

# How to train the cardiovascular patient ?

## Physical activity in patients with heart disease: how much is good enough?

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# Conflicts of interest

- No fee from speakers bureau
- No advisory board participation
- No financial industry interest
- Institutional research contribution as clinical investigator from
  - Sanofi-Aventis, Bayer, MSD, Boehringer

# ESC Council of Cardiology Practice (CCP)

- created to bring together practicing cardiologists with common interest in the field of cardiovascular medicine
- promote education and training of cardiologists in clinical practice
- develop standards for training, continuous education and professional conduct.

# Second European Meeting of Cardiology Practice

29-30 April 2011  
Nice, France

A course on the recent ESC Guidelines with focus on the role of the cardiologist in private practice

- Atrial fibrillation
- Device therapy in heart failure
- Coronary revascularisation
- Grown-up congenital heart disease
- Peripheral artery disease\*



\*to be confirmed

[www.escardio.org/councils](http://www.escardio.org/councils)

ESC Council for  
Cardiology Practice



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2nd European Meeting of  
Cardiology Practice  
29-30 April EHH, Nice

- Program starts Friday morning and ends Saturday at noon
- Top experts will discuss the recent ESC guidelines with emphasis on the viewpoint from cardiology practice
- See info at the council's web pages  
[www.escardio.org/Practice](http://www.escardio.org/Practice)
- On line registration on the web

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# Different patients and different training

Post AMI

Post PCI

Post CABG

Heart Failure

Hypertension

Perif Artery  
Disease

Metabolic  
syndrome

Chronic  
Stable CAD

## RESISTANCE

- Concentric
- Eccentric
- Isotonic
- No of rep
- % of MR

## AEROBIC

- Continuous low / moderate
- High level interval
- Combinations

# Training Cardiovascular Patients

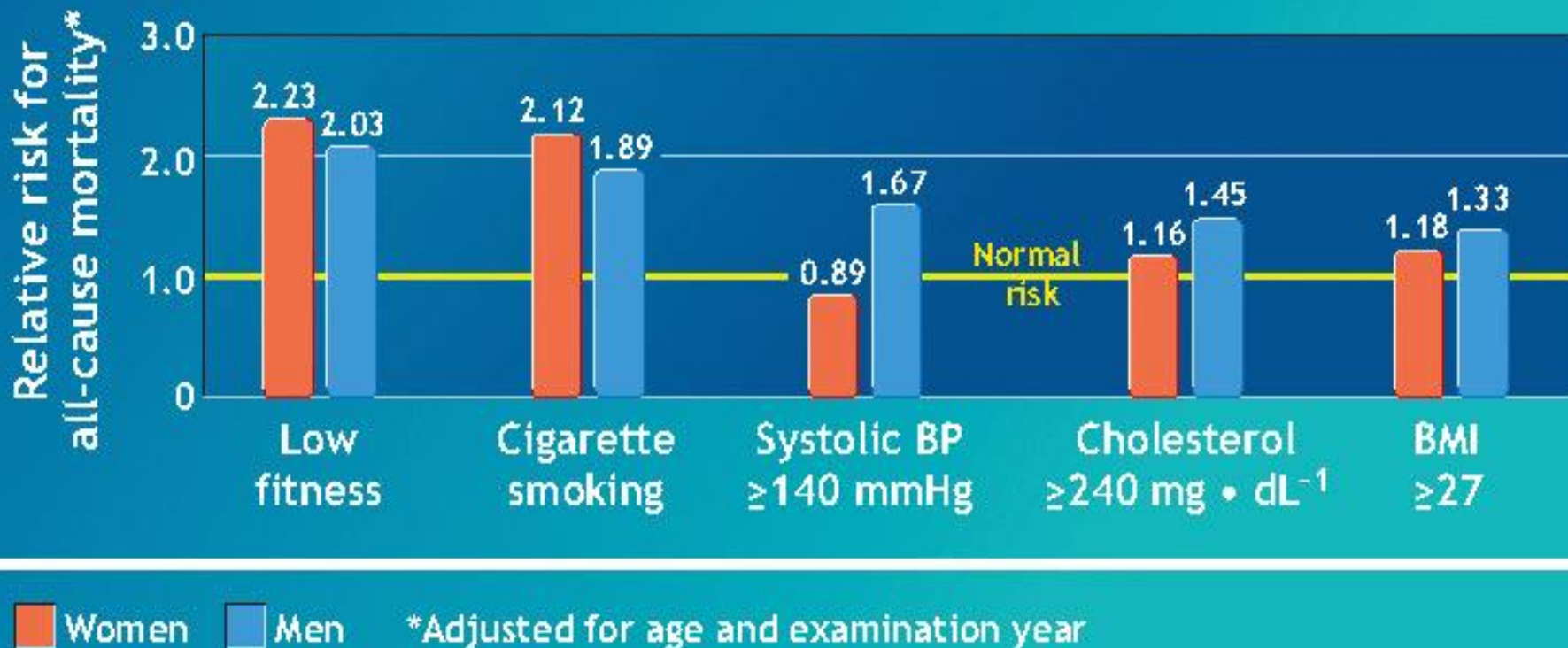
- Why train ?
- Who to train ?
- How to train ?
- When to train ?

# Why train ?

- Decreased mortality
- Decreased morbidity
  - Angina symptoms
  - Heart failure symptoms
  - Claudication symptoms
- Increased fitness level
- Increased general well-being



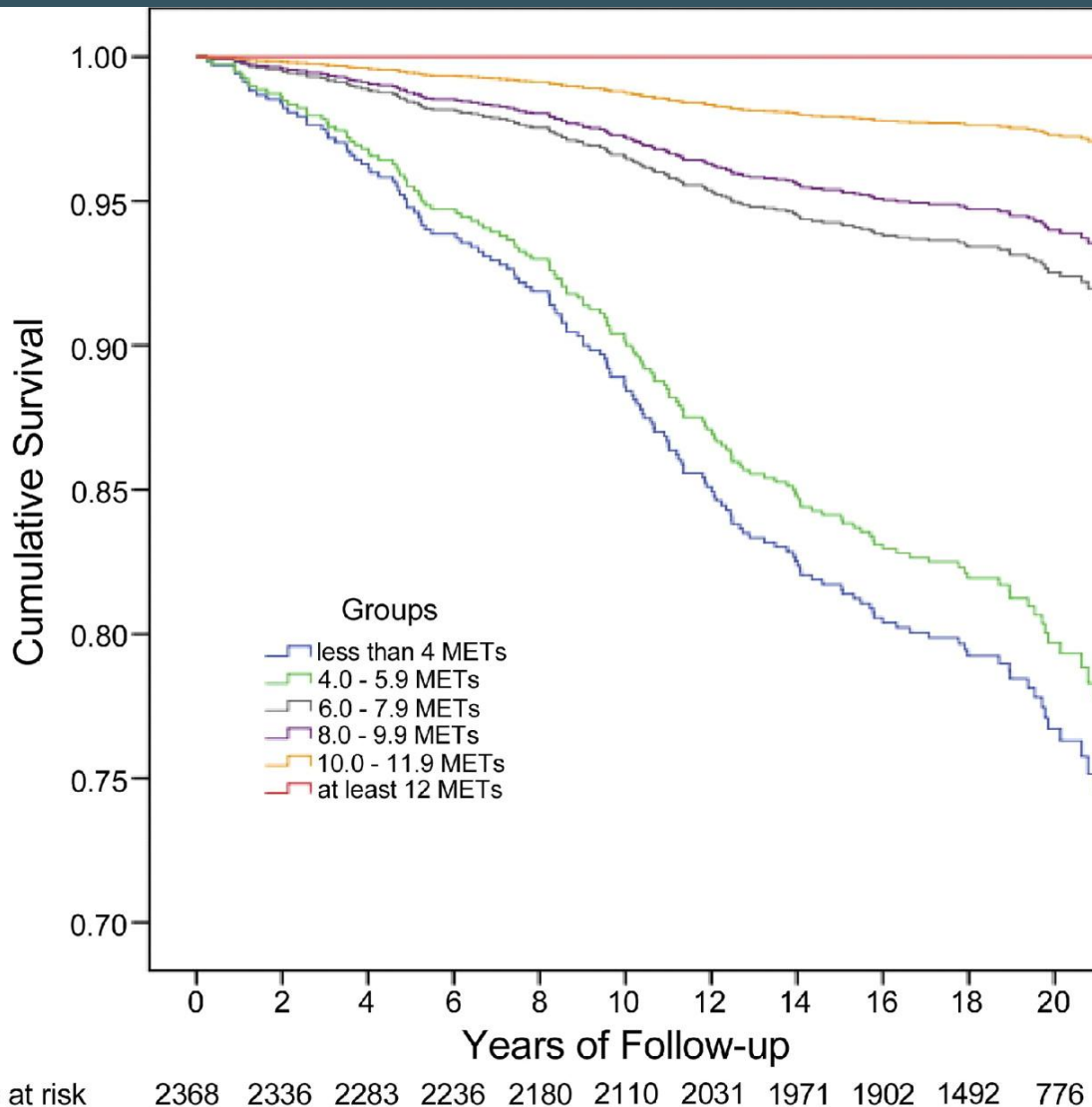
# Low fitness is a major risk factor for all-cause mortality



Blair et al . JAMA 1996;276:205.



## Proportions of SCD According to Achieved METs During Maximal Exercise Testing

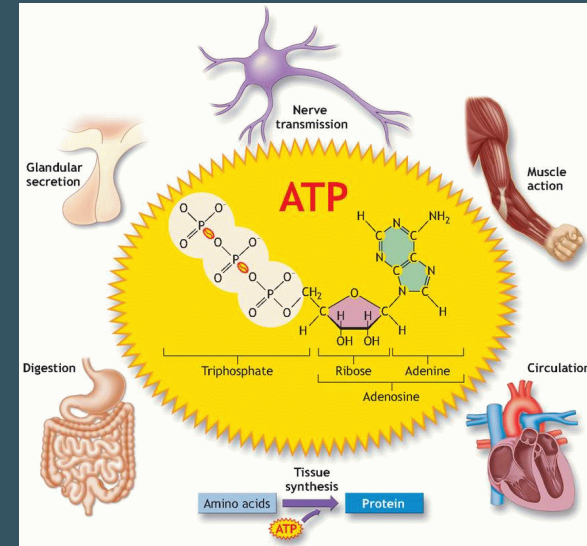
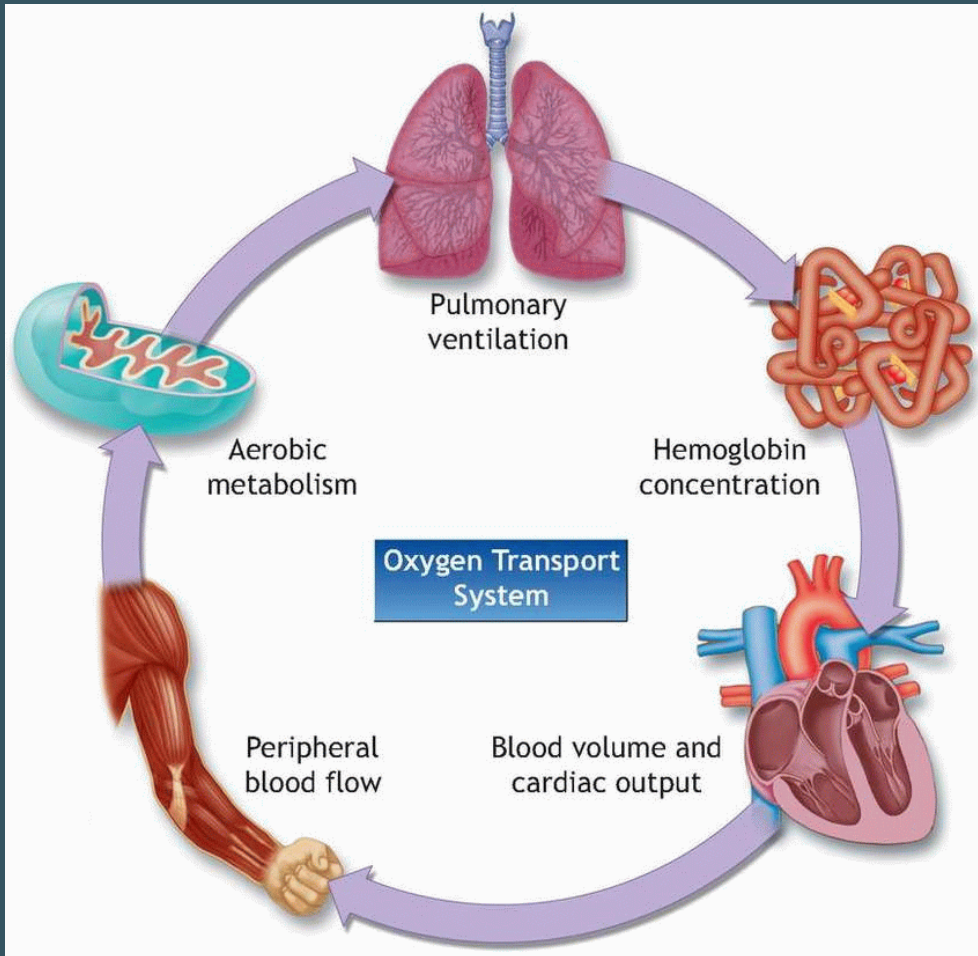


2,368 men 42 to 60 years of age. Followed for 17 years

A clear relation between physical fitness and the risk of sudden cardiac death

Laukkanen, J. A. et al. J Am Coll Cardiol 2010;56:1476-1483

# The oxygen transport system



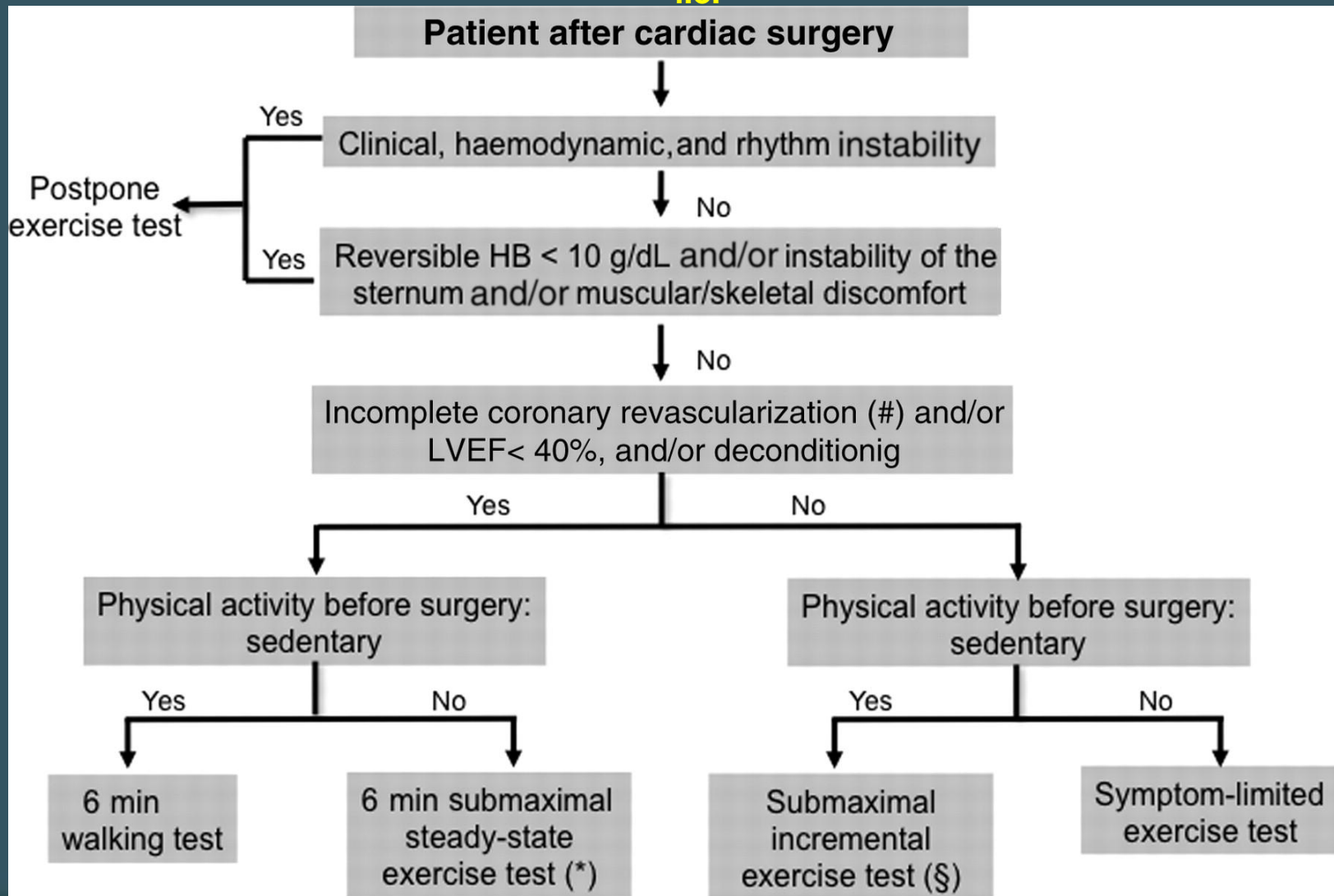
# Secondary prevention through cardiac rehabilitation: physical activity counselling and exercise training

**Key components of the position paper from the Cardiac Rehabilitation Section of the European Association of Cardiovascular Prevention and Rehabilitation**

**EACPR Committee for Science Guidelines: Ugo Corrà (Chairperson), Massimo F. Piepoli, François Carré; Peter Heuschmann; Uwe Hoffmann; Monique Verschuren; Julian Halcox**  
**Document Reviewers: Pantaleo Giannuzzi, Hugo Saner, David Wood**

**Massimo F. Piepoli\*, Ugo Corrà, Werner Benzer, Birna Bjarnason-Wehrens, Paul Dendale, Dan Gaita, Hannah McGee, Miguel Mendes, Josef Niebauer, Ann-Dorthe Olsen Zwisler, and Jean-Paul Schmid**

**Proposed algorithm for functional evaluation in exercise prescription after cardiac surgery, i.e.**



et al. Eur Heart J 2010;31:1967-1974

European Heart Journal

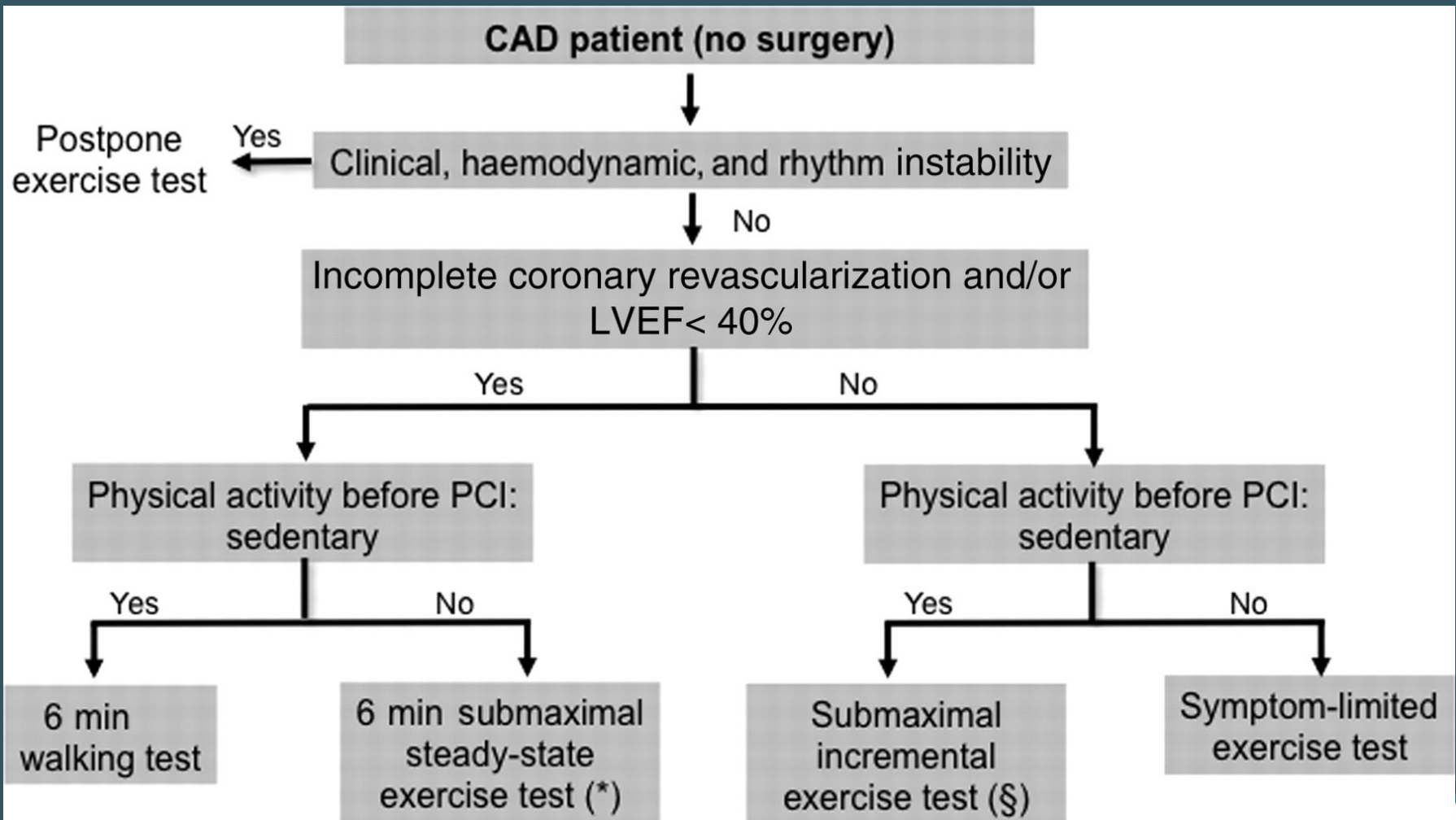
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# Proposed algorithm for functional evaluation in exercise prescription in coronary artery disease (CAD) patients not treated with cardiac surgery.

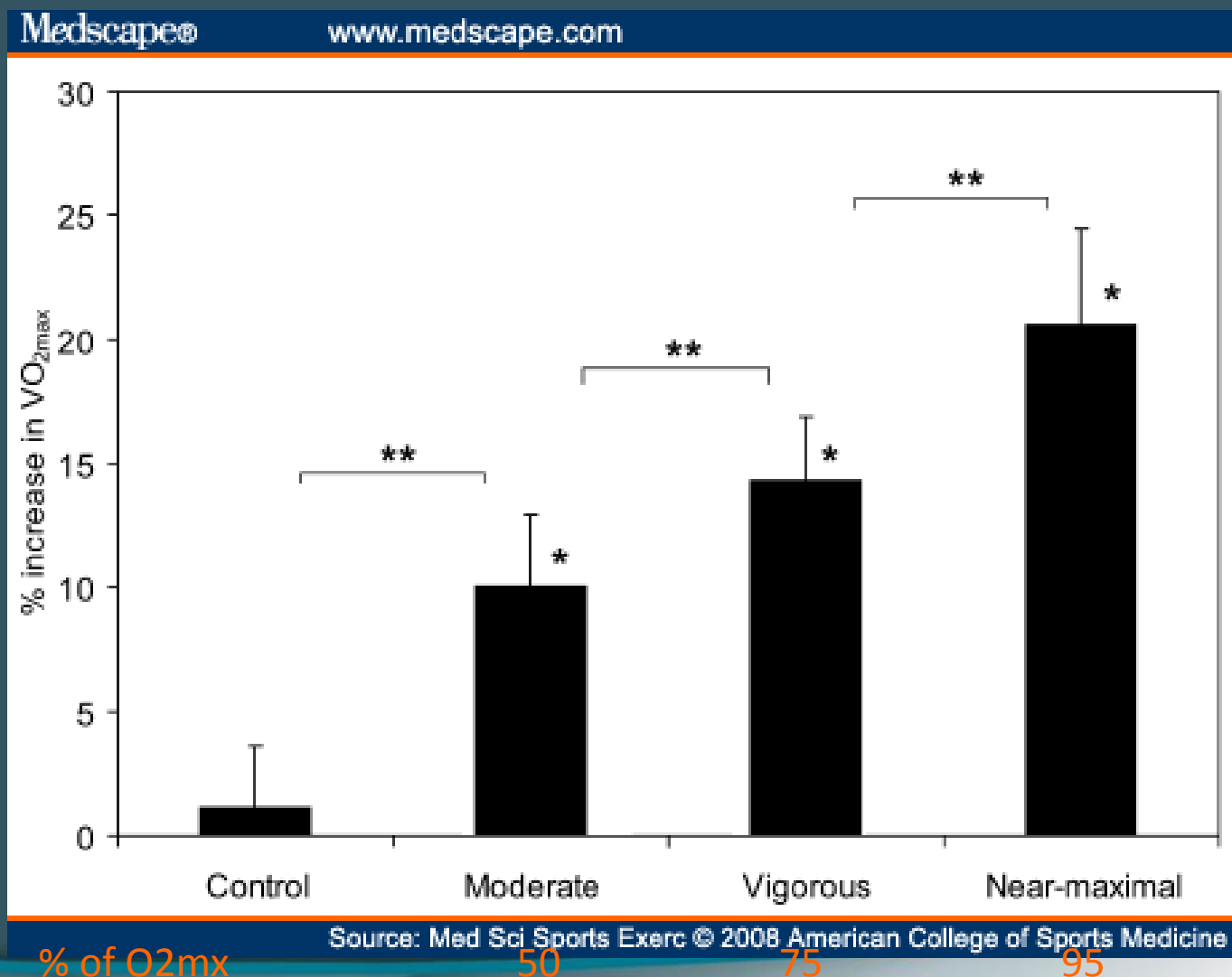


et al. Eur Heart J 2010;31:1967-1974

European Heart Journal  
Council for  
Cardiology Practice



# Effect of Intensity of Aerobic Training on VO2max



Gormley et al Med Sci Sports Exerc, 2008:40:1336-43



# Italian Diabetes and Exercise Study (IDES)

- for 12 months study of 606 pts in 22 outpatient diabetes clinics across Italy randomized by center, age, and diabetes treatment
- twice-a-week supervised aerobic and resistance training plus structured exercise counseling (exercise group)
- counseling alone (control group)
- Significant improvement
  - HBA1c,
  - Blood pressure,
  - Glucose
  - cholesterol level;
  - waist circumference);
  - body mass index;
  - insulin resistance;
  - Inflammation markers

Balducci et al Arch Intern Med. 2010 ; 8;170(20):1794-803..

# What intensity of endurance training is recommended for cardiac patients?

EACPR position paper: :

- individualized approach after careful clinical evaluation
- 150 min/week ideally 3–4 h/week Sub-maximal endurance training,
- Start at 50% and gradually increasing to 50-70% of maximal HR
- 50% HRmax in high-risk patients
  - left ventricular dysfunction,
  - coronary disease severity,
  - co-morbidities,
  - ageing

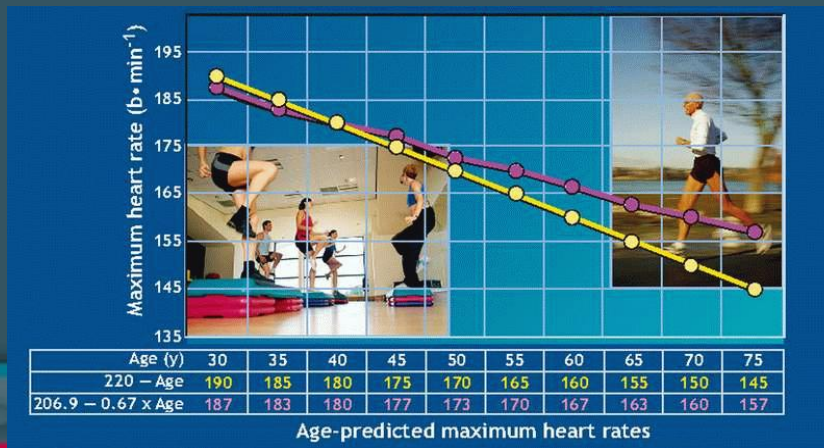
ACSM: 40-80% of HR max or HR rest + 20

European Journal of Cardiovascular Prevention and Rehabilitation 2010, 17:1–17

# What is maximal Heart Rate?

- HR max should be measured directly at maximal ex test
- Influence of drugs (beta blockers)
- 10% higher on treadmill
- Formula 220-Age not useful: large SD(12-15)
- $206.9 - 0.67 * \text{Age}$  better

Percentage HR <sub>max</sub>	Percentage $\dot{V}O_{2\text{max}}$
50	28
60	40
70	58
80	70
90	83
100	100



# High level interval training in heart failure

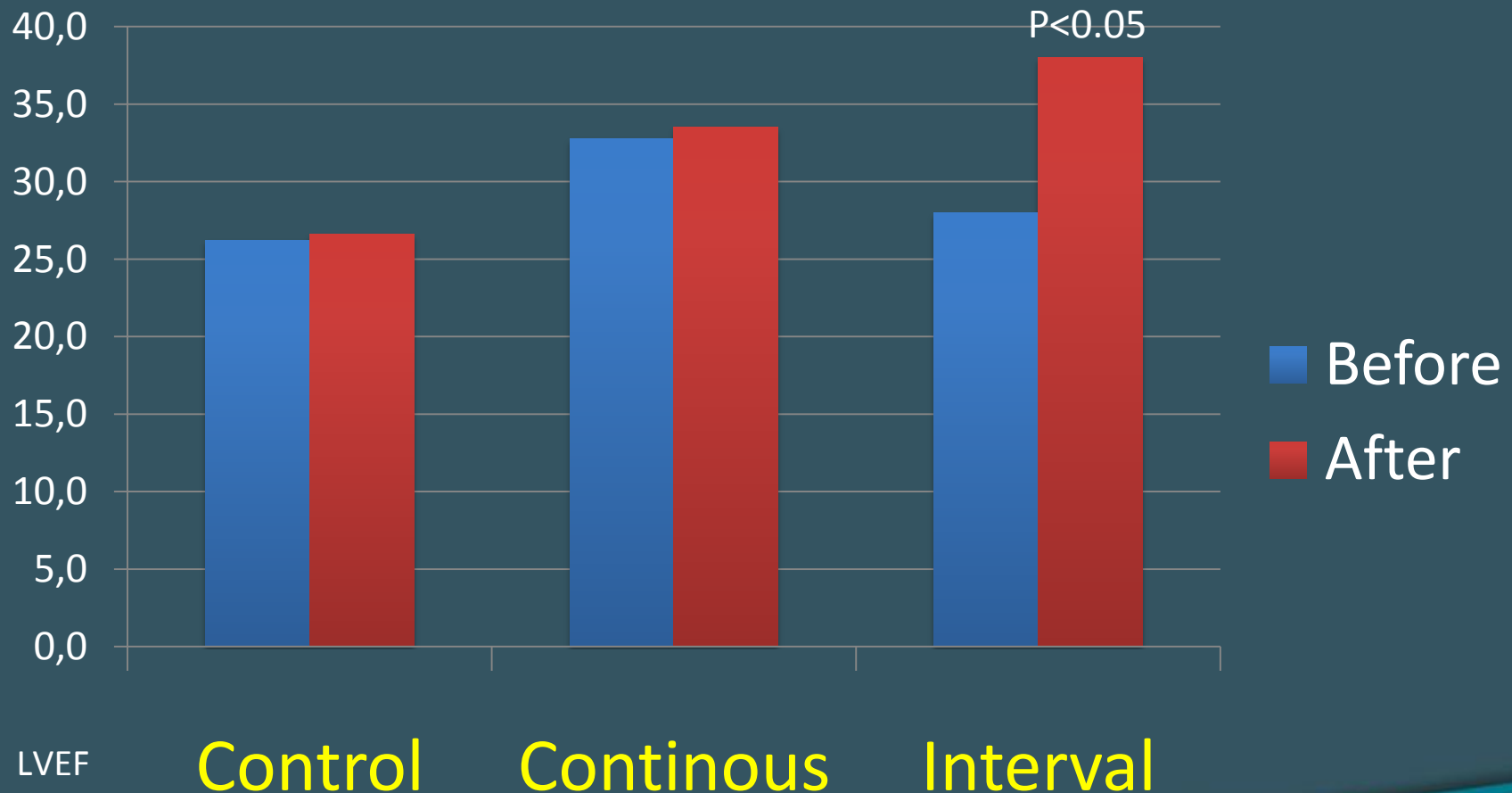
## Exercise Physiology

### **Superior Cardiovascular Effect of Aerobic Interval Training Versus Moderate Continuous Training in Heart Failure Patients** **A Randomized Study**

- 27 pts with HF, mena EF 30% LVIDD67mm
- high intensity interval training or isocaloric continuous training
- High intensity group:
  - Warm up for 10 minutes at 60-70% of peak HR
  - Four 4-minute intervals at 90% to 95% of peak HR
  - Each interval was separated by 3-minute active rest intervals

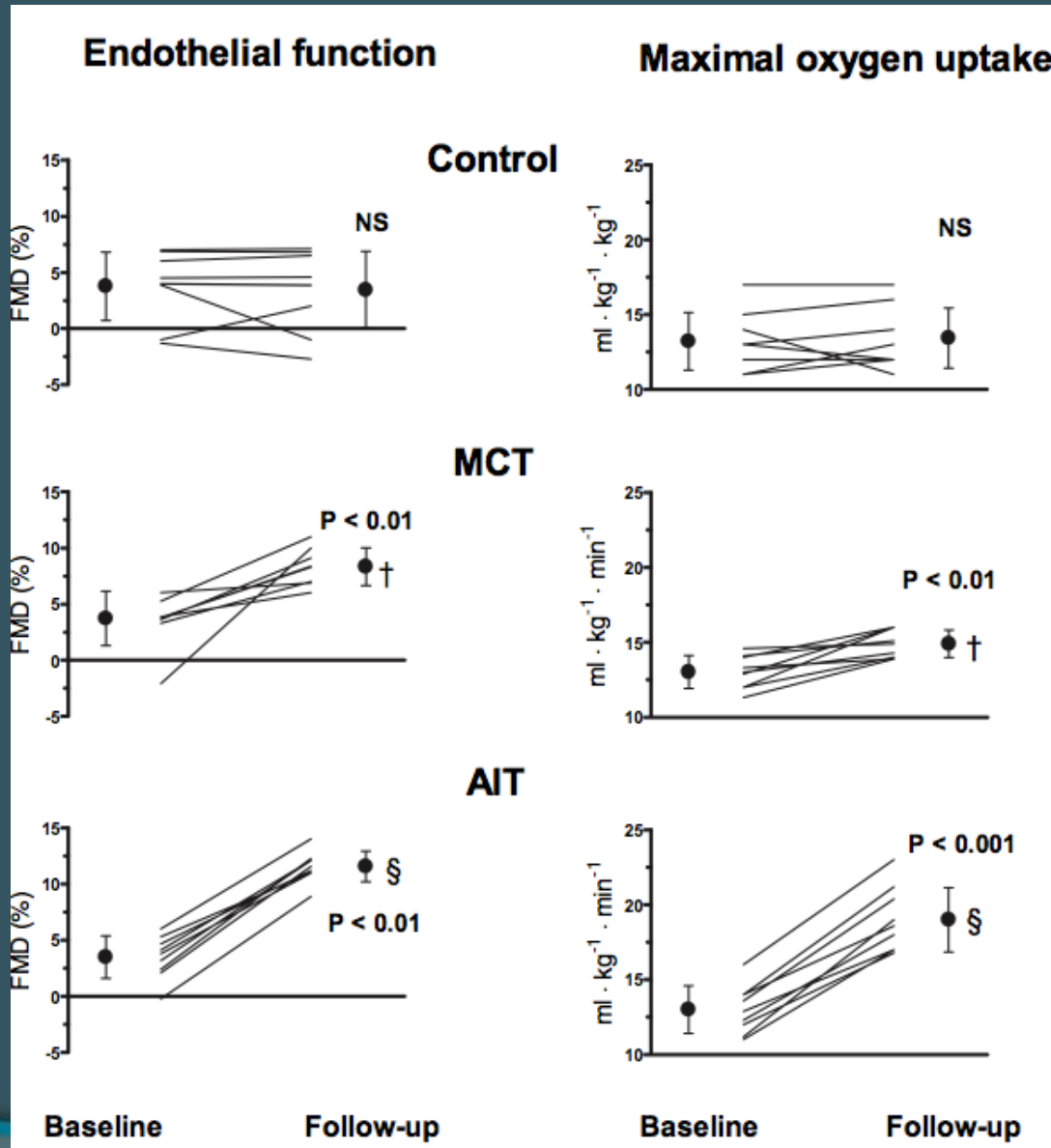
Wisløff et al *Circulation*. 2007;115:3086-3094

# Effect of interval training on the LVEF in heart failure patients



Wisløff et al *Circulation*. 2007;115:3086-3094

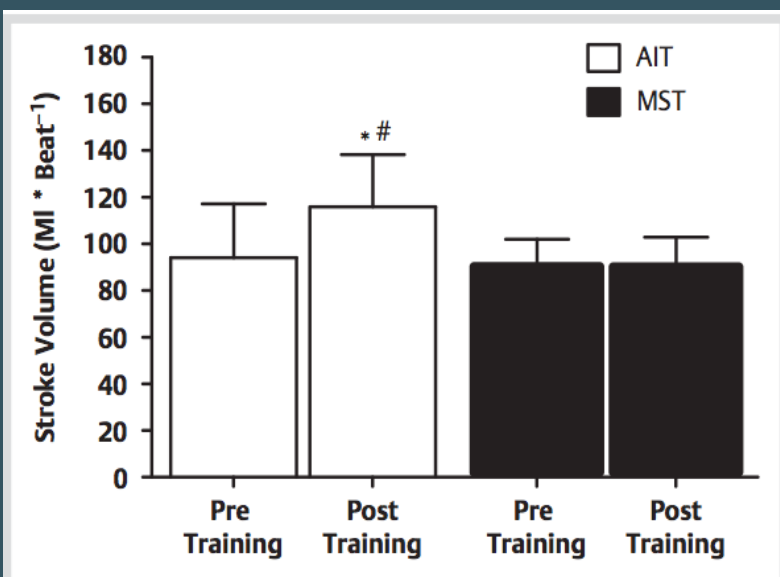
# Effects on endothelial function and VO2Max



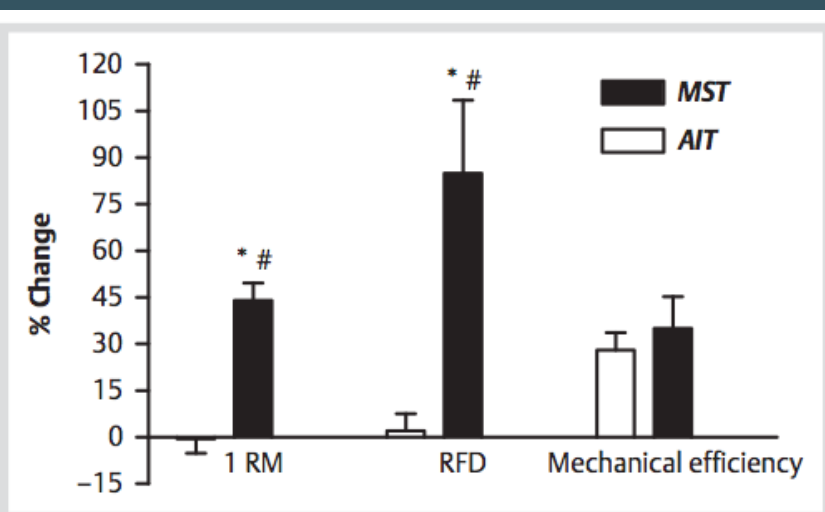


# Interval and Strength Training in CAD Patients

20 pts randomized to endurance interval training or resistance training  
CO measured at rest and peak exercise through a single breath gas technique,  
Cardiac volumes by MR



**Fig. 1** Peak stroke volume before and after training, in the aerobic interval training (AIT)- and the maximal strength training group (MST). \* P<0.05 changes within group before vs. after training, # P<0.05 changes in the AIT group vs. the MST group.



**Fig. 2** Percent change in maximal leg strength (1RM), rate of force development (RFD) and walking mechanical efficiency from before to after training in the maximal strength training group (MST) and the aerobic interval training (AIT) group. \* P<0.05 changes within group before vs. after training, # P<0.05 changes in the MST group vs. the AIT group.

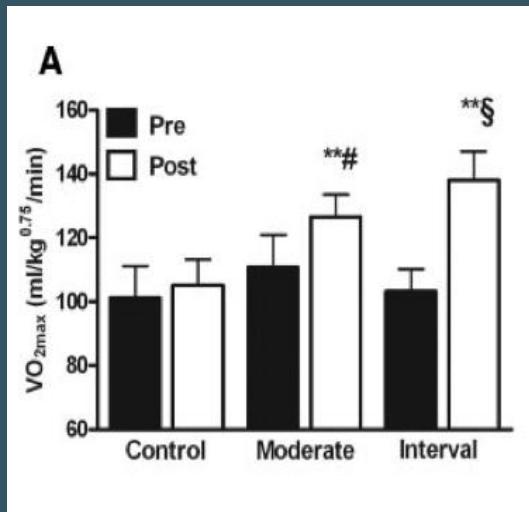
Helgerud . Et al. Int J Sport Med Nov 2010,

# Effects of aerobic interval training vs. continuous exercise in metabolic syndrome

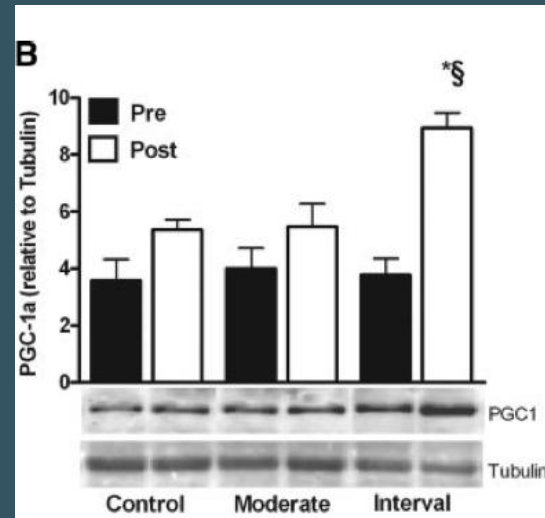
- 35 pts random, to 70% HRmax continuous exercise (isocaloric) or aerobic interval 90% HRmax or control group 3/week 16 weeks

	Control	Continuous	Interval
<b>No with METS</b>	100%	63%	54%
<b>Blood Pressure</b>	≈	↓	↓
<b>HDL</b>	≈	↑	↑
<b>Insulin sensitivity</b>	≈	↑	↑
<b>Waist and weight</b>	≈	↓	↓
<b>Microalbuminuria</b>	≈	↓	↓↓

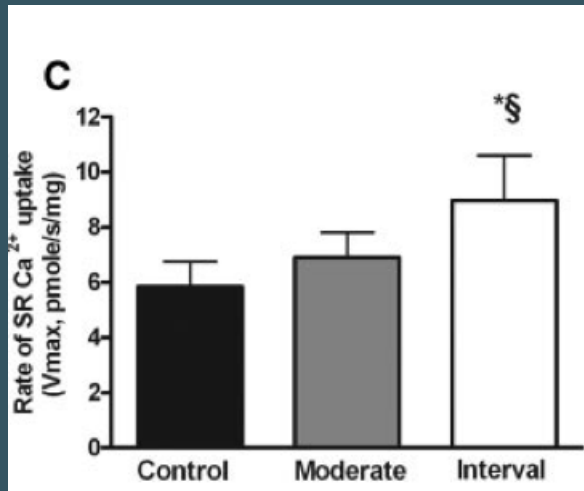
*Tjønnå et al Circulation. 2008;118:346-354.*



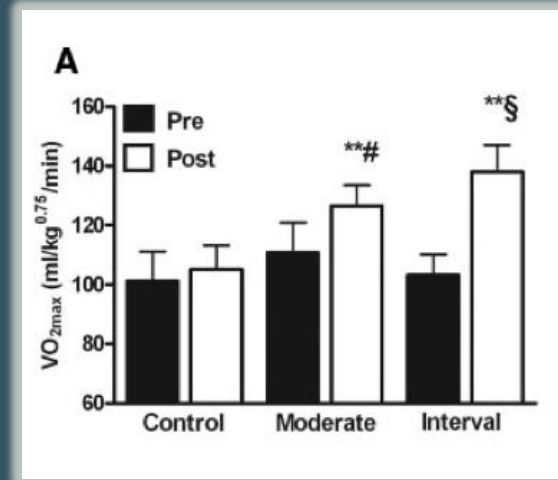
VO<sub>2</sub>max



Expression of PGC-1 $\alpha$  in vastus lateralis



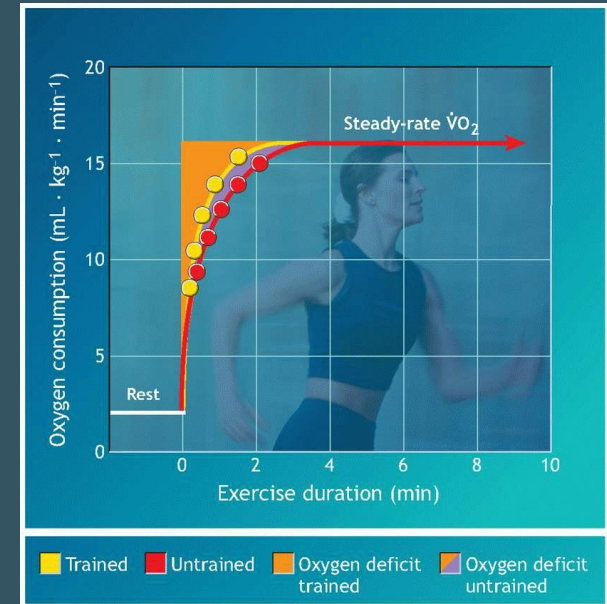
Max re-uptake of Ca into sarcoplasmic reticulum



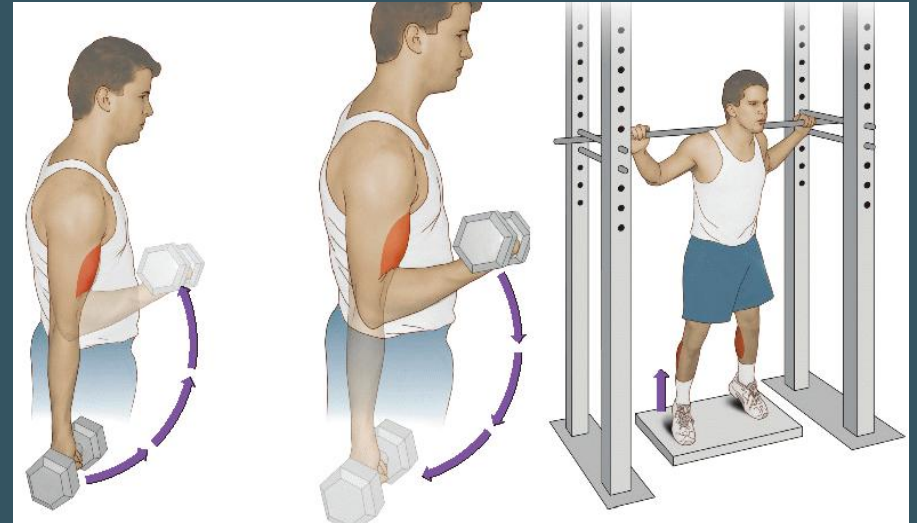
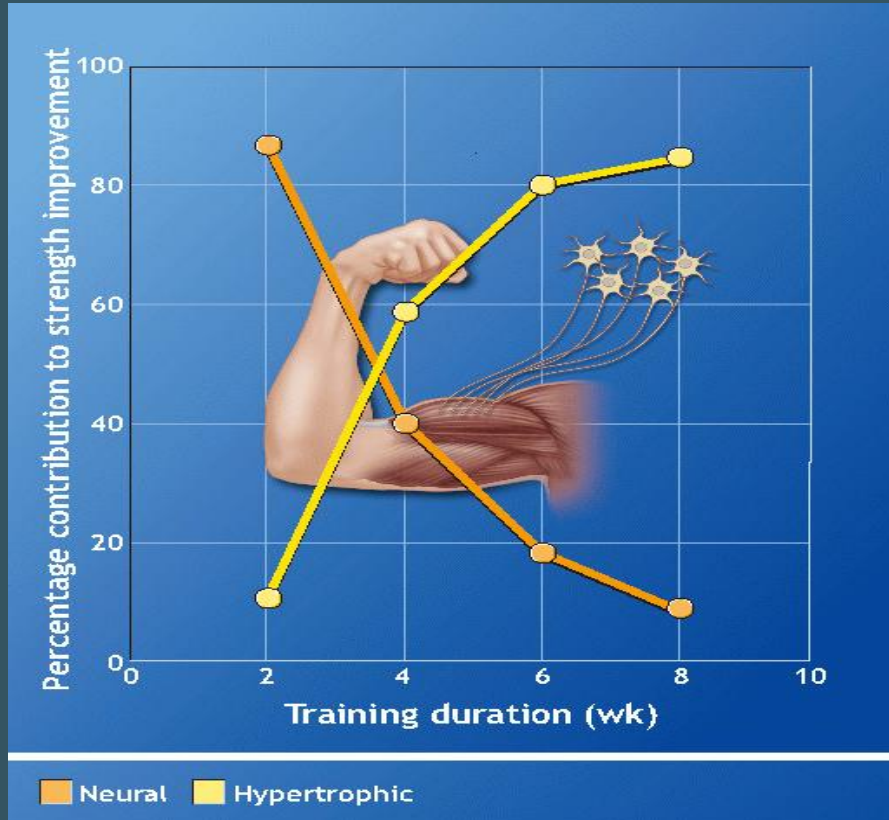
FMD – brachial artery

# High Intensity Aerobic Interval Training

- Best performed on treadmill walking upwards or on bicycle
- Warm up at least 5 min 60-70% of  $HR_{max}$
- 4 min intervals at 90-95% of  $HR_{max}$
- 3 min active "rest" at 60% of  $HR_{max}$
- 3-4 times a week
- **Readjust** the load as the aerobic capacity improves
- Heart rate must be followed regularly
- Now experience with > 2000 sessions without serious incidences
- Large randomized HF training study is ongoing

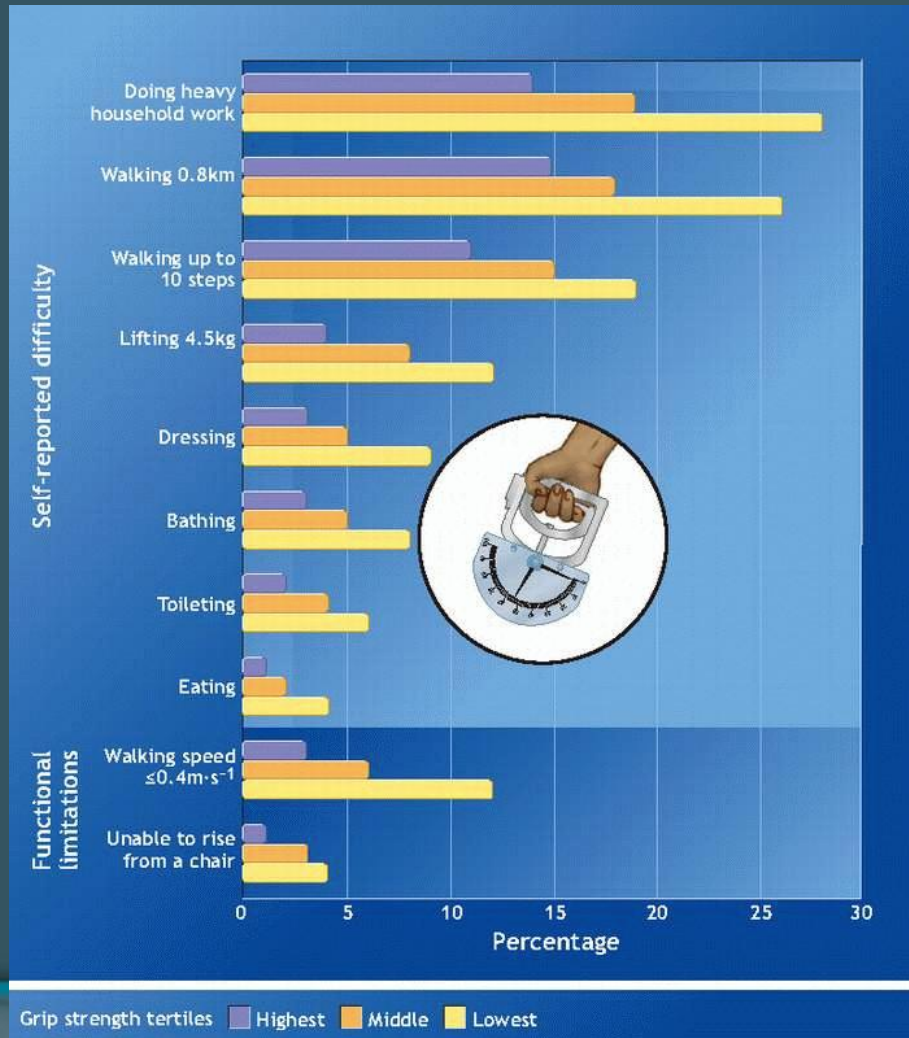


# Resistance training





# Relation between grip strength and functional limitations 25 years later





# Resistance training

- During the pressor phase
  - Abrupt increase in blood pressure and afterload
  - Modest increase in heart rate
  - Acute strain on the heart and vessels
    - Aware of aortic dilatation
  - What number of rep and %RM is best for the cardiovascular patient?

# Resistance training - How much how fast?

 Wolters Kluwer Health | Lippincott Williams & Wilkins



## Original Scientific Paper

# Acute cardiovascular response to resistance training during cardiac rehabilitation: effect of repetition speed and rest periods

Michel Lamotte, Fany Fleury, Melissa Pirard, Alexander Jamon and Philippe van de Borne

Department of Cardiology, Erasme Hospital, Free University of Brussel, Belgium

European Journal of Cardiovascular Prevention and Rehabilitation 2010, 17:329–336

# Varying resistance training

- 17 male cardiac patients
- Hemodynamic measurement by task force monitor system
- Varying pause 3 x 10 repetitions  
75% RM separated by 30, 60, 90 or 120 s.
- Progressive drift of HR, BP and CO with slow contractions and short recovery time between

# Recommendations resistance training

On the basis of this research and earlier works, we can suggest this following RT protocol:

- Three sets of 10 repetitions
- 70–75% of 1RM
- at fast speed of repetitions
- with a recovery time of 90 s

# Which cardiac patients should NOT exercise heavily?

- Acute coronary syndromes
- ?days after AMI
- Obstructive cardiomyopathy
- Severe aortic stenosis
- Aortic root dilatation (not resistance tr)
- AF with uncontrolled rate
- Uncompensated heart failure with congestion
- Peri- and myocarditis

# Physical activity in patients with heart disease: how much is good enough?

- Most patients benefit from regular physical exercise
- Endurance training, especially high intense interval training may increase cardiac performance and endothelial and muscular function
- Adding resistance training may strengthen muscles and improve basis for endurance training but should be performed with 70%RM and fast repetitions with intervals



# Physical exercise as a therapeutic option in CVD

- Underestimated
- Underused
- Underfinanced
- No industry promotion
- Limited reimbursement
- But is perhaps one of the most important therapeutic actions we can take besides basal guideline-based medical treatment

Thank you for the attention!