

# KHRS 2023

June 23(Fri.) - 24(Sat.), 2023  
Grand Walkerhill Seoul, Korea

The 15<sup>th</sup> Annual Scientific Session of the Korean Heart Rhythm Society

## Cross Specialty 2: EP-Neurology

# Rhythm control in AF-stroke: Who may benefit?



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TOGETHER.  
TOMORROW.  
EWHHA

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## The Korean Society of Cardiology COI Disclosure



***Name of First Author: Junbeom Park M.D., Ph.D.***

The author acknowledges technical and financial support from the followings in various research studies.

- Synergy AI
- Daewoonong

2810 Patients were assessed for eligibility

21 Did not meet inclusion criteria

2789 Underwent randomization at 135 sites in 11 countries

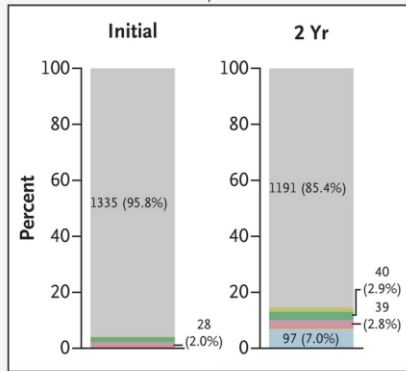
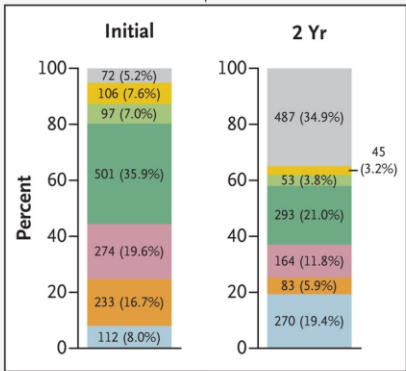
1395 Were assigned to early rhythm control

1394 Were assigned to usual care

1395 Were included in primary analysis

1394 Were included in primary analysis

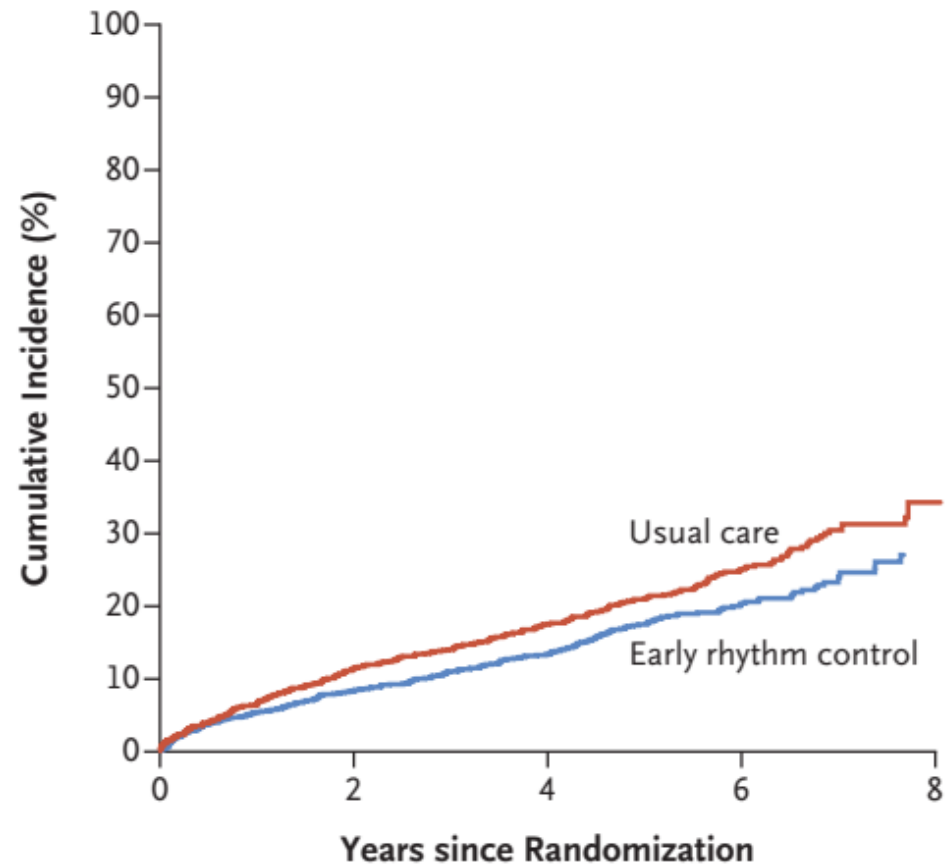
Rhythm Control Chosen by Site



- None
- Other antiarrhythmic drug
- Propafenone
- Flecainide
- Amiodarone
- Dronedaron
- AF ablation

Total follow-up yr lost: 681/7596 (9.0%)  
 524 (6.9%) Follow-up yr lost because  
 123 Withdrew  
 157 (2.1%) Follow-up yr lost because  
 102 Were lost to follow-up

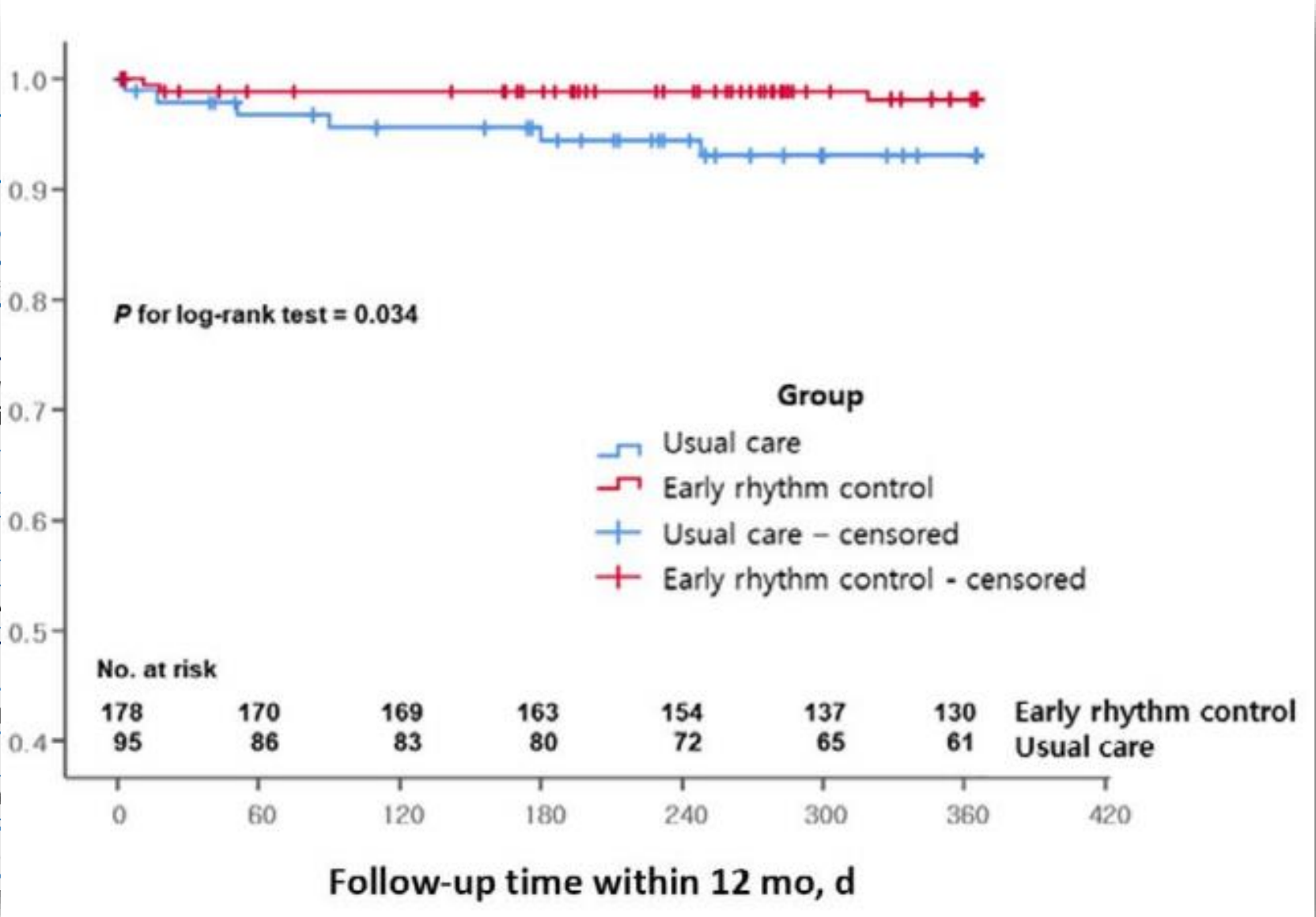
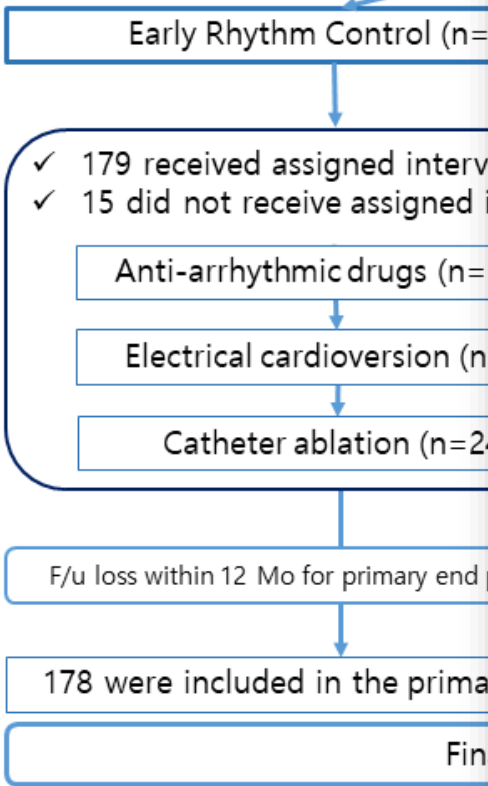
Total follow-up yr lost: 491/7479 (6.6%)  
 339 (4.5%) Follow-up yr lost because  
 83 Withdrew  
 152 (2.0%) Follow-up yr lost because  
 106 Were lost to follow-up



No. at Risk

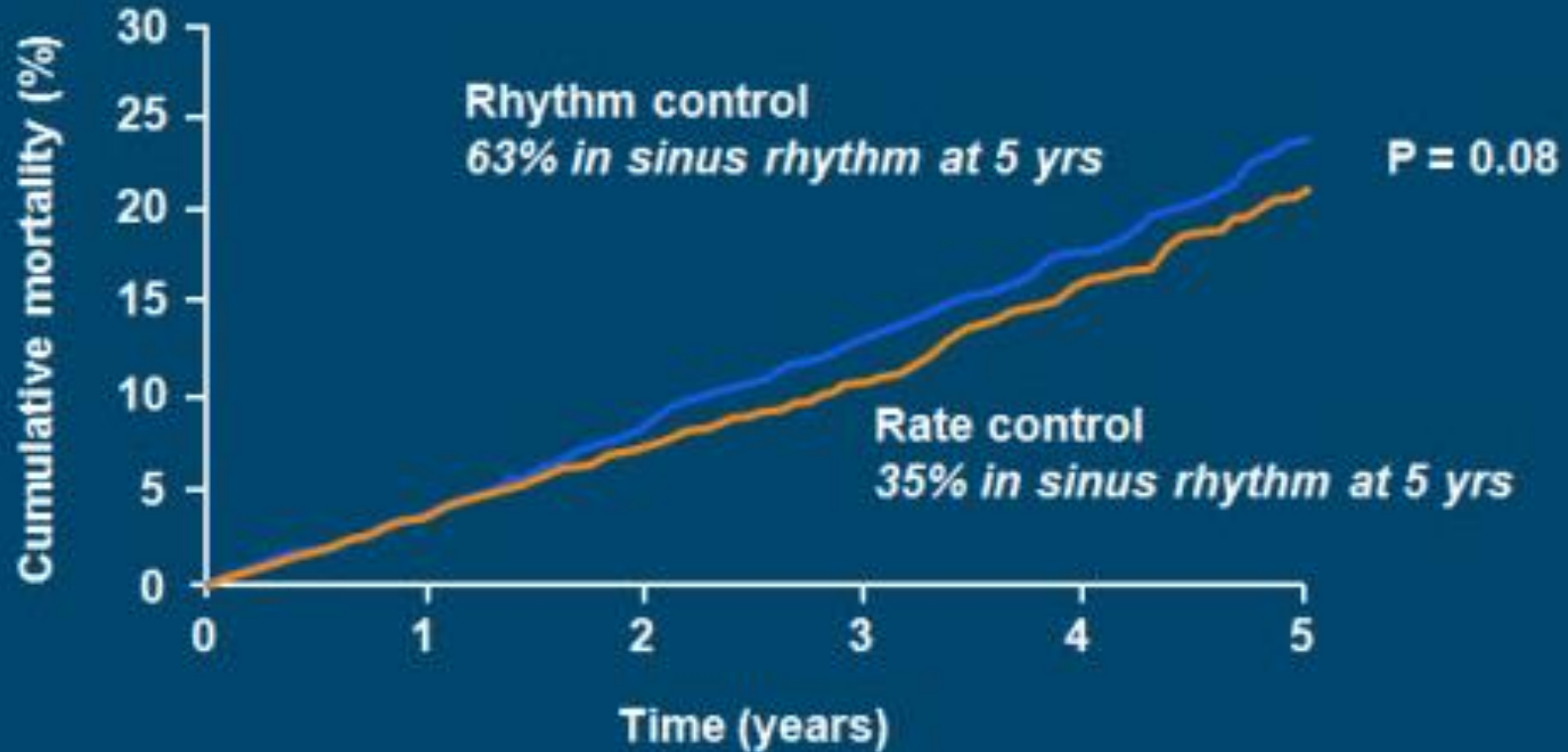
	0	2	4	6	8
Usual care	1394	1169	888	405	34
Early rhythm control	1395	1193	913	404	26

Assessed for Acute stroke (n=11397)



# AFFIRM study

## All cause mortality

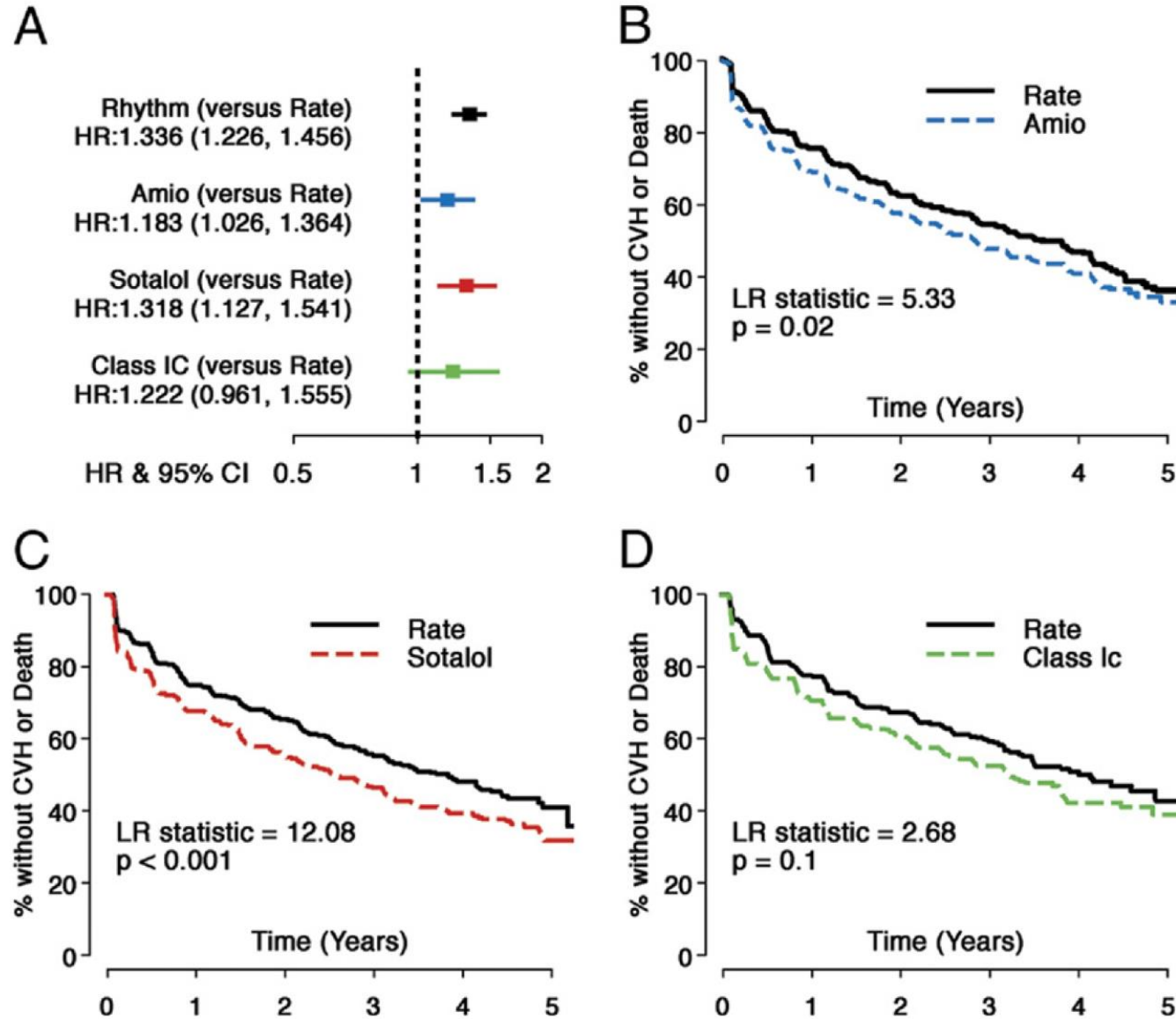


### No. of deaths (%)

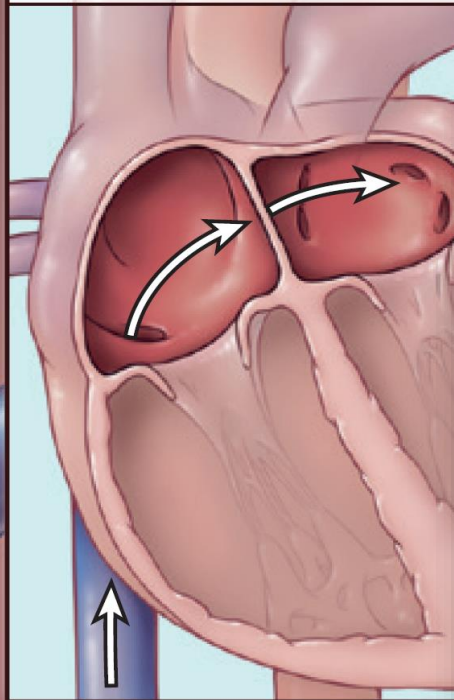
Rhythm control	0	80 (4)	175 (9)	257 (13)	314 (18)	352 (24)
Rate control	0	78 (4)	148 (7)	210 (11)	275 (16)	306 (21)

# Anti arrhythmic drug toxicity

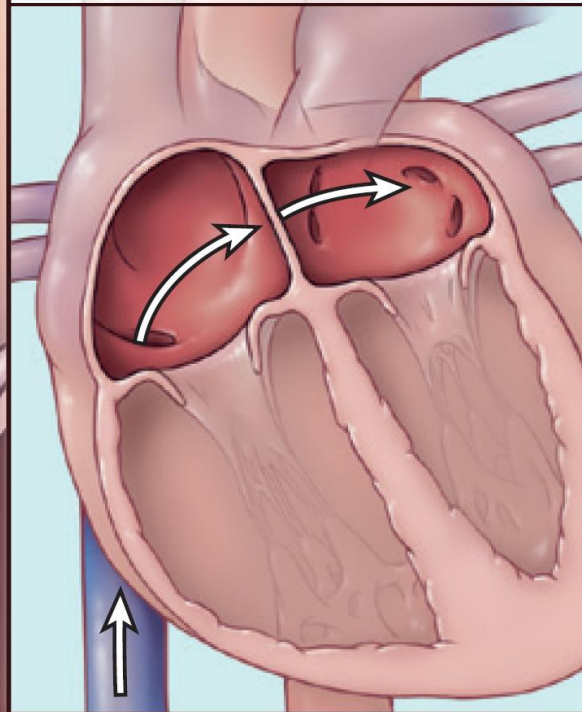
## Cardiovascular hospitalization and mortality



Left Atrium Access Route



Left Atrium Access Route



PULMONARY VEIN

Integrated circular mapping catheter

PULMONARY VEIN

LEFT ATRIUM

Cryoballoon

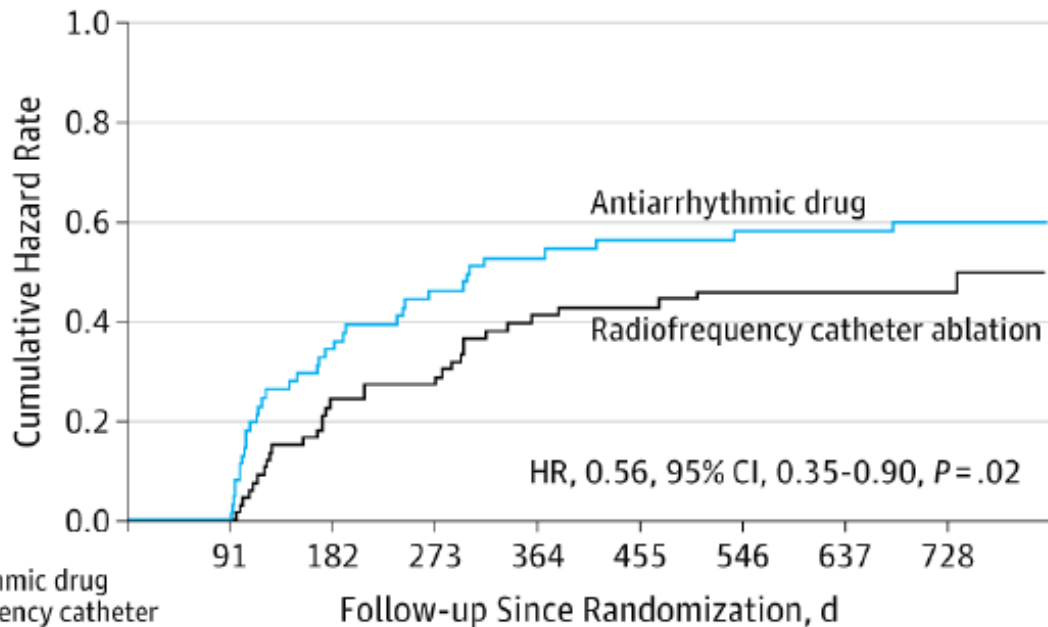
Cryoballoon catheter

12-French steerable sheath

PULMONARY VEIN

# Rhythm control

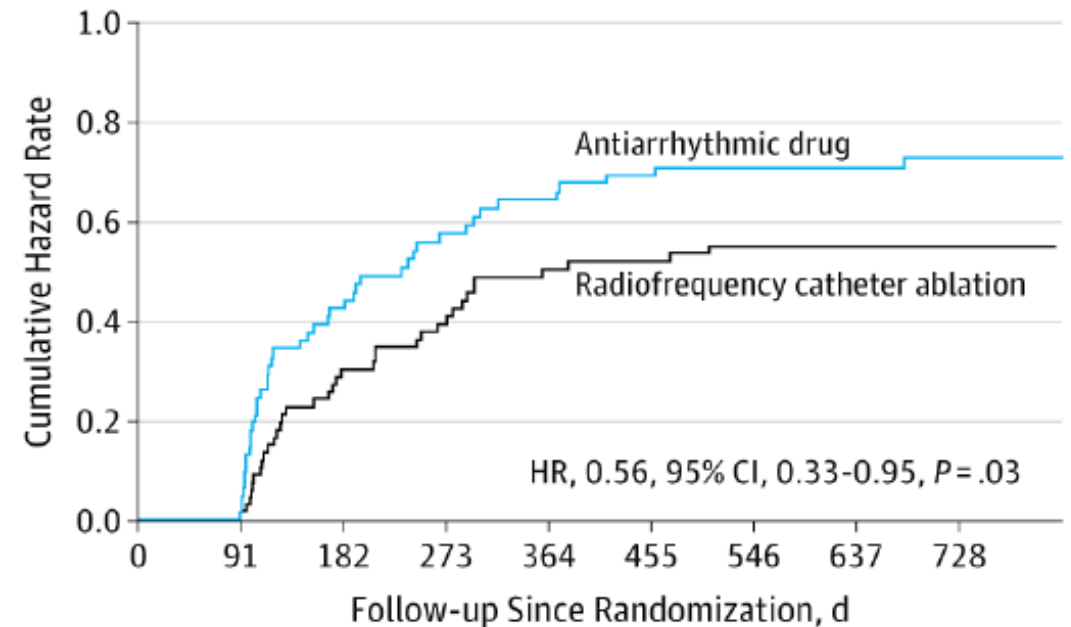
**A** Primary efficacy outcome



No. at risk  
Antiarrhythmic drug  
Radiofrequency catheter  
ablation

	91	182	273	364	455	546	637	728
Antiarrhythmic drug	61	61	35	25	21	18	17	17
Radiofrequency catheter ablation	66	66	46	39	32	30	28	27

**B** Time to first recurrence of symptomatic atrial tachyarrhythmias

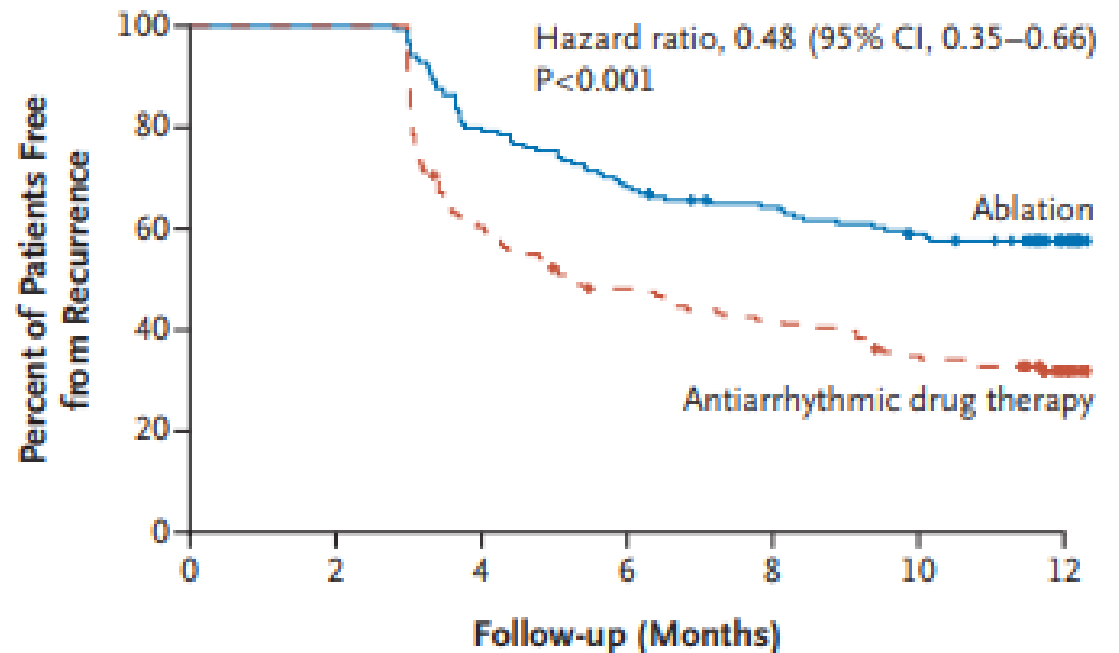


	91	182	273	364	455	546	637	728
Antiarrhythmic drug	61	61	40	32	28	25	24	24
Radiofrequency catheter ablation	66	66	50	47	38	36	34	33



## Cryoablation or Drug Therapy for of Atrial Fibrillation

Jason G. Andrade, M.D., George A. Wells, Ph.D., Marc W. Deyell, M.D., Vidal Essebag, M.D., Ph.D., Jean Champagne, M.D., Jean-François Blais, M.D., Allan Skanes, M.D., Yaariv Khaykin, M.D., Carlos Morillo, M.D., Ulf Schotten, M.D., Evan Lockwood, M.D., Guy Amit, M.D., Paul Angaran, M.D., John J. Goldberger, M.D., Sandra Lauck, Ph.D., Laurent Macle, M.D., and Atul Verma, M.D.



### No. at Risk

	0	2	4	6	8	10	12
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.**

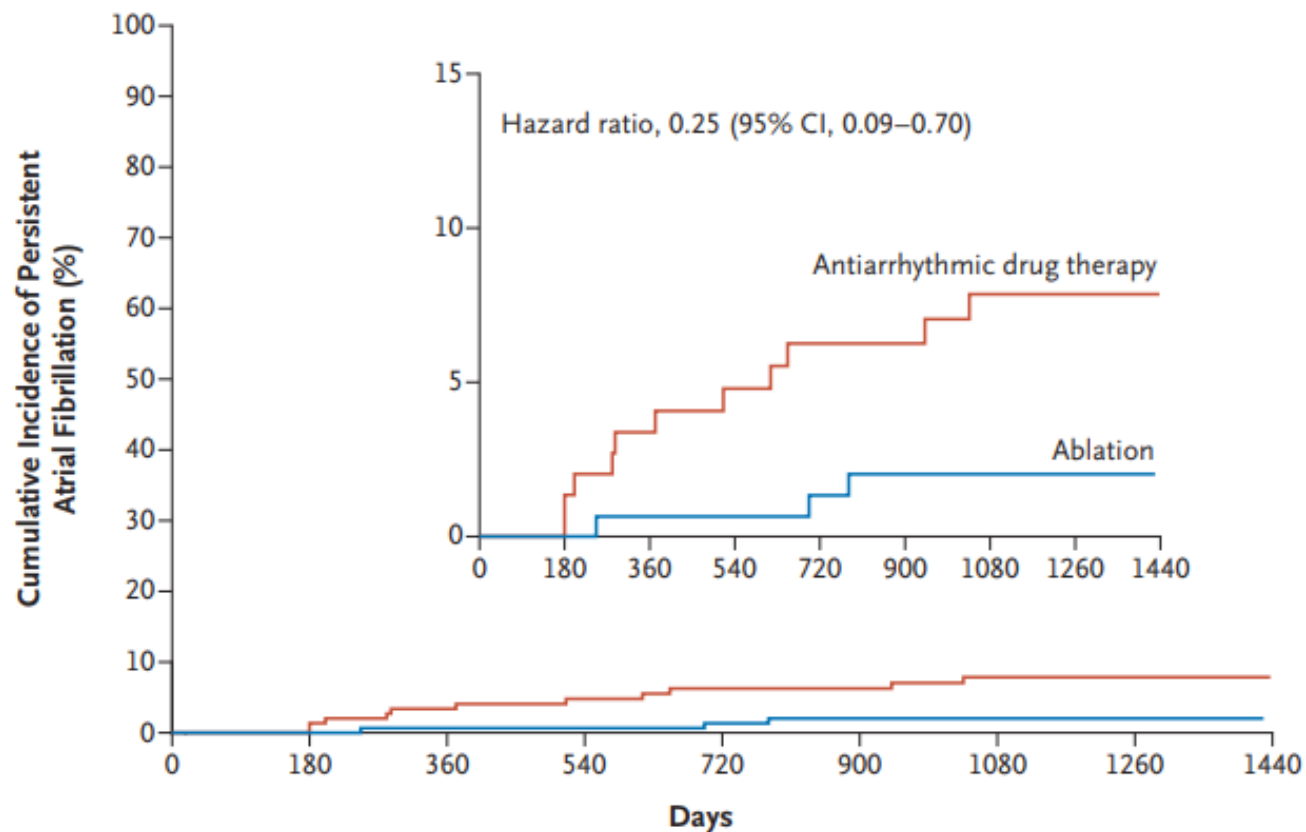
Shown are Kaplan–Meier estimates of the primary end point, freedom from recurrence of any atrial tachyarrhythmia (atrial fibrillation, atrial flutter, or atrial tachycardia) lasting 30 seconds or longer between 91 and 365 days after the initiation of an antiarrhythmic drug or catheter ablation. Tick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

# The NEW JOURNAL

ESTABLISHED IN 1812

## Progression of Atrial Fibrillation

J.G. Andrade, M.W. Deyell, L. Macle, G.A. Hays, A. Skanes, Y. Khaykin, C. Morillo, U. Jolly, S. Lauck, J. Cadrin-Tourigny, S. K... (Note: text is partially cut off)

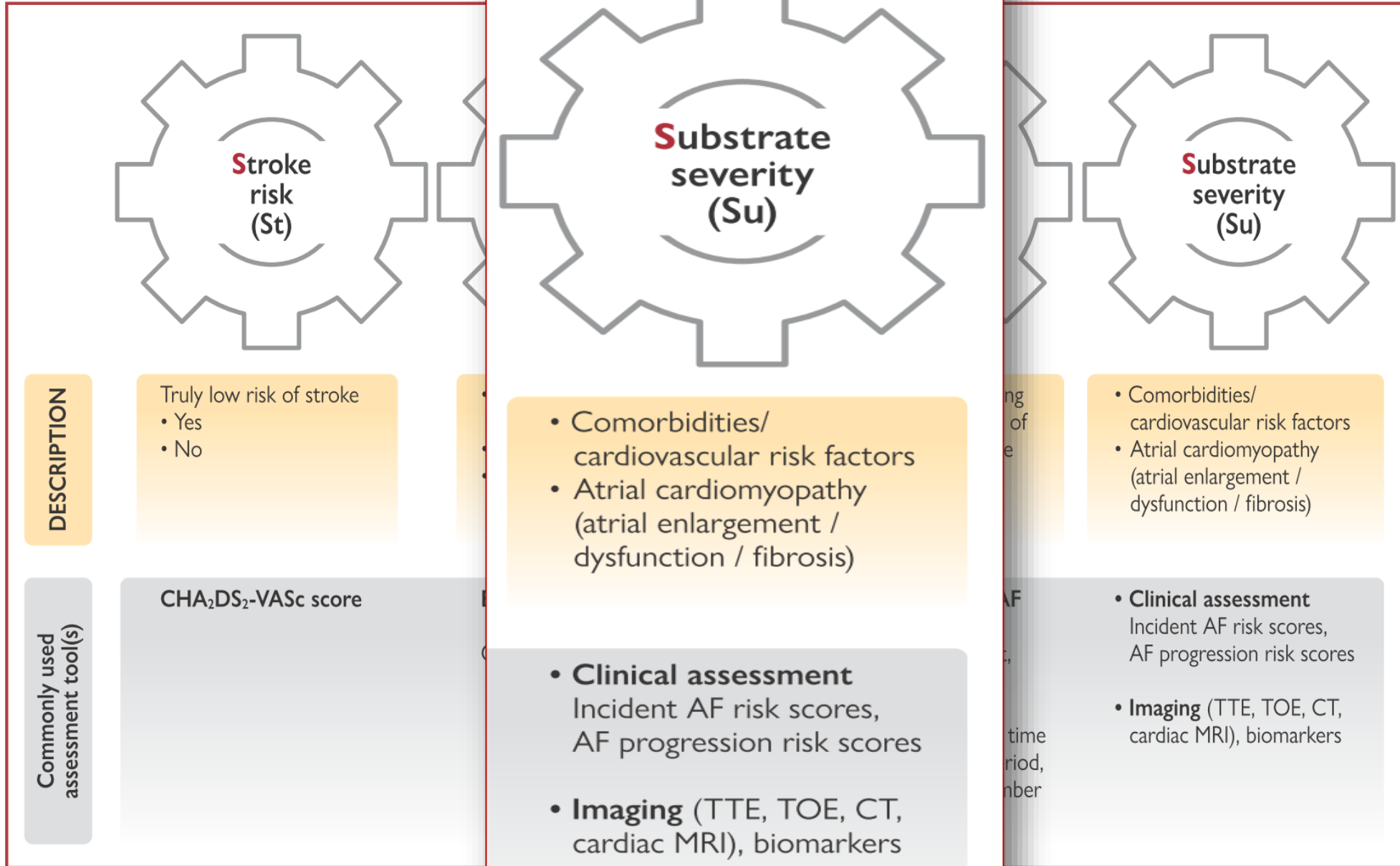


**No. at Risk**

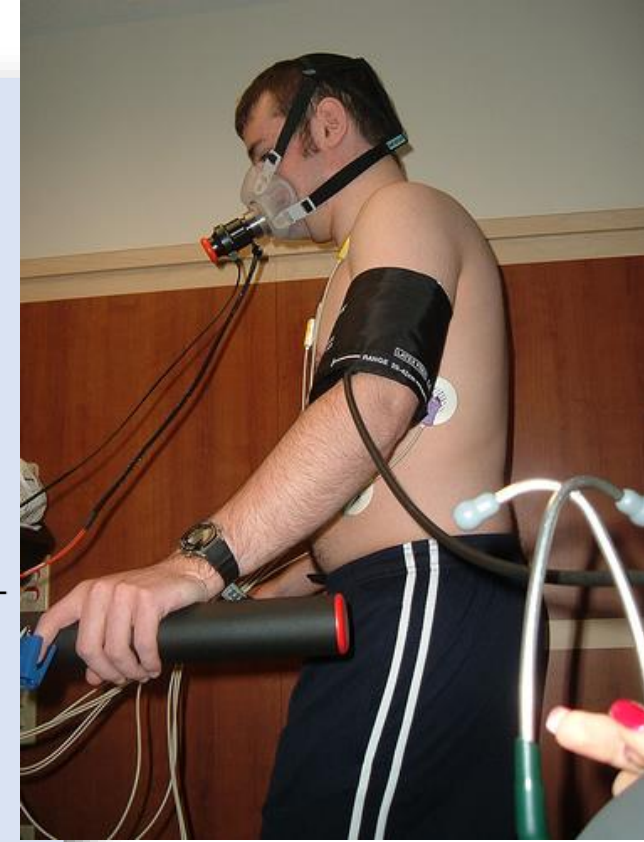
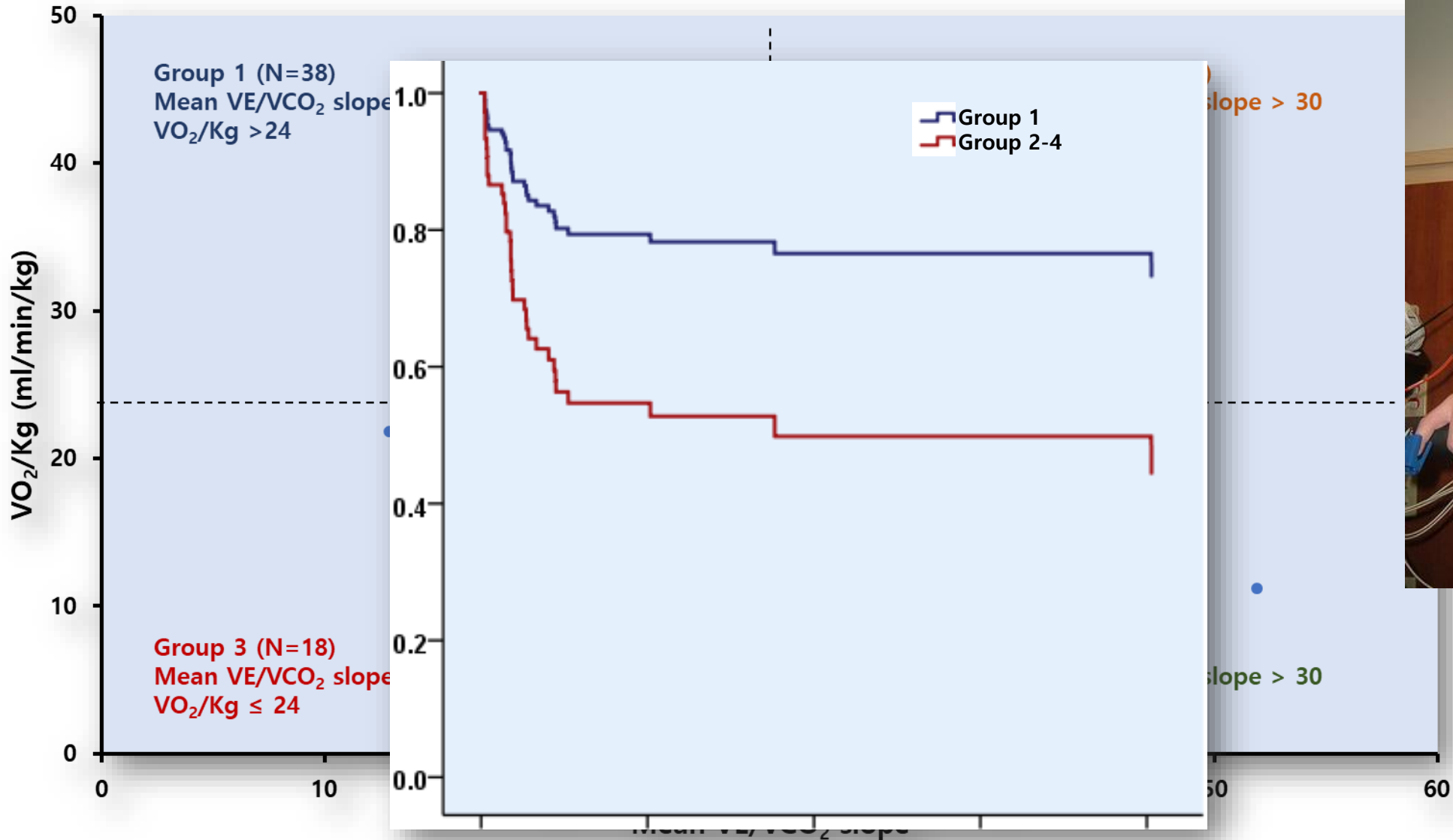
Antiarrhythmic drug therapy	149	148	142	133	129	123	104	43	0
Ablation	154	154	153	151	145	141	125	43	0

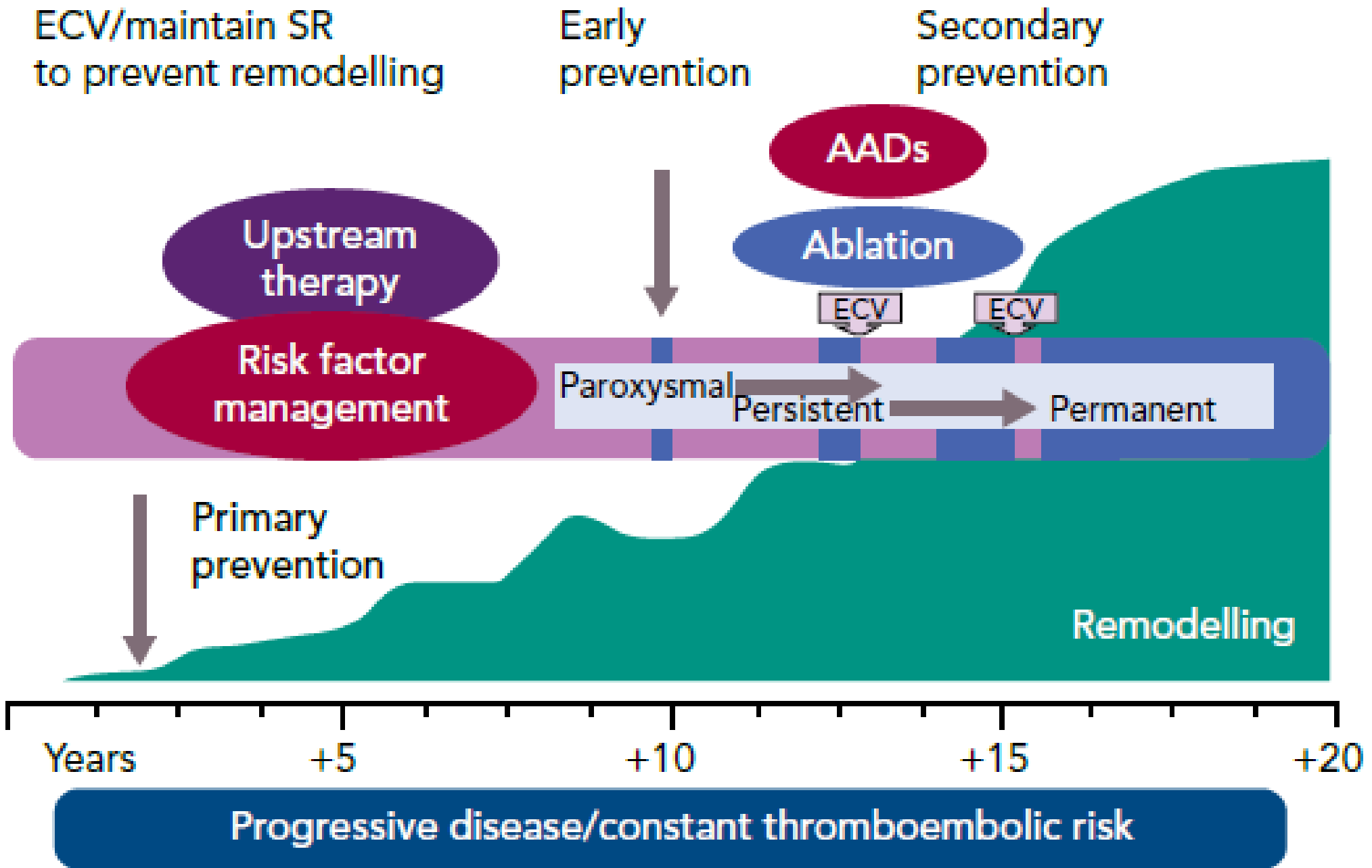
**Figure 2. Cumulative Incidence of First Episode of Persistent Atrial Fibrillation.**

Shown is a time-to-event analysis of the first occurrence of persistent atrial fibrillation, as documented by the implantable cardiac monitor between 91 days after the initiation of treatment (receipt of antiarrhythmic drug or catheter ablation) and final trial follow-up. The inset shows the same data on an enlarged y axis.



# Distribution of $VO_2/Kg$ and Mean $VE/VCO_2$ slope in Persistent AF ( EHRA Sx Score 1~2 )





# Various Wearable ECGs for Early detection of AF

	Sensors	Measurements	Clinical applications
	<b>Activity</b>		
	Accelerometer	Step count, impact force, speed, sedentary time, exercise	<ul style="list-style-type: none"> <li>• Risk assessment in healthy individuals and those with established CVD</li> <li>• Physical activity behavioural interventions in primary and secondary prevention</li> <li>• Cardiac telerehabilitation</li> <li>• Heart failure management</li> </ul>
	Barometer	Stair count	
	GPS	Distance traveled	
		Calories burned estimated from multiple measurements	
	<b>Biometric</b>		
	PPG	HR, HRR, HRV, cuff-less BP, SaO <sub>2</sub> , cardiac output, stroke volume, pulse-based rhythm detection, sleep and its stages	<ul style="list-style-type: none"> <li>• Risk prediction in healthy individuals and those with established CVD</li> <li>• Hypertension screening and management</li> <li>• Cardiac telerehabilitation</li> <li>• Arrhythmia screening and diagnosis</li> <li>• Acute coronary syndrome diagnosis</li> <li>• Diagnosis of electrolyte abnormalities such as hyperkalaemia</li> <li>• Long QTc diagnosis</li> <li>• Heart failure management</li> <li>• Medication titration such as <math>\beta</math>-blockers</li> </ul>
	ECG	Single-lead and multi-lead ECG, continuous or as-needed ECG monitoring, interval measurements such as QTc, arrhythmia detection and electrolyte abnormality changes	
	Oscillometry	Wrist cuff BP	
	<b>Other</b>		
Biochemical sensors	Invasive for continuous blood glucose and electrolyte monitoring Non-invasive for sweat and saliva electrolytes and hydration status	<ul style="list-style-type: none"> <li>• Identifying electrolyte abnormalities</li> <li>• Continuous blood glucose monitoring</li> <li>• Heart failure management</li> </ul>	
Biomechanical sensors such as ballistocardiograms, seismocardiograms and dielectric sensors	Cardiac output, stroke volume, lung fluid volume, body vibrations, weight		

- Definition and diagnosis of atrialfibrillation

Recommendations	Class <sup>a</sup>	Level <sup>b</sup>
ECG documentation is required to establish the diagnosis of AF.	I	B
<ul style="list-style-type: none"> <li>• A standard 12-lead ECG recording or a single-lead ECG tracing of <math>\geq 30</math> s showing heart rhythm with no discernible repeating P waves and irregular RR intervals (when atrioventricular conduction is not impaired) is diagnostic of clinical AF.<sup>6</sup></li> </ul>		

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Recommendation	Class <sup>a</sup>	Level <sup>b</sup>
Opportunistic screening for AF by pulse taking or ECG rhythm strip is recommended in patients $\geq 65$ years of age. <sup>188,211,223,225</sup>	I	B
<p>When screening for AF it is recommended that<sup>217,218</sup></p> <ul style="list-style-type: none"> <li>• The individuals undergoing screening are informed about the significance and treatment implications of detecting AF.</li> <li>• A structured referral platform is organized for screen-positive cases for further physician-led clinical evaluation to confirm the diagnosis of AF and provide optimal management of patients with confirmed AF.</li> </ul>	I	B
<ul style="list-style-type: none"> <li>• Definite diagnosis of AF in screen-positive cases is established only after physician reviews the single-lead ECG recording of <math>\geq 30</math> s or 12-lead ECG and confirms that it shows AF.</li> </ul>		
Systematic ECG screening should be considered to detect AF in individuals aged $\geq 75$ years, or those at high risk of stroke. <sup>212,224,227</sup>	IIa	B

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# CANDLE - AF Trial ([cris.nih.go.kr](http://cris.nih.go.kr) / KCT0005592)

frontiers | Frontiers in Cardiovascular Medicine

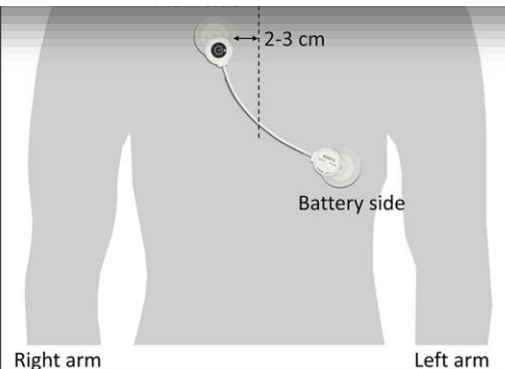
STUDY PROTOCOL  
published: 04 April 2022  
doi: 10.3389/fcvm.2022.837958

## Clinical Implications of Atrial Fibrillation Detection Using Wearable Devices in Patients With Cryptogenic Stroke (CANDLE-AF) Trial: Design and Rationale

Sodam Jung<sup>1</sup>, Hye Ah Lee<sup>2</sup>, In Sook Kang<sup>1</sup>, Sang Hoon Shin<sup>3</sup>, Yoonkyung Chang<sup>1</sup>, Dong Woo Shin<sup>4</sup>, Moo-Seok Park<sup>5</sup>, Young Dae Kim<sup>6</sup>, Hyo Suk Nam<sup>6</sup>, Ji Hoe Heo<sup>6</sup>, Tae-Hoon Kim<sup>7</sup>, Hee Tae Yu<sup>7</sup>, Jung Myung Lee<sup>8</sup>, Sung Hyuk Heo<sup>9</sup>, Ho Geol Woo<sup>9</sup>, Jin-Kyu Park<sup>10</sup>, Seung-Young Roh<sup>11</sup>, Chi Kyung Kim<sup>12</sup>, Young-Soo Lee<sup>13</sup>, Jin Kuk Do<sup>14</sup>, Dong-Hyeok Kim<sup>3\*</sup>, Tae-Jin Song<sup>5\*</sup>, Junbeom Park<sup>1\*</sup> and CANDLE-AF Trial Investigators

- 뇌졸중 진단 7일 ~ 30일 사이의 퇴원전 원내 EKG monitoring
- 퇴원 이후 정기적인 외래 방문과 심전도 (필요시 Holter), 증상 발현시 심전도

- 뇌졸중 EKG monitoring
- 퇴원 후 정기적인 외래 방문 (필요시 Holter), 증상 발현시 심전도
- 외래 방문 시 심전도



환자 (Unknown origin Stroke)

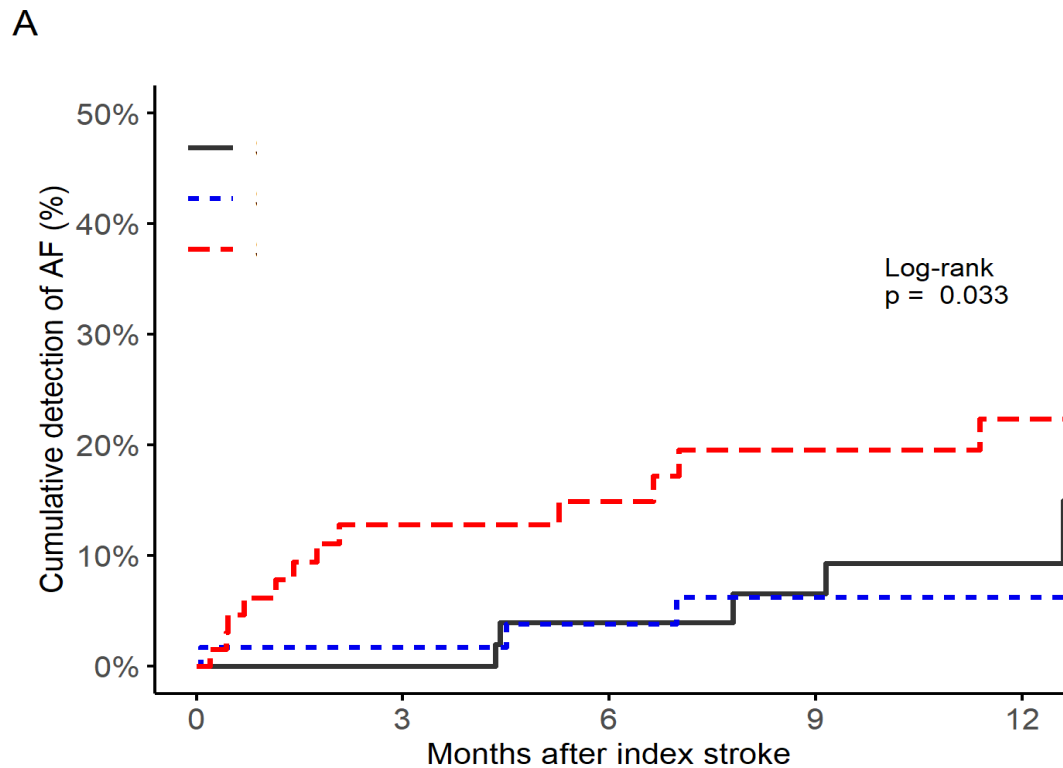
Patients with cryptogenic stroke  
are monitoring (CANDLE -AF Trial)

(1:1:1) 배정

스, 대구 가톨릭, 충북대, 길병원

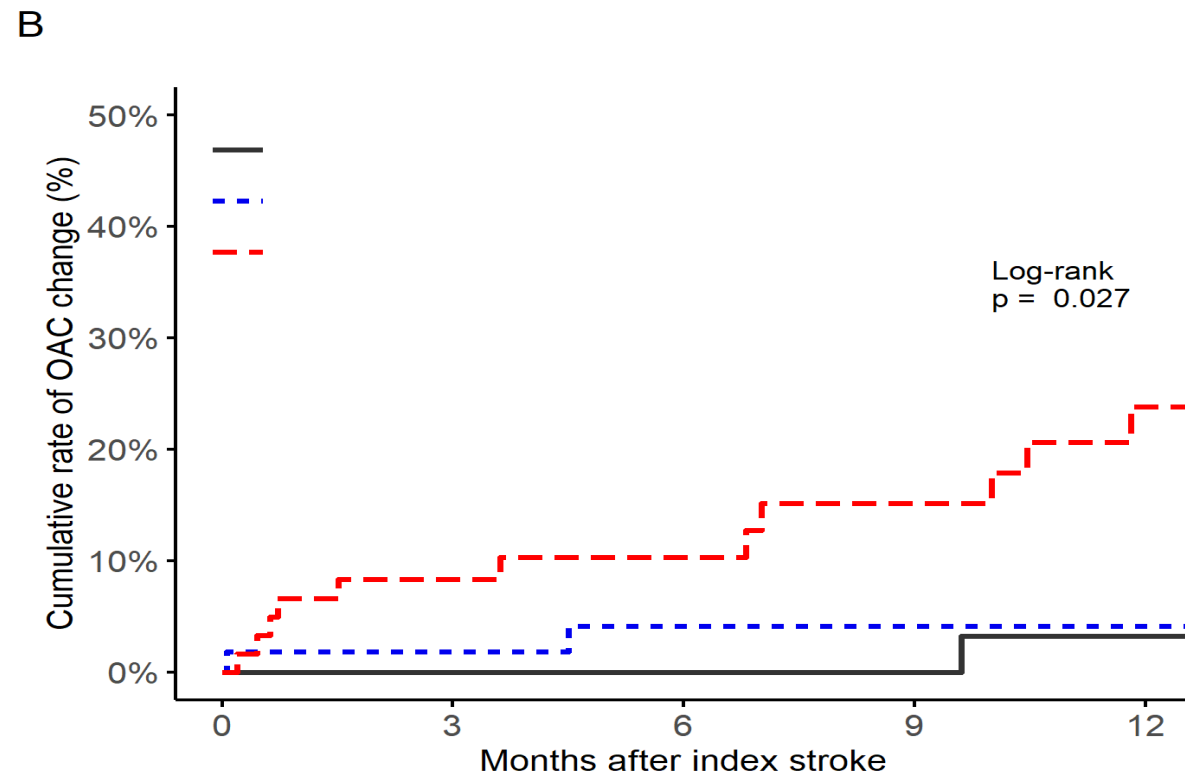






Number at risk

—	63	57	46	34	23
—	59	49	42	33	23
—	65	49	39	33	21



Number at risk

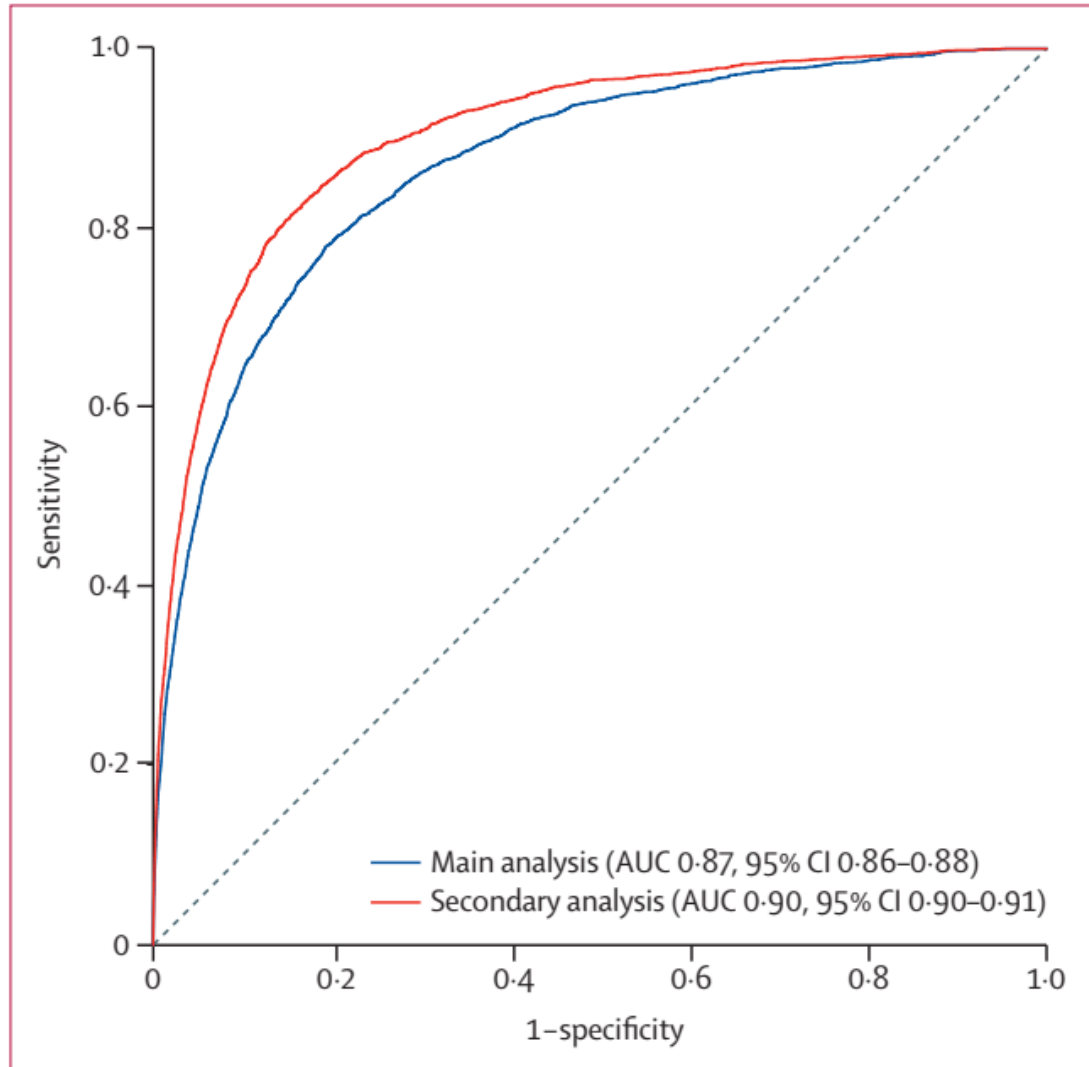
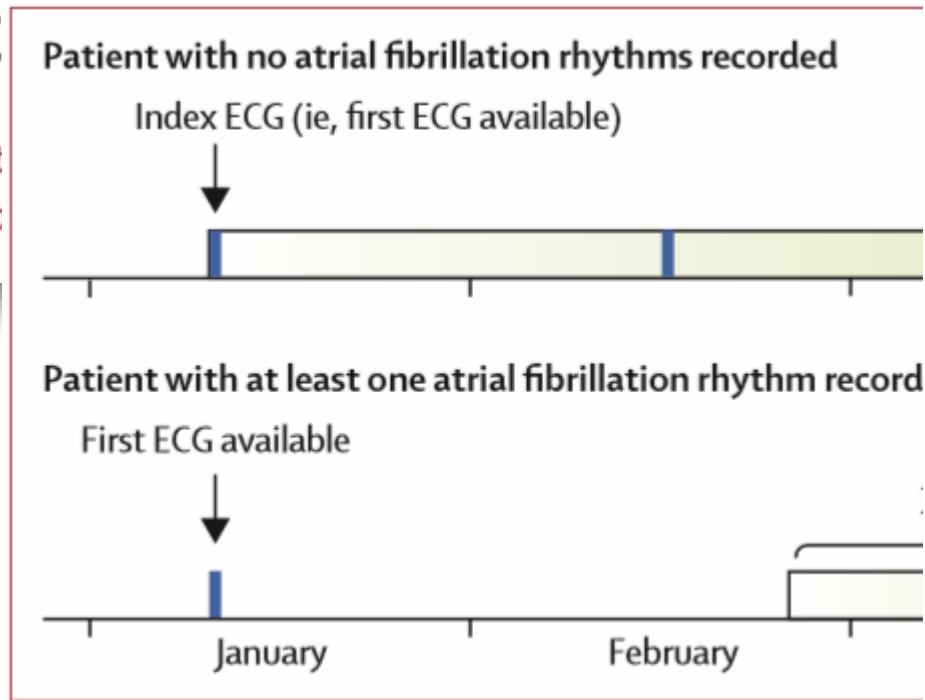
—	53	48	41	32	24
—	54	46	39	32	23
—	61	49	40	34	20

**Preliminary Results. Figure. KM of AF detection rate, OAC change rate, Re-admission rate of 3 groups**

# ECG and AI application

## An artificial intelligence-enabled ECG algorithm for the identification of patients with atrial fibrillation

Zachi Attia  
Xiaoxi Yao



# Artificial intelligence-guided screening for atrial fibrillation using electrocardiogram during sinus rhythm: a prospective non-randomised

Peter A Noseworthy, Zachi I Attia, Jun Yin, Bernard J Gersh, Jonathan

Atrial fibrillation

Atrial fibrillation

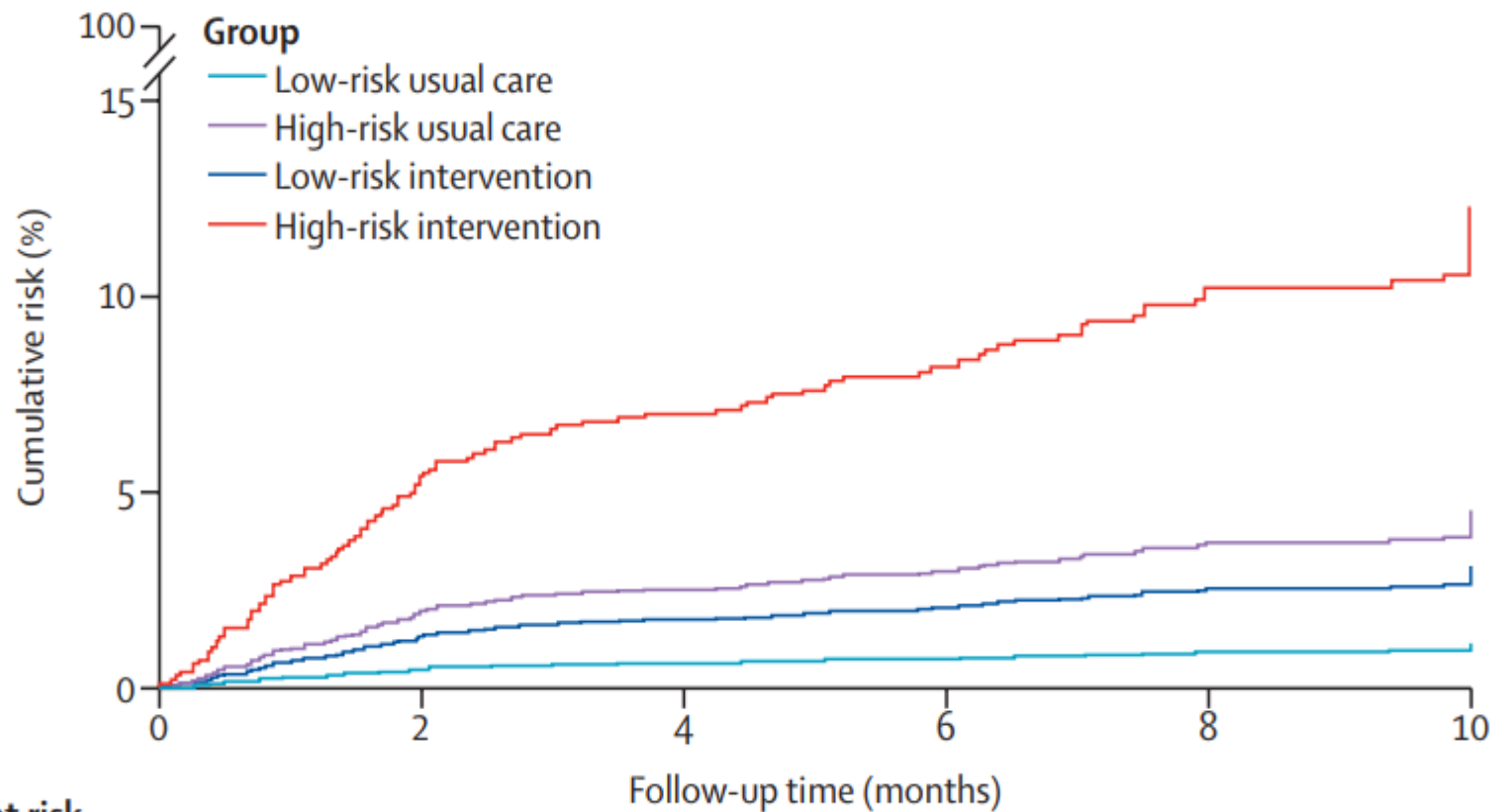
Atrial fibrillation

Atrial fibrillation

Longest episode of fibrillation within

Time to atrial fibrillation diagnosis, days\*

Data are n (%) or median diagnosed with atr



	Number at risk					
	0	2	4	6	8	10
Low-risk usual care	342	341	338	236	149	90
High-risk usual care	661	648	638	570	412	382
Low-risk intervention	371	365	364	253	145	99
High-risk intervention	632	593	577	514	399	375

# AI algorithm for early detection of PAF and prospective validation

## Prospective validation study of artificial intelligence-based prediction algorithm for the prediction of paroxysmal atrial fibrillation (PROVISION-AF Trial)

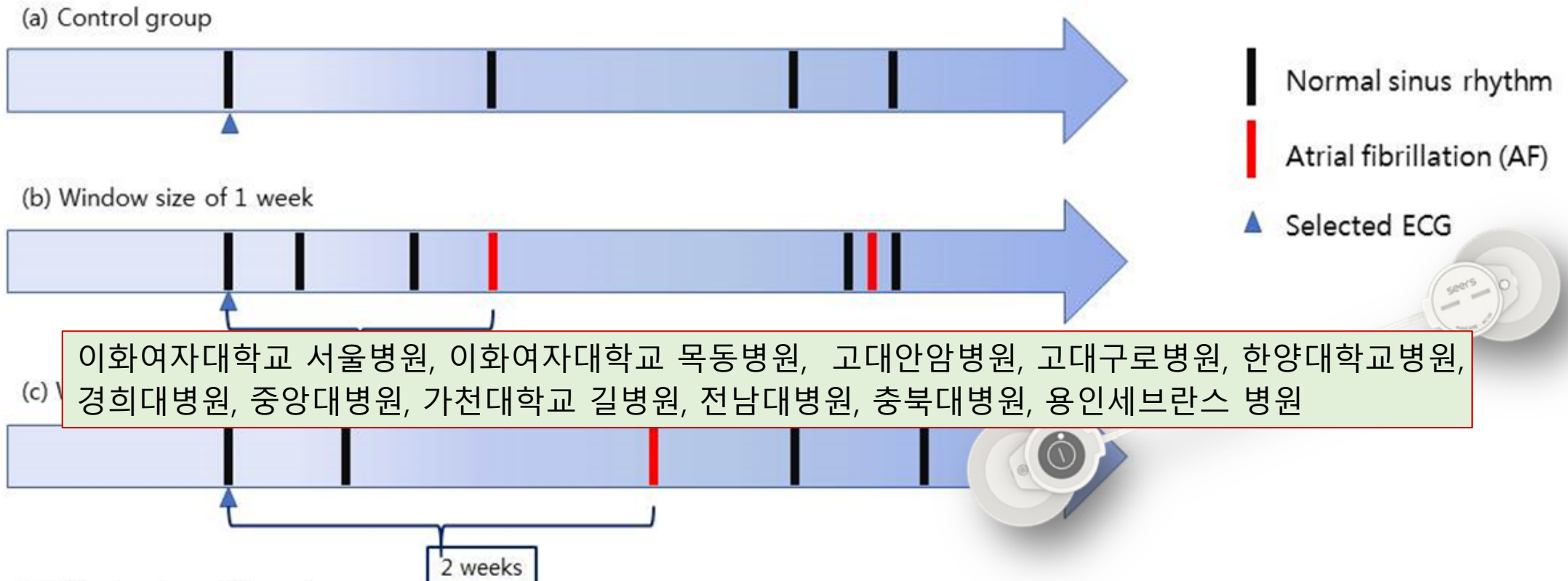
16,4

8,079  
inappr

927 (C  
train

736 ECGs  
1 week  
window  
period w  
used.

Figure1. Pa



이화여자대학교 서울병원, 이화여자대학교 목동병원, 고대안암병원, 고대구로병원, 한양대학교병원, 경희대병원, 중앙대병원, 가천대학교 길병원, 전남대병원, 충북대병원, 용인세브란스 병원

# LOOP Study – ILR (a randomised controlled trial)

	ILR 1501	Control 4503	HR/(95% CI)	P
<b>AF</b>	477(31.8%)	550 (12.2%)	3.17 (2.81-3.59)	<0.0001
<b>OAC</b>	445 (29.7%)	591 (13.1%)	2.72 (2.41-3.08)	<0.0001
<b>Stroke/SE</b>	318 (4.5)%	251 (5.6%)	0.80 (0.61-1.05)	0.11
<b>CV death</b>				차이없음
<b>Major bleeding</b>	65 (4.3%)	156 (3.5%)	1.26 (0.95-1.69)	0.11

Not all AF is worth screening for, and not all screen-detected AF merits anticoagulation

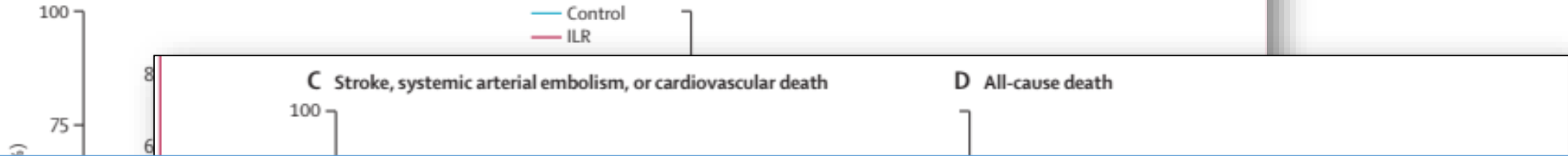
# LOOP Study – ILR (a randomised controlled trial)

A Stroke or systemic arterial embolism

B Ischaemic stroke, systemic arterial embolism, or transient ischaemic attack

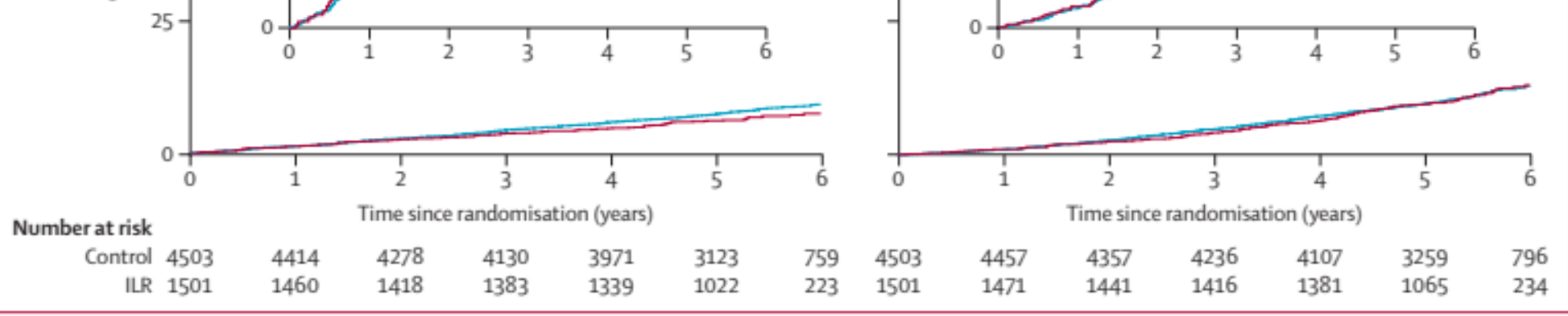
C Stroke, systemic arterial embolism, or cardiovascular death

D All-cause death



- ✓ LOOP study showed that short time of AF events is not related to stroke or embolic events.
- ✓ We are collecting 24~72hr HOLTTER data for making AI algorithm to predict AF burden as well as the presence of AF.

Number at risk  
Control 4503  
ILR 1501



# Rhythm control in AF-stroke: Who may benefit?

## 1. Early detection and early rhythm control of AF

(1) Early Anticoagulation (CHA2DS2-VASc score)

=> Prevention of stroke by AF

(2) Screening of AF

: immediate and continuous monitoring through a wearable ECG can increase the early detection of AF and increase the use of anticoagulant treatment

## 2 . AI algorithm to determine Optimal AF burden for improving MACE

(1) Early detection of patients with **optimal rhythm control in whom LA remodeling has not progressed.**

(2) Early detection of AF patients who need optimal anticoagulation treatment



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