

# Fibrillazione Atriale ed indicazione all'ablazione della Fibrillazione atriale

**Dott.ssa Angelica Fundaliotis**

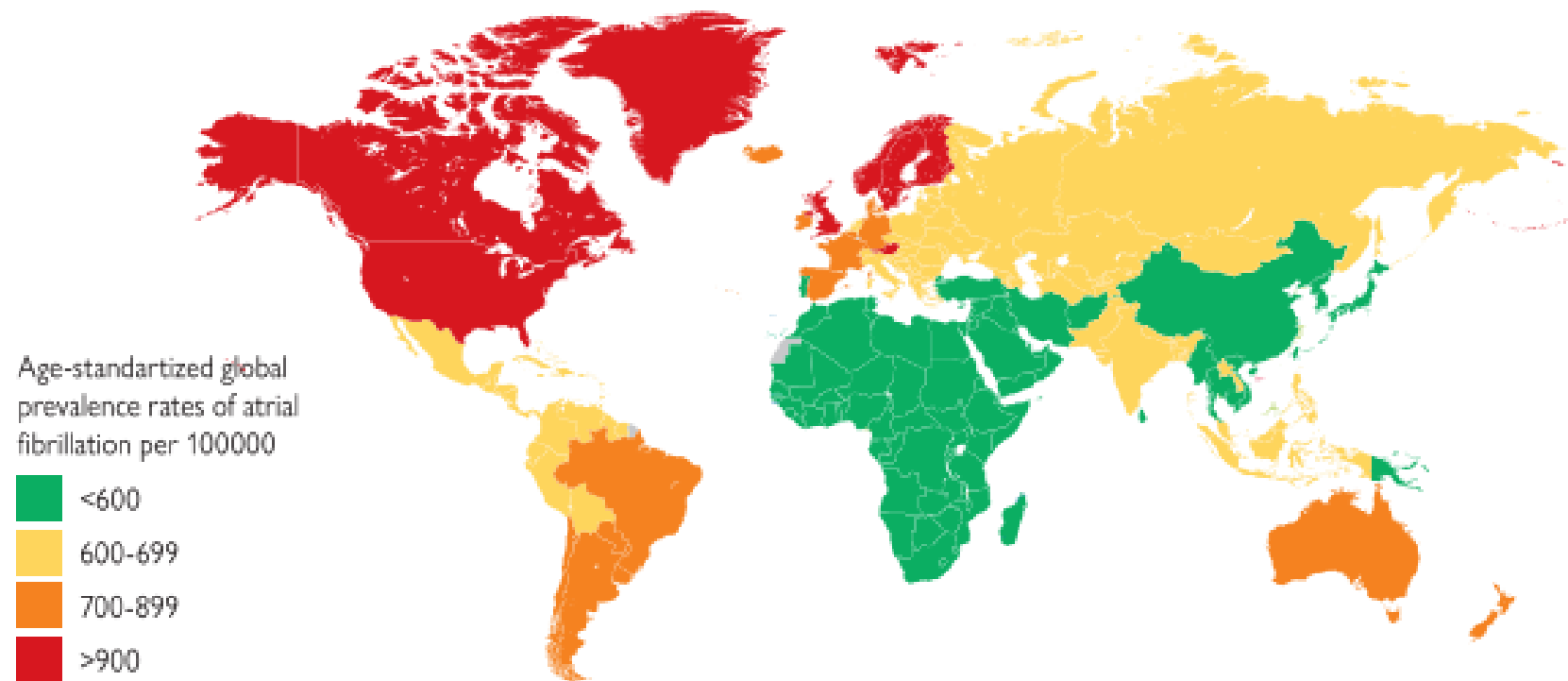
U.O.S Laboratorio di Elettrofisiologia ed Elettrostimolazione

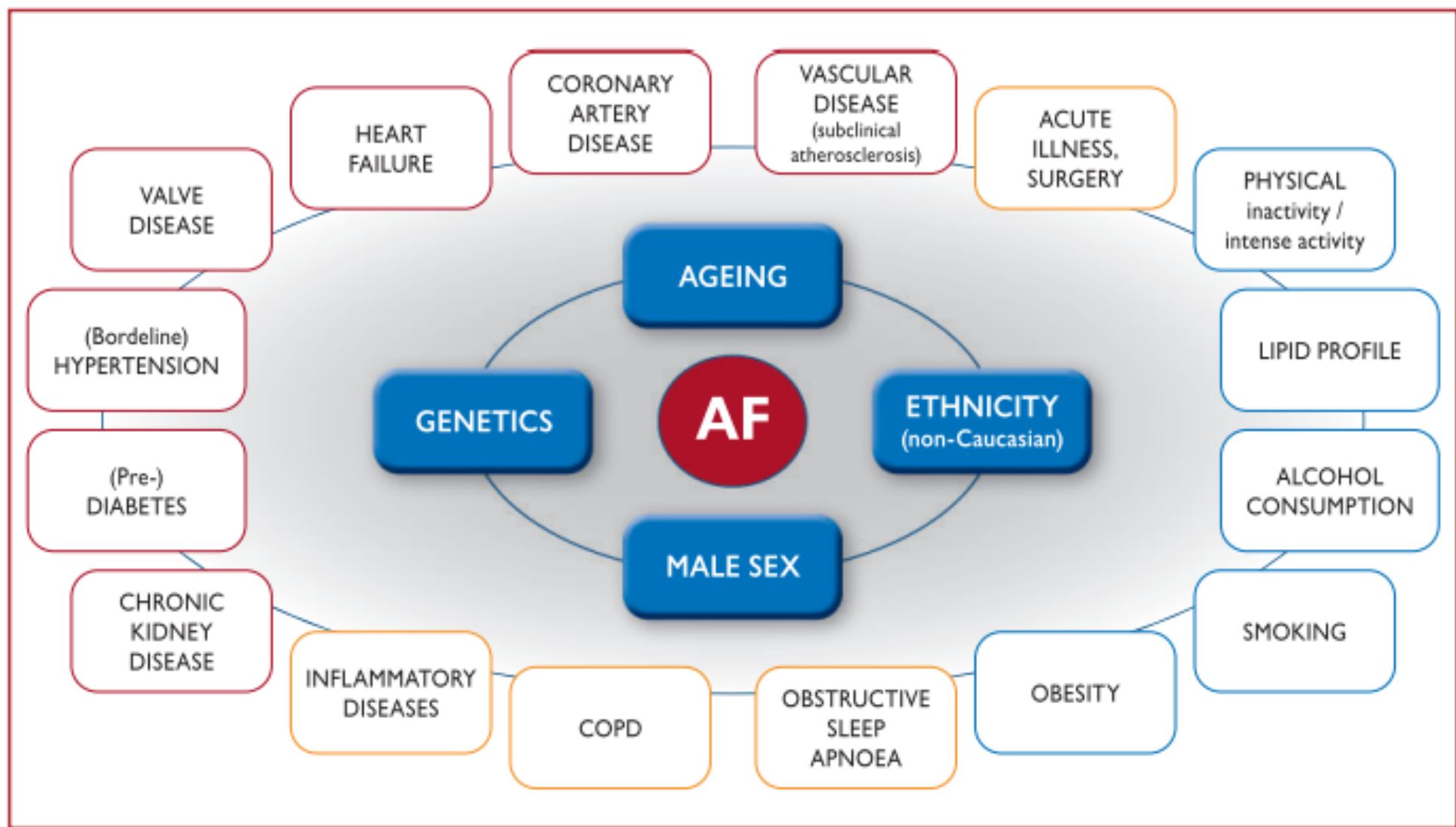
Ospedale Bolognini Seriate

1 Aprile 2023

## GLOBAL PREVALENCE OF AF

(globally, 43.6 million individuals had prevalent AF/AFL in 2016)





## Clinical Presentation



Asymptomatic or Silent (!)



Symptomatic

Palpitations, dyspnoea, fatigue,

Chest tightness/pain, poor effort tolerance, dizziness, syncope, disordered sleep, etc.

**Haemodynamically unstable**

- Syncope
- Symptomatic hypotension
- Acute HF, pulmonary oedema
- Ongoing myocardial ischaemia
- Cardiogenic shock

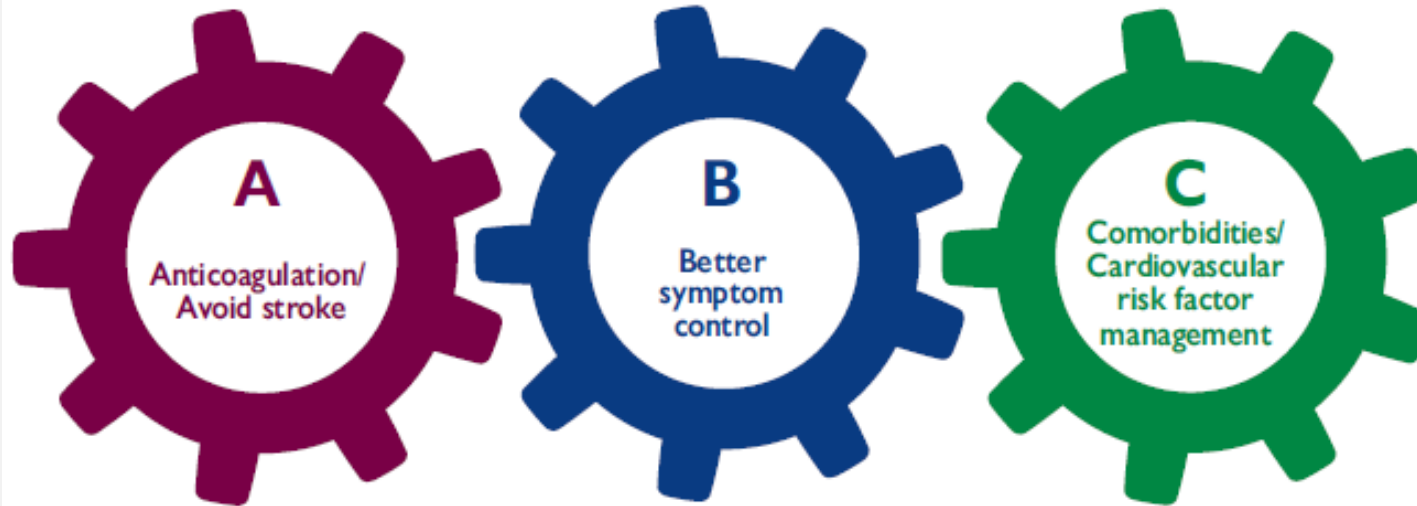
**Haemodynamically stable**

## AF-related OUTCOMES

| AF-Related Outcome                        | Frequency in AF   | Mechanism(s)   |
|---|---|--|
| <br>Death                                 | 1.5 - 3.5 fold increase                                     | Excess mortality related to: <ul style="list-style-type: none"> <li>• HF, comorbidities</li> <li>• Stroke</li> </ul>   |
| <br>Stroke                                | 20-30% of all ischaemic strokes, 10% of cryptogenic strokes | <ul style="list-style-type: none"> <li>• Cardioembolic, or</li> <li>• Related to comorbid vascular atheroma</li> </ul>   |
| <br>LV dysfunction / Heart failure        | In 20-30% of AF patients                                    | <ul style="list-style-type: none"> <li>• Excessive ventricular rate</li> <li>• Irregular ventricular contractions</li> <li>• A primary underlying cause of AF</li> </ul> |
| <br>Cognitive decline / Vascular dementia | HR 1.4 / 1.6 (irrespective of stroke history)               | <ul style="list-style-type: none"> <li>• Brain white matter lesions, inflammation,</li> <li>• Hypoperfusion,</li> <li>• Micro-embolism</li> </ul>                        |
| <br>Depression                            | Depression in 16-20% (even suicidal ideation)               | <ul style="list-style-type: none"> <li>• Severe symptoms and decreased QoL</li> <li>• Drug side effects</li> </ul>   |
| <br>Impaired quality of life              | >60% of patients  | <ul style="list-style-type: none"> <li>• Related to AF burden, comorbidities, psychological functioning and medication</li> <li>• Distressed personality type</li> </ul> |
| <br>Hospitalizations                      | 10-40% annual hospitalization rate                          | <ul style="list-style-type: none"> <li>• AF management, related to HF, MI or AF related symptoms</li> <li>• Treatment-associated complications</li> </ul>                |

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

## Treat AF: The ABC pathway



1. Identify low-risk patients  
CHA<sub>2</sub>DS<sub>2</sub>-VASc 0(m), 1(f)
2. Offer stroke prevention if  
CHA<sub>2</sub>DS<sub>2</sub>-VASc ≥1(m), 2(f)  
Assess bleeding risk, address  
modifiable bleeding risk factors
3. Choose OAC (NOAC or VKA  
with well-managed TTR)

Assess symptoms,  
QoL and patient's  
preferences

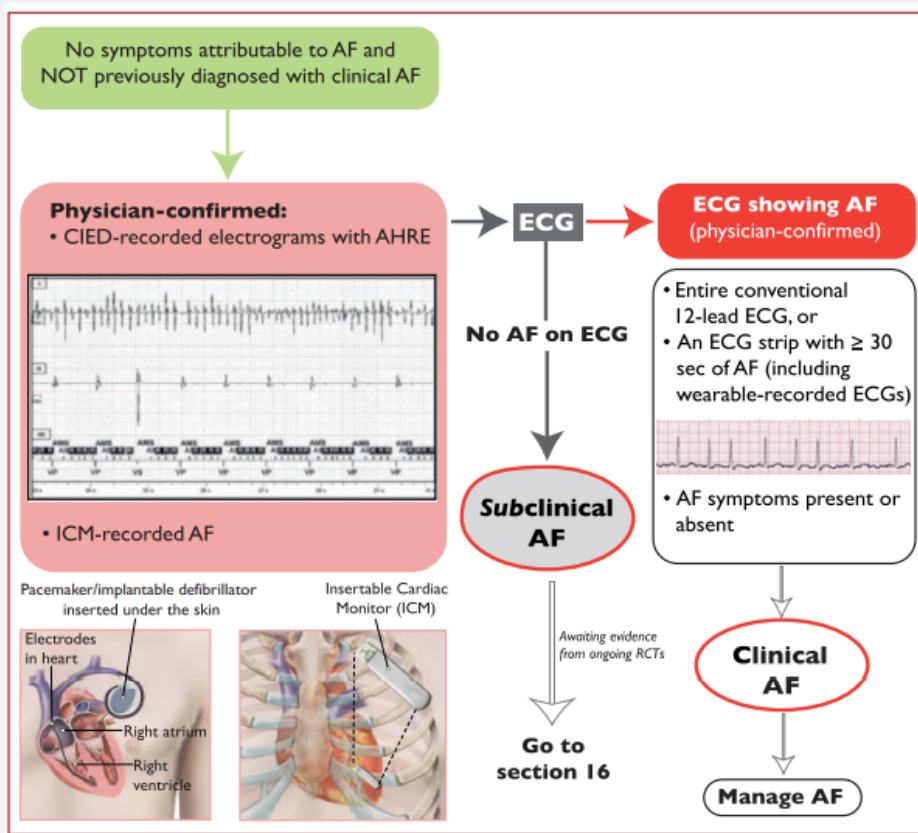
Optimize rate  
control

Consider a rhythm  
control strategy  
(CV, AADs, ablation)

Comorbidities and  
cardiovascular risk  
factors

Lifestyle changes  
(obesity reduction,  
regular exercise,  
reduction of alcohol use,  
etc.)

# Quando avviare la terapia anticoagulante nella FA



| Criteria   | Yes                      | No                                  | Poss. Point |
|--|--------------------------|-------------------------------------|-------------|
| <b>Congestive heart failure</b><br>Signs/symptoms of heart failure confirmed with objective evidence of cardiac dysfunction        | <input type="checkbox"/> | <input checked="" type="checkbox"/> | +1          |
| <b>Hypertension</b><br>Resting BP > 140/90 mmHg on at least 2 occasions <u>or</u> current antihypertensive pharmacologic treatment | <input type="checkbox"/> | <input checked="" type="checkbox"/> | +1          |
| <b>Age 75 years or older</b>   | <input type="checkbox"/> | <input checked="" type="checkbox"/> | +2          |
| <b>Diabetes mellitus</b><br>Fasting glucose > 125 mg/dL or treatment with oral hypoglycemic agent and/or insulin                   | <input type="checkbox"/> | <input checked="" type="checkbox"/> | +1          |
| <b>Stroke, TIA, or IFE</b><br>Includes any history of cerebral ischemia  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | +2          |
| <b>Vascular disease</b><br>Prior MI, peripheral arterial disease, or aortic plaque   | <input type="checkbox"/> | <input checked="" type="checkbox"/> | +1          |
| <b>Age 65 to 74 years</b>  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | +1          |
| <b>Sex Category (female)</b><br>Female gender confers higher risk  | <input type="checkbox"/> | <input checked="" type="checkbox"/> | +1          |

CHA2DS2 Vasc score >1 UOMINI; 2>DONNE

# Quale terapia anticoagulante avviare nella FA

**Table 11** Dose selection criteria for NOACs

|                                | Dabigatran  | Rivaroxaban         | Apixaban  | Edoxaban  |
|--------------------------------|---|---------------------|---|---|
| <b>Standard dose</b>           | 150 mg b.i.d.   | 20 mg o.d.          | 5 mg b.i.d.   | 60 mg o.d.  |
| <b>Lower dose</b>              | 110 mg b.i.d.   |                     |   | 30 mg o.d.  |
| <b>Reduced dose</b>            |   | 15 mg o.d.          | 2.5 mg b.i.d.   | <del>30 mg o.d./15 mg o.d.</del>  |
| <b>Dose-reduction criteria</b> | Dabigatran 110 mg b.i.d. in patients with: <ul style="list-style-type: none"> <li>● Age <math>\geq</math>80 years</li> <li>● Concomitant use of verapamil, or</li> <li>● Increased bleeding risk</li> </ul> | CrCl 15 - 49 mL/min | At least 2 of 3 criteria: <ul style="list-style-type: none"> <li>● Age <math>\geq</math>80 years,</li> <li>● Body weight <math>\leq</math>60 kg, or</li> <li>● Serum creatinine <math>\geq</math>1.5 mg/dL (133 <math>\mu</math>mol/L)</li> </ul> | If any of the following: <ul style="list-style-type: none"> <li>● CrCl 30 - 50 mL/min,</li> <li>● Body weight <math>\leq</math>60 kg,</li> <li>● Concomitant use of verapamil, quinidine, or dronedarone</li> </ul> |

b.i.d. = bis in die (twice a day); CrCl = creatinine clearance; o.d. = *omni die* (once daily).

# B: Better symptom control

Due strategie possibili:

1. **Rate control** = Controllo FC (<80-110bpm)
  2. **Rhythm control** = controllo ritmo = ripristino e mantenimento RS (prevenzione recidive)
- In **passato** considerati **equivalenti**
  - **Recenti studi** in favore di **rhythm control** -> **raccomandata (classe I)** se sono presenti

## sintomi

Hindricks G, et al. 2020 ESC Guidelines for the diagnosis and management of atrial fibrillation. Eur Heart J. 2021;42(5):373-498.

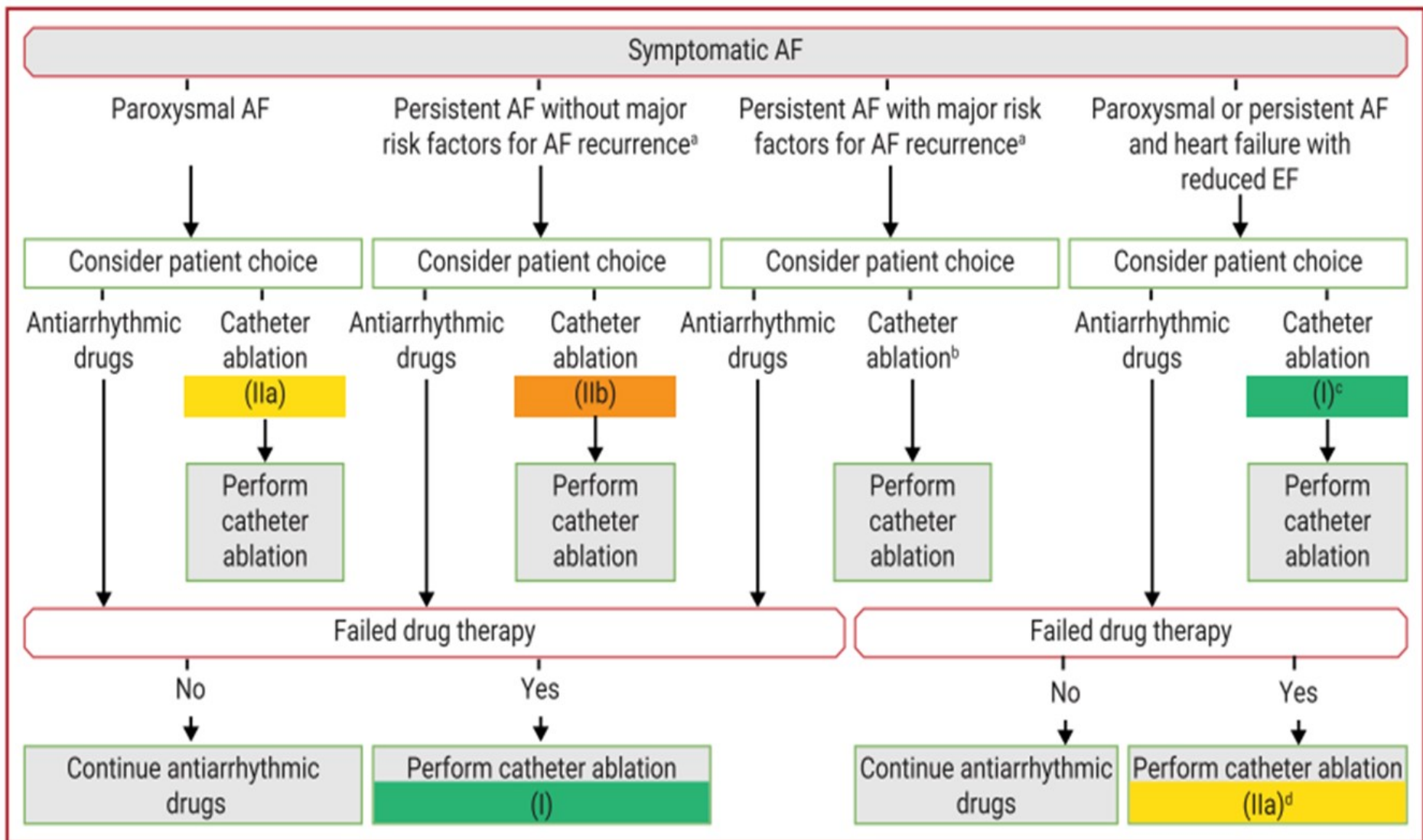
Frankel G, Kamrul R, Kosar L, Jensen B. Rate versus rhythm control in atrial fibrillation. Can Fam Physician. 2013;59(2):161-168.

## Prospettiva "storica"

| FAVOURING RATE CONTROL                  | FAVOURING RHYTHM CONTROL                   |
|---|--|
| Persistent AF                           | Paroxysmal AF or newly detected AF         |
| Less symptomatic                        | More symptomatic                           |
| Age $\geq$ 65 y                         | Age < 65 y                                 |
| LA enlargement                          | LA not dilated                             |
| No history of HF                        | HF clearly exacerbated by AF               |
| Previous failure of antiarrhythmic drug | No previous failure of antiarrhythmic drug |
| Patient preference                      | Patient preference                         |

## Raccomandazioni attuali

| Recommendations  | Class <sup>a</sup> | Level <sup>b</sup> |
|--|--------------------|--------------------|
| <u>Rhythm control therapy is recommended for symptom and QoL improvement in symptomatic patients with AF.</u> <sup>551-553</sup> | I                  | A                  |





**3** IN **10** Are indicated for an ablation.

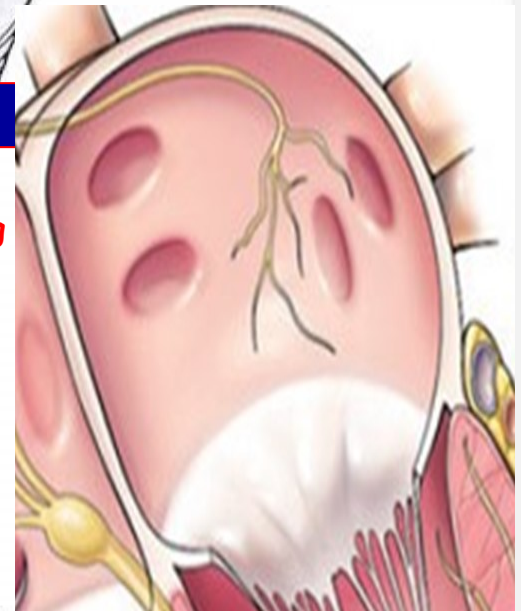
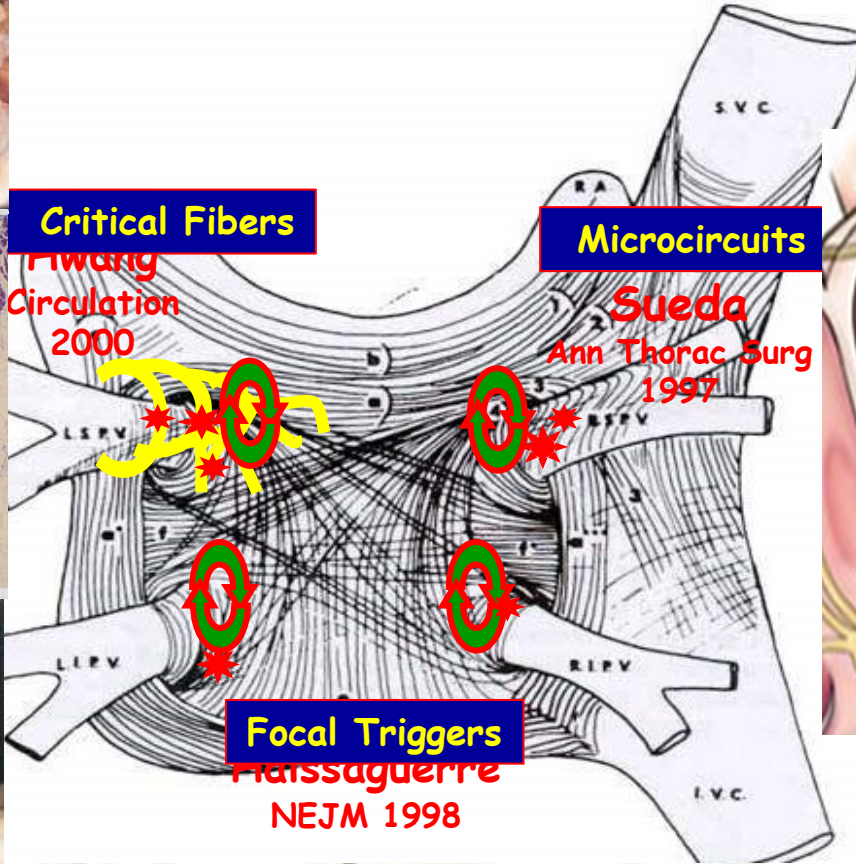
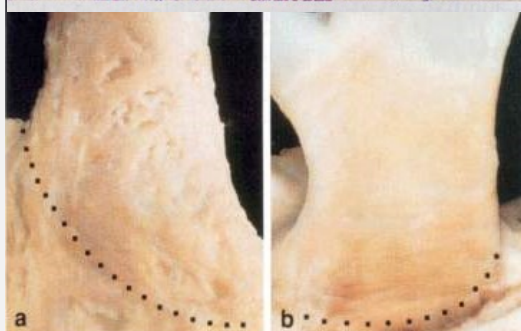
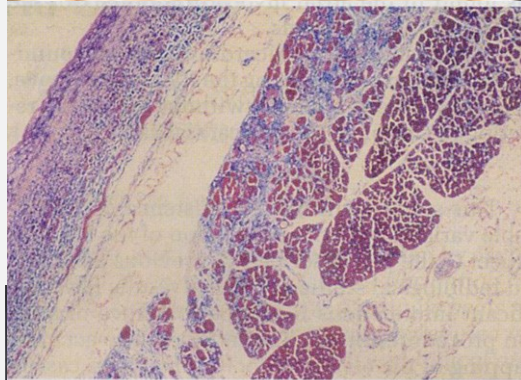
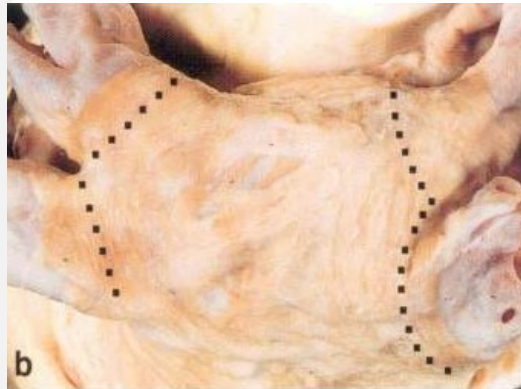
**4%** Are treated with an ablation annually.<sup>6</sup>

Results from the Outcomes Registry for Better Informed Treatment of Atrial Fibrillation (ORBIT-AF) registry. *Am Heart J.* 2013 Apr;265(4):622-629.

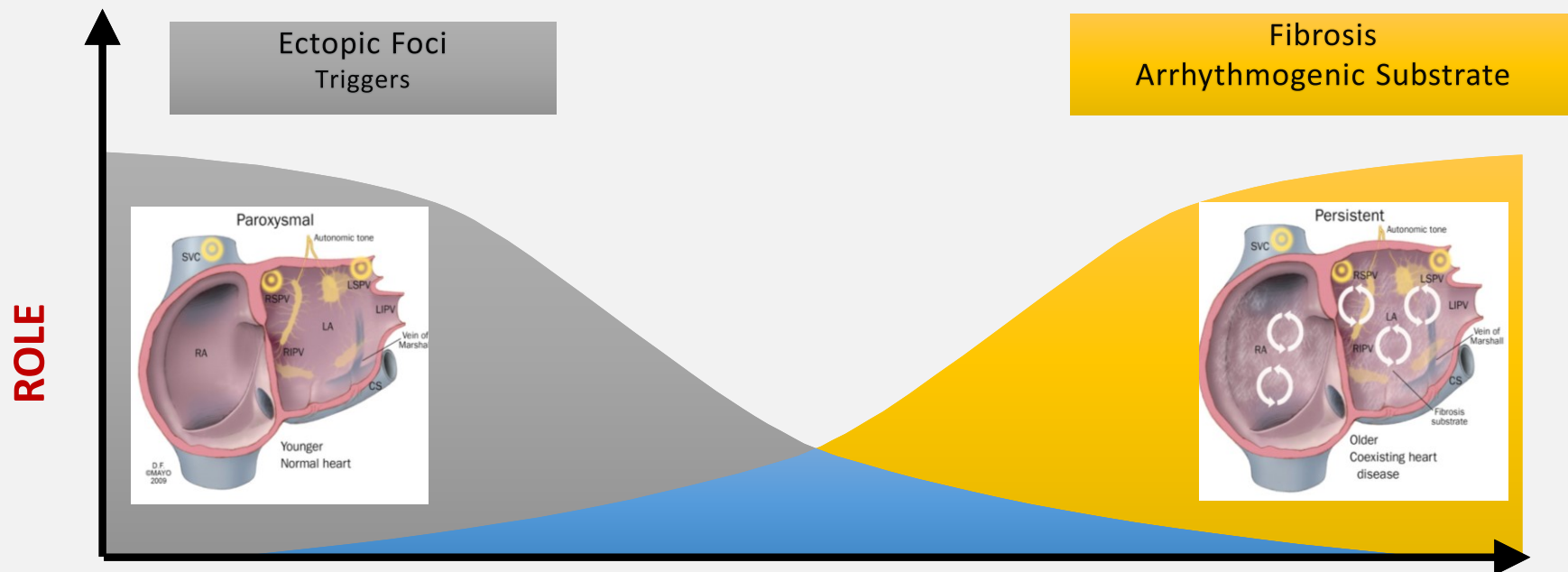
<sup>5</sup>Calkins H, et al. Treatment of atrial fibrillation with anti-arrhythmic drugs or radio frequency ablation: two systematic literature reviews and meta-analyses. *Circulation: Arrhythmia and Electrophysiology* (2009): CIRCEP-108.

<sup>6</sup>Medtronic internal estimates taking into account of clinical and economic exclusion.

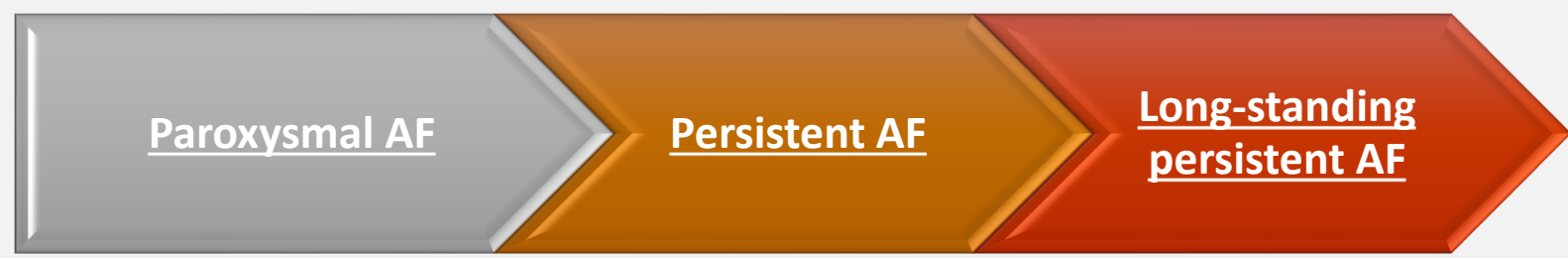
# PV INSULATION : wHy THE TaRGET



# Atrial Fibrillation Evolution



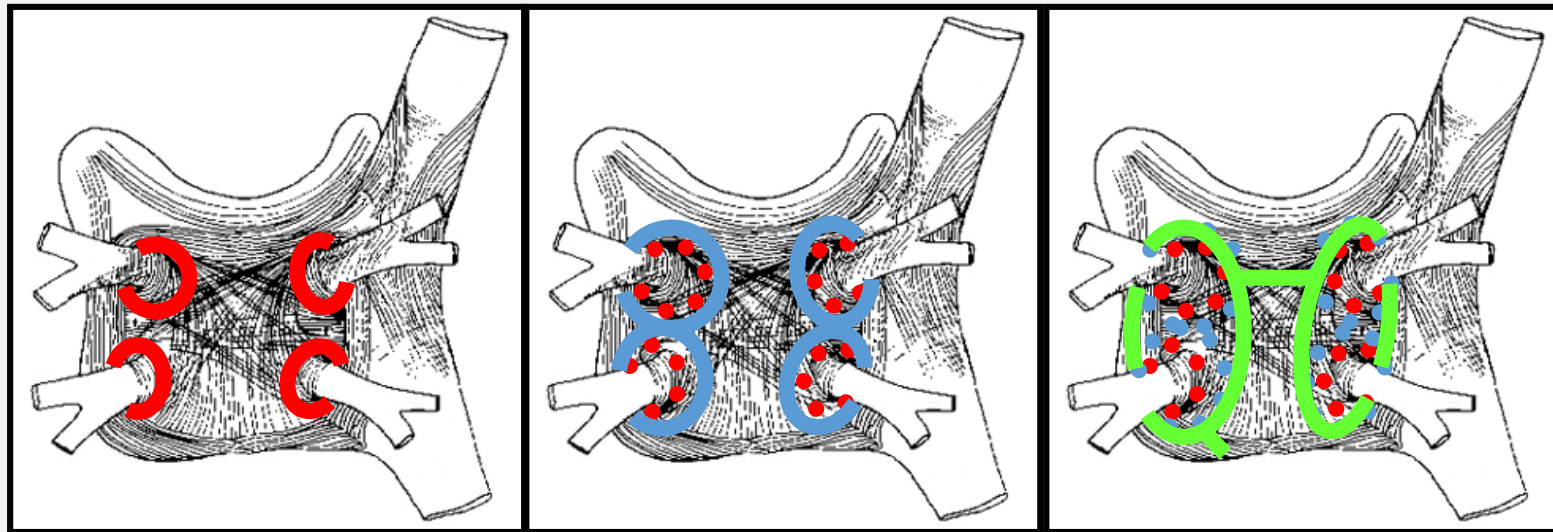
***"Atrial fibrillation begets atrial fibrillation"***



*Clinical AF results from the complex interplay between the triggers for the initiation of AF and the substrate for maintenance and perpetuation of AF.*

# Transcatheter ablation of AF

Current techniques are focalized on th exclusion of mechanism involved in the beginnig and manteinance of AF : triggers and substrate

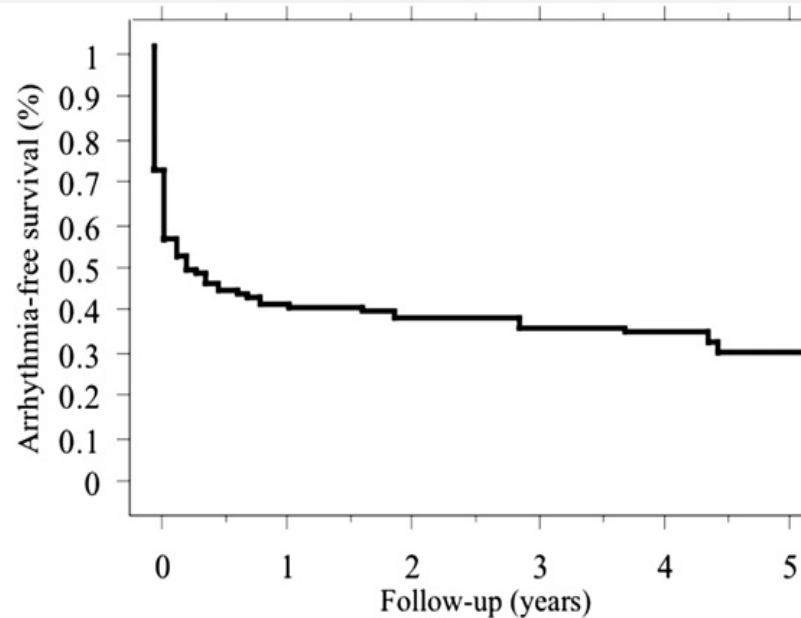


## Catheter Ablation for Atrial Fibrillation

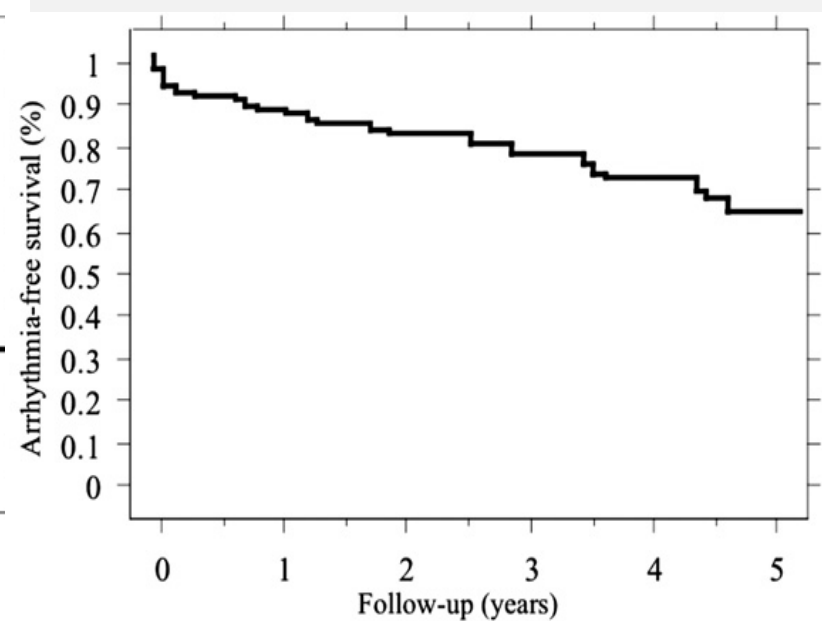
### Are Results Maintained at 5 Years of Follow-Up?

Rukshen Weerasooriya, BMEDSc(HONS), MBBS,\*† Paul Khairy, MD, PhD,‡ Jean Litalien, MD,\*  
Laurent Macle, MD,‡ Meleze Hocini, MD,\* Frederic Sacher, MD,\* Nicolas Lellouche, MD,\*  
Sebastien Knecht, MD,\* Matthew Wright, PhD, MD,\* Isabelle Nault, MD,\* Shinsuke Miyazaki, MD,\*  
Christophe Scavee, MD,\* Jacques Clementy, MD,\* Michel Haissaguerre, MD,\* Pierre Jais, MD\*  
*Bordeaux-Pessac, France; Crawley, Western Australia; and Montreal, Quebec, Canada*

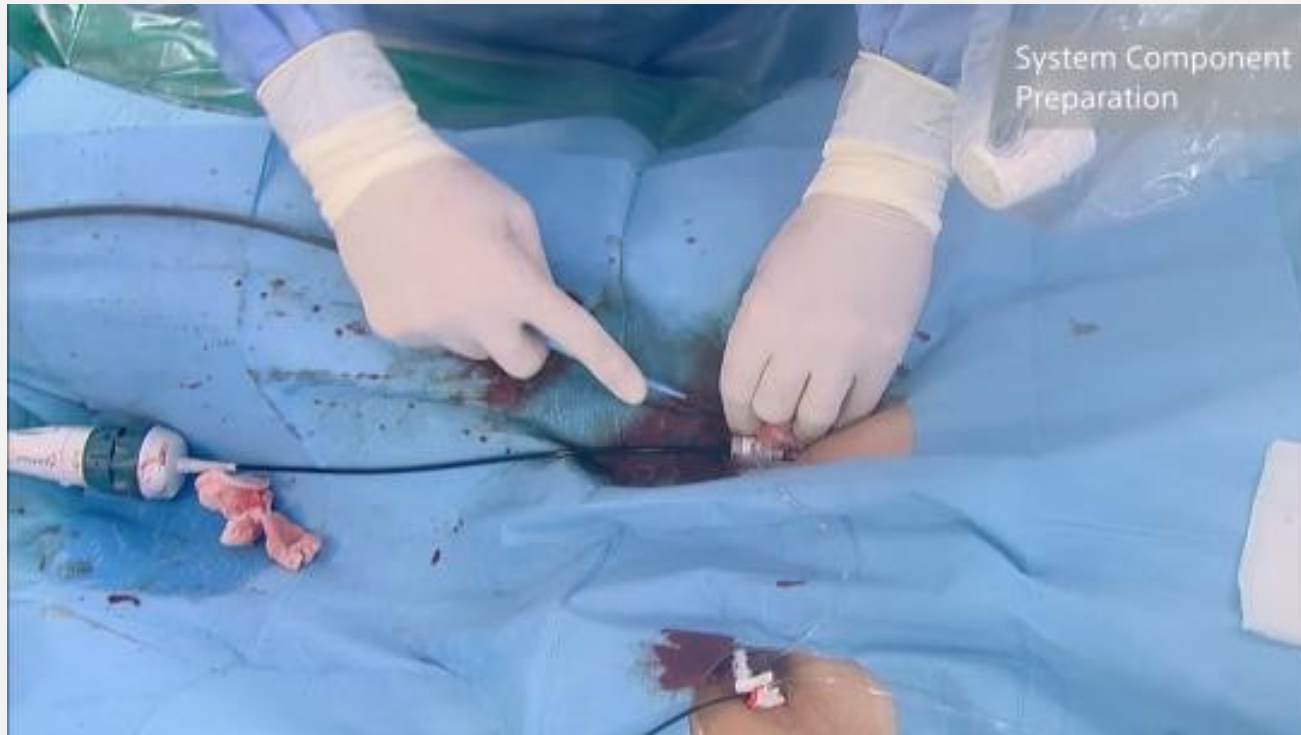
#### Single procedure success at 5-years F.U.

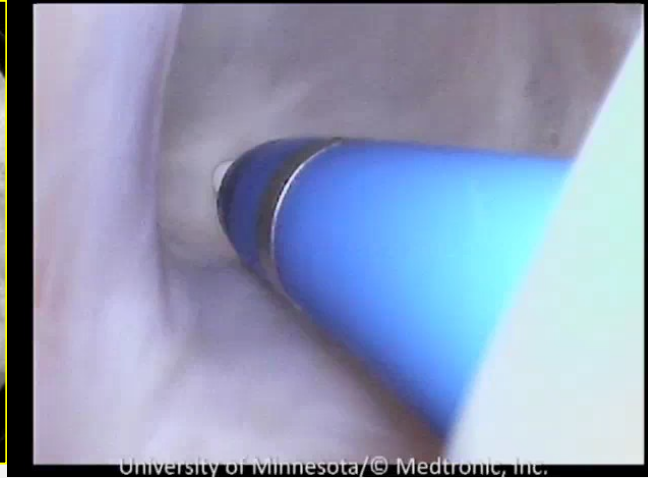
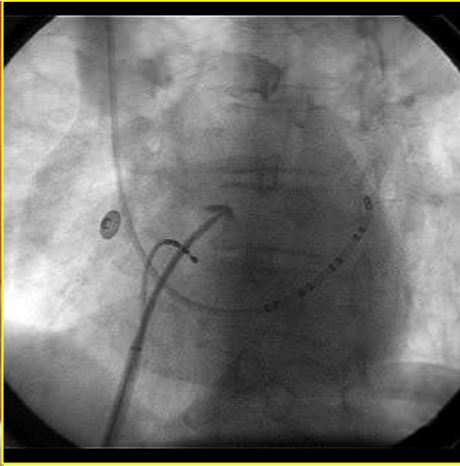
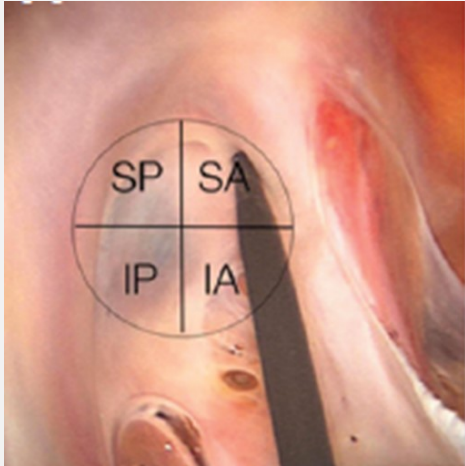


#### Multiple Procedure Success at 5-years F.U.



## Vascular Access:

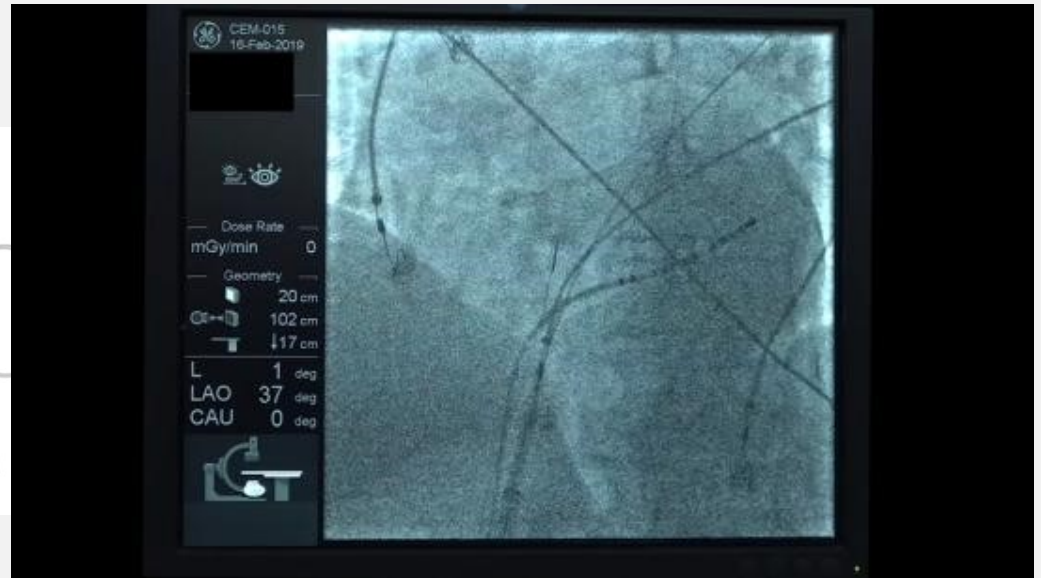
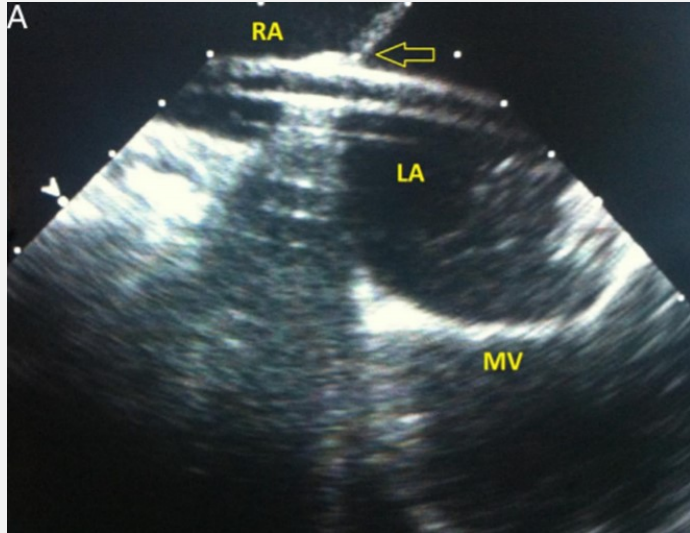




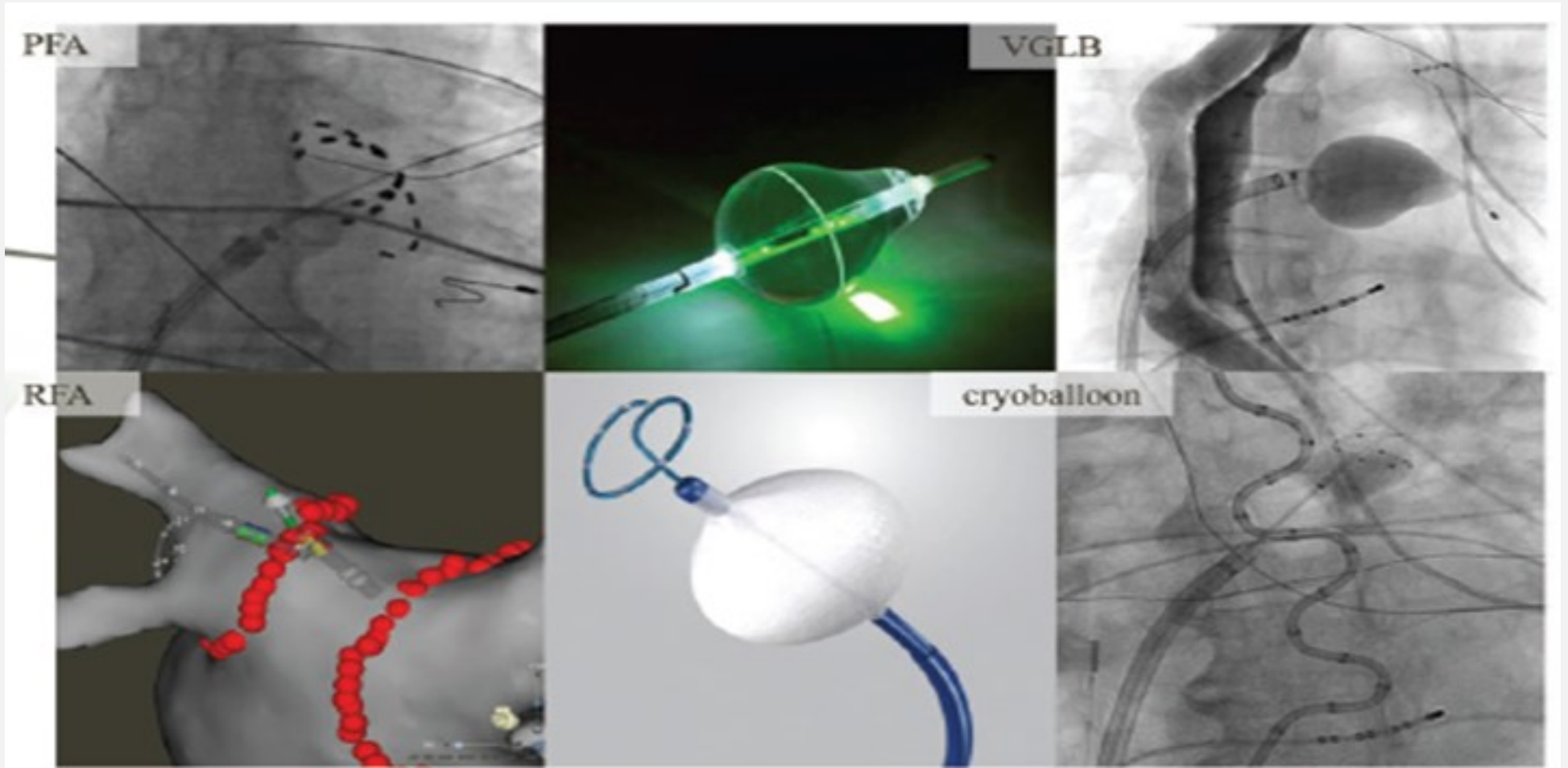
# Transeptal puncture

## Intracardiac echocardiography (ICE)

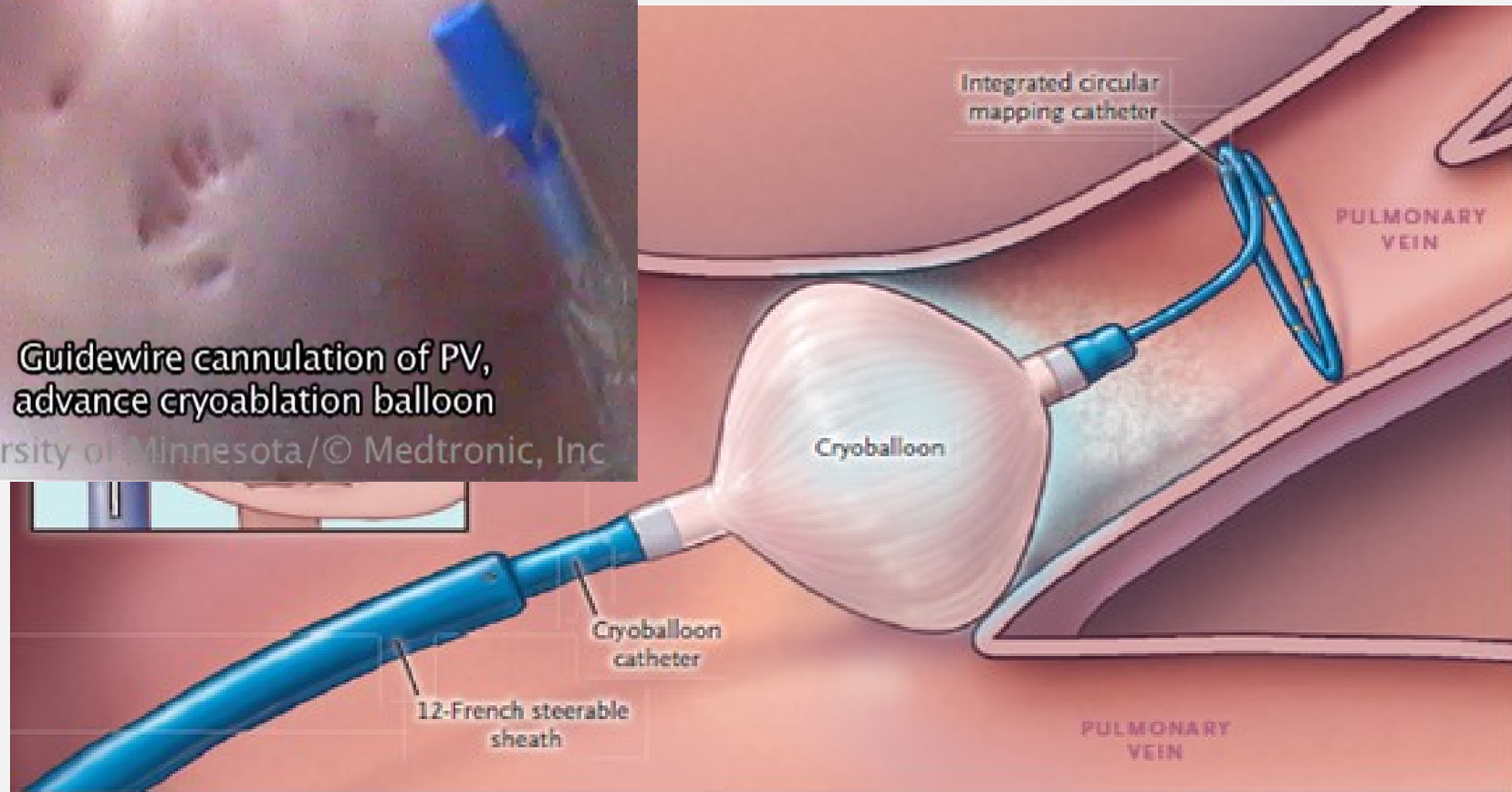
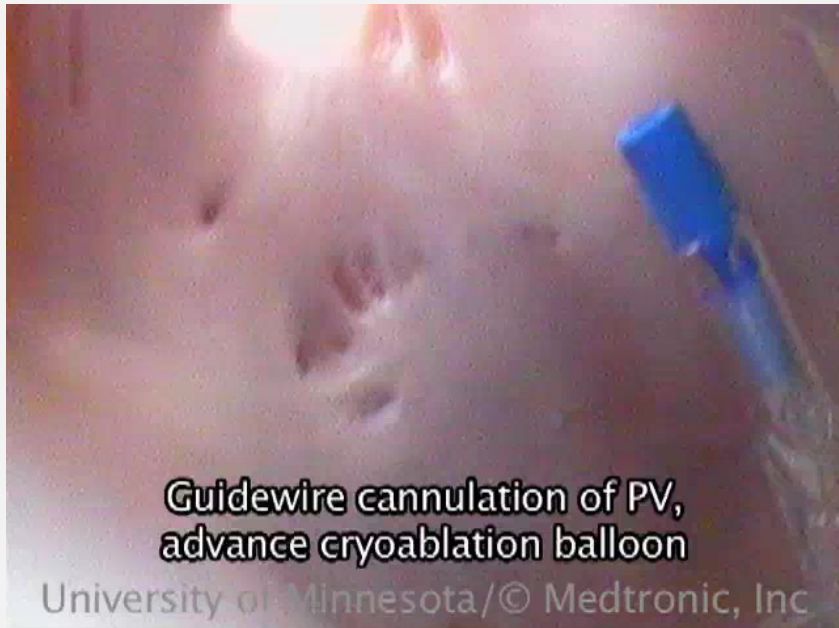
University of Minnesota/© Medtronic, Inc.



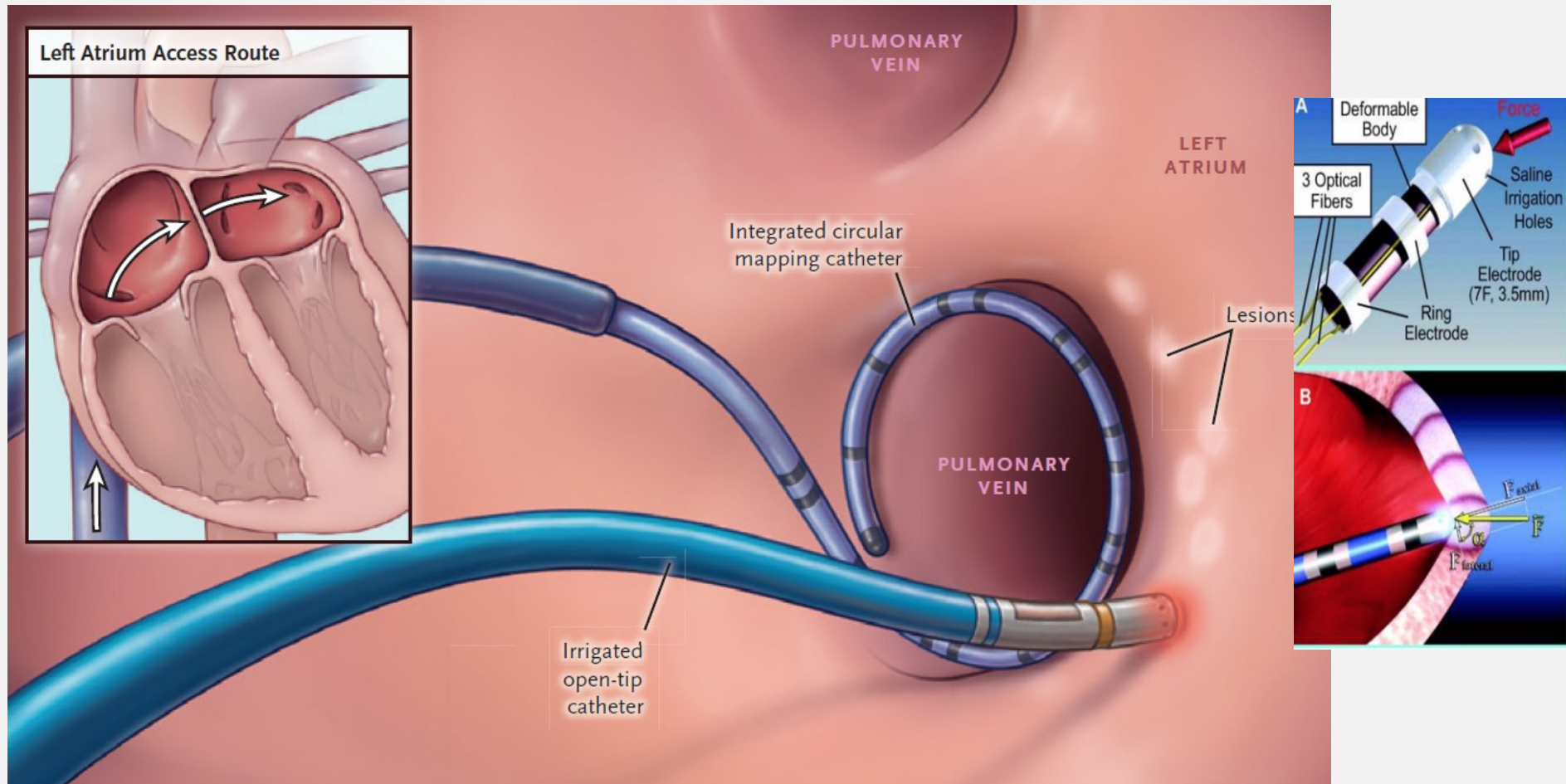
# ***PVI APPROACH***



## CRYO ABLATION

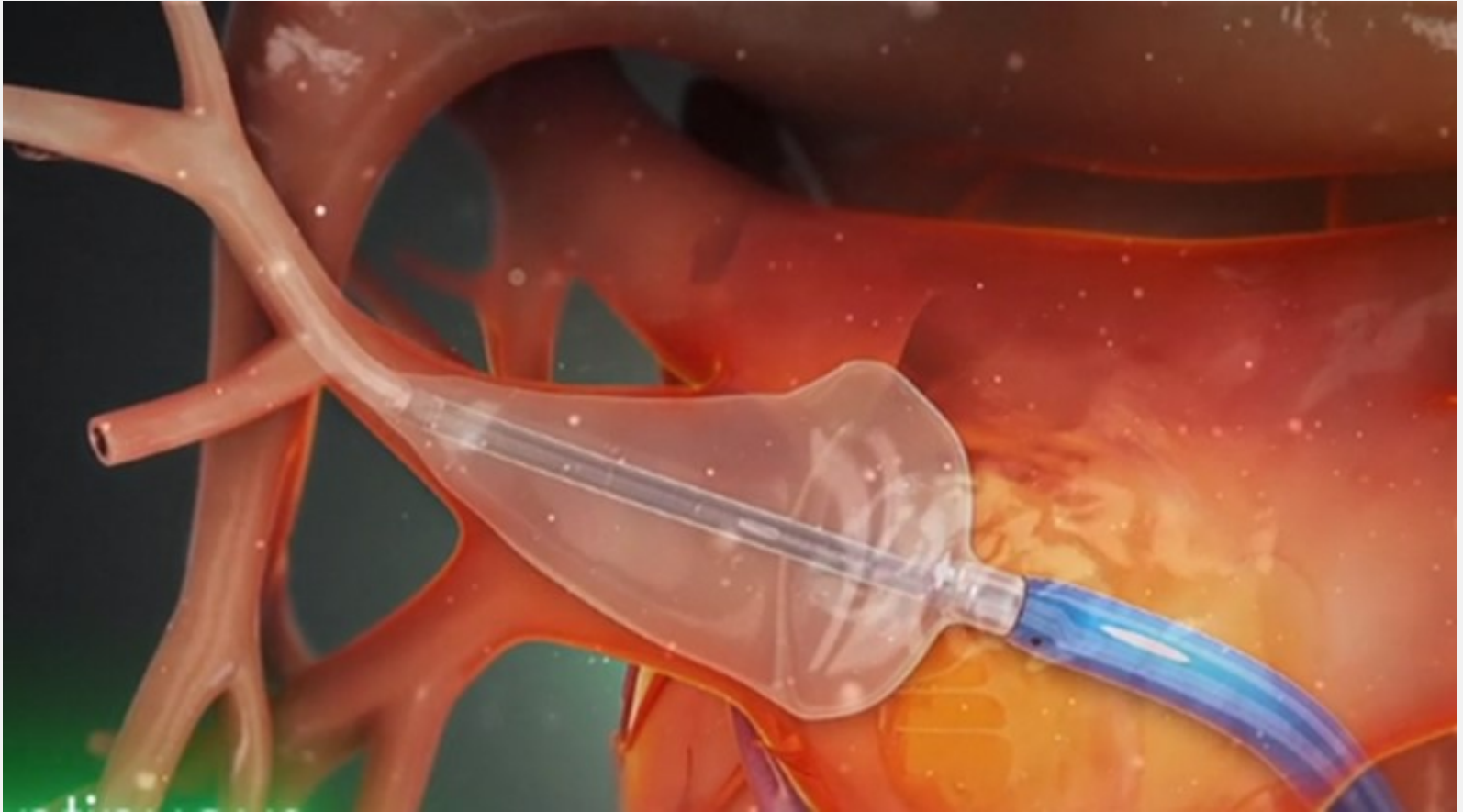


# Radiofrequency point-by-point Ablation



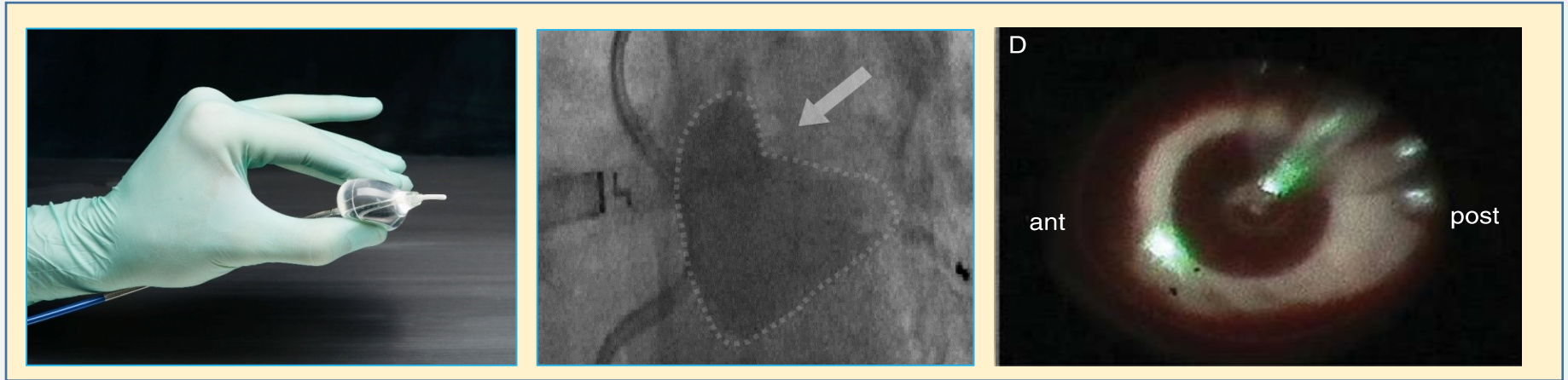
Kuck KH, et al. Fire&ICE Trial. NEJM 2016

## LASER ABLATION



# Laser technology - HeartLight X3

HeartLight X3 laser technology is based on a universally compliant balloon platform



## Rapid and stable contact

The balloon catheter allows the operator to achieve a stable occlusion by making a durable lesion for each pulmonary vein

## Compliant balloon

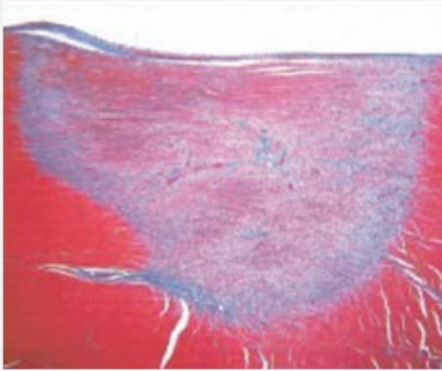
Variable balloon diameter, from 7 to 38 mm, in order to accommodate all types of pulmonary veins and/or common ostia. Unique feature in that laser energy can be used in order to create the lesion even if the balloon is not at maximum filling

## Direct Visualization

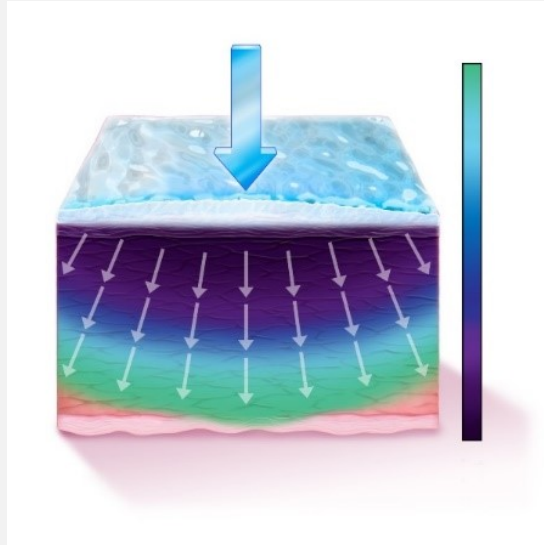
With the use of a 2F endoscope inserted inside the laser balloon, it is possible to have direct visualization of the pulmonary vein ostium, which ensures precise targeting of the area to be ablated

# Ways of creating lesion

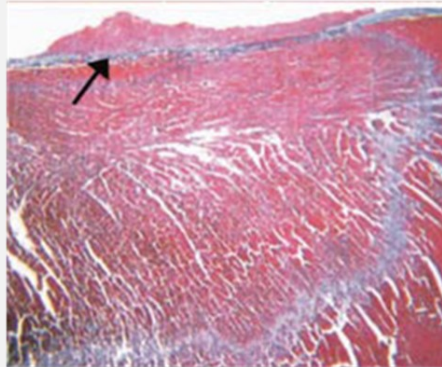
Cryo ablation



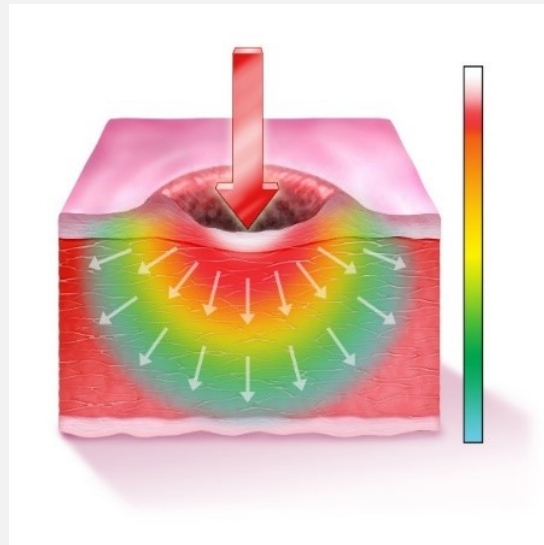
Cryolesion at one week.<sup>3</sup>  
Well demarcated with minimal thrombus and endocardium intact.



RF Catheter

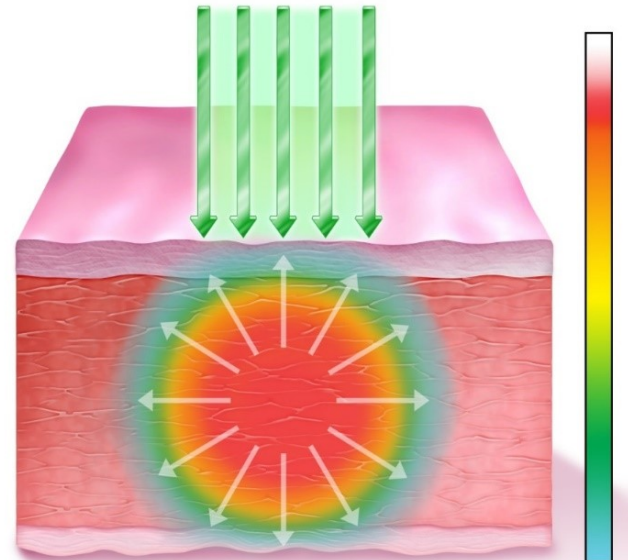


Radiofrequency lesion at one week.<sup>3</sup> Arrow indicating thrombus and disrupted endocardium.



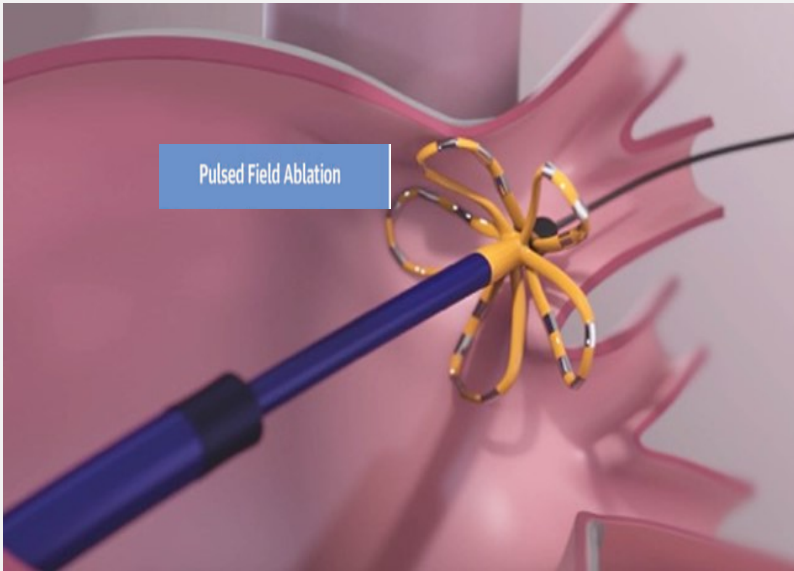
## HeartLight laser technology

gives rise to controlled and uniform heating below the endothelial surface



DISCLAIMER: These illustrations are conceptual and are for illustrative purposes only.

# Electroporation



Il nuovo sistema di **ablazione a campo pulsato** (o elettroporazione), diversamente dalle tecniche di ablazione impiegate fino ad ora, si basa su **campi elettrici pulsati**, che non determinano effetti termici sui tessuti interessati e agiscono esclusivamente sulle cellule bersaglio (cardiomiociti); si caratterizza dunque da un'elevata selettività dei tessuti e salvaguarda interamente le aree di tessuto cardiaco non coinvolto nell'ablazione, con elevati livelli di protezione e sicurezza

**PFA IS TISSUE-SELECTIVE**

PFA can ablate myocardium alone while sparing surrounding tissue

**PULSED FIELD ABLATION**

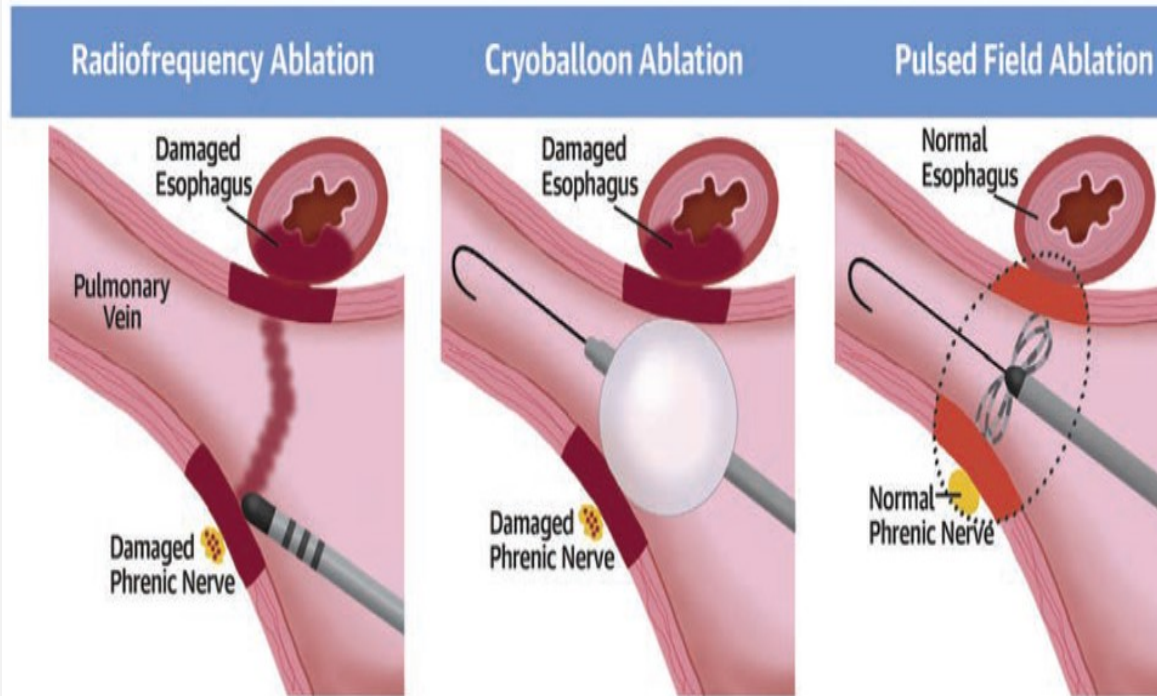
NORMAL ESOPHAGUS

NORMAL PHRENIC NERVE

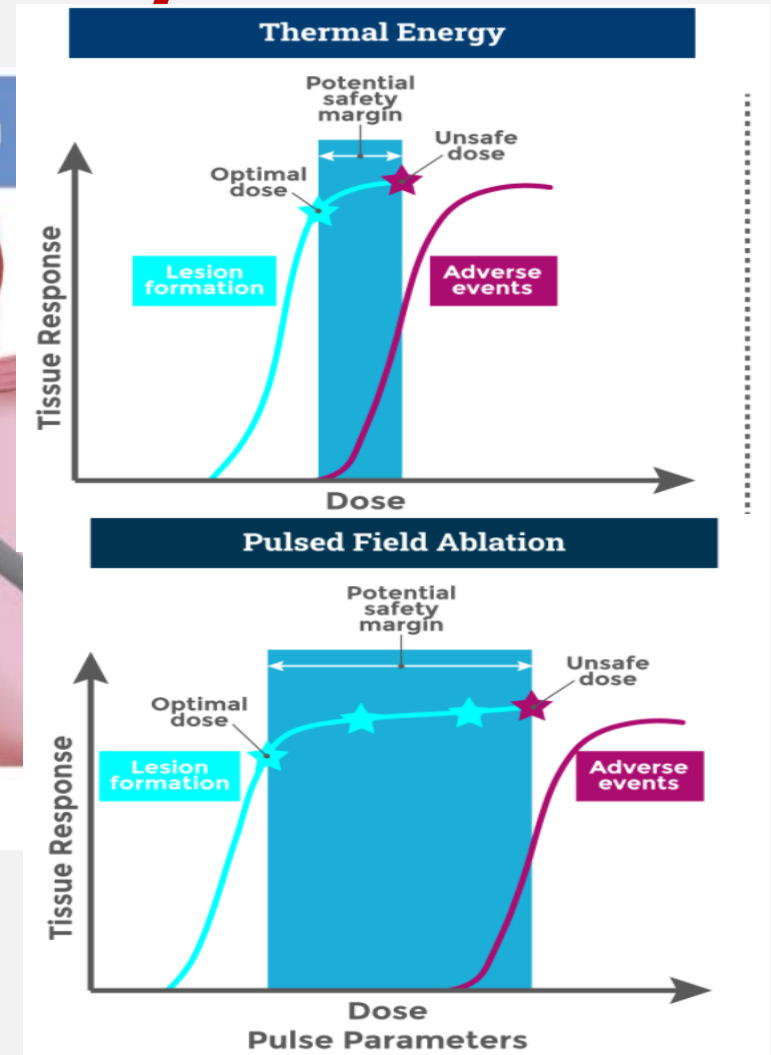
**Other tissue types are more resistant to PFA and remained uninjured despite exposure to the field**

The diagram shows a cross-section of the heart wall with a catheter tip. The myocardium is being ablated, while the esophagus and phrenic nerve are shown as normal and unharmed. A callout box explains that other tissue types are more resistant to PFA and remain uninjured despite exposure to the field.

# Electroporation promises greater safety for the same efficacy



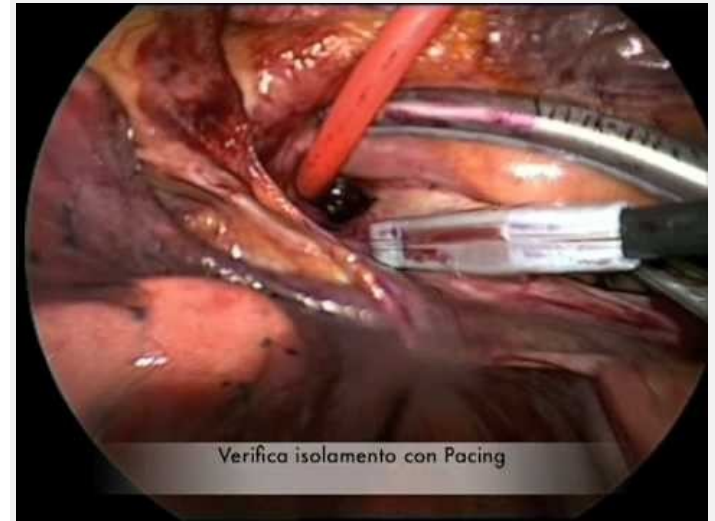
Reddy VY, et al. *J Am Coll Cardiol* 2019;74:315-26.



# Recommendation for surgical ablation of AF

| Recommendations   | Class <sup>a</sup> | Level <sup>b</sup> |
|---|--------------------|--------------------|
| Concomitant AF ablation should be considered in patients undergoing cardiac surgery, balancing the benefits of freedom from atrial arrhythmias and the risk factors for recurrence (left atrial dilatation, years in AF, age, renal dysfunction, and other cardiovascular risk factors). <sup>461,843,857–859</sup>   | <b>IIa</b>         | <b>A</b>           |
| Thoracoscopic—including hybrid surgical ablation—procedures should be considered in patients who have symptomatic paroxysmal or persistent AF refractory to AAD therapy and have failed percutaneous AF ablation, or with evident risk factors for catheter failure, to maintain long-term sinus rhythm. The decision must be supported by an experienced team of electrophysiologists and surgeons. <sup>860,861</sup> | <b>IIa</b>         | <b>B</b>           |
| Thoracoscopic—including hybrid surgical ablation—procedures may be considered in patients with persistent AF with risk factors for recurrence, who remain symptomatic during AF despite at least one failed AAD and who prefer further rhythm control therapy.  | <b>IIb</b>         | <b>C</b>           |

© ESC 2020

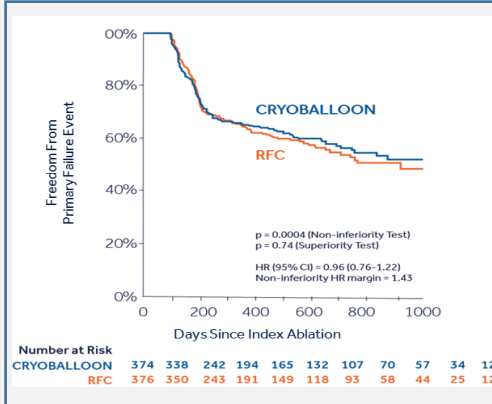


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**Cryoballoon or Radiofrequency Ablation for Paroxysmal Atrial Fibrillation**

Kuck et al.  
N Engl J Med 2016; 374:2235-2245



**Non inferiority Cryo vs RF PVI**



**Cryoballoon or radiofrequency ablation for symptomatic paroxysmal atrial fibrillation: reintervention, rehospitalization, and quality-of-life outcomes in the FIRE AND ICE trial.**

Kuck et al.  
Eur Heart J. 2016 ;37(38):2858-2865.

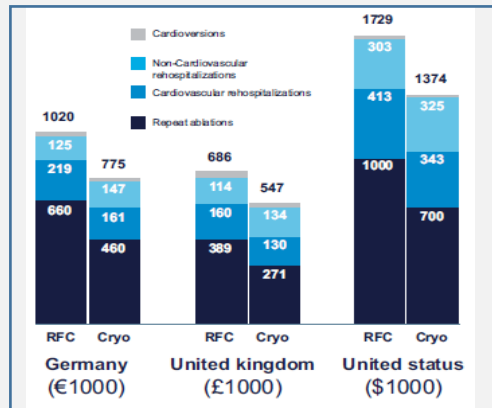


**Re-Hosp Repeat Ablation Rate favors Cryo-PVI rather than RF PVI**



**The Impact of Cryoballoon Versus Radiofrequency Ablation for Paroxysmal Atrial Fibrillation on Healthcare Utilization and Costs: An Economic Analysis from the FIRE AND ICE Trial**

Chun et al.  
J Am Heart Association. 2017;6:e006043



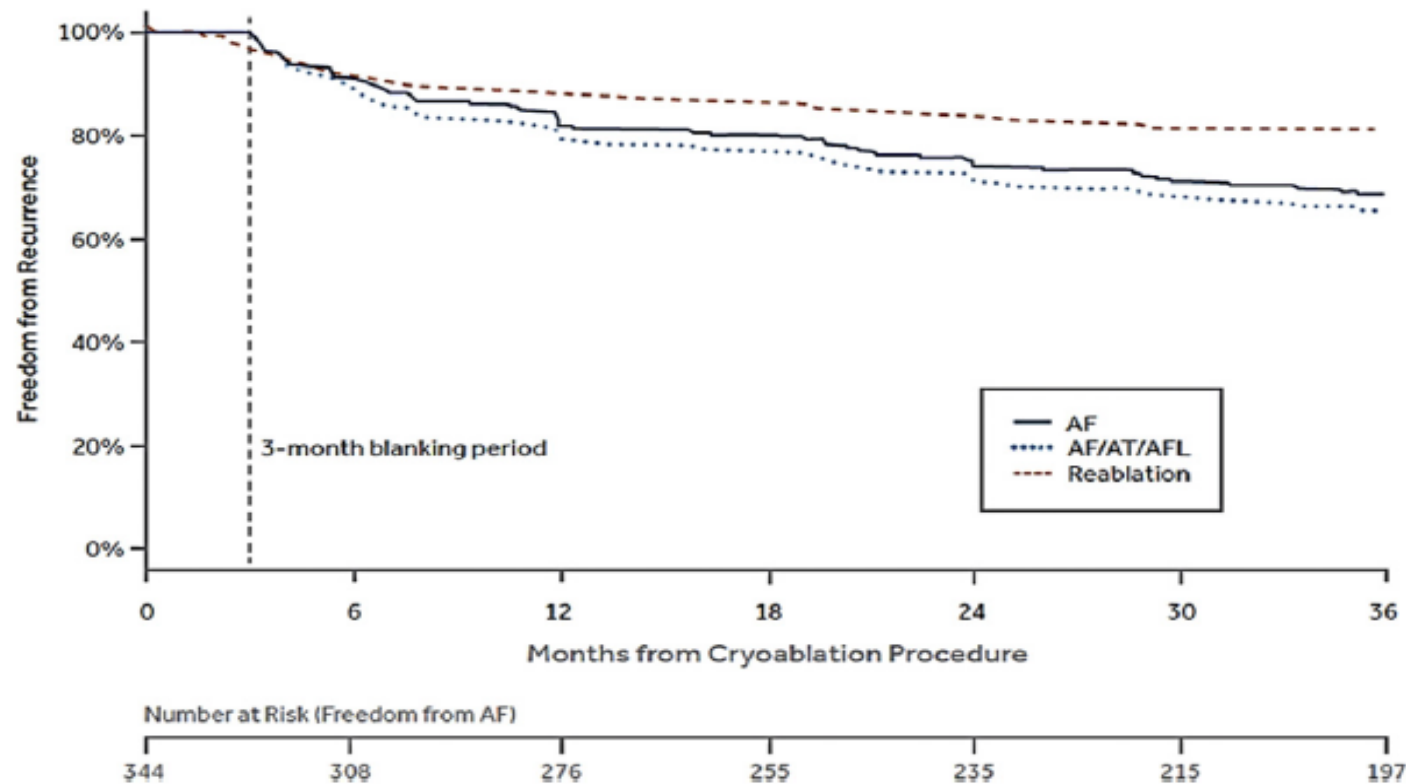
**Significant saving in healthcare costs favoring Cryo vs RF**



# Long-Term Outcomes After Ablation for Paroxysmal Atrial Fibrillation Using the Second-Generation Cryoballoon

Final Results From STOP AF Post-Approval Study

**FIGURE 1** Freedom From AF Recurrence



**freedom from all AF  
of 84% at 36 mths.**

## Cryoablation for persistent and longstanding persistent atrial fibrillation: results from a multicentre European registry

The arrhythmia-free survival is **65%** at 24months in the present study

- This data is comparable to previously published results using cryoballoon in persistent AF patients
  - Straube et al, arrhythmia-free survival 59% at 18months;
  - Tondo et al.<sup>2</sup> reported an arrhythmia-free survival of 63.9% at 12mths)
  - **was in the largest patient cohort yet reported with persistent AF,**
  - **included 20% patients with longstanding persistent AF**
  - **a longer follow-up than previously reported in the literature.**

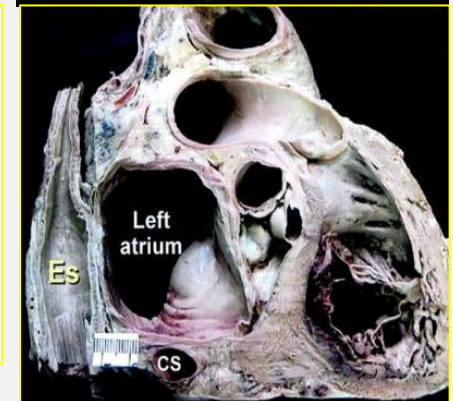
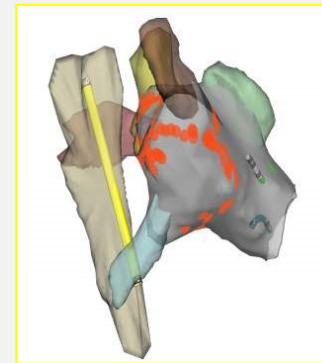
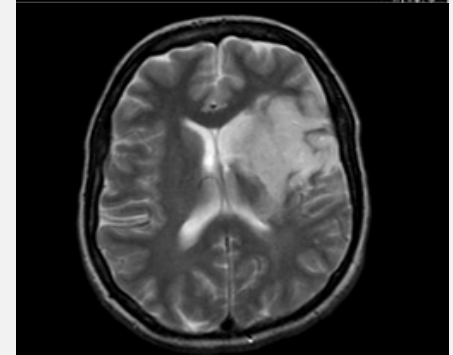
## First experiences on Persistent AF: EU registry

Straube F, Hartl S, Dorwarth U et al Cryoballoon ablation for persistent atrial fibrillation—large single-center experience, J Cardiol 2016;68:492–7.

Tondo C, Iacopino S, Pieragnoli P, et al. Pulmonaryvein isolation cryoablation for patients with persistent and long-standing persistent atrial fibrillation: Clinical outcomes from the real-world multicenter observational project. Heart Rhythm 2018;15:363–8

# COMPLICATIONS OF PVI

1. New or worsening heart rhythm problems (arrhythmias)
2. Bleeding at the site where the catheter was inserted.
3. Blood vessel damage.
4. Heart valve damage.
5. Slow heart rate that could require a PM to correct.
6. Blood clots (venous thromboembolism)
7. Stroke or heart attack
8. Atrioesophageal fistula – phrenic nerve injury



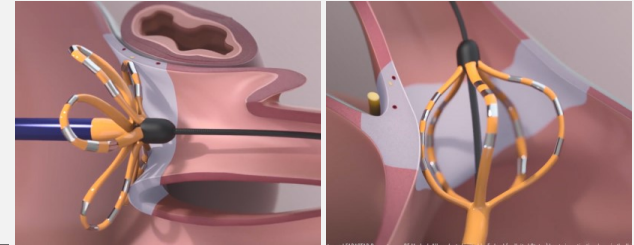
# Clinical Cases – Consistent with Promise of PFA

FARAPULSE procedures have demonstrated safety that is consistent with tissue selectivity

In this study<sup>1</sup>, all patients treated:

0

- ✓ Death
- ✓ Stroke
- ✓ Myocardial Infarction
- ✓ Phrenic Nerve Injury
- ✓ Esophageal Injury
- ✓ PV Stenosis



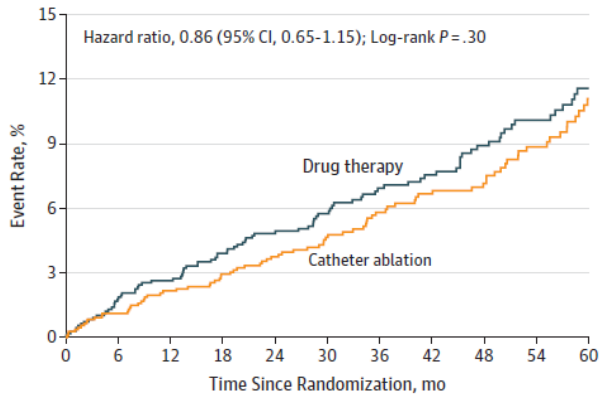
| Primary Safety Events<br>(121 PAF pts) | n | Rate |
|--|---|------|
| <b>Esophageal Injury</b>               | 0 | 0.0% |
| Esophageal Dysmotility                 | 0 | 0.0% |
| Atrio-esophageal Fistula               | 0 | 0.0% |
| <b>PV Stenosis</b>                     | 0 | 0.0% |
| <b>Phrenic Nerve Injury</b>            | 0 | 0.0% |
| <b>Stroke</b>                          | 0 | 0.0% |
| <b>Transient Ischemic Attack</b>       | 1 | 0.8% |
| <b>Pericardial Effusion</b>            | 1 | 0.8% |
| <b>Vascular Injury</b>                 | 2 | 1.7% |
| <b>Myocardial infarction</b>           | 0 | 0.0% |
| <b>Death</b>                           | 0 | 0.0% |

<sup>1</sup>Reddy et al. *JACC: Clinical Electrophysiology* 7.5 (2021): 614-627

JAMA | Original Investigation

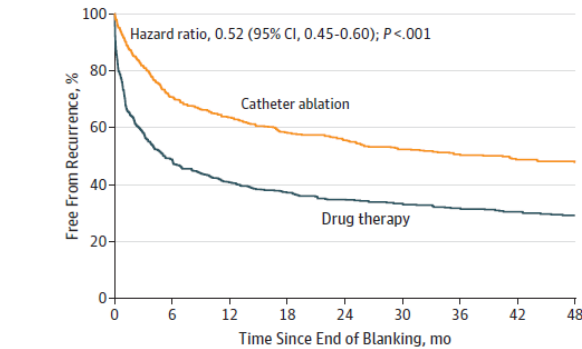
# Effect of Catheter Ablation vs Antiarrhythmic Drug Therapy on Mortality, Stroke, Bleeding, and Cardiac Arrest Among Patients With Atrial Fibrillation

## The CABANA Randomized Clinical Trial



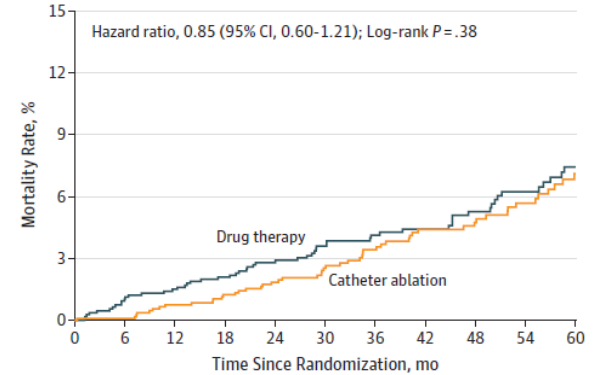
| No. at risk       | 0    | 6    | 12   | 18  | 24  | 30  | 36  | 42  | 48  | 54  | 60  |
|-------------------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|
| Drug therapy      | 1096 | 1036 | 1006 | 970 | 880 | 763 | 652 | 578 | 499 | 418 | 312 |
| Catheter ablation | 1108 | 1045 | 1021 | 996 | 915 | 793 | 700 | 614 | 535 | 432 | 309 |

**the Primary End Point**

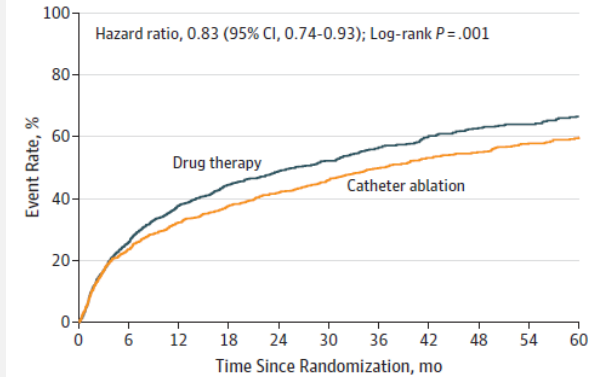


| No. at risk       | 0   | 6   | 12  | 18  | 24  | 30  | 36  | 42  | 48  |
|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Drug therapy      | 629 | 304 | 252 | 212 | 181 | 157 | 131 | 115 | 94  |
| Catheter ablation | 611 | 432 | 381 | 328 | 291 | 241 | 201 | 163 | 134 |

**A** All-cause mortality



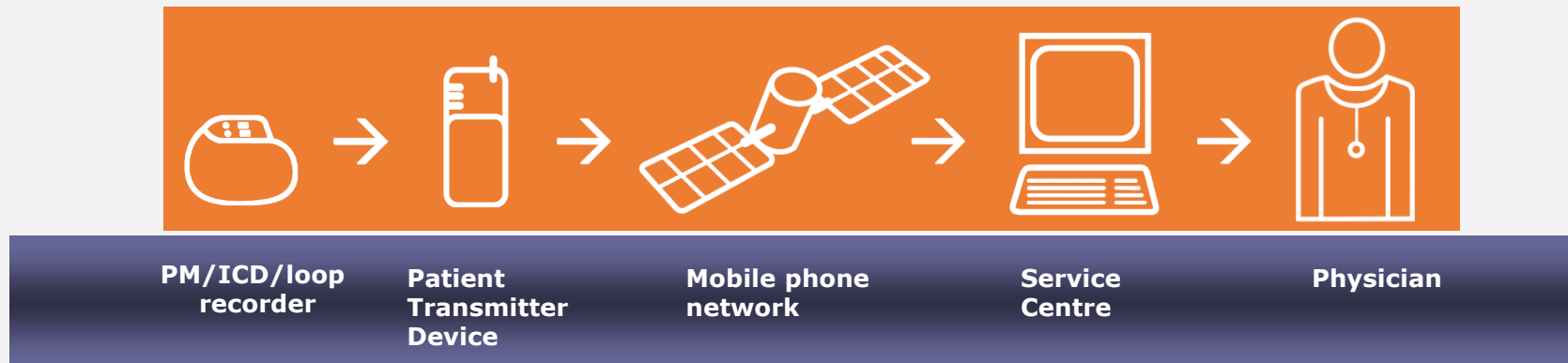
**B** Mortality or cardiovascular hospitalization



JAMA April 2, 2019 Volume 321, Number 13 (

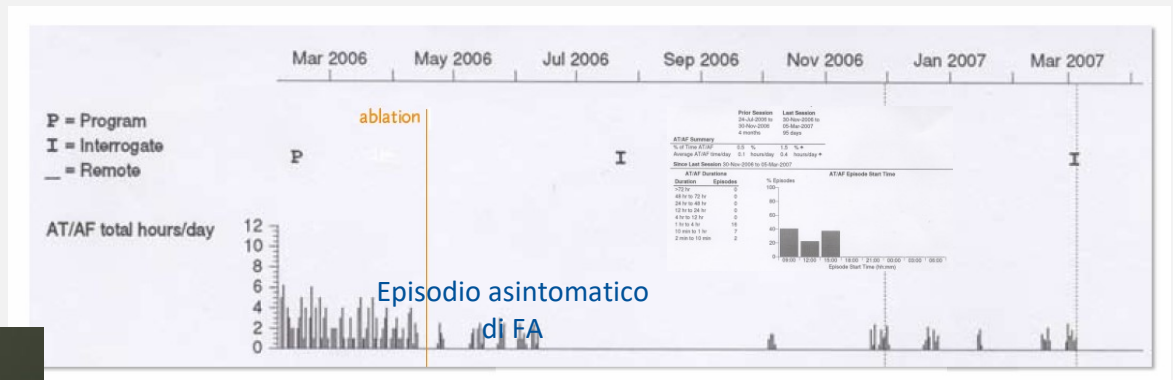
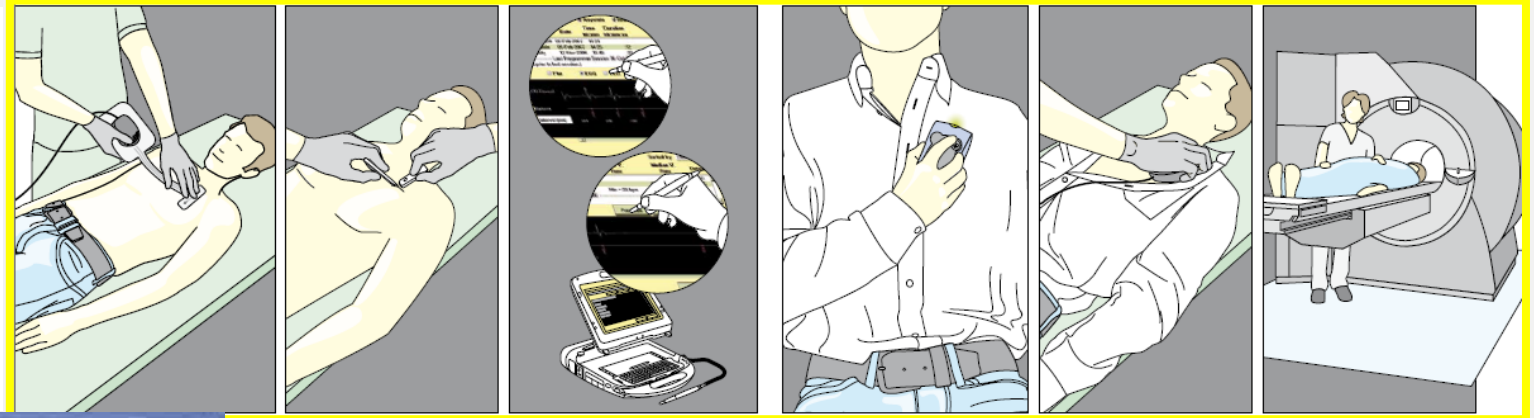
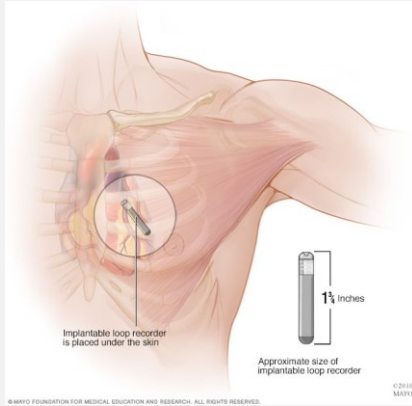
# Home Monitoring

Automatic data transmission without patient intervention



**Available worldwide**  
**Safe**  
**Efficient**

# ARRHYTHMIA MONITORING



Compass report on daily burden

**Risk factors to be  
treated to  
optimize ablation  
outcome  
transcatheter  
ablation**

**Hypertension**

Guideline adherent  
management

**Blood glucose control**

Reduction HbA1c < 6,5 %

**Alcohol**

Reduction or cessation

**Obesity and  
Overweight**

Target BMI < 27 kg/m<sup>2</sup>

**Physical inactivity**

Optimization of exercise

**Hyperlipidemia**

Guideline adherent  
management

**OSA**

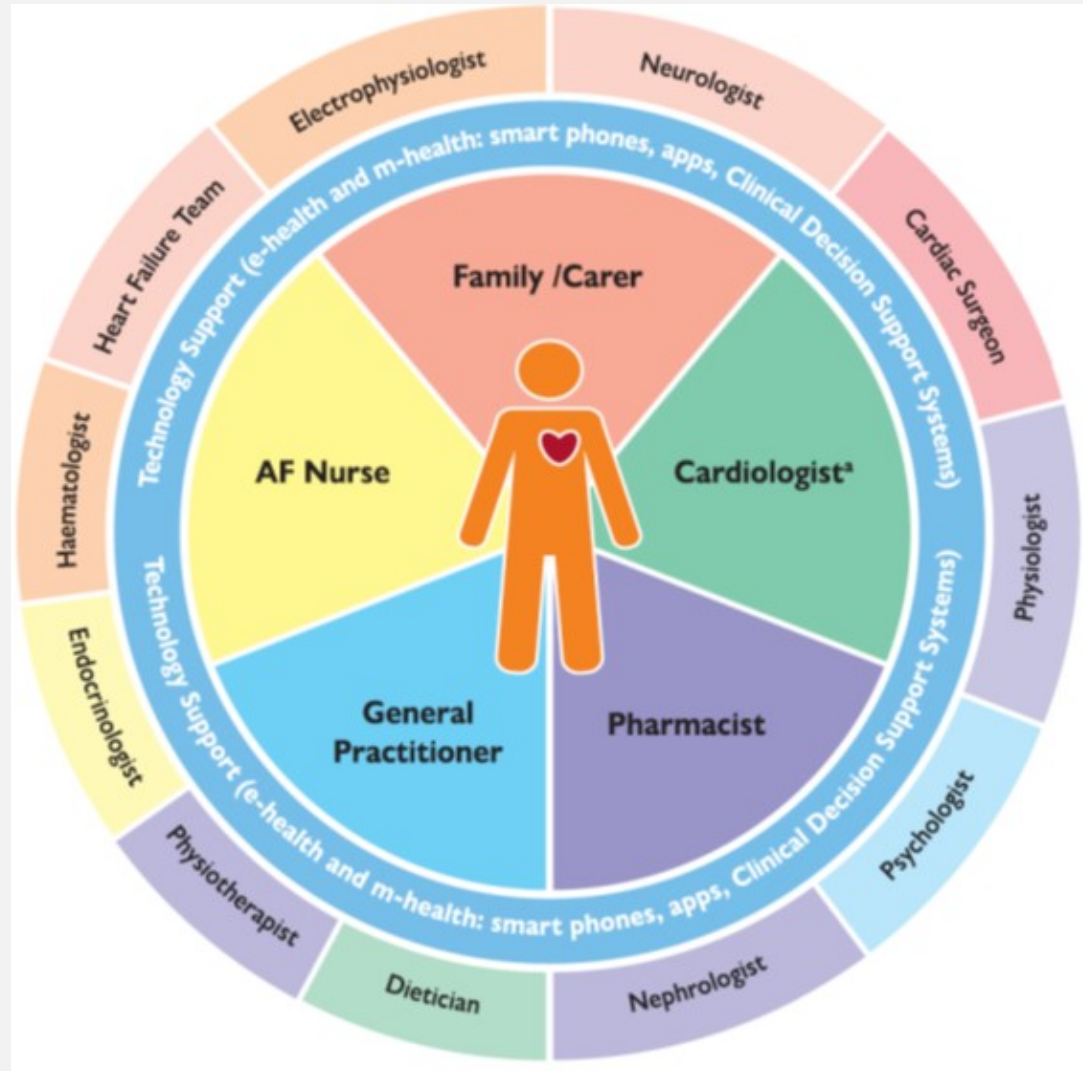
Guideline adherent  
management

**Smoking**

Cessation

# ATRIAL FIBRILLATION TEAM

Conclusion



Conclusion

# ATRIAL FIBRILLATION TEAM

***Grazie  
dell'attenzione***

***Elettrofisiologia ed Elettrostimolazione  
Asst Bergamo Est  
Ospedale Bolognini –Seriata  
Bergamo***