XIII CONGRESO INTERNACIONAL DE CARDIOLOGIA

CARDIOLOGIA INTERVENCIONISTA - LII JORNADA ACCI-SOLACI

DE LA

PREVENCIÓN

A LA **INTERVENCIÓN**

8, 9 y 10 de octubre

Lugar:

INTERCONTINENTAL
SAN JOSÉ, COSTA RICA

Organiza:

ASOCAR
Asociación Costarricense de Cardiología

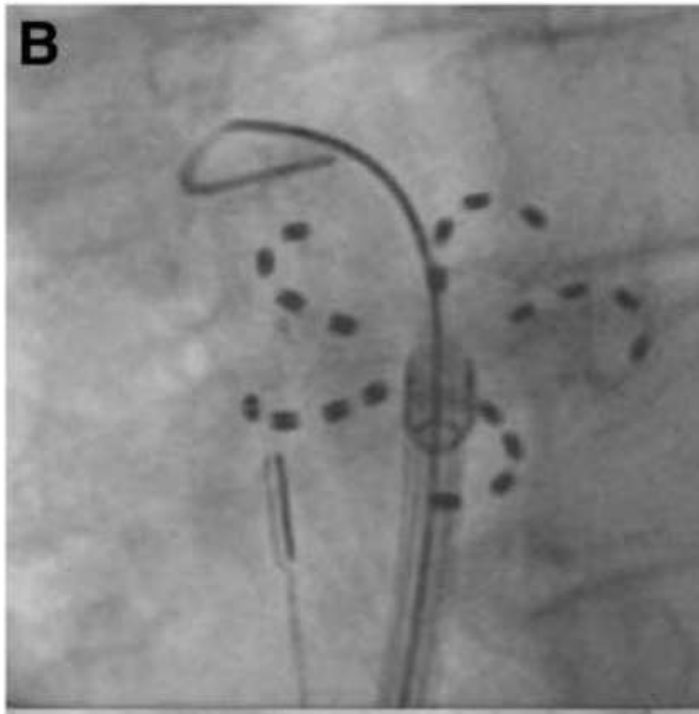
ASOCAR
Capítulo de Enfermería

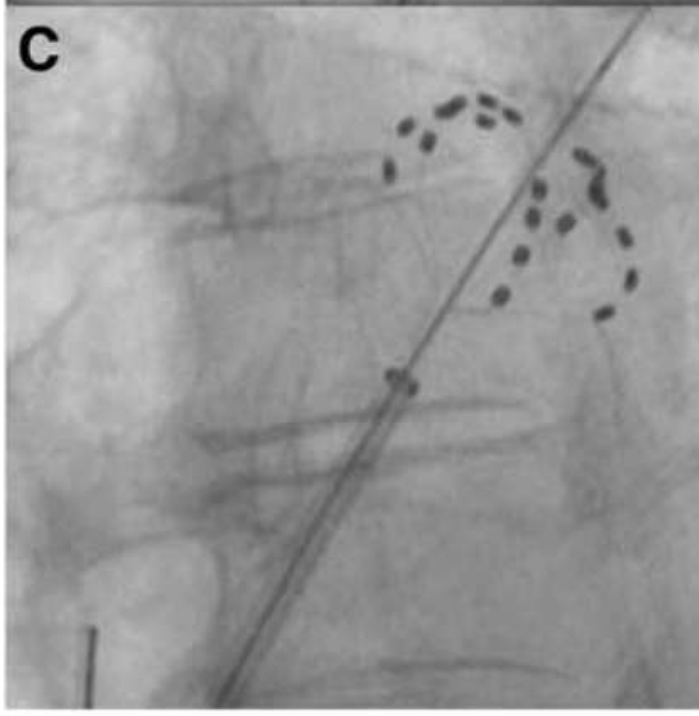
ACCI

JORNADAS SOLACI

Ablación de fibrilación auricular: dos caminos al mismo objetivo.

Energía pulsada.





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Servicio de Cardiología, Hospital R.A. Calderón Guardia.

Profesor Instructor de Medicina - Escuela de Medicina.
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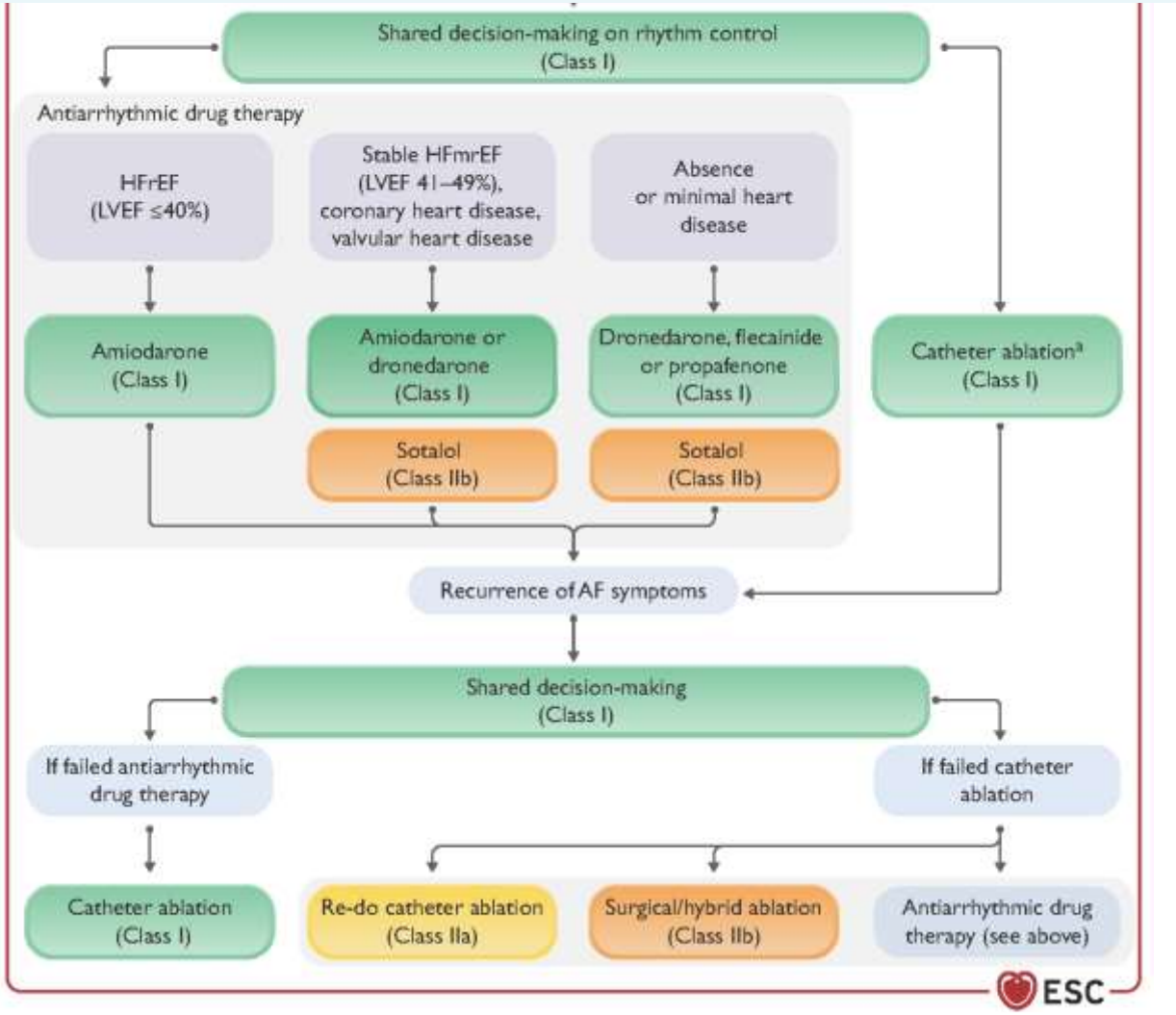
Eur H J, Vol 45; 36, 21 Sep 2024, 3314–3414
Eur H J, Vol 41; 5, 1 Feb 2020, 655–720

Ablación es el pilar para el control arrítmico.

1. La terapia de ablación es hoy el pilar del tratamiento de la fibrilación auricular.
2. La ablación permite una alta tasa de curación, menor tasa de recurrencias, mejor calidad de vida y una menor mortalidad.
3. La evolución tecnológica dispone de herramientas que mejoran la eficacia y seguridad de la terapia de ablación.



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Principios bioelectroquímicos

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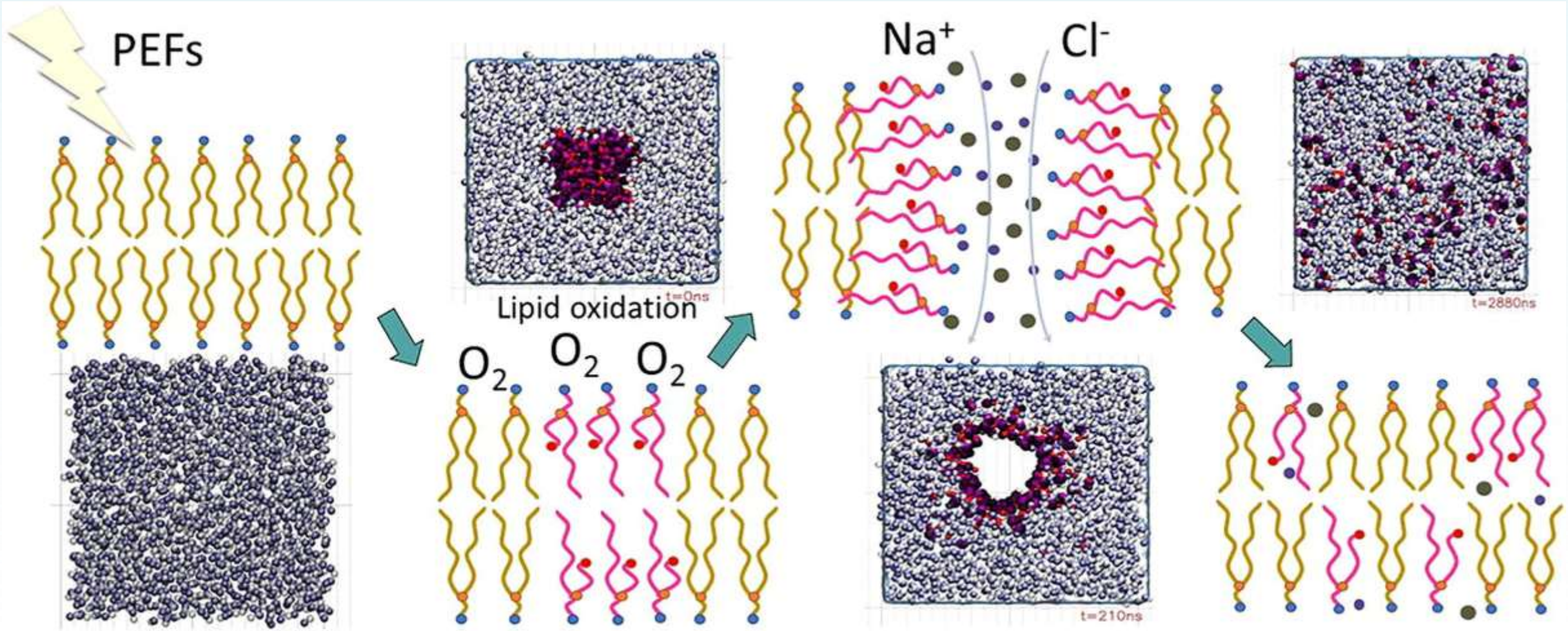
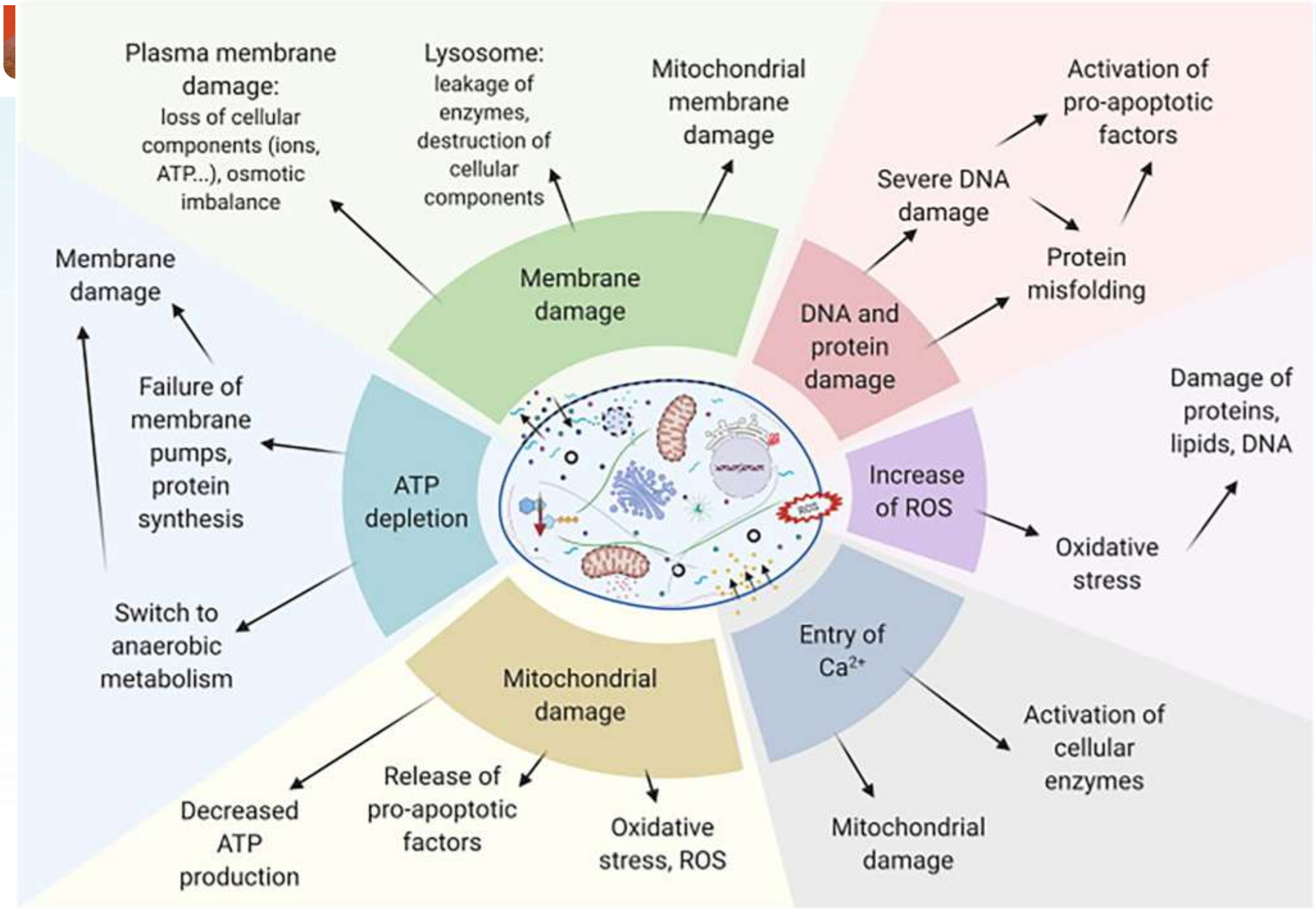
Bioelectrochemistry. 2021;141:107869

Pulse electrical field



Mecanismos de lesión: formación de nanoporos, desestabilización de lípidos y proteínas de membrana.


Plasma membrane damage:
loss of cellular components (ions, ATP...), osmotic imbalance
Lysosome:
leakage of enzymes, destruction of cellular components
Mitochondrial membrane damage
Membrane damage
Membrane damage
Failure of membrane pumps, protein synthesis
Switch to anaerobic metabolism
ATP depletion
Activation of pro-apoptotic factors
Severe DNA damage
Protein misfolding
DNA and protein damage
Damage of proteins, lipids, DNA
Increase of ROS
Oxidative stress
Entry of Ca^{2+}
Activation of cellular enzymes
Mitochondrial damage
Mitochondrial damage
Decreased ATP production
Release of pro-apoptotic factors
Oxidative stress, ROS

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Parámetros de onda

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Heart Rhythm 2019;16:1112–1120

Parámetros clave de entrega de energía

Voltaje: ideal entre 400–1,200 V/cm.

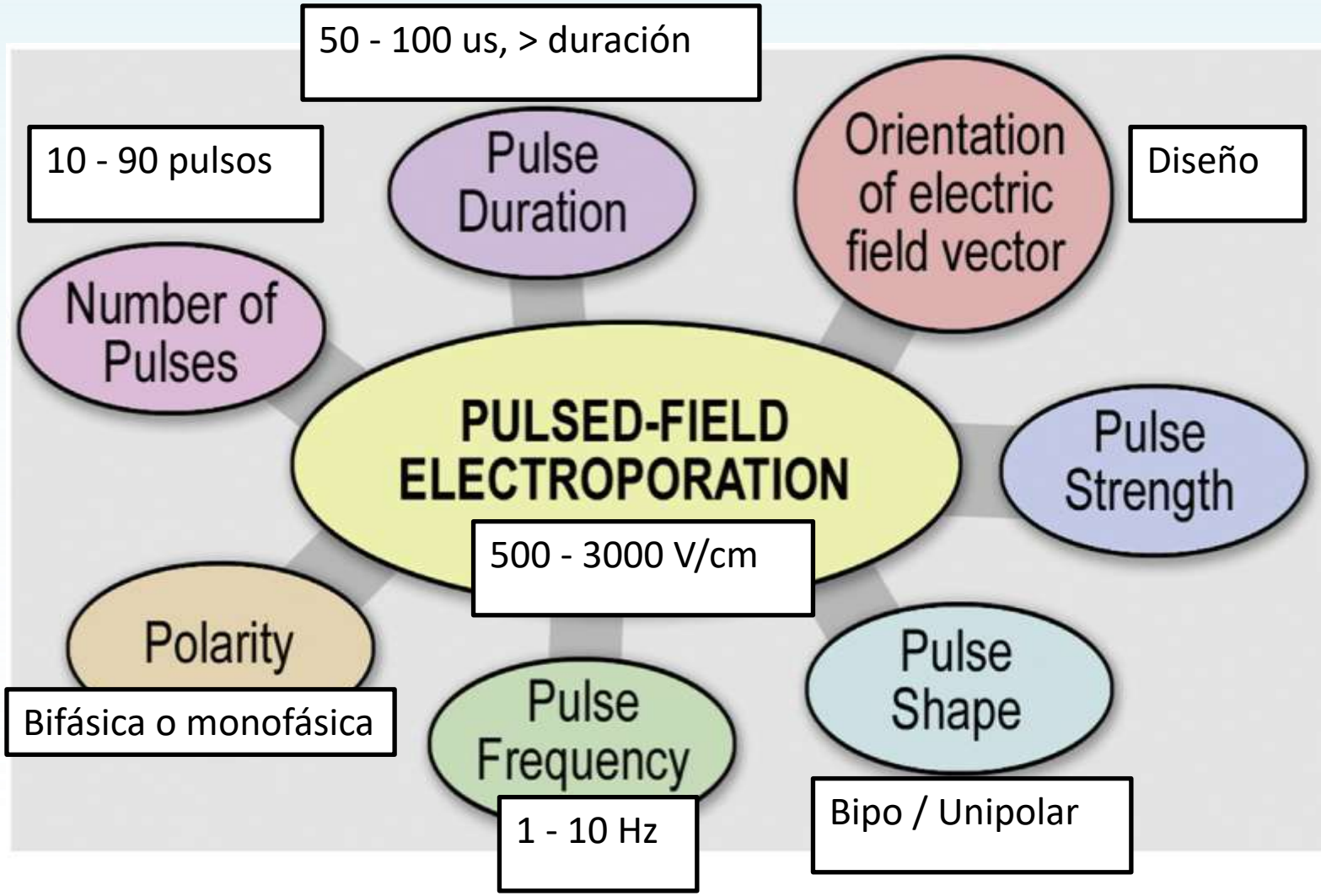
Duración de pulso: pulsos más largos → menor voltaje, pero riesgo de captura muscular.

Forma de onda:
- **Bifásica** → mayor seguridad y durabilidad de la lesión, menos contracción muscular.
- **Monofásica** → más captura muscular y dolor.

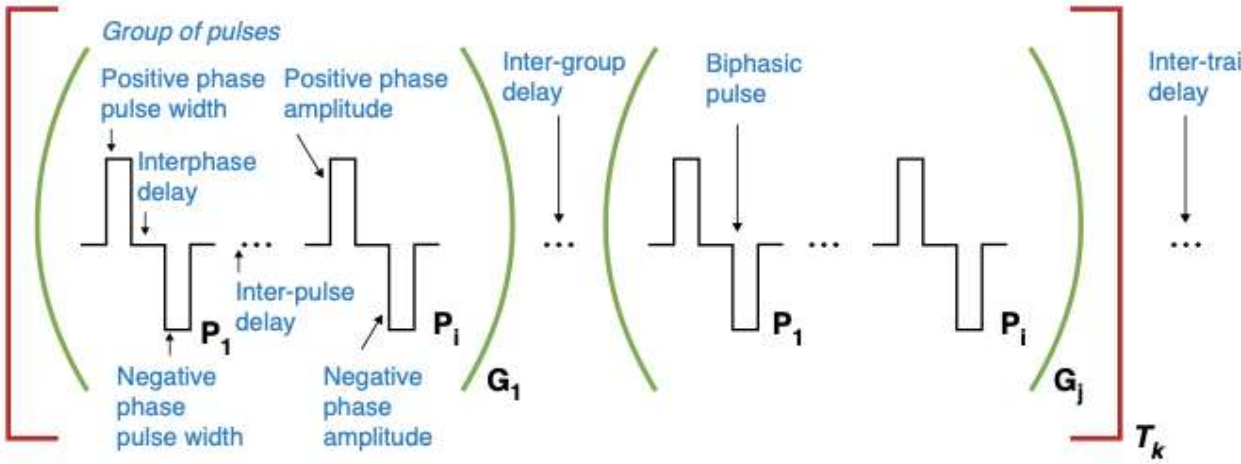
Modo de entrega:
- **Bipolar** → campo localizado y menos dolor, adecuado para endocardio.
- **Unipolar** → lesiones profundas, más contracción muscular.

Repetición de pulsos: sumar aplicaciones aumenta profundidad.

Contacto tisular: mejora la transmisión de energía, es menos dependiente que RF.



Train of biphasic pulses



Gi - Group of pulses: Pi number of pulses in a burst/packet delivered between two different splines or segments of catheter

Inter group delay: time between bursts/packets of pulses, e.g. between different splines or segments of catheter

T_k - Train of biphasic pulses: delivered to various segments of the catheter—complete delivery in one position of the catheter (also number of PFA deliveries)

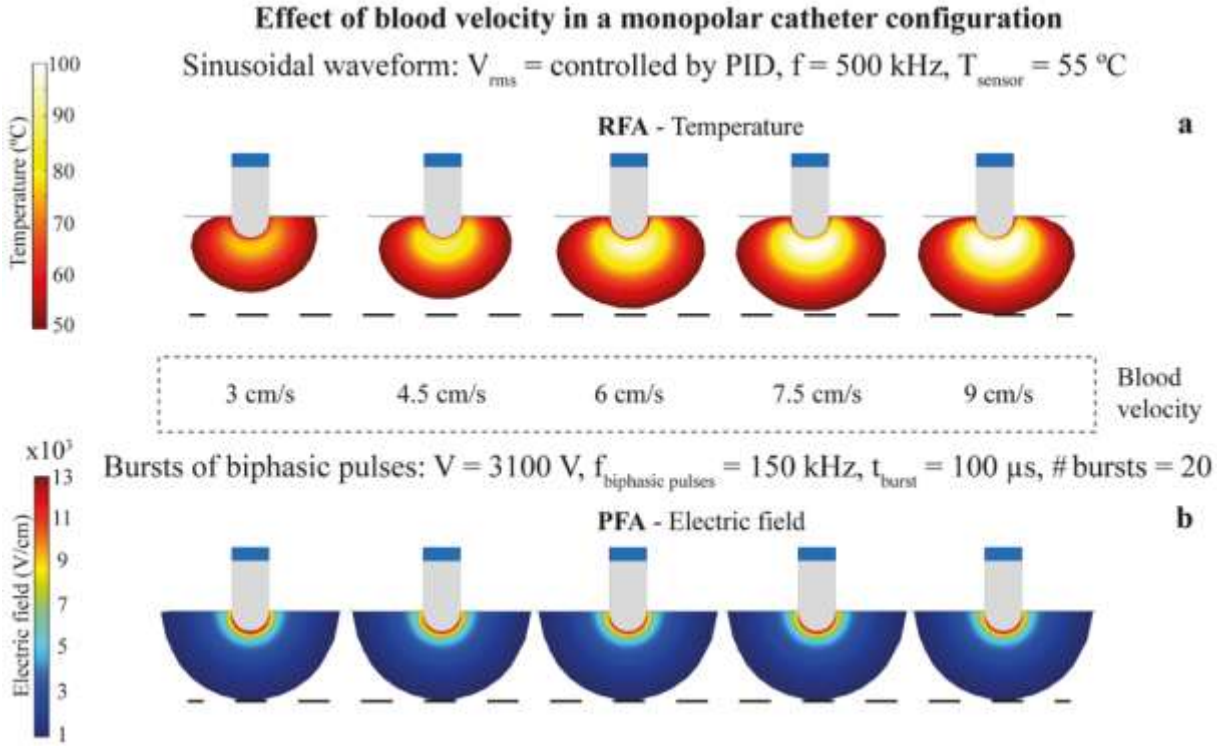
Inter-train delay: delivery of train of pulses to the same or different/new position of the catheter (time between PFA deliveries)

Pulse parameter	Subject to operators choice	Lesion size/ effectivenes	Nerve and muscle caption	Temperature rise	Risks*
Amplitude (V)	(+)	+	+	+	+
Duration/pulse width (μs)	–	+	+	+	+
Group/number of pulses (–)	–	+	+	+	+
Burst/packet (ms)**	–	(±)	(±)	+	(±)
Pause/time between packets (ms)	–	(±)	(±)	–	–
Number of trains—T_k (–)	+	+	+	+	–
Time between trains (s)	(+)	–	–	–	–

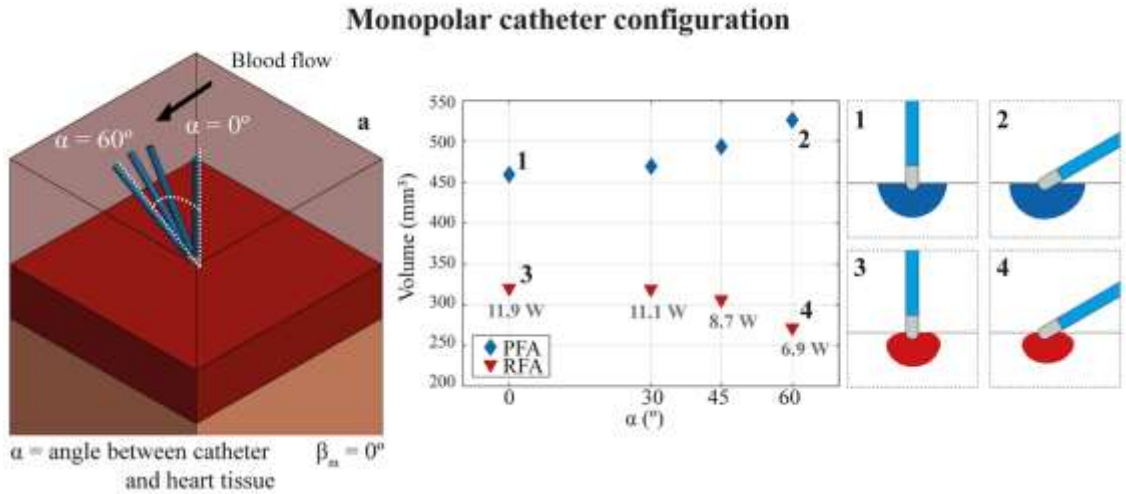
https://doi.org/10.1038/s41598-022-20212-9

PFA vs ablación térmica

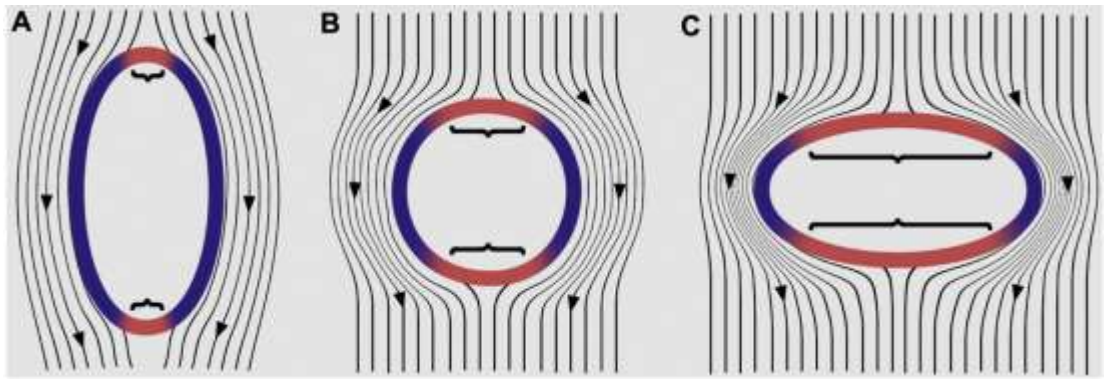
Efecto del flujo sanguíneo



Efecto de la angulación con el tejido



Efecto de la orientación del campo eléctrico



https://doi.org/10.1038/s41598-022-20212-9

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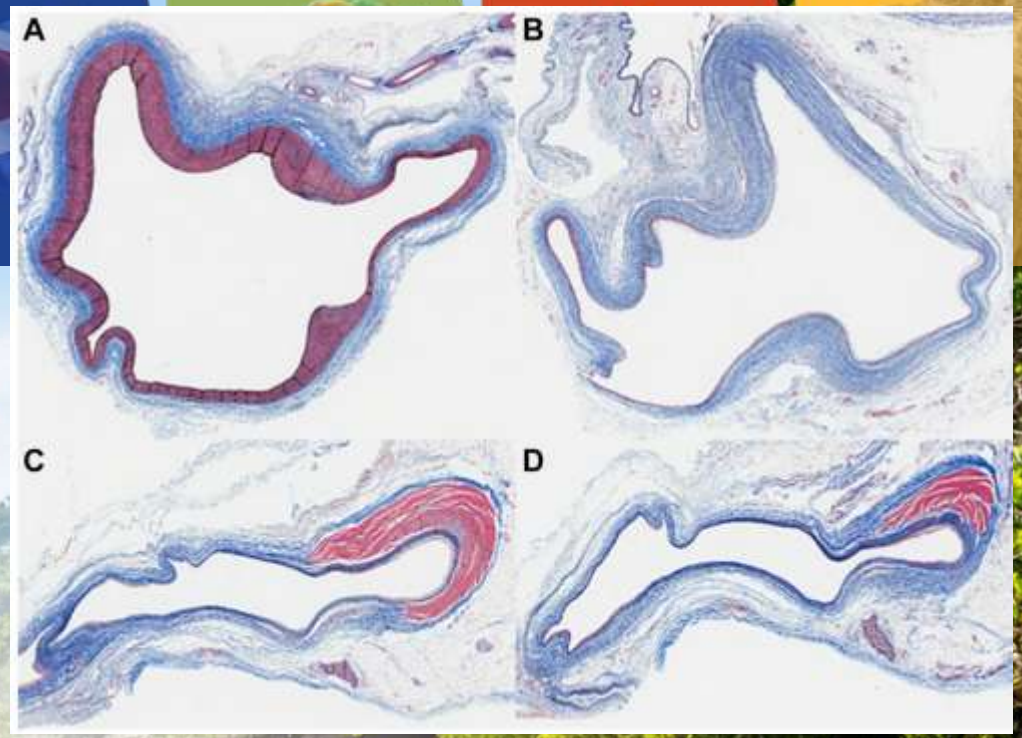

Anatomía de la lesión

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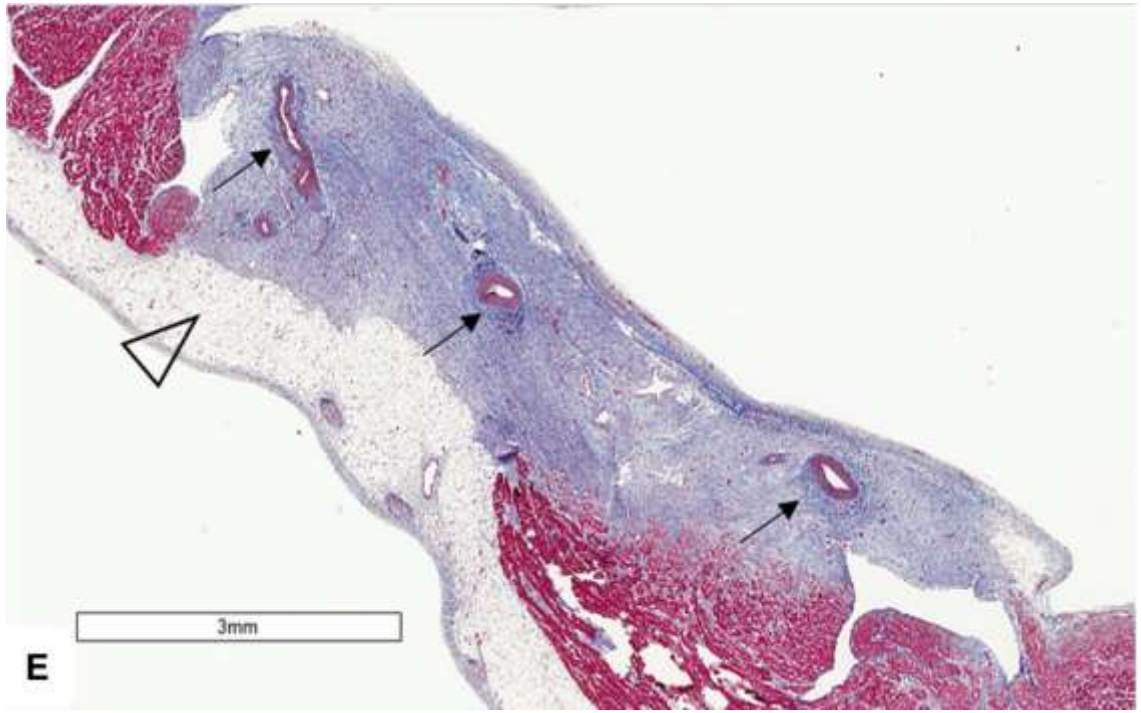
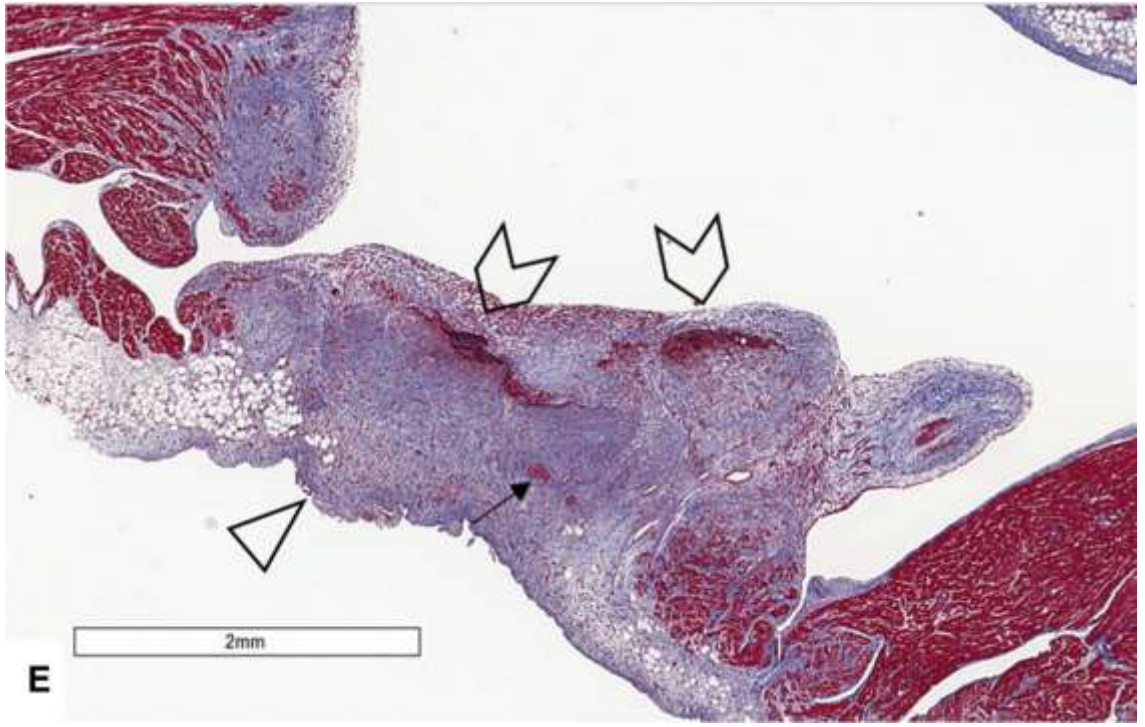
PFA vs ablación térmica

PFA



Respeta grasa epicárdica y arterias.

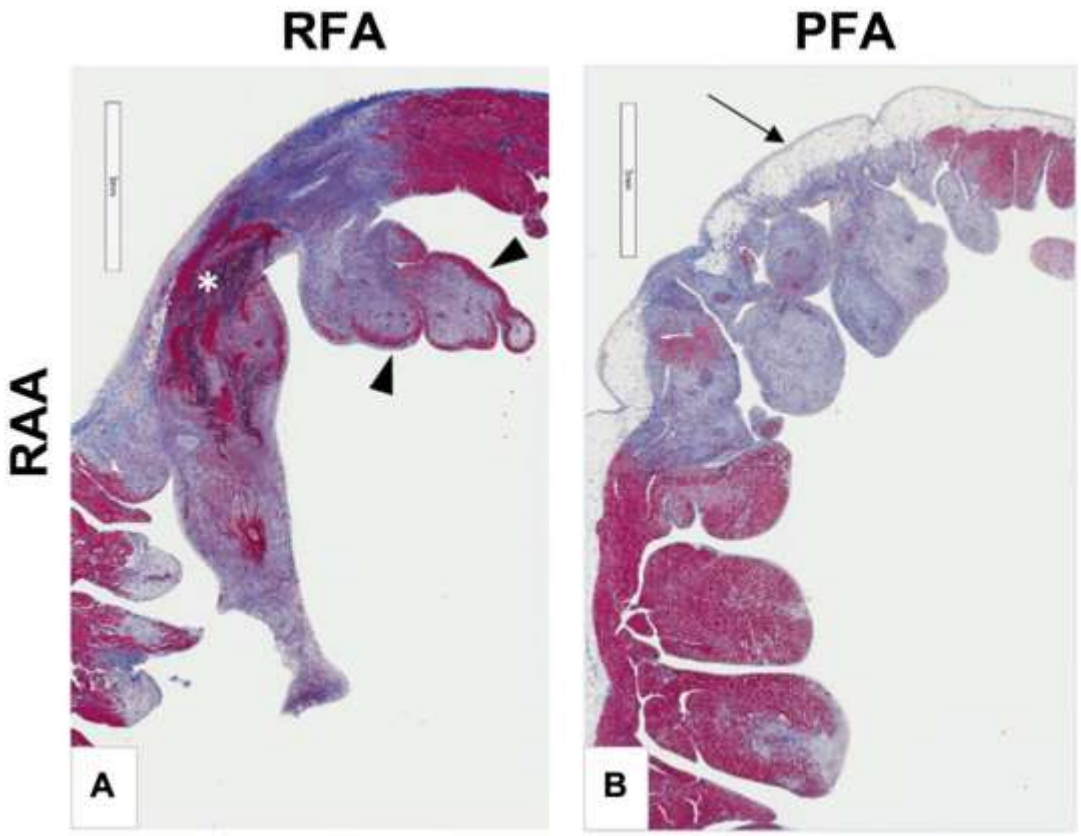
RF



Esfacelación de grasa epicárdica con inflamación.
Trombosis intralesional de arterias
Sustitución fibrótica inicial con focos de hemorragia.

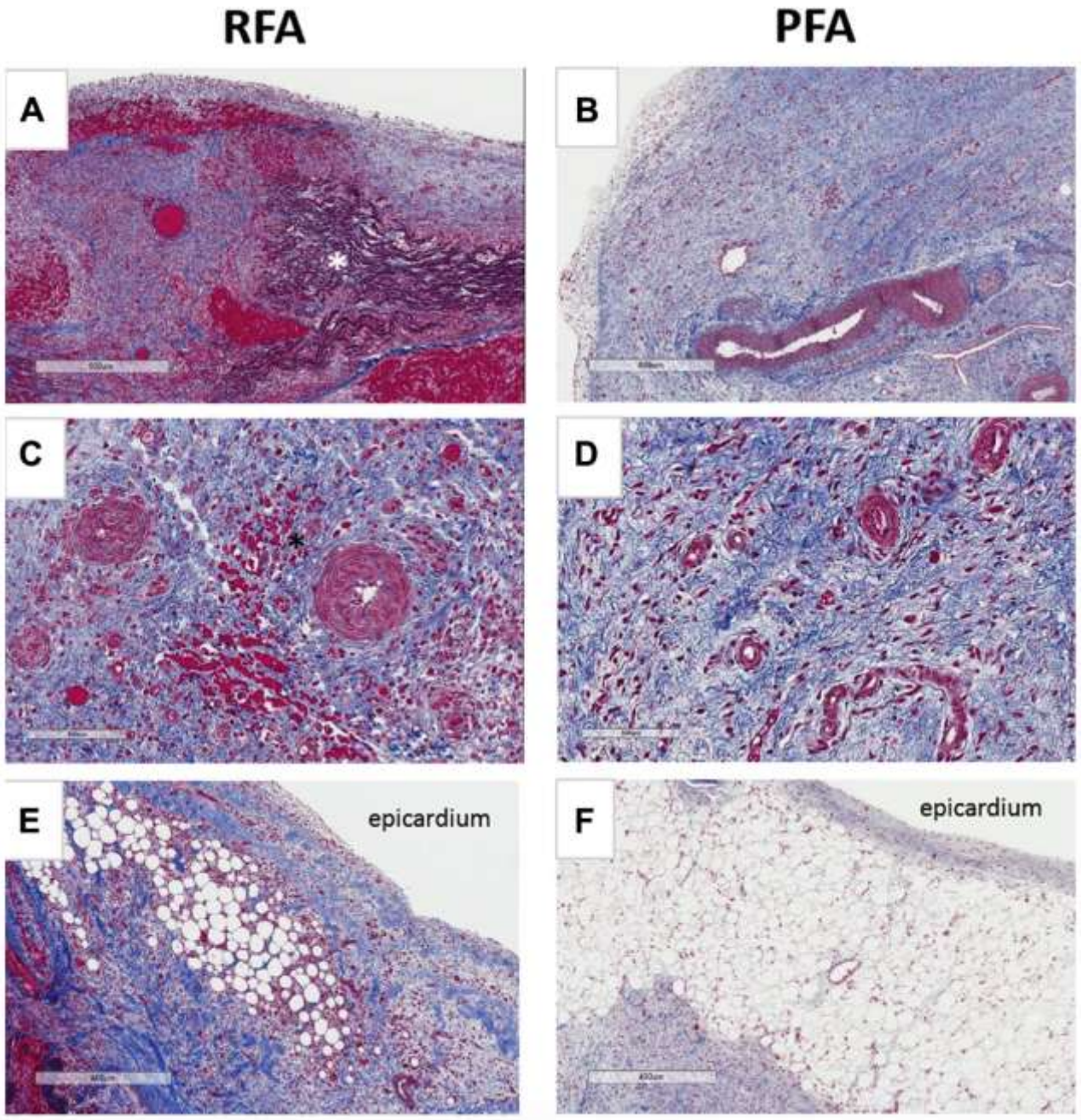
Heart Rhythm 2019;16:754–764

PFA vs ablación térmica



RF produce **necrosis** térmica con posibilidad **fibrosis heterogénea** o “islas” de miocitos viables (“sequesters”).

PFA tiene alta **selectividad** para **miocardio**: preserva grasa, vasos, nervios y estructuras no cardiacas. El campo eléctrico afecta miocitos incluso con **contacto irregular**.



Heart Rhythm 2019;16:754–764

Dr. Melvin Scheinman: 40th Anniversary of Catheter Ablation

44 años

Forty years ago, patients with abnormal heart rhythms had few treatment options: frequently ineffective medications, or open-heart surgery.

Dr. Melvin Scheinman
Photo credit: Marco Sanchez, UCSF

UCSF cardiac electrophysiologist Melvin Scheinman, MD, now the *Walter H. Shorenstein Endowed Chair in Cardiology,* spent years developing a new approach. In 1981 he performed the first catheter ablation in humans, threading a catheter through a blood vessel into the heart and successfully delivering an electric shock to short-circuit the arrhythmia. That innovation has revolutionized the care of millions of patients worldwide, relieving their suffering and even curing many of their arrhythmias.

"Dr. Scheinman's contribution to the field has been one of the most transformative in all of electrophysiology," said Jeffrey Olgin, MD, Ernest Gallo-Kanu Chatterjee Distinguished Professor in Clinical Cardiology and chief of the UCSF Division of Cardiology.

Treating Arrhythmias without Surgery

Dr. Scheinman arrived at UCSF in 1965 as a cardiology fellow, drawn by exciting research underway at the Cardiovascular Research Institute, as well as the chance to work with leaders such as electrocardiographer Maurice Sokolow, MD, chief of the Division of Cardiology, and Lloyd Hollingsworth "Holly" Smith, Jr., MD, legendary chair of the Department of Medicine.

After fellowship, Dr. Scheinman joined the UCSF faculty, and founded the Coronary Care Unit (CCU) at San Francisco General Hospital (SFGH). That experience fueled his fascination with heart rhythm disorders. In the mid-1970s, he spent a sabbatical year at Duke University working with cardiac electrophysiologists Harold Strauss, MD, and John Gallagher, MD. "I learned about fundamental electrophysiology, and how to do mapping of heart rhythm disorders in humans," said Dr. Scheinman.

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Protocolo de trabajo

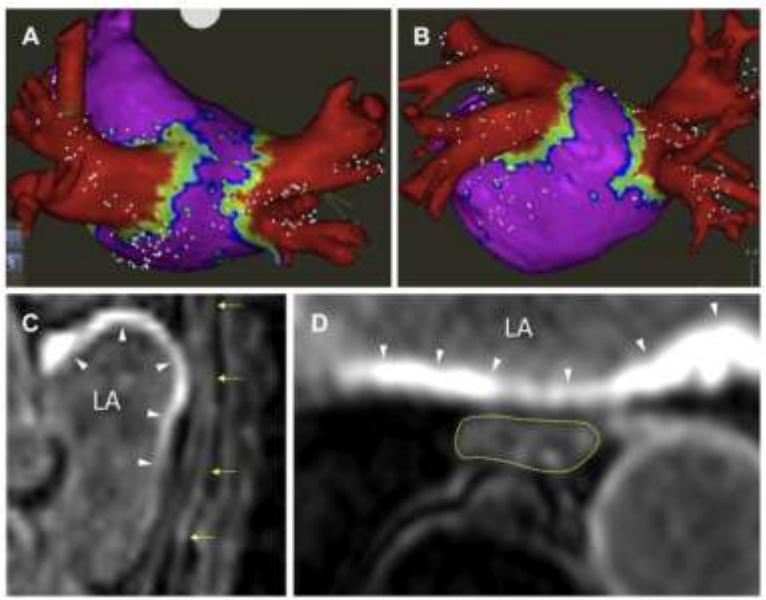
Organiza: ASOCAR Asociación Costarricense de Cardiología · ASOCAR Capítulo de Enfermería · ACCI · JORNADAS SOLACI

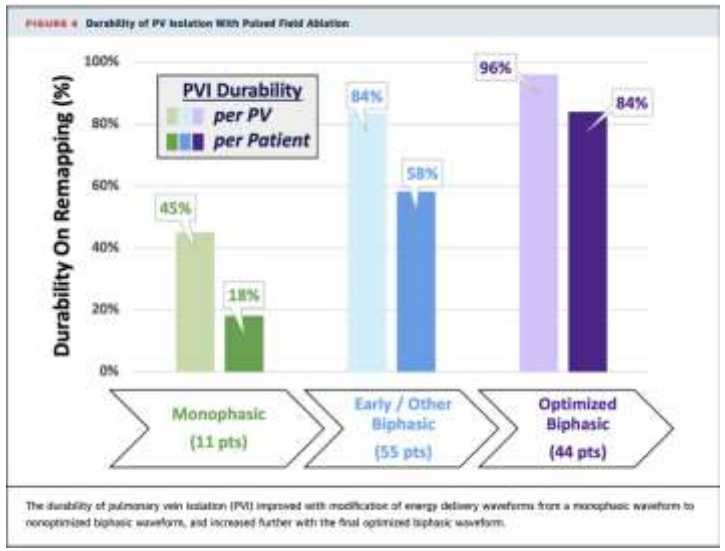
Pulsed Field Ablation of Paroxysmal Atrial Fibrillation

1-Year Outcomes of IMPULSE, PEFCAT, and PEFCAT II

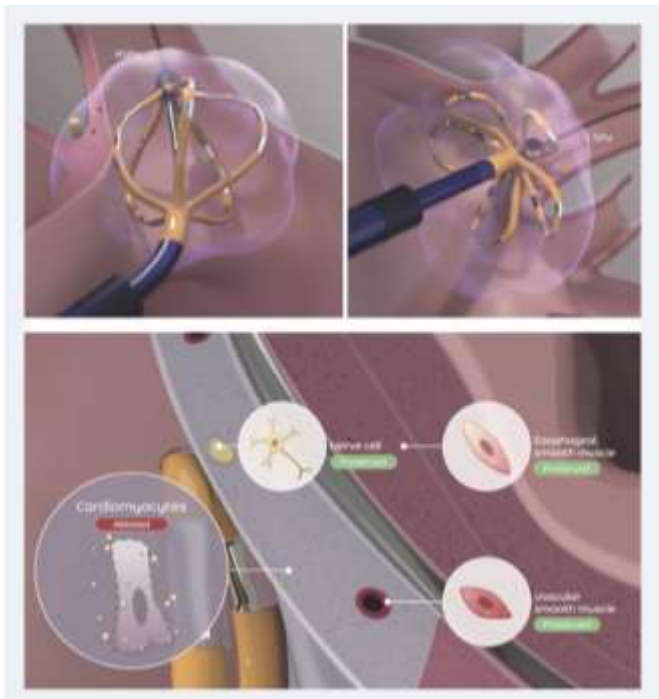
TABLE 2 Procedural Characteristics

	Total Cohort (N = 121)*	Monophasic PF Waveform (n = 15)	Biphasic PF Waveforms	
			Early/Other (n = 57)	Optimized (n = 49)
PVI success	475/475 (100)	57/57 (100)	223/223 (100)	195/195 (100)
Number of lesions/PV				
Combined PVs	7.2 ± 2.2	3.3 ± 0.5	6.9 ± 1.6	8.7 ± 1.5
LCPV	12.9 ± 6.1	6.3 ± 0.6	10.2 ± 2.5	18.5 ± 4.7
LSPV	7.3 ± 2.4	3.0 ± 0.0	7.1 ± 2.0	8.6 ± 1.7
LIPV	6.9 ± 2.2	3.0 ± 0.0	6.5 ± 1.5	8.5 ± 1.6
RSPV	7.2 ± 2.4	3.4 ± 1.1	7.1 ± 2.1	8.5 ± 1.6
RIPV	6.9 ± 2.5	3.0 ± 0.0	6.5 ± 2.1	8.6 ± 1.6
Procedure time, min	96.2 ± 30.3	84.1 ± 13.1	98.4 ± 34.0	97.2 ± 29.1
Mapping time, min	19.3 ± 12.0	23.6 ± 10.0	17.9 ± 11.0	19.0 ± 13.5
Catheter dwell time, min*	34.4 ± 15.8	27.3 ± 4.1	36.8 ± 19.6	33.7 ± 12.2
Fluoroscopy time, min	13.7 ± 7.8	12.2 ± 4.0	14.4 ± 8.8	13.4 ± 7.6
CTI block success	4/4 (100)	–	–	4/4 (100)
Catheter dwell time, min†	8.5 ± 7.7	–	–	8.5 ± 7.7





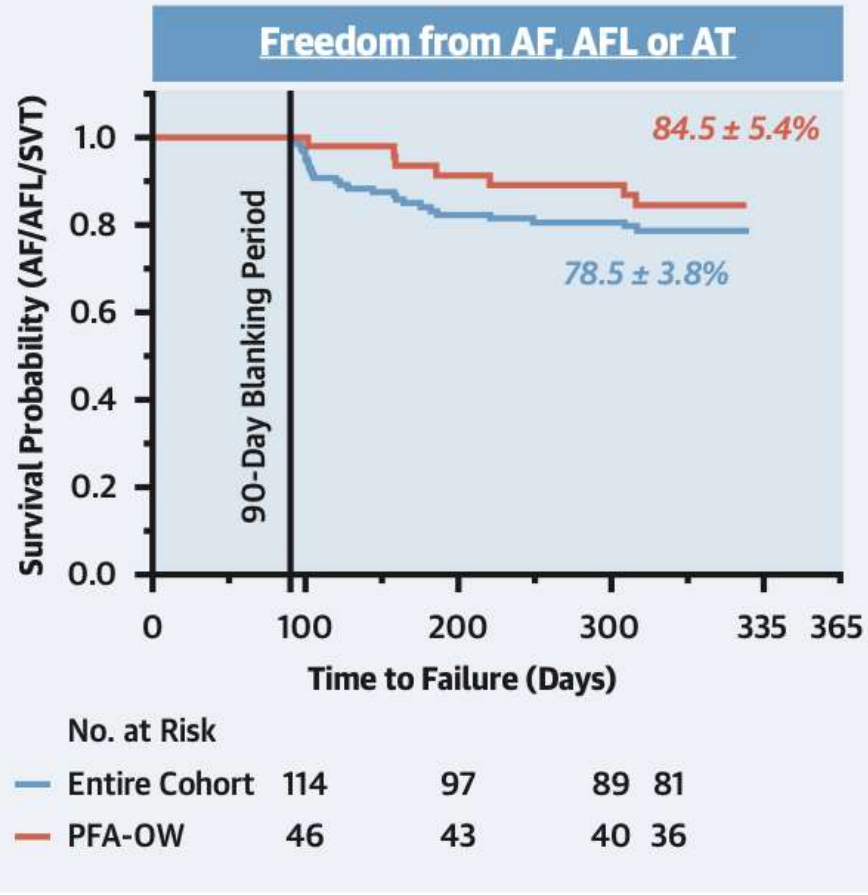
The durability of pulmonary vein isolation (PVI) improved with modification of energy delivery waveforms from a monophasic waveform to nonoptimized biphasic waveform, and increased further with the final optimized biphasic waveform.



Efficacy

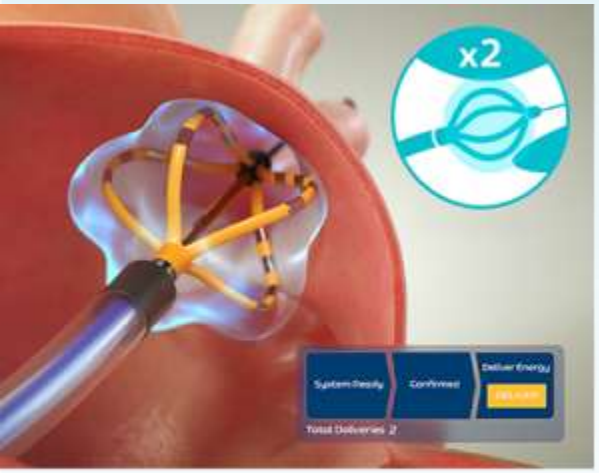
Durability of PV Isolation (Invasive Remapping)

PFA Waveform	Per PV Basis		Per Pt Basis	
	No.%	Durable	No.%	Durable
All	429	84.8%	110	64.5%
PFA-OW	173	96.0%	44	84.1%



JACC: CLINICAL ELECTROPHYSIOLOGY VOL. 7, NO. 5, 2021 MAY 2021:614–27

Catéter + forma de onda + dosis



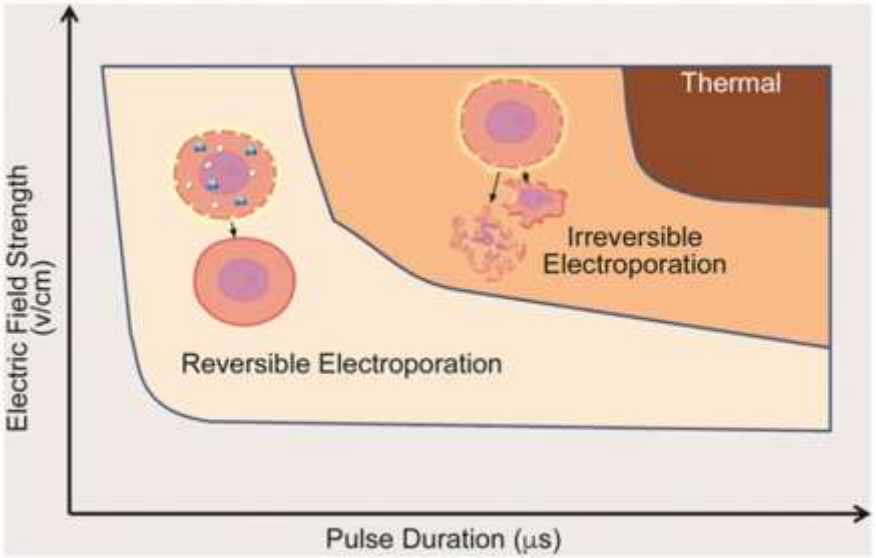
1 Basket position

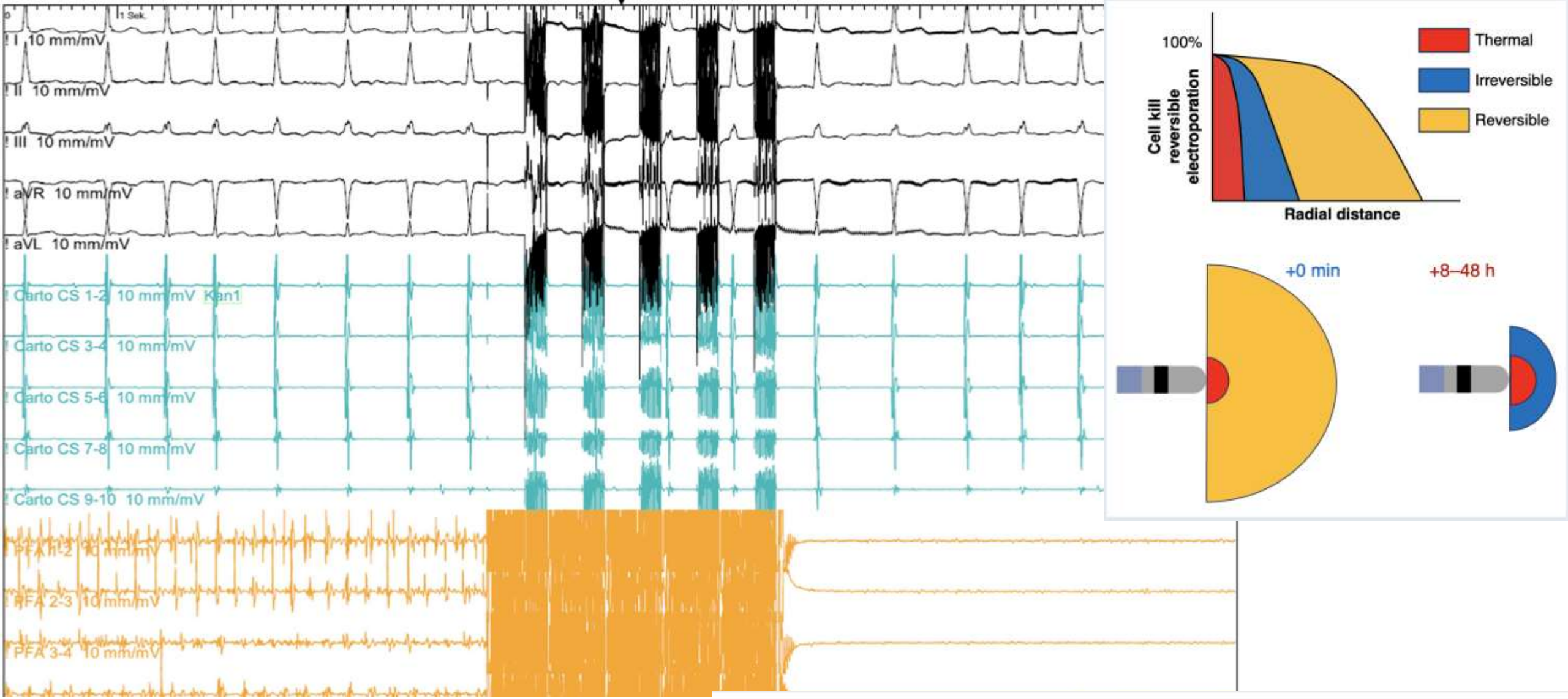
2 Basket position, rotated

3 Flower position

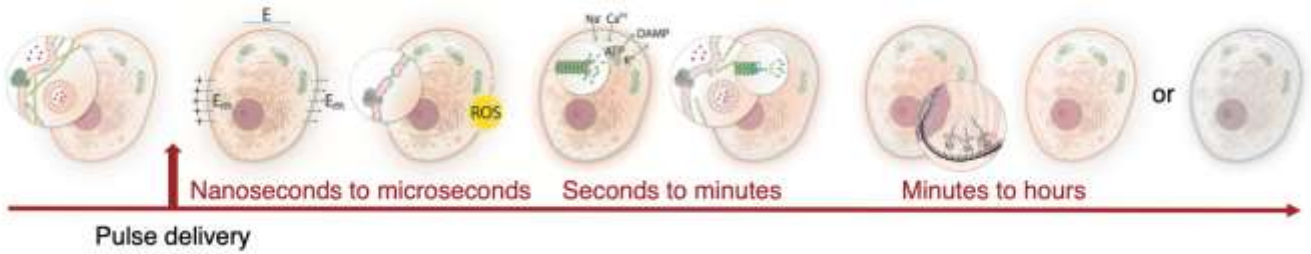
4 Flower position, rotated

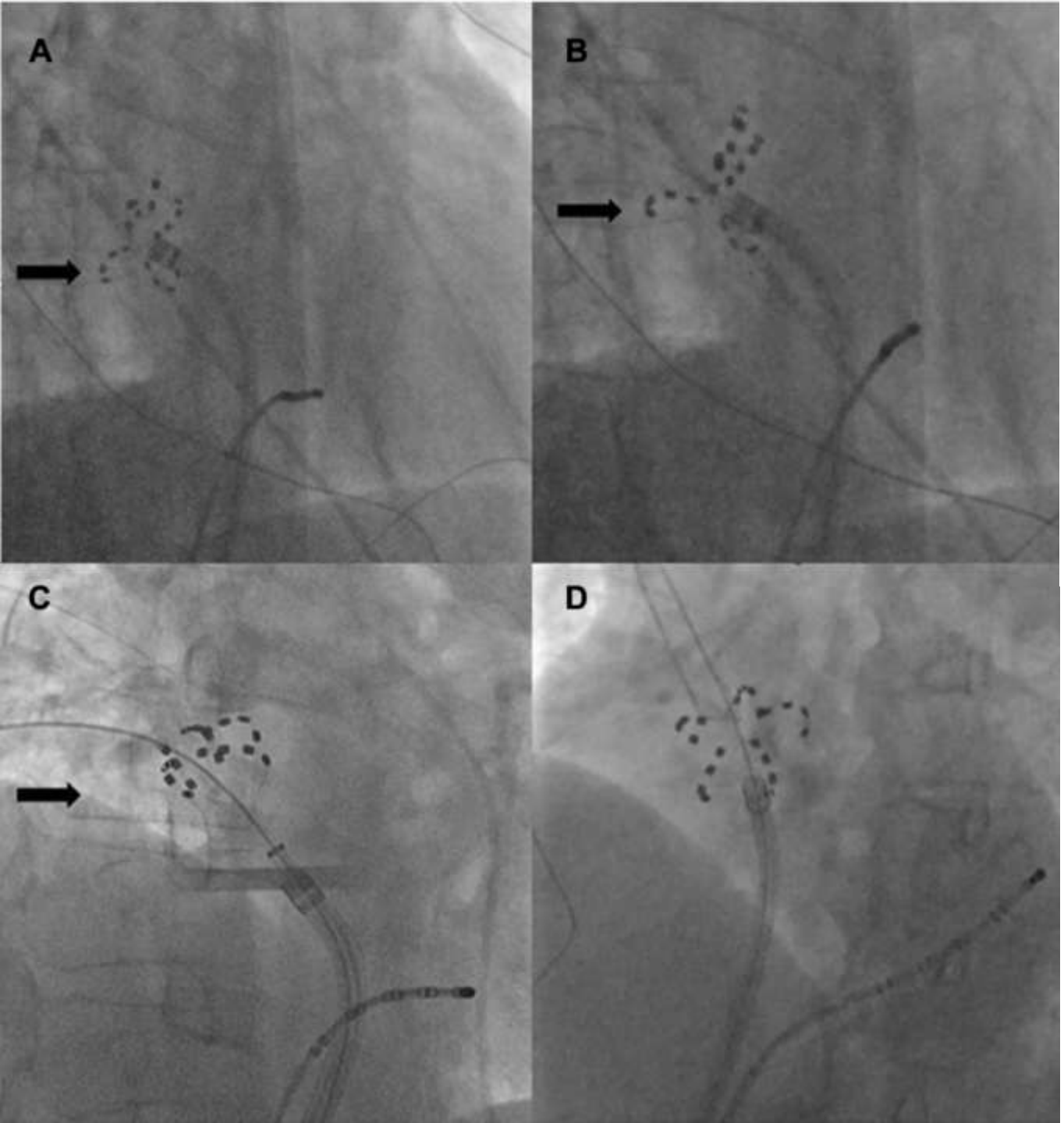
1. **Eficacia.**
2. **Durabilidad de lesión.**
3. **Reproducibilidad.**
4. **Seguridad.**
5. **Versatilidad de uso.**

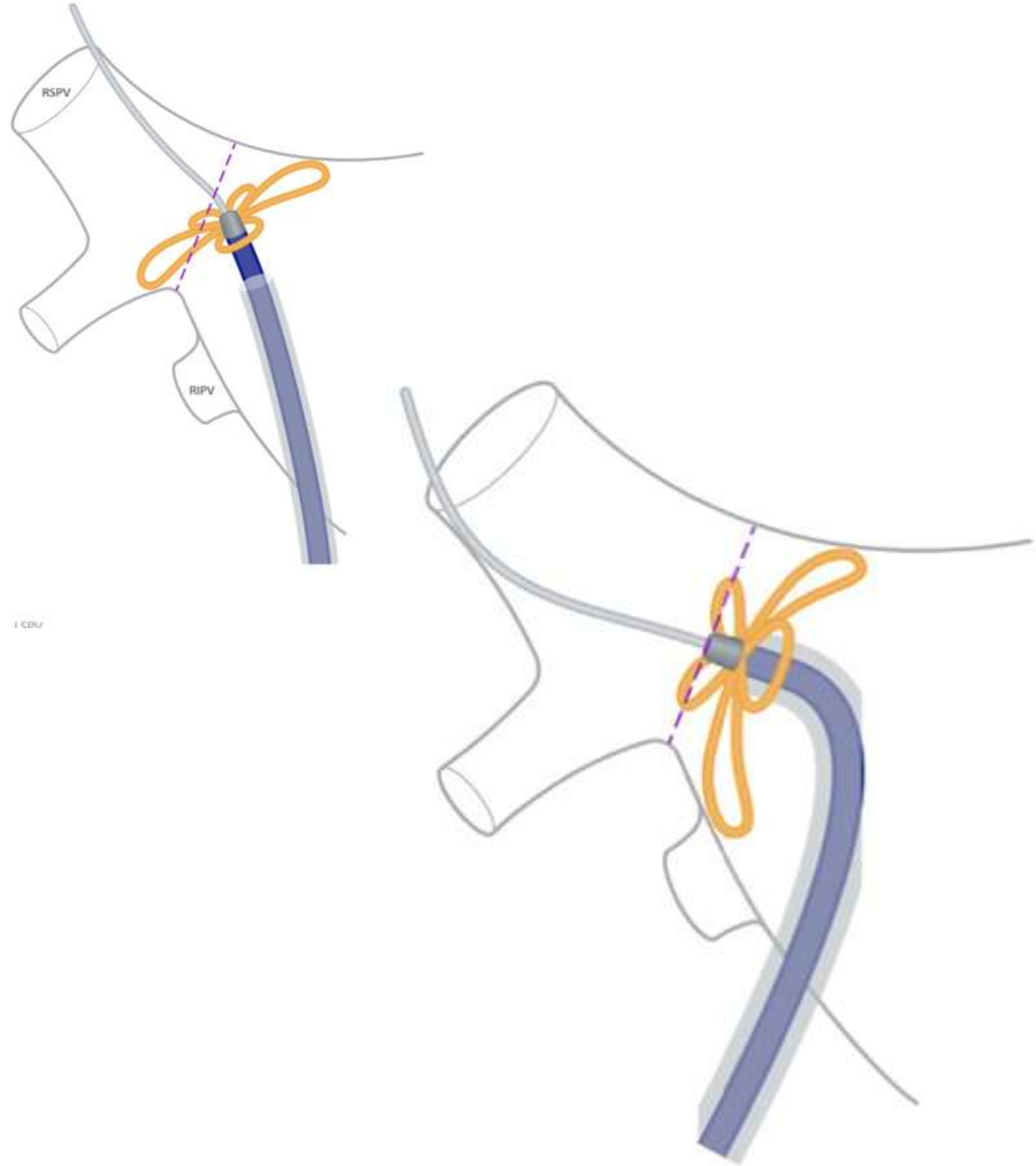


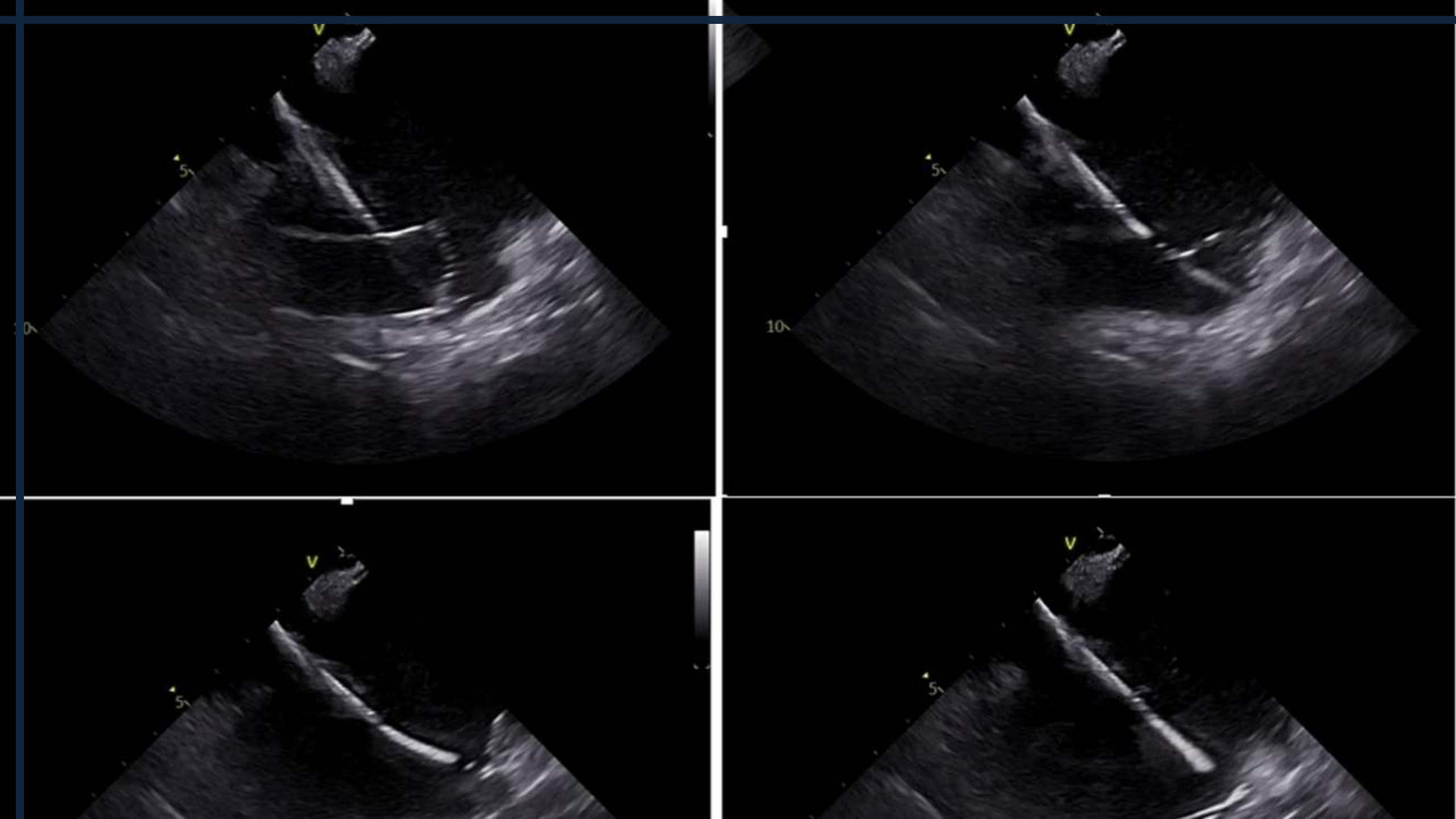

1 Sek.
I 10 mm/mV
II 10 mm/mV
III 10 mm/mV
aVR 10 mm/mV
aVL 10 mm/mV
Carto CS 1-2 10 mm/mV Kan1
Carto CS 3-4 10 mm/mV
Carto CS 5-6 10 mm/mV
Carto CS 7-8 10 mm/mV
Carto CS 9-10 10 mm/mV
PFA 1-2 10 mm/mV
PFA 2-3 10 mm/mV
PFA 3-4 10 mm/mV

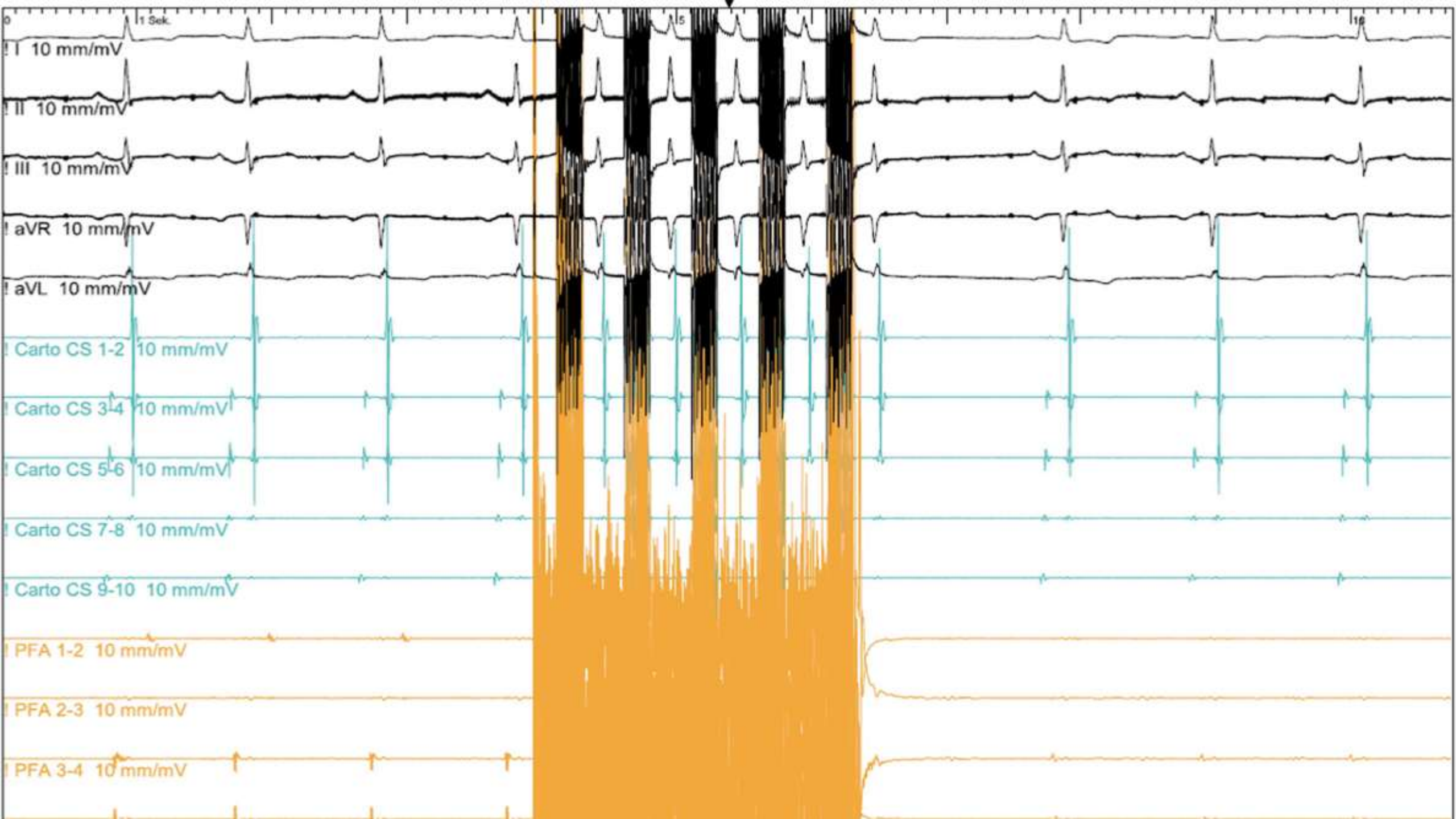
100%
Cell kill
reversible
electroporation
Radial distance
Thermal
Irreversible
Reversible
+0 min
+8–48 h


E
ROS
DAMP
ATP
or
Nanoseconds to microseconds
Seconds to minutes
Minutes to hours
Pulse delivery


A
B
C
D


RSPV
RIPV




1 Sek.
I 10 mm/mV
II 10 mm/mV
III 10 mm/mV
aVR 10 mm/mV
aVL 10 mm/mV
Carto CS 1-2 10 mm/mV
Carto CS 3-4 10 mm/mV
Carto CS 5-6 10 mm/mV
Carto CS 7-8 10 mm/mV
Carto CS 9-10 10 mm/mV
PFA 1-2 10 mm/mV
PFA 2-3 10 mm/mV
PFA 3-4 10 mm/mV

Comparativa

Característica	RF	Crioablación	PFA
Tipo de energía	Calor resistivo	Frío extremo	Campo eléctrico no térmico
Lesión	Necrosis térmica coagulativa	Necrosis por hielo + estasis vascular con isquemia	Electroporación irreversible
Selectividad	No selectiva, lesión irregular.	No selectiva, preserva matriz extracelular.	Alta selectividad miocárdica.
Dependencia contacto	Alta, ángulo de catéter	Alta (balón debe sellar PV)	Menor
Influencia flujo sanguíneo	“Heat sink” limita lesión	Perfusión atenúa frío	No relevante
Daño colateral	Esófago, nervio frénico, PV, trombogénico.	Nervio frénico, esófago	Muy bajo
Tiempo aplicación	Minutos/punto	2–4 min/congelación	Milisegundos
Marcadores eficacia	Potencia, temperatura, fuerza de contacto	Tiempo, T° nadir, recalentamiento	Parámetros de pulso (voltaje, duración, número, repetición)

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Eficacia

Organiza: ASOCAR Asociación Costarricense de Cardiología · ASOCAR Capítulo de Enfermería · ACCI · JORNADAS SOLACI

Safety and Effectiveness of Pulsed Field Ablation to Treat Atrial Fibrillation: One-Year Outcomes From the MANIFEST-PF Registry

Table 1. Baseline Characteristics

Characteristics	Patients with available data	Value
Age, n (%)/ mean±SD	1568 (100)	64.5±11.5
Female, n (%)	1568 (100)	553 (35)
Atrial fibrillation type, n (%)		
Paroxysmal	1568 (100)	1021 (65)
Persistent	1568 (100)	498 (32)
Long-standing persistent	1568 (100)	49 (3)
CHA_2DS_2-VASc, n (%)/mean±SD	1568 (100)	2.2±1.6
Medical history		
Body mass index, n (%)/mean±SD	1554 (99.1)	28±5
Atrial flutter, n (%)	1235 (78.8)	158 (12.8)
Coronary artery disease, n (%)	1235 (78.3)	167 (13.5)
Diabetes, n (%)	1568 (100)	196 (12.5)
Hypertension, n (%)	1568 (100)	959 (61.1)
Heart failure, n (%)	1568 (100)	226 (14.4)
Sleep apnea, n (%)	1104 (70.4)	102 (9.2)
Prior stroke/transient ischemic attack, n (%)	1568 (100)	97 (6.2)
Chronic obstructive pulmonary disease, n (%)	992 (63.3)	50 (5)
Echocardiographic parameters		
Left ventricular ejection fraction, n (%)/median (interquartile range)	1381 (88.1)	60 (55–64)
Left atrium diameter (mm), n (%)/median (interquartile range)	1220 (77.8)	42 (39–46)
Antiarrhythmic medications, n (%)		
Class I antiarrhythmic drugs	1566 (99.9)	343 (21.9)
Class III antiarrhythmic drugs	1567 (99.9)	279 (17.8)

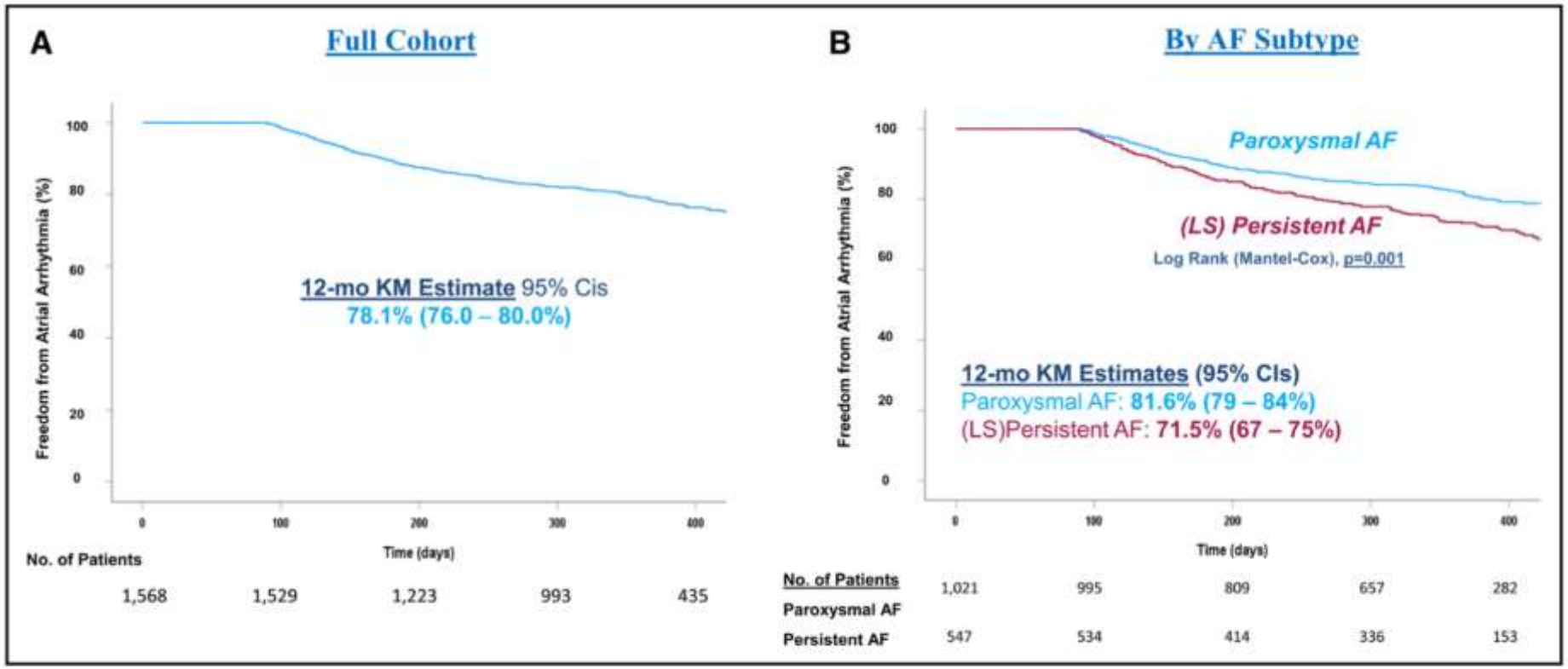


Figure 2. Primary effectiveness outcome.
Kaplan-Meier analysis demonstrating 1-year freedom from arrhythmia in either the full cohort (**A**) or by AF subtype: paroxysmal AF vs (long-standing) persistent AF (**B**). AF indicates atrial fibrillation; KM, Kaplan-Meier; and LS, long-standing.

Circulation Volume 148, Issue 1, 4 July 2023; Pages 35-46

EUropean real-world outcomes with Pulsed field ablatiOn in patients with symptomatic atRIAl fibrillation: lessons from the multi-centre EU-PORIA registry

7 European centers

42 operators

1233 AF patients treated with PFA

EUPORIA

Acute efficacy

99.96% PVI
58 min procedure time

Acute safety

1.7% major complications

(1.1% pericardial tamponade, 0.41% stroke, 0.16% TIA)

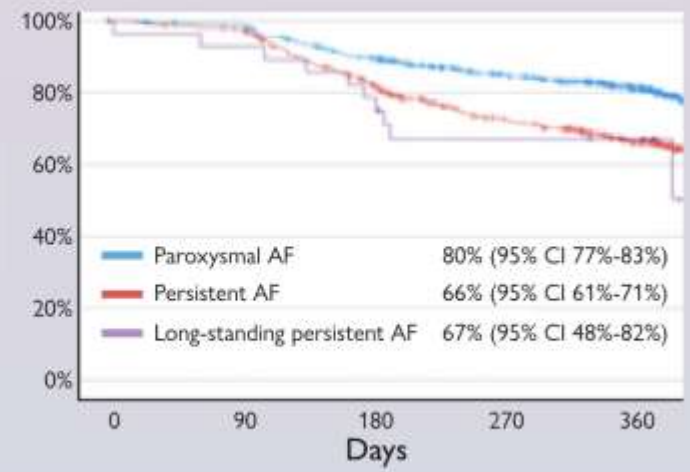
Chronic efficacy

AF/AT-free survival at 365 days median follow up

80% in paroxysmal AF
66% in persistent AF

Reproducible results among centers irrespective of operator experience

Freedom from AF/AT recurrence by AF indication (PFA index procedures)

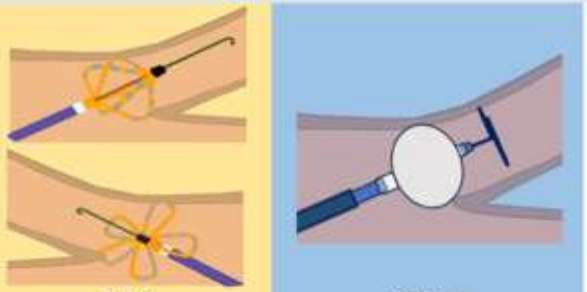


*Europace (2023) **25**, 1–11 https://doi.org/10.1093/europace/euad185*

Eficacia de PFA

- ADVENT: Mayor proporción de pacientes con carga arrítmica <0.1%.
- EU-PORIA: 71% de venas pulmonares permanecen aisladas en re-mapeo.
- PFA: mayor tasa de éxito agudo, menor recurrencia de TA a 1 año.

Multielectrode catheter-based pulsed electric field vs. cryoballoon for atrial fibrillation ablation: a systematic review and meta-analysis



	PFA (*N* = 2481)	CRYO (*N* = 13 766)	*P*-value
Procedural success (per vein)	**99.9%** (95% CI: 99.8–100)	**99.1%** (95% CI: 98.7–99.5)	***P* < 0.001**
Procedural success (patient basis)	**99.5%** (95% CI: 99.2–99.8)	**98.4%** (95% CI: 97.9–98.9)	***P* < 0.001**
Procedural time	**75.9 min** (95% CI: 59.4–92.3)	**105.6 min** (95% CI: 96.7–114.6)	***P* < 0.001**
Fluoroscopy time	**14.2 min** (95% CI: 11.8–16.6)	**18.9 min** (95% CI: 17.1–20.7)	***P* < 0.001**
Major complications	**1.2%** (95% CI: 0.7–1.7)	**1.0%** (95% CI: 0.8–1.2)	*P* = 0.46
Overall complications	**3.1%** (95% CI: 2.2–4.0)	**5.6%** (95% CI: 4.6–6.6)	***P* < 0.001**

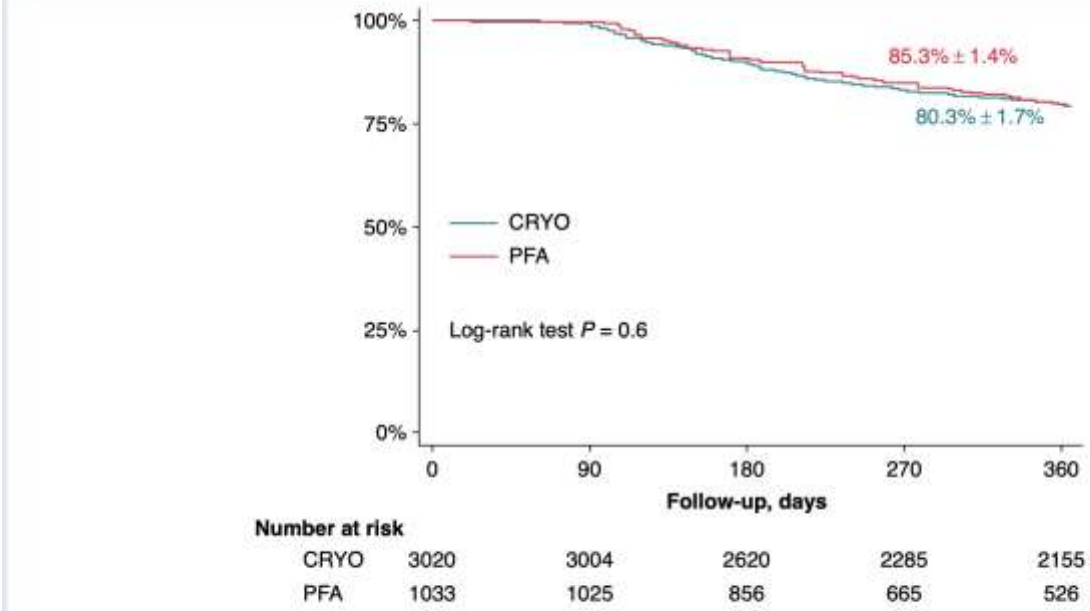


Figure 7 Kaplan–Meier survival estimates for atrial tachycardia recurrences comparing PFA and CRYO. CRYO, cryoballoon ablation; PFA, pulsed field ablation.

Europace (oct 2024) 26, euae293 https://doi.org/10.1093/europace/euae293

Pulsed-field vs cryoballoon vs radiofrequency ablation: Outcomes after pulmonary vein isolation in patients with persistent atrial fibrillation

PVI for persistent AF

Pulsed-field- vs. Cryoballoon- vs. Radiofrequency ablation

Acute | *Long-term*

Methods

Index PVI in persistent-AF patients

PFA	**CBA**	**RFA**
214 patients	190 patients	129 patients
At least 32 applications	Time-to-effect + 2min	CLOSE Protocol

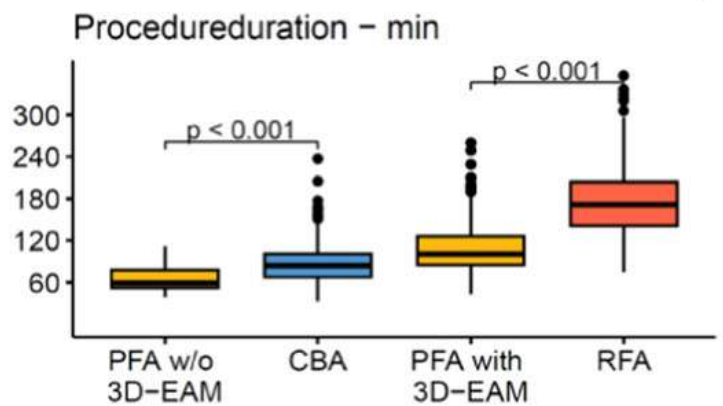
Confirmation of bidirectional block without adenosine testing

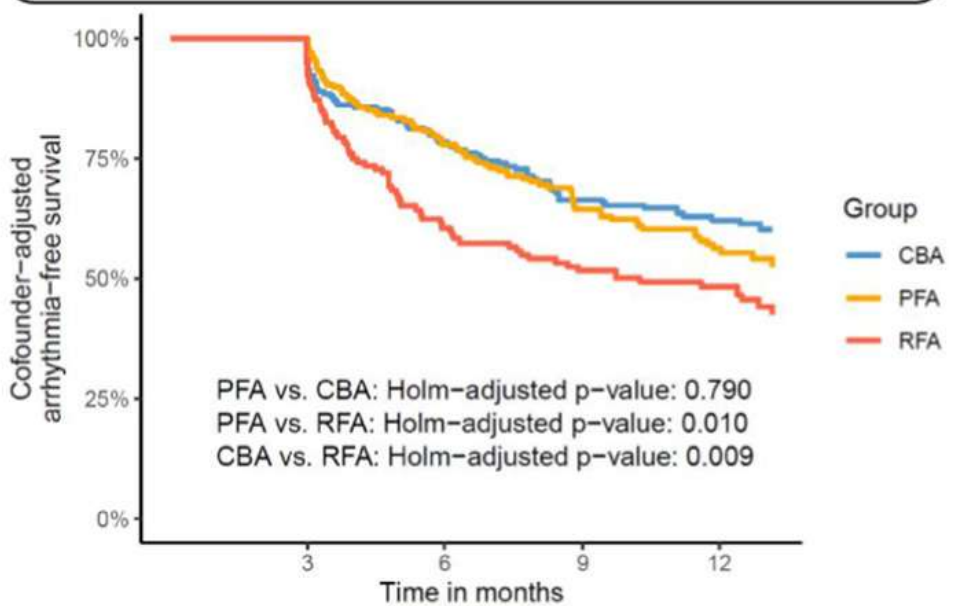
7- day Holter ECG at 3, 6, and 12 months

Primary effectiveness endpoint:
Occurrence of any atrial tachyarrhythmia 91 to 365 days after ablation and lasting >30 s.

Results

Acute safety (p=0.545)
PFA 5/214 (2.3%)
CBA 5/190 (2.6%)
RFA 1/129 (0.8%)





(Heart Rhythm 2024;21:1227–1235)

XIII CONGRESO INTERNACIONAL DE CARDIOLOGIA

CARDIOLOGIA INTERVENCIONISTA - LII JORNADA ACCI-SOLACI

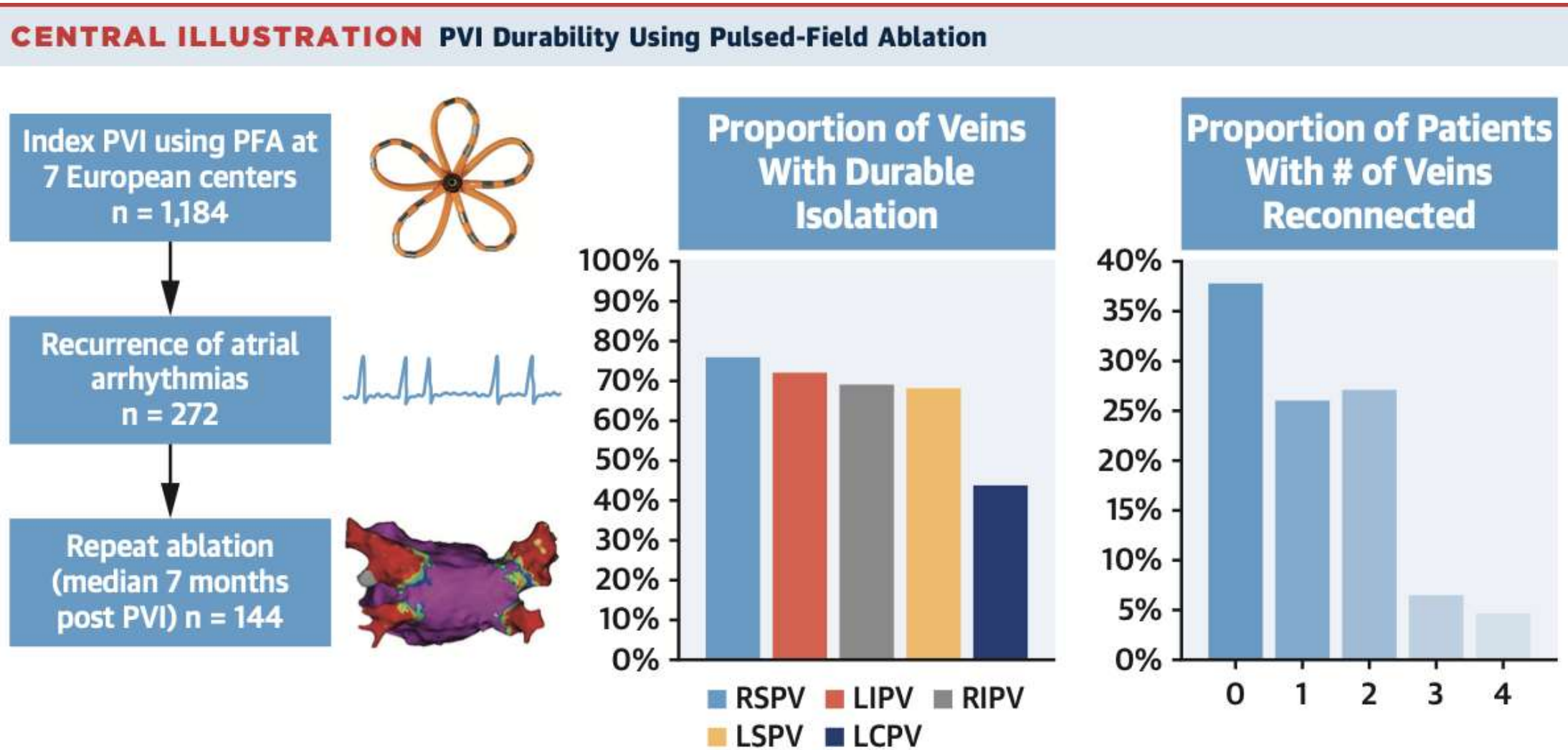
Durabilidad

Organiza: ASOCAR Asociación Costarricense de Cardiología · ASOCAR Capítulo de Enfermería · ACCI · JORNADAS SOLACI

Durability of Pulmonary Vein Isolation Using Pulsed-Field Ablation

Results From the Multicenter EU-PORIA Registry

CENTRAL ILLUSTRATION PVI Durability Using Pulsed-Field Ablation



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

*Europace (2023) **25**, 1–11 https://doi.org/10.1093/europace/euad185*

Pulmonary vein reconnection and repeat ablation characteristics following cryoballoon-compared to radiofrequency-based pulmonary vein isolation

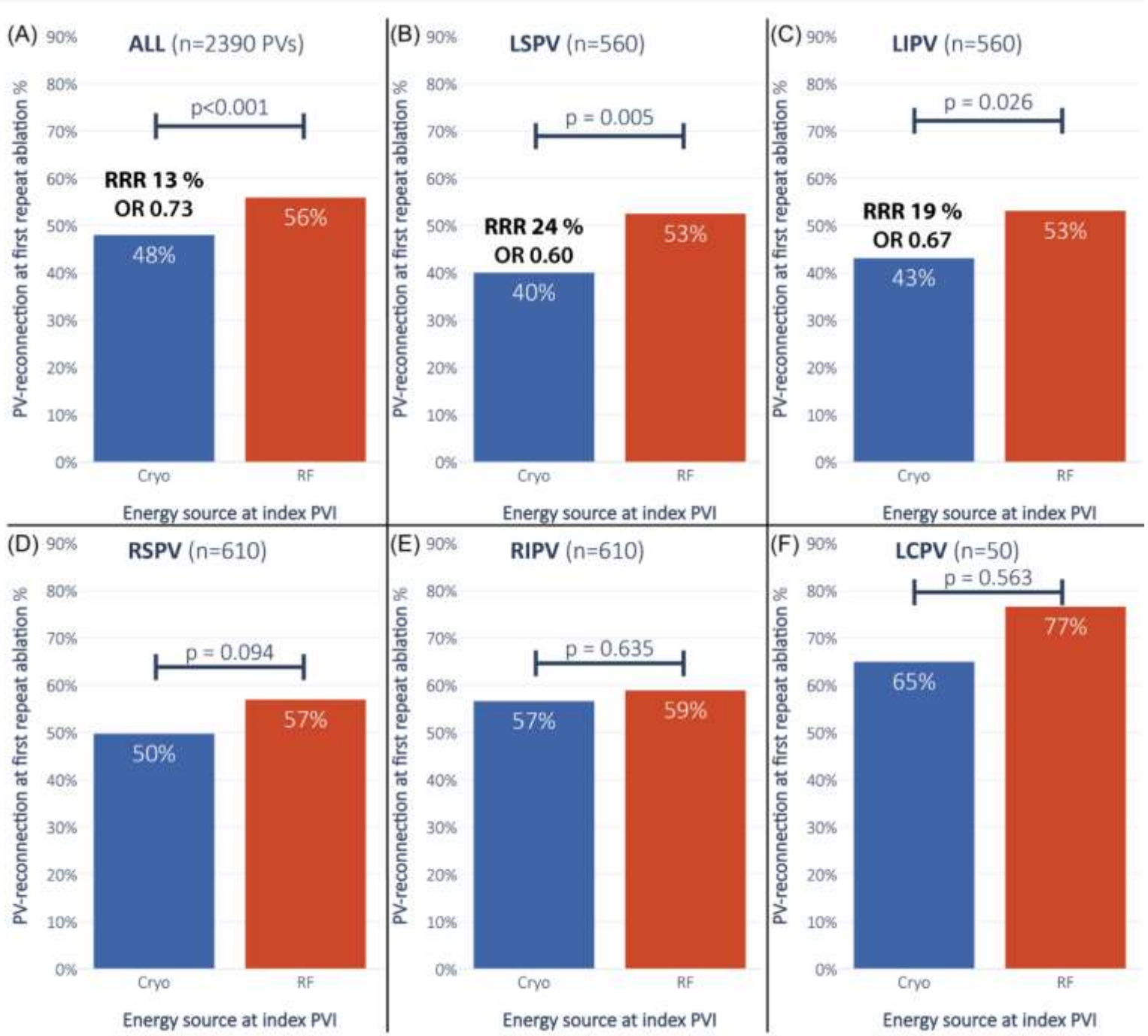


FIGURE 1 Percentage of reconnected pulmonary veins (PV) at first repeat ablation grouped by energy source at index pulmonary vein

J Card Elec Vol 35, Issue9
September 2024 Pages 1766-1778

Repeat Ablation for Atrial Fibrillation Recurrence Post Cryoballoon or Radiofrequency Ablation in the FIRE AND ICE Trial

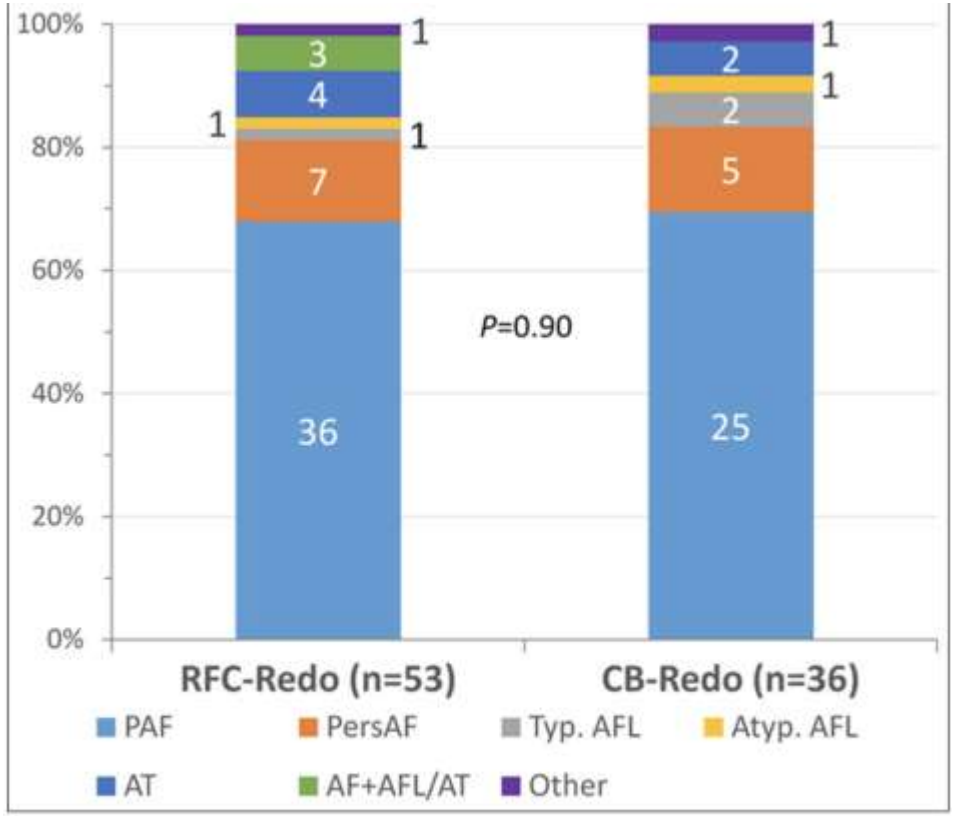


Figure 1. **Recurrent arrhythmias before reablation**. Paroxysmal atrial fibrillation (AF) was the most prevalent recurrent arrhythmia in both patient groups (68% in radiofrequency current [RFC]-Redo patients, 69% in cryoballoon [CB]-Redo patients). Seven patients (13%) in the RFC-Redo group and 5 patients (14%) in the CB-Redo group progressed from paroxysmal to persistent AF. There was no difference in the type of atrial arrhythmia recurrence before reablation between cohorts (*P*=0.09). Numbers in stacked

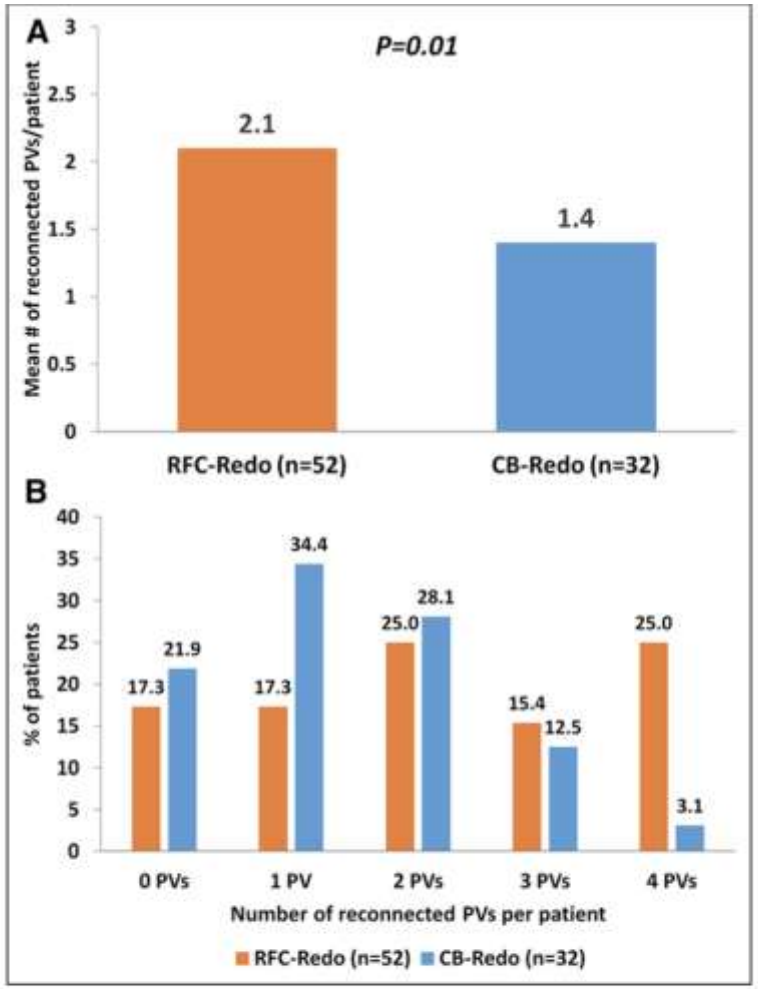


Figure 2. **Pulmonary vein (PV) reconnections identified during repeat ablation. A**, Mean number of reconnected PVs according to patient group. In the radiofrequency current (RFC)-Redo cohort a significantly higher mean number of reconnected PVs per patient than in the cryoballoon (CB)-Redo cohort was observed during repeat ablation (*P*=0.01). **B**, Percentage of patients with 0 to 4 reconnected PVs per patient according to patient group.

Circulation: Arrhythmia and Electrophysiology *Vol 12, 6, June 2019*
https://doi.org/10.1161/CIRCEP.119.007247

Pulsed Field or Cryoballoon Ablation for Paroxysmal Atrial Fibrillation

PFA vs Crio

Single Shot CHAMPION trial

Table 1. Characteristics of the Patients at Baseline.*

	Pulsed Field Ablation (N=105)	Cryoballoon Ablation (N=105)
Age — yr	64.0±9.4	63.3±9.6
Male sex — no. (%)	77 (73)	74 (70)
Body-mass index†	27.0±3.9	27.3±4.7
Median CHA_2DS_2-VASc score (IQR)‡	2.0 (1.0–3.0)	2.0 (1.0–3.0)
Currently smoker — no. (%)	10 (10)	12 (11)
Concomitant clinical conditions — no. (%)		
Hypertension	56 (53)	58 (55)
Vascular disease	12 (11)	16 (15)
History of congestive heart failure	9 (9)	3 (3)
Diabetes	13 (12)	9 (9)
Previous stroke, TIA, or peripheral embolism	4 (4)	7 (7)

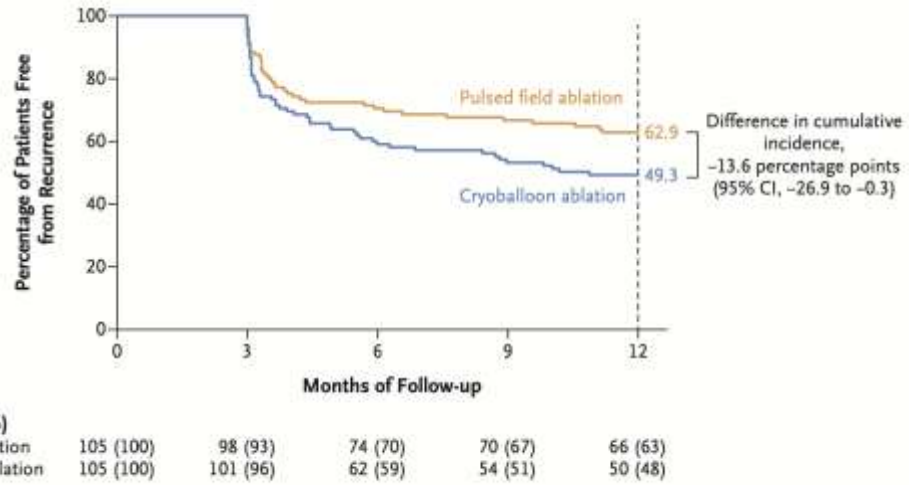
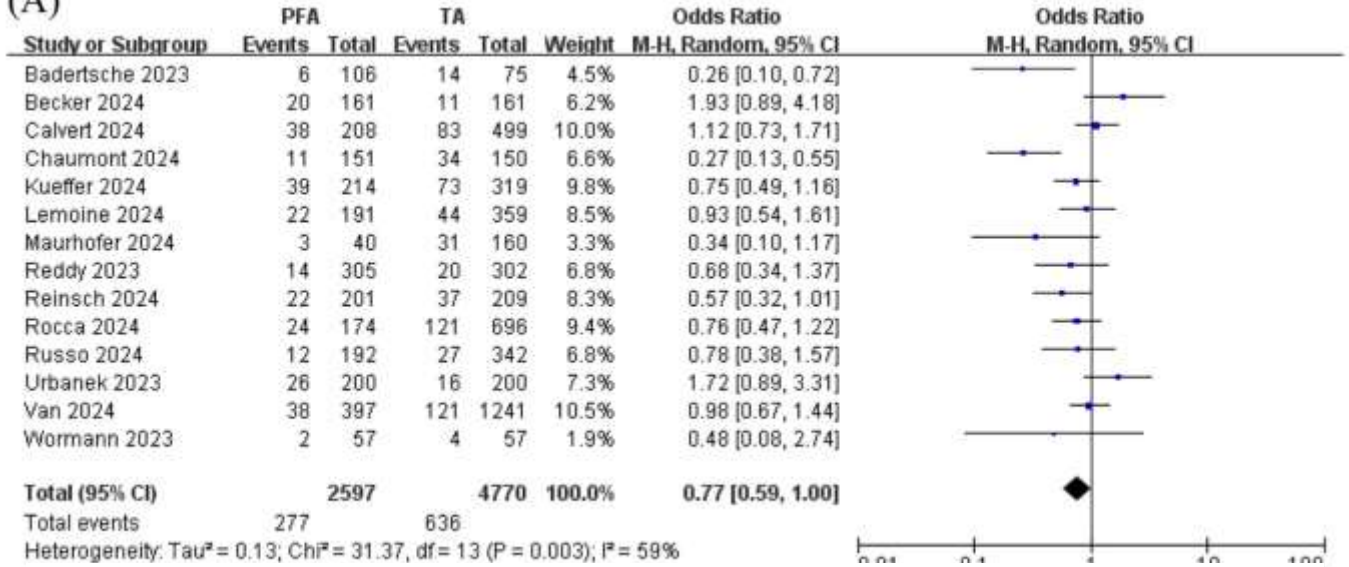


Figure 2. Freedom from Recurrence of Atrial Tachyarrhythmia during the Period from 91 to 365 Days.

Meta-Analysis of Thermal Versus Pulse Field Ablation for Pulmonary Vein Isolation Durability in Atrial Fibrillation: Insights From Repeat Ablation

PFA vs HPSD

(A)



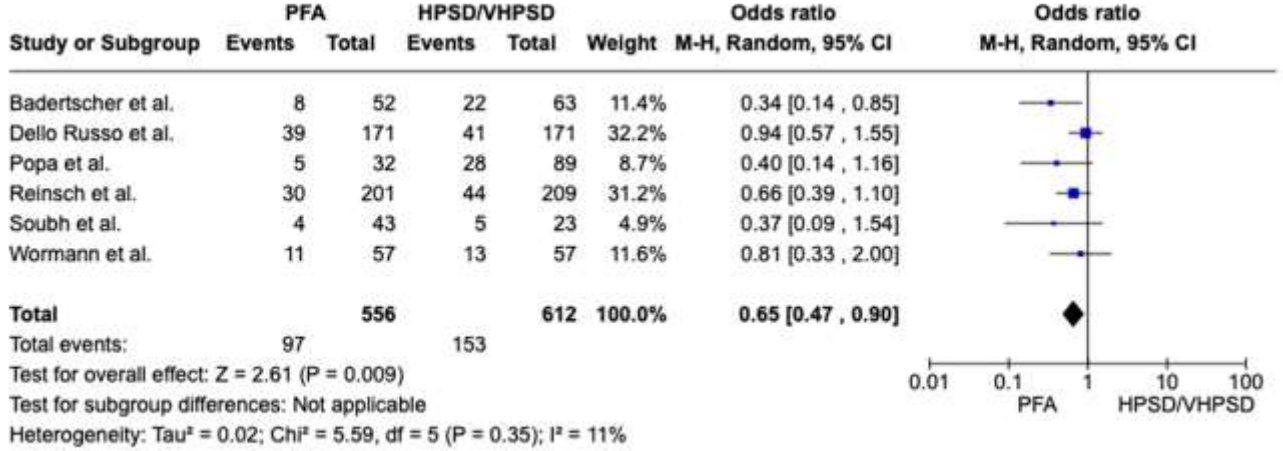
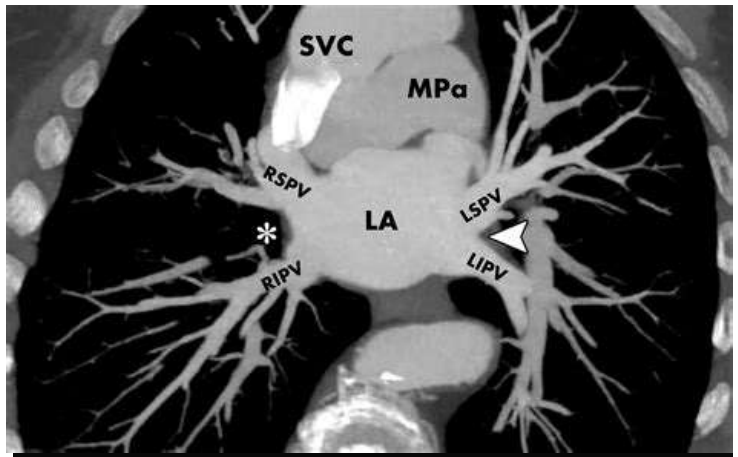
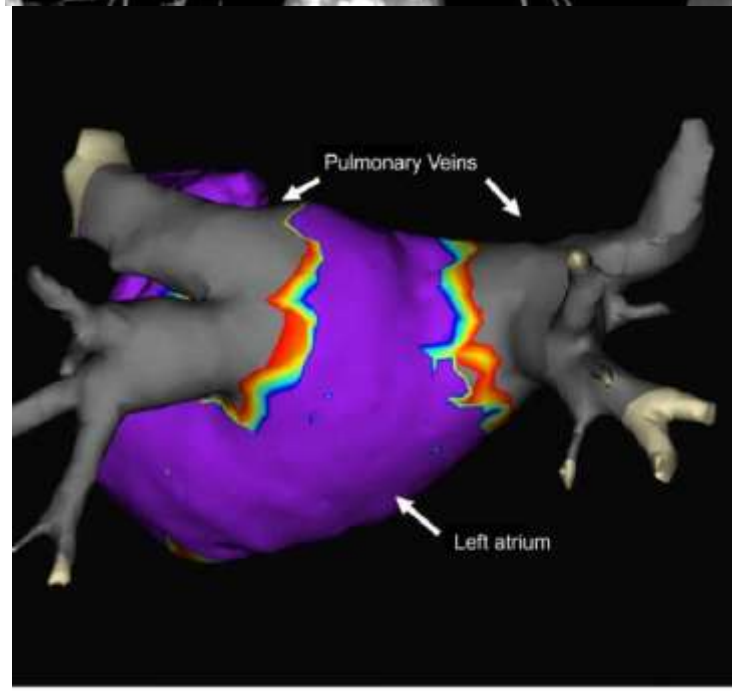


FIGURE 3 | Comparison of AF recurrence between PFA and HPSD/vHPSD RFA in overall population. CI, confidence interval; HPSD, high-power short-duration; PFA, pulsed field ablation; vHPSD, very high-power short-duration.

Journal of Cardiovascular Electrophysiology, 2025; 36:2165–2178
Clin Cardiology, 48: e70151, may 2025 https://doi.org/10.1002/clc.70151

Durability of pulmonary vein isolation for atrial fibrillation: a meta-analysis and systematic review





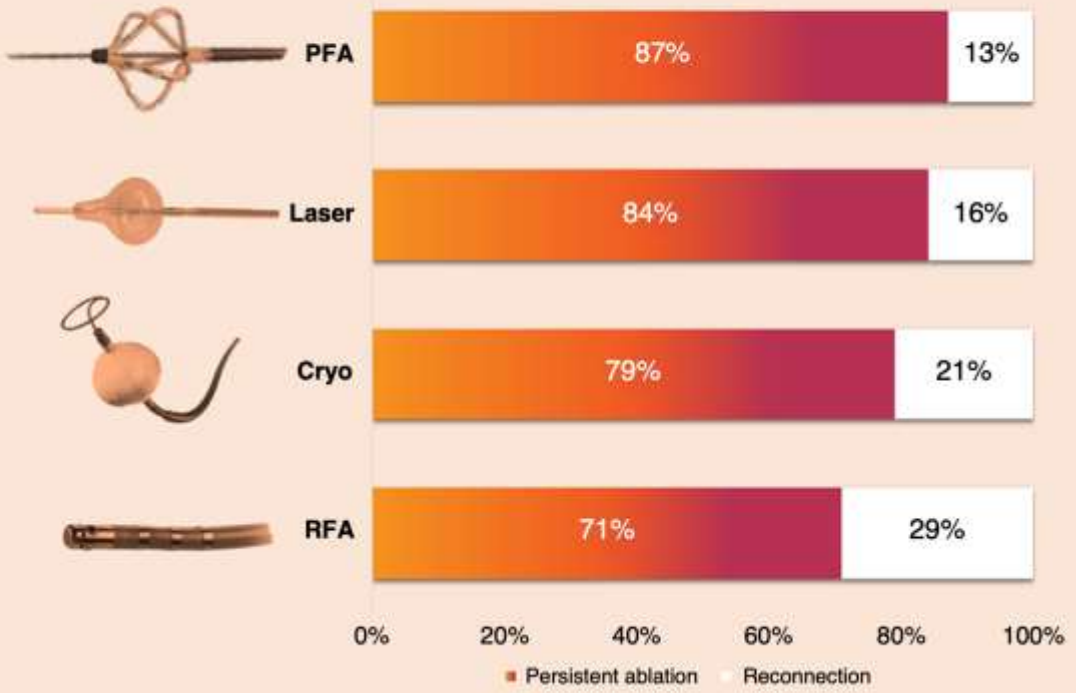
PFA > Crio > RF

Abstract screening
Invasive redo mapping during FU regardless of AF recurrence

19 studies included
1050 patients

Outcome
Durable pulmonary vein isolation

Results – Lesion durability at follow-up



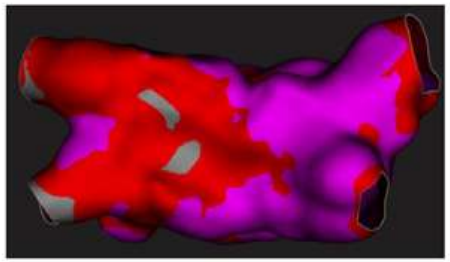
Cryoballoon	98.25	53.57
Radiofrequency	99.86	45.81
Laser	94.64	61.54
Pulsed-field ablation	100.00	70.00

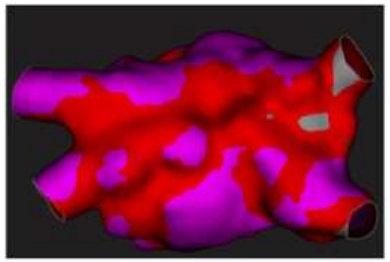
*Europace (2023) **25**, 1–10 https://doi.org/10.1093/europace/euad335*

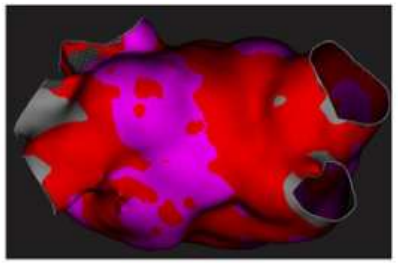
Durability of Thermal Pulmonary Vein Isolation in Persistent Atrial Fibrillation Assessed by Mandated Repeat Invasive Study

38 patients
Time since AF diagnosis: 22.5 months
LA volume: 36ml/m²
Myocardial shell area <0.5mV: 47%

Cryoballoon:
17 patients







Radiofrequency:
21 patients

2-Month Mandated Repeat Invasive Study
Irrespective of Arrhythmia Recurrence

58.8% PVs reconnected at redo

39.3% PVs reconnected at redo

Durability of PVI is poor in patients with significantly dilated and scarred left atria

Durabilidad es peor cuanto mayor remodelado auricular.

Heart Rhythm 2024;21:1545–1554

XIII CONGRESO INTERNACIONAL DE CARDIOLOGIA

CARDIOLOGIA INTERVENCIONISTA - LII JORNADA ACCI-SOLACI

Reproducibilidad

Organiza: ASOCAR Asociación Costarricense de Cardiología · ASOCAR Capítulo de Enfermería · ACCI · JORNADAS SOLACI

*Europace (2025) **27**, euaf182*

FARADISE Global Registry
1-year outcomes with the pentaspline PFA Catheter

Study design

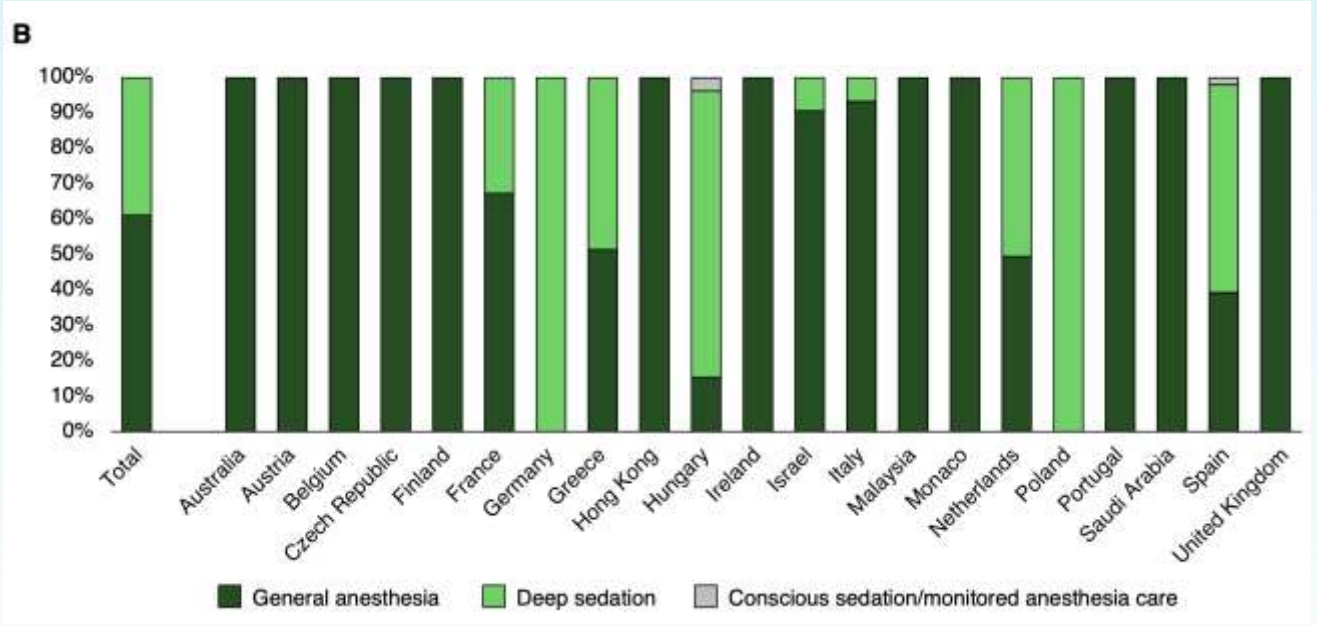
- **1158** AF patients
- **48** Centers
- **21** Countries
- **Real-World Registry**

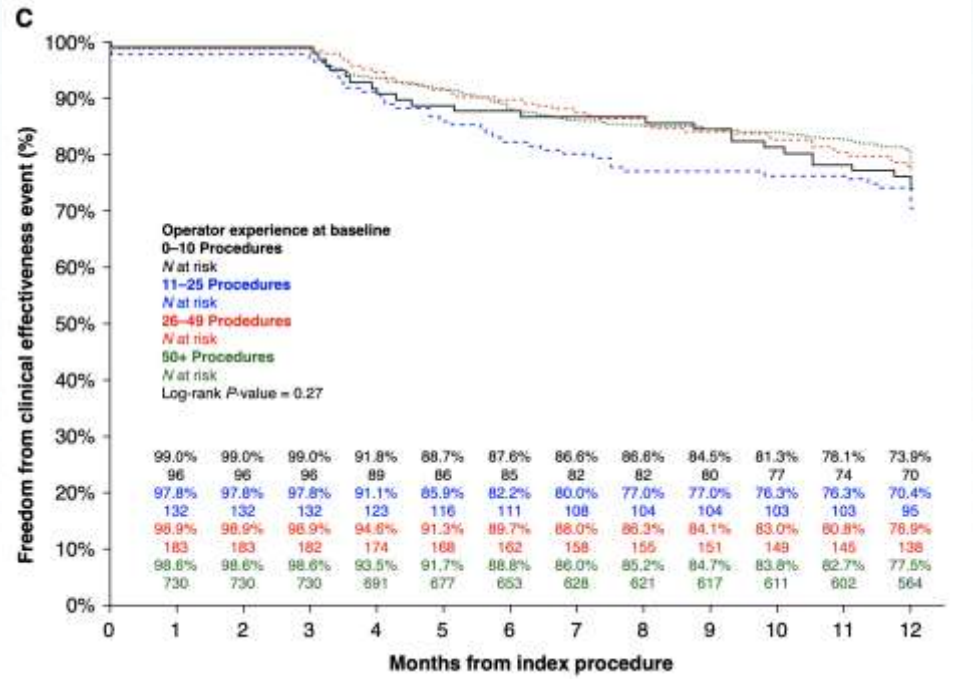
Safety
1.5%
Serious adverse event rate

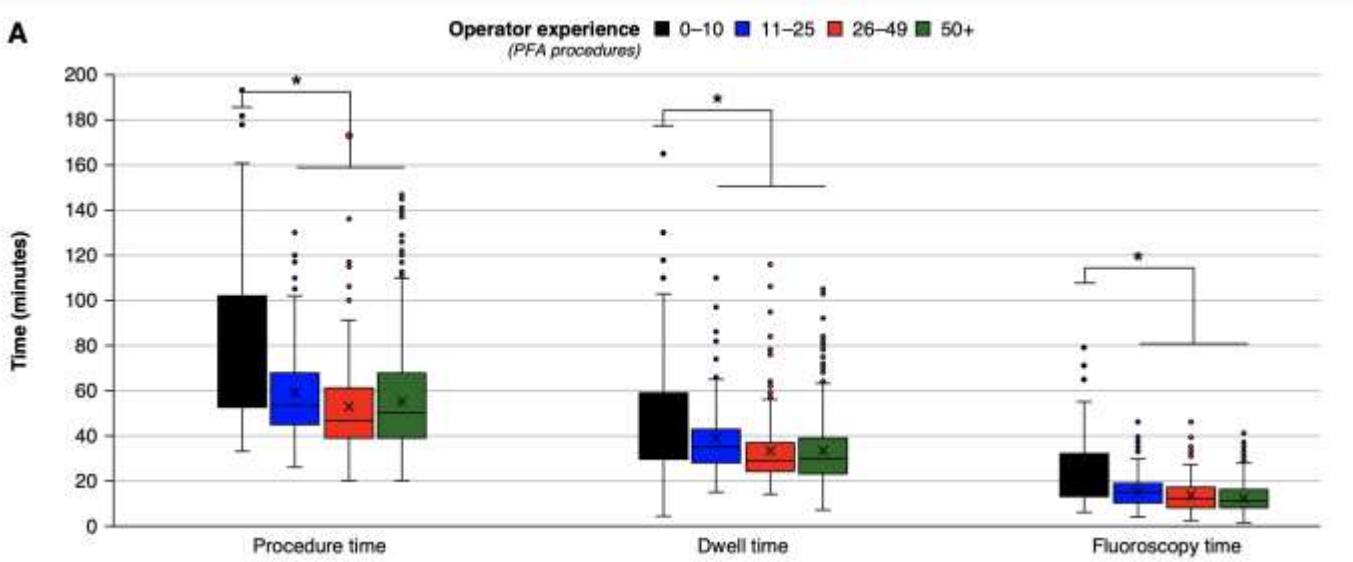
Learning Curve
- Procedure times
- Extra-PV ablations
- 1-year outcomes

Clinical effectiveness
80.8%
Paroxysmal AF
67.7%
Non-paroxysmal AF

Predictors of success
- ✓ AF Indication (PAF)
- ✓ De Novo ablation
- ✓ Age (<65 yrs)
- ✓ Biological sex (male)
- ✗ Lesion set







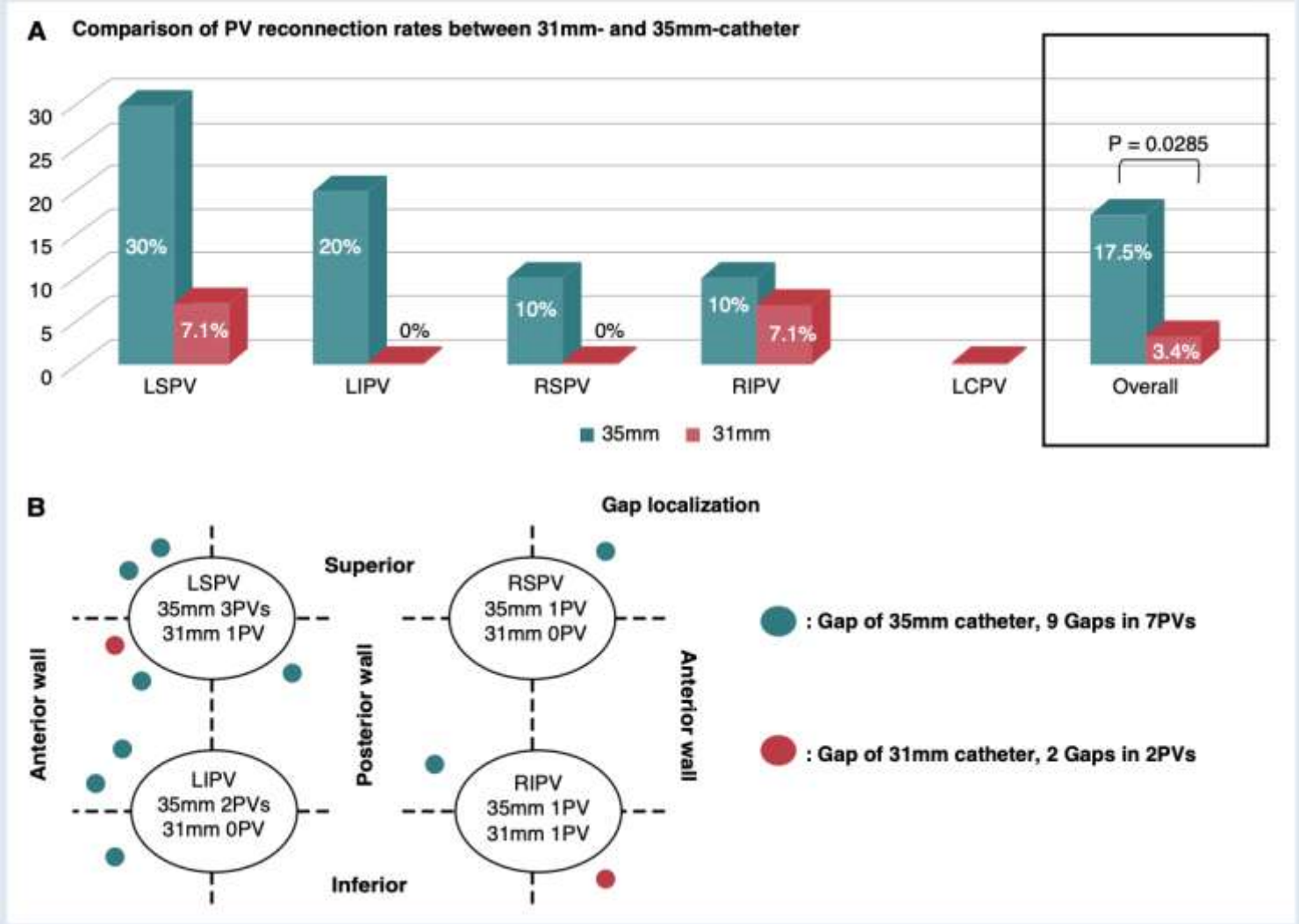
XIII CONGRESO INTERNACIONAL DE CARDIOLOGIA

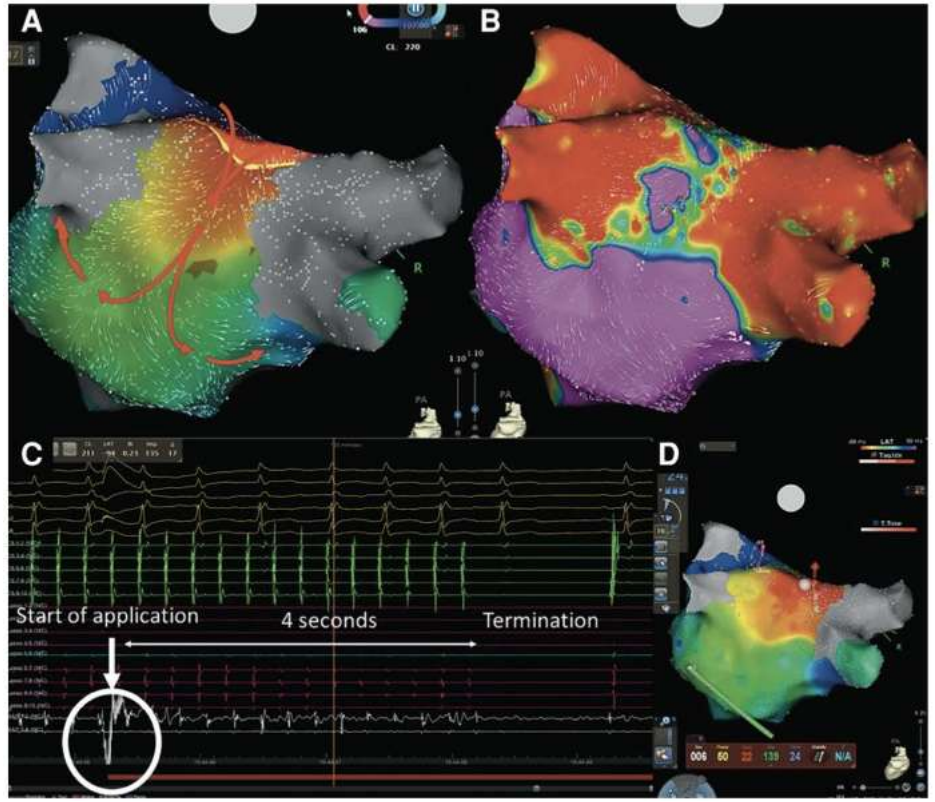
CARDIOLOGIA INTERVENCIONISTA - LII JORNADA ACCI-SOLACI

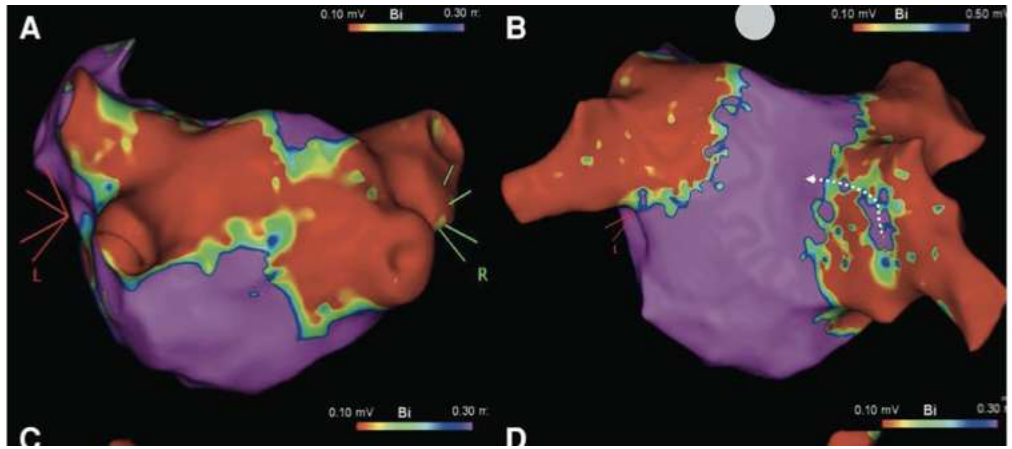
Versatilidad

Organiza: ASOCAR Asociación Costarricense de Cardiología · ASOCAR Capítulo de Enfermería · ACCI · JORNADAS SOLACI

Findings from repeat ablation using high-density mapping after pulmonary vein isolation with pulsed field ablation

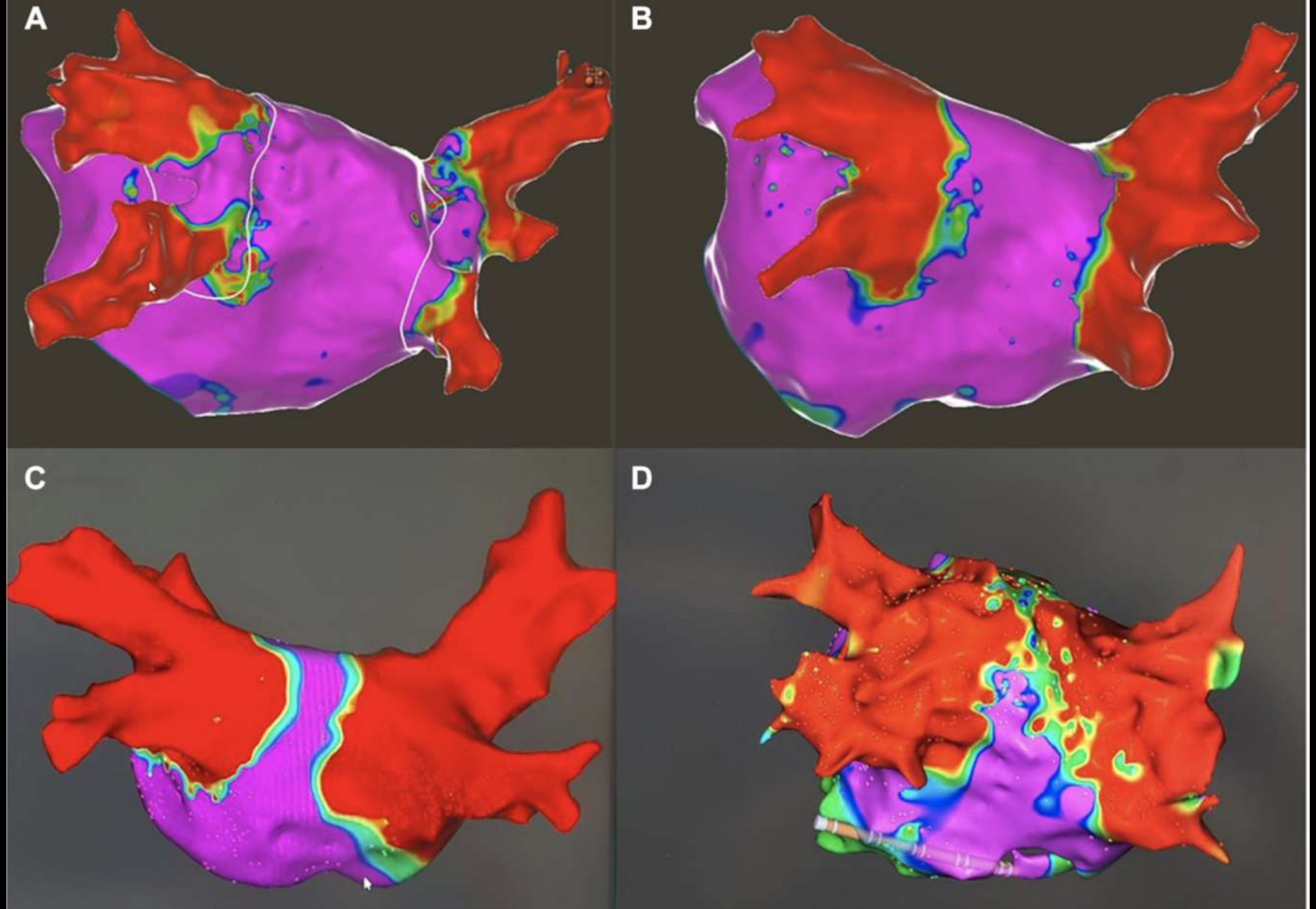






Recomendaciones: Uso de pentaspline 31 mm, energía 2 Kv, mapa 3D.

Europace (2023) ***25****, 433–440*


A
B
C
D

Durability of Pulmonary Vein Isolation Using Pulsed-Field Ablation

Results From the Multicenter EU-PORIA Registry

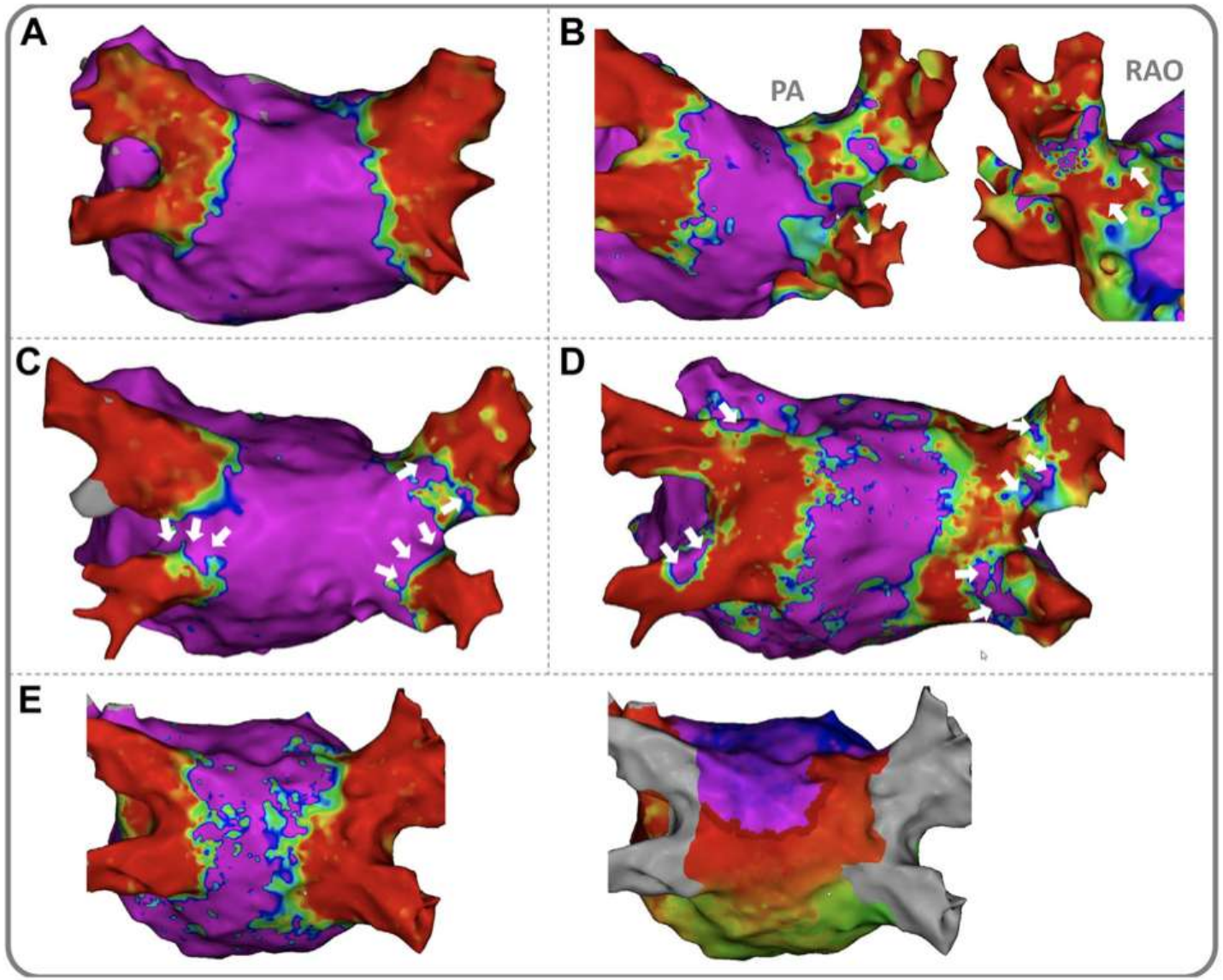
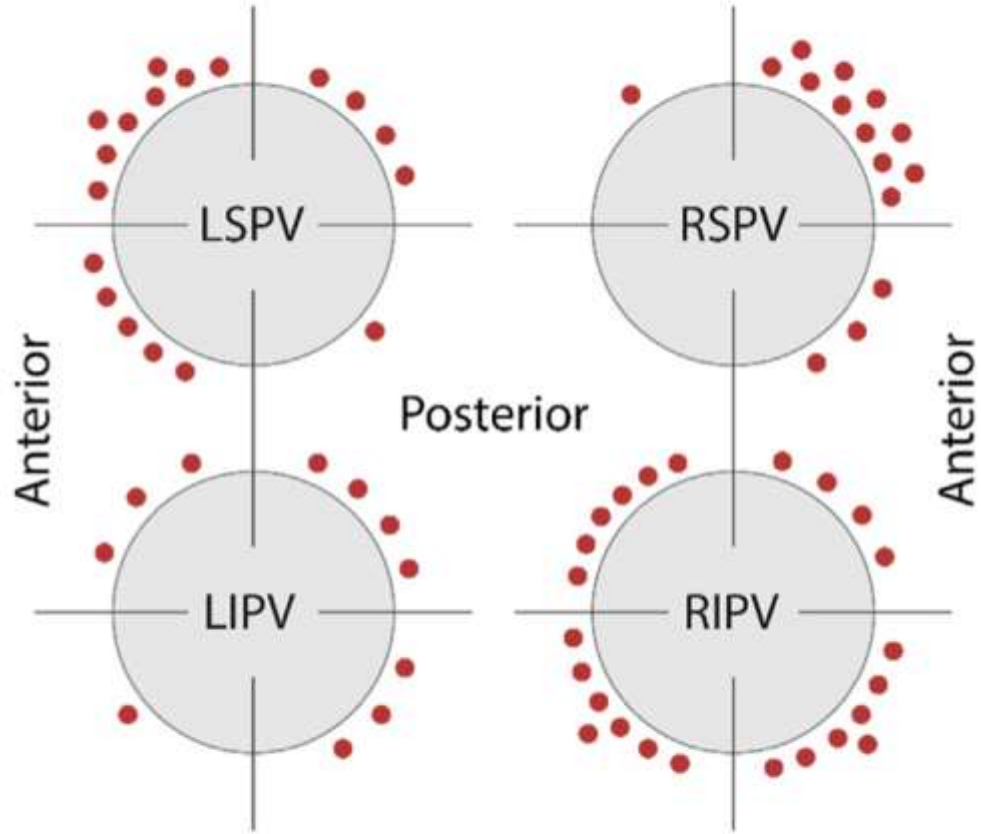


FIGURE 4 **Localization of Reconnection Sites Found During Repeat Ablation After PVI Using PFA**

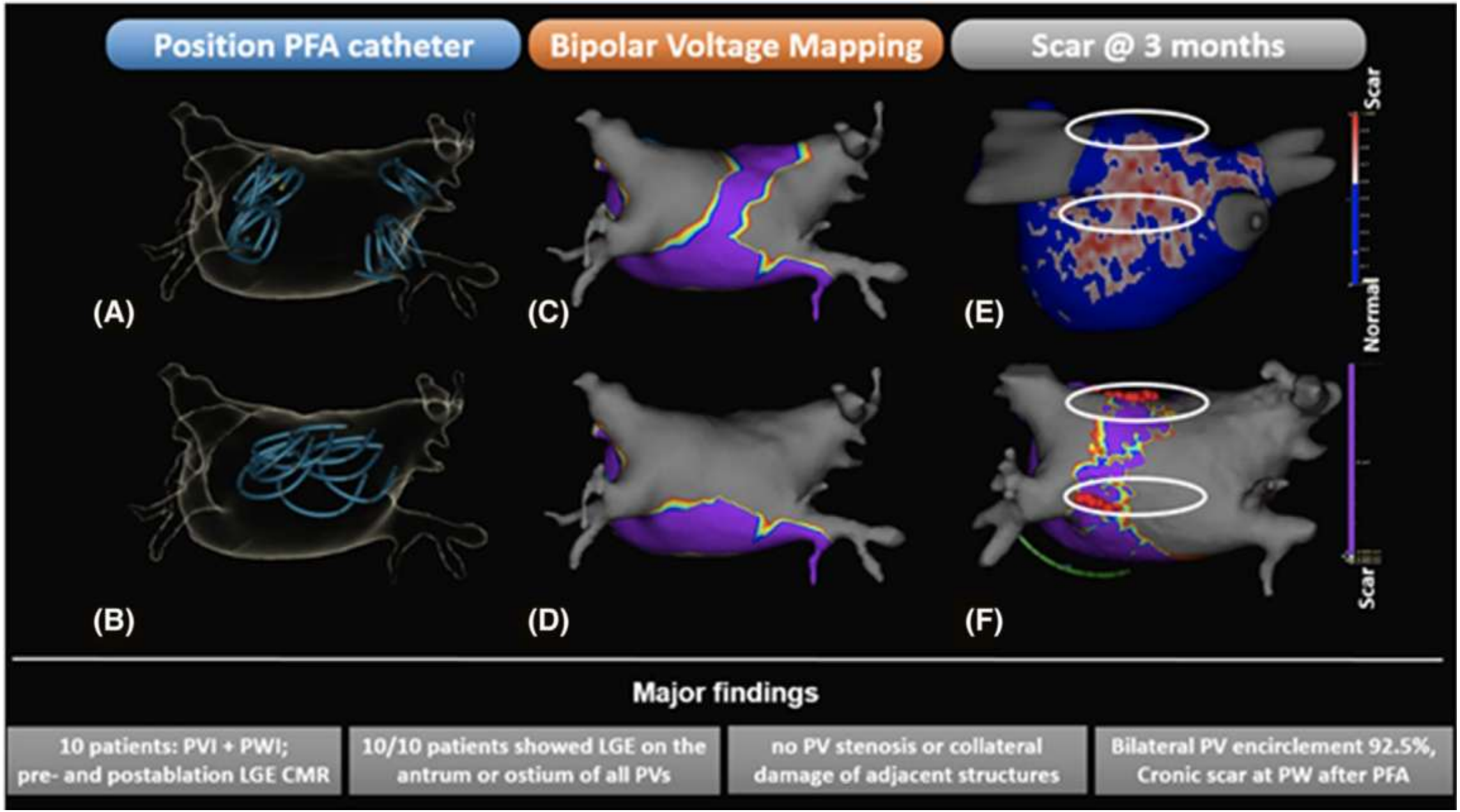


Gaps identified by high-density mapping during repeat ablation after an index PVI using PFA. Abbreviations as in Figures 1 and 2.

*Europace (2023) **25**, 1–11 https://doi.org/10.1093/europace/euad185*

Lesion formation following pulsed field ablation for pulmonary vein and posterior wall isolation

Europace (2023) 25, 433–440
JIntC Electrophysiology (2024) 67:1359–1364 }



Impact of Left Atrial Posterior Wall Ablation During Pulsed Field Ablation for Persistent Atrial Fibrillation: A *MANIFEST-PF* Registry Sub-Study

***MANIFEST-PF* population**
N=1,568

Pers-AF cohort
N=547

PVI
N=416

PVI + LAPW
N=131

Population

Adults with PersAF undergoing first-time AF ablation using pulsed-field

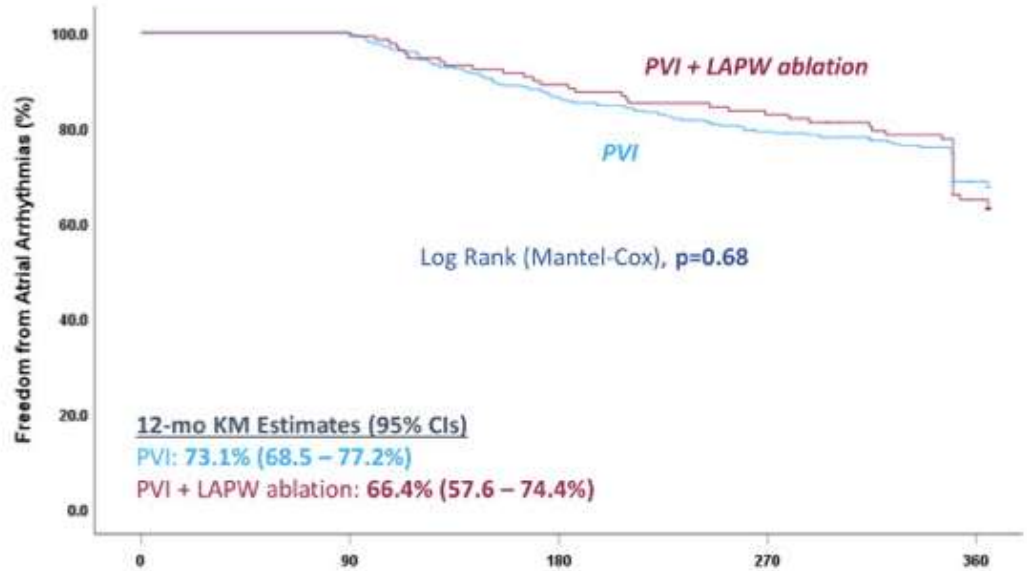
Mean age: 66.3 years

Locations

24 centers from 8 countries

Primary Outcome

Freedom from any atrial arrhythmia of ≥30 seconds with or without antiarrhythmic drugs, after a single ablation procedure



No. of Patients					
PVI + LAPW ablation	131	130	112	101	65
PVI	416	413	326	256	167

Conclusion

Addition of LAPW ablation to PVI did not significantly improve freedom from atrial arrhythmia at 1-year compared with PVI along

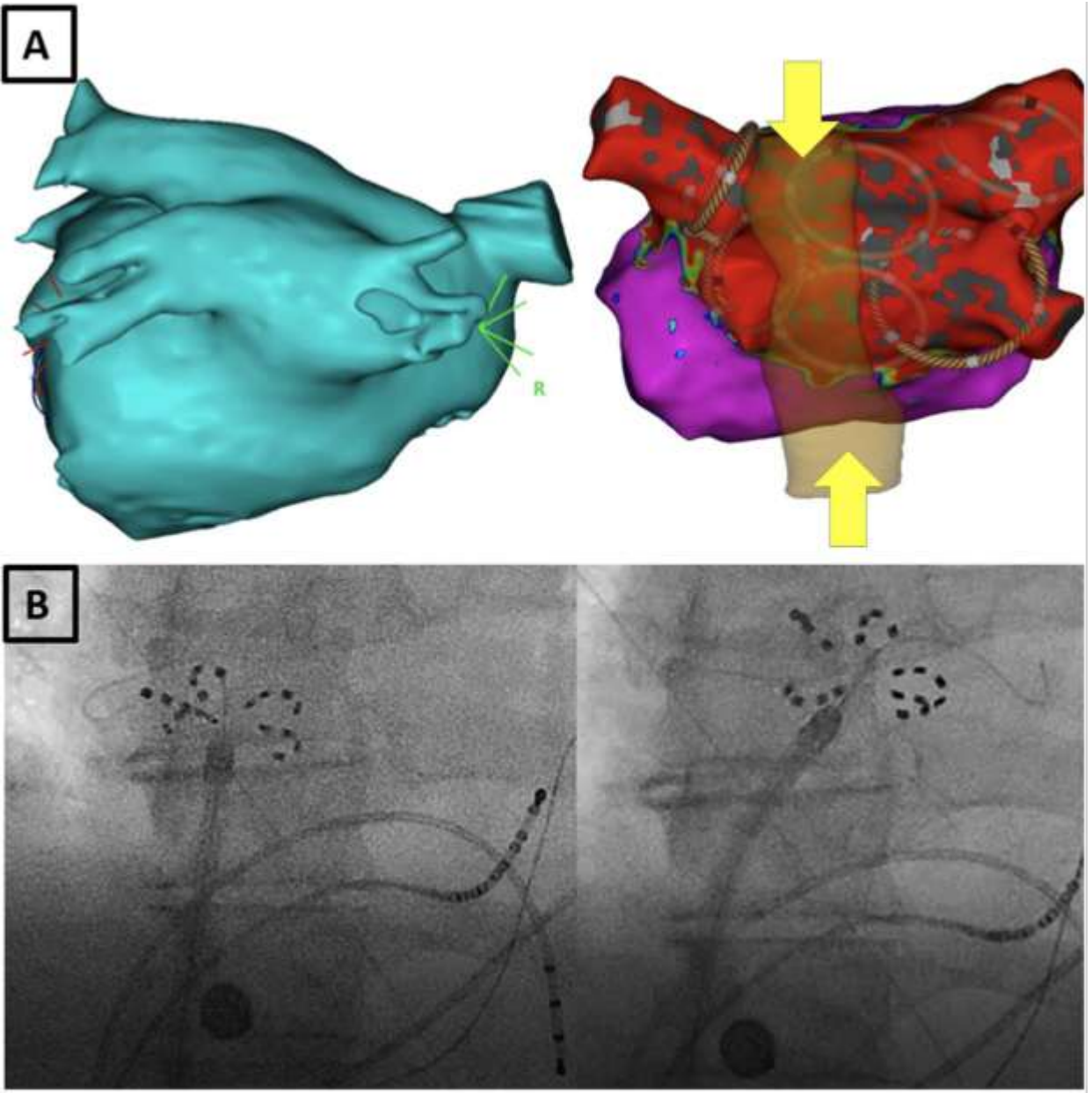
Safety Outcomes	Entire Cohort (n=547)
Acute major adverse events (%)	9 (1.6%)
Esophageal fistula	0
Symptomatic PV stenosis	0
Cardiac tamponade	6 (1.1%)
Percutaneous drainage	5 (1.2%)
Surgical drainage	0
Stroke	2 (0.4%)
Coronary spasm	1 (0.2%)
Phrenic nerve injury (persistent)	0
Death	0
Vascular complications requiring surgery	0
Acute minor adverse events (%)	24 (4.4%)
Pericardial effusion w/o intervention	2 (0.5%)
Pericarditis	1 (0.2%)
Air embolism	3 (0.5%)
TIA	2 (0.4%)
Phrenic nerve injury, transient	1 (0.2%)
Vascular access complications	13 (2.3%)
Hematoma	11 (2.0%)
A-V fistula	1 (0.2%)
Pseudoaneurysm	1 (0.2%)
DVT	0
Respiratory-related	2 (0.4%)
Chronic major adverse events	0

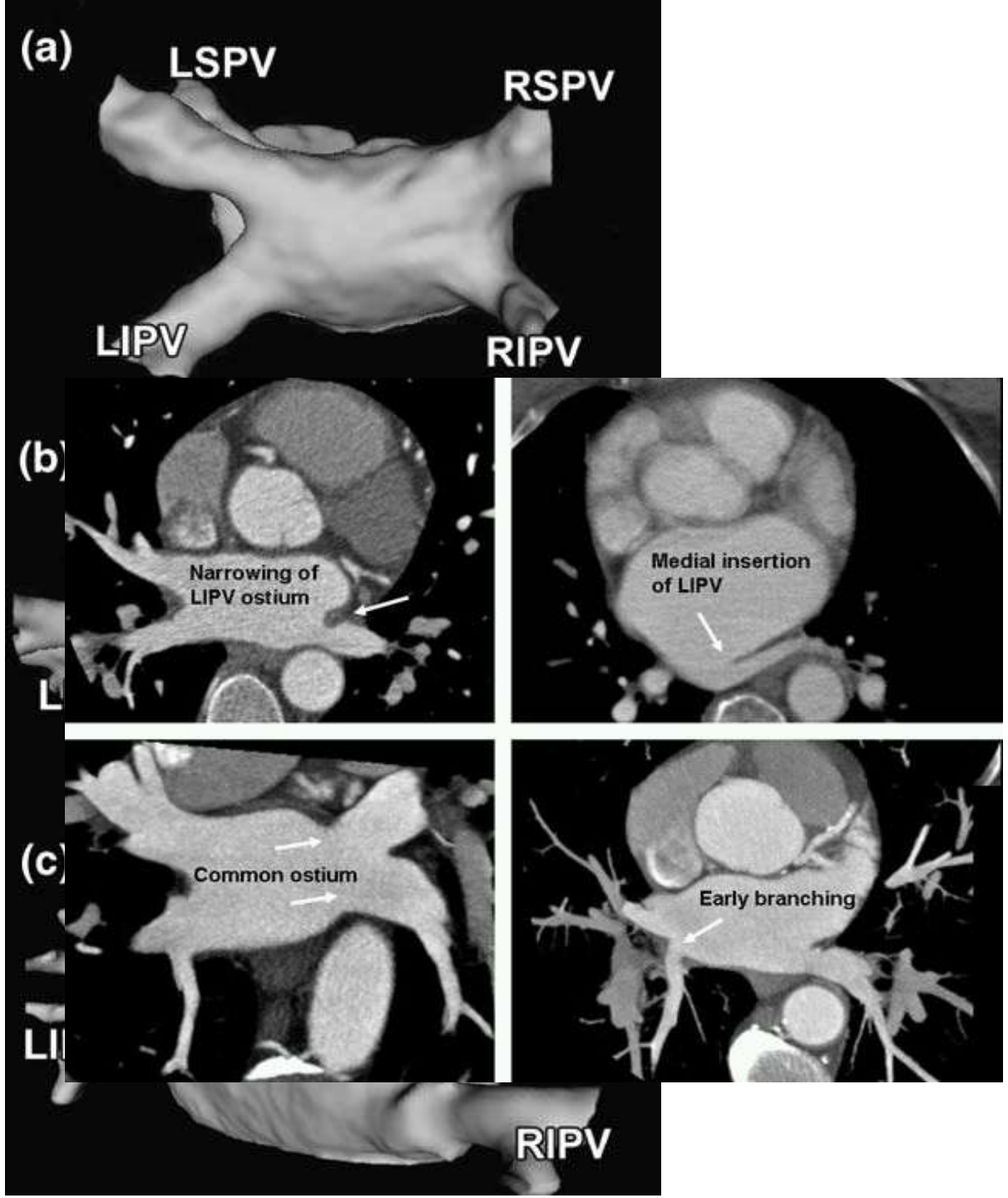
Recomendaciones: Uso de pentaspline 31 mm, energía 2 Kv, mapa 3D.

*Europace (2023) **25**, 433–440*

Pulsed field ablation in common inferior pulmonary trunk

J Interv Card Electrophysiol **66**, 809–810 (2023)





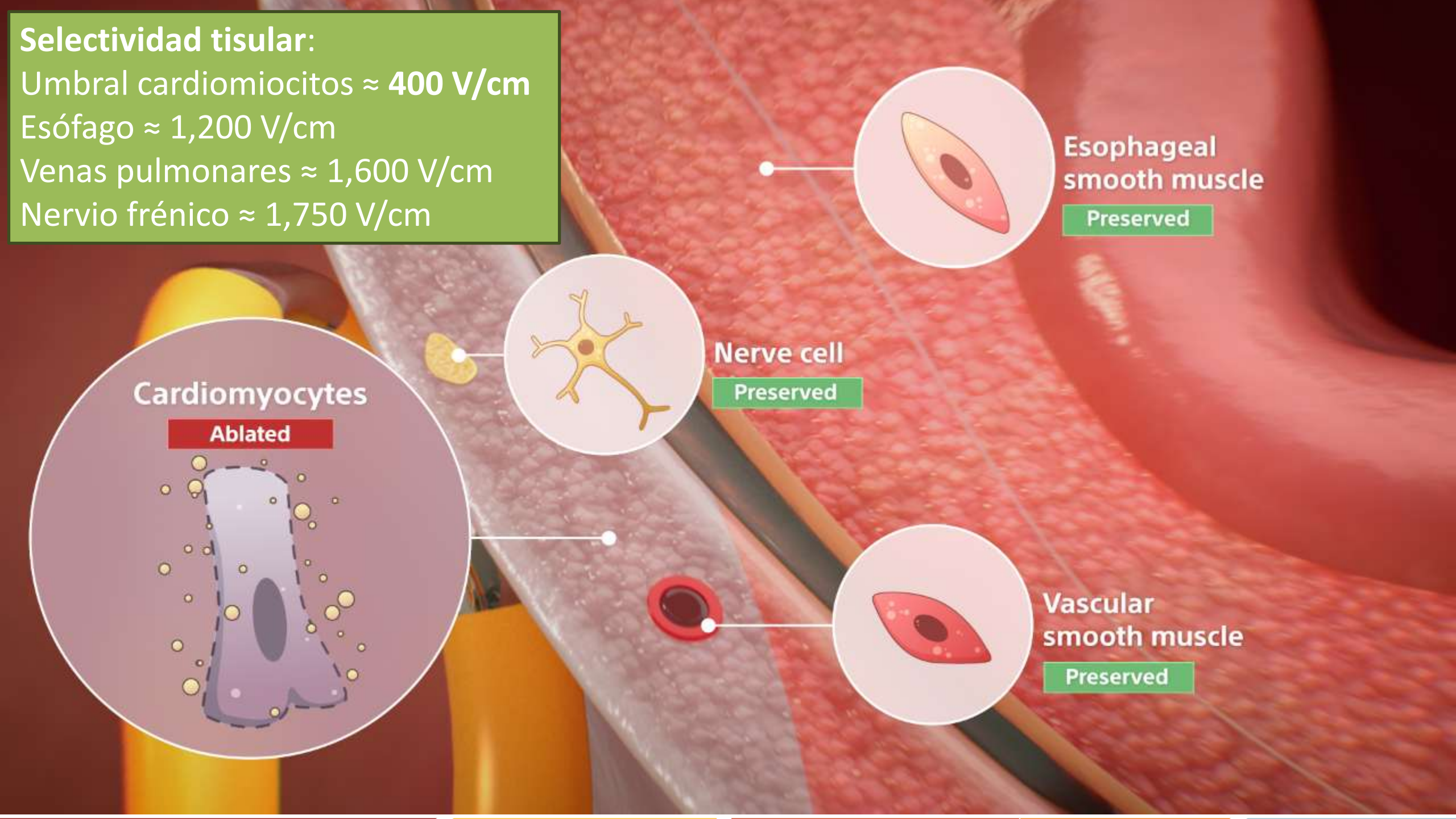
XIII CONGRESO INTERNACIONAL DE CARDIOLOGIA

CARDIOLOGIA INTERVENCIONISTA - LII JORNADA ACCI-SOLACI

Seguridad

Organiza: ASOCAR Asociación Costarricense de Cardiología · ASOCAR Capítulo de Enfermería · ACCI · JORNADAS SOLACI

Selectividad tisular:
Umbral cardiomiocitos ≈ **400 V/cm**
Esófago ≈ 1,200 V/cm
Venas pulmonares ≈ 1,600 V/cm
Nervio frénico ≈ 1,750 V/cm



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

Seguridad: el diferenciador

- Esófago y venas pulmonares: 0% lesiones.
- Parálisis frénica: 11 casos, 0.06%. Recuperación total 100%.
- Coronarias: vasoespasmo reversible, sin lesiones crónicas.
- Hemólisis: 0.03%, lesiones extensas.

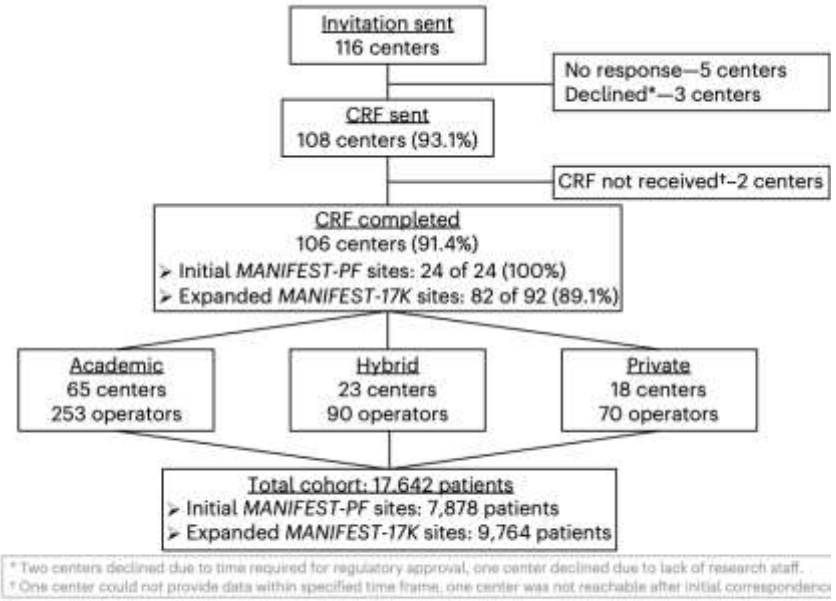
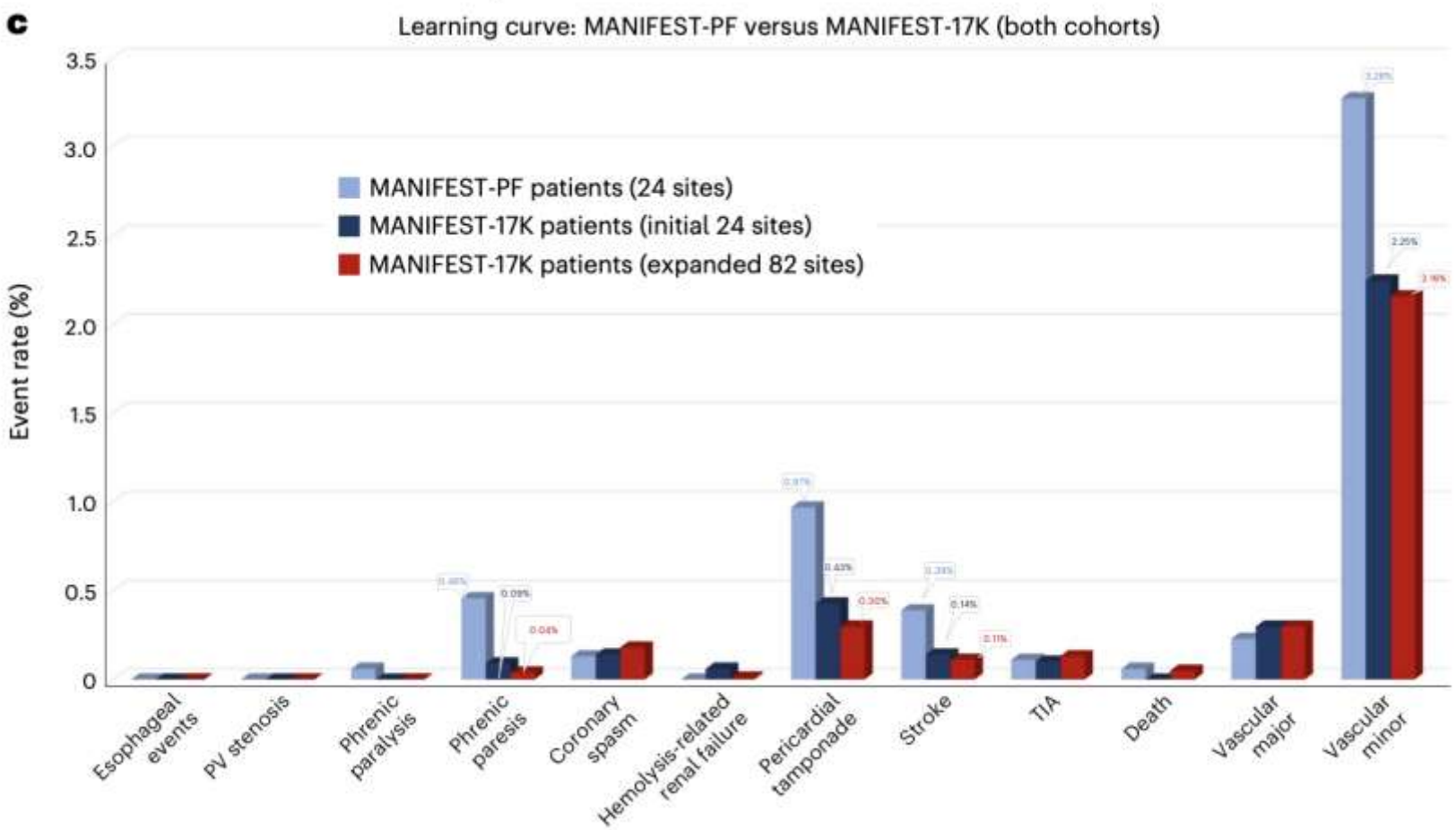


Fig. 1 | Study center, operator and patient numbers. Shown are the invited an participating centers, along with the number of operators and the number of patients included in the study. CRF, case report form.



Nature Medicine | Volume 30 | July 2024 | 2020–2029

ARTICLE IN PRESS

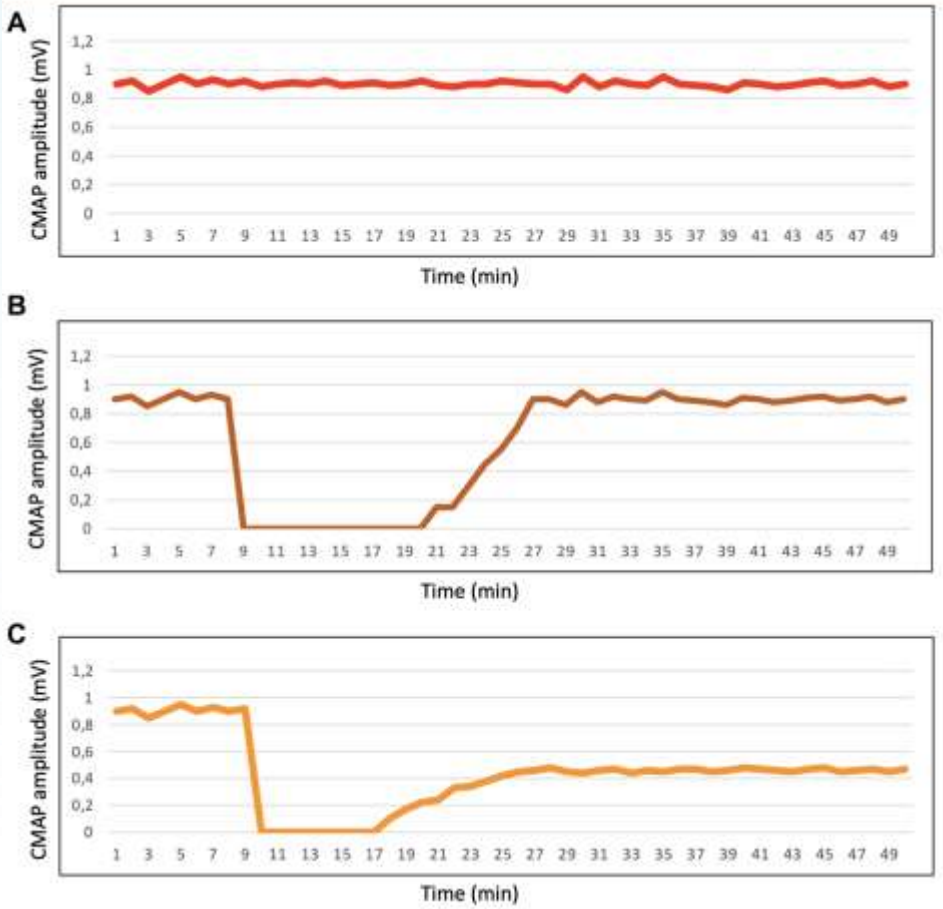
HeartRhythm

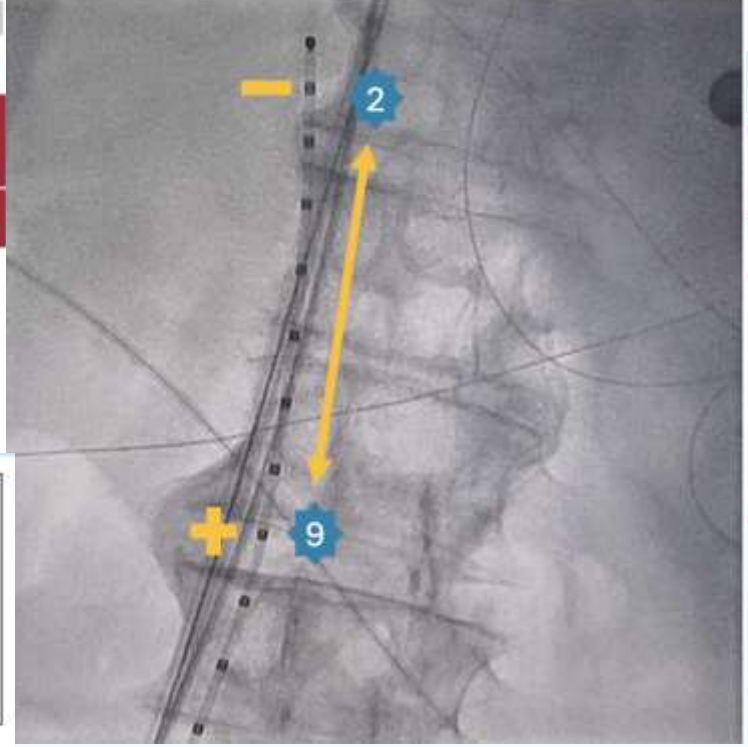
The Official Journal of the Heart Rhythm Society, The Cardiac Electrophysiology Society, and The Pediatric & Congenital Electrophysiology Society

Heart Rhythm Society

High incidence of phrenic nerve injury in patients undergoing pulsed field ablation for atrial fibrillation

Louis Chéhirlian, MD,[1,2] Linda Koutbi, MD,[1,2] Julien Mancini, MD, PhD,[2,3] Jérôme Hourdain, MD,[1,2] Robin Richard-Vitton, MD,[1,2] Marie Wilkin, MD,[1,2] Jean-Claude Deharo, MD,[1,2,4] Baptiste Maille, MD, PhD,[1,2,4] Frédéric Franceschi, MD, PhD[1,2,4]





Heart Rhythm 2025;■:1–8) © 2025

Table 3 Fluoroscopic follow-up and outcomes in patients with abnormal diaphragmatic motion after phrenic nerve palsy (PNP)

PNP side	Discharge (%)	Follow-up	Timing	Value (%)
Right	−19%	Not performed	-	-
Right	−47%	Yes	2 months	−8%
Right	−20%	Yes	6 months	−5%
Right	−35%	Yes	3 months	−35%
Left	−20%	Yes	2 months	−5%
Left	−53%	Yes	1 months	0%

These findings support routine use of dedicated diaphragmatic monitoring and post-procedural dynamic imaging in ablation workflows. Large-scale prospective studies are needed to better assess the incidence, risk factors, and long-term clinical impact of PNI in this context.

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Disclosures: Prof Frédéric Franceschi is a consultant and holds stock in the company Circle-Safe; the other authors have no conflicts of interest to declare.

HeartRhythm
The Official Journal of the Heart Rhythm Society, The Cardiac Electrophysiology Society, and The Pediatric & Congenital Electrophysiology Society
Heart Rhythm Society

AL DE CARDIOLOGIA
II JORNADA ACCI-SOLACI
INTERVENCIÓN

Heart Rhythm 2025;■:1–8) © 2025

High incidence of phrenic nerve injury in patients undergoing pulsed field ablation for atrial fibrillation

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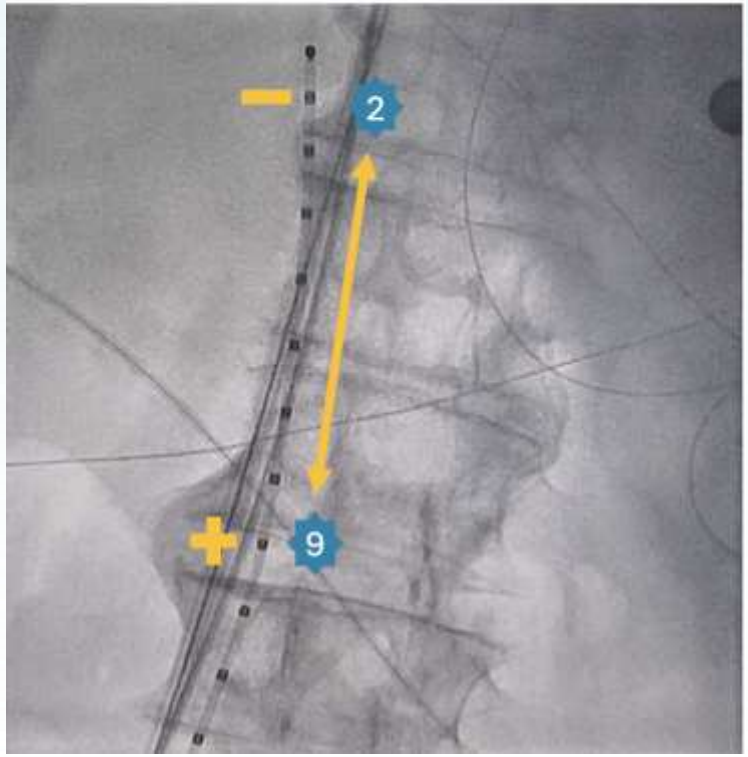

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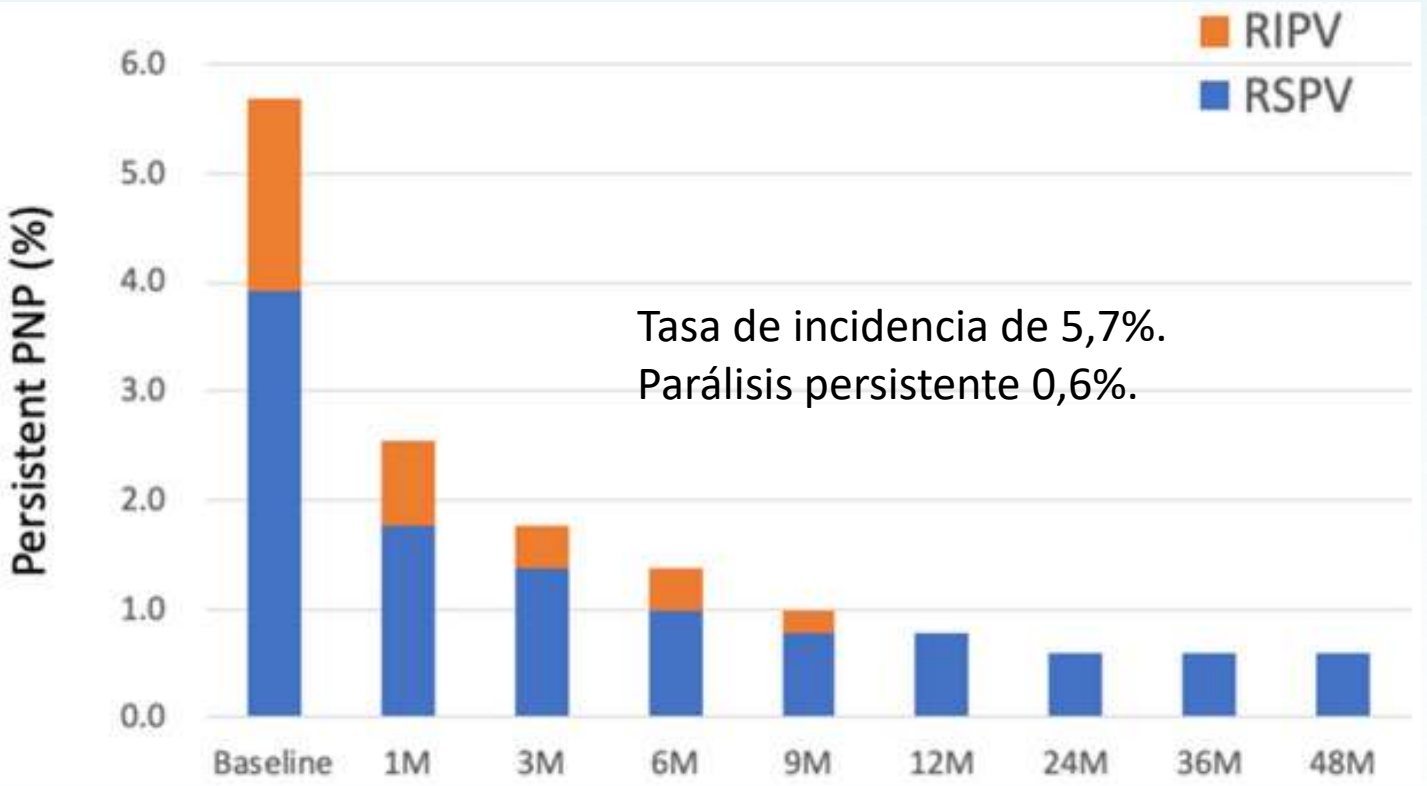
Nat Sci Report (2021) 11:6226

	N = 511	PNP (−) N = 482	PNP (+) N = 29	*P* value
Sex (male)	423 (83%)	403 (84%)	20 (69%)	0.04
Age (years)	59.8 ± 10.1	59.3 ± 10.8	62.9 ± 9.5	0.59
Body mass index (kg/m^2)	24.1 ± 3.2	24.1 ± 3.3	24.2 ± 3.4	0.93
Left atrial diameter (mm)	37.9 ± 16.3	37.9 ± 17.0	36.4 ± 5.4	0.25
LVEF (%)	64.4 ± 5.8	64.3 ± 5.8	64.1 ± 4.4	0.78
eGFR (ml/min/1.73 m^2)	76.9 ± 17.0	76.7 ± 17.3	77.8 ± 13.8	0.81
BNP (pg/ml)	56.1 ± 72.5	56.1 ± 72.5	49.8 ± 45.7	0.66
Hypertension	207 (41%)	194 (40%)	13 (45%)	0.63
Diabetes mellitus	52 (10%)	50 (10%)	2 (7%)	0.55
$CHADS_2$ score	0.7 ± 0.9	0.7 ± 0.9	0.7 ± 0.8	0.87
CHA_2DS_2-VASc score	1.2 ± 1.2	1.2 ± 1.3	1.4 ± 1.1	0.45
Paroxysmal AF	482 (94%)	457 (95%)	25 (86%)	0.052
Operator's experience (cases)				
< 20 cases	153 (30%)	149 (30%)	4 (22%)	0.60
< 30 cases	205 (40%)	199 (41%)	6 (33%)	0.54
< 40 cases	255 (50%)	247 (50%)	8 (44%)	0.62
< 50 cases	296 (58%)	286 (58%)	10 (56%)	0.81

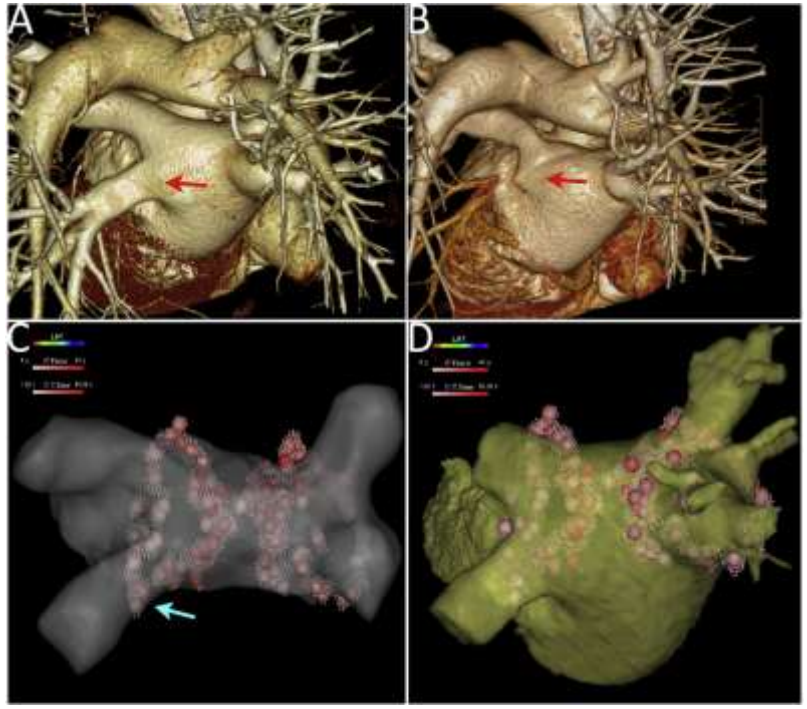
Long-term course of phrenic nerve injury after cryoballoon ablation of atrial fibrillation

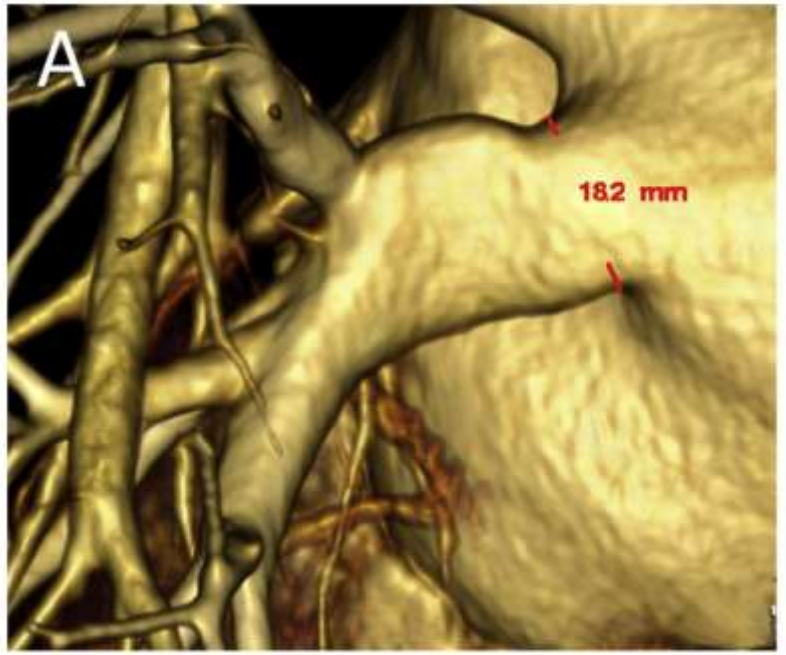


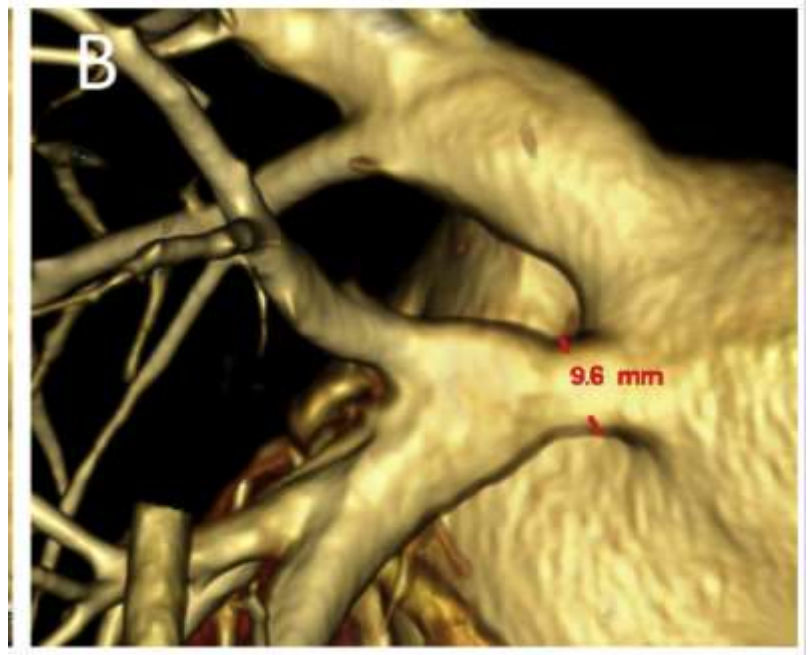
Tasa de incidencia de 5,7%.
Parálisis persistente 0,6%.

Estenosis de venas pulmonares y ablación de FA

JACC Clin Electrophysiol. 2017 Jun;3(6):589-598.







Estenosis de venas pulmonares y ablación de FA

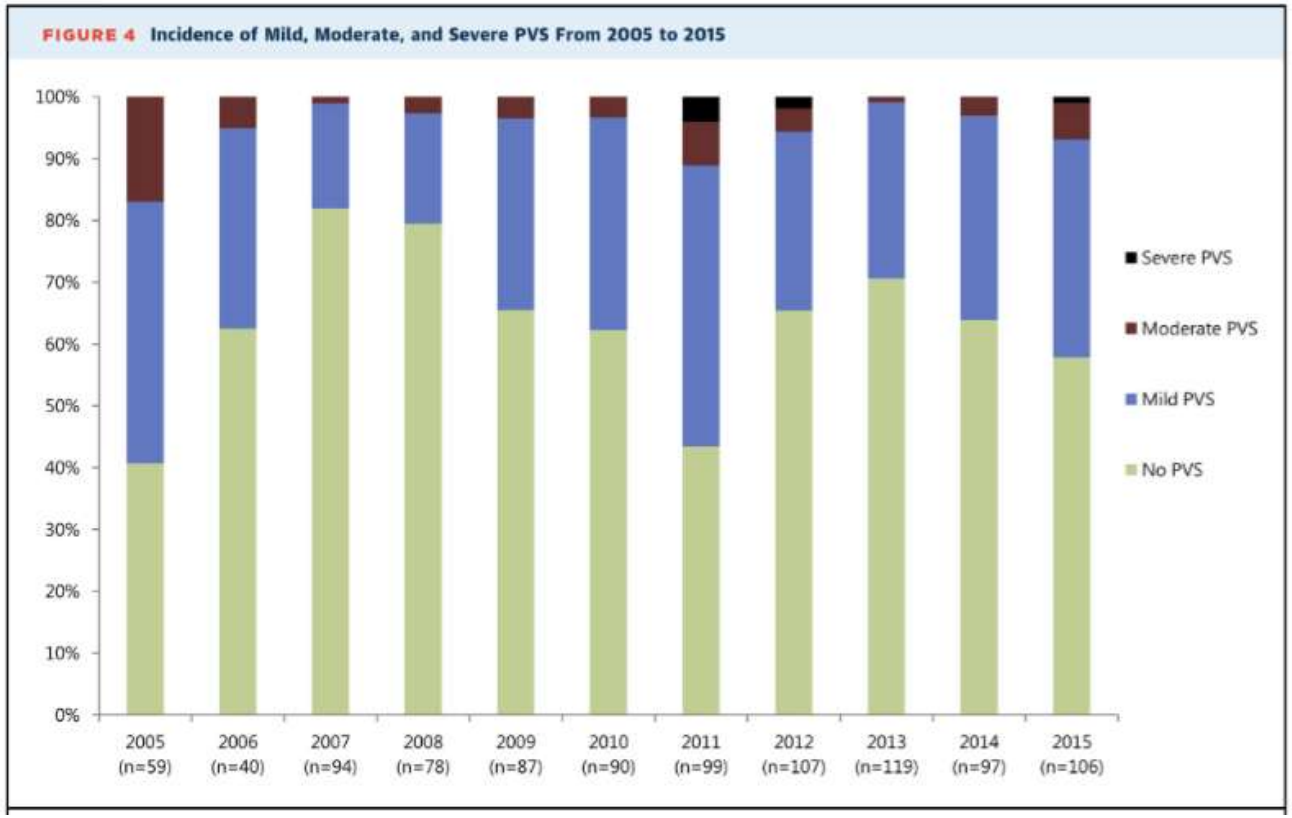
976 pacientes, seguimiento con MRI/CT, 4 a 6 meses posterior a procedimiento.

Hallazgos clave

- **Leve PVS (30–50%)**: 31%
- **Moderada (50–70%)**: 4%
- **Severa (>70%)**: 0.7%
- **Sintomática**: 0.1% (solo 1 paciente requirió stent)

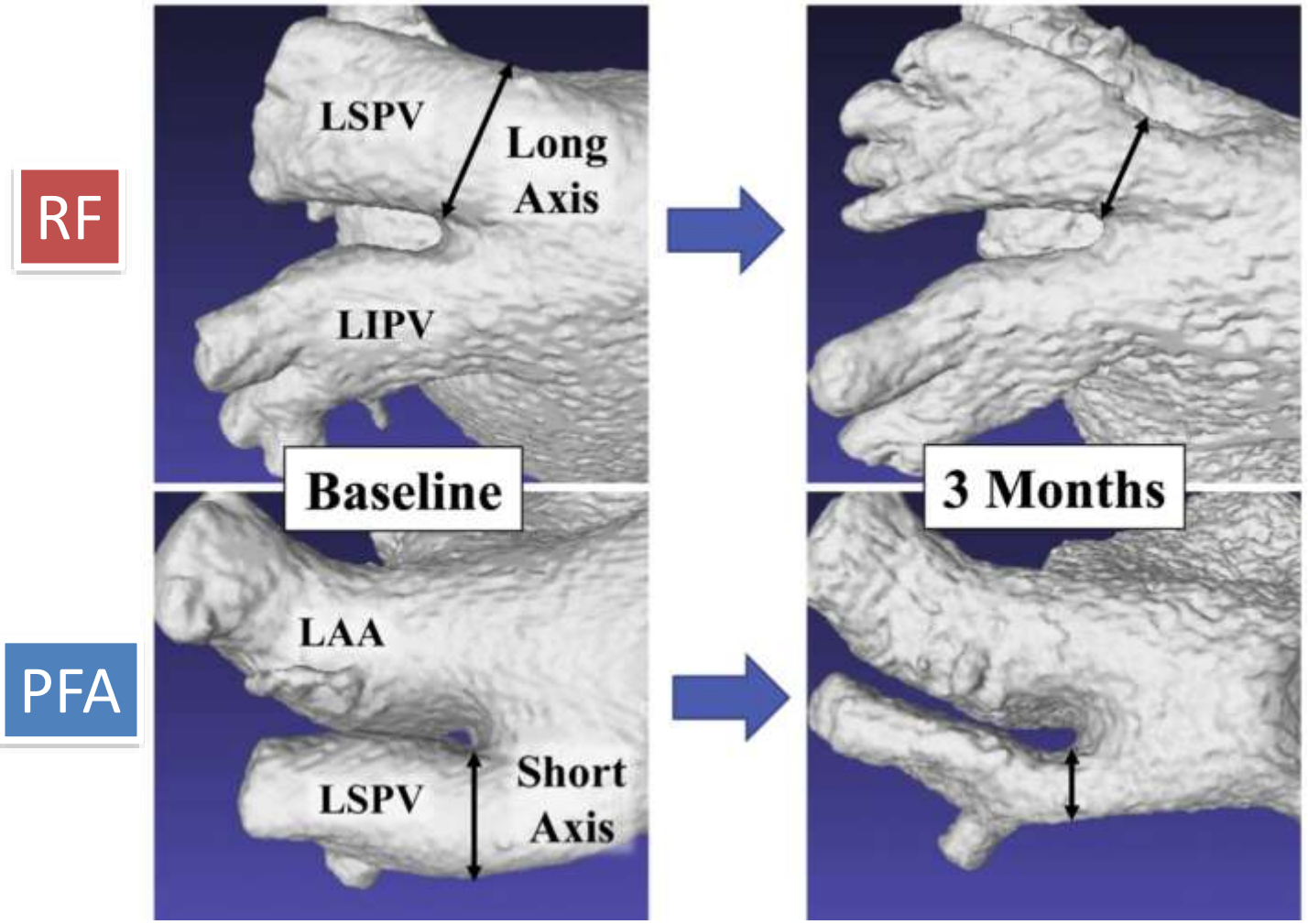
Factores asociados

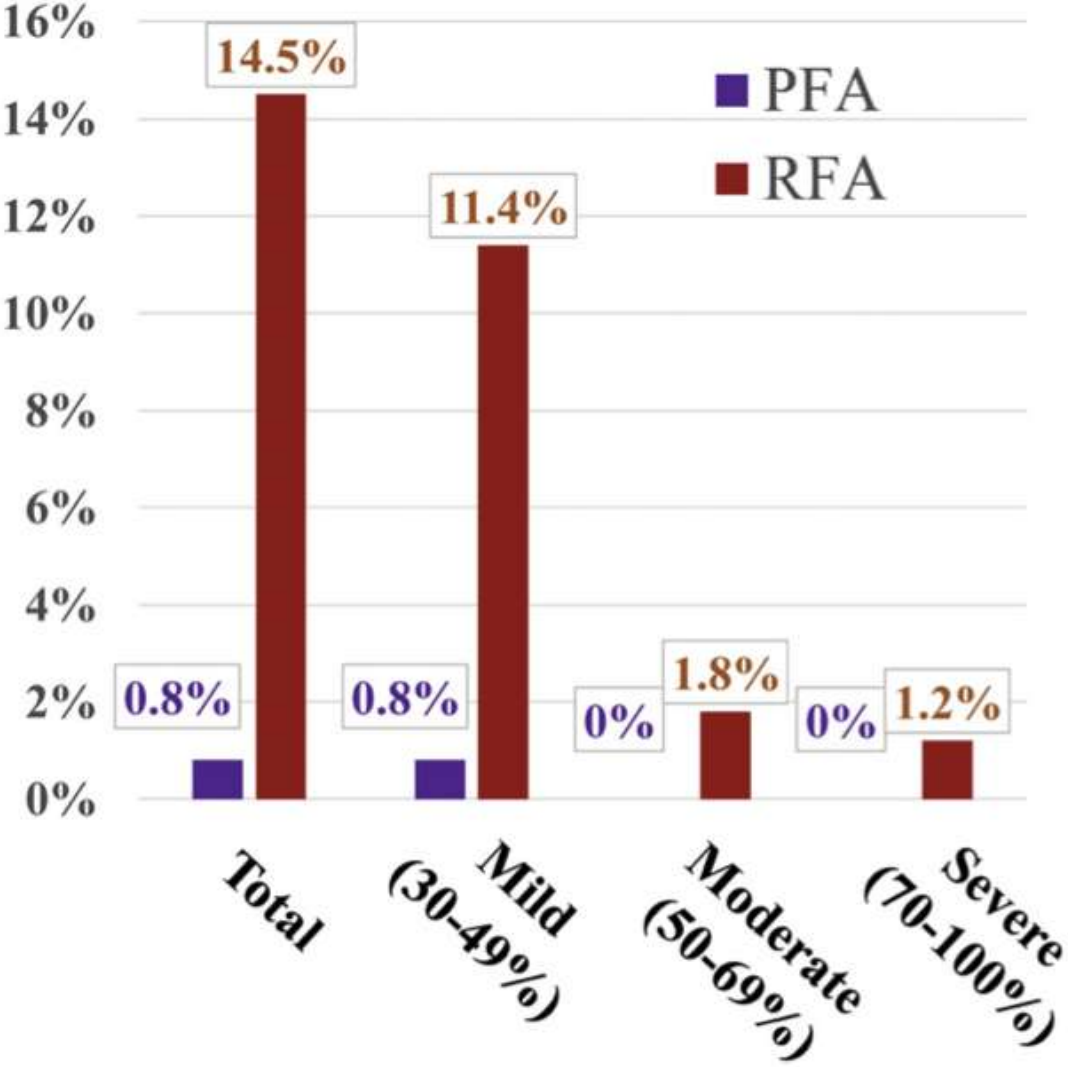
- Ablación **dentro de la vena** con buen contacto tisular.
- Uso de **vainas largas** y catéteres con **contact-force.**
- Más frecuente en **venas pulmonares izquierdas** y troncos comunes.



JACC Clin Electrophysiol. 2017 Jun;3(6):589-598.

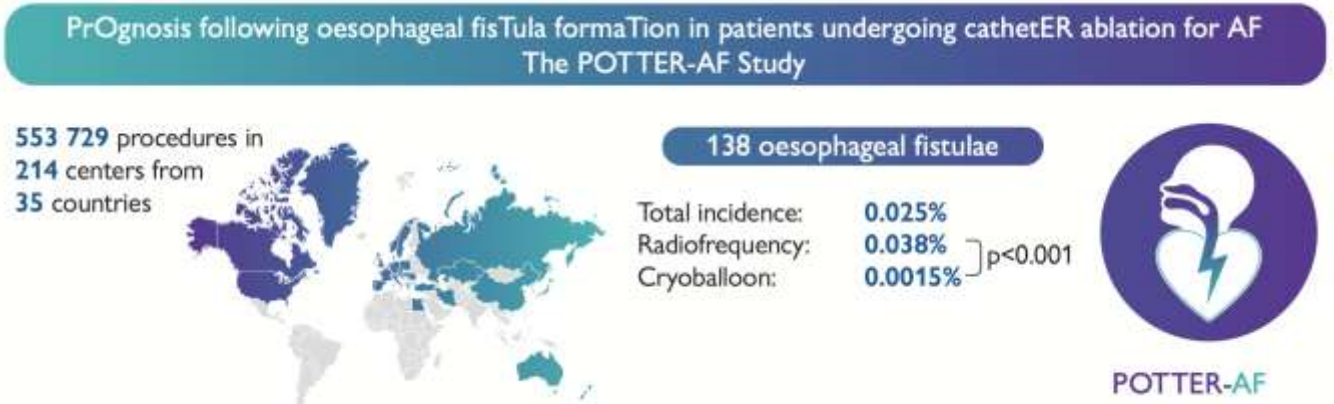
Ostial dimensional changes after pulmonary vein isolation: Pulsed field ablation vs radiofrequency ablation





Heart Rhythm 2020;17:1528–1535

A worldwide survey on incidence, management, and prognosis of oesophageal fistula formation following atrial fibrillation catheter ablation: the POTTER-AF study

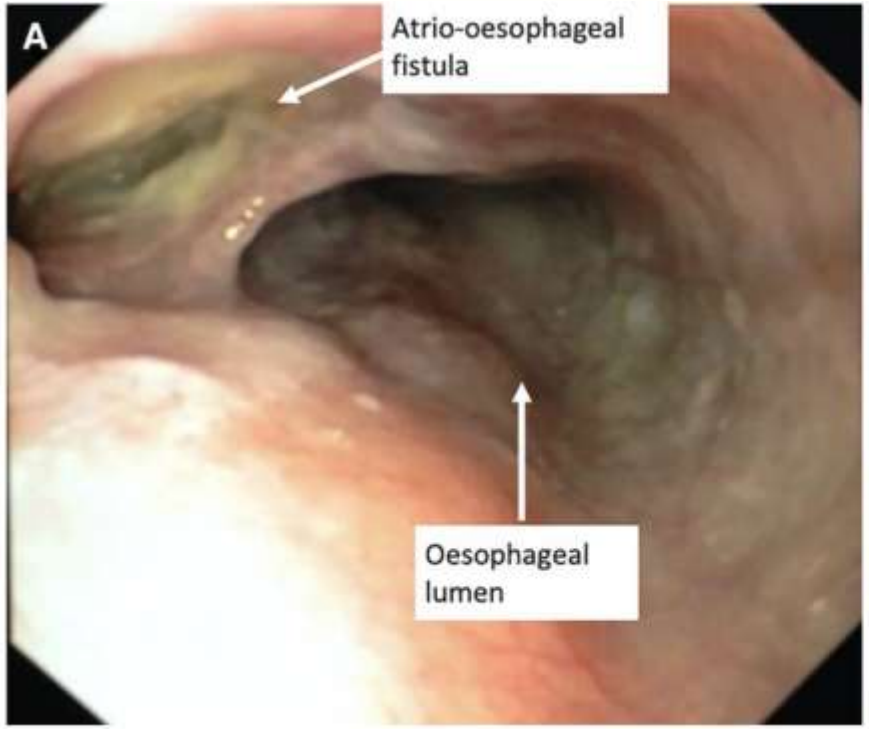


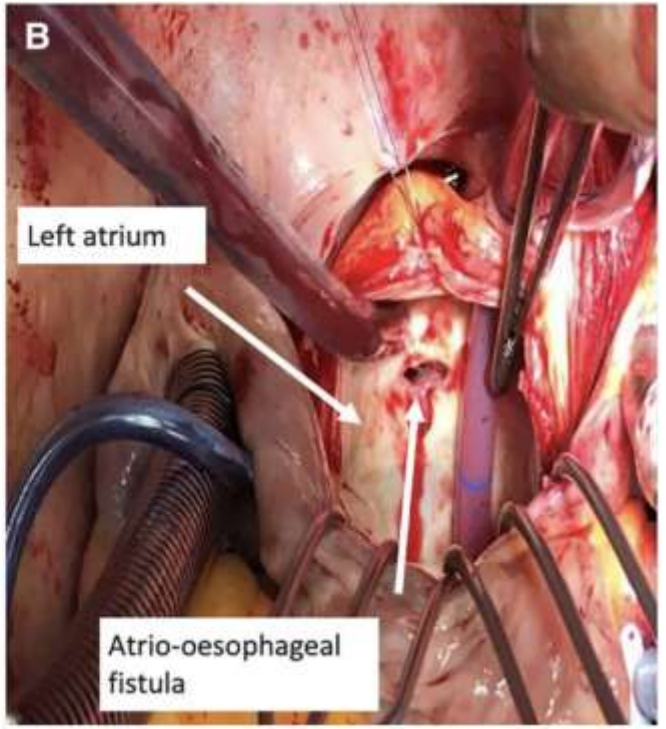
Registro multicéntrico, internacional: **214 centros** en **35 países**.
553,729 procedimientos de ablación de FA (RF 62.9 %, crio 36.2 %, otras modalidades 0.9 %).
138 casos de fístula esofágica (incidencia total **0.025**)

Incidencia según modalidad energética
Radiofrecuencia (RF): incidencia **0.038 %**.
Criobalón: incidencia **0.0015 %** ($p < 0.0001$ frente a RF).

Tratamiento y mortalidad
Cirugía esofágica: 47.4 % - 51.9% mortalidad.
Endoscópico directo: 19.8 % - 56.5% mortalidad.
Manejo conservador: 32.8 % - 89.5% mortalidad.

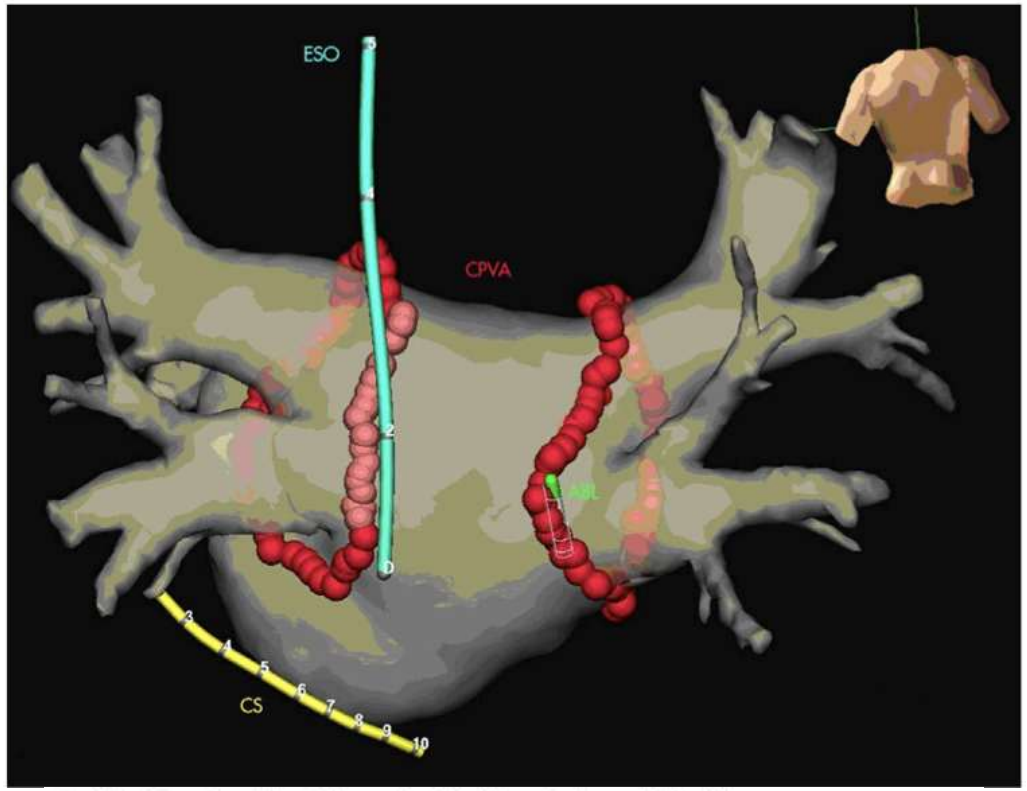
Mortalidad global: **65.8 %**.

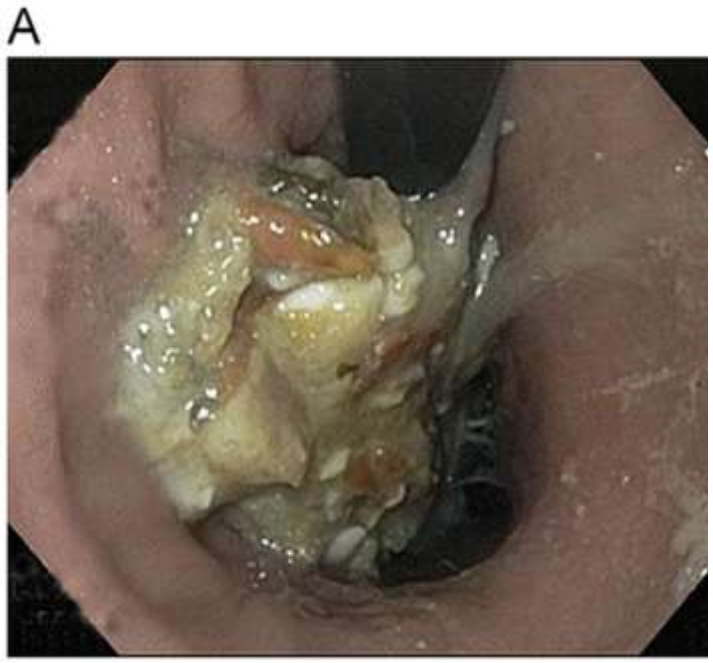




*European Heart Journal (2023) **44**, 2458–2469 https://doi.org/10.1093/eurheartj/ehad250*

Esófago y ablación de FA





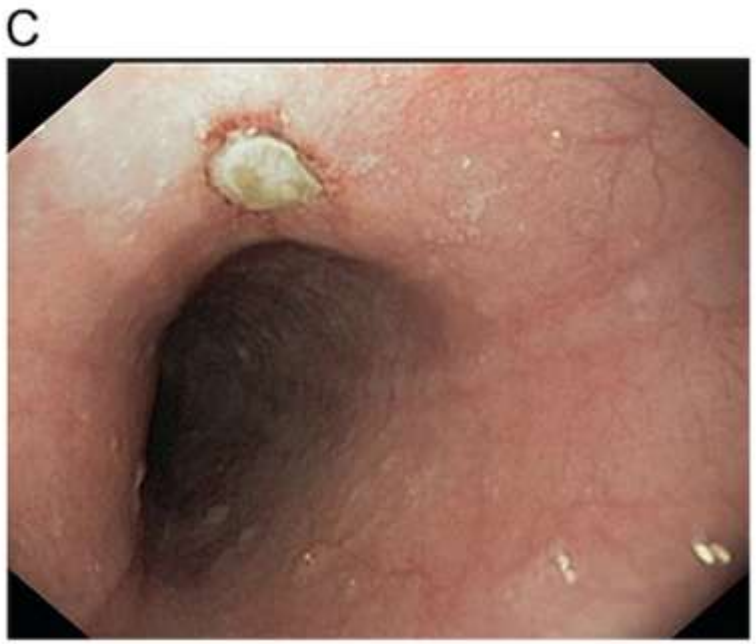


Table 2 Incidental and ablation induced findings

Characteristic	n (%)
Gastric/duodenal erosions	94 (22)
Gastric/duodenal erythema	91 (21)
Gastroparesis	70 (17)
Hiatal hernia	68 (16)
Reflux esophagitis	50 (12)
Grade I	34 (8)
Grade II	11 (3)
Grade III	1 (0)
Thermal lesions	48 (11)

Endoscopia:

N = 425

1 a 3 días posterior a ablación.

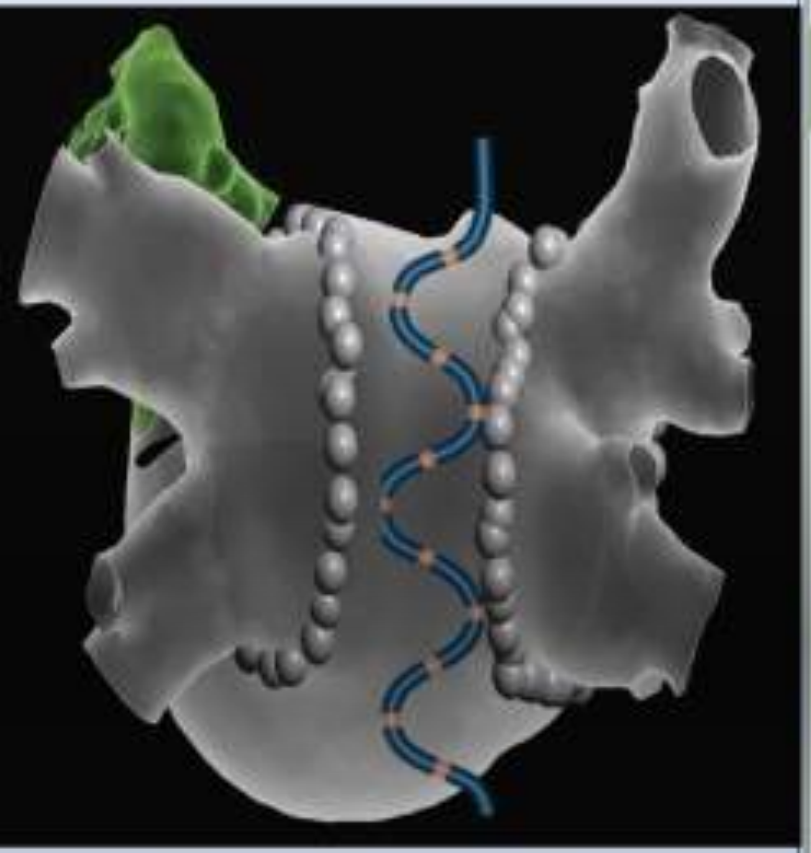
Si temperatura esofágica >41 °C.

17% desarrollaron gastroparesia.

11% tenía lesiones térmicas.

Heart Rhythm 2014;11:574–578

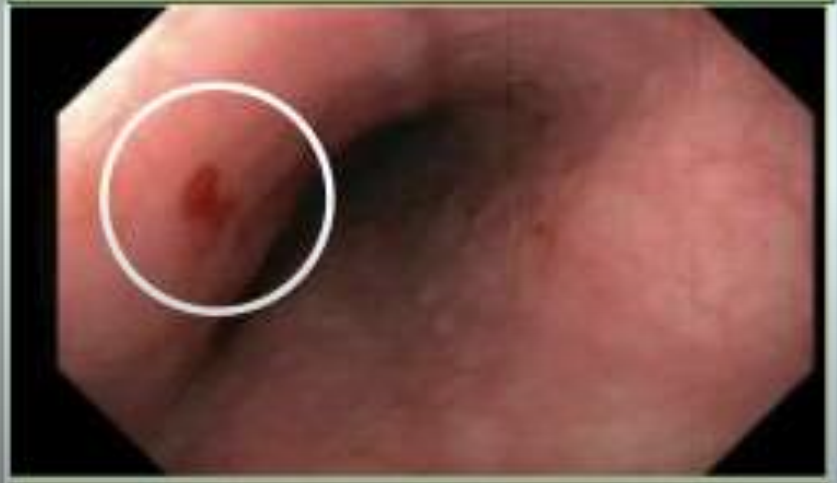
Hi-Lo HEAT Trial



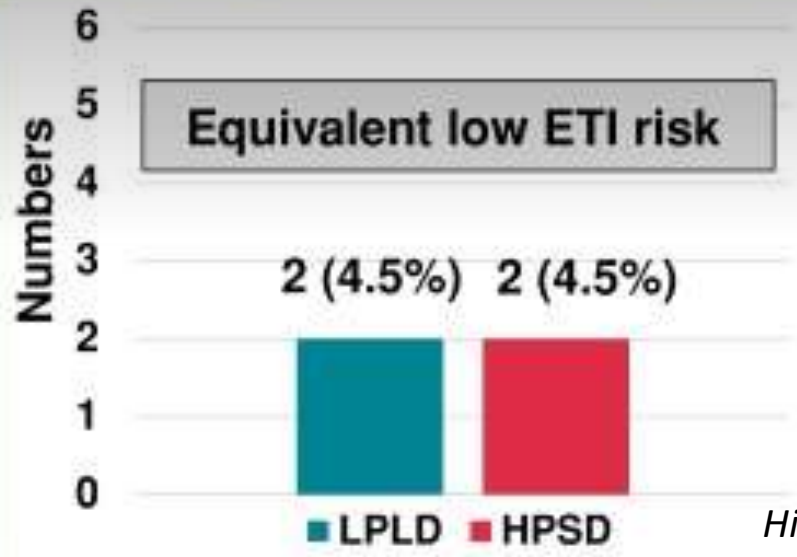
Higher Power Short Duration (40W) versus Lower Power Longer Duration (25W) on posterior LA wall

88 patients

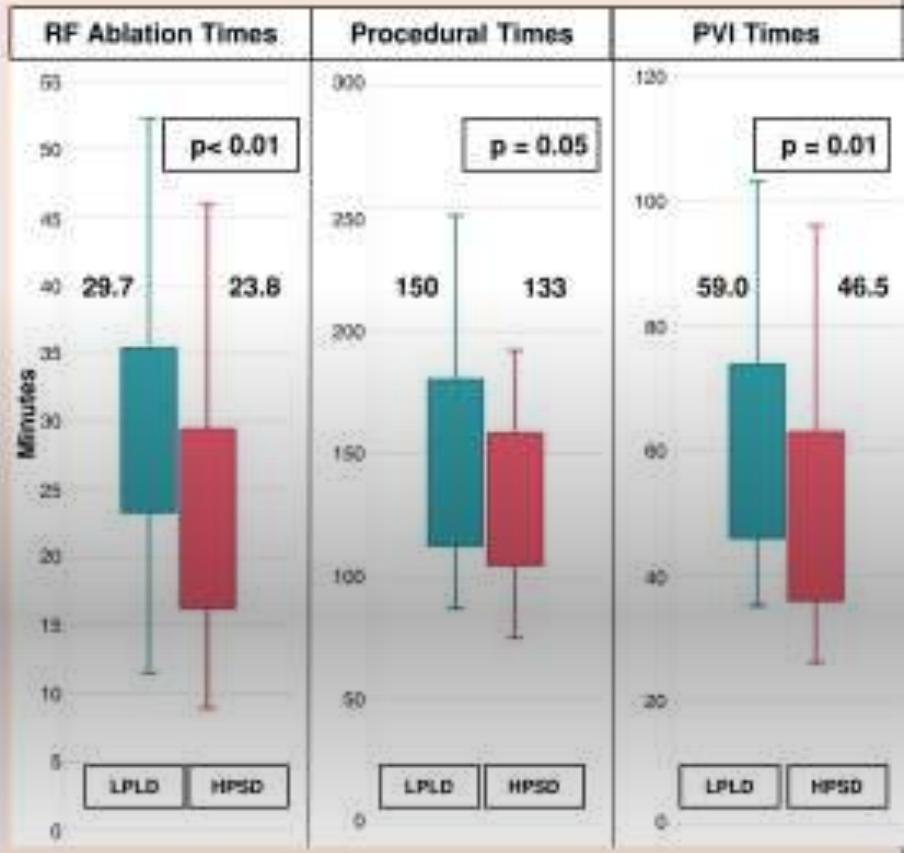
Post ablation Endoscopy



Esophageal Thermal Injury



Procedural Outcomes

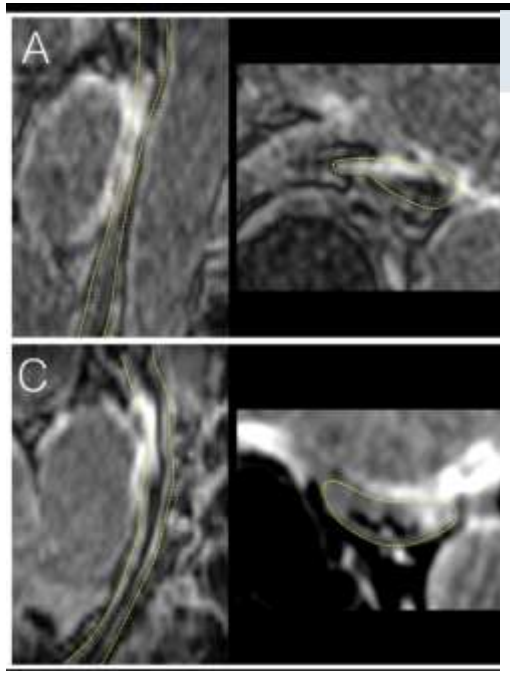


Reduced RF Ablation, Total Procedural and PVI Times with HPSD ablation

Hi-Lo HEAT trial. Europace. 2023 Feb 16;25(2):417-424.

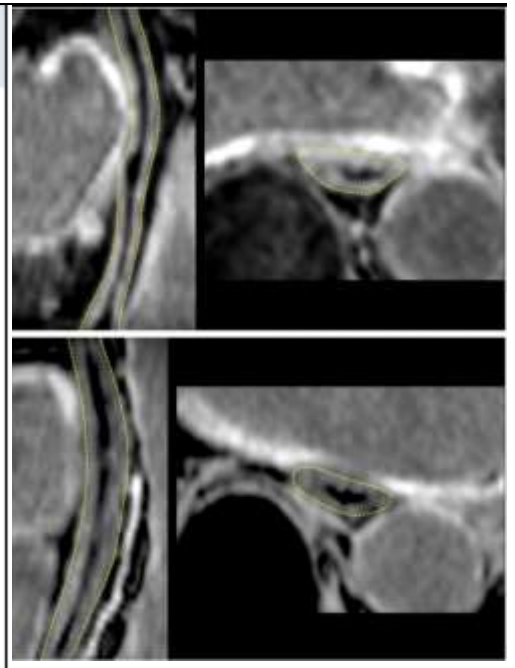
Pared anterior de esófago está en **contacto** con zona de ablación (VPII 7/10, VPID 2/10) **48 al 61%** de veces.

A,C - RF - B,D - Cryo



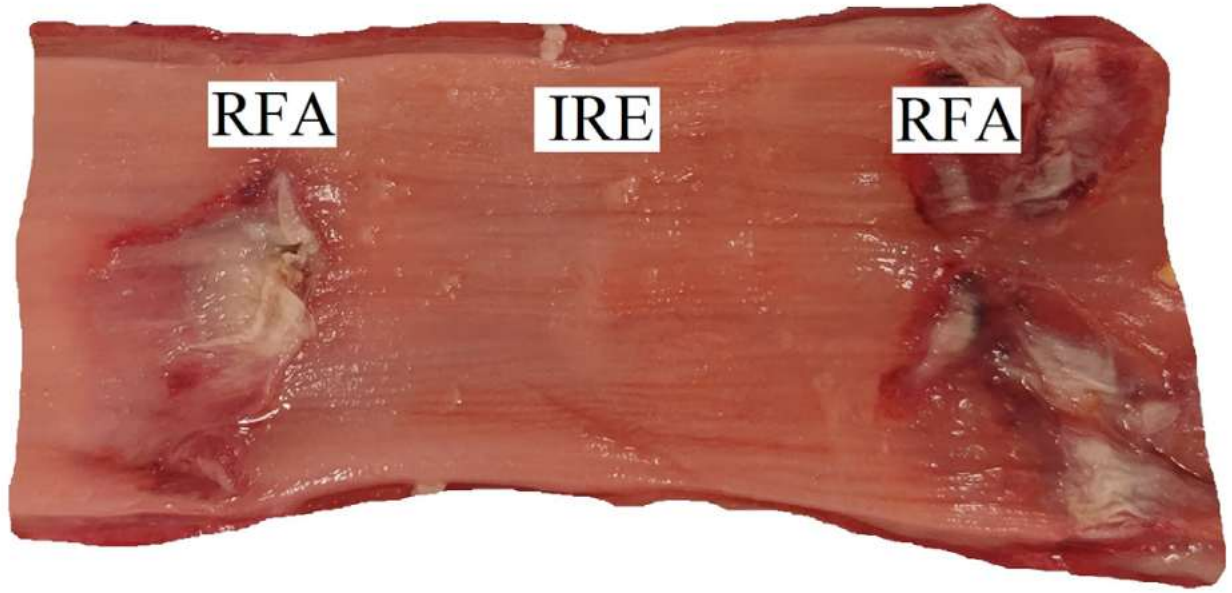
Lesiones esofágicas co
10/23 (43 %) pacientes (6 con RF, 4 con criobalón).
50% fueron **transmurales** y 40% con engrosamiento de pared.
El 91% de los pacientes con contacto directo tuvo lesión.

A, D - PFA



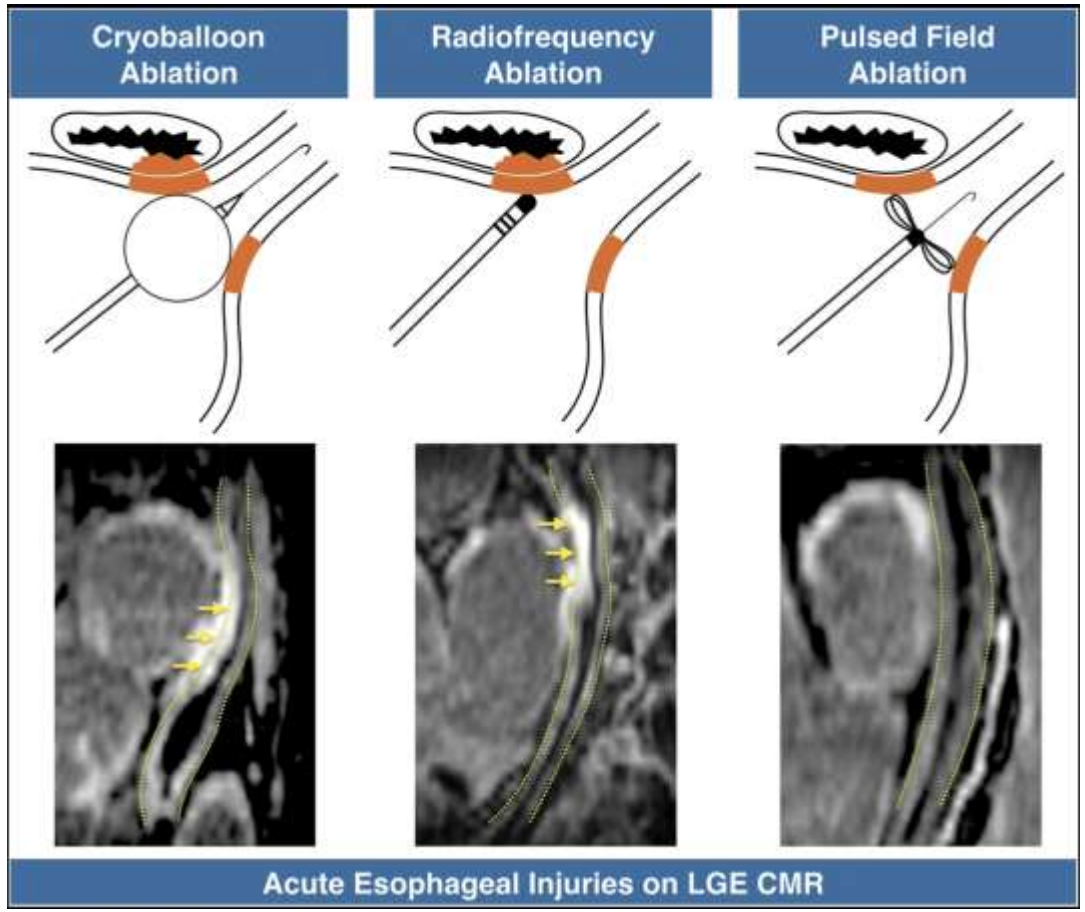
Lesiones esofágicas con PFA: 0/0

FIGURE 3 Effect of IRE and RFA Application on the Esophagus



EP Europace, Volume 23, Issue 9, September 2021, Pages 1391–1399
J Am Coll Cardiol EP 2023;9:2008–2023

Esófago y ablación de FA



Medidas de mitigación:

1. Monitorización de temperatura [2].
2. Sistemas de enfriamiento [3].
3. Desplazamiento esofágico mecánico [4].

1. *EP Europace*, Volume 23, Issue 9, September 2021, Pages 1391–1399
2. *Heart Rhythm* 2015; 12: 268 – 74.
3. *J Cardiovasc Electrophysiol* 2009; 20: 1272 – 8.
4. *J Cardiovasc Electrophysiol* 2012 ;23: 147 – 54

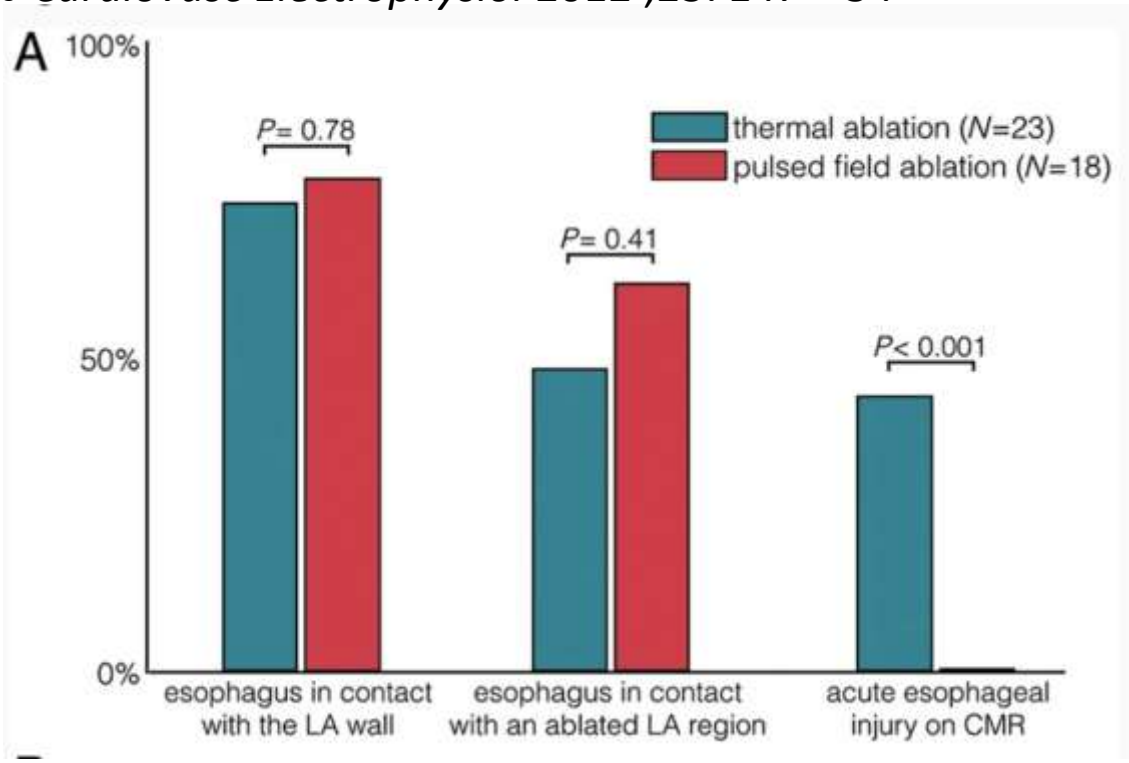


Table 2

Procedural characteristics

Group	Total	Thermal (*N*=23)	PFA (*N*=18)	*P*-value
Total procedure time (min)	141±50	142±51	126±37	0.27
Fluoro time (min)	24±11	25±14	24±9	0.78
Energy delivery duration (min)	NA	RF: 45±23 CRYO: 17±3	0.57±0.08	<0.001[a]
Succesfull PVI	41 (100%)	23 (100%)	18 (100%)	NA

Incidence and Characteristics of Coronary Artery Spasms Related to Atrial Fibrillation Ablation Procedures

— Large-Scale Multicenter Analysis —

Métodos

Registros de ablación de FA de **22,232 pacientes** en **15 hospitales** japoneses.

Incidencia

42 de 22,232 pacientes: incidencia de **0,19 %** (≈ 1 de cada 526):

- 21 (50 %) **durante la aplicación de energía**.
- 9 (21 %) **antes** del inicio de ablación (tiopental).
- 12 (29 %) **después** hasta 24 h.

Diagnóstico y tratamiento

- Angiografía 37 de los 42 casos (88 %).
- Estenosis o espasmos focales/oclusión.
- Resolución completa con nitratos.
- 7/42 pacientes (17 %) complicaciones graves.

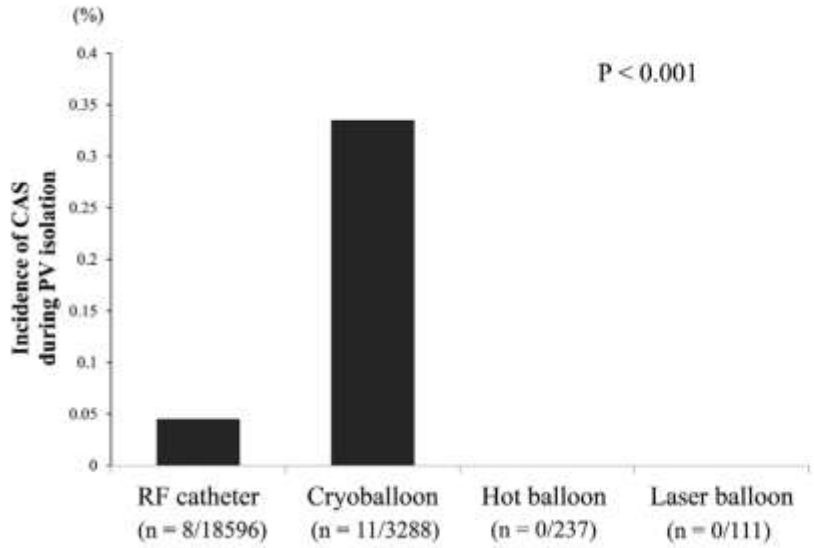
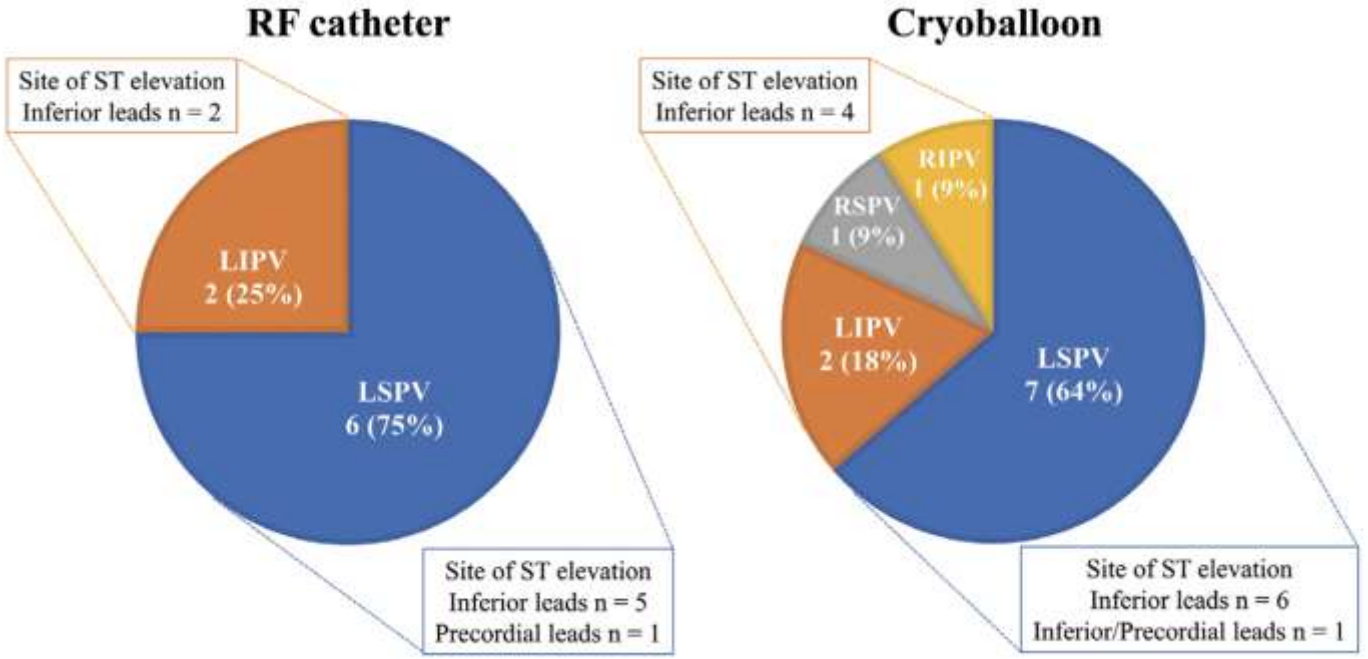


Figure 3. Comparison of the incidence of coronary artery spasms (CASs) during delivery of ablation energy using different ablation energy sources. PV, pulmonary vein. RF, radiofrequency.



Circulation Journal. Circ J 2021; **85:** 264–271. doi:10.1253/circj.CJ-20-1096

XIII CONGRESO INTERNACIONAL DE CARDIOLOGIA

CARDIOLOGIA INTERVENCIONISTA - LII JORNADA ACCI-SOLACI

Costo

Organiza: ASOCAR Asociación Costarricense de Cardiología · ASOCAR Capítulo de Enfermería · ACCI · JORNADAS SOLACI

Pulsed field ablation with the pentaspline catheter compared with cryoablation for the treatment of paroxysmal atrial fibrillation in the UK NHS: a cost-comparison analysis

Table 3 Base case results

Cost component	Costs by modality		
	Cryoablation	PFA*	Δ PFA*—cryoablation
De novo ablation, *of which*	10 733	11 516	+783
Catheter and accessories	6005	6950	+945
Procedure	4371	4371	–
Complications	357	195	–162
Repeat ablation, *of which*	2171	1045	–1126
Catheter and accessories	958	461	–497
Procedure	1119	538	–580
Complications	94	45	–49
Total	**12 904**	**12 561**	**–343**

Costo total: Crio > PFA

Cost, efficiency, and outcomes of pulsed field ablation vs thermal ablation for atrial fibrillation: A real-world study

Table 4 Procedural costs (£) per modality

Item	PFA (n = 208)	CB (n = 325)	RF (n = 174)	*P*
Ablation equipment*	5363	3277	3755	<.001
Cardiologist time	852 (750–1019)	1019 (902–1152)	1027 (862–1332)	<.001
Anesthetic support	457 (402–547)	0†	426 (0–555)	<.001
Catheter laboratory use costs	2327 (2047–2784)	2784 (2464–3149)	2806 (2356–3640)	<.001
Ward costs	765 (340–879)	355 (320–807)	807 (615–877)	<.001
Total costs‡	10,010 (9441–10,821)	8106 (7537–8665)	8949 (8334–10,249)	<.001

Costo directo: PFA > RF > Crio

*BMJ Open 2024;**14**:e079881. doi:10.1136/ bmjopen-2023-079881*

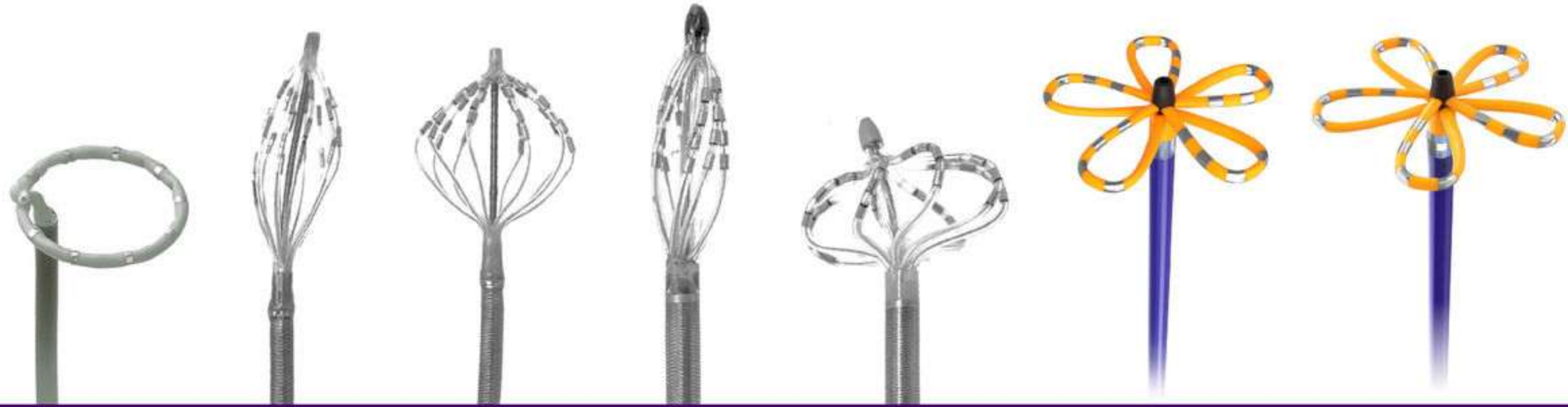
XIII CONGRESO INTERNACIONAL DE CARDIOLOGIA

CARDIOLOGIA INTERVENCIONISTA - LII JORNADA ACCI-SOLACI

Diseño y desarrollo

Organiza: ASOCAR Asociación Costarricense de Cardiología · ASOCAR Capítulo de Enfermería · ACCI · JORNADAS SOLACI

Design evolution of the FARAWAVE Pulsed Field Ablation Catheter over 10 years



LASSO | 8-SPLINE | 10-SPLINE | 6-SPLINE | BALLOON | FARAWAVE™ Pulsed Field Ablation Catheter | FARAWAVE™ NAV Pulsed Field Ablation Catheter

Circunferenciales

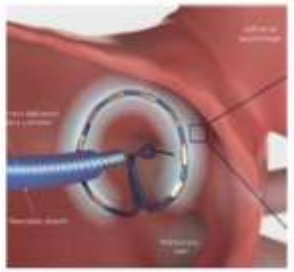
Indicación de uso (FDA, CE):
Fibrilación auricular paroxística.
Fibrilación auricular persistente.
Ablación de pared posterior*.

Bajo investigación:
Vías accesorias
Arritmias ventriculares.

Heart Rhythm. 2025;22(7):e74-e84.
Circulation. 2024;150(15):1174-1186
Euroace 2023;25(6):euad147.
JACC . 2019;74(3):315-326
Heart Rhythm. 2025;22(7):e13-e22.
Heart Rhythm. 2025;:S1547-5271(25)02552-4
Heart Rhythm. 2024;21(8):1211-1217.
Europace (2024) **26**, euae134

Table 2 Overview of contemporary circumferential PVI tools

Farapulse™ Boston Scientific

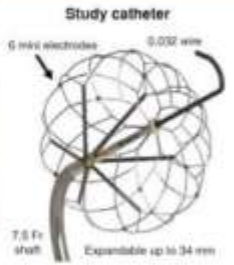


PulseSelect™ Medtronic

Inspire™ Biosense Webster

Globe PF™ Kardium

Volt™ Abbott

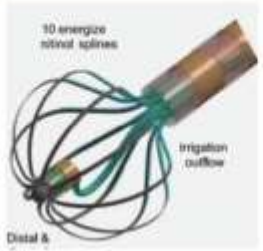


Sphere 360™ Medtronic

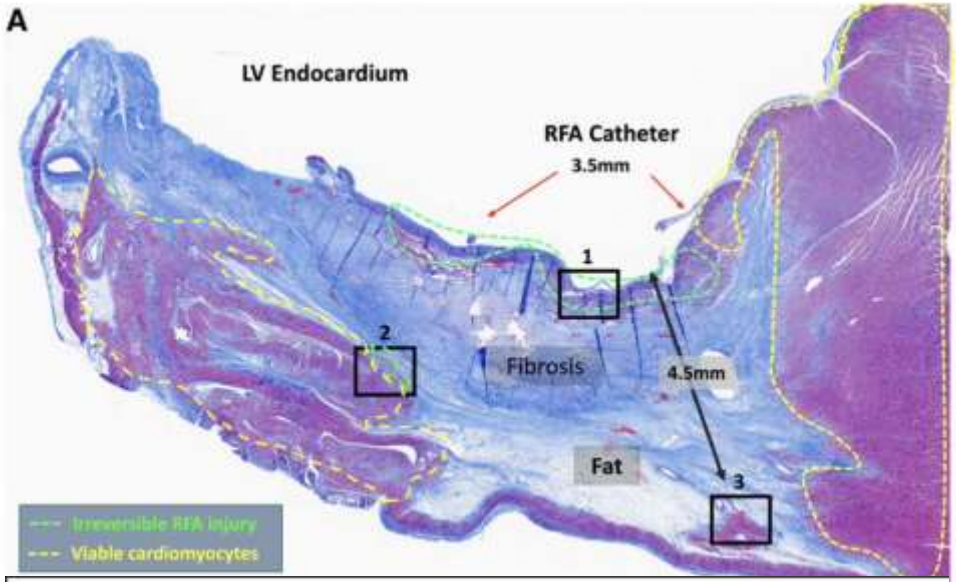
Diameter	31/35 mm	25 mm	25–35 mm	30 mm	28 mm	34 mm
Size	12F	9F	8.5F	16F	13F	8.5F
Over the wire	Yes	Yes	No	No	Yes	Yes
PVI	++++	++++	++++	++++	++++	++++
Non-PV lesions/ versatility	+++	++	++	++	+	+
Clinical experience	+++++	+++	++	+	+	++
Ablation mode	Bipolar	Bipolar	Bipolar	Bipolar	Bipolar	Monopolar
Dedicated 3D mapping	No	No	Yes	Yes	Yes	Yes
Approval	EU/USA	EU/USA	EU/Japan	No	No	No

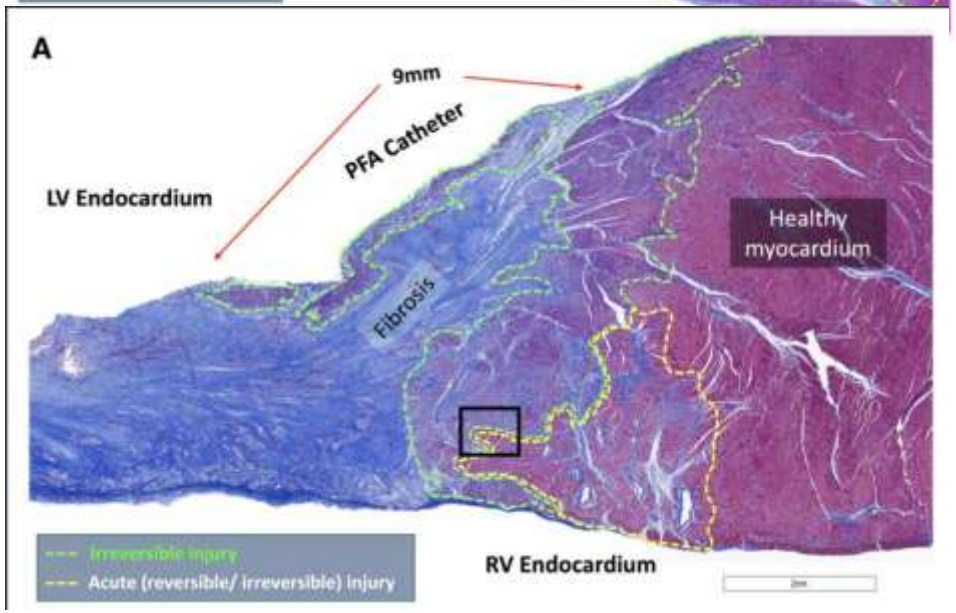
Focales de huella grande - Mapeo/PFA/RF

Table 3 Overview of focal point-by-point large/intermediate footprint PFA catheters and a specific generator enabling PFA using conventional RF catheters

					
	Sphere 9™ Medtronic	**Omnypulse ™ Biosense Webster**	**Faraflex ™ Boston Scientific**	**LFC Centauri**	**Centauri**
Diameter	9 mm	12 mm	10 mm	10 mm	3.5–4 mm
Size	8F	7.5F	8F	8.5Fs	8F
Catheter deflection	Bidirectional	Bidirectional	Bidirectional	Bidirectional	Unidirectional/bidirectional
PVI	++++	+++	+++	NA	+++
Non-PV lesions/versatility	++++	++++	++++	NA	++++
Clinical experience	++++	+	+	No	++
Ablation mode	Monopolar	Bipolar	Bipolar Monopolar	Monopolar	Monopolar
PFA/RFC	Yes/Yes	Yes/No	Yes/No	Yes/No	Yes/Yes
Dedicated 3D mapping	Yes	Yes	Yes	multiple	multiple
Approval	EU	No	No	No	EU

Europace (2024) **26**, euae134





Circ Arrhythm Electrophysiol. 2022;15:e011209

Europace (2024) **26**, euae134

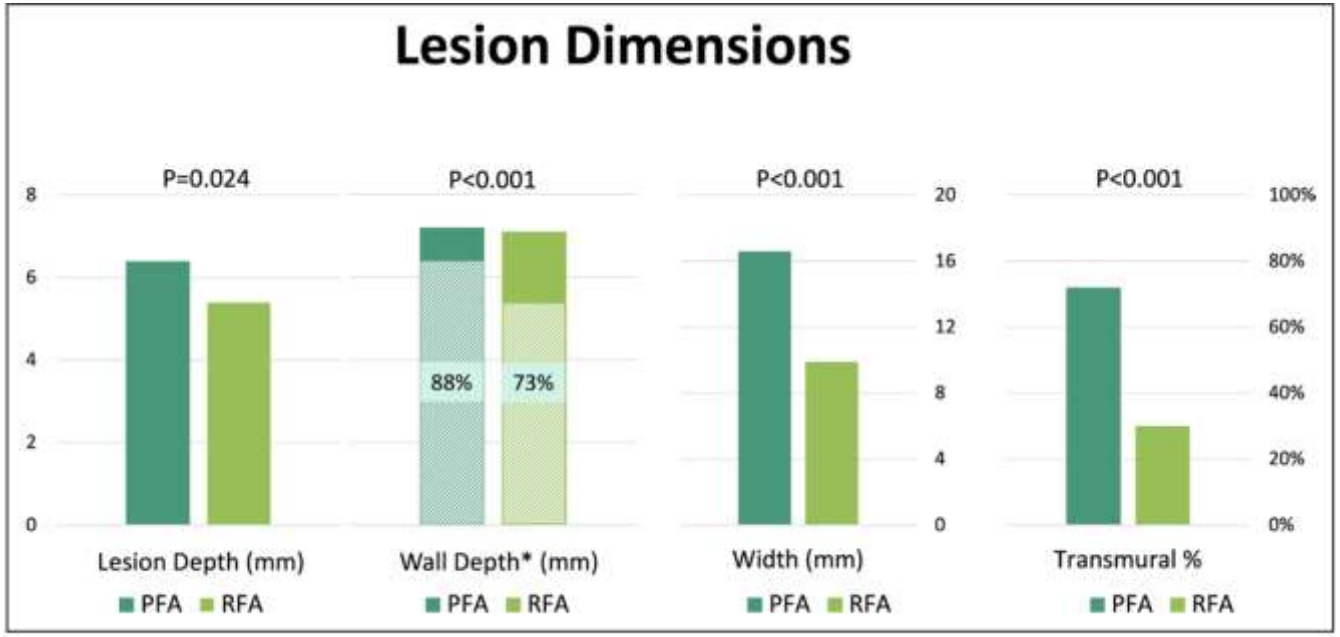
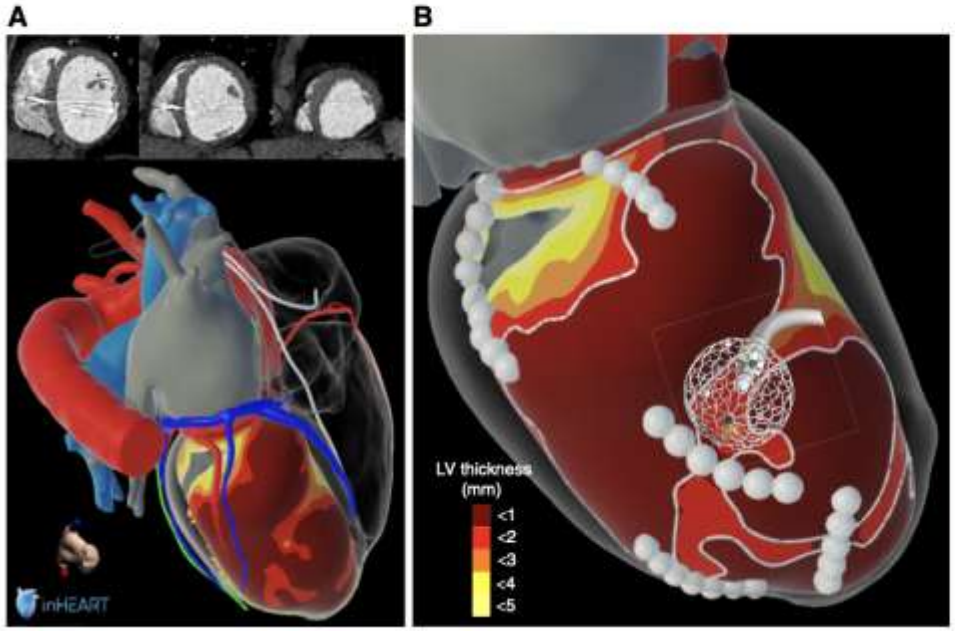
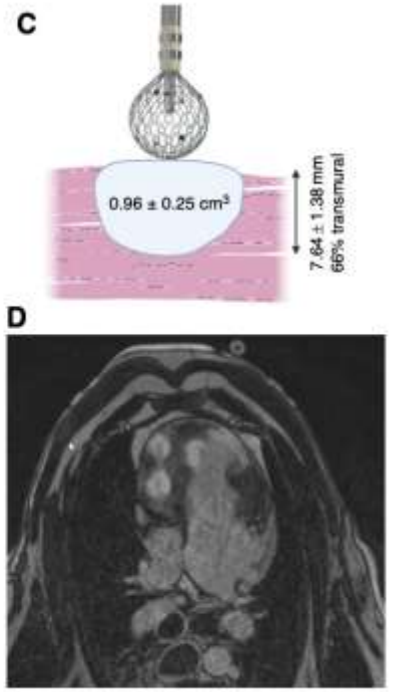


Figure 3. **Comparison of lesion dimensions at infarct border zone.**





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Conclusiones

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LD Solís en Santa Teresa Beach, Costa Rica
4 mar

Publicación de Edgar

Edgar Fuentes está con **Vivien Araya** y **4 personas más** en **Clínica Bíblica**.
12 nov 2017 ·

Ecocardiografía 3D + Electrofisiología: Ablación por Radiofrecuencia de Venas Pulmonares para Fibrilación Auricular. #3DEcho Con grandes amigos!

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Ecocardiografía 3D + Electrofis… Radiofrecuencia de Venas Pulmon… Auricular. **#3DEcho** Con grandes amig…

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Publicaciones Fotos Reels

LD Solís se 😇 siente bendecido con **Vivien Araya** y **2 personas más**.
28 ago 2019 ·

Con este equipo de trabajo excepcional, seguimos cosechando éxitos!
Dos nuevos casos de ablación exitosa para fibrilación auricular y seguimos contando....
Hugo Arguedas-Jimenez Vivien Araya Fer Aguero

206 24 com… …ces compartido

LD Solís

Publicaciones Fotos Reels

Hugo Arguedas-Jimenez está con **LD Solís** y **2 personas más** en **Hospital CIMA-San José**.
26 oct 2019 · ·

Hace frío en el oeste!

26 de octubre de 2019 con Yamilah Bouzid, Leonardo Meza y LD Solís en Hospital CIMA-San José

Gracias al apoyo de Medtronic y la tecnología @articfrontadvance muchas personas con @fibrilacionauricular podrán curarse! La tecnología de ablacion con balón frío permite mejorar el control de esta arritmia y el desarrollo de insuficiencia cardíaca.
https://youtu.be/uY3mfcYF6DI

68 3 comentarios 6 veces compartido

Me gusta Comentar Compartir

XIII CONGRESO IN
CARDIOLOGIA INTERV
DE LA PREVE

Hace 2 años.....
hace rato que
perdimos la
cuenta, pero son
más de 200 y
contando! A ver
cuándo llegamos a
las 1000.😂😜👍

HACE 2 AÑOS

Hoy celebrando la 10ma ablación juntos y seguimos contando!!! 👍👍 Por que "el sufrimiento se lleva mejor en compañía y el éxito se disfruta mucho más en equipo!!!"

O INTERNACIONAL DE CARDIOLOGIA
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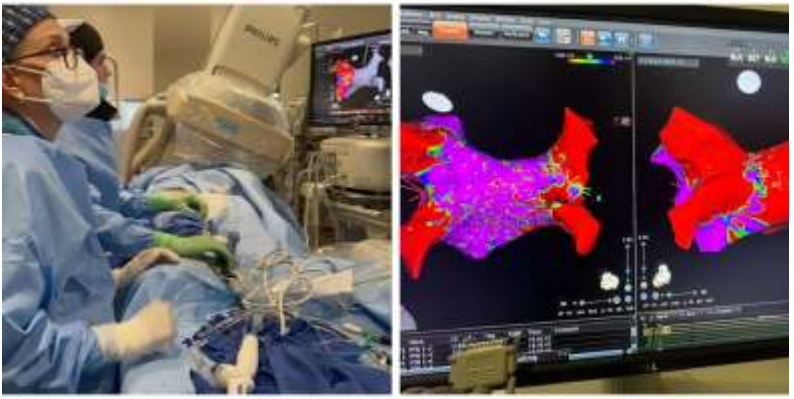
/ENCIÓN A LA INTERVENCIÓN

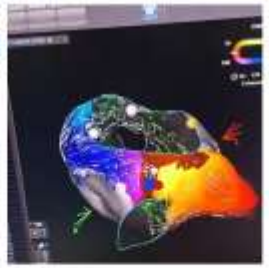
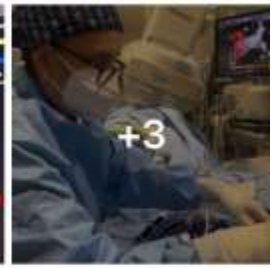
Vivien Araya

Publicaciones Fotos Reels

Vivien Araya
4 días ·

Setiembre , mes del corazón. Trabajando con el corazón 😁😃❤️



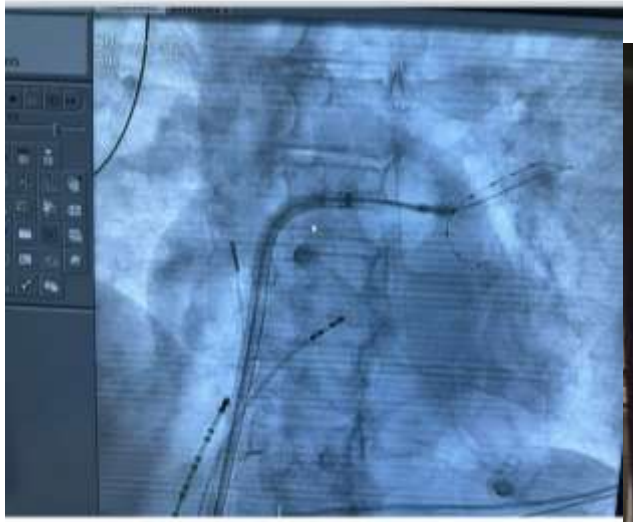




LD Solís y 54 personas más 8 comentarios

Me gusta Comentar Enviar

Publicación de Vivien

Me gusta Comentar Enviar



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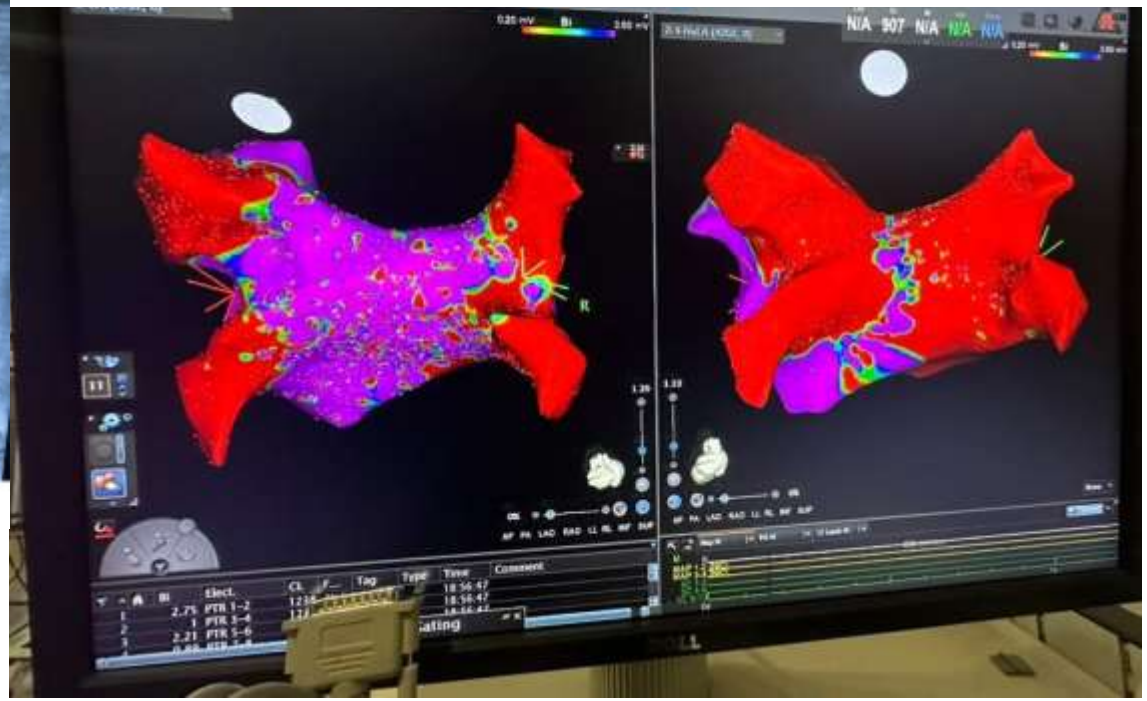
3 1 comentario



¿Percibió la fuerte rayería sobre el Valle Central? Instituto Meteorológico explica a qué se debió

Se prevé que el fenómeno persista en los próximos días

Por Sebastián Sánchez

09 de octubre 2025, 03:24 p. m.

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DE LA PREVENCIÓN A LA INTERVENCIÓN

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