New and Future Technology in the EP Lab

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Relevant Disclosures

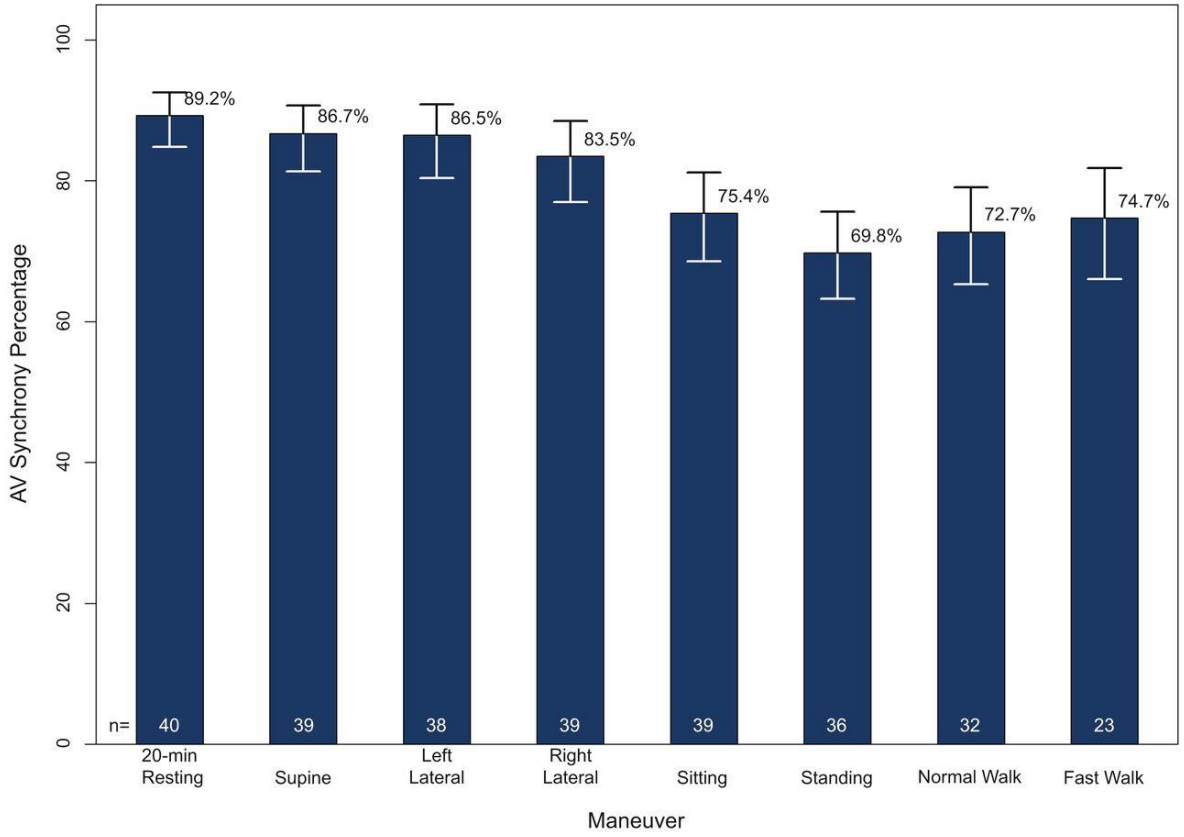
- None!

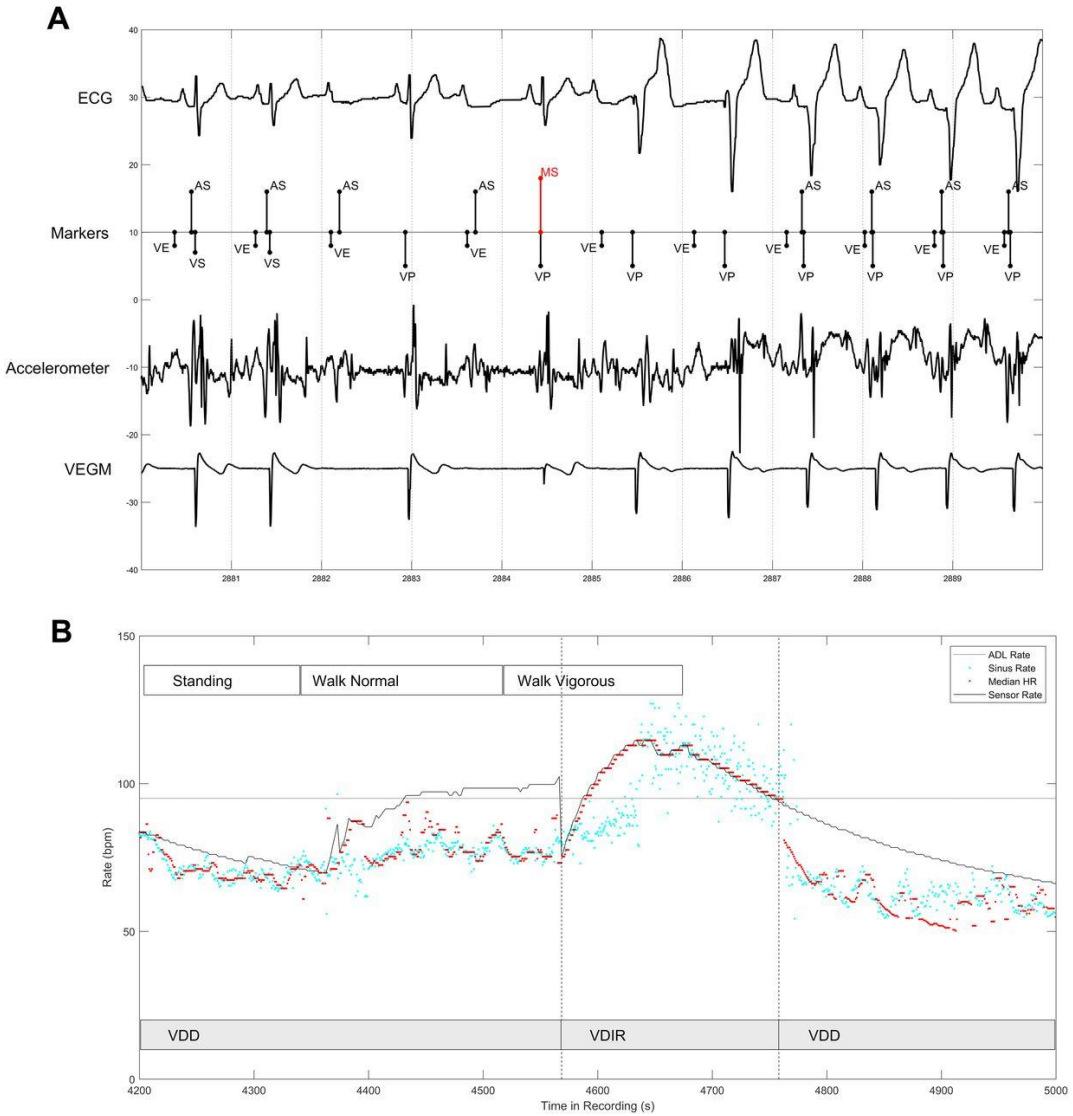
Bradycardia Pacing

Leadless Pacemakers	Nanostim LCP	Micra TPS
		
Dimensions, mm	42.0 x 5.99	25.9 x 6.7
Volume, cc	1	0.8
Weight, g	2	2
Sheath Size, Fr	21 OD/ 18 ID	27 OD/ 23 ID
Battery Longevity, yrs	8.5 – 9.8	4.7 – 9.6
Fixation Mechanism	Helix	4 Nitinol Tines

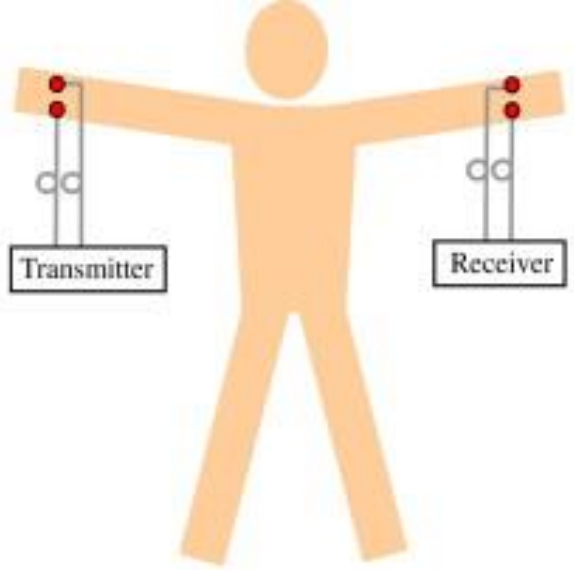
10.15420/aer.2017:16:1

Leadless Pacemaker With Atrial Sensing

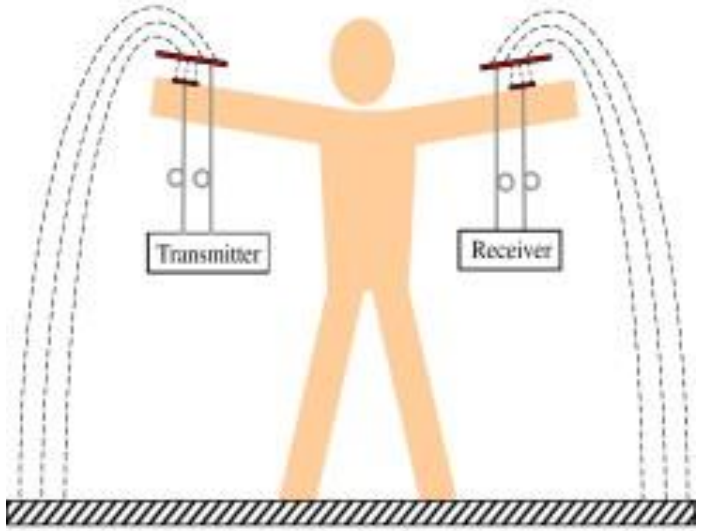




MARVEL 2. JACC Clin Electrophysiol. 2020 Jan;6(1):94-106

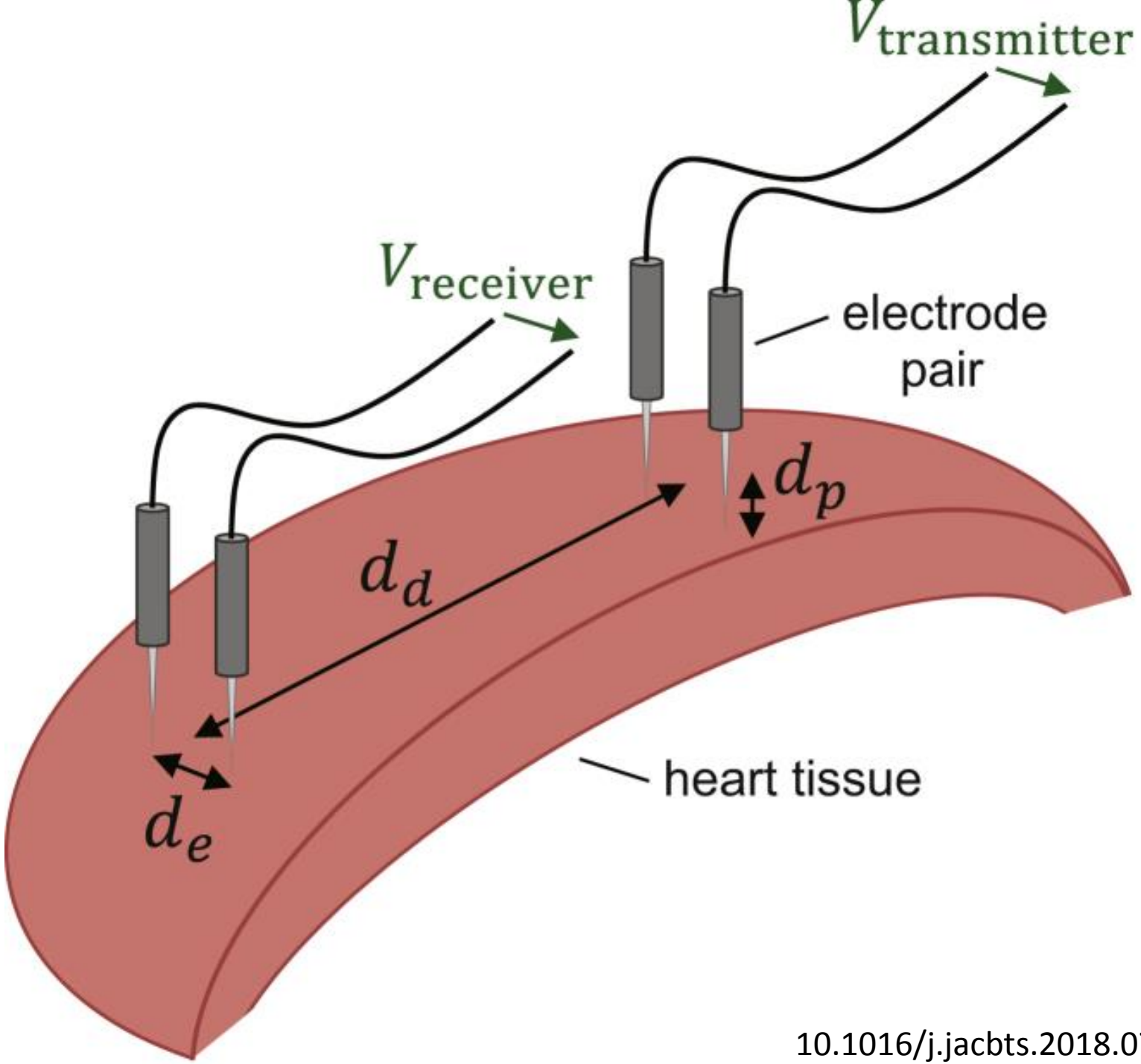


(a) Galvanic coupling IBC

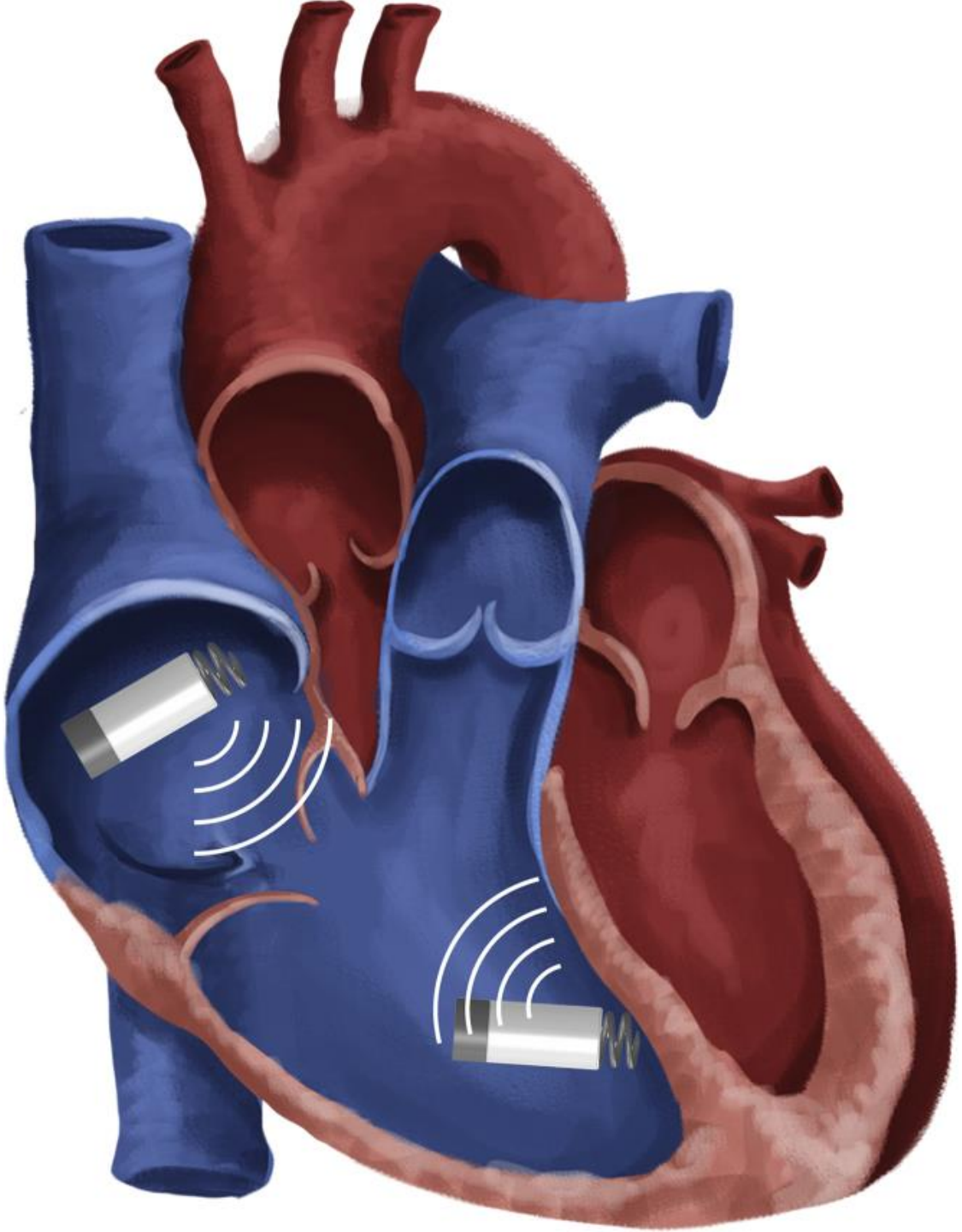


(b) Electrostatic coupling IBC

10.1016/j.dt.2013.10.001

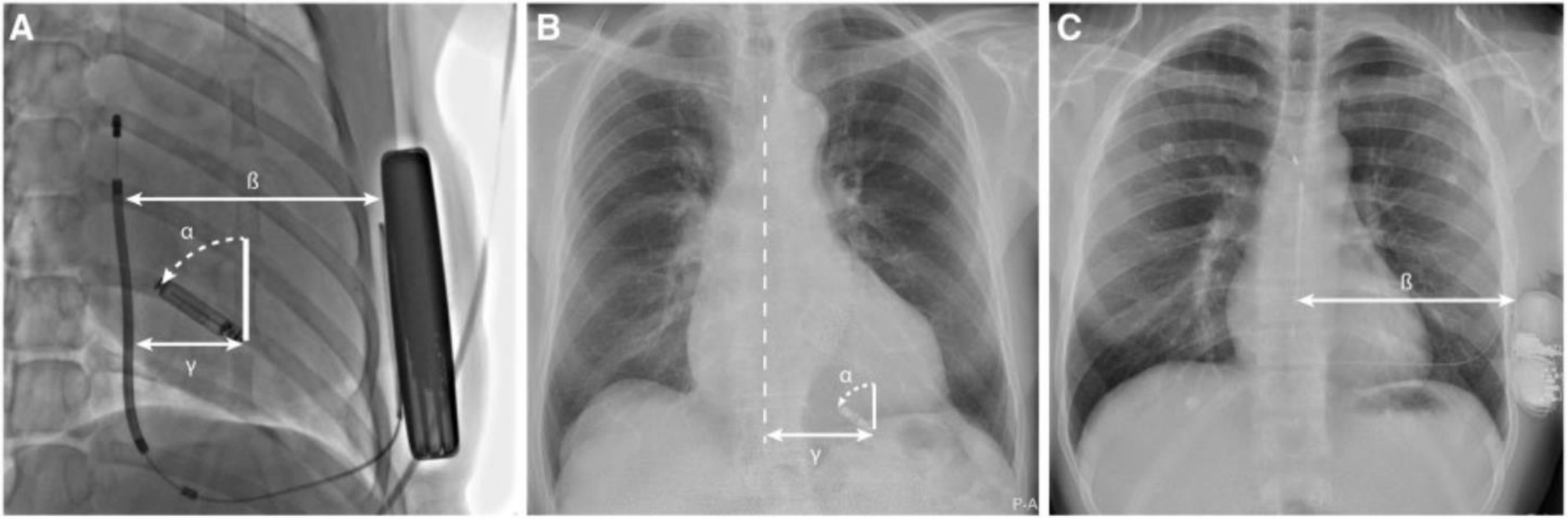


10.1016/j.jacbts.2018.07.009



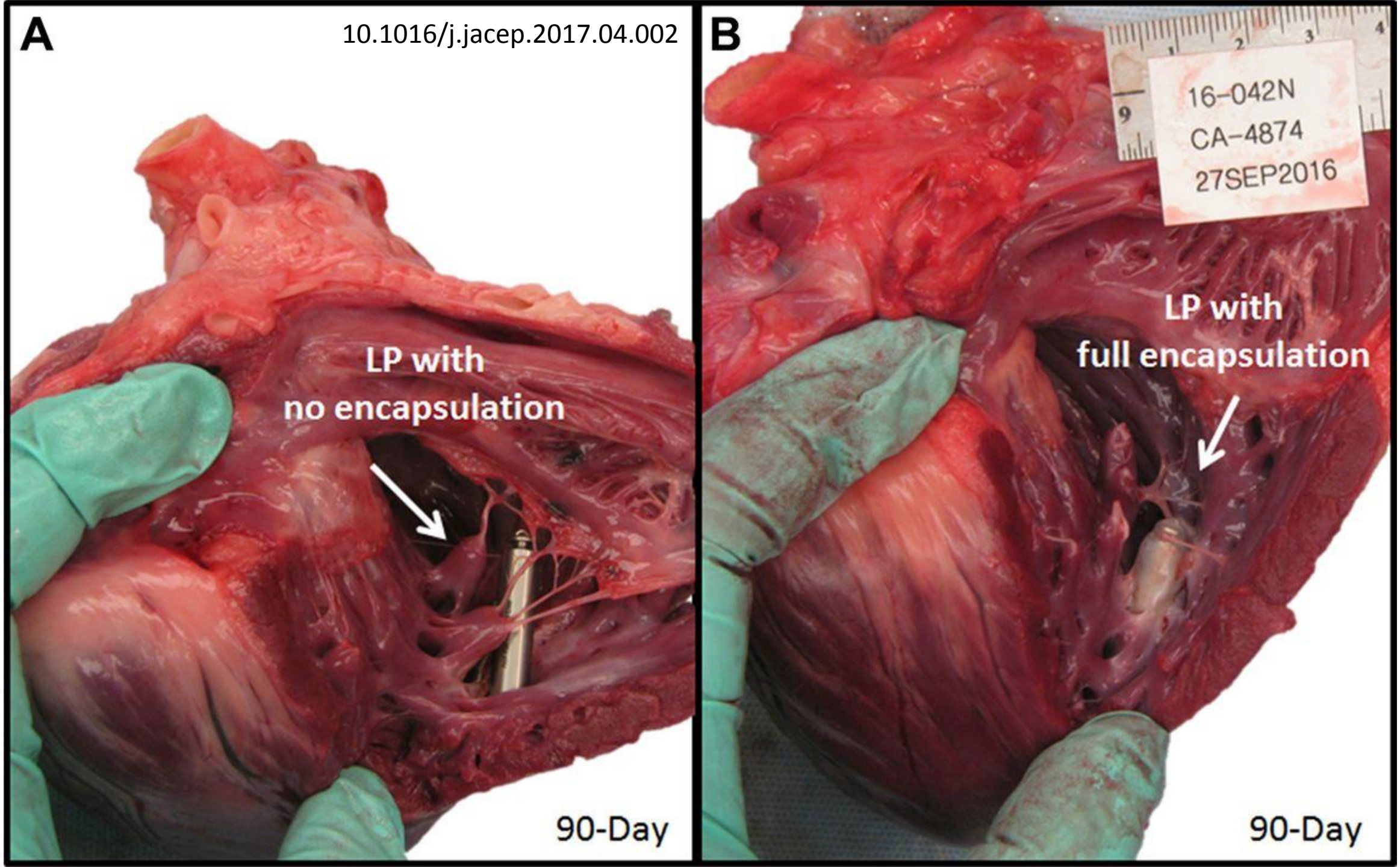
10.1016/j.jacbts.2018.07.009

Leadless Pacemaker for ATP

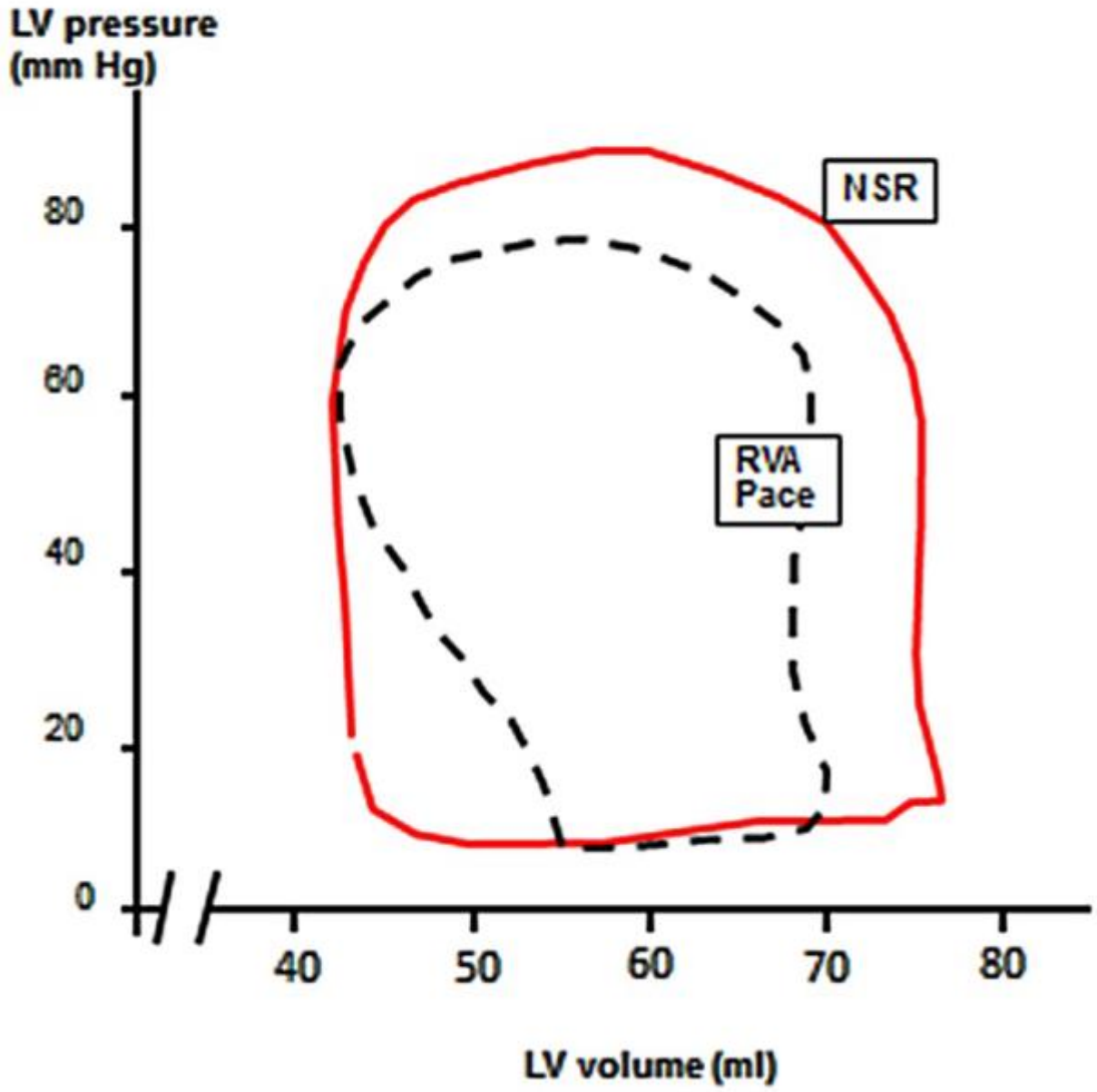


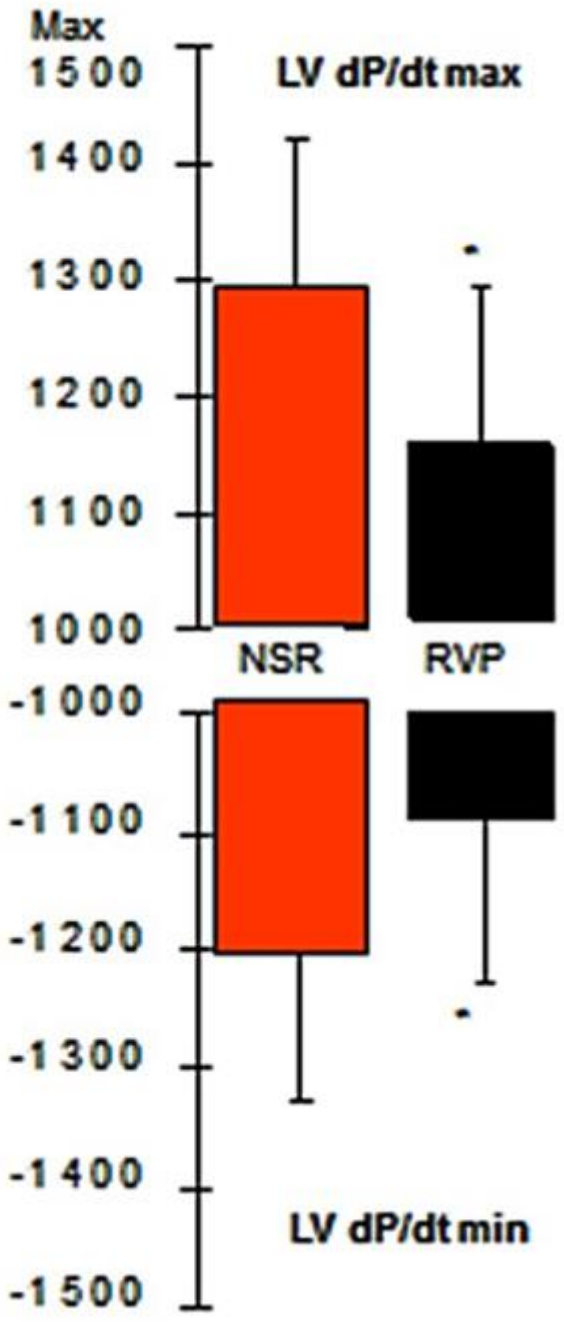
10.1093/europace/euy019

10.1016/j.jacep.2017.04.002

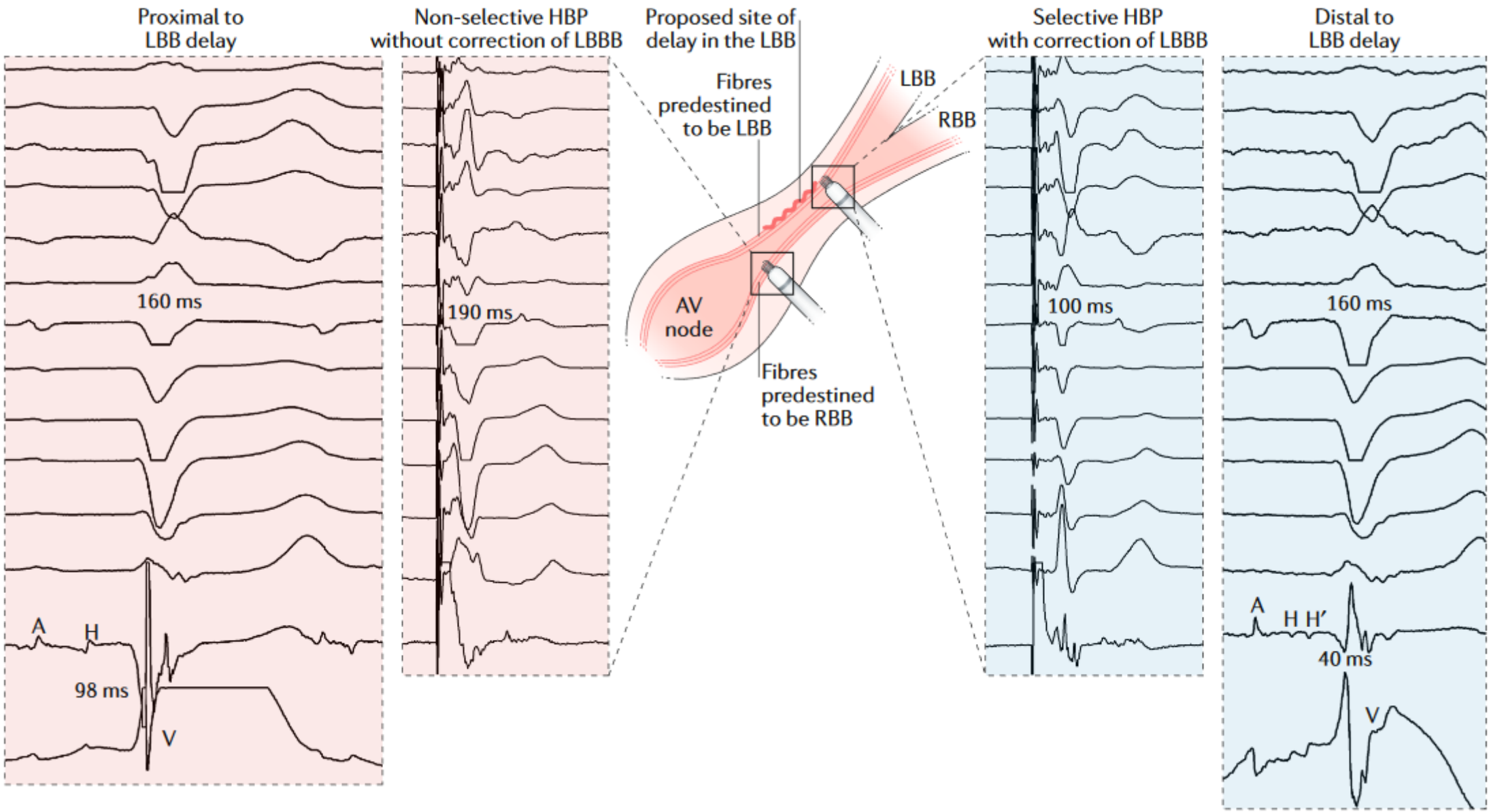


Physiologic Pacing

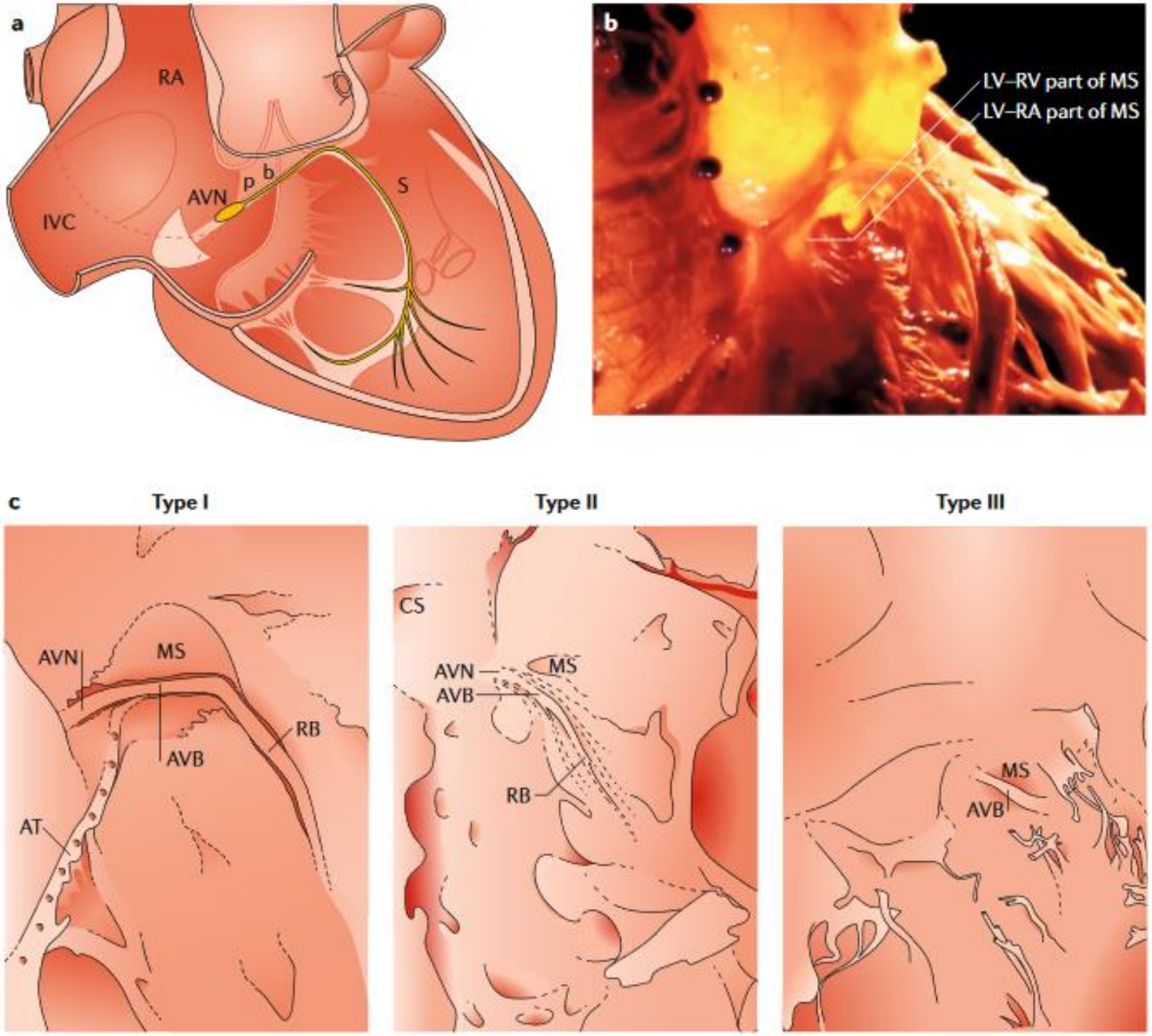




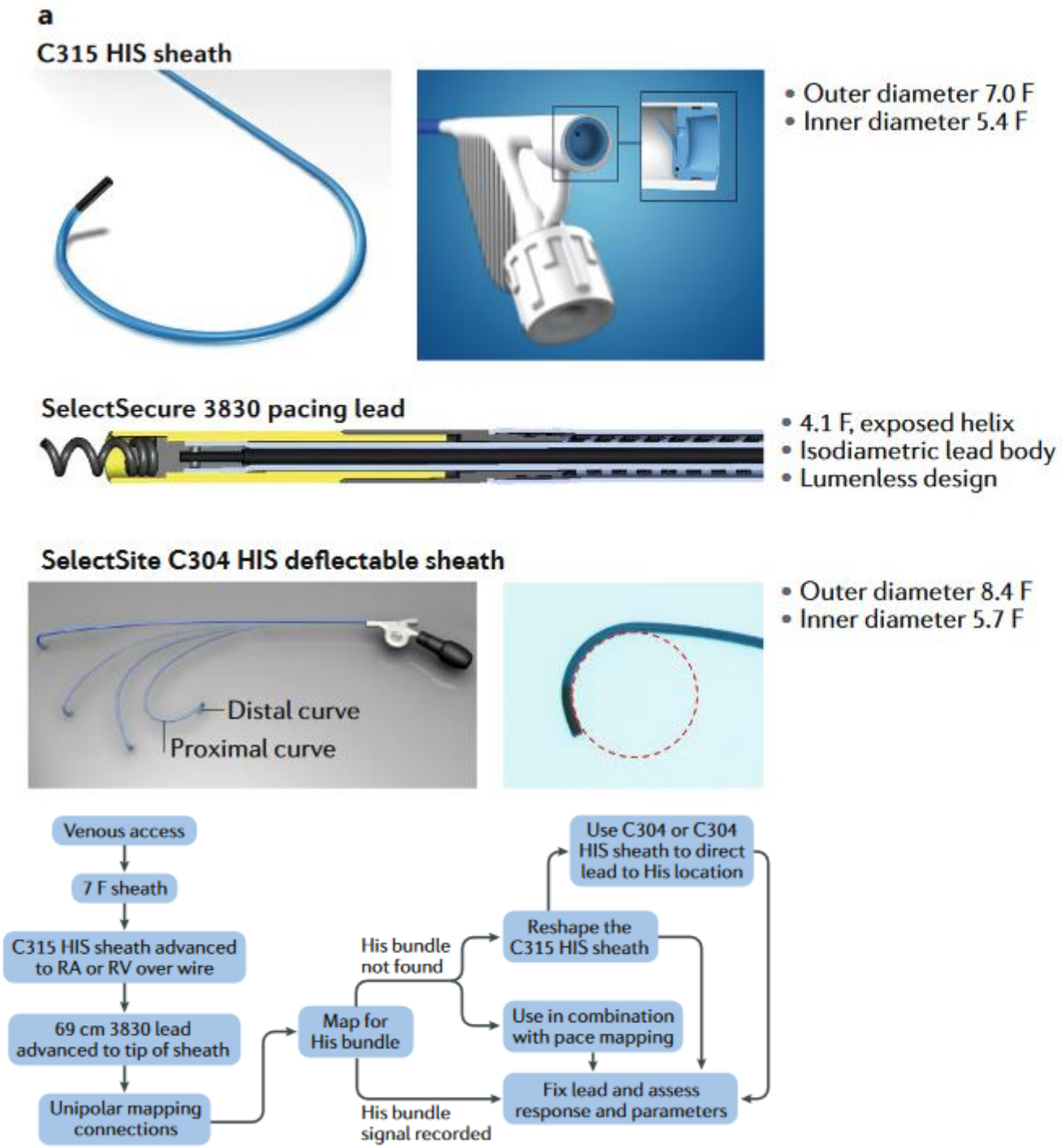
10.1111/jce.14248

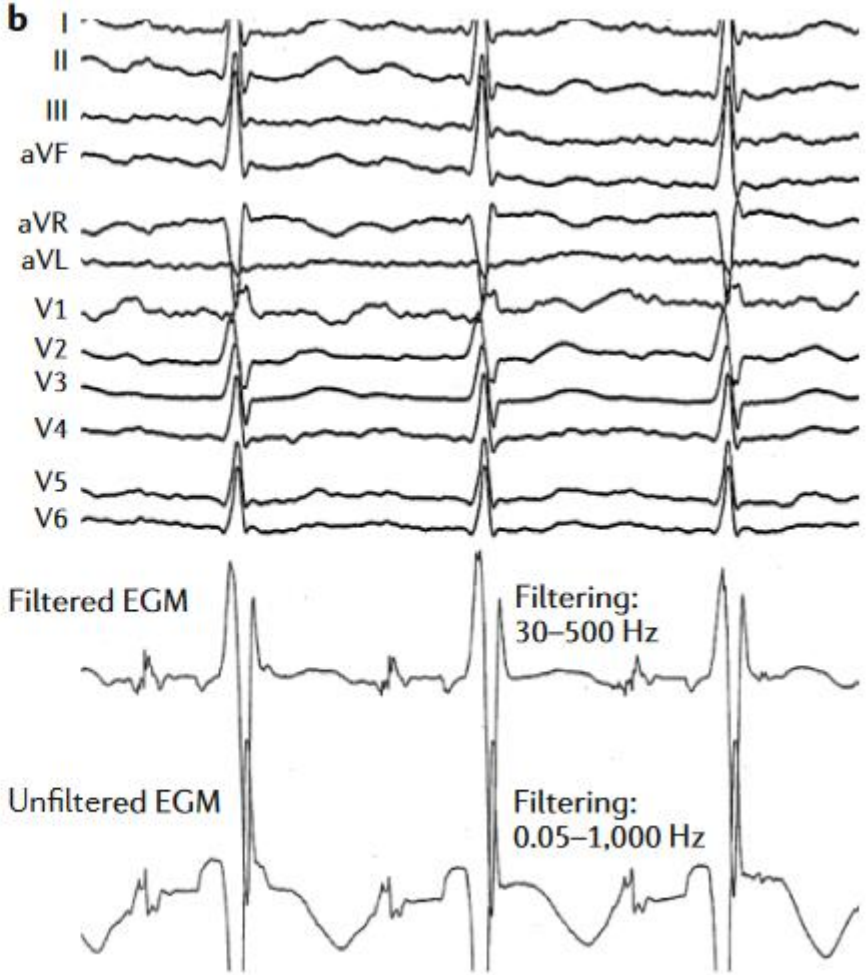


Nat Rev Cardiol. 2020 Jan;17(1):22-36



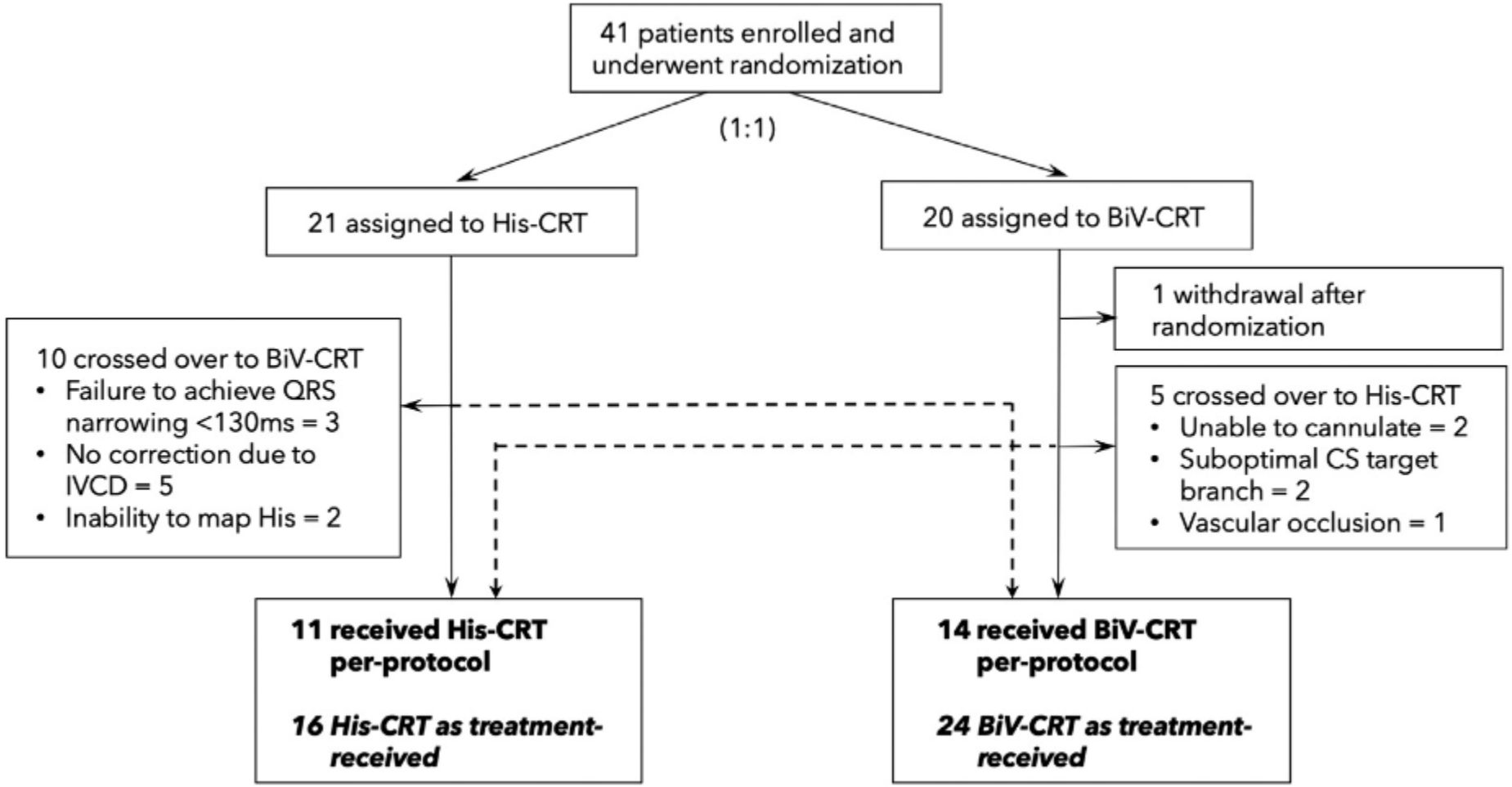
Nat Rev Cardiol.
2020 Jan;17(1):22-36





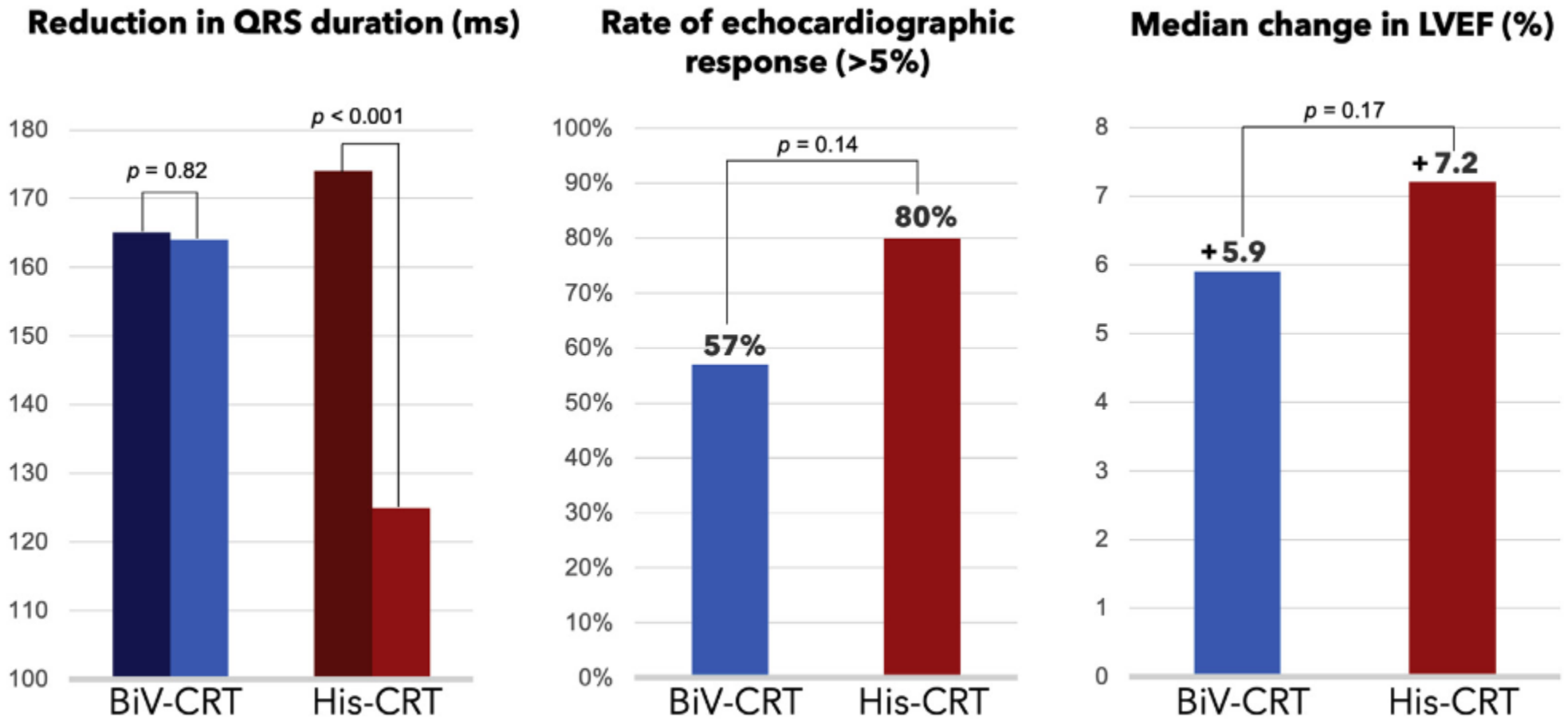
Nat Rev Cardiol. 2020 Jan;17(1):22-36

His-SYNC Pilot Trial



Heart Rhythm. 2019 Dec;16(12):1797-1807.

His-SYNC: On-Treatment Results

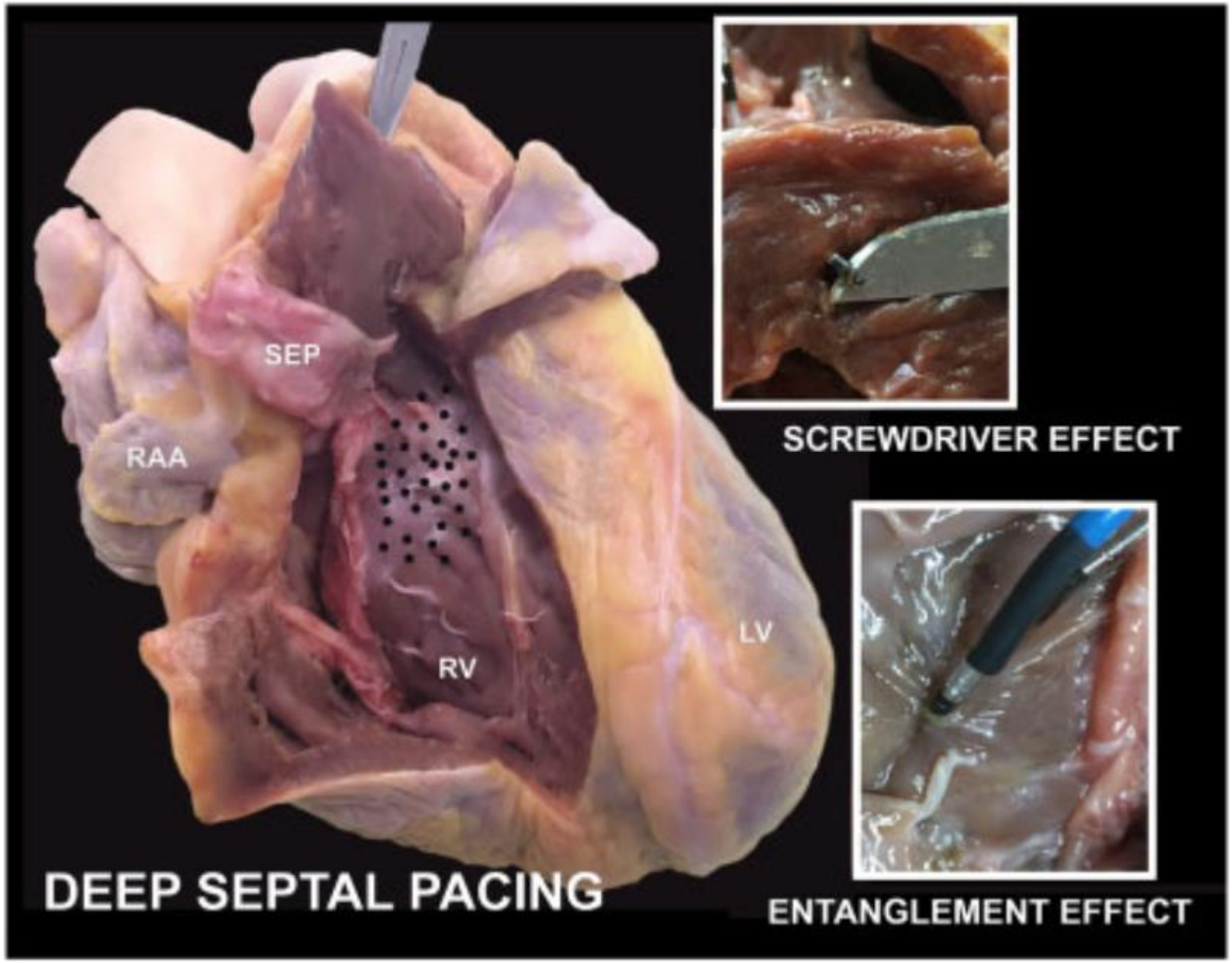


Heart Rhythm. 2019 Dec;16(12):1797-1807.

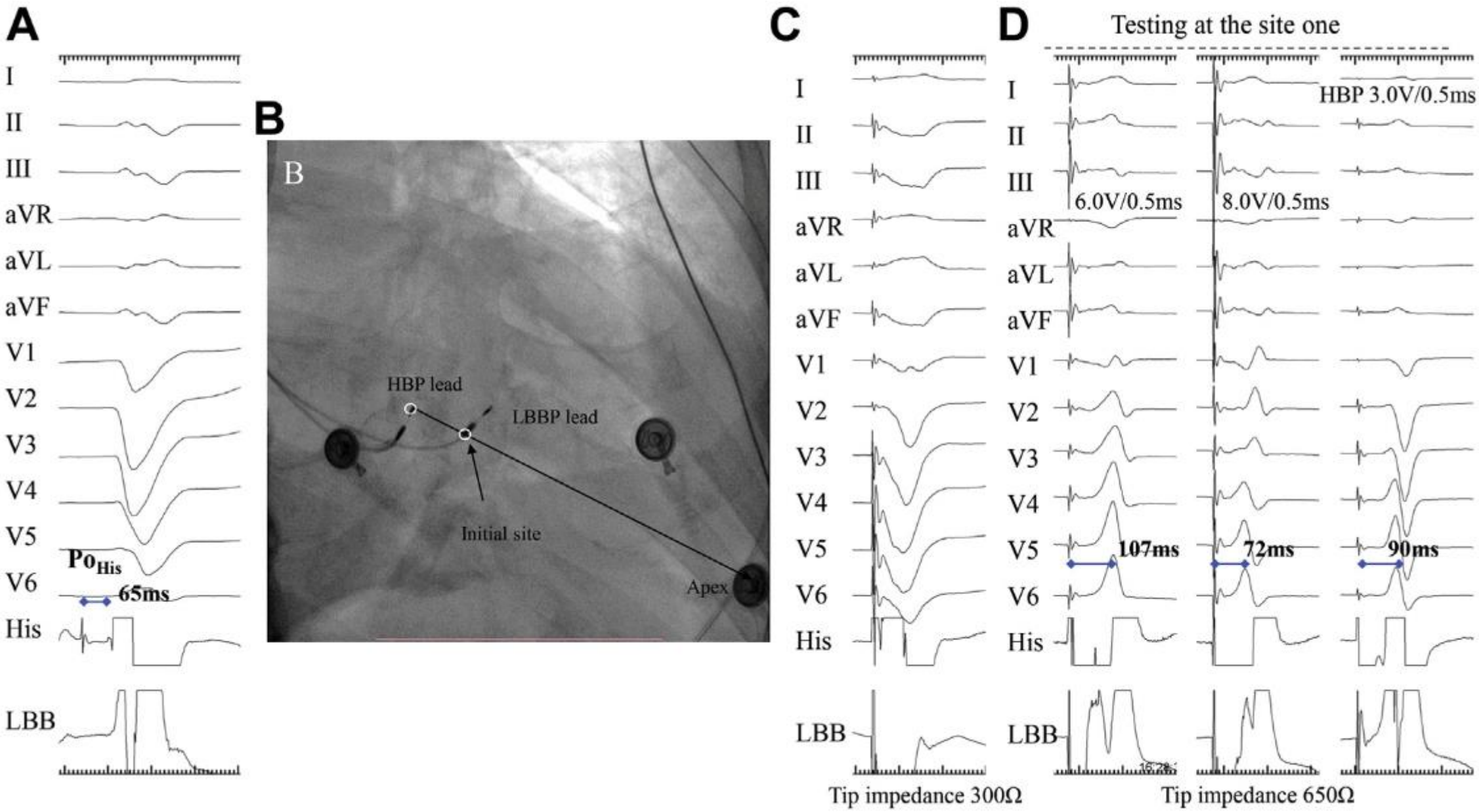
Conduction system pacing: challenges

- Technical difficulty of implantation
- High long-term thresholds: capture, bundle branch correction
- Need for bespoke device selection and programming
- Optimal patient selection

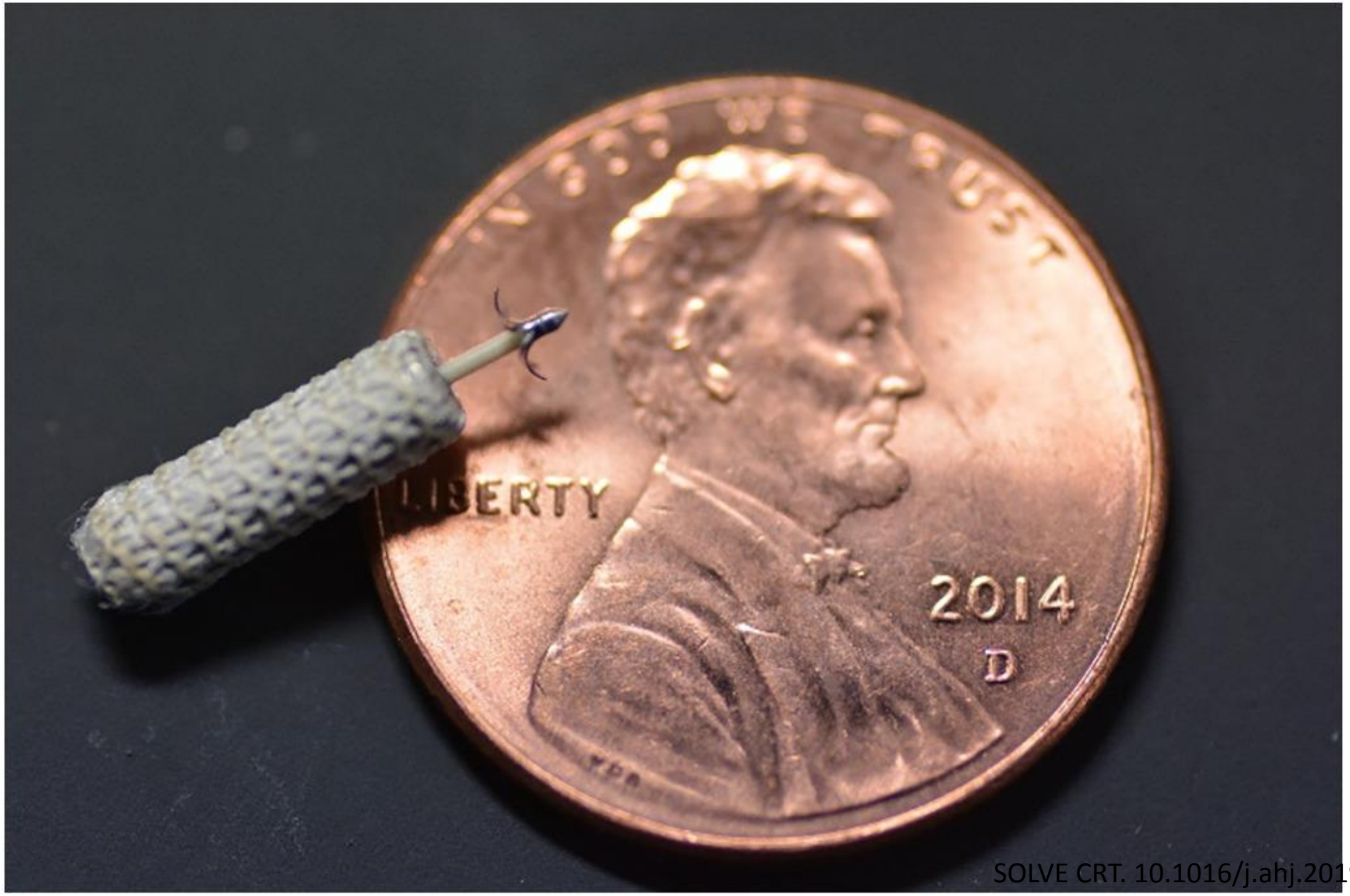
Left Bundle Branch Pacing



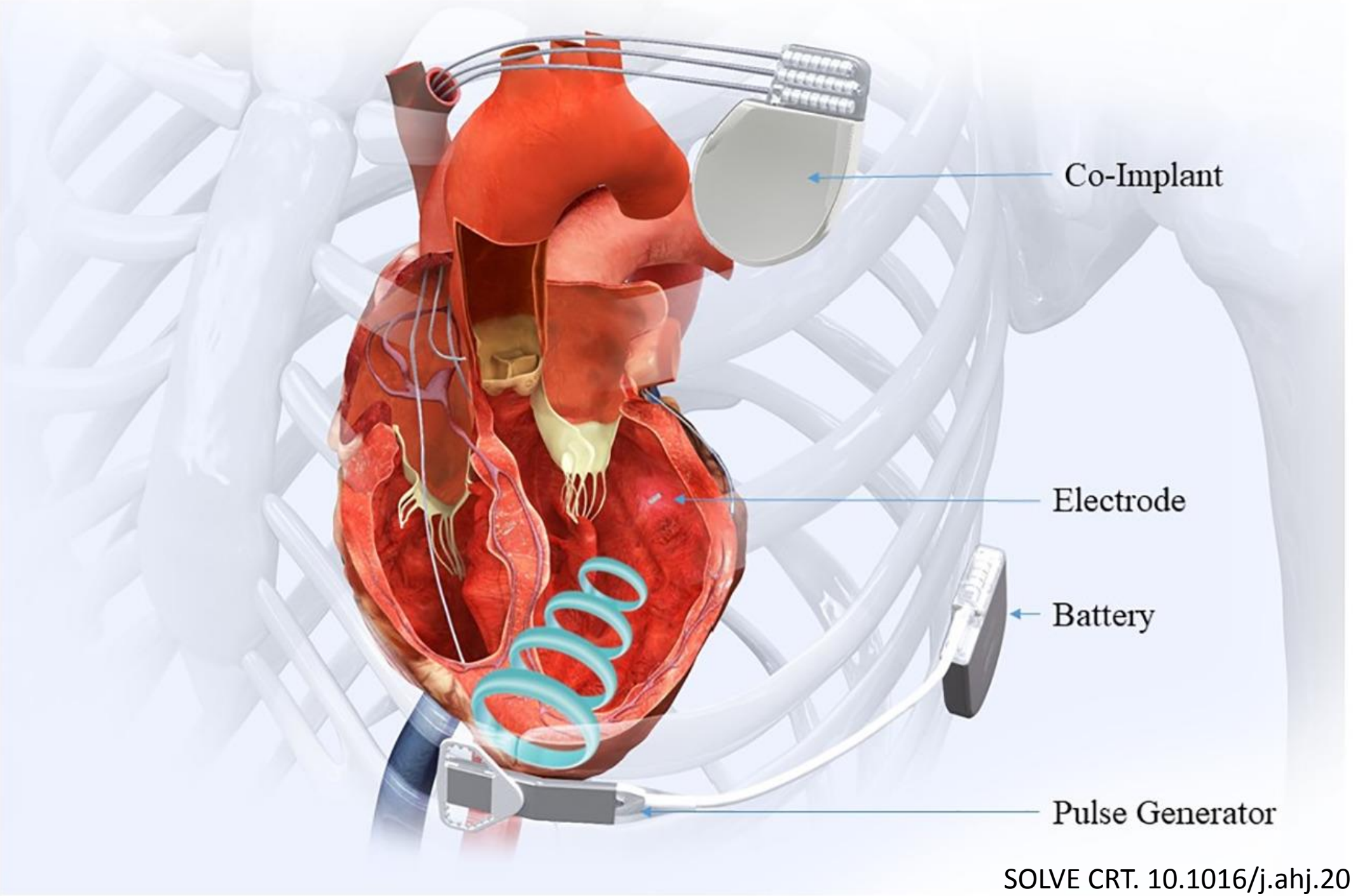
10.1093/europace/euz270



Heart Rhythm. 2019 Dec;16(12):1791-1796.

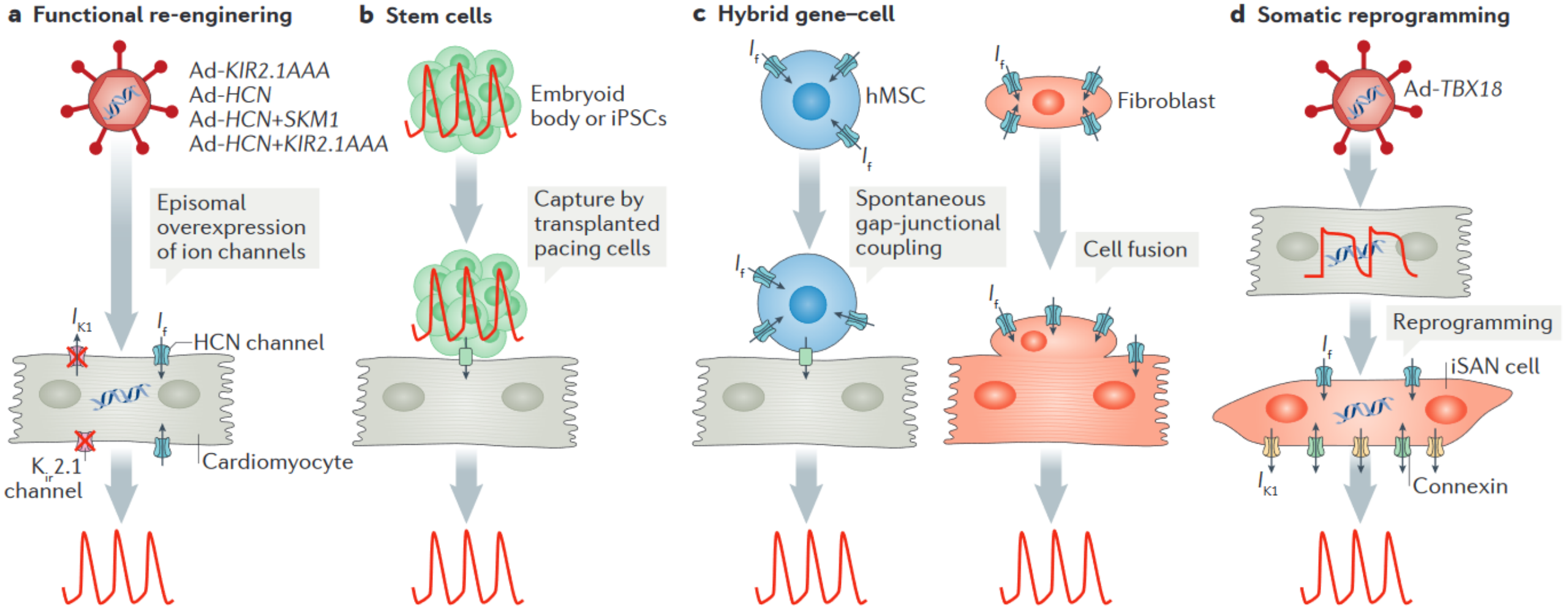


SOLVE CRT. 10.1016/j.ahj.2019.04.002



SOLVE CRT. 10.1016/j.ahj.2019.04.002

Biologic Pacemakers



Nat Rev Cardiol. 2018 Mar; 15(3): 139–150.

Prevention of Sudden Death

Subcutaneous ICD

ImageReady™ MR-Conditional System*[1,2]

Approved for full-body scans, with no anatomical restrictions in 1.5 tesla MR environments. Device also has an automatic time-out feature available while in MRI protection mode.

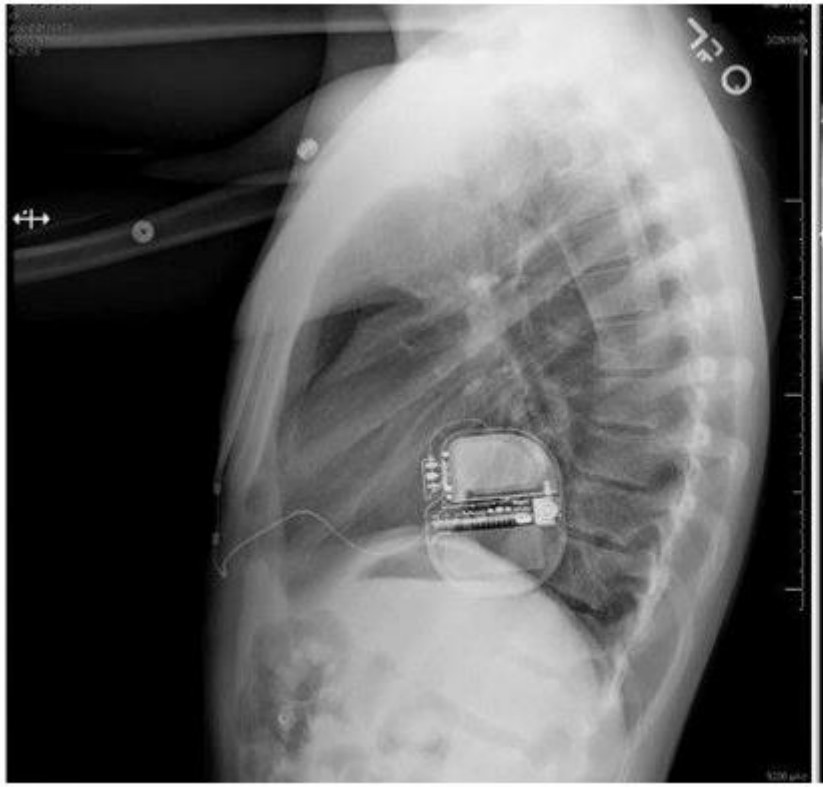
*when conditions of use are met

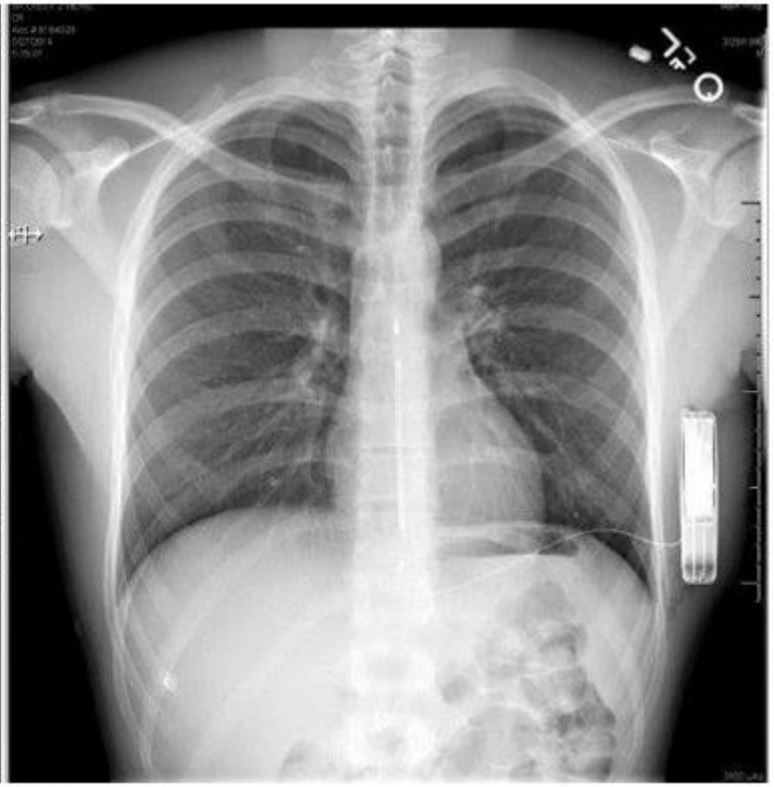
AF Monitor™

Designed to assist in the detection of silent, new onset, or the progression of atrial fibrillation.[1] LATITUDE alerts help physicians to monitor and appropriately manage patient's condition.

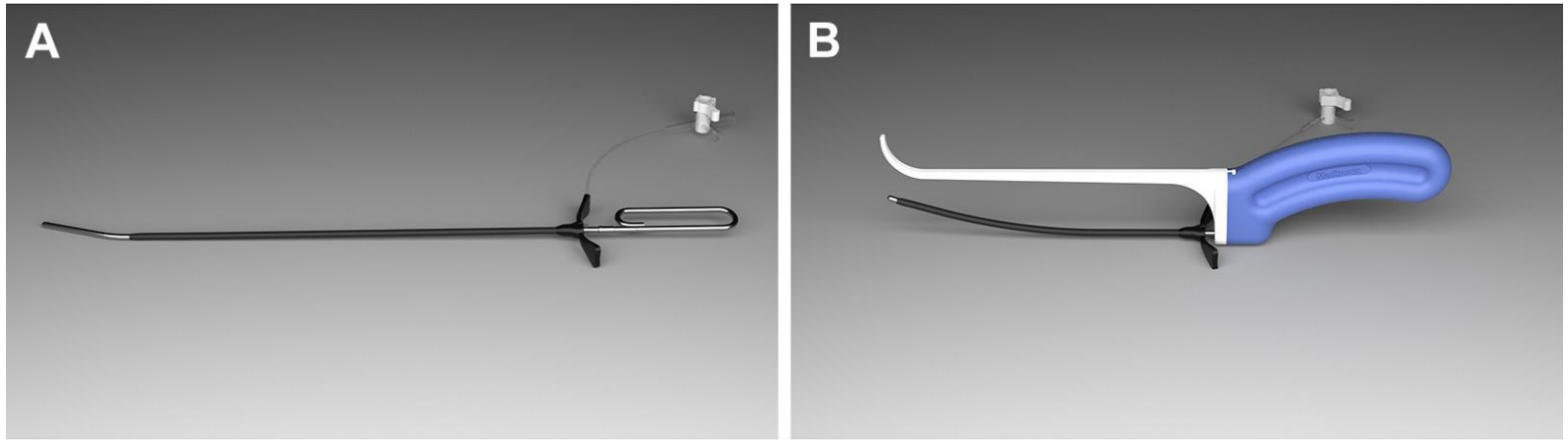
SMART Pass

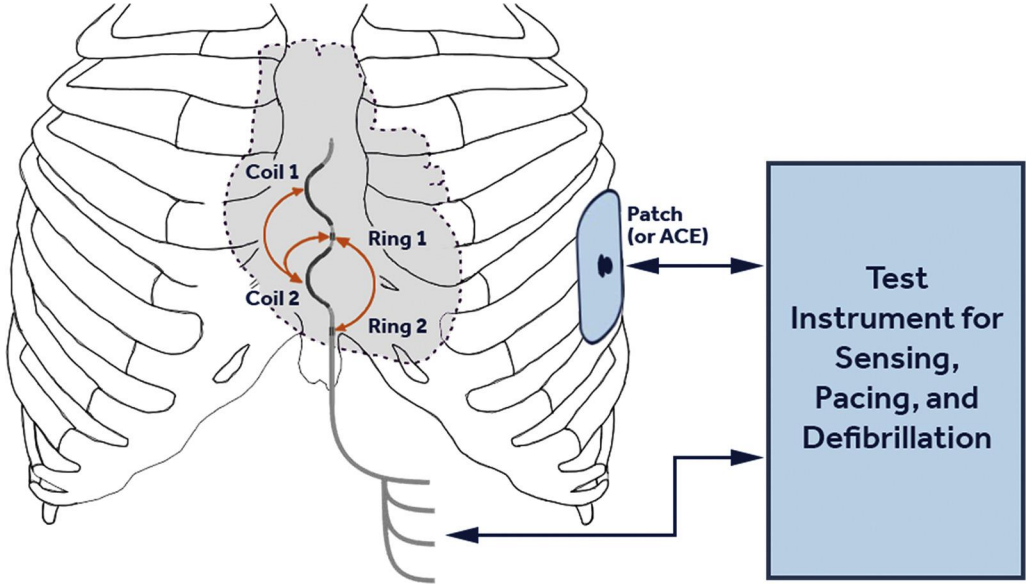
SMART Pass is a high pass filter designed to reduce cardiac over-sensing. It has been shown to reduce inappropriate therapy due to cardiac over-sensing by 71% from the EMBLEM device.[3]

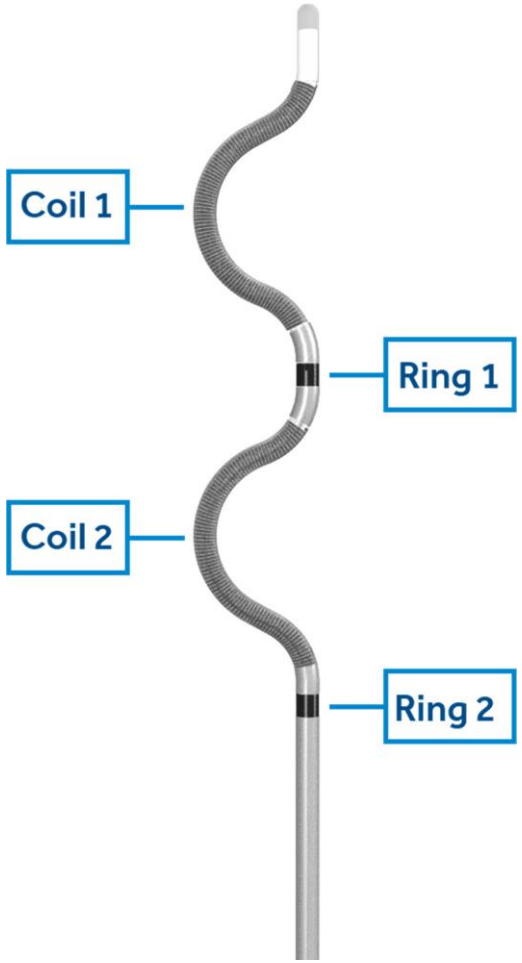




Substernal Extravascular ICD

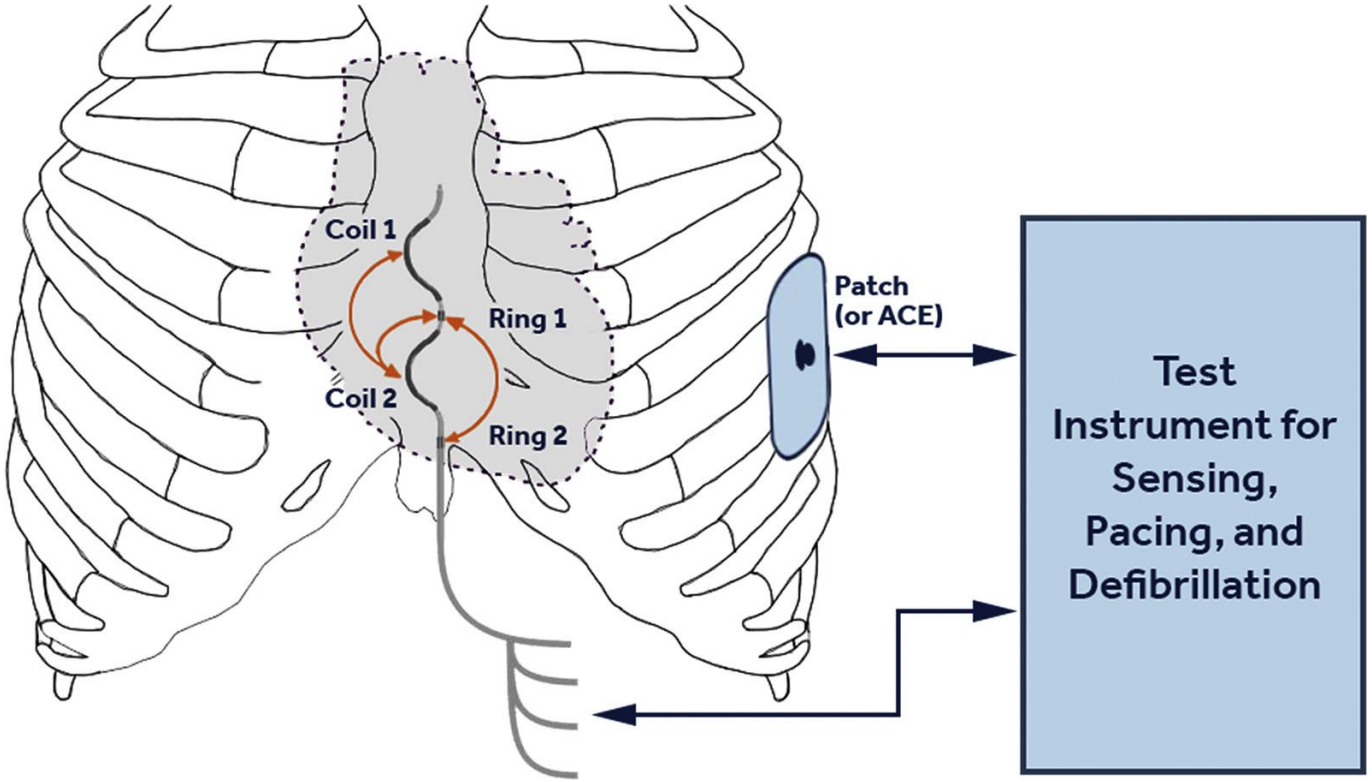






JACC Clin Electrophysiol. 2019 Feb;5(2):186-196

Substernal Extravascular ICD: ASD2 Study

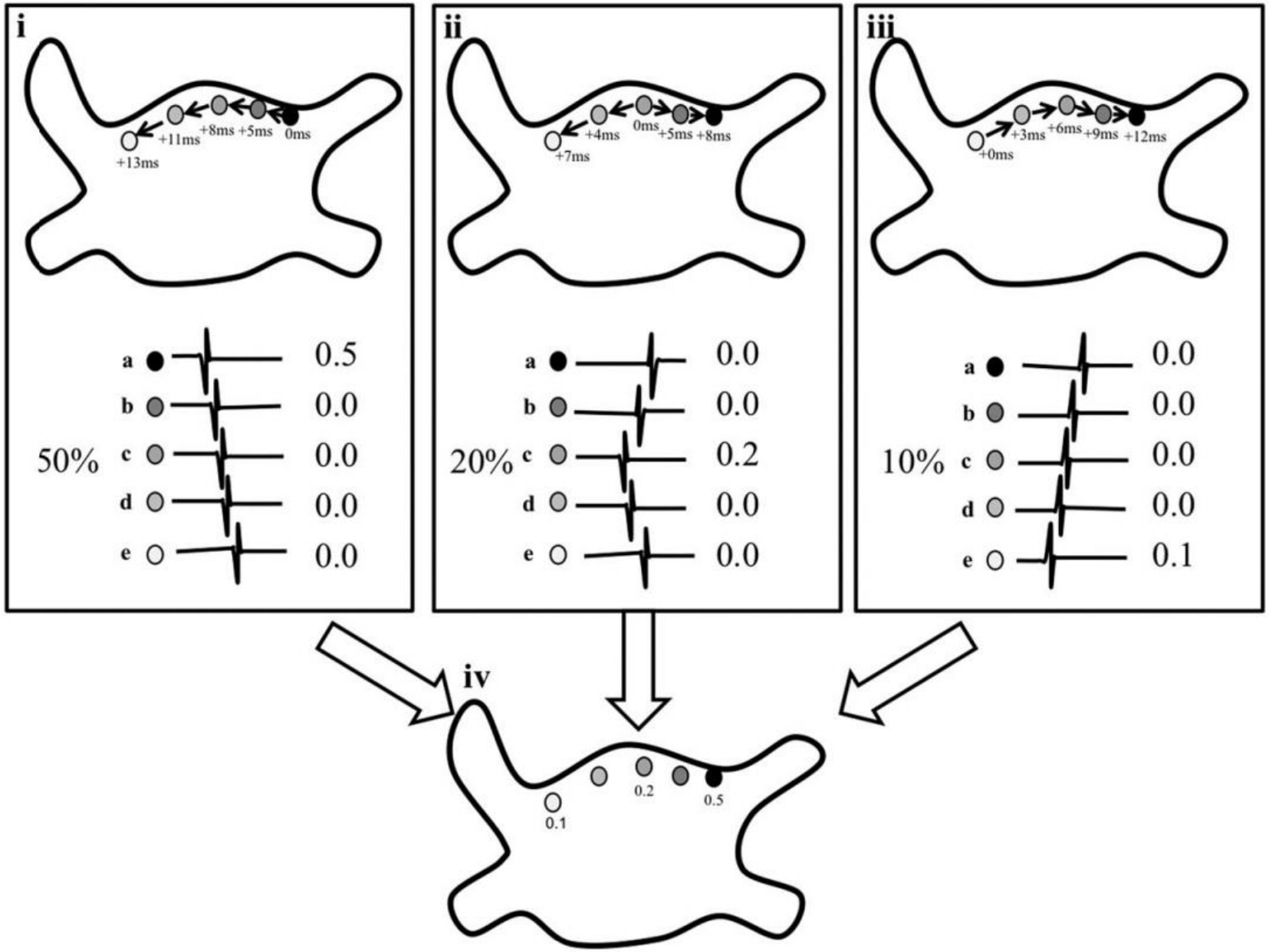


- Adequate VF detection in all patients with 16.6 seconds time to therapy
- 80% first-shock defibrillation at 30 J; 95% success with 2 shocks
- All patients with active can emulator had success at 30 J
- Able to pace 97% of patients
- 1 death due to tamponade

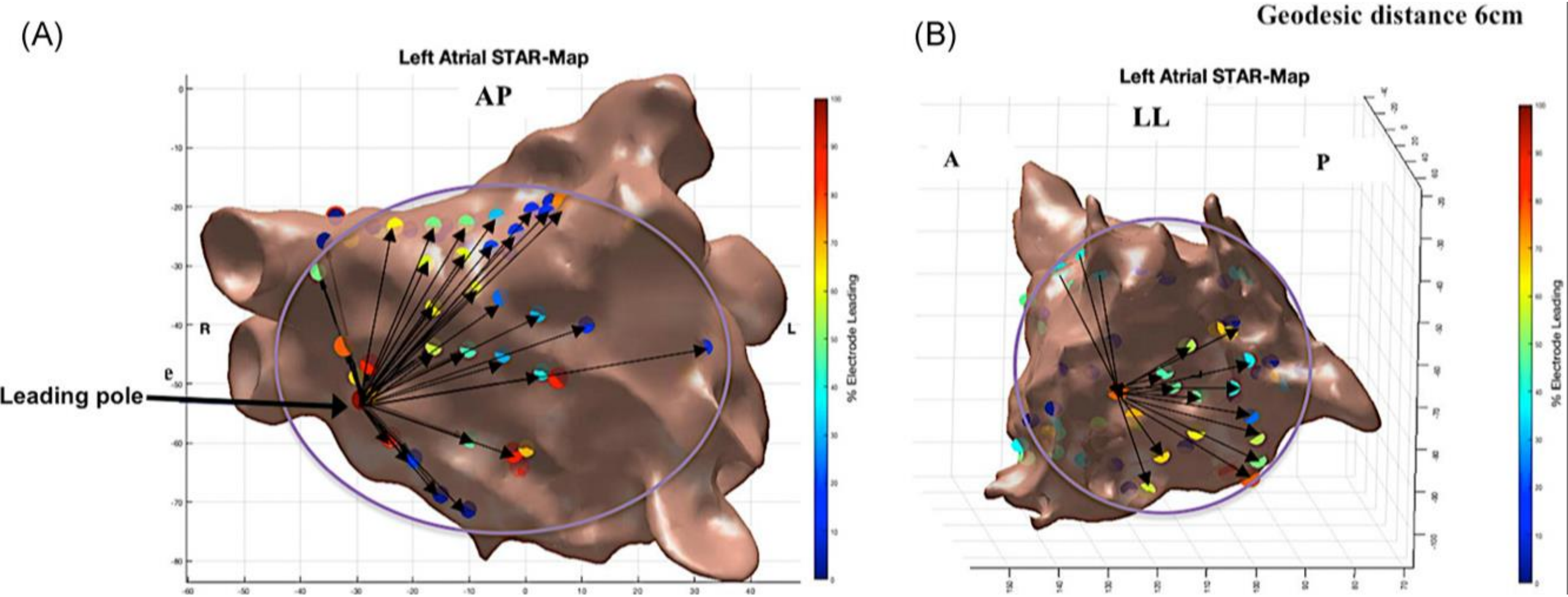
JACC Clin Electrophysiol. 2019 Feb;5(2):186-196

Atrial Fibrillation: Diagnostics

STAR Mapping

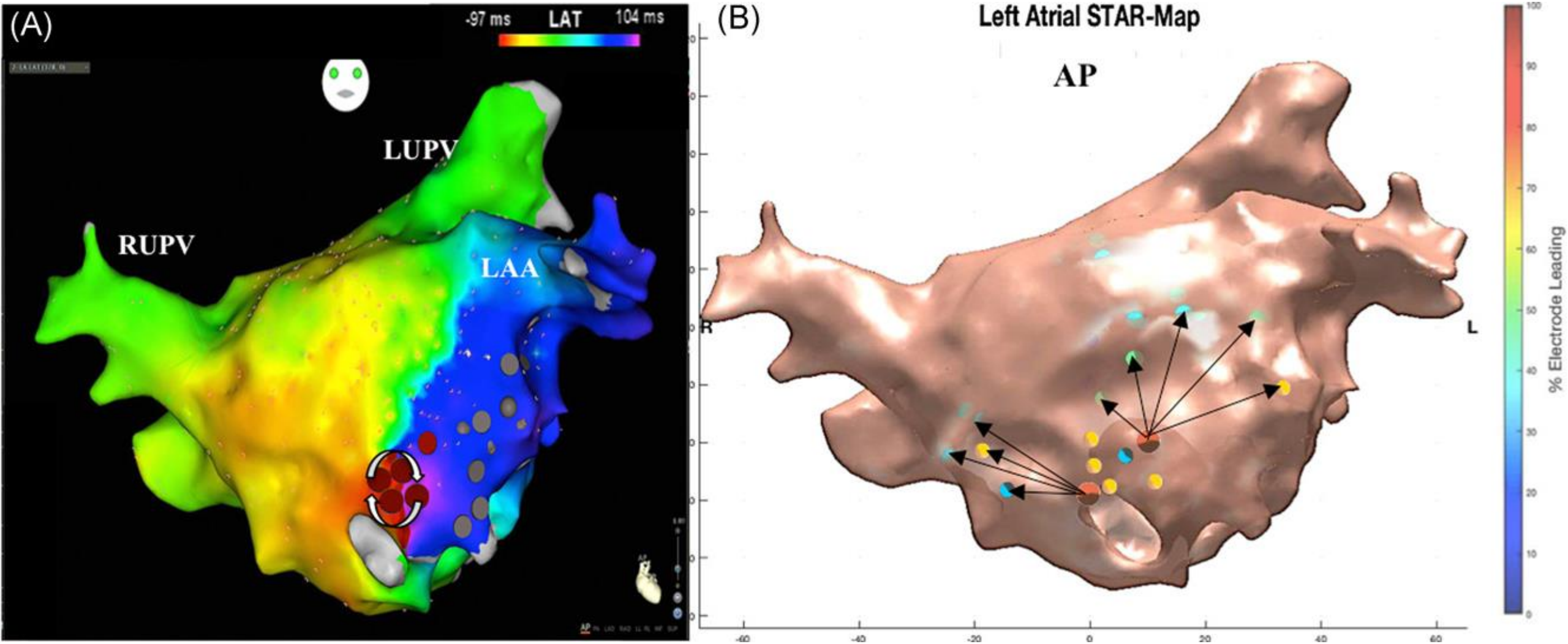


STAR Mapping: Development in Focal AT



10.1111/jce.13882

STAR Mapping: Validation in Focal AT



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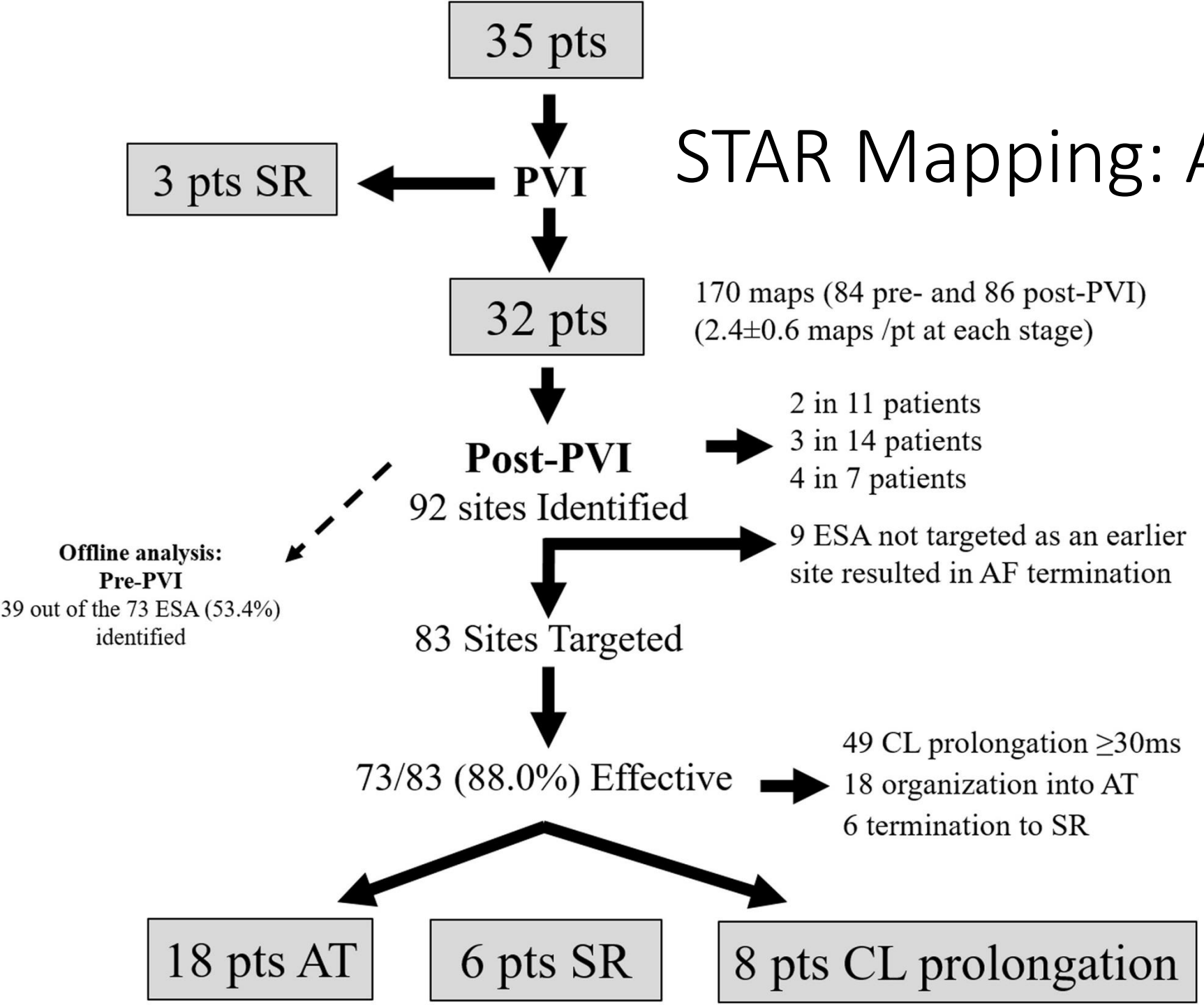
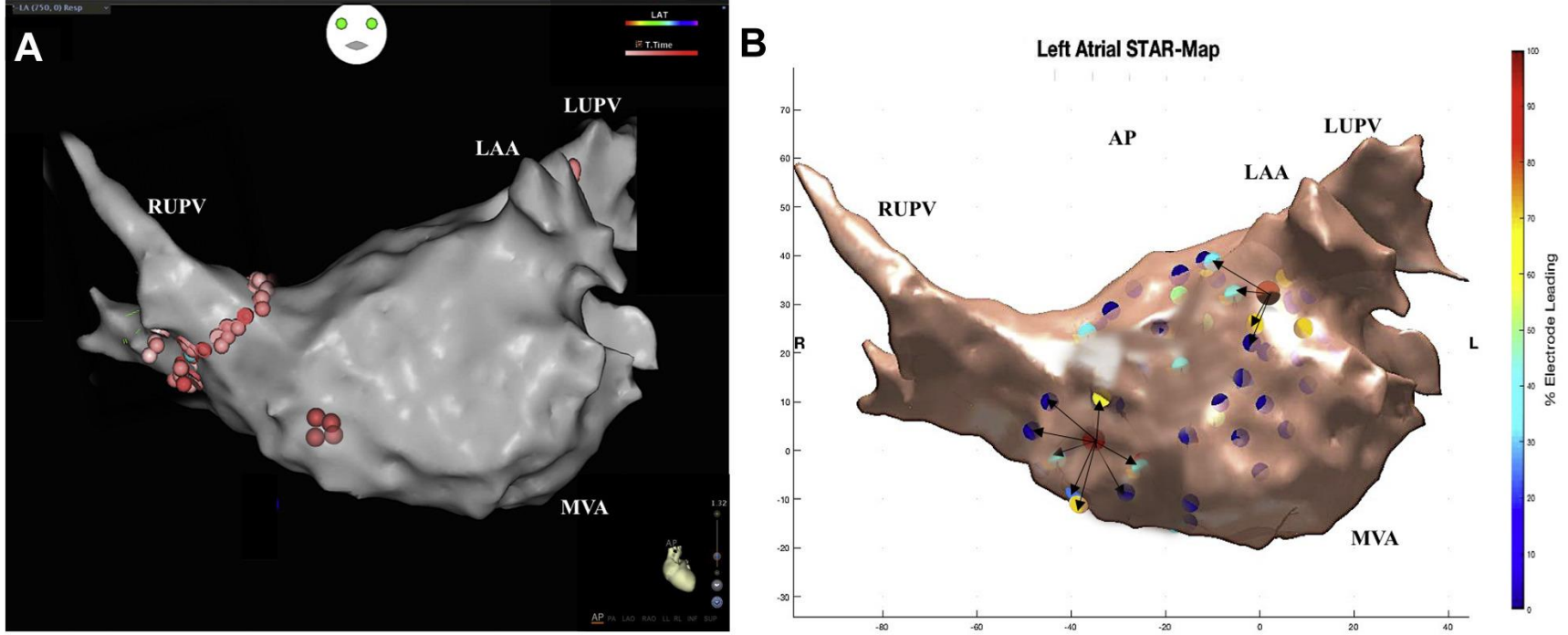
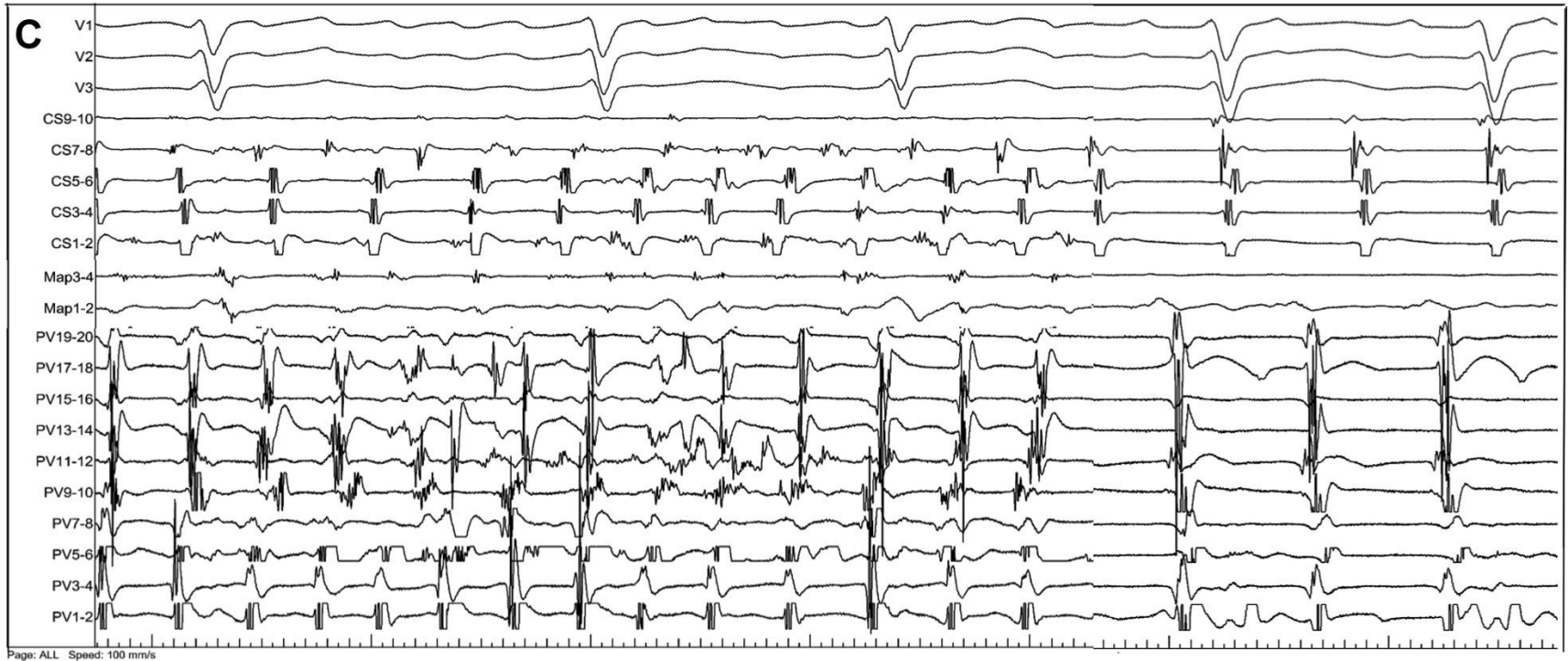
STAR Mapping: Application to AF



10.1016/j.jacep.2019.04.007

STAR Mapping: Initial Results in AF





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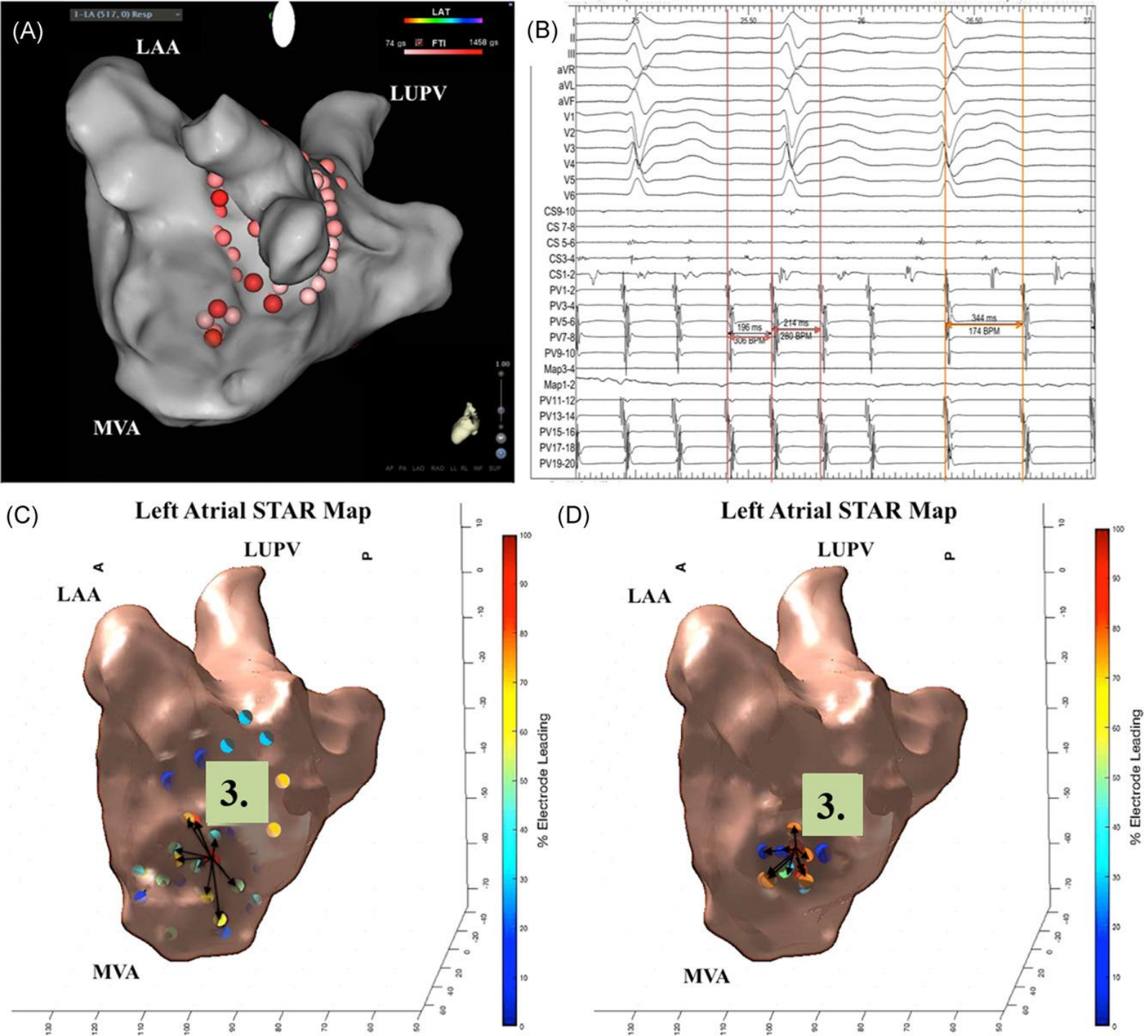
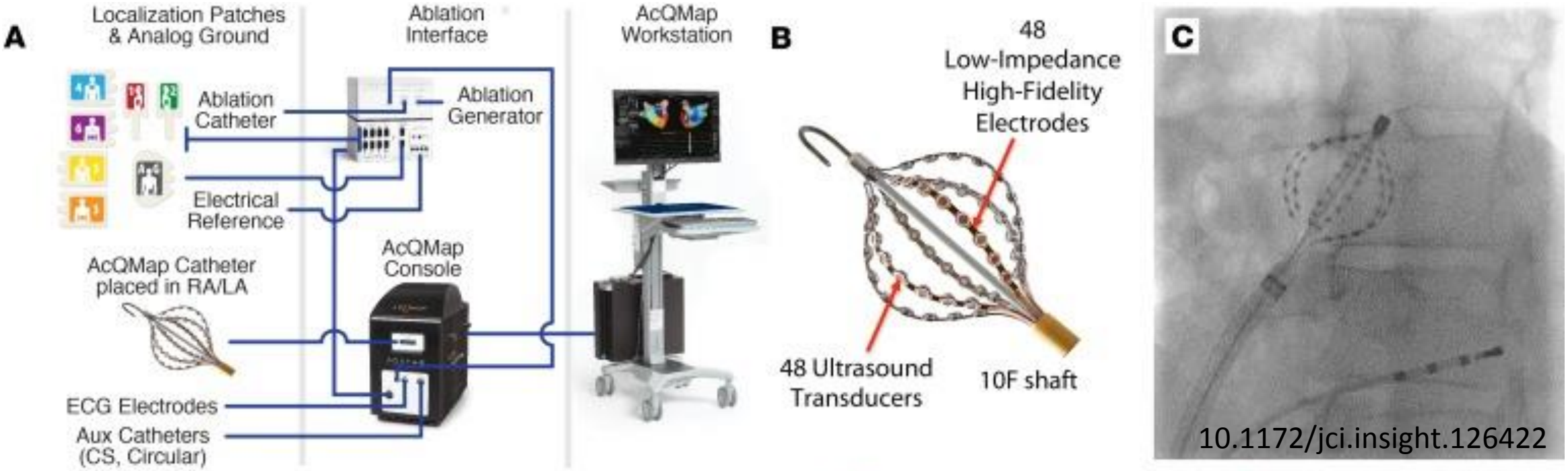


STAR Mapping: Ditching the Basket

10.1111/jce.14201

Dipole Density Mapping



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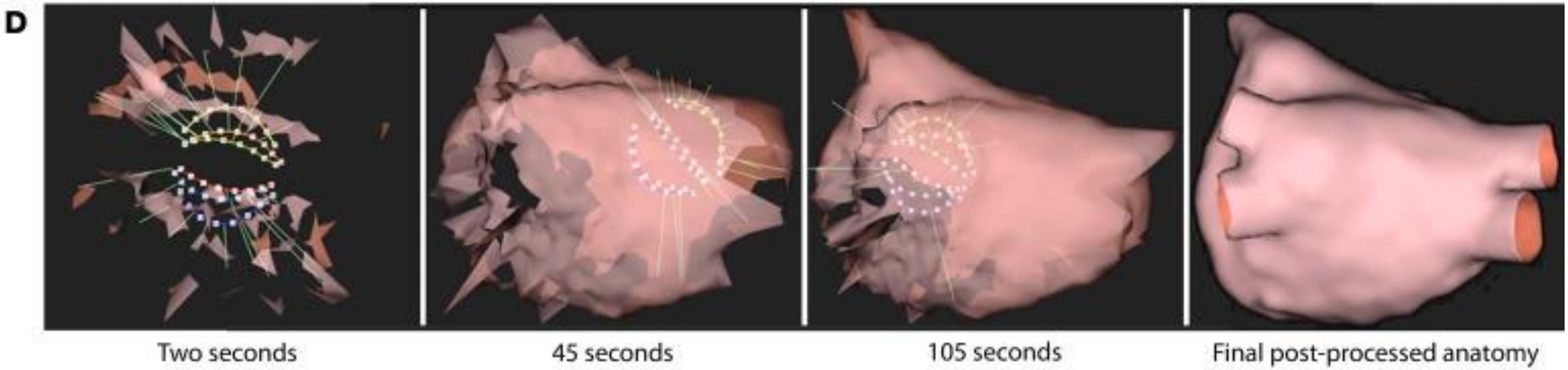
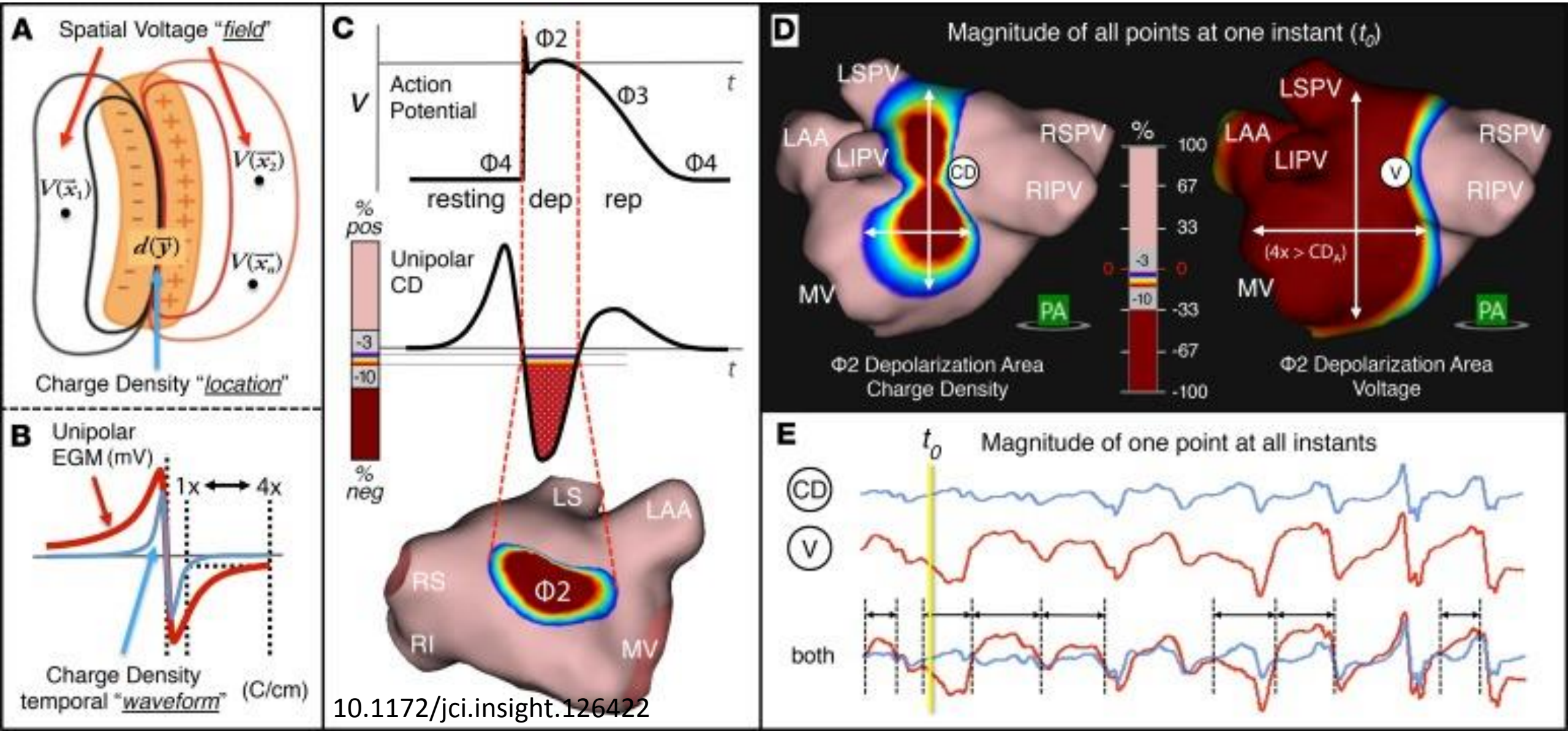


Dipole Density, Voltage, and Local Activation



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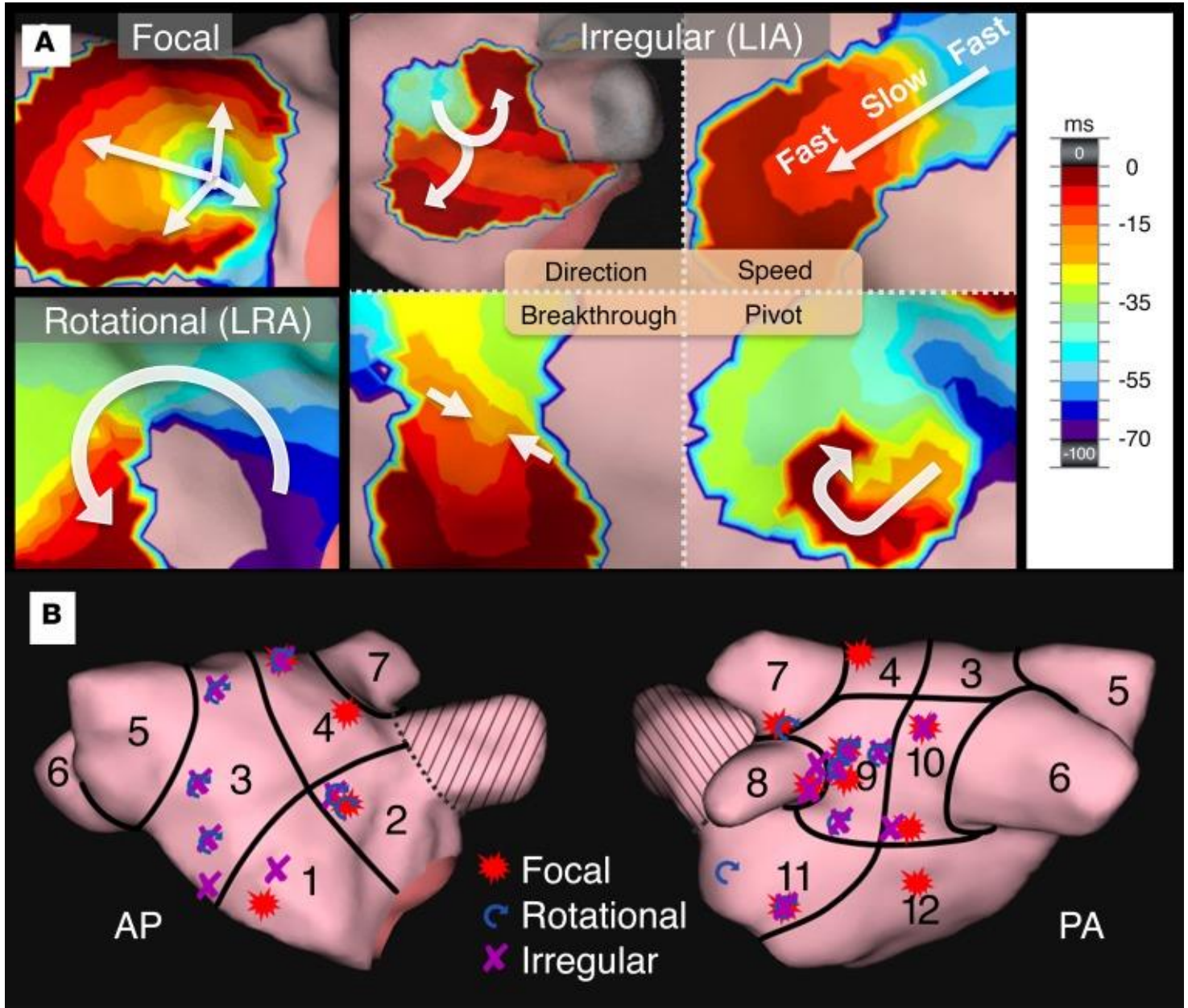
Visual Activation Patterns in AF

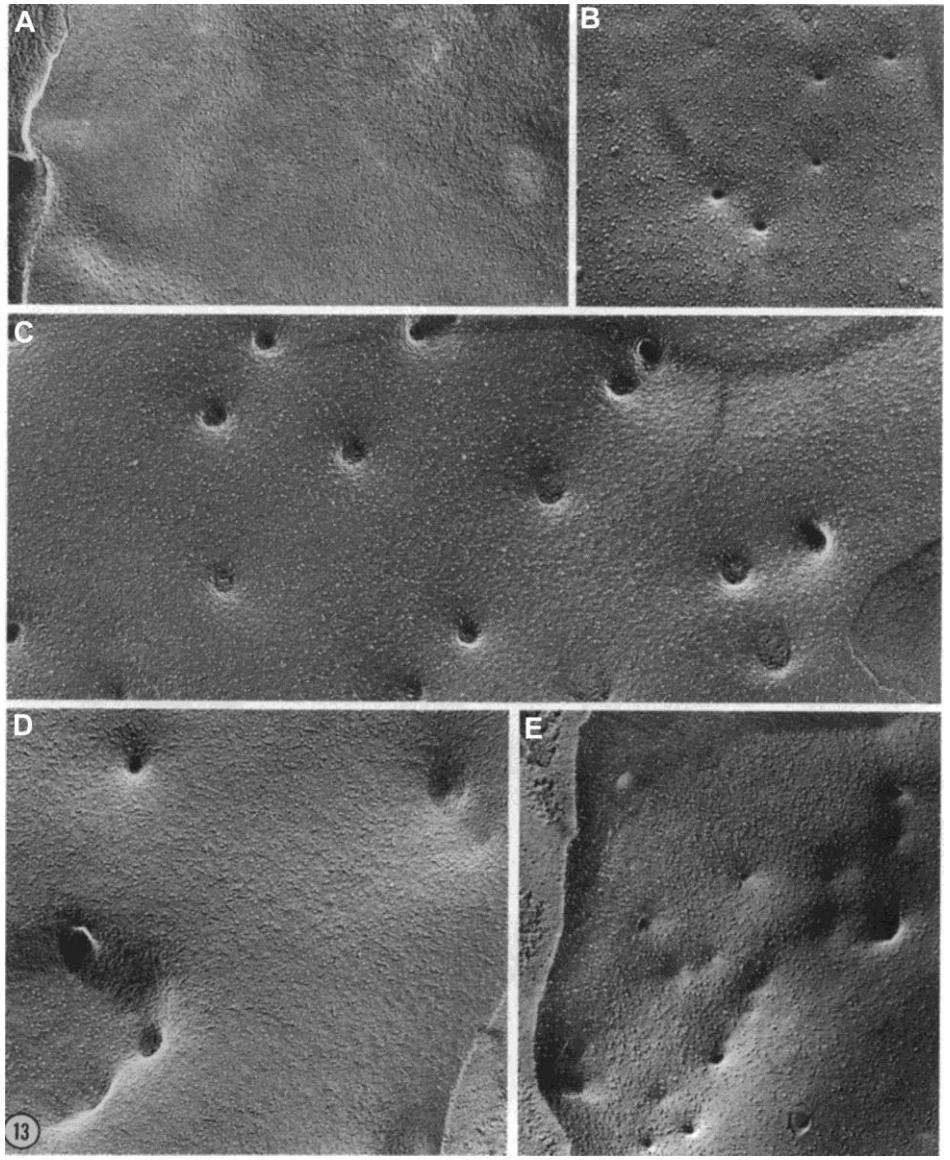


10.1172/jci.insight.126422

Atrial Fibrillation: Therapeutics

Cardiac Electroporation: An Old New Energy Source

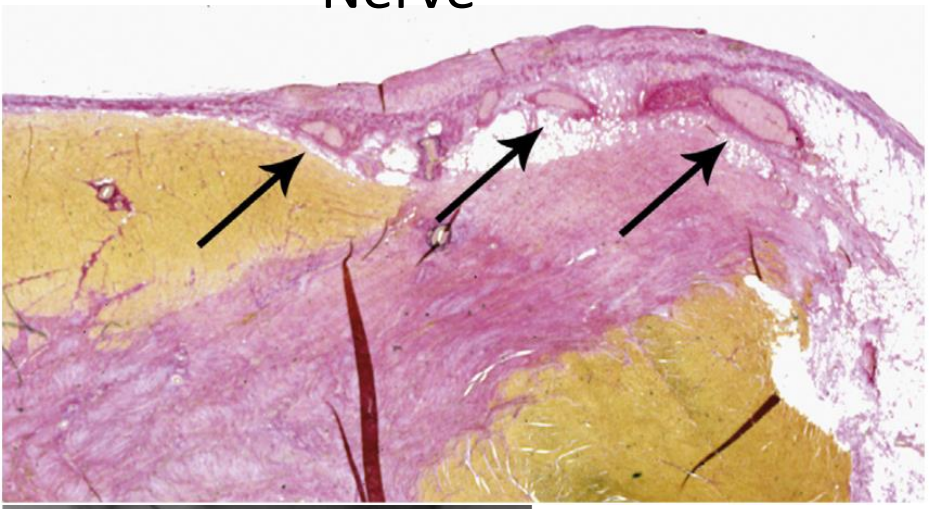
- Nonthermal energy source
- Applied current creates a local electrical field
- Circular or petal-like catheters
- Can use DC, AC, or pulsed DC
- Because of much different physics than RF, can create larger and deeper lesions
- Related to DC fulguration, the first energy source used for ablation

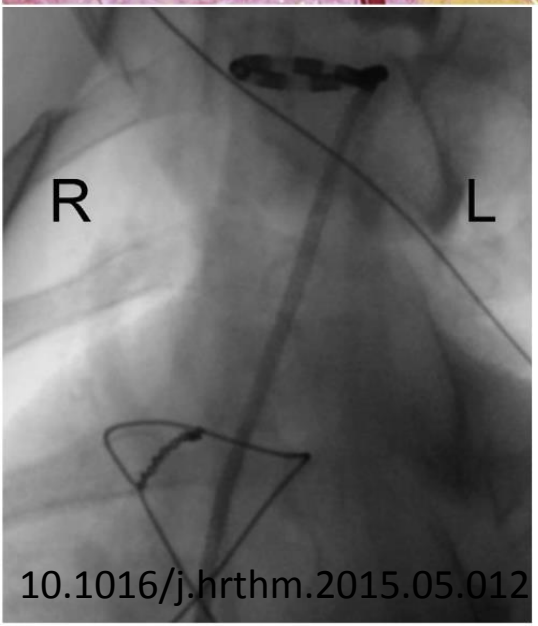


JACC Clin Electrophysiol. 2018 Aug;4(8):977-986

Electroporation is Relatively Cardioselective

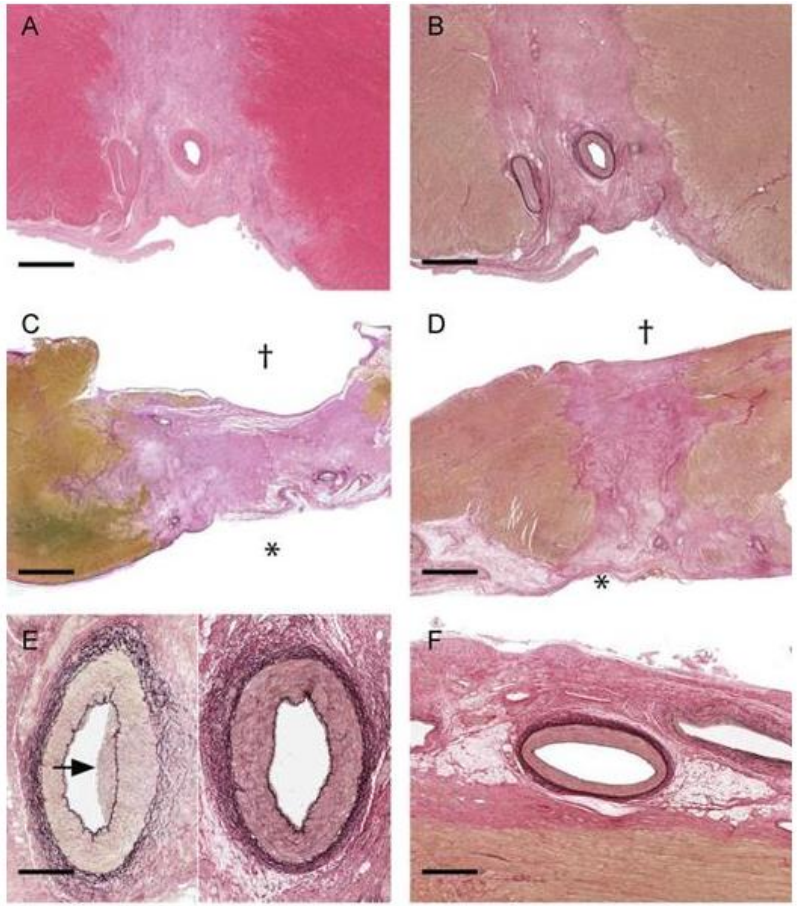
Nerve





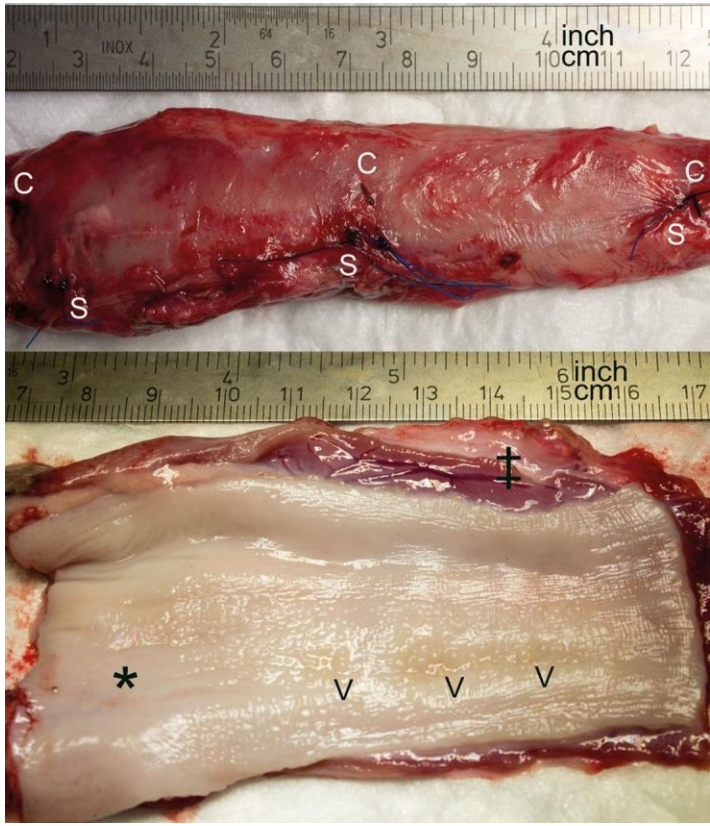
10.1016/j.hrthm.2015.05.012

Vessels



10.1093/europace/eus171

Esophagus



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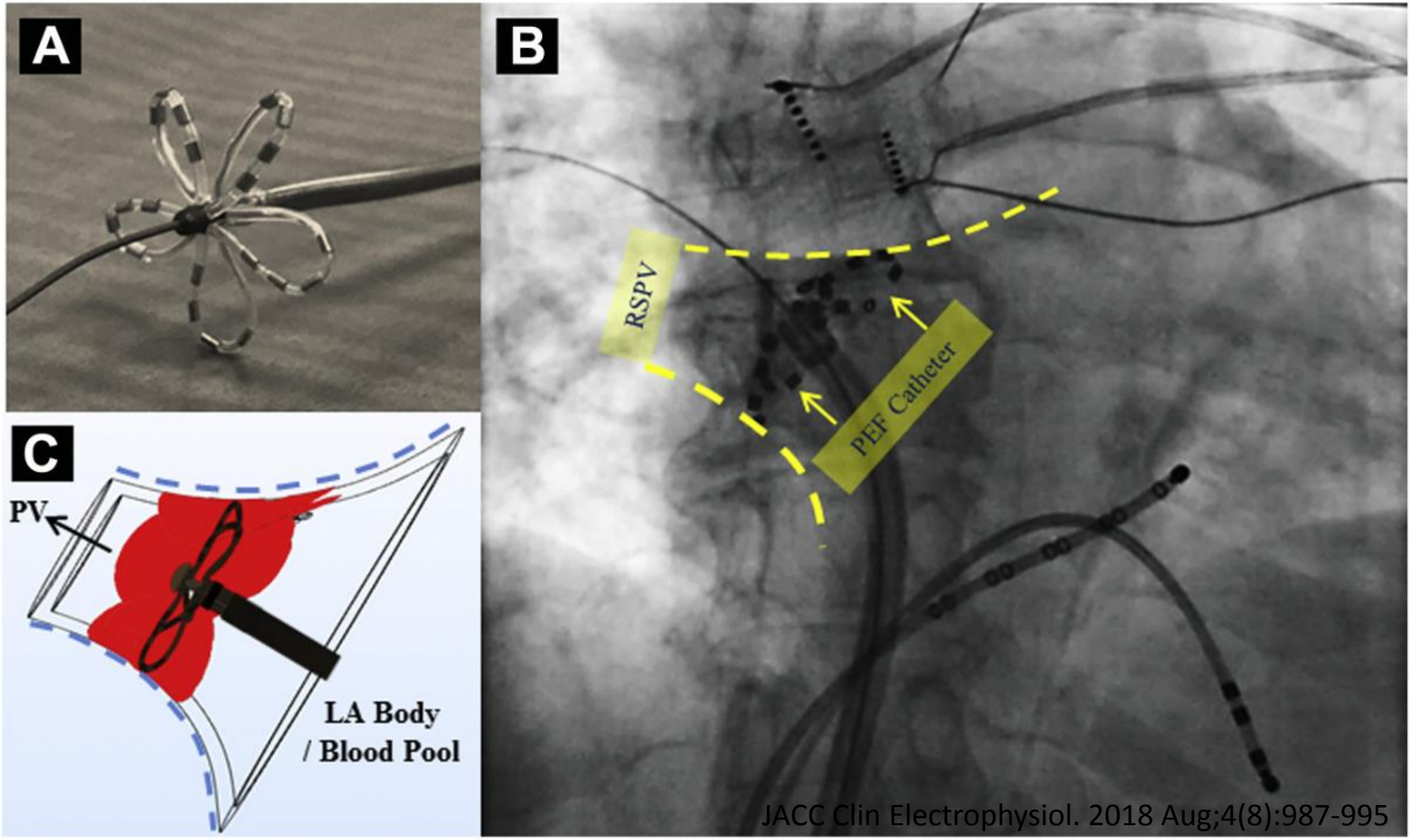
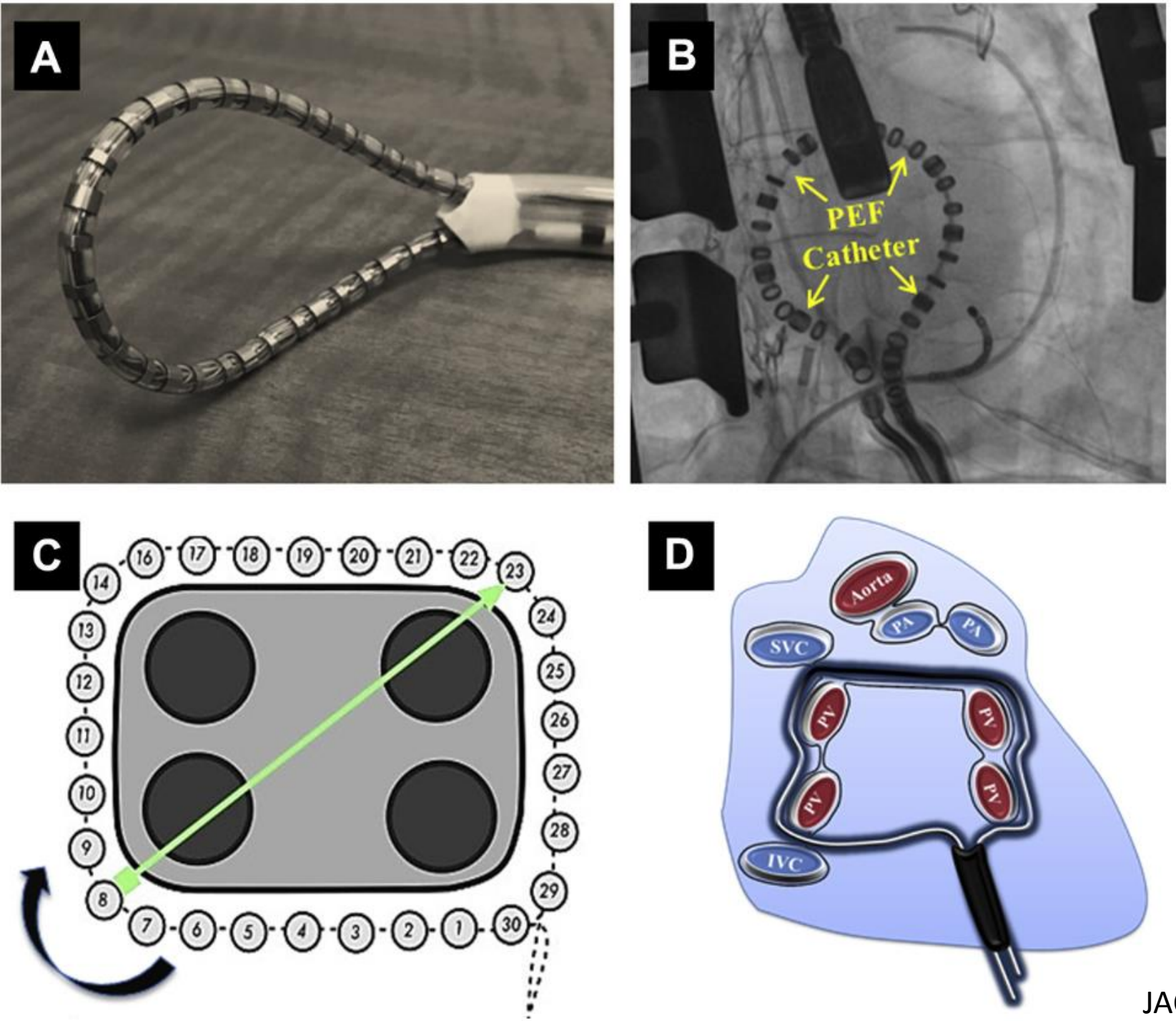
Cardiac Electroporation



JACC Clin Electrophysiol. 2018 Aug;4(8):987-995

Epicardial Electroporation

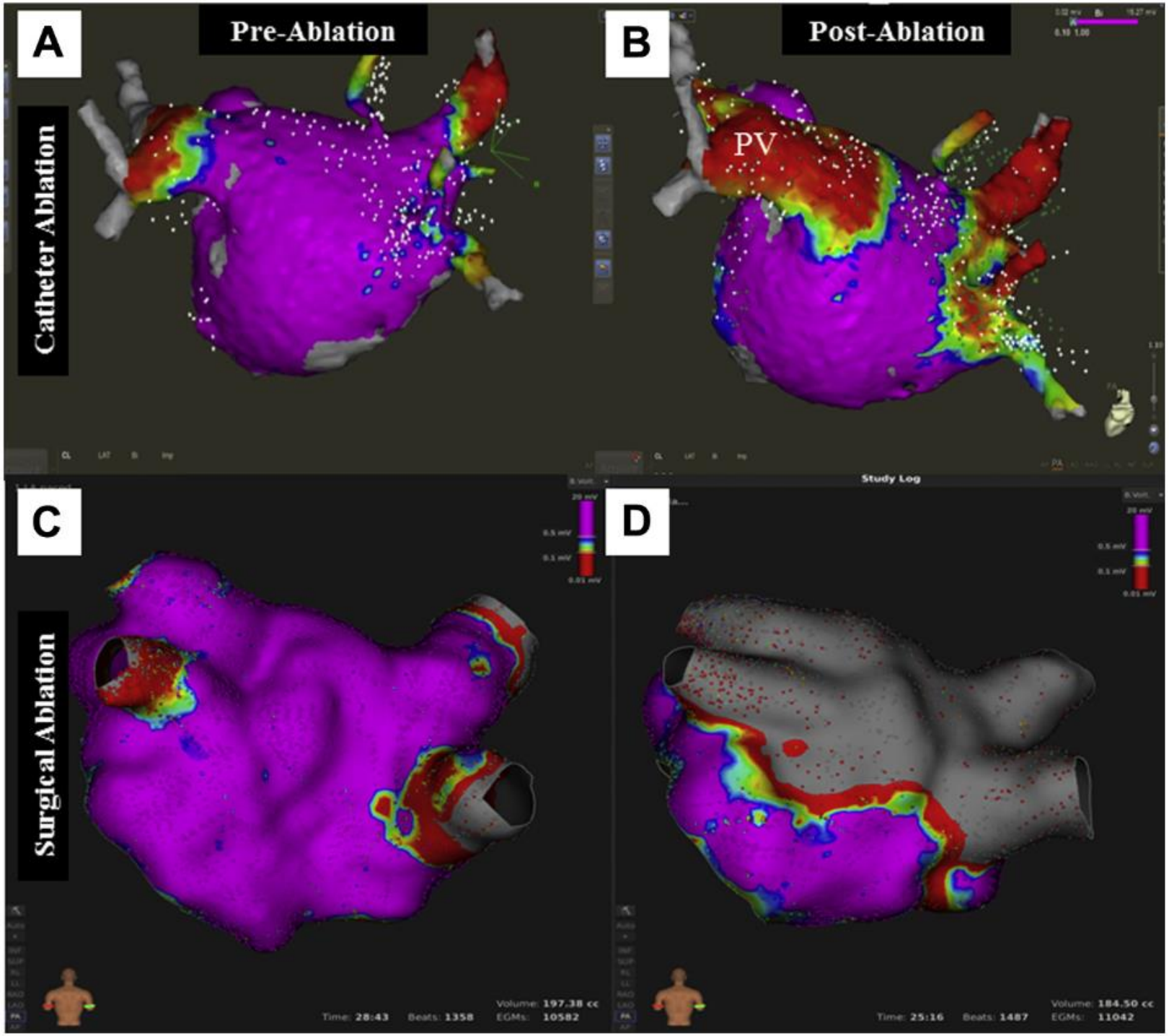


JACC Clin Electrophysiol. 2018 Aug;4(8):987-995

Electroporation Ablation Effects

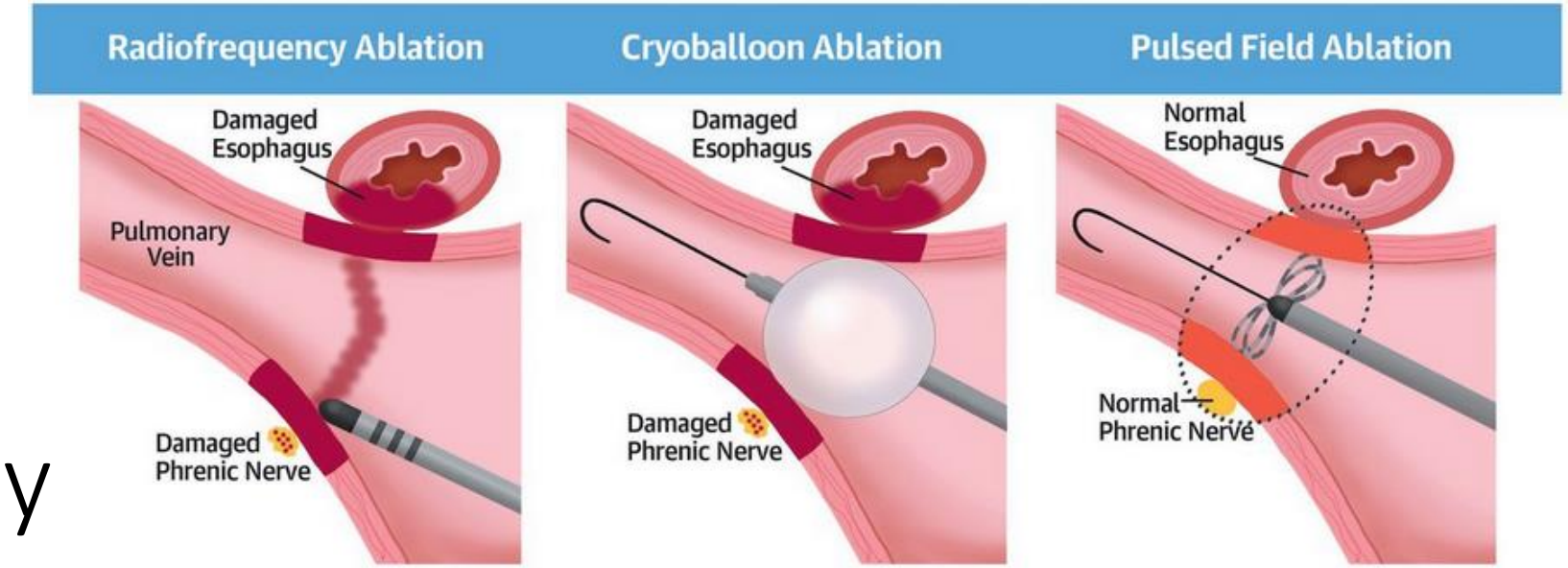
TABLE 2 Procedural Characteristics of Endocardial and Epicardial Cohorts

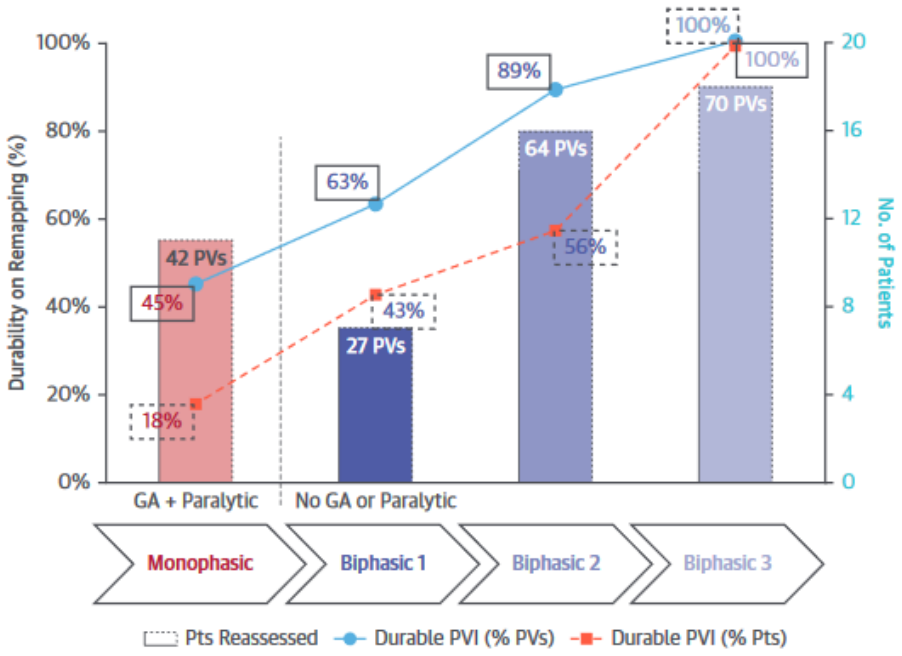
	Endocardial Cohort (n = 15)	Epicardial Cohort (n = 7)
Procedure time	67.0 ± 10.5	N/A
Mapping time	41.4 ± 9.3	N/A
Catheter time	26.0 ± 4.3	50.7 ± 19.5
Ablation time	19.0 ± 2.5	25.0 ± 17.5
Fluoroscopy time	12.3 ± 4.0	6.6 ± 3.8
Isolation success	15/15 (100)	6/7 (86)

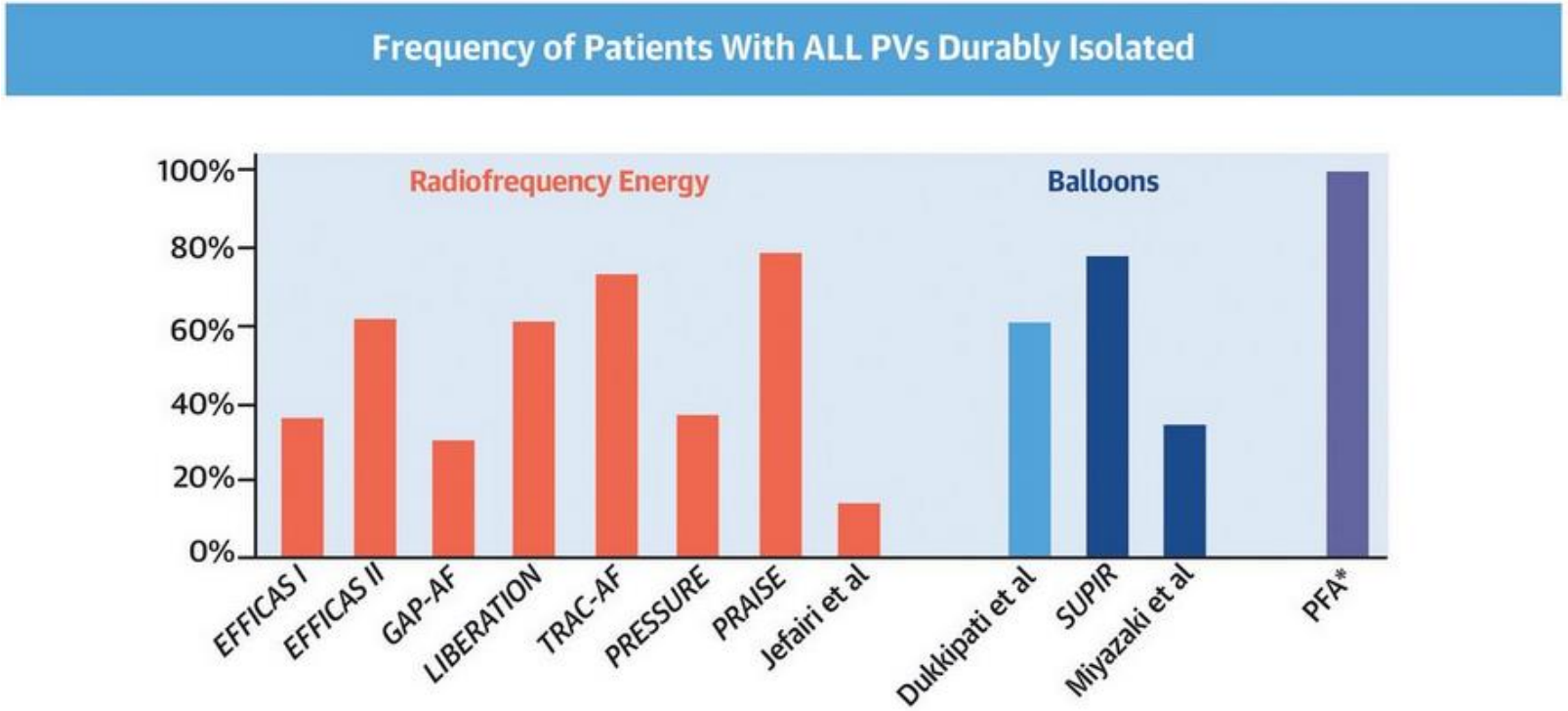


JACC Clin Electrophysiol. 2018 Aug;4(8):987-995

Wavefront Tuning Improves PV Isolation Durability

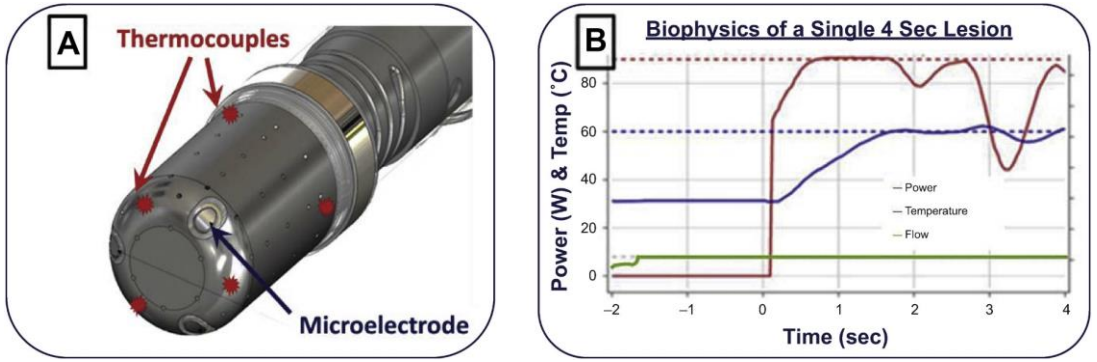






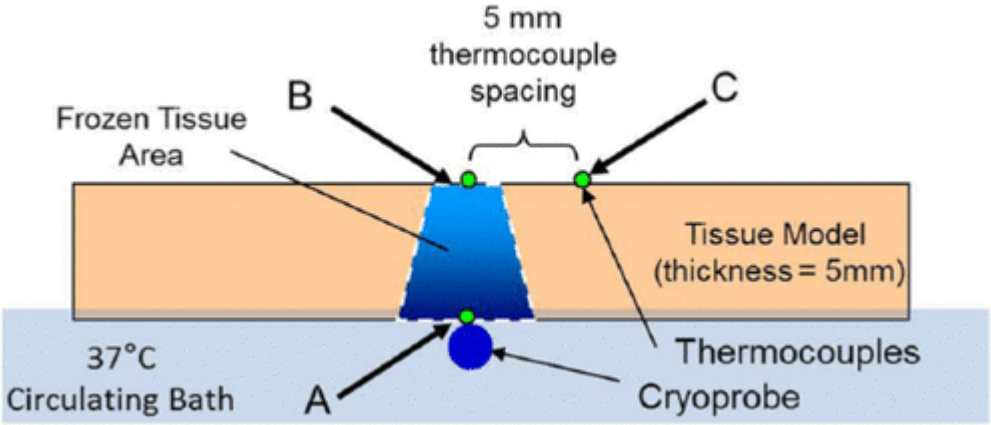
Reddy, V.Y. et al. J Am Coll Cardiol. 2019;74(3):315-26. 10.1016/j.jacc.2019.04.021

Very High Power, Short Duration



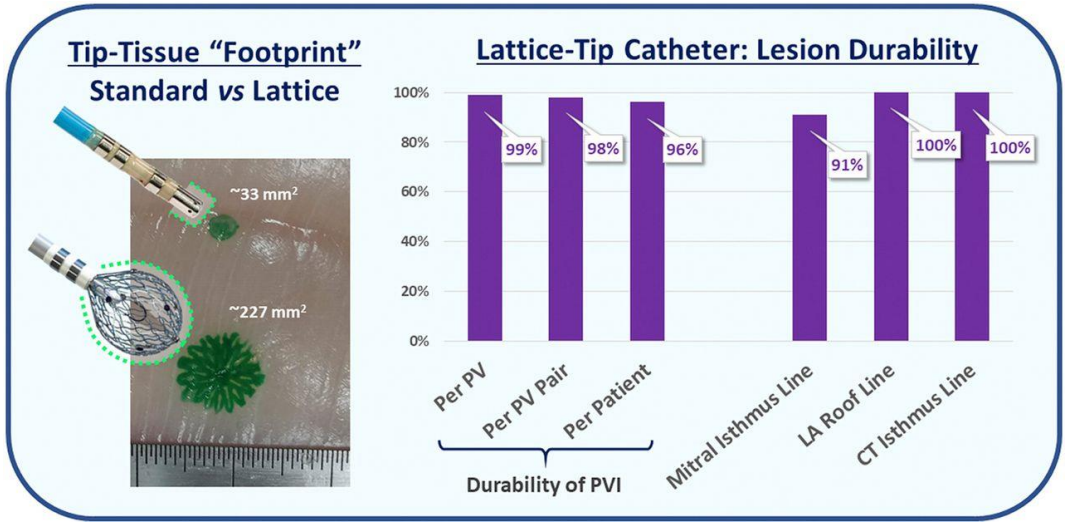
QDOT-FAST. 10.1016/j.jacep.2019.04.009

Near Critical Nitrogen

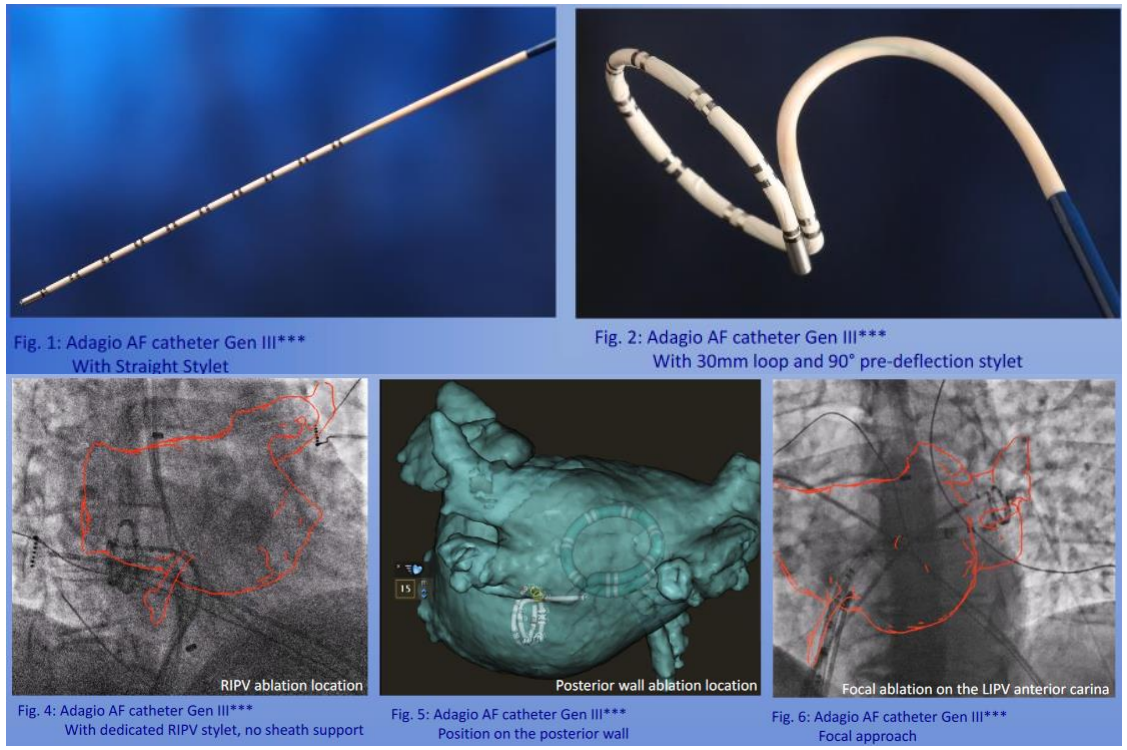


10.1177/2050312118769797

Lattice RF Catheter



10.1016/j.jacep.2020.01.002



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Summary and Take Home Points

- Trends in device therapy toward leadless pacing for traditional pacing targets, currently VVI, shortly will be able to do VDD and DDD
- New pacing targets in the conduction system and endocardial LV

- As PVI has become more reliable in AF ablation, new diagnostic tools are being developed to identify and target arrhythmogenic substrate
- New modalities (esp. electroporation) and advances in RF and cryo to increase safety and efficacy of AF ablation