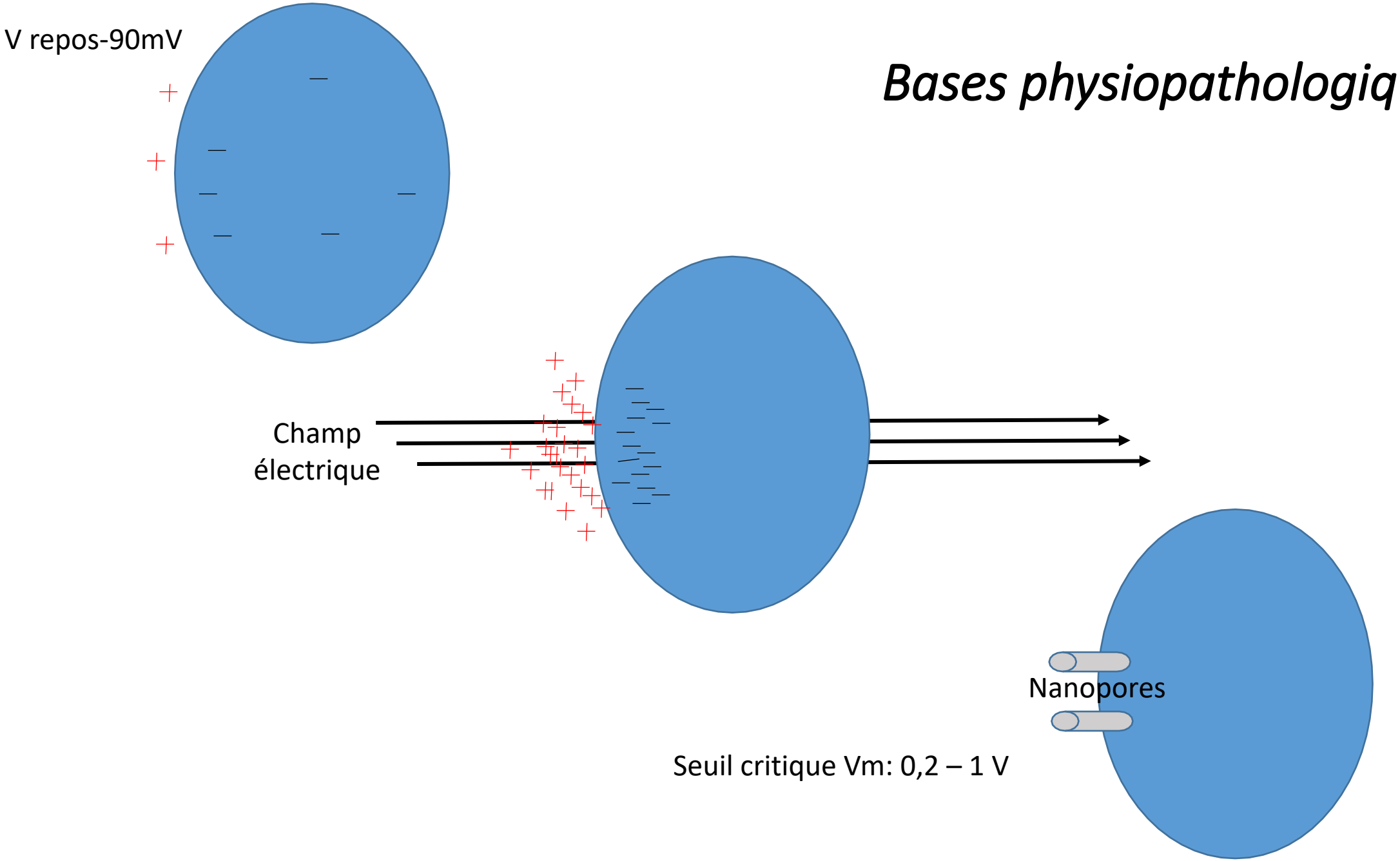
Electroporation: progrès ou révolution

B. MAILLE (CHU La Timone)

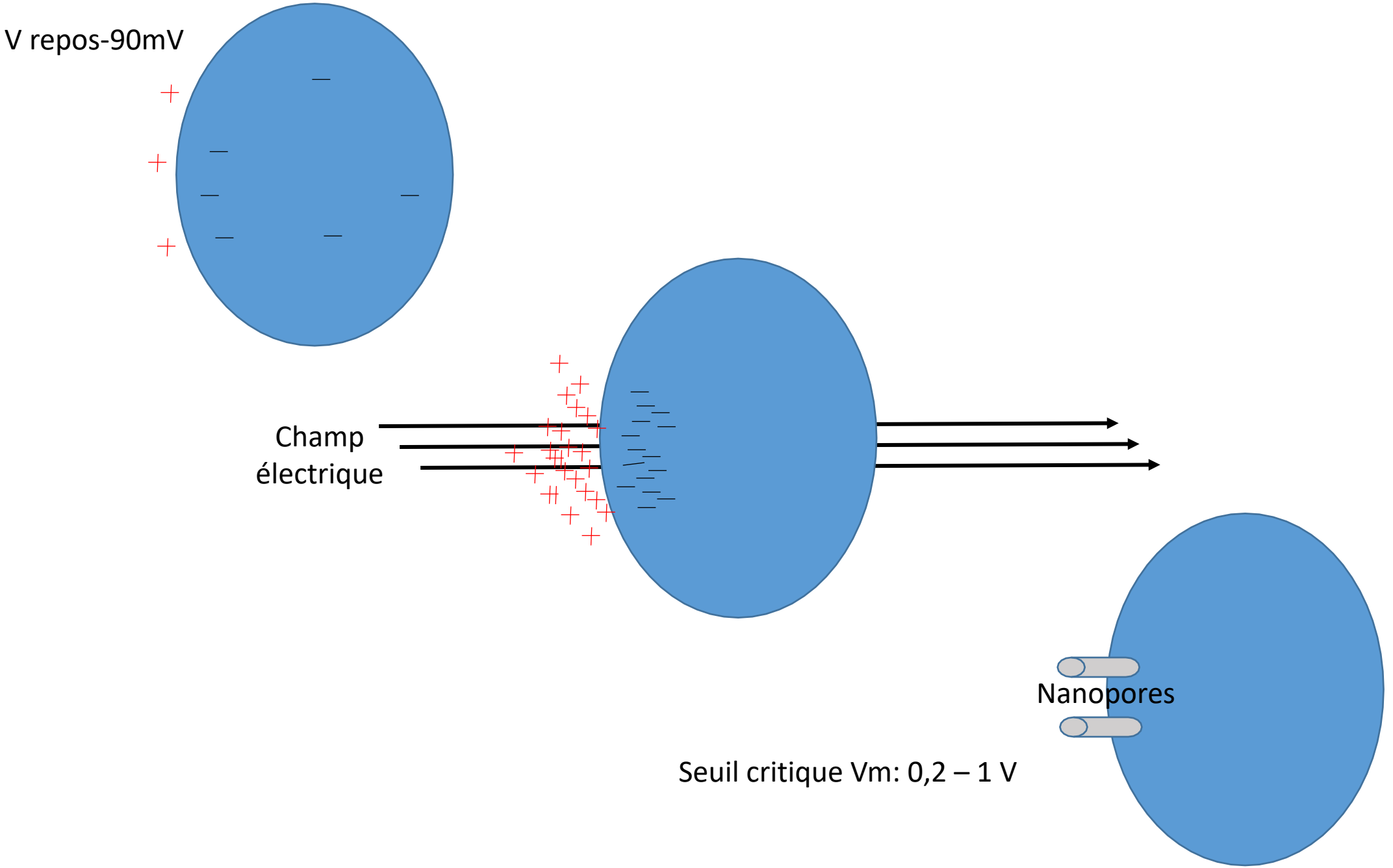
Conflits d’intérêt

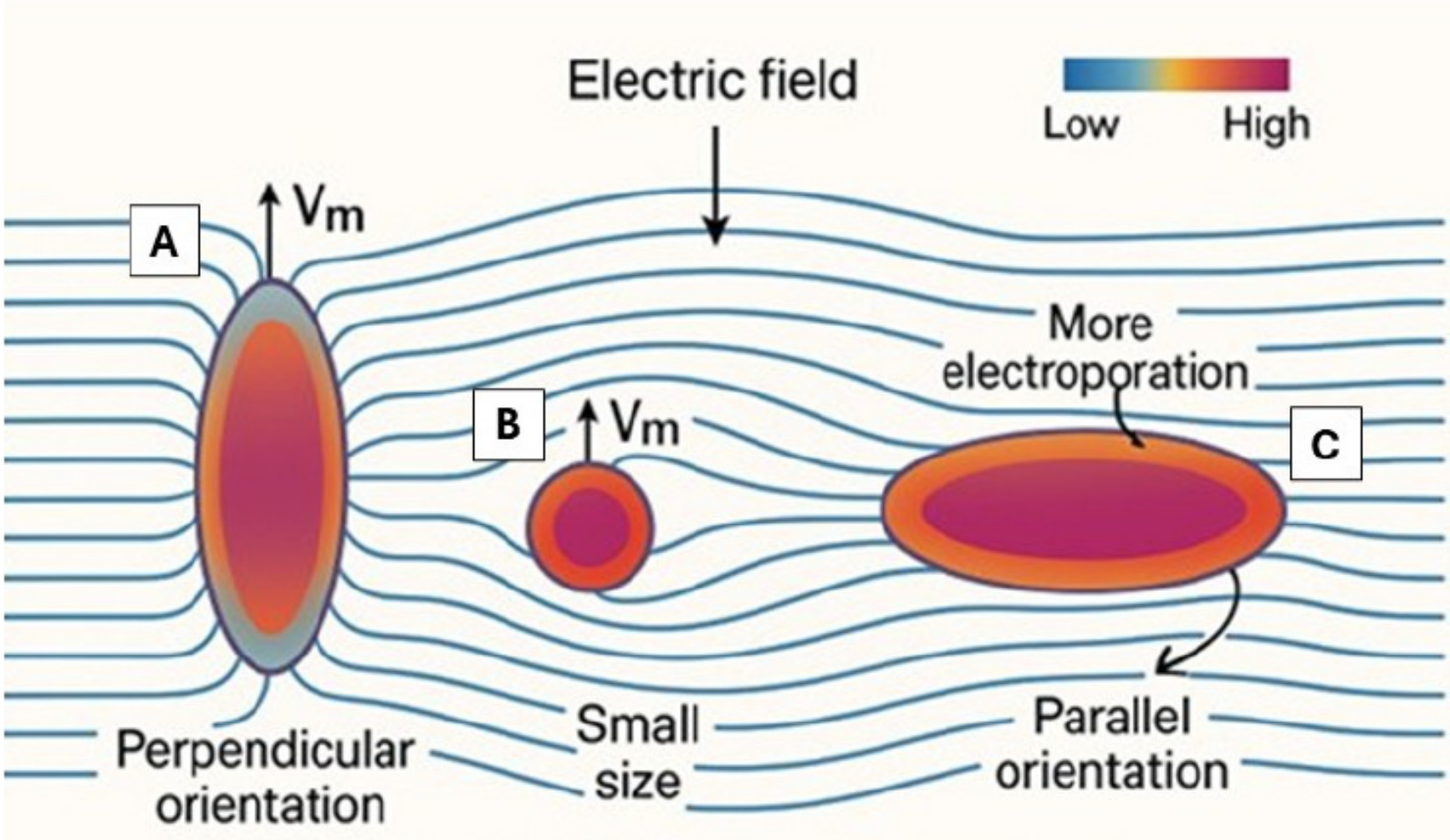
- AUCUN

Bases physiopathologiques



Seuil critique Vm: 0,2 – 1 V

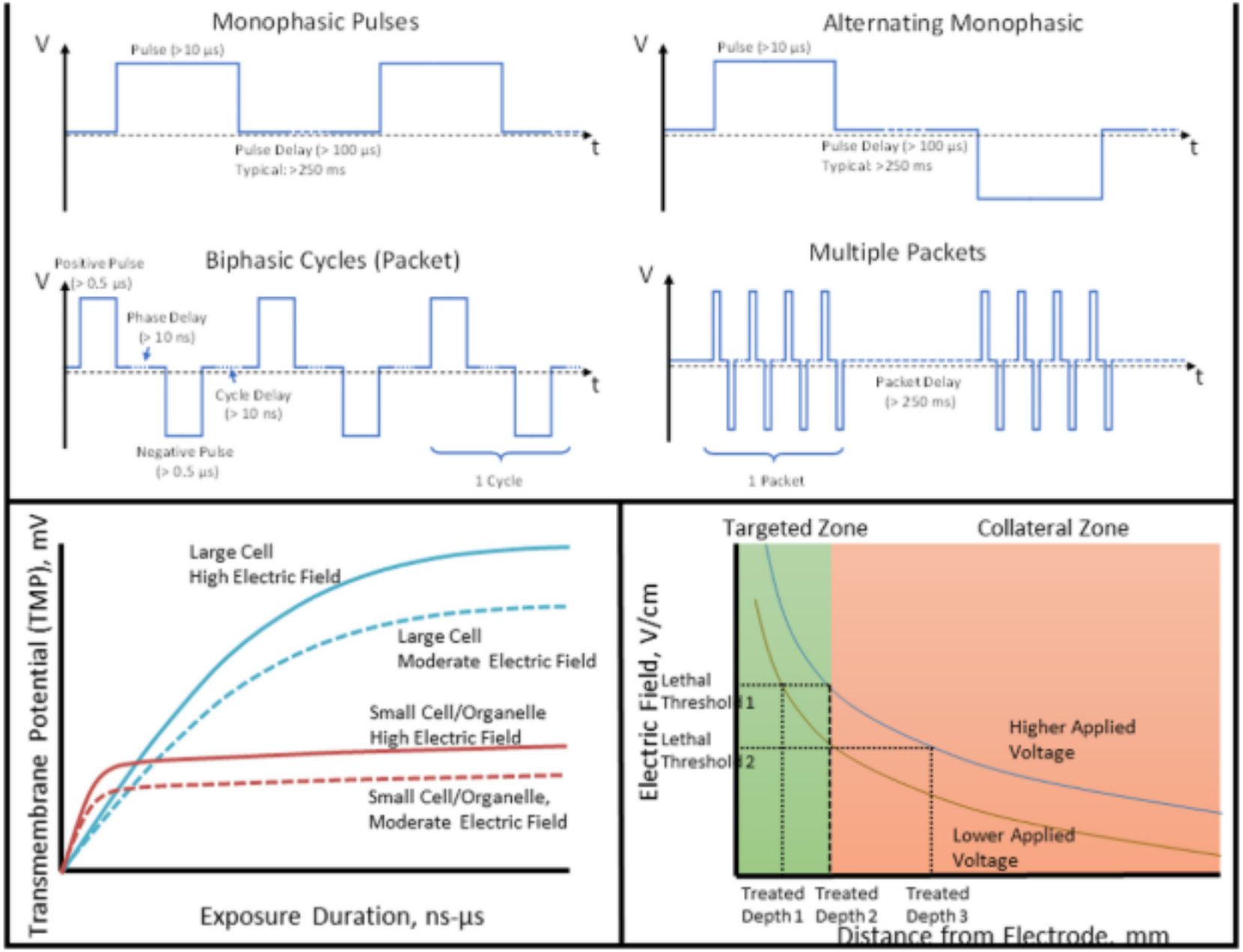

V repos-90mV
Champ
électrique
Nanopores
Seuil critique Vm: 0,2 – 1 V



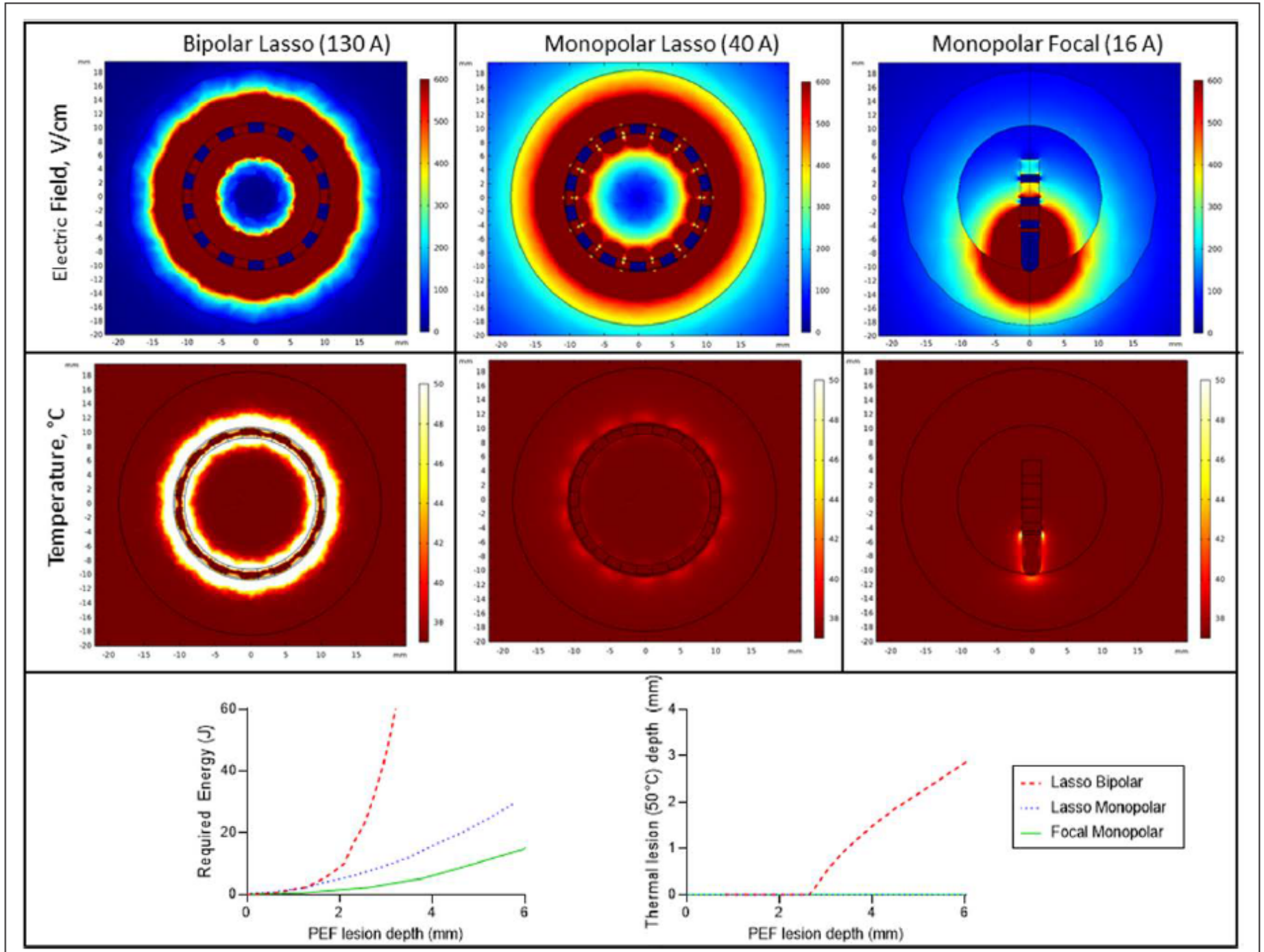
Pour une cellule sphérique dans un champ uniforme :

$$\Delta V_m = 1.5\, E\, r\, \cos\theta$$

1. Cano Ó, Dandamudi G, Schaller RD, Pérez-Roselló V, Ayala HD, Izquierdo M, Osca J, Sancho-Tello M-J, Rueda J, Ruiz E, Insa B, Martínez-Dolz L, Vijayaraman P. Safety and feasibility of conduction system pacing in patients with congenital heart disease. J Cardiovasc Electrophysiol 2021.



1. Verma A, Asivatham SJ, Deneke T, Castellvi Q, Neal RE. Primer on Pulsed Electrical Field Ablation. Circulation: Arrhythmia and Electrophysiology 2021;14:e010086.


Bipolar Lasso (130 A)
Monopolar Lasso (40 A)
Monopolar Focal (16 A)
Electric Field, V/cm
Temperature, °C
Required Energy (J)
PEF lesion depth (mm)
Thermal lesion (50°C) depth (mm)
PEF lesion depth (mm)
Lasso Bipolar
Lasso Monopolar
Focal Monopolar

Parameter	Parameter Change	Lesion Size	Muscle Contraction	Temperature Rise	Treatment Delivery Time	Gaseous Emboli Risk	Electrical Arcing Risk	Electrode Breakdown Risk	Barotrauma Risk
Voltage	↑	↑	↑	↑	=	↑	↑	↑	↑
Waveform	Monophasic	↑	↑	=	=	↑	↑	↑	↑
Fundamental Frequency	↑	↓	↓	=	=	↓	=	=	↓
Packet Duration	↑	↑	↑	↑	=	↑	↑	↑	↑
Number of Packets	↑	↑	=	↑	↑	=	=	=	=
Packet Delivery Rate	↑	=	=	↑	↓	=	=	=	=

ORIGINAL ARTICLE

Effect of Pulsed-Field and Radiofrequency Ablation on Heterogeneous Ventricular Scar in a Swine Model of Healed Myocardial Infarction

Arwa Younis, MD; Israel Zilberman, DVM; Alison Krywanczyk, MD; Koji Higuchi, MD; Hagai D. Yavin, MD; Jakub Sroubek, MD, PhD; Elad Anter, MD

- 22 swin
- Ablation of infarct border zone

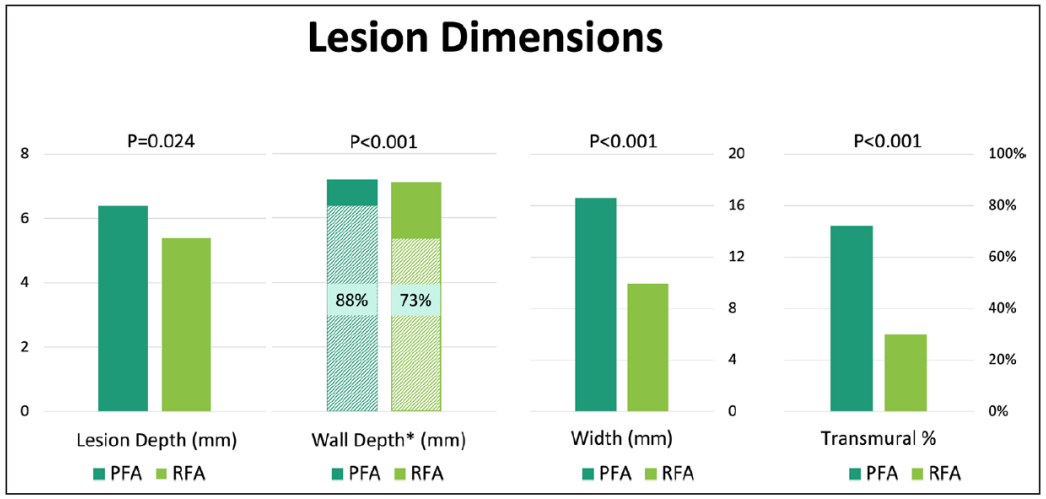


Figure 3. Comparison of lesion dimensions at infarct border zone.
Bar graphs comparing absolute lesion depth, lesion depth/total wall depth, lesion width, and transmurality between radiofrequency ablation (RFA) and pulsed-field ablation (PFA). *Lesion depth/total wall depth is shown with a diagonal pattern fill and reported in percentage.

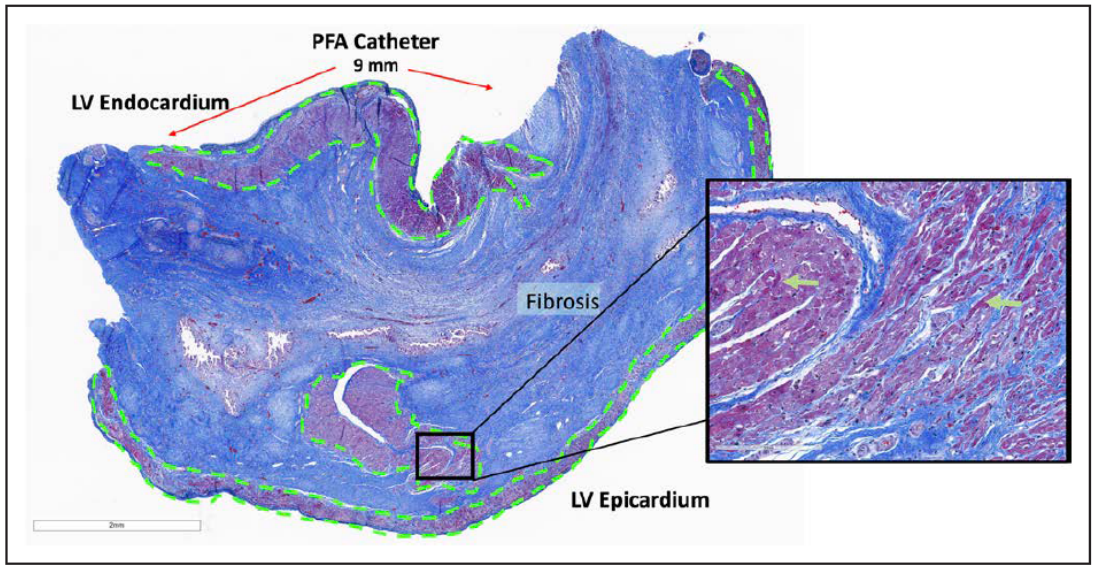


Figure 6. Histological effect of pulsed-field ablation (PFA) on subepicardial islands of surviving cardiomyocytes.

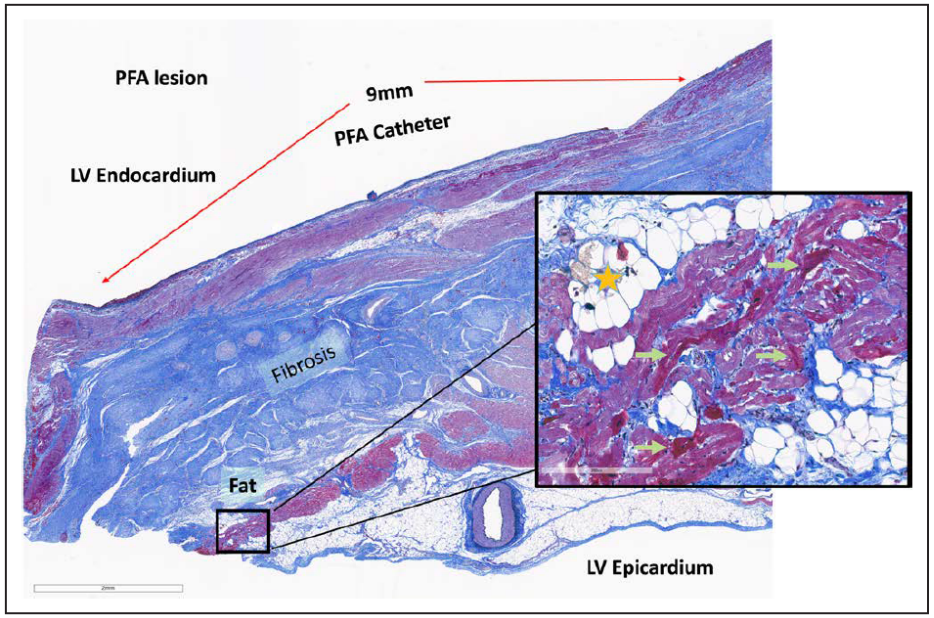
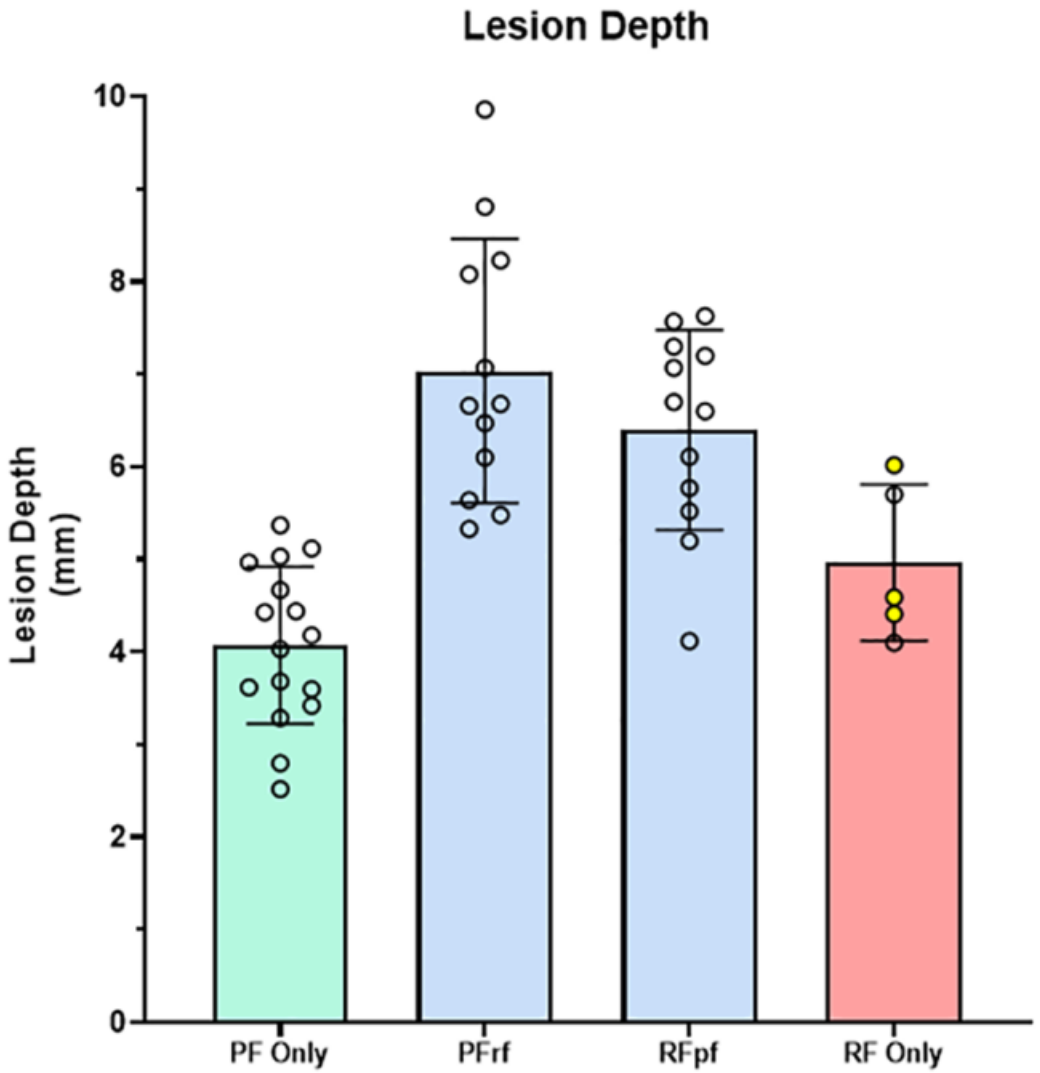
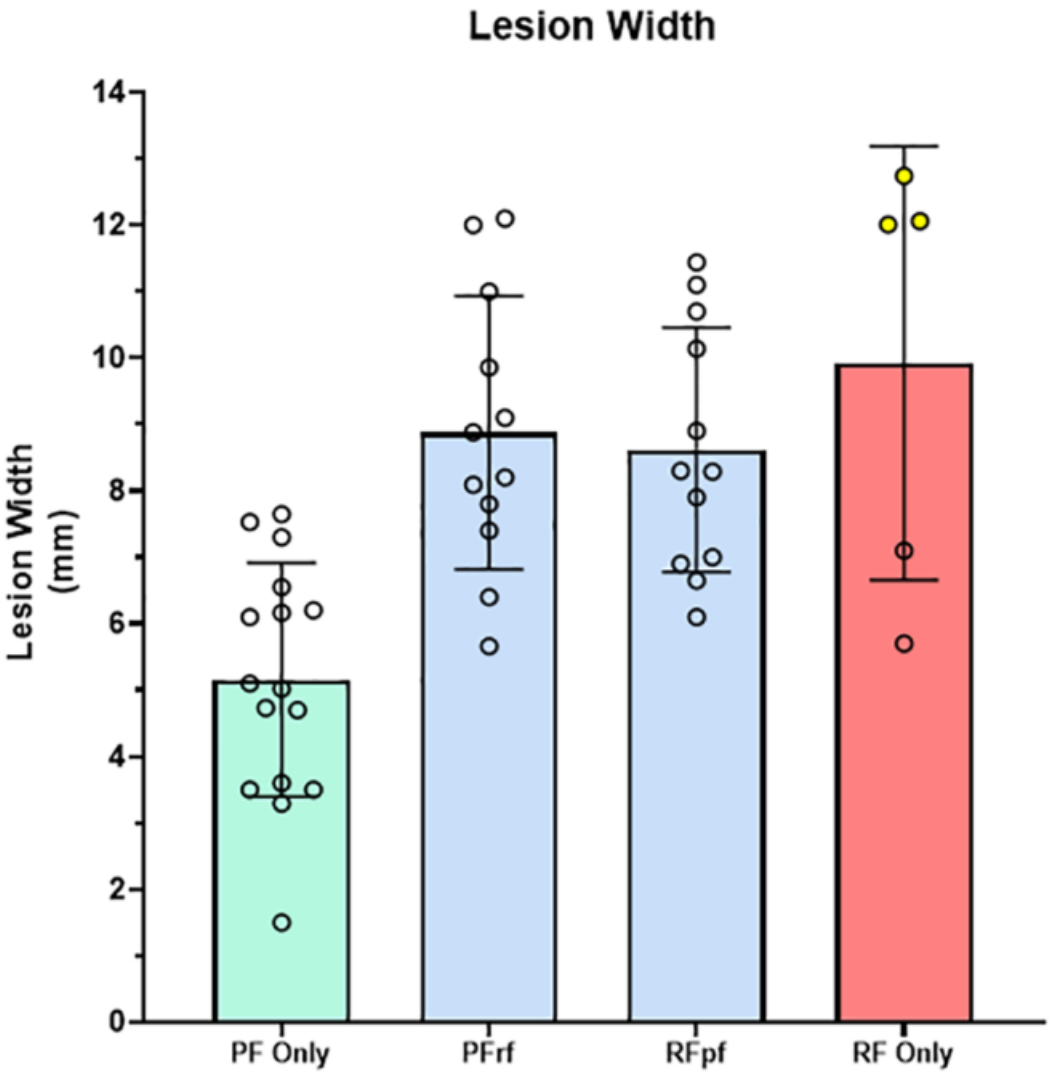


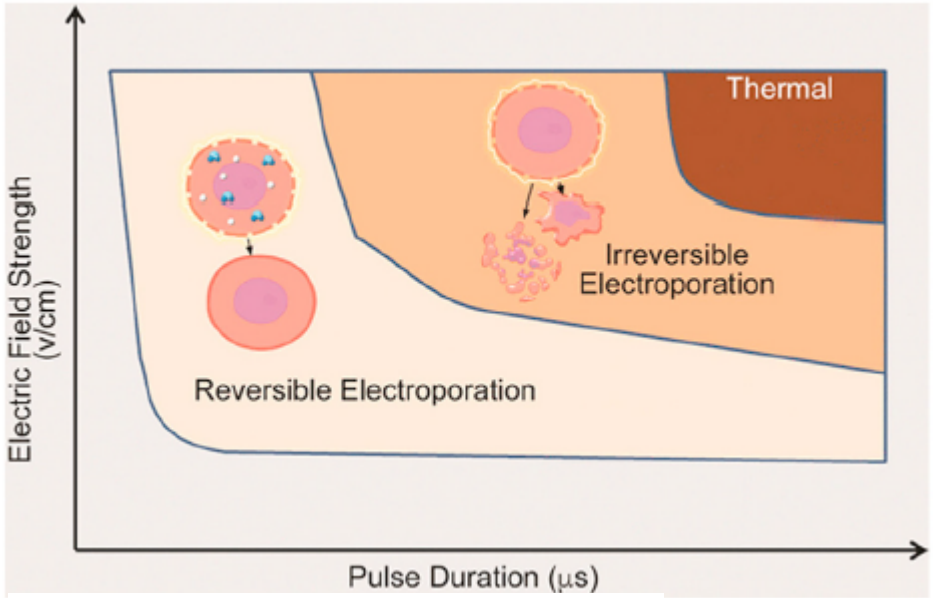
Figure 7. Effect of pulsed-field ablation (PFA) on cardiomyocytes separated from the catheter by fat. Mason Trichrome staining of an infarct border zone.





Verma A, Maffre J, Sharma T, Farshchi-Heydari S. **Effect of Sequential, Colocalized Radiofrequency and Pulsed Field Ablation on Cardiac Lesion Size and Histology**. Circulation: Arrhythmia and Electrophysiology 2025;18:e013143.

Heat=I2×R×t



Considerations regarding safety with pulsed field ablation for atrial fibrillation

Alan Sugrue, MBBCh, MSc,[1] Samuel Shabtaie, MD,[1] Nicholas Y. Tan, MD, MS,[1] Elad Maor, MD,[2] Suraj Kapa, MD,[1] Samuel J. Asirvatham, MD[1]

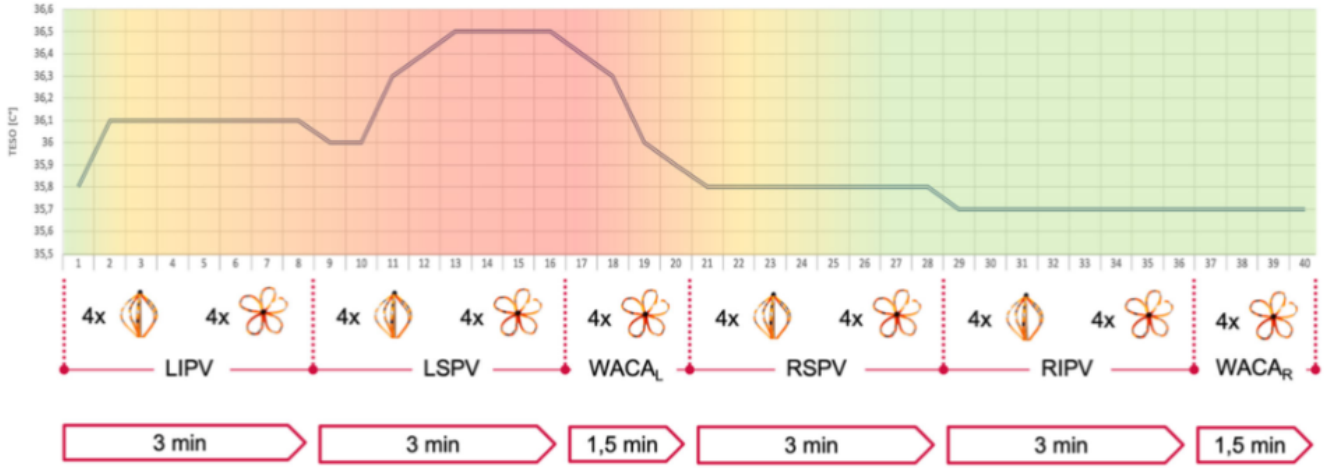


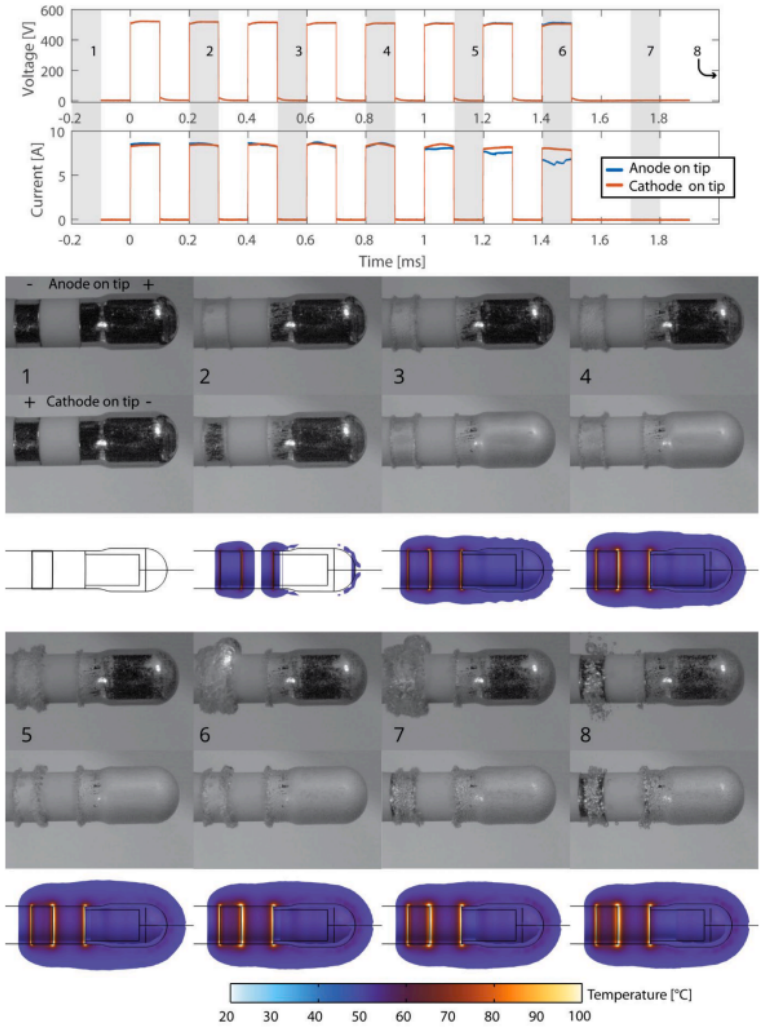
FIGURE 2 Diagram showing the time course and change of the intraluminal esophageal temperature (TESO) by 0.7°C during pulsed field pulmonary veins isolation with wide antral circumferential ablation (WACA) in a patient with an esophagus coursing behind the left pulmonary veins. LIPV, left inferior pulmonary vein; LSPV, left superior pulmonary vein; RIPV, right inferior pulmonary vein. RSPV, right superior pulmonary vein.

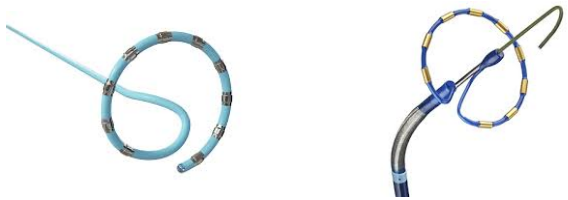
TABLE 3 Intraluminal esophageal temperature changes during pulsed field ablation ($N = 43$).

Location	TESO base [°C]	TESO end [°C]	ΔTESO [°C]	*p* Value
Left PVs	36.1 ± 0.5	36.4 ± 0.6	0.3 ± 0.4	<.001[a]
Right PVs	36.3 ± 0.6	36.4 ± 0.6	0.3 ± 0.4	<.228
WACA	36.4 ± 0.8	36.7 ± 0.8	0.4 ± 0.3	<.001[a]
Total PFA	36.1 ± 0.5	36.9 ± 0.9	0.8 ± 0.6	<.001[a]

DOI: 10.1111/jce.16096

Bubbles – silent strokes

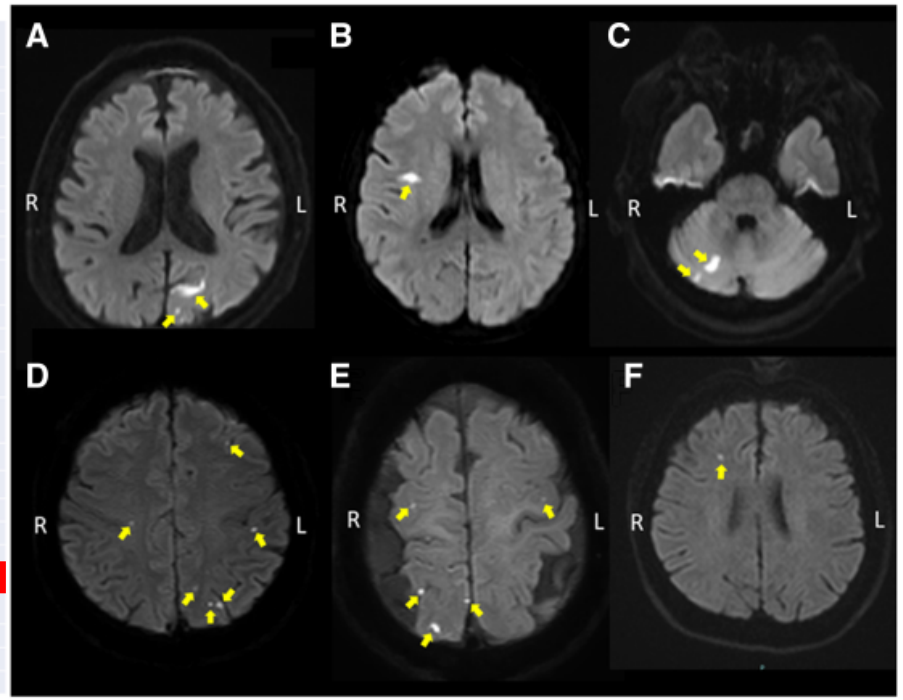




Different Incidence and Size of Silent Strokes After Pulsed Field Ablation With Circular Shaped Ablation Catheters

Shinsuke Miyazaki, MD; Iwanari Kawamura, MD; Yoshihiro Iwasa, MD; Miho Negishi, MD; Ryo Tateishi, MD; Masaki Honda, MD; Kentaro Goto, MD; Takuro Nishimura, MD; Kazuya Yamao, MD; Susumu Tao, MD; Masateru Takigawa, MD; Tetsuo Sasano, MD

	All n=16	VLCC n=7	CMAC n=9	P value
Patient characteristics				
Age, years	62 [54-75]	64 [61-75]	56 [37-71]	0.10
Male gender, n (%)	10 (62.5%)	3 (42.9%)	7 (77.8%)	0.30
Body mass index, kg/m^2	23.8±3.0	23.6±4.3	24.0±1.7	0.84
Paroxysmal AF, n (%)	15 (93.8%)	7 (100%)	8 (88.9%)	1.00
$CHADS_2$ score	1 [0-1]	1 [1-2]	1 [0-1]	0.20
CHA_2DS_2-VASc score	2 [0.3-2.8]	2 [1-3]	1 [0-2.5]	0.15
Left atrial diameter, mm	36.8±3.8	37.4±4.7	36.3±3.2	0.58
Left ventricular ejection fraction, %	63.5±5.1	62.7±4.8	64.1±5.5	0.60
Procedural characteristics				
LA dwell time, min	67.4±10.2	69.1±7.7	66.0±12.2	0.56
Time between first and last application, min	50.1±8.1	54.1±7.7	46.9±7.2	0.07
Time between first and last application for PVI, min	26.5±5.7	26.8±5.4	26.3±6.3	0.86
Number of PFA applications		32.4±2.5	55.6±4.2	<0.001
Number of PFA pulses		97.3±7.5	222.2±17.0	<0.001
Catheter exchange, n	1 (6.3%)	0 (0%)	1 (11.1%)	1.00
Electrical cardioversion, n	3 (18.8%)	0 (0%)	3 (33.3%)	0.21
MRI findings				
SCE/SCL, n	8 (50.0%)	6 (85.7%)	2 (22.2%)	0.04
Number of SCE/SCLs	7.5[2.3-14.8]	13.0[3.0-18.8]	2.0[2.0-2.0]	0.19
SCL, n	7 (43.8%)	6 (85.7%)	1 (11.1%)	<0.01
Lesion size >3 mm, n	7 (43.8%)	6 (85.7%)	1 (11.1%)	<0.01
Lesion size ≥10 mm, n	3 (18.8%)	3 (42.9%)	0 (0%)	0.06



Continuous data are expressed as the mean ± standard deviation for normally distributed variables or as the median [25th, 75th percentiles] for non-normally distributed variables, and were compared using student's t-test or Mann-Whitney U-test. Categorical variables were compared using Chi-square or Fisher's exact tests when the number of events was less than 5.

1. Mahnič-Kalamiza S, Miklavčič D, Lombergar P, Mikuž B, Mattison LM, Sigg DC, Kos B. Elucidating the mechanisms of microbubble formation in intracardiac pulsed field ablation. Electrochimica Acta 2024;497:144550.

nature medicine

Article https://doi.org/10.1038/s41591-024-03114-3

Safety of pulsed field ablation in more than 17,000 patients with atrial fibrillation in the MANIFEST-17K study

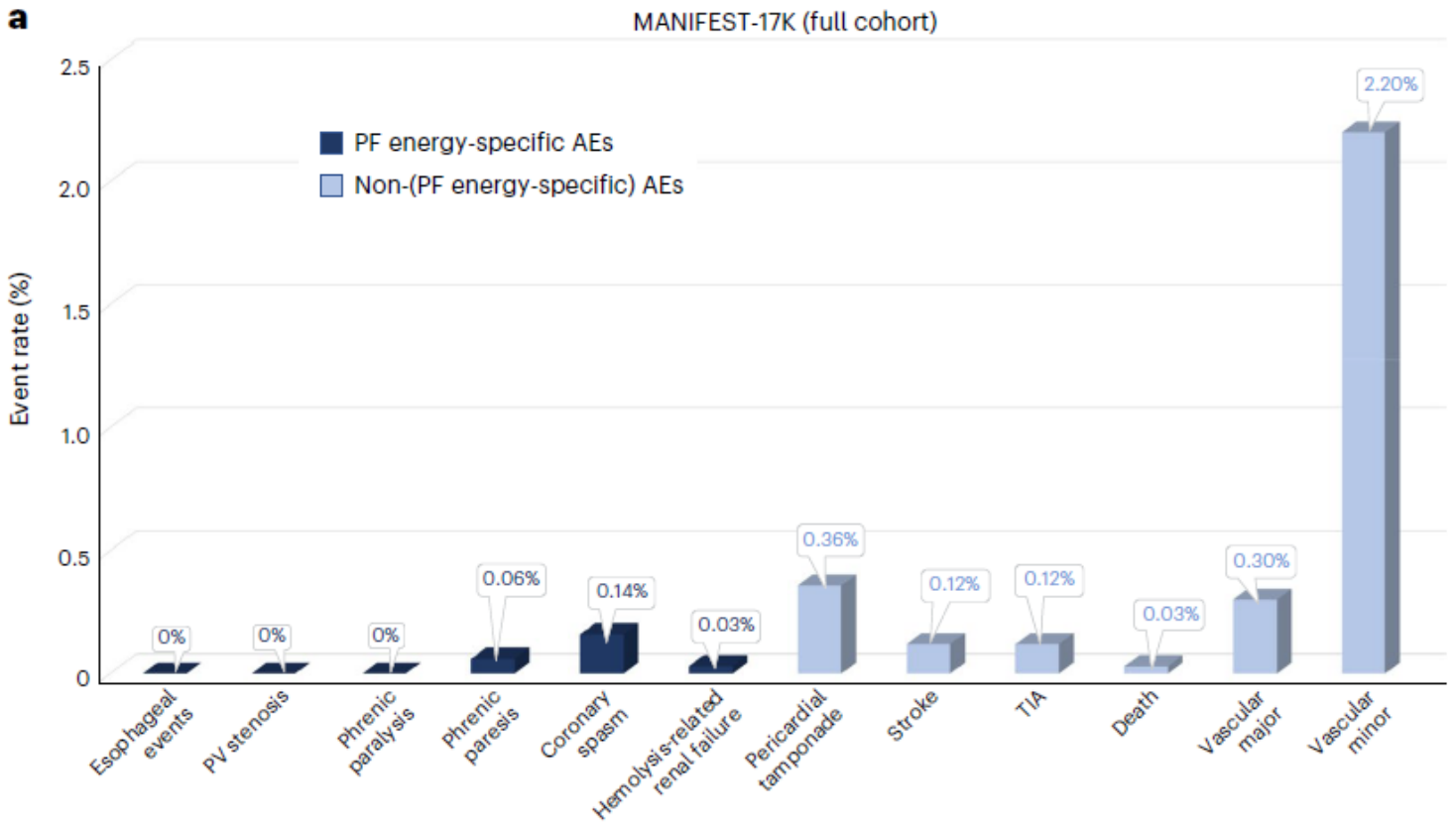
- 17 642 patients, multicenter, multinational
- Restrospective post approval registry
- 35,2% persistent 5,6% long standing

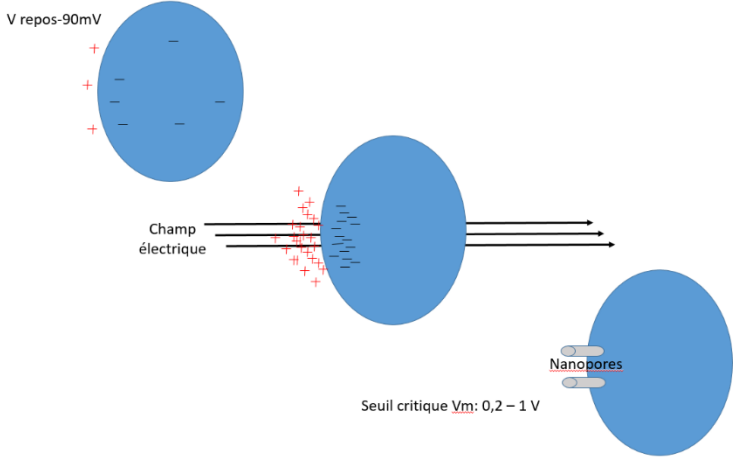
	Full patient cohort from all 106 MANIFEST-17K sites[a] (*N*=17,642)
Major AEs	173 (0.98%)

Table 3 | Coronary artery spasm

	Coronary spasm (*N*=25)
Type of spasm:	
Proximity-related spasm[a]	22 (88%)
Generalized spasm[b]	3 (12%)
EKG changes	23 (92%)
Hypotension	5 (20%)
Clinical sequelae	4 (16%)
Chest pain	2 (8%)
Ventricular fibrillation	2 (8%)
Intravenous nitroglycerin administered	21 (84%)

[a]Spasm occurring during PFA adjacent to a coronary artery, either during mitral isthmus or CTI ablation. [b]Spasm occurring during conventional PV application remote from the location of a coronary artery.



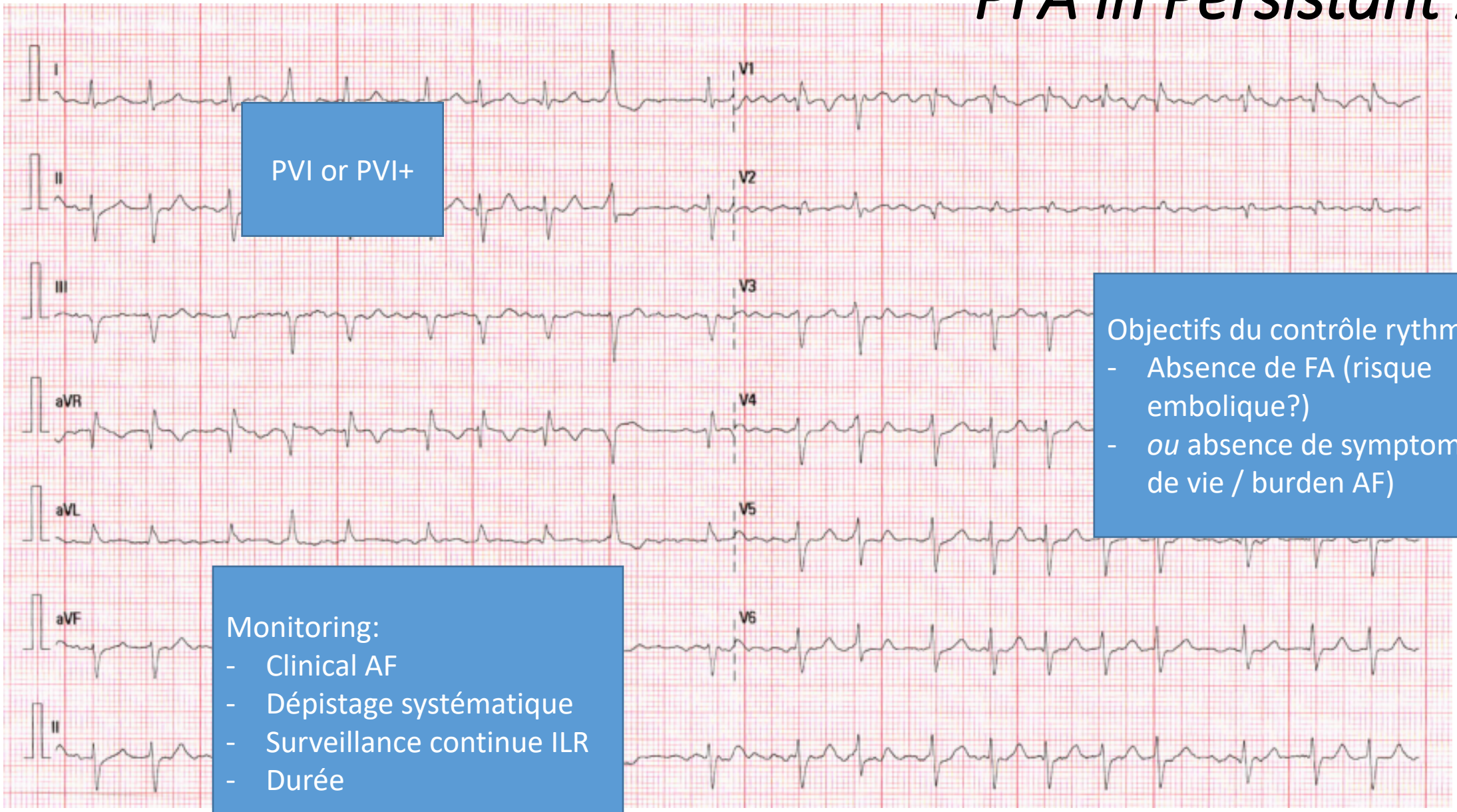


Bases physiopathologiques

- Nouvelle énergie en ablation cardiaque

- Plusieurs électroporations:
  - Paramètres adaptés au cathéter
  - Paramètres adaptés au tissus cible
  - Complications spécifiques
  - Efficacité spécifique

PFA in Persistant AF ?



PVI or PVI+

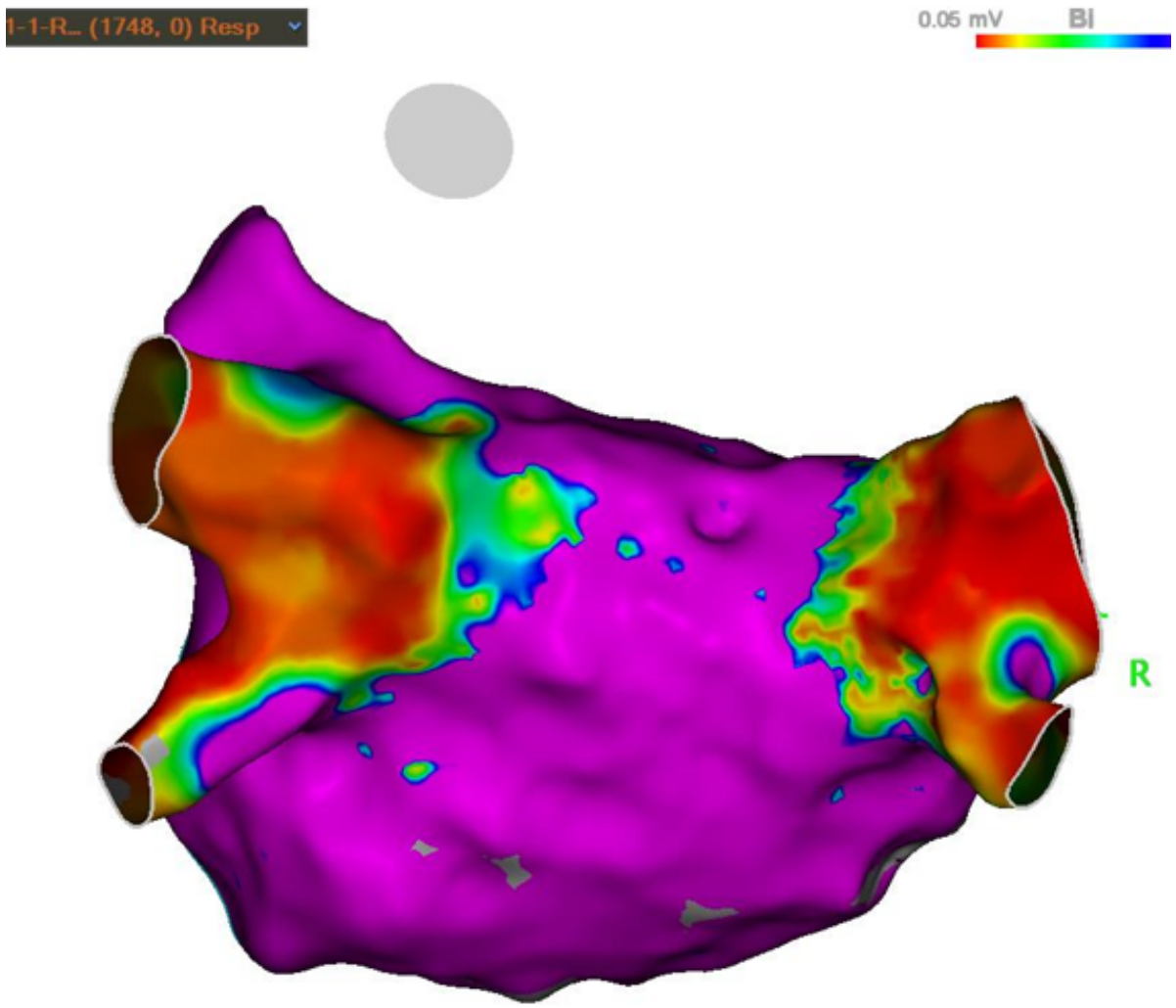
Objectifs du contrôle rythme:

- Absence de FA (risque embolique?)
- *ou* absence de symptome (qualité de vie / burden AF)

Monitoring:

- Clinical AF
- Dépistage systématique
- Surveillance continue ILR
- Durée

PVI?



Catheter ablation may be considered as a first-line option within a shared decision-making rhythm control strategy in selected patients with persistent AF to reduce symptoms, recurrence, and progression of AF.	IIb	C

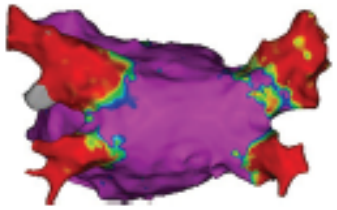
"**Pulmonary vein isolation (PVI**) remains the cornerstone of AF catheter ablation, but the **optimal ablation strategy has not been clarified** in the non-paroxysmal AF population"

CENTRAL ILLUSTRATION PVI Durability Using Pulsed-Field Ablation

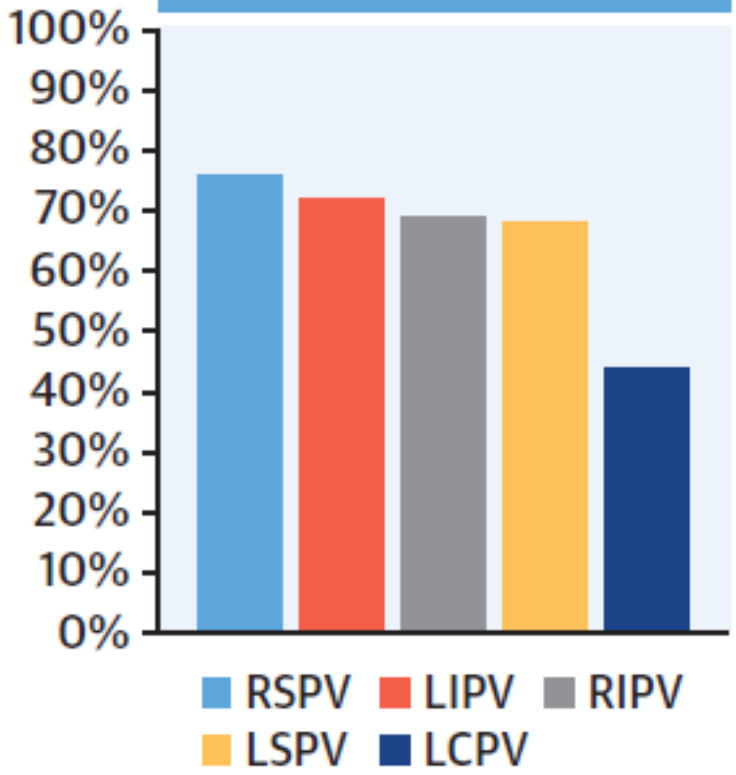
Index PVI using PFA at 7 European centers n = 1,184

Recurrence of atrial arrhythmias n = 272

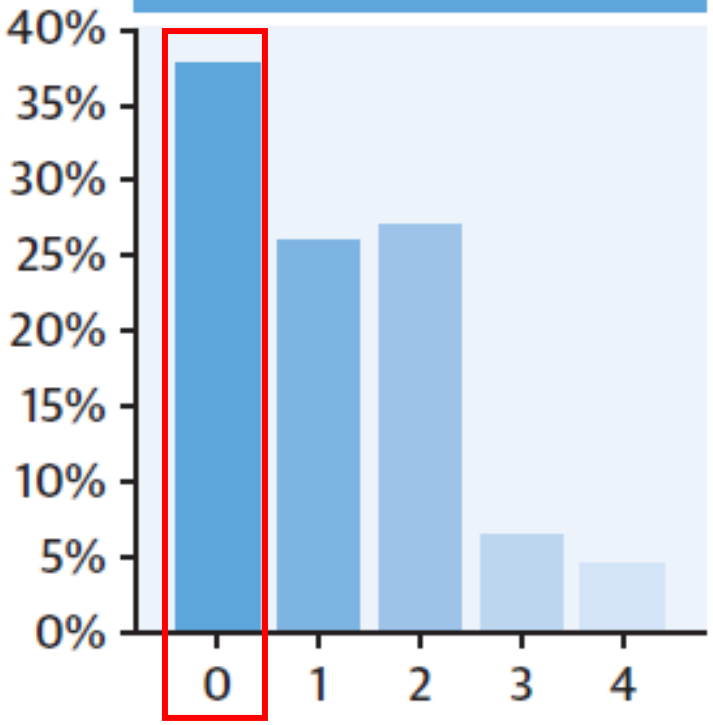
Repeat ablation (median 7 months post PVI) n = 144



Proportion of Veins With Durable Isolation



Proportion of Patients With # of Veins Reconnected

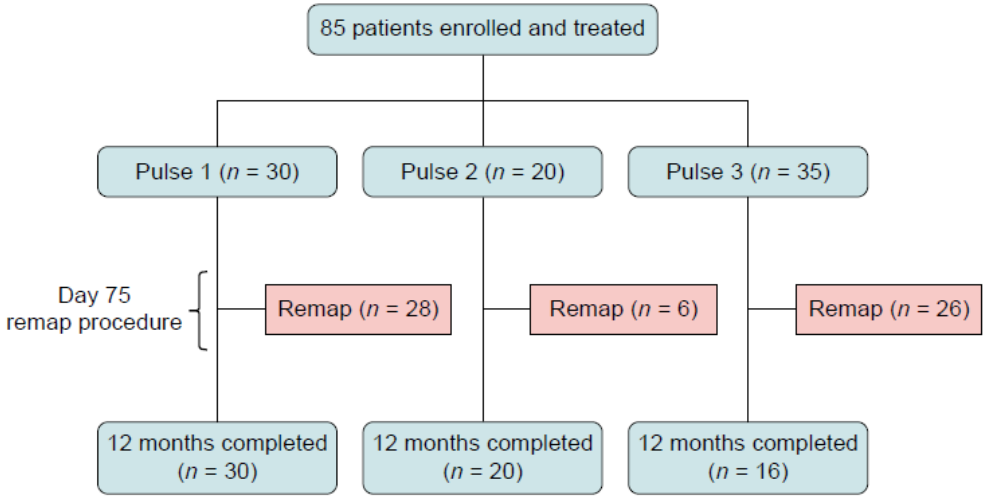


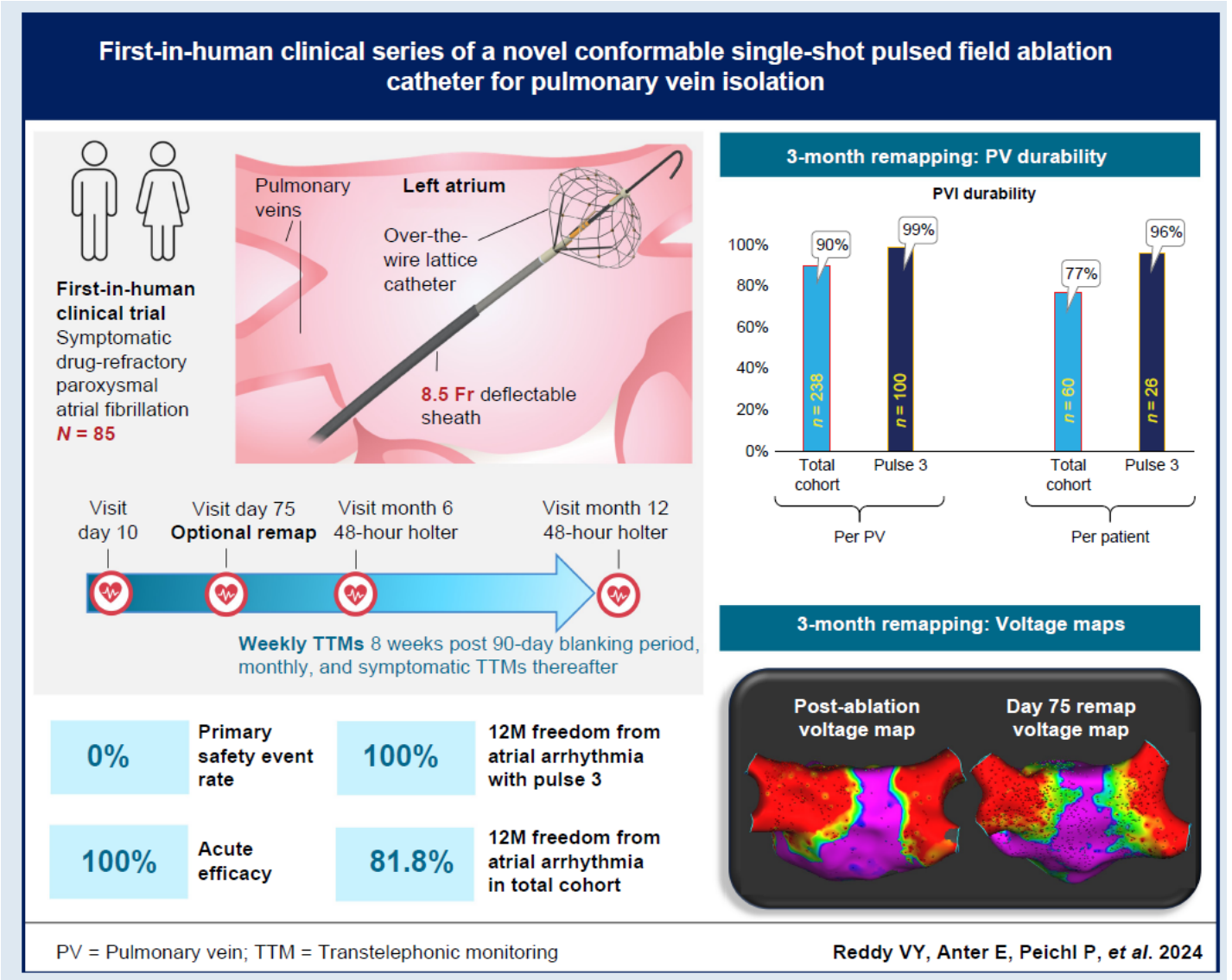
Kueffer T, et al. J Am Coll Cardiol EP. 2024;10(4):698-708.

First-in-human clinical series of a novel conformable large-lattice pulsed field ablation catheter for pulmonary vein isolation

Vivek Y. Reddy [1,2]*, Elad Anter [3], Petr Peichl [4], Gediminas Rackauskas [5], Jan Petru[2], Moritoshi Funasako [2], Jacob S. Koruth [1], Germanas Marinskis[5], Mohit Turagam[1], Audrius Aidietis[5], Josef Kautzner [4], Andrea Natale [6,7], and Petr Neuzil [2]

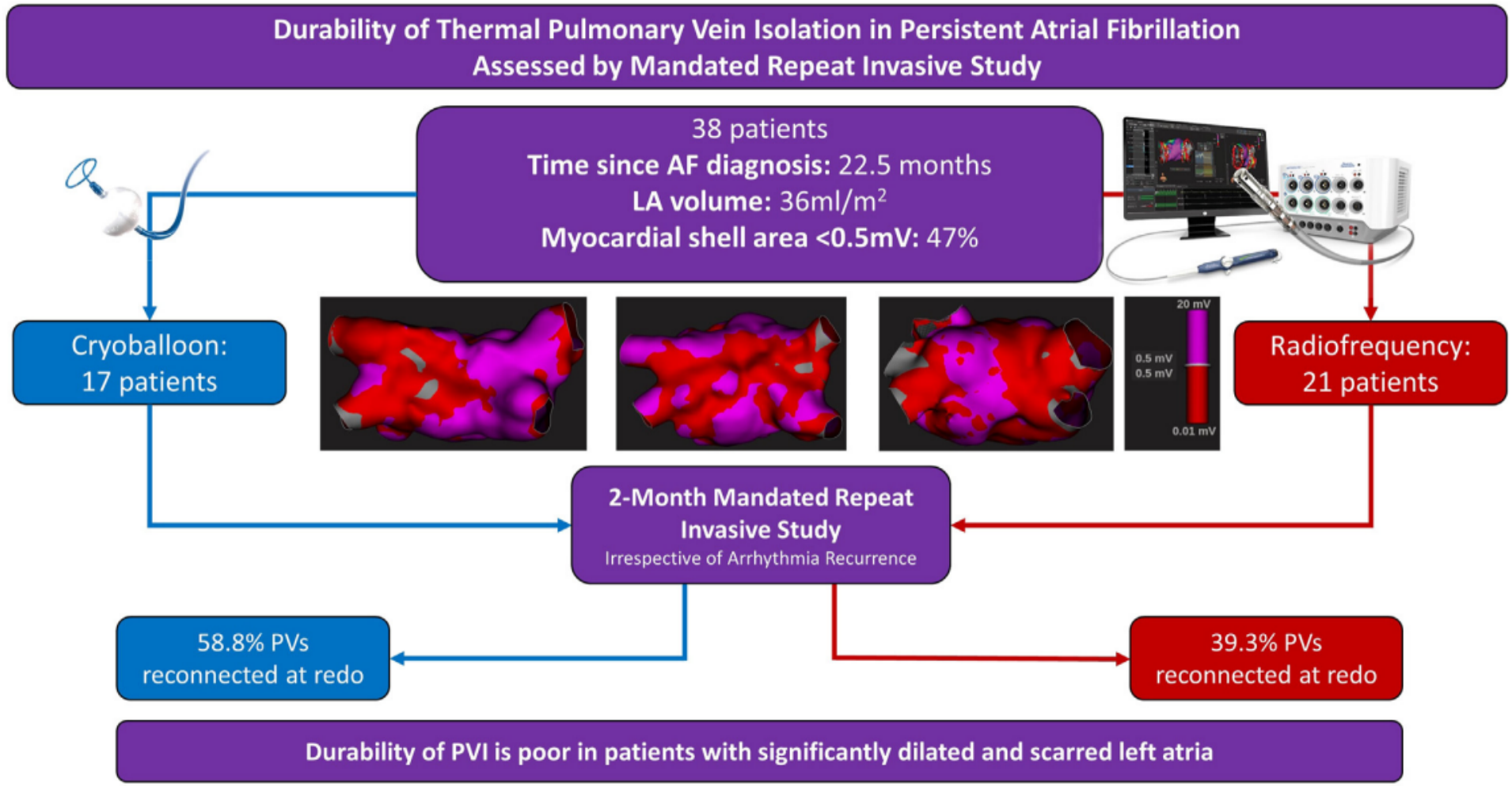
75 patients
12 months FU
Transtelephonic monitoring
Elective invasive remapping procedure





Durability of thermal pulmonary vein isolation in persistent atrial fibrillation assessed by mandated repeat invasive study

Peter Calvert, MBChB,[1,2] Wern Yew Ding, PhD,[1] Mark T. Mills, MBChB,[1,2] Richard Snowdon, MD,[1]
Zoltan Borbas, PhD,[1] Simon Modi, MD,[1] Mark Hall, MBBS,[1] Maureen Morgan, BSc,[1]
Nichola Clarkson, BSc,[1] Sijimole Chackochen, RGN,[1] Janet Barton, RGN,[1] Ian Kemp, PhD,[1]
Vishal Luther, PhD,[1] Dhiraj Gupta, MD[1,2]

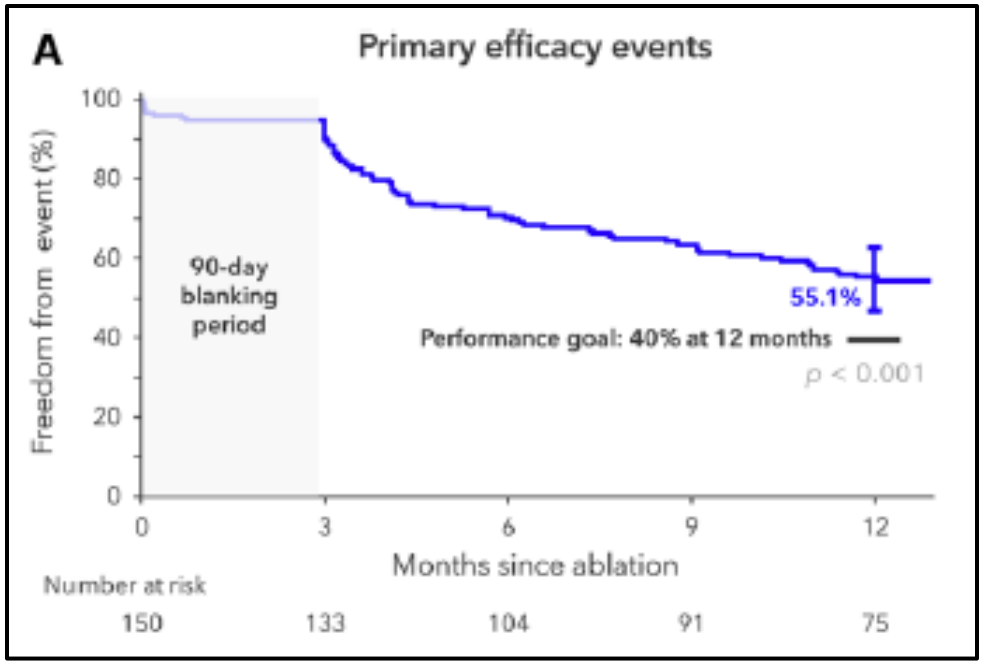


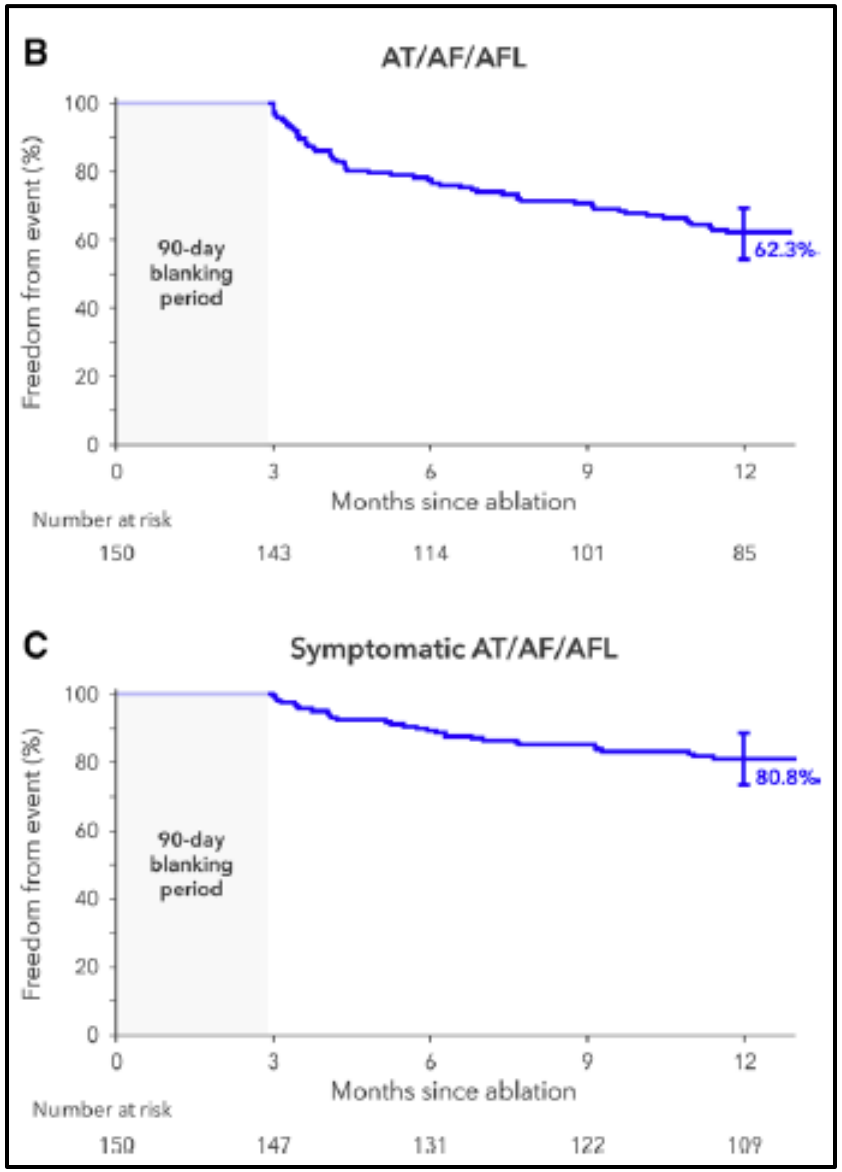
ORIGINAL RESEARCH ARTICLE

Pulsed Field Ablation for the Treatment of Atrial Fibrillation: PULSED AF Pivotal Trial

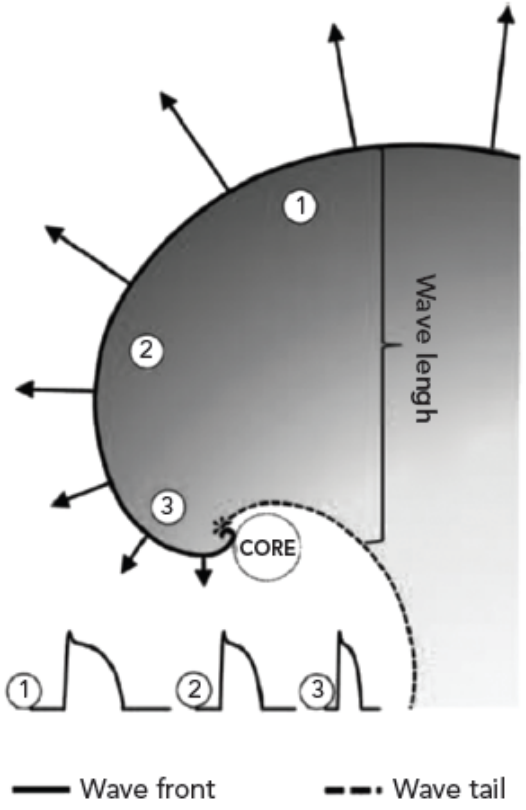
Atul Verma, MD; David E. Haines, MD; Lucas V. Boersma, MD; Nitesh Sood, MD; Andrea Natale, MD; Francis E. Marchlinski, MD; Hugh Calkins, MD; Prashanthan Sanders, MBBS; Douglas L. Packer, MD; Karl-Heinz Kuck, MD; Gerhard Hindricks, MD; Birce Onal, PhD; Jeffrey Cerkvenik, MS; Hiroshi Tada, MD; David B. DeLurgio, MD; on behalf of the PULSED AF Investigators

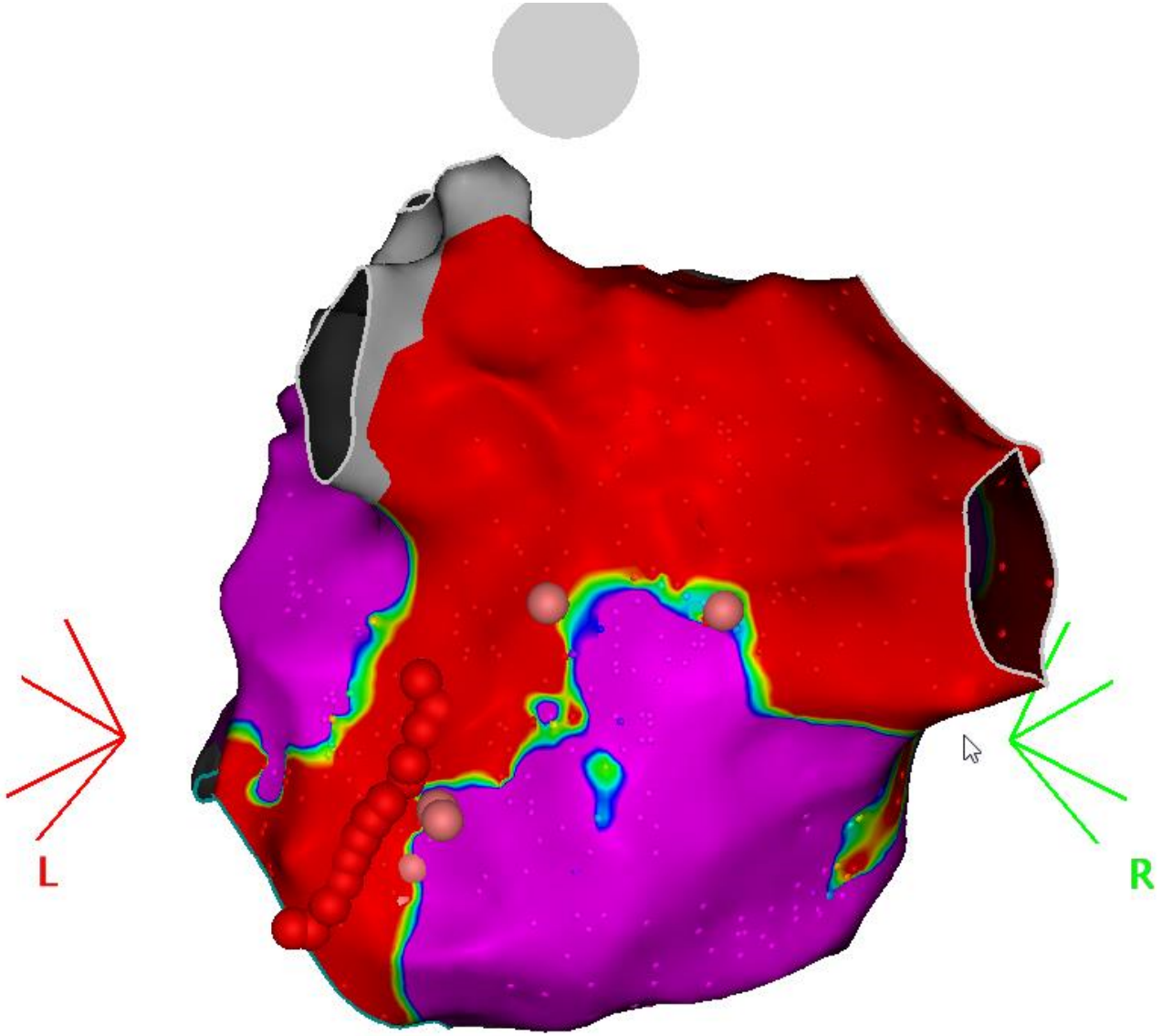
- Sous groupe PeAF n=150
- PVI only - Remap 20 min
- 12 moiths FU
- Transtelephonic monitoring weekly





PVI + ?

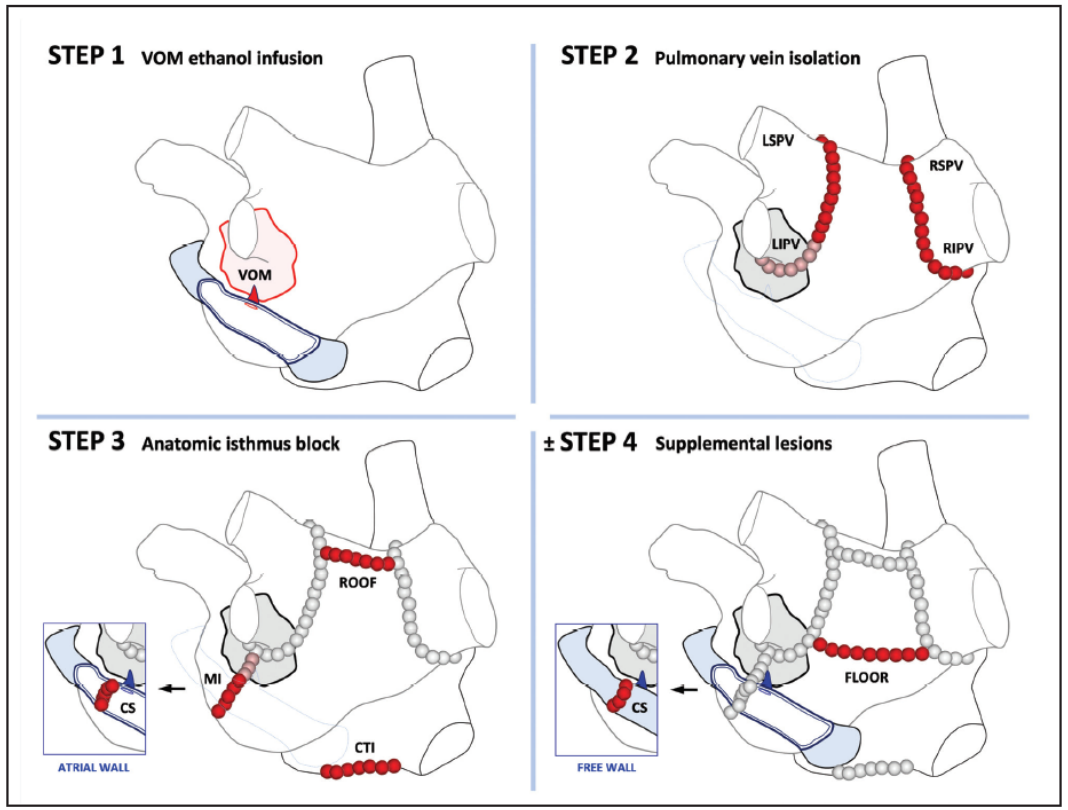


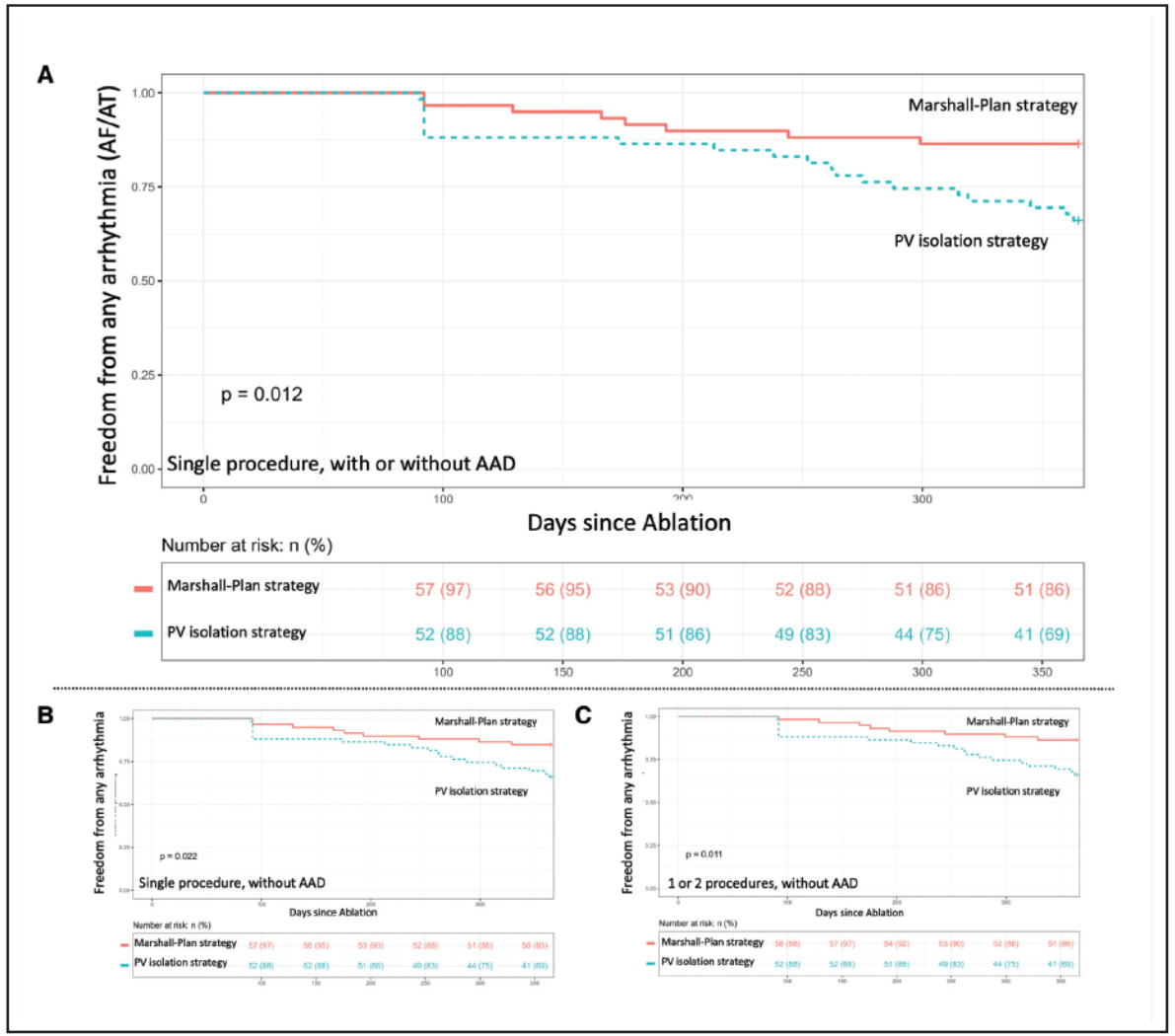


Nattel, Stanley et al 'Demystifying Rotors and Their Place in Clinical Translation of Atrial Fibrillation Mechanisms'. *Nature Reviews* 2017

Marshall-Plan Ablation Strategy Versus Pulmonary Vein Isolation in Persistent AF: A Randomized Controlled Trial

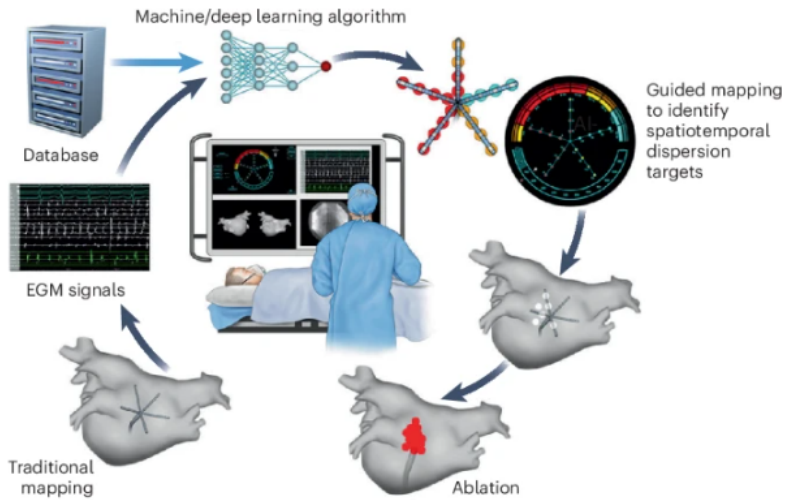
Nicolas Derval, MD; Romain Tixier, MD; Josselin Duchateau, MD, PhD; Xavier Bouteiller, PhD; Timothé Loock, MSc; Arnaud Denis, MD; Rémi Chauvel, MD; Benjamin Bouyer, MD; Marine Arnaud, MD; Masaaki Yokoyama, MD; Christopher Kowalewski, MD; Cinzia Monaco, MD; Ciro Ascione, MD; Frédéric Sacher, MD, PhD; Mélèze Hocini, MD; Pierre Jaïs, MD, PhD; Michel Haïssaguerre, MD; Thomas Pambrun, MD



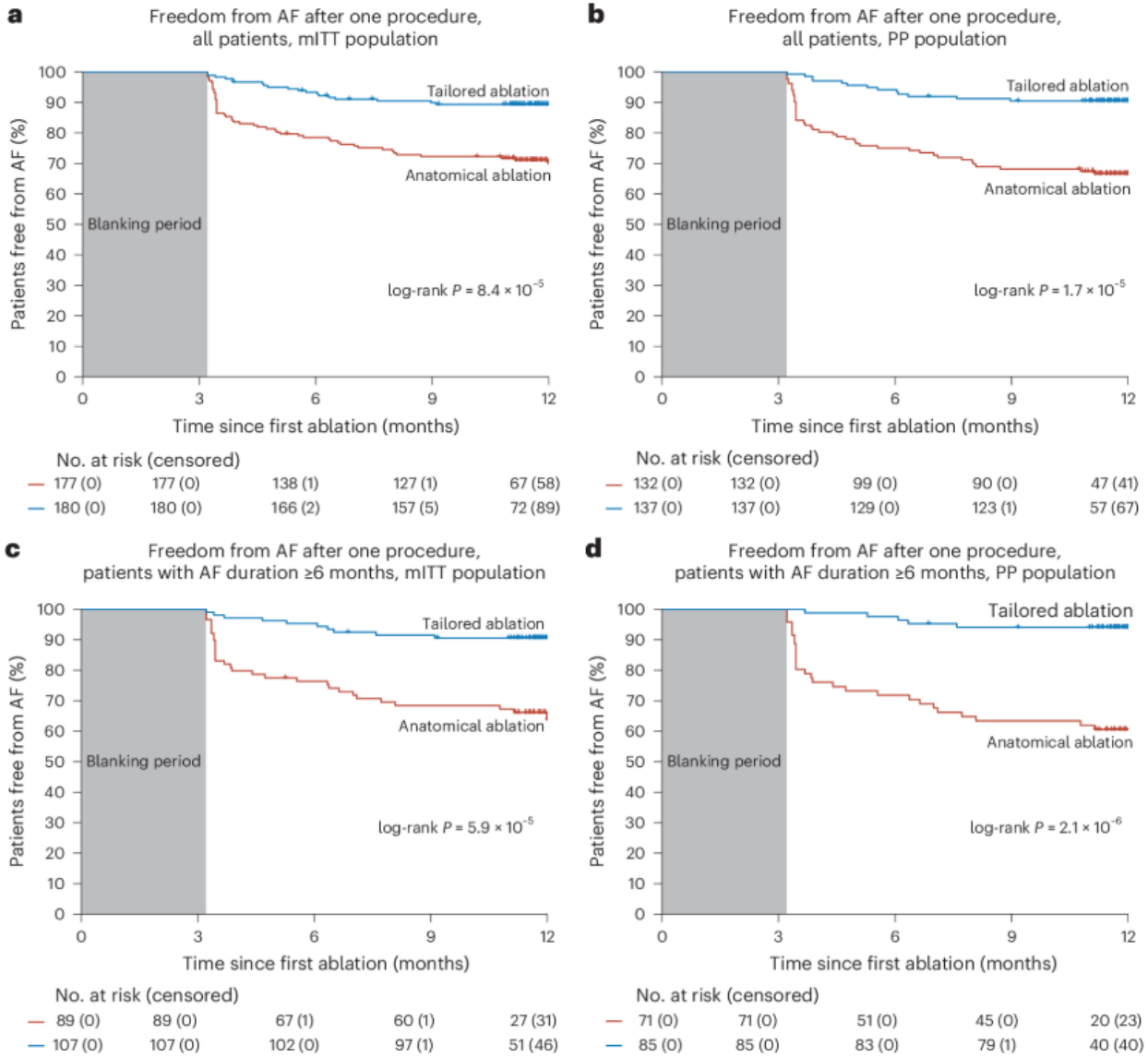


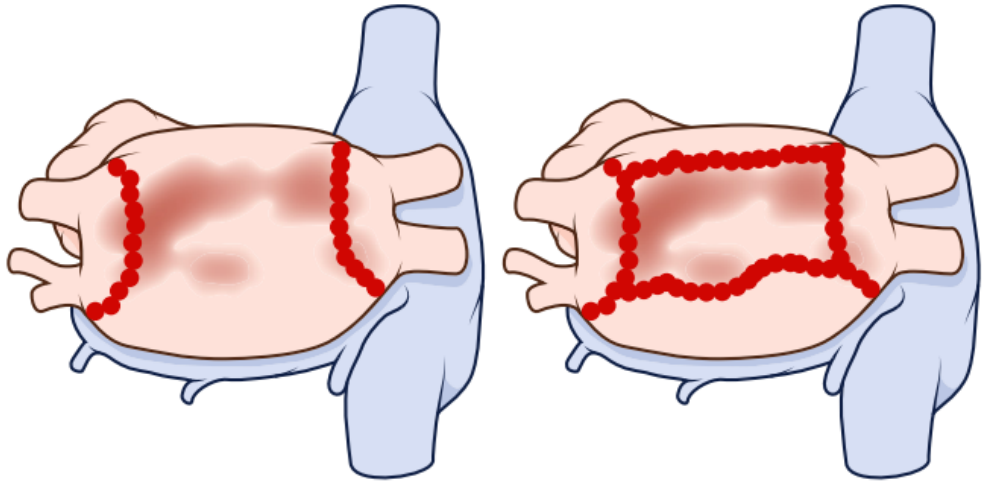
Artificial intelligence for individualized treatment of persistent atrial fibrillation: a randomized controlled trial

Isabel Deisenhofer ✉, Jean-Paul Albenque, Sonia Busch, Edouard Gitenay, Stavros E. Mountantonakis, Antoine Roux, Jerome Horvilleur, Babe Bakouboula, Saumil Oza, Selim Abbey, Guillaume Theodore, Antoine Lepillier, Yves Guyomar, Francis Bessiere, Jaap Jan Smit, Theophile Mohr Durdez, Paola Milpied, Anthony Appetiti, Daniel Guerrero, Tom De Potter, Christian De Chillou, Seth Goldbarg, Atul Verma, John D. Hummel & TAILORED-AF Investigators



Strengths	Challenges
First randomized trial of AI-guided AF ablation	No difference in single-procedure arrhythmia recurrence
Less AF in follow-up	Unclear how results will translate to pulsed field ablation
Demonstrates importance of spatiotemporal dispersion in persistent AF recurrence	Long procedures, high redo rates, more atrial tachycardias





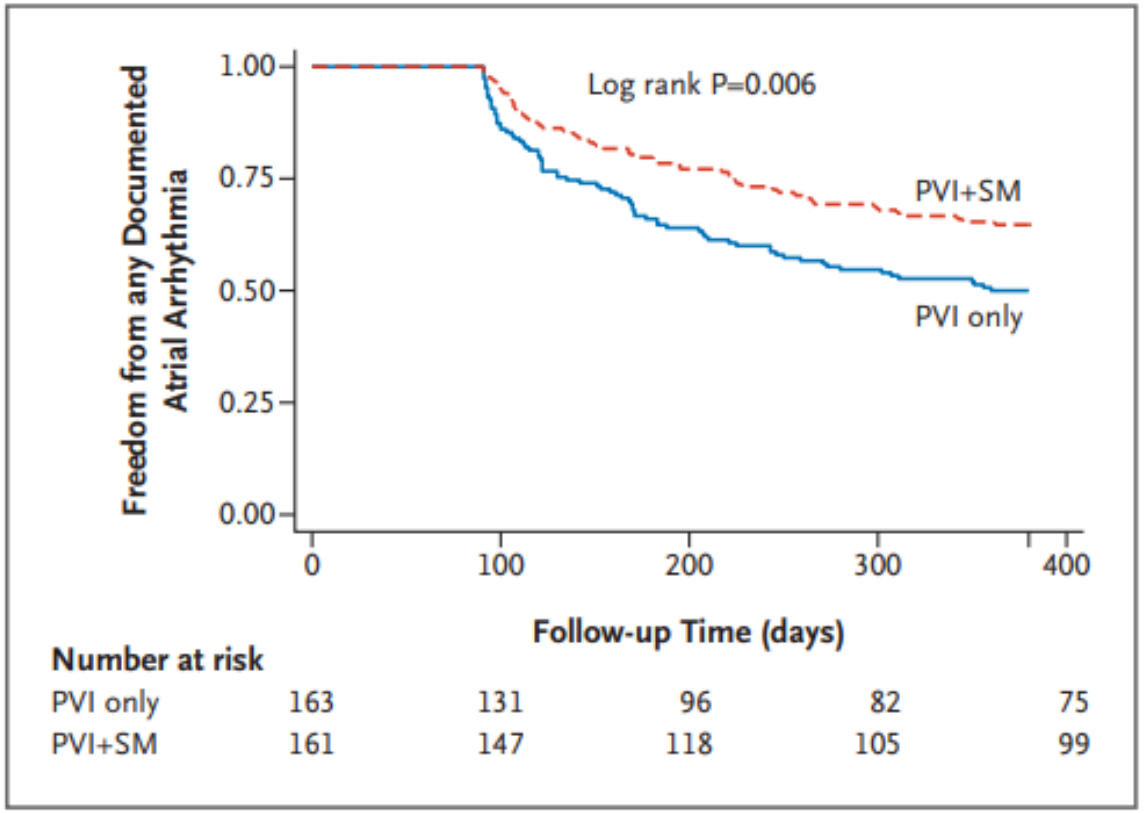


Table 1. Baseline Characteristics.*

Characteristic	Total (N=324)	PVI+SM (n=161)	PVI Only (n=163)
Age — yr	66±10	65±10	66±10
Gender — male	216 (67)	112 (70)	104 (64)
AF history — mo	31 (11–77)	31 (8–77)	31 (12–77)
Longstanding persistent AF	24 (7)	11 (7)	13 (8)
BMI	30±5	29±5	30±5
HTN	267 (82)	130 (81)	137 (84)
DM	80 (25)	40 (25)	40 (25)
CHF	74 (23)	32 (20)	42 (26)
PAD	21 (6)	8 (5)	13 (8)
CAD	94 (29)	48 (30)	46 (28)
Previous TIA/stroke	27 (8)	12 (7)	15 (9)
EHRA score	2 (2–3)	2 (2–3)	2 (2–3)
CHA2DS2-VASc	3 (2–4)	3 (2–4)	3 (2–4)
pfAA	316 (98)	158 (98)	158 (97)
OAC	315 (97)	155 (96)	160 (98)
LVEF — %	53±11	53±12	54±11
LAD — mm	45±7	45±7	45±6

Table 2. Intention-to-Treat, Efficacy End Points.*

Outcome After Index Procedure	PVI Only†	PVI+SM†	Percent Difference (95% CI)‡
Efficacy end point			
Primary (n=303)	75/150 (50)	54/153 (35)	15 (4 to 26)
Secondary (n=239)	65/119 (55)	47/120 (39)	15 (3 to 28)
Antiarrhythmic drugs§	19/150 (13)	17/153 (11)	2 (−6 to 9)
Reablation	13/150 (9)	4/153 (3)	6 (1 to 11)

Huo, Yan et al. 'Low-Voltage Myocardium-Guided Ablation Trial of Persistent Atrial Fibrillation'. *NEJM Evidence*, 2022

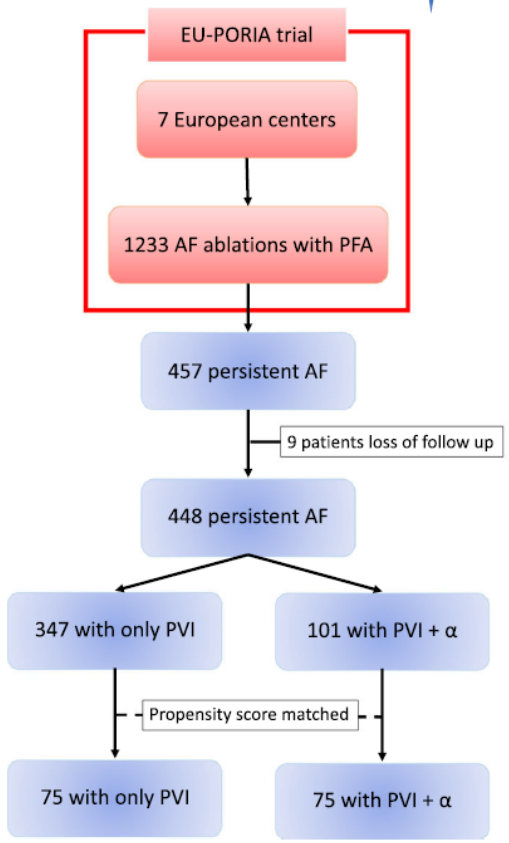
PVI + with PFA ?

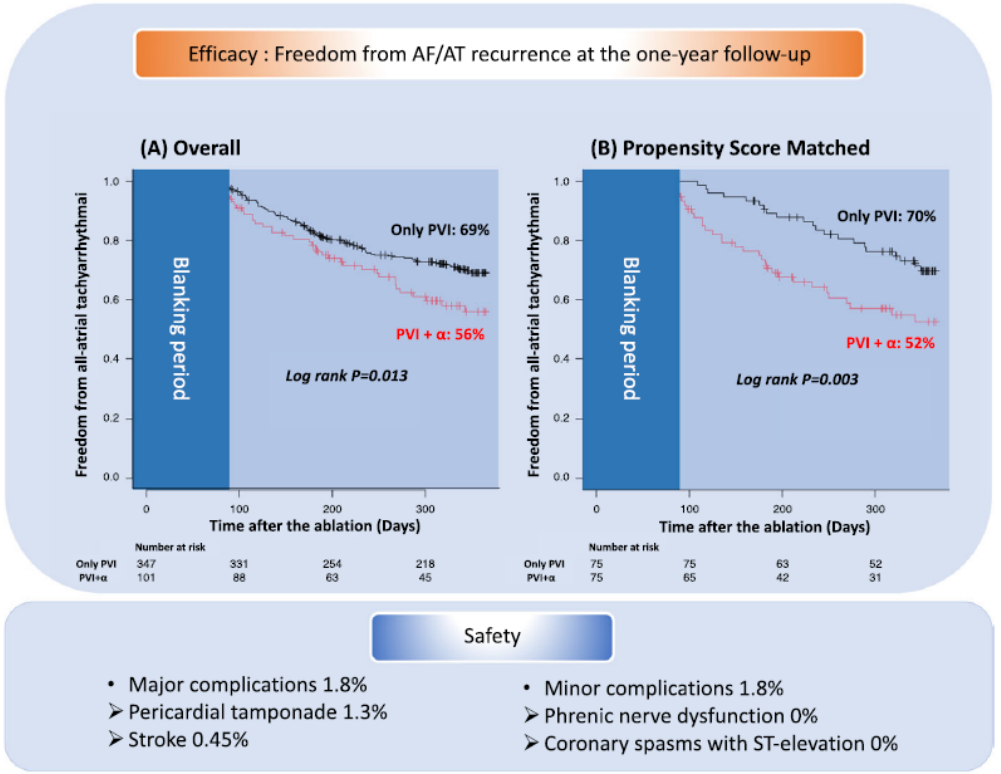
Pulsed-Field Ablation for Persistent Atrial Fibrillation in EU-PORIA Registry

Jun Hirokami[1] | Kyoung Ryul Julian Chun[1] | Stefano Bordignon[1] | Shota Tohoku[1] | Kars Neven[2,3] | Tobias Reichlin[4] | Yuri Blaauw[5] | Jim Hansen[6] | Raquel Adelino[7] | Alexandre Ouss[8] | Anna Füting[2,3] | Laurent Roten[4] | Bart A. Mulder[5] | Martin H. Ruwald[6] | Roberto Mené[7] | Pepijn van der Voort[8] | Nico Reinsch[2,3] | Thomas Kueffer[4] | Serge Boveda[7] | Elizabeth M. Albrecht[9] | Boris Schmidt[1,10]

- Observational retrospective PFA for PeAF
- 352 only PVI and 105 PVI +
  - 87% PW
  - 37% MI
  - 3% CTI
- Holter 3-6-12 months

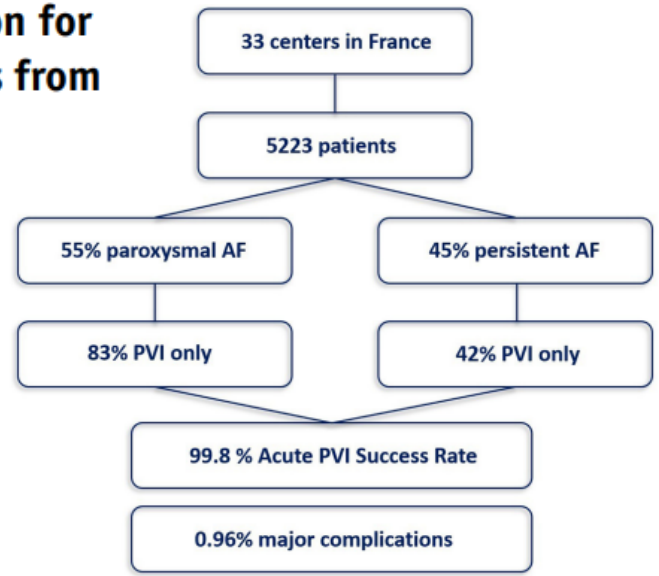
Persistent AF in EU-PORIA

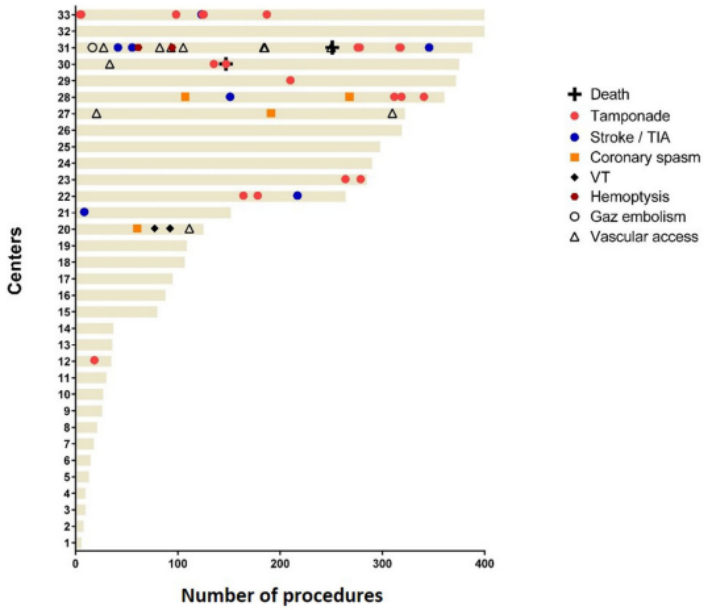


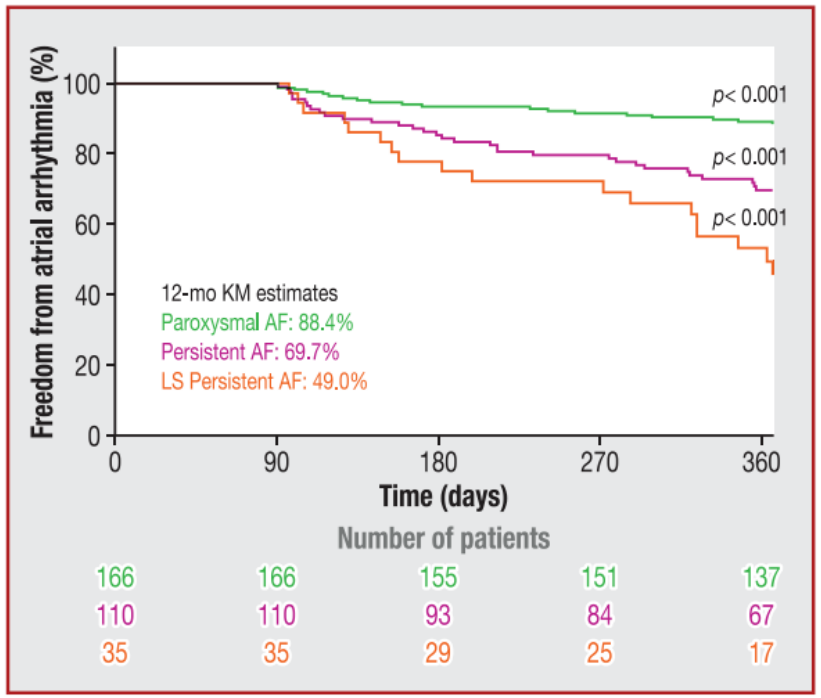


CENTRAL ILLUSTRATION 1 | A total of 457 persistent AF patients from EU-PORIA were included in this trial and Propensity score matched (PSM) analysis was conducted. The Kaplan-Meier curve of all-atrial arrhythmia-free survival for (A) all persistent patients and (B) patients who underwent PSM conducted to the higher recurrence rate in PVI + α group.

Countrywide introduction of pulsed field ablation for the treatment of atrial fibrillation: Acute results from the FRANCE-PFA registry







- 3 centers 2021-222
- 311 patients
- FU: clinical AF

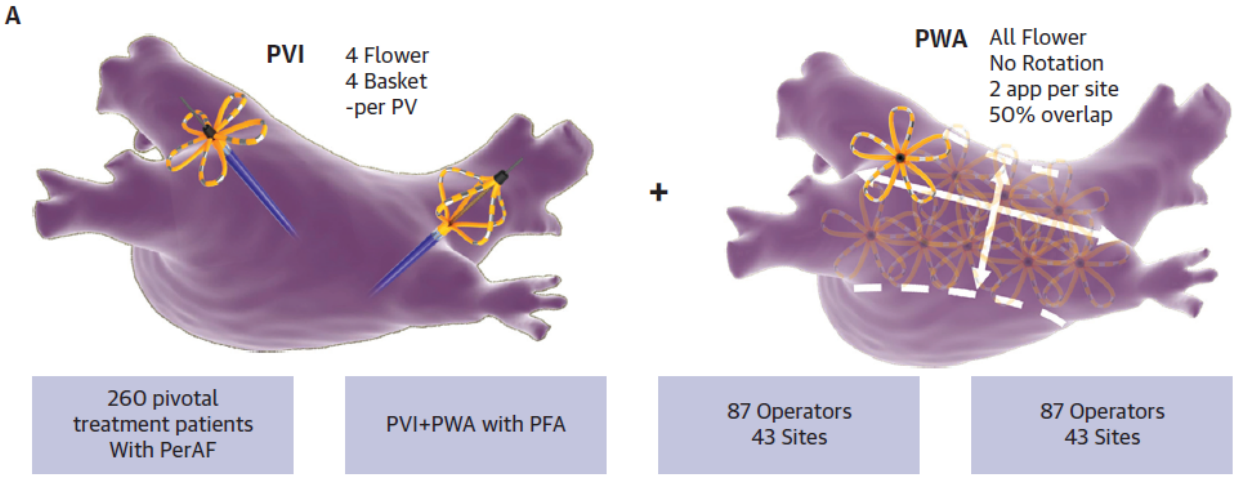
Prospective 1-year results of atrial fibrillation ablation using the pentaspline pulsed field ablation catheter: The initial French experience

Corentin Chaumont[a,b,1], Emily McDonnell[a,1], Serge Boveda[c,d], Arnaud Savoure[a], Anne Rollin[e], Stephane Combes[c], Raphael Al Hamoud[a], Franck Mandel[e], Sarah Zeriouh[c], Helene Eltchaninoff[a,b], Philippe Maury[e,f], Frederic Anselme[a,b,*]

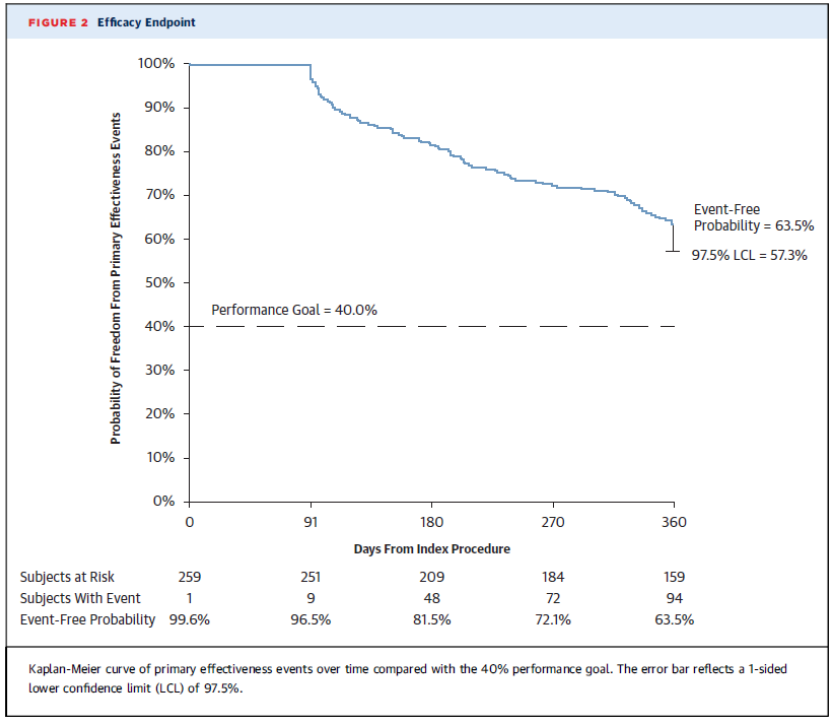
Pulsed Field Ablation for Persistent Atrial Fibrillation

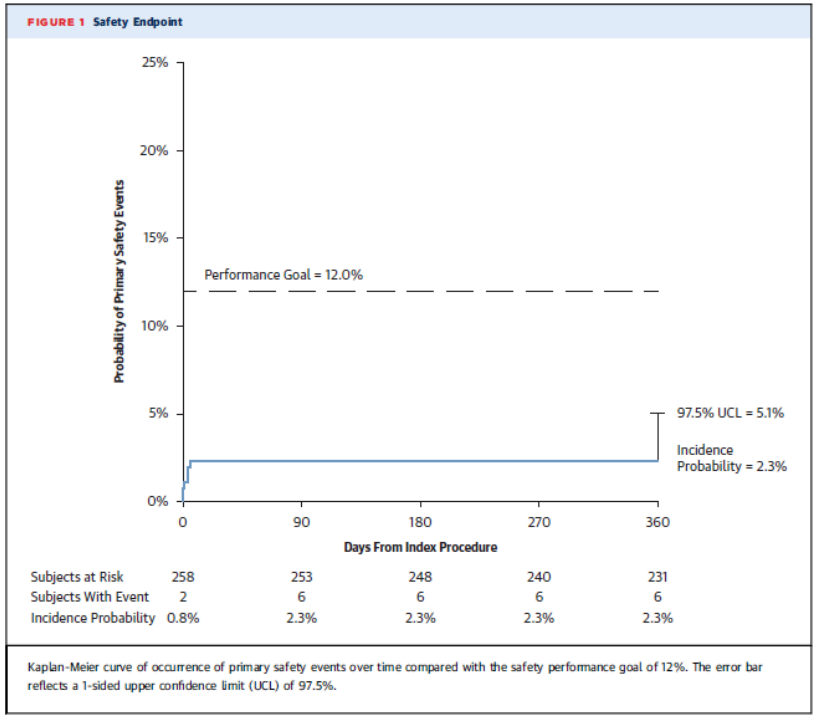
1-Year Results of ADVANTAGE AF

Vivek Y. Reddy, MD,[a] Edward P. Gerstenfeld, MD,[b] Boris Schmidt, MD,[c] Devi Nair, MD,[d] Andrea Natale, MD,[e,f,g] Walid Saliba, MD,[h] Atul Verma, MD,[i] Philipp Sommer, MD,[j,k] Andreas Metzner, MD,[l] Mohit Turagam, MD,[m] Stanislav Weiner, MD,[n] Jean Champagne, MD,[o] Ignacio García Bolao, MD, PhD,[p] Hugh Calkins, MD,[q] Jeffrey Olson, MD,[r] Ziad Issa, MD,[s] Marshall Winner, MD,[t] Wilber Su, MD,[u] Gery Tomassoni, MD,[v] Jamie Kim, MD,[w] Bruce Hook, MD,[x] David B. Delurgio, MD,[y] Douglas N. Gibson, MD,[z] Marcos Daccarett, MD,[aa] Chinmay Patel, MD,[bb] Karan Bhalla, MD,[cc] Michael Shehata, MD,[dd] John D. Harding, MD,[ee] Jim W. Cheung, MD,[ff] Jonathan D. Raybuck, PhD,[gg] Stephanie Roelke, MPH,[gg] Torri Schwartz, MS,[gg] Brad S. Sutton, MD,[gg] Moussa Mansour, MD,[hh] the ADVANTAGE-AF Investigators



- 260 patients
- Prospective pivotal study, single arm
- Designed by the sponsor, post approval
- Effectiveness endpoind > 40%
- Safety endpoint < 12%
- Transtelephonic monitoring



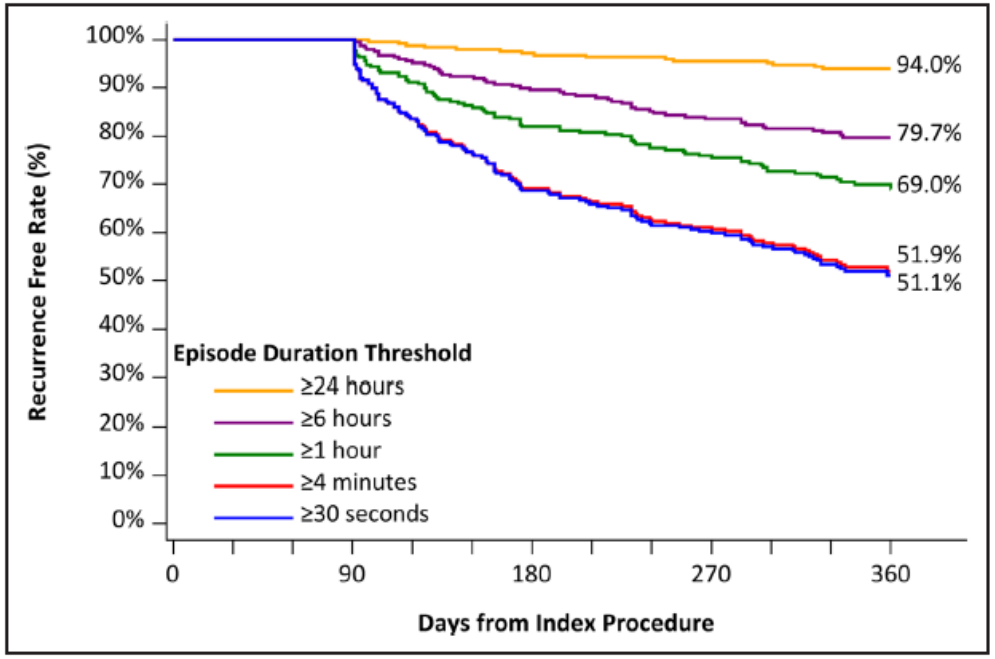


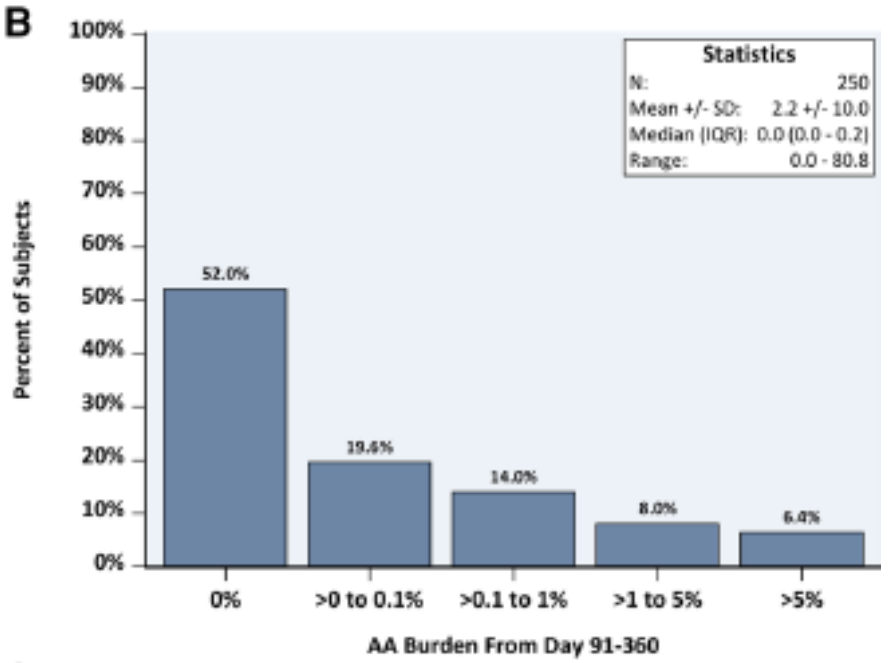
ORIGINAL RESEARCH ARTICLE

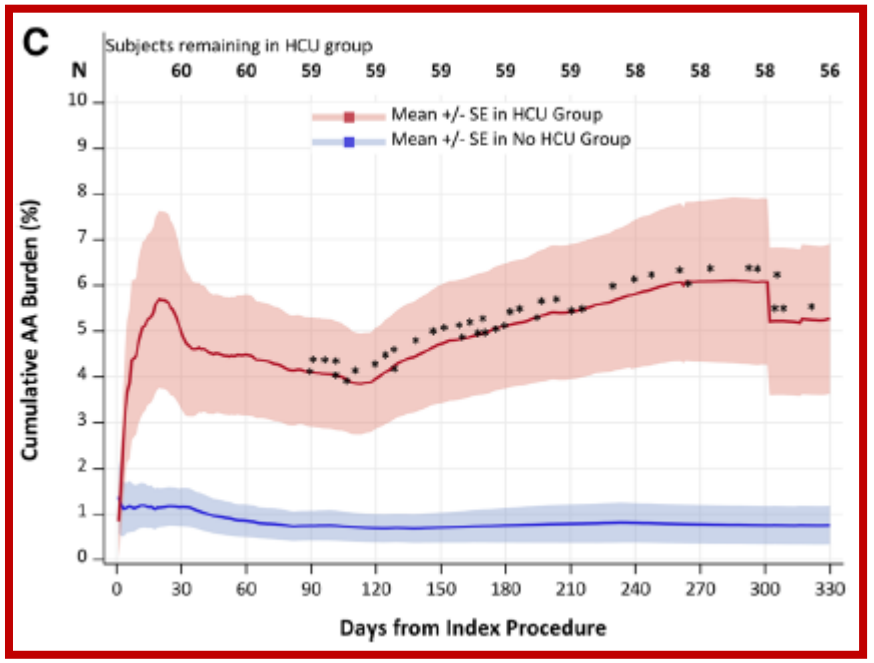
Pulsed Field Ablation of Persistent Atrial Fibrillation With Continuous Electrocardiographic Monitoring Follow-Up: ADVANTAGE AF Phase 2

Vivek Y. Reddy, MD; Edward P. Gerstenfeld, MD; Boris Schmidt, MD; Jason G. Andrade, MD; Devi Nair, MD; Andrea Natale, MD; Walid Saliba, MD; Philipp Sommer, MD; Andreas Metzner, MD; Atul Verma, MD; Troy Hounshell, DO; Anish Amin, MD; Philip Gentlesk, MD; Stanislav Weiner, MD; Frank A. Cuoco, MD; Jamie Kim, MD; Mohit K. Turagam, MD; Gery Tomassoni, MD; Chinmay Patel, MD; Ziad Issa, MD; Michael Shehata, MD; Allison M. Anderson, MS; Thomas J. Stoltz, BS; Jonathan D. Raybuck, PhD; Torri Schwartz, MS; Brad S. Sutton, MD; Moussa Mansour, MD; for the ADVANTAGE AF Investigators

250 patients
Prospective pivotal study, single arm
Designed by the sponsor
Effectiveness endpoind > 40%
Safety endpoint < 12%
ILR







Impact of Left Atrial Posterior Wall Ablation During Pulsed-Field Ablation for Persistent Atrial Fibrillation

- Manifest registry
- PeAF / LSAF
- 12 months clinical FU
  - 30s AF

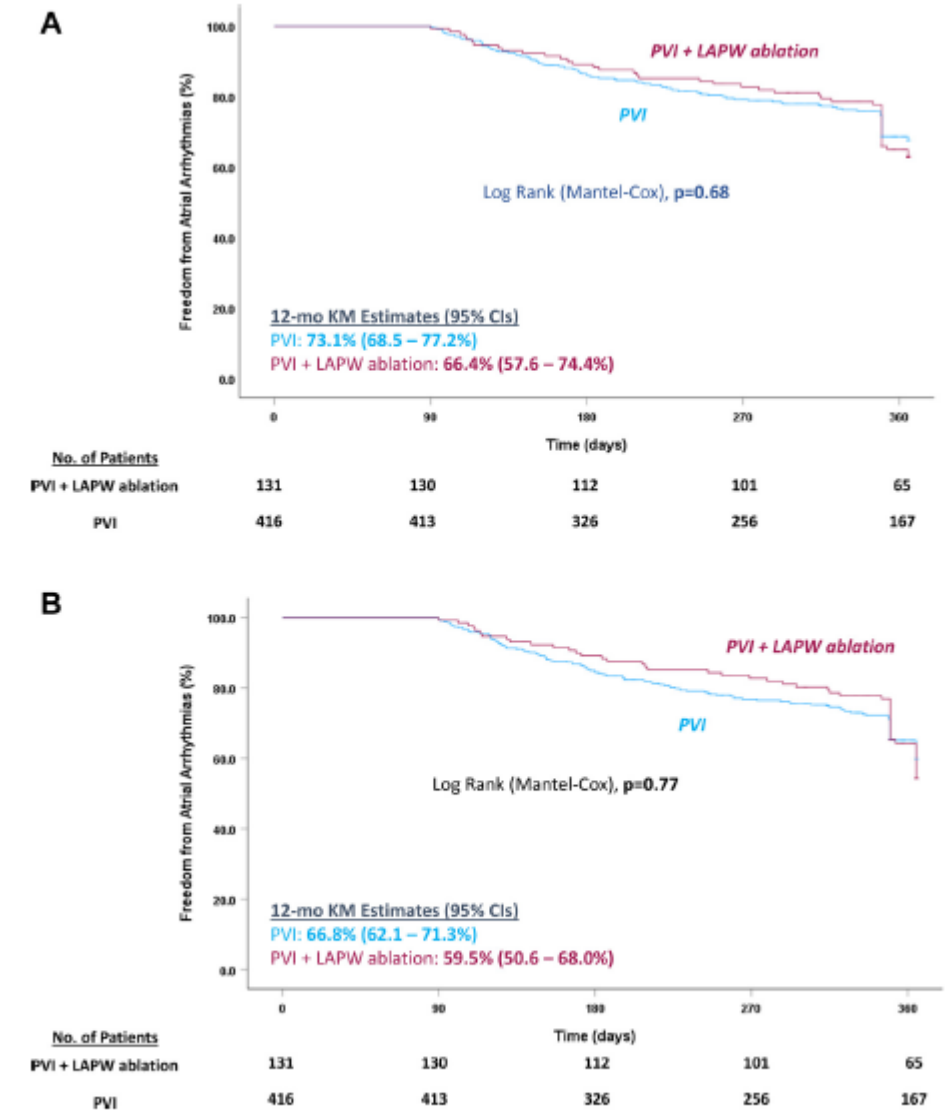
TABLE 1 Baseline Characteristics

	Entire Cohort (N = 547)	PVI + LAPW Ablation (n = 131)	PVI (n = 416)	*P* Value
Age, y	66.3 ± 2.6	64.8 ± 10.4	66.7 ± 10.8	0.08
Female	165 (30.2)	36 (27.5)	129 (31.0)	0.51
CHA_2DS_2-VASc score	2.5 ± 1.6	2.3 ± 1.6	2.6 ± 1.6	0.08
Mean body mass index, kg/m^2	28.9 ± 5.2 (n = 544)	28.9 ± 4.5	28.9 ± 5.4	0.96
Past medical history				
Atrial flutter	66 (15.5) (n = 427)	22 (17.2)	44 (14.7)	0.56
Coronary artery disease	77 (18.0) (n = 427)	16 (12.5)	61 (20.4)	0.055
Diabetes	97 (17.7)	29 (22.1)	68 (16.3)	0.15
Hypertension	377 (68.9)	90 (68.7)	287 (69.0)	1.00
Heart failure	139 (25.4)	35 (26.7)	104 (25.0)	0.73
Sleep apnea	48 (11.6) (n = 413)	13 (11.0)	35 (11.9)	0.86
Prior stroke/TIA	38 (7.0)	7 (5.4)	31 (7.5)	0.55
COPD	29 (7.9) (n = 365)	10 (9.4)	19 (7.3)	0.52
Echocardiographic parameters				
LVEF, %	57 (50-60) (n = 486)	60 (50-60)	55 (50-60)	0.31
LA diameter, mm	44 (40-48) (n = 429)	45 (42-48)	44 (40-48)	0.04
Antiarrhythmic medications				
Class I AADs	74 (13.6) (n = 545)	24 (18.3)	50 (12.1)	0.08
Class III AADs	137 (25.1) (n = 546)	30 (22.9)	107 (25.8)	0.56

Values are mean ± SD, n (%), or median (Q1-Q3).

AAD = anti-arrhythmic drug; COPD = chronic obstructive pulmonary disease; LA = left atrium; LVEF = left ventricular ejection fraction; TIA = transient ischemic attack.

FIGURE 1 Primary and Secondary Effectiveness Outcomes



Shown are the Kaplan-Meier (KM) analyses for both (A) the primary endpoint of 1-year freedom from atrial arrhythmia, and (B) the secondary endpoint of 1-year freedom from arrhythmia with patients not receiving antiarrhythmic drugs or re-ablation, as compared between the pulmonary vein isolation (PVI) + left atrial posterior wall (LAPW) and PVI-alone groups.

JACC EP 2024

Feasibility and Safety of Pulsed Field Ablation for Coronary Sinus and Left Atrial Appendage Isolation and Mitral Isthmus Ablation: Acute and Chronic Findings

Vincenzo Mirco La Fazia, MD; Sanghamitra Mohanty, MD; Carola Gianni, MD; Elio Zito, MD; Nicola Pierucci, MD; Giuseppe Stifano, MD; Preem Geeta Torlapati, MD; Domenico G. Della Rocca, MD; Weeranun Dechyapirom Bode, MD; J. David Burkhardt, MD; Rodney Horton, MD; Amin Al-Ahmad, MD; Luigi Di Biase, MD; Andrea Natale, MD

- Long standing AF, at least one previous procedure
- Scheduled to undergo LAA occlusion (2 months)
- Procedure:
  - PVs + PW
    - Then if isolated: LAA, CS and mitral isthmus ablation
- 236 patients CS LAA and MI

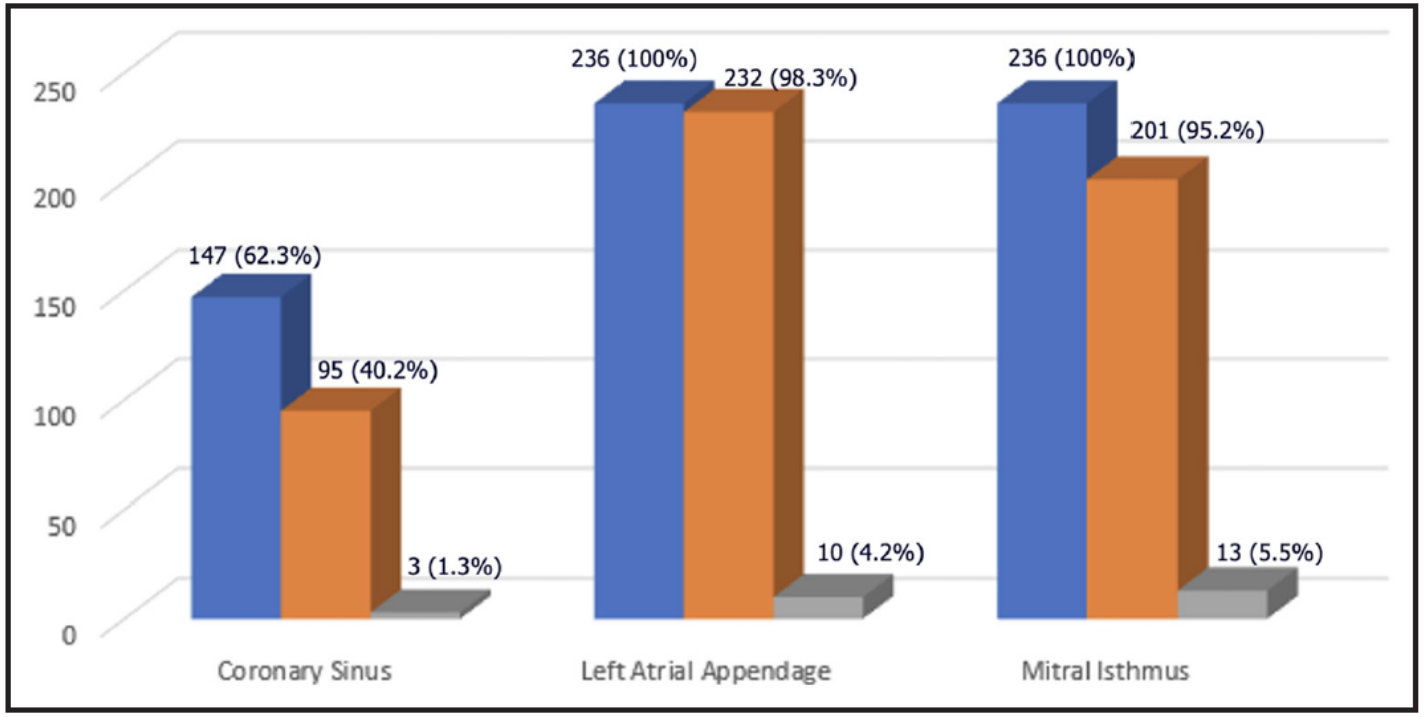


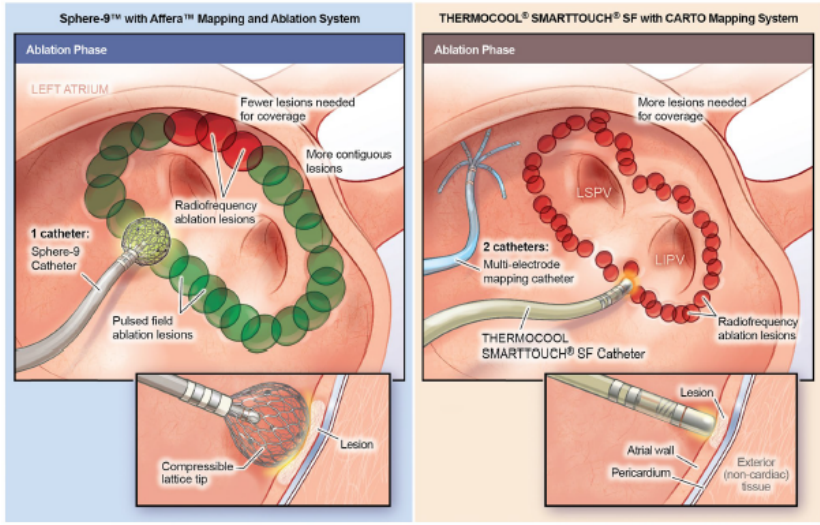
Figure 8. Acute, postadenosine and 3-month isolation rates in coronary sinus, left atrial appendage, and mitral isthmus. Bar graph showing isolation/block in acute (blue), after waiting time and adenosine (orange), and at 3-month follow-up (gray) for the coronary sinus, left atrial appendage, and mitral isthmus.

Article https://doi.org/10.1038/s41591-024-03022-6

Dual-energy lattice-tip ablation system for persistent atrial fibrillation: a randomized trial

Nature medecine 2024

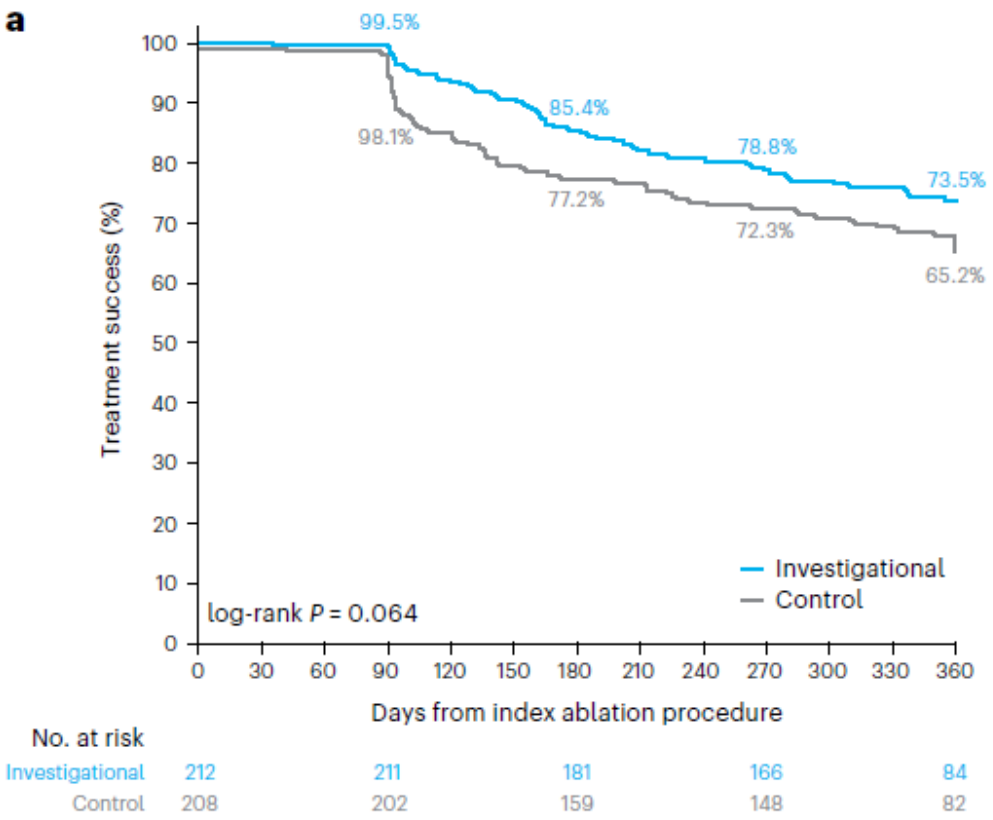
Characteristic [a]	Investigational (n = 212)	Control (n = 208)
Age (years)	67.8±8.3	66.7±8.8
Sex, male	139 (65.6%)	147 (70.7%)
Race, White or Caucasian	199 (93.9%)	199 (95.7%)
Body mass index (kg m^{-2}) [b]	30.0±4.8	30.3±4.9
Left atrial diameter (mm) [c]	43.0±6.1	44.0±5.4
Left ventricular ejection fraction (%)	57.7±7.2	55.5±8.0
Number of failed class I or class III anti-arrhythmic drugs [d]	1.2±0.4	1.1±0.4
Prior cardioversion for atrial arrhythmias		
Electrical	146 (68.9%)	140 (67.3%)
Pharmacologic	13 (6.1%)	15 (7.2%)
Time from first diagnosis of persistent AF (years)	1.3±2.6	1.3±2.2
CHA_2DS_2VASc score [e]	2.4±1.4	2.3±1.4
Medical characteristics		
Congestive heart failure	36 (17.0%)	26 (12.5%)
Coronary artery disease	37 (17.5%)	35 (16.8%)
Diabetes	38 (17.9%)	34 (16.3%)
Hypertension	160 (75.5%)	157 (75.5%)
Myocardial infarction	9 (4.2%)	7 (3.4%)
Obstructive sleep apnea	47 (22.2%)	57 (27.4%)
Renal disease	22 (10.4%)	15 (7.2%)
Stroke/transient ischemic attack	16 (7.5%)	11 (5.3%)
Baseline medications		
Class I anti-arrhythmic drugs	41 (19.3%)	39 (18.8%)
Class II anti-arrhythmic drugs	102 (48.1%)	98 (47.1%)
Class III anti-arrhythmic drugs	103 (48.6%)	96 (46.2%)
Class IV anti-arrhythmic drugs	26 (12.3%)	21 (10.1%)
Direct oral anti-coagulation	209 (98.6%)	203 (97.6%)

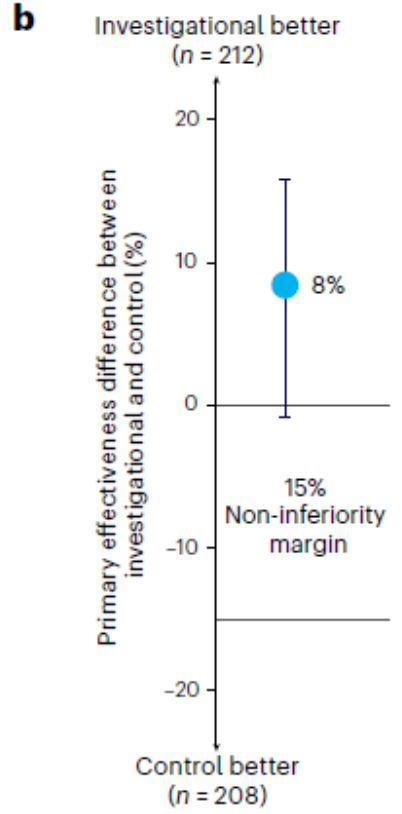


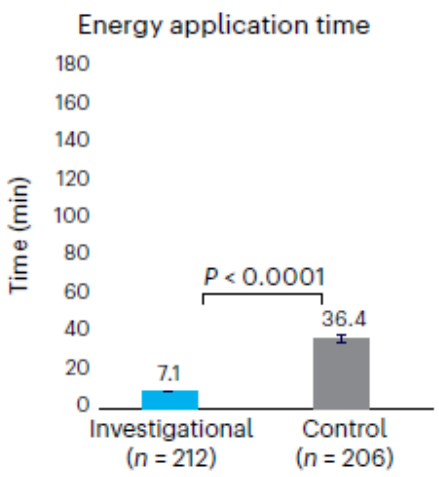
Extended Data Fig. 1 | Comparison of catheter ablation systems in the SPHERE Per-AF clinical trial. The investigational Sphere-9™ lattice-tip dual energy catheter with Affera™ Mapping and Ablation System is shown in the left panel. This system utilizes the Sphere-9™ catheter for both electroanatomical mapping and ablation, employing radiofrequency (red circles) or pulsed field (green circles) energies to create a line of electrical isolation around the pulmonary veins. The control system, depicted in the right panel, consists of a multielectrode mapping catheter for electroanatomical mapping and a separate catheter for radiofrequency ablation (THERMOCOOL® SMARTTOUCH® Surround Flow). As shown in the inserts, the investigational Sphere-9™ catheter has a wider footprint capable for creating wider lesions, resulting in a more contiguous ablation line. LIPV=left inferior pulmonary vein. LSPV=left superior pulmonary vein.

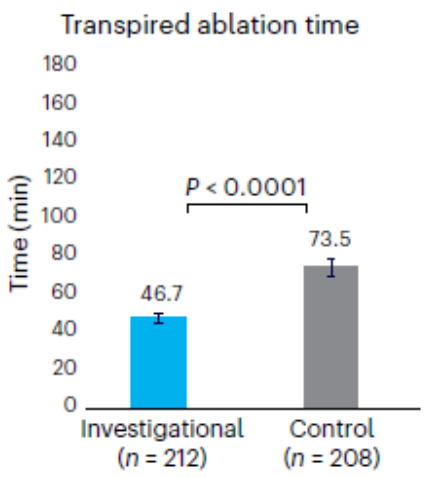
- 423 patients randomized
- **PVI + in 95,8 % vs 85,6%**
  - PW
  - CTI
  - Mitral line
- Trans telephonic monthly ECG

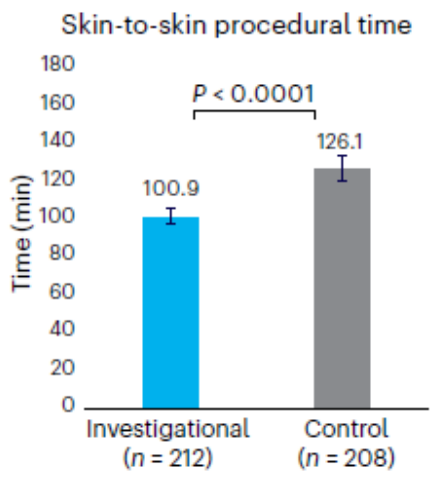
Parameter[a]	Investigational (n=212)	Control (n=208)	One-sided P value for investigational device superiority[b]
Skin-to-skin procedural time (min) (95% CI)	100.9±30.8 (96.8, 105.1)	126.1±49.2 (119.4, 132.8)	P<0.0001
Transpired ablation time (min) (95% CI)	46.7±20.0 (44.0, 49.4)	73.5±34.4 (68.8, 78.2)	P<0.0001
Total ablation energy application time (min) (95% CI)[c]	7.1±2.0 (6.8, 7.4)	36.4±17.7 (33.9, 38.8)	P<0.0001
Fluoroscopy time (min)	4.9±6.6	6.3±9.1	
Time from beginning to end of PVI (min)[d]	25.9±10.7	53.6±28.8	
Usage of adenosine	97 (45.8%)	105 (50.5%)	
Usage of isoproterenol	31 (14.6%)	37 (17.8%)	
Total fluid delivered by ablation catheters (ml)[e]	482.0±142.6	727.1±378.7	
Esophageal temperature probe usage	63 (29.7%)	158 (76.0%)	
Esophageal deviation device used	3 (1.4%)	34 (16.3%)	
Number of transseptal accesses			
1	202 (95.3%)	129 (62.0%)	
>1	10 (4.7%)	79 (38.0%)	
Number of mapping and/or ablation catheters used in left atrium[f]			
One catheter	206 (97.2%)	0 (0%)	
Two catheters	6 (2.8%)	200 (96.2%)	
Three catheters	0 (0%)	4 (1.9%)	
Ablation lesion sets beyond PVI[g]	203 (95.8%)	178 (85.6%)	
Cavo-tricuspid isthmus line	115 (54.2%)	98 (47.1%)	
Mitral line	72 (34.0%)	22 (10.6%)	
Left atrial roof, posterior or inferior line	198 (93.4%)	137 (65.9%)	

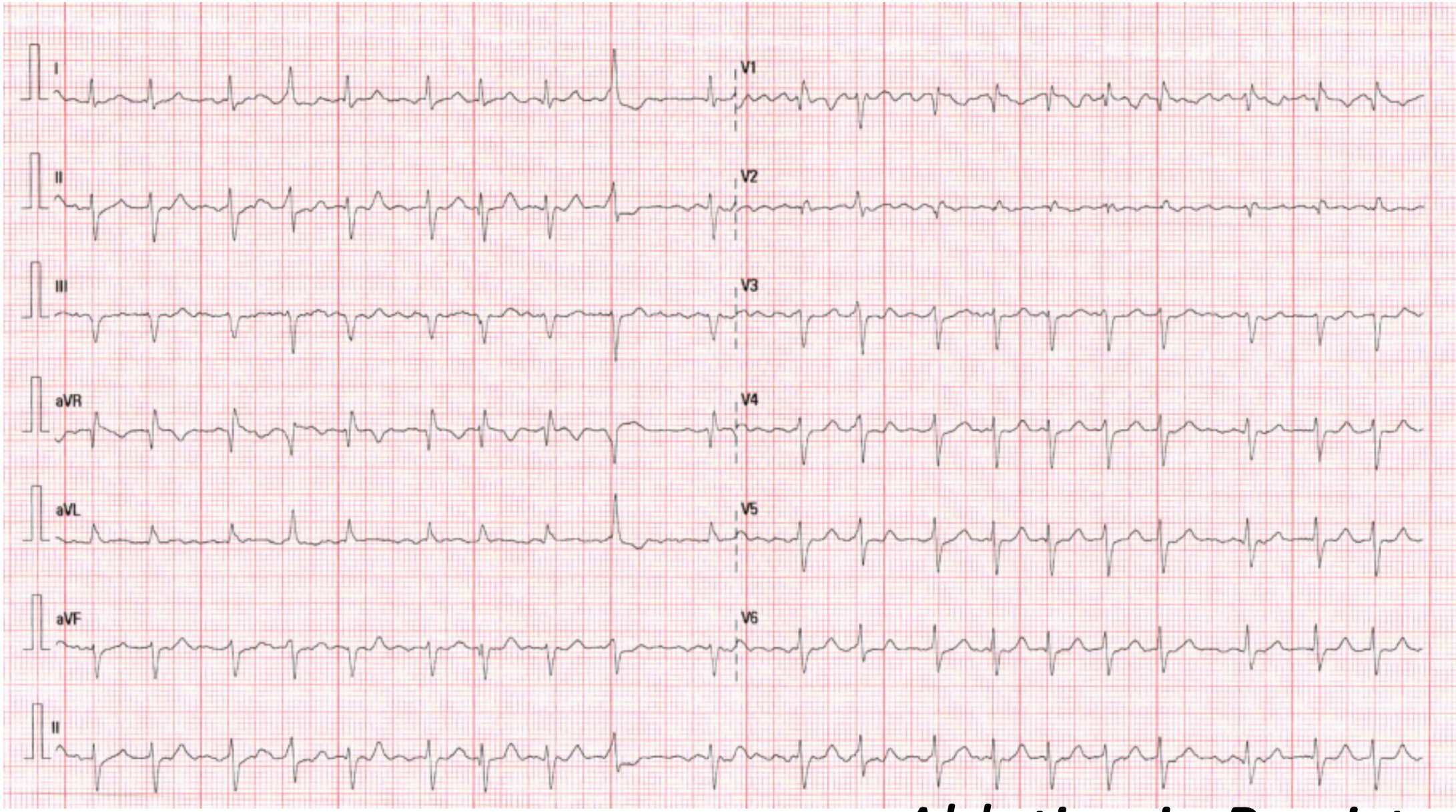






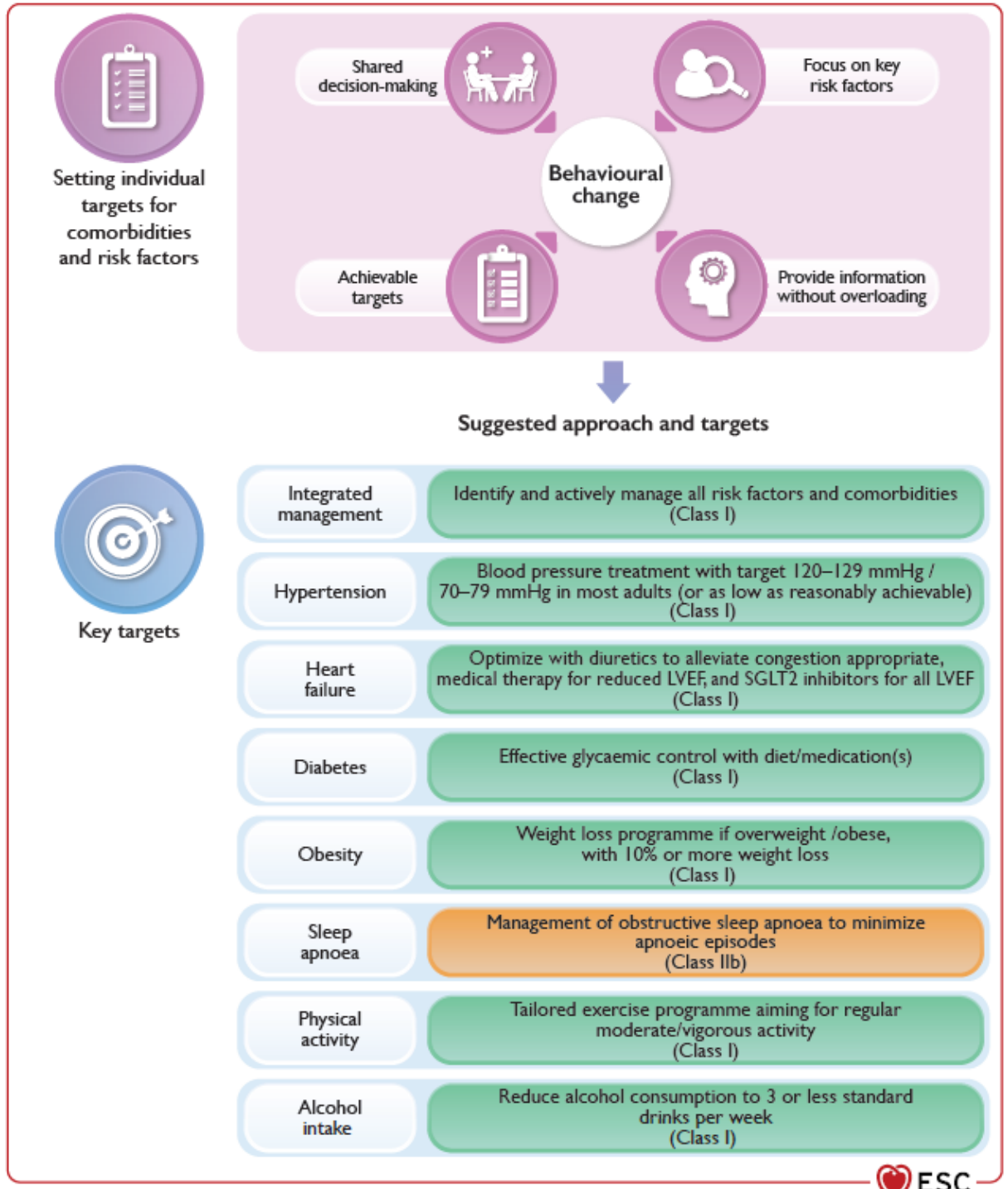






Ablation in Persistant AF ?

Durée follow-up



PREVEntion and regReSsive Effect of weight-loss and risk factor modification on Atrial Fibrillation: the REVERSE-AF study

Melissa E. Middeldorp[1†], Rajeev K. Pathak[1†], Megan Meredith[1], Abhinav B. Mehta[2], Adrian D. Elliott[1], Rajiv Mahajan[1], Darragh Twomey[1], Celine Gallagher[1], Jeroen M. L. Hendriks[1], Dominik Linz[1], R. Doug McEvoy[3], Walter P. Abhayaratna[4], Jonathan M. Kalman[5], Dennis H. Lau[1], and Prashanthan Sanders[1*]

- 2018

Table 2 Weight loss

Risk factors	<3% WL Group 1; *n* = 116			3–9% WL Group 2; *n* = 104			≥10% WL Group 3; *n* = 135			*P*-value[†]
	Baseline	Follow-up[a]	*P*-value*	Baseline	Follow-up[a]	*P*-value*	Baseline	Follow-up[a]	*P*-value*	
BMI (kg/m^2)	33.0 ± 4.9	33.5 ± 5.3	<0.001	32.7 ± 4.4	30.8 ± 4.2	<0.001	33.7 ± 4.7	28.4 ± 4.0	<0.001	<0.001
Mean SBP (mmHg)	146 ± 17	139 ± 15	<0.001	144 ± 17	134 ± 14	<0.001	147 ± 17	129 ± 12	<0.001	<0.001
Medication use										
Mean no. of anti-HTN, *n*	0.8 ± 1.0	1.0 ± 0.7	0.01	0.7 ± 0.8	0.7 ± 0.6	0.74	1.0 ± 0.9	0.5 ± 0.6	<0.001	<0.001
Mean no. of AAD, *n*	0.8 ± 0.8	0.4 ± 0.6	<0.001	1.0 ± 0.7	0.5 ± 0.6	<0.001	1.1 ± 0.7	0.1 ± 0.4	<0.001	<0.001
AF type, *n* (%)										
Paroxysmal AF	61 (53)	–		62 (60)	–		73 (54)	–		0.55
Persistent AF	55 (47)	–		42 (40)	–		62 (46)	–		
Paroxysmal to persistent AF	–	48 (41)		–	33 (32)		–	4 (3)		<0.001
Persistent to paroxysmal AF	–	1 (1)		–	18 (17)		–	49 (36)		
No change in AF type	–	37 (32)		–	20 (19)		–	12 (9)		
No AF	–	30 (25)		–	33 (32)		–	70 (52)		
Last AF episode duration										
Paroxysmal AF 48 h, *n* (%)	20 (17)	1 (1)		13 (14)	5 (5)		21 (15)	21 (15)		<0.001
Δ to <1 week		19 (16)			8 (8)		–	0 (0)		
<1 week, *n* (%)	41 (35)	38 (33)		49 (47)	15 (14)		52 (39)	8 (6)		
Δ to 48 h, *n* (%)		3 (3)			34 (33)		–	44 (33)		
Persistent AF >1 week, *n* (%)	40 (34)	21 (18)		36 (34)	15 (14)		49 (36)	39 (29)		
Δ to >3 months, *n* (%)		19 (16)			21 (20)		–	10 (7)		
>3 months, *n* (%)	15 (13)	12 (10)		5 (5)	1 (1)		13 (10)	0 (0)		
Δ to >1 week, *n* (%)		3 (3)			4 (4)		–	13 (10)		
Total AF freedom and ablation										
Total freedom from AF	–	45 (39)		–	69 (67)		–	116 (86)		<0.001
No AF ablation	–	5 (13)		–	15 (22)		–	53 (45.5		0.001
Single AF ablation	–	15 (34		–	32 (46		–	44 (37.5)		0.8
Multiple AF ablation	–	25 (53)		–	22 (32)		–	19 (17)		0.007

AAD, anti-arrhythmic drug; AF, atrial fibrillation; BMI, body mass index; HTN, hypertension; SBP, systolic blood pressure; WL, weight loss.
[a]Median follow-up 48.3 ± 18.4, 46.0 ± 16.7, and 48.4 ± 18.2 months, respectively.
**P*-value refers to within group differences (baseline to follow-up).
[†]*P*-value refers to difference between groups over time (group–time interaction).

Prevention and Treatment of Atrial Fibrillation via Risk Factor Modification

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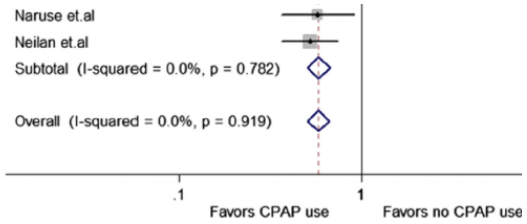

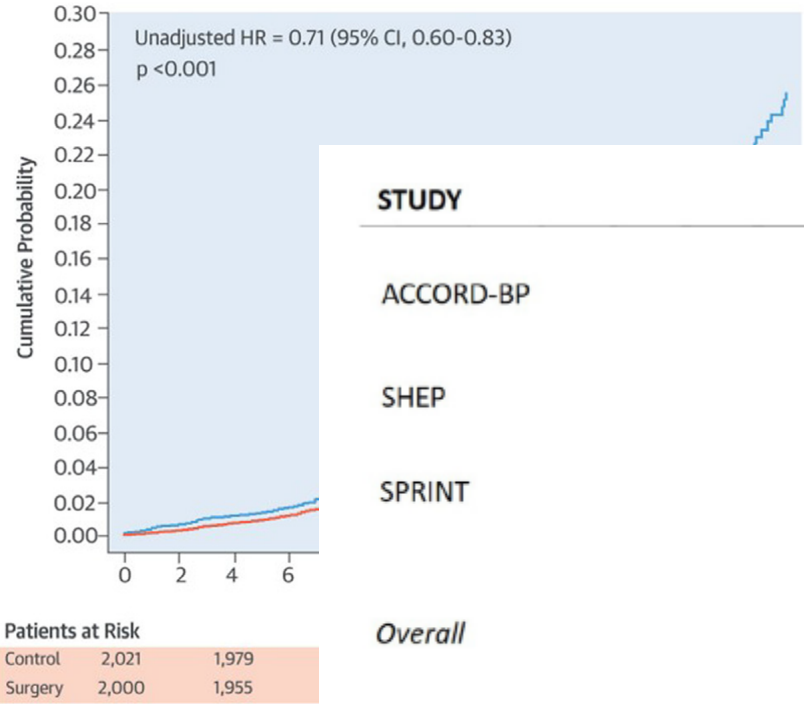

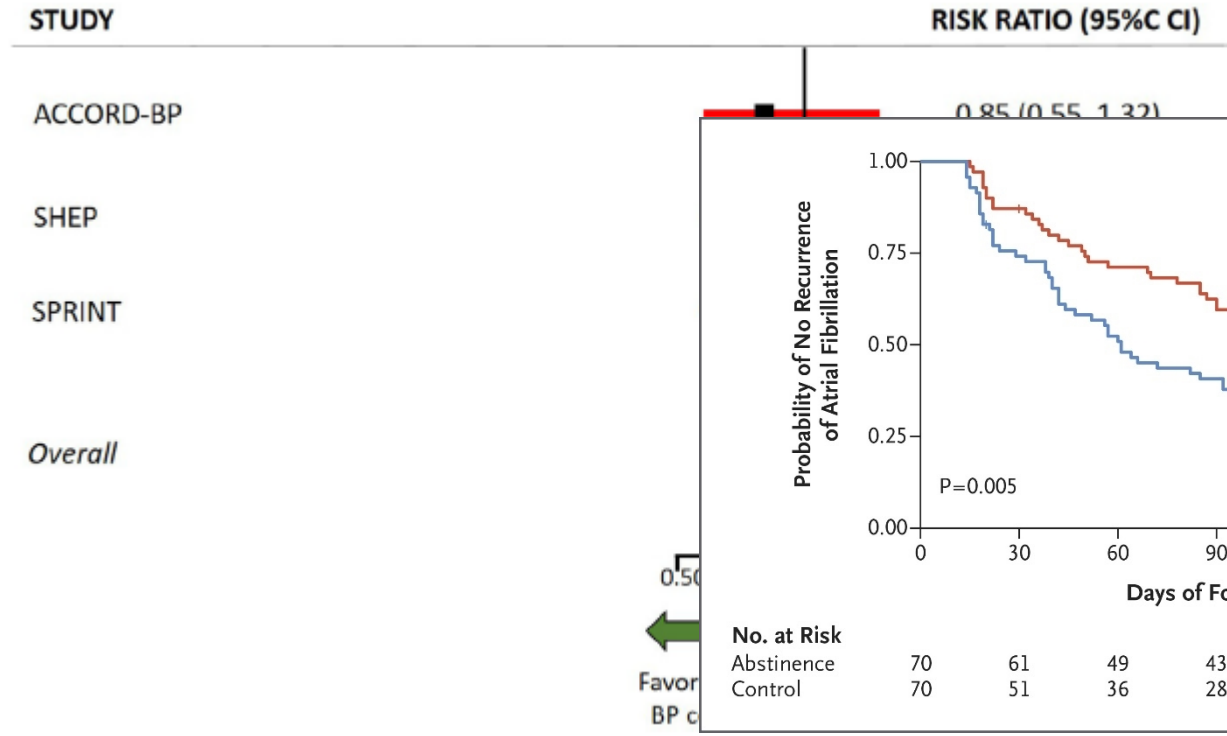

Alcohol Abstinence in Drinkers with Atrial Fibrillation

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