Center of Rehabilitation Research

Impact of Training Methods and Patient Characteristics on Exercise Capacity during Inpatient Cardiac Rehabilitation

Annett Salzwedel[1], Rona Reibis[2], Stefan Kaminski[3], Hermann Buhlert[3], Karl Wegscheider[4], Klaus Balzer[4], Heinz Völler[1,2]

Purpose

Exercise training is a core component of Cardiac Rehabilitation (CR). We aimed to identify factors associated with increase of training volume (TV) and fitness during CR.

Methods

We analyzed sociodemographic and clinical data from a prospective registry of 557 patients (mean age 51.7±6.9 years, 87.9% men), who were referred to inpatient CR between 06/2009 to 12/2011, predominantly after PCI (62.5%), CABG (16.2%) and heart valve replacement (9.5%) (Table 1).

Table 1. Patient characteristics

Variable	mean±SD
Age	51,7±6,9 years
Gender (m)	87,9%
Rehabilitation-indication	
PCI with/without ACS	348 (62,5%)
CABG	90 (16,2%)
Valve replacement/reconstruction correction	53 (9,5%)
other (PE; myocarditis, DCM)	66 (11,8%)
Length of stay (hospital)	9,6±8 days
Risk factors	
Diabetes mellitus	100 (18,0%)
Smoker	156 (28,0%)
Ex smoker (≥5 years)	268 (48,1%)
Comorbidities (number)	0,52±0,7

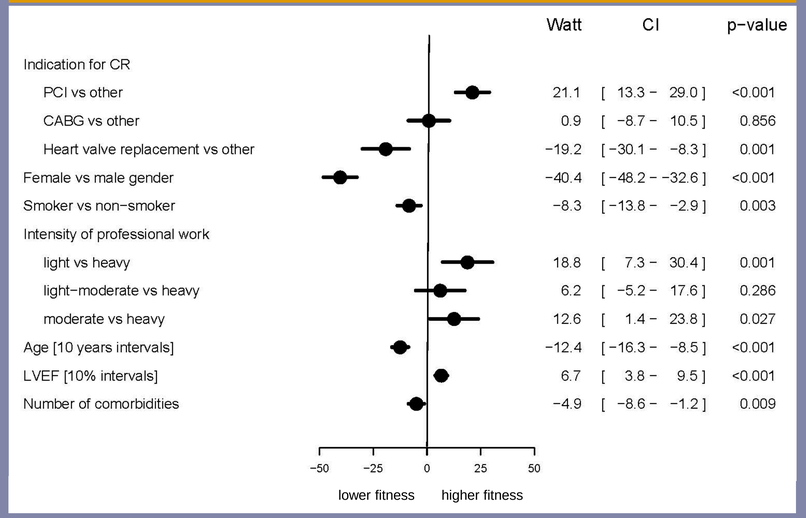
PCI, percutaneous intervention; CABG, coronary artery bypass graft; PE, pulmonary embolism; DCM, dilative cardiomyopathy.

At admission, patients underwent a bicycle exercise stress test to determine exercise intensity. TV as a product of exercise intensity (Watt) and time (min) was collected at admission and end of CR. Cardiopulmonary exercise testing (CPX) was performed at discharge for defining fitness according to VO_2peak.

Results

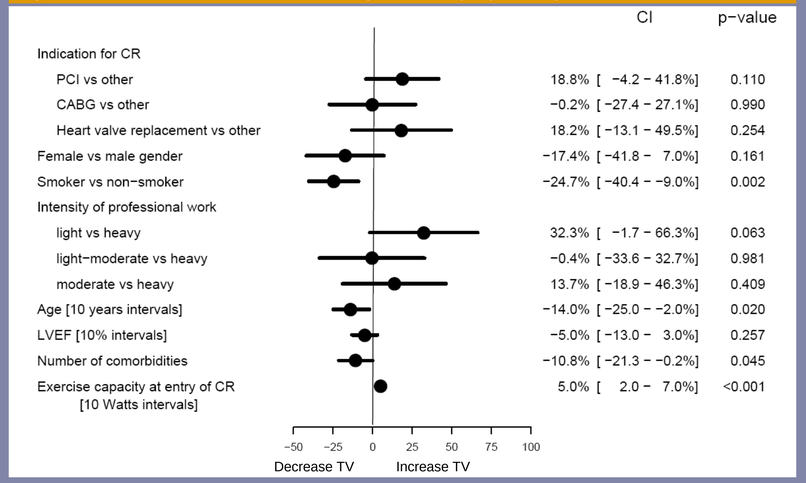
Training frequency was 11.3±2.7/3 weeks and intensity 90.7±9.7% of maximum heart rate (81% continuous, 19% interval training, 64% additional strength training). The forest plot in figure 1 displays factors significantly associated with higher exercise capacity: PCI as main diagnosis (versus others), light activities (vs heavy work) and preserved left ventricular ejection fraction (LVEF). On the contrary factors significantly associated with lower exercise capacity were female gender, previous heart valve replacement, higher age and higher number of comorbidities. Increase of TV by an average of 784.3±623.4 Watts x min was significantly associated with smoking, blue or white collar work, and exercise capacity at entry of CR (Figure 2).

Figure 1. Factors associated with exercise capacity at entry of CR (Watt)



LVEV, left ventricular ejection fraction.

Figure 2. Relative increase of training volume (TV) during CR



Fitness at the end of CR was influenced by age, gender, exercise capacity at entry, training method and indication for CR (Table 2).

Table 2. Determinants of physical fitness (VO_2peak) at dis charge from CR

Variable	P value	Explained variance %
Indication for CR	0.024	2.1
Gender, female/male	0.033	1.0
Smoking	0.441	0.1
Blue/white collar work	0.183	1.1
Age, years	<0.001	7.7
LVEF, %	0.505	0.1
Number of comorbidities	0.305	0.
Exercise capacity at entry of CR, Watt-max	<0.001	3.6
Training intensity, % of heart rate	0.975	0.0
Increase of training work, Watt x min	<0.001	4.2
Additional strength training, yes/no	0.824	0.0
Training method, continuous/interval	<0.001	3.0

Conclusions

Patients were trained with high intensity and most of them reached a considerable increase of their training volume. Because fitness at the end of CR was influenced by age, exercise capacity at admission and increase of TV during CR, especially patients from the age of 50 should continue training in aftercare programs to preserve work ability.

1 Center of Rehabilitation Research, University of Potsdam, Germany;
2 Kardiologische Gemeinschaftspraxis am Park Sanssouci, Potsdam, Germany;
3 Klinik am See, Rehabilitation Center for Internal Medicine, Ruedersdorf, Germany;
4 Department of Medical Biometry and Epidemiology, University Medical Center, Hamburg, Germany

The authors declare that there is no conflict of interest.
contact: annett.salzwedel@uni-potsdam.de