HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

# Trends in Atrial Fibrillation Management


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# Objectives

1) **Describe advances in medical and interventional treatments for prevention of AF- related stroke.**

2) **Describe advances in medical and interventional treatments for minimizing the burden of AF.**

3) **Summarize how these advances informed the current guidelines for AF management.**

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# Outline

1) **Clinical Case**
2) **Epidemiology of AF**
3) **Physiology of AF**
4) **Advances in medical and interventional treatment:**
    - *Reduce the risk of AF-related stroke*
    - *Minimize consequences of AF on heart function (symptoms, CHF)*
5) **Current recommendations for management of AF**

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# Clinical Case

## History of Present Illness

67-year-old woman reports for a routine care visit. Exertional capacity stable, no new exertional dyspnea or chest discomfort. No palpitations, presyncopal symptoms, or syncopal events.

## Past Medical History

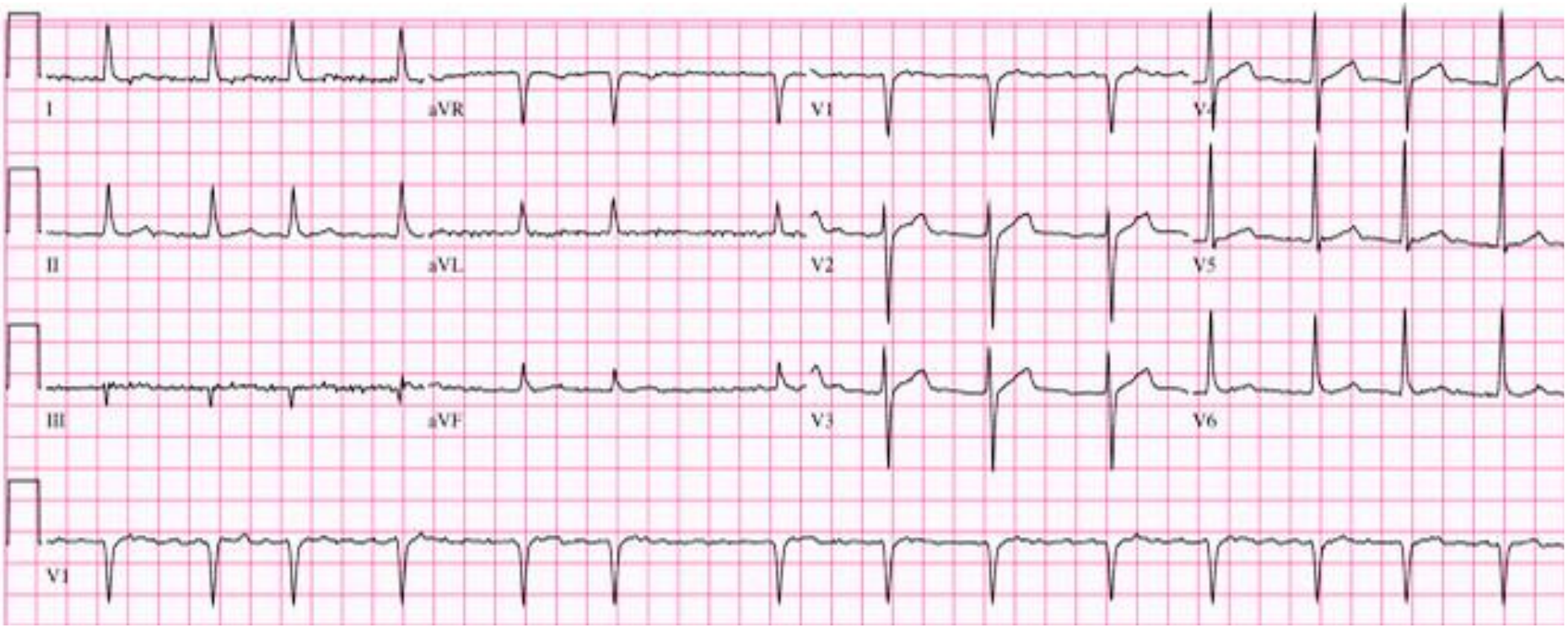
Hypertension
Hyperlipidemia
Diabetes Mellitus

## Physical Exam

Vital signs: BP 136/80 HR 96 RR 12 O2 sat 99% on RA
General: Well-appearing
Pulmonary: clear lung sounds throughout both lung fields
Cardiac: irregularly irregular S1S2, no S3, no rubs/murmurs
Abdomen: benign
Lower extremities: well-perfused, no edema

# Clinical Case

## 12-Lead ECG

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# Clinical Case

## Echocardiogram

- Left ventricular ejection fraction 66% with no ventricular hypertrophy or wall motion abnormalities.
- No hemodynamically significant valvular disease.

## Exercise Stress Test

- Good exercise capacity (6 METS).
- Adequate workload (88% age-predicted maximum heart rate).
- No ECG evidence of ischemia.

# Question 1

**Which of the following represents the most appropriate strategy for AF management in this patient?**

1) Initiation of oral anticoagulant and a rate control strategy with beta blocker or calcium channel blocker.
2) Initiation of oral anticoagulant and a rhythm control strategy (anti-arrhythmic drug or ablation procedure).
3) Initiate a platelet inhibitor (aspirin) and a rate control strategy with beta blocker or calcium channel blocker.
4) Initiate a platelet inhibitor (aspirin) and a rhythm control strategy (anti-arrhythmic drug or ablation procedure).

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# Prevalence of AF/AFL

**AF is the most common arrhythmia in adults.**

- 1-2% of people in the US are affected.
- 50 million people affected worldwide in 2020.[1]

**Incidence of AF increases with age.**

- 9% of people over 65 are affected.
- Prevalence expected to double between 2010 and 2030.[1]

*(From 5 to 12 million people in the US)*


1. Joglar et al., Circulation 2024;1:e1-e156.
2. Ball et al., Int J Cardiol 2013;167:1807-1824.

# Question 2

Which of the following are correct regarding consequences of AF:

1. AF increases the risk of death ≥ 3-fold and increases risk of stroke 3-fold.
2. AF increases the risk of death ≥ 5-fold and increases risk of stroke 1.5-fold.
3. AF increases the risk of death ≥ 1.5-fold and increases risk of stroke 5-fold.
4. AF increases the risk of death ≥ 2 fold and increases risk of stroke 4-fold.

# Question 2

Which of the following are correct regarding consequences of AF:

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3. AF increases the risk of death ≥ 1.5-fold and increases risk of stroke 5-fold.
4. AF increases the risk of death ≥ 2 fold and increases risk of stroke 4-fold.

# Impact of AF/AFL on Patient Outcomes

**Morbidity and mortality is higher in patients with AF than in patients without AF.**

- AF is associated with a 1.5- to 2-fold increase in risk of death.[1]
- Worse outcomes in AF are driven by increased stroke risk.[2]

**Presence of AF increases risk of stroke by 500%.**

- Almost 20% of all strokes occur in patients with AF.
- AF-related stroke mortality is 50% higher than for strokes not due to AF.[3,4]

**Many people with AF are asymptomatic.**

- Stroke could be the first presenting sign of AF.


1. Joglar et al., Circulation 2024;1:e1-e156.
2. Alkhouli et al., JACC Clin EP 2018;4:618-625.
3. Lamassa et al., Stroke 2001;32:392-398.
4. Steger et al. Eur Heart J 2004;25:1734-1740.

# AF-Related Treatment Costs

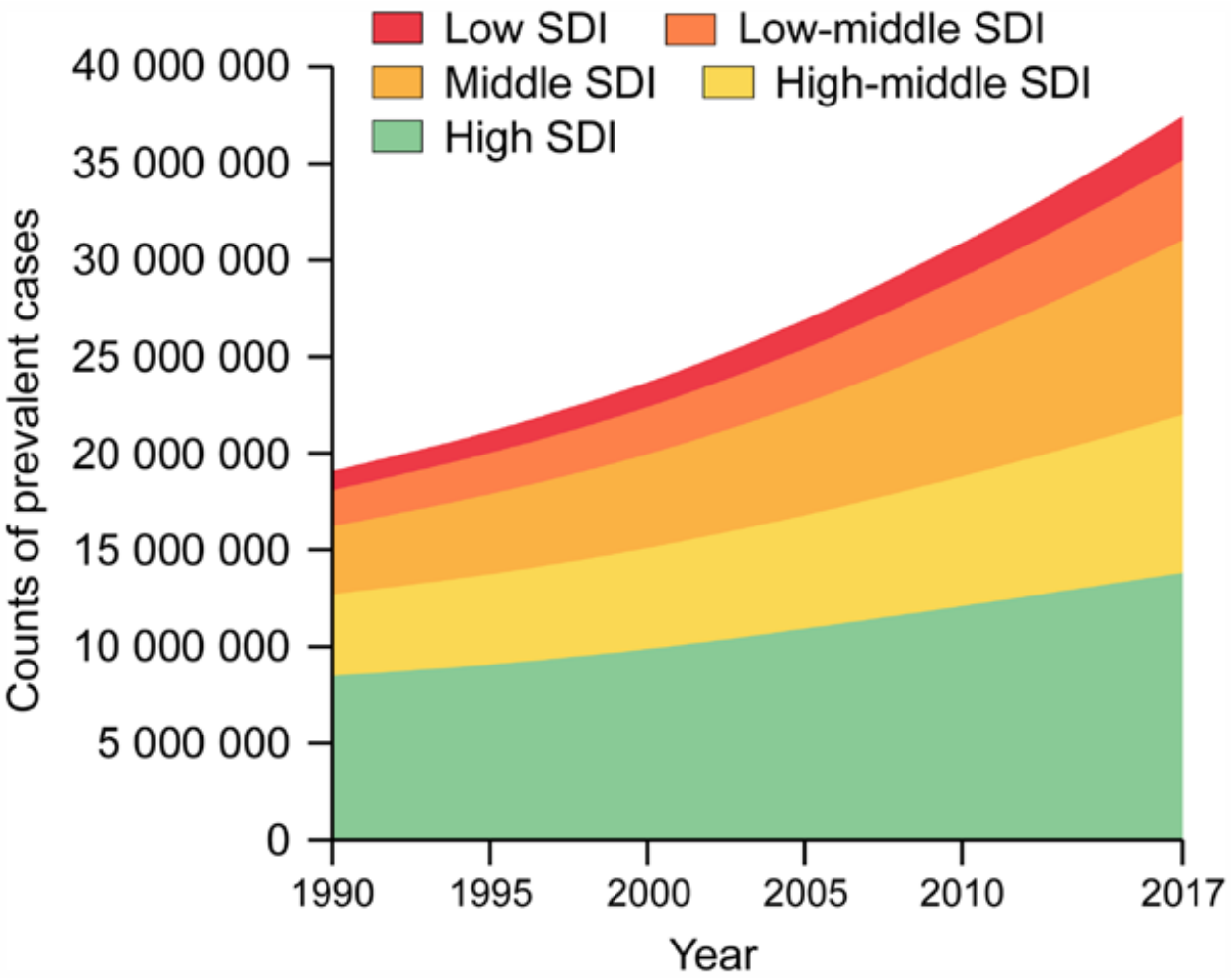
**AF is associated with higher health care utilization.**

- Increased risk of ED visits and inpatient admissions [RR 2.41].[1,2]
- Increased health care costs per annum ($63K vs. $27K for non-AF).[1,2]

**AF-related treatment costs exceed $28 billion per annum.[3]**


1. Bode and Ptaszek, Current Cardiology Reports 2021;23:179.
2. Desmukh et al., Heart Rhythm O2 2022;3:577-586.
3. Joglar et al., Circulation 2024;1:e1-e156.

# Prevalence of AF is Higher in People with Lower Social Demographic Index




Joglar et al., Circulation 2024;1:e1-e156.

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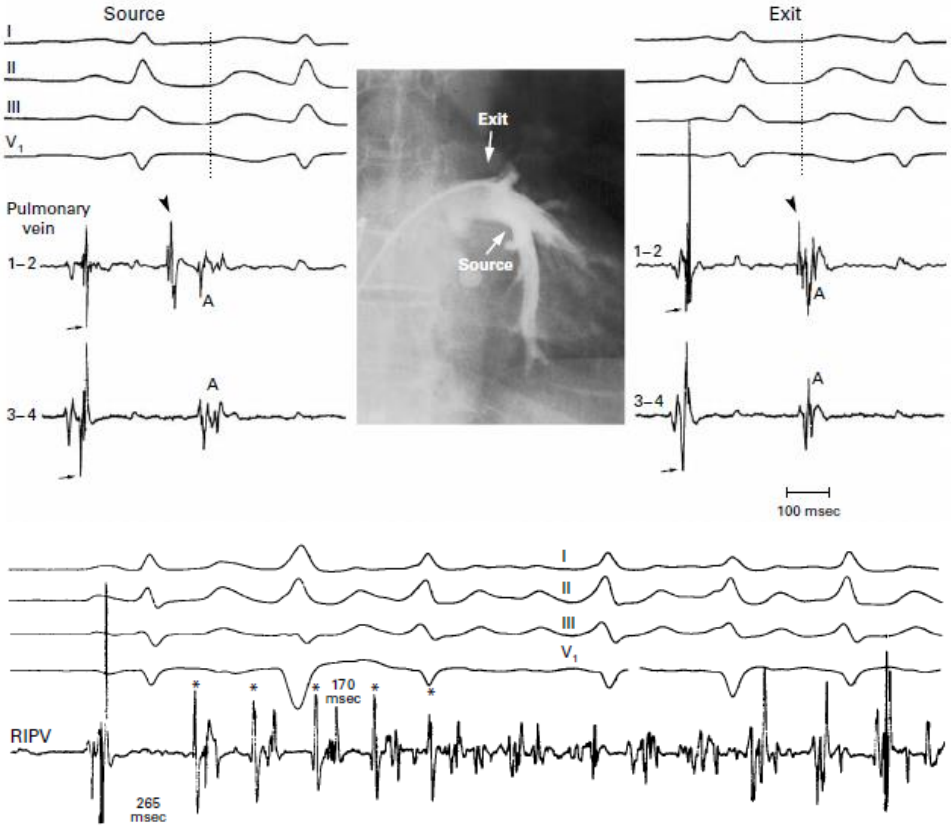
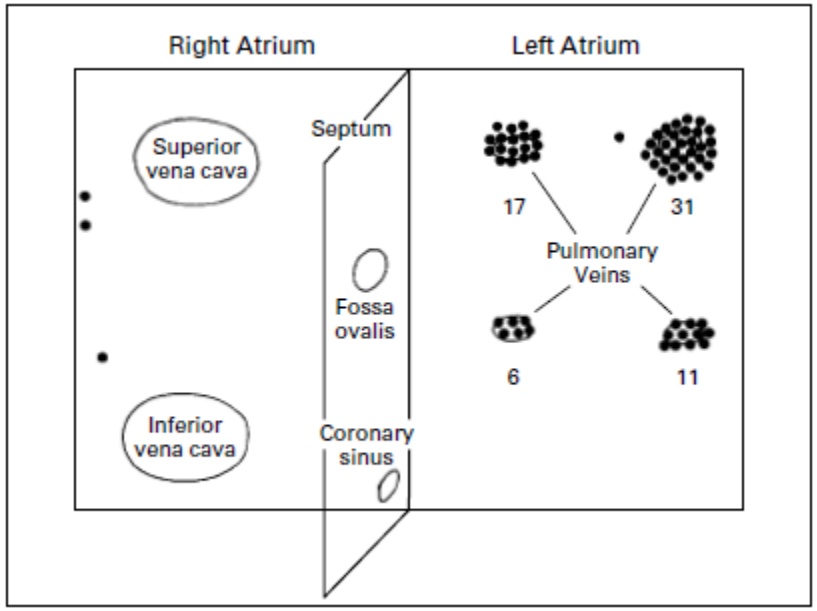
# Pathophysiology of AF and AFL

AF is the result of rapid, chaotic electrical impulses emanating from multiple areas of the atria, notably the pulmonary veins.




M Haissaguerre et al., NEJM 1998;339:659-66

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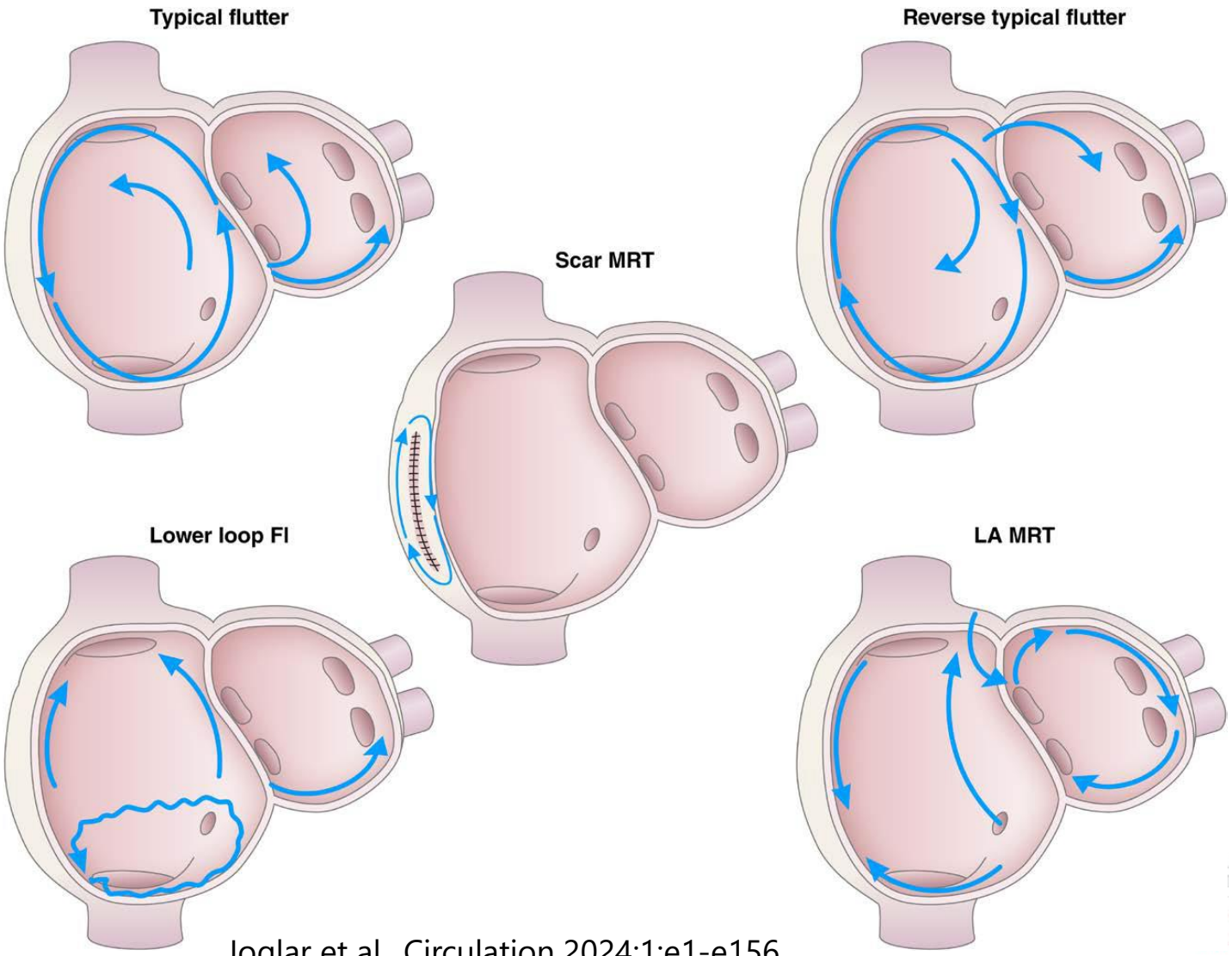
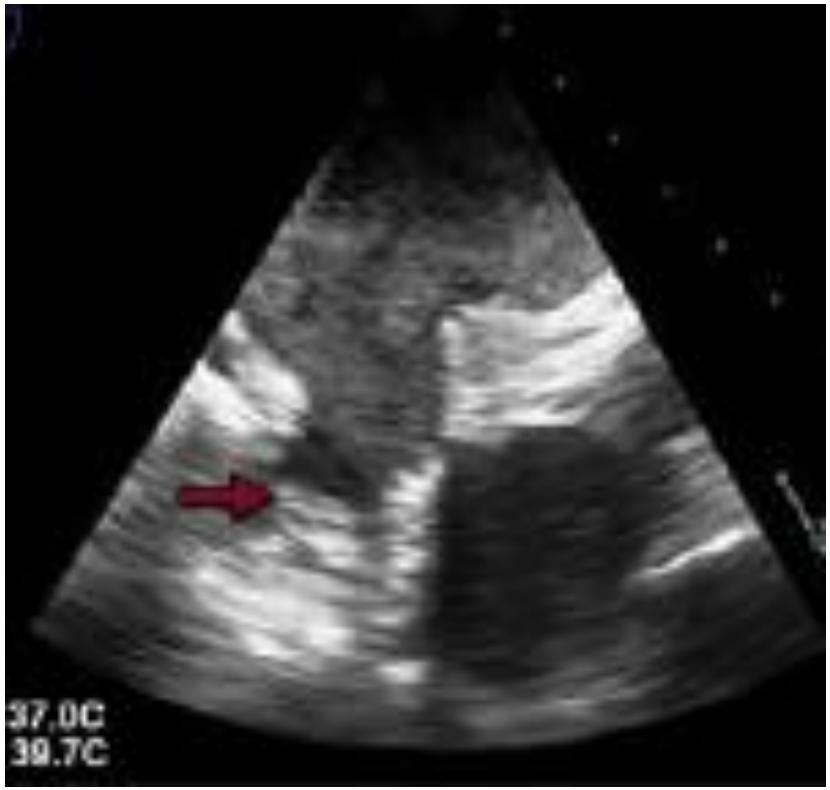
# Types of AFL




Joglar et al., Circulation 2024;1:e1-e156.

# AF is Associated with Thrombus Formation in the Atria

TEE With Contrast: Left Atrium




R Beigel et al., JACC Cardiovasc Imaging 2014;7:1251-1265.

TEE is the gold standard for LAA thrombus detection but cardiac CT and cardiac MR have excellent sensivity/specificity and are viable alternatives to TEE (T Vira et al., Europace 2018;21:e1-e10).

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# AF is Associated with Lower Cardiac Output and Can Precipitate Heart Failure

**Rapid and irregular heart rhythm in the context of AF can produce symptoms and can decrease quality of life.[1]**

**Sustained tachycardia due to AF can precipitate tachycardia-induced cardiomyopathy.[2]**

**AF and heart failure are both common: each makes the other more difficult to treat.[3]**


1. Ha et al., Circ Cardiovasc Qual Outcomes 2014;7:896-904.
2. Keefe et al., JACC Heart Fail 2024;12:605-615.
3. Joglar et al., Circulation 2024;1:e1-e156.

# Classification of AF

| Category | Duration |
|---|---|
| **Paroxysmal** | Intermittent, terminates within ≤7 days of onset |
| **Persistent** | Continuous for >7 days and requires intervention |
| **Long-Standing Persistent** | Continuous for ≥12 months |

Joglar et al., Circulation 2024;1:e1-e156.

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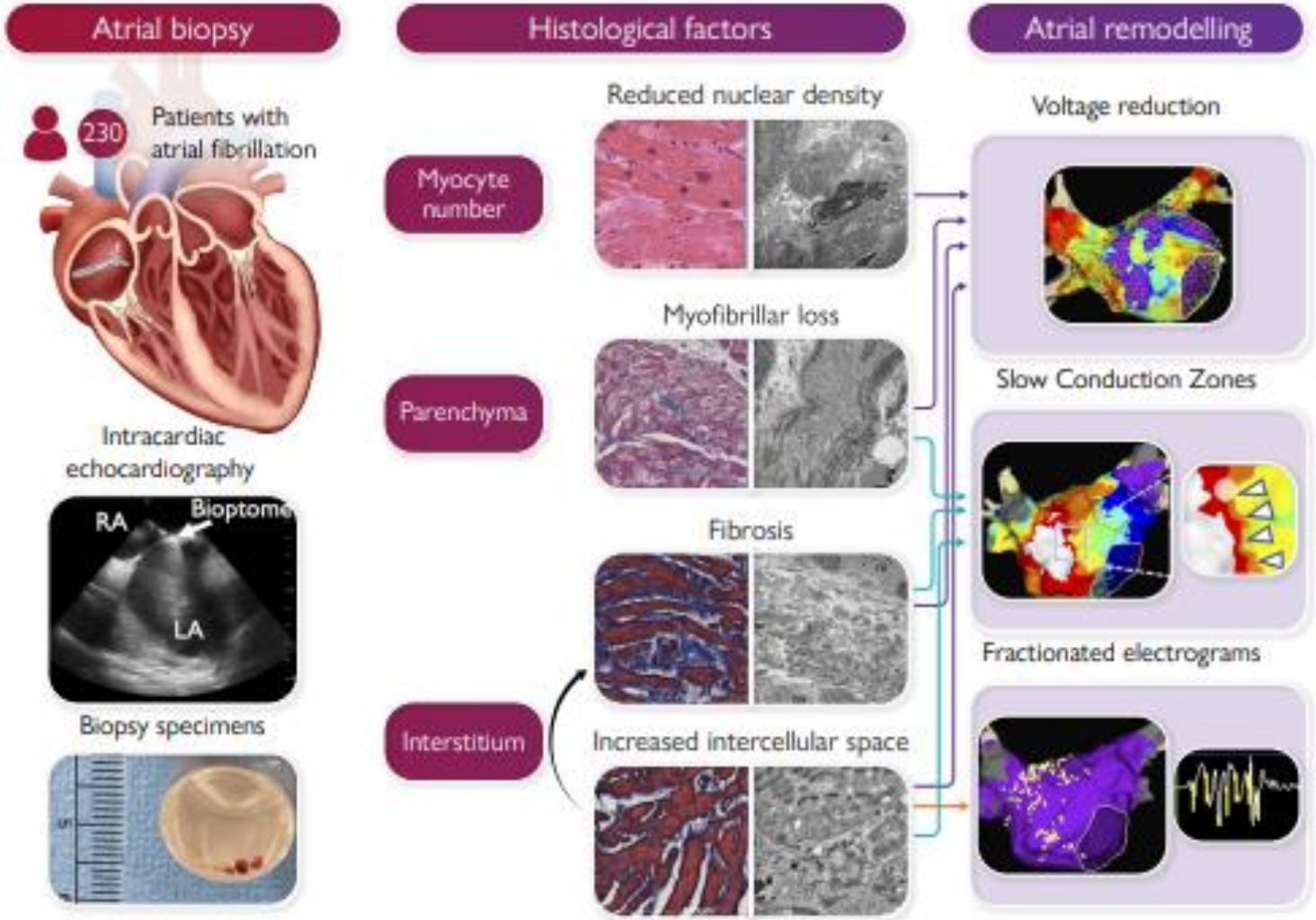
# AF-Related Atrial Remodeling




Takahashi et al., European Heart J 2023;44:3339-3353.

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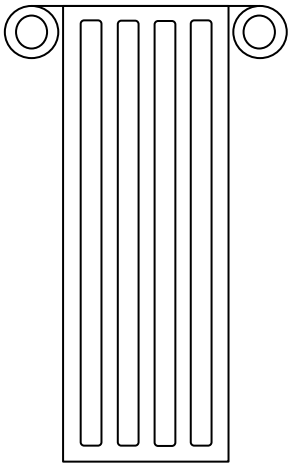
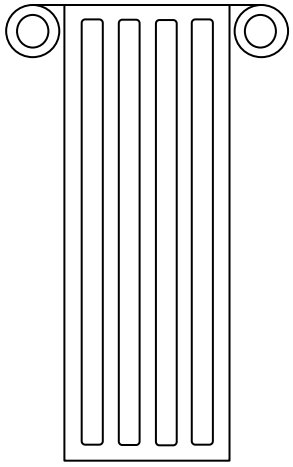
# Two “Pillars” of AF Management

**Reduce Risk of AF-Related Stroke**



**Minimize Hemodynamic Consequences of AF**



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# Stroke Prevention in Non-Valvular AF

- **Oral anticoagulant (OAC) therapy is the cornerstone of stroke risk reduction.[1]**

- **Appropriate use of OAC can reduce the risk of AF-related stroke by ~65%.**

- **Guidelines support the use of OAC for stroke risk reduction in qualifying patients with NVAF.[2,3]**

  *- Risk for AF-related stroke can be estimated with metrics (e.g., CHA2DS2-VASC).*

1. Alkhouli et al., JACC 2018;71:2790-2801.
2. Kirchof et al., Eur Heart J 2016;37:2893-2962.
3. Joglar et al., Circulation 2024;149:e1-e156.

# Identifying Patients who Qualify for OAC: Calculating Risk of NVAF-Related Stroke

**CHADS-VASC score**

**C**ongestive heart failure +1

**H**TN +1

**A**ge ≥ 65 +1

**A**ge ≥ 75 +1

**D**iabetes +1

**S**troke/TIA/thromboembolism +2

**S**ex (female) +1

**Vasc**ular disease (peripheral or CAD) +1

→ **Score = 1:** 0.6% CVA/year

→ **Score ≥ 2:** ≥ 2.2% CVA/year

Friberg et al., Eur Heart J 2012;33:1500-1510.

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# OAC Therapy for Patients with AF

## Vitamin K Antagonists (e.g., warfarin)

- Reduce stroke risk by 65%

## DOACs (e.g., apixaban)

- Superior stroke prevention than coumadin
- Lower bleeding risk than coumadin[1]

## Anti-platelets (e.g., aspirin, clopidogrel)

- Effectiveness debated[2]
- 19% stroke risk reduction (8 trials, >4,000 patients)

1. Hsu et al. 2018 Clin Pharmacol Ther 104:301-310.
2. Hsu et al. 2016 JACC 67:2913-2923.

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# OAC Therapy for Patients with AF

## Outcomes for patients with AF receiving OAC are better even if they have a stroke:

Severity and in-hospital mortality is reduced for patients receiving therapeutic coumadin or DOAC.[1]

## Lack of OAC is associated with higher risk of:

Initial stroke (OR 2.95)

Recurrent stroke (OR 2.8)

All-cause death (OR 2.75).[2]

1. Xian et al., JAMA 2017 ;317:1057-1067.
2. Mazurek et al., Stroke 2017;48:2198-2205.

# Question 3

Which of the following scenarios describes appropriate utilization of oral anticoagulation:

1. Use of eliquis in an 80-year-old woman with persistent AF and rheumatic mitral stenosis.
2. Use of coumadin in an 80-year-old woman with persistent AF and rheumatic mitral stenosis.
3. Use of eliquis in an 80-year-old woman with persistent AF and a mechanical aortic valve replacement.
4. Use of coumadin in an 80-year-old woman with persistent AF and a mechanical aortic valve replacement.
5. Choices 2 and 4.

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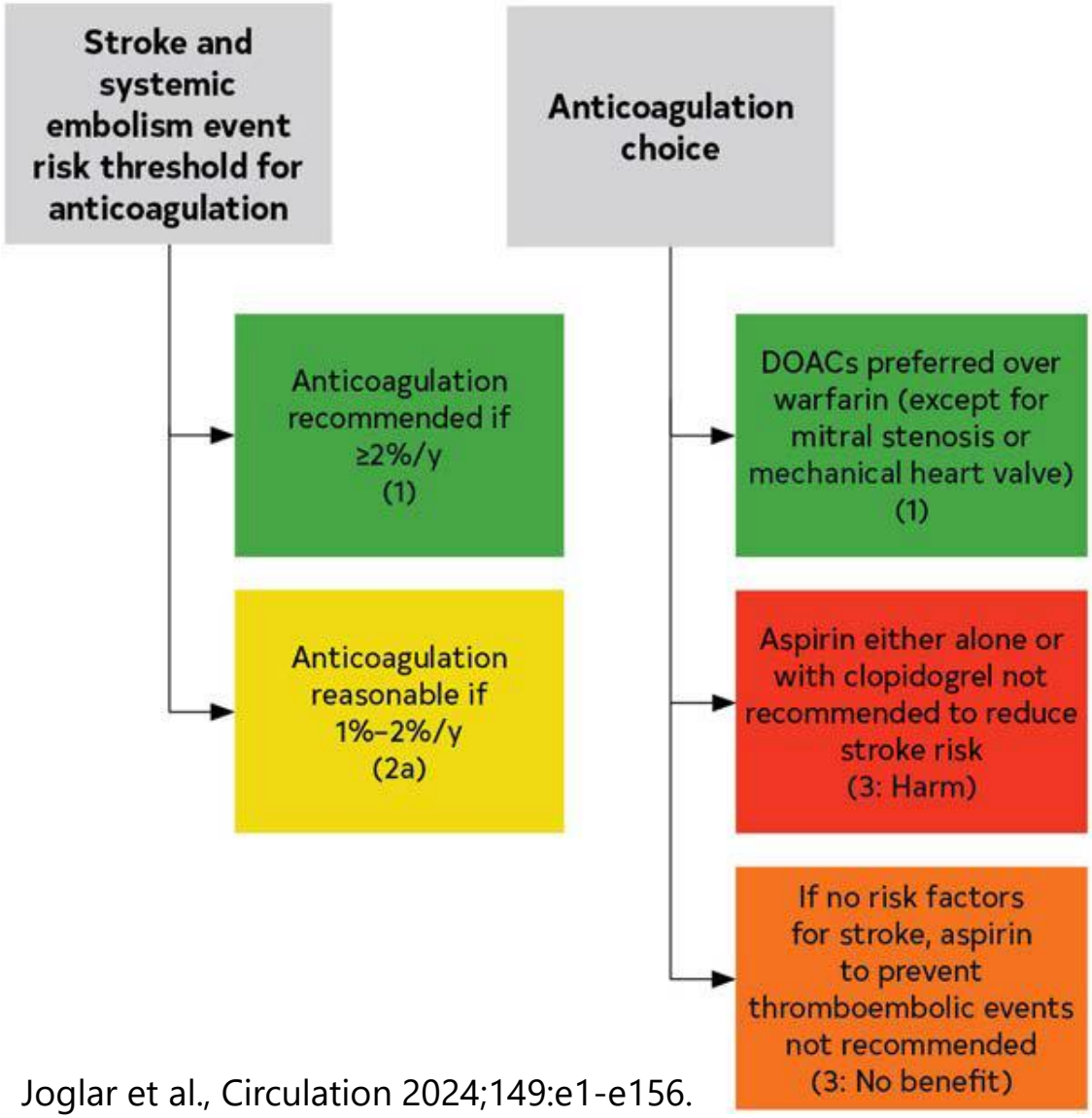
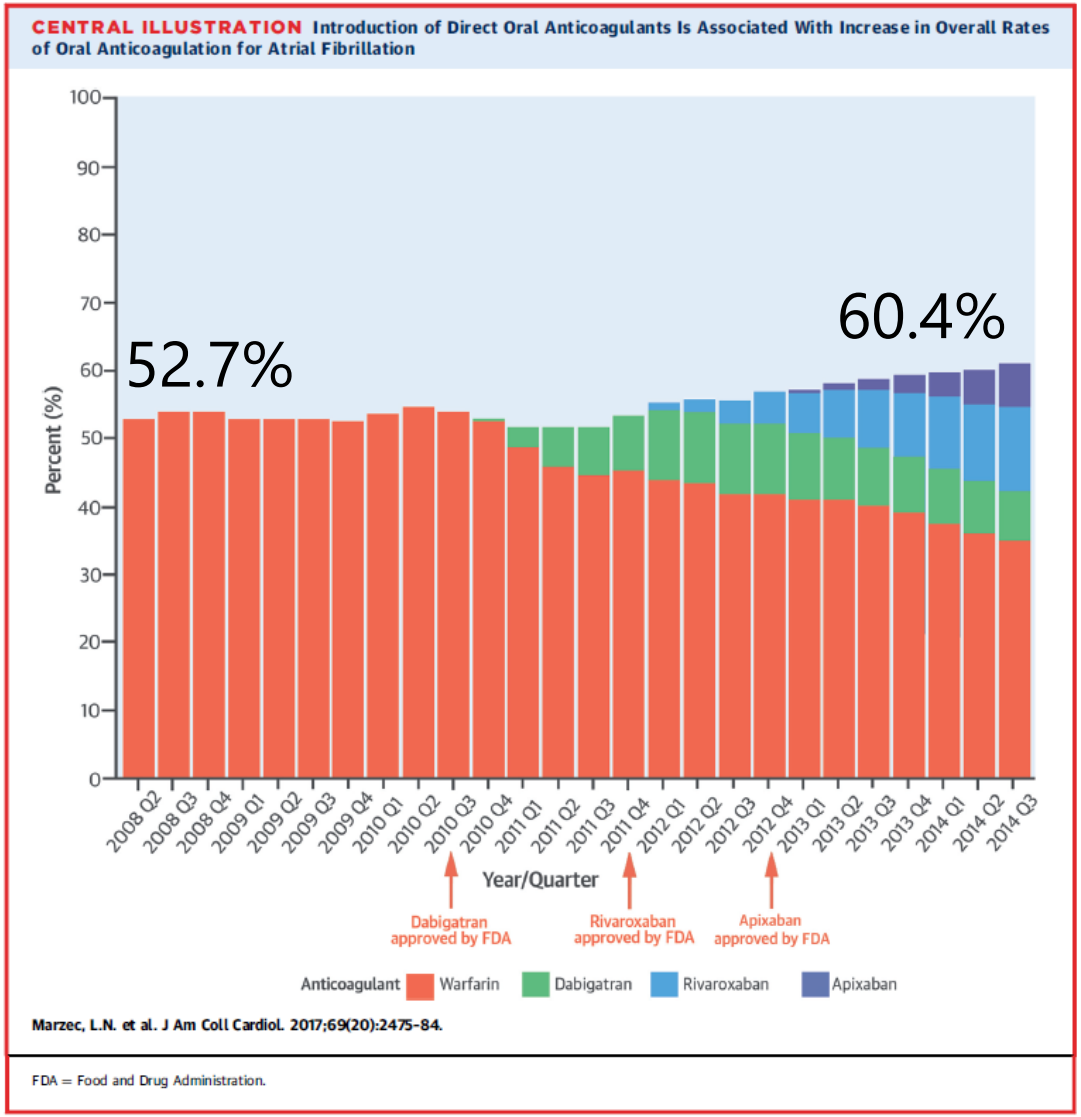
# Anticoagulation Options in AF




Joglar et al., Circulation 2024;149:e1-e156.

# Underutilization of Anticoagulation in the US




Marzec et al., JACC 2017;69:2475-2484.

# Primary Reason for Withholding Anticoagulant: Bleeding Risk

Bleeding risk associated with OAC use: HAS-BLED score

**H**TN (+1)
**A**bnormal liver fxn (+1)
**A**bnormal renal fxn (+1)
**S**troke/TIA (+1)
**B**leeding predisposition (+1)
**E**lderly: Age ≥ 65 (+1)
**D**rugs (anti-platelet) (+1)
**D**rugs (alcohol) (+1)

→ **Score 1:** 1% bleed/yr
→ **Score 2:** 1.9% bleed/yr
→ **Score 3:** 3.7% bleed/yr
→ **Score 4:** 8.7% bleed/yr
→ **Score 5:** >10% bleed/yr

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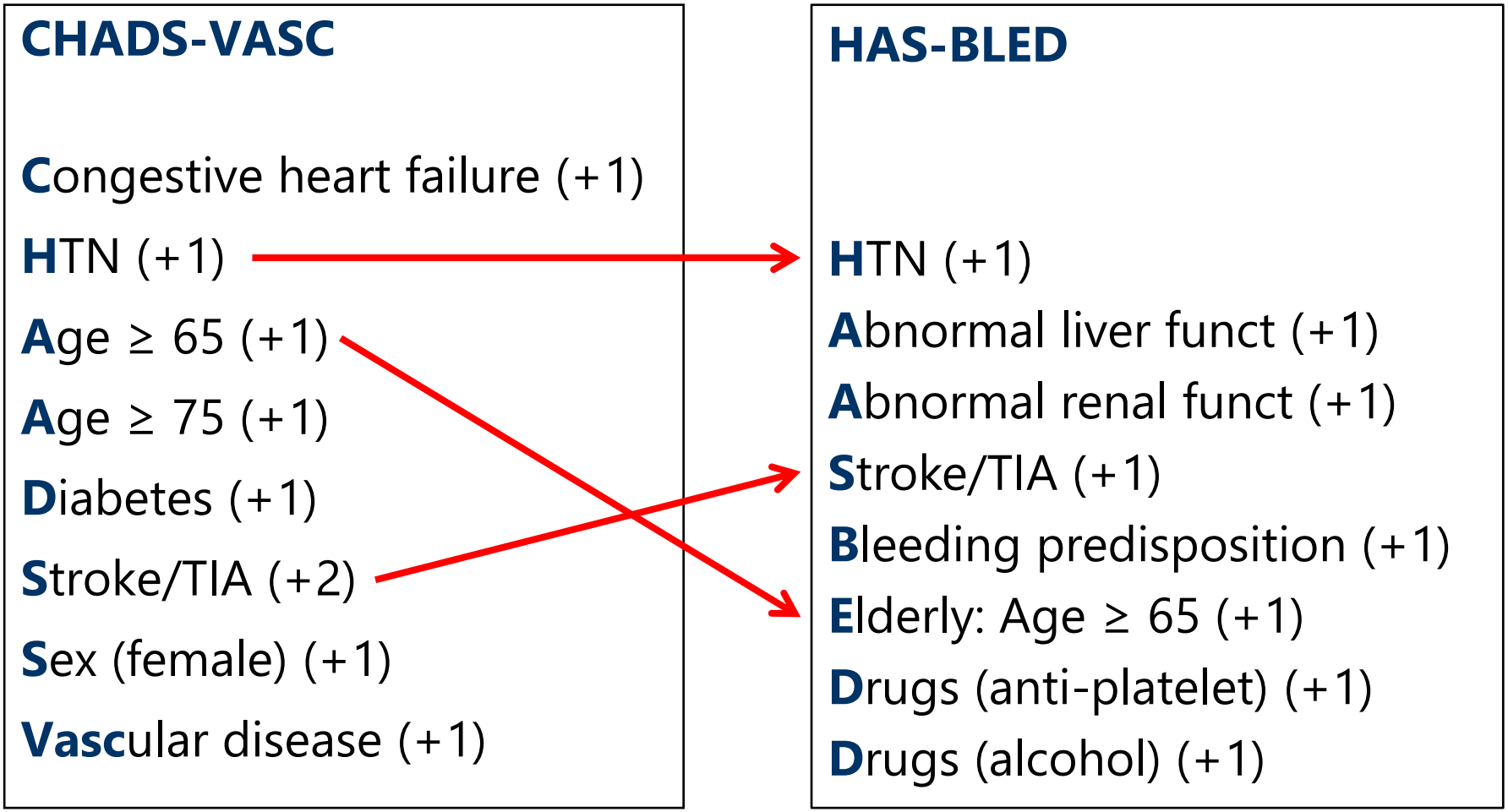
# Underutilization of OAC: Stroke Risk and Bleeding Risk Rise Together

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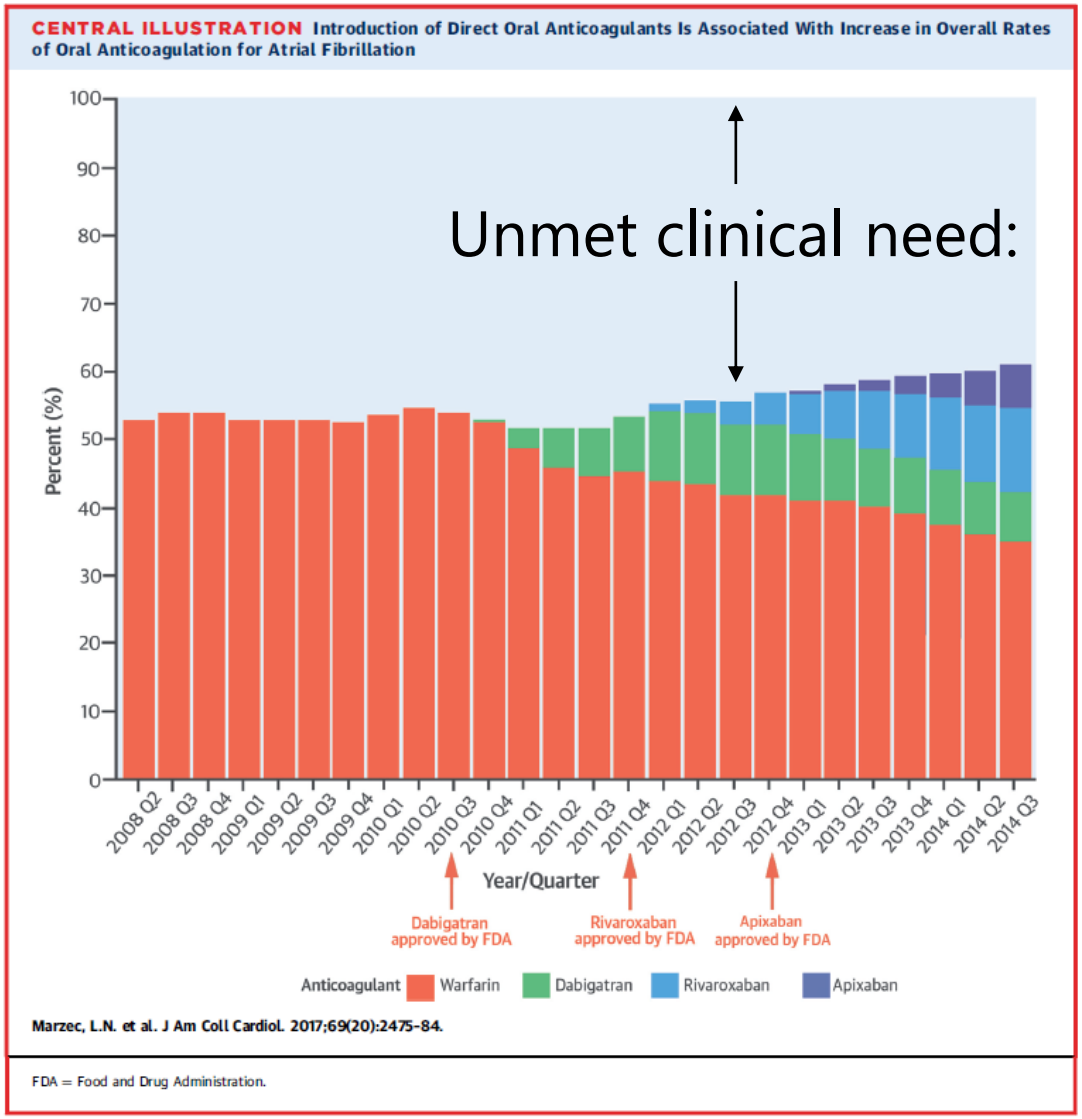


Marzec et al., JACC 2017;69:2475-2484.

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# Question 4

What is the most appropriate stroke prevention strategy for: 82-year-old woman with AF and prior stroke, eliquis 5mg twice daily not tolerated due to gait instability and repeated falls with subdural hemorrhages:

1. Aspirin 81mg daily
2. Eliquis 2.5mg twice daily
3. Surgical ligation of the left atrial appendage
4. Percutaneous left atrial appendage occlusion

# Question 4

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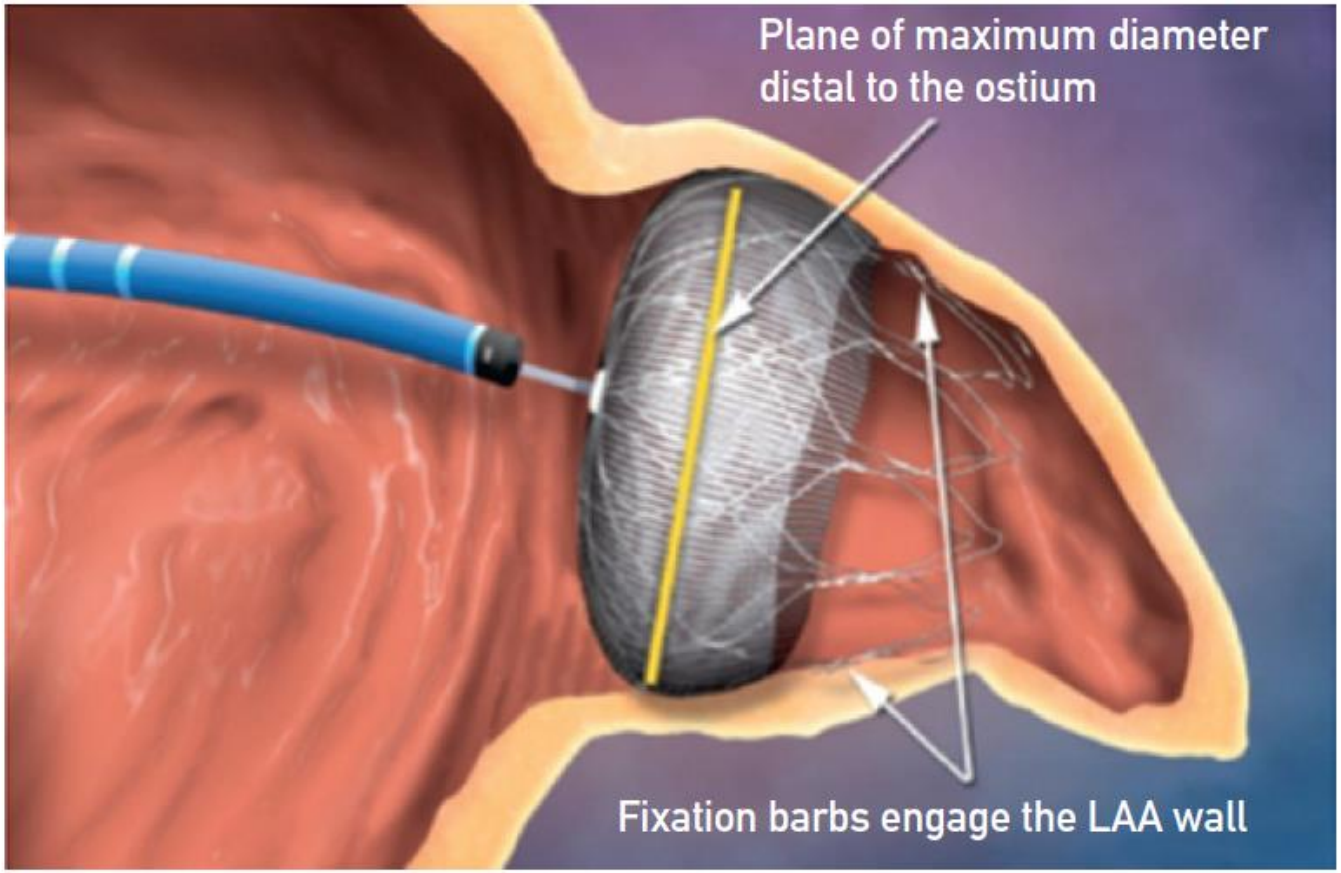
# Thrombi that Cause AF-Related Stroke Usually Emanate from the Left Atrial Appendage

| Study | # of patients | Thrombus in LAA | Thrombus in LA cavity |
|---|---|---|---|
| Stoddard et al. 1995 JACC 25:452-459 | 317 | 66 | 1 |
| Manning et al. 1994 Circ 90:1-21a | 233 | 34 | 1 |
| Aberg et al. 1969 Acta Med Scand 185:373-379 | 506 | 35 | 12 |
| Tsai et al. 1990 J Formosan Med Assoc 89:270-274 | 52 | 2 | 2 |
| Brown et al. 1993 Int J Card Imaging 9:65-72 | 48 | 12 | 1 |
| Manning et al. 1994 Circ 90:1202a | 171 | 8 | 3 |
| Klein et al. 1994 Circ 90 (Suppl 1):21a | 359 | 19 | 1 |
| Leung et al. 1994 JACC 24:755-762 | 272 | 19 | 0 |
| Hart et al. 1994 Stroke 25:1337-1341 | 60 | 6 | 0 |
| **Total** | **1,288** | **201 (91%)** | **21** |

Blackshear JL et al., Ann Thorac Surg 1996;61:755-759
Odell JA et al., Ann Thorac Surg 1996;61:565-569

# Watchman Device Deployed in the LAA




Holmes DR et al., Mayo Clinic Proc 2019;94:864-874.

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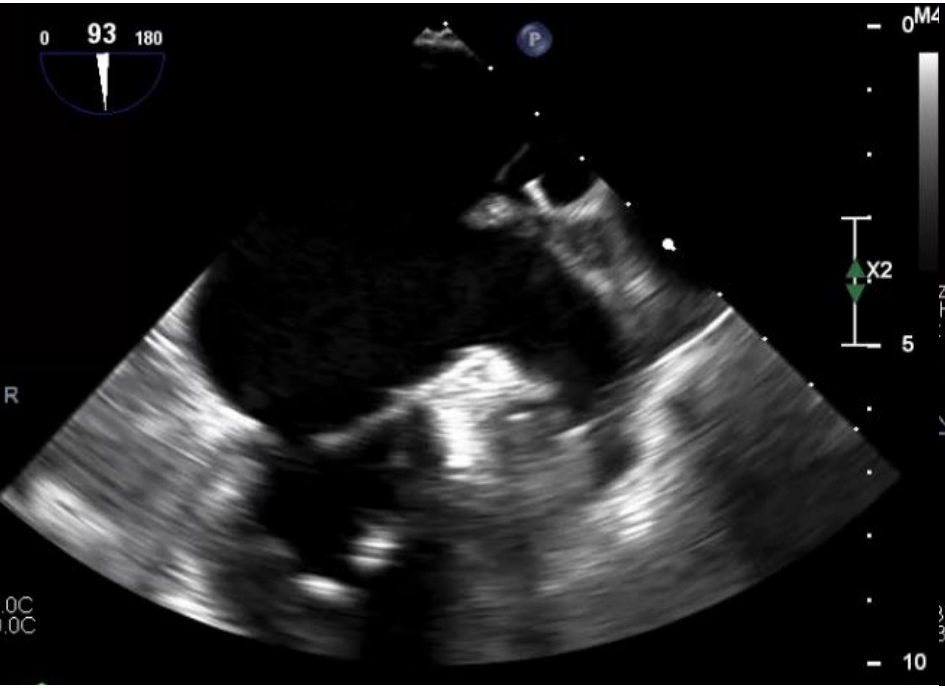
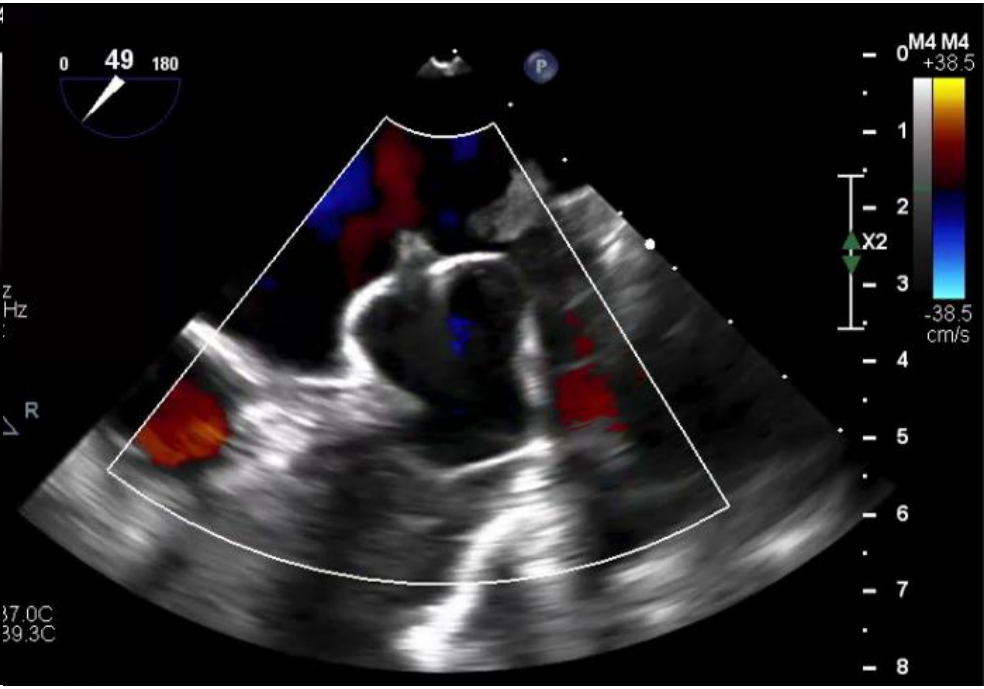
# TEE Visualization of Watchman Device in the Left Atrial Appendage (TEE)

Before Watchman




After Watchman

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# Watchman Clinical Trials

## Randomized Clinical Trials: Watchman vs Coumadin

- PROTECT AF (NCT00129545)[1]
  - Watchman non-inferior and superior to coumadin for mortality, MACE
- PREVAIL (NCT01182441)[2]
  - Watchman non-inferior to coumadin except for cardiovascular/unexplained death

1. Holmes DR et al., Lancet 2009;374:534-542.
2. Reddy V et al., Stroke 2018;49:1464-1470.

# Cost Effectiveness of LAA Occlusion

- Based on the pivotal trials, LAA occlusion is cost-saving compared with DOACs in 5 years and coumadin in 10 years.[1]
- LAA occlusion is the lowest cost therapy at 5 years (patient out-of-pocket costs).[2]
- LAA occlusion is the lowest cost therapy at 10 years (Medicare).[1]

1. Reddy et al., JACC 2015;66:2728-2739.
2. Reddy et al., JACC 2017;70:880.

# Ongoing/Future Clinical Trials: Watchman vs DOACs

| Trial (identifier) | Subpopulation with NVAF | LAAO device | Control group |
|---|---|---|---|
| OPTION (NCT03795298) | 1,600 patients undergoing ablation | WATCHMAN FLX | Direct OAC |
| CHAMPION-AF (NCT04394546) | 3,000 patients eligible for long-term OAC | WATCHMAN FLX | Direct OAC |
| CATALYST (NCT04226547) | 2,650 patients eligible for long-term OAC | Amulet | Direct OAC |
| OCCLUSION-AF (NCT03642509) | 750 patients eligible for long-term OAC | WATCHMAN FLX, Amulet | Direct OAC |
| ASAP-TOO (NCT02928497) | 888 patients with a contraindication to OAC | WATCHMAN 2.5 | Aspirin or no medication |
| CLOSURE-AF (NCT03463317) | 1,512 patients at high risk of bleeding or with a contraindication to OAC | Any device with a CE mark | Direct OAC or VKA |
| COMPARE-LAAO (NCT04676880) | 609 patients with a contraindication to OAC | WATCHMAN FLX, Amulet | Antiplatelet or no medication |
| STROKECLOSE (NCT02830152) | 750 patients with intracerebral haemorrhage in past 12 months | Amulet | No medication, OAC or antiplatelet |
| CLEARANCE (NCT04298723) | 550 patients with intracerebral haemorrhage | WATCHMAN FLX | No medication, OAC or antiplatelet |
| LAA-KIDNEY (NCT05204212) | 430 patients with end-stage renal disease (eGFR <15 ml/min/1.73 $m^2$) | Amulet | Best medical therapy |
| LAAOS-4 (NCT05963698) | 4,000 patients with $CHA_2DS_2$-VASc score of ≥4 | WATCHMAN FLX plus direct OAC | Direct OAC alone |

eGFR, estimated glomerular filtration rate; LAAO, left atrial appendage occlusion; NVAF, non-valvular atrial fibrillation; OAC, oral anticoagulation; VKA, vitamin K antagonist.

J Saw et al., Nat Rev Cardiol 2024;21:153-154

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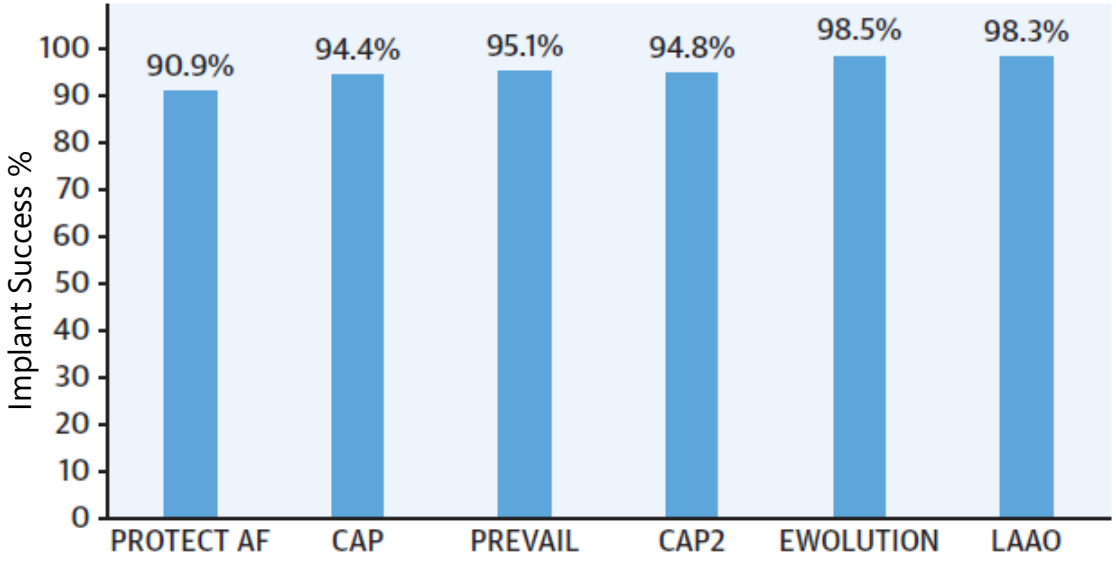
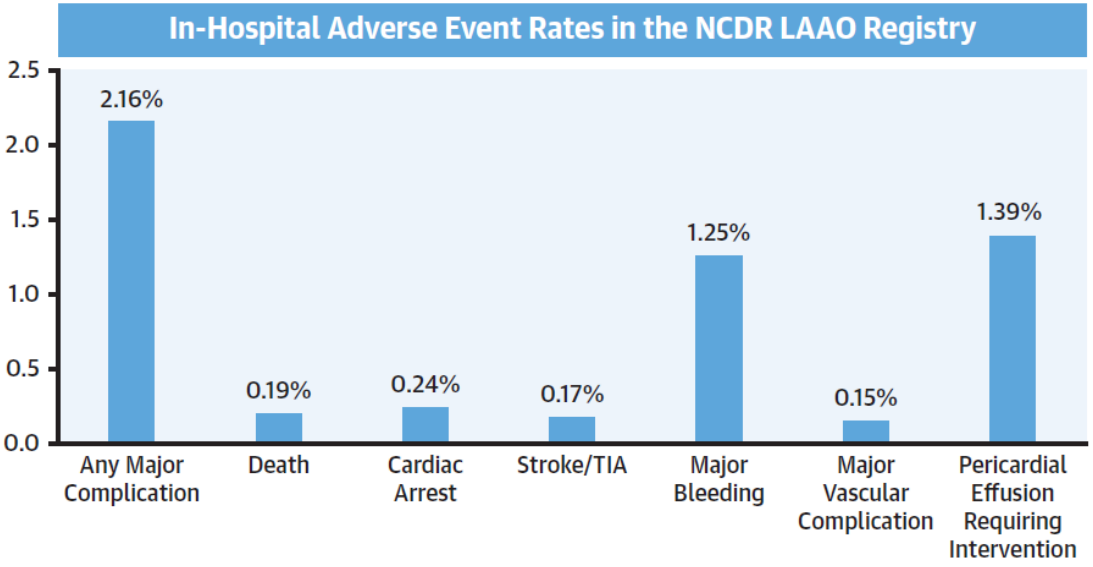
# Watchman Implantation Outcomes: Clinical Trials versus Post-Approval Registry




Freeman JV et al.,
J Am Coll Cardiol
2020;75:1503-1518

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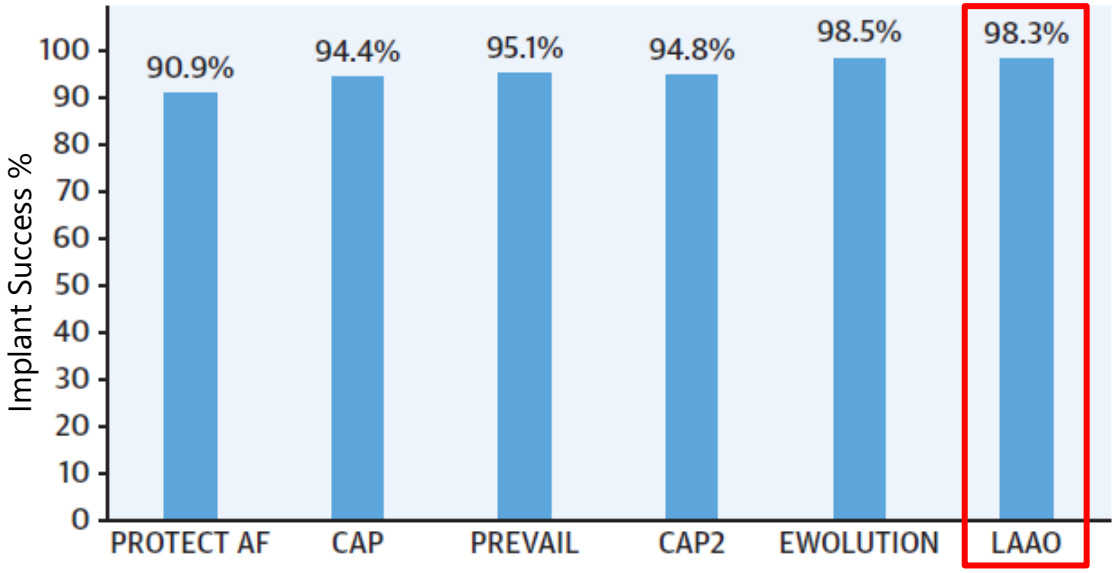


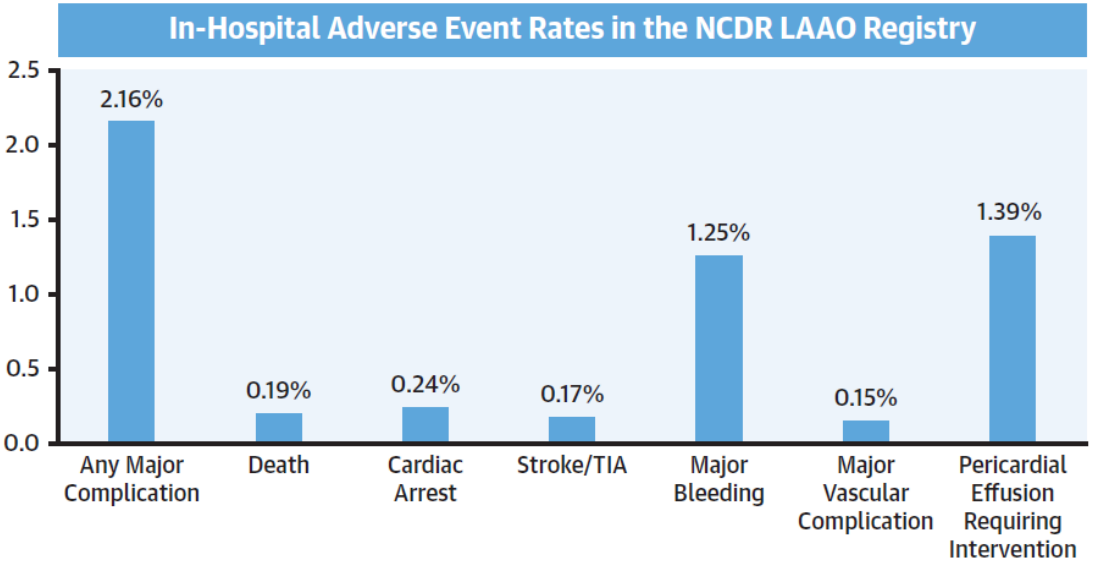


Freeman JV et al., J Am Coll Cardiol 2020;75:1503-1518

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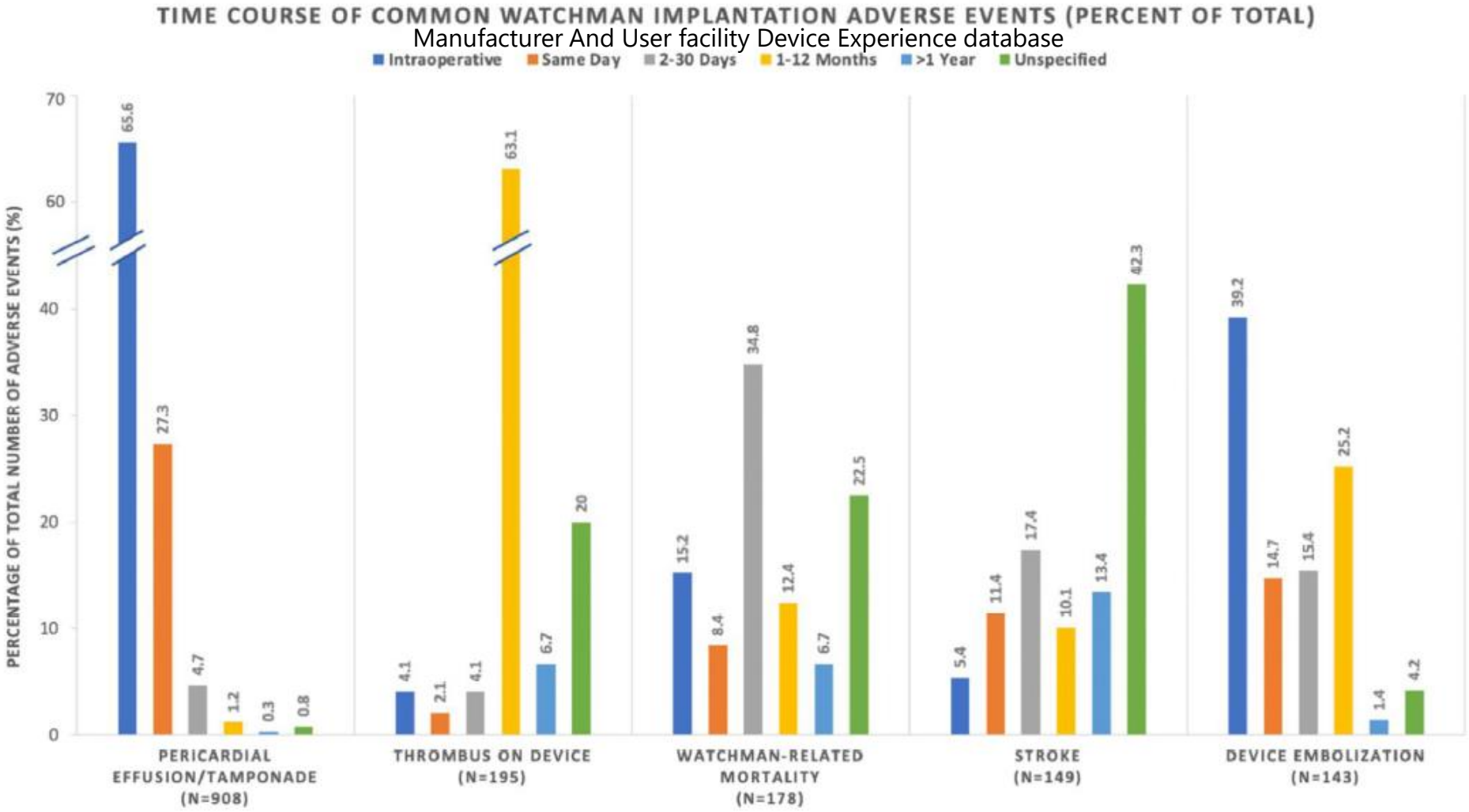
# Safety Considerations after Watchman Implantation: Analysis of the MAUDE Database

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Ledesma et al., Am J Cardiol 2021;152:78-87

# Incomplete LAA Occlusion

**The LAA orifice is typically oval, and the Watchman device is round, raising the possibility of blood leakage around the device.**

**Significant leak has been defined to be 1 to 5mm on TEE.**

**Leak >5 mm is an indication for continuation of OAC.**

**Leak closure can also be considered in such cases.[1]**

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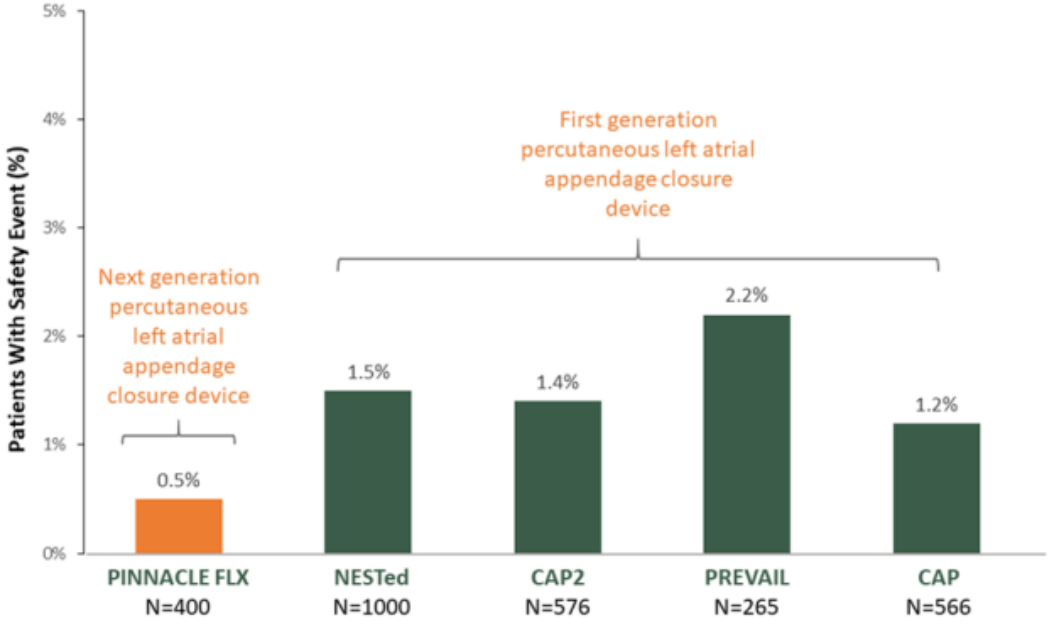
1. Alkhouli et al., JACC Cardiovasc Interv 2018;11:e83-e85.

# Next Generation Watchman Devices

**Watchman FLX:**

- Decreased pericardial effusion and device embolism
- Improved device sealing
- Evaluated with PINNACLE FLX Trial (NCT02702271)




Kar et al., Circulation 2021;143:1754-1762.

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# Percutateous Approach to LAA Occlusion

| COR | LOE | Recommendations |
|---|---|---|
| **2a** | **B-NR** | In patients with AF, a moderate to high risk of stroke (CHA2DS2-VASc score ≥2), and a contraindication to long-term oral anticoagulation due to a nonreversible cause, percutaneous LAAO (pLAAO) is reasonable. |
| **2b** | **B-R** | In patients with AF and a moderate to high risk of stroke and a high risk of major bleeding on oral anticoagulation, pLAAO may be a reasonable alternative to oral anticoagulation based on patient preference, with careful consideration of procedural risk and with the understanding that the evidence for oral anticoagulation is more extensive. |

Joglar et al., Circulation 2024;149:e1-e156.

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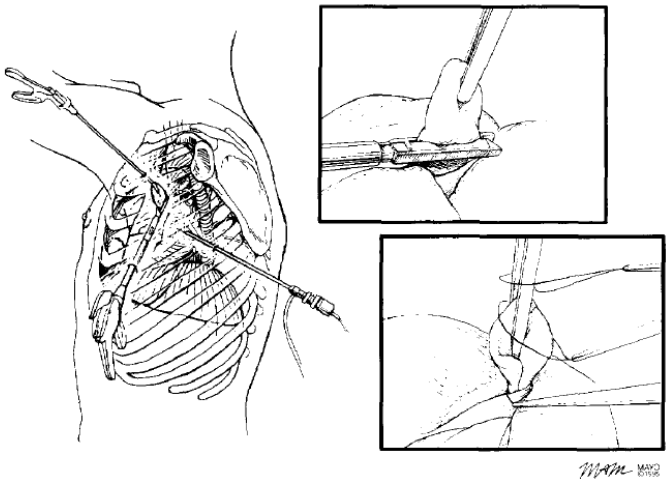
# Other LAA Occlusion Devices

- **Endocardial:**
  - Amplatzer Cardiac Plug (ACP)
  - Amulet
- **Epicardial/Surgical:**
  - AtriClip
  - Lariat

# Surgical LAA Occlusion

- Surgical LAA occlusion has been described and is typically performed in the context of other cardiac surgery (e.g., valve surgery, CABG).
- Techniques for closure vary, including oversew of the appendage versus true amputation.



Adapted from Odell JA et al., Ann Thoracic Surg 1996;61:565-569.

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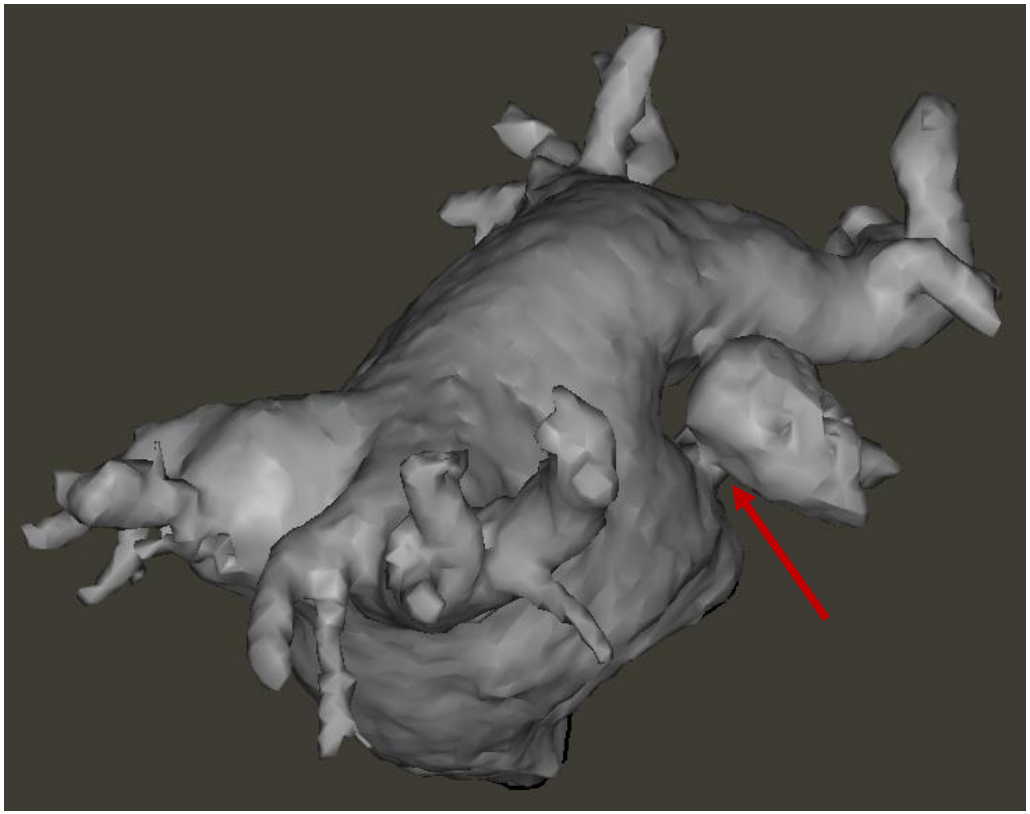
# Surgical LAA Occlusion

Incomplete closure is associated with thromboembolic events.



Aryana et al., Heart Rhythm 2015;12:1431-1437.
Ptaszek et al., J Innov Card Rhythm Mgmt 2013;4:1237-1241

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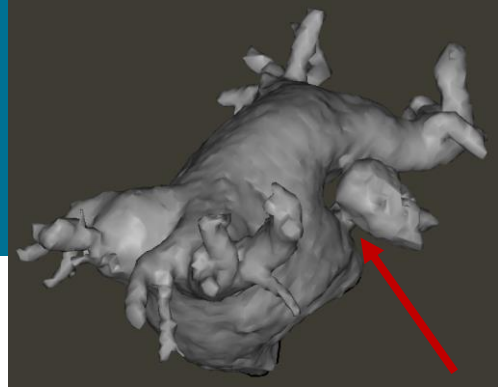
# Surgical LAA Occlusion



| COR | LOE | Recommendations |
|---|---|---|
| **1** | **A** | In patients with AF undergoing cardiac surgery with a CHA2DS2-VASc score ≥2 or equivalent stroke risk, surgical LAA exclusion, in addition to continued anticoagulation, is indicated to reduce the risk of stroke and systemic embolism. |
| **1** | **A** | In patients with AF undergoing cardiac surgery and LAA exclusion, a surgical technique resulting in absence of flow across the suture line and a stump of <1 cm as determined by intraoperative transesophageal echocardiography should be used. |
| **2b** | **A** | In patients with AF undergoing cardiac surgery with CHA2DS2-VASc score ≥2 or equivalent stroke risk, the benefit of surgical LAA exclusion in the absence of continued anticoagulation to reduce the risk of stroke and systemic embolism is uncertain. |



Joglar et al., Circulation 2024;149:e1-e156.

# Second "Pillar" of AF Management: Address Hemodynamic Consequences

- **For each patient, the clinician must decide if a rate control strategy or a rhythm control strategy is most appropriate.**
- **In some situations, the decision to adopt a rhythm control strategy can be straightforward:**
  - *Adequate rate control cannot be achieved*
  - *Intolerable symptoms even with adequate rate control*
  - *Heart failure*
- **What about rate versus rhythm control in the general population of patients with AF?**

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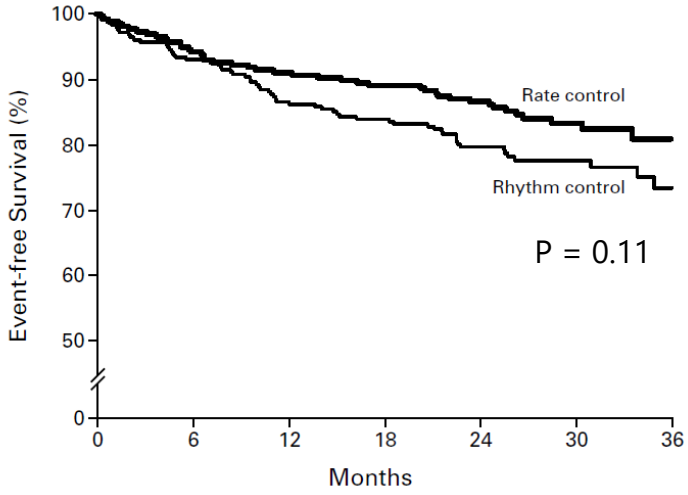
# Rate vs Rhythm Control: RACE and AFFIRM

The RACE and AFFIRM trials concluded rate control is non-inferior to rhythm control (anti-arrhythmic drugs and cardioversion only, ablation therapy was not included).

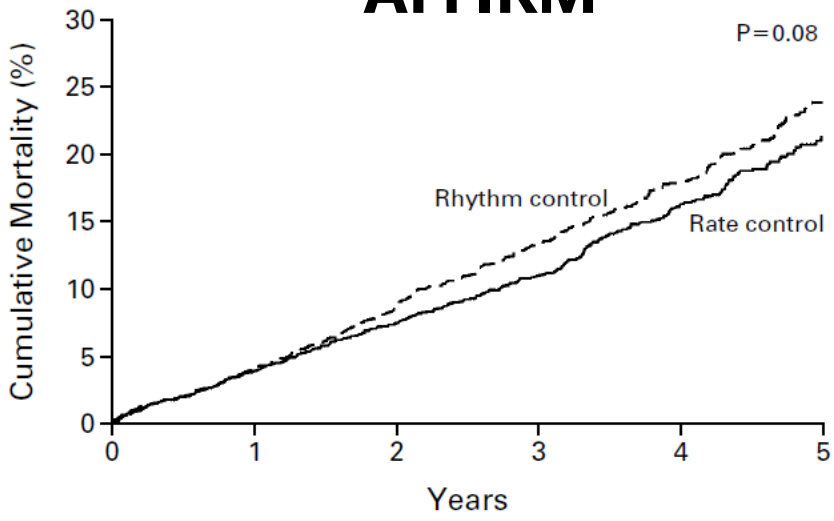
## RACE




| No. at Risk | | | | | | | |
|---|---|---|---|---|---|---|---|
| Rate control | 256 | 239 | 232 | 222 | 212 | 99 | 25 |
| Rhythm control | 266 | 243 | 224 | 218 | 207 | 85 | 24 |

IC Van Gelder et al., NEJM 2002;347:1834-1840.

## AFFIRM




| No. of Deaths | | | | | | |
|---|---|---|---|---|---|---|
| | number (percent) | | | | | |
| Rhythm control | 0 | 80 (4) | 175 (9) | 257 (13) | 314 (18) | 352 (24) |
| Rate control | 0 | 78 (4) | 148 (7) | 210 (11) | 275 (16) | 306 (21) |

AFFIRM Investigators, NEJM 2002;347:1825-1833

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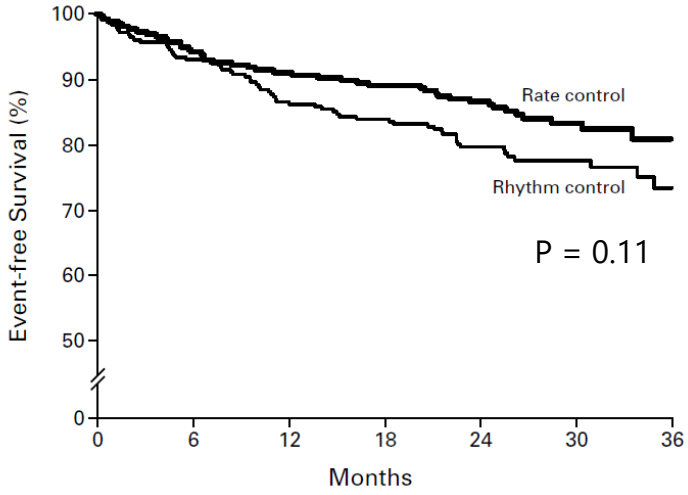
# Rate vs Rhythm Control: RACE and AFFIRM

The RACE and AFFIRM trials concluded rate control is non-inferior to rhythm control

## RACE

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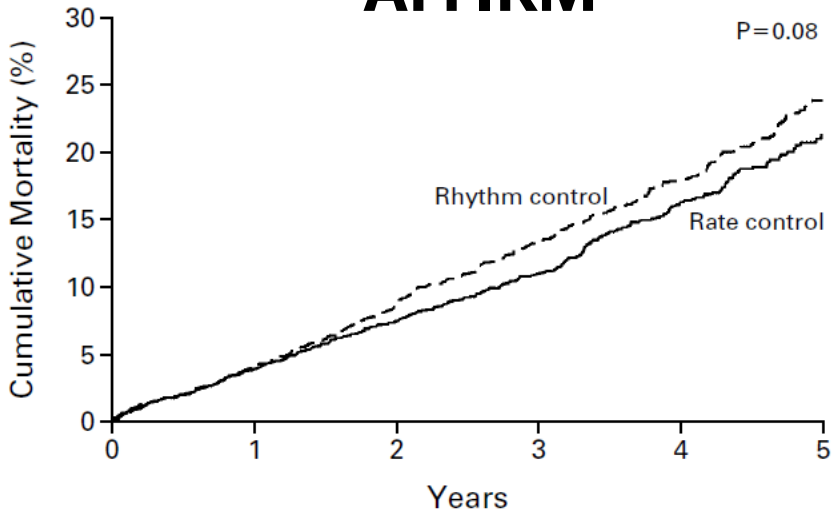
IC Van Gelder et al., NEJM 2002;347:1834-1840.

From four weeks before until four weeks after electrical cardioversion, all patients received acenocoumarol or fenprocoumon (target international normalized ratio [INR], 2.5 to 3.5). If sinus rhythm was present at one month, the oral anticoagulant could be stopped or changed to aspirin (80 to 100 mg daily). Aspirin was also allowed

## AFFIRM




| No. of Deaths | | number (percent) | | | | |
|---|---|---|---|---|---|---|
| Rhythm control | 0 | 80 (4) | 175 (9) | 257 (13) | 314 (18) | 352 (24) |
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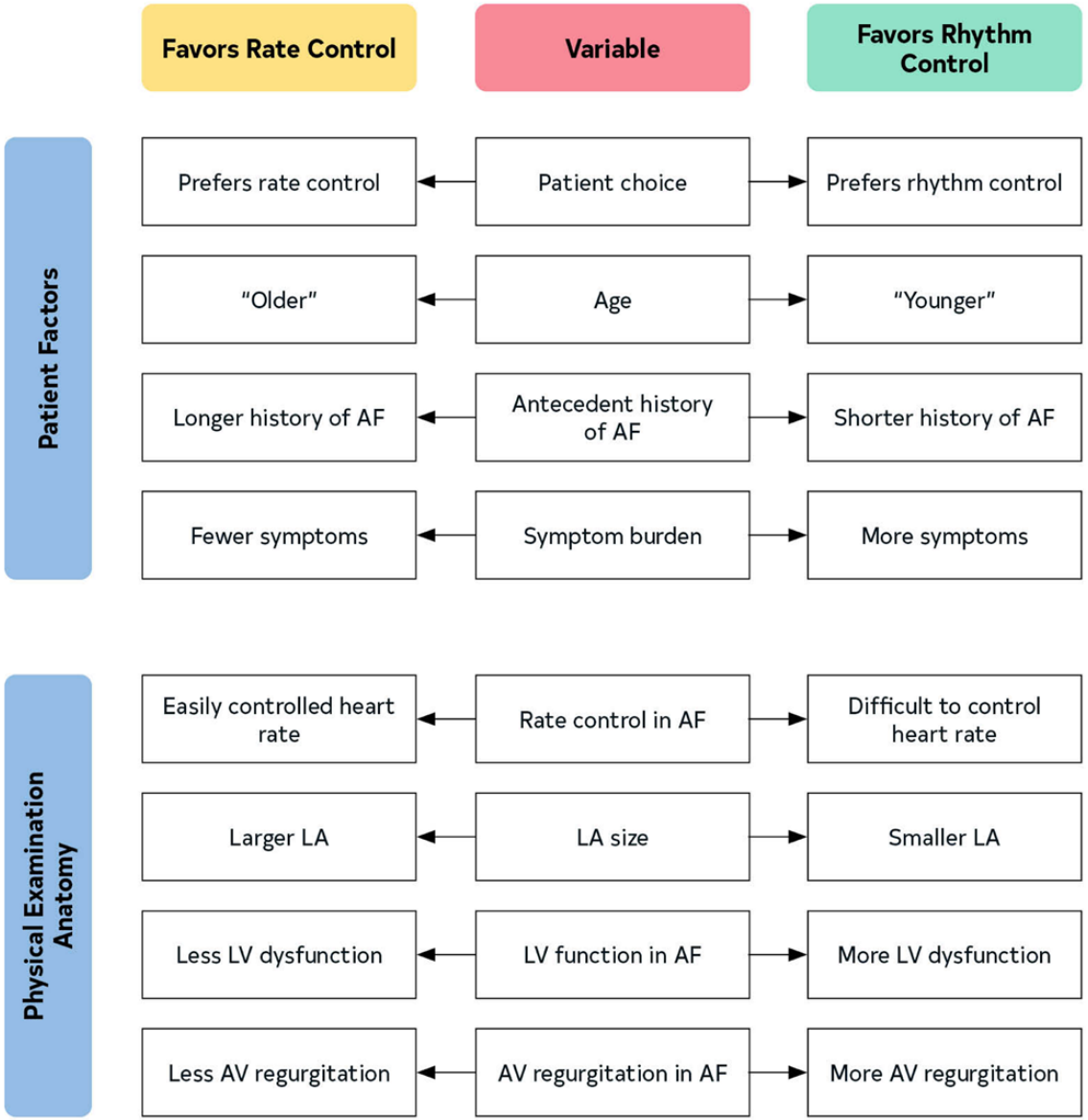
AFFIRM Investigators, NEJM 2002;347:1825-1833

international normalized ratio (INR) of 2.0 to 3.0. In the rhythm-control group, continuous anticoagulation was encouraged but could be stopped at the physician's discretion if sinus rhythm had

# Rate versus Rhythm Control




Joglar et al.,
Circulation 2024;149:e1-e156.

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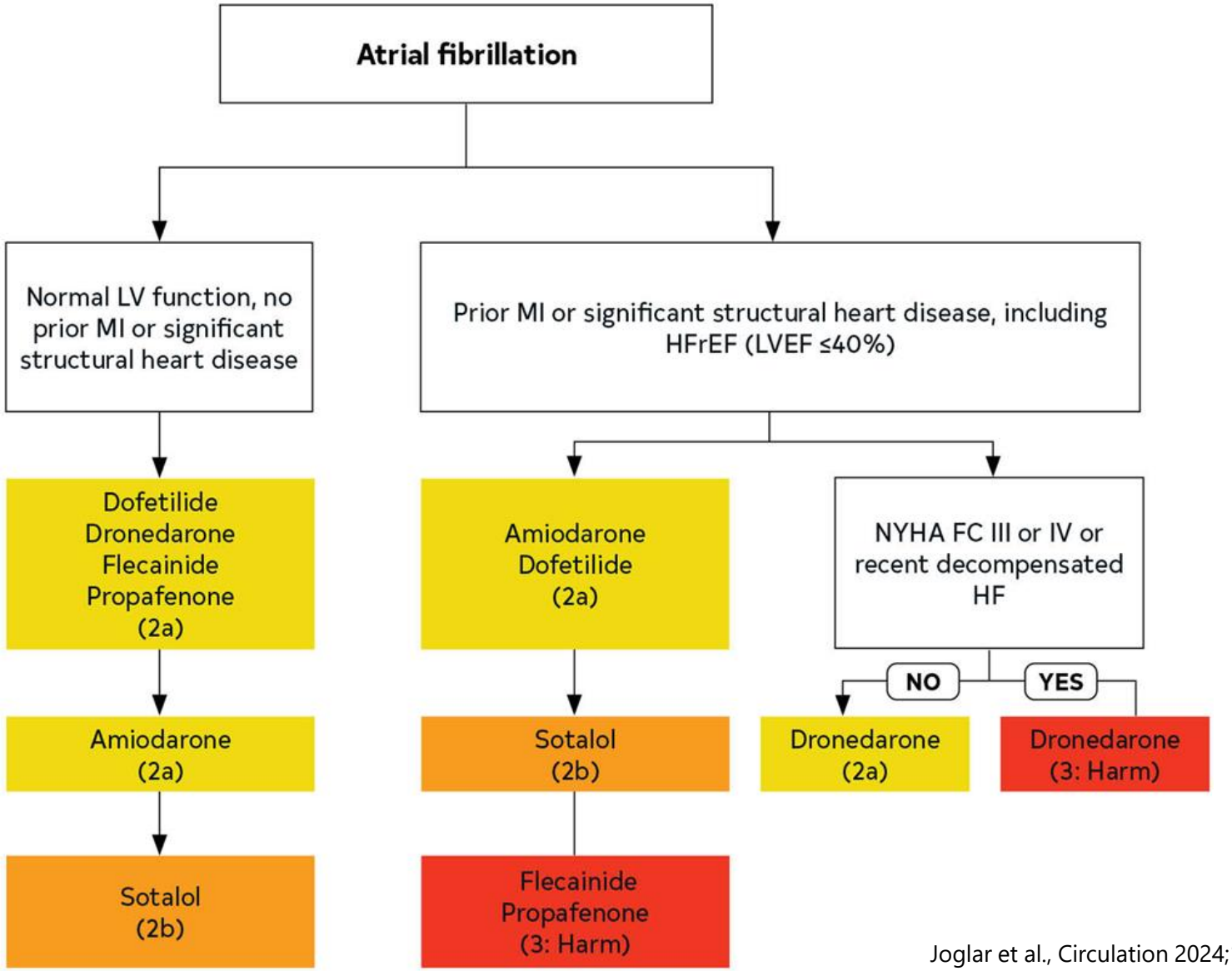
# Rhythm Control with Drug Therapy

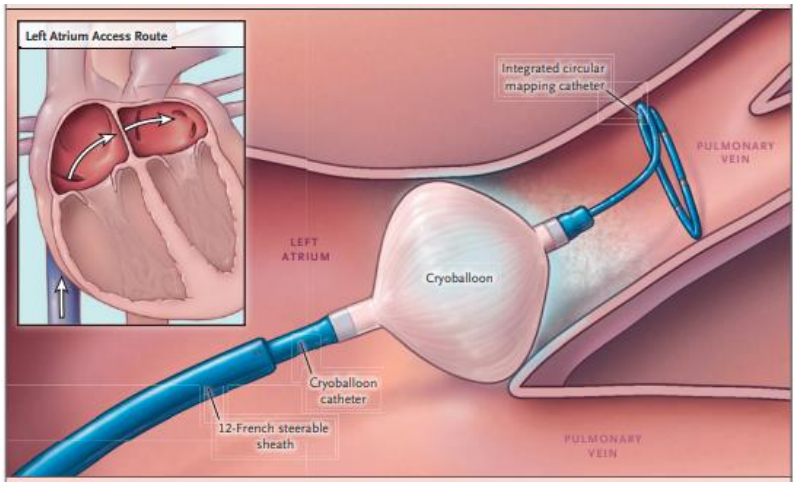




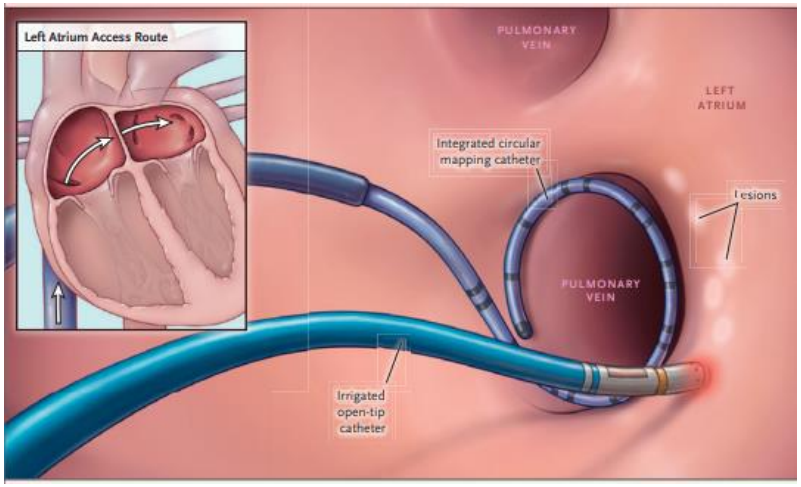

Joglar et al., Circulation 2024;149:e1-e156.

# Rhythm Control with Catheter Ablation

Cryoablation




Radiofrequency Ablation




Kuck et al., NEJM 2016;374:2235-2245

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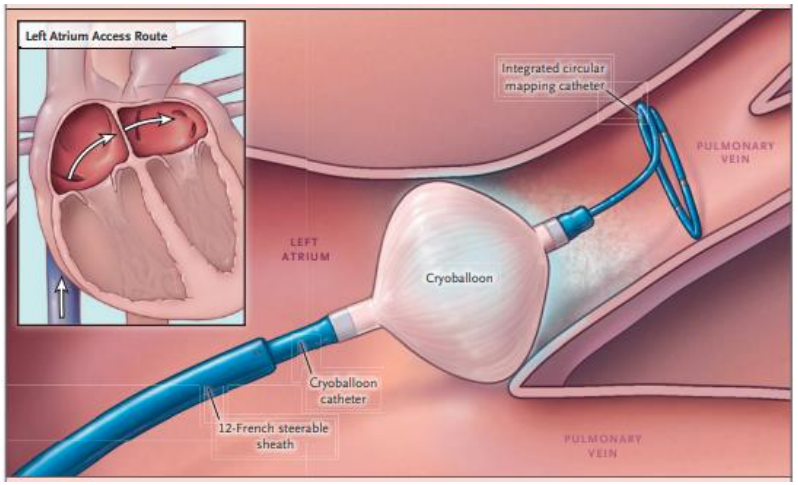
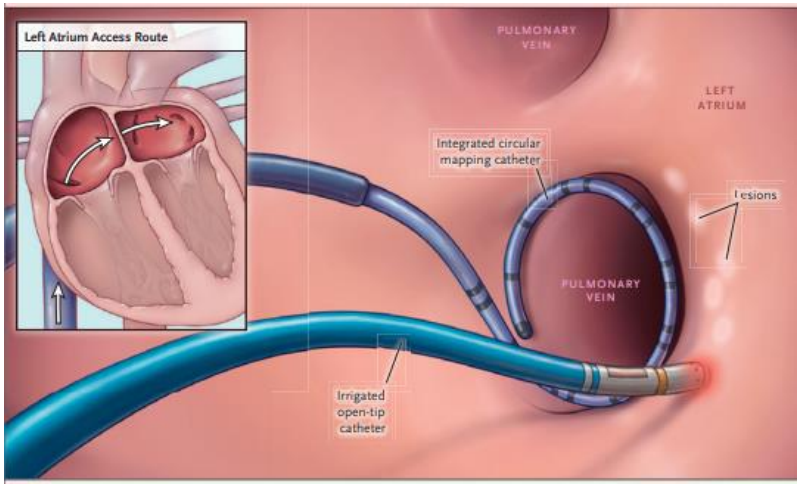
# Rhythm Control with Catheter Ablation

Cryoablation




Radiofrequency Ablation




Ablation creates thermal injury which prevents electrical conduction

Kuck et al., NEJM 2016;374:2235-2245

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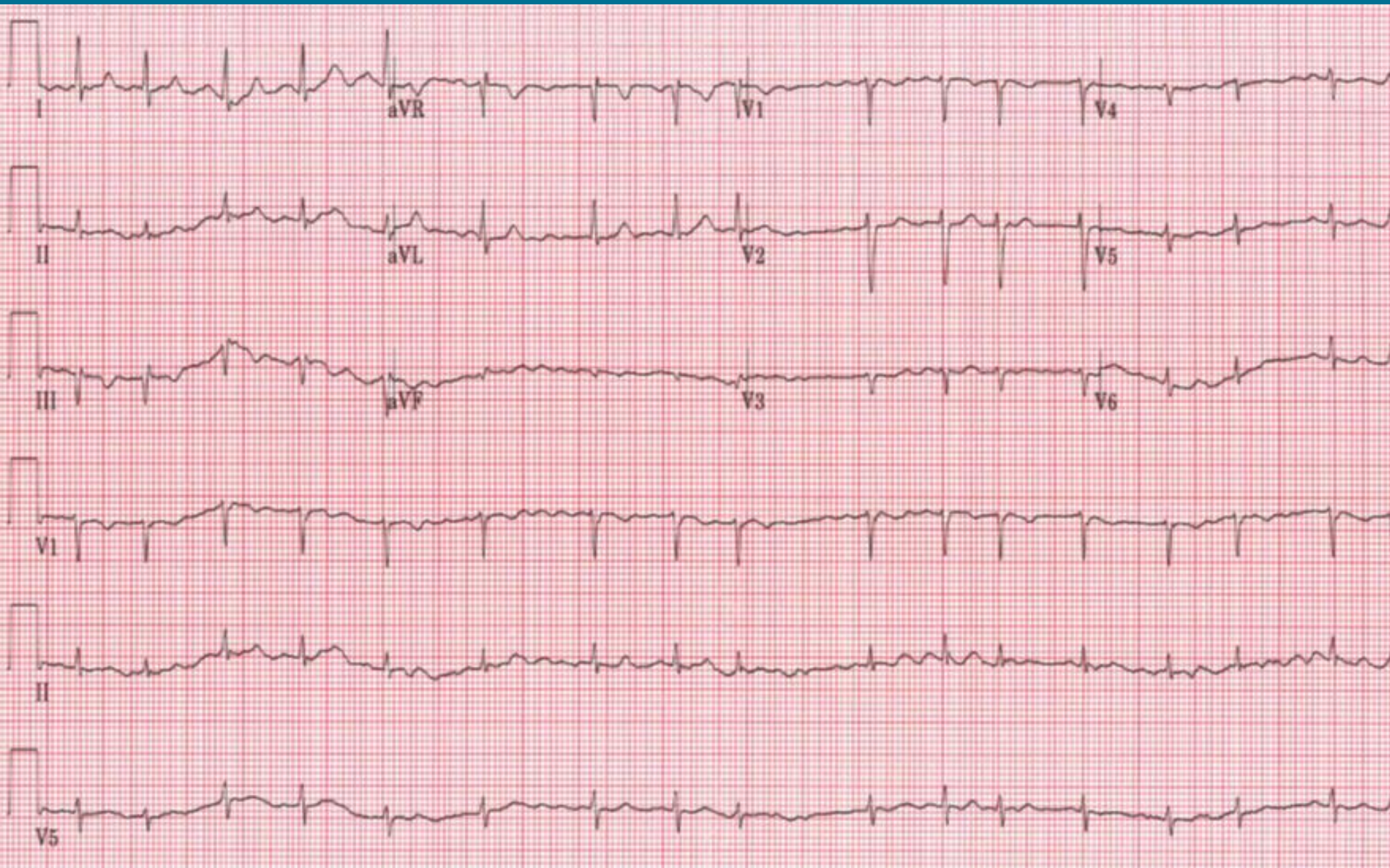
# Atrial Fibrillation



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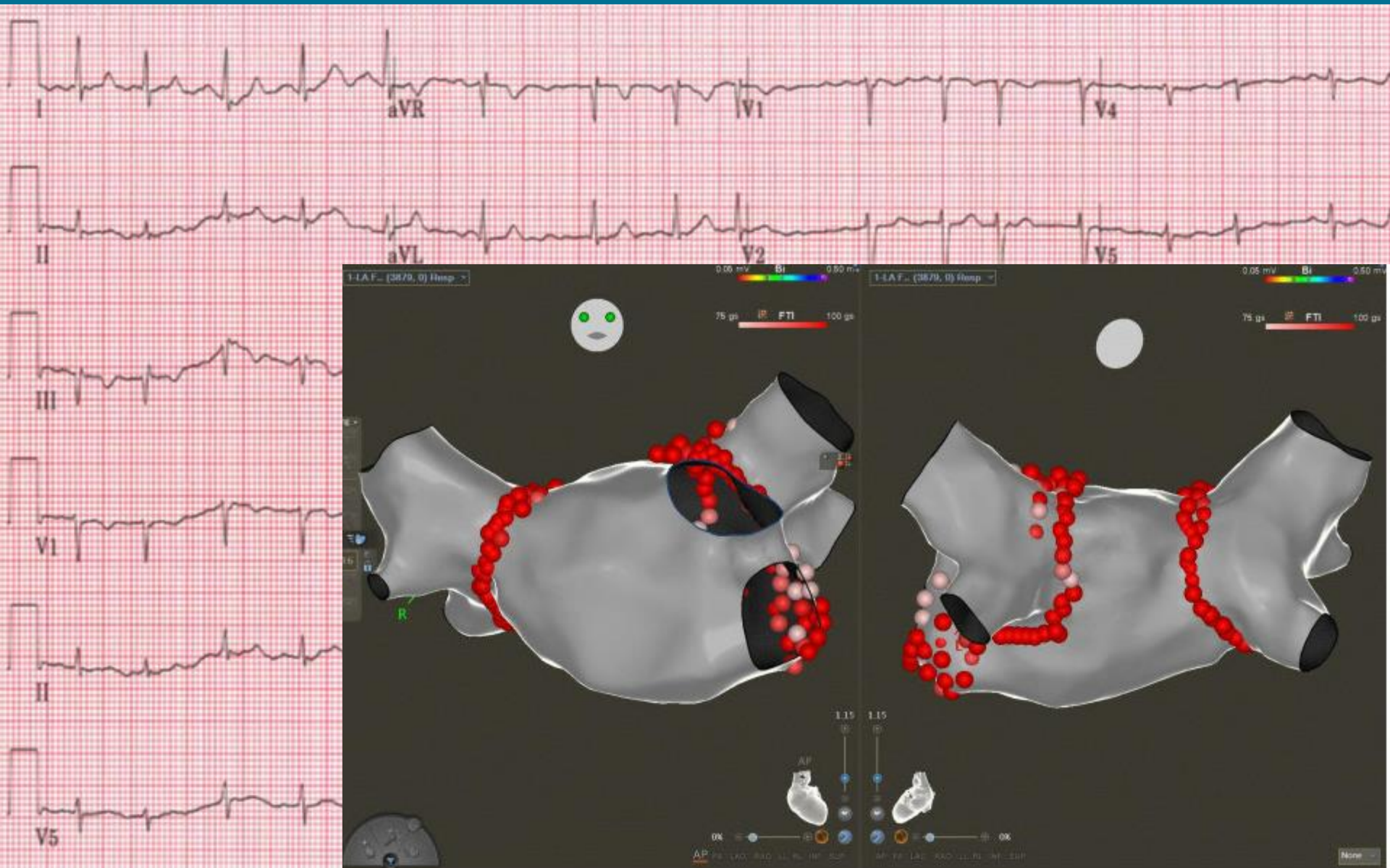
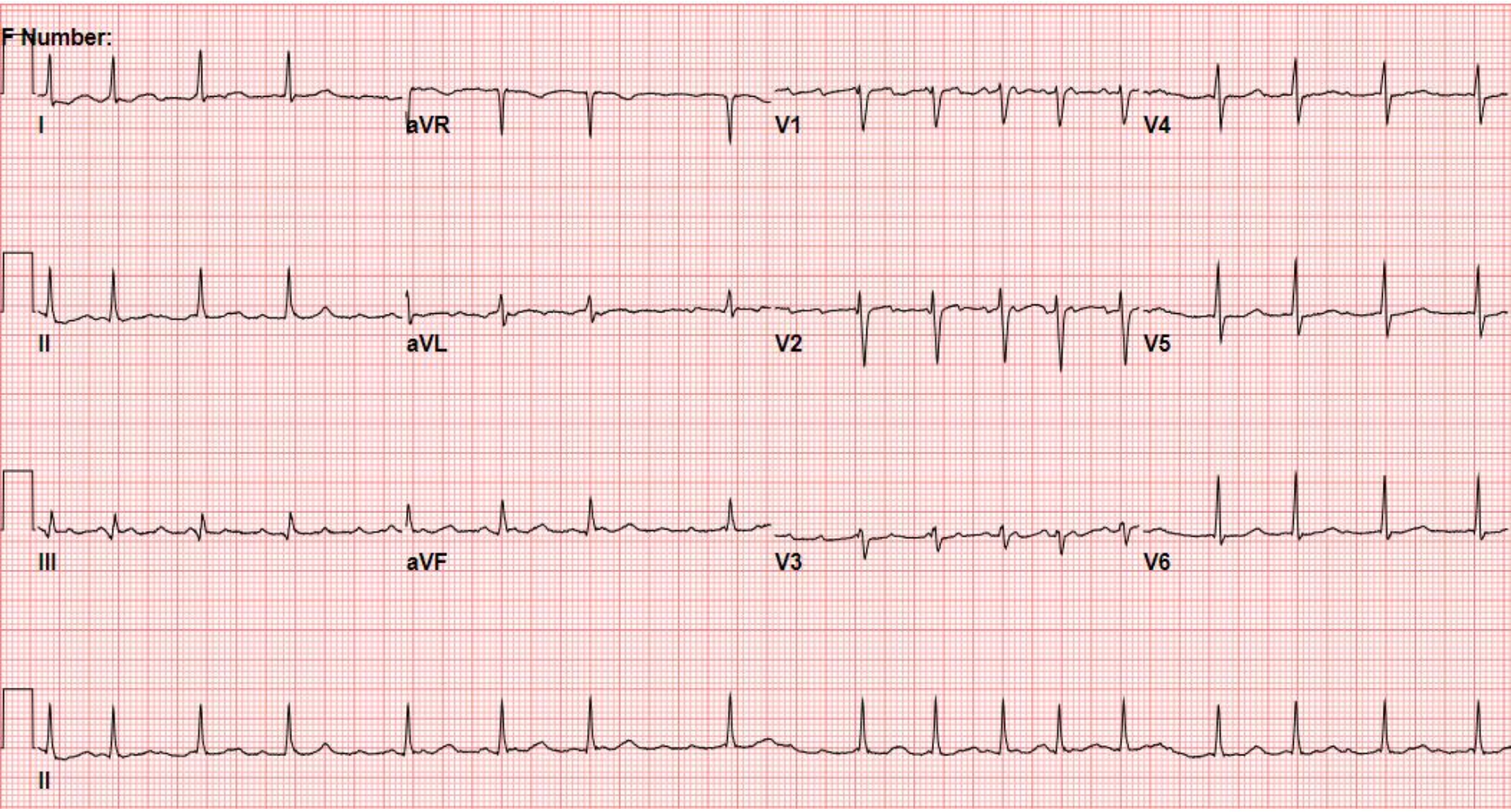


# Atypical Atrial Flutter

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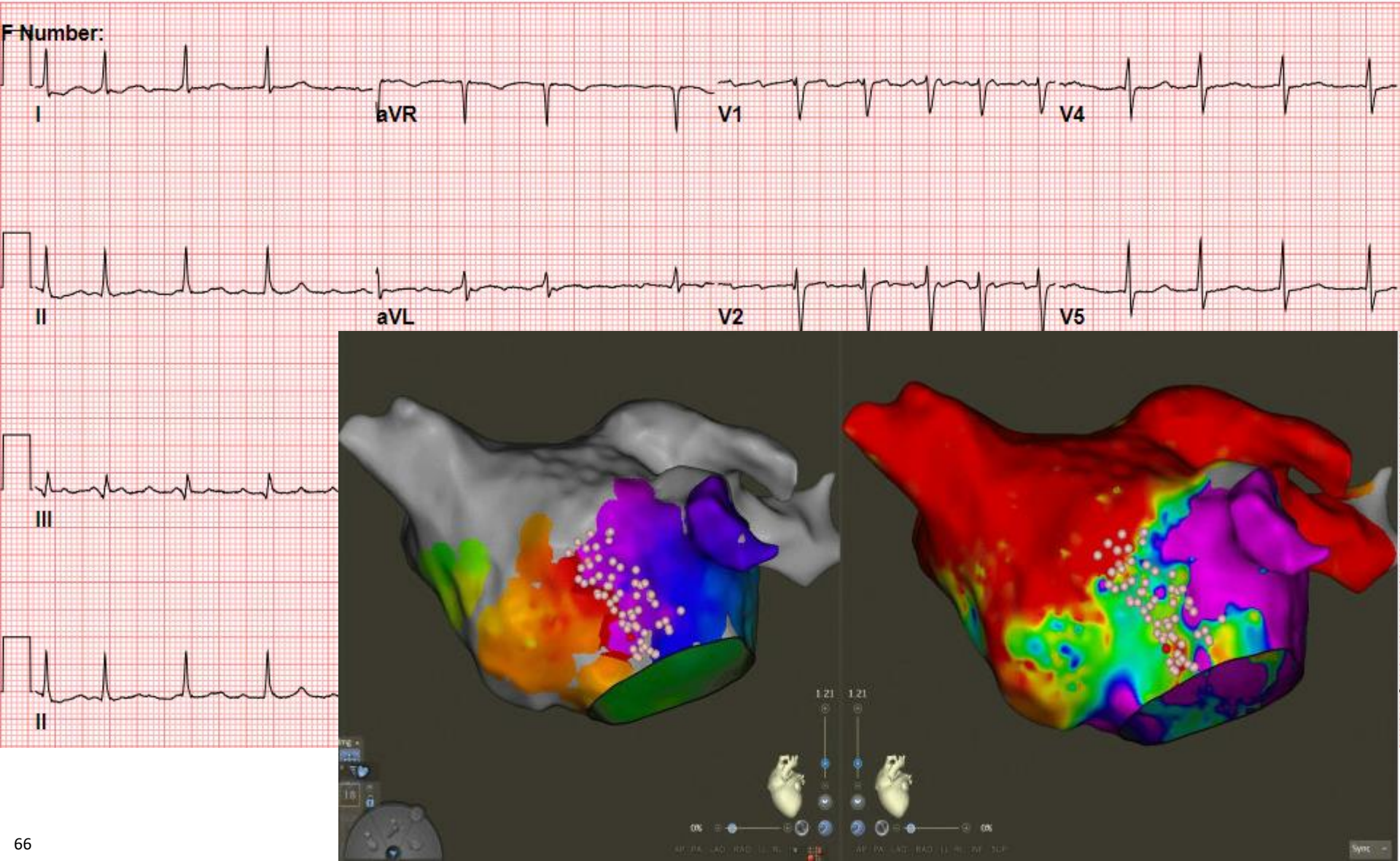
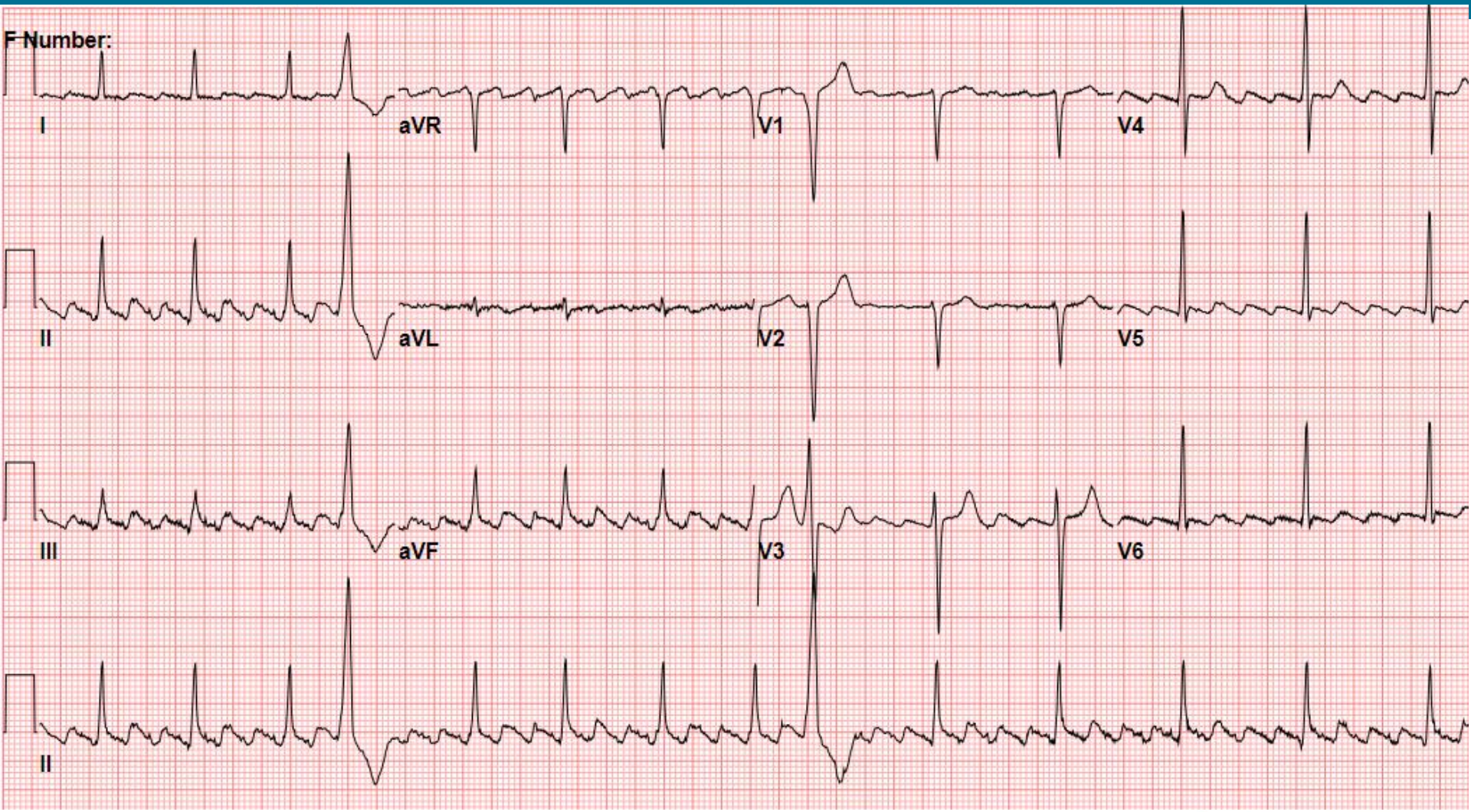
# Atypical Atrial Flutter



# Typical Atrial Flutter

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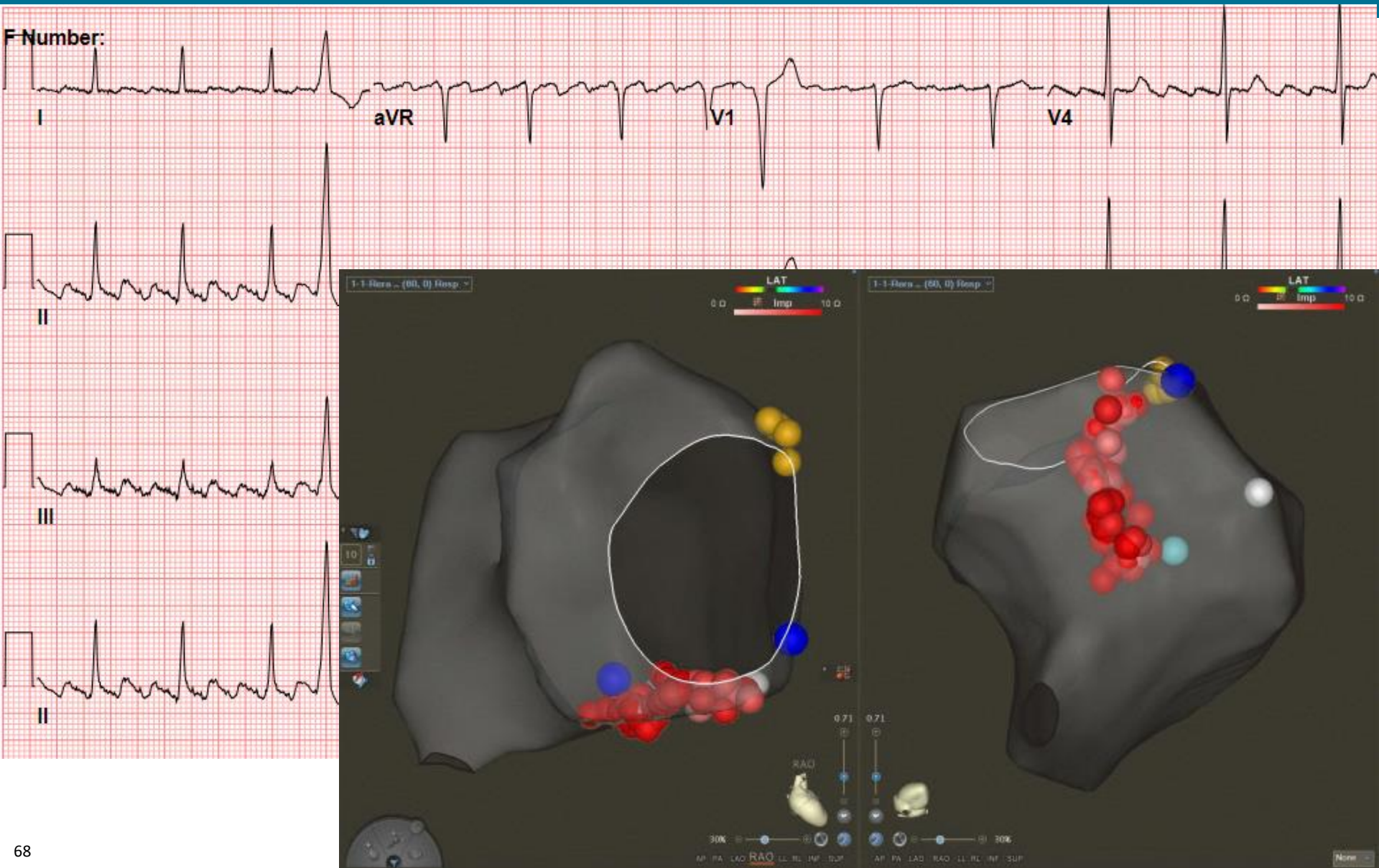
# Typical Atrial Flutter



# Outcomes for Ablation with RF Circa 2009

2-year AF-free survival after RFA for Paroxysmal AF: **70%**

2-year AF-free survival after RFA for Persistent AF: **60%**

2-year AFL-free survival after CTI RFA for typical AFL: **90%**

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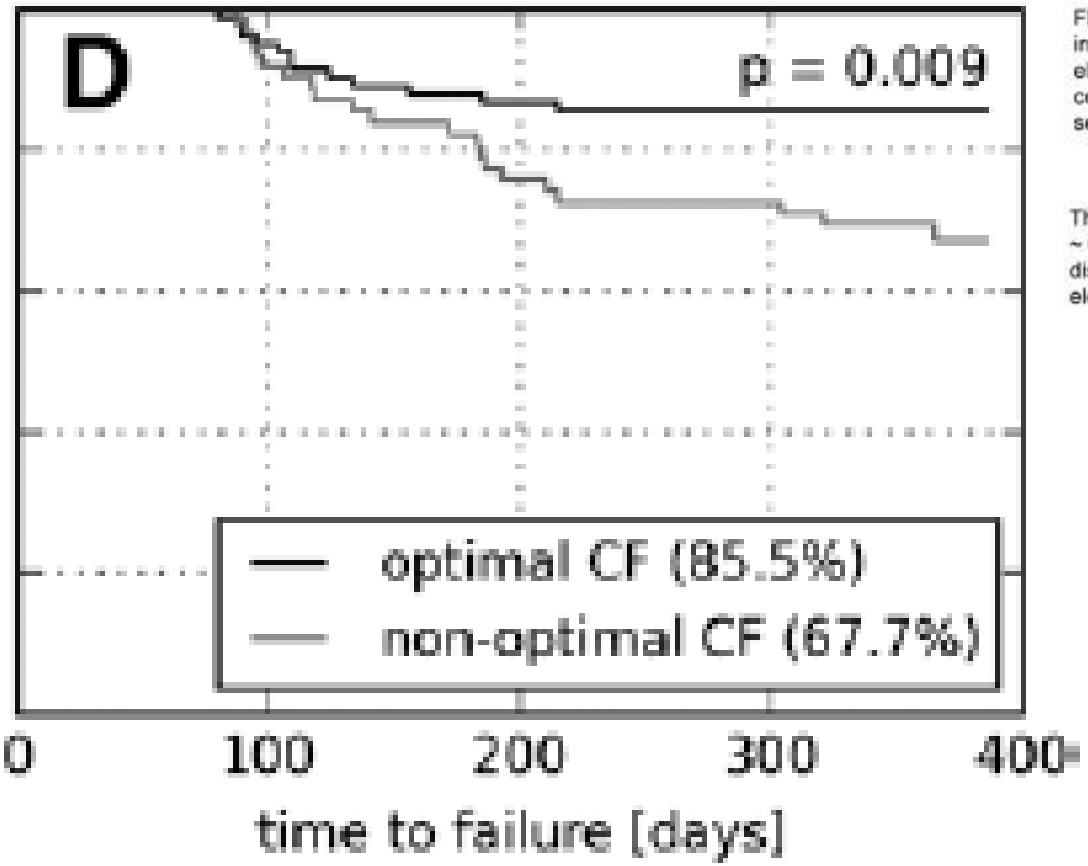
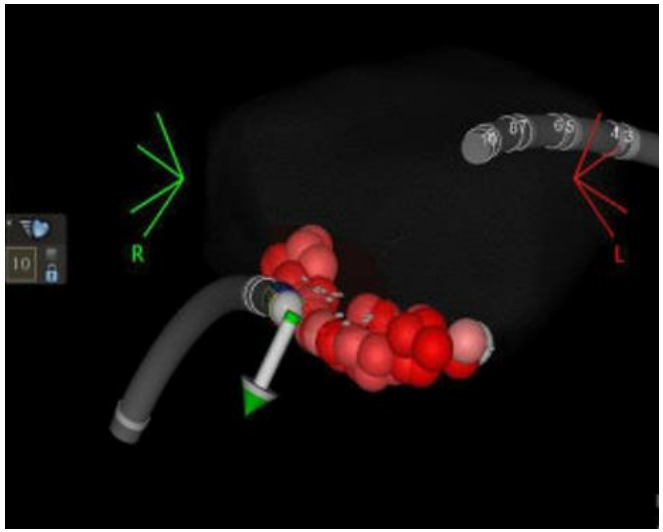
# Improvements in Ablation Catheter and Mapping System Technology are Associated with Improved Ablation Outcomes








VY Reddy et al., Circulation 2015;132:905-915
L Ptaszek et al., Heart Rhythm O2 2023;4:42-50

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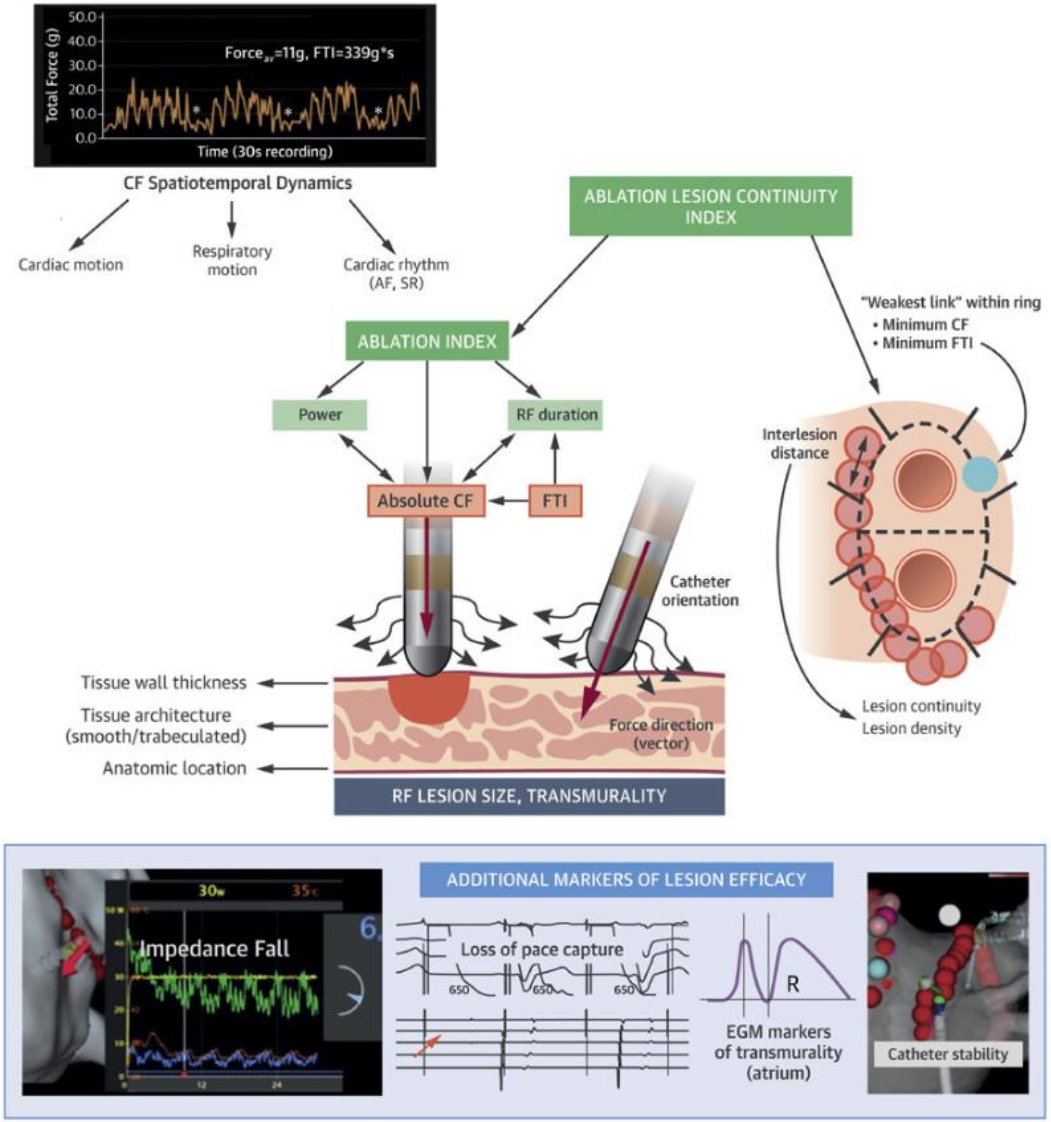
# Impact of Contact Force Sensor-Equipped Catheters on Ablation Outcomes




Ariyarathna, N. et al. J Am Coll Cardiol EP. 2018;4(6):707-23.

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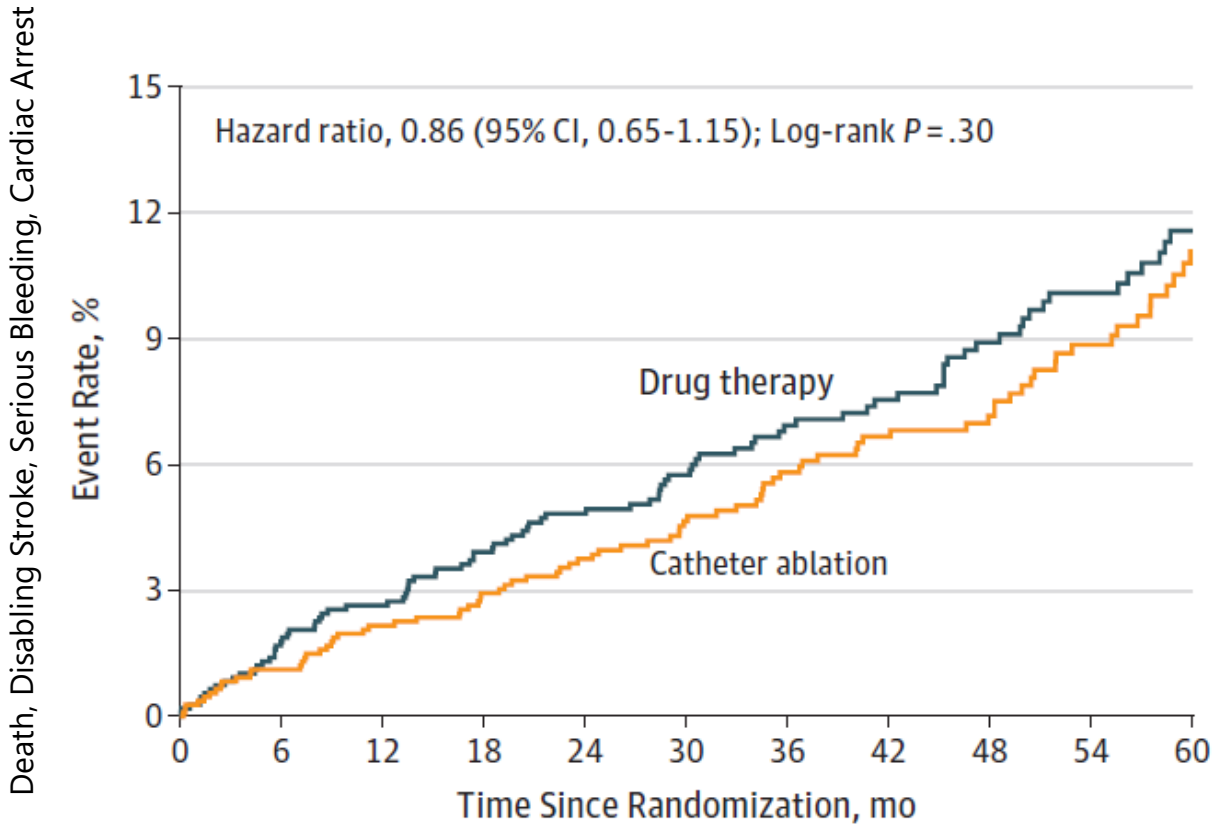
# Outcomes for RF Ablation vs Medications: CABANA Trial




No. at risk

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |

DL Packer et al., JAMA 2019;321:1261-1274

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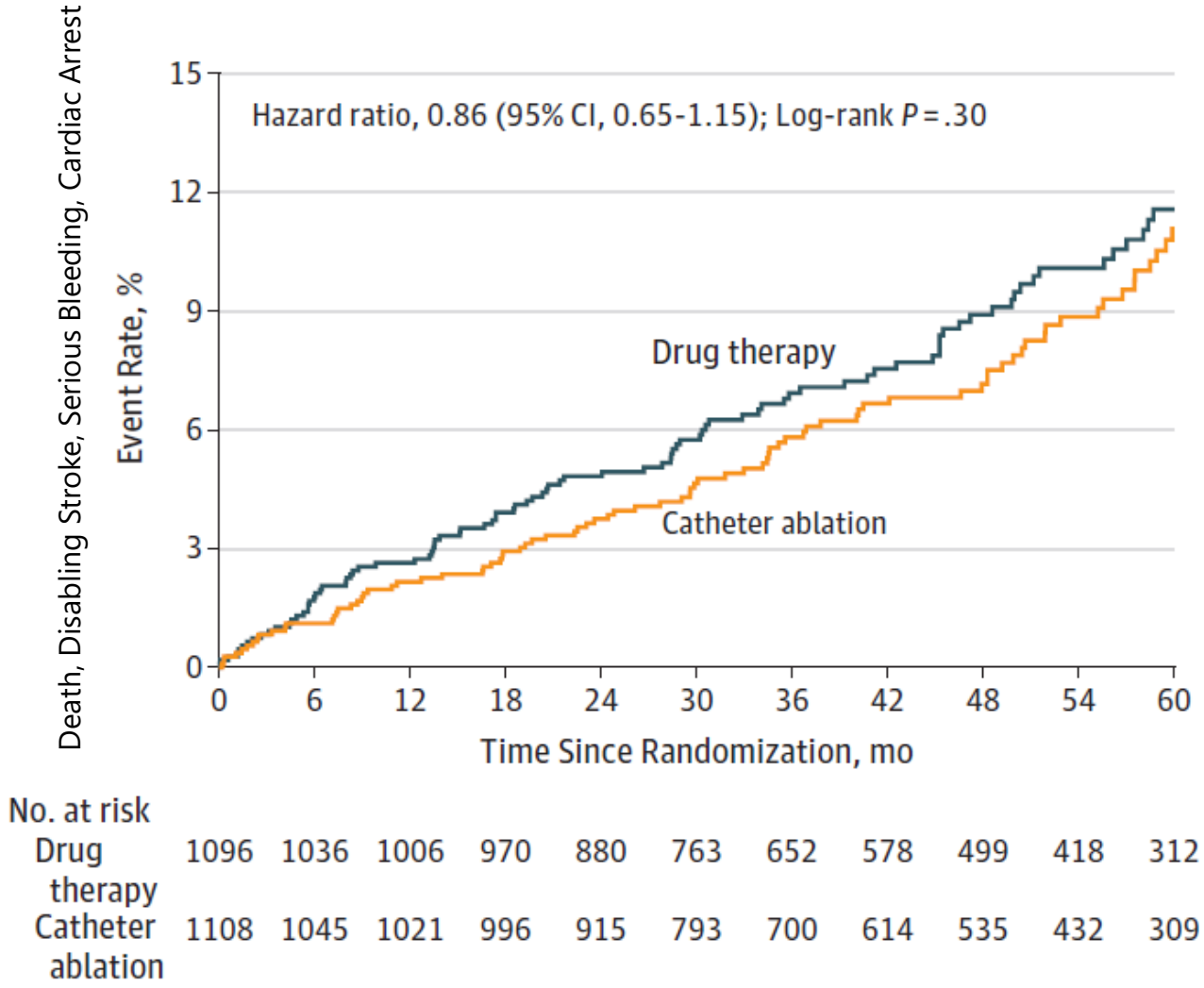
# Outcomes for RF Ablation vs Medications: CABANA Trial




Ablation produced sig. lower burden of AF than AADs.

Ablation produced sig. lower hospitalization rate than AADs.

**Possible underestimation of treatment effect:**

Lower event rate than anticipated.

Treatment crossover

DL Packer et al., JAMA 2019;321:1261-1274

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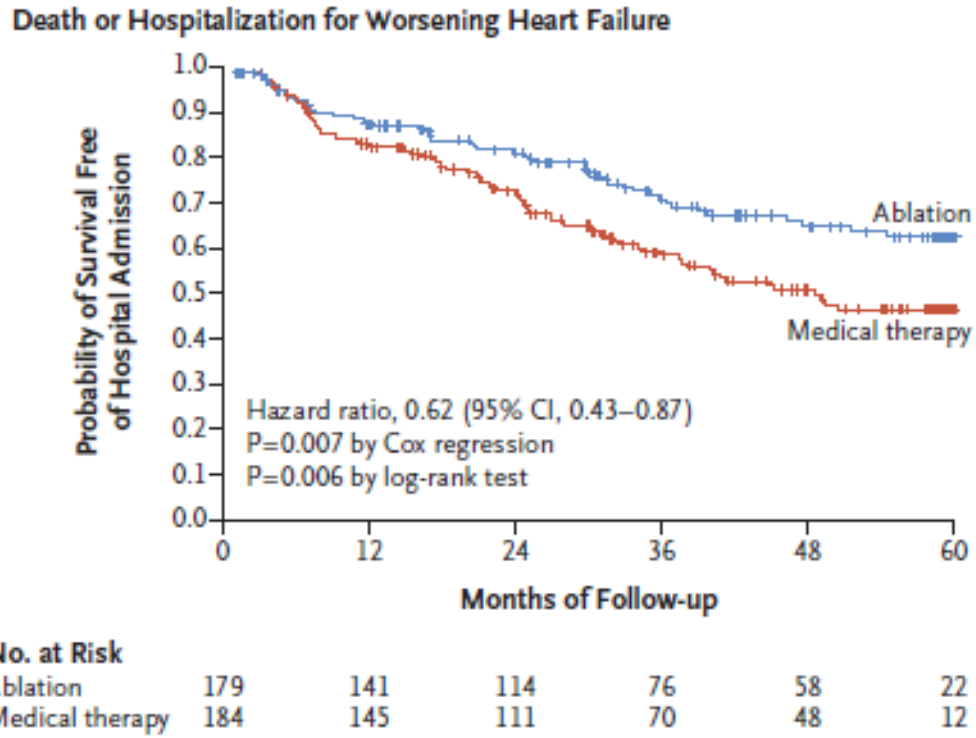
# CASTLE-AF Trial

- Randomized trial comparing ablation vs. AADs in patients with CHF (LVEF 35%).
- Composite outcome: all-cause death, HF hospitalization.




Marrouche et al., New Engl J Med 2018;378:417-427.

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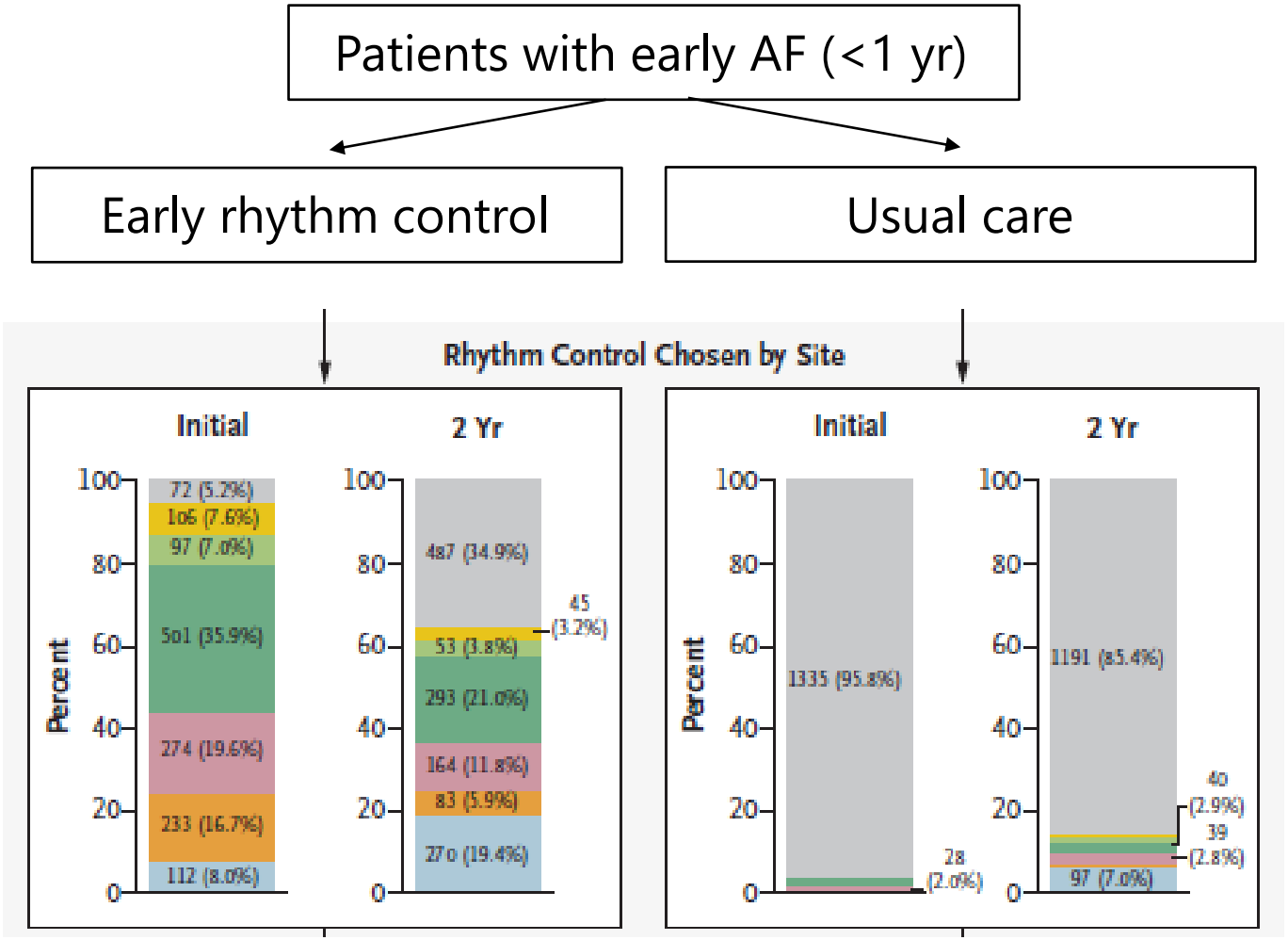
# Early Rhythm Control Therapy for AF: EAST-AFNET 4 Trial




Kirchhof et al., New Engl J Med 2020;383:1305-1316.

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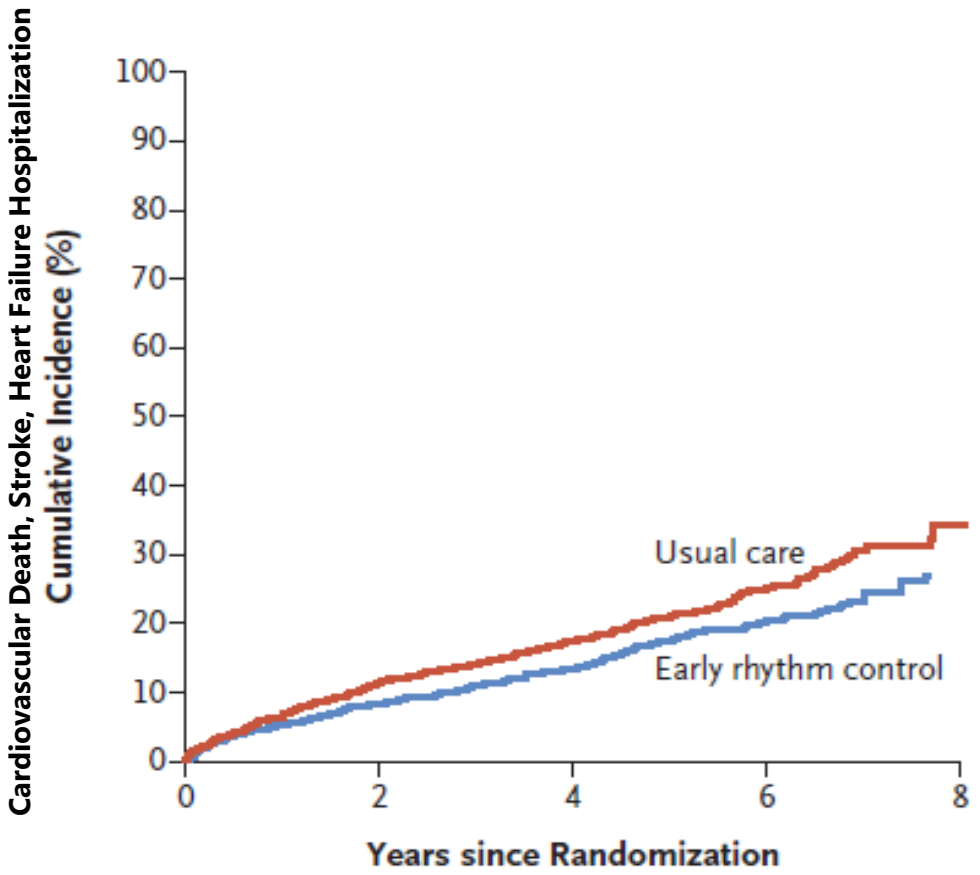
# Early Rhythm Control Therapy for AF: EAST-AFNET 4 Trial




| No. at Risk | | | | | |
|---|---|---|---|---|---|
| Usual care | 1394 | 1169 | 888 | 405 | 34 |
| Early rhythm control | 1395 | 1193 | 913 | 404 | 26 |

Kirchhof et al., New Engl J Med 2020;383:1305-1316.

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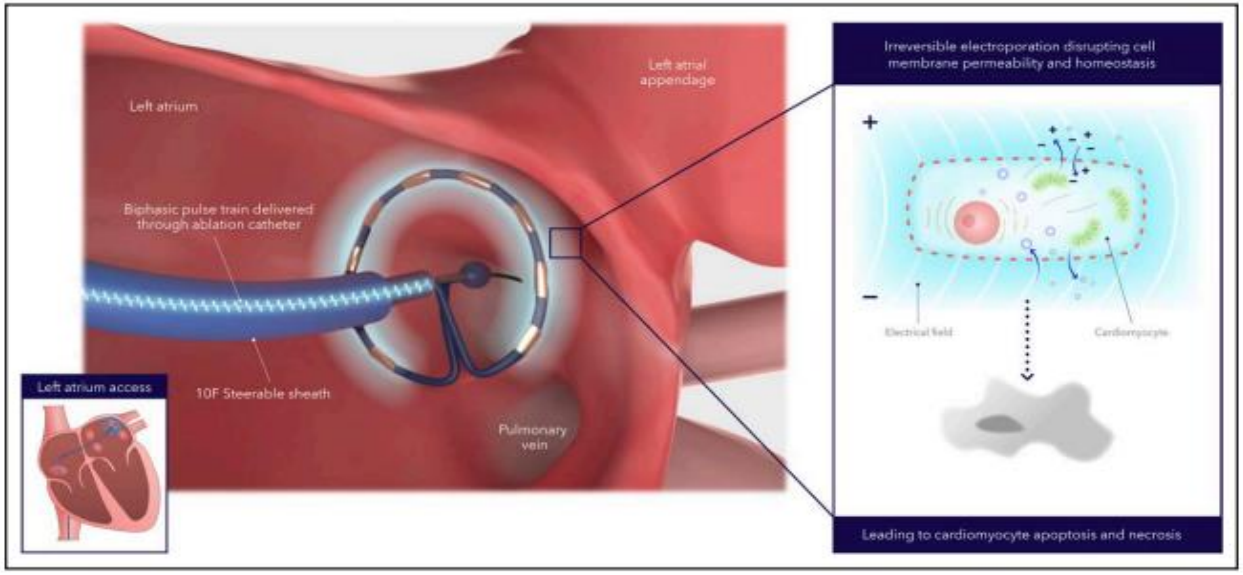
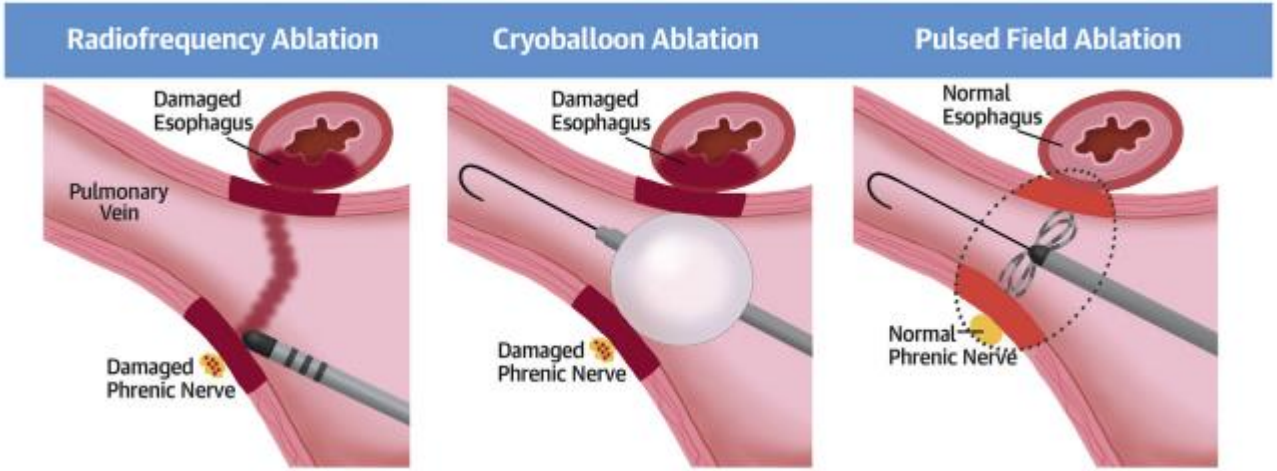
# Pulsed Field Ablation Technique




Verma et al., Circulation 2023;47:1422-1432.




Reddy VY et al., J Am Coll Cardiol 2019;74:315-326

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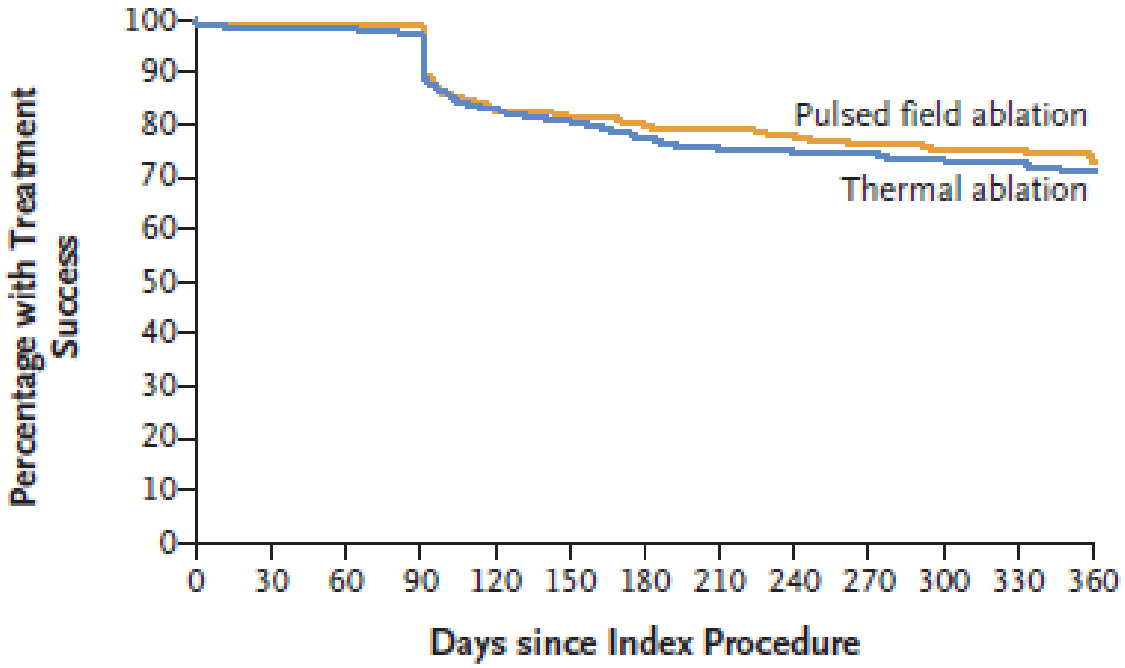
# PFA Non-Inferior to RFA: ADVENT Trial




| No. at Risk | | | | | |
|---|---|---|---|---|---|
| Pulsed field ablation | 301 | 298 | 238 | 228 | 176 |
| Thermal ablation | 296 | 292 | 228 | 219 | 150 |
| **Treatment Success (%)** | | | | | |
| Pulsed field ablation | 99.3 | 99.0 | 79.7 | 76.4 | 73.1 |
| Thermal ablation | 98.7 | 97.3 | 77.5 | 74.5 | 71.3 |

Reddy VY et al., NEJM 2023;660-1671

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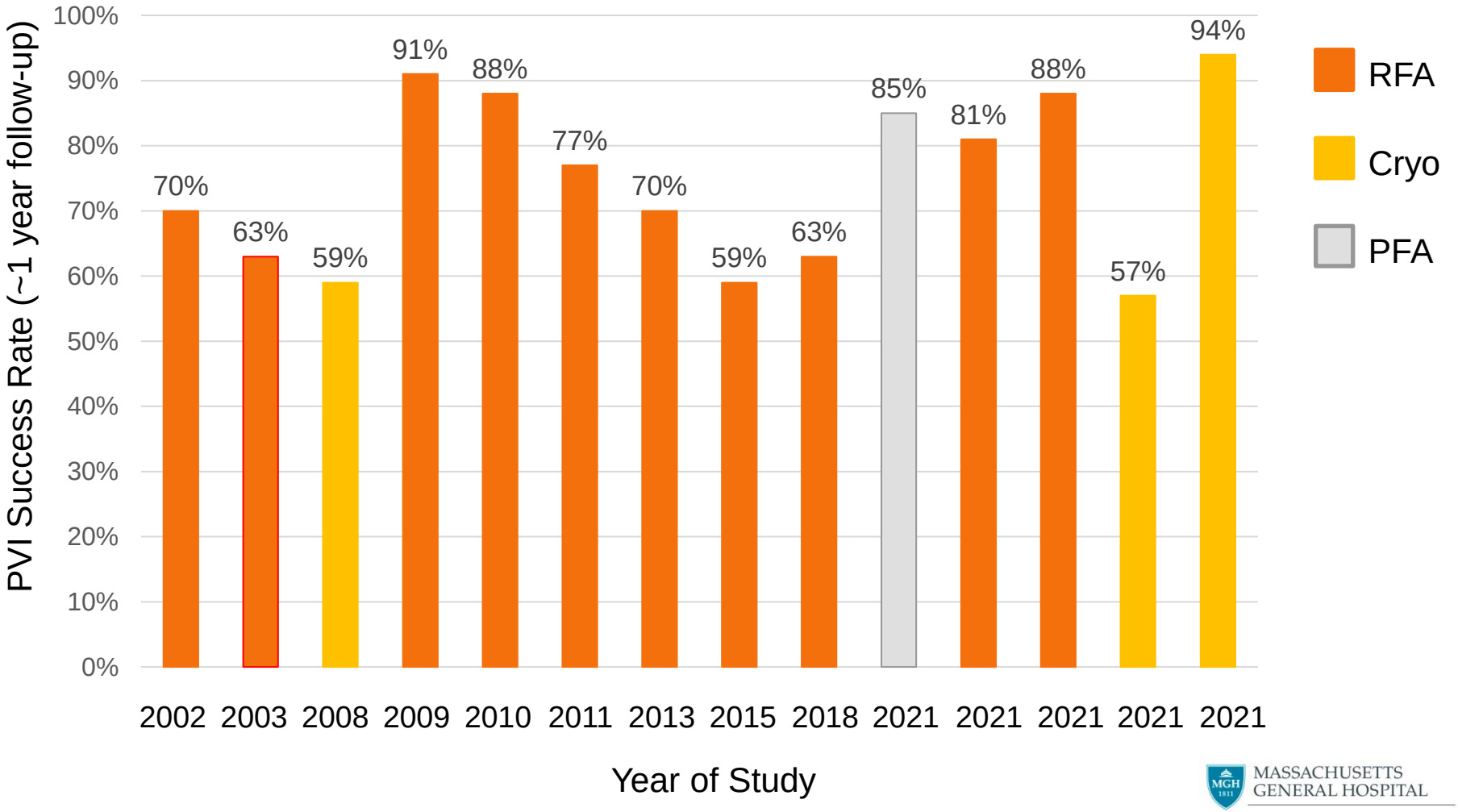
# Variability in PVI Success Rate Persists Despite Advances in Mapping and Ablation Technology

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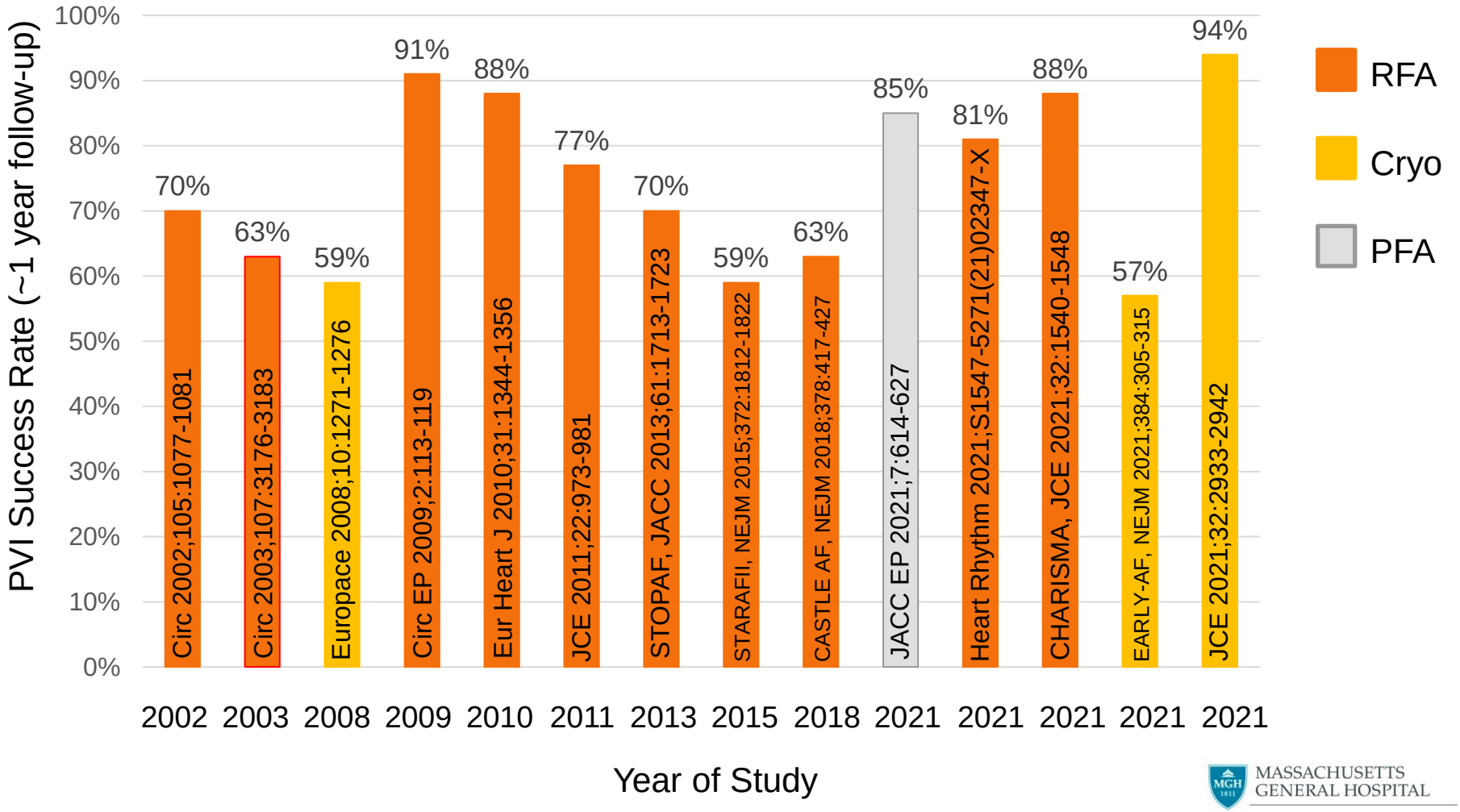


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# Outline

1) **Clinical Case**
2) **Epidemiology of AF/AFL**
3) **Physiology of AF/AFL**
4) **Advances in medical and interventional treatment:**
   - *Reduce the risk of AF/AFL-related stroke*
   - *Minimize consequences of AF/AFL on heart function (symptoms, CHF)*
5) **Current recommendations for management of AF/AFL**

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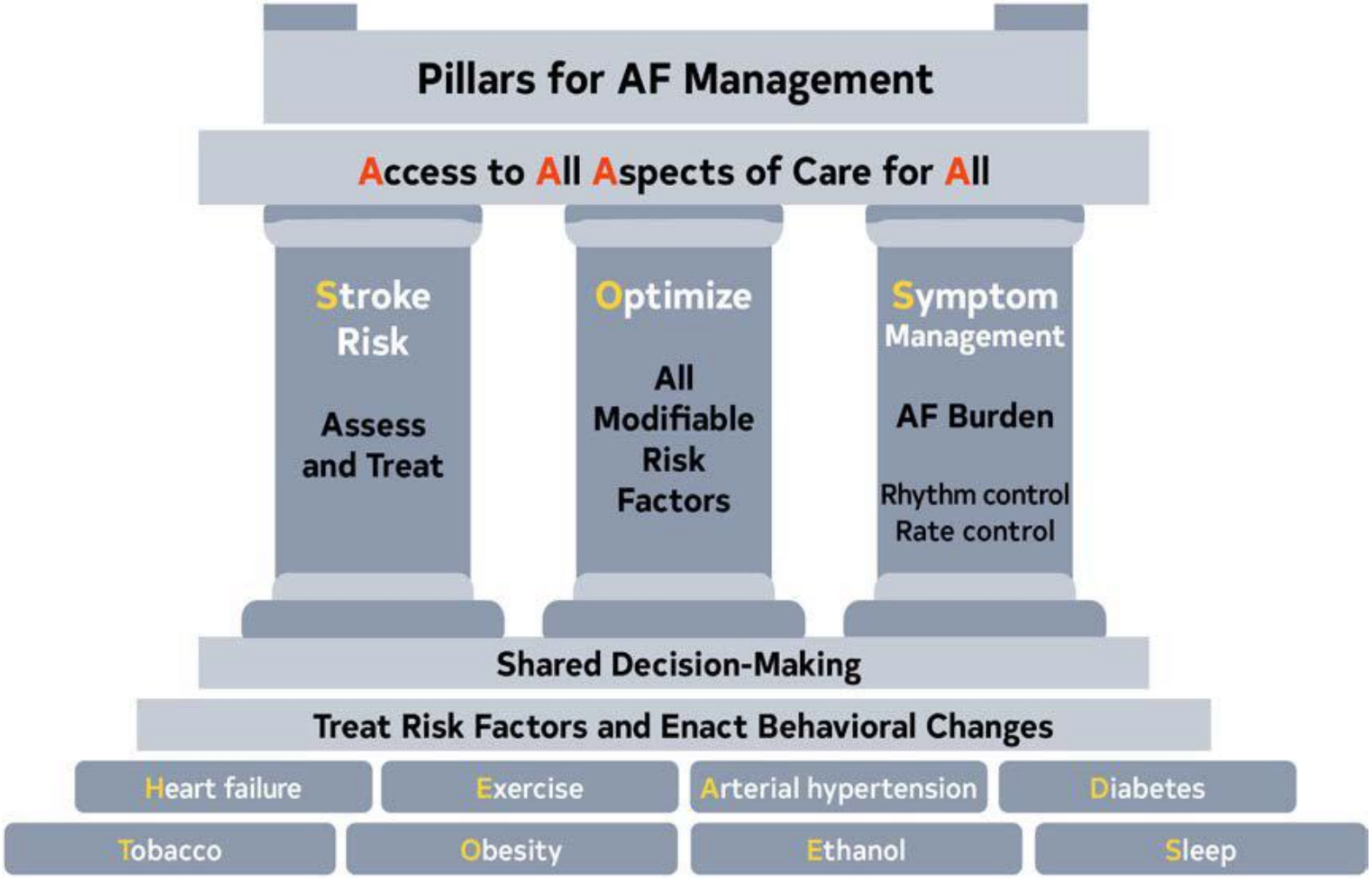
# Summary




Joglar et al., Circulation 2024;1:e1-e156.

# Summary

1) Utilize a stroke risk score (e.g., CHA2DS2-VASC) to assess indication for initiation of OAC.
2) Utilize a bleeding score (e.g., HAS-BLED) to assess risk of bleeding with OAC. For patients who not good candidates for OAC consider LAA closure device implantation.
3) Consider catheter ablation for patients in whom AADs are not effective, contraindicated, not tolerated, or not preferred.
4) Catheter ablation can be considered as first-line therapy to improve symptoms or reduce progression of paroxysmal to persistent AF.

# Summary

5) Early rhythm control is associated with a greater likelihood of maintaining sinus rhythm in the long term and minimizing AF burden and reducing progression of the disease.

6) Lifestyle and risk factor modification is a pillar of AF management.

- Weight loss for those with body mass >27 kg/m$^2$
- Tobacco cessation
- Minimization or elimination of alcohol consumption
- Screening for sleep-disordered breathing
- Moderate-to-vigorous exercise 210 min/wk

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Thank you
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