SHG: Klinikum Idar-Oberstein
Akademisches Lehrkrankenhaus der Johannes Gutenberg-Universität Mainz

NEW DEVELOPMENTS IN CARDIAC ELECTROPHYSIOLOGY

Natig Gassanov

Medizinische Klinik II
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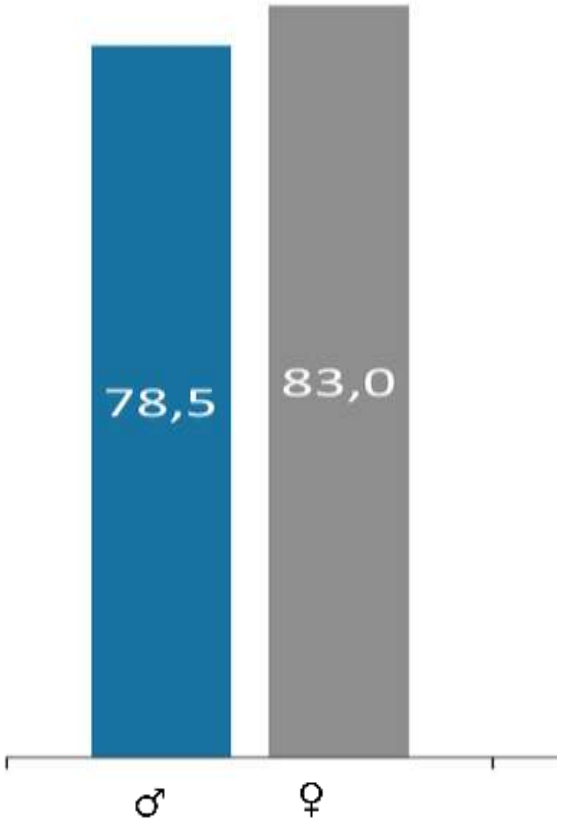
Klinikum Idar-Oberstein,
Akademisches Krankenhaus der Universität Mainz

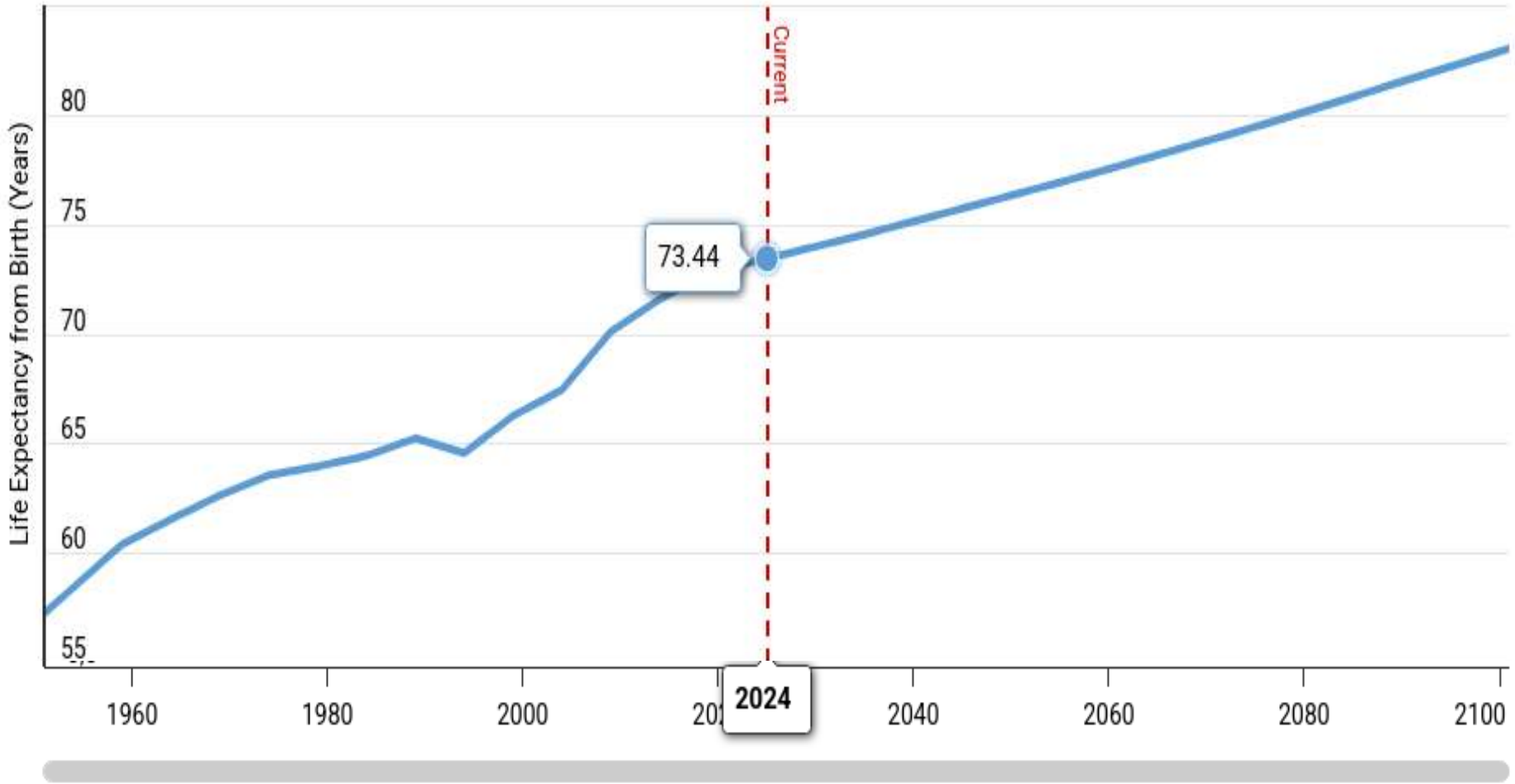
Life expectancy 2024

Germany

80,8 years



Azerbaijan



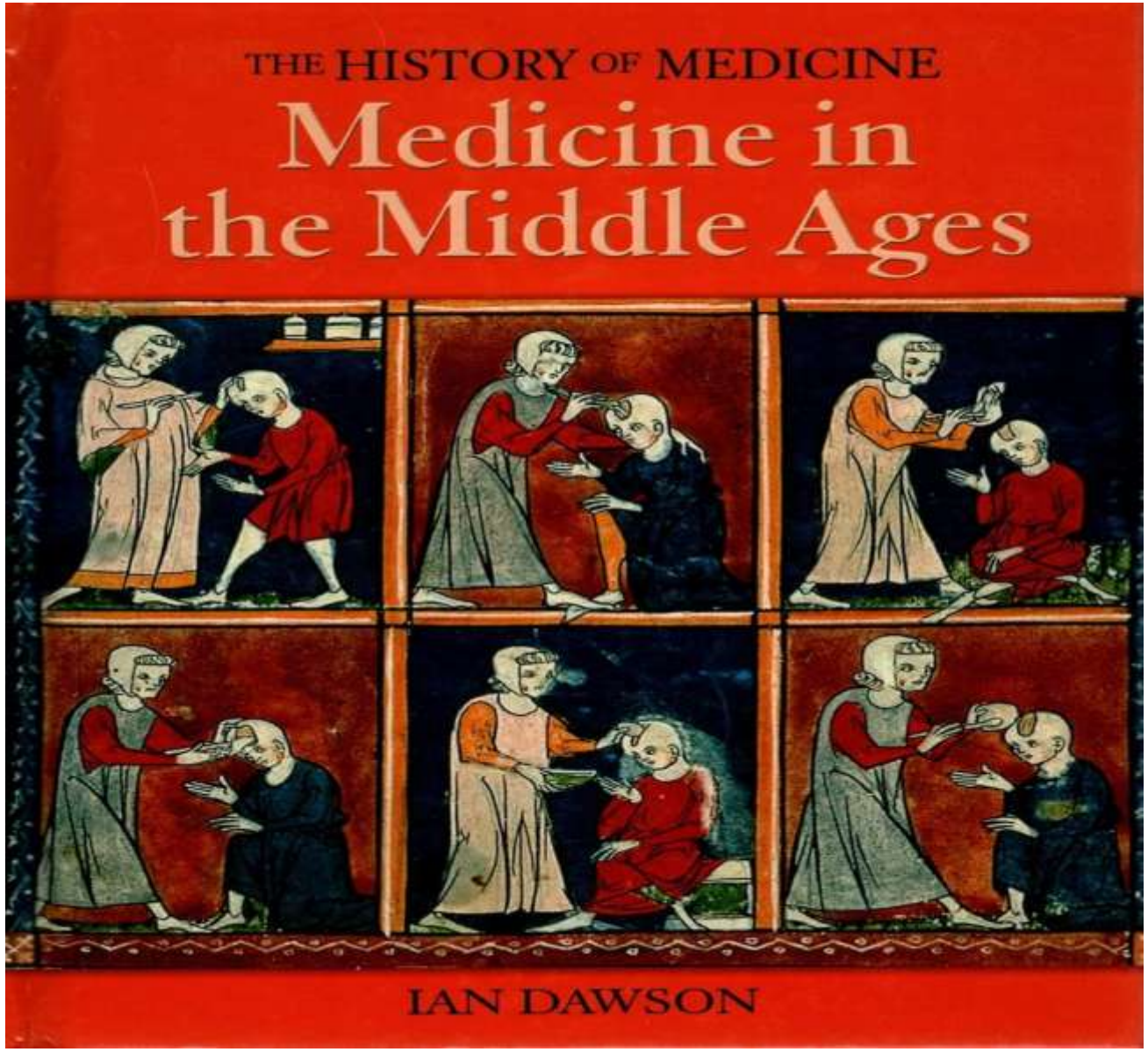
WHO, https://data.who.int/countries/031

Life expectancy

Entwicklung der Lebenserwartung bei Geburt seit 1880
Datenbasis: Periodensterbetafeln 1880 bis 2011* [6, 7]

Jahre	Jahre	
	Frauen	Männer
1880	-	-
1881	38,45	35,58

Gesundheitsberichterstattung des Bundes, Statistisches Bundesamt


THE HISTORY OF MEDICINE
Medicine in the Middle Ages
IAN DAWSON

Medicine in the Middle Ages

Life expectancy in Germany

Entwicklung der Lebenserwartung bei Geburt seit 1880
Datenbasis: Periodensterbetafeln 1880 bis 2011* [6, 7]

Jahre	Jahre	
	Frauen	Männer
1880	-	-
1881	38,45	35,58
1890	40,25	37,17
1900	43,97	40,56
1910	48,33	44,82
1911	50,68	47,41
1926	58,82	55,97
1934	62,81	59,86
1951	68,48	64,56
1962	72,39	66,86
1972	73,83	67,41
1988	78,68	72,21
1993	79,01	72,47
1996	79,72	73,29
1999	80,57	74,44
2002	81,22	75,38
2005	81,78	76,21
2008	82,40	77,17
2011	82,73	77,72

Gesundheitsberichterstattung des Bundes, Statistisches Bundesamt


Clinical Expertise
What the clinician knows
Best Research Evidence
What the literature says
Evidence-Based Medicine
Patient Values
What the patient wants

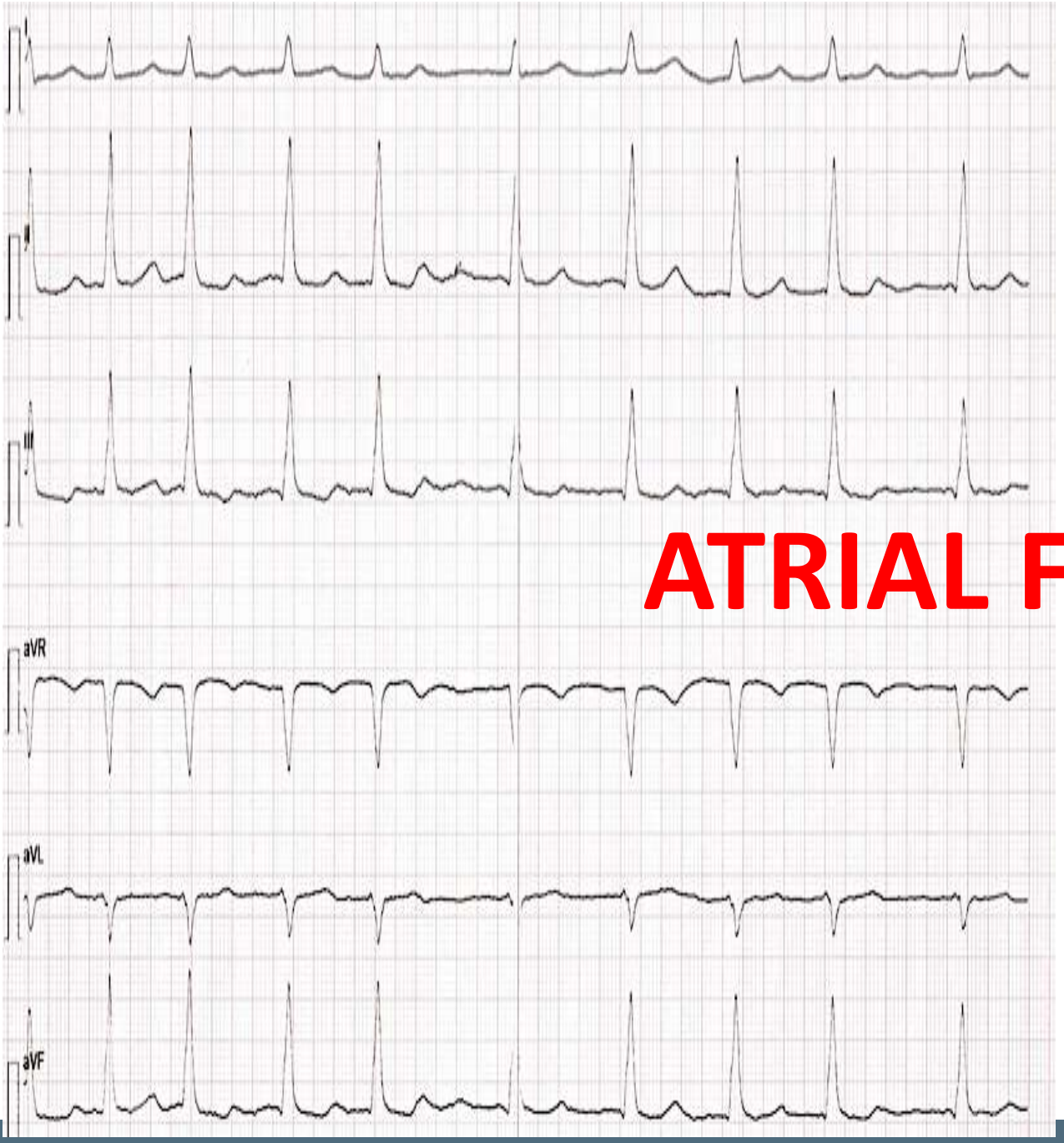
Clinical case

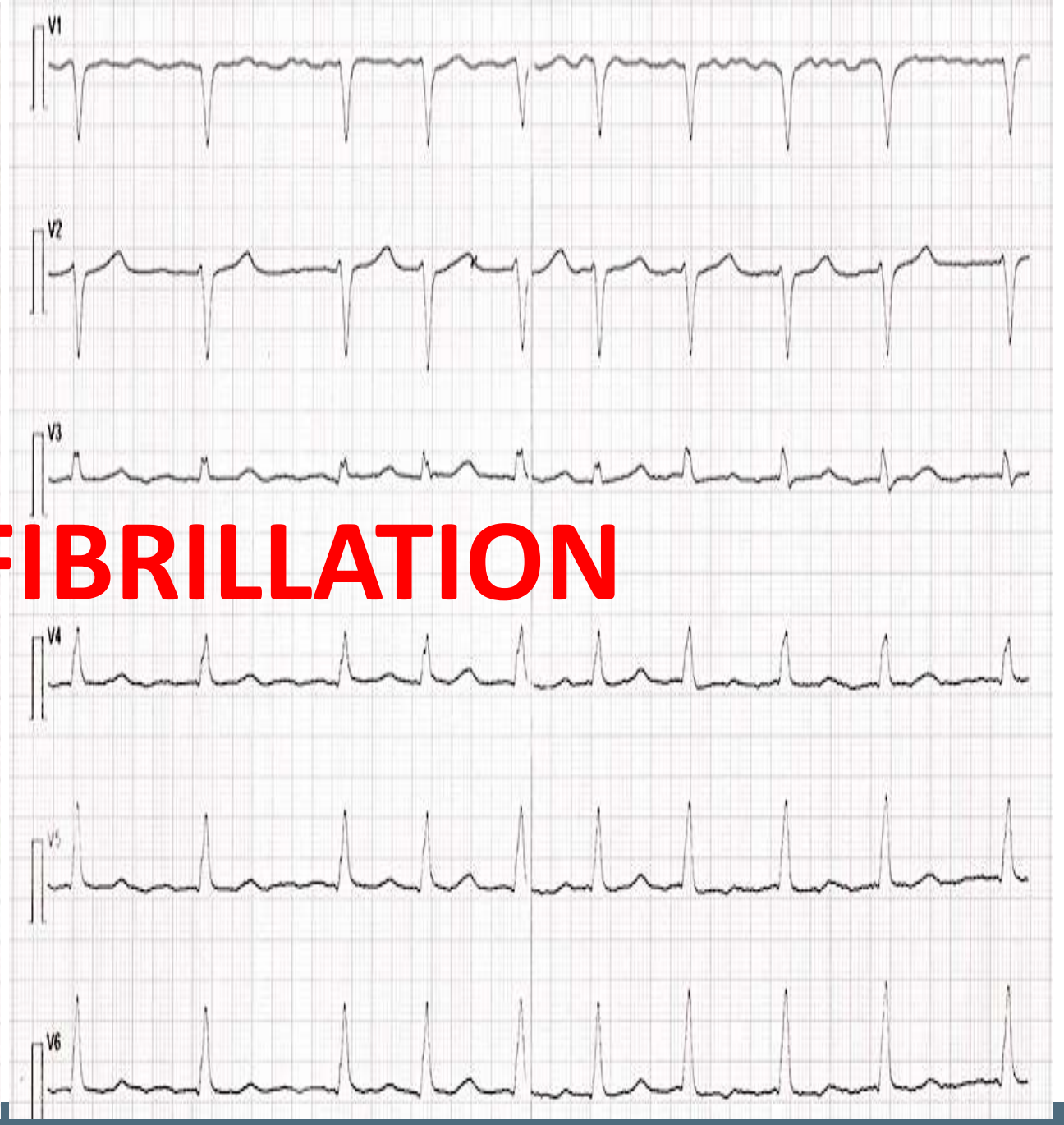
74 years old man

- Chest pain since yesterday
- Tachycardia and palpitations

<u>Pt. History</u>

- Arterial hypertension
- Transient ischemic attack 2022
- Exclusion of coronary artery disease (coronary angiography 2022)
- HFpEF





ATRIAL FIBRILLATION

Atrial fibrillation

3% prevalence in general population

AF-related OUTCOMES

AF-Related Outcome	Frequency in AF	Mechanism(s)
Death	1.5 - 3.5 fold increase	Excess mortality related to: • HF, comorbidities • Stroke
Stroke	20-30% of all ischaemic strokes, 10% of cryptogenic strokes	• Cardioembolic, or • Related to comorbid vascular atheroma
LV dysfunction / Heart failure	In 20-30% of AF patients	• Excessive ventricular rate • Irregular ventricular contractions • A primary underlying cause of AF
Cognitive decline / Vascular dementia	HR 1.4 / 1.6 (irrespective of stroke history)	• Brain white matter lesions, inflammation, • Hypoperfusion, • Micro-embolism
Depression	Depression in 16-20% (even suicidal ideation)	• Severe symptoms and decreased QoL • Drug side effects
Impaired quality of life	>60% of patients	• Related to AF burden, comorbidities, psychological functioning and medication • Distressed personality type
Hospitalizations	10-40% annual hospitalization rate	• AF management, related to HF, MI or AF related symptoms • Treatment-associated complications

Hindricks et al., 2020 Eur Heart J

THERAPY OPTIONS

Rhythm vs. frequency control

- Cardioversion + antiarrhythmics?
- Cardioversion + no therapy change?
- Ablation?

Anticoagulation

(CHA_2DS_2-VASC-Score)

- **Dabigatran**
- **Apixaban**
- **Rivaroxaban**
- **Edoxaban**

SPONTANEOUS INITIATION OF ATRIAL FIBRILLATION BY ECTOPIC BEATS ORIGINATING IN THE PULMONARY VEINS

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.

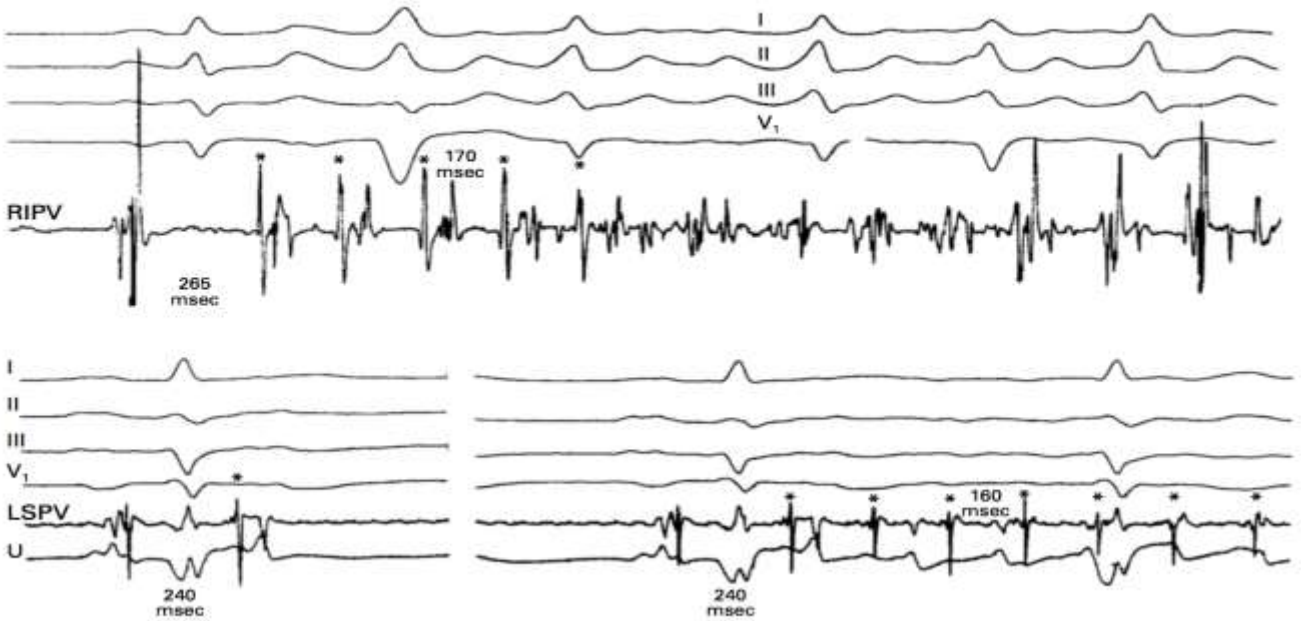


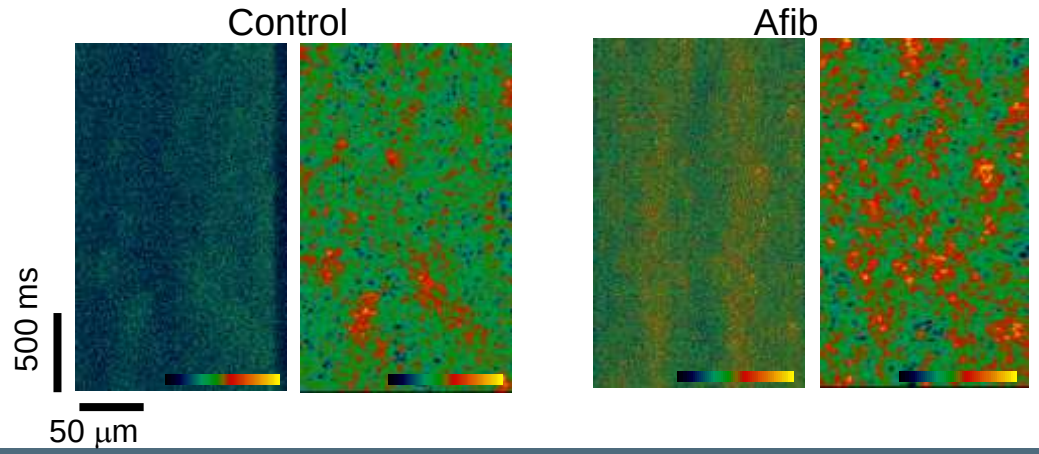
Figure 3. Two Examples of the Onset of Atrial Fibrillation from Foci in a Right Inferior Pulmonary Vein and a Left Superior Pulmonary Vein.

Cell
Volume 39, Issue 2, February 2006, Pages 175-186

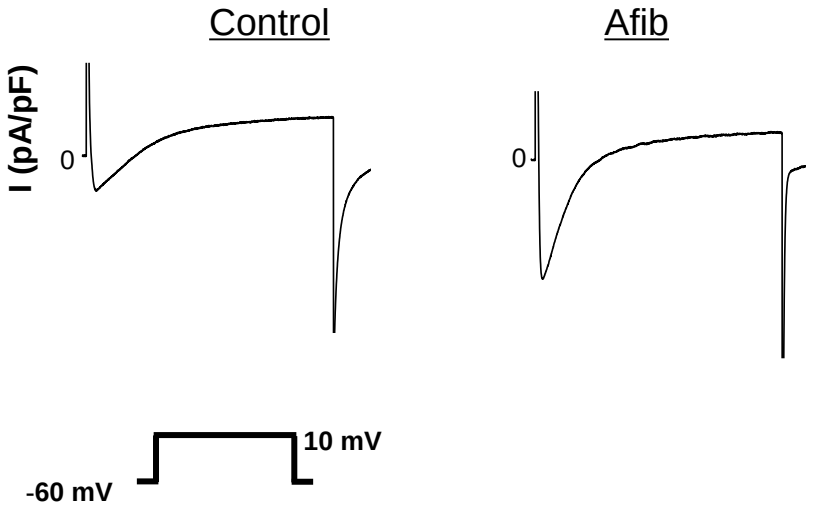
Angiotensin II-induced changes of calcium sparks and ionic currents in human atrial myocytes: Potential role for early remodeling in atrial fibrillation

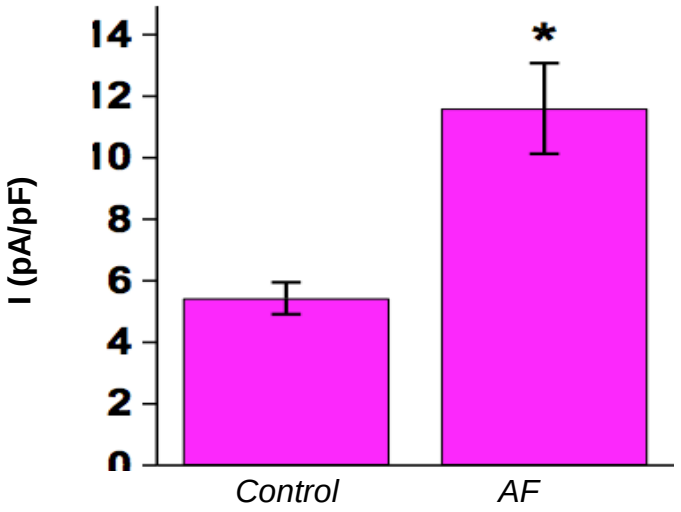
Natig Gassanov [a], Mathias C. Brandt [a b], Guido Michels [a b], Michael Lindner [a], Fikret Er [a], Uta C. Hoppe [a b]

Ca^{2+}- homeostasis in atrial fibrillation



Overexpression of L-type-calcium channels in atrial fibrillation ($I_{Ca,L}$)





Gassanov et al., JBC, 2008

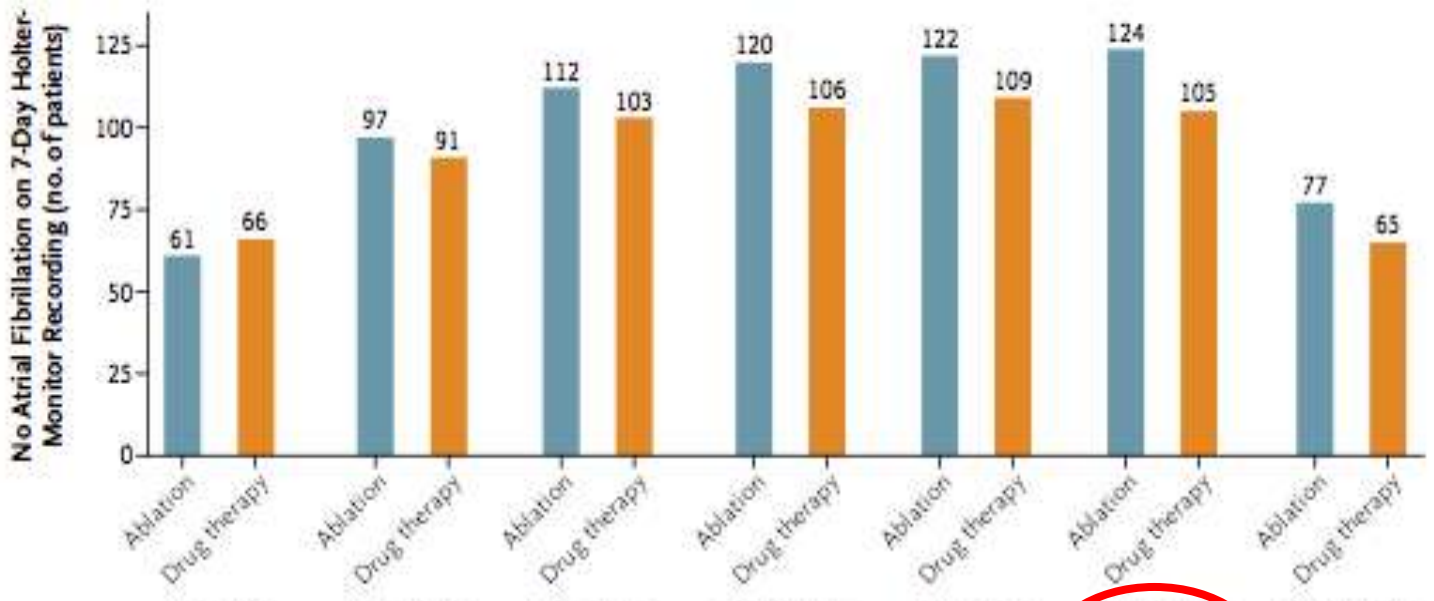
MANTRA-PAF

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 OCTOBER 25, 2012 VOL. 367 NO. 17

Radiofrequency Ablation as Initial Therapy in Paroxysmal Atrial Fibrillation

Jens Cosedis Nielsen, M.D., D.M.Sc., Arne Johannessen, M.D., D.M.Sc., Pekka Raatikainen, M.D., Ph.D., Gerhard Hindricks, M.D., Ph.D., Håkan Walfridsson, M.D., Ph.D., Ole Kongstad, M.D., Ph.D., Steen Pehrson, M.D., D.M.Sc., Anders Englund, M.D., Ph.D., Juha Hartikainen, M.D., Ph.D., Leif Spange Mortensen, M.Sc., and Peter Steen Hansen, M.D., D.M.Sc.



	Baseline	3 Months	6 Months	12 Months	18 Months	24 Months	Cumulative
(Mann–Whitney test)	149 146	145 150	144 151	141 154	141 154	138 157	140 155
P Value	0.72	0.49	0.34	0.08	0.07	0.007	0.10

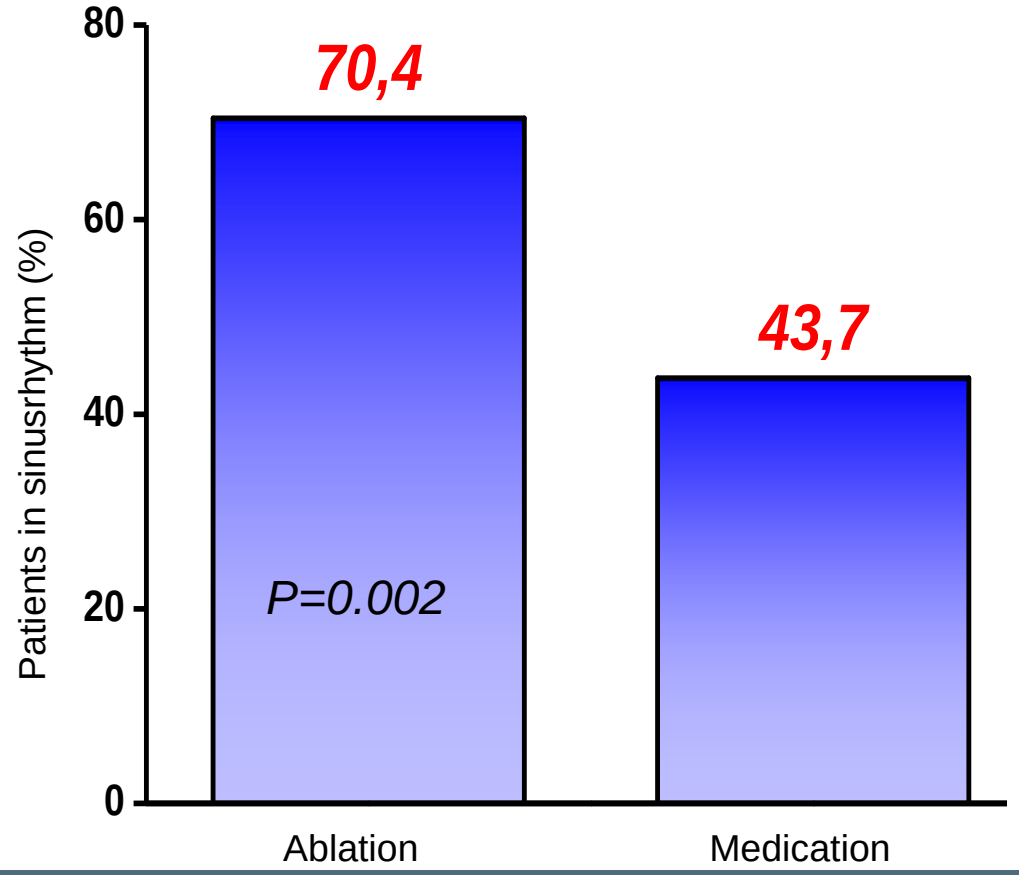
SARA-Study

Catheter ablation vs. antiarrhythmic drug treatment of <u>persistent</u> atrial fibrillation: a multicentre, randomized, controlled trial

(n=449)

Primary Endpoint: *Afib at 1 year*

Follow-up: *2 years*



Mont et al., Eur Heart J 2014

Guidelines

Recommendation Table 19 — Recommendations for catheter ablation of AF (see also Evidence Table 19)

First-line rhythm control therapy		
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.[16,591–594]	I	A
AF patients resistant or intolerant to antiarrhythmic drug therapy		
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.[3,15,503,505,506,508]	I	A

Left atrial catheter ablation

Recommendations	Class[a]	Level[b]
Catheter ablation of AF may be considered in patients with symptomatic long-standing persistent AF refractory to antiarrhythmic drugs.	IIb	C
Catheter ablation of AF in patients with heart failure may be considered when antiarrhythmic medication, including amiodarone, fails to control symptoms.	IIb	B
Catheter ablation of AF may be considered prior to antiarrhythmic drug therapy in symptomatic patients despite adequate rate control with paroxyxmal symptomatic AF and no significant underlying heart disease.	IIb	B

[a]Class of recommendation.
[b]Level of evidence.
AF = atrial fibrillation; i.v. = intravenous; LMWH = low molecular weight heparin; OAC = oral anticoagulant; UFH = unfractionated heparin.

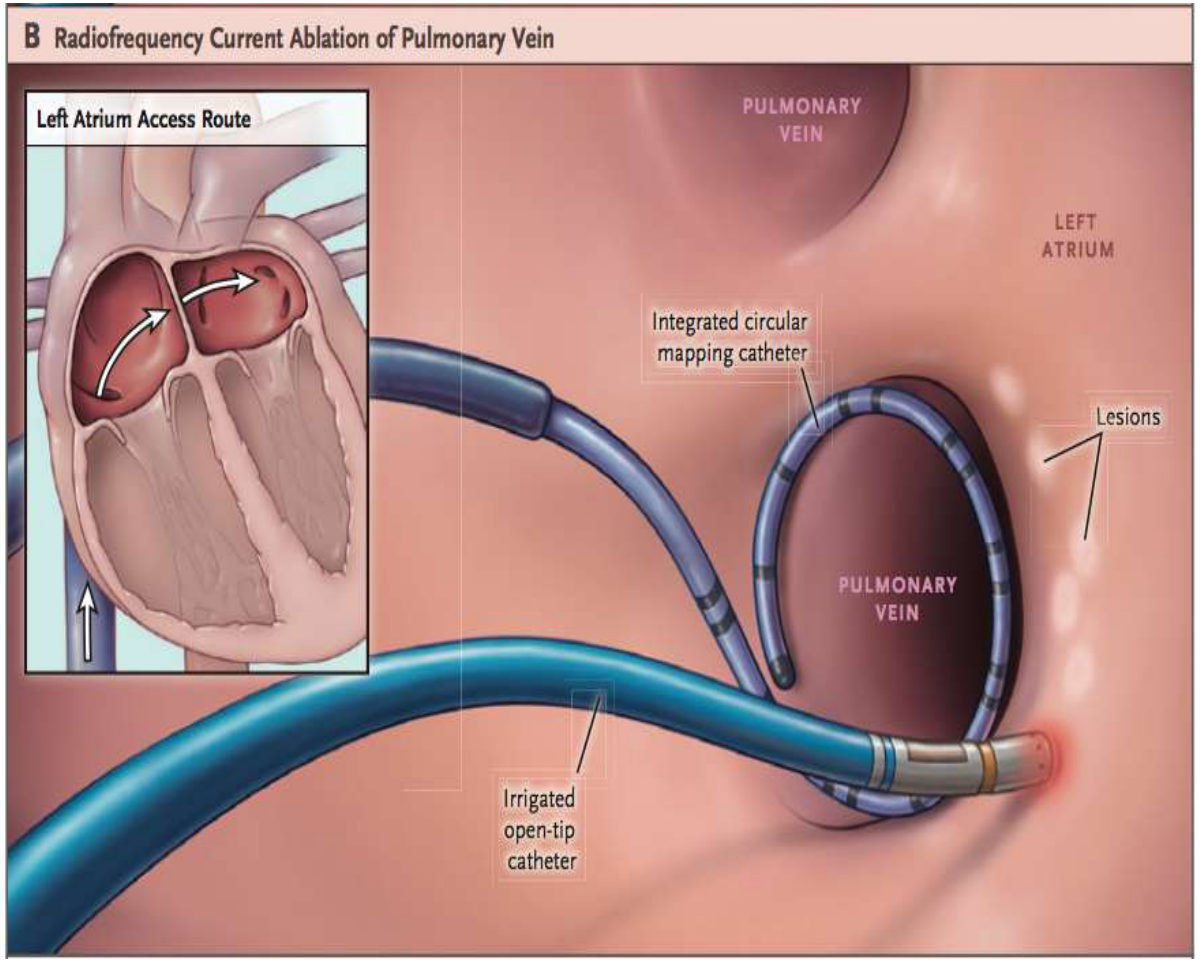
www.escardio.org/guidelines

European Heart Journal (2010) 31, 2369-2429

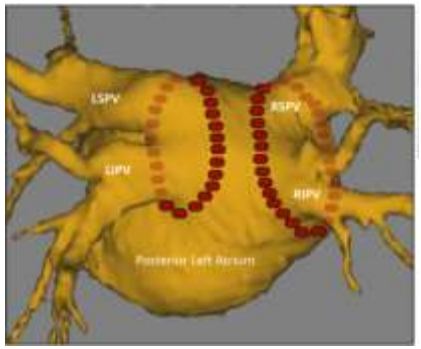
EUROPEAN SOCIETY OF CARDIOLOGY®

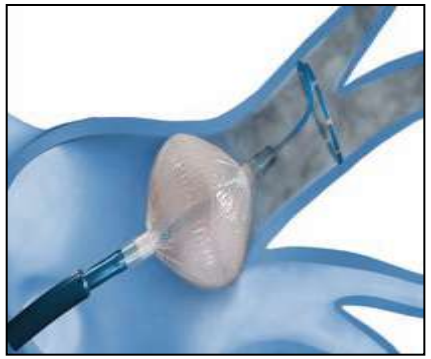
Pulmonary vein isolation

2005-2016

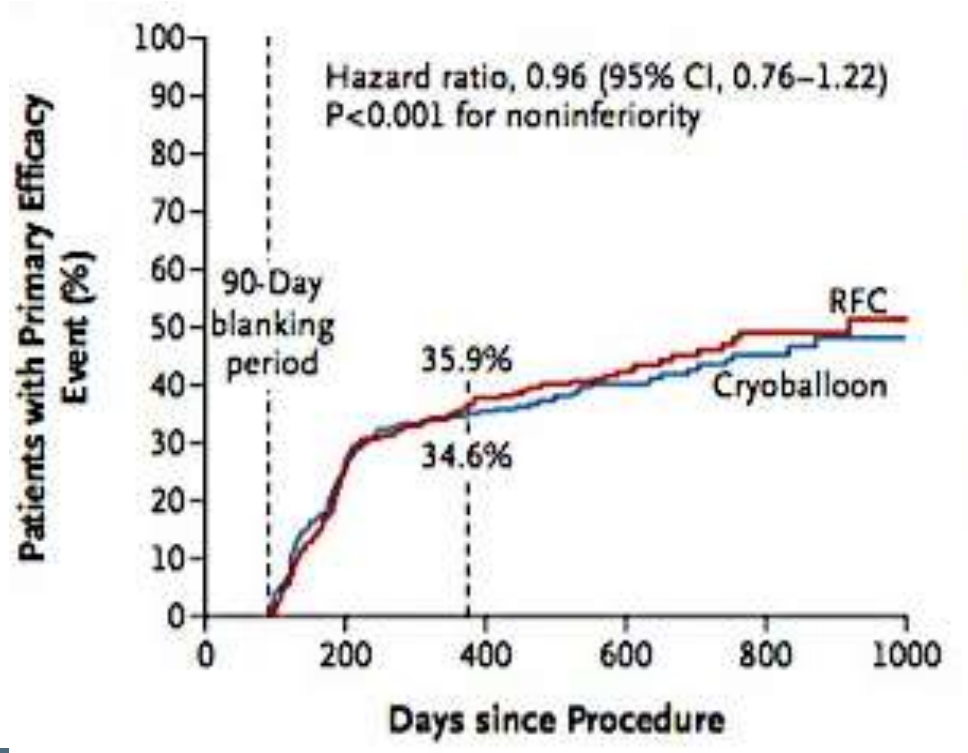


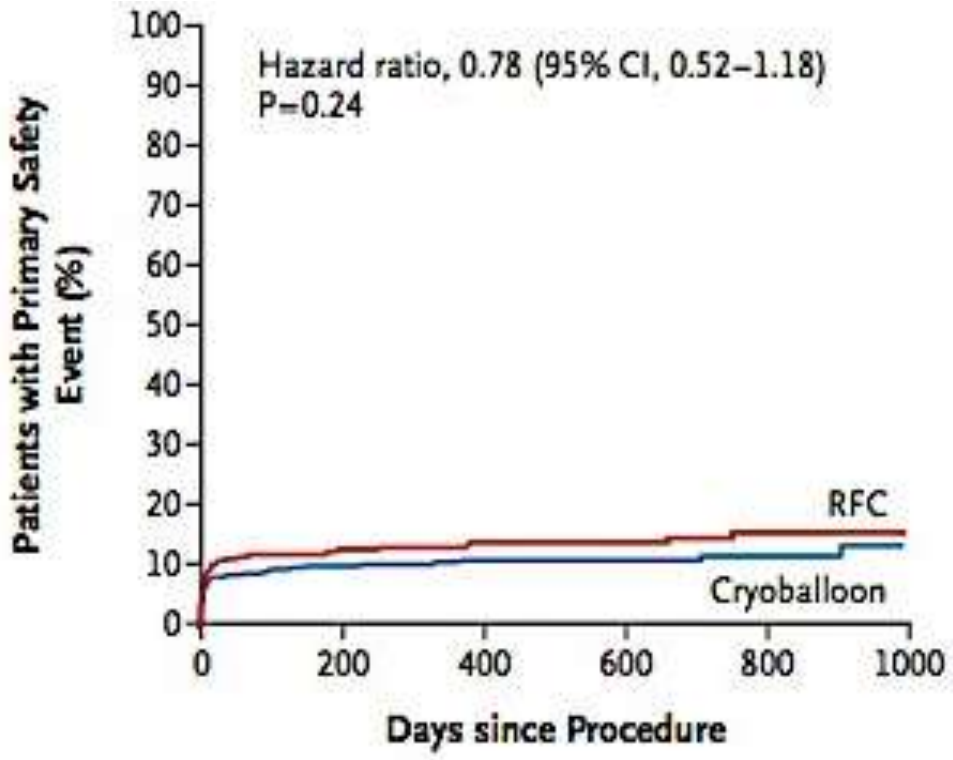
FIRE AND ICE





- *Patients with paroxysmal AF (n=762), Follow-up 1,5 years*
- *Primary efficacy endpoint: SVT (AF, atrial flutter, atrial tachycardia)*
- *Primary safety endpont: death, apoplex/TIA, complicatons of the PVI*

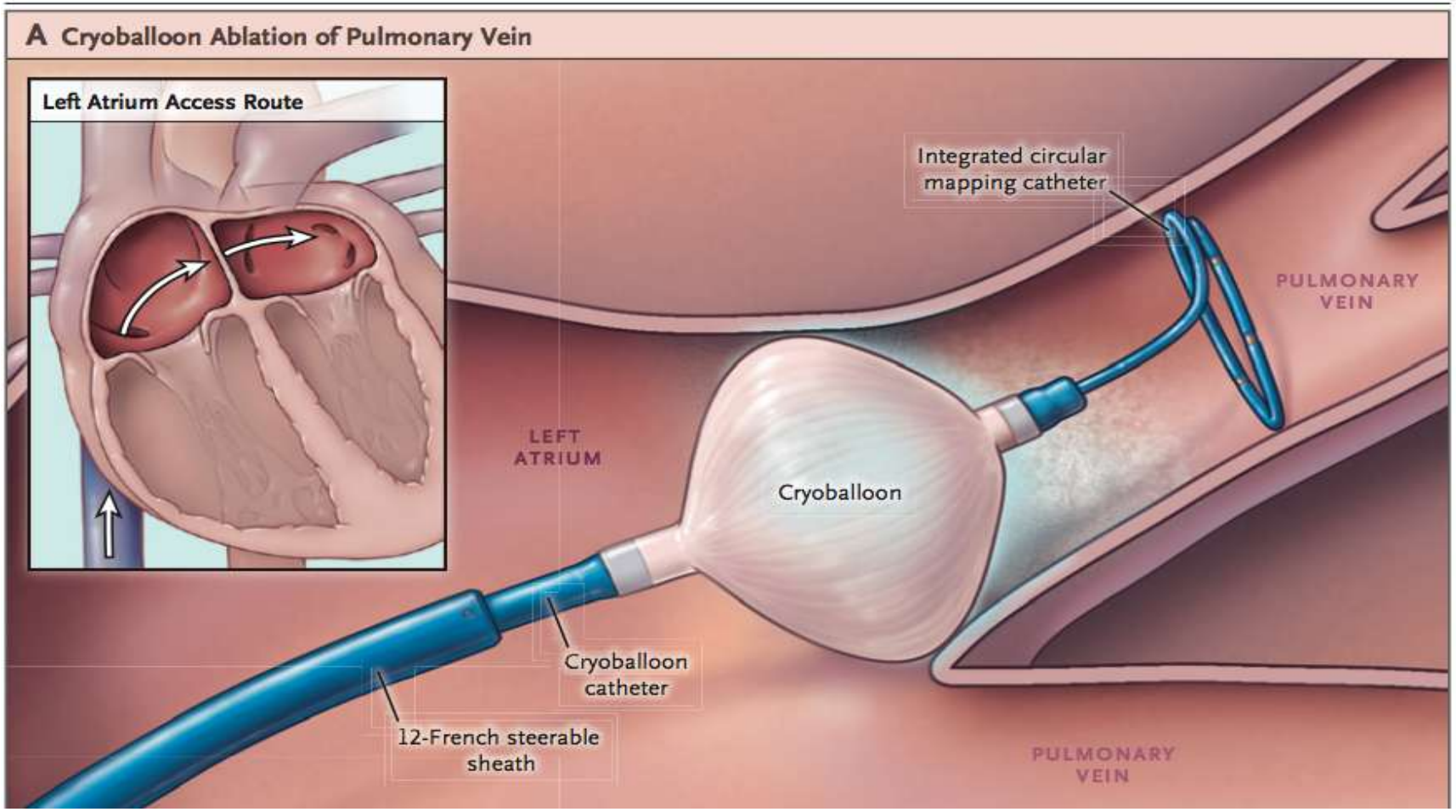


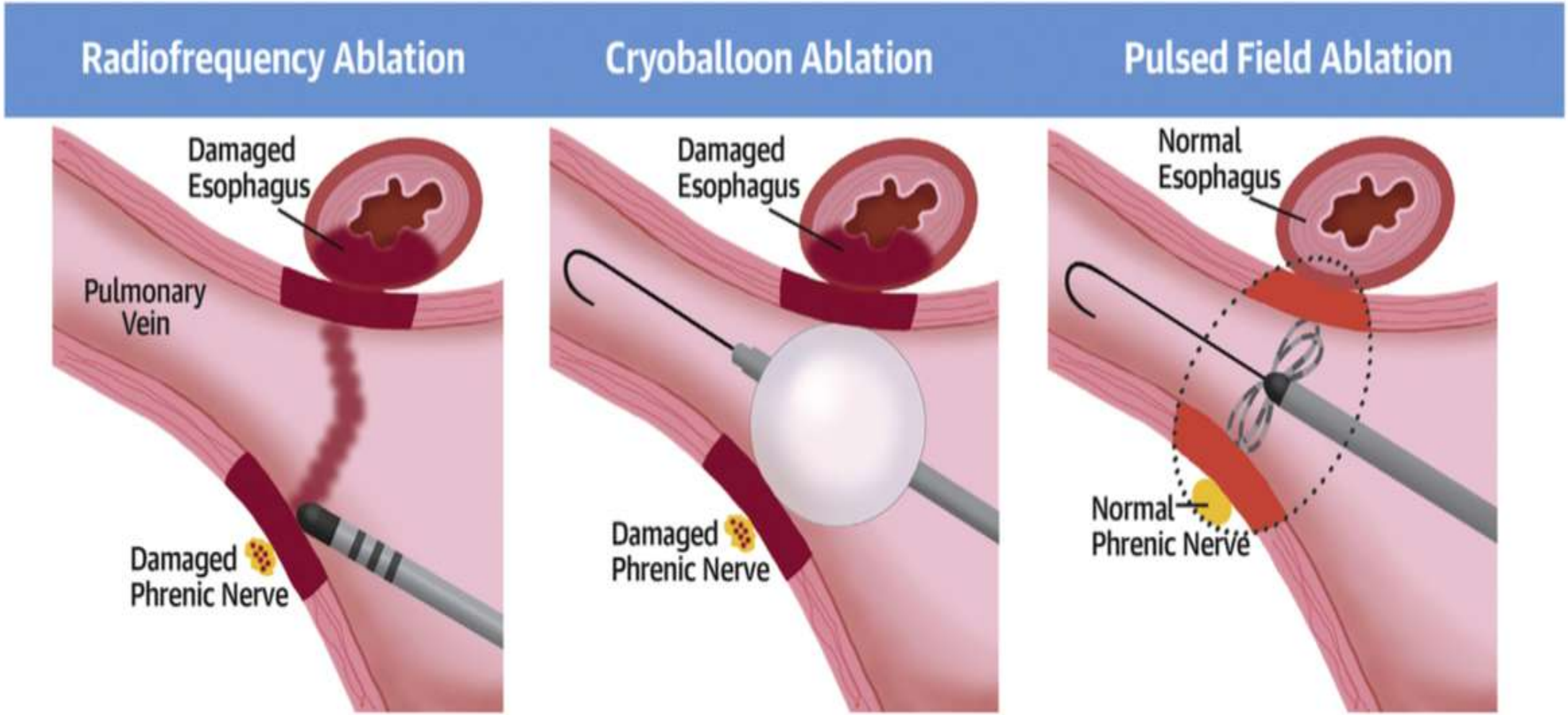


Kuck et al., NEJM, 2016

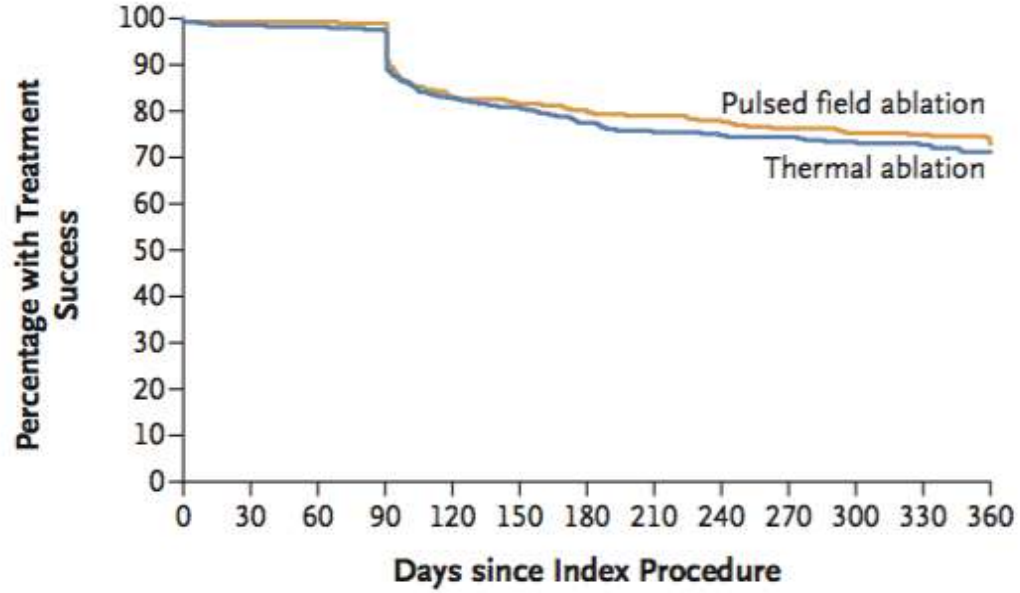
Pulmonary vein isolation

Since 2016




Radiofrequency Ablation
Cryoballoon Ablation
Pulsed Field Ablation
Damaged Esophagus
Pulmonary Vein
Damaged Phrenic Nerve
Damaged Esophagus
Damaged Phrenic Nerve
Normal Esophagus
Normal Phrenic Nerve

Pulsed field Ablation: new chances, new risks?



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

Table 3. Serious and Nonserious Adverse Events.*

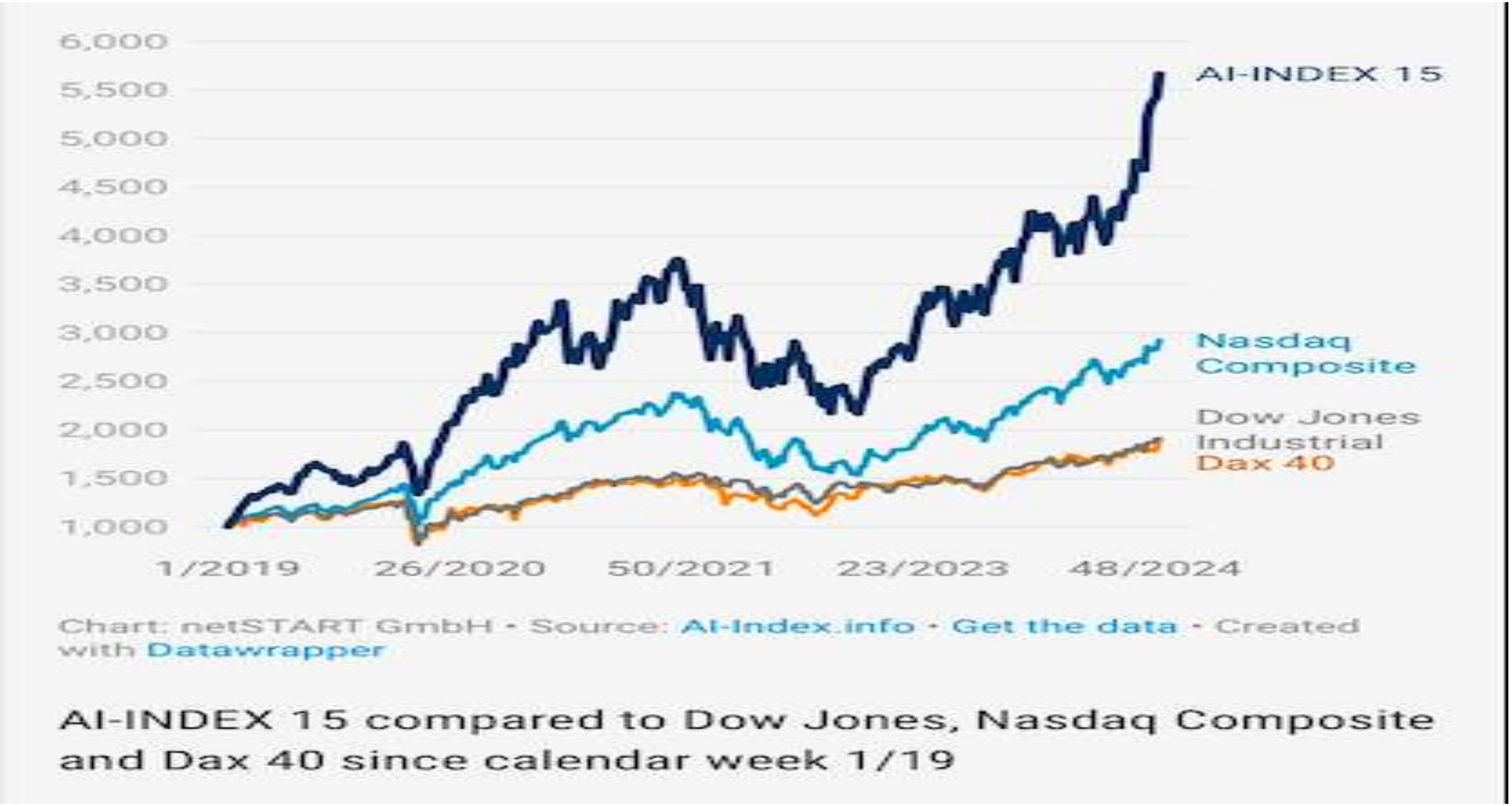
Event	Serious Adverse Events†		Serious or Nonserious Adverse Events‡	
	Pulsed Field Ablation (N=305)	Thermal Ablation (N=302)	Pulsed Field Ablation (N=305)	Thermal Ablation (N=302)
	number of patients (percent)			
Any event	6 (2.0)§	4 (1.3)	7 (2.3)§	6 (2.0)
Death	1 (0.3)	0	1 (0.3)	0
Myocardial infarction	0	0	0	0
Persistent phrenic-nerve palsy	0	0	0	2 (0.7)
Stroke	0	1 (0.3)	0	1 (0.3)
TIA	1 (0.3)	0	1 (0.3)	0
Systemic thromboembolism	0	0	0	0
Cardiac tamponade or perforation	2 (0.7)	0	2 (0.7)	0
Pericarditis	1 (0.3)	0	2 (0.7)	0
Pulmonary edema	1 (0.3)	1 (0.3)	1 (0.3)	1 (0.3)
Vascular-access complication	1 (0.3)	2 (0.7)	1 (0.3)	2 (0.7)
Heart block	0	0	0	0
Gastric motility or pyloric spasm	0	0	0	0
Pulmonary vein stenosis	0	0	0	0
Atrioesophageal fistula	0	0	0	0

Reddy et al., NEJM, 2023

First cases in Idar-Oberstein Hospital *(n=14)*

- Average time < 50 Minutes
- AF-Recurrence: 1/14
- No major complication

ARTIFICIAL INTELLIGENCE (AI)



ARTIFICIAL INTELLIGENCE IN CARDIAC ELECTROPHYSIOLOGY?

TAILORED-AF

first multicenter trial on PVI using artificial intelligence (AI) in persistent AF

n =374 in 26 centres in Europe and North America

- AI-Software identified 3D-guided appropriate ablation sites (n=188)
- Primary endpoint: AF-free survival after 1 year

Results

- Compared with PVI alone, AI-Guided Ablation Lowers AF at 12 Months (88% vs. 70%, p<0,0001)
- Longer procedure time (178 vs 62 minutes, p<0,001)

Deisenhofer et al, HRS, 2024, Boston

CONCLUSION

- Evidence-based medicine in the driving motor of the medical progress
- Ablation is now a standard treatment of atrial fibrillation
- The technological progress will possibly make it more effective and easier in future
- Open for collaboration with our collegues in Azerbaijan