

CRT for Heart Failure Patients with Atrial Fibrillation

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CRT History

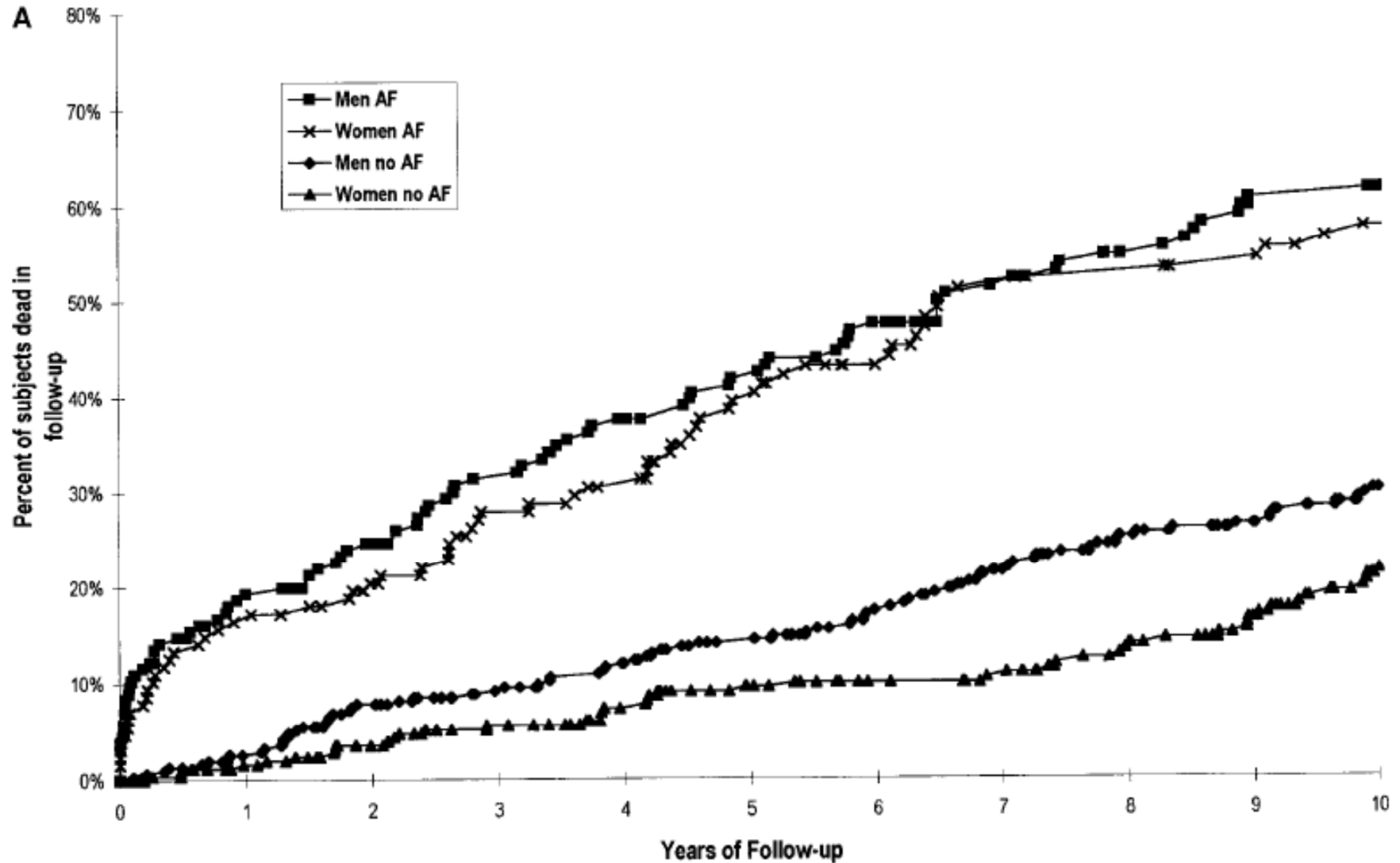
- **1995–1997**
- **Animal Study and Short Clinical Observation**
 - **1998–1999**
- **Randomized, Comparative Study: Exercise Tolerance, Cardiac Function and Life Quality**
 - **2000–**
- **Randomized/Comparative Clinical Trial: Mortality and Hospitalization**
 - **2005**
- **Class I Indication by ACC/AHA,ESC**

CRT: Unanswered Questions

- 50% pts with HF and narrow QRS have mechanical dyssynchrony. Do they respond to CRT?
- 60% pts with QRS >120 ms respond to CRT. What about the rest?
- 70% pts with functional class III or IV have QRS <120 ms. Do they respond to CRT?
- Does V-V timing have clinical implication?
- Are AF pts suitable for CRT?

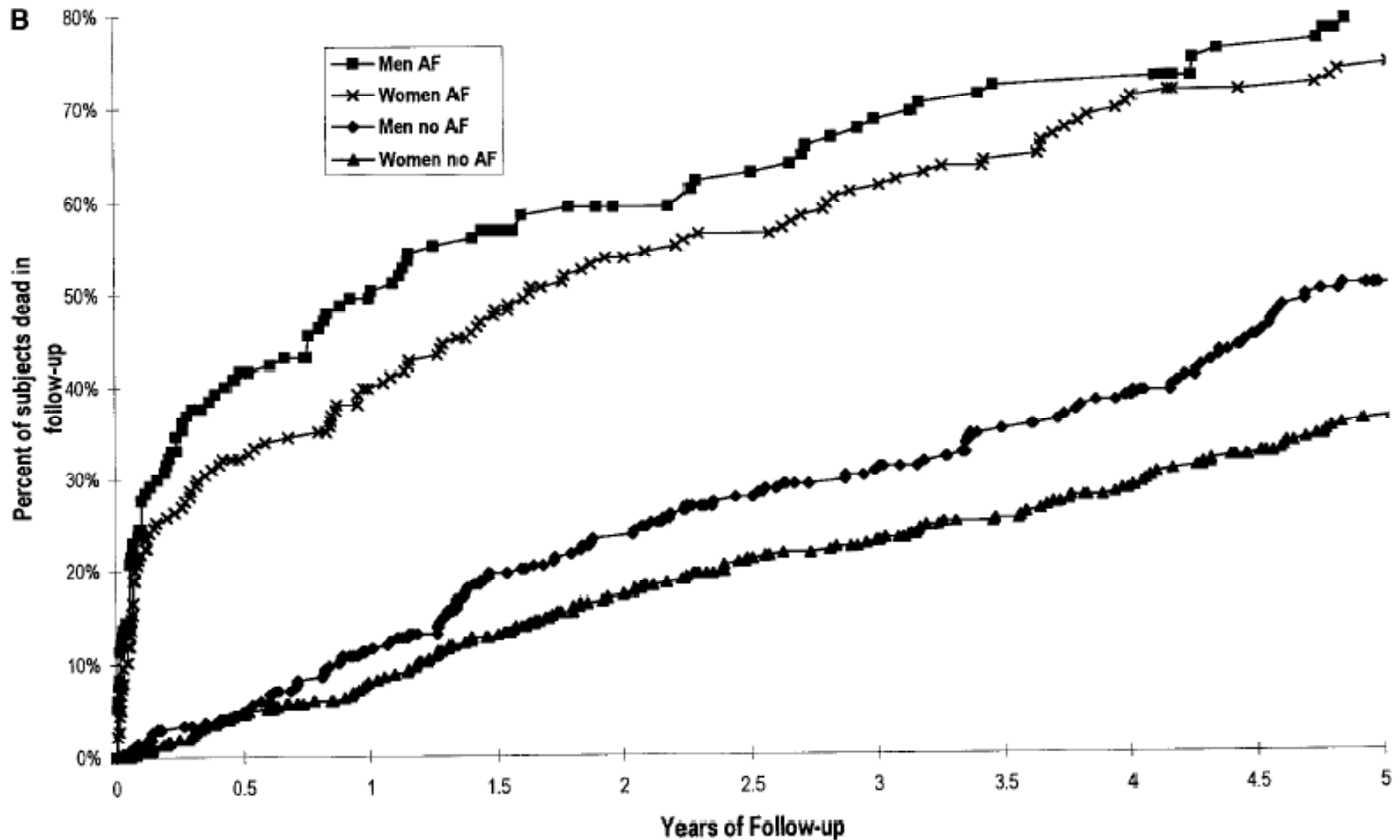
AF on mortality: age 55-74

The Framingham Heart Study *Circulation* 1998;98:946-52



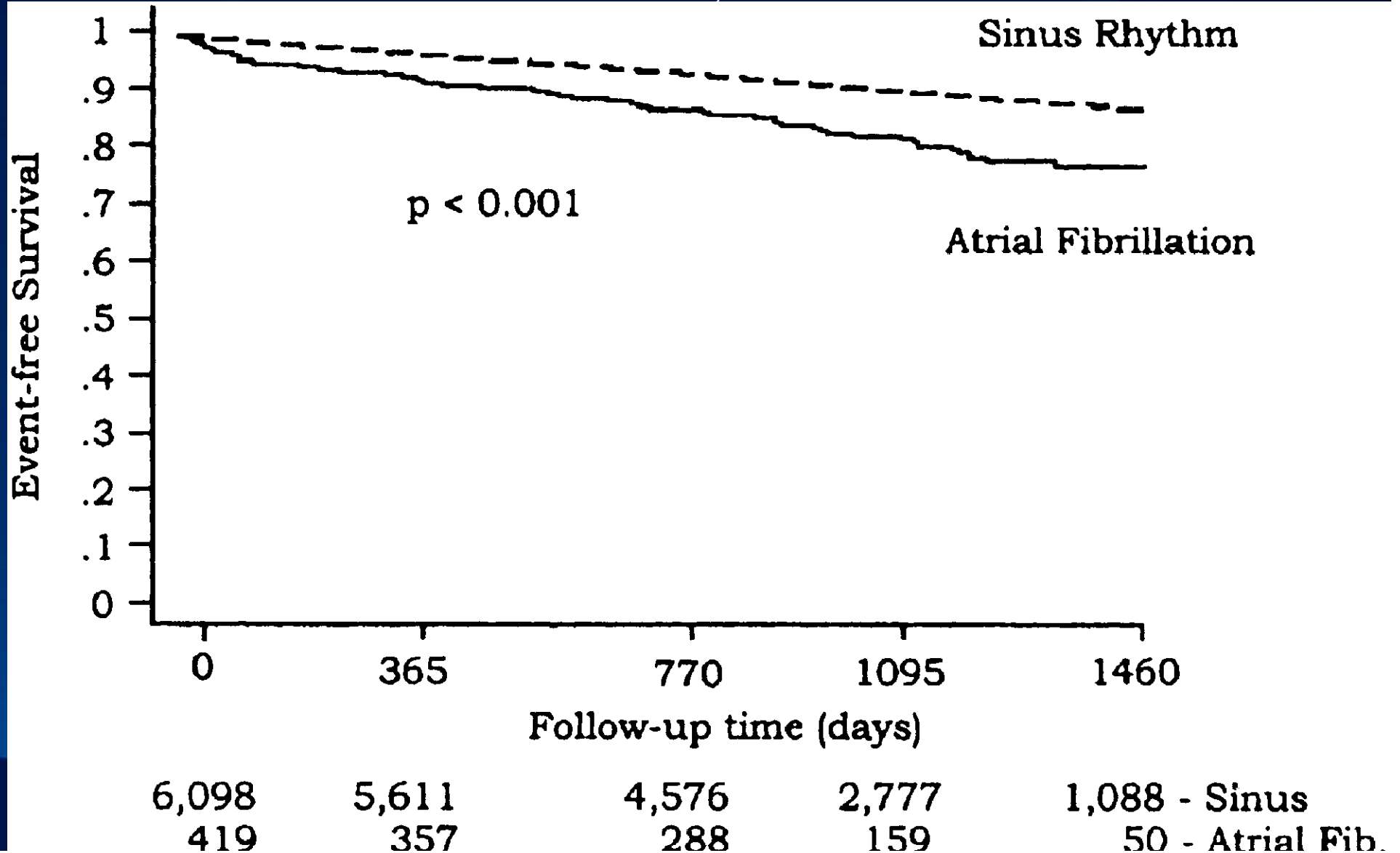
AF on mortality: age 75-94

The Framingham Heart Study *Circulation* 1998;98:946-52



Death due to progressive pump failure

EJHF 2002;4:571-5



Conflicting Reports of CRT on AF burden

- CRT reduces AF burden
 - Fung J, et al. AJC 2005;96:728-31
 - Adelstein EC & Saba S. AJC 2007;100:268
- CRT does not reduce AF burden
 - Hoppe UC, et al. (COMPANION-SUB) Cir 2006;114:18-25
 - Bristow MR, et al. (CARE-HF) NEJM 2004;350:2140-50

Beneficial Effect of CRT on HF & AF

- Improved cardiac functional class
 - Six-minute walk time
 - Hospitalization
-
- Cuzeau S et al. MUSTIC Study Investigators: Effects of multisite biventricular pacing in patients with heart failure and hintraventricular conduction delay. *N Engl J Med* 2001;344:873– 880.

Benefit despite remained AF

- 74 pts with persistent or permanent AF.
Significant improvement after six months of CRT despite 93% remained AF:
 - NYHA class
 - Quality of life score
 - Six-minute walk test
 - LV ejection fraction
 - Left atrial and LV end diastolic and end systolic diameters
 - Kies P, et al. Heart 2006;92:490

Better outcomes after AVN ablation

- Benefit from CRT as SR
- Better Outcomes in AVN ablation patients
 - Molhoek SG, et al. AJC 2004;94:1506-9

Molhoek SG, et al. AJC 2004;94:1506-9

TABLE 1 Characteristics of Patients Who Had Sinus Rhythm (n = 30) and Atrial Fibrillation (n = 30) at Baseline and Six-Month Follow-up

| Parameters | Sinus Rhythm (n = 30) | | | AF (n = 30) | | |
|--------------------------------|--------------------------|------------|---------|----------------|------------|---------|
| | Baseline | 6 Months | p Value | Baseline | 6 Months | p Value |
| Men/Women | 24/6 | | | 27/3 | | |
| Age (yrs) | 68 ± 8 | | | 63 ± 10 | | |
| NYHA class | 3.2 ± 0.4 | 2.2 ± 0.8 | <0.05 | 3.2 ± 0.4 | 2.3 ± 0.6 | <0.05 |
| Quality of life score | 43 ± 13 | 28 ± 15 | <0.05 | 43 ± 17 | 32 ± 21 | <0.05 |
| 6-Minute walking test (m) | 262 ± 97 | 388 ± 141* | <0.05 | 227 ± 113 | 326 ± 155* | <0.05 |
| LV ejection fraction (%) | 23 ± 8 | 32 ± 12 | <0.05 | 20 ± 11 | 27 ± 8 | <0.05 |
| LV end-diastolic diameter (cm) | 7.4 ± 2.8 | 6.7 ± 2.1 | <0.05 | 7.6 ± 3.1 | 6.5 ± 1.8 | <0.05 |
| LV end-systolic diameter (cm) | 6.8 ± 2.7 | 6.1 ± 2.2 | <0.05 | 6.7 ± 1.9 | 6.3 ± 2.2 | <0.05 |

*p <0.05, sinus rhythm versus AF after 6 months of CRT.
LV = left ventricular.

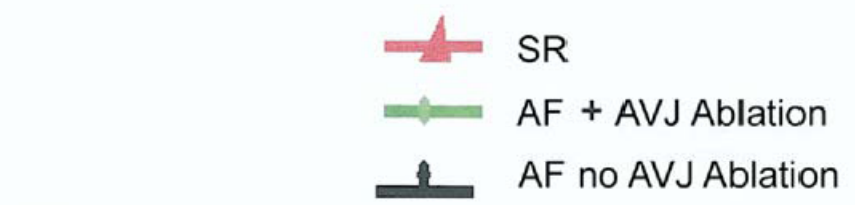
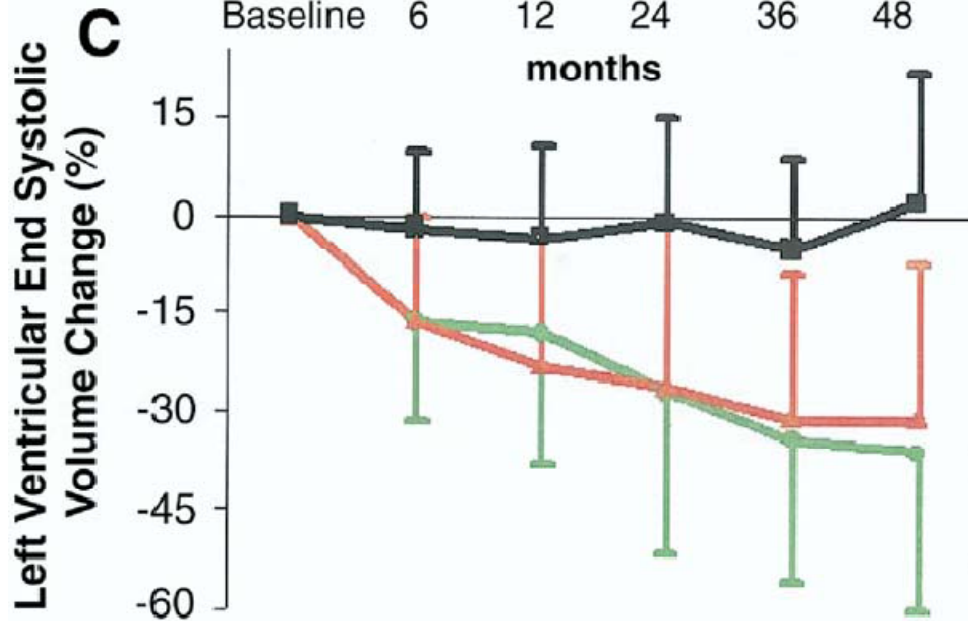
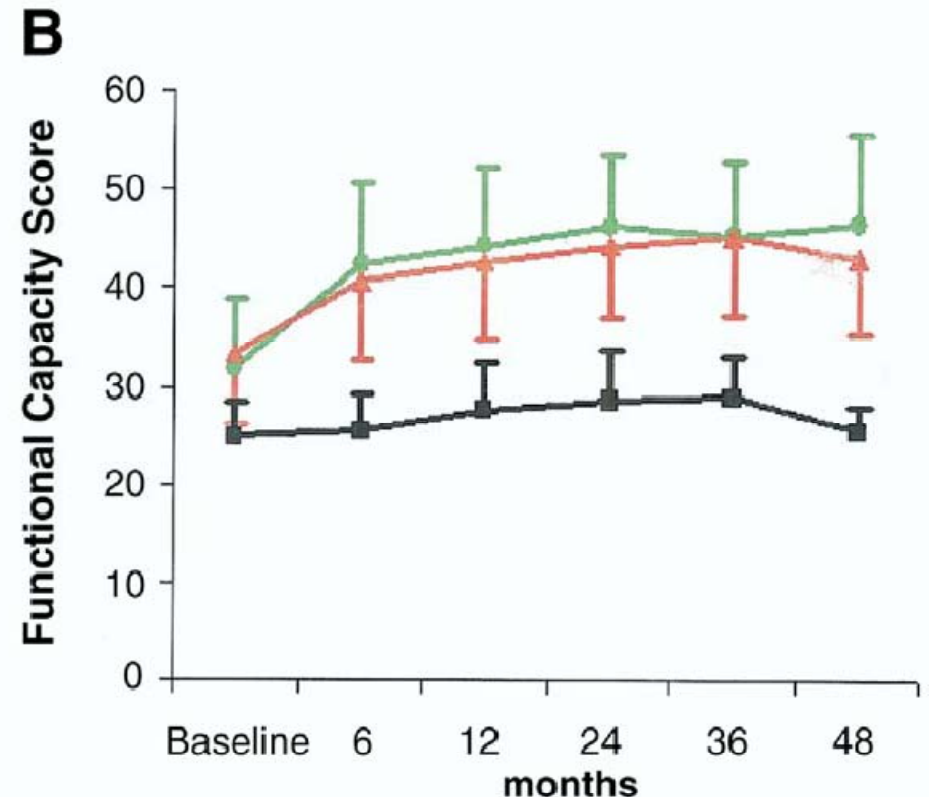
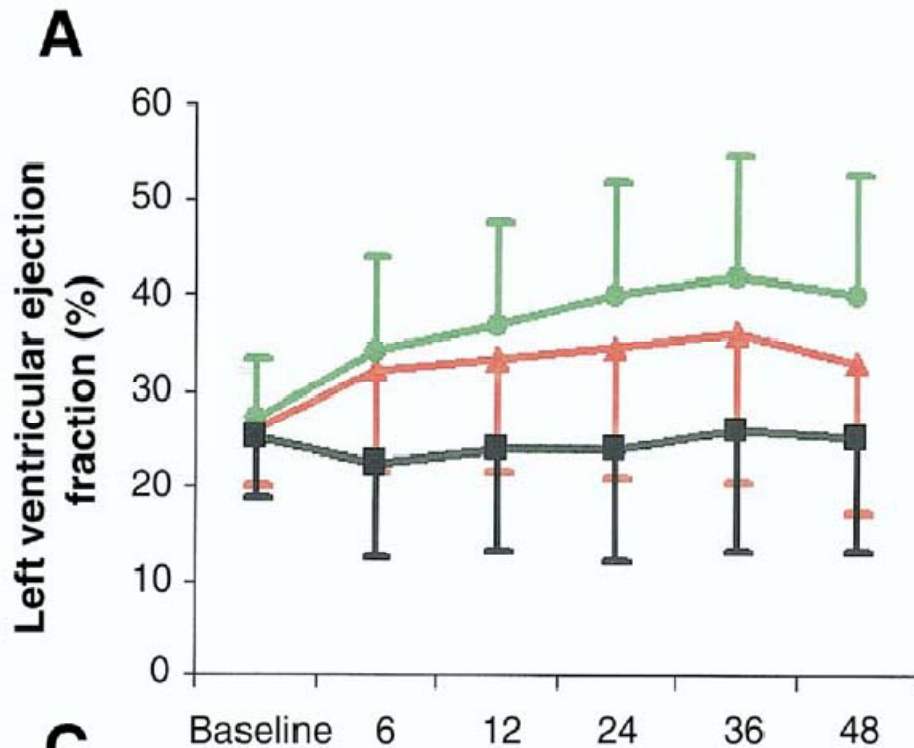
TABLE 2 Characteristics of Patients Who Had Atrial Fibrillation (n = 30) With and Without Atrioventricular Node Ablation at Baseline and Six-Month Follow-up

| Parameters | Node Ablation (n = 17) | | | No Node Ablation (n = 13) | | |
|---------------------------|---------------------------|-----------|---------|------------------------------|-----------|---------|
| | Baseline | 6 Months | p Value | Baseline | 6 Months | p Value |
| NYHA class | 3.1 ± 0.3 | 2.2 ± 0.5 | <0.05 | 3.2 ± 0.4 | 2.4 ± 0.7 | <0.05 |
| Quality of life score | 42 ± 19 | 28 ± 21 | <0.05 | 44 ± 13 | 37 ± 22 | NS |
| 6-Minute walking test (m) | 229 ± 125 | 388 ± 172 | <0.05 | 224 ± 101 | 310 ± 134 | <0.05 |
| LV ejection fraction (%) | 21 ± 7 | 30 ± 12 | <0.05 | 19 ± 9 | 26 ± 10 | <0.05 |

Abbreviation as in Table 1.

Better outcomes after AVN ablation

- Large and sustained long-term (up to four years) improvements of EF. Exercise tolerance similar to patients in SR only if AVJ ablation was performed. (see following figure)
 - Gasparini et al. JACC 2006;48:734



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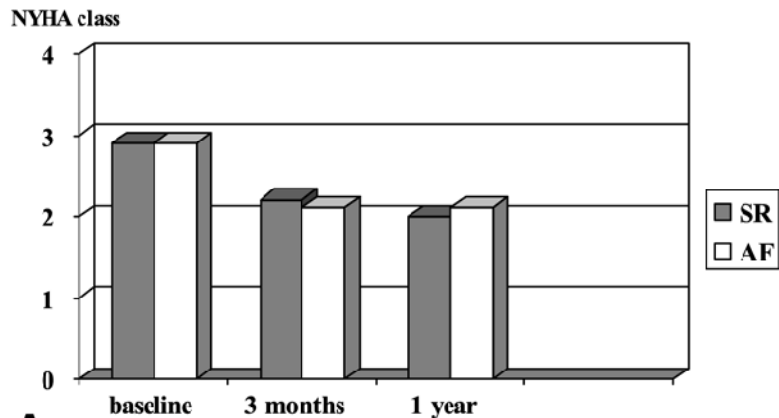
| | Baseline | 6 | 12 | 24 | 36 | 48 |
|--------------|----------|-----|-----|-----|-----|-----|
| Total n. pts | 673 | 649 | 523 | 365 | 233 | 127 |
| n. deaths | 0 | 12 | 7 | 13 | 7 | 5 |

months

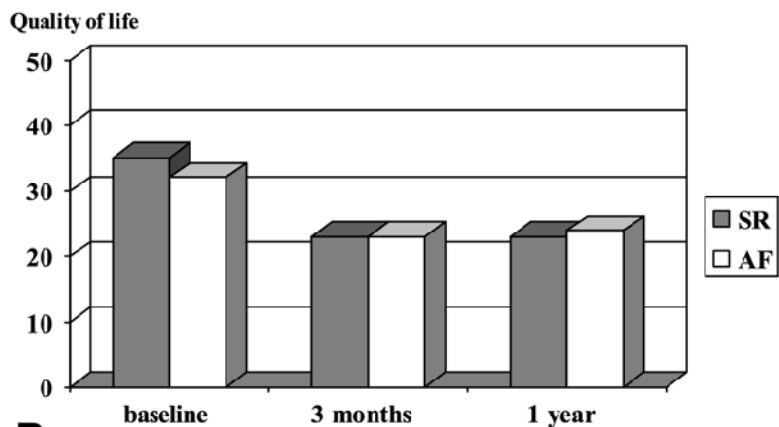
Gasparini et al. JACC 2006;48:734

Delnoy PPHM, et al.
AJC 2007;99:1252-7

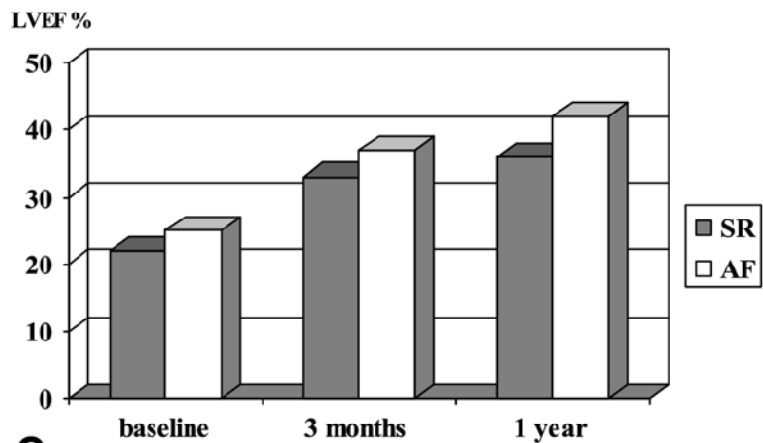
The benefit of CRT in
Pts with chronic AF and
HF is similar to those
with SR
(21% had AVN ablation)



A



B



C

Effect of AF on CRT

- Melenovsky V, et al. EHJ 2005;26:705-11
 - Loss of AV synchrony, esp. with RR irregularity and heart rate >120bpm
- Bax JJ, et al. JACC 2005;46:2168
 - If CRT is considered, it is essential that rapid intrinsic AV node conduction does not inhibit resynchronization therapy, i.e. AV node ablation is considered

Restore SR as a possibility

- In CRT candidates with supposed permanent AF, more vigorous external or internal cardioversion attempts are justified.
- In the majority of patients, SR can persist and be established for at least 1 year with a super-proportional improvement in functional capacity.

– Butter C, et al. EHJ 2004;6(supplD);D106

Clinical Outcomes of CRT on Pts with HF and AF

- AVERT-AF
 - Prospective, randomized, double-blinded, multicenter
 - AVN ablation...
 - Will be completed in 2008

Atrial Lead for CRT patients with Persistent AF?

Reasons for Atrial Lead

- Differential SVT from VT
- Avoid pacemaker syndrome
- Good for CRT
 - Reduces atrial diameter
 - Induces atrial reverse remodeling
 - Improves atrial pump function
 - Spontaneous reversion to SR

Against Atrial Lead Implantation in persistent or permanent AF

- Increased hardware
 - Large vein thrombosis
 - Loss of lead integrity
- Longer implantation and X-ray time
- Atrial lead dislodgement or other complications
- Increased costs

Summary

- Benefit to HF pts with AF
 - NYHA class
 - quality of life score
 - six minute walk test
 - LV ejection fraction
 - LV diameters
- May or may not affect AF burden
- Important to inhibiting AV conduction
- Try to restore and maintain SR
- Atrial lead implantation

Thanks

Studies of HF, AF, CRT

- **Molhoek SG, et al. AJC 2004;94:1506-9***
- **Leclercg C, et al. EHJ 2002;23:1780-7**
- **Linde C, et al. (MUSTIC) JACC 2002;40:111-8**
- **Brignole M, et al. EHJ 2005;26:712-22**
- **Doshi RN, et al. (PAVE) JCE 2005;16:1160-5**
- **Leclercg C, et al. AJC 2000;85:1154-6**
- **Leon AR, et al. JACC 2002;39:1258-63**
- **Gasparini M, et al. JACC 2006;48:734-43***
 - * indicating AVN ablation