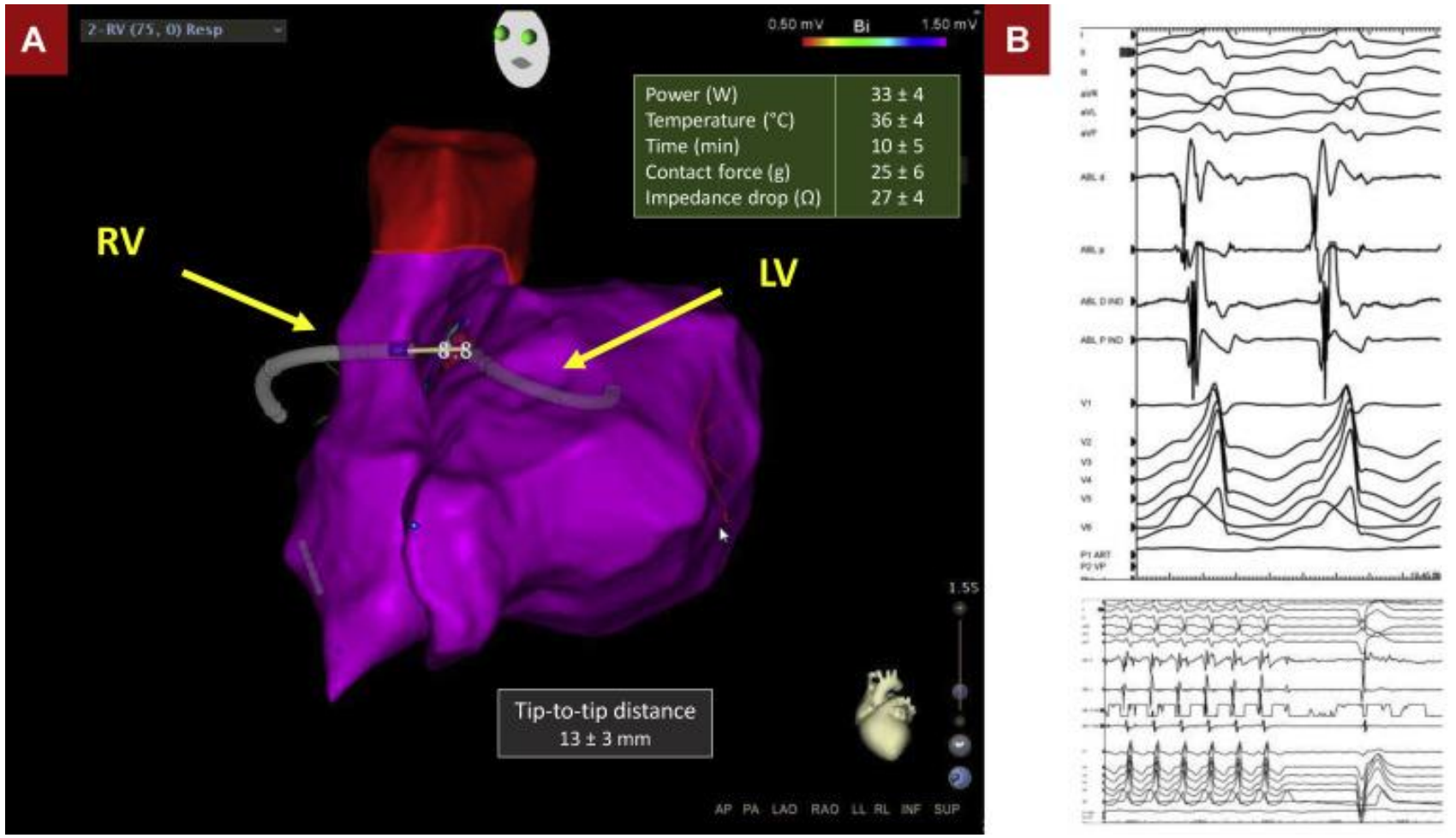
First published: 12 June 2019 | https://doi.org/10.1111/jce.14025 | Citations: 11

Energy values?



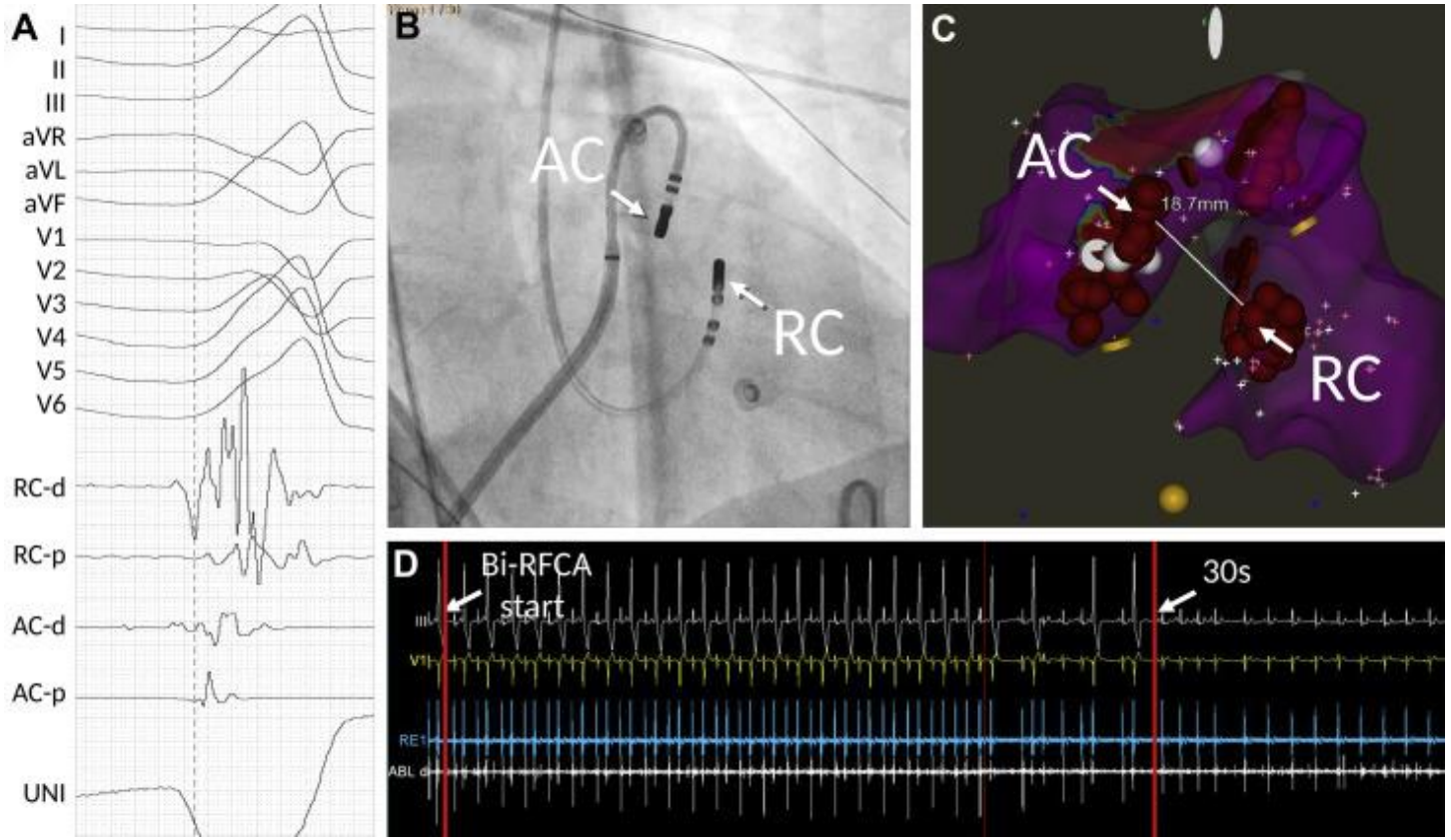
Patient	Age	Arrhythmia	AC	IRE	Ablation target	Bipolar RF configuration	Bipolar applications No	Mean effective power [W]	Max effective power [W]
#1	43	PVC	open-irrigated	4mm	accessible LV summit	distal CS ↔ LVOT	5	18±7	25
#2	59	PVC	open-irrigated	4mm	accessible LV summit	distal CS ↔ LVOT	5	17±8	26
#3	66	nsVT	open-irrigated	4mm	accessible LV summit	distal CS ↔ LVOT	5	14±1	15
#4	51	PVC	open-irrigated	8mm	accessible LV summit	distal CS ↔ LVOT	6	23±4	28
#5	71	PVC	open-irrigated	4mm*	inaccessible LV summit	LPC ↔ LVOT	5	10±4	17
				8mm†			2	33±6	37
#6	65	PVC	open-irrigated	8mm	inaccessible LV summit	LPC ↔ RCC/LCC	2	33±3	35
#7	39	nsVT	open-irrigated	8mm	inaccessible LV summit	LPC/RVOT ↔ RCC/LCC/LVOT	8	25±6	33
#8	55	PVC	open-irrigated	8mm	inaccessible LV summit	LPC/RVOT ↔ RCC/LCC/LVOT	7	24±4	28
#9	61	PVC	open-irrigated	4mm	inferior parahisian	RA ↔ PSP LV	4	13±3	17
#10	77	PVC	open-irrigated	4mm	inferior parahisian	TA ↔ PSP LV	3	22±12	33
#11	31	nsVT	open-irrigated	4mm	superior parahisian	TA ↔ RCC	25	25±7	17
#12	70	nsVT	open-irrigated	4mm	superior parahisian	TA ↔ RCC/NCC	12	20±10	33
#13	44	PVC	open-irrigated	4mm	posterosuperior LV	CS diverticulum ↔ PSP LV	2	33±10	40
#14	67	PVC	open-irrigated	4mm	posterosuperior LV	TA ↔ MA	14	16±9	38
#15	66	VT	open-irrigated	4mm*	posterosuperior LV	RA ↔ PSP LV	14	29±5	39
				8mm†			14	44±6	58
#16	50	AFL	open-irrigated	4mm	CTI	TA ↔ CTI ridge	3	23±5	28
#17	77	AFL	4mm	4mm	CTI	TA ↔ CTI ridge	11	18±7	29
#18	76	AFL	8mm	4mm‡	CTI	TA ↔ CTI ridge	20	17±4	24
			4mm	8mm§			3	36±7	43
#19	55	AFL	open-irrigated	8mm	CTI	TA ↔ CTI ridge	8	38±6	47

Bipolar ablation using moderate power 33±4W



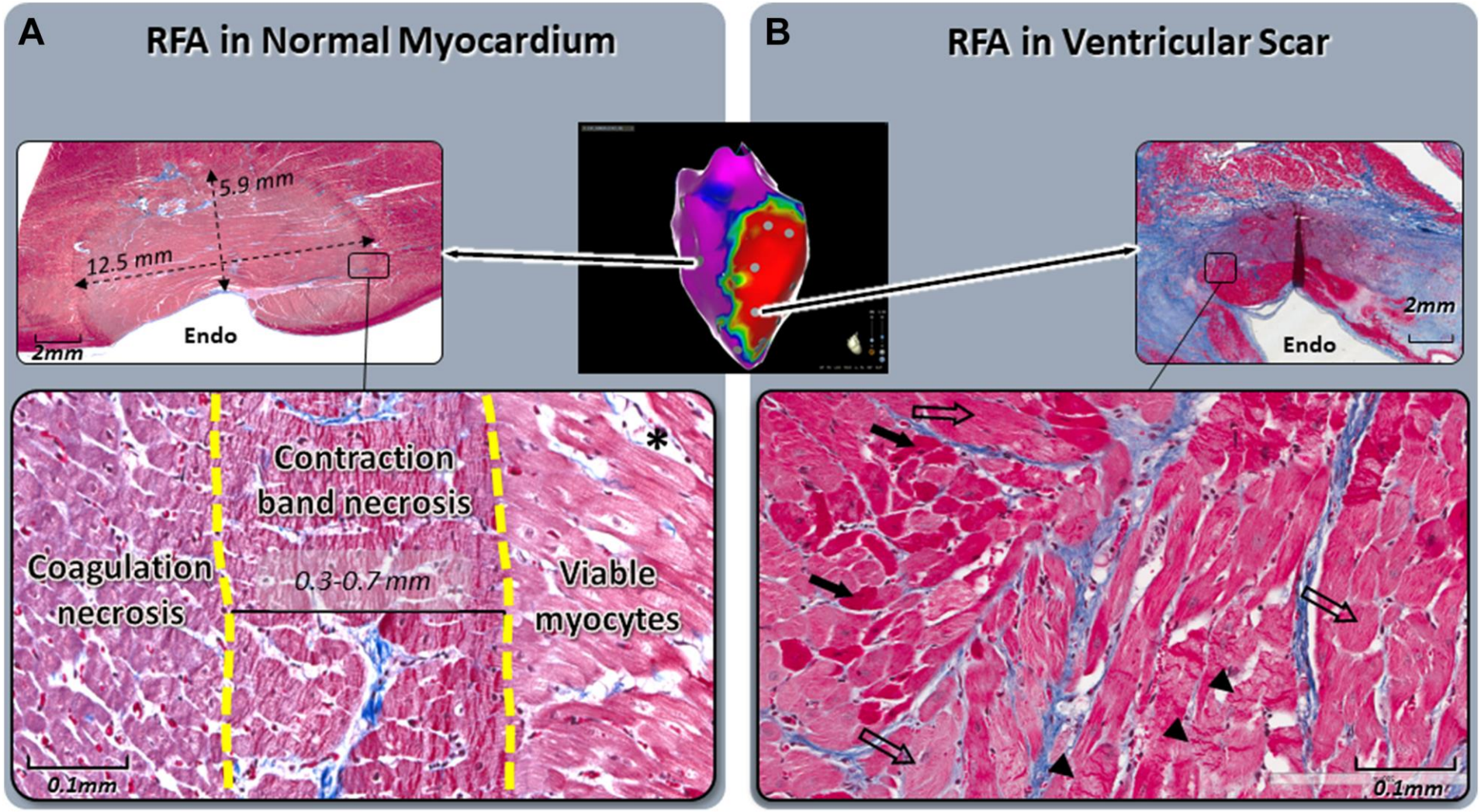
Della Bella P et al., Heart Rhythm 2020

Bipolar ablation – value of prolonged applications



Neira V, Santangeli P, Futyma P et al.,
Heart Rhythm 2020

Protective properites of a scar against radiofrequency



Barkagan M et al. JACC EP 2020

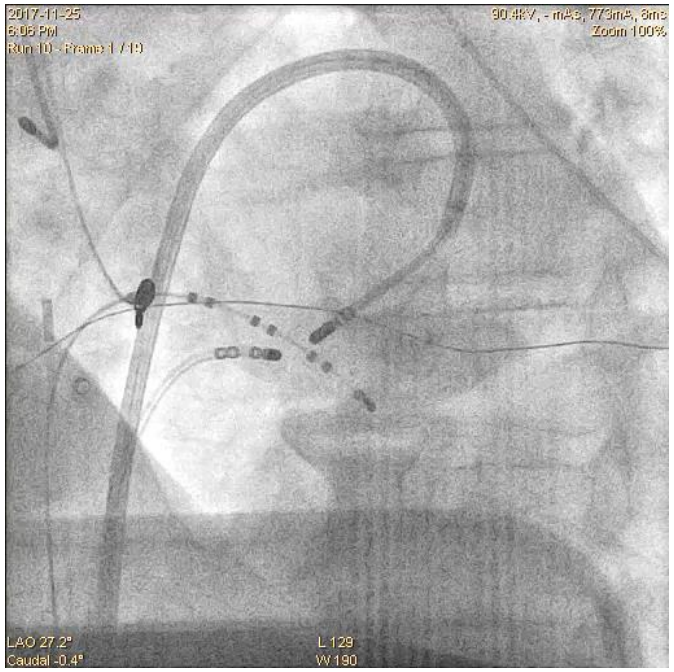
High-power bipolar ablation 50-70W

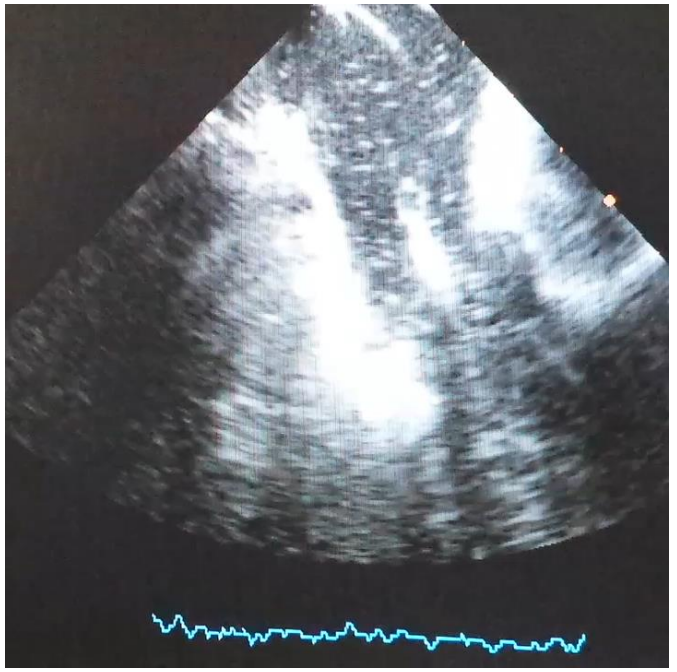
Patient	Clinical details	Bipolar configuration	Max Power	Arrhythmia	Location	Approach	VT characteristics	VT termination	Inducibility
Patient 1, Procedure 1	68 M mixed ICM/NIDCM, CABG incesssant VT	8 (RV)- SF TC (LV)	70W	VT	Basal RV/Basal LVOT	RV/LV transseptal	concealed entrainment, MDPs	Yes, during bipolar ablation	No
Patient 1, Procedure 2	68 M mixed ICM/NIDCM, CABG incesssant VT, VT storm	8 (RV)-SF TC (LV)	70W	VT	Basal RV/inferoseptal LV	RV/LV retrograde	concealed entrainment, MDPs	Ablation in sinus rhythm	No
Patient 2	66 M NIDCM, LVAD, VT storm.	SF TC (LV)-TC (RV)	50W	VT	mid LV septum	RV/LV retrograde	MDPs	Yes	No
Patient 3	67 M outflow tract VT	RMT TC (RVOT)-SF TC (R/L commisure)	50W	VT	RVOT/LV OT	RV/LV retrograde	Activation map	Yes	No
Patient 4	52 M ICM, ICD, anteroseptal scar, shocks for VT	8 (RV)-TC (LV)	70W	VT	RV/LV anteroseptum	RV/LV retrograde	Activation map	No	No
Patient 5, Procedure 1	53 M with exercised induced PVCs	8 (RV) - ST TC (RV)	70W	PVCs	RV papillary muscle	RV	Activation map	PVC termination	No
Patient 5, Procedure 2	53 yo M with exercised induced PVCs	8 (RV)-ST TC (RV)	70W	PVCs	RV papillary muscle	RV	Activation map	PVC termination	No
Patient 6	59 F w sx PVCs	8 (RVOT)- SF TC (L/R commisure)	70W	PVCs	RVOT/LVOT - L/R commisure	RV/LV retrograde	Pacemap	No	No
Patient 7, Procedure 1	65M ICM, CRT, CHB, VT, ICD shocks	ST TC (RV)- SF TC (LV)	50W	VT	RVOT/sept al LVOT	RV/LV retrograde	Pacemap	No	Partial-nonclinical VT remain
Patient 7, Procedure 2	65M ICM, CRT, CHB, VT, ICD shocks	8 (RVOT)- ST TC (LVOT)	50W	VT	RVOT/high LV anteroseptum	RV/LV retrograde	Activation map	No	Partial-multiple nonclinical VTs remain
Patient 7, Procedure 3	65M ICM, CRT, CHB, VT, ICD shocks	SF TC (RV)- ST TC (LV)	50W	VT	RVOT/basal LV septum	RV/LV retrograde	Activation map	No	Partial-nonclinical VT remain
Patient 8	65 M ICM, ICD shocks	ST TC (LV)- SF TC (RV)	50W	VT	RV/LV anteroseptum	RV/LV retrograde	concealed entrainment, MDPs	No	Partial-nonclinical VT remain
Patient 9	54M NIDCM, incessant VT	8 (RV)-ST TC (LV)	70W	VT	septum	RV/LV retrograde	concealed entrainment, MDPs	Yes	Partial-nonclinical VT remain
Patient 10	65M ICM, LV dysfunction, PVCs	SF TC(LV)-RMT TC (LV)	50W	PVCs	Anterolateral Papillary muscle	LV transseptal/LV retrograde	Activation map	No	Yes but more difficult to induce

Nguyen DT et al. Heart Rhythm 2016

High power bipolar ablation – return electrode overheating

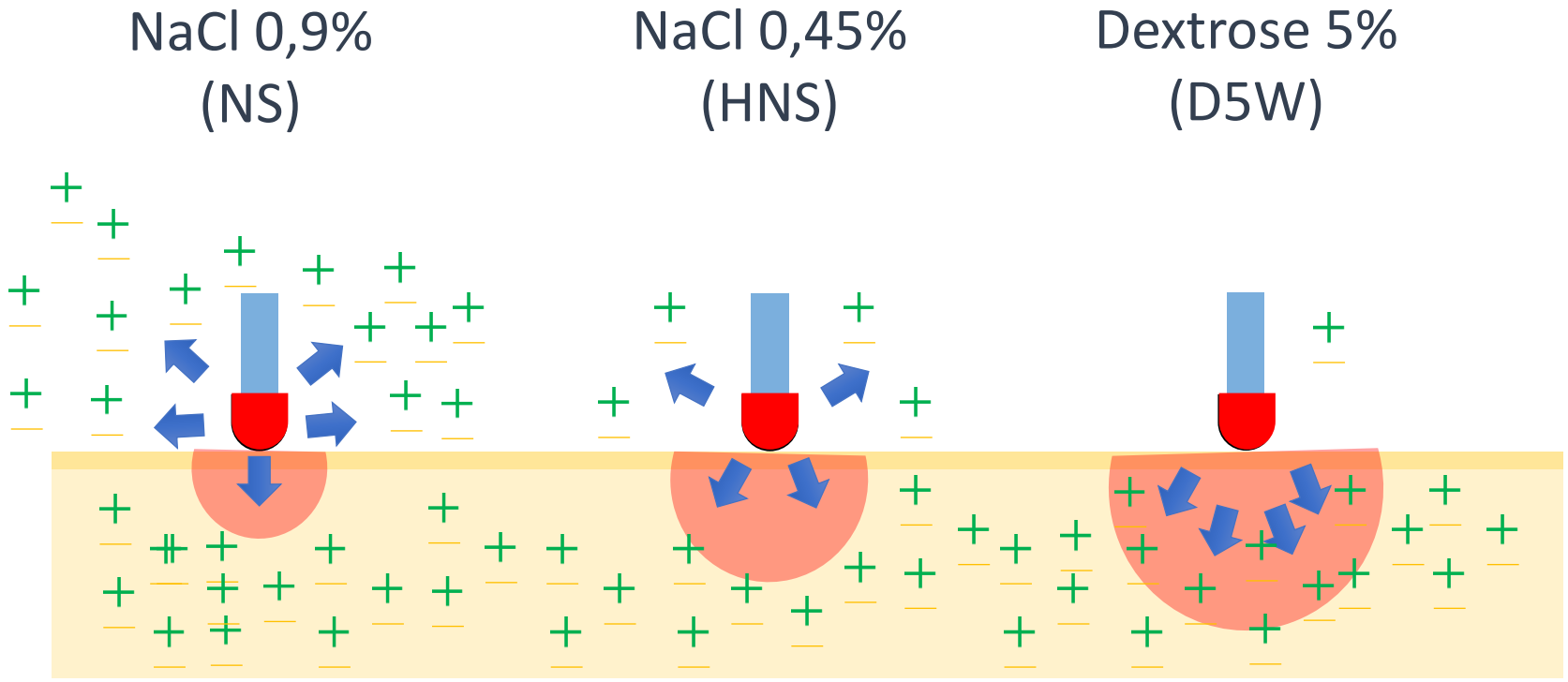
- procedure time 255min
- bipolar RF time 30min
- power up to 60W
- bipolar between open-irrigated 3,5mm and non-irrigated 4mm IRE
- max T IRE → 97°C
- IRE exchange 4mm → 8mm



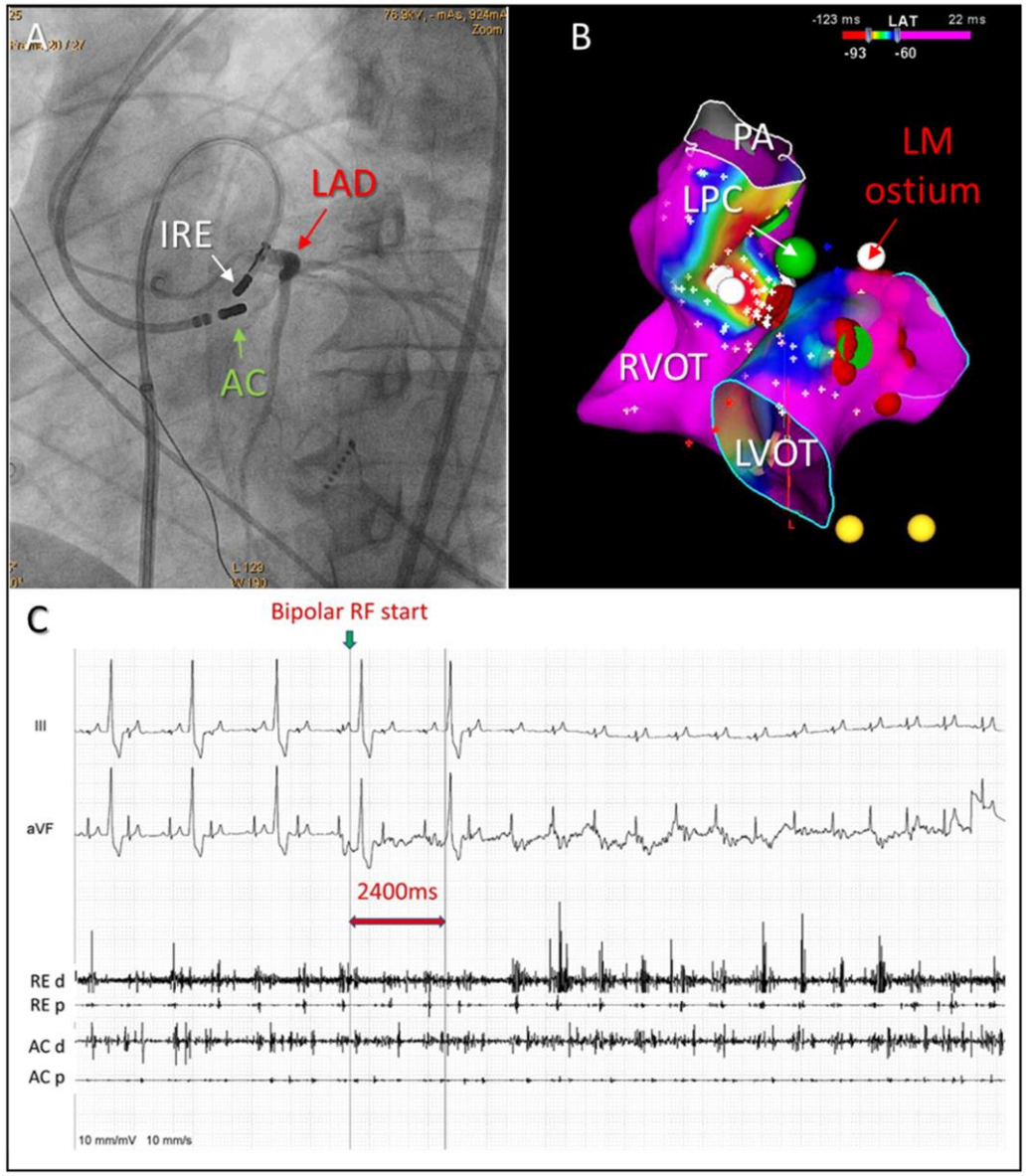


Futyma P et al. PACE 2019

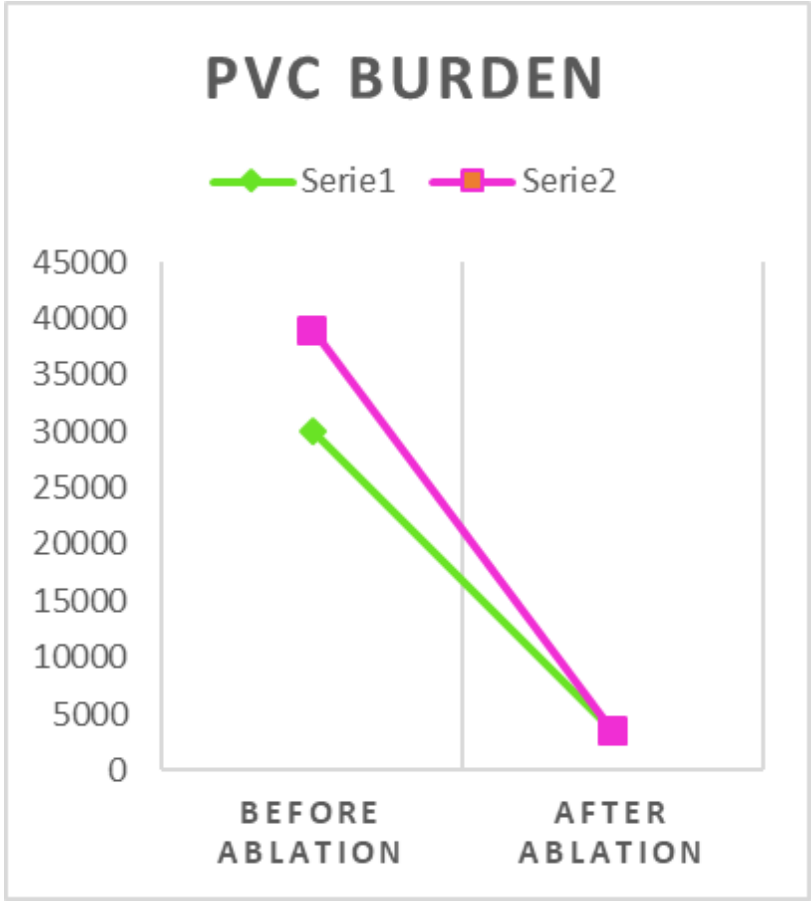
Low and non-ionic coolants



Sweet bipolar ablation (dextrose 5 in water)



Futyma P, Santangeli P, Pürerfellner H, et al. Heart Rhythm 2020



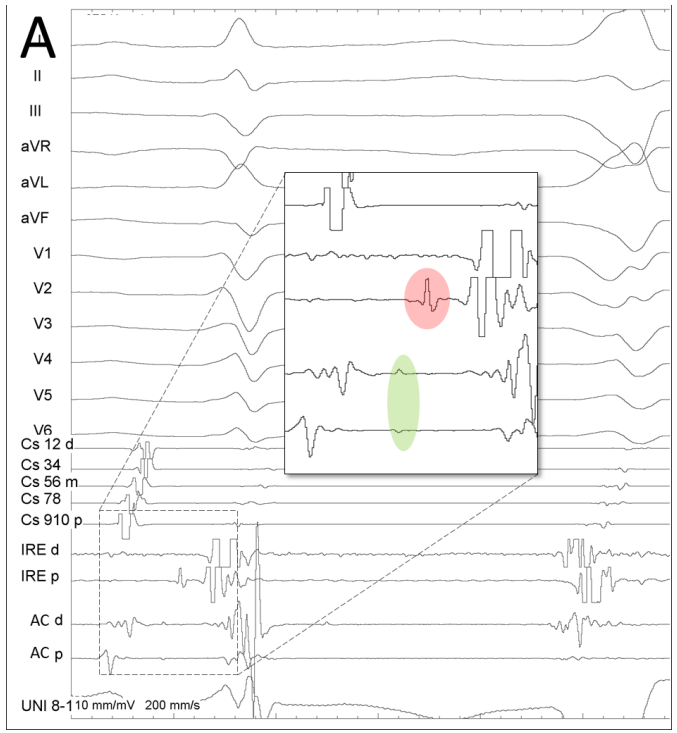
Futyma P, Kułakowski P. ESC 2019

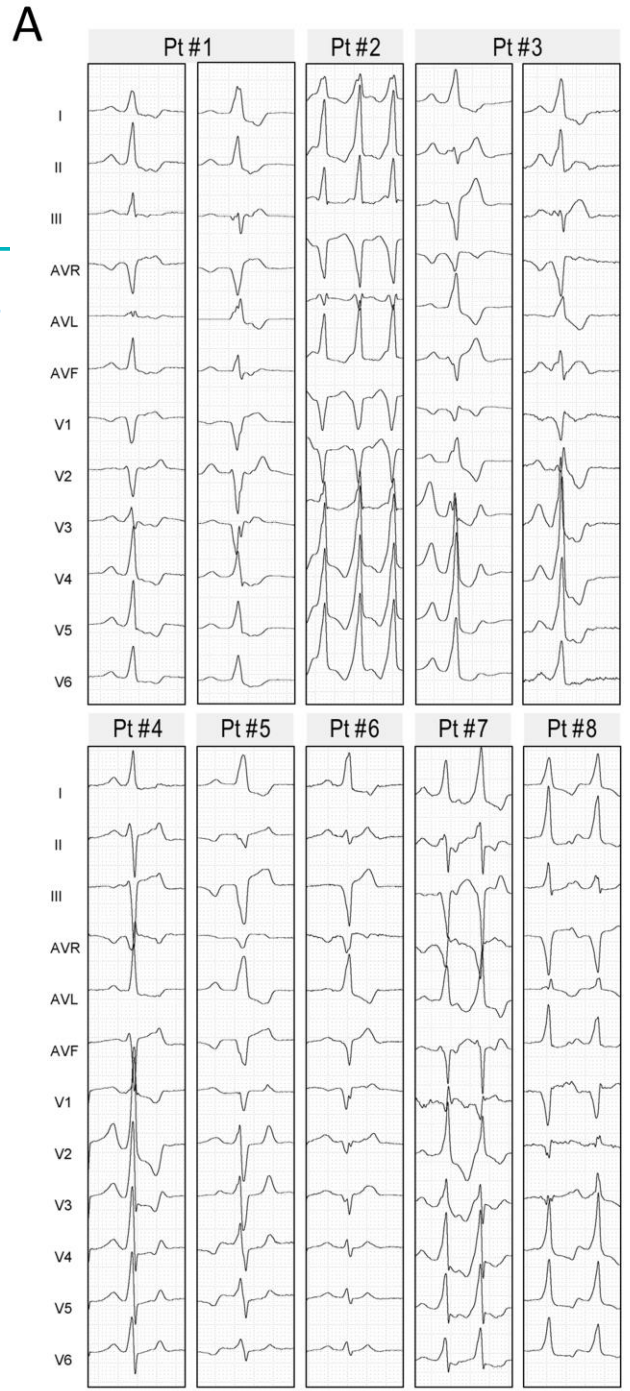
Circulation: Arrhythmia and Electrophysiology

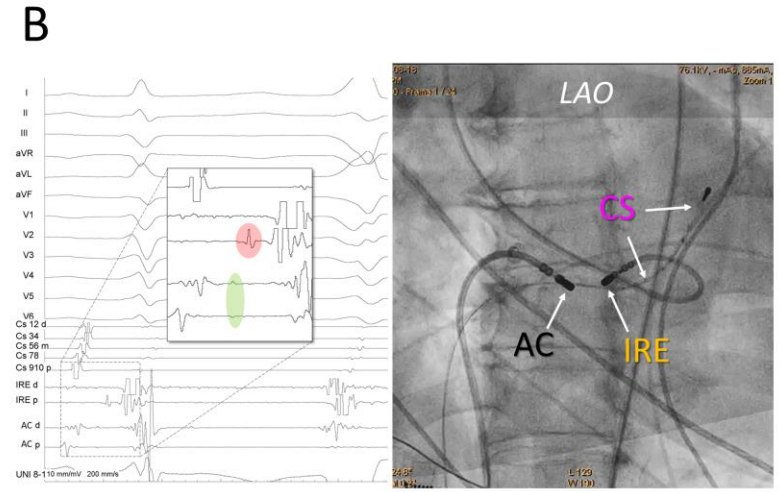
SPECIAL REPORT

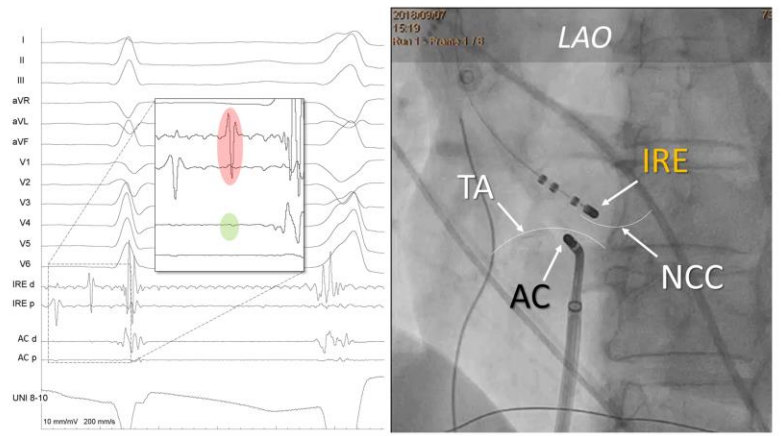
Bipolar Radiofrequency Ablation of Ventricular Arrhythmias Originating in the Vicinity of His Bundle

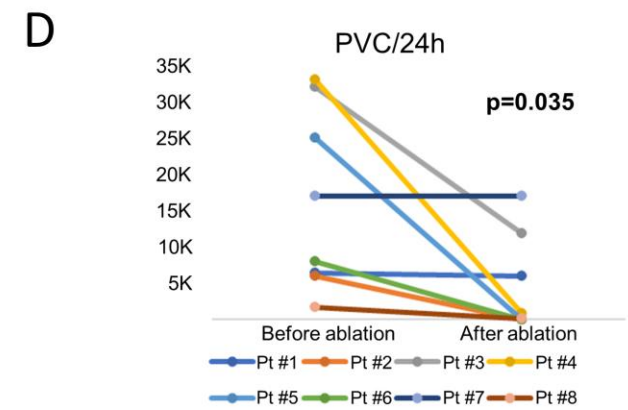
Piotr Futyma, MD, PhD; Kamil Ciąpała, MD; Jarosław Sander, MD; Ryszard Głuszczyk, MD; Marian Futyma, MD, PhD; Piotr Kułakowski, MD, PhD











Bipolar ablation - conclusions

- Can be safe and effective with a few precautions
- Is more effective for deep substrates
- It can be selective
- High-power can be necessary in the setting of a scar
- Possiblities for future optimalization (catheters, irrigants and tools)

Thank you

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