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Endurance training in cardiac rehabilitation: Which protocol is the most effective?

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Introduction

Endurance training is a key component of cardiac secondary prevention. Studies of our and other groups, have shown that regular exercise training positively affects exercise capacity, quality of life, endothelial function, morbidity, rehospitalization as well as cardiac and all-cause mortality[1,2]. Today, endurance training is an evident part of cardiac rehabilitation. During the past decades different endurance training protocols and their advantages for patients have been studied[3,4].

Aim

The study aims to assess, if a standardized pyramid protocol is equal or more effective than other common endurance protocols in cardiac rehabilitation.

Methods

This prospective, randomized study compares the effectiveness of three different isocaloric[5] training protocols on individual exercise capacity in 45 cardiac patients: Continuous endurance training (CET), high-intensity interval training (HIT) or pyramid training (PYR; see table 1 and figure 1).
Supervised training was performed for 6 weeks on cycle ergometers on 2-non-consecutive days per week. Primary endpoint was physical work capacity (Watt) during maximal, cycle ergometry.

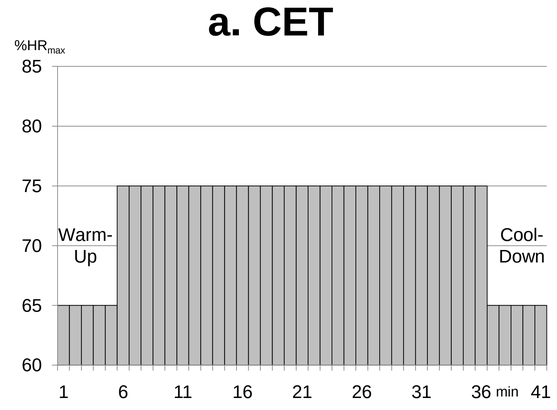
Table 1. Training protocols

Protocol	Duration	Intensity	Metabolic Work Load
CET (n=15)	31min	65–75% HR_{max}	Aerobic
HIT (n=15)	I: 4x4min; R: 3x3min Total: 25min	I: 85–95% HR_{max}; R: 60–70% HR_{max}	Anaerobic; fast lactate accumulation and degradation
PYR (n=15)	P: 3x8min; R: 2x2min Total: 28min	I: 65–95% HR_{max}; R: 60–70% HR_{max}	Anaerobic; slower lactate accumulation, delayed degradation

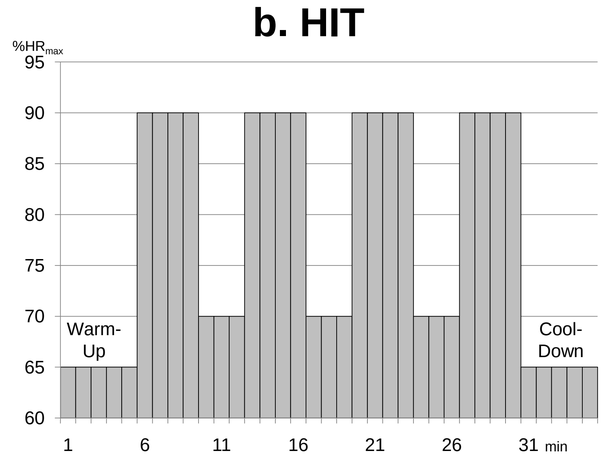
CET = continuous endurance training; HIT = high-intensive interval training; PYR = pyramid training; HR_{max} = maximal heart rate; I = interval time; R = active recovery; P = pyramid time

Figure 1. Exercise protocols

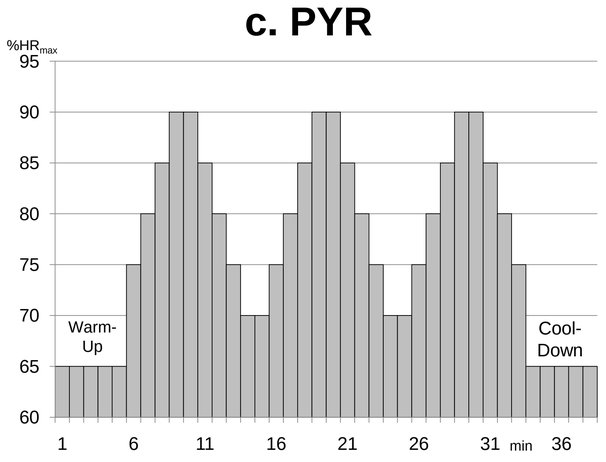
a. CET



b. HIT



c. PYR



Results

Twenty-seven of the planned 45 patients (CET n=8; HIT n=10; PYR n=9) finished the intervention until now. All protocols led to a significant increase (p<0.001, figure 2) of individual exercise capacity (pre vs. post intervention): CET: 140W vs. 169W; HIT: 140W vs. 175W; PYR: 141W vs. 179W). No significant differences could be elucidated between protocols so far.

Figure 2. Exercise capacity (pre vs. post intervention)

CET = continuous endurance training; HIT = high-intensive interval training; PYR = pyramid training; *p<0.001

Discussion

The interim results of this ongoing study showed a significant improvement in physical work capacity to a similar extend in all three training groups. If these results can be confirmed at the closing of the study, exercise training could be even more individualized and thus tailored to the specific preferences and needs of patients. Thus, it would be interesting if there is a positive impact on patients' compliance and motivation.

Literature: 1) Flynn, K.E. et al., JAMA, 2009. 301(14); 2) Niebauer, J. et al., Circulation, 1997. 96(8); 3) Tjonna, A.E. et al., Circulation, 2008. 118(4); 4) Wisloff, U. et al., Circulation, 2007. 115(24); 5) Rognmo, O., et al., Eur J Cardiovasc Prev Rehabil, 2004. 11(3)