



# Actualité dans la prise en charge de la fibrillation auriculaire

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# Intervenants



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Electrophysiologie  
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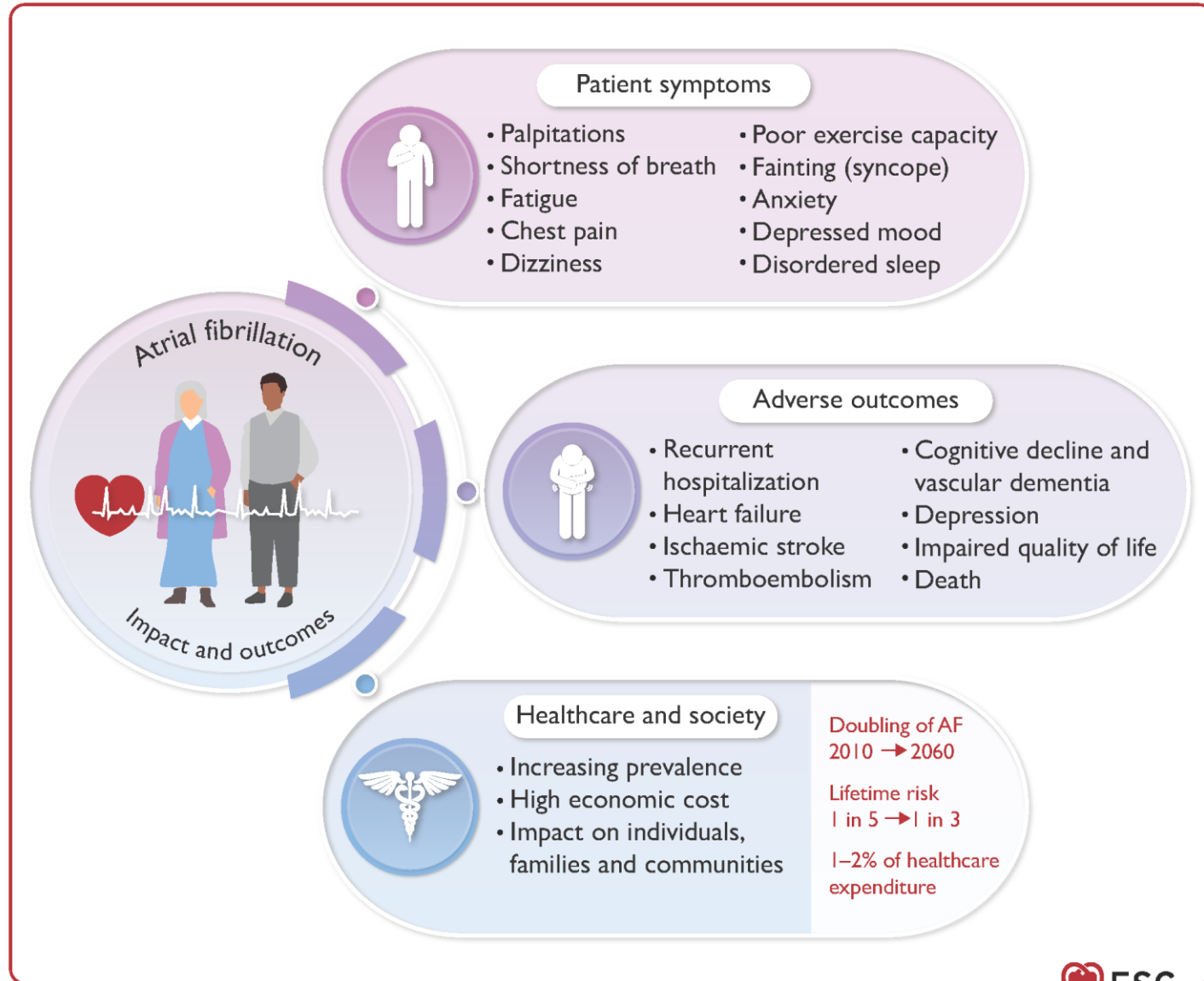
Médecine générale



# 2024 ESC Guidelines for the management of atrial fibrillation

# Figure 1

## Impacts and outcomes associated with clinical atrial fibrillation

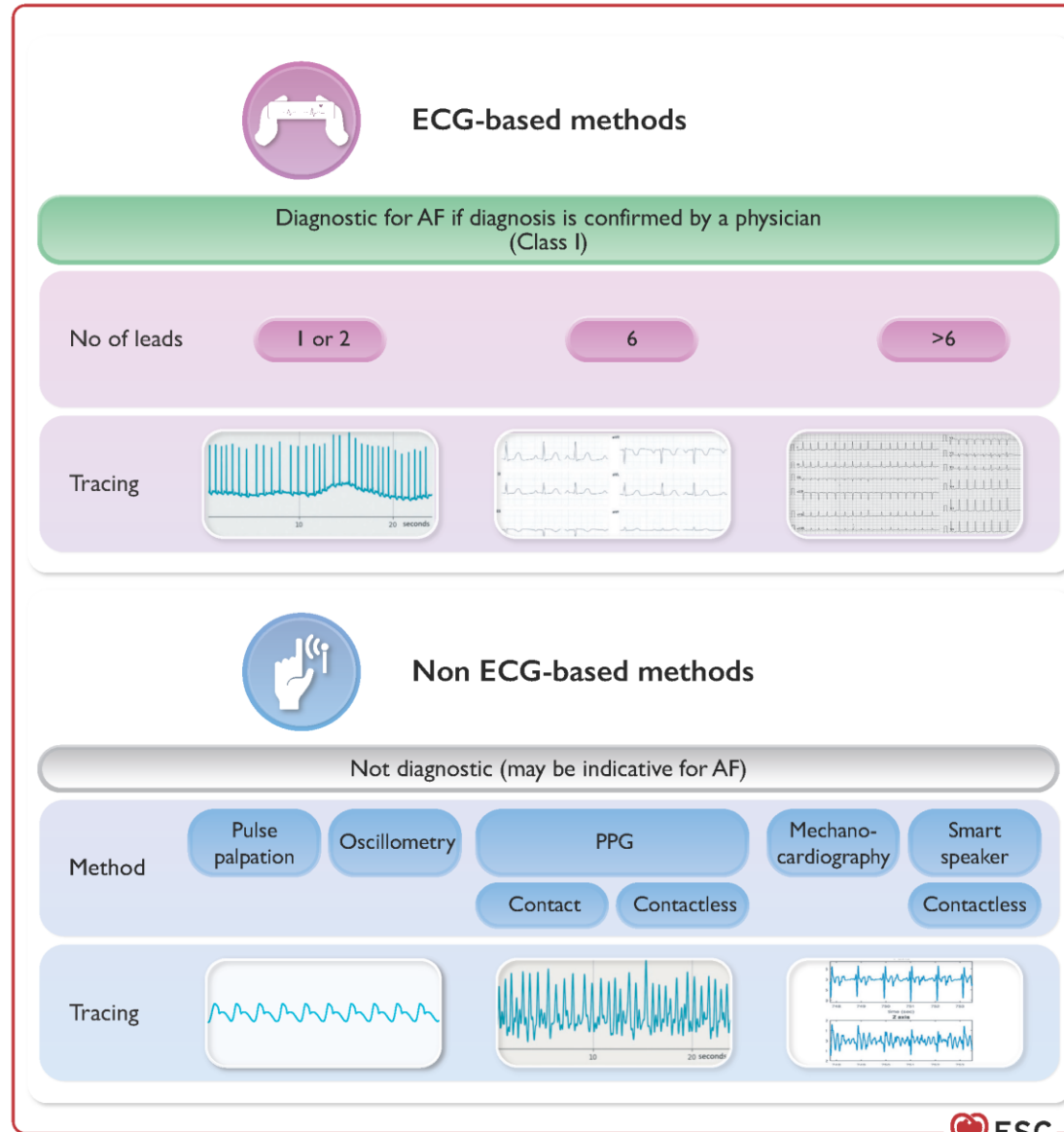


# New recommendations (1)

Recommendations	Class	Level
<b><i>Diagnostic evaluation of new atrial fibrillation – Section 3.4</i></b>		
A transthoracic echocardiogram is recommended in patients with an AF diagnosis where this will guide treatment decisions.	I	C
<b><i>Principles of AF-CARE – Section 4.2</i></b>		
Education directed to patients, family members, caregivers, and healthcare professionals is recommended to optimize shared decision-making, facilitating open discussion of both the benefit and risk associated with each treatment option.	I	C
Access to patient-centred management according to the AF-CARE principles is recommended in all patients with AF, regardless of gender, ethnicity, and socioeconomic status, to ensure equality in healthcare provision and improve outcomes.	I	C
Patient-centred AF management with a multidisciplinary approach should be considered in all patients with AF to optimize management and improve outcomes.	IIa	B
<b><i>[C] Comorbidity and risk factor management – Section 5</i></b>		
Diuretics are recommended in patients with AF, HF, and congestion to alleviate symptoms and facilitate better AF management.	I	C

# Figure 15

## Non-invasive diagnostic methods for atrial fibrillation screening

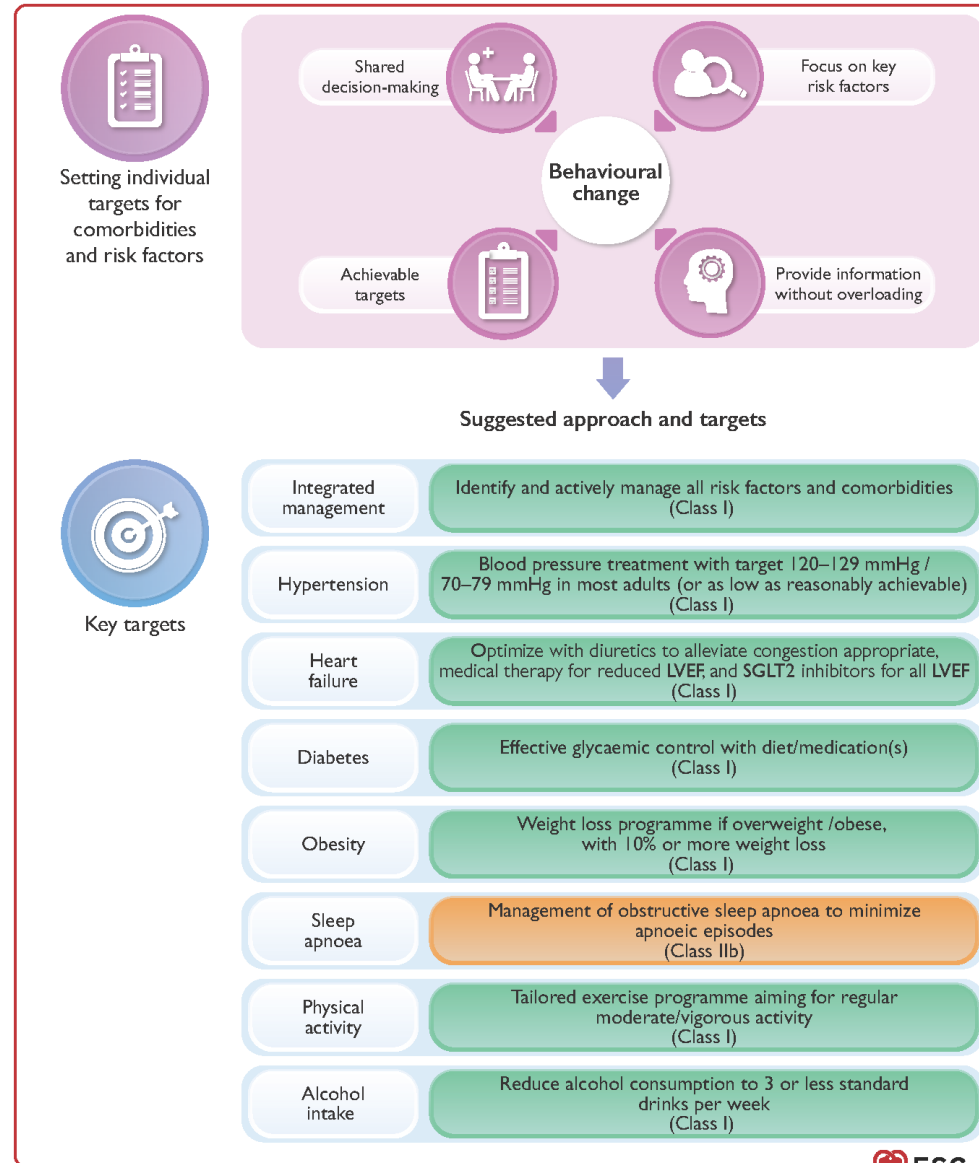


## New recommendations (2)

Recommendations	Class	Level
<b><i>[C] Comorbidity and risk factor management cont.</i></b>		
Appropriate medical therapy for HF is recommended in AF patients with HF and impaired LVEF to reduce symptoms and/or HF hospitalization and prevent AF recurrence.	I	B
Sodium-glucose cotransporter-2 inhibitors are recommended for patients with HF and AF regardless of left ventricular ejection fraction to reduce the risk of HF hospitalization and cardiovascular death.	I	A
Effective glycaemic control is recommended as part of comprehensive risk factor management in individuals with diabetes mellitus and AF, to reduce burden, recurrence, and progression of AF.	I	C
Bariatric surgery may be considered in conjunction with lifestyle changes and medical management in individuals with AF and body mass index $\geq 40$ kg/m <sup>2</sup> where a rhythm control strategy is planned, to reduce recurrence and progression of AF.	IIb	C
Management of obstructive sleep apnoea may be considered as part of a comprehensive management of risk factors in individuals with AF to reduce recurrence and progression.	IIb	B

# Figure 8

## Management of key comorbidities to reduce atrial fibrillation recurrence










# New recommendations (3)

Recommendations	Class	Level
<b><i>[C] Comorbidity and risk factor management cont.</i></b>		
When screening for obstructive sleep apnoea in individuals with AF, using only symptom-based questionnaires is not recommended.	III	B
<b><i>Initiating oral anticoagulation – Section 6.1</i></b>		
Oral anticoagulation is recommended in patients with clinical AF at elevated thromboembolic risk to prevent ischaemic stroke and thromboembolism.	I	A
A CHA <sub>2</sub> DS <sub>2</sub> -VA score of 2 or more is recommended as an indicator of elevated thromboembolic risk for decisions on initiating oral anticoagulation.	I	C
A CHA <sub>2</sub> DS <sub>2</sub> -VA score of 1 should be considered an indicator of elevated thromboembolic risk for decisions on initiating oral anticoagulation.	IIa	C
Oral anticoagulation is recommended in all patients with AF and hypertrophic cardiomyopathy or cardiac amyloidosis, regardless of CHA <sub>2</sub> DS <sub>2</sub> -VA score, to prevent ischaemic stroke and thromboembolism.	I	B

# Figure 9

## Common drug interactions with oral anticoagulants

Vitamin K antagonist oral anticoagulants	Direct oral anticoagulants			
	Apixaban	Dabigatran	Edoxaban	Rivaroxaban
				
<b>Avoid where possible</b> NSAIDs Fluconazole Voriconazole Fluoxetine	<b>Avoid where possible</b> Carbamazepine Phenytoin Phenobarbital Rifampicin Ritonavir Itraconazole Ketoconazole	<b>Avoid where possible</b> Dronedarone Carbamazepine Phenytoin Rifampicin Ritonavir Itraconazole Ketoconazole Cyclosporin Glecaprevir/pibrentasvir Tacrolimus	<b>Avoid where possible</b> Carbamazepine Phenytoin Phenobarbital Rifampicin Ritonavir	<b>Avoid where possible</b> Dronedarone Carbamazepine Phenytoin Phenobarbital Itraconazole Ketoconazole Posaconazole Voriconazole Rifampicin Ritonavir
<b>Reduce warfarin dose</b> Amiodarone Metronidazole Sulphonamides Allopurinol Fluvastatin Gemfibrozil Fluorouracil	<b>Avoid or reduce apixaban dose if another interacting drug therapy</b> Posaconazole Voriconazole Protease inhibitors Apalutamide Enzalutamide Tyrosine kinase inhibitors	<b>Delay timing of drugs and/or adjust dose</b> Amiodarone Ticagrelor Verapamil Quinidine Clarithromycin Posaconazole	<b>Avoid or reduce edoxaban dose</b> Dronedarone	<b>Avoid if another interacting drug therapy</b> Protease inhibitors Tyrosine kinase inhibitors
<b>Increase warfarin dose</b> Carbamazepine			<b>Avoid or reduce edoxaban dose if another interacting drug therapy</b> Cyclosporin Itraconazole Ketoconazole Erythromycin	<b>Caution if renal function impaired</b> Verapamil Cyclosporin Clarithromycin Erythromycin Fluconazole
<b>Monitor INR carefully</b> Dronedarone Statins Penicillin antibiotics Macrolide antibiotics Quinolone antibiotics Rifampicin Methotrexate Ritonavir Phenytoin Sodium valproate Tamoxifen Chemotherapies	<b>Limit consumption</b> Grapefruit juice St John's wort	<b>Limit consumption</b> Grapefruit juice St John's wort	<b>Limit consumption</b> Grapefruit juice St John's wort	<b>Limit consumption</b> Grapefruit juice St John's wort
<b>Limit consumption</b> Alcohol Grapefruit/cranberry juice St John's wort				

# Revised recommendations (6)

2020 Guidelines	Class	Level	2024 Guidelines	Class	Level
<b><i>Rhythm control strategies in patients with atrial fibrillation</i></b>					
AF catheter ablation for PVI should/may be considered as first-line rhythm control therapy to improve symptoms in selected patients with symptomatic: <ul style="list-style-type: none"><li>• Paroxysmal AF episodes.</li></ul>	<b>IIa</b>	<b>B</b>	Catheter ablation is recommended as a first-line option within a shared decision-making rhythm control strategy in patients with paroxysmal AF, to reduce symptoms, recurrence, and progression of AF.	<b>I</b>	<b>A</b>



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ORIGINAL ARTICLE



# Spontaneous Initiation of Atrial Fibrillation by Ectopic Beats Originating in the Pulmonary Veins

**Authors:** Michel Haïssaguerre, M.D., Pierre Jaïs, M.D., Dipen C. Shah, M.D., Atsushi Takahashi, M.D., Mélèze Hocini, M.D., Gilles Quiniou, M.D., Stéphane Garrigue, M.D., Alain Le Mouroux, M.D., Philippe Le Métayer, M.D., and Jacques Clémenty, M.D. [Author Info & Affiliations](#)

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# Updated definitions for the CHA<sub>2</sub>DS<sub>2</sub>-VA score

CHA <sub>2</sub> DS <sub>2</sub> -VA component		Definition and comments	Points awarded
<b>C</b>	Chronic heart failure	Symptoms and signs of heart failure (irrespective of LVEF, thus including HFpEF, HFmrEF, and HFrEF), or the presence of asymptomatic LVEF ≤40%.	1
<b>H</b>	Hypertension	Resting blood pressure >140/90 mmHg on at least two occasions, or current antihypertensive treatment. The optimal BP target associated with lowest risk of major cardiovascular events is 120–129/70–79 mmHg (or keep as low as reasonably achievable).	1
<b>A</b>	Age 75 years or above	Age is an independent determinant of ischaemic stroke risk. Age-related risk is a continuum, but for reasons of practicality, two points are given for age ≥75 years.	2
<b>D</b>	Diabetes mellitus	Diabetes mellitus (type 1 or type 2), as defined by currently accepted criteria, or treatment with glucose lowering therapy.	1
<b>S</b>	Prior stroke, TIA, or arterial thromboembolism	Previous thromboembolism is associated with highly elevated risk of recurrence and therefore weighted 2 points.	2
<b>V</b>	Vascular disease	Coronary artery disease, including prior myocardial infarction, angina, history of coronary revascularization (surgical or percutaneous), and significant CAD on angiography or cardiac imaging OR Peripheral vascular disease, including: intermittent claudication, previous revascularization for PVD, percutaneous or surgical intervention on the abdominal aorta, and complex aortic plaque on imaging (defined as features of mobility, ulceration, pedunculation, or thickness ≥4 mm).	1
<b>A</b>	Age 65–74 years	1 point is given for age between 65 and 74 years.	1

# Recommendations for catheter ablation of atrial fibrillation (1) ESC

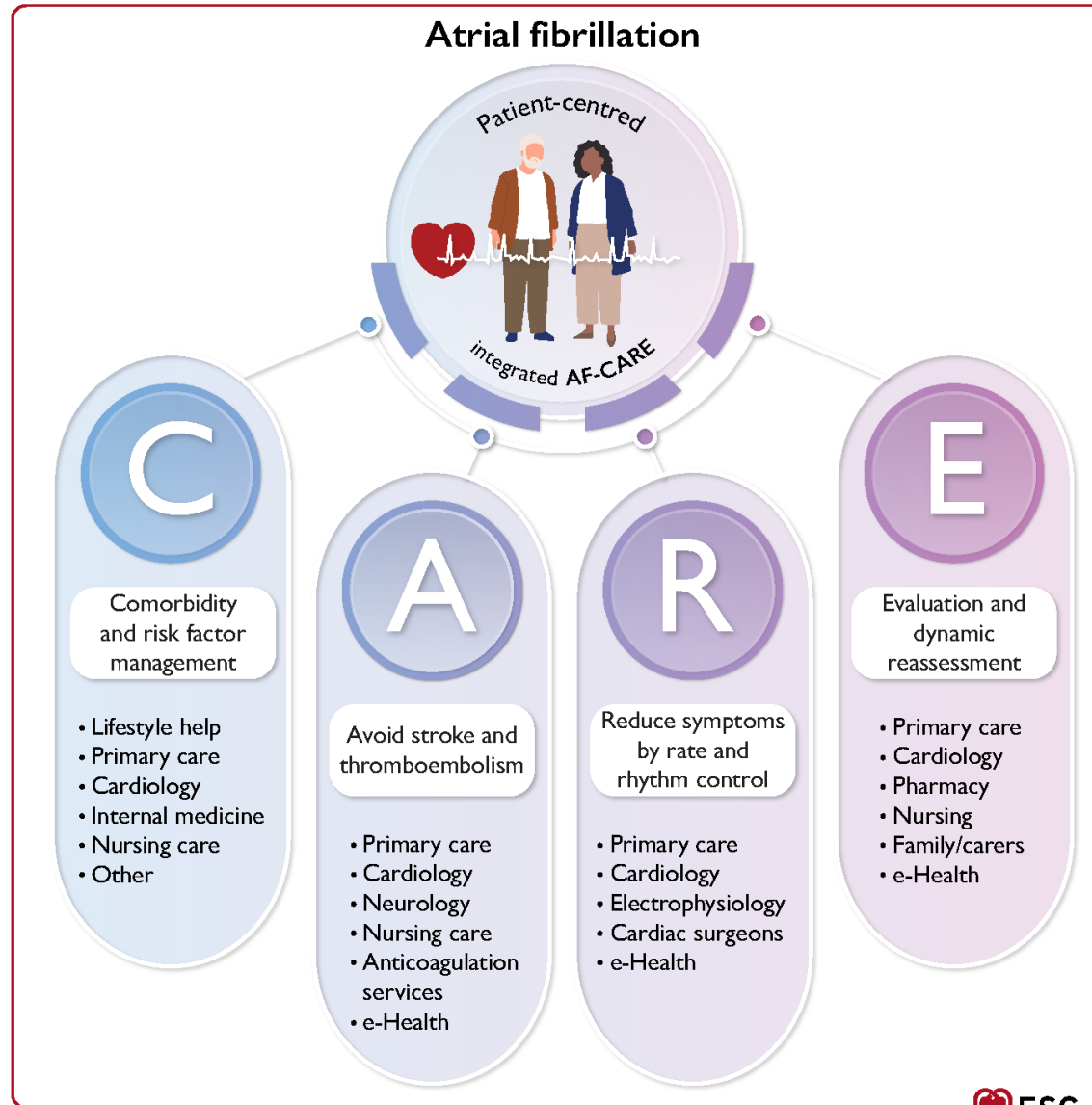
Recommendations	Class	Level
<b><i>Shared decision-making</i></b>		
Shared decision-making is recommended when considering catheter ablation for AF, taking into account procedural risks, likely benefits, and risk factors for AF recurrence.	I	C
<b><i>Atrial fibrillation patients resistant or intolerant to antiarrhythmic drug therapy</i></b>		
Catheter ablation is recommended in patients with paroxysmal or persistent AF resistant or intolerant to antiarrhythmic drug therapy to reduce symptoms, recurrence, and progression of AF.	I	A
<b><i>First-line rhythm control therapy</i></b>		
Catheter ablation is recommended as a first-line option within a shared decision-making rhythm control strategy in patients with paroxysmal AF, to reduce symptoms, recurrence, and progression of AF.	I	A
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

# Recommendations for catheter ablation of atrial fibrillation (2) ESC

Recommendations cont.	Class	Level
<b><i>Patients with heart failure</i></b>		
Atrial fibrillation catheter ablation is recommended in patients with AF and HFrEF with high probability of tachycardia-induced cardiomyopathy to reverse left ventricular dysfunction.	I	B
Atrial fibrillation catheter ablation should be considered in selected AF patients with HFrEF to reduce HF hospitalization and prolong survival.	IIa	B
<b><i>Sinus node disease/tachycardia–bradycardia syndrome</i></b>		
Atrial fibrillation catheter ablation should be considered in patients with AF-related bradycardia or sinus pauses on AF termination to improve symptoms and avoid pacemaker implantation.	IIa	C
<b><i>Recurrence after catheter ablation</i></b>		
Repeat AF catheter ablation should be considered in patients with AF recurrence after initial catheter ablation, provided the patient’s symptoms were improved after the initial PVI or after failed initial PVI, to reduce symptoms, recurrence, and progression of AF.	IIa	B

# Figure 2

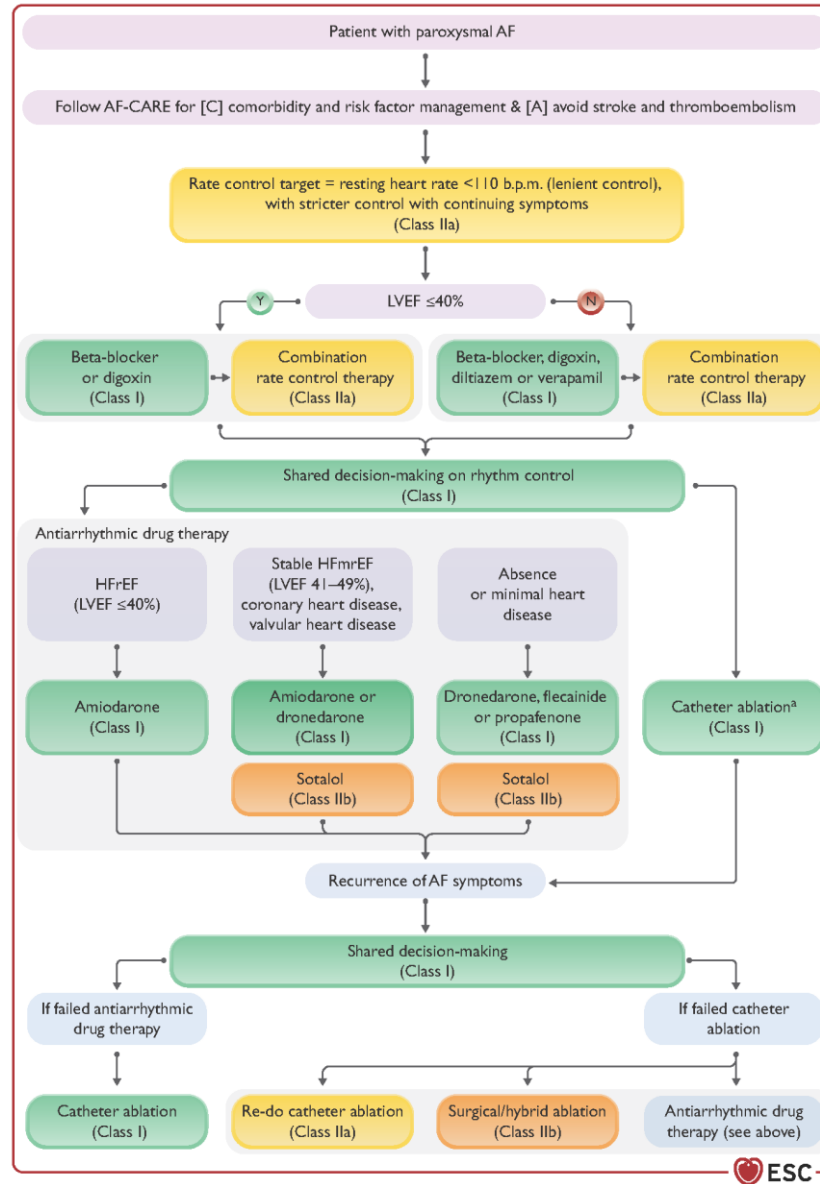
## Multidisciplinary approach to atrial fibrillation management





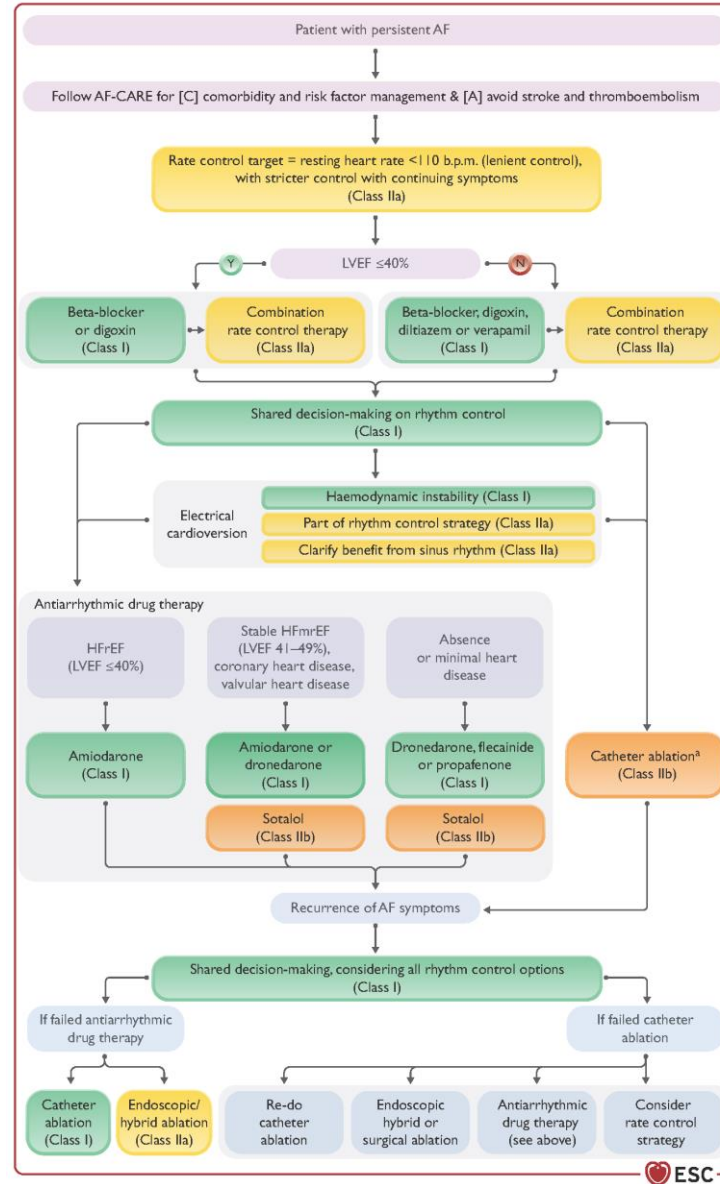
# Figure 5

## [R] Pathway for patients with paroxysmal atrial fibrillation



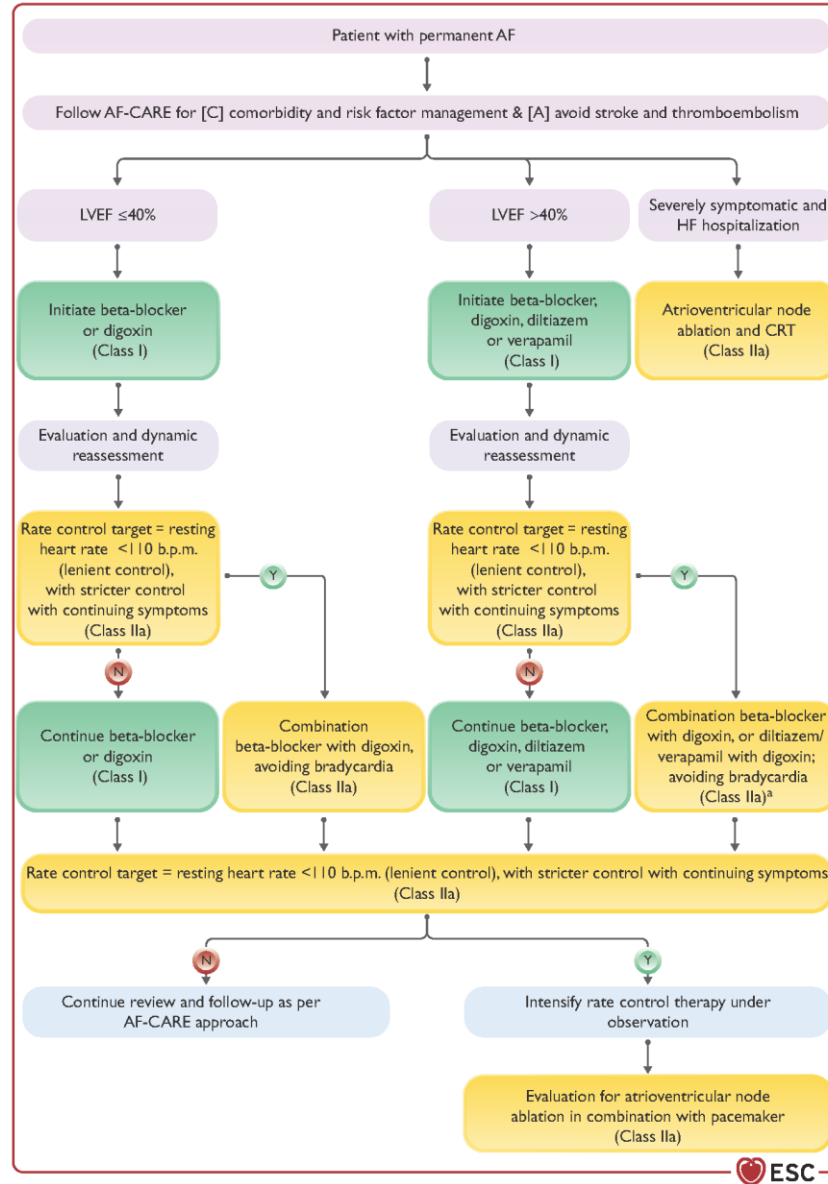
# Figure 6

## [R] Pathway for patients with persistent atrial fibrillation



# Figure 7

## [R] Pathway for patients with permanent atrial fibrillation

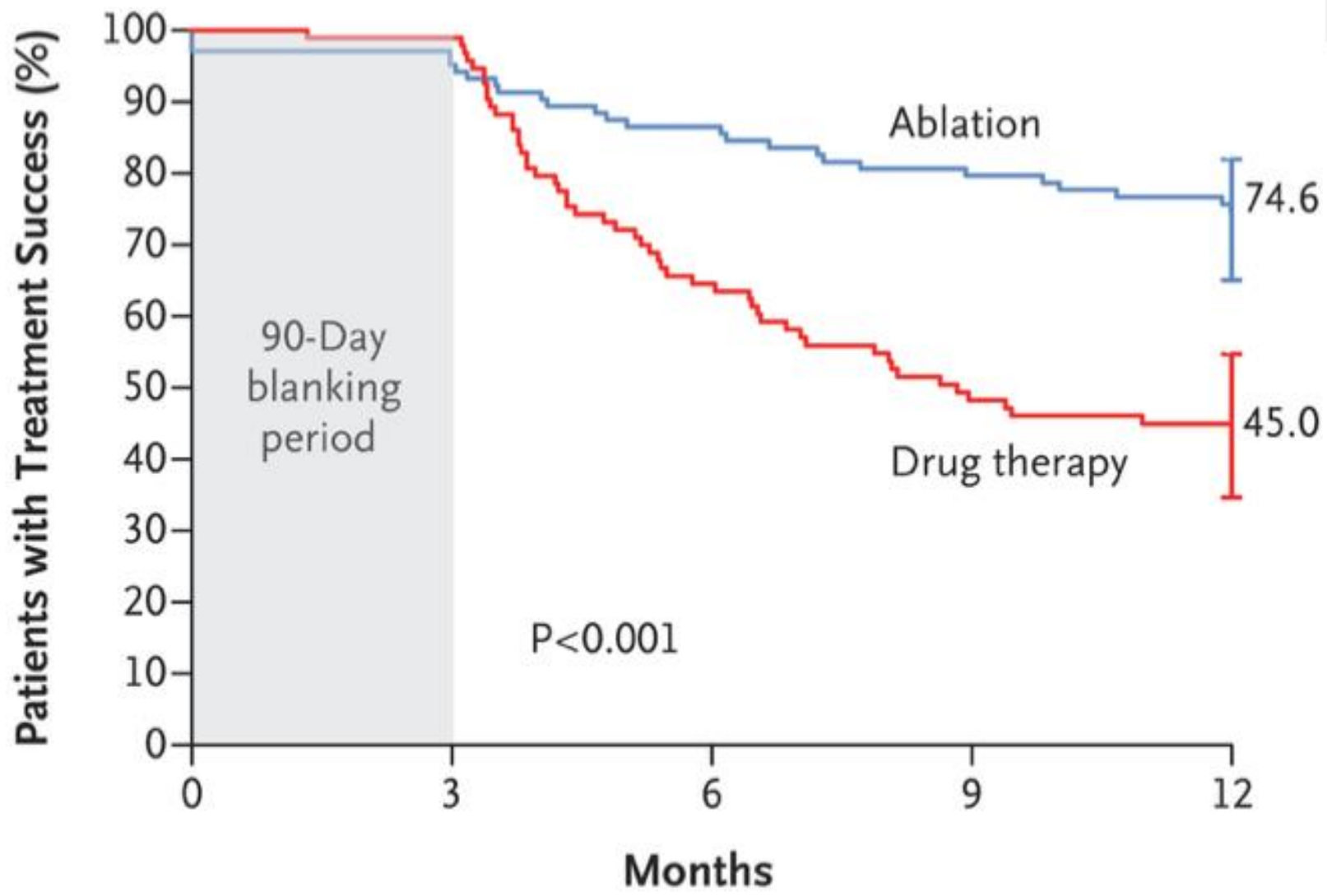


# Fibrillation auriculaire paroxystique

ORIGINAL ARTICLE

# Cryoballoon Ablation as Initial Therapy for Atrial Fibrillation

Oussama M. Wazni, M.D., Gopi Dandamudi, M.D., Nitesh Sood, M.D., Robert Hoyt, M.D., Jaret Tyler, M.D., Sarfraz Durrani, M.D., Mark Niebauer, M.D., Kevin Makati, M.D., Blair Halperin, M.D., Andre Gauri, M.D., Gustavo Morales, M.D., Mingyuan Shao, Ph.D., Jeffrey Cerkenvenik, M.S., Rachelle E. Kaplon, Ph.D., and Steven E. Nissen, M.D., for the STOP AF First Trial Investigators\*



**No. at Risk**

Ablation	104	99	88	81	70
Drug therapy	99	93	60	44	39



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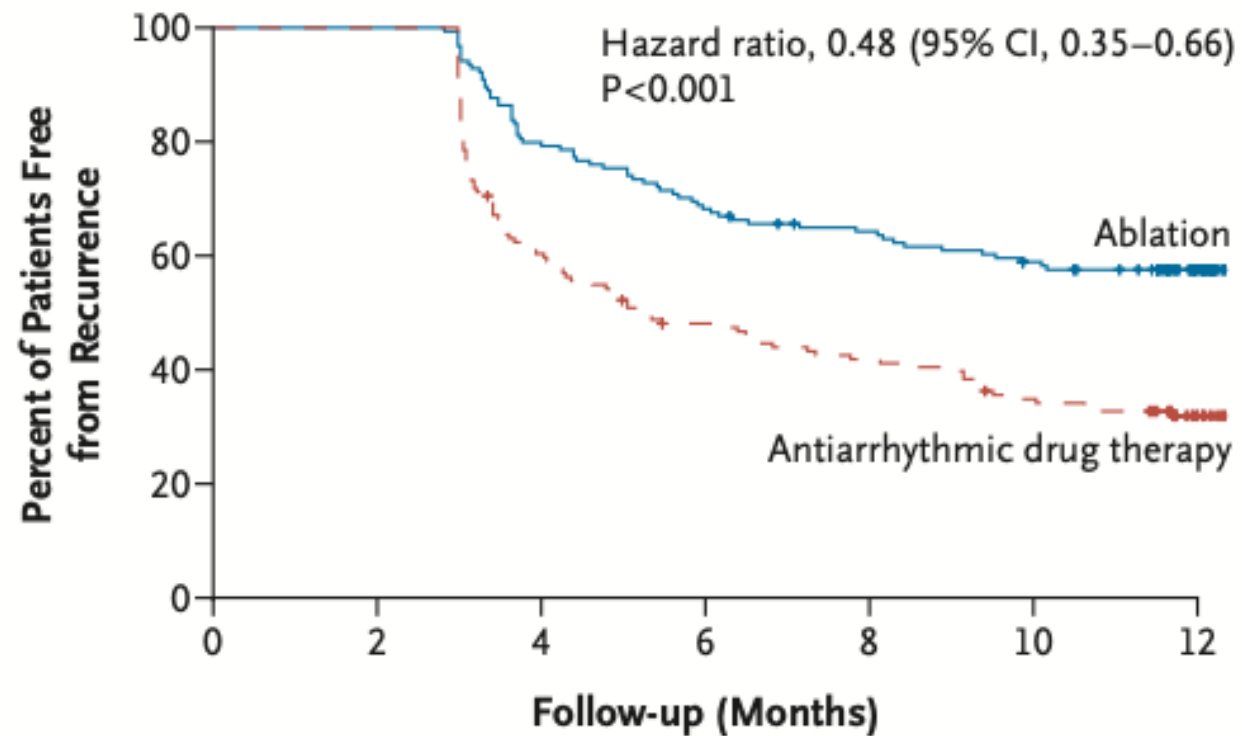
ESTABLISHED IN 1812

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## Cryoablation or Drug Therapy for Initial Treatment of Atrial Fibrillation

Jason G. Andrade, M.D., George A. Wells, Ph.D., Marc W. Deyell, M.D., Matthew Bennett, M.D., Vidal Essebag, M.D., Ph.D., Jean Champagne, M.D., Jean-Francois Roux, M.D., Derek Yung, M.D., Allan Skanes, M.D., Yaariv Khaykin, M.D., Carlos Morillo, M.D., Umjeet Jolly, M.D., Paul Novak, M.D., Evan Lockwood, M.D., Guy Amit, M.D., Paul Angaran, M.D., John Sapp, M.D., Stephan Wardell, M.D., Sandra Lauck, Ph.D., Laurent Macle, M.D., and Atul Verma, M.D., for the EARLY-AF Investigators\*



**No. at Risk**

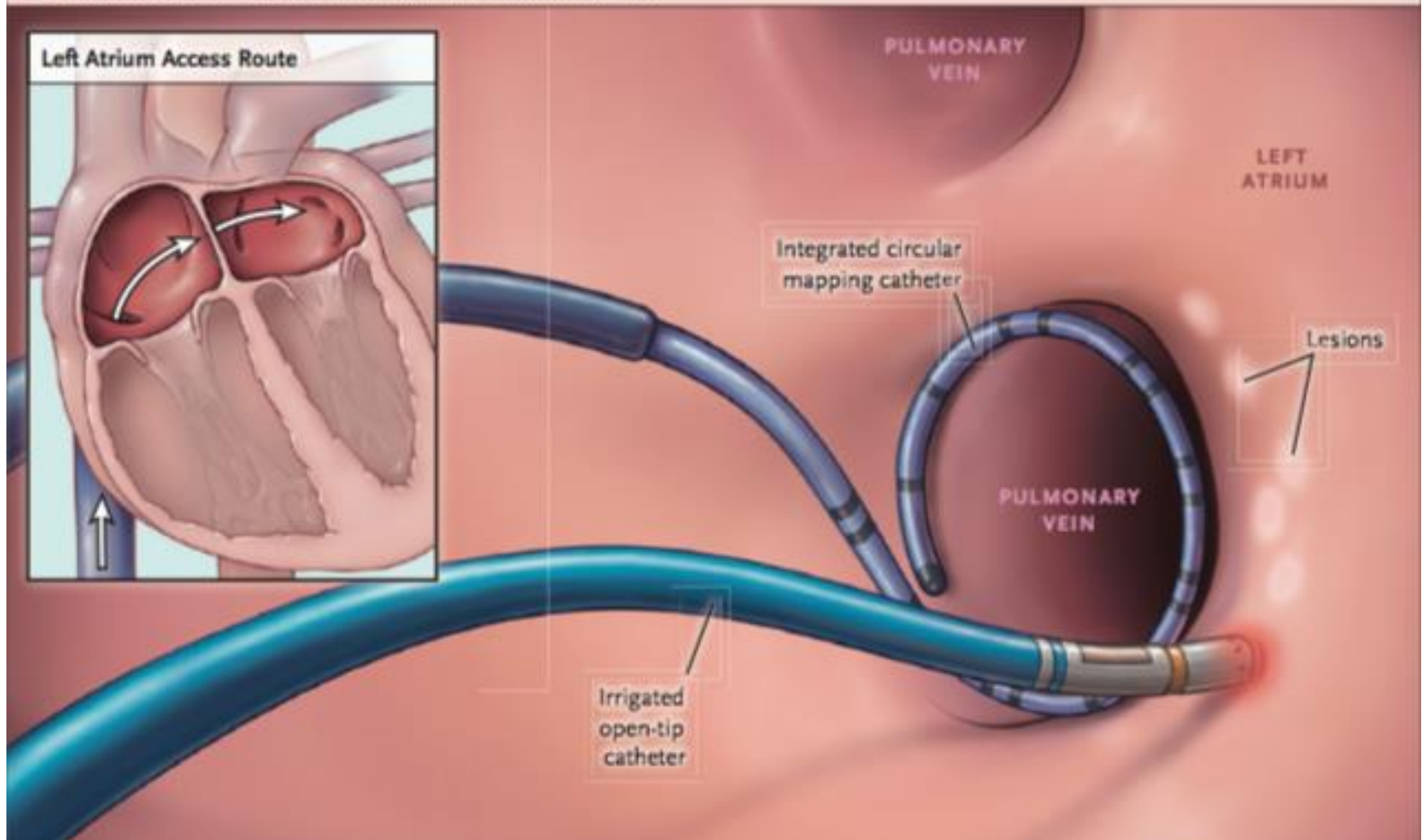
Ablation	154	154	123	105	96	86	55
Antiarrhythmic drug therapy	149	149	89	69	60	49	27

**Figure 1. Freedom from Recurrence of Atrial Tachyarrhythmia over Time.**

Shown are Kaplan–Meier estimates of the primary end point, freedom from recurrence of any atrial tachyarrhythmia (atrial fibrillation, atrial flutter, or atrial tachycardia) lasting 30 seconds or longer between 91 and 365 days after the initiation of an antiarrhythmic drug or catheter ablation. Tick marks indicate censored data. CI denotes confidence interval.



## B Radiofrequency Current Ablation of Pulmonary Vein





# Simplified Approach to PV Isolation

## How Cryoballoon System Works



1. Access Vein



2. Inflate Cryoballoon



3. Position to Occlude and Freeze



4. Assess PV Isolation

# Première procédure

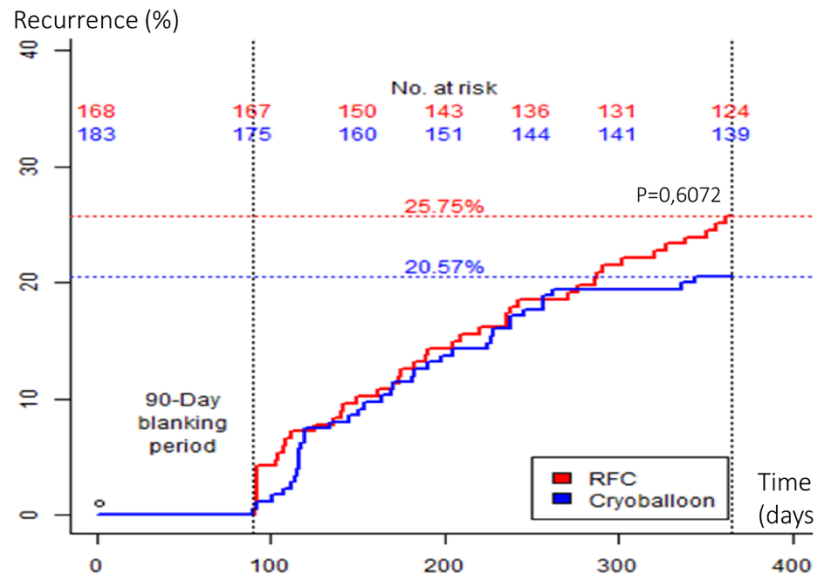
## Does radiofrequency using contact force supersede cryoballoon for atrial fibrillation (AF) ablation ?

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 (1) CHR Citadelle, Cardiology, Liège, Belgium (2) Faculté de Médecine Vétérinaire, Biostatistique, Liège, Belgium

**PURPOSE** Radiofrequency (RF) and cryoballoon (CRYO) are the main technologies for the catheter ablation of AF. Several observational studies and RCT have compared efficiency of both techniques with conflicting results. Recent RF catheters use contact-force technology to precisely calibrate the energy delivered to tissue. The purpose of our study is to evaluate the contribution of this technology in « real life » conditions and its hypothetical potential to supersede CRYO for the ablation of AF.

**METHODS** Single center retrospective study. 376 patients underwent a first ablation procedure. **Primary endpoint** : rate of AF recurrence for each technique, twelve months after initial procedure, respecting an initial 90 days blanking period. **Secondary endpoint** :  
 → **Efficacy** : mortality, fluoroscopy time, procedure duration, hospitalizations for CV causes.  
 → **Safety** : complications.  
 → **Impact on recurrence** ; temporal pattern, left atrial dimensions, AF history, BMI and CHADS<sup>2</sup>VA<sup>2</sup>Sc.

Characteristic	Radiofrequency (N=174)	Cryoballoon (N=202)	P-values
Age - yr	64.60 ± 9.00	63.65 ± 8.72	0.1663
Age > 65 yr - no. (%)	91 (52.3)	93 (46.0)	0.2260
PA - no. (%) vs PE	99 (56.9)	134 (66.3)	0.0601
Male sex - no. (%)	119 (68.4)	137 (67.8)	0.9061
Years since first AF diagnosis	3.18 ± 4.71	3.44 ± 4.82	0.3221
Body mass index	28.55 ± 4.50	28.46 ± 4.53	0.8565
Left atrial surface (cm <sup>2</sup> )	26.71 ± 6.50	26.14 ± 6.96	0.3946
Left atrial diameter (cm)	4.74 ± 0.95	4.55 ± 0.75	0.5513
CHA <sub>2</sub> DS <sub>2</sub> -VASc score	2.58 ± 1.60	2.16 ± 1.53	0.0079
<b>Medical history</b>			
Previous stroke - no. (%)	15 (8.62)	18 (8.91)	0.9210
Coronary artery disease - no. (%)	41 (23.56)	20 (9.90)	0.0003
Left ventricular hypertrophy - no. (%)	48 (27.59)	59 (29.21)	0.7282
Chronic kidney disease - no. (%)	25 (14.37)	10 (4.95)	0.0017
Hypertension - no. (%)	117 (67.24)	127 (62.87)	0.3760
Hyperlipidemia - no. (%)	106 (60.92)	112 (55.45)	0.2836
Type 2 diabetes - no. (%)	47 (27.01)	34 (16.83)	0.0167



### RESULTS

- Trend toward lower incidence of recurrences in the CRYO group (p=0,607)
- Hospitalizations for cardiovascular causes and death from any cause slightly higher in the RF group.
- Time of procedure lower / fluoroscopy time higher in CRYO group.
- Association between recurrence and both left atrium diameter and CHADS<sup>2</sup>VA<sup>2</sup>Sc score (slightly higher in RF group).

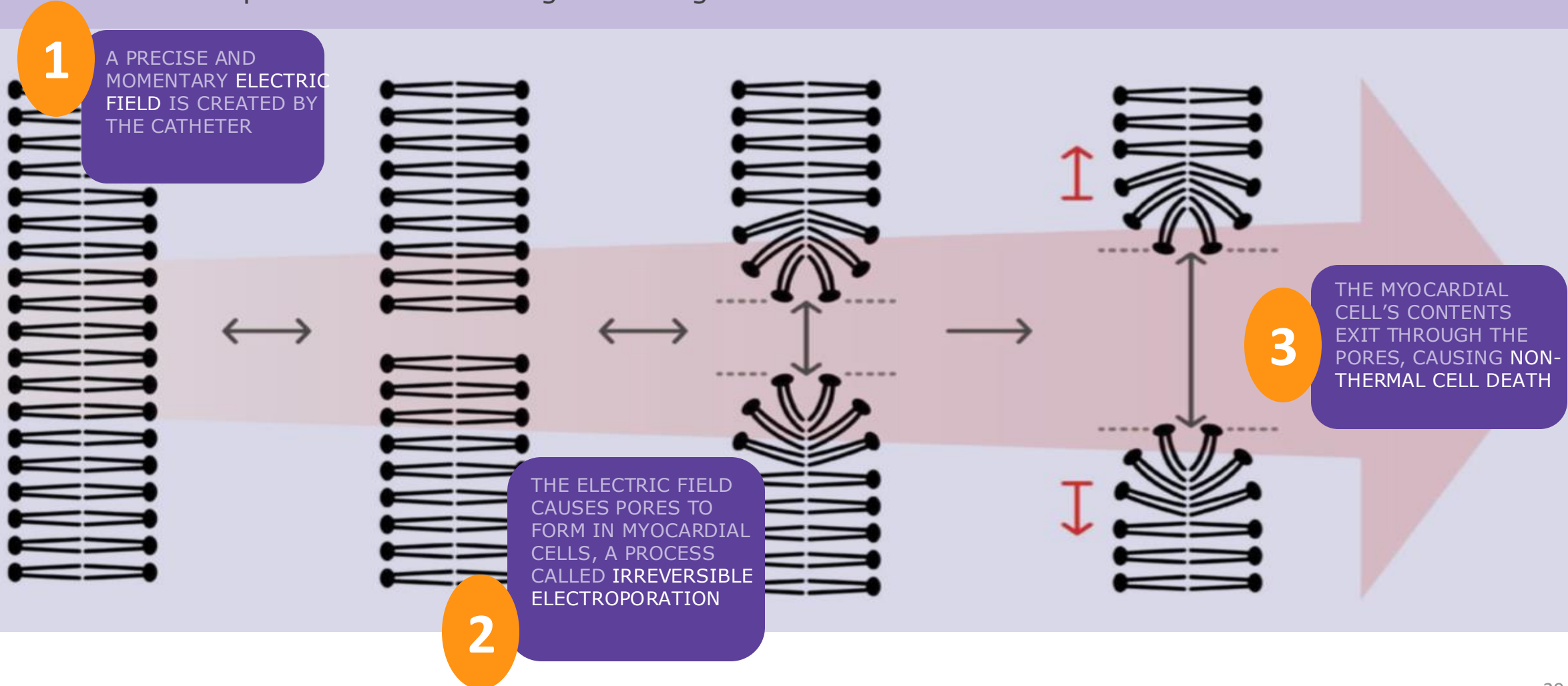
End Point	Radiofrequency N = 167	Cryoballoon N = 175	P-value
<b>Primary efficacy end point - no. of patients (%)</b>	43 (25.75)	36 (20.57)	0.6072
Repeat ablation - no. of patients (%)	12 (7.19)	15 (8.57)	0.6347
<b>Components of the secondary end point</b>			
Death from any cause - no. of patients (%)	5 (3.72)	1 (0.55)	0.1140
Death from arrhythmia - no. of patients (%)	0 (0.00)	0 (0.00)	1.0000
Rehospitalization for cardiovascular causes - no. of patients (%)	46 (27.54)	29 (16.76)	0.0165
Procedure duration - minutes	129.5	65.9	0.0000
Fluoroscopy time - seconds	298	533	0.0000
<b>Medication use - after</b>			
Sotalol - no. (%)	8 (4.76)	8 (4.26)	0.8021
Class Ic - no. (%)	43 (25.60)	47 (25.00)	0.7433
Cordarone - no. (%)	38 (22.62)	18 (9.57)	0.0004
Calcium channel blocker - no. (%)	0 (0.00)	3 (1.60)	0.2522
<b>Medication use - before</b>			
Sotalol - no. (%)	9 (5.17)	11 (5.45)	1.0000
Class Ic - no. (%)	56 (32.18)	76 (37.62)	0.2705
Calcium channel blocker - no. (%)	0 (0.00)	5 (2.48)	0.0643
Cordarone - no. (%)	73 (41.95)	60 (29.70)	0.0132

### CONCLUSION

Use of latest generation ablation catheters failed to demonstrate significant difference in recurrence of AF between radiofrequency and cryoballoon ablation of AF. Left atrium diameter and higher CHADS<sup>2</sup>VA<sup>2</sup>Sc score are two predictors of recurrence, easy to use in daily clinical practice.

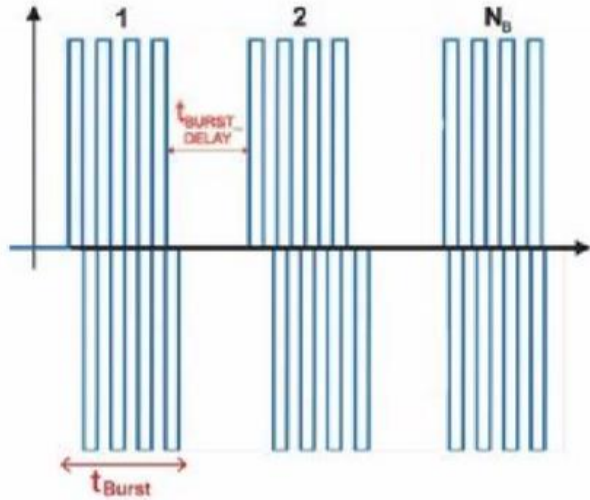
# PFA IS NON-THERMAL

Irreversible Electroporation - not heating or cooling - is PFA's mechanism for ablation



# Dosing

## Deconstructing a single PFA application



A biphasic PFA application

### Packet Delay

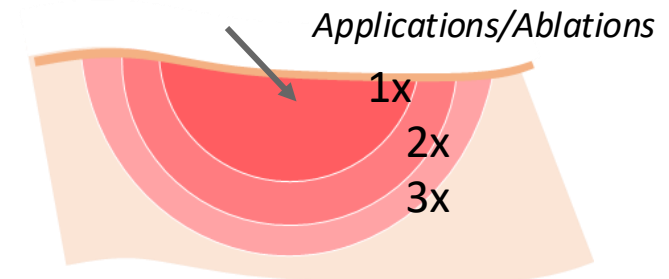
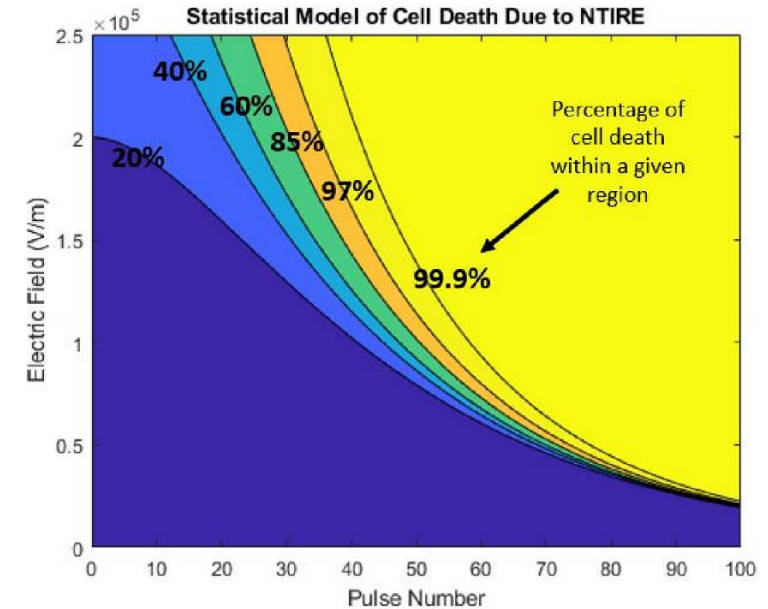
- Allows time for heat to dissipate which prevents thermal stacking and unwanted artifact
- Blood flow acts as a heat sink

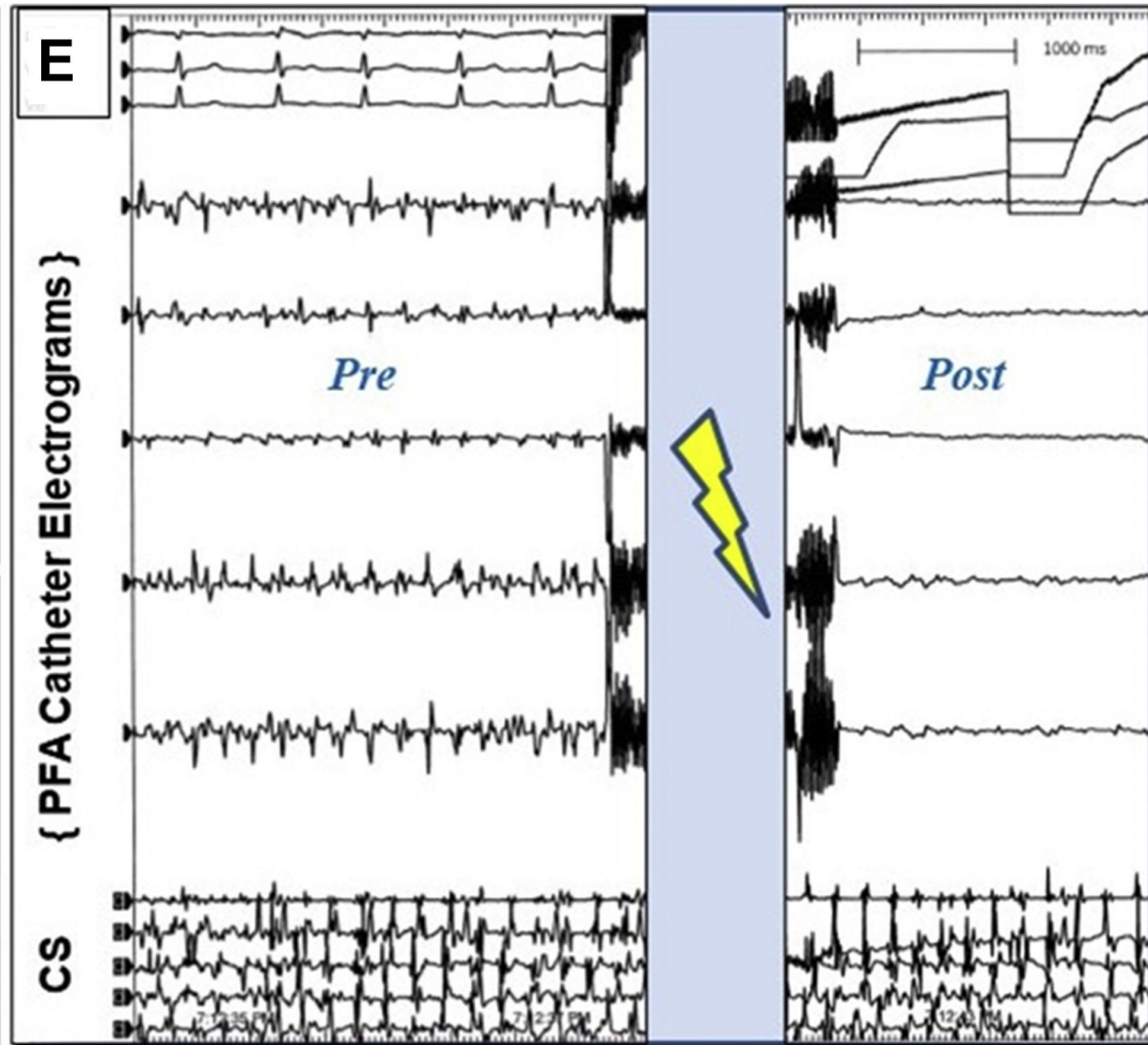
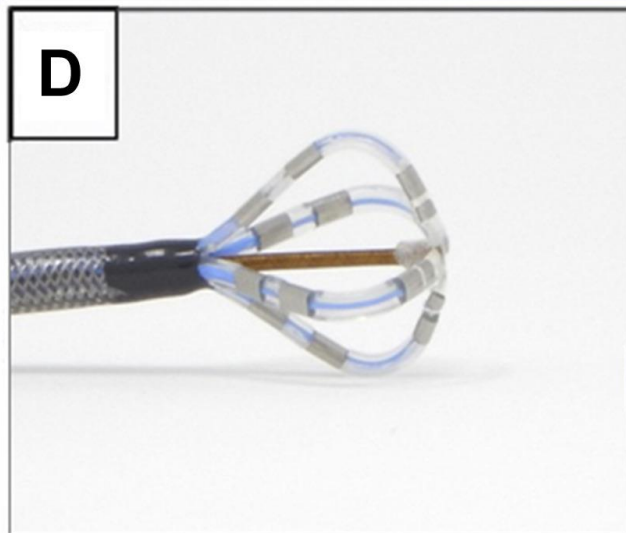
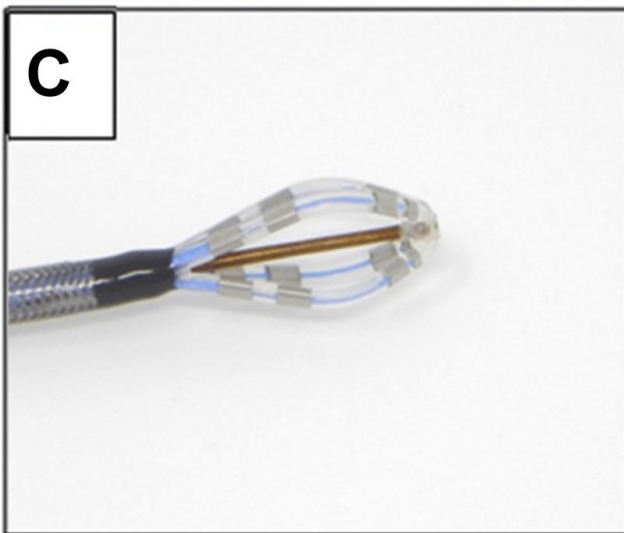
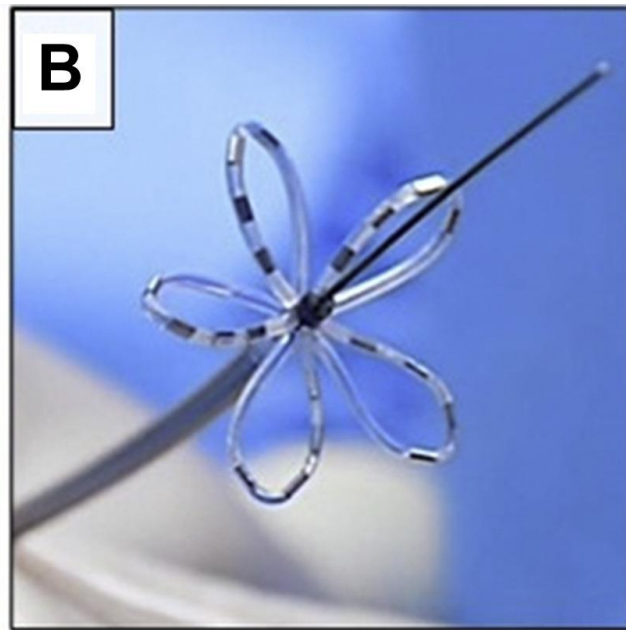
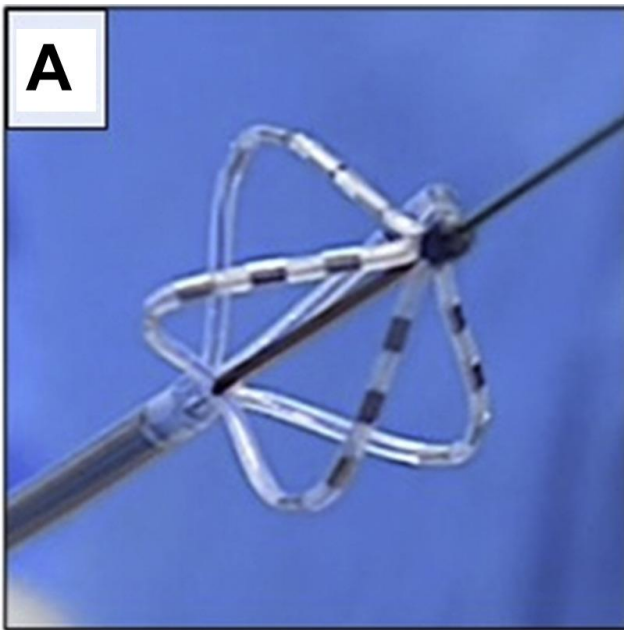
### Pulse/Group/Packet Number

- More pulses will increase efficacy, **to a limit.**
- At a certain point, delivering more pulses will increase risk of thermal stacking and artifact **without** improving efficacy.

### Application Number

- Depth increases with the number of applications but also **reaches a limit.**
- It is important to **complete the recommended number of applications in a workflow** even if electrograms disappear after the First application.







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<https://doi.org/10.1093/eurheartj/ehae618>

STATE OF THE ART REVIEW

Arrhythmias

# Catheter ablation for atrial fibrillation: indications and future perspective

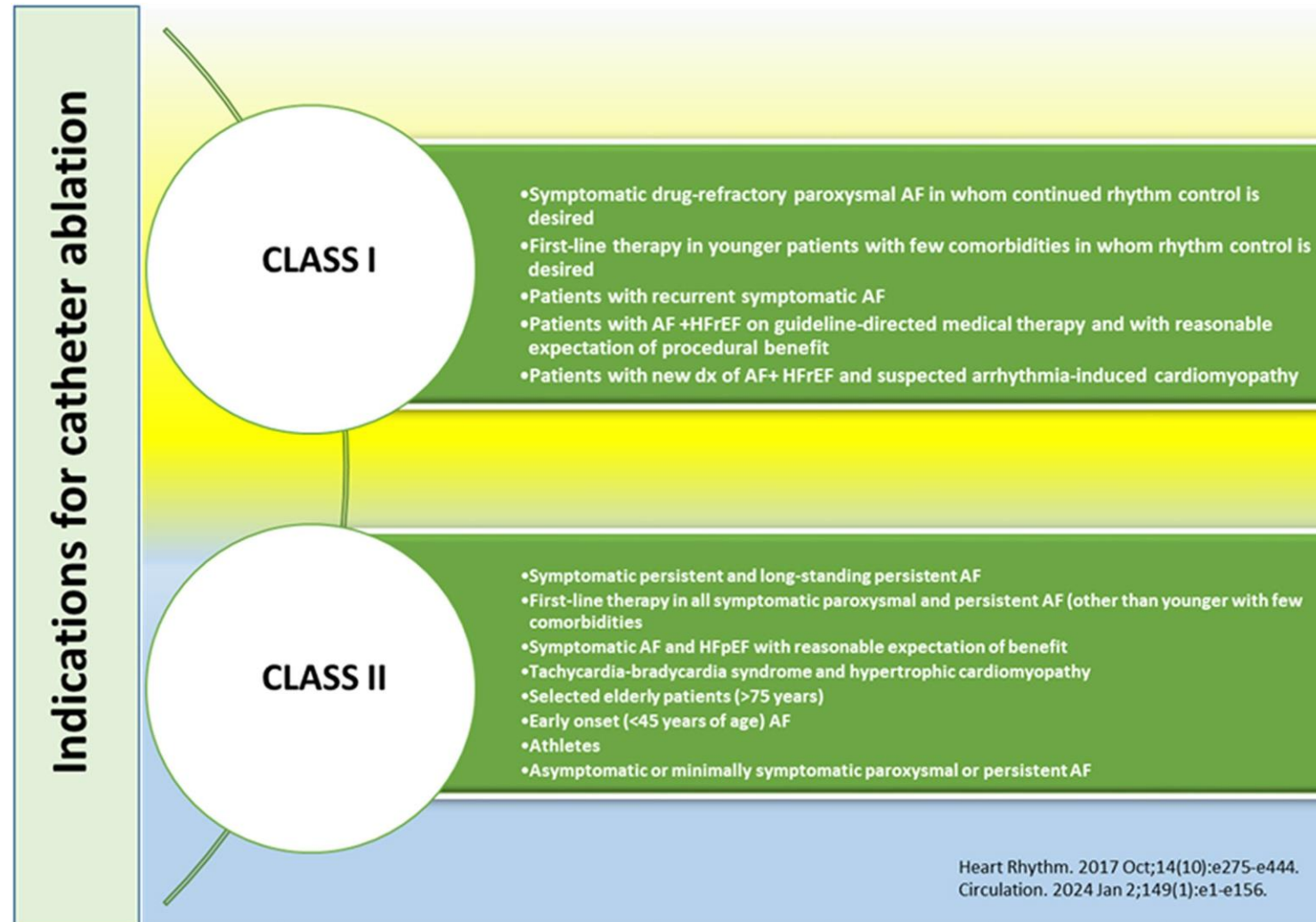
**Andrea Natale** <sup>1,2,3,4,\*</sup>, **Sanghamitra Mohanty** <sup>1</sup>, **Prashanthan Sanders** <sup>5</sup>,  
**Elad Anter** <sup>6</sup>, **Ashok Shah**<sup>7</sup>, **Ghaliah Al Mohani**<sup>8</sup>, and **Michael Haissaguerre** <sup>7</sup>

<sup>1</sup>Texas Cardiac Arrhythmia Institute, St. David's Medical Center, 3000 N. I-35, Suite 720, Austin, TX 78705, USA; <sup>2</sup>Interventional Electrophysiology, Scripps Clinic, 9898 Genesee Avenue, La Jolla, San Diego, CA 92037, USA; <sup>3</sup>Department of Internal Medicine, Metro Health Medical Center, Case Western Reserve University School of Medicine, Cleveland, OH 44109, USA; <sup>4</sup>Department of Biomedicine and Prevention, Division of Cardiology, University of Tor Vergata, Rome, Italy; <sup>5</sup>University of Adelaide, Australia; <sup>6</sup>Shamir Medical Center, Tel Aviv University, Israel; <sup>7</sup>Haut-Lévêque Cardiology Hospital, Bordeaux, France; and <sup>8</sup>Alameda Group Hospitals, Cairo, Egypt

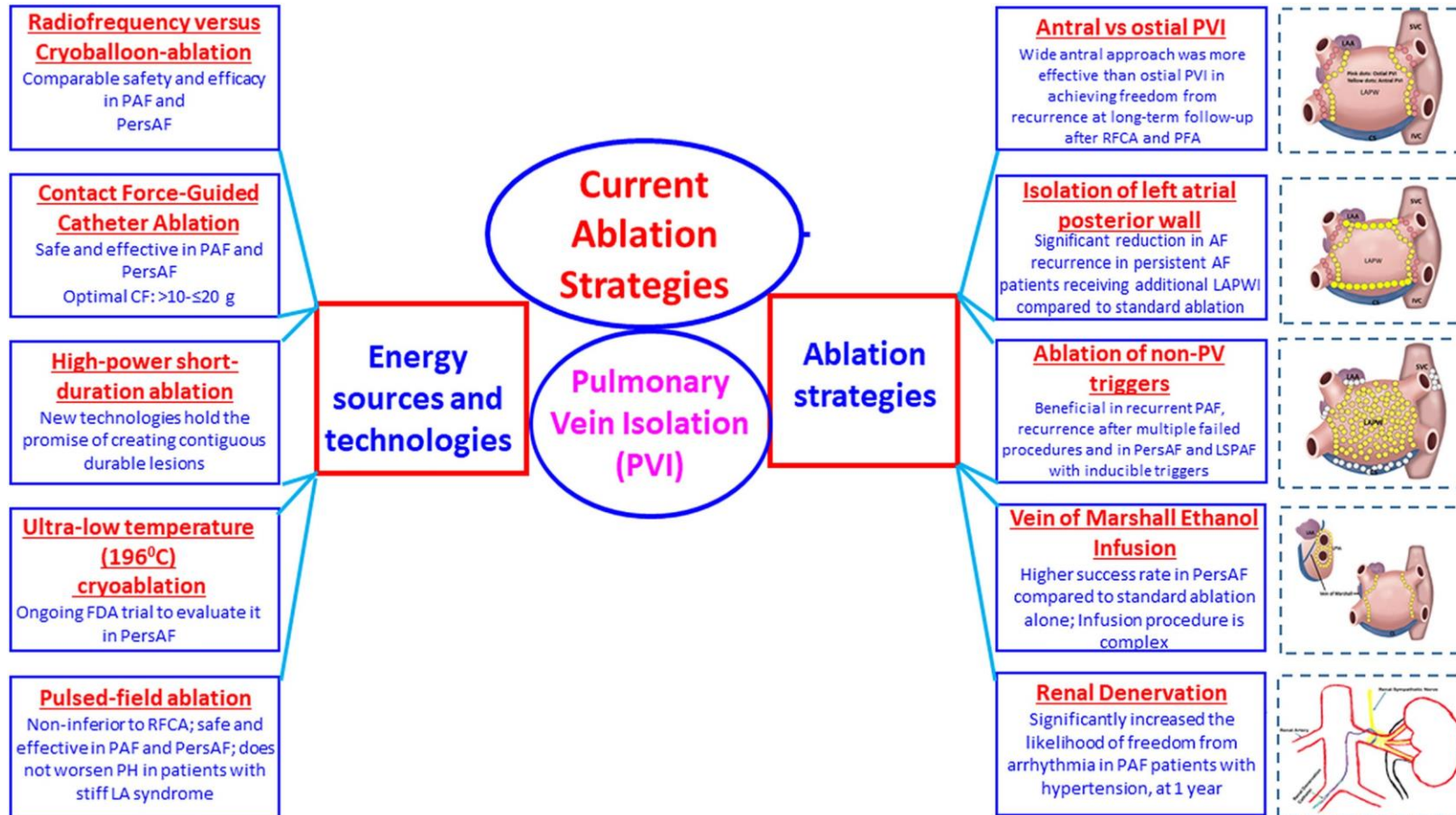
Received 12 February 2024; revised 12 April 2024; accepted 30 August 2024; online publish-ahead-of-print 26 September 2024



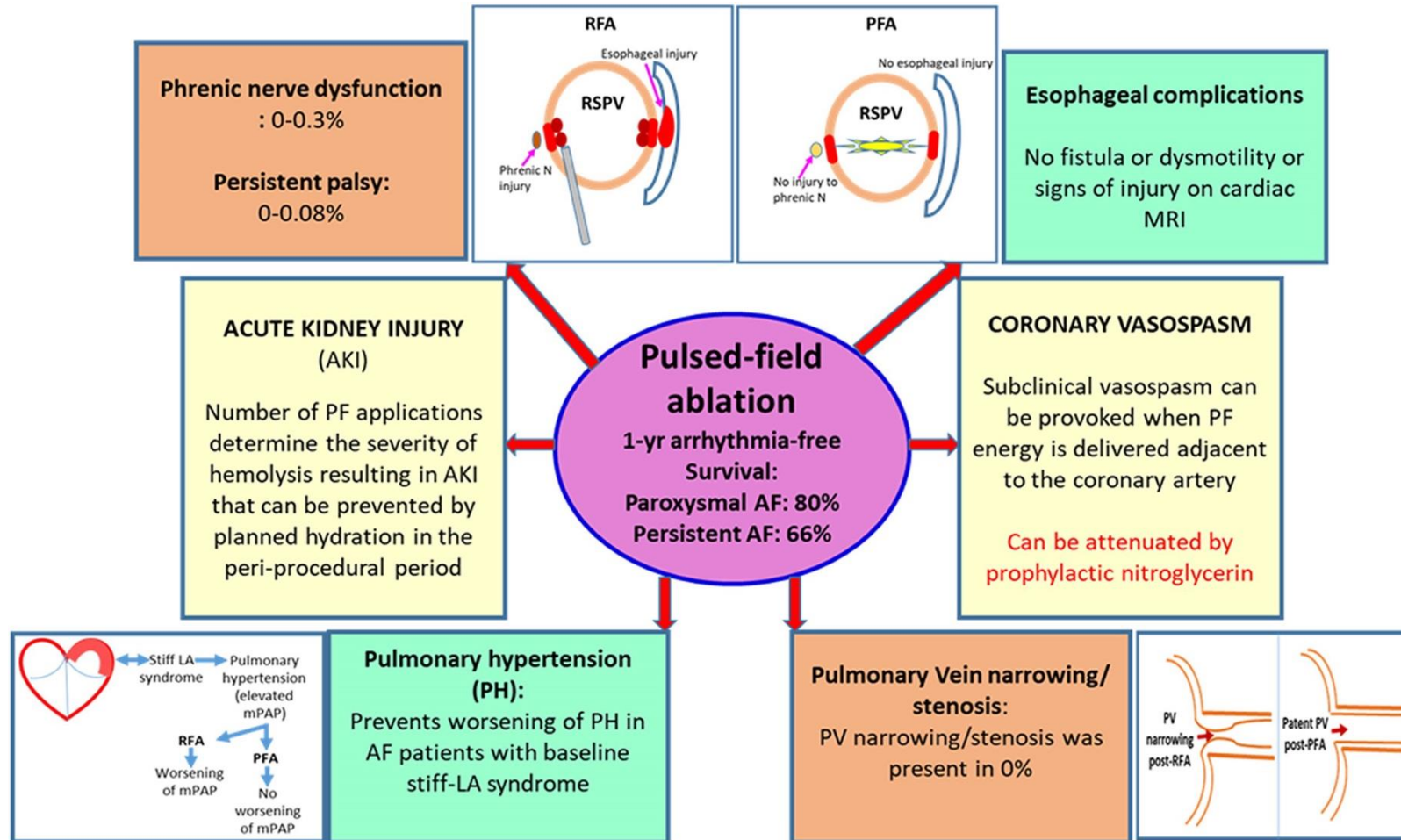
**Figure 2** Schematic showing indications for catheter ablation based on the recommendations of latest guidelines



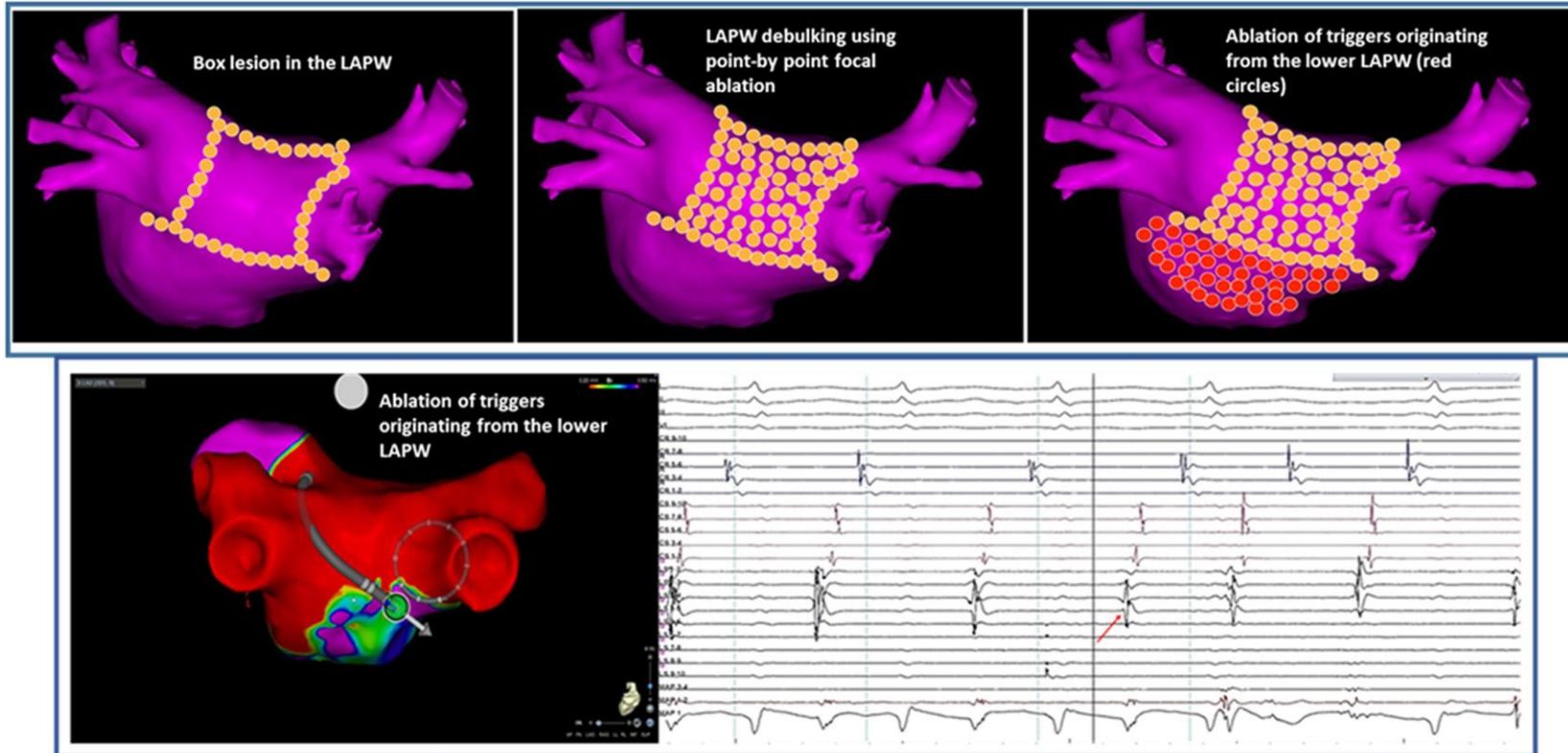
**Figure 3** Summary of techniques and technologies of atrial fibrillation ablation with the introduction of newer energy ...



**Figure 4** Benefits and risks associated with pulsed-field ablation

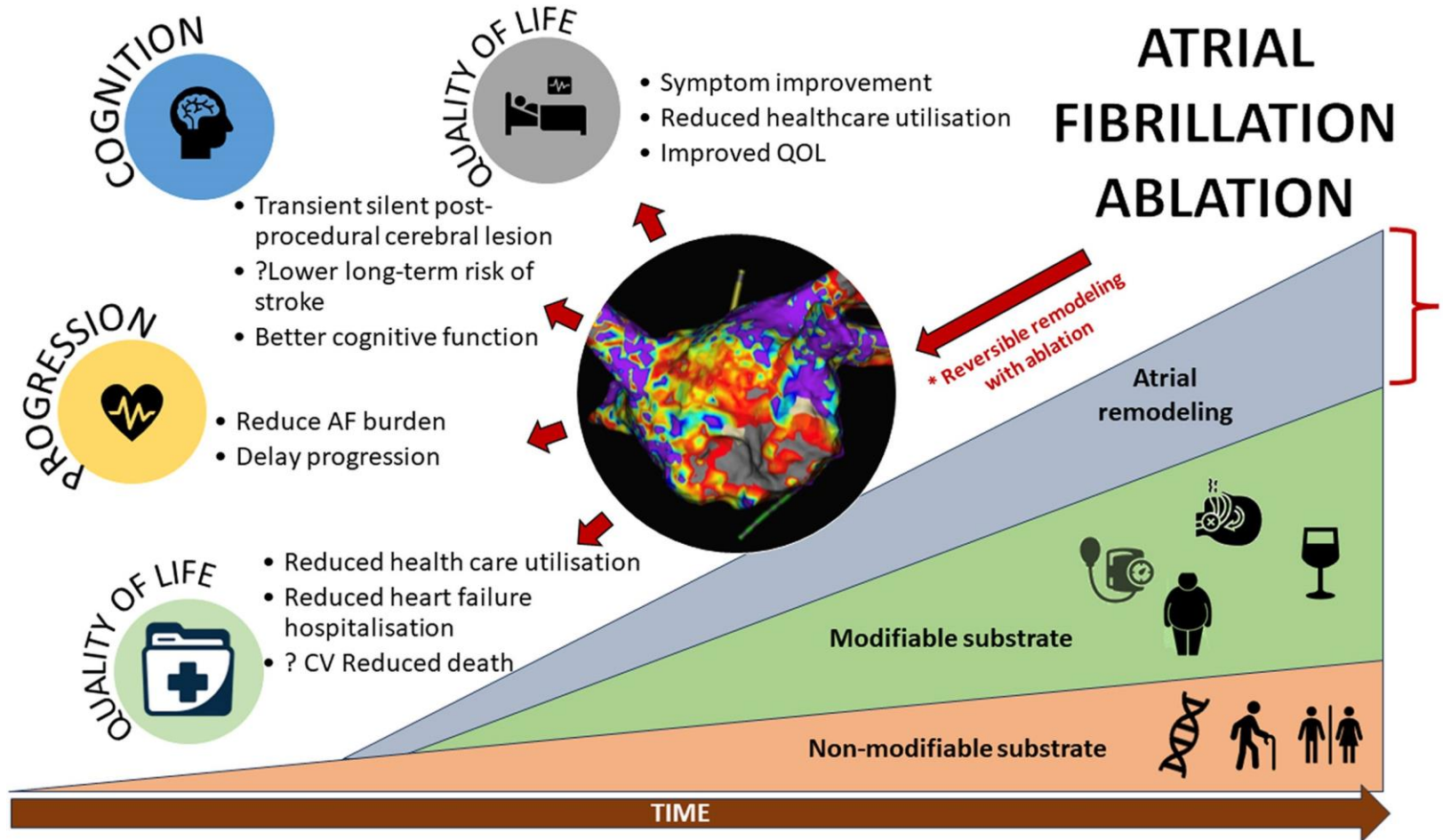


**Figure 5** Different ablation strategies for electrical isolation of left atrial posterior wall. The lower panel shows ...



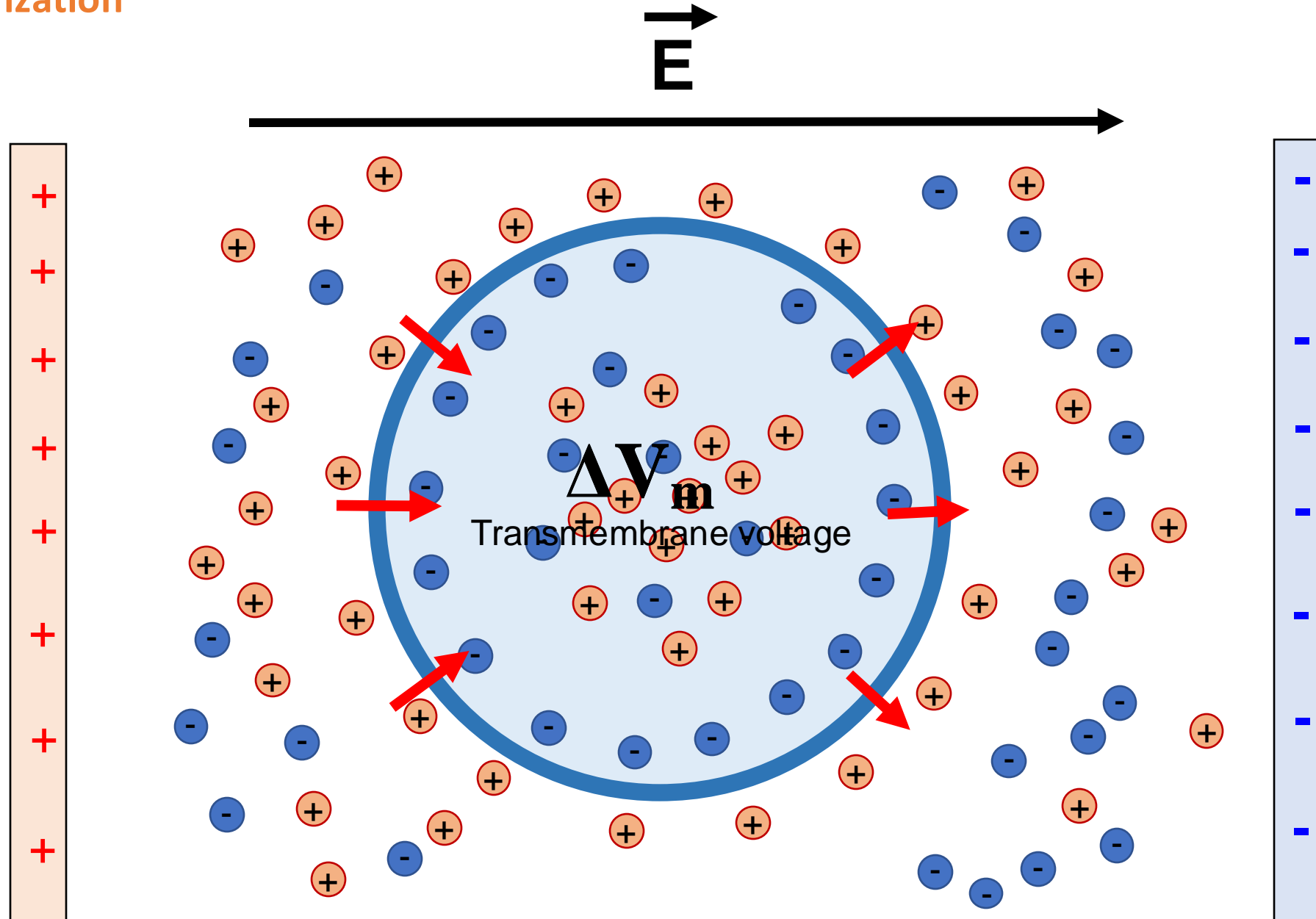
		Success rate		
		PVI only	PVI+PWI	
CAPLA study (n=338)	All Persistent AF	53.60%	52.40%	p=NS
CAPLA substudy (n=151)	Persistent AF with with Rapid PW activity	38.60%	56.40%	p=0.030

**Figure 7** Schematic showing impact of atrial fibrillation ablation on quality of life, cognition and atrial ...



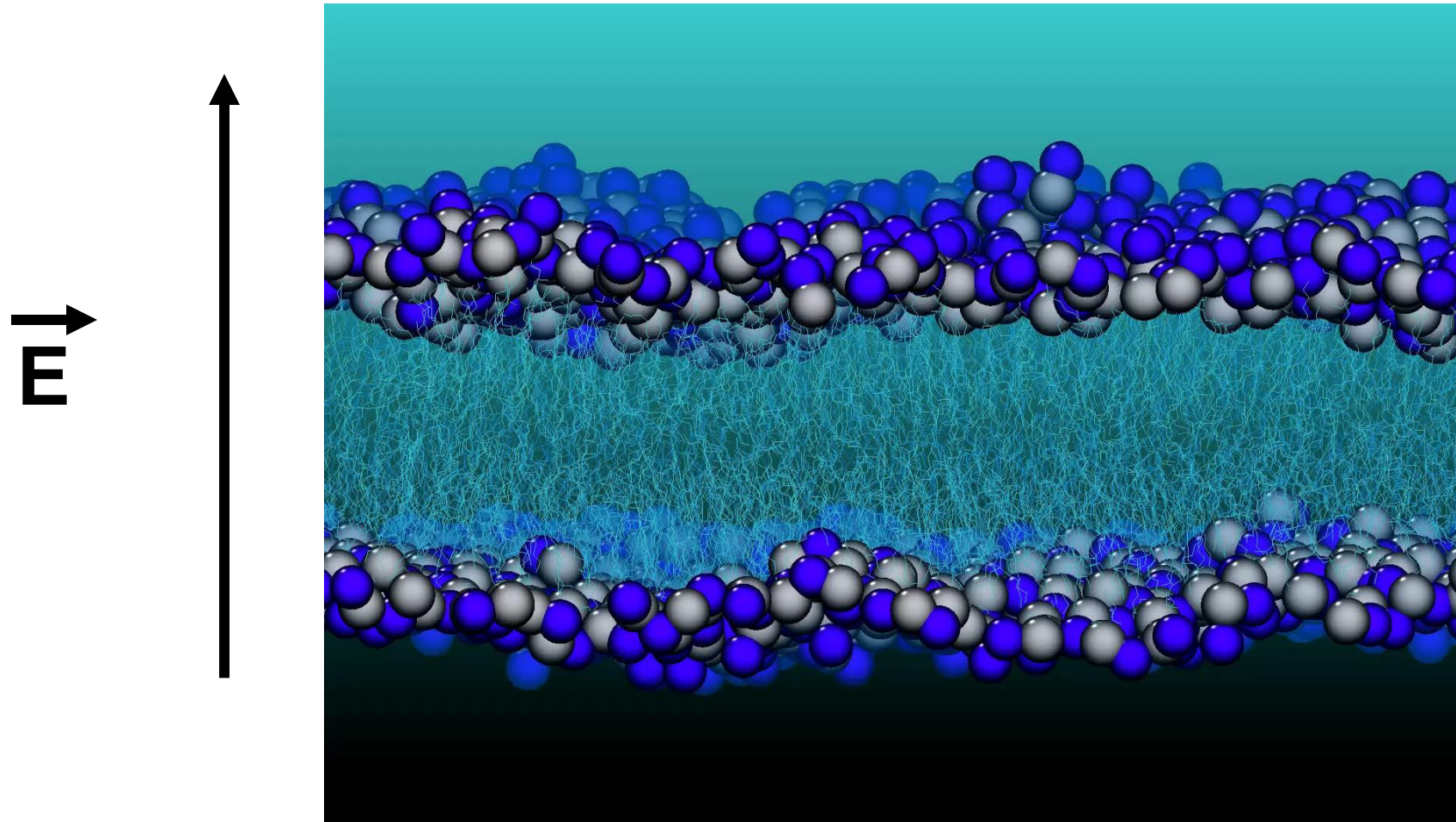
# A cell inside an electric field

## Polarization



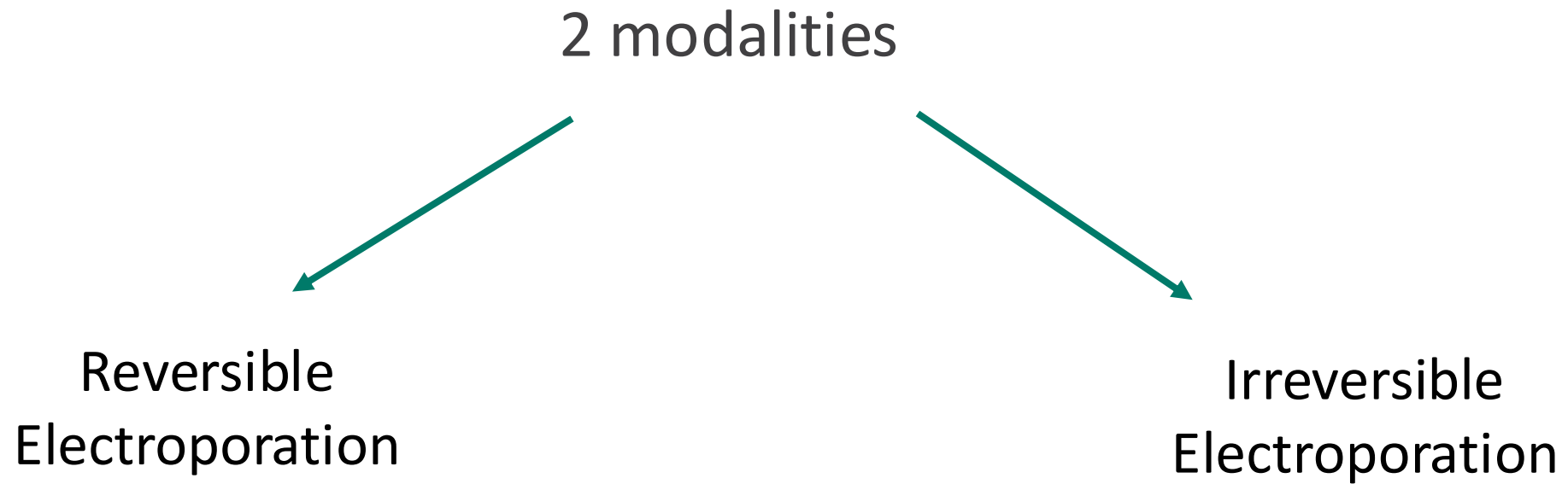
# Mechanisms

## Pore creation



Molecular dynamics simulations

# Electroporation



EP-1932502-AA © 2024 Boston Scientific

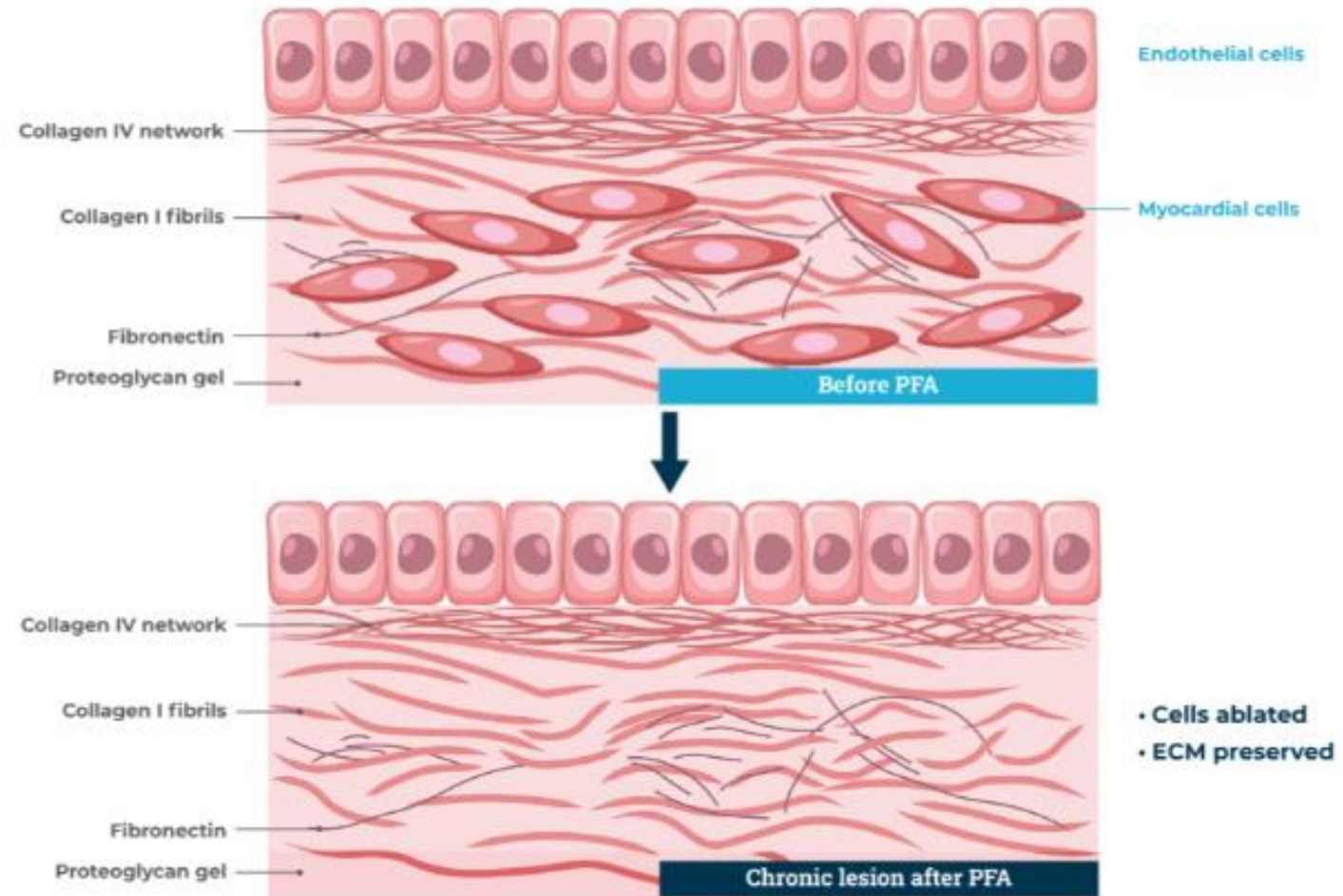


# Non-thermal ablation

## Unique PFA feature

- Preservation of extracellular matrix

✓ Cells are ablated but extracellular matrix is preserved

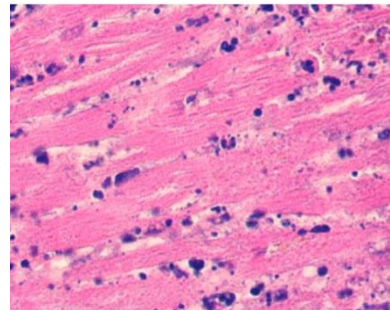


# Lesion Formation

## Acute response

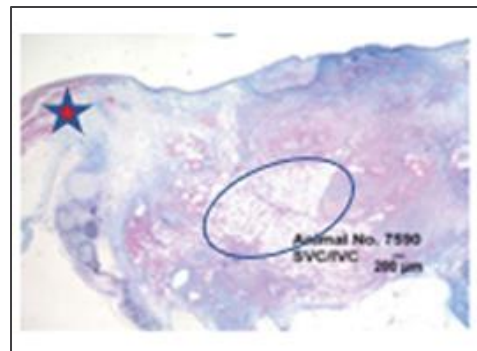
### Thermal ablation

Coagulative necrosis



Thermally denatured collagen

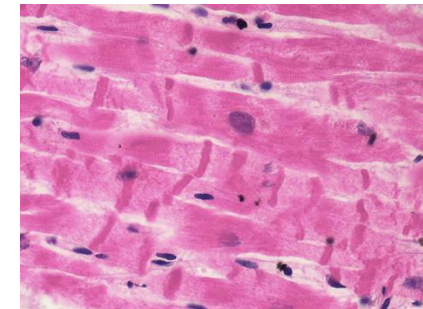
## Chronic lesion



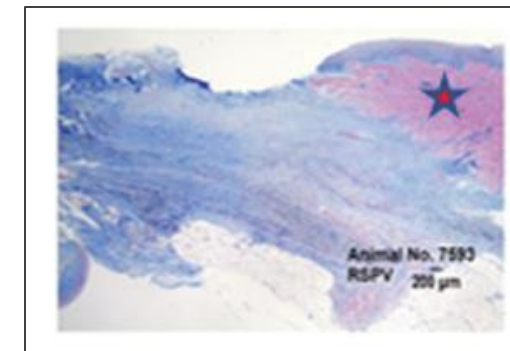
Inflammation, non-homogenous scar

### Pulsed field ablation

Contraction band necrosis/ Apoptosis ...



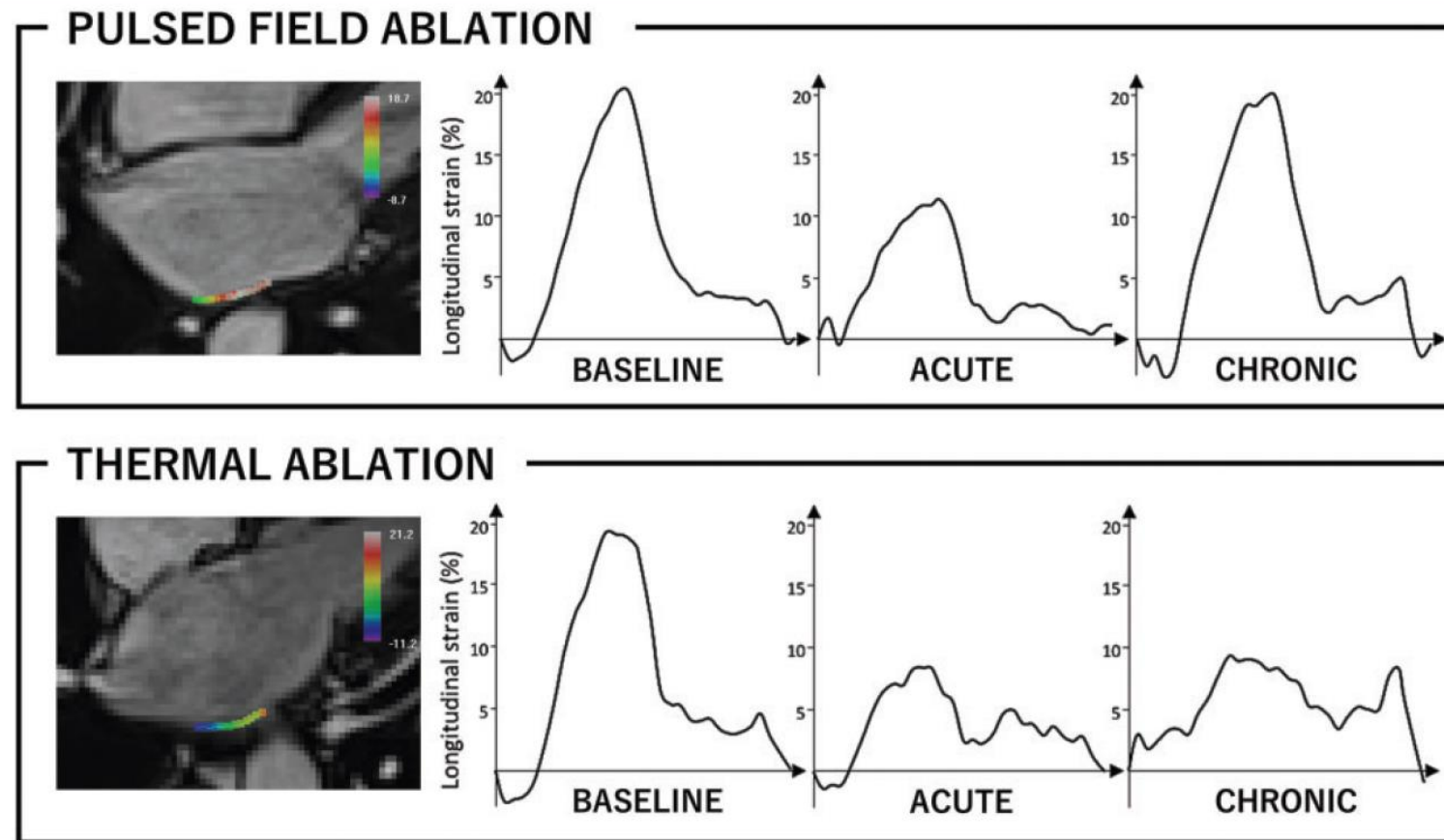
Preserved ECM



“Layered”, homogenous scar

# Lesion Formation

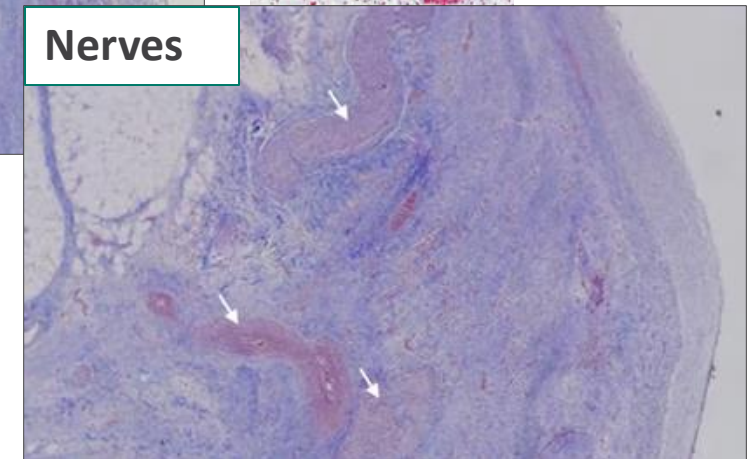
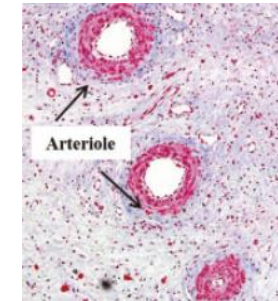
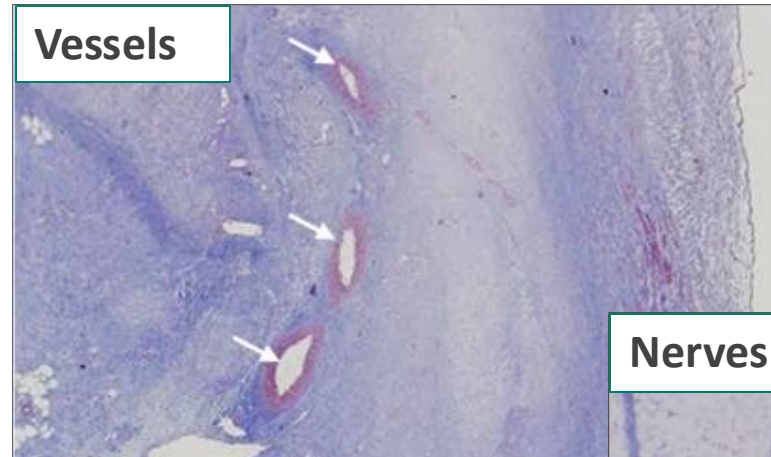
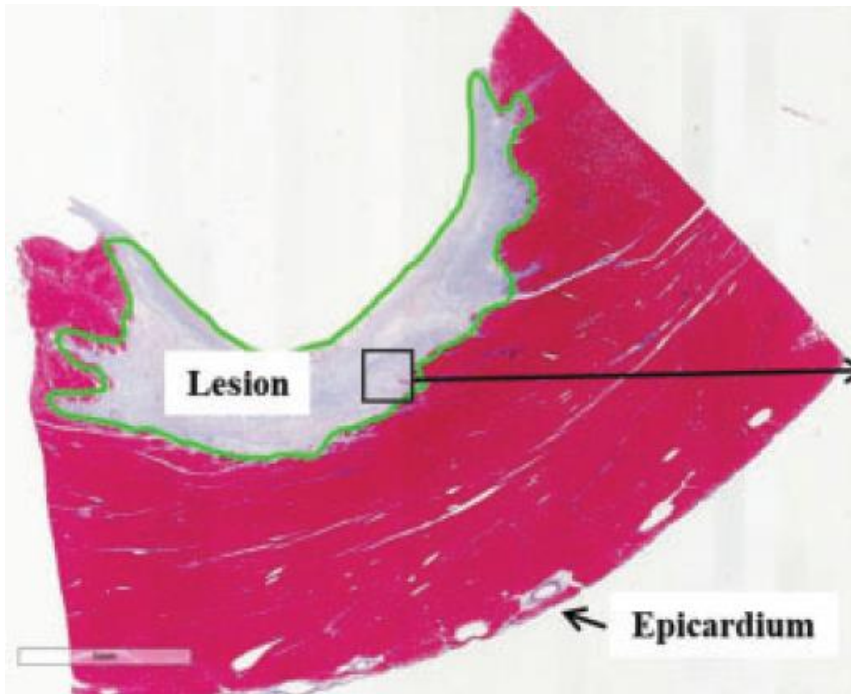
- Atrial function (tissue stiffness)



# Preferential myocardial ablation

## Observations

1. Preservation of non-myocardial tissue inside lesion areas (**vasculature and nerves**)



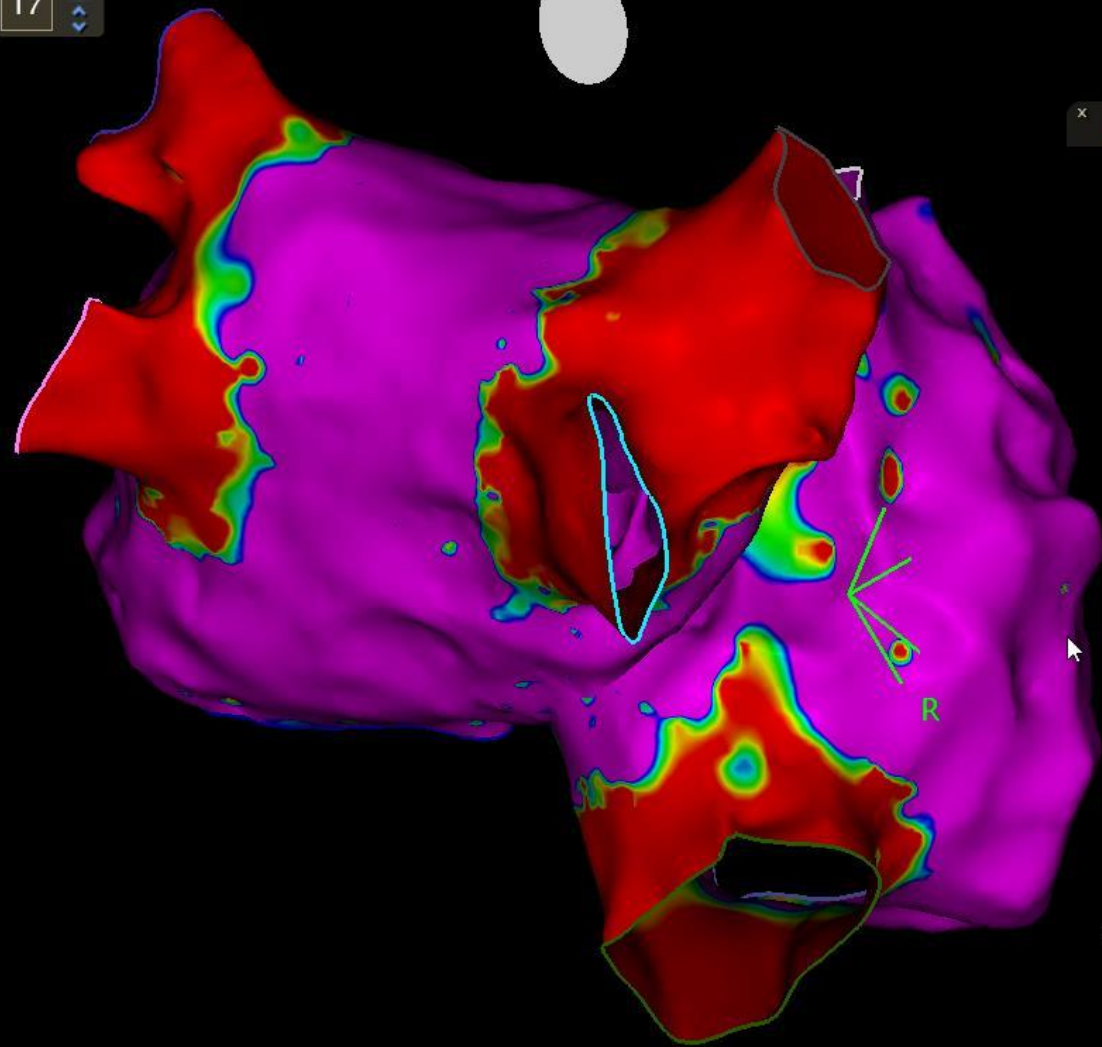
2. Undamaged surrounding structures (**esophagus, phrenic nerve**)

1-LA (4252, 0) Resp

0.15 mV Bi 0.50 mV

Tag.Idx

17



1.26

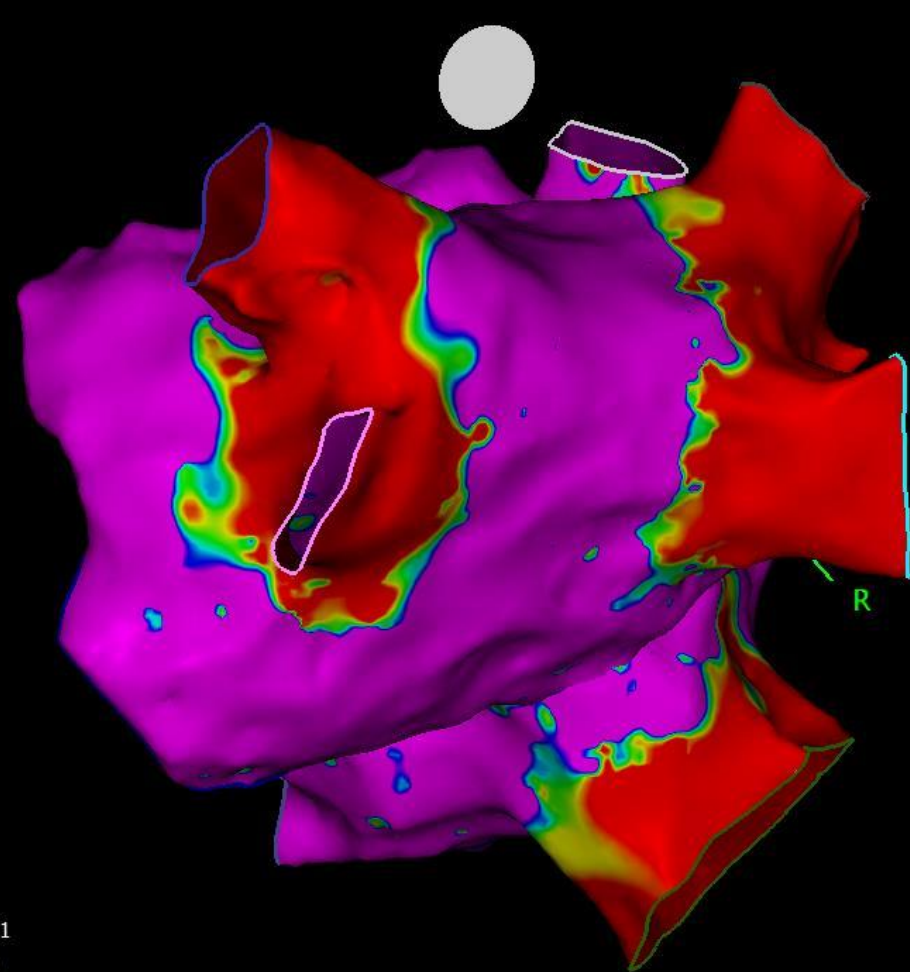
Volume: 149.40 RAO: 139°  
Cranial: 11° Swivel: 0°



1-LA (4252, 0) Resp

0.15 mV Bi 0.50 mV

Tag.Idx



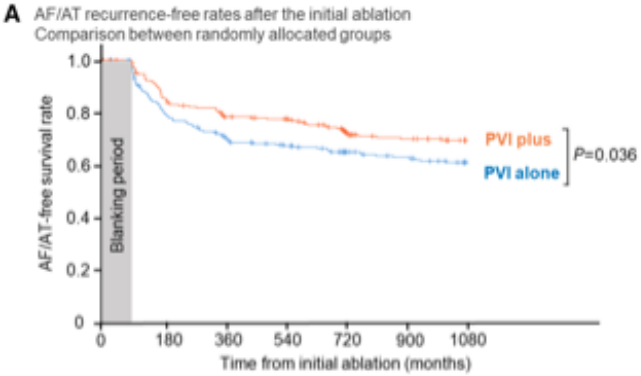
1.21



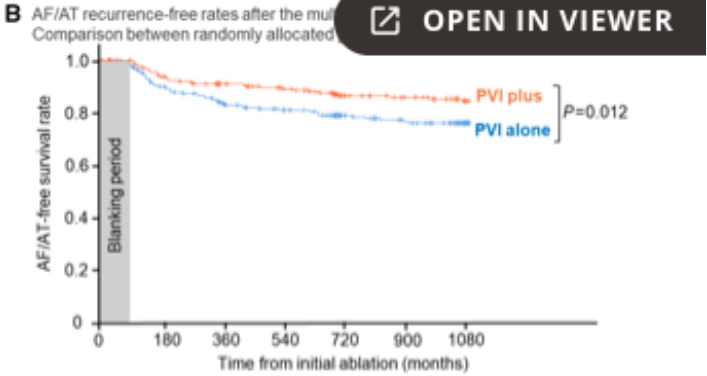
# Fibrillation auriculaire persistante ou récidive

## Bénéfice en faveur de l'ablation

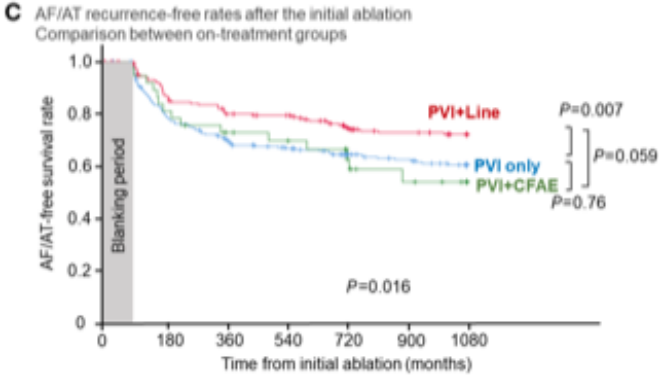
# EARNEST-PVI



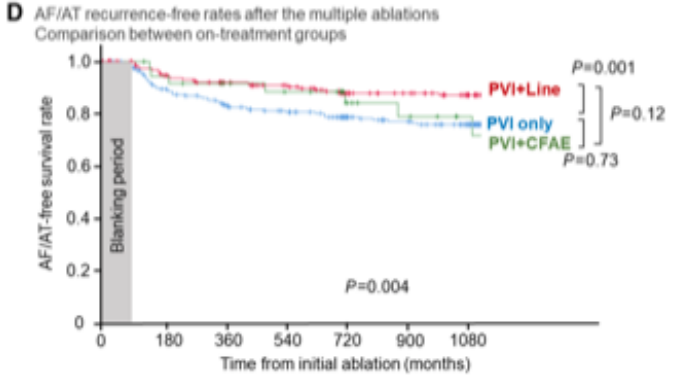
No. at risk (n)	
PVI alone	248 199 173 155 139 136 114
PVI Plus	245 211 190 177 155 135 124



No. at risk (n)	
PVI alone	248 212 193 175 157 135 121
PVI Plus	245 218 202 188 166 145 129



No. at risk (n)	
PVI only	251 201 174 156 140 126 116
PVI+Line	205 179 163 151 134 122 115
PVI+CFAE	37 31 26 22 20 11 8




No. at risk (n)	
PVI only	251 213 194 176 158 136 124
PVI+Line	205 183 169 159 140 129 117
PVI+CFAE	37 35 33 29 26 16 11



ORIGINAL ARTICLE



# Catheter Ablation for Atrial Fibrillation with Heart Failure

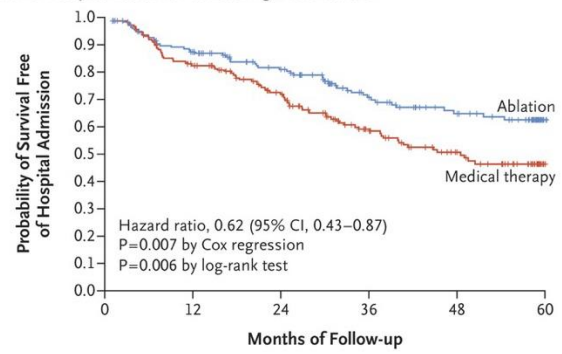
**Authors:** Nassir F. Marrouche, M.D., Johannes Brachmann, M.D., Dietrich Andresen, M.D., Jürgen Siebels, M.D., Lucas Boersma, M.D., Luc Jordaens, M.D., Béla Merkely, M.D.,  , for the CASTLE-AF Investigators\* [Author Info & Affiliations](#)

Published January 31, 2018 | N Engl J Med 2018;378:417-427 | DOI: 10.1056/NEJMoa1707855 | [VOL. 378 NO. 5](#)

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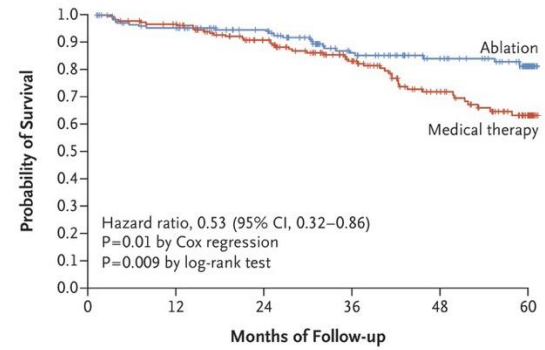
**A Death or Hospitalization for Worsening Heart Failure**



**No. at Risk**

Ablation	179	141	114	76	58	22
Medical therapy	184	145	111	70	48	12

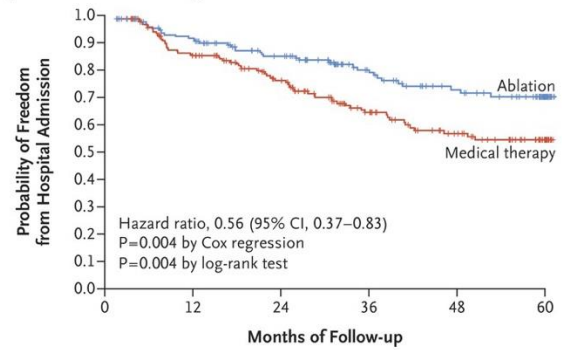
**B Death from Any Cause**



**No. at Risk**

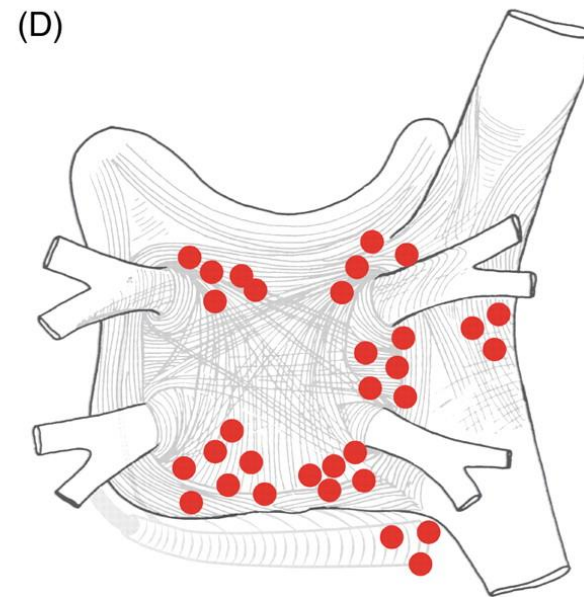
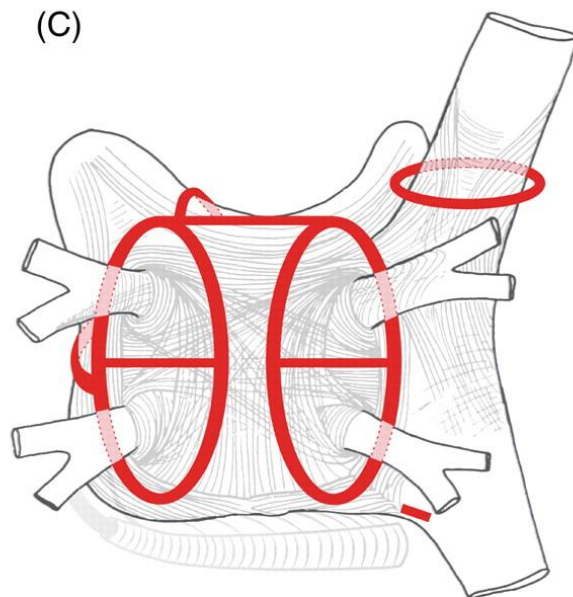
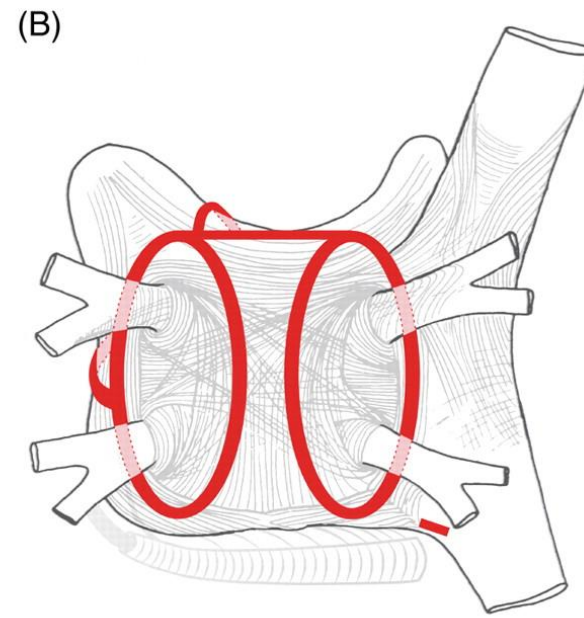
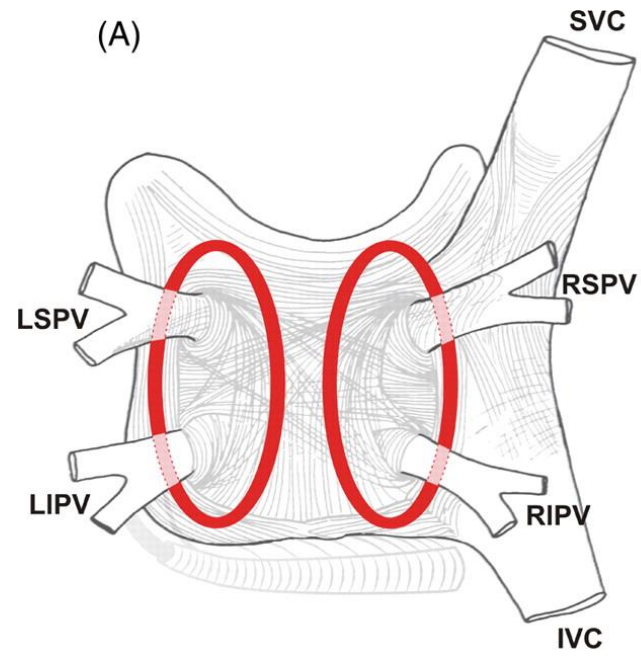
Ablation	179	154	130	94	71	27
Medical therapy	184	168	138	97	63	19

**C Hospitalization for Worsening Heart Failure**



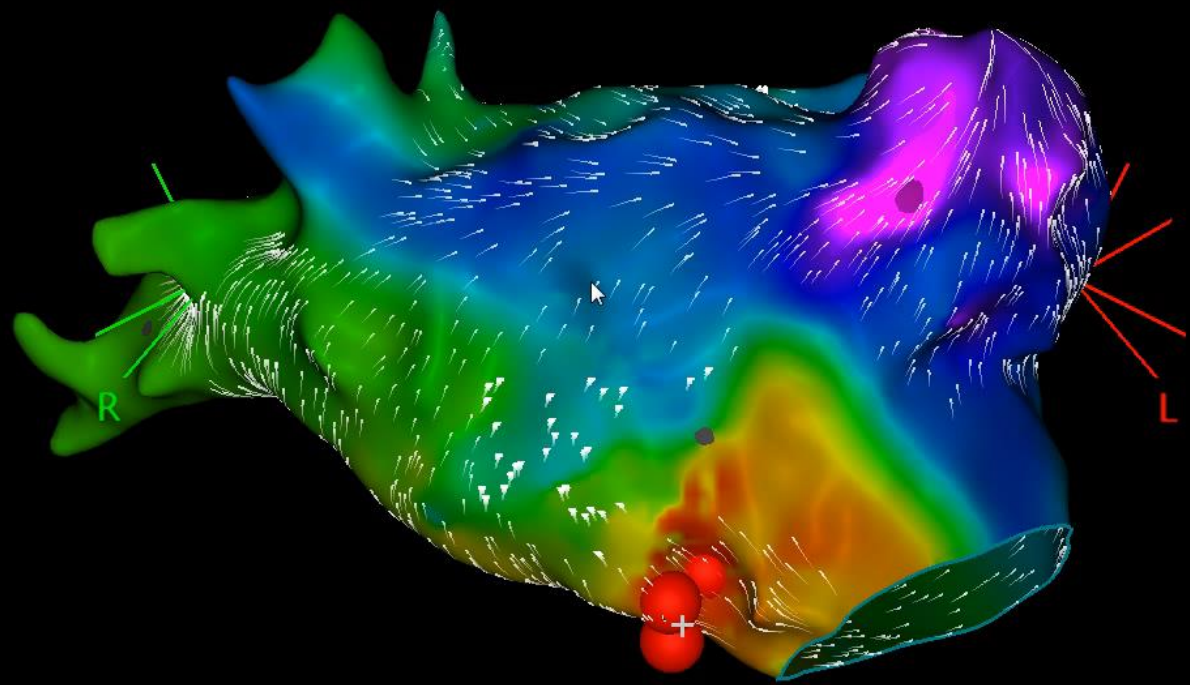
**No. at Risk**

Ablation	179	141	114	76	58	22
Medical therapy	184	145	111	70	48	12





Pause button with 35.00 timer

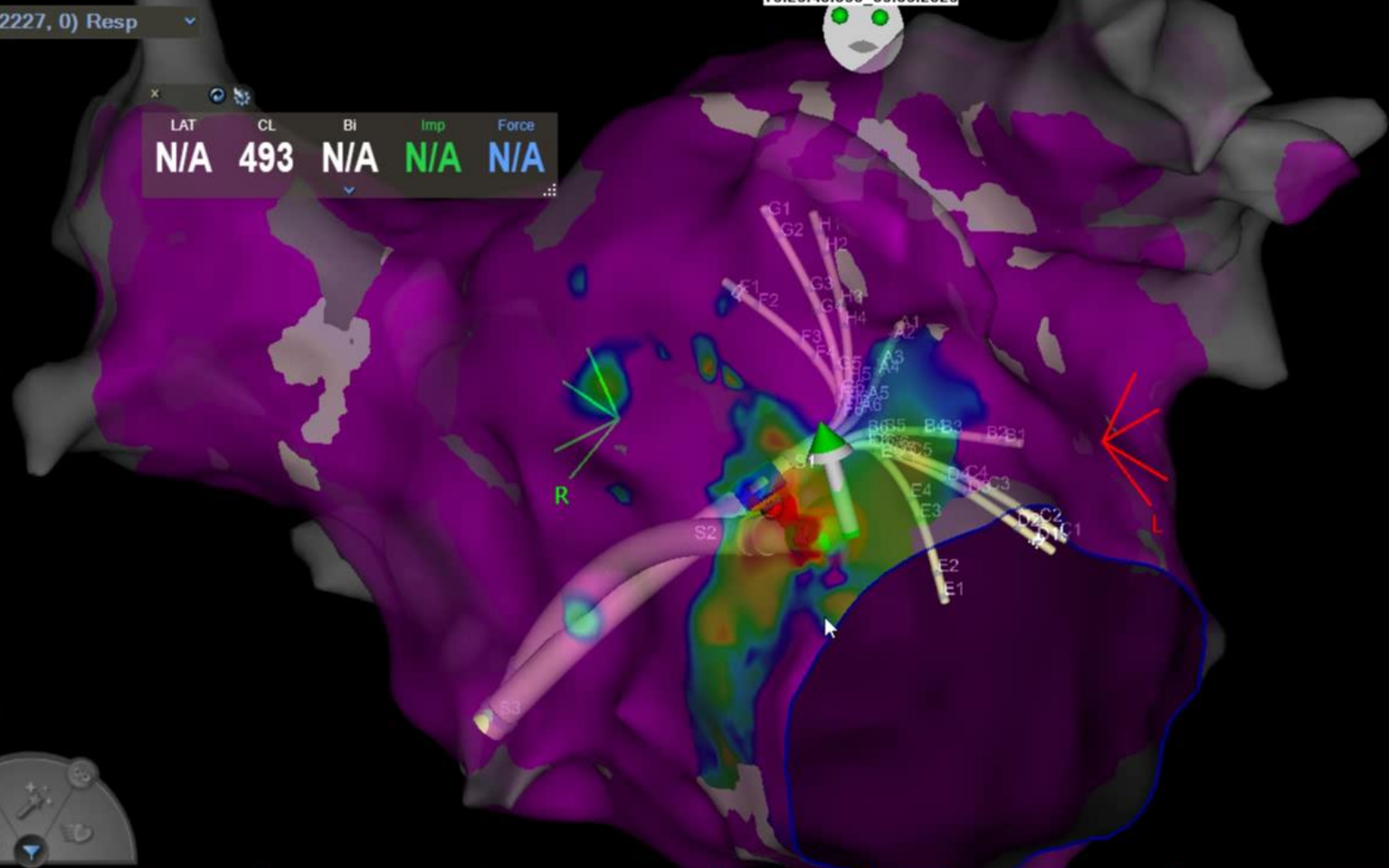


Navigation controls including a semi-circular trackball and various tool icons.

View control interface with a 3D heart model, a vertical slider set to 1.33, and zoom in/out buttons.

-61 ms **LAT** 28 ms  
 -57 -47  
 Tag.Idx

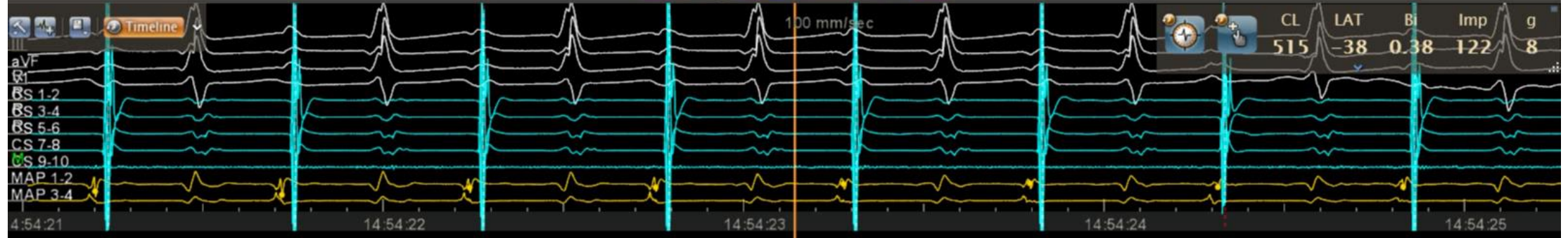
LAT	CL	Bi	Imp	Force
N/A	493	N/A	N/A	N/A



0.71



20% AP PA LAO RAO LL RL INF SUP

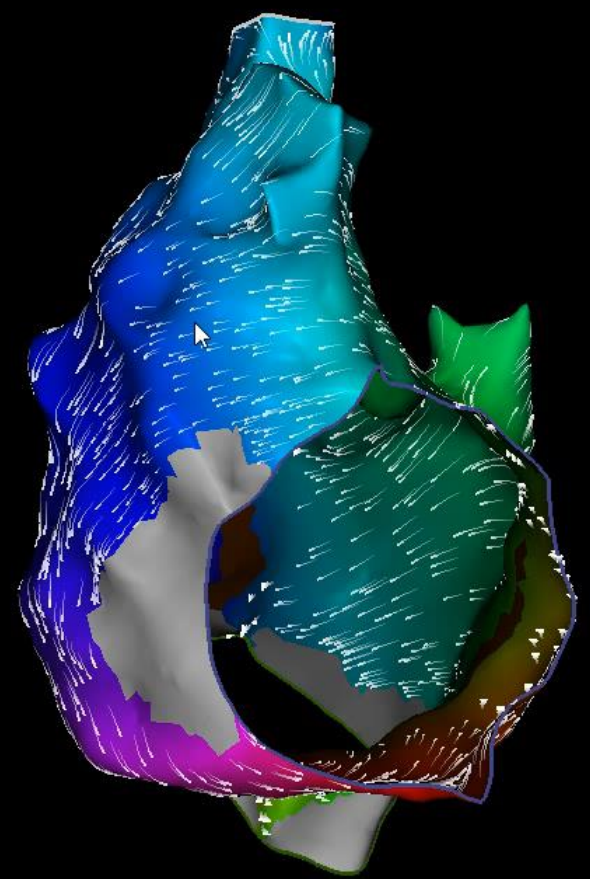




CL: 260 (active map)



16



1.68

Volume: 138.29 LAO: 17 °  
Caudal: 2 ° Swivel: -1 °



# Retrograde Ethanol Infusion in the Vein of Marshall Regional Left Atrial Ablation, Vagal Denervation, and Feasibility in Humans

Miguel Valderrábano, MD; Harvey R. Chen, MD; Jasvinder Sidhu, MD; Liyun Rao, PhD;  
Yuesheng Ling, PhD; Dirar S. Khoury, PhD

**Background**—The vein of Marshall (VOM) is an attractive target during ablation of atrial fibrillation because of its autonomic innervation, its location anterior to the left pulmonary veins, and its drainage in the coronary sinus.

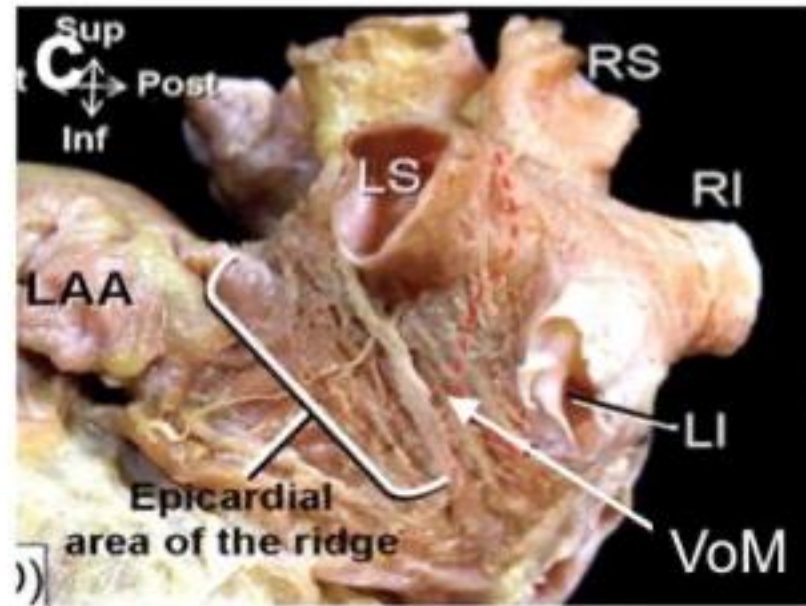
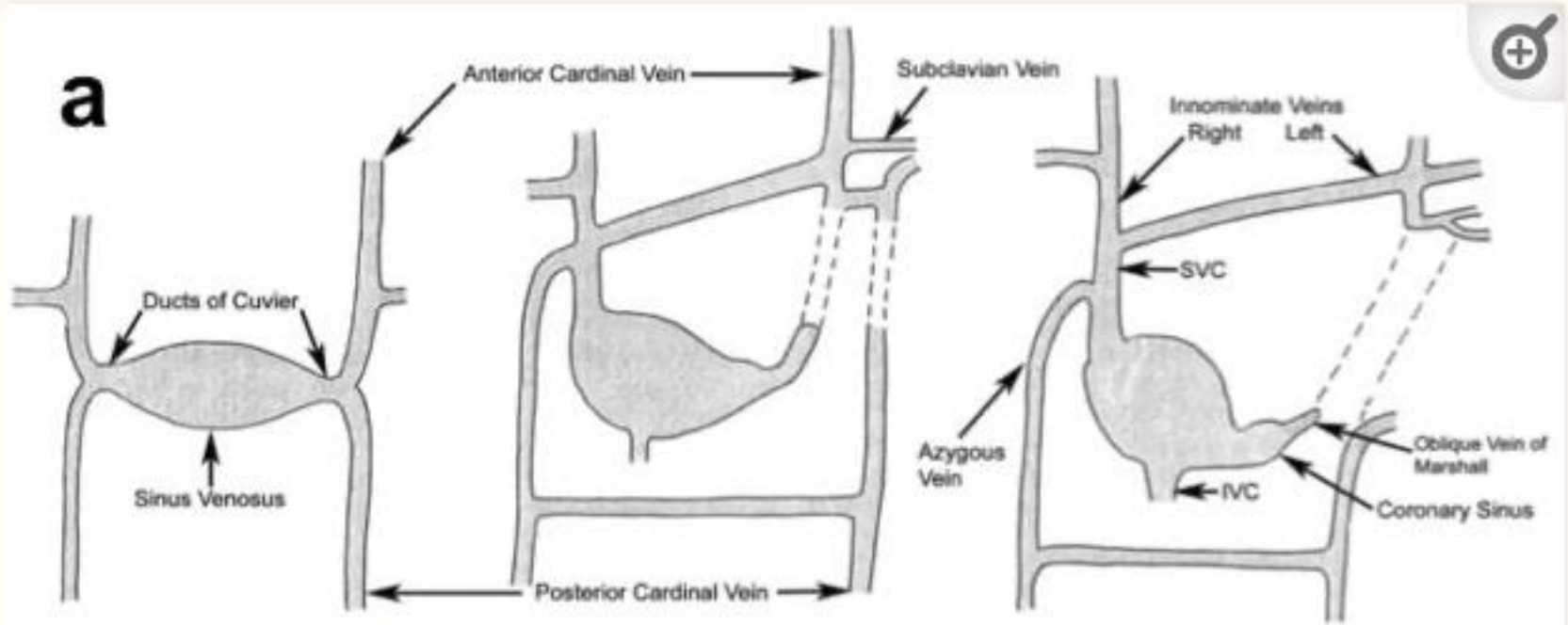
**Methods and Results**—We studied 17 dogs. A coronary sinus venogram showed a VOM in 13, which was successfully cannulated with an angioplasty wire and balloon. In 5 dogs, electroanatomical maps of the left atrium were performed at baseline and after ethanol infusion in the VOM, which demonstrated a new crescent-shaped scar, extending from the annular left atrium toward the posterior wall and left pulmonary veins. In 4 other dogs, effective refractory periods (ERP) were measured at 3 sites in the left atrium, before and after high-frequency bilateral vagal stimulation. The ERP decreased from  $113.6 \pm 35.0$  to  $82.2 \pm 25.4$  ms ( $P < 0.05$ ) after vagal stimulation. After VOM ethanol infusion, vagally-mediated ERP decrease was eliminated (from  $108.6 \pm 24.1$  to  $96.4 \pm 16.9$  ms,  $P = \text{NS}$ ). The abolition of vagal effects was limited to sites near the VOM (ERP,  $104 \pm 14$  versus  $98.6 \pm 12.2$  ms postvagal stimulation;  $P = \text{NS}$ ), as opposed to sites remote to VOM (ERP,  $107.2 \pm 14.9$  versus  $78.6 \pm 14.7$  ms postvagal stimulation;  $P < 0.05$ ). To test feasibility in humans, 6 patients undergoing pulmonary vein antral isolation had successful VOM cannulation and ethanol infusion; left atrial voltage maps demonstrated new scar involving the inferoposterior left atrial wall extending toward the left pulmonary veins.

**Conclusions**—Ethanol infusion in the VOM achieves significant left atrial tissue ablation, abolishes local vagal responses, and is feasible in humans. (*Circ Arrhythmia Electrophysiol.* 2009;2:50-56.)

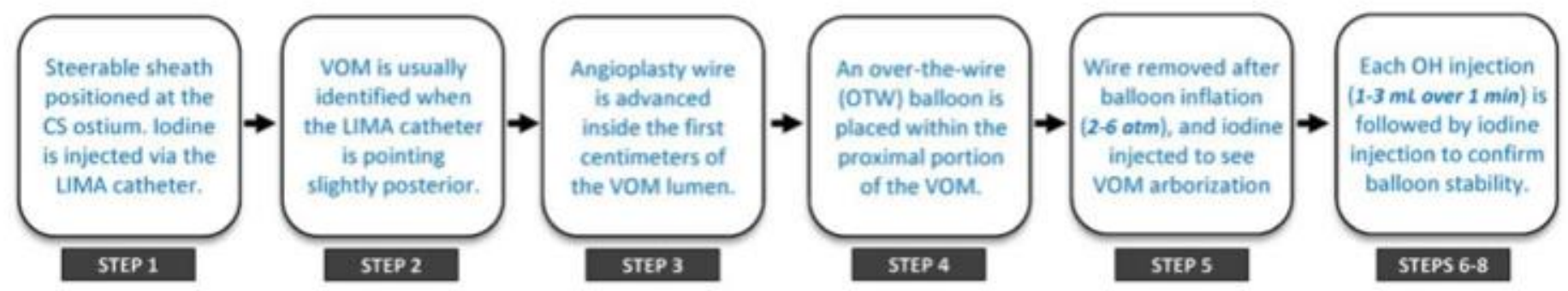
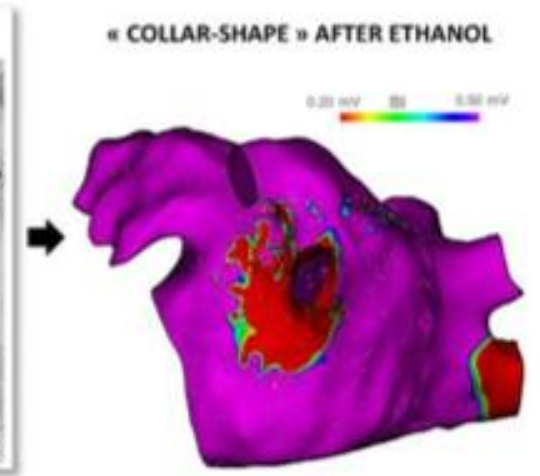
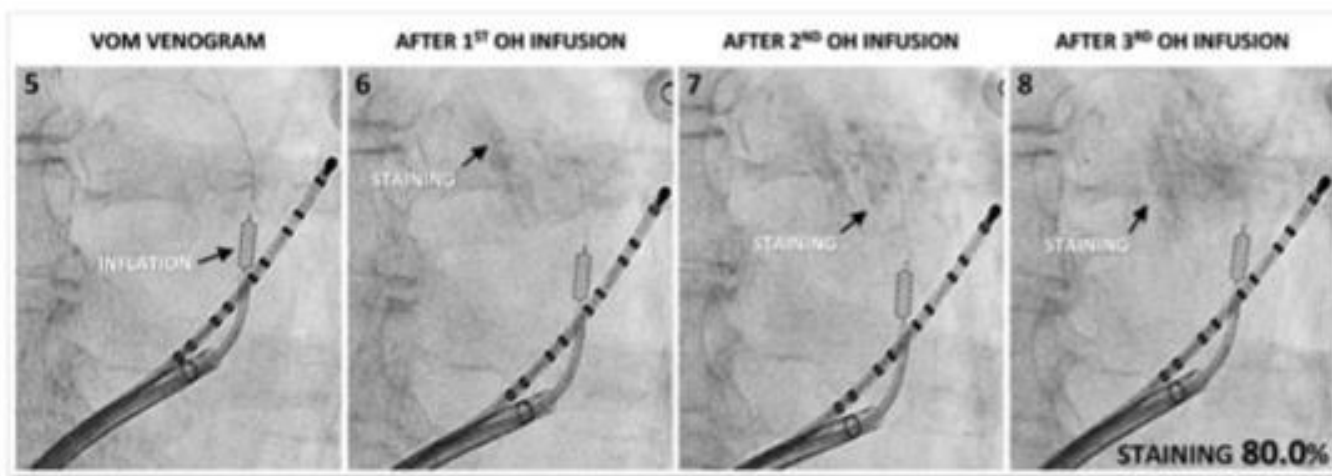
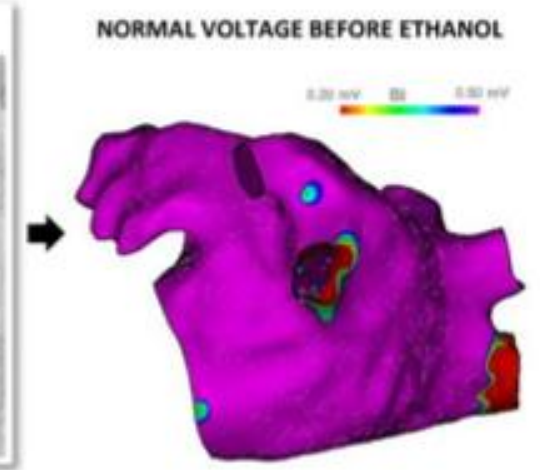
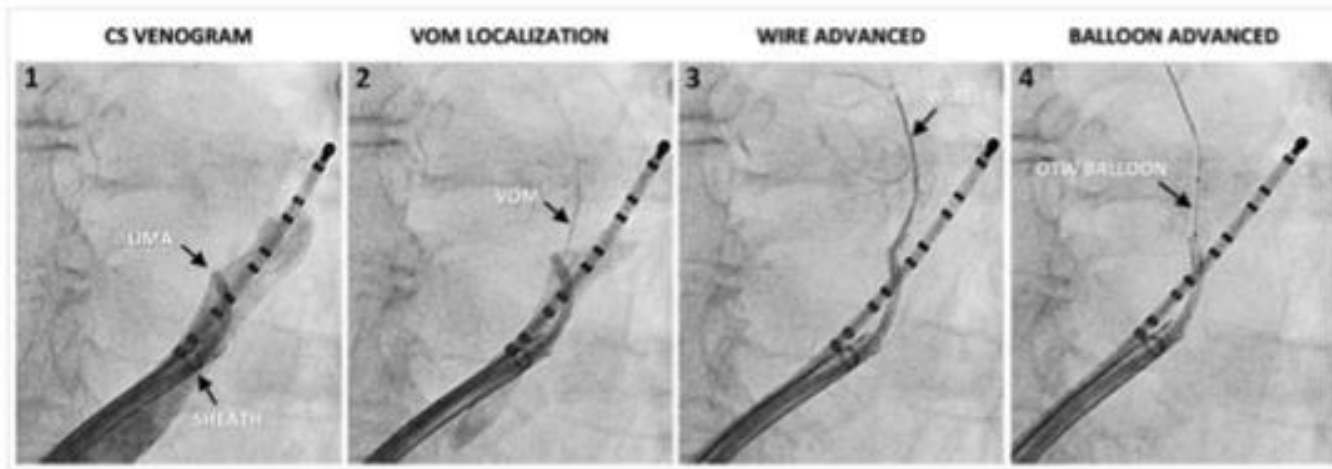
**Key Words:** ethanol ■ ablation ■ vein of Marshall ■ atrial fibrillation ■ vagal

1

The VOM and its neighboring tissue are attractive targets for ablation in AF. It contains autonomic parasympathetic<sup>7</sup> and sympathetic<sup>6</sup> innervations that have been implicated in the pathogenesis of AF.<sup>8</sup> The atrial tissue surrounding the VOM, which connects the mitral annulus (coronary sinus) to the posterior left atrium, as well as the lateral ridge, are routinely targeted during ablation of AF.

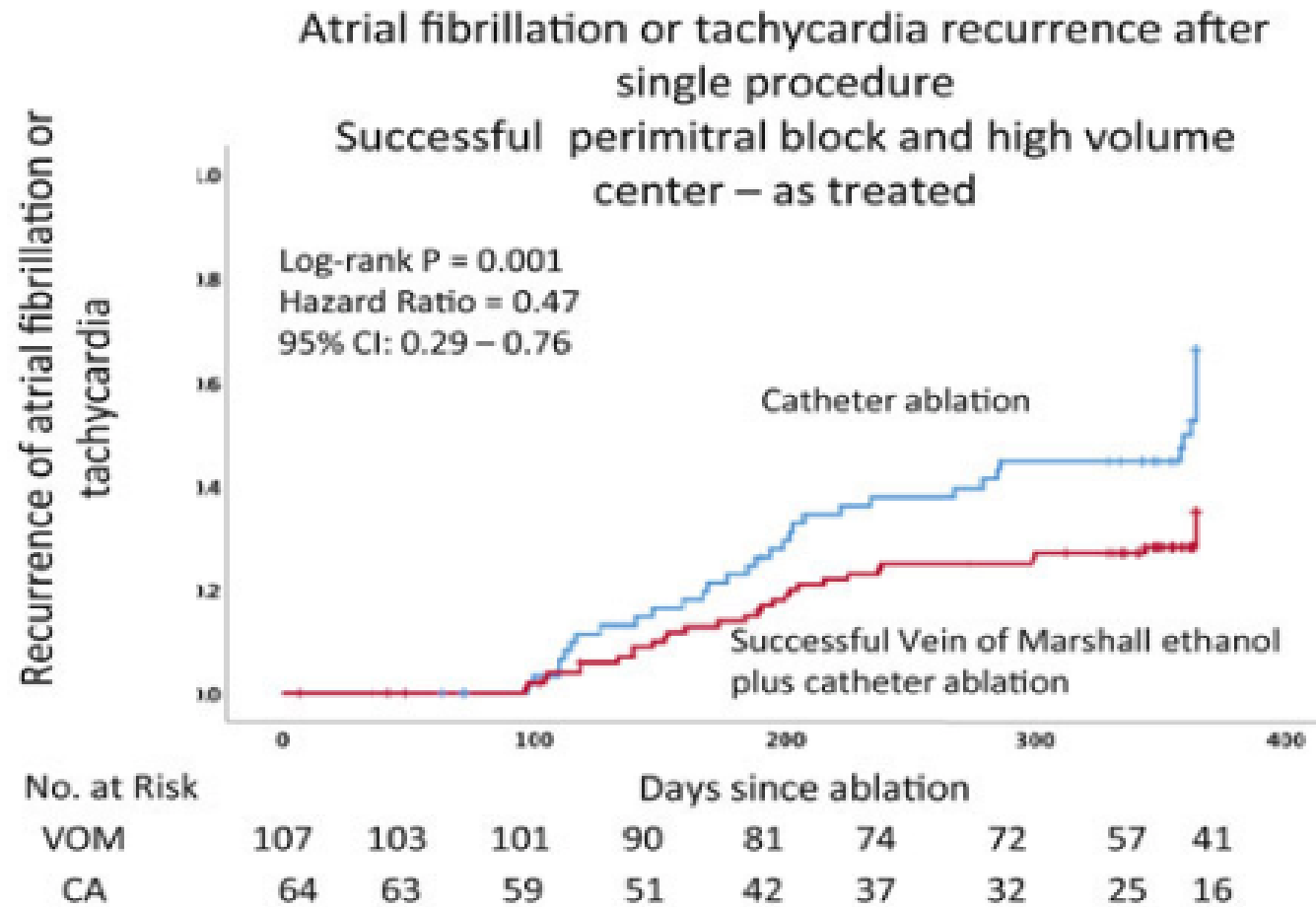






EVENT	RATE	TIME	COMMENT	MANAGEMENT
VOM PERFORATION: 20	2.8%	ACUTE	Infusion still feasible, but with a higher risk of delayed tamponade (10% vs 0,7% p=0.014).	Anti-inflammatory drugs and repeated echography should be considered in this category of patients.
PERICARDITIS: 13	1.8%	DELAYED	Usually at day-2.	Anti-inflammatory drugs.
DELAYED TAMPONADE: 6	0.8%	DELAYED	Serous nature of cardiac effusion in 2/3 of patients: inflammatory reaction may play a key role.	Pericardiocentesis (surgical access not necessary)
STROKE: 4	0.6%	DELAYED	Stroke rate in the reported range.	Medical management.
ACUTE TAMPONADE: 1	< 0.2%	ACUTE	Related to per-procedural steam pop.	Surgical drainage necessary.
ANAPHYLAXIS: 1	< 0.2%	ACUTE	Must be evocated first, in case of hemodynamic collapse during infusion.	Adrenaline, corticosteroids.
HIGH-DEGREE AVB: 1	< 0.2%	ACUTE	Might be favored by very proximal VOM ostium.	Monitoring of atrioventricular conduction during ethanol infusion.
LAA ISOLATION: 1	< 0.2%	ACUTE	Risk increased in case of large anterior wall scarring.	Bachmann conduction assessment prior to VOM ethanol infusion, if history of extensive ablation.

# The VENUS TRIAL



## Intention-to-treat Analysis

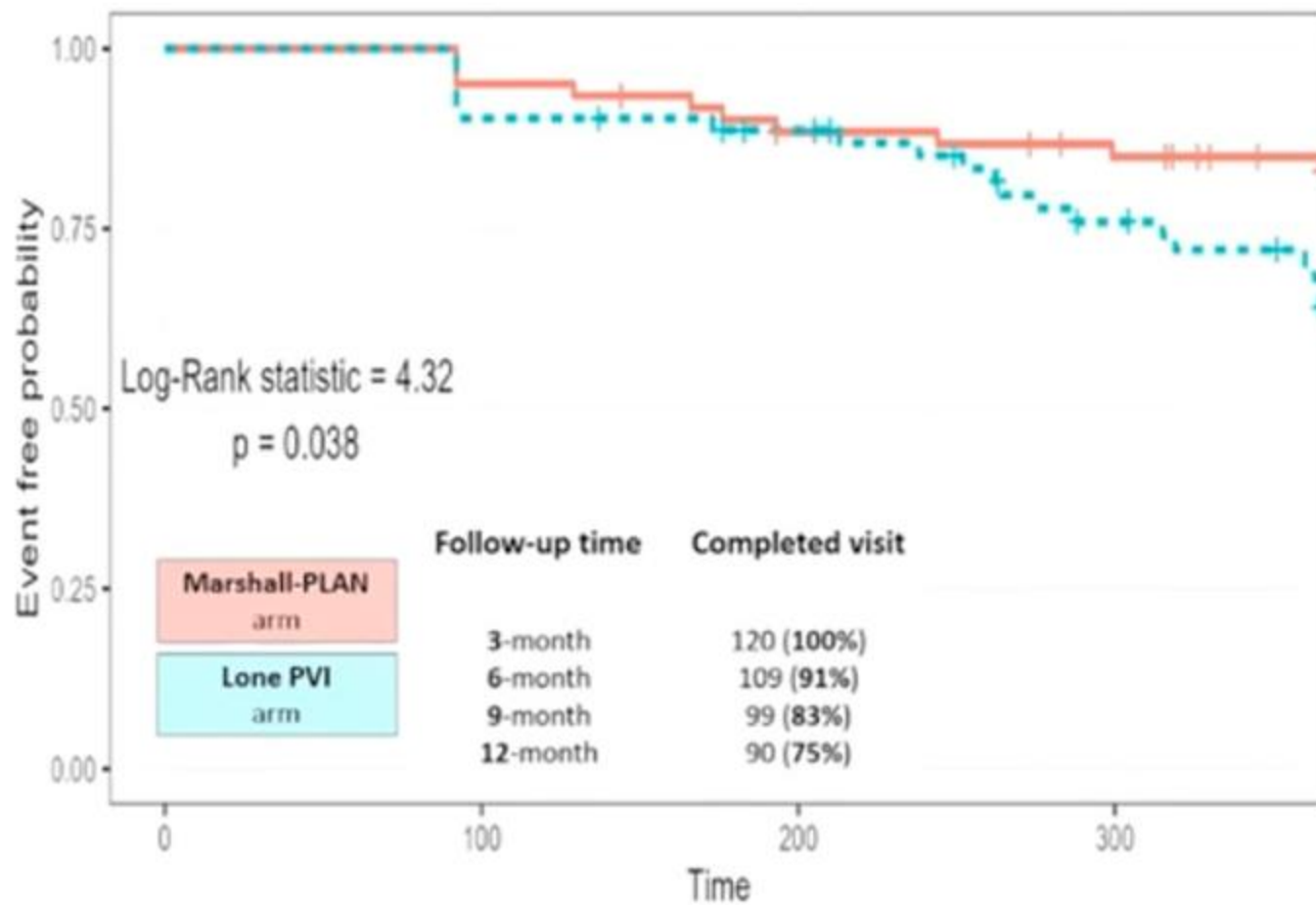
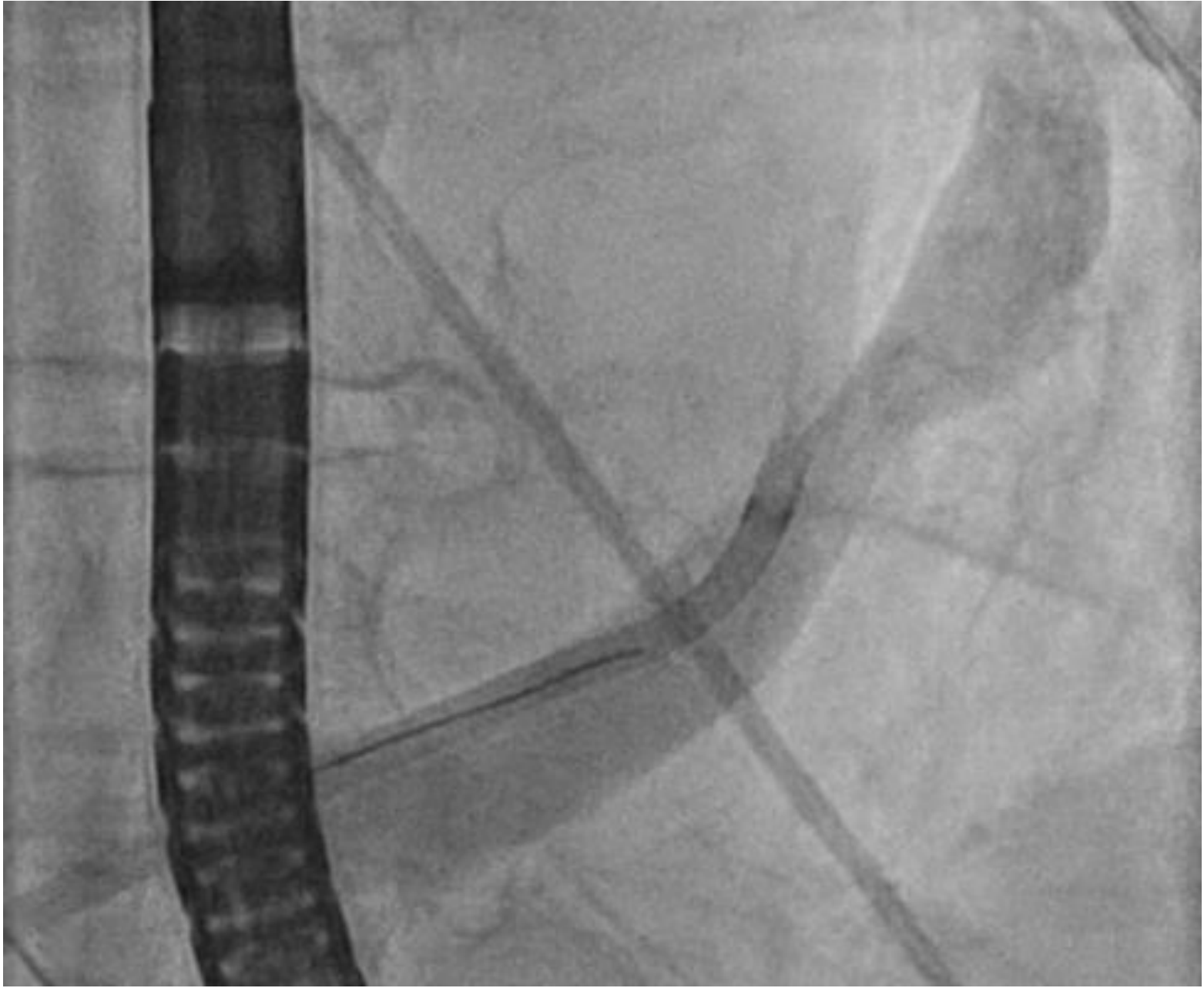


Figure : analyse en intention de traiter

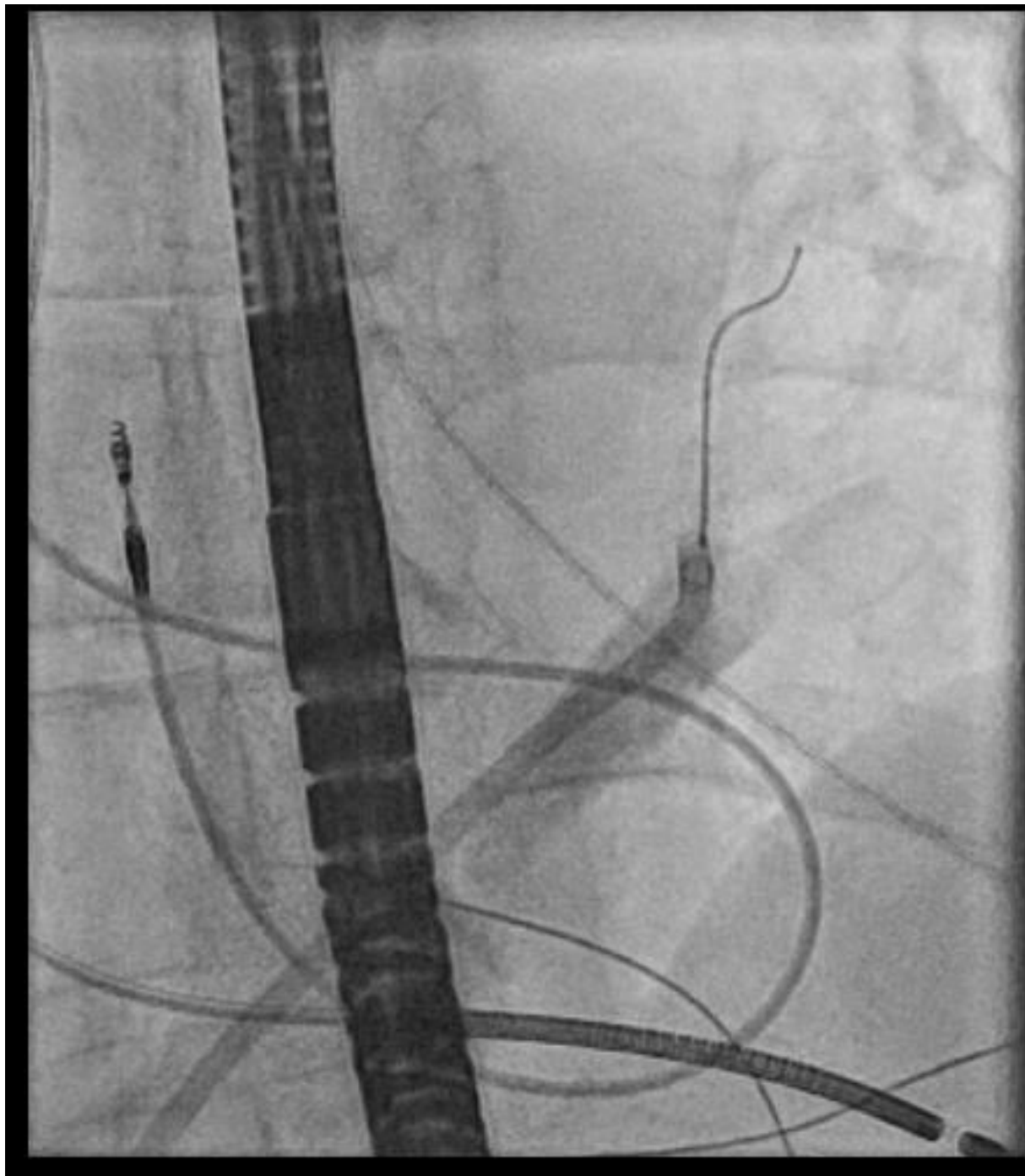
Source : présentation de Thomas Pambrun (Bordeaux, France) à l'EHRA 2023

# Expérience Hôpital de la Citadelle - Liège

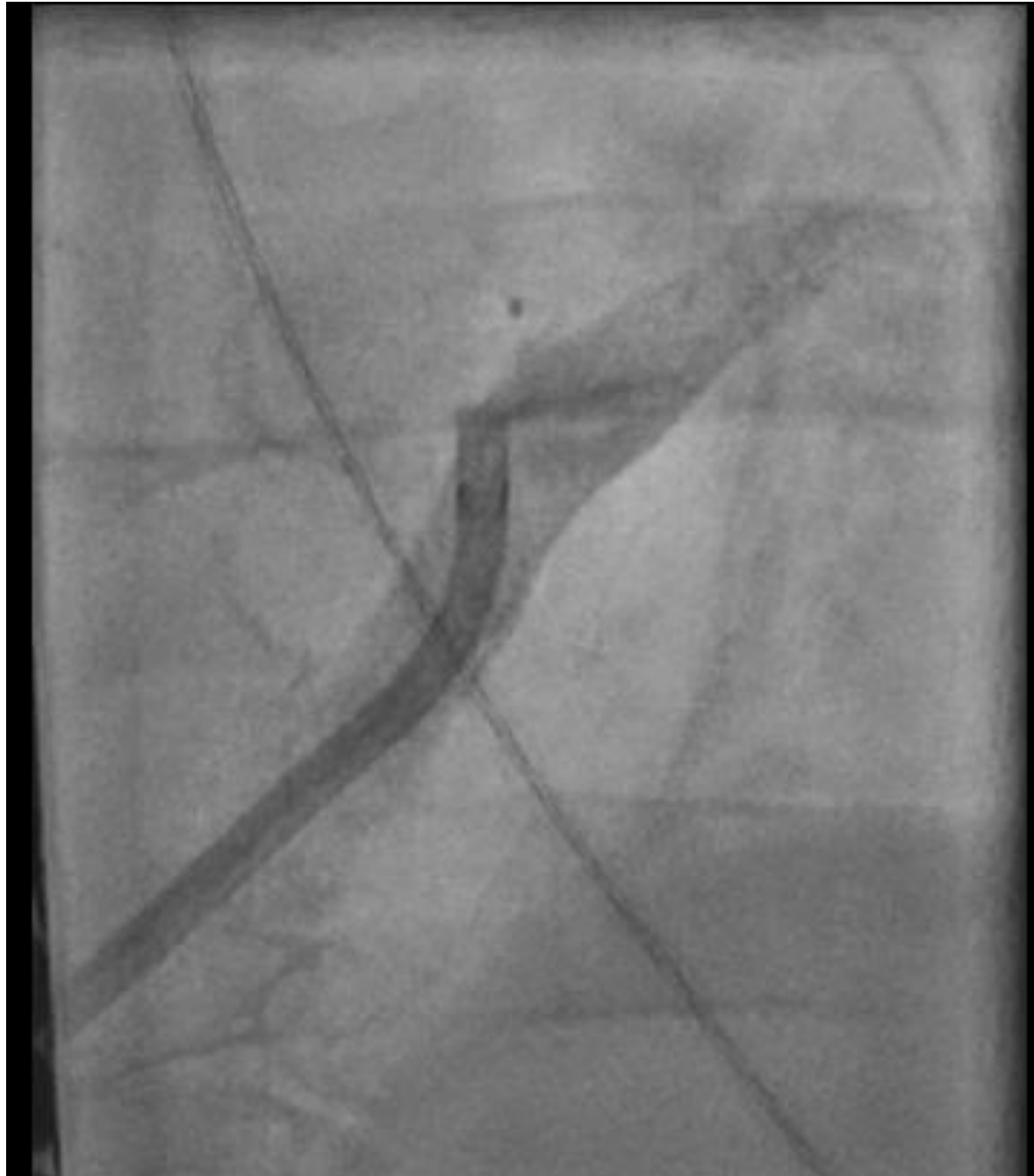
- 2021 : Visite VUB, 14 procédures
- 2022 : 22 procédures
- 2023 : 57 procédures
- Octobre 2024 : 74 procédures
- Guiding JR4 (8 Fr) 90 cm
- Tachycardies atriales gauches et reprises de FA persistantes





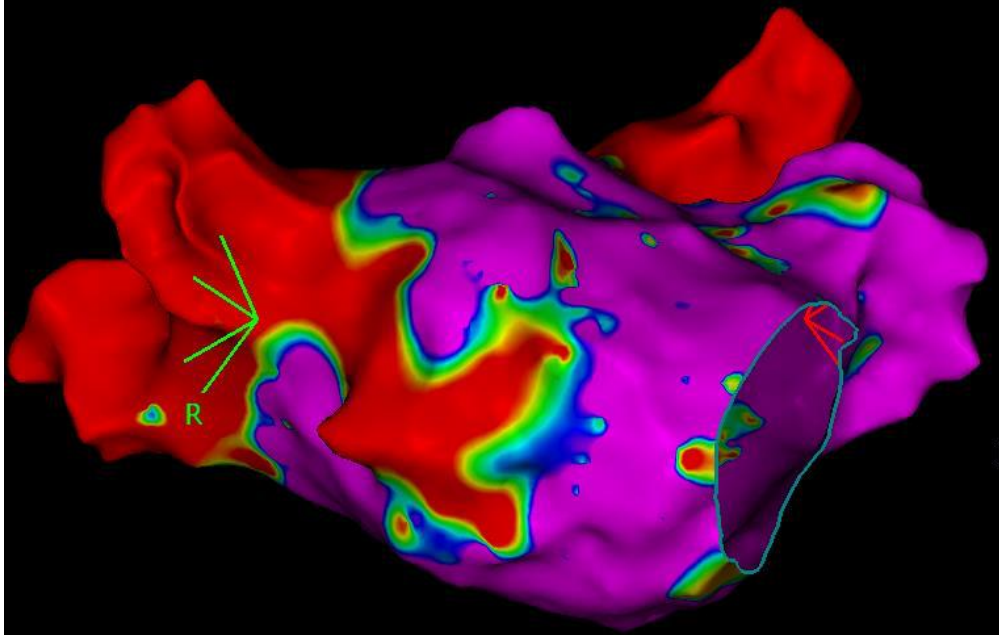




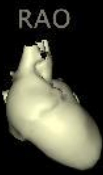


1-LA (986, 0) Resp

0.15 mV Bi 0.50 mV



1.39



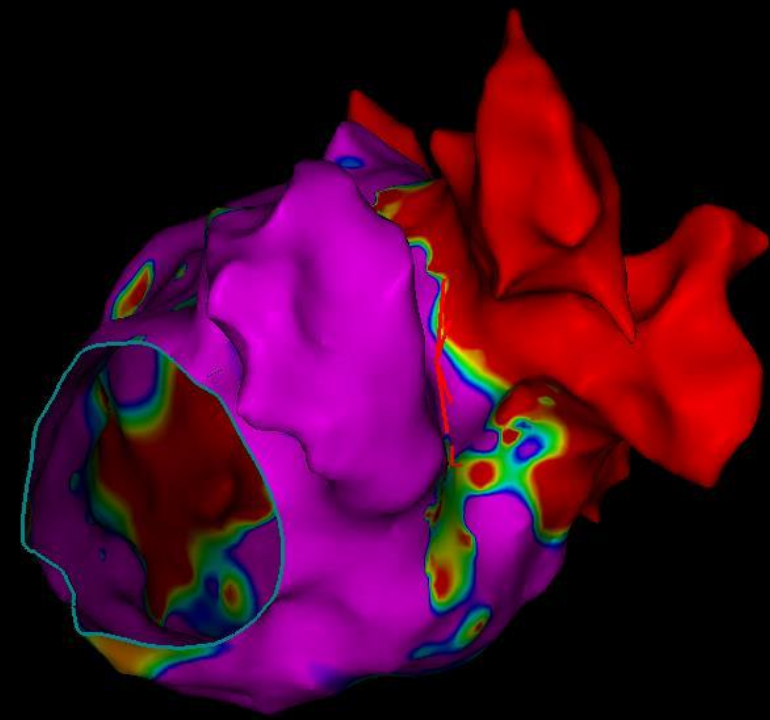
Volume: 209.16 RAO: 30°  
Cranial: 0° Swivel: 0°

0% AP PA LAO RAO LL RL INF SUP



1-LA (986, 0) Resp

0.15 mV Bi 0.50 mV



1.21



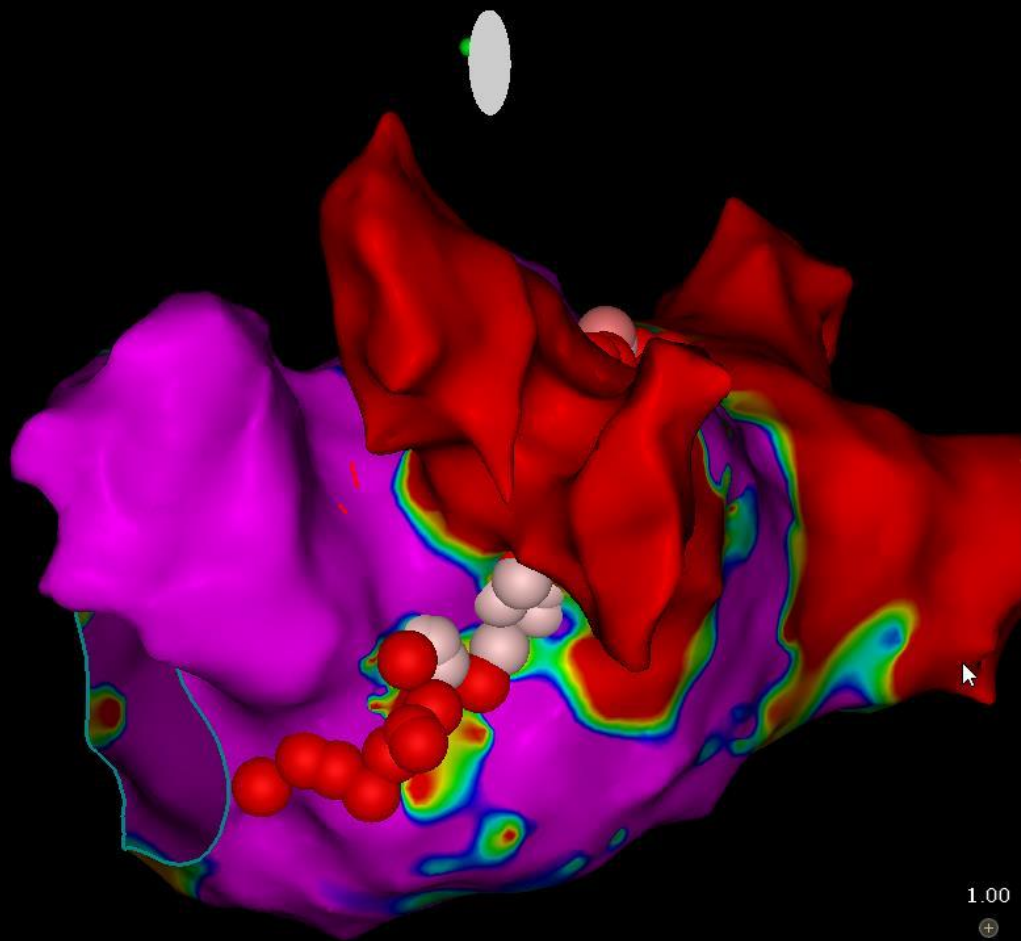
AP PA LAO RAO LL RL INF SUP

None

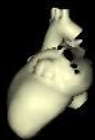
1-LA (986, 0) Resp

0.15 mV Bi 0.50 mV

Tag.Idx



Volume: 209.16 LAO: 114°  
Cranial: 0° Swivel: 1°



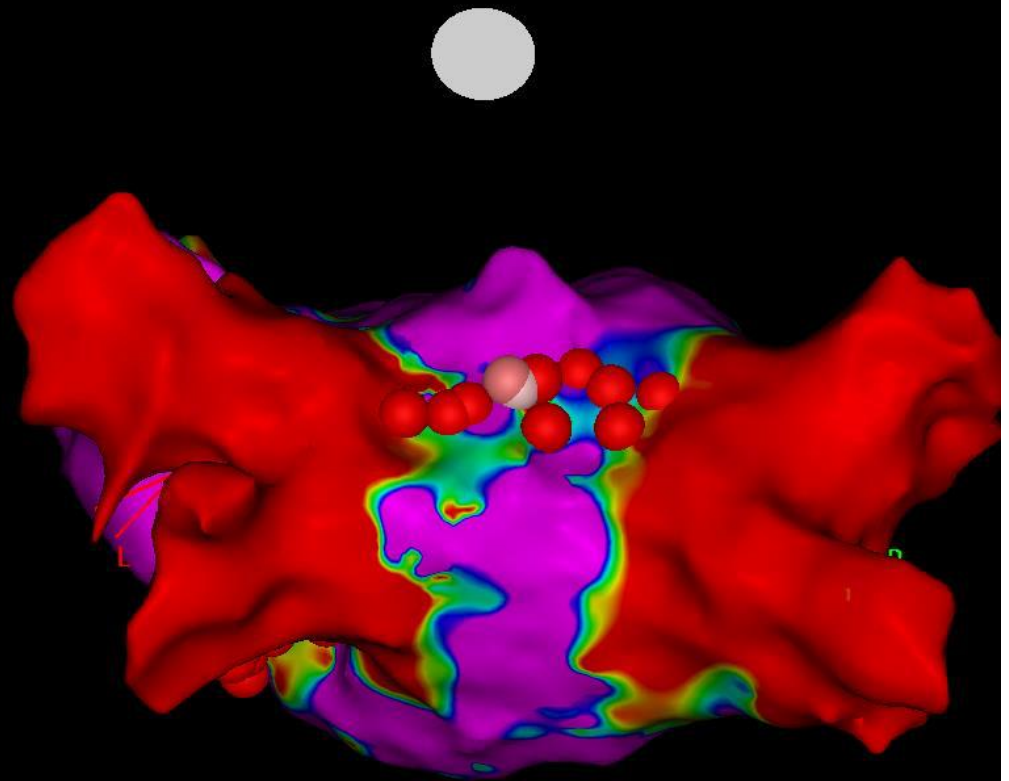
0% AP PA LAO RAO LL RL INF SUP



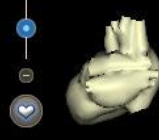
1-LA (986, 0) Resp

0.15 mV Bi 0.50 mV

Tag.Idx



1.21

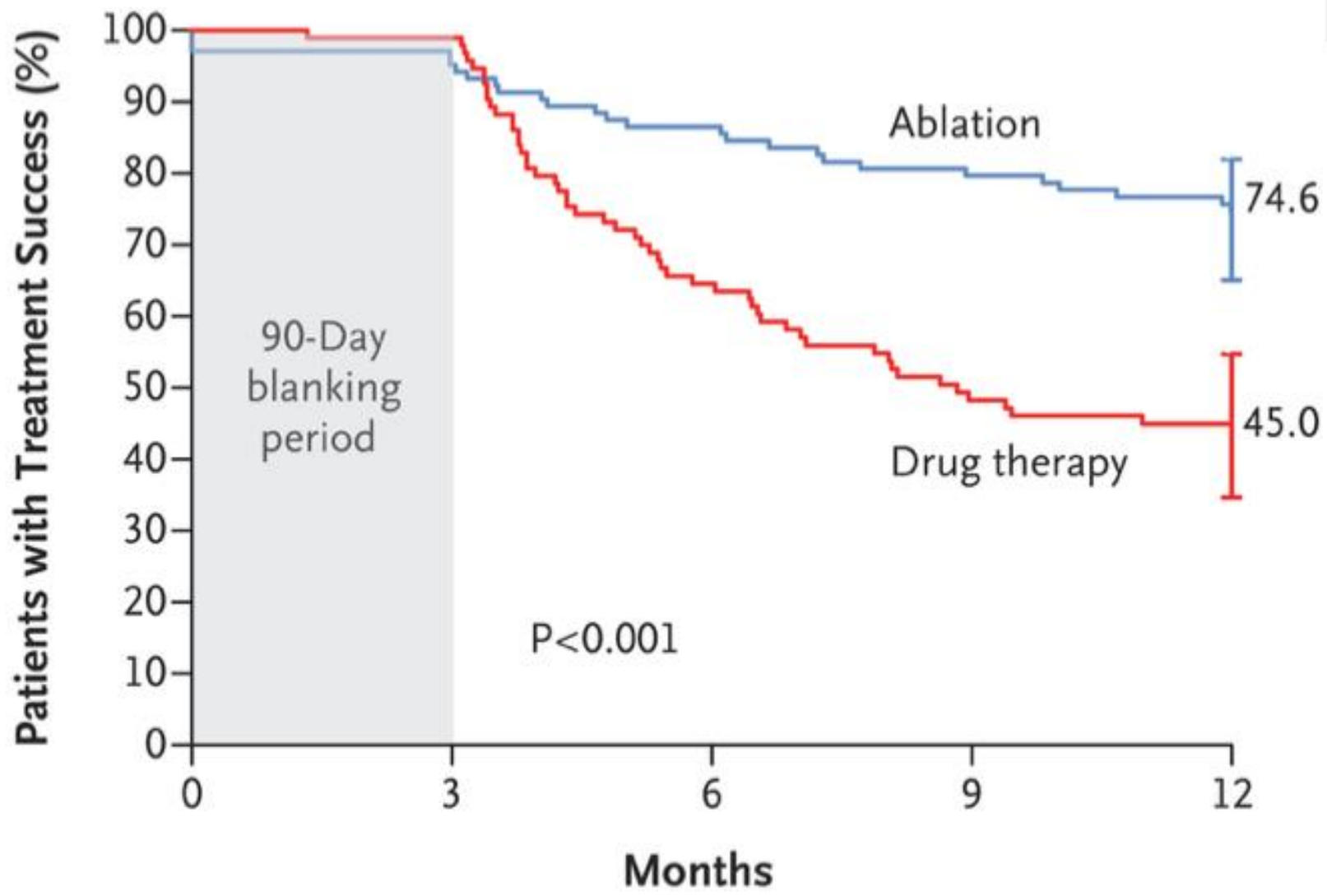


AP PA LAO RAO LL RL INF SUP

None

# New recommendations (6)

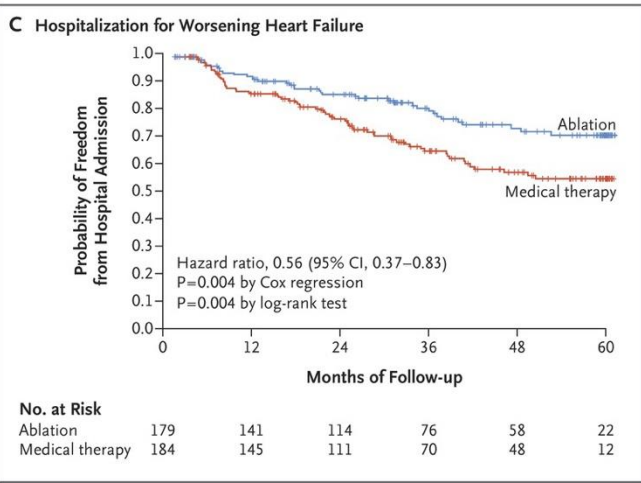
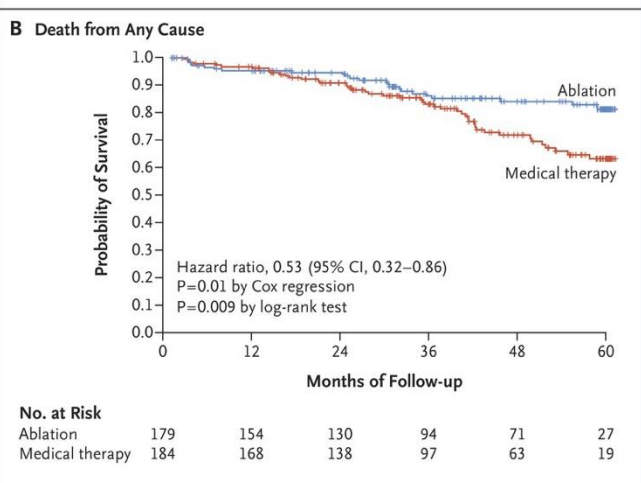
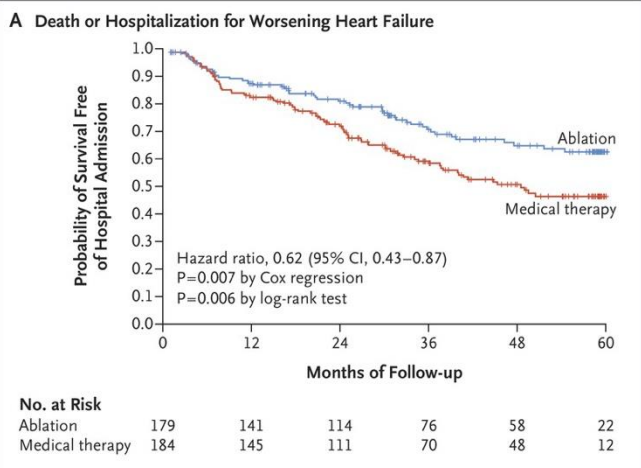
Recommendations	Class	Level
<b><i>Management of bleeding on anticoagulant therapy – Section 6.7.2</i></b>		
Specific antidotes should be considered in AF patients on a DOAC who develop a life-threatening bleed, or bleed into a critical site, to reverse the antithrombotic effect.	Ila	B
<b><i>Management of heart rate in patients with atrial fibrillation – Section 7.1</i></b>		
Rate control therapy is recommended in patients with AF, as initial therapy in the acute setting, an adjunct to rhythm control therapies, or as a sole treatment strategy to control heart rate and reduce symptoms.	I	B
Beta-blockers, diltiazem, verapamil, or digoxin are recommended as first-choice drugs in patients with AF and LVEF >40% to control heart rate and reduce symptoms.	I	B
Atrioventricular node ablation combined with cardiac resynchronization therapy should be considered in severely symptomatic patients with permanent AF and at least one hospitalization for HF to reduce symptoms, physical limitations, recurrent HF hospitalization, and mortality.	Ila	B



**No. at Risk**

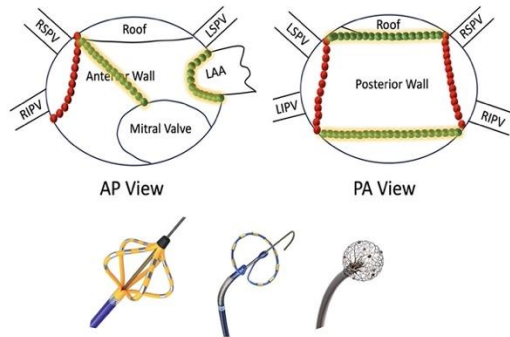
Ablation	104	99	88	81	70
Drug therapy	99	93	60	44	39





**Figure 8** Schematic summarizing the future directions in ablative therapy for atrial fibrillation

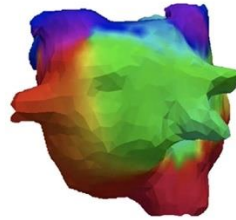
### Ablation tools



#### Unresolved issues

- Durability of RFA/PFA linear lesions
- Determine adjunctive lesion sets
  - ↳ Validation in RCTs
- Potential risks of 'over-ablation'

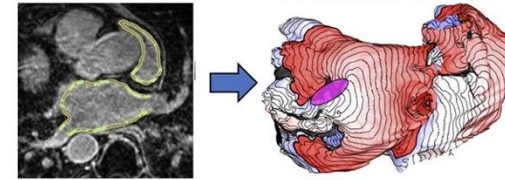
### AF mapping



#### Unresolved issues

- Spatial vs. temporal resolution
- Relevance to long-term remodeling
- Optimal mapping tools
- Method of interpretation
- Ablation strategy

### AF Modeling and AI



#### Unresolved issues

- Imaging modality (MRI vs. Photon CT)
- Type of fibrosis, fiber angles, thickness
- Correlation between simulation to reality
- Relevance to long-term remodeling
- Ablation strategy
  - ↳ Validation in RCTs

# Conclusion

- Traitement de la Fibrillation Auriculaire : Isolation des veines pulmonaire
- Première procédure en « Single shot » : électroporation « Farapulse »
- Reprise : Stratégie PVI plus type « Marshall plan »





# Citadelle Hopital

**Merci pour votre attention !**



HÔPITAL DE LA CITADELLE

# Journée Médicale

SAMEDI 23.11.24



**MediC+mpta**

Bureau Comptable spécialisé  
en professions (para)médicales

