Cardiac Rehabilitation in Patients with Chronic Heart Failure

II nd Chair and Clinic of Cardiology

History

- In the eighties chronic heart failure (CHF) was considered an absolute contraindication to exercise training
- Bed rest was supposed to cure CHF.
- In the late eighties some studies showed that in patients with coronary artery disease and impaired left ventricular function exerciase training is beneficial.

Exercie training effects in CHF

- **↑ peak oxygen consumption (peak VO_2)**
- ↓ sympathetic activity
- ↓ renin-angiotensin-aldosterone activity
- ↓ heart rate at rest and also the decrease of blood pressure
- ↑ cardiac output
- Improvement of endothelial function(vasorelaxation)

Peak oxygen consumption VO_2

Practically in is the same value as maximal oxygen consumption - max VO_2

VO2 max is the maximal oxygen uptake or the maximum volume of oxygen that can be utilized in one minute during maximal or exhaustive exercise performed at sea level. It is measured as milliliters of oxygen used in one minute per kilogram of body weight. Contining exercises after reaching VO2 max does not cause the increase in oxygen consumption (plateau).

Peak VO_2 and prognosis in CHF

- Peak VO_2< 50%
  - one-year survival– 74%
  - two-year survival – 43%
- Peak VO_2 > 50%
  - one-year survival – 98%
  - two-year survival – 90%

Effects of exercise training in CHF

- Improvement of the structure and function of the skeletal muscles
- Improvement of oxygen utilization and the metabolic efficiency
- Delayed lactate accumulation

Effects of exercise training in CHF

- ↑ peripheral perfusion
- Improvement of the mechanics of breathing (reduction of the exertion hyperventilation)
- Improvement of ventilation/perfusion ratio
- Better quality of life

Exercise training should be preceeded by :

- Physical examination
- Laboratory tests (blood count, electrolytes, glucose and creatitnine level)
- Echocardiography
- 24h-Holter monitoring
- 6-minute walk test
- Ergospirometry (ideally)

Necessary conditions for the implementation of exercise training in CHF

- clinical stabilization for at least 3 weeks
- reaspiratory rate< 30/min
- resting heart rate<110/min
- less than moderate fatigue
- cardiac index (CI) ≥ 2.1 l/min/m^2
- central venous pressure (CVP) < 12 mm H_2O

Relative contraindication to exercise training in CHF

Increase of the body mass more than 1.8 kg in the last 3 days
Dobutamine infusion
Decrease of systolic blood pressure during exercise
NYHA IV
complex ventricular arrhythmia at rest or during exercise
Resting heart rate > 100/min
Significant concomitant diseases

Absolute contraindication to exercise training in CHF

CHF symptoms exacerbation in the last 3 days.
significant ischaemia at low workload (<2 MET)
uncontrolled diabetes mellitus
any acute systemic disease or fever
venous thromboembolic disease
myocarditis or pericarditis

Absolute contraindication to exercise training in CHF

moderate and severe aortic stenosis

ane valvular regurgitation requiring surgical correction

myocardial infarction in the last 3 weeks

paroxysmal atrial fibrillation – during an episode

The kinds of training in CHF

Dynamic training

- ✓ interval
- ✓ continuous

Resistance/strenght training

Respiratory training

Relaxation exercise

The kinds of physical training in CHF

- **Recommended**

  # cycloergometer training

  # treadmill training

- **Not-recommeneded**

  # running

  # swimming

  # cycling (only selected patients)

Aerobic interval training

- Allows for more intensive peripheral stimulation (muscles) without an excessive workload comparing to continuous training
- Particularly recommended for patients with markedly limited exercise tolerance

Planning of the interval training

- At the beginning the exercise intensity should be about 40-50% of peak oxygen consumption (peak VO_2)
- Cycloergometer – usually the active phase lasts 30s followed by the recovery phase lasting 60s, combinations of 15s/60s, 10s/60s with the higher exercise intensity are also used
- Treadmill– 60s/60s
- In the recovery phase patients cycle or walk at the lowest possible speed

Resistance training

- Rhythmic sequences of the submaximal isometric muscle contraction improve perfusion and increase venous return, decrease systemic vascular resistance leading to the improvement of left ventricular function
- Very important in prevention of muscular atrophy

Resistance training

Applying resistance training with few repetitions, engaging only small groups of muscles seems to be beneficial in patients with chronic heart failure and significantly impaired exercise tolerance mięśni i niewielką liczbą powtórzeń.

Fequency and duration of exercise sessions

Depends on the clinical status

< 3 MET – several short 5-10-minute sessions a day
3-5 MET – 1-2 15-minute sessions a day
>5 MET 3-5 sessions of 20-30 minute a week

Progression of training

- Initial phase – 40-50% peak VO_2, until reaching 10-15 minutes of exercising
- Progress phase – increase of the training intensity to70% peak VO_2, and duration to 30 min, increase of the frequency
- Maintenance phase – usually after 6 months

Respiratory training

- Should be an element of all training regimens in CHF patients
- Devices for respiratory training (Respirex, Treshold)
- Resistance exercise of the diaphragm and abdominal muscles

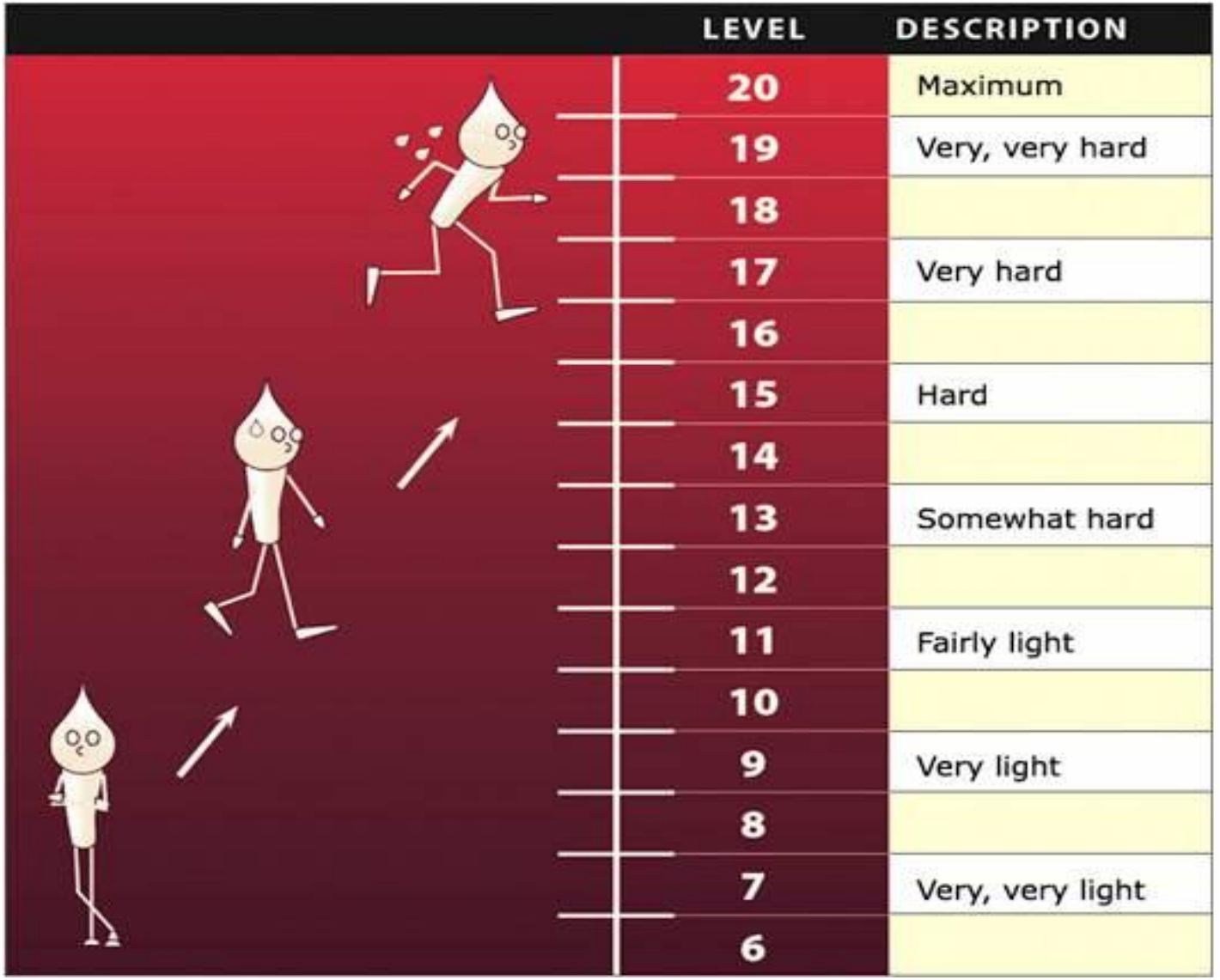
Symptoms necessitating the modification or interruption of the training

- Significant dyspnea or fatigue (≥ 14 in the Borg score)
- Respiratory rate during training > 40/min.
- Third sound or signs of pulmonary congestion
- Exacerbation of the previously observed pulmonary congestion
- Louder pulmonary component of the second sound

Symptoms necessitating the modification or interruption of the training

- The difference between systolic and diastolic blood pressure < 10mmHg
- Drop in the systolic blood pressure (> 10mmHg) during training
- Increasing number of supraventricular and ventricular extrasystolic beats
- Profuse sweating, pallor, disorientation

Borg scale



LEVEL	DESCRIPTION
20	Maximum
19	Very, very hard
18	
17	Very hard
16	
15	Hard
14	
13	Somewhat hard
12	
11	Fairly light
10	
9	Very light
8	
7	Very, very light
6	

Complication of the exercise training in CHF patients

- Sudden cardiac death -1/60.000 patients
- Myicardial infarction – 4-20% during exercise or shortly after
- Hypotension
- Supraventricular and ventriculat arrhythmias
- Exacerbation of CHF symptoms
- Trauma

Safety

- Careful initial assessment and cautious qualification
- Optimal pharmacotherapy
- Subjective and objective individualization of the training regimens
- Initiation of training during hospitalisation
- Periodic analysis of the training effects and modification of exercise
- Alternate idividual and supervised sessions

Safety

- Recording and evaluation of the cardiac rhythm during home-based exercise
- Careful patients monitoring during training
- Experience of the rehabilitation center

Monitoring

- Heart and lung auscultation
- Serial weighting
- Assessment of the peripheral oedema
- Bloood pressure and cardiac rhythm assessment before, during and after training
- Monitoring of symptoms and clinical condition

Specific populations

- Patients with implantable cardiac resynchronization device - without contraindication to cardiac rehabilitation
- Patients with left ventricular assist devices – clinical trials in small groups of patients indicate safety and benefit associated with exercise training in this population

Specific populations

- Patients with implantable cardioverter-defibrillators (ICD)
  - ✓ ICD is not a contraindication to the exercise training
  - ✓ During first 6 weeks after implantation exercises engaging left (or less likely right)shoulder should be avoided because of the risk of the electrode dislocation

Patients with implantable cardioverter-defibrillators (ICD)

- **Maximal training pulse should be 20 beats per minute lower than defibrillation treshold!**
- Hospital stage:
  - ✓ ECG monitoring
  - ✓Immediate resuscitation available
  - ✓Possibility to switch off the ICD
  - ✓Contact with the implantation center

Specific populations

- Patient after heart transplantation
  - ✓ Muscular atrophy and osteoporosis resulting from long-term immobilization and corticotherapy
  - ✓ Inadequate respiratory system response to exertion
  - ✓ Increased susceptibility to infection
  - ✓ Risk of rejection
  - ✓ Premature coronary srteries atherosclerosis
  - ✓ Denervated heart

Patient after heart transplantation

- Consequences of the heart denervation important for rehabilitation process
  - Patient may not experience chest pain even in the presence of singnificant ischaemia
  - Inadequate heart rate increase (chronotropic insufficiency) and blood pressure during exercise

Patient after heart transplantation

Risk of rejection

Suspected acute rejection is an ABSOLUTE contraindication to exercise training

Attention!

- ✓ Unexplained fever
- ✓ Hypotension
- ✓ Exacerbation of CHF symptoms

May suggest rejection process

Patient after heart ftransplantation

- Initiation of the rehabilitation in the hospital setting
- Fast mobilization with special regard to muscle function
- Careful monitoring
- Training rules same as in CHF population
- Resistance training in order to increase muscle mass and bone density
- Prevention of premature atherosclerosis

Benefits of cardiac rehabilitation in CHF patients

- Increase of muscular oxygen extraction
- Improvement of respiratory system sufficiency
- Increase of the bone density
- Reversal of the muscular atrophy
- Increase of the muscular strenght

Steward K.J., Badenhop D.,
Brubaker P.H et al.:
Cardiac Rehabilitation Following
Percutaneous Revascularisation,
Heart Transplant, Heart Valve Surgery
and for Chronic Heart Failure.

Chest 2003; 123;2104-2111

Summary

Patients with chronic heart failure benefit from skillfully applied cardiac rehabilitation. The key to success is an appropriate qualification to exercise training and careful monitoring of patients, regarding effects and complication of training in order to provide maximal safety.