

Cryoablation of Persistent Atrial Fibrillation



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Disclosure Statement of Financial Interest

I currently have, or have had over the last two years, an affiliation or financial interests or interests of any order with a company or I receive compensation or fees or research grants with a commercial company :

Speaker's name : Serge, Boveda, Toulouse

Consultant : Medtronic, Boston Scientific, MicroPort CRM,
ZOLL



2020 ESC Guidelines for the diagnosis and management of atrial fibrillation developed in collaboration with the European Association of Cardio-Thoracic Surgery (EACTS)

Techniques and technologies

Complete electrical isolation of the pulmonary veins is recommended during all AF catheter-ablation procedures.^{235–237,239,606,608–610,613,614,678,679,681,683,684,686,713,731,759,780}

I

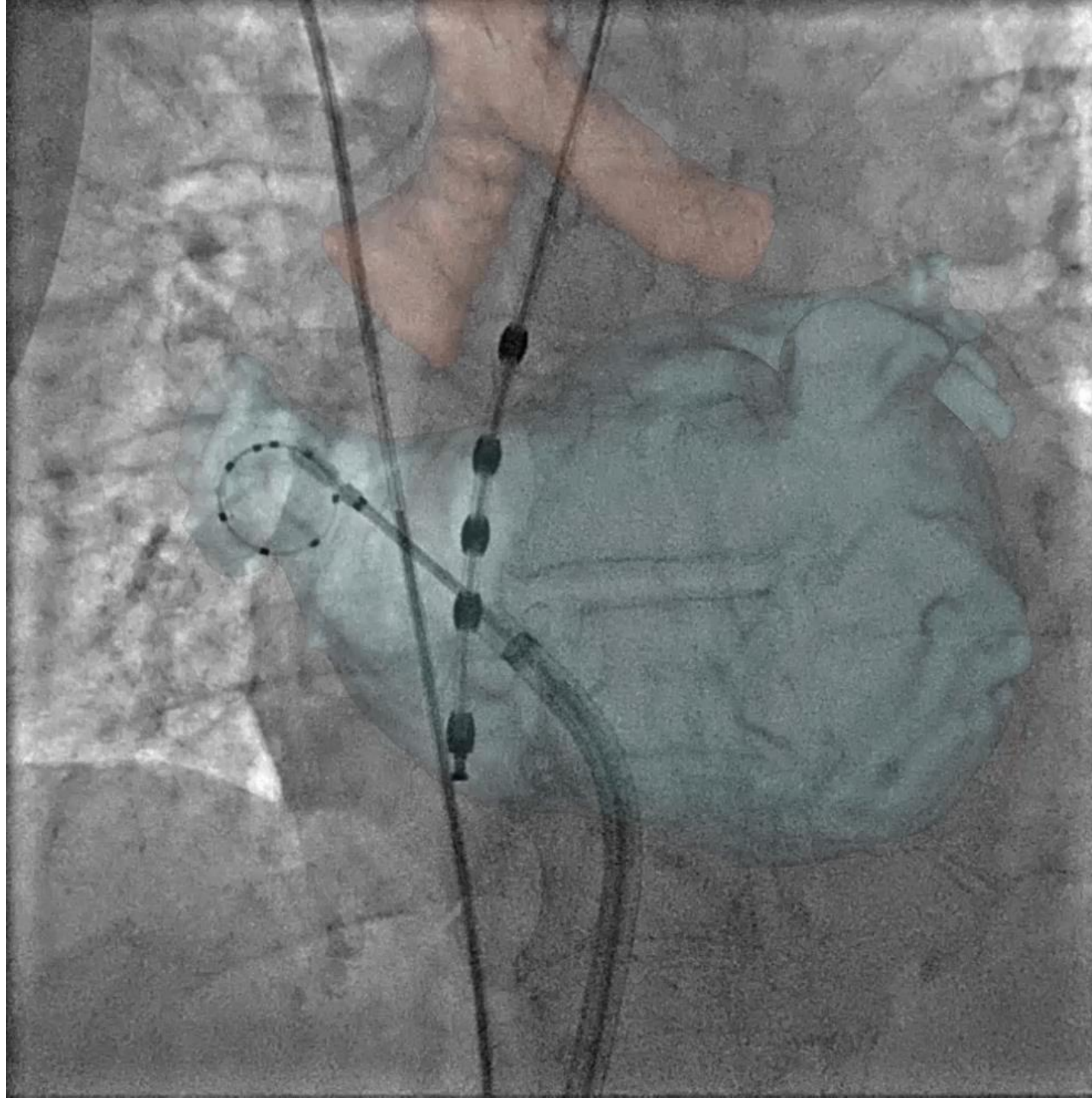
A



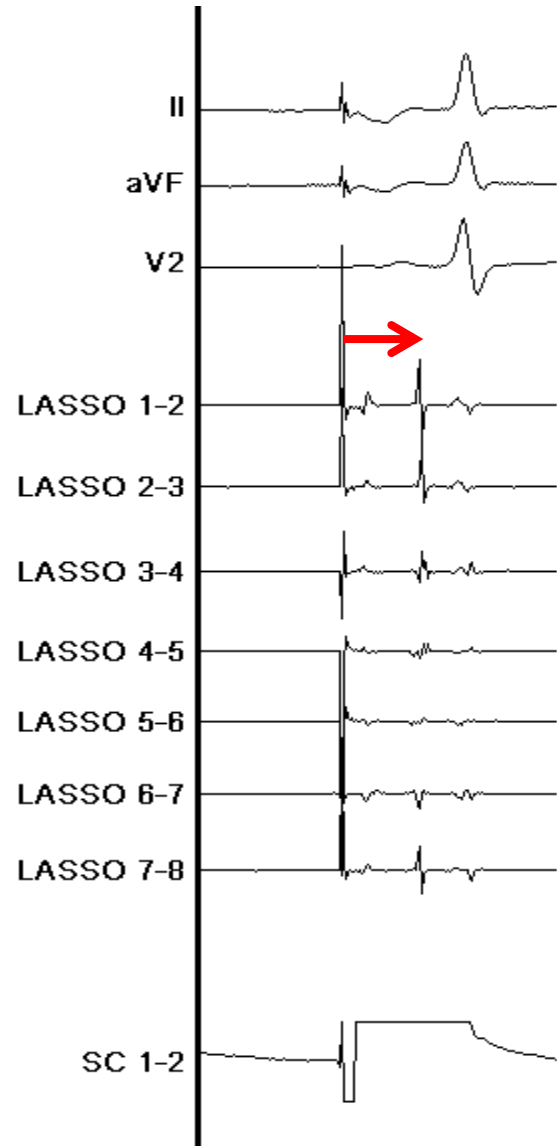
*Cryoballoon ablation
Medtronic Arctic Front
Advance Pro 28mm*

*CT-scan image fusion
GE AW workstation*

*Clinique Pasteur
Toulouse*



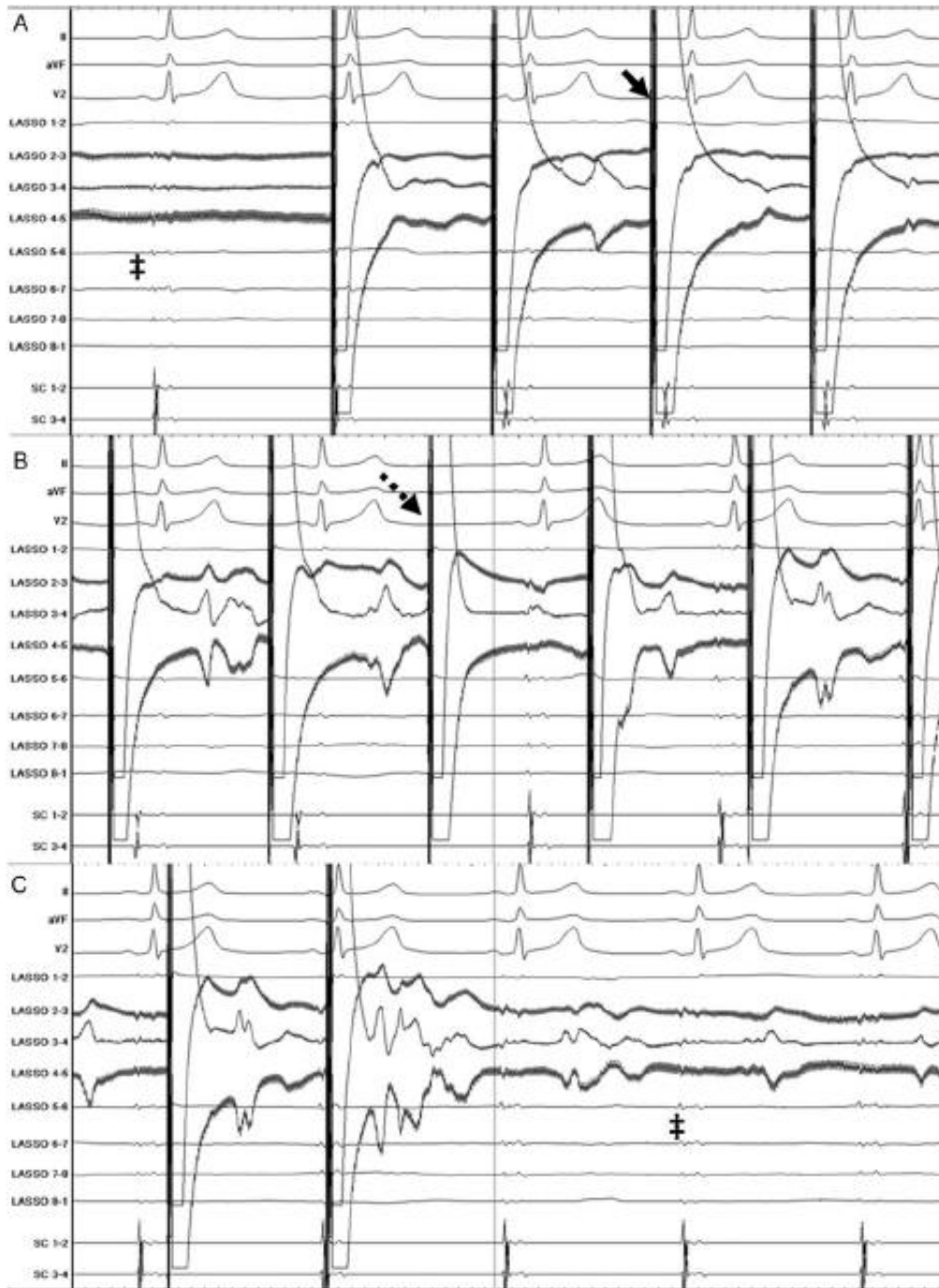
LSPV PER CRYO



Real-time assessment of pulmonary vein disconnection during cryoablation of atrial fibrillation: can it be 'achieved' in almost all cases?

Serge Boveda^{1*}, Rui Providência¹, Jean-Paul Albenque¹, Nicolas Combes¹, Stéphane Combes¹, Hassiba Hireche¹, Benjamin Casteigt¹, Abdeslam Bouzeman¹, François Jourda¹, Kumar Narayanan², and Eloi Marijon²

Overall
(128 PV)



Number of applications	8.2 ± 1.1
Time of cryoenergy (s)	1917.4 ± 285.1
Time to PV disconnection (s)	48.6 ± 33.0
Average temperature (°C)	-52.6 ± 5.8
Temporary phrenic nerve paralysis	7.0% (9)

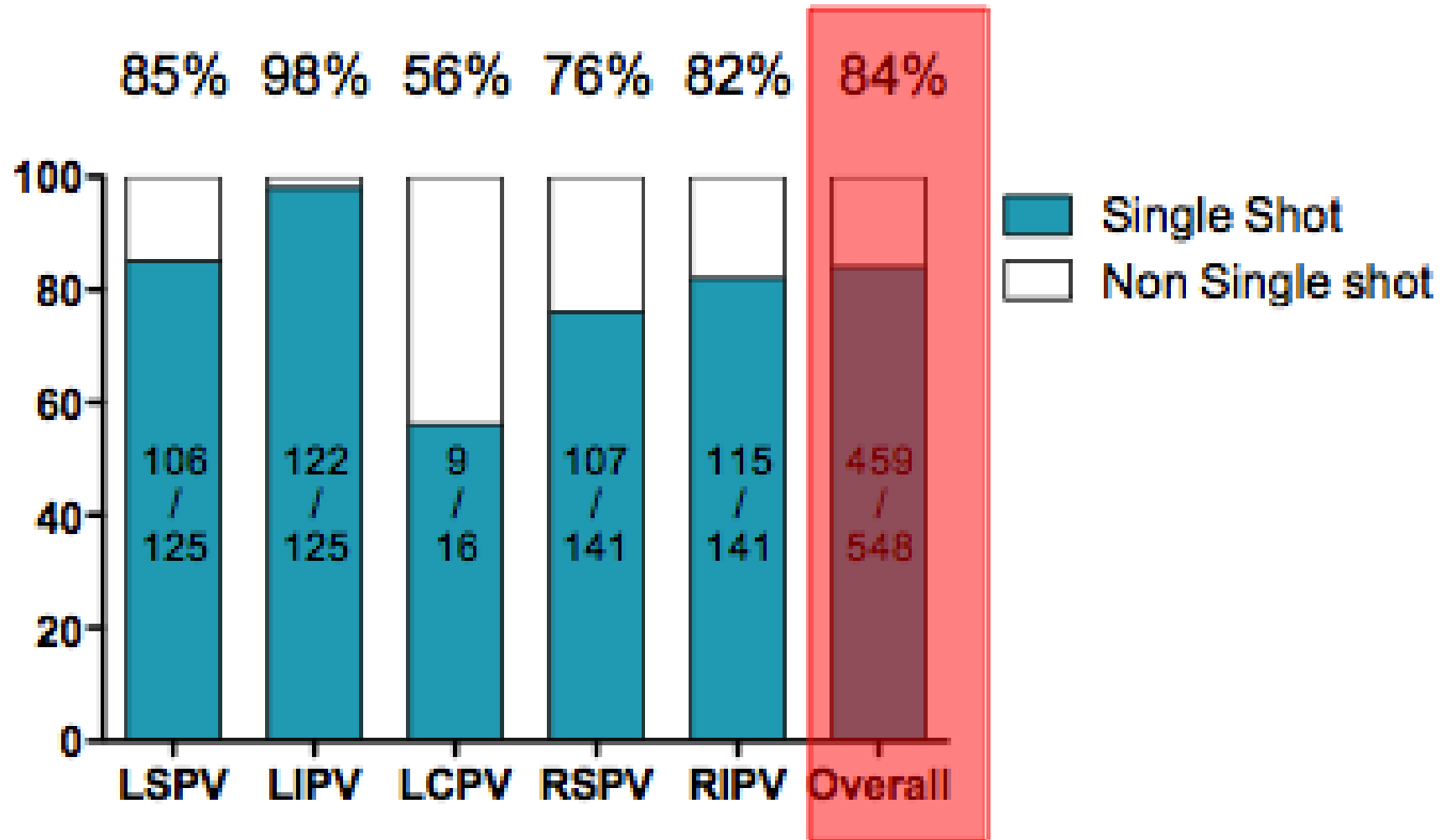
Real-time assessment of PV disconnection

Standard AC technique/Type 1 PV	36.7% (47)
Need for AC manoeuvre/Type 2 PV	49.2% (63)
Real-time exit block/Type 3 PV	11.7% (15)
No documentation/Type 4 PV	2.3% (3)

>90%...

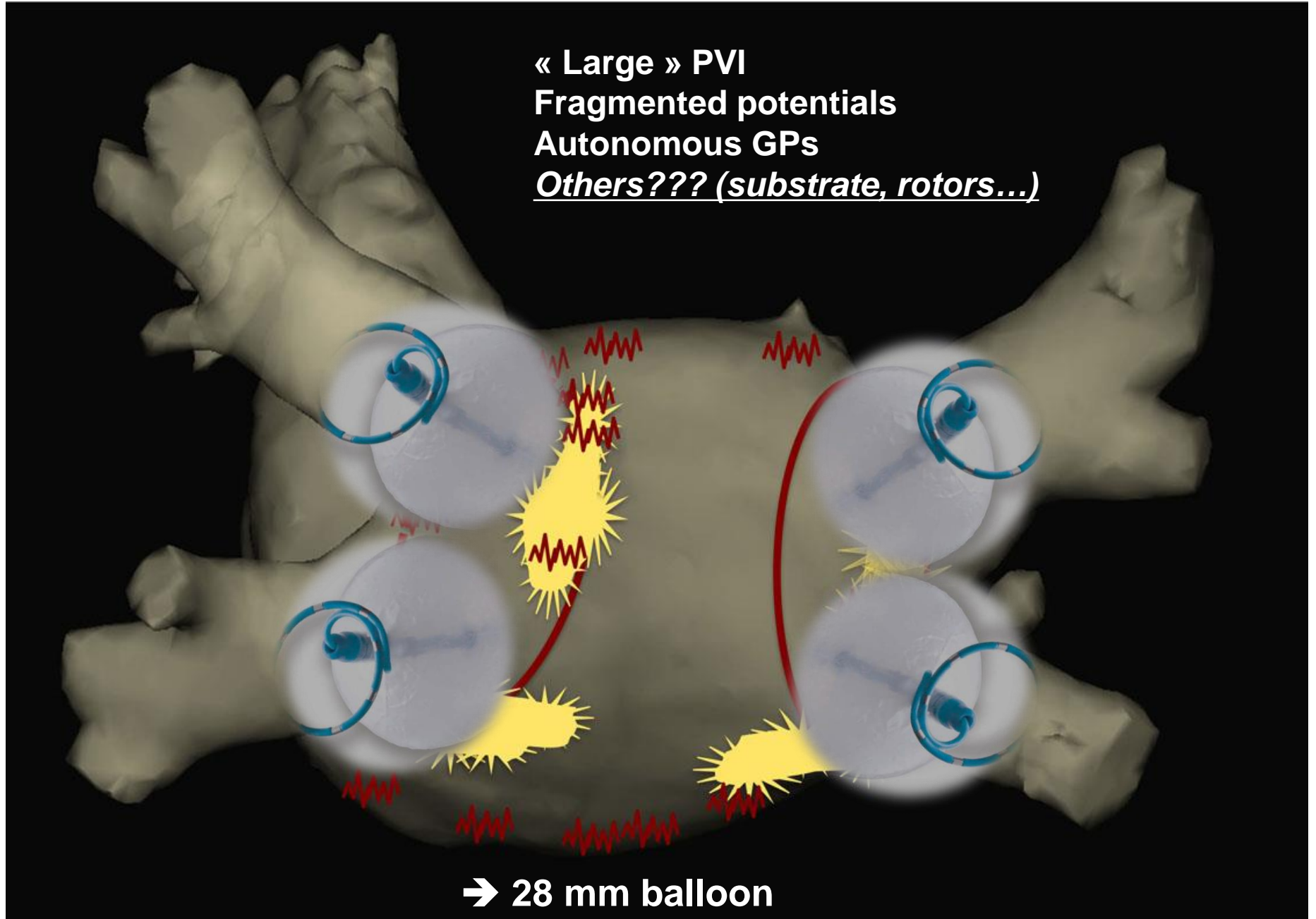
Single Shot PV Isolation

Single Shot Isolation

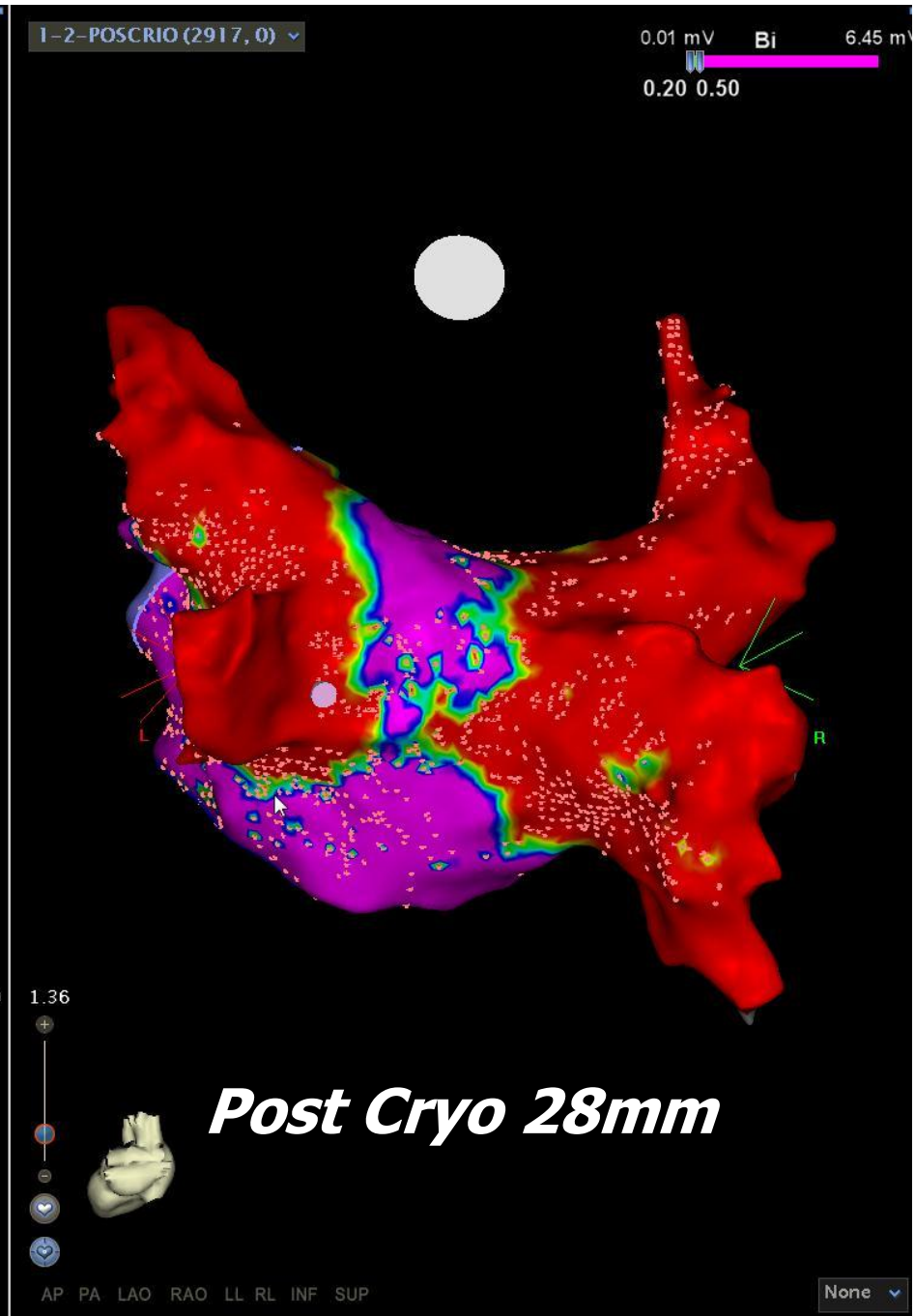
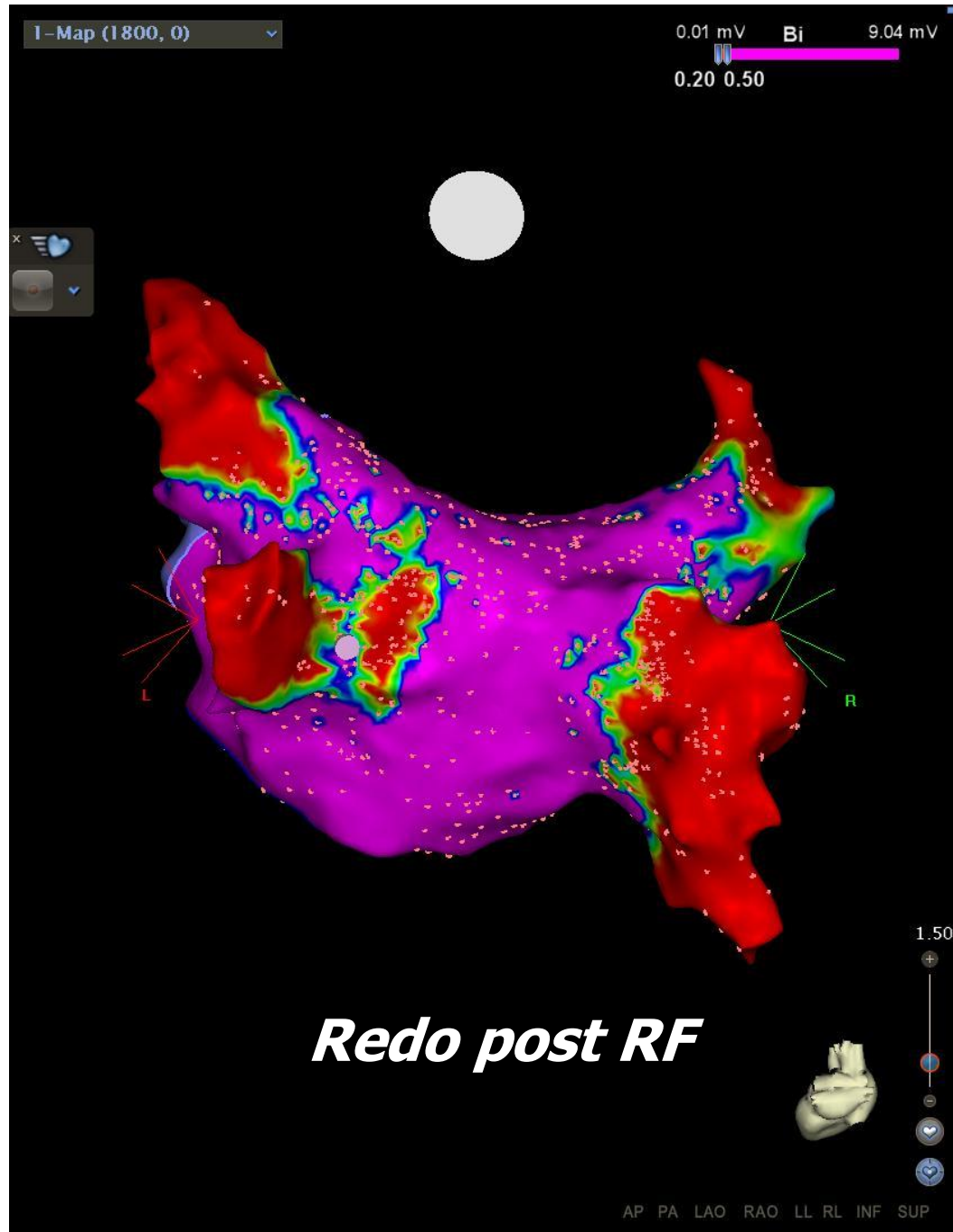


**Not only
PVI...**

« Large » PVI
Fragmented potentials
Autonomous GPs
Others??? (substrate, rotors...)



→ 28 mm balloon



Single-Procedure Outcomes and Quality-of-Life Improvement 12 Months Post-Cryoballoon Ablation in Persistent Atrial Fibrillation

Results From the Multicenter CRYO4PERSISTENT AF Trial

Serge Boveda, MD,^a Andreas Metzner, MD,^b Dinh Q. Nguyen, MD,^c K.R. Julian Chun, MD,^d Konrad Goehl, MD,^e George Noelker, MD,^f Jean-Claude Deharo, MD,^g George Andrikopoulos, MD,^h Tillman Dahme, MD,ⁱ Nicolas Lellouche, MD,^j Pascal Defaye, MD^k

Results



JACC-EP 2018

TABLE 1 Patients' Baseline Characteristics	
Demographics	N = 101
Male	75 (74.3)
Age, yrs	61.8 ± 10.5
PerAF onset, days	120.6 ± 98.0
CHA ₂ DS ₂ -VASc	1.6 ± 1.3
BMI, kg/m ²	28.2 ± 4.2
Systolic BP, mm Hg	129.9 ± 14.0
Diastolic BP, mm Hg	82.0 ± 11.1
LAD, mm	43 ± 5
LVEF, %	56 ± 8
Coronary artery disease	5 (5.0)
Hypertension	63 (62.4)
Type II diabetes	5 (5.0)
Dyslipidemia	20 (19.8)
Smoking	22 (21.8)
Alcoholism	4 (4.0)
Prior DCCV <12 Months	51 (50.5)
Prior stroke/transient ischemic event	4 (4.0)
NYHA functional classification	
Subject does not have heart failure	46 (45.5)
I	23 (22.8)
II	26 (25.7)
III	5 (5.0)
IV	0 (0)
Not reported	1 (1.0)

TABLE 2 Index Procedural Characteristics	
Procedure Characteristics	N = 101
Cryoballoon applications (per patient)	6.1 ± 2.2
Mean application duration (per vein), s	213.9 ± 28.8
Nadir balloon temperature, °C	-55.2 ± 6.1
Time to isolation when observed, s	
LSPV	54.5
LIPV	44.3
RSPV	38.6
RIPV	48.3
28-mm balloon use	101 (100)
Achieve mapping catheter use	101 (100)
Conscious sedation	57 (56.4)
Phrenic nerve pacing	101 (100)
Esophageal monitoring	50 (49.5)
3D mapping	0 (0)
Right atrial flutter ablation	8 (7.9)
Lab occupancy time, min	133.1 ± 51.3
Procedure time, min	53.2 ± 22.2
Elapsed fluoroscopy, min	17.7 ± 11.5

Single-Procedure Outcomes and Quality-of-Life Improvement 12 Months Post-Cryoballoon Ablation in Persistent Atrial Fibrillation

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Outcomes

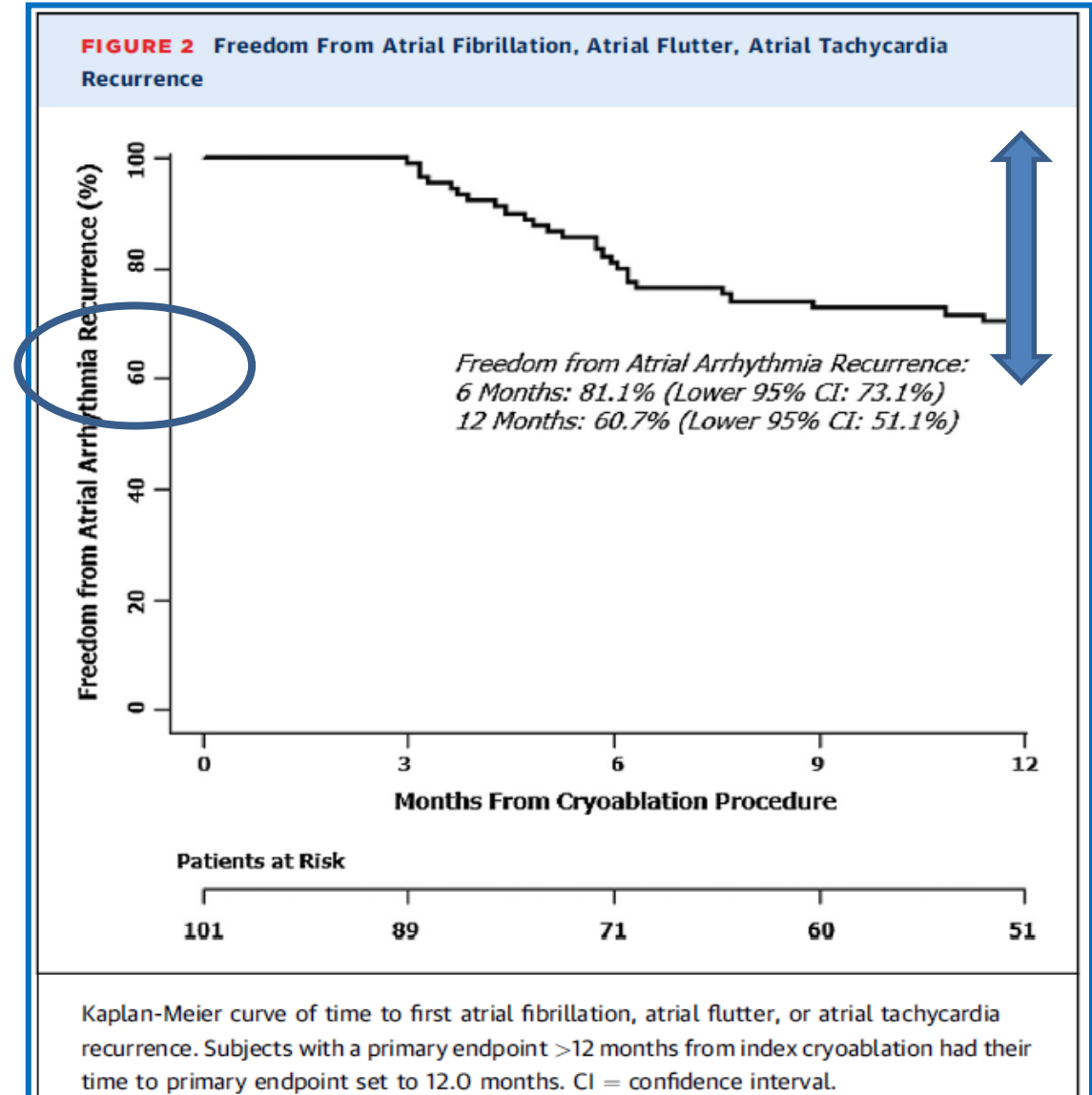


JACC-EP 2018

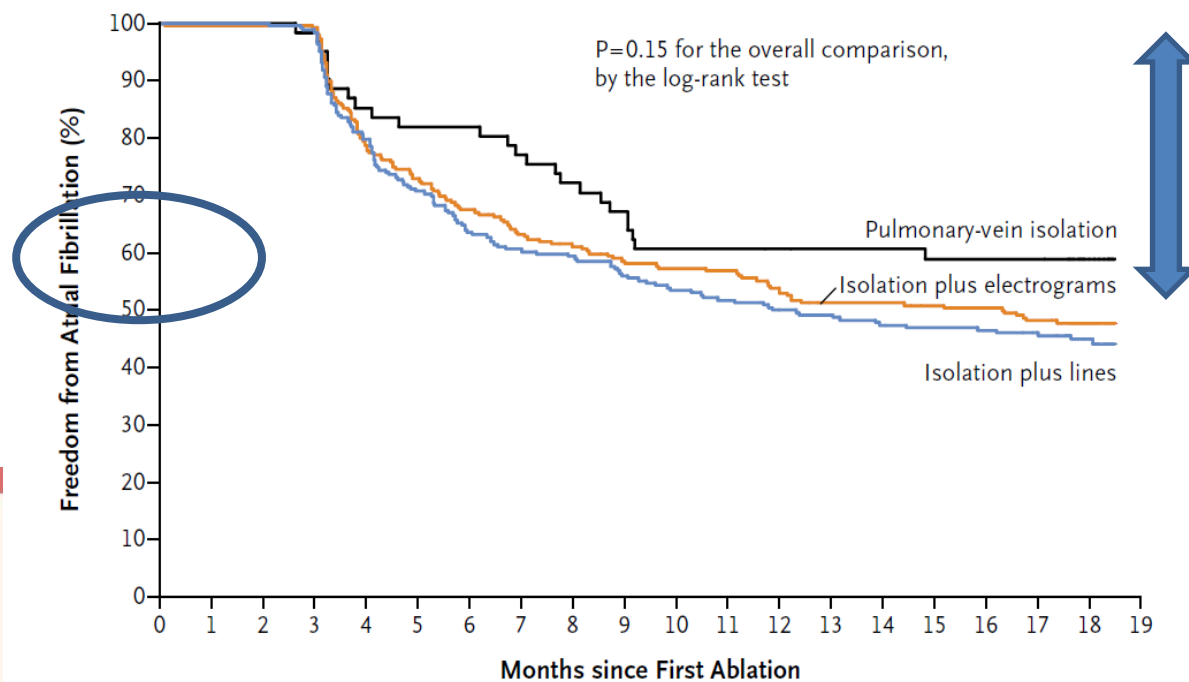
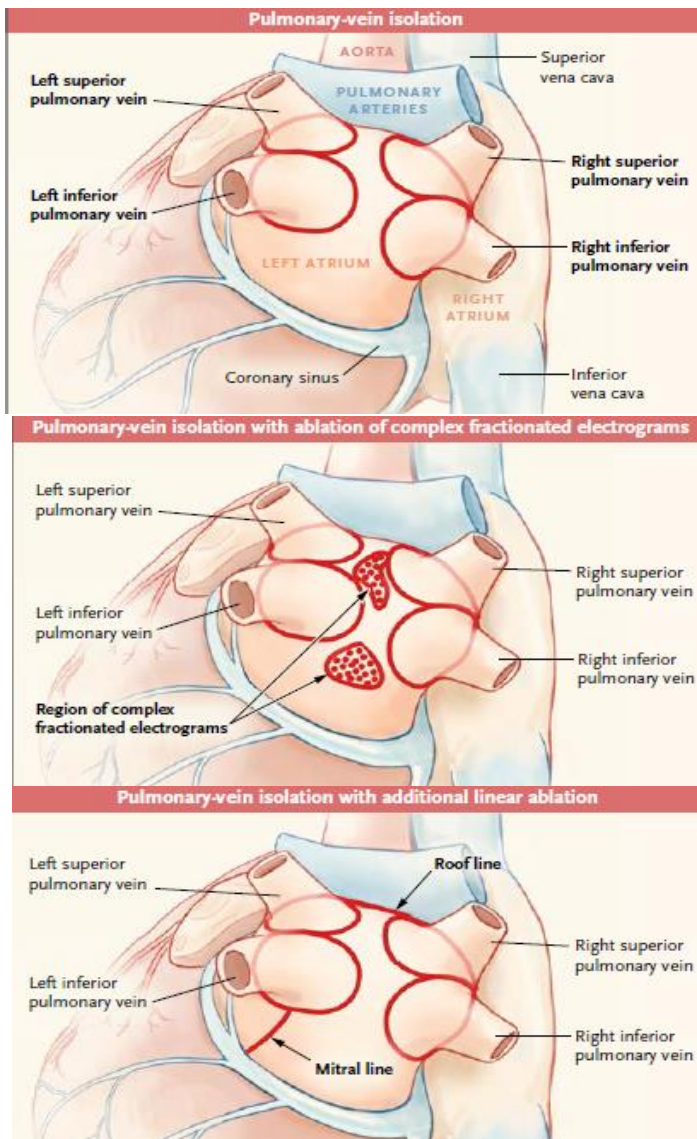
- 60.7% freedom from all atrial arrhythmias (AF/AT/AFL)
- PVI only cryoballoon ablation
- Single procedure
 - All repeat ablations were failures, inclusive of blanking period
- 3/51 (5.9%) patients in sinus rhythm remain on AADs at 12 months



We need something else...



Approaches to Catheter Ablation for Persistent Atrial Fibrillation



No reduction in the rate of recurrent AF when either linear ablation or ablation of complex fractionated electrograms was performed in addition to PVI

Verma A, N Engl J Med 2015



2020 ESC Guidelines for the diagnosis and management of atrial fibrillation developed in collaboration with the European Association of Cardio-Thoracic Surgery (EACTS)

***Lesions on
top on PVI...***

Use of additional ablation lesions beyond PVI (low voltage areas, lines, fragmented activity, ectopic foci, rotors, and others) may be considered but is not well established.^{677,680,708,711–730}

IIb

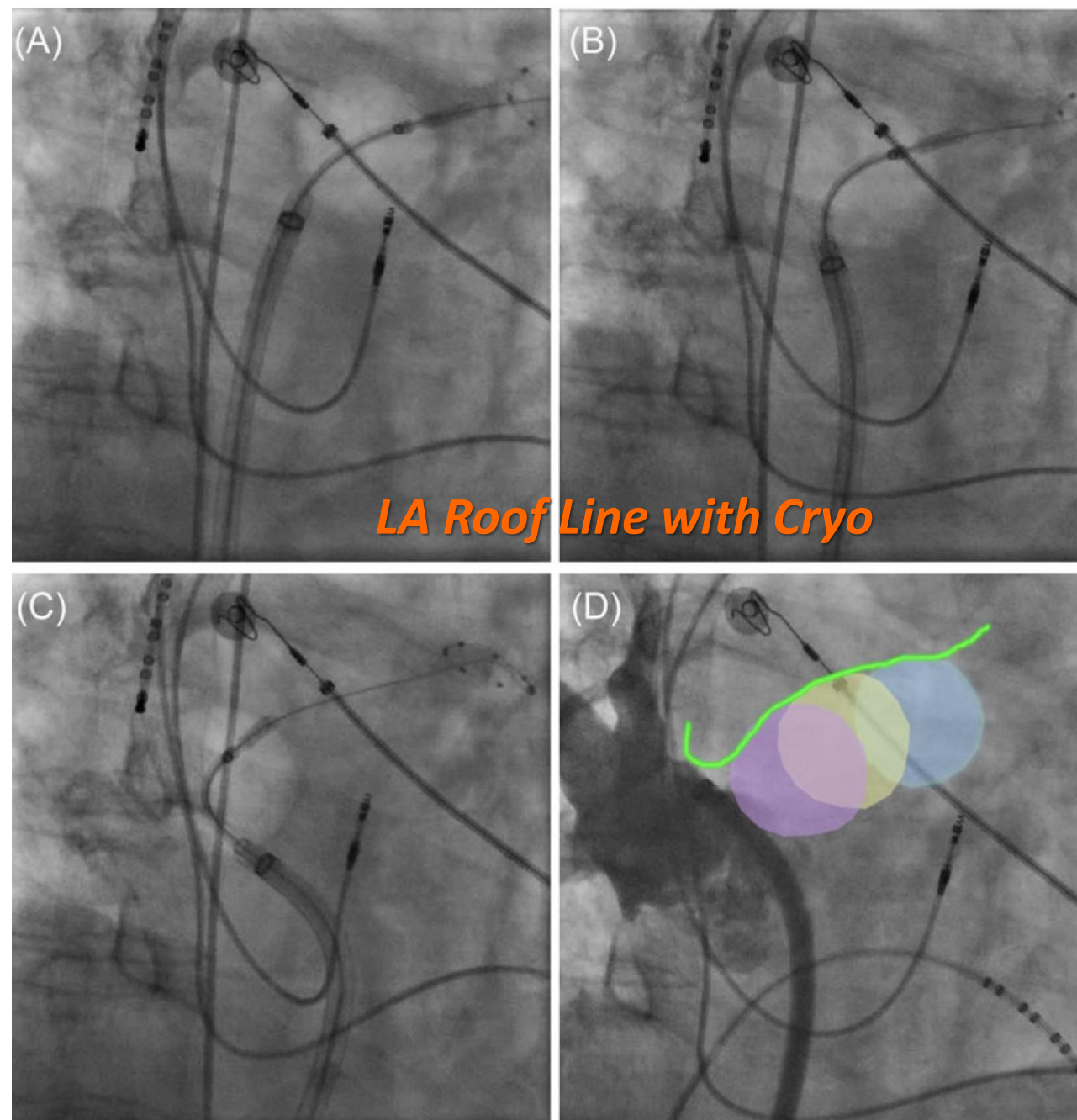
B

Ice or fire? Comparison of second-generation cryoballoon ablation and radiofrequency ablation in patients with symptomatic persistent atrial fibrillation and an enlarged left atrium

Ersan Akkaya MD¹  | Alexander Berkowitsch PhD¹ | Sergej Zaltsberg MD¹ | Harald Greiss MD¹ | Christian W. Hamm MD^{1,2} | Johannes Sperzel MD¹ | Thomas Neumann MD¹ | Malte Kuniss MD¹

222 Pts, Persistent AF, Propensity score (RF vs Cryo)

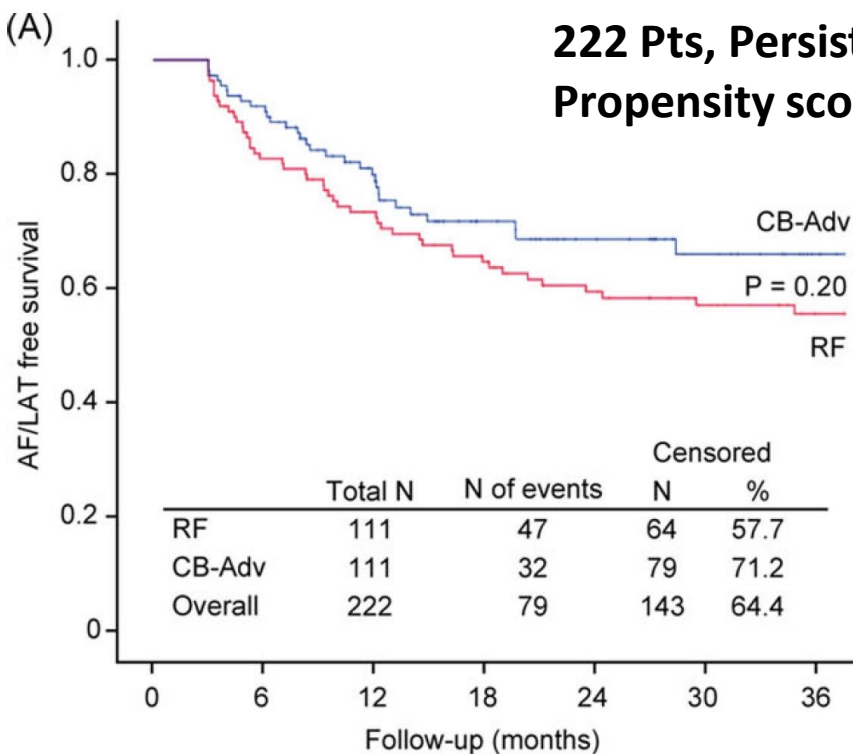
Variables	RF group n = 111	CB-Adv group n = 111	P-value
Procedure performed in AF, n (%)	51 (45.9)	49 (44.19)	0.89
IntraECV, n (%)	45 (40.5)	40 (36.0)	0.58
Spontaneous conversion, n (%)	6 (5.4)	9 (8.1)	0.59
Roof line, n (%)	49 (44.1)	48 (43.2)	1.00



Ice or fire? Comparison of second-generation cryoballoon ablation and radiofrequency ablation in patients with symptomatic persistent atrial fibrillation and an enlarged left atrium

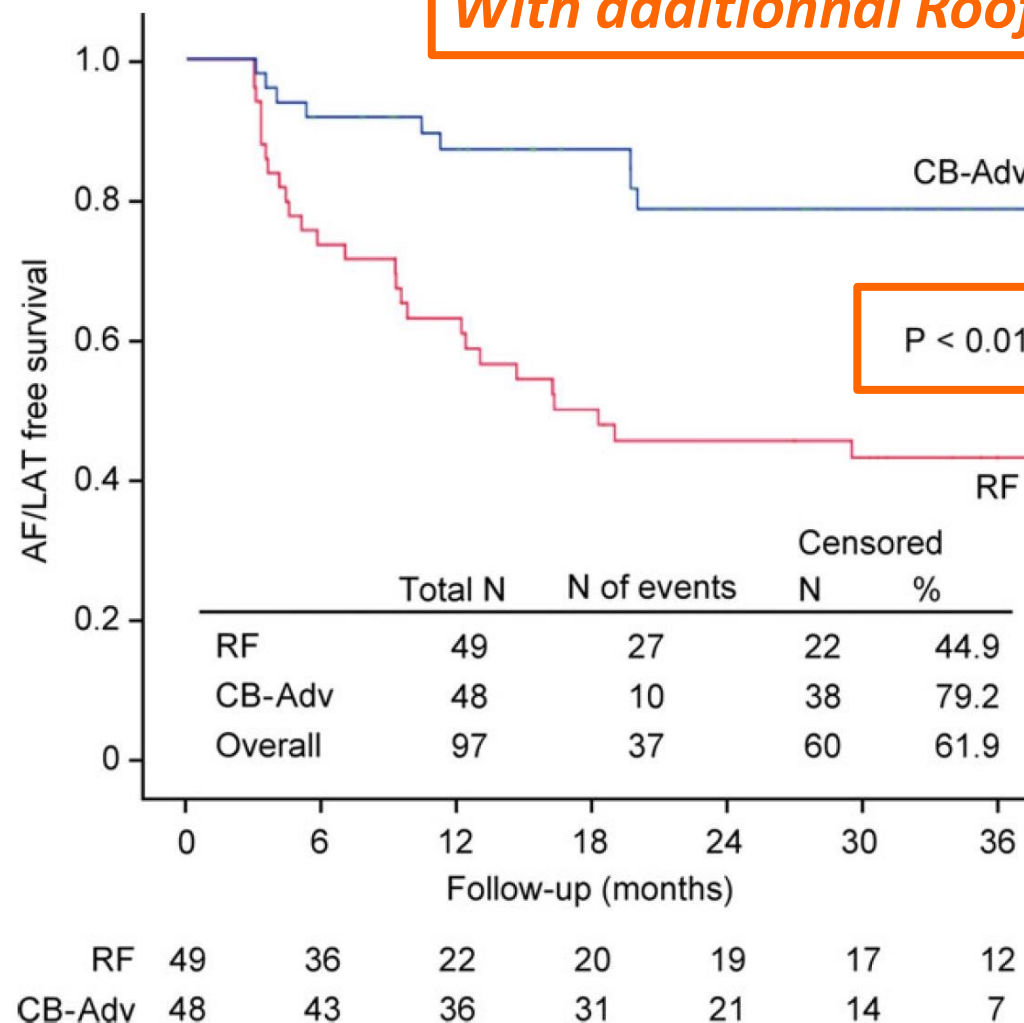
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(A) **222 Pts, Persistent AF, Propensity score (RF vs Cryo)**



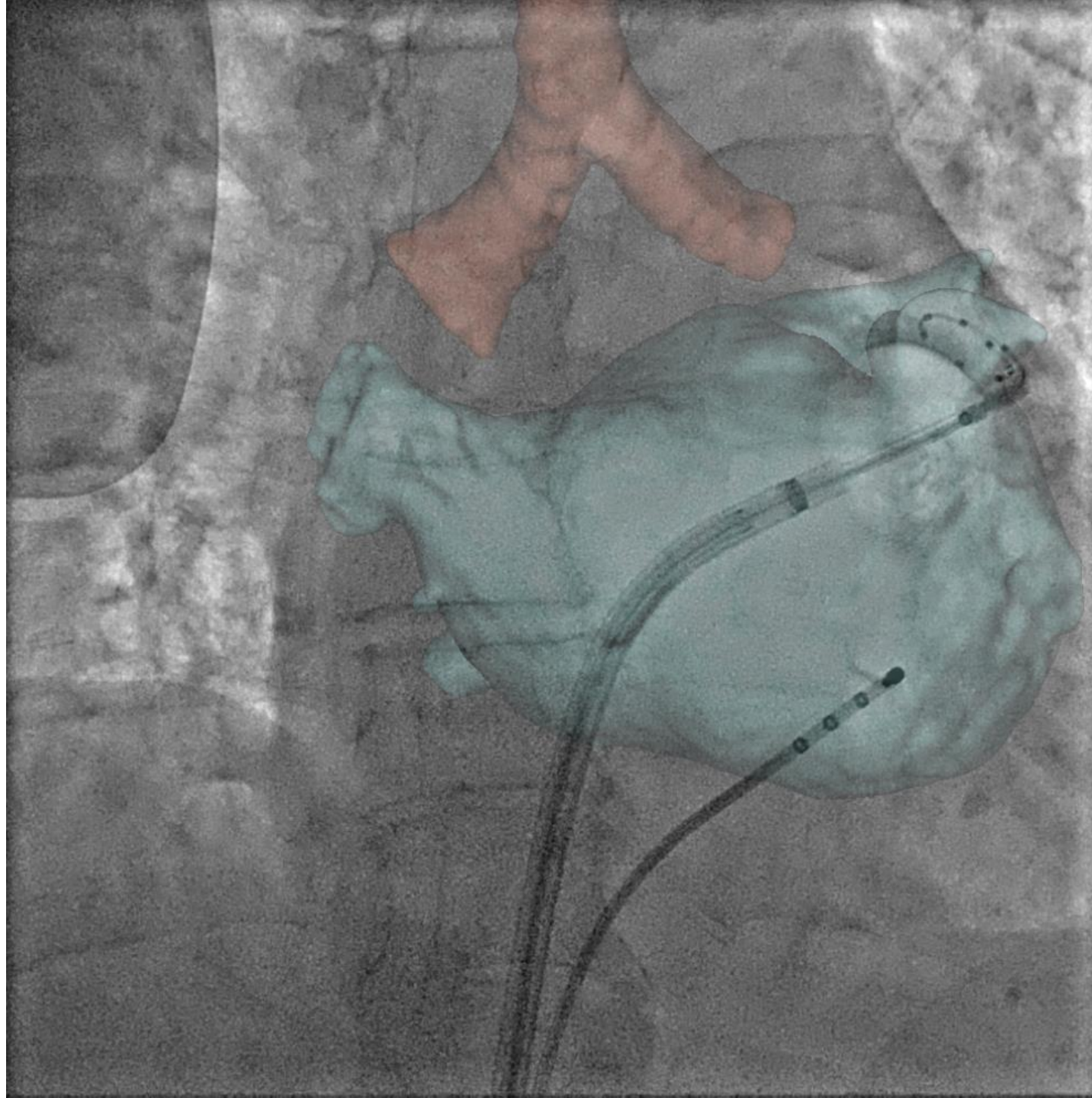
RF	111	89	75	64	54	44	35
CB-Adv	111	99	70	48	33	22	14

With additional Roof Line



AF/LAT-free survival of all patients in the RF and CB-Adv groups with additional RLs

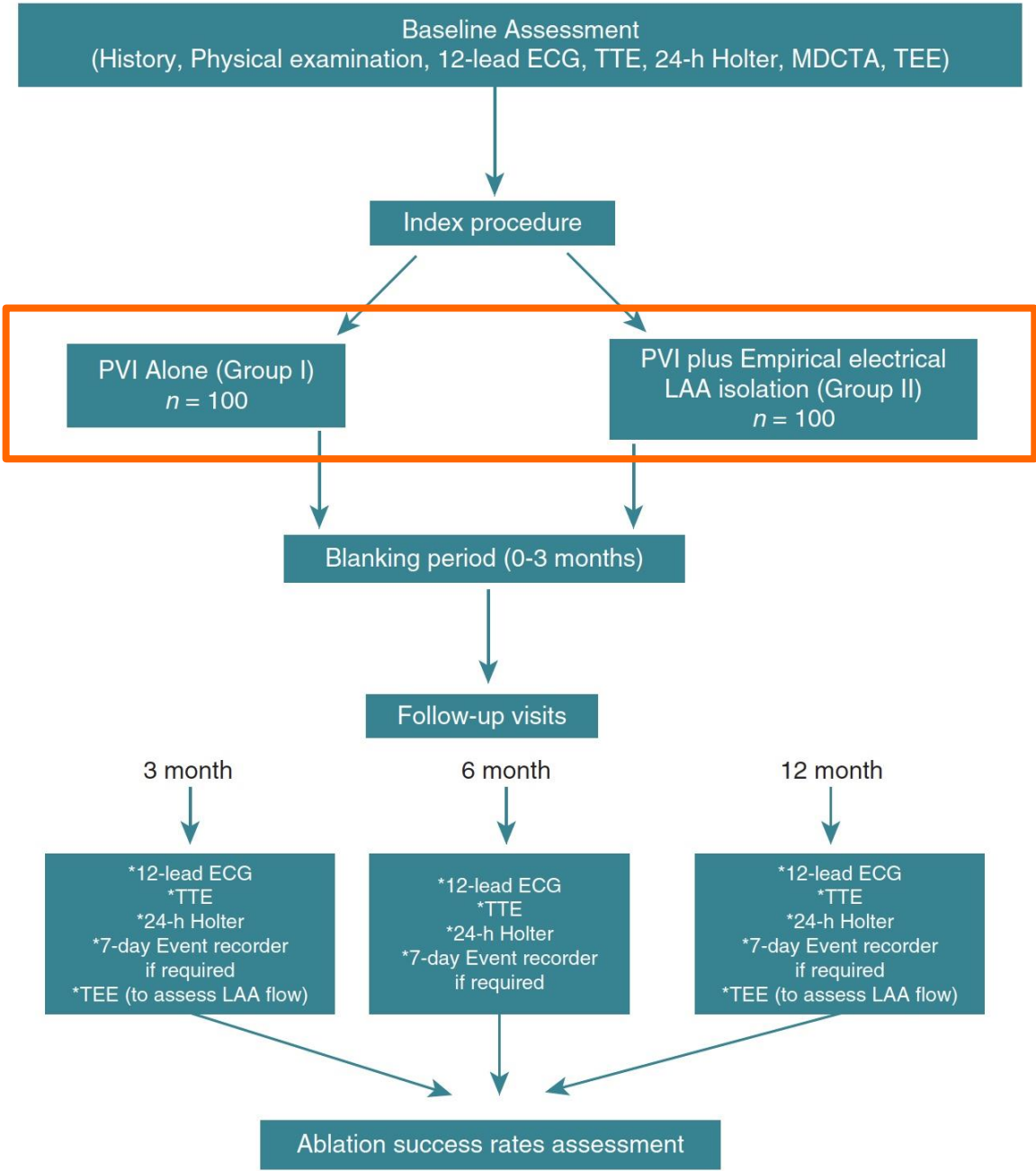
LAAI...



Left atrial appendage isolation in addition to pulmonary vein isolation in persistent atrial fibrillation: one-year clinical outcome after cryoballoon-based ablation

Hikmet Yorgun, Uğur Canpolat*, Duygu Kocyigit, Cem Çöteli, Banu Evranos, and Kudret Aytemir

**200 Pts, Persistent AF,
Propensity score study
(all Cryo, PVI vs PVI + LA)**



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200 Pts, Persistent AF, Propensity score study (all Cryo, PVI vs PVI + LA)

Table 3 Baseline and 12-month follow-up assessment of left atrial appendage functions by transoesophageal echocardiography (n = 200)

Parameters	Group I (PVI-only) (n = 100)	Group II (PVI + EEI-LAA) (n = 100)	P
Smoke in LAA before ablation	18 (18.0%)	21 (21.0%)	0.742
Degree of smoke in LAA before ablation			
Grade I	13 (13.0%)	12 (12.0%)	
Grade II	4 (4.0%)	7 (7.0%)	
Grade III	1 (1.0%)	2 (2.0%)	
Grade IV	0 (0.0%)	0 (0.0%)	
Smoke in LAA 12-months after ablation	–	28 (28.0%)	NA
Degree of smoke in LAA 12-month after ablation			
Grade I	–	22 (22.0%)	NA
Grade II	–	5 (5.0%)	NA
Grade III	–	1 (1.0%)	NA
Grade IV	–	0 (0.0%)	NA
LAA flow velocity before ablation (m/s)	0.54 ± 0.20	0.52 ± 0.19	0.693
LAA flow velocity 12-month after ablation (m/s)	–	0.46 ± 0.15	NA
LAA flow velocity <0.4 m/s before ablation	25 (25.0%)	25 (25.0%)	1.000
LAA flow velocity <0.4 m/s 12-months after ablation	–	34 (34.0%)	NA
Thrombus in LAA after ablation	–	0 (0.0%)	NA

In the LAA isolation group, patients with poor LAA flow velocity (<0.4 m/s) and severe smoke (Grades III and IV) at the third month follow-up maintained on long-term oral anticoagulation

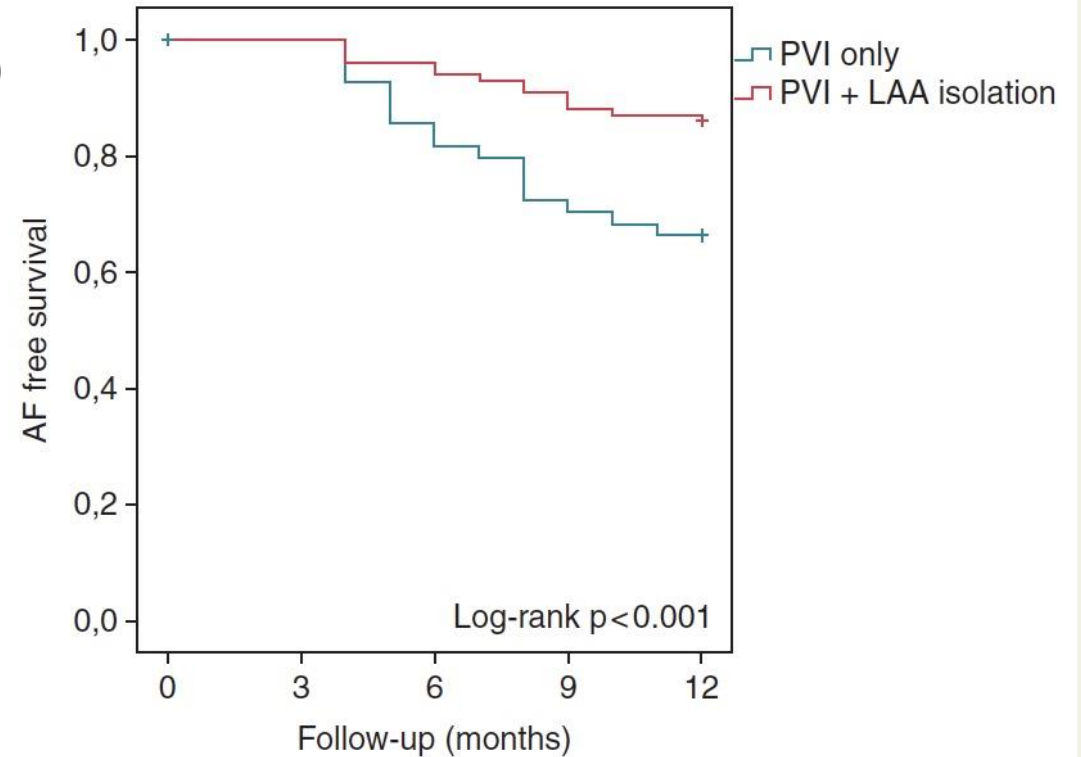
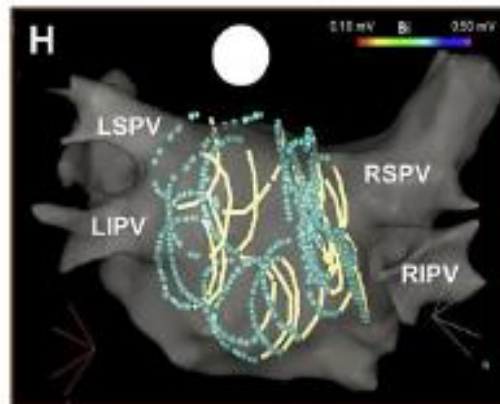
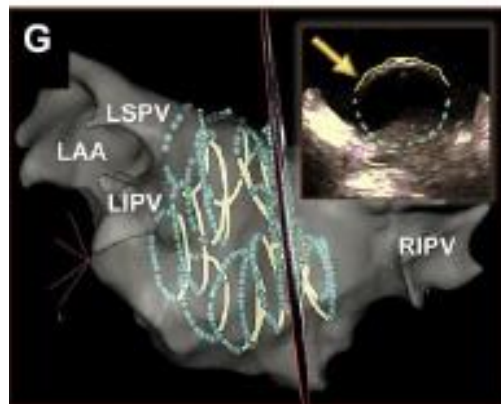
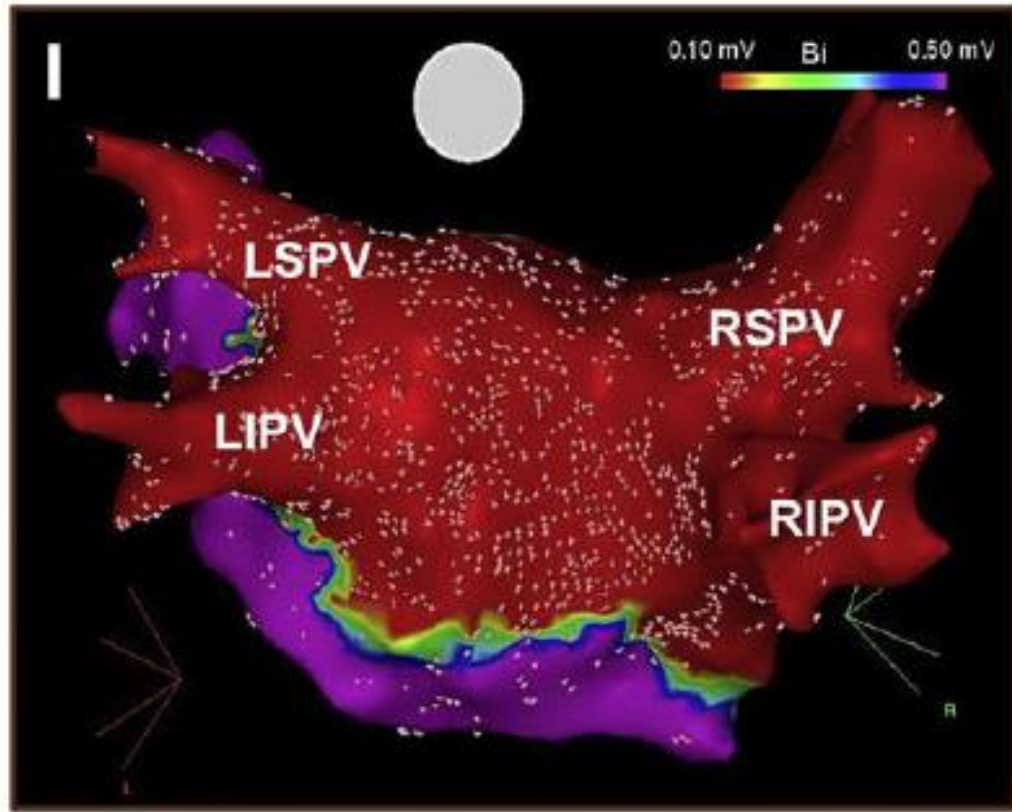
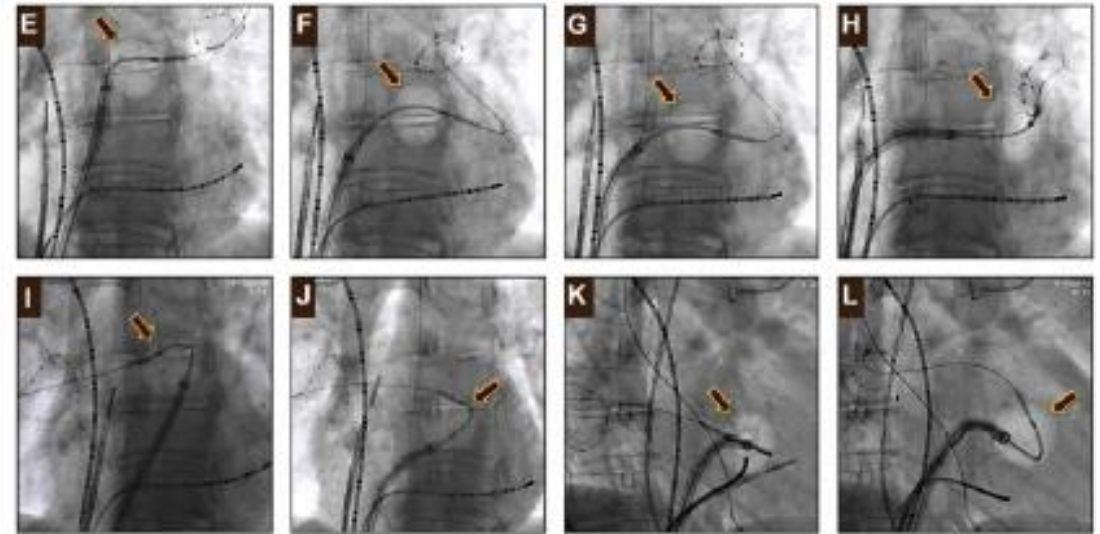


Figure 4 Kaplan–Meier curve illustrating the freedom from atrial arrhythmias at the end of 12-month follow-up in PVI alone group (67%) and PVI plus LAA isolation group (86%) after CB ablation when a 3-month blanking period considered ($P < 0.001$). CB, cryoballoon; LAA, left atrial appendage; PVI, pulmonary vein isolation.

Cryoballoon for persistent AF – Post. Wall isolation + PVI

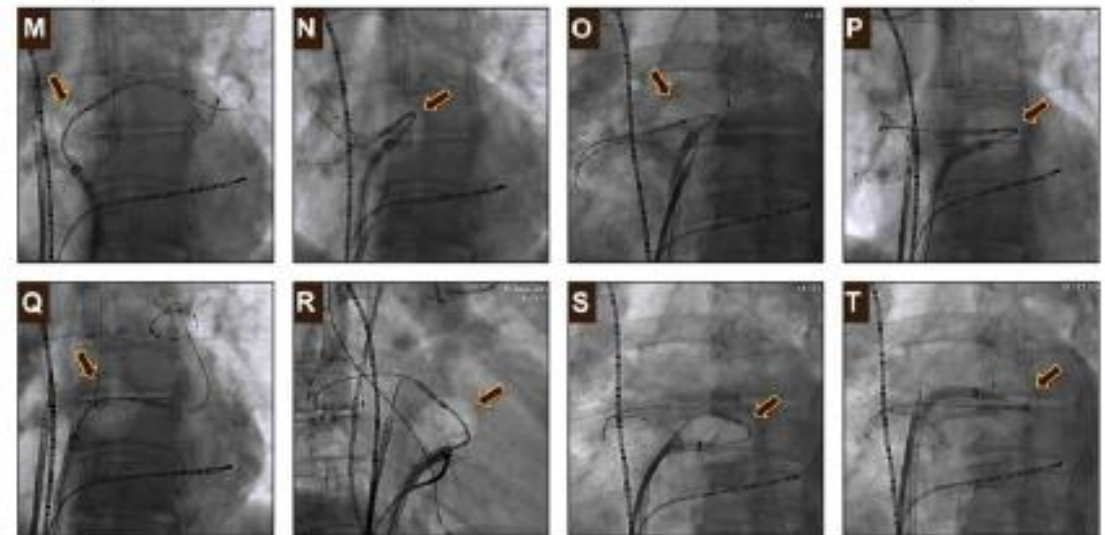


Cryoballoon Maneuvers for Ablation of the Left Posterior Wall Segments



Aryana A, HR 2018

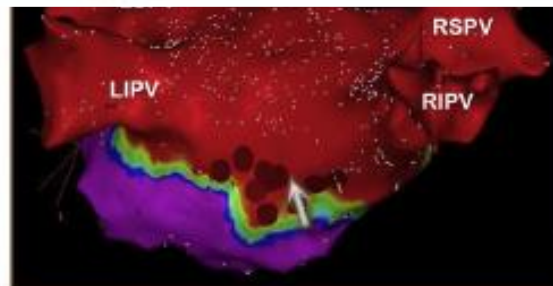
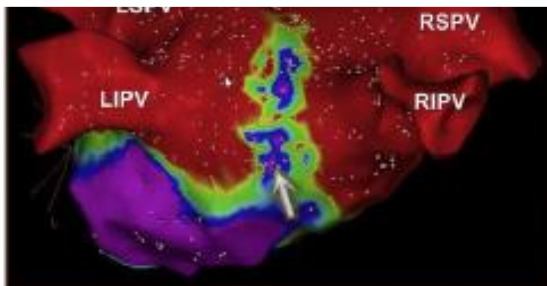
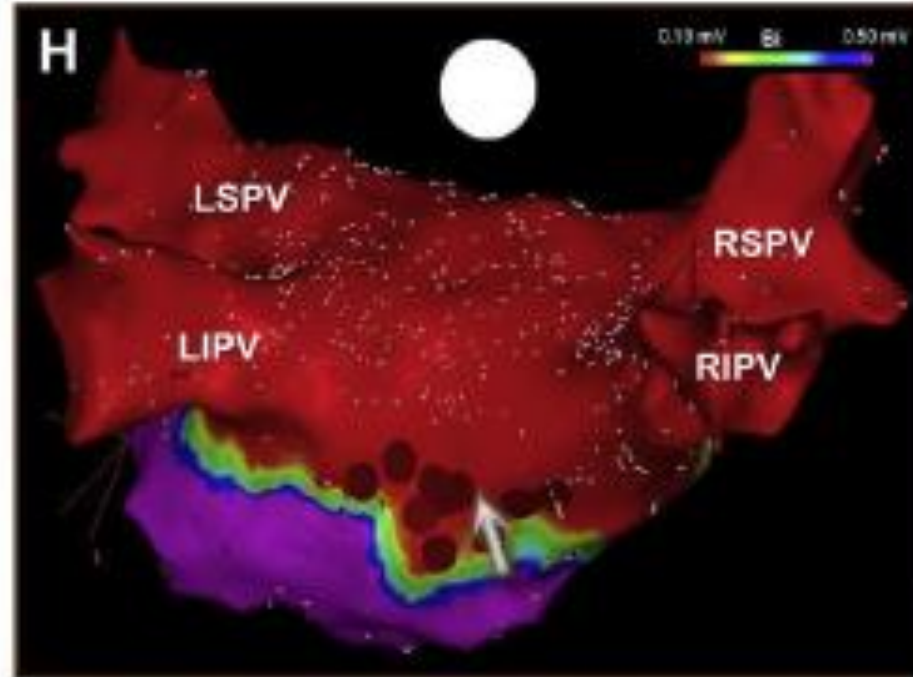
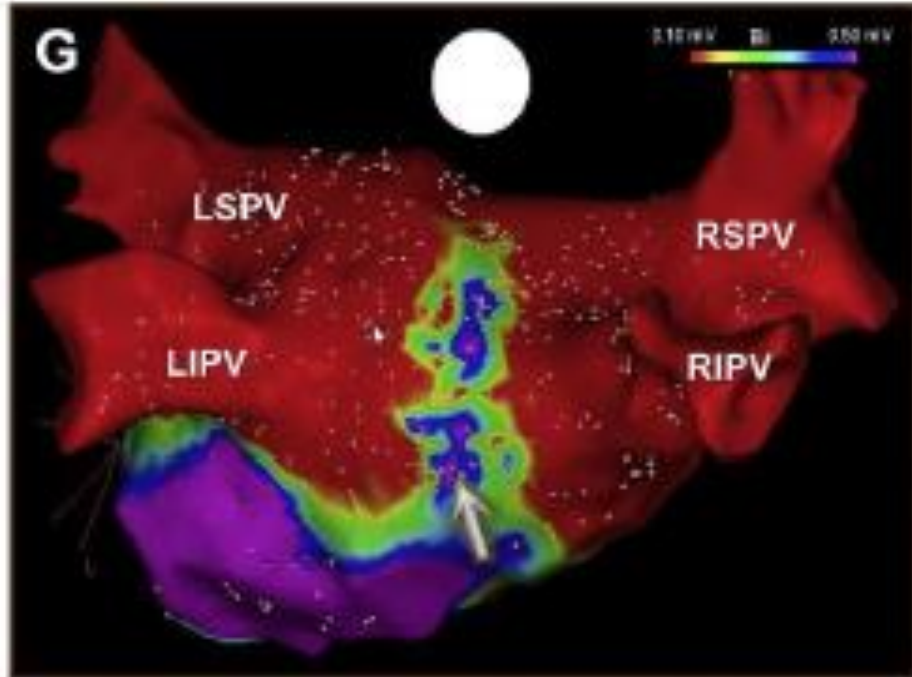
Cryoballoon Maneuvers for Ablation of the Right Posterior Wall Segments



Cryoballoon for persistent AF – Post. Wall isolation + PVI

Characteristic	PVI only (n = 168)	PVI+PWI (n = 222)	P
Age (y)	67 ± 11	67 ± 9	.78
Sex: male	108 (64)	146 (66)	.76
Body mass index (kg/m ²)	31 ± 7	32 ± 7	.27
CHA ₂ DS ₂ -VASc score	2.5 ± 1.4	2.7 ± 1.5	.20

Variable	PVI only (n = 168)	PVI+PWI (n = 222)	P
Cryoballoon ablation			
PVs isolated using the cryoballoon	634 (99.3)	865 (99.8)	.23

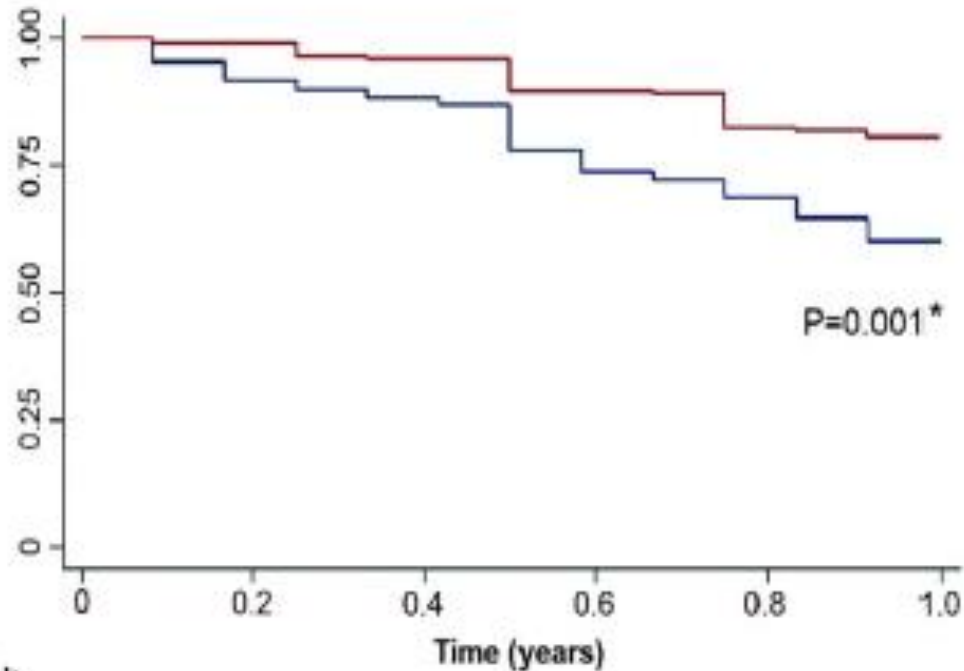


1.0 ± 1.4	<.001*
16 ± 2	<.001*
1.7 ± 3.2	-
34 ± 10	-
51 ± 13	<.001*
(0.9)	.13
2 ± 1	.24
1 (32.4)	-
5 ± 2	-
18 ± 7	<.001*
41 ± 13	.39
44 ± 7	.16
63 ± 27	.08
8 ± 4	.14
35 ± 23	.19

PWI			P
Cryoballoon temperature (°C)	-	-42 ± 7	-
Application duration (s)	-	158 ± 26	-
iTT ₀ (s)	-	6 ± 2	-
Total thaw time (s)	-	26 ± 13	-
Left atrial dwell time (min)	45 ± 14	83 ± 19	<.001*
Fluoroscopy time (min)	19 ± 7	28 ± 9	<.001*
Total procedure time (min)	97 ± 29	188 ± 42	<.001*

Cryoballoon for persistent AF – Post. Wall isolation + PVI

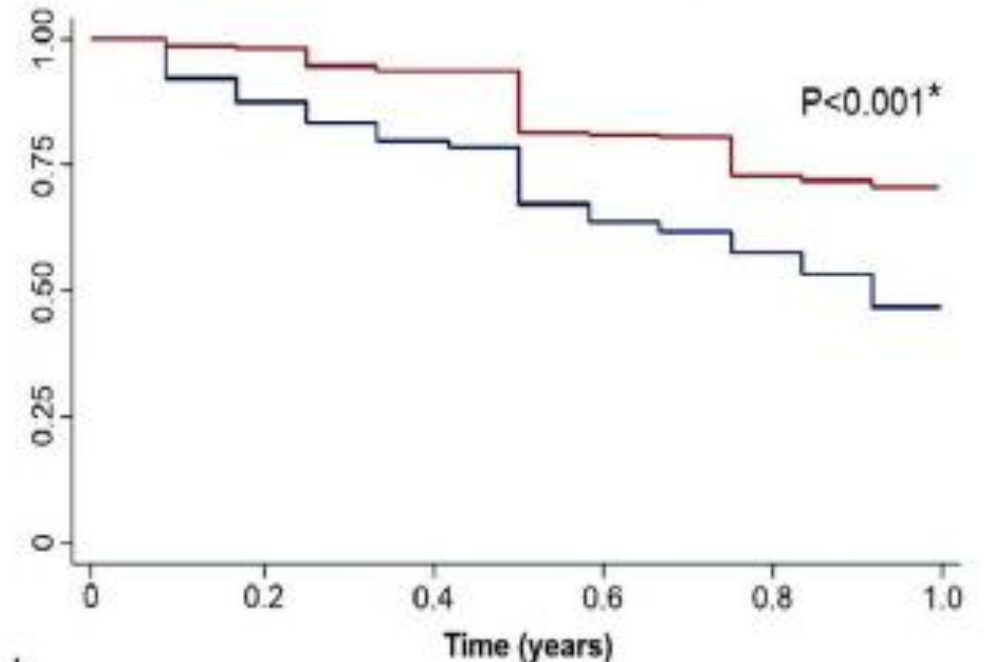
Freedom from Recurrent Atrial Fibrillation



Number at risk	0	0.2	0.4	0.6	0.8	1.0
PVI only	168	154	148	124	104	86
PVI+PWI	222	219	212	198	182	178

PVI+PWI — PVI only —

Freedom from All Atrial Arrhythmias



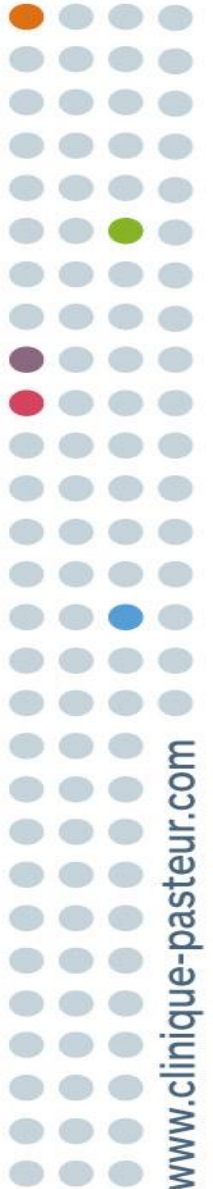
Number at risk	0	0.2	0.4	0.6	0.8	1.0
PVI only	168	147	134	107	88	70
PVI+PWI	222	217	207	179	161	156

PVI+PWI — PVI only —

Take Home Messages – Persistent AF

Cryoballoon ablation is nowadays a reasonable, effective and safe option for the first ablation procedure:

- ***High rate of durable PVI with wide antral lesions***
- ***Fast procedure with low fluoro times***
- ***Additional left atrial substrate modification besides PVI and extra PV ablations are possible and feasible (under investigation...)***





CP

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