Atrial Fibrillation and Heart Failure

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Two new epidemics of cardiovascular disease are emerging: **heart failure** and **atrial fibrillation**.

…..heart failure ….is now responsible for more than 875,000 admissions each year in the United States.

….. the number of hospital discharges for **atrial fibrillation** more than doubled from 111,000 in 1984 to 270,000 in 1994.

Atrial Fibrillation
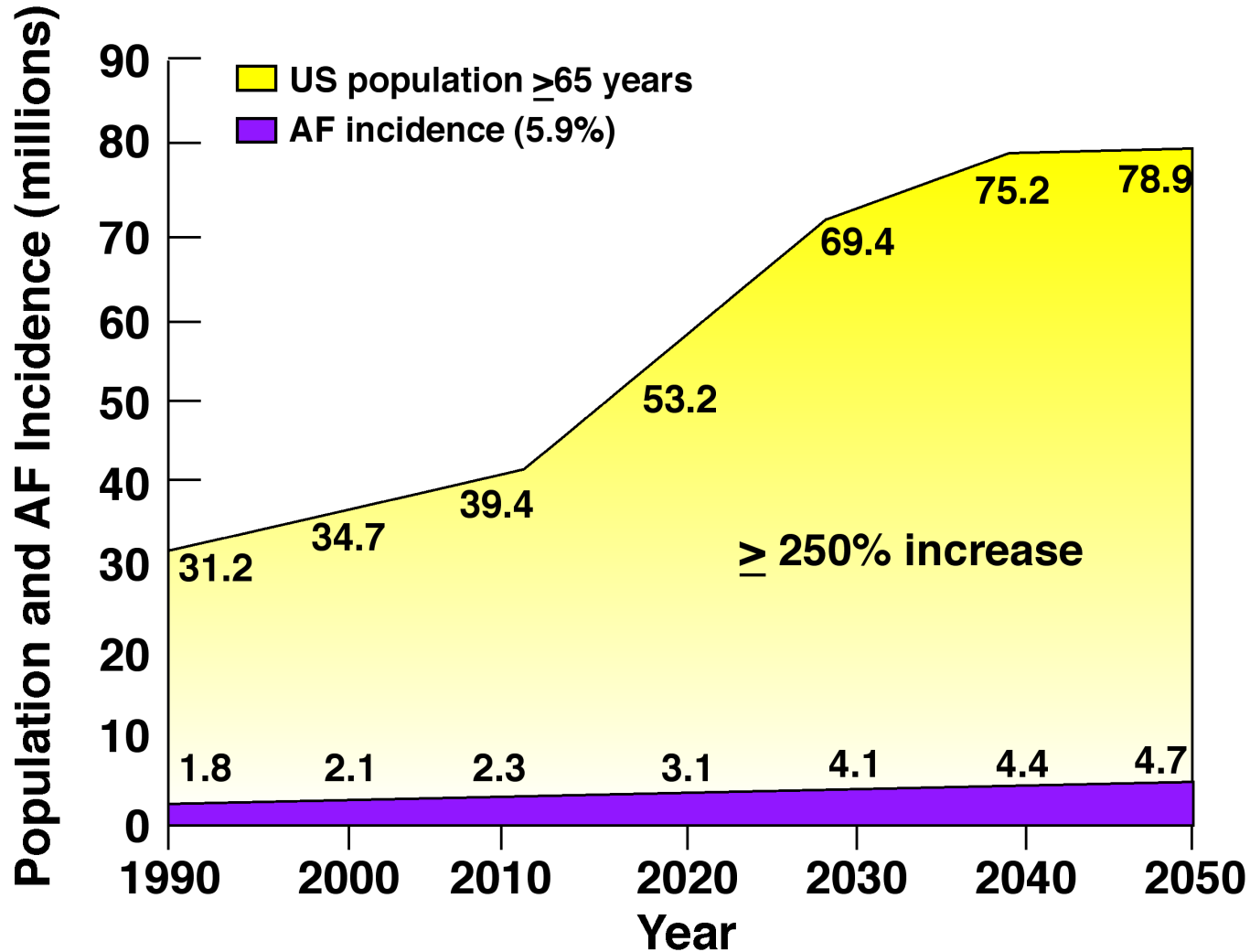
Prevalence — **2.2 million US; ~ 4 million in EU**

Incidence — **30-60 per 1000 population after age 65**
70% of AF patients between age 65 and 85 yrs

Morbidity — **384,000 hospitalizations (2000)**
1-2 % of all admissions
12% of hospitalized patients have AF
15% of all strokes occur in AF patients

Mortality — **Framingham Study reported increased total death rate (risk ratio 1.7 for men and 1.8 for women)**
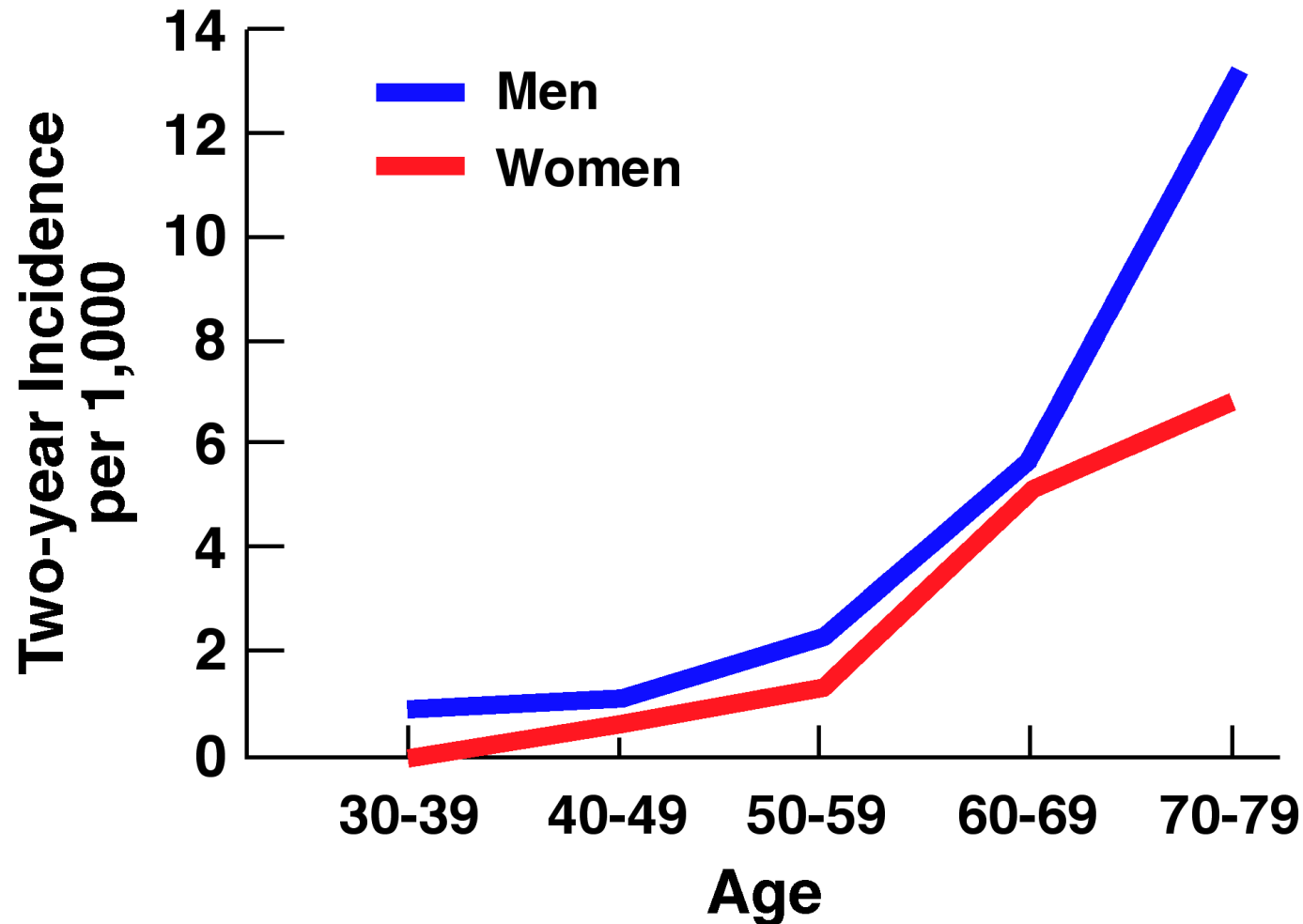
Prevalence of AF in Relation to Age of Population

Adapted from Feinberg et al,[3] and US Bureau of the Census[6]

Incidence of Atrial Fibrillation increases with Age

Murgatroyd F, Camm AJ. Atrial Arrhythmias. Lancet 1993;341:1317-1322

Heart Failure

Prevalence	**4.7 million US; ~8-10 million in EU**
Incidence	**550,000 new cases/year** **10 per 1000 population after age 65**
Morbidity	**870,000 hospitalizations (1995)** **5% to 10% of all admissions** **Most frequent cause of hospitalizations in elderly**
Mortality	**Causes or contributes to = 280,000 deaths/yr** **Up to 60% to 70% of patients die suddenly**

Age well-established as a principal determination of onset of heart failure
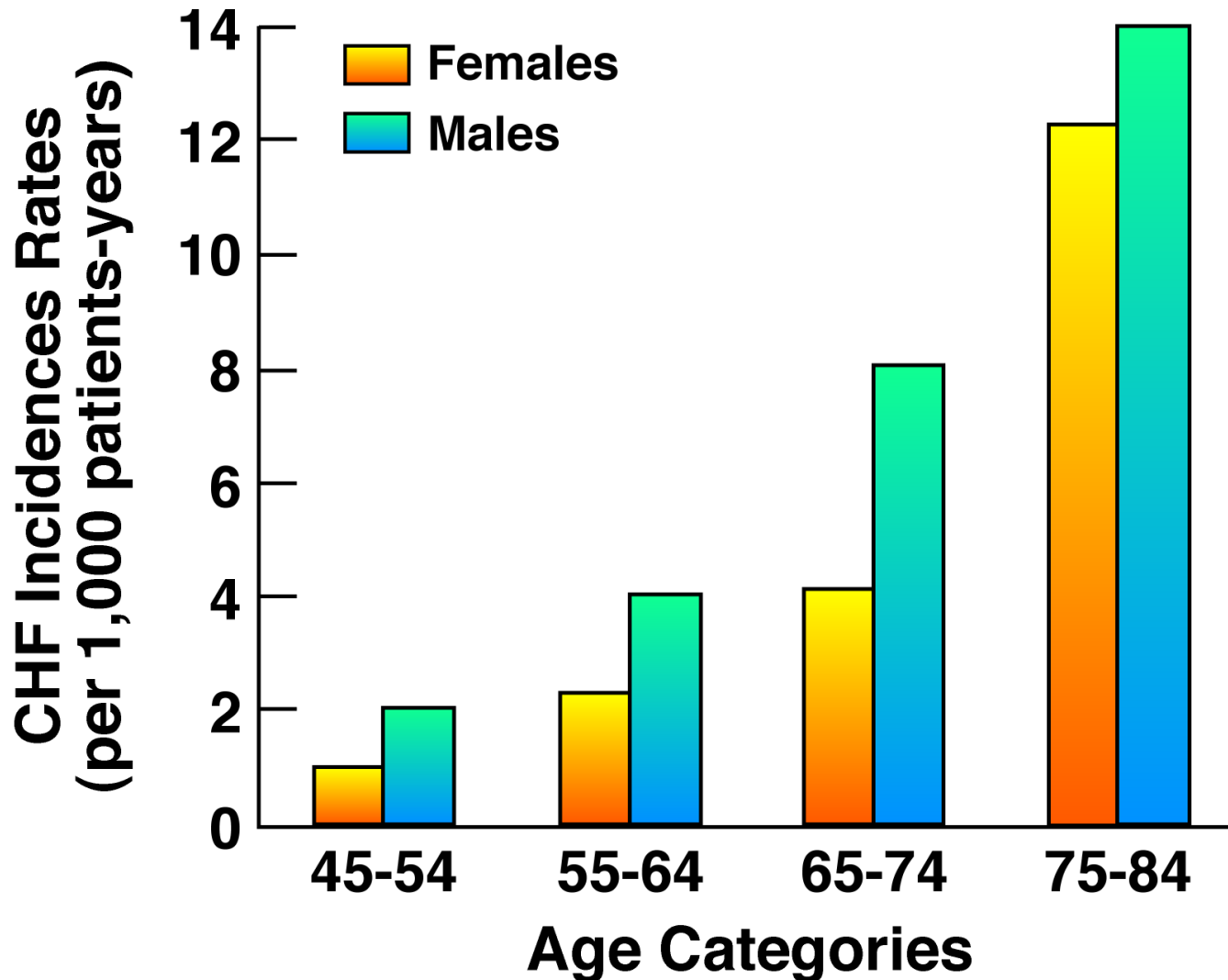
Atrial Fibrillation & Heart Failure

In the AFFIRM trial, 23% of patients had a history of CHF (average EF ~ 57%); in RACE trial, 50% of patients had Hx CHF;

In the major heart failure trials, 10% to 50% of patients had a diagnosis of AFIB, depending on NYHA Class.

AFFIRM Investigators, NEJM 2002; 347:1825-33
Van Gelder, NEJM 2002: 347:1834-1840
Dries D, JACC 1998: 32:695-703
Carson PE, Circulation 1993; Suppl VI: VI 102-10

New York Heart Association Functional Class

| I | II-III | III-IV | IV |
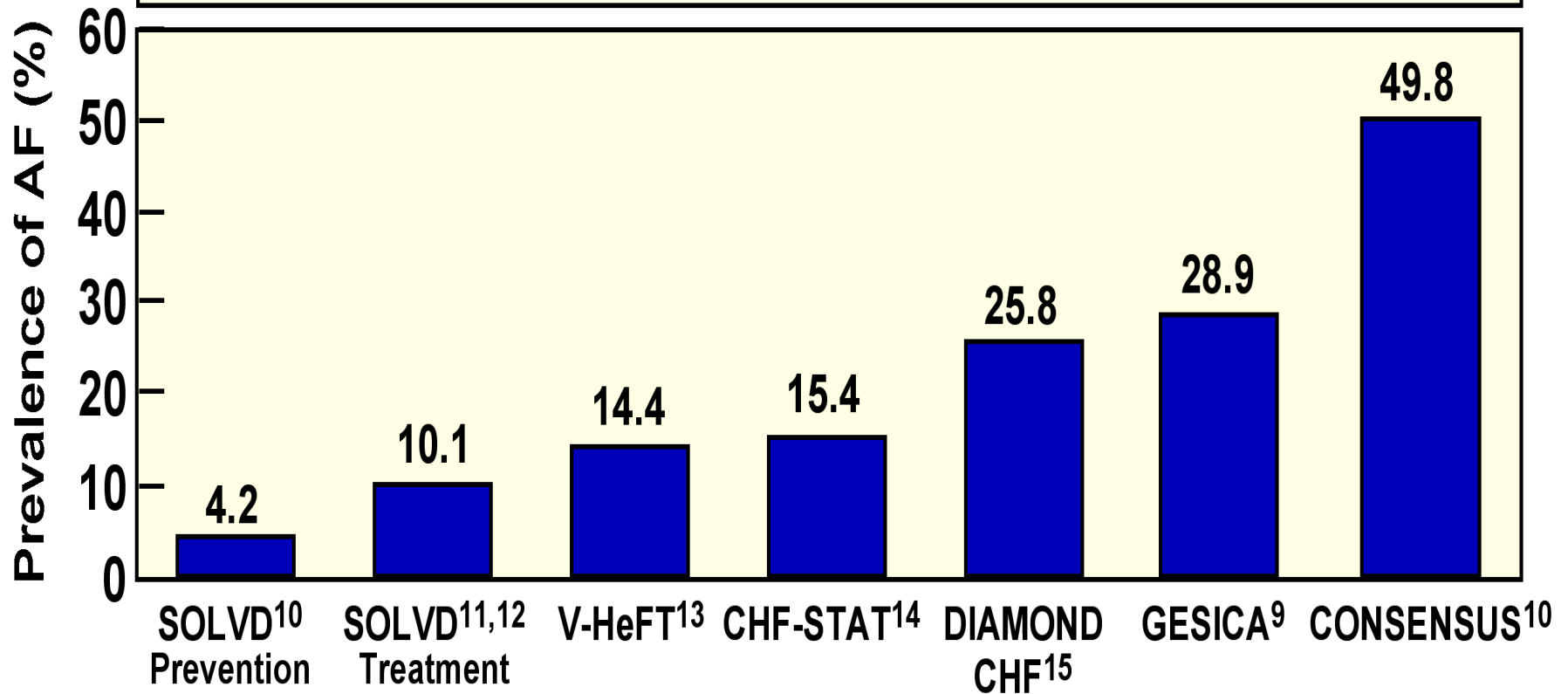
20% of patients with heart failure develop AF within 4 years

Unadjusted cumulative incidence of first AF after Heart Failure - Framingham Study

Cumulative incidence of AF vs Years

No. at risk   708   323   230   146   92   62
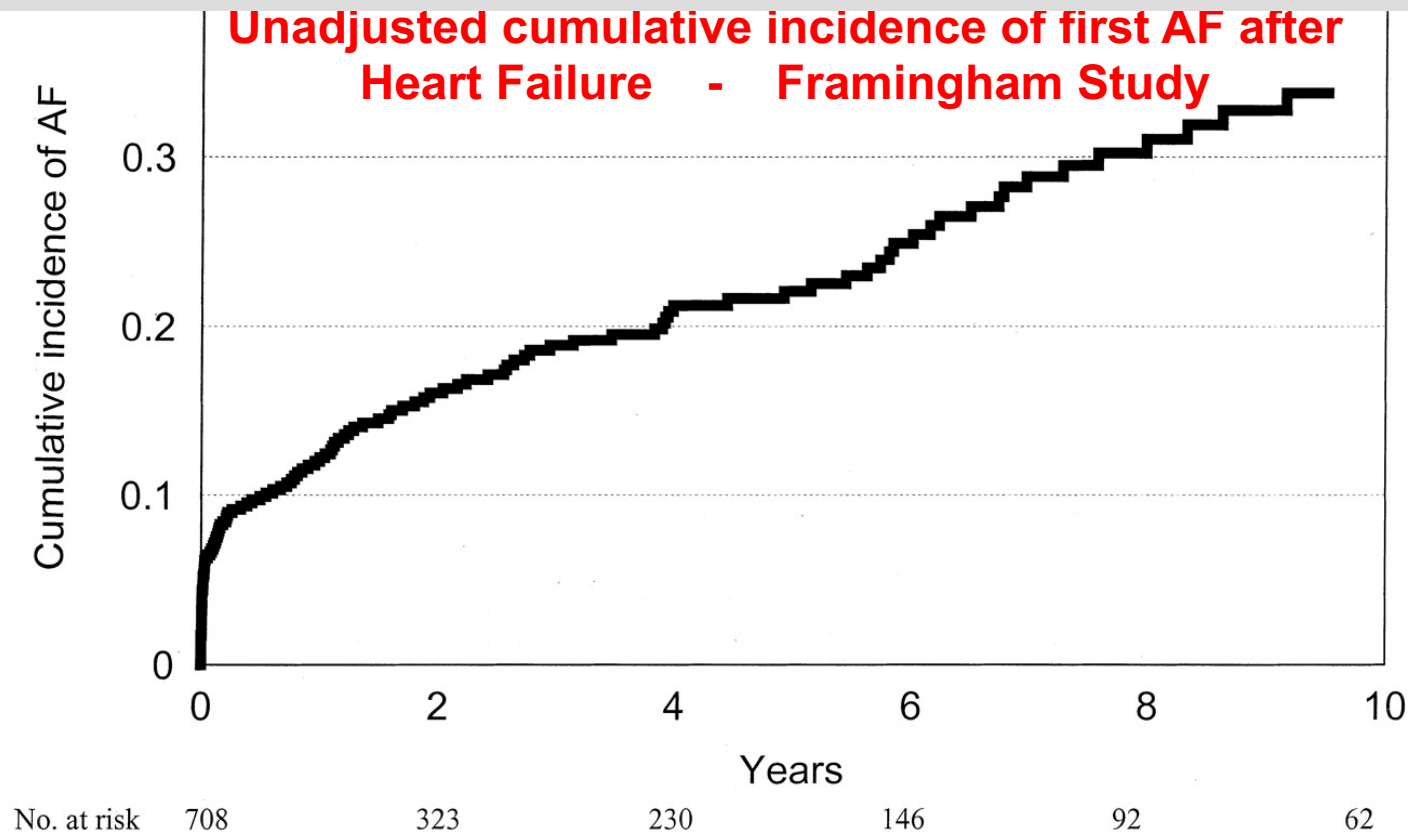
Development of AF was associated with increased mortality: hazard ratio of 1.6 (95% CI, 1.2 to 2.1) in men and 2.7 (95% CI, 2.0 to 3.6) in women.

Wang, T. J. et al. Circulation 2003;107:2920-2925

Atrial Fibrillation & Heart Failure

Complex, reciprocal relation between heart failure AF:

- **Heart failure may cause AF (neurohumoral activation & atrial stretch)**

- **AF may promote heart failure (fast ventricular rates, irregular contractions)**

Atria Fibrillation (AF) Begets Heart Failure (HF), and HF Begets AF. A Number of Mechanisms Contribute to the Initiation and Maintenance of Both AF and HF.

Heterogeneity of Conduction

Loss of AV Synchrony

Altered Atrial Refractory Properties

AF

Rapid Ventricular Response

Interstitial Fibrosis

HF

R-R Variability

Volume and Pressure Load

Toxicity of Therapy (eg, antiarrhythmic drugs, calcium antagonists)

Maisel, A Stevenson, L. Am. J Cardiol. 2003; 91:2D-8D
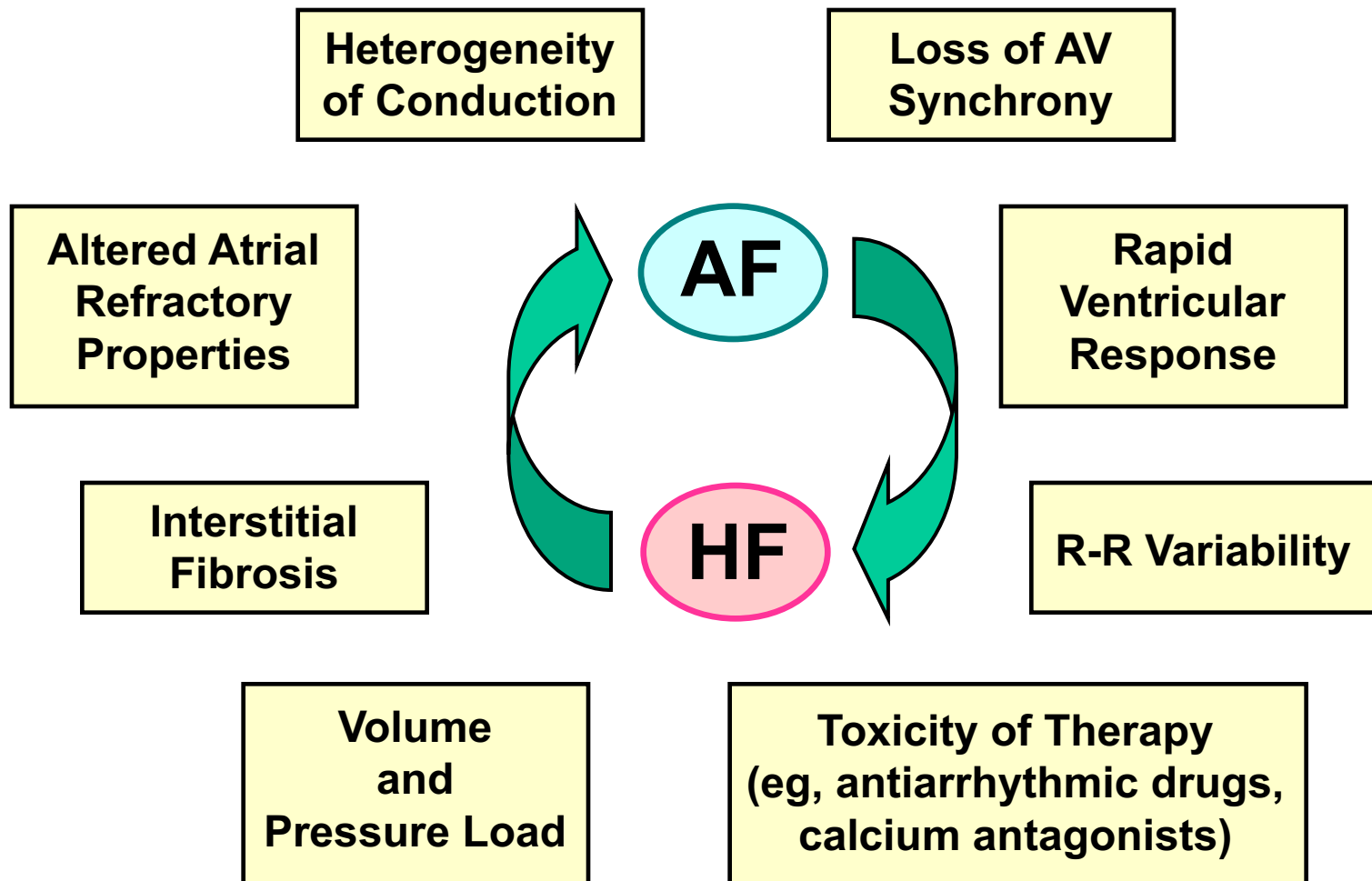
AF-Induced LV Dysfunction Frequency: Perspective

Cha, Gersch et al. Circulation 2004: 109:2839-2843
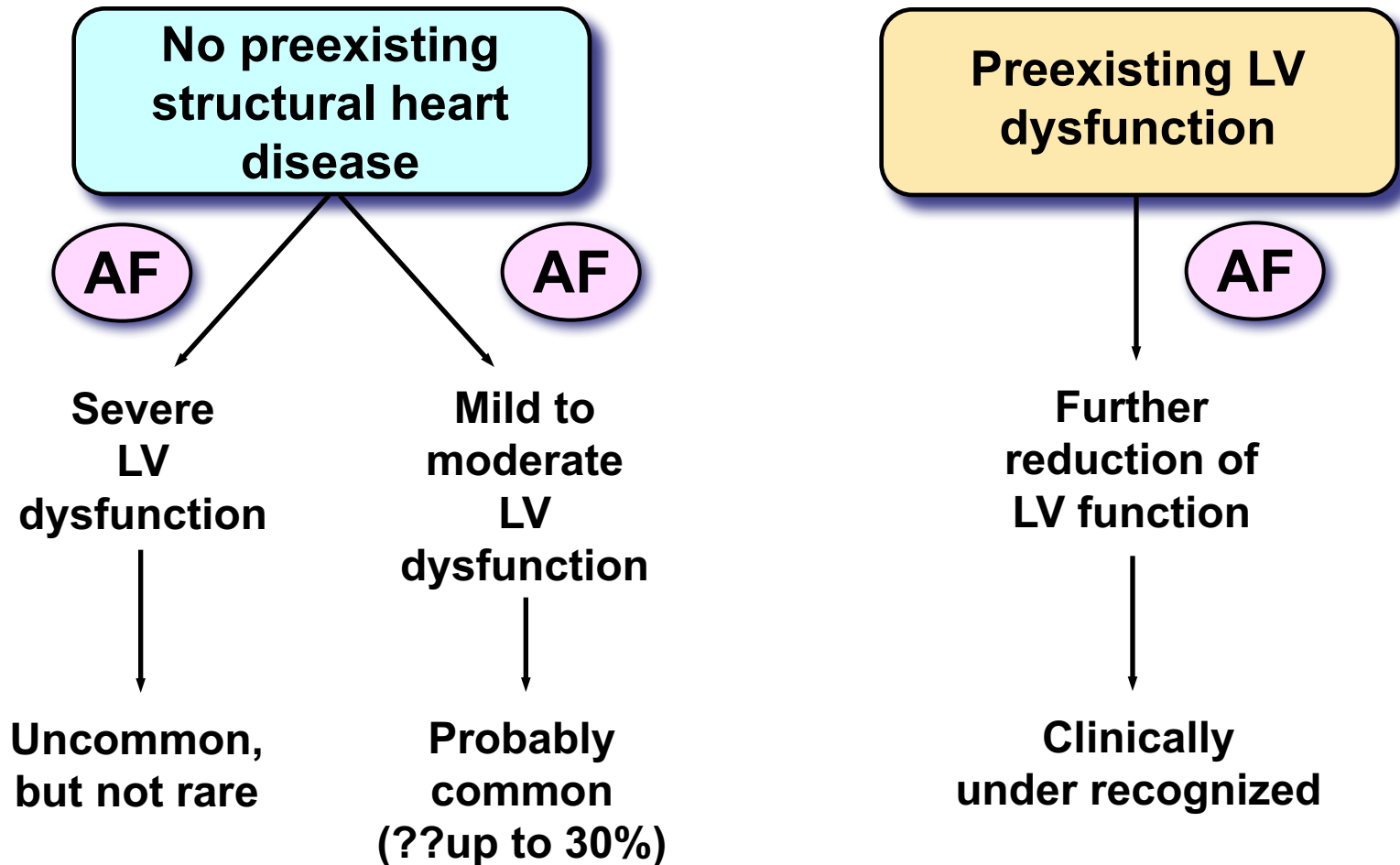
Models of Atrial Fibrillation

Reentry	- Multiple circuits	: Moe (1964)
	- Functional reentry	: Alessie (1984)
	- Spiral waves	: Weiss/Garfinkel (1997)
Single Focus	- Aconitine on RAA	: Scherf (1947)
	- Focal ablation site	: Hassaguerre (1996)

Electrophysiological Mechanisms of Atrial Fibrillation
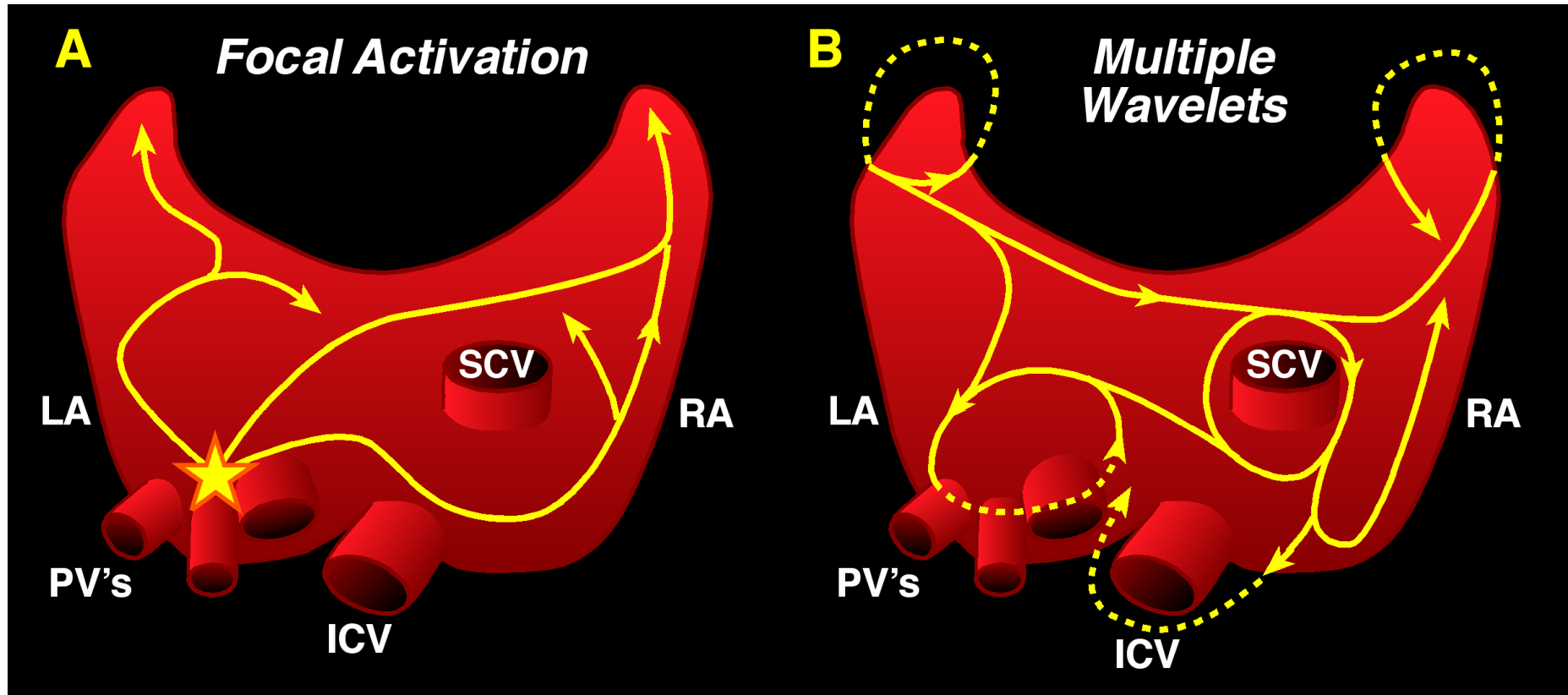
Electrical Remodeling in Atrial Fibrillation

Δ Current		Putative Clone
~	I_{Na}	SCN5a
↓60-70%	I_{Ca}	α1C
?	I_f	HCN2,4
↓50-60%	I_{TO}	Kv4.3
↓50%	I_{Kuf}	Kv1.5
?	I_{kr}	ERG/miRP1
?	I_{KS}	KvLQT1/minK
↑	I_{K1}	Kir 2.1, 2.3
↑	I_{KACh}	Kir 3.1 + Kir 3.4

Van Wagoner, J. Moll. Card. 2000, 32:1101-111
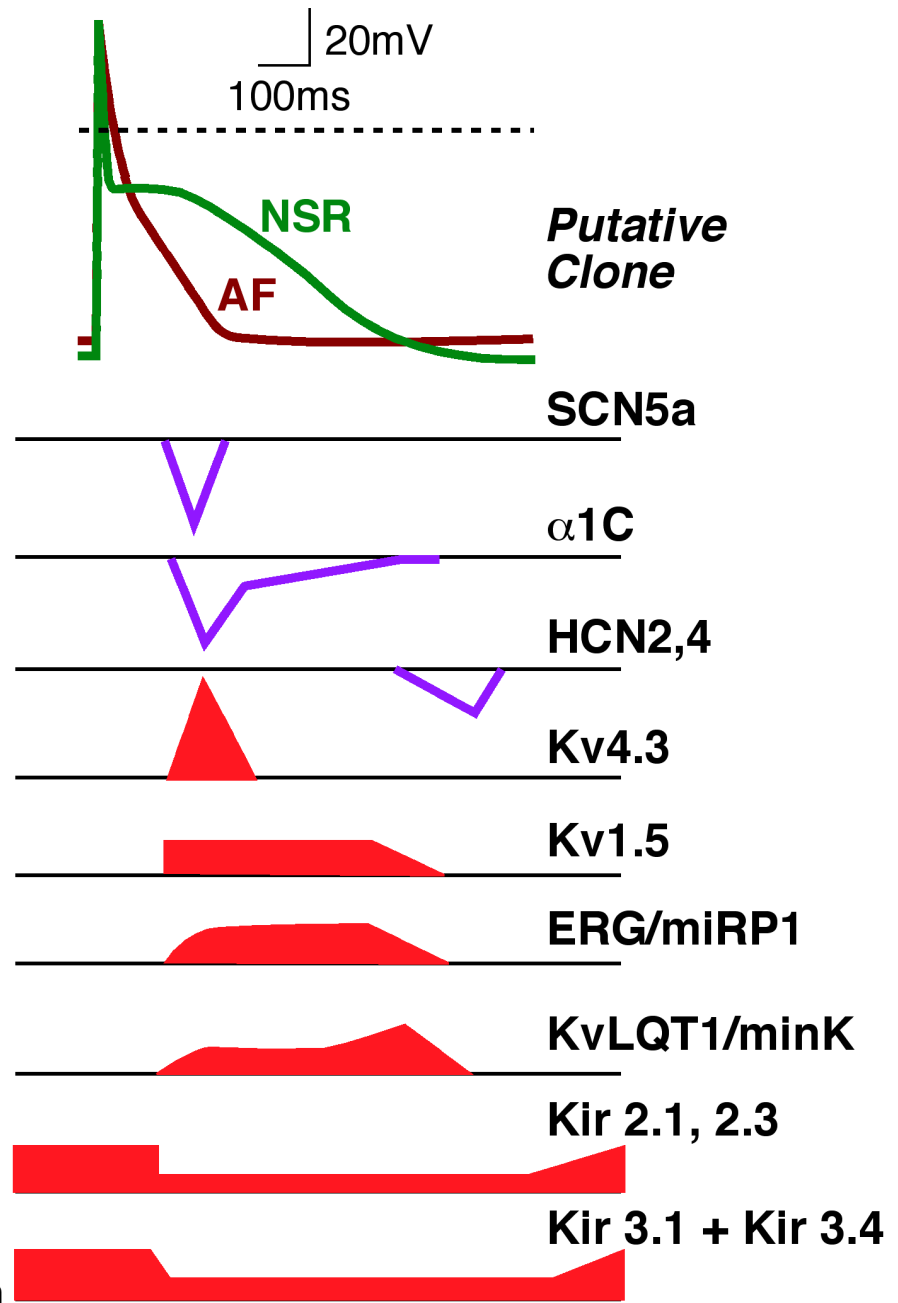
Anatomical Remodelling in Atrial fibrillation

- Dedifferentiation of cardiac myocytes
- - cellular hypertrophy
- - increased fibrosis
- - increased glycogen
- - mitochondrial breakdown
- - dispersal of chromatin in nucleus
- - sarcomere distortion

Thijssen et. at, Cardiovascular Pathology 2000; 9: 17-22.
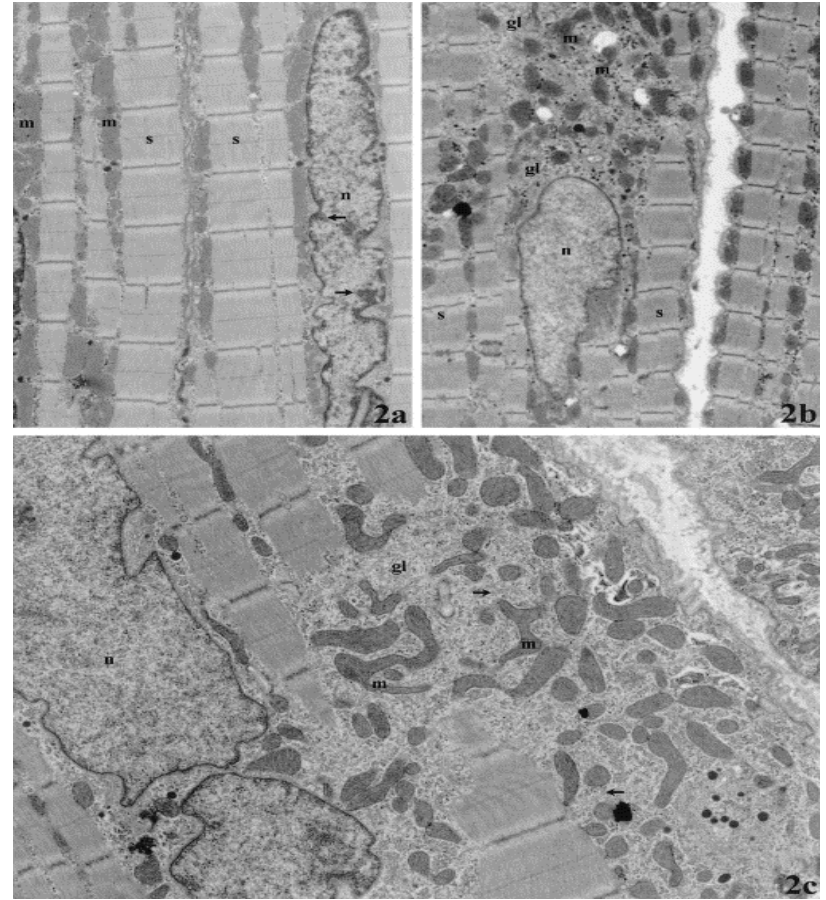
Effects of ACE Inhibition on Development of Atrial Fibrillation Substrate in Dogs with Ventricular Tachypacing-Induced CHF

A CTL

B 5W

C 5W+E
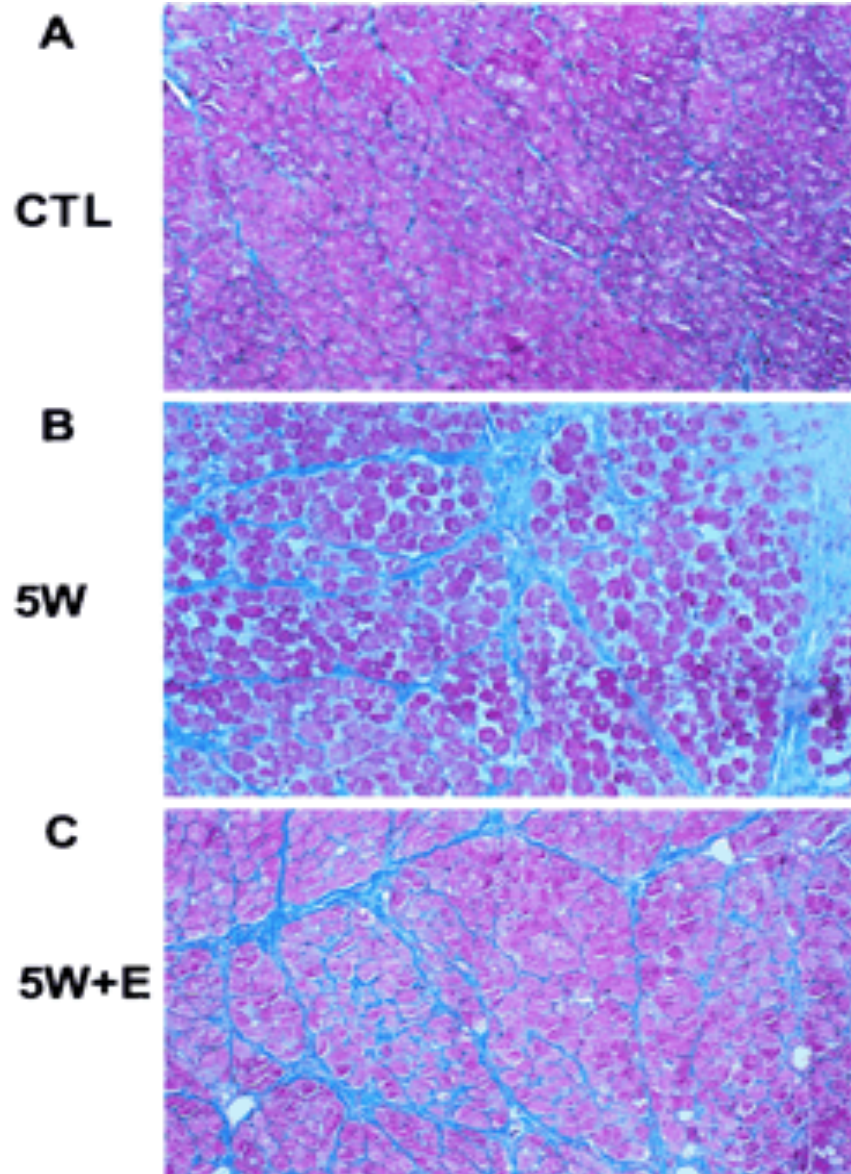
D % Connective Tissue
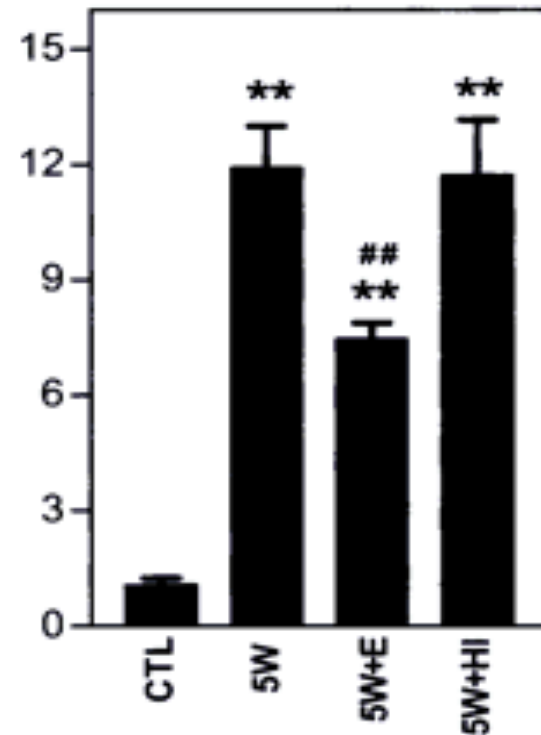
** P<0.01 vs CTL
P<0.01 vs 5W and 5W+HI

•Enalapril also decreased mean AF duration from 650 to 218 seconds.

Li, D. Circulation 2001; 104:2608-14

AF Clinical Classification

- **Paroxysmal**   episodes < 48 hours; self terminates
- **Persistent**   >48 hrs and < 6 months; does not self terminate
- **Permanent**   > 6 months; CV failed or was not attempted

- **First detected** episode should be defined clinically

- **Secondary** e.g. thyrotoxicosis, alcohol

- **Lone** - no clinical or echo evidence of disease

Duration of Atrial Fibrillation Predicts Likelihood of Remaining in Normal Sinus Rhythm after Cardioversion

Dittrich HC. Am J Cardiol. 1989; 63: 193-197
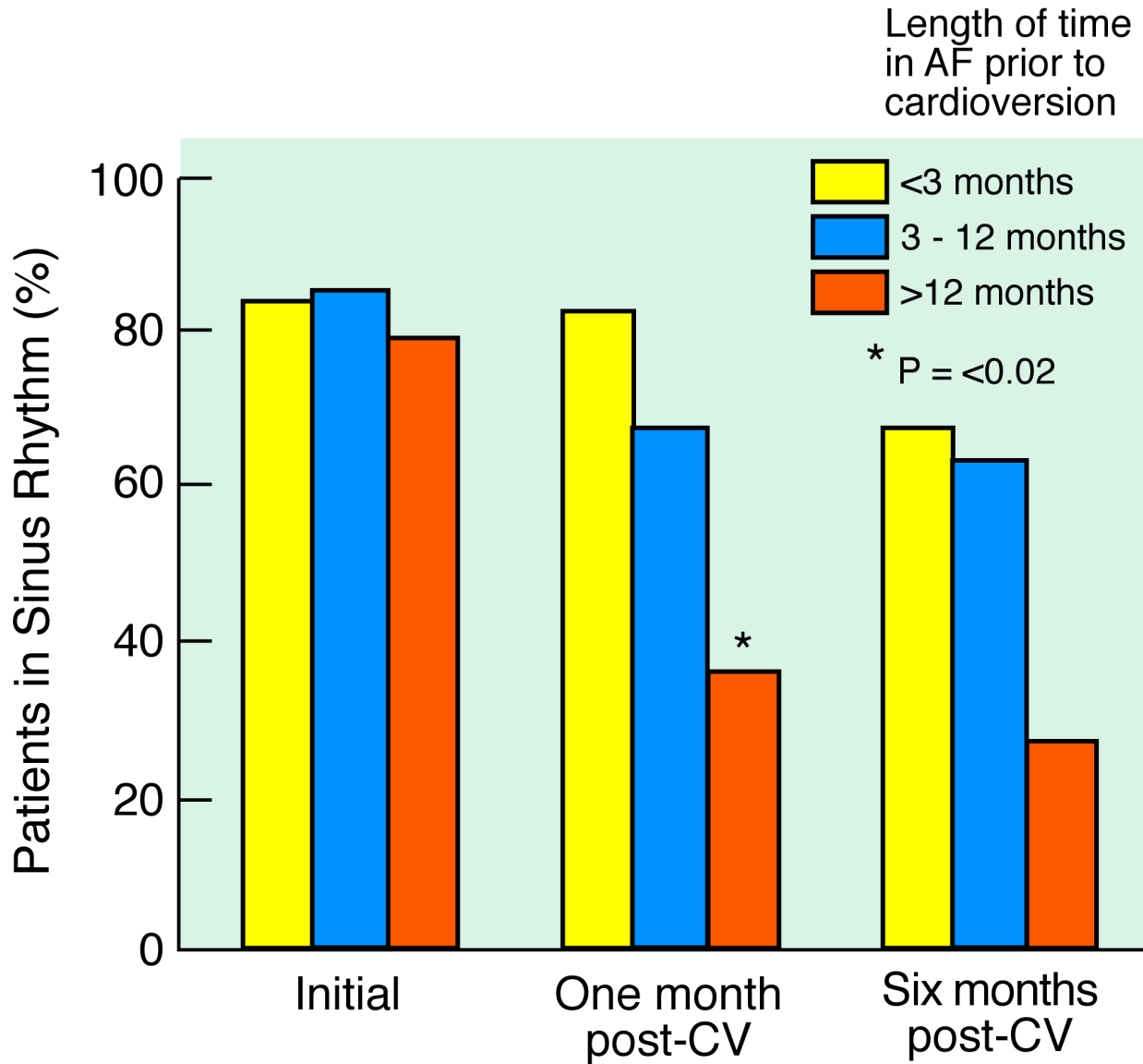
Atrial Fibrillation in Heart Failure:

Prognosis

SOLVD Trials Findings

Atrial Fibrillation and Mortality Risk - SOLVD Trials: All Cause Mortality

Event-free Survival

Sinus Rhythm

p<0.001

Atrial Fibrillation

Mean EF=26%(SR and AF groups)
NYHA class III/IV: 22%-AF, 12%-SR (p=0.001)

Follow-up Time (days)

	0	365	770	1095	1460
Sinus	6,098	5,611	4,576	2,777	1,088
Atrial Fib.	419 (6.5%)	357	288	159	50

SOLVD Investigators, JACC 1998

Atrial Fibrillation and Mortlity Risk - SOLVD Trials: Pump Failure Deaths

Sinus Rhythm

Atrial Fibrillation

p<0.001

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NYHA class III/IV: 22%-AF, 12%-SR (p=0.001)

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SOLVD Investigators, JACC 1998
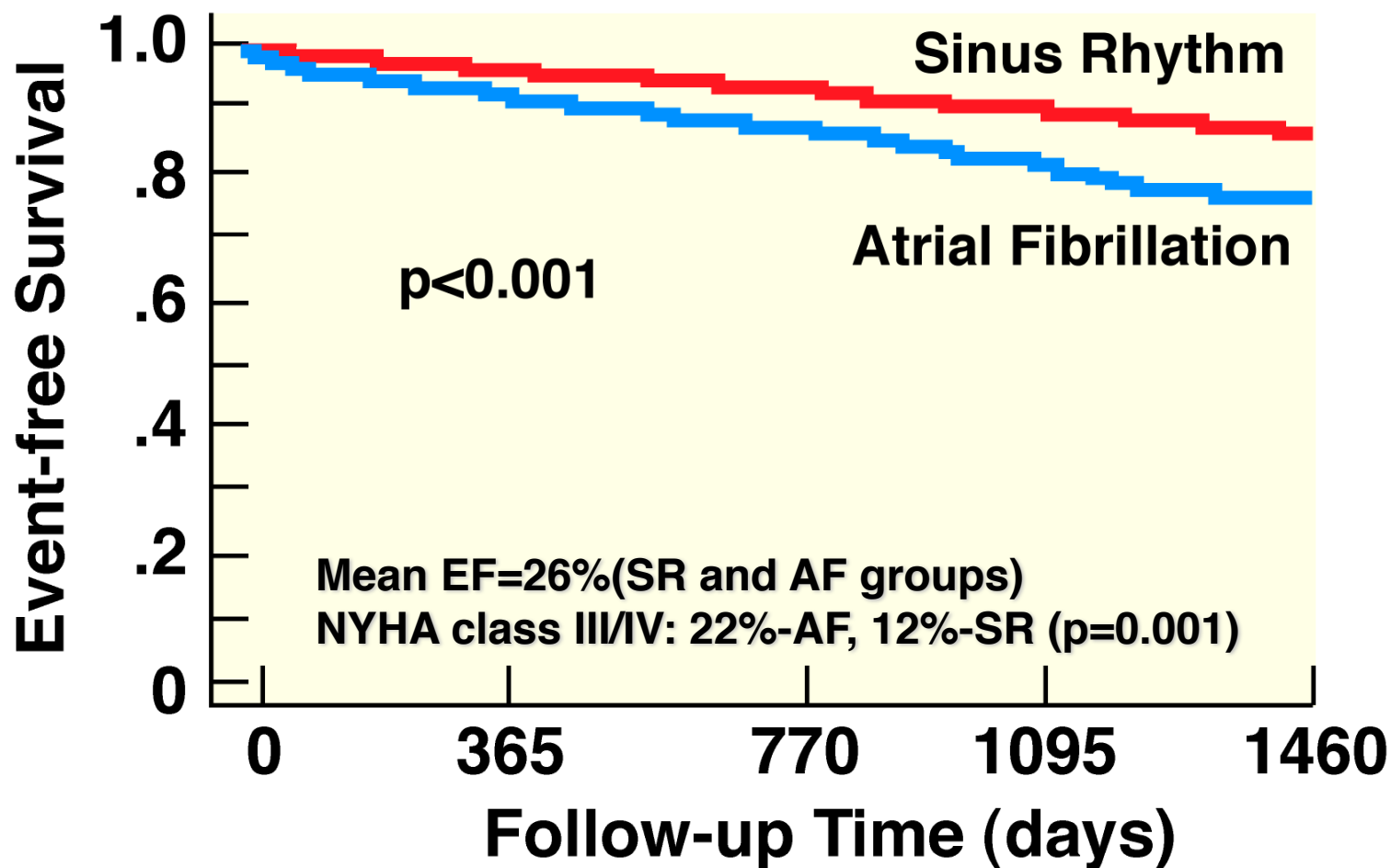
SOLVD Trials - Implications

- Increased all cause mortality in those with AF versus SR at baseline [34% vs 23%, p<0.001]
- Increased pump failure deaths in AF [16.7% vs 9.4%,p<0.001]
- No difference in SCD between AF and SR groups
- AF group more likely than SR group to reach composite end point of death or CHF hospitalization [45% vs 33%, p,0.001]
- Suggests AF is associated with progression of LV systolic dysfunction

Survival of Patients with and without Atrial Fibrillation

(UCLA data 1996)
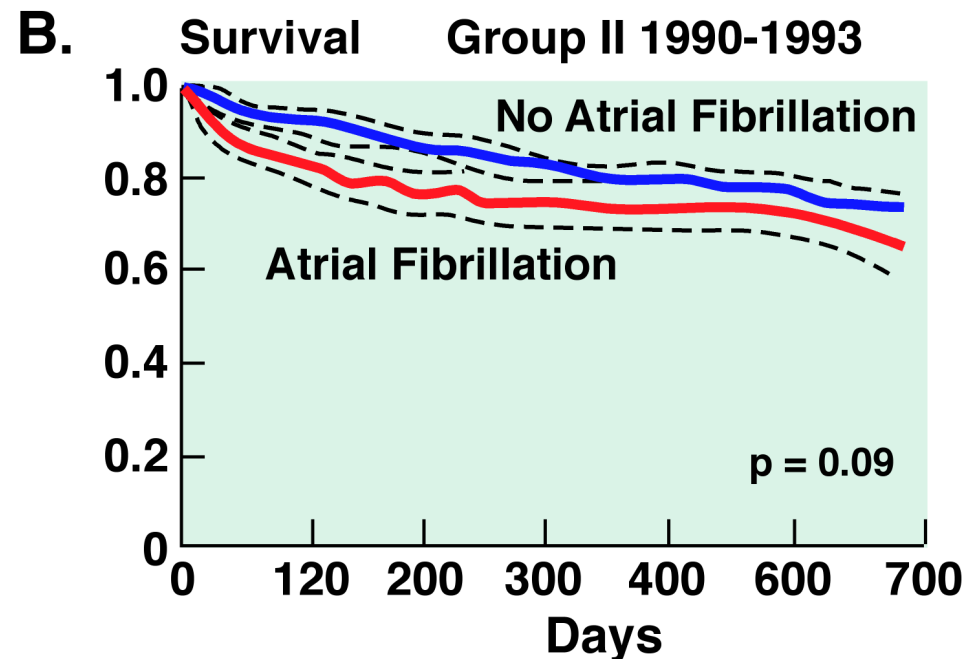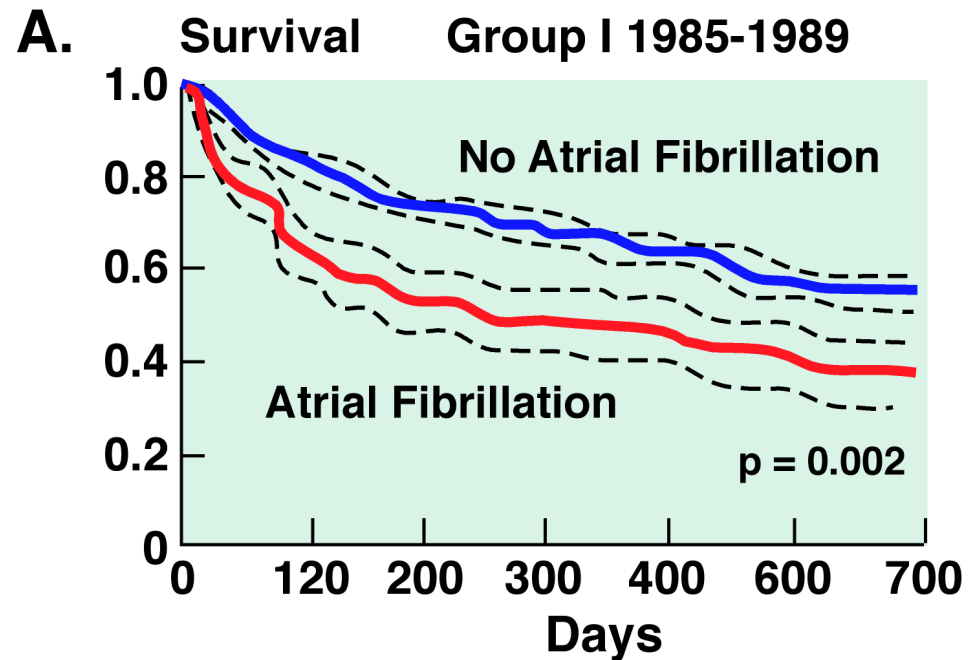
Middlekauff, H Circ 1991 84:40-48
Stevenson,W. JACC 1996 28 :1458-63

A. Survival   Group I 1985-1989

No Atrial Fibrillation

Atrial Fibrillation

$p = 0.002$

Days

B. Survival   Group II 1990-1993

No Atrial Fibrillation

Atrial Fibrillation

$p = 0.09$

Days

Atrial fibrillation is a marker for worse outcomes in heart failure CHARM   Olsson et al JACC 2006;47:1997

Time to cardiovascular death or heart failure hospitalization

Low EF:
Hazard ratio 1.29
(95% CI 1.14-1.46)
p<0.001

AF at baseline (Low EF)

No AF at baseline (Low EF)
≤ 0.40

AF at baseline (Preserved)

No AF at baseline (Preserved
LVEF > 0.40

Preserved EF (PEF):
Hazard ratio 1.72
(95% CI 1.45-2.06)
p<0.001

Cumulative distribution function

Year
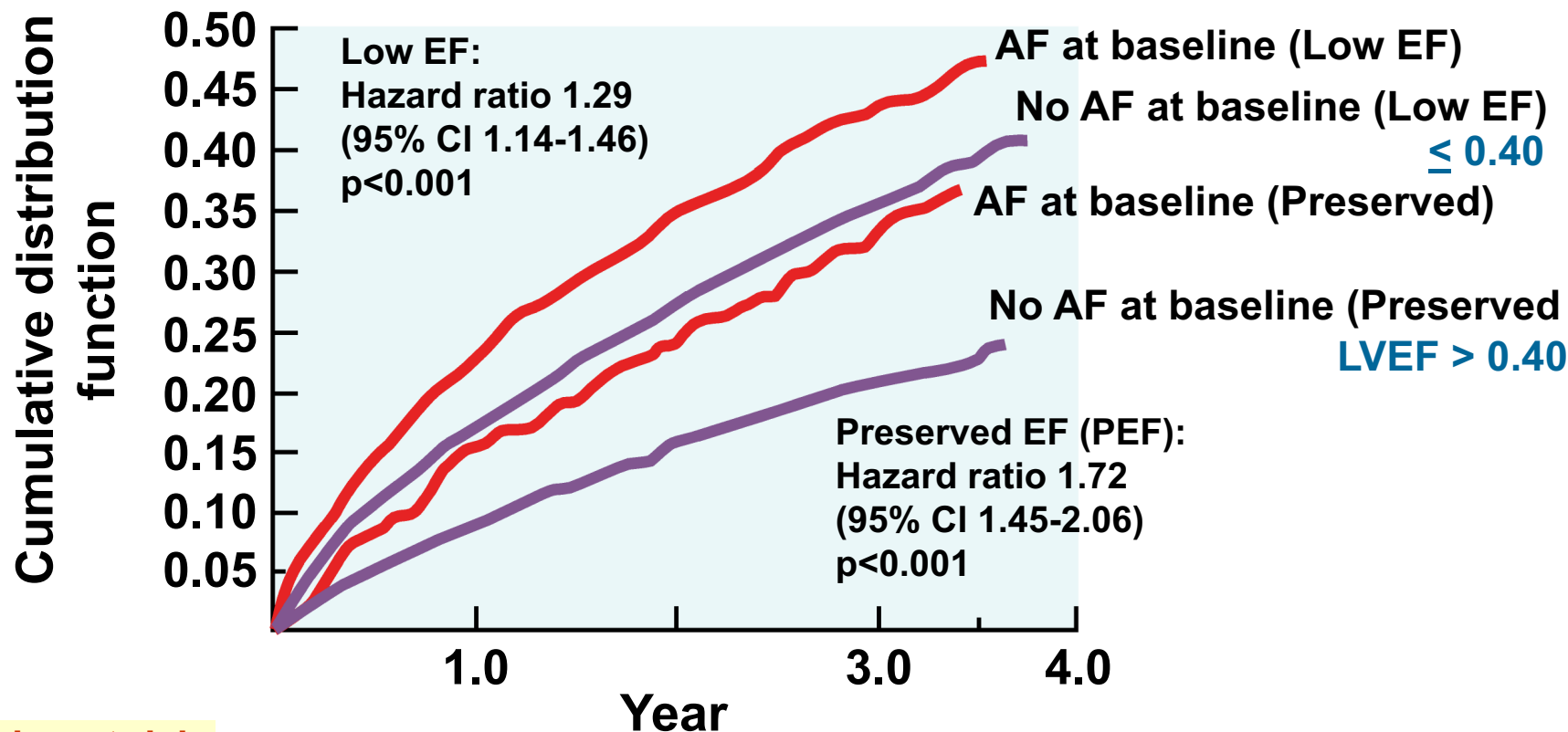
Number at risk

No AF & Low EF	3906	3207	2755	1963
No AF & PEF	2545	2294	2096	1276
AF & Low EF	670	509	417	289
AF & PEF	478	399	353	203

AF predicted mortality for both preserved EF and depressed EF groups and CV death or heart failure hospitalizations for preserved EF group

Prognostic Significance of Atrial Fibrillation in Patients with Congestive Heart Failure

Study	Year	NYHA	No. of Patients	Patients in AF	Mean Follow-up (months)
Middlekauff*	1991	III-IV	390	75	19
Bourassa*	1993	II-III	6273	731	12
Matthew*	2000	I-IV	7788	866	37
Dries*	1998	II-III	6517	419	30
Opasich**	1998	I-IV	3327	755	12
Mahoney**	1999	II-IV	234	62	13
Crijns**	2000	III-IV	427	84	40
Carson**	1993	II-III	795	107	24

* Studies suggesting significantly increased mortality associated with atrial fibrillation (AF) in patients with congestive heart failure

** Studies in which atrial fibrillation did not significantly increase mortality

Prognostic Significance of Atrial Fibrillation in Patients with Congestive Heart Failure (continued)

Study	MORTALITY			
	Overall	SR	AF	P Value
Middlekauff*	32%	29%	48%	*0.0013*
Bourassa*	18%	NA	NA	*<0.001*
Matthew*	34%	32%	43%	*<0.0001*
Dries (16)*	27%	23%	34%	*<0.001*
Opasich**	16%	NA	NA	NS
Mahoney**	19%	16%	23%	0.21
Crijns**	50%	47%	60%	0.04
Carson**	25%	21%	20%	0.18

* Studies suggesting significantly increased mortality associated with atrial fibrillation (AF) in patients with congestive heart failure

** Studies in which atrial fibrillation did not significantly increase mortality

Framingham Study : Temporal Relations of new onset AF and CHF and Their Joint Influence on Mortality.

Eligible Subjects
n=1470

AF Only
n=539
37%

AF + CHF
n=382
26%

CHF Only
n=549
37%

AF First
n=144
38%

Same Day
n=79
21%
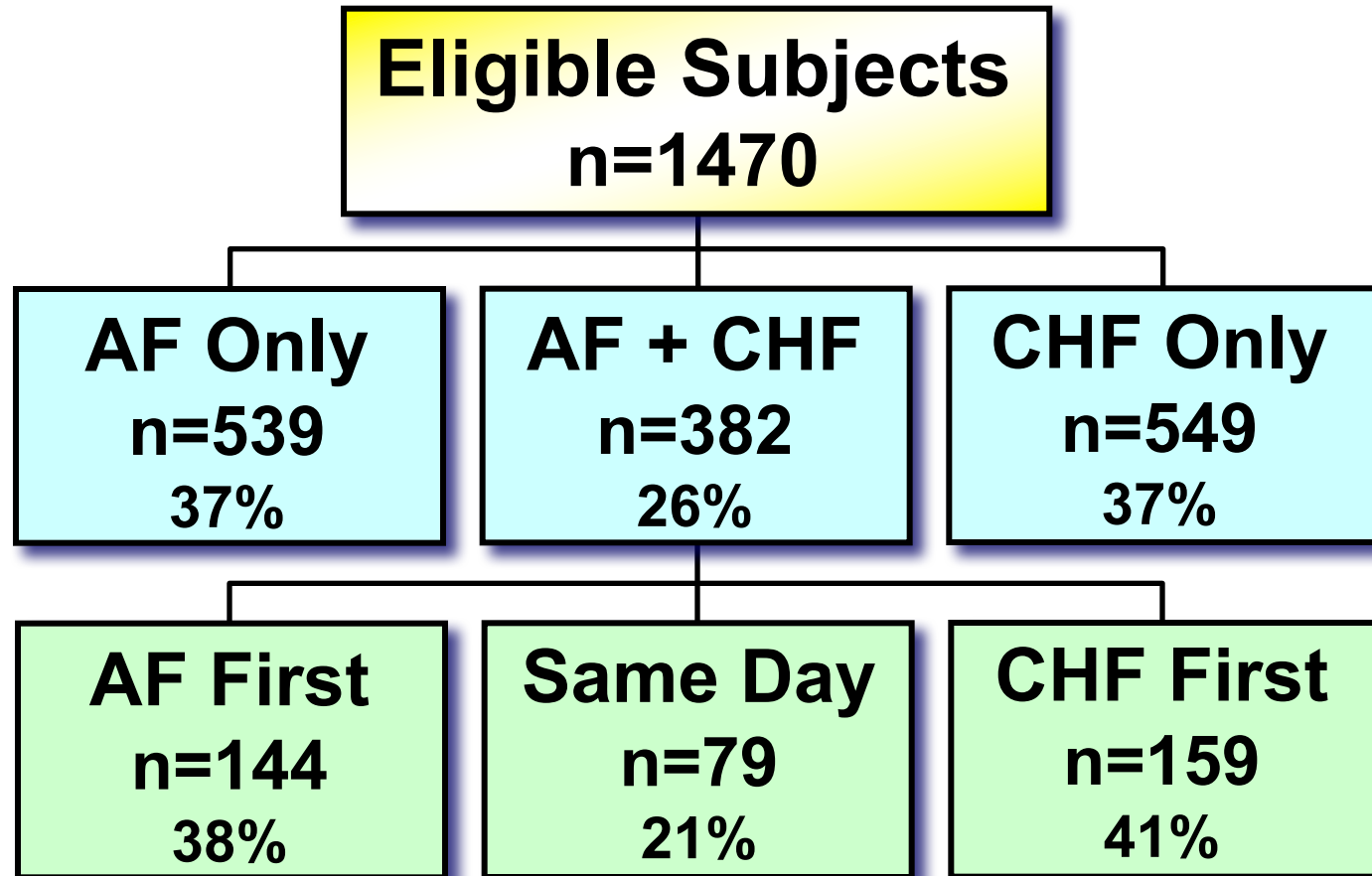
CHF First
n=159
41%

Individuals with AF or CHF who subsequently develop the other condition have a poor prognosis

Wang et al. Circulation 2003; 107: 2929-2925

Unadjusted Cumulative Incidence of First CHF in Individuals with AF

Unadjusted Cumulative Incidence of First AF in Individuals with CHF

A — Cumulative Incidence of CHF vs Years
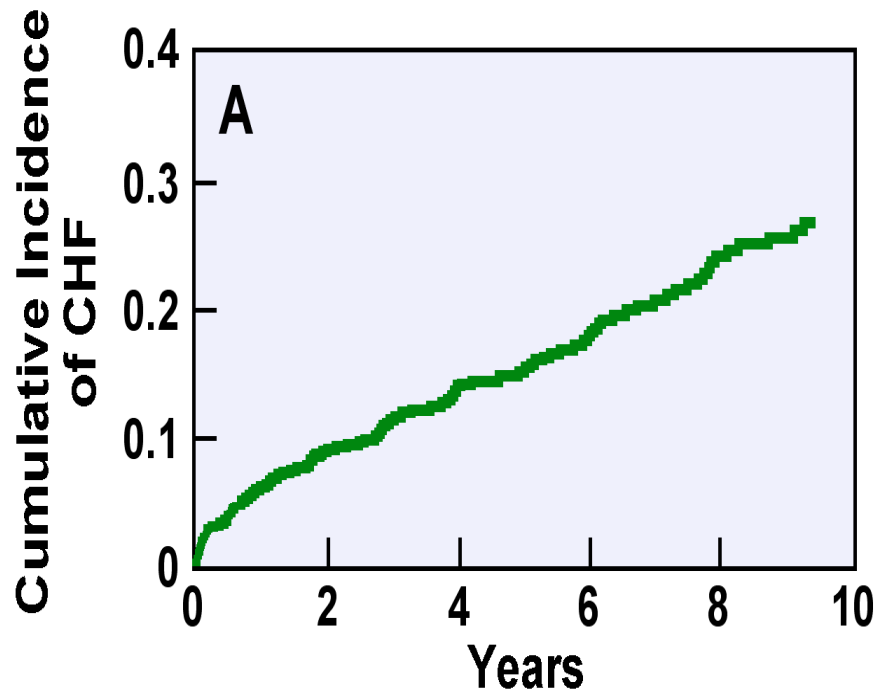
No. at risk	683	454	360	250	171	120

B — Cumulative Incidence of AF vs Years

No. at risk	708	323	230	146	92	62

Wang et al. Circulation 2003; 107: 2929-2925
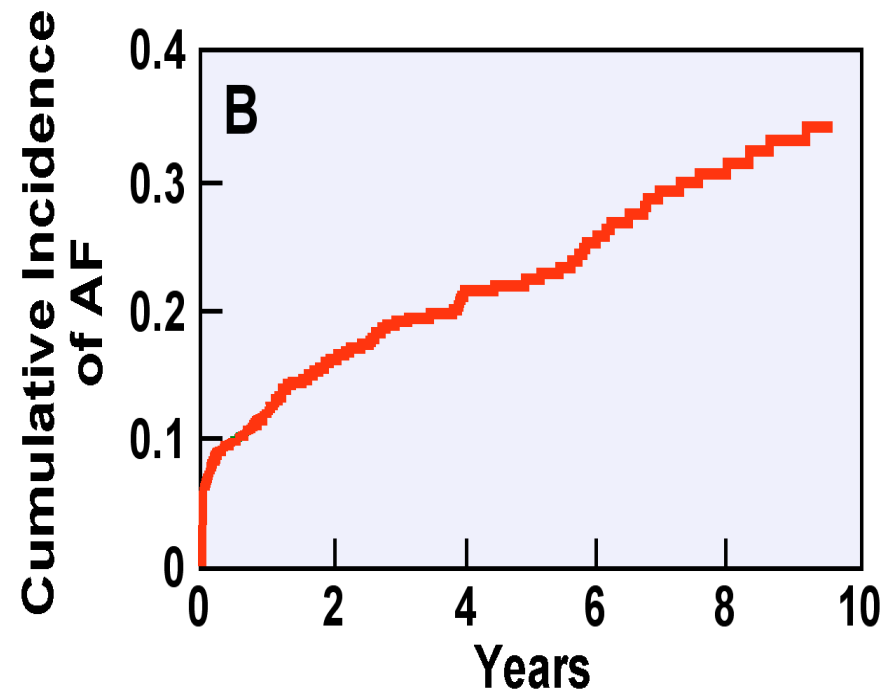
AF and CHF: Cox Multivariate Proportional Hazards Models Examining the Impact of the Comorbid Condition on Mortality

Models	Men, Adjusted HR (95% CI)	Women, Adjusted HR (95% CI)
Comorbid condition as a time-dependent variable		
(A) Mortality after AF impact of incident CHF	2.7 (1.9 to 3.7)*	3.1 (2.2 to 4.2)*
(B) Mortality after CHF impact of incident AF	1.6 (1.2 to 2.1)**	2.7 (2.0 to 3.6)*
Comorbid condition as a categorical variable		
(C) Mortality after AF		
Impact of prior CHF	2.2 (1.6 to 3.0)*	1.8 (1.3 to 2.3)*
Impact of concurrent CHF	2.4 (1.6 to 3.5)*	1.4 (1.0 to 1.9)
(D) Mortality after CHF		
Impact of prior AF	0.8 (0.6 to 1.0)	1.2 (0.9 to 1.6)
Impact of concurrent AF	1.0 (0.7 to 1.4)	1.1 (0.8 to 1.5)

*$p<0.0001$, **$p<0.001$

Survival Curves in Heart Failure Patients with AF Who Converted (n=16) and Did Not Convert (n=35) to Sinus Rhythm on Treatment with Amiodarone
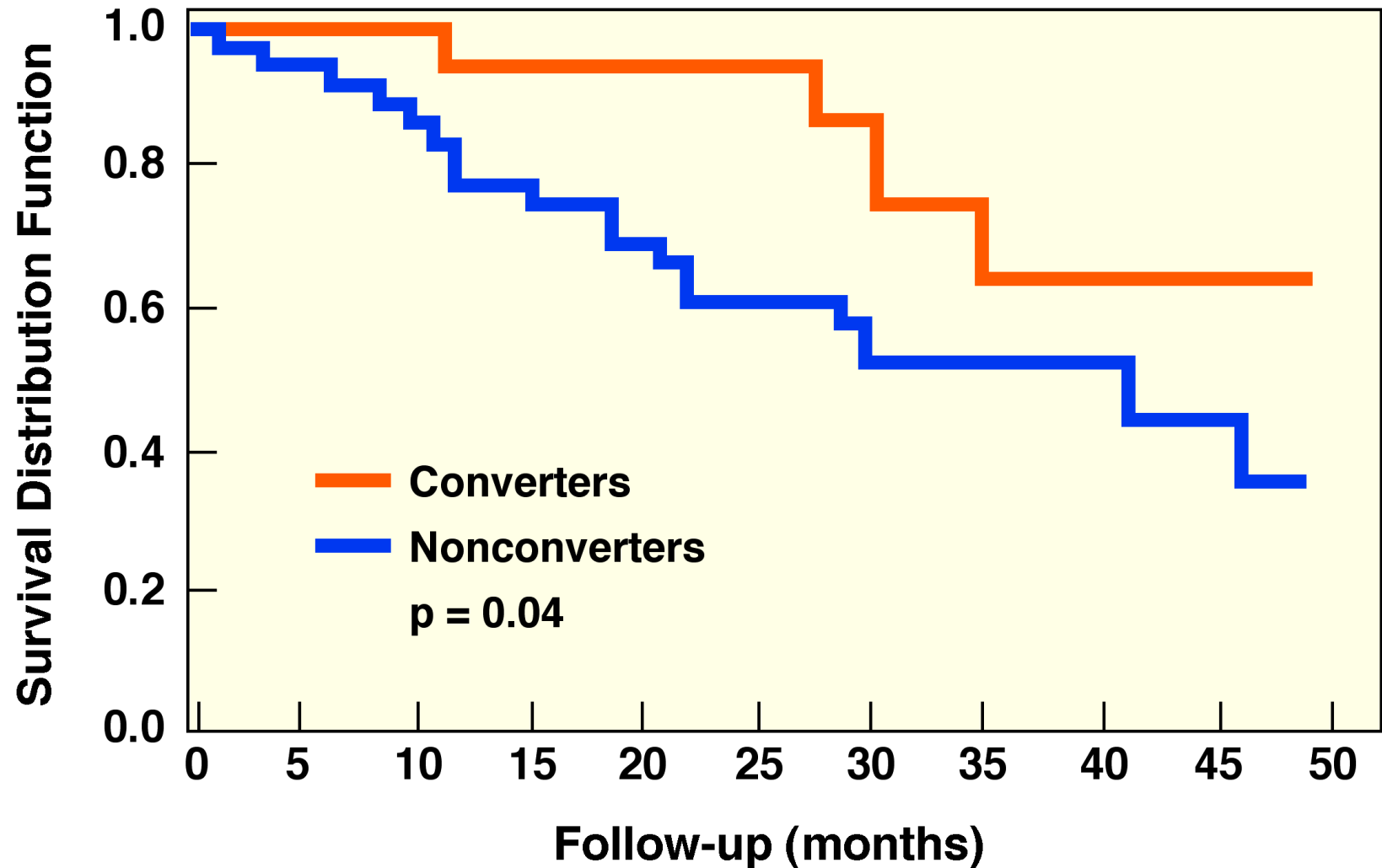
From subanalysis of CHF-STAT study

AFFIRM : Antiarrhythmic Drug Substudy

Percentage without Recurrence vs Years

Amiodarone (n=106)

Class 1 Drugs (n=125)

Sotalol (n=116)

(p<0.01)
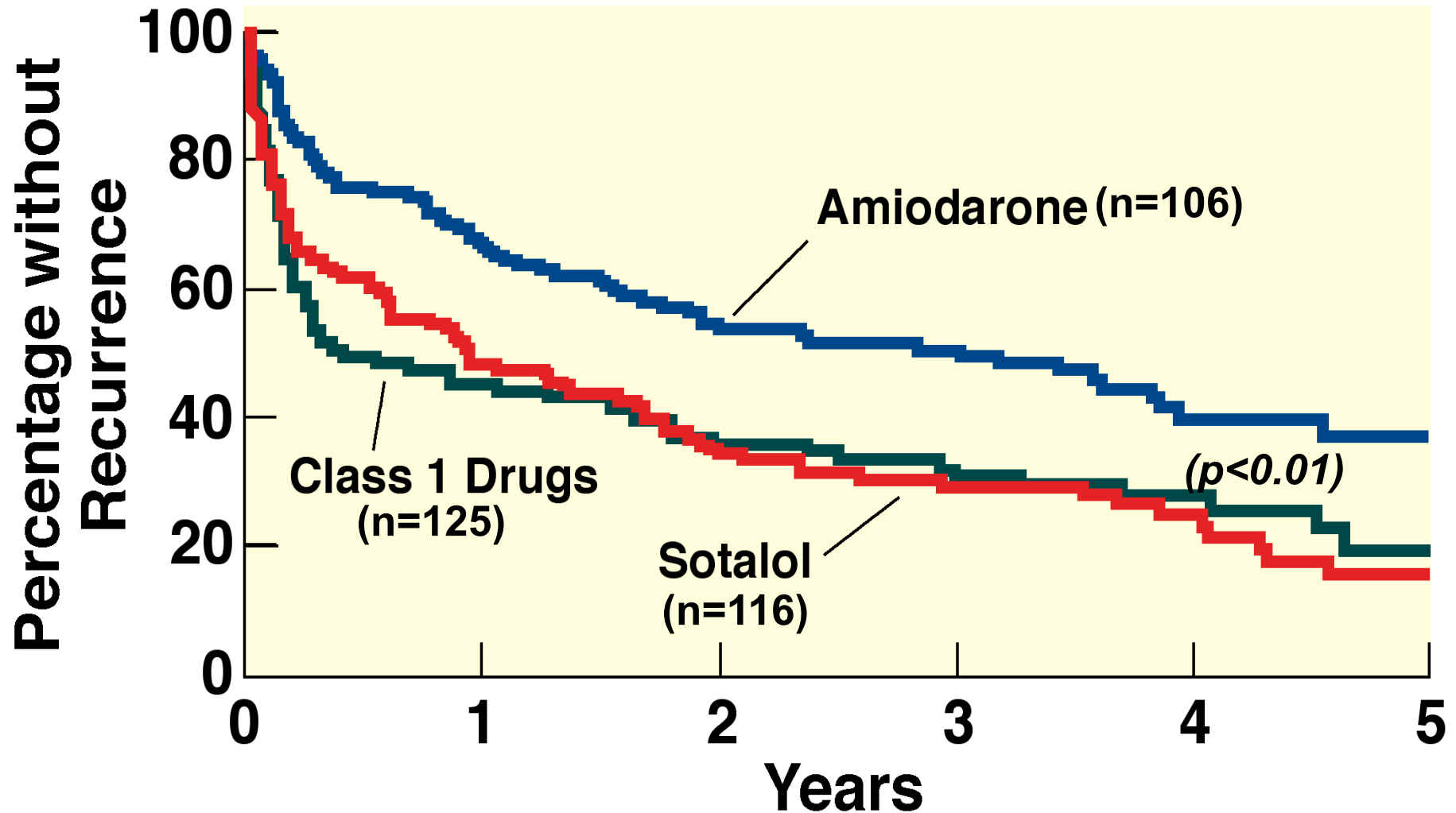
Drug use in AF patients

Agent	1991-1992 (%)	1999-2000 (%)	p for trend
Rate-control agents	71.6	56.2	0.01
Digoxin	64.4	36.7	<0.001
Beta blockers	16.3	22.2	0.09
Calcium channel blockers	15.8	13.5	0.13
Sinus-rhythm agents	9.8	12.2	0.88
Quinidine	5.0	0.0	0.01
Amiodarone	0.2	6.4	<0.001
Antithrombotic agents	35.9	46.4	0.05
Oral anticoagulants in patients $\geq$ 80 years	14.3	47.5	<0.001
Anticoagulants in patients with high stroke risk	25.0	46.5	0.002

Fang MC et al. *Arch Intern Med* 2004 Jan 12; 164(1):55-60.

Kaplan-Meier Cumulative Incidence of the Adjudicated First Recurrence of Atrial Fibrillation or Flutter

Dronaderone (n=828)
Placebo (n=409)

EF=58%
Paroxysmal – 70&
Persistent 30%

C

Cumulative Incidence (%)

Placebo

Dronedarone

Hazard ratio, 0.75 (95% CI, 0.65 to 0.87)

P<0.001

Days

No. at Risk

Placebo	409	192	156	133	112	90
Dronedarone	828	450	389	347	307	262
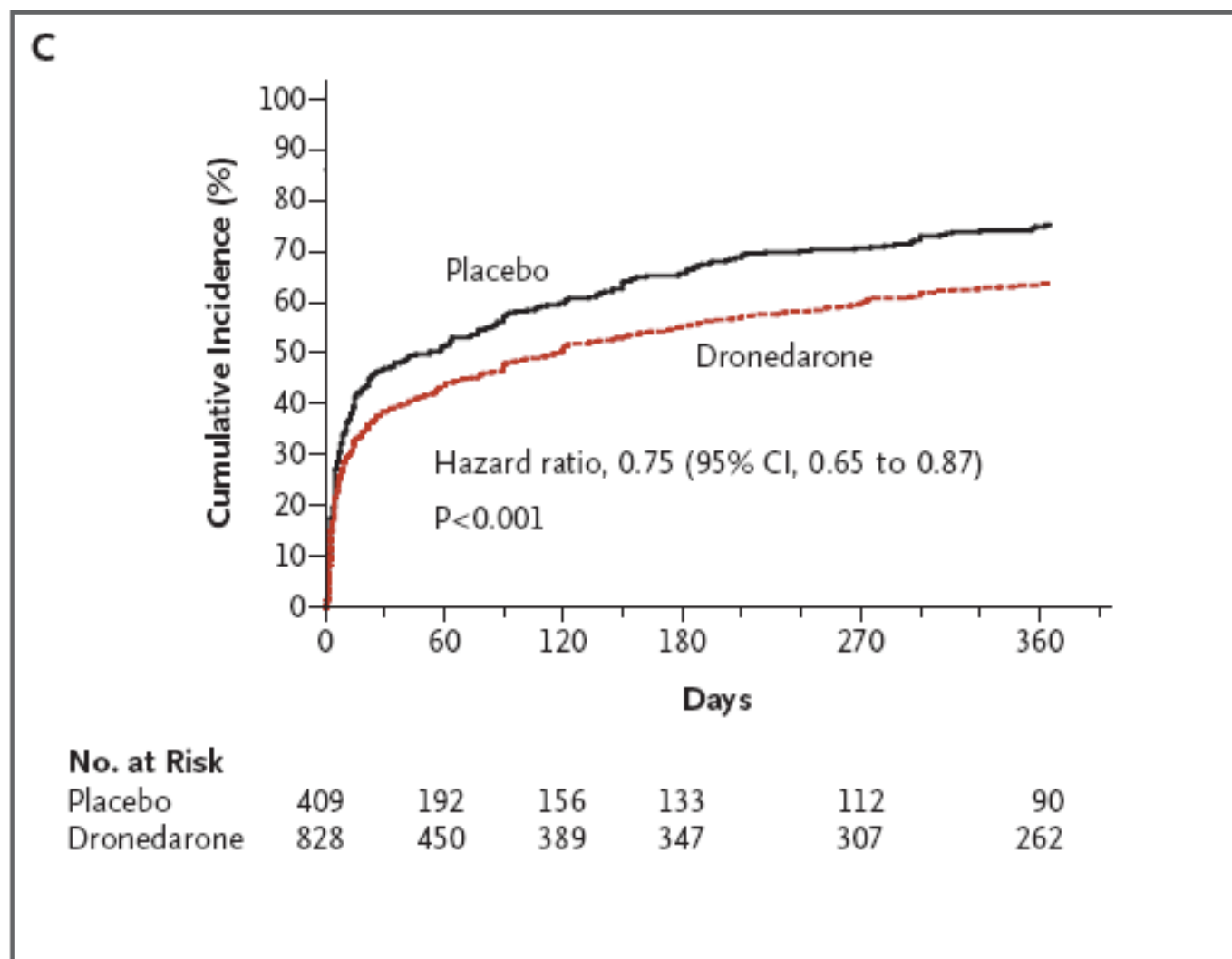
Drugs for Maintenance of Sinus Rhythm in CHF

IA

Quinidine

Procainamide

Disopyramide

IC

Flecainide

Propafenone

Moricizine

III

Sotalol

Amiodarone

Ibutilide

Dofetilide

II

Beta Blockers

IV

Calcium Channel Blockers

(Emerging Role : ACE inhibitors, ARBs)

FDA Approved : Quinidine, Flecainide, Propafenone, Ibutilide, Sotalol, Dofetilide
AMIODARONE is NOT FDA approved for treatment of Atrial Fibrillation

AFFIRM

- 214 centres U.S./Canada

- N = 4060
- Age ≥ 65 years
- ≥ risk factor for TE
- AF >6 hours, <6 months
- 1 AF episode within 12 wk
- No contraindications for W

- Follow-up 3.5 (2-6) years
- HTN 51%, lone AF 26%
- 2033 rhythm control
- 2027 rate control

All-cause death
27% vs 26%
(p = 0.058)

Rhythm control

Rate control
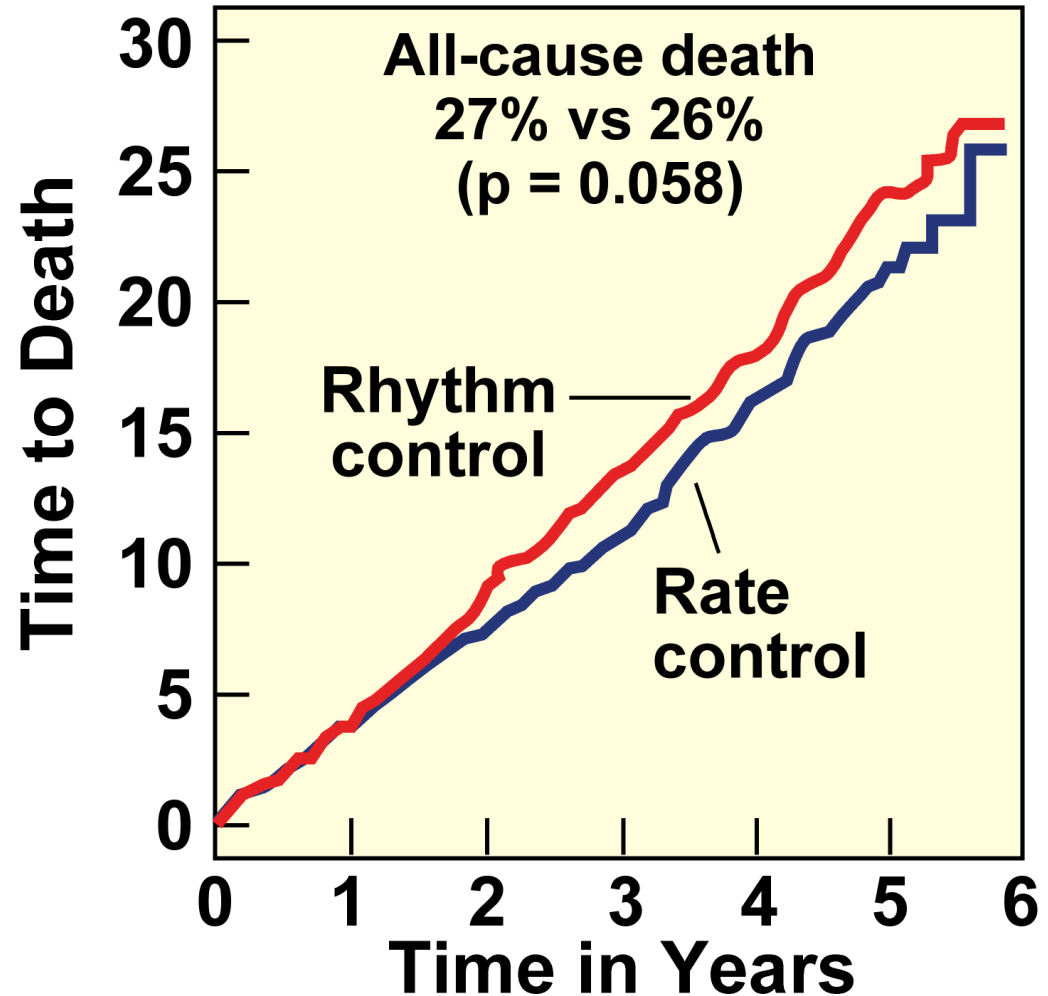
After adjustment for confounders
p = 0.034

AFFIRM
Trial

Variable	Hazard Ratio
Age	
<65 yr (n = 969)	
>65 yr (n = 3091)	
Rhythm at Randomization	
Atrial fibrillation (n = 1778)	
Sinus rhythm (n = 2095)	
Type of episode of atrial fibrillation	
Recurrent (n= 2526)	
First (n = 1391)	
Coronary artery disease	
No (n= 2509)	
Yes (n = 1551)	
Hypertension	
No (n= 1184)	
Yes (n = 2876)	
Congestive heart failure	
No (n= 3121)	
Yes (n = 939)	
Left Ventricular ejection fraction	
<50% (n = 788)	
>50% (n = 2244)	
Sex	
Female (n = 1594)	
Male (n = 2466)	
Duration of atrial fibrillation	
<2 days (n = 1251)	
>2days (n = 2808)	
Overall (n = 4060)	

0.3   1.0   1.7

Rhythm Control Better   Rate Control Better

AFFIRM Investigators, NEJM 2002; 347:1825-33

scientific sessions 2007

Pre-Sessions Symposia: November 3
Exhibits: November 4–6
Sessions: November 4–7
Orlando, Florida

American Heart Association
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Clinical Trials

Trial Summary

Title: Atrial Fibrillation and Congestive Heart Failure (AF-CHF - Presented at AHA 2007)
Year Presented: 2007
Topic(s): Arrhythmias, Heart Failure/Transplant
Summary Posted: 11/6/2007
Writer: Ms. Sabina A. Murphy (view disclosure)

Description
The goal of the trial was to evaluate rhythm control with rate control among patients with heart failure and atrial fibrillation.

Drugs/Procedures Used
Patients were randomized to rhythm control (n = 682) or rate control (n = 694). Rhythm control included use of electrical cardioversion combined with antiarrhythmic drugs, including amiodarone as first line therapy and dofetilide and sotalol if needed, and additional non-pharmacological therapy in resistant patients. Rate control included use of beta-blockers, digoxin or pacemaker and AV node ablation if necessary. Patients were to receive optimal heart failure therapy and anticoagulation.

Principal Findings
At baseline, 31% of patients had NYHA class III or IV heart failure. Mean LVEF was 27%. Atrial fibrillation was paroxysmal in 31% of patients and persistent in 69%. By trial design, rhythm control was predominantly done with amiodarone (82%) with less use of sotalol (1.8%) and dofetilide (0.4%) in the rhythm control cohort. In the rate control group, beta-blockers were used in 88% of patients and digoxin in 75%. Crossover from rhythm to rate control occurred in 21% of the rhythm group and from rate to rhythm control in 10% of the rate group.

There was no difference in the primary endpoint of cardiovascular death between the groups (26.7% of the rhythm control group vs. 25.2% of the rate control group, hazard ratio [HR] 1.06, 95% CI 0.86-1.30, p = 0.59). There was also no difference in total mortality (31.8% vs. 32.9%, p = 0.73), stroke (2.6% vs. 3.6%, p = 0.32), worsening heart failure (27.6% vs. 30.8%, p = 0.17) or the composite of CV death, stroke, or worsening CHF (42.7% vs. 45.8%, p = 0.20) for rhythm control vs. rate control, respectively. In the rhythm control group, 39% had cardioversion compared with 8% of the rate control group (p = 0.0001). Bradyarrhythmias were more common in the rhythm control group (8.5% vs. 4.9%, p = 0.007).

Interpretation
Among patients with heart failure and atrial fibrillation, use of rhythm control was not associated with differences in cardiovascular mortality compared with rate control through a mean follow-up of 3 years.

Results of the present study are similar to those of the AFFIRM trial, which also showed no impact on mortality with rhythm control compared with rate control for management of atrial fibrillation. Atrial fibrillation has adverse hemodynamic effects, due in part to an excessive ventricular rate, irregularity of ventricular response, and loss of atrial contraction. These adverse hemodynamic effects could potentially have an unduly negative influence in patients with CHF. Conversely, restorating sinus rhythm can improve cardiac output, exercise capacity, and maximal oxygen consumption. Despite these potential benefits with rhythm control, no impact was observed on clinical events, even worsening heart failure.

Related Resources

Related Trial: Atrial Fibrillation Follow-up Investigation of Rhythm Management (AFFIRM)

Related Trial: Management of Atrial Fibrillation Suppression in AF-HF COmorbidity Therapy (MASCOT - Presented at AHA 2007)

AF - CHF Trial

NYHA Class II-IV; EF <35%
One episode of AF within last 6 months
(paroxysmal 31%; persistent 69%) mean age 67 yrs; 18% F; mean EF 27%

RHYTHM CONTROL	RATE CONTROL
N = 682	N = 694

RHYTHM CONTROL		RATE CONTROL	
Amiodarone	82%	Beta Blockers	88%
Sotalol	1.8%	± Digoxin	75%
Dofetilide	0.4%		
DC CV	39%	DC CV	8%
Bradycardia	8.5%	Bradycardia	4.9%

21%
10%

Mean F/U = 37 months

	RHYTHM CONTROL	RATE CONTROL	
1^0 CV Mortality	26.7%	25.2%	p = 0.59
RR = 1.06 (0.86-1.30)			
2^0 Total Mortality	31.8%	32.9%	p = 0.73
Stroke	2.6%	3.6%	p = 0.32
Worsening CHF	27.6%	30.8%	p = 0.17

RESULT: NO difference in Clinical Outcomes with a mean follow-up of 3 years

Choice of Rate Control vs Rhythm Control should be individualized for each patient

Rate Control Preferred

- **Minimally symptomatic**
- **Antiarrhythmic drug intolerance or inefficacy**
- **Risk of proarrhythmia**
- **? Age >65 yrs**
- **AF likely to recur**
- **Patient preference**

RATE CONTROL IS NOT an INFERIOR STRATEGY (4 trials)

Anticoagulate based on risk factors for stroke

Rhythm Control Preferred

- **Highly symptomatic**
- **Antiarrhythmic drug is tolerated and is effective**
- **?'Focal' Afib-RF available**
- **? Age <65 yrs (AFFIRM)**
- **CHF patients (AFFIRM)**
- **Patient Preference**

OVER 50% OF AF EPISODES ARE ASMPTOMATIC IN 'SYMPTOMATIC' PTS

Anticoagulation still needed if risk factors for stroke present

TRACE Study

Incidence of AF during four year F/U in 1577 post MI patients with reduced EF (average 33%) and Sinus Rhythm at baseline (RR=0.45)

%

10

8

6

4

2

0

Placebo

Trandolapril

P<0.05

RR=0.45

0   1   2   3   4

Years

Pedersen, Circulation 1999; 100:376-380
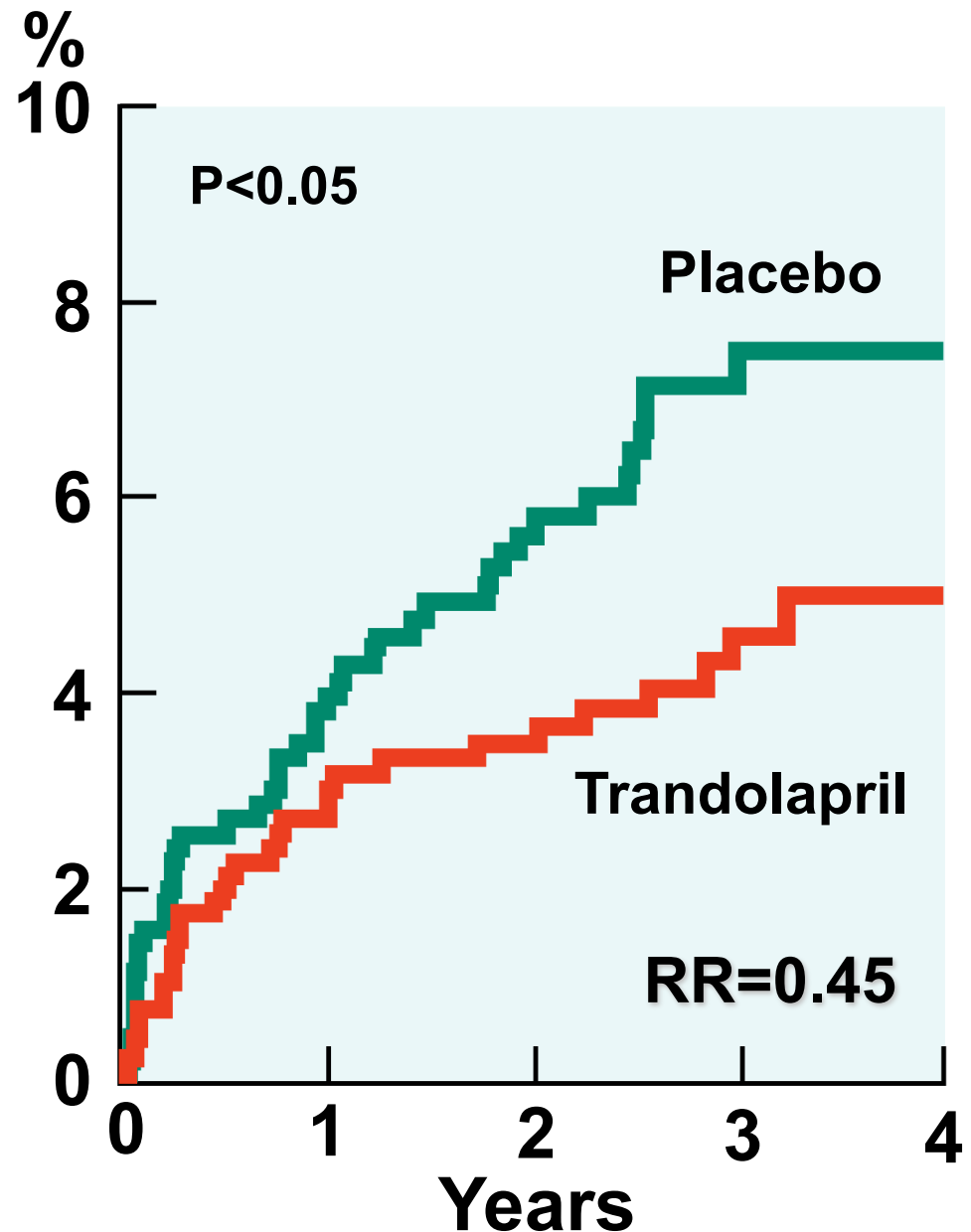
Freedom from AF in 374 "SOLVD Trial" Patients randomly assigned to Enalapril or Placebo

Freedom from Atrial Fibrilation

Time (years)

Enalapril

Placebo

Mean EF=27%
NYHA Class II
'Prevention':n=251
'Treatment': n=123

Vermes et al. Circulation 2003; 107:2926-2931
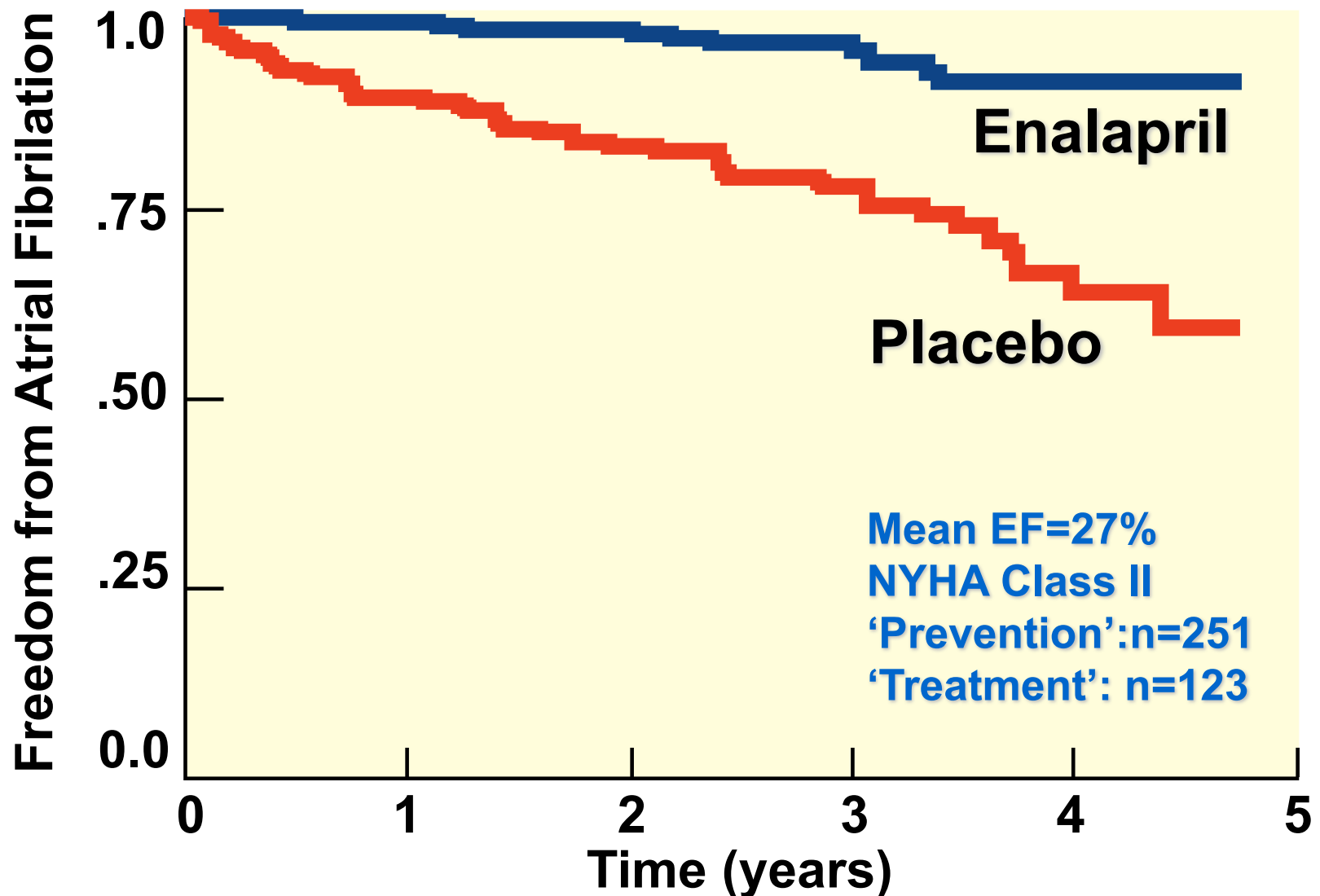
Use of Enalapril to Maintain Sinus Rhythm after Cardioversion for Long Term Persistent Atrial Fibrilation

TOTAL COHORT

Amiodarone plus enalapril

Amiodarone

p = 0.021

Y-axis: Patients Free of Recurrence (%) — 0, 20, 60, 80, 100

X-axis: Time of Follow-up (months) — 0, 4, 6, 12, 18, 24
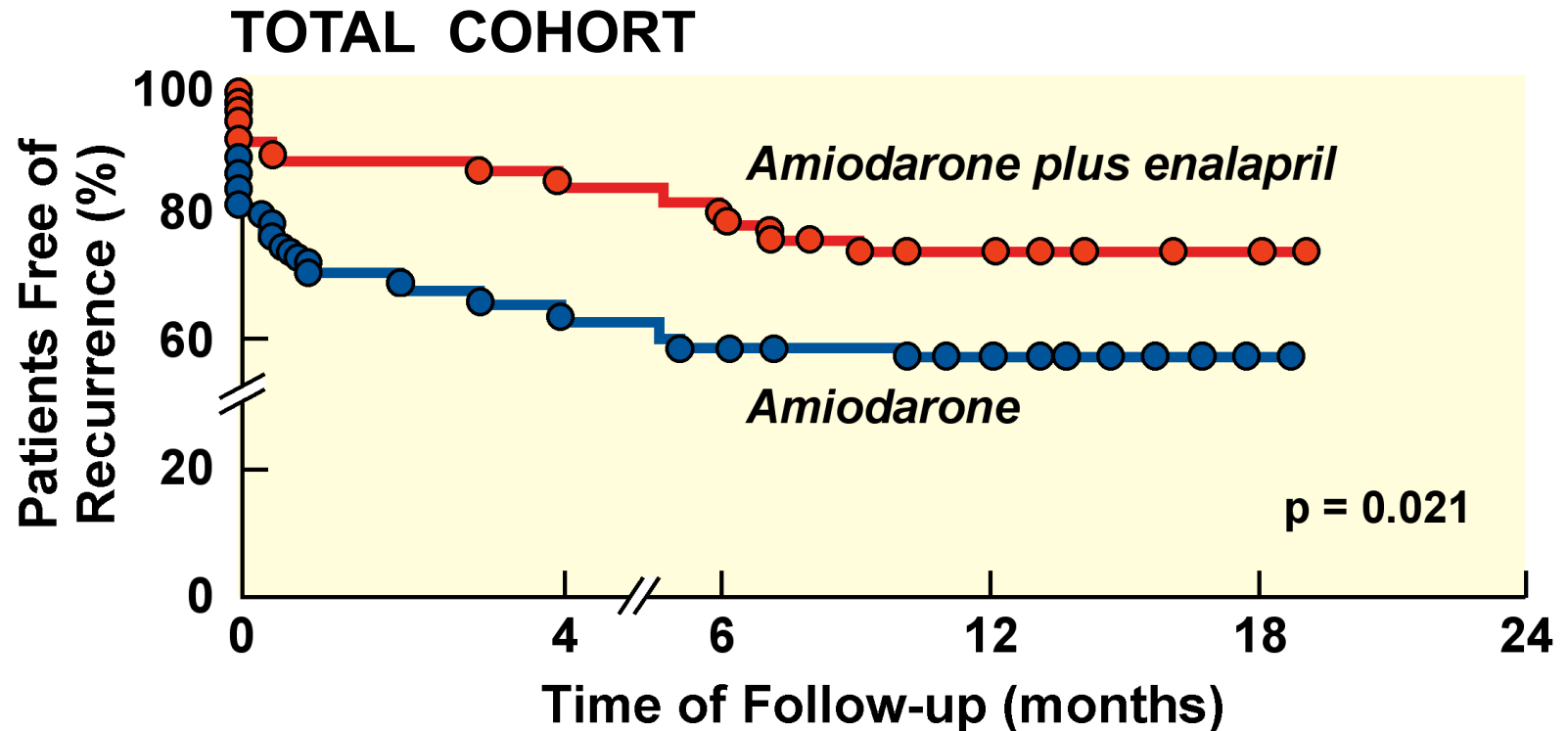
Number at Risk						
Combination	70	59	55	52	52	0
Amiodarone	75	47	44	43	43	0

Heart Rhythm Disorders

Prevention of Atrial Fibrillation With Angiotensin-Converting Enzyme Inhibitors and Angiotensin Receptor Blockers

A Meta-Analysis

Jeff S. Healey, MD,* Adrian Baranchuk, MD,* Eugene Crystal, MD,† Carlos A. Morillo, MD,*
Michael Garfinkle, BA,† Salim Yusuf, MD, PHD,* Stuart J. Connolly, MD*

Hamilton and Toronto, Ontario, Canada

PREVENTION OF AF WITH ANGIOTENSIN INHIBITION

Comparison: 04 Effect of treatment based on class of drug
Outcome: 01 Atrial Fibrillation

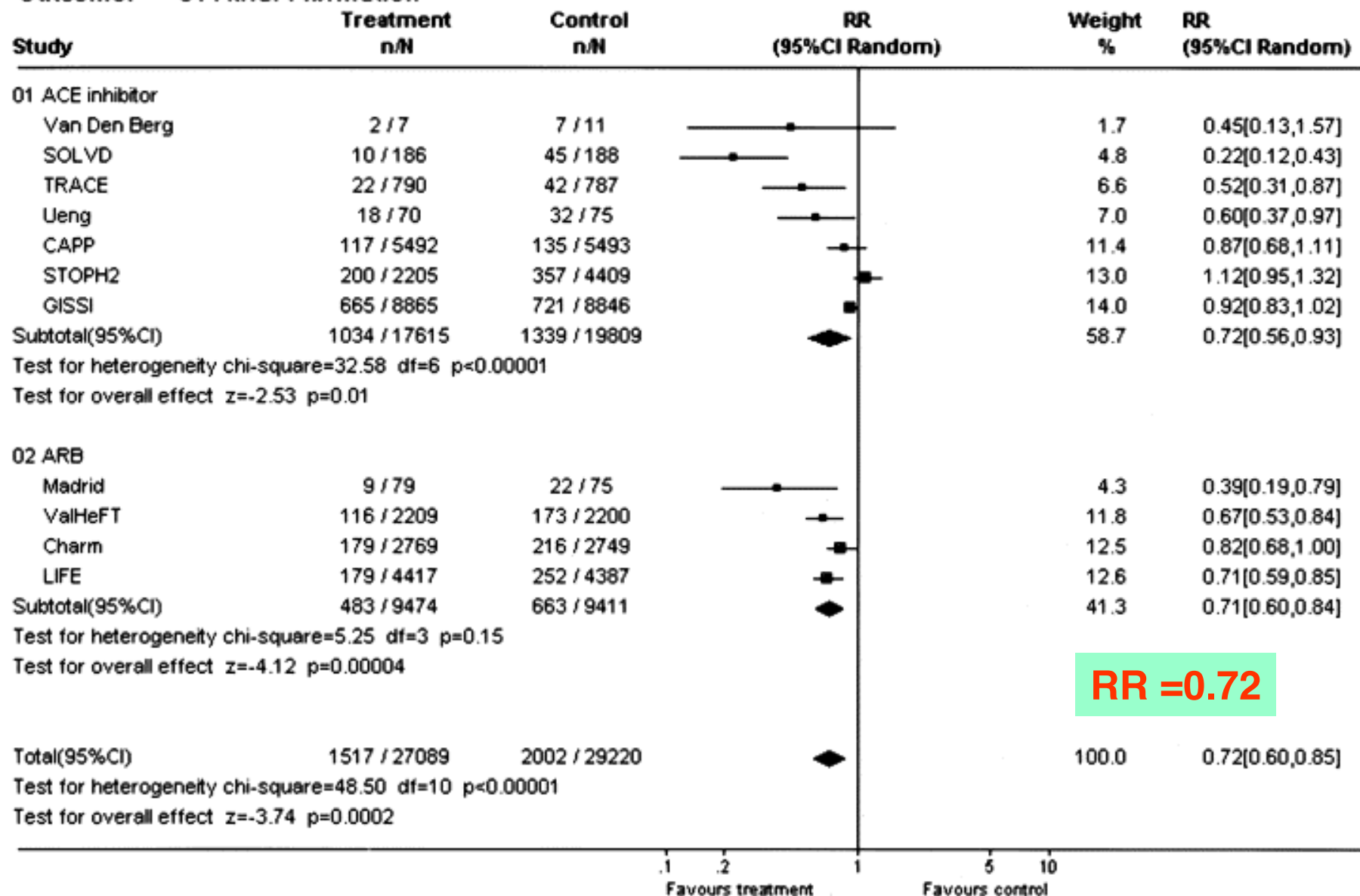| Study	Treatment n/N	Control n/N	RR (95%CI Random)	Weight %	RR (95%CI Random)
01 ACE inhibitor					
Van Den Berg	2 / 7	7 / 11		1.7	0.45[0.13,1.57]
SOLVD	10 / 186	45 / 188		4.8	0.22[0.12,0.43]
TRACE	22 / 790	42 / 787		6.6	0.52[0.31,0.87]
Ueng	18 / 70	32 / 75		7.0	0.60[0.37,0.97]
CAPP	117 / 5492	135 / 5493		11.4	0.87[0.68,1.11]
STOPH2	200 / 2205	357 / 4409		13.0	1.12[0.95,1.32]
GISSI	665 / 8865	721 / 8846		14.0	0.92[0.83,1.02]
Subtotal(95%CI)	1034 / 17615	1339 / 19809		58.7	0.72[0.56,0.93]

Test for heterogeneity chi-square=32.58 df=6 p<0.00001
Test for overall effect z=-2.53 p=0.01

Study	Treatment n/N	Control n/N	RR (95%CI Random)	Weight %	RR (95%CI Random)
02 ARB					
Madrid	9 / 79	22 / 75		4.3	0.39[0.19,0.79]
ValHeFT	116 / 2209	173 / 2200		11.8	0.67[0.53,0.84]
Charm	179 / 2769	216 / 2749		12.5	0.82[0.68,1.00]
LIFE	179 / 4417	252 / 4387		12.6	0.71[0.59,0.85]
Subtotal(95%CI)	483 / 9474	663 / 9411		41.3	0.71[0.60,0.84]

Test for heterogeneity chi-square=5.25 df=3 p=0.15
Test for overall effect z=-4.12 p=0.00004

RR =0.72

Study	Treatment n/N	Control n/N	RR (95%CI Random)	Weight %	RR (95%CI Random)
Total(95%CI)	1517 / 27089	2002 / 29220		100.0	0.72[0.60,0.85]

Test for heterogeneity chi-square=48.50 df=10 p<0.00001
Test for overall effect z=-3.74 p=0.0002

.1 .2   1   5 10
Favours treatment   Favours control

Healey et. Al. JACC 2005; 45:1832-9.

A paradigm shift in treatment of atrial fibrillation : from electrical to structural therapy ?

Hein Heidbuchel, Eur. Heart J. 2003; 24:2077-78

Atrial Fibrillation Treatment Options : Summary

Atrial Fibrillation

Rate Control

Rhythm Control

DC or Chemical CV to reestablish SR as needed

Beta blocker
+ digoxin
Ca Channel blocker
+ digoxin
AV node ablation
+ pacer

Antiarrhythmic drugs

Catheter ablation

Atrial defibrillator

Surgery

Propafenone
Flecainide
Sotalol
Amiodarone
Dofetilide
Disopyramide
Quinidine
Procainamide

Pulmonary veins
LA linear lesions
RA linear lesions
Focal lesions

MAZE
Procedure

Anticoagulation for all patients with risk factors for stroke.

Anticoagulation for all patients with risk factors for stroke.

Atrial Fibrillation in CHF : Treatment Options

Atrial Fibrillation

Rate Control

Rhythm Control

DC CV to reestablish SR as needed

Beta blocker + digoxin

AV node ablation + pacer /CRT

Antiarrhythmic drugs

Catheter ablation

Atrial Defibrillator + CRT

Surgery

Pulmonary vein isolation

LA linear lesions

MAZE Procedure

Amiodarone

Dofetilide

Anticoagulation for all patients with risk factors for stroke.

Anticoagulation for all patients with risk factors for stroke.