

Atrial Fibrillation and Rate Optimisation

AFRO Study

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AF

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graph TD; AF([AF]) --> Rate([↑ Ventricular rate]); AF --> Control([Loss of physiological control of heart rate]); AF --> Rhythm([Irregular rhythm]);
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↑ Ventricular rate

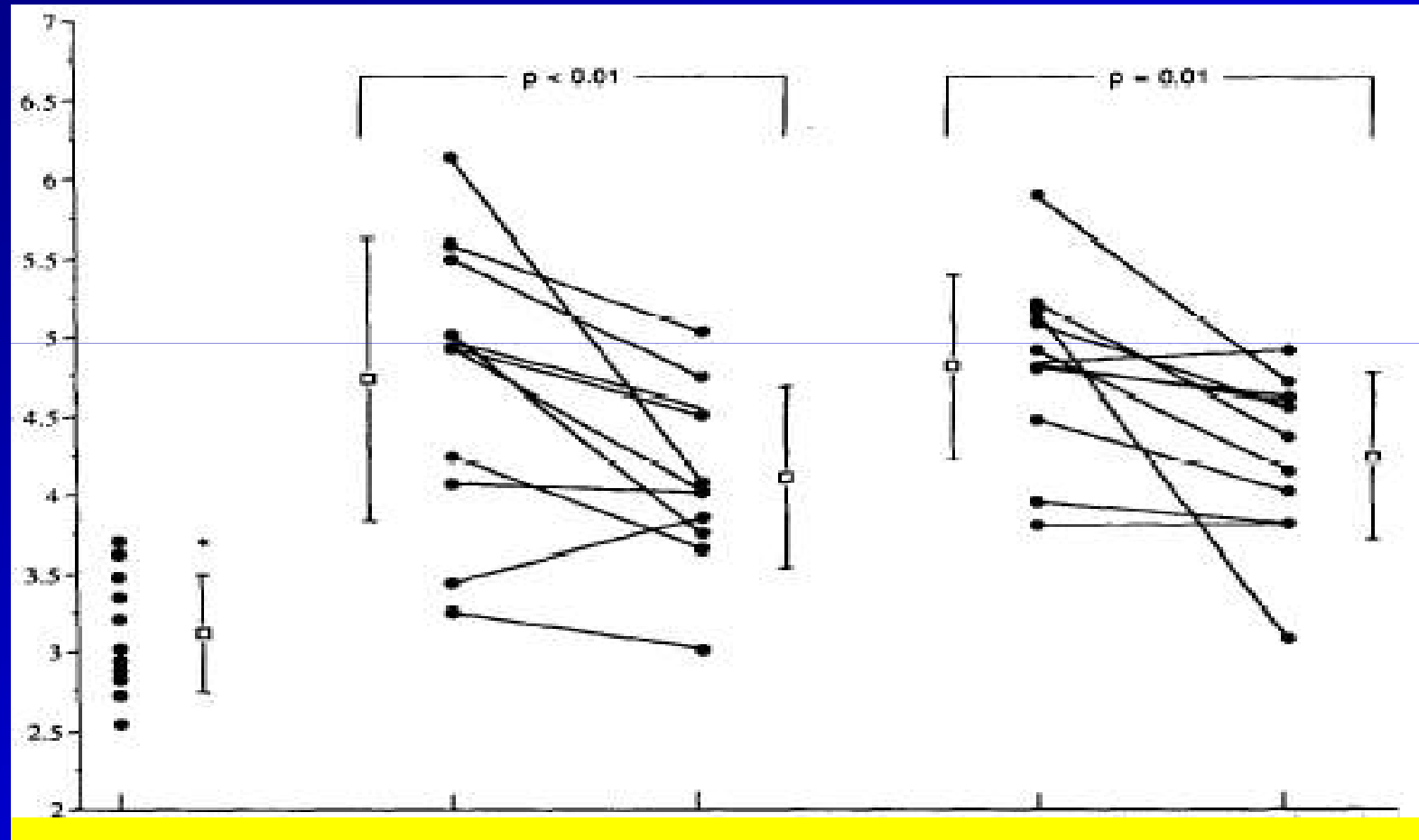
Loss of physiological control of heart rate

Irregular rhythm

Effect of an irregular ventricular rhythm on cardiac output

E.G. Daoud et al, Am J Cardiol 1996

Cardiac output (L/min)



Junctional Rhythm
Mean CL 1582 sec

Regular Ventricular
Pacing at 750 msec

Irregular Ventricular
Pacing at 750 msec

Regular Ventricular
Pacing at 500 msec

Irregular Ventricular
Pacing at 500 msec

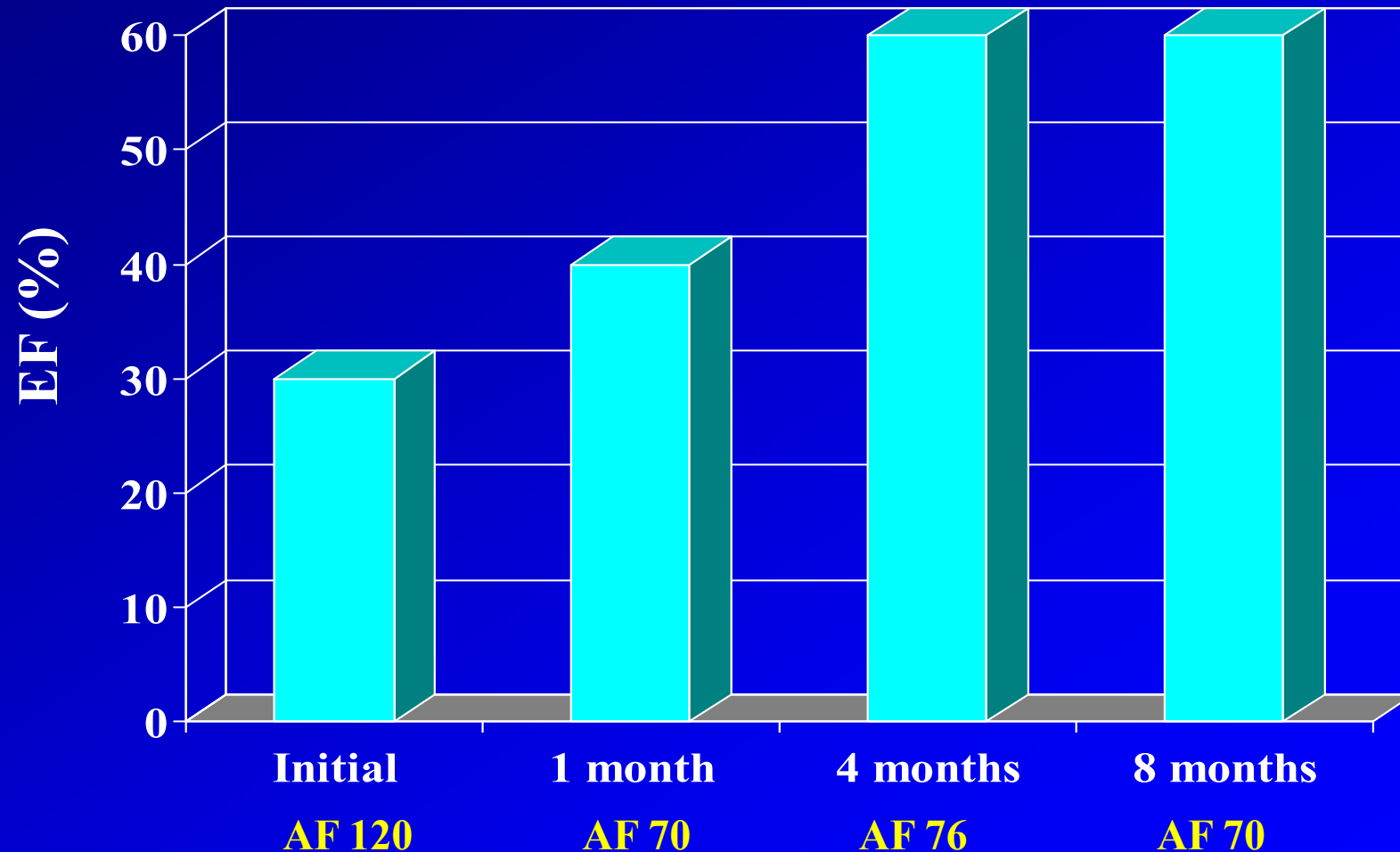
As with many things in medicine, the routine treatment of a common problem may be an acceptable standard most of the time.

However, atrial fibrillation, although a common problem, occasionally poses a more difficult challenge, such as the appropriate control of heart rate.

Falk RH 1992

LV dysfunction due to AF in pts initially believed to have idiopathic dilated cardiomyopathy

Grogan et al, Am J Cardiol 1992



AF pharmacological rate control

Goal: resting heart rate (bpm)

60 – 70	Friedberg 1966
50 – 90	Bigger 1980 *
60 – 80	Stortstein 1981
70 – 85	Waktare - Camm 2000
60 – 80	Olgin - Zipes 2001 **
60 – 80	ACC/AHA/ESC Guidelines 2001
< 80	AFFIRM 2002
< 100	RACE 2002
< 80	AIRCRAFT 2003

* Braunwald 1st Edition ** Braunwald 6th Edition

AF pharmacological rate control

Goal: slight exercise heart rate (bpm)

90 – 115	Bigger, 1980 *
< 100	Waktare - Camm 2000
< 100	Olgin - Zipes 2001 **
90 – 115	ACC/AHA/ESC Guidelines 2001
< 100	AFFIRM 2002
< 100	RACE 2002

* Braunwald 1st Edition ** Braunwald 6th Edition

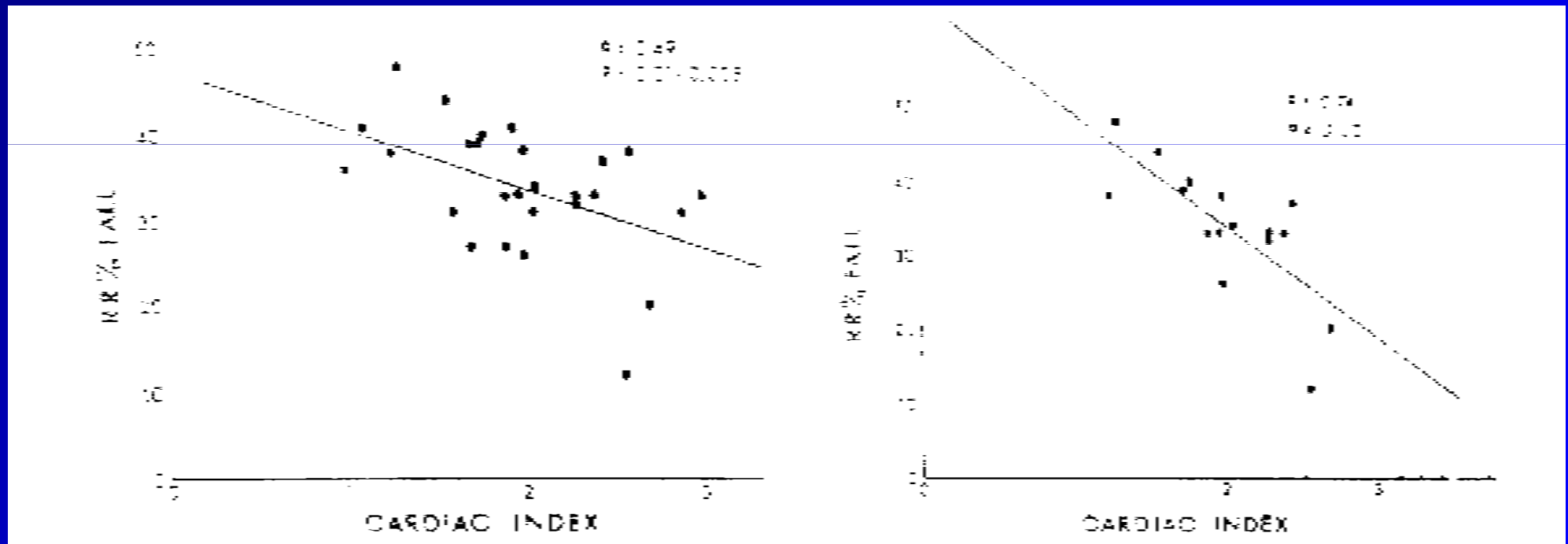
Goal: maximal exercise heart rate (bpm)

< 150	AIRCRAFT 2003
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Cardiac Output and the Varying R-R Interval of Atrial Fibrillation

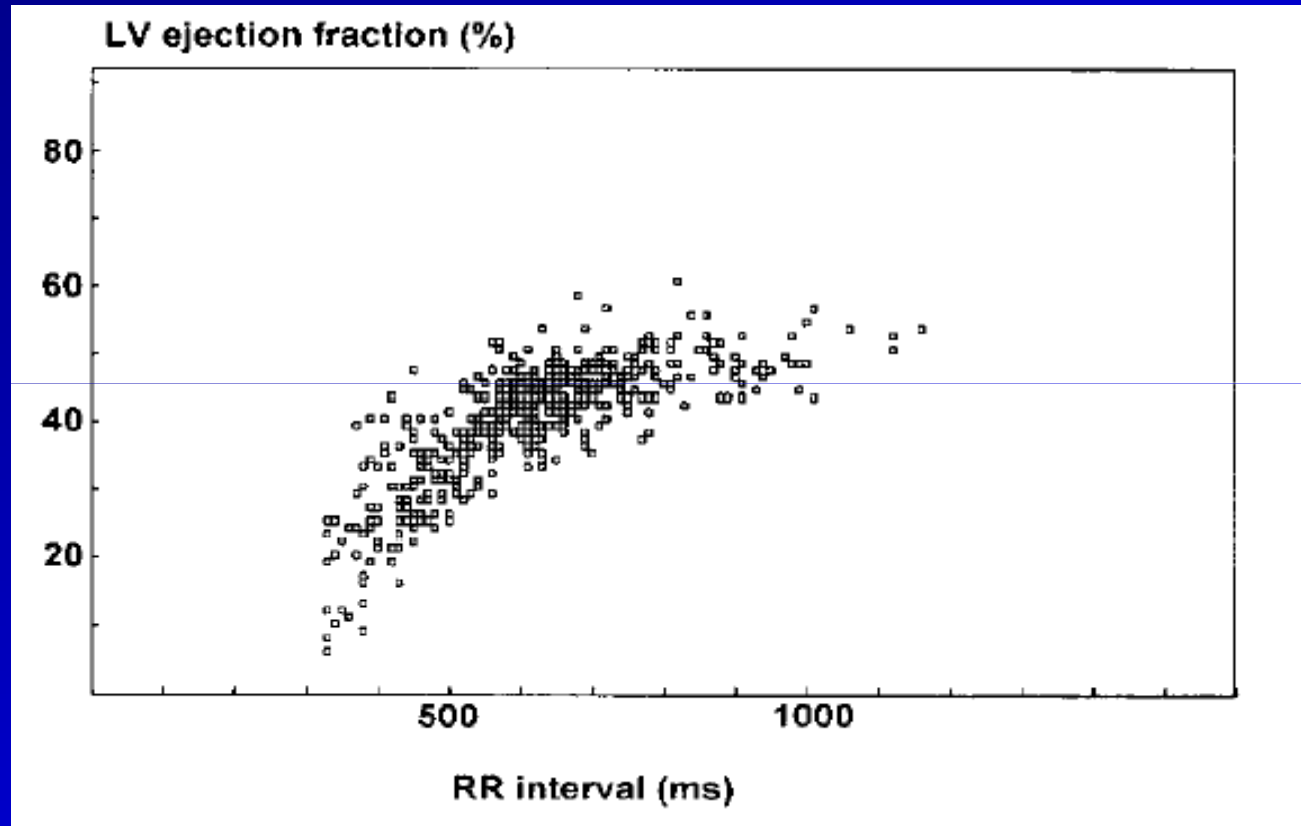
All patients (No 27)

HR > 75 bpm (No 16)



Left ventricular beat-to-beat performance in AF

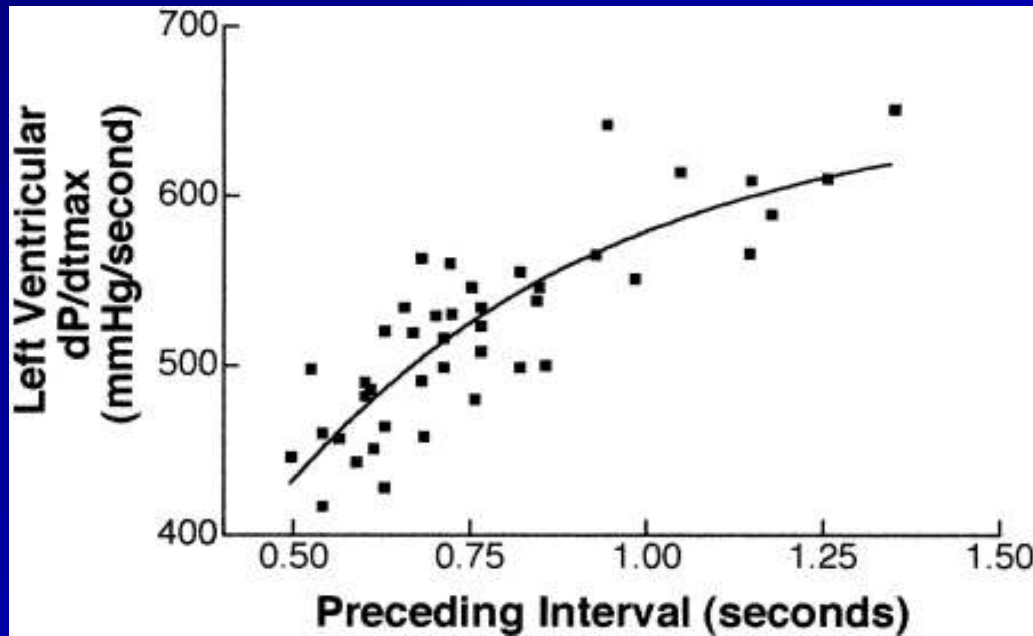
Gosselink ATM et al, J Am Coll Cardiol 1995;26:1516-1521



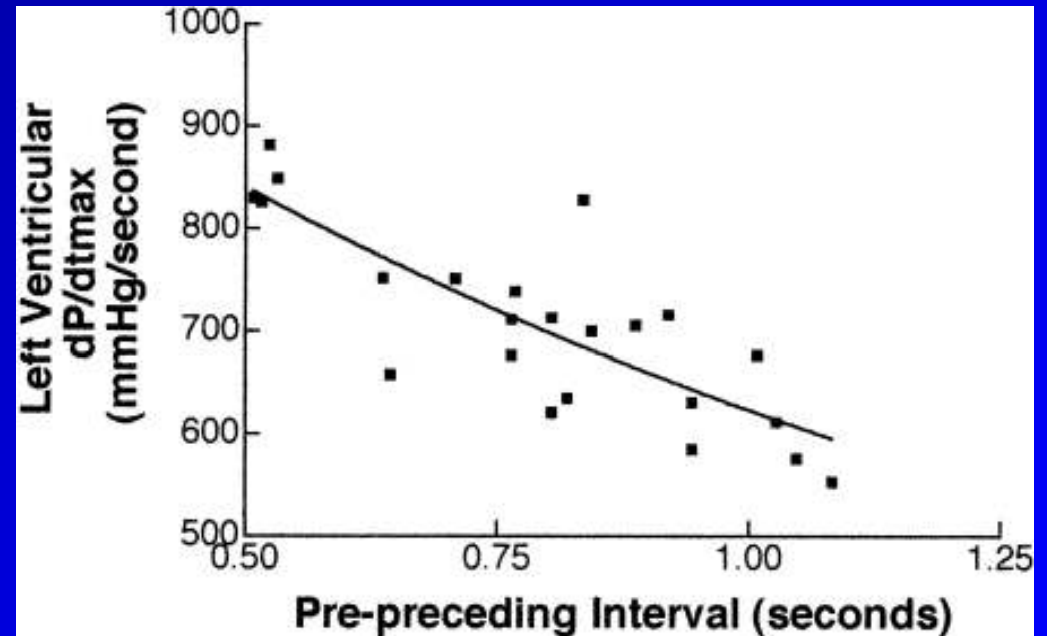
Relation between preceding RR interval and left ventricular ejection fraction.

Beat-to-beat contractility in AF

Brookes CIO et al, Circulation 1998;98:1762-1768



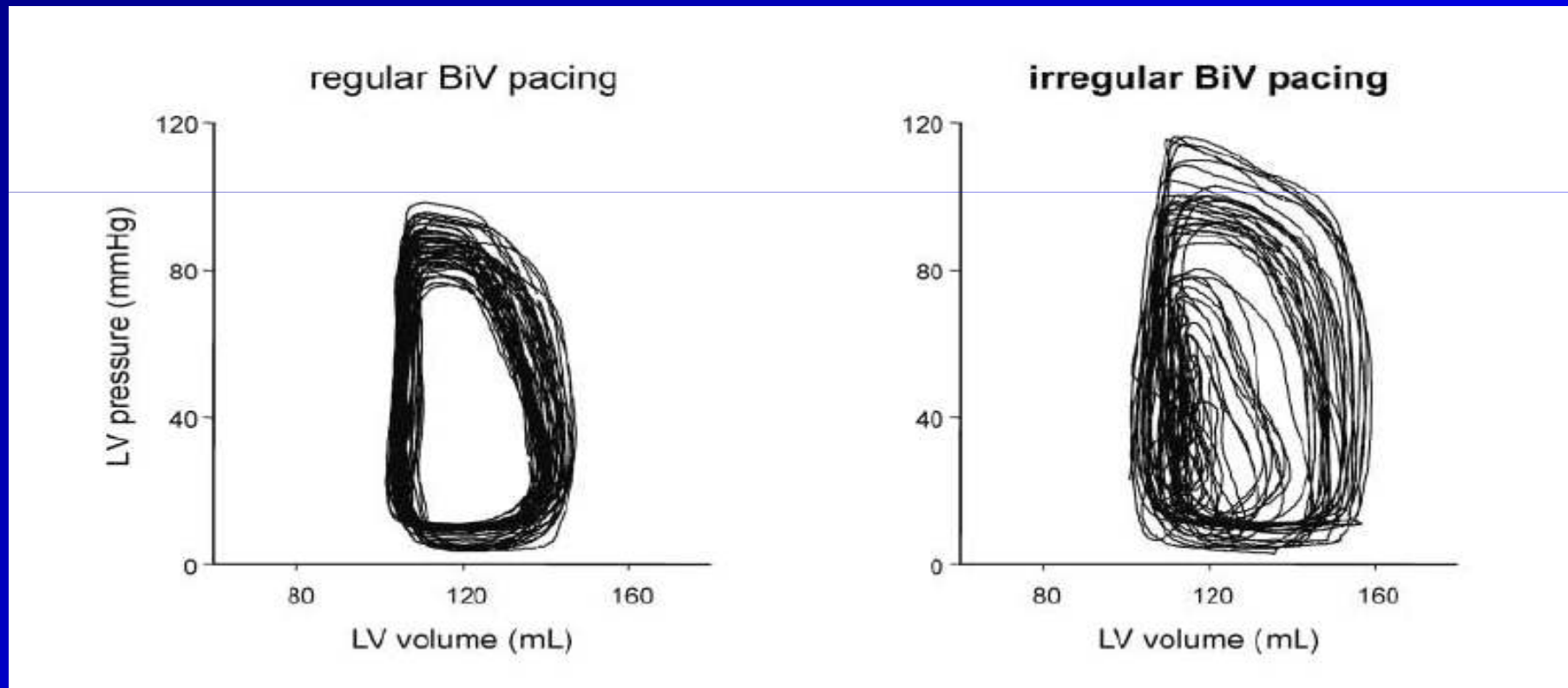
Relationship, during atrial fibrillation, between maximum rate of rise of left ventricular pressure (LV dP/dtmax) and preceding R-R interval.



Relationship, during atrial fibrillation, between maximum rate of rise of left ventricular pressure (LV dP/dtmax) and R-R interval before preceding interval.

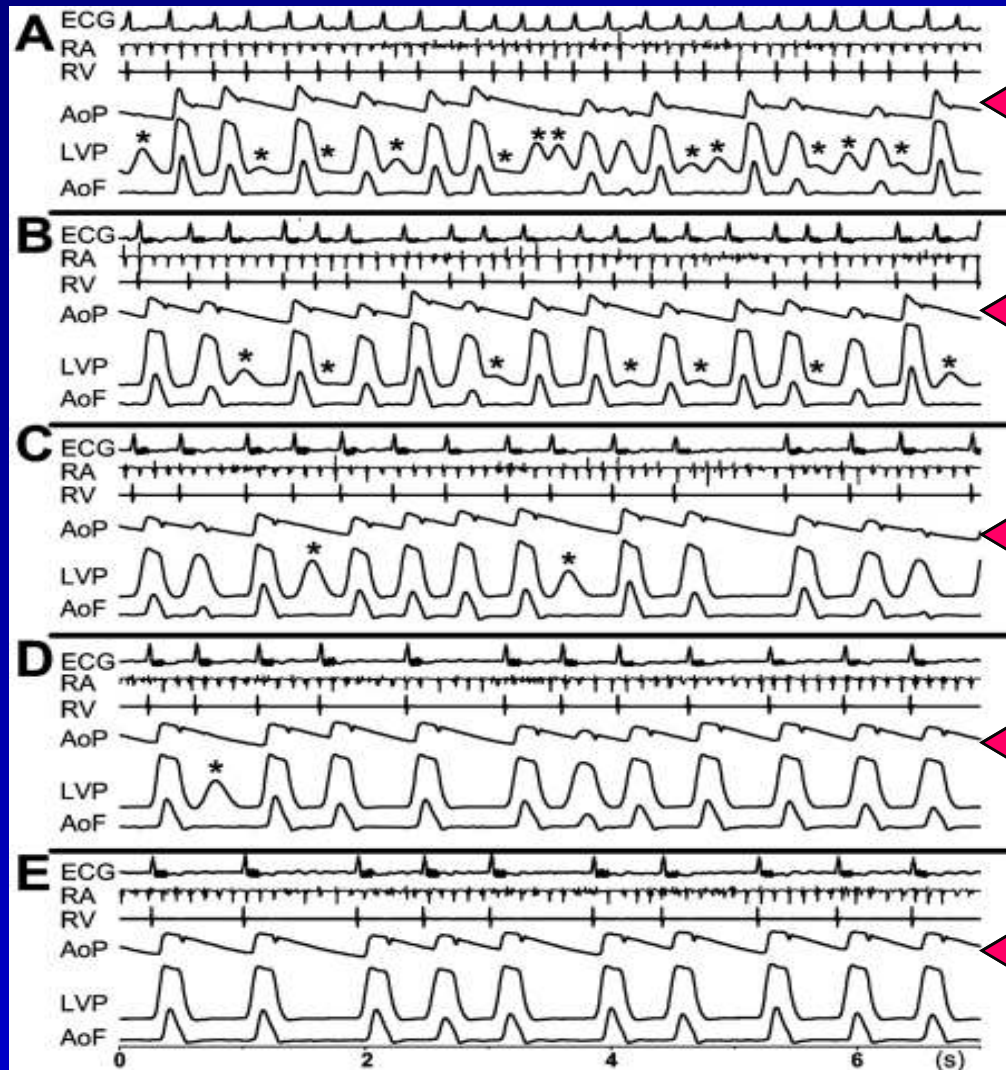
Functional impact of rate irregularity in patients with heart failure and atrial fibrillation receiving cardiac resynchronization therapy

Melenovsky V et al, Eur Heart J 2004



Optimal ventricular rate slowing during AF by feedback AV nodal-selective vagal stimulation

Zhang Y et al, Am J Physiol Heart Circ Physiol 2002;282:H1102-H1110



AF

AF with V rate < 75% sinus cycle length

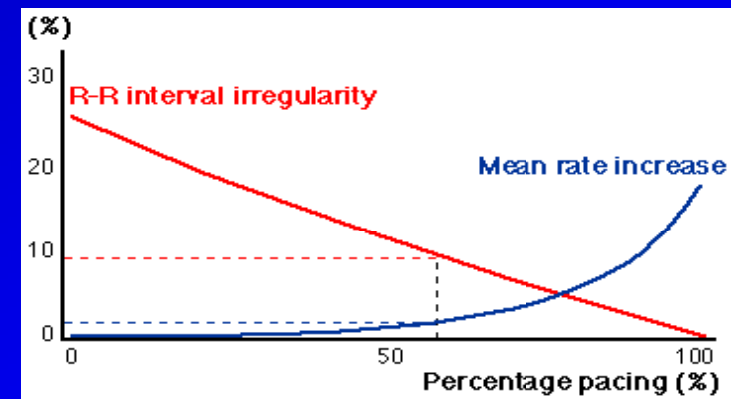
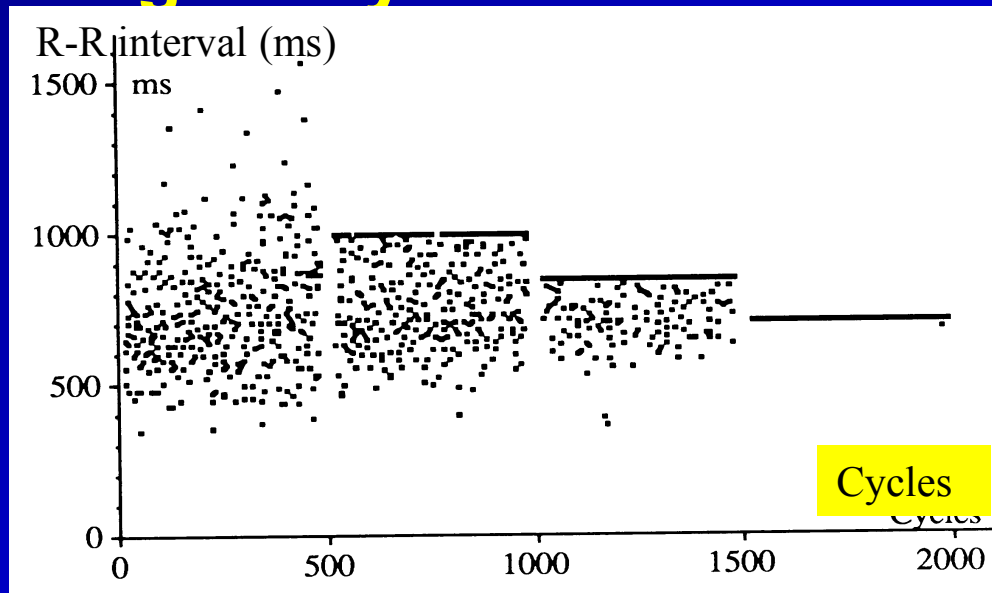
AF with V rate < 10% sinus cycle length

AF with V rate < 125% sinus cycle length

AF with V rate < 150% sinus cycle length

Pacing for Ventricular Rate Stabilization

- Abolishes not only the long *but also* (part of) the short R-R intervals
- Stabilizes the ventricular rate, more pacing less irregularity

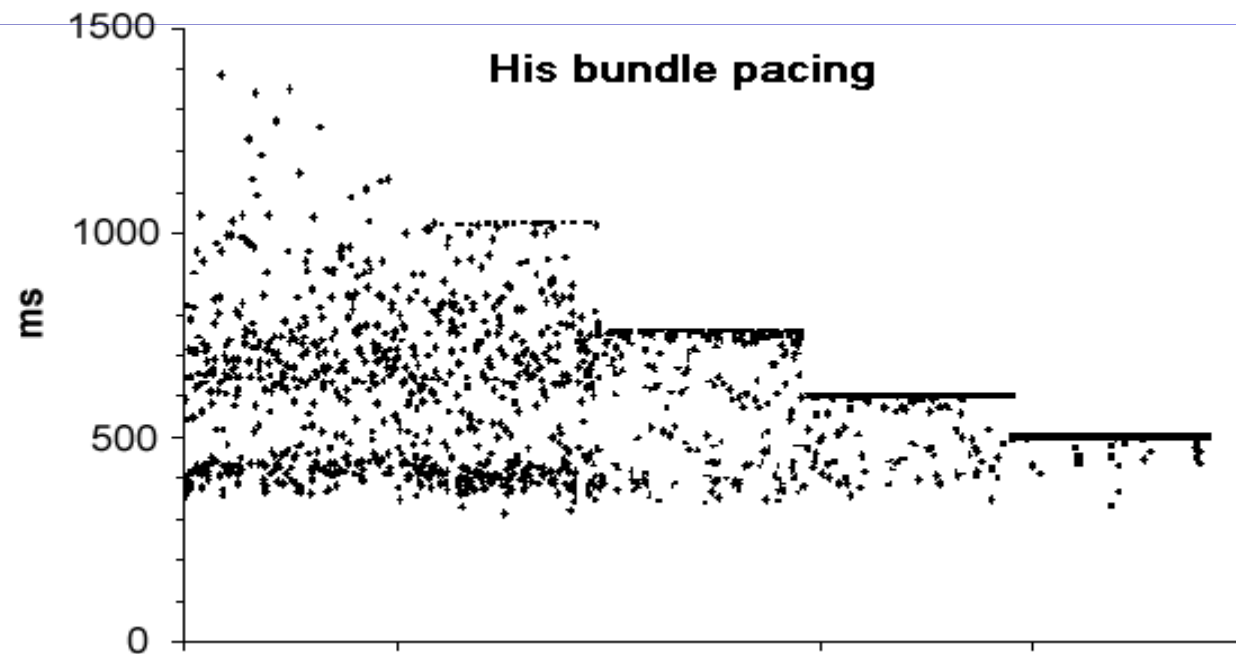
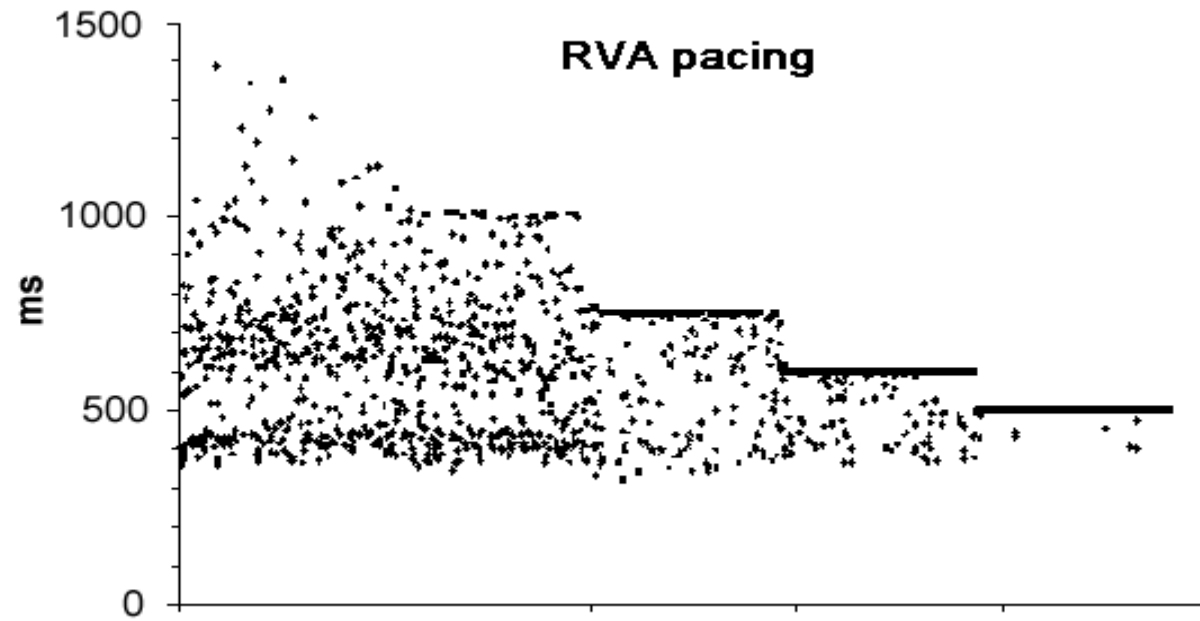


FHM Wittkamp, JACC 1988; 11: 539

Irregular Ventricular Rhythm during AF

Hypotheses

- 1- Decremental conduction
- 2- Electrotonic modulation of AV node automaticity
- 3- Electrotonic modulation of AV node propagation



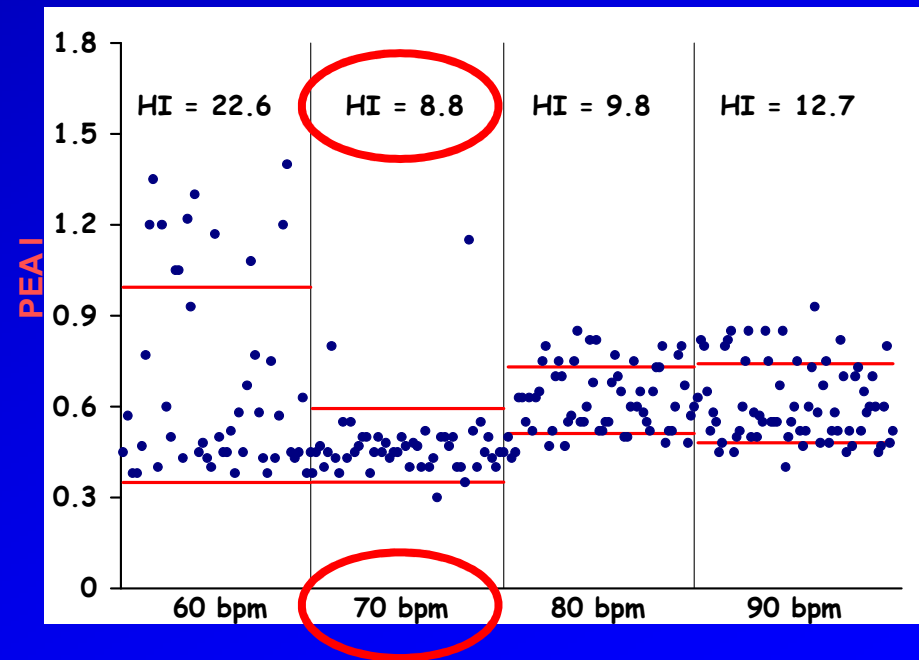
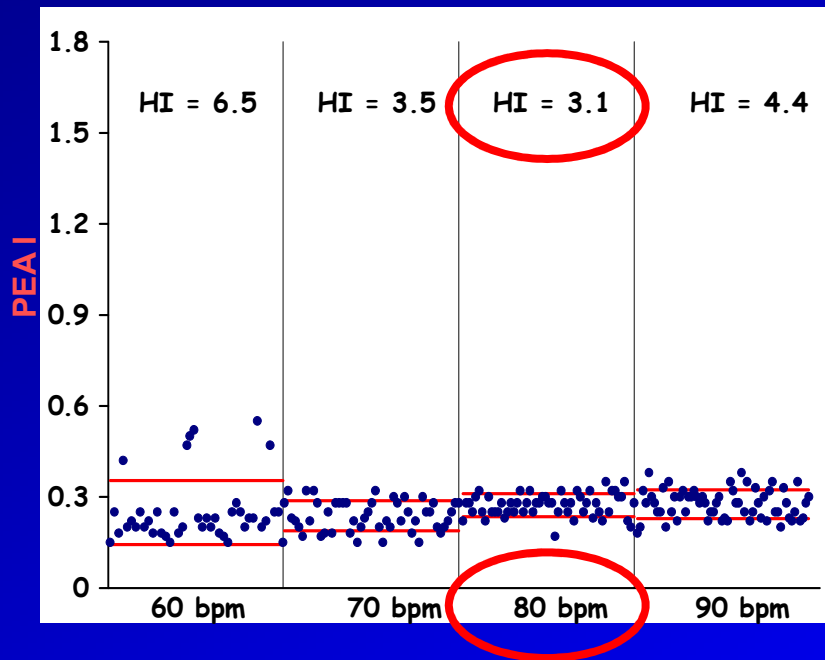
Padeletti L et al, Rate Stabilization by Right Ventricular Apex or His Bundle Pacing in Patients With Atrial Fibrillation.

in press Europace 2005

PEA and Haemodynamic Interference Index

PEA I can be used to quantify the hemodynamic variability in AF patients defining an index of **Hemodynamic Interference (HI)**:

$$HI = HR \cdot \Delta PEA$$



Optimal pacing rate: value with minimum HI

AFRO: primary endpoint

Verify clinical benefits due to rate optimization by PEA-based Haemodynamic Interference index vs standard setting stimulation in AF patients implanted with VVIR pacemaker

AFRO: characteristics

International

2 arms

Randomised

Single-blind study

Sample size: 250 patients

Inclusion period: 18 months

Study duration: 13 months

AFRO: study design

PM NewLiving SR implant

Randomisation (1 month):

Group A

- 1. 6 months nominal basic rate and accelerometr RR-driven pacing**
- 2. 6 months PEA HI guided basic rate and PEA RR-driven pacing**

Group B

- 1. 6 months PEA HI guided basic rate and PEA RR-driven pacing**
- 2. 6 months nominal basic rate and accelerometr RR-driven pacing**

AFRO: study design

Clinical outcome evaluation:

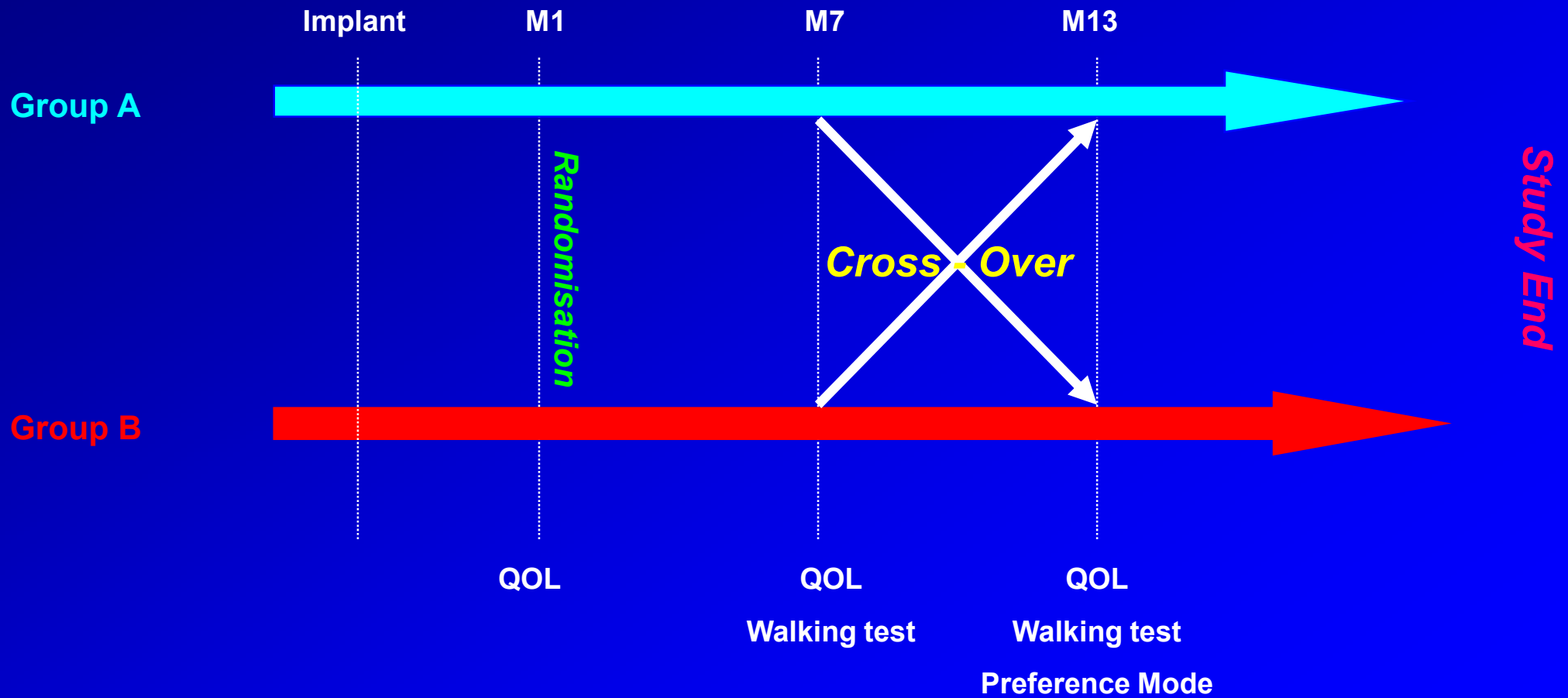
Patients modality preference

6 minutes walking test

QoL Score

Oxygen consumption (optional)

AFRO: Flow-Chart



AFRO: inclusion criteria

- **Patients with permanent atrial fibrillation**
- **ACC/AHA indication for single-chambers PM implantation**

AFRO: exclusion criteria

- **Not able to understand aim of the study and procedures;**
- **Refuse to cooperate;**
- **Life expectation less than 1 year;**
- **Participation to other clinical study;**
- **Women in pregnancy;**
- **Age < 18y;**
- **Indication to CRT**

AFRO: characteristics

Easy to perform

High clinical value

Easy PEA-based rate optimization

Benefit for patient

AFRO: device

New Living SR

Mini-Best RV catheter

