

The Role of Transcatheter Atrial Fibrillation Ablation in Hypertrophic Cardiomyopathy



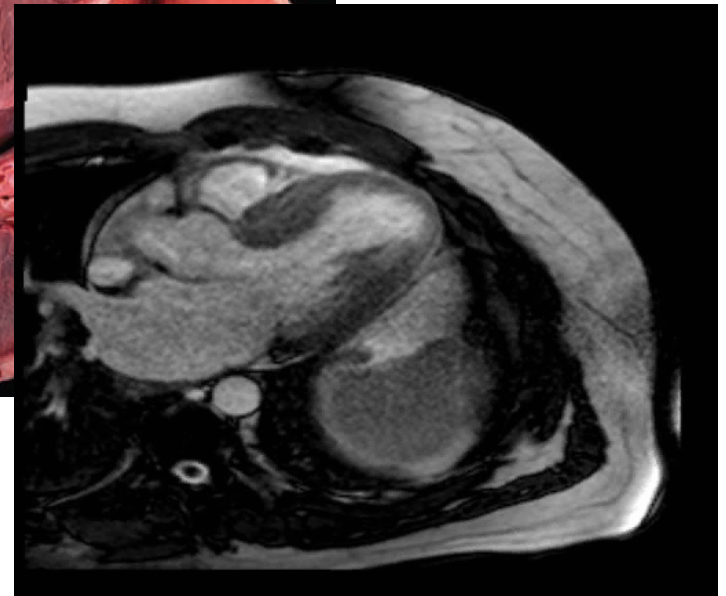
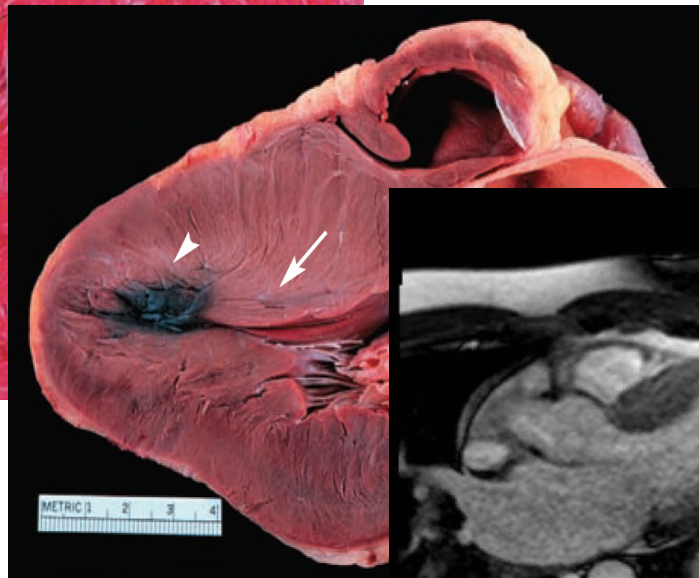
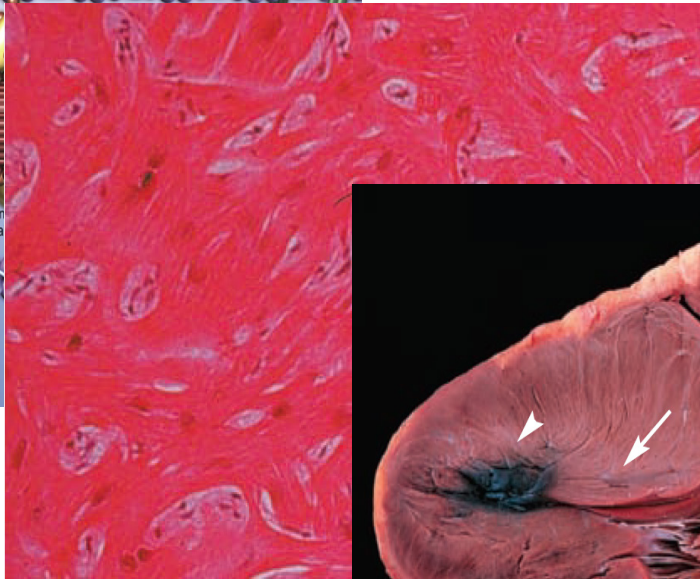
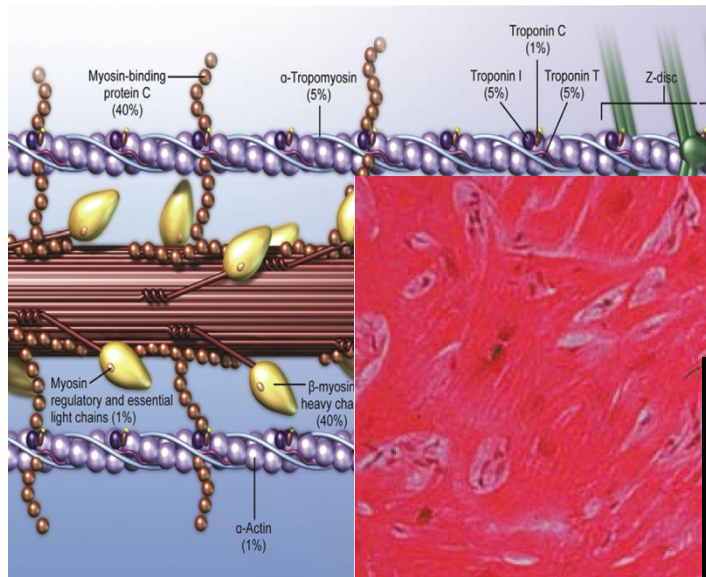
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Disclosure Information

**No financial relationships or
conflicts of interest to declare**

Hypertrophic Cardiomyopathy (CMP)

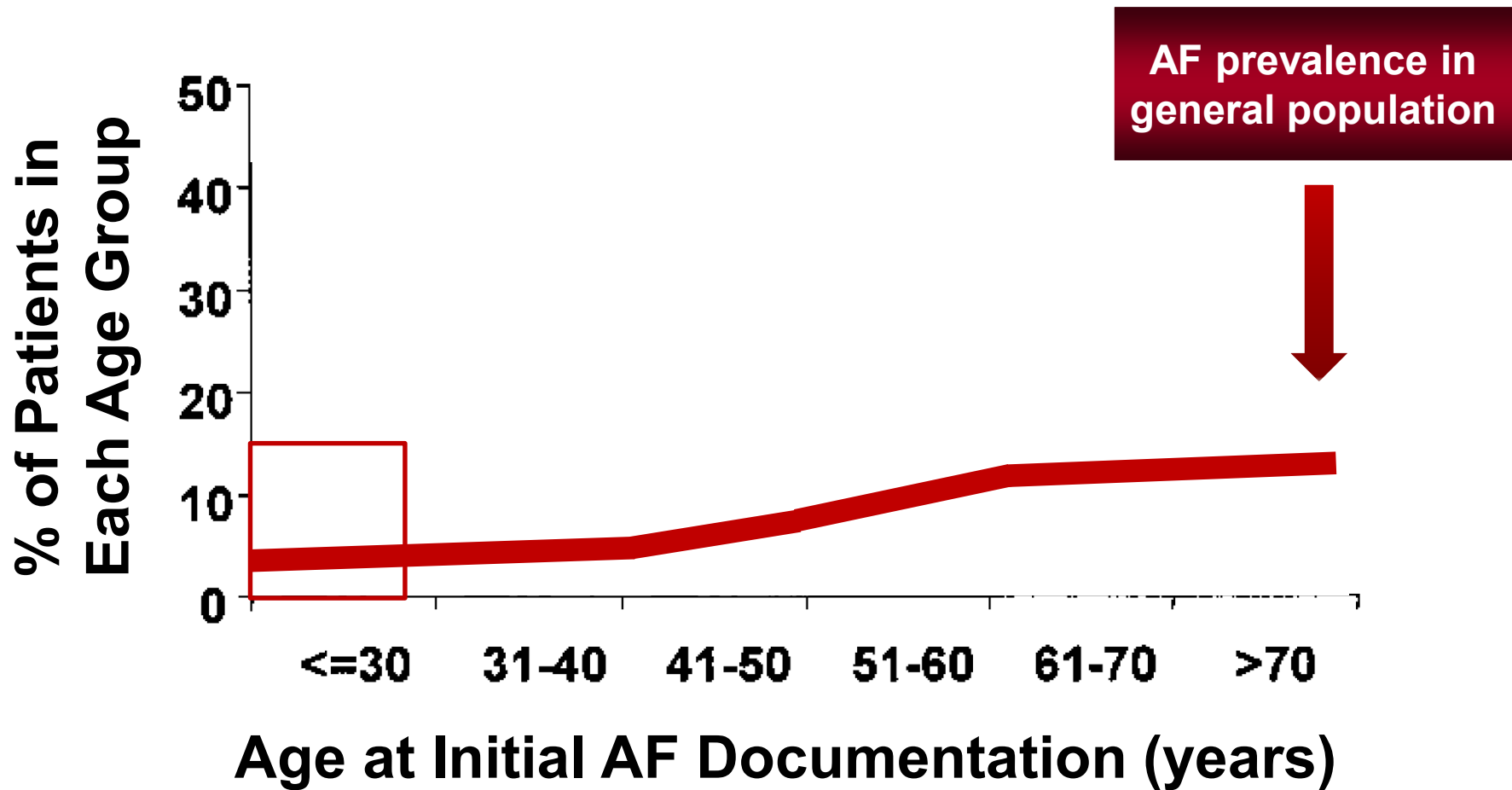


Maron BJ et al, *J Am Coll Cardiol* 2014;64:83-99

Murphy JG et al, *Mayo Clinic Cardiology Concise Textbook* 3rd ed. 2007

To ACY et al. *J Am Coll Cardiol Img* 2011; 4:1123-37

AF prevalence in Hypertrophic CMP (HCM)

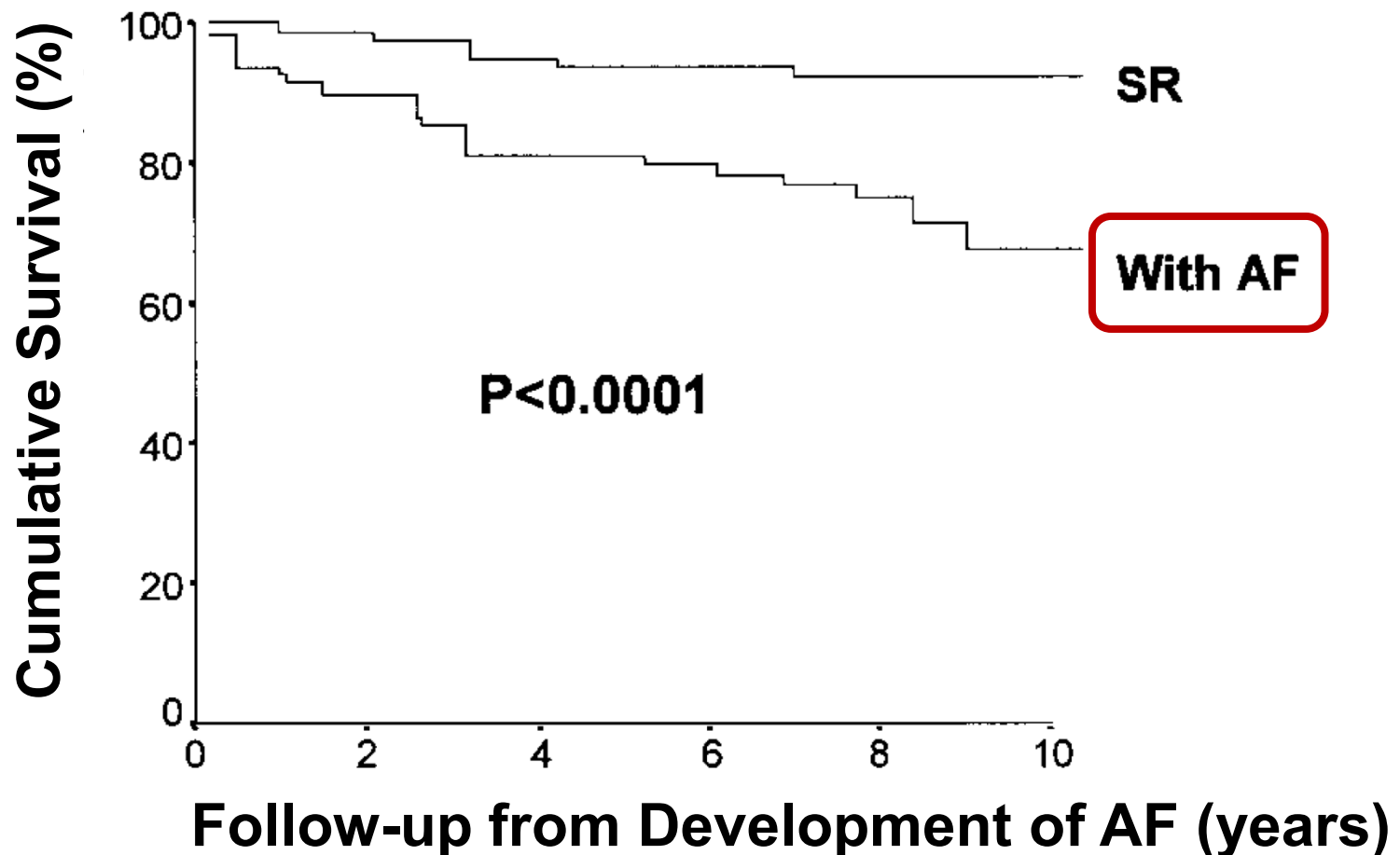


Olivotto I. et al, *Circulation* 2001;104:2517-2524

Feinberg WM et al. *Arch Intern Med* 1995;155:469-473

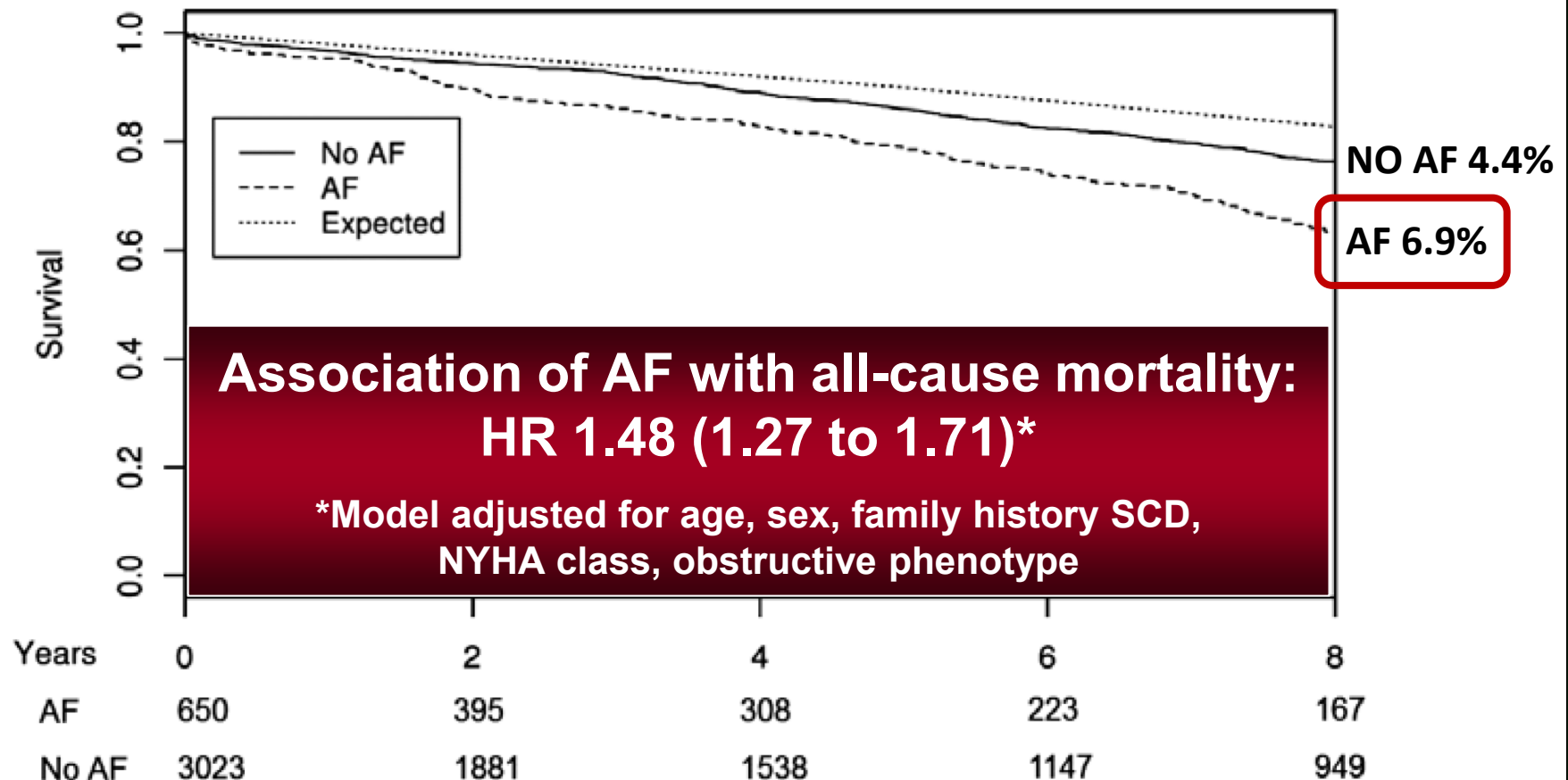
Prognostic Impact of AF in HCM

Mortality in HCM patient during a 10 years follow-up

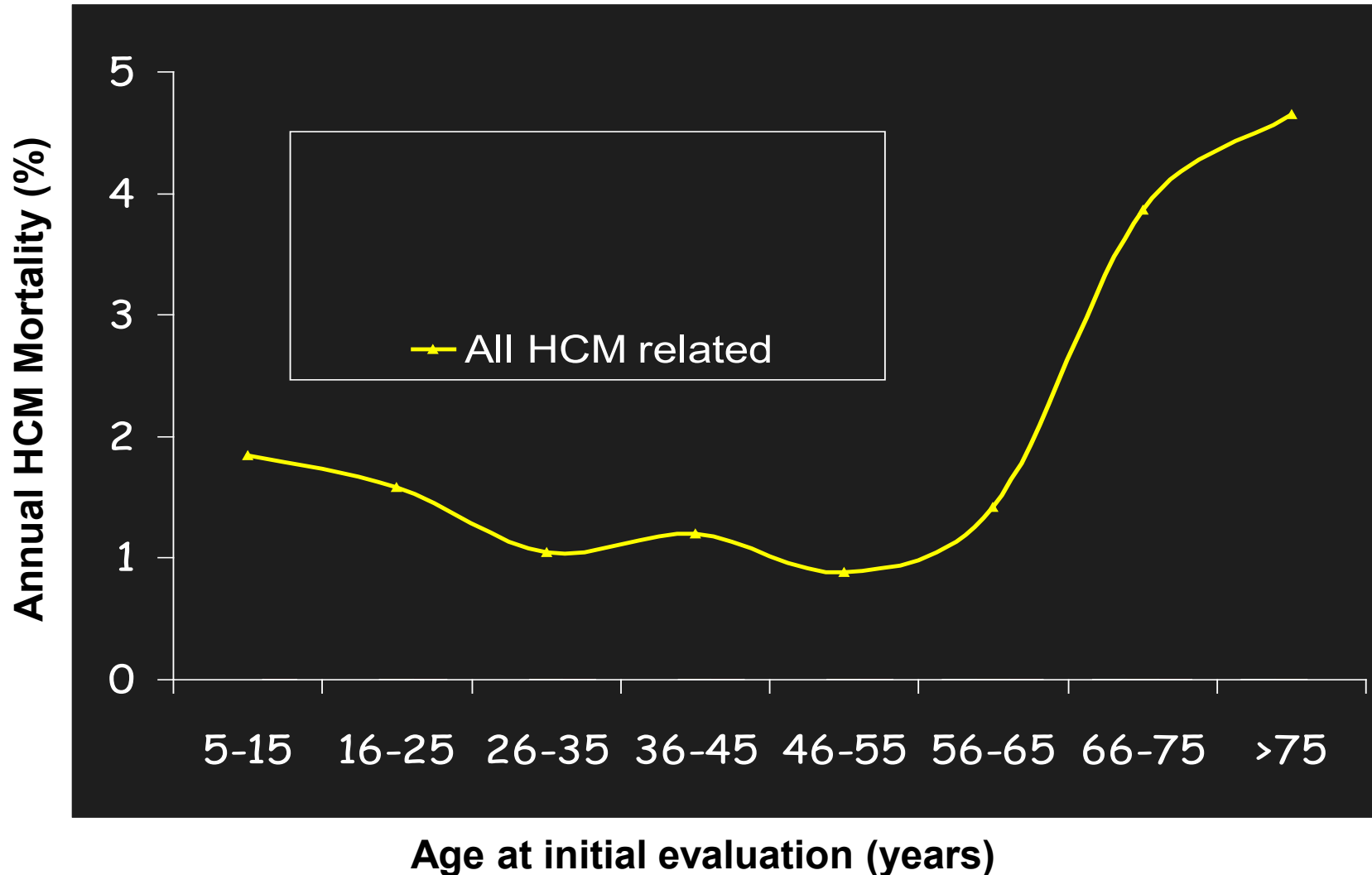


Prognostic Impact of AF in HCM

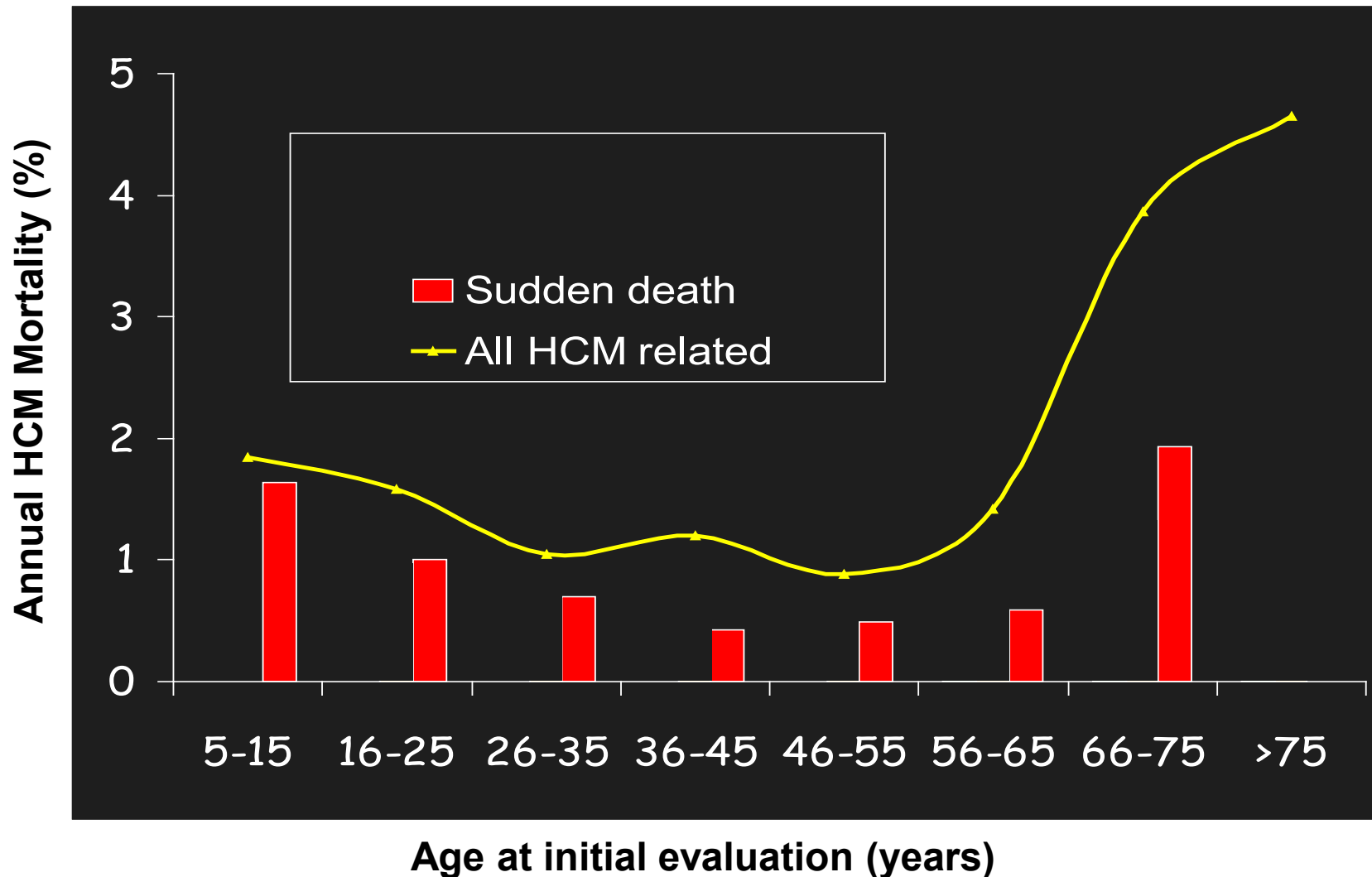
**3673 HCM patients, 650 (18%) with AF
median follow-up 4.1 years**



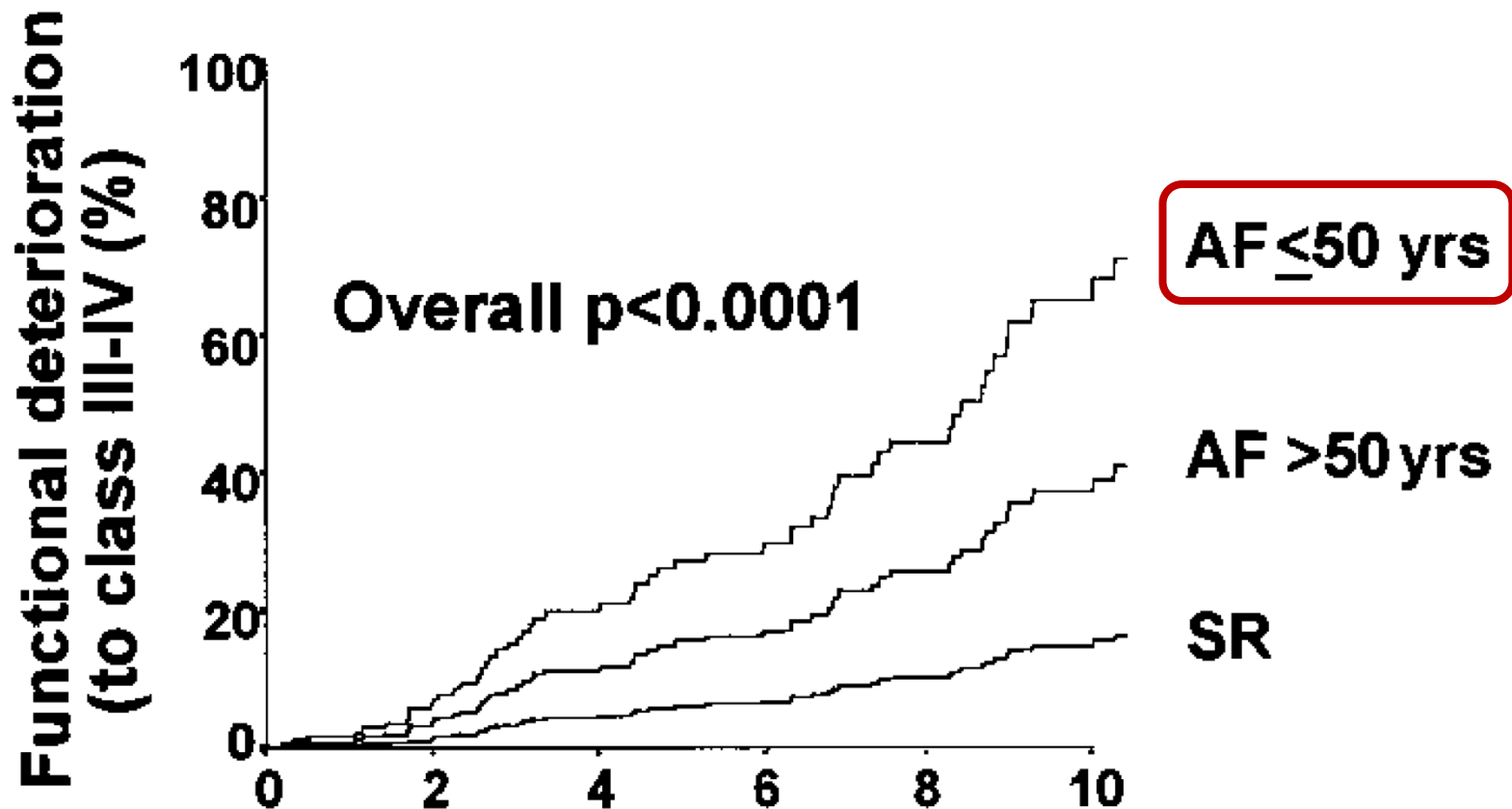
Cause of Death and Age in HCM



Cause of Death and Age in HCM

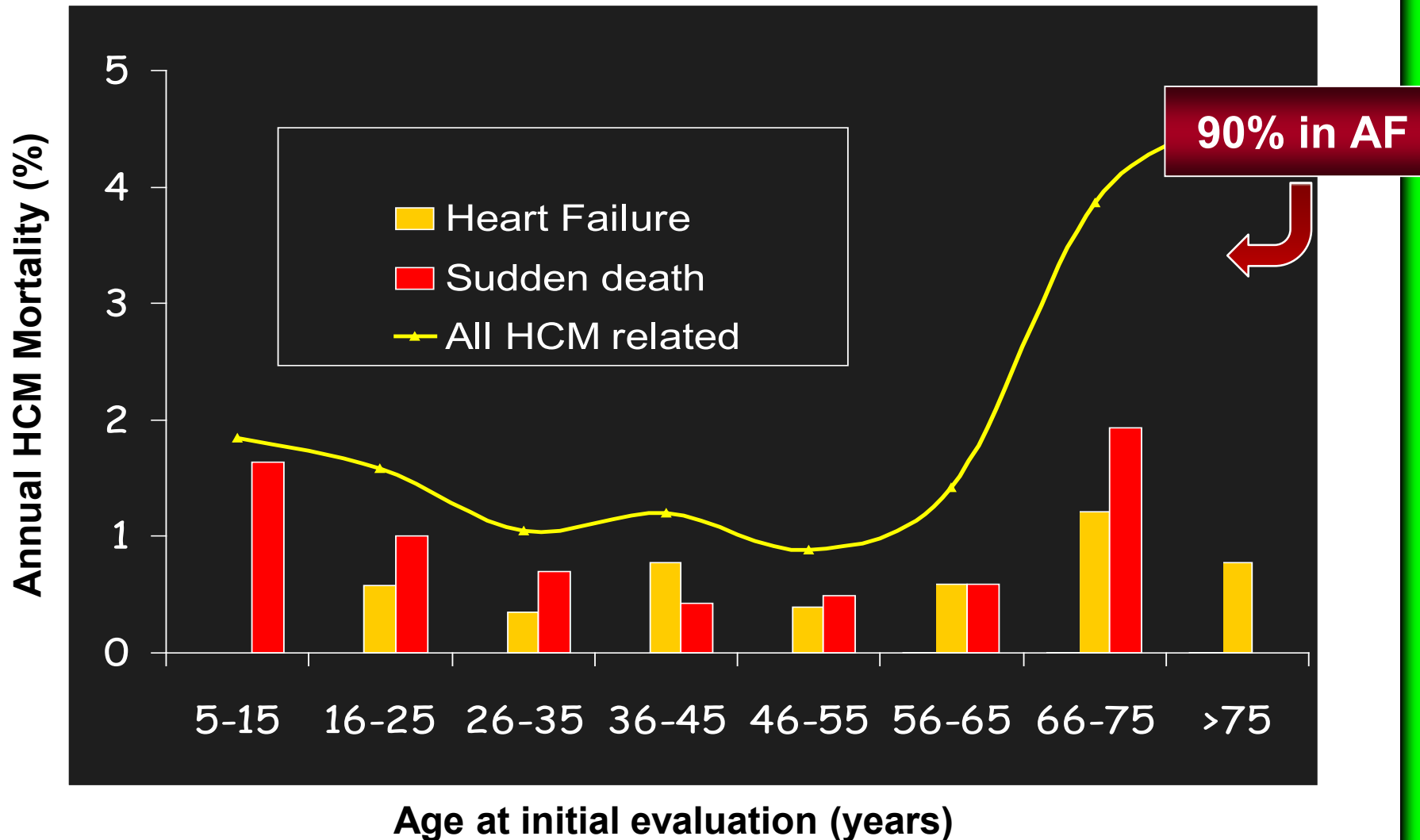


AF Increases the Risk of HF in HCM

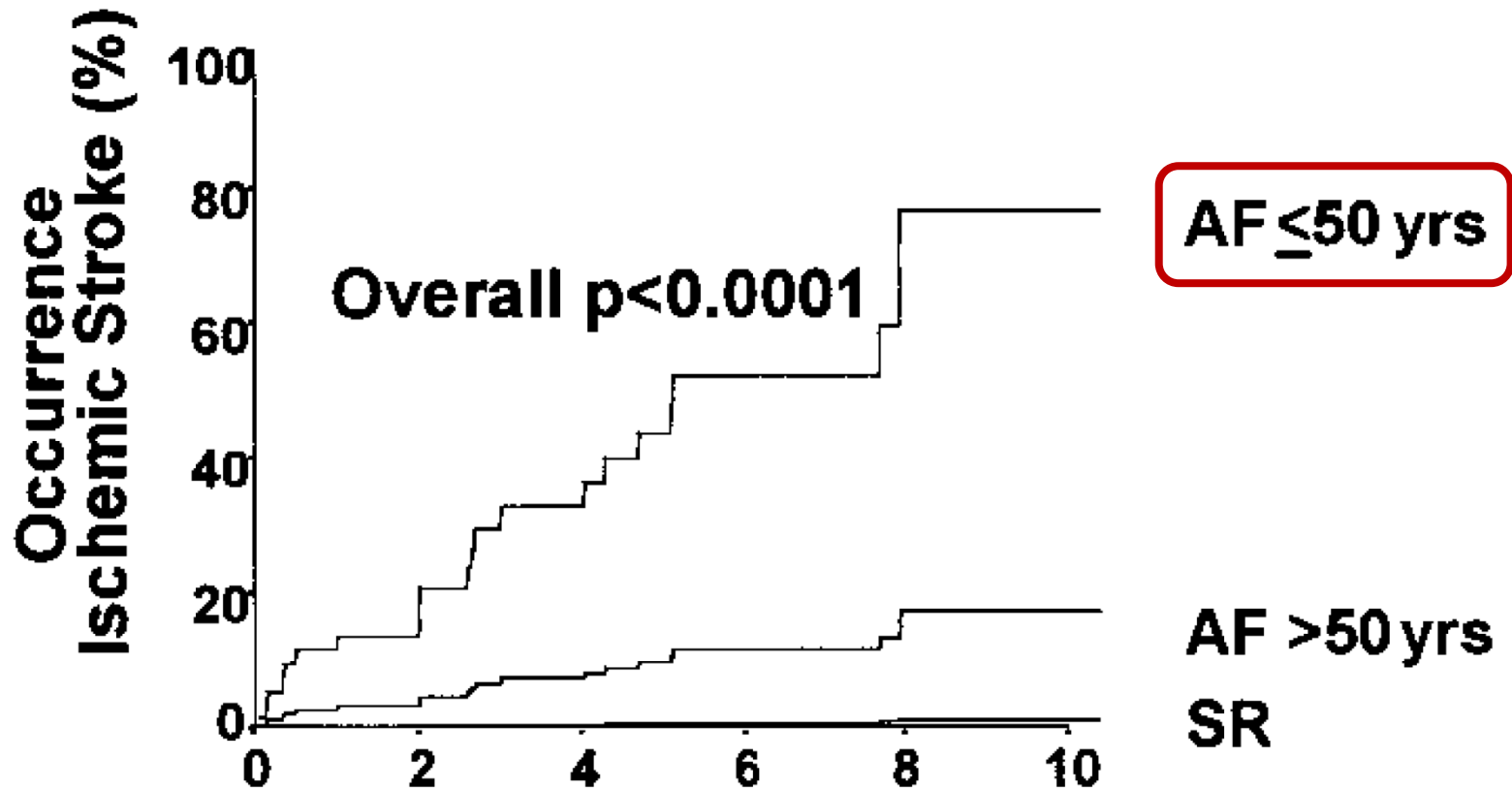


AF is associated with HF symptoms progression in HCM patients

Cause of Death and Age in HCM



AF Increases the Risk of Stroke in HCM



AF is associated with higher risk of stroke in younger patients

AF Management in Patients with HCM

**Due to high morbidity and mortality
(SCD, HF, Stroke)**



**Aggressive therapeutic
strategy for AF is required**



**ANTICOAGULATION
(independently from
AF subtype)**

2014 ESC Guidelines on HCM: Thromboembolism Prophylaxis

Recommendations	Class ^a	Level ^b	Recommendations	Class ^a	Level ^b
Unless contraindicated, oral anticoagulation with VKA (target INR 2.0–3.0) is recommended in patients who develop persistent, permanent or paroxysmal AF, to prevent thromboembolism.	I	B	48-Hour ambulatory ECG monitoring every 6–12 months to detect AF should be considered in patients who are in sinus rhythm and have an LA diameter of ≥ 45 mm	IIa	C
Unless there is a reversible cause of AF, lifelong OAC therapy with a VKA (INR 2.0–3.0) is recommended, even if sinus rhythm is restored.	I	C			



AF Management in Patients with HCM

Due to high morbidity and mortality
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ANTICOAGULATION
(independently from
AF subtype)



VENTRICULAR
RATE CONTROL

2014 ESC Guidelines on HCM: Ventricular Rate Control

Asymptomatic or Minimally
Symptomatic AF

B-blocker

**Non-dihydropyridine
Ca²⁺ channel antagonist**

Digitalis
(in the absence of LVOTO)

Recommendations	Class ^a	Level ^b
β-Blockers, verapamil and diltiazem are recommended for controlling ventricular rate in patients with permanent or persistent AF.	I	C

**Continue treatment
and follow-up**

Yes

Heart rate
< 100 bpm

No

**If symptoms persist
AV node ablation + PM**

Recommendations	Class ^a	Level ^b
Ablation of the AV node to control heart rate may be considered when the ventricular rate cannot be controlled with drugs and when AF cannot be prevented by anti-arrhythmic therapy or is associated with intolerable side-effects.	IIb	C

AF Management in Patients with HCM

Due to high morbidity and mortality
(SCD, HF, Stroke)



Aggressive therapeutic
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ANTICOAGULATION
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AF subtype)



**VENTRICULAR
RATE CONTROL**



**SINUS RHYTHM
MAINTENANCE**

Maintenance of Sinus Rhythm

Drugs

Catheter Ablation

Surgical Ablation

Pharmacological Treatment of AF in HCM

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- ☐ [Update on **hypertrophic cardiomyopathy** and a guide to the guidelines.](#)
- 1. Sen-Chowdhry S, Jacoby D, Moon JC, McKenna WJ.
Nat Rev Cardiol. 2016 Sep 29. doi: 10.1038/nrcardio.2016.140. Review.
PMID: 27681577
[Similar articles](#)
- ☐ [\[Long-term outcome and related predictors of alcohol septal ablation for patients with **hypertrophic obstructive cardiomyopathy**\].](#)
- 2. Liu R, Qiao SB, Hu FH, Yang WX, Yuan JS, Cui JG.
Zhonghua Xin Xue Guan Bing Za Zhi. 2016 Sep 24;44(9):771-776. doi: 10.3760/cma.j.issn.0253-3758.2016.09.008. Chinese.
PMID: 27667275
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- ☐ [Impact of Cryoballoon Ablation in **Hypertrophic Cardiomyopathy**-related Heart Failure due to Paroxysmal **Atrial Fibrillation**. A Comparative Case Series.](#)
- 3. Maagh P, Plehn G, Christoph A, Oernek A, Meissner A.
Int J Med Sci. 2016 Aug 1;13(9):664-72. doi: 10.7150/ijms.16181. eCollection 2016.
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... Many Other Studies

Pharmacological Treatment of AF in HCM

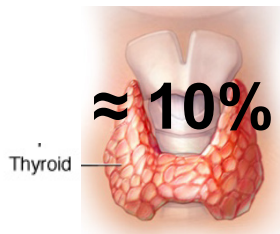
No systematic randomized trials comparing the efficacy and safety of antiarrhythmic drugs for AF prophylaxis



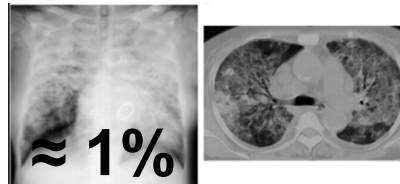
Medication	Author	Year	N° of pts	Follow-up (months)	Efficacy (SR %)
Sotalol	Tendera M	1993	30	6	86%
Disopyramide	Sherrid MV	2005	188	36	Safe
Amiodarone	Robinson K	1990	52	66	63%

2014 ESC Guidelines on HCM: Pharmacological Rhythm Control

Recommendations	Class ^a	Level ^b
Amiodarone should be considered for achieving rhythm control and to maintain sinus rhythm after DC cardioversion.	IIa	B



<http://www.mayoclinic.org/thyroid-gland/img-20007063>

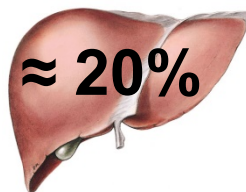


Sato N et al. Chest. 2013;143(4):1146-1150.

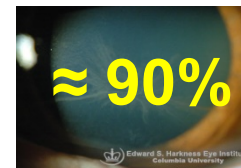
≈ 4%



Enseleit F et al. Circulation.2006; 113: e63



<http://www.surgery.usc.edu/hepatobiliary/liversurgery.html>



<http://dro.hs.columbia.edu/vortexk2.htm>

Elliot PM et al. *Eur Heart J* 2014; 35:2733-2779

Maintenance of Sinus Rhythm

Drugs

Catheter Ablation

2014 ESC Guidelines on HCM: Catheter Ablation for Atrial Fibrillation

Recommendations	Class ^a	Level ^b
Catheter ablation for atrial fibrillation should be considered in patients without severe left atrial enlargement, who have drug refractory symptoms or are unable to take anti-arrhythmic drugs.	IIa	B

AF Ablation in HCM: Previous Studies

Study, Year	Design	N° of pts	Follow-up (months)	Success 1st procedure (%)	Redo procedure (%)	Overall success (%)
Kilicaslan, 2006	Retrospective	27	11.4	52	26	70
Gaita, 2007	Retrospective	26	19	56	20	64
Bunch, 2008	Prospective	33	18	47	39	62
Di Donna, 2010	Retrospective	61	29	28	52	67
Derejko, 2013	Prospective	30	22.8	33	43	53
Santangeli, 2013	Prospective	43	42	49	58	94
Hayashi, 2014	Retrospective	17	29	53	47	82
Okamatsu, 2014	Retrospective	22	21	45	14	59
Moussigbrodt, 2015	Prospective	22	-	41	36	54
Bassiouny, 2015	Retrospective	79	35	29	55	39
Contreras, 2015	Retrospective	40	54	35	35	48

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Contreras, 2015	Retrospective	40	54	35	35	48
OVERALL	⅔ Retrosp.	400	28	42	38	64

AF Catheter Ablation in Pts With HCM



Which Are the Long-term Results of Transcatheter Atrial Fibrillation Ablation in patients with HCM?

Long-term Results of AFTCA in HCM



**Cardinal Massaia &
"Città della Salute e della Scienza"
University Hospital, Asti-Torino, IT**



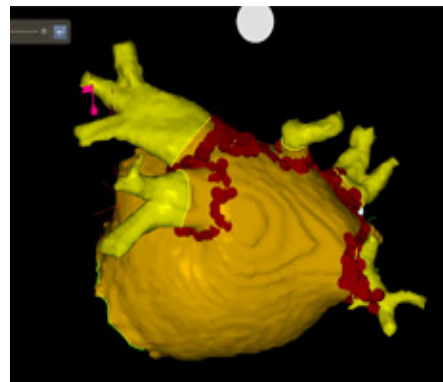
**Haut-Leveque University Hospital
Bordeaux, Pessac, FR**



**Careggi University Hospital
Florence, IT**



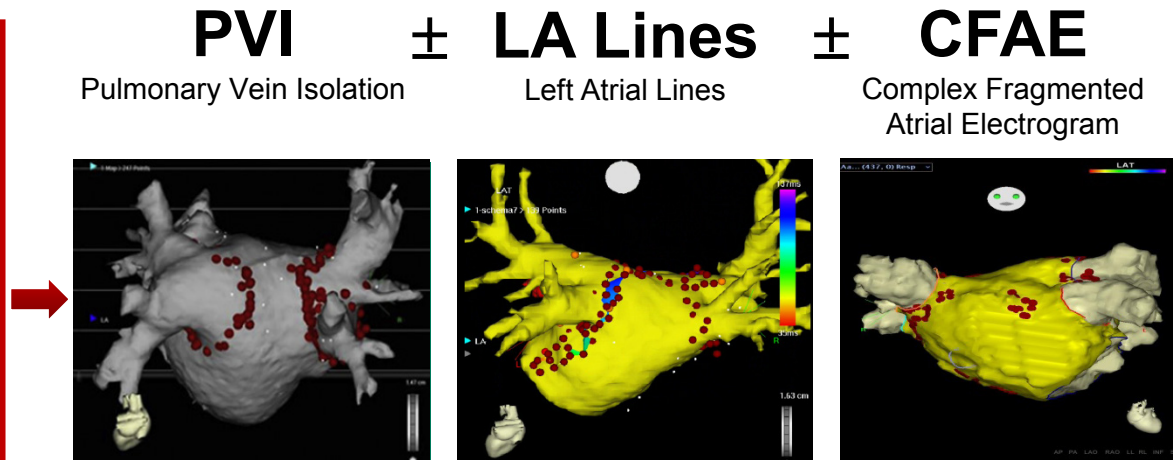
**Policlinico Casilino Hospital
Rome, IT**



**RF TC AF Ablation
From 2001 to 2015**

Long-term Results of AFTCA in HCM

- CV examination
- ECG 12 leads
- TT and TE Echo
- MR / CT
- RF TC ABLATION
- TLM monitoring



- 3 months blanking period → AF, atrial tachycardia, or atrial flutter $\geq$ 3 min at follow-up considered as relapse (Symptomatic or at ECG/Holter recording/PM/ICD memory)

Study Population – Baseline Characteristics

	Study Population N = 116
Mean Age at 1 st Ablation	54 ± 11
Female	34 (29%)
Hypertension	40 (34%)
Diabetes	6 (5%)
History of CAD	5 (4%)
Dysthyroidism	27 (23%)
Familiar history of HCM	39 (34%)
Familiar history of SCD	29 (25%)
Years since 1 st HCM diagnosis	14 ± 9
Obstructive HCM	25 (22%)
Mean LV septal thickness (mm)	21 ± 5
Septal myectomy/alcoholization	13 (11%) / 9 (8%)
ICD / CRT-D	31 (27%) / 4 (3%)

Study Population – History of Atrial Fibrillation

	Study Population N = 116
Years since 1st AF diag.	5 ± 4
Paroxysmal AF	43 (37%)
Persistent AF	51 (44%)
Long-standing AF	22 (19%)

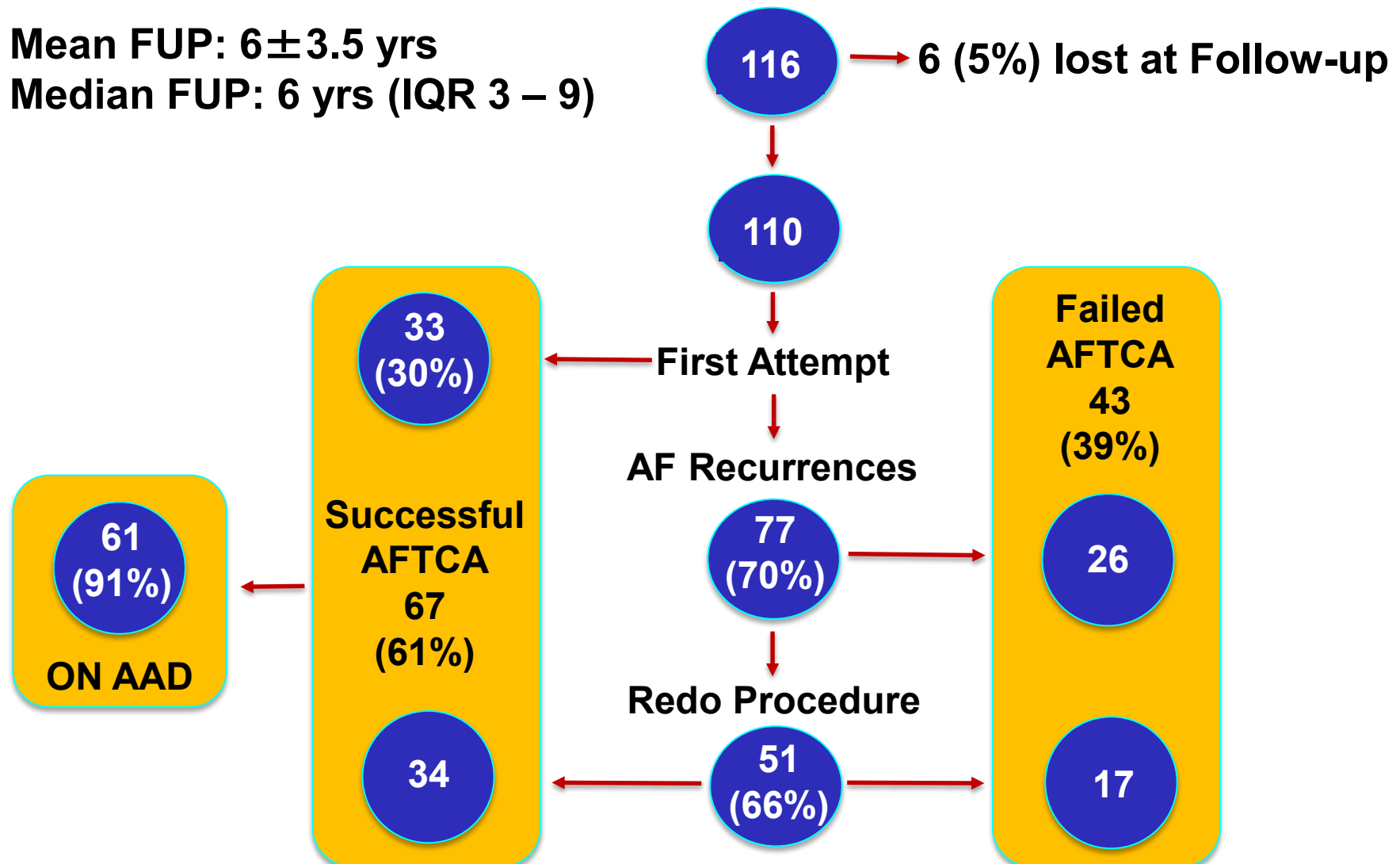
Results – AF Transcatheter Ablation

	Study Population N = 110
Cardiac rhythm at admission	
- SR	49 (44%)
- Atrial fibrillation	53 (48%)
- Atrial flutter / ectopic AT	8 (8%)
Left atrial volume (ml)	171 ± 45
Ablation scheme	
- PVI	38 (34%)
- PVI + LA Lines	60 (55%)
- PVI + CFAE	3 (3%)
- PVI + LA Lines + CFAE	9 (8%)
NO Major periprocedural complication	
SR following ECV	33 (31%)
Mean procedure time (min)	148 ± 59
Mean RF time (min)	65 ± 25

Results – Long-term Follow-up

Mean FUP: 6 ± 3.5 yrs

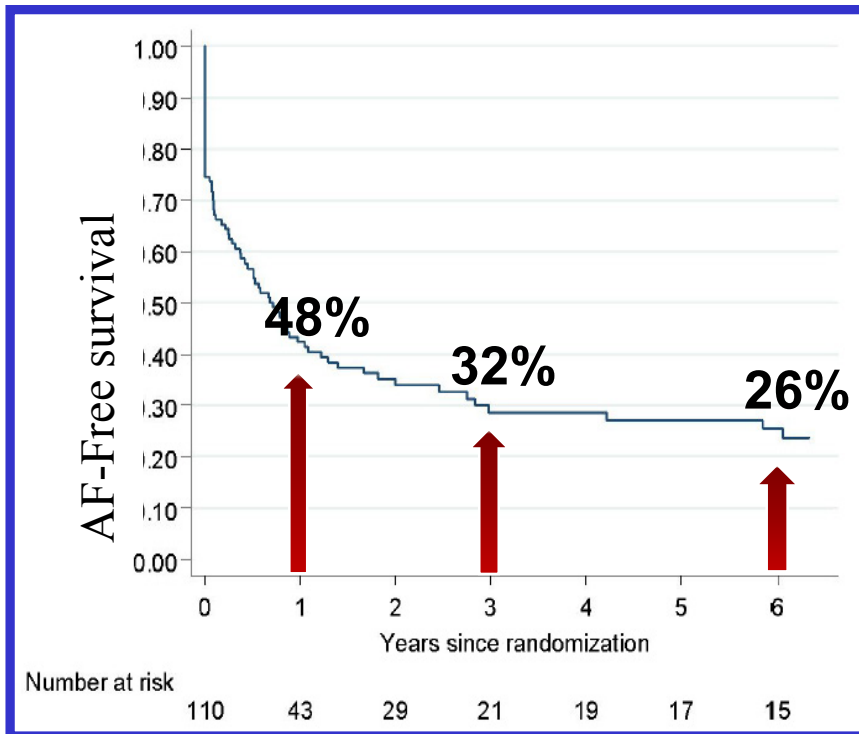
Median FUP: 6 yrs (IQR 3 – 9)



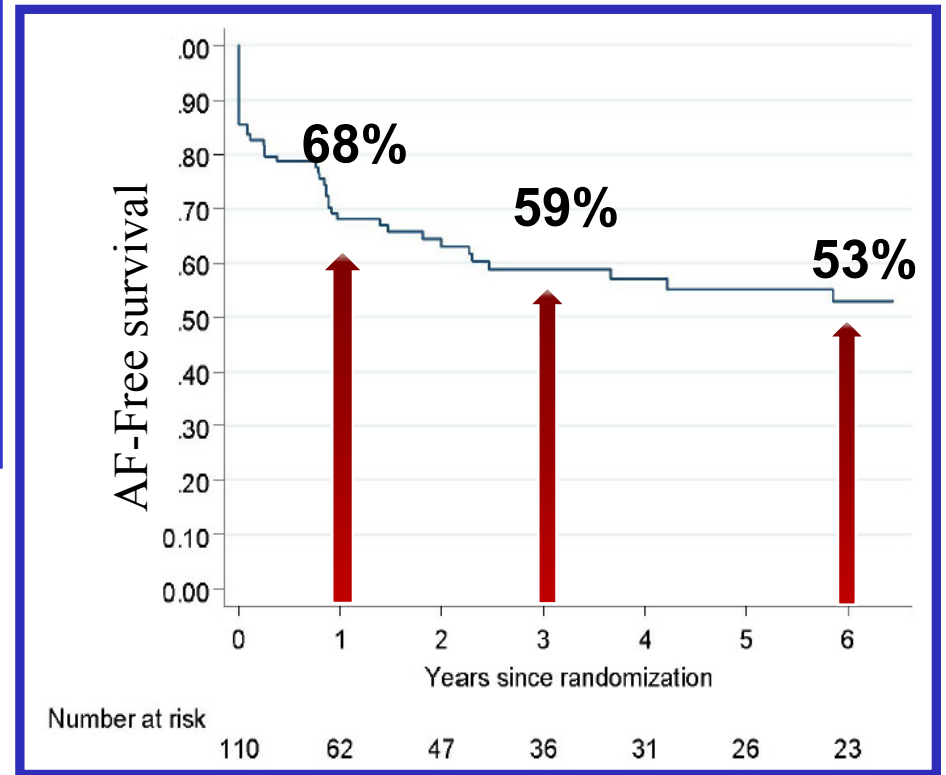
Mean Num. of Procedures / Patient = 1.6

Results – Long-term Follow-up

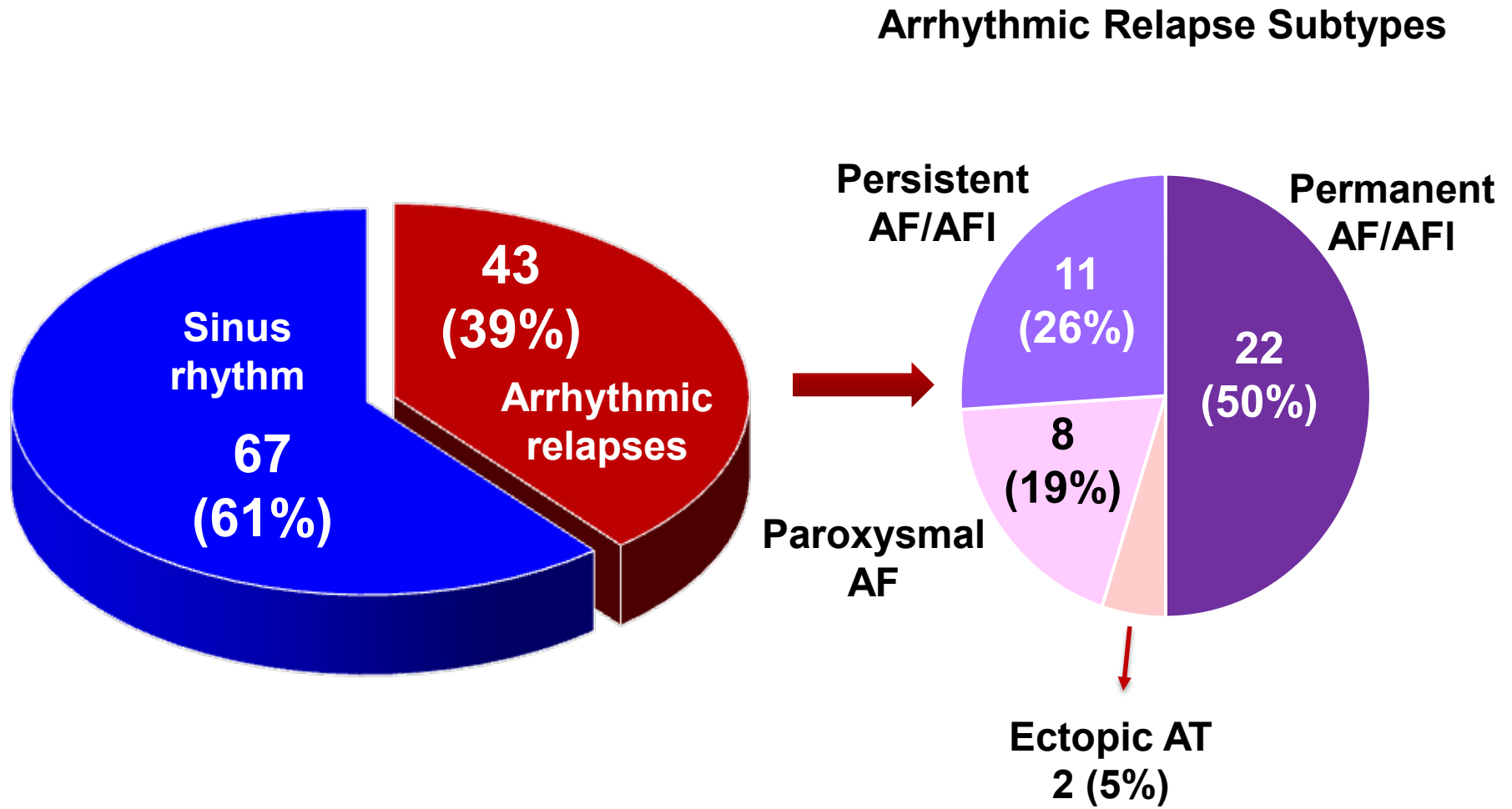
AF-freedom after single ablation



AF-freedom at last follow-up (including multiple procedures)

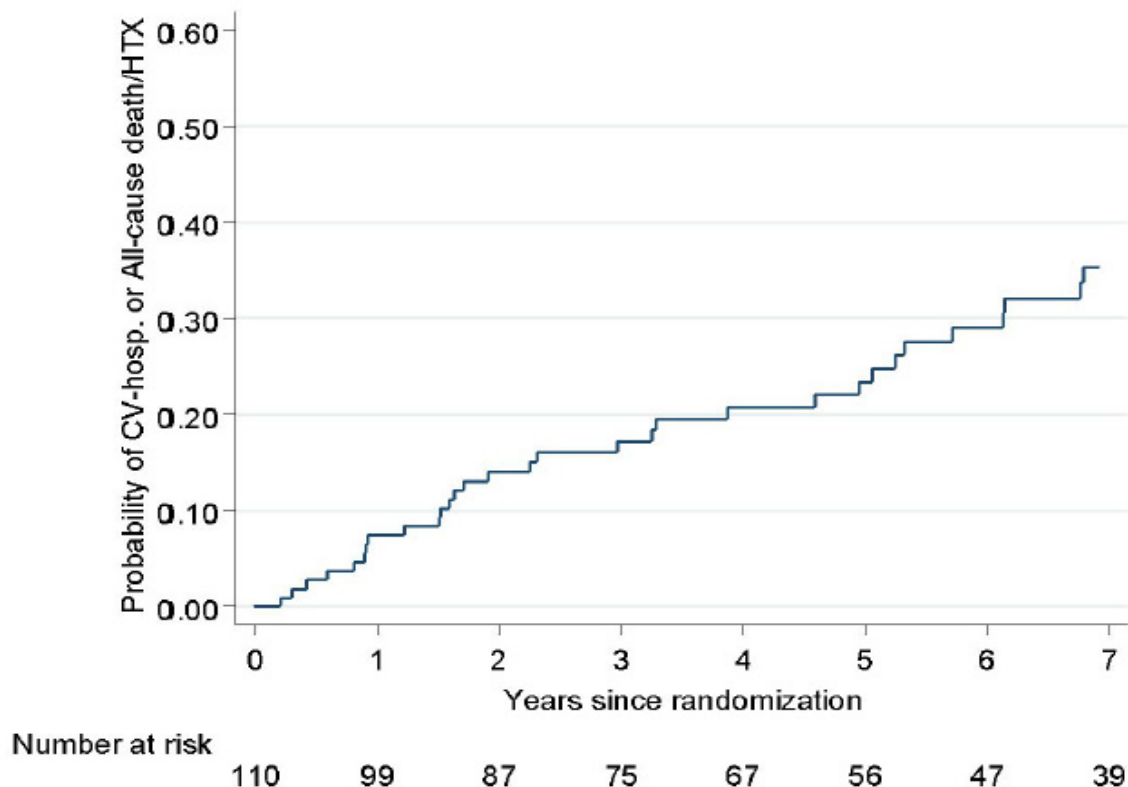


Results – Long-term Follow-up



Results – Long-term Clinical Outcomes

CV-hospitalization / All-cause mortality / Tx



41 (37%) CV-hospitalizations

- 21 Heart failure
- 16 TE events
- 4 Heart transplantation

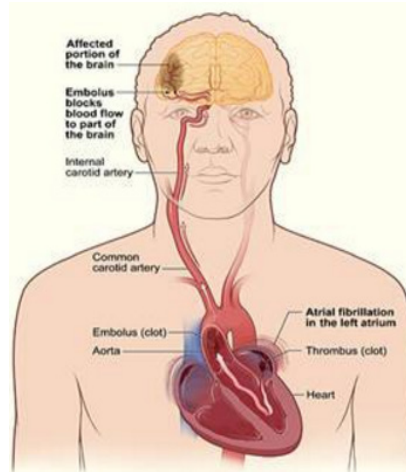
16 (15%) Fatal endpoints

- 8 CV-deaths
- 4 Non-CV deaths
- 4 Heart transplantation

Results – Thromboembolic Events

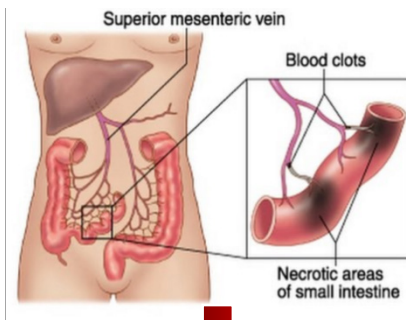
6 Stroke (5%)

- 2 INR not in range
- 1 on Dabigatran
- 3 during OAT stop



6 TIA (5%)

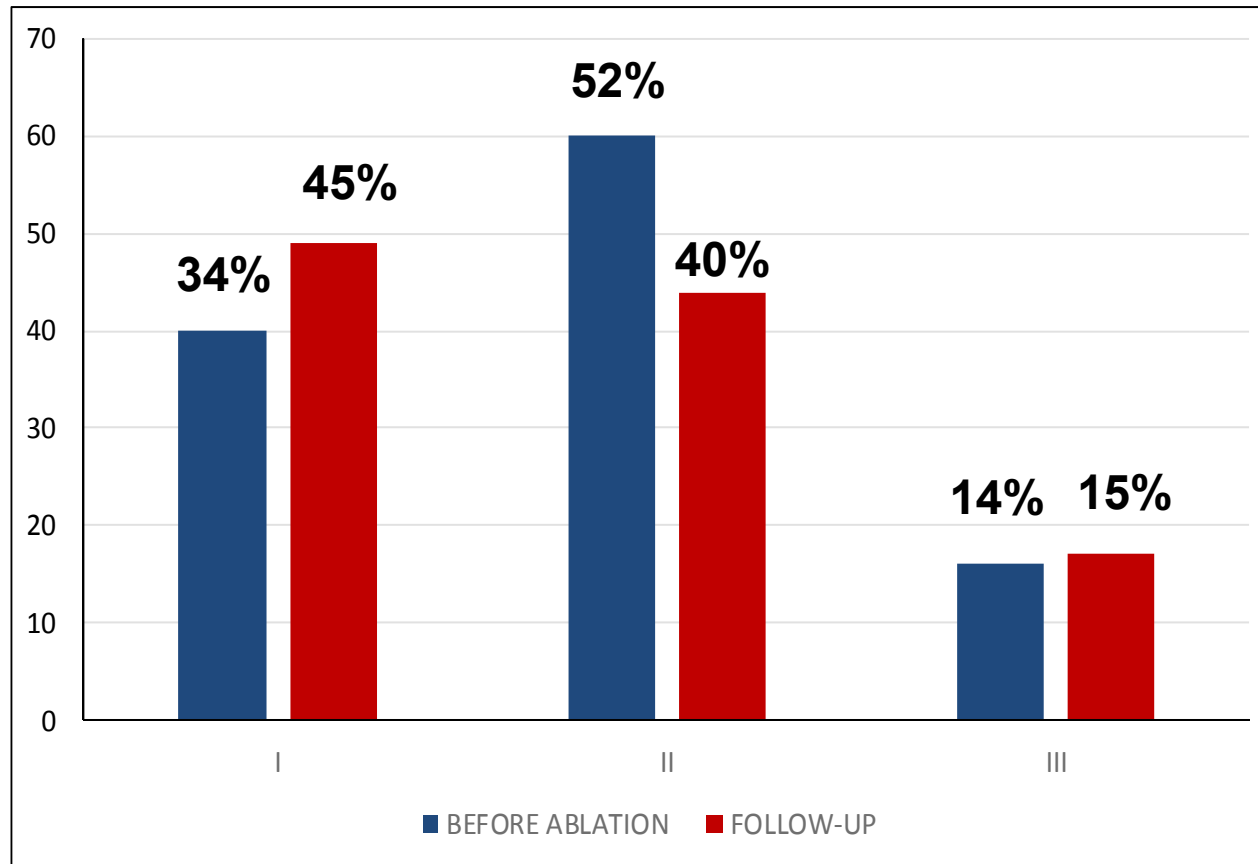
- 3 INR not in range
- 3 INR not available



4 Peripheral embolisms (4%)

- 2 deaths cause of mesenteric embolism on OAT
- 2 arterial embolisms in lower extremities on OAT

Results – Functional NYHA Class



NYHA Baseline 1.8 ± 0.1 vs Follow-up 1.7 ± 0.1 , $p=0.59$

NYHA SR at F-up 1.6 ± 0.1 vs. Relapses at F-up 2 ± 0.1 , $p=0.009$

Conclusions

AF represents a **clinical turning point** in the clinical course of HCM patients due to the increased risk of **functional impairment, stroke and mortality**

Aggressive treatment in terms of **anticoagulation and maintenance of sinus rhythm** should be recommended, especially in **young patients**

Conclusions

When AADs fail, **ablation** should be proposed (although we have no data regarding mortality)

Best results of ablation are obtained in the **early phases of the disease**, with mild diastolic dysfunction without severe atrial dilatation

In most cases **multiple procedures** are required

A nighttime photograph of the Colorado State Capitol building in Denver. The large, white, ribbed dome is illuminated from below, and a vertical line of red lights runs up its side. The building's spire reaches into a dark sky with scattered clouds. In the background, a range of mountains is silhouetted against a soft, orange and pink glow from the setting or rising sun. The foreground shows the city of Denver with various buildings and streetlights. The entire image is framed by a thick green border.

Thank you for your attention!

Back-up Slides

2014 ESC Guidelines on HCM: Thromboembolism Prophylaxis

"Given the high incidence of stroke in patients with HCM and paroxysmal, persistent or permanent AF, it is recommended that all patients with AF should receive treatment with VKA. In general, lifelong therapy with oral anticoagulants is recommended, even when sinus rhythm is restored."

Recommendations	Class ^a	Level ^b	Recommendations	Class ^a	Level ^b
Unless contraindicated, oral anticoagulation with VKA (target INR 2.0–3.0) is recommended in patients who develop persistent, permanent or paroxysmal AF, to prevent thromboembolism.	I	B	48-Hour ambulatory ECG monitoring every 6–12 months to detect AF should be considered in patients who are in sinus rhythm and have an LA diameter of ≥45 mm	IIa	C
Unless there is a reversible cause of AF, lifelong OAC therapy with a VKA (INR 2.0–3.0) is recommended, even if sinus rhythm is restored.	I	C			

ESC 2014 GL on HCM: Anticoagulation

Recommendations	Class ^a	Level ^b			
Unless contraindicated, oral anticoagulation with VKA (target INR 2.0–3.0) is recommended in patients who develop persistent, permanent or paroxysmal AF, to prevent thromboembolism.	I	B	48-Hour ambulatory ECG monitoring every 6–12 months to detect AF should be considered in patients who are in sinus rhythm and have an LA diameter of ≥45 mm	IIa	C
Antithrombotic therapy is recommended for patients with atrial flutter, as for those with AF.	I	C	Ablation procedures during septal myectomy may be considered in patients with HCM and symptomatic AF.	IIb	C
Assessment of the risk of bleeding with the HAS-BLED score should be considered when prescribing antithrombotic therapy (whether with VKA or antiplatelet therapy).	IIa	B	Antiplatelet therapy using aspirin 75–100 mg <i>plus</i> clopidogrel 75 mg daily (where there is a low risk of bleeding) should be considered when patients refuse the use of any OAC (whether VKAs or NOACs).	IIa	B
Restoration of sinus rhythm, by DC or pharmacological cardioversion with intravenous amiodarone, should be considered in patients presenting with recent-onset AF.	IIa	C	When adjusted-dose VKA (INR 2–3) cannot be used in a patient with AF—due to failure to maintain therapeutic anticoagulation, side-effects of VKAs, or inability to attend or undertake INR monitoring—a direct thrombin inhibitor (dabigatran) or an oral factor Xa	I	B
Amiodarone should be considered for achieving rhythm control and to maintain sinus	IIa	B			

Background

In our center...

Usefulness and Safety of Transcatheter Ablation of Atrial Fibrillation in Patients With Hypertrophic Cardiomyopathy

*26 pts, 58 ± 11 ys,
50% Paroxysmal, 50% Persistent*

*Asti, Florence and
Bordeaux*

*RFCA with PVI+
lines*

SR in 16 pts (64%)

*Pts in SR improved NYHA
class*

*Mean f-up 19 ± 10
months*

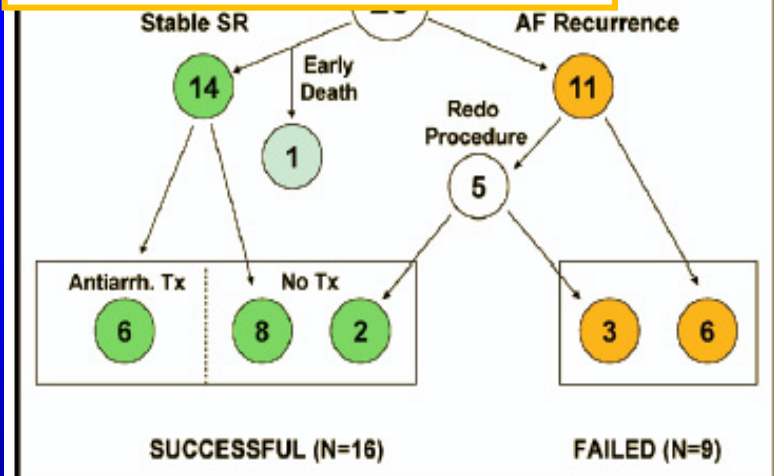


Figure 2. Outcome of 26 patients with HC who underwent RFCA of AF. The final success rate of RFCA for the study group was 64% and was higher in patients with a history of paroxysmal AF (10 of 13, 77%) compared with those with previous permanent AF (6 of 12, 50%; see text).

Background

In our center...

Efficacy of catheter ablation for atrial fibrillation in hypertrophic cardiomyopathy: impact of age, atrial remodelling, and disease progression

*61 pts, 58 ± 11 ys,
57% paroxysmal, 25%
persistent, 18% long-standing*

SR in 41 pts (67%)

*Mean f-up 29 ± 16
months*

