Rehabilitation in ischaemic heart disease

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Cybulska K., Mamcarz A. Rehabilitacja kardiologiczna w chorobie niedokrwiennie serca
Piotrowicz R., Wolszczakiewicz J. Rehabilitacja kardiologiczna pacjentów z chorobą wieńcową

IInd Chair and Clinic of Cardiology
Initial examination before starting rehabilitation

It should evaluate:

✓ Stability of the clinical state regarding primary and secondary disease
✓ Risk of cardiovascular events
✓ Exercise tolerance
✓ Acceptable forms of training, its intensity and safety
Clinical evaluation before starting rehabilitation

- Anamnesis and physical examination
- Rest ECG
- Exercise test (except for the first stage)
- Echocardiography
- 24-h Holter monitoring
- **Some situations require more detailed assessment** (lab tests, chest X-ray, ergospirometry, Duplex Scan of the peripheral vessels, ambulatory blood pressure monitoring)
# Model of the cardiovascular event risk stratification

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Left ventricular systolic function</strong></td>
<td>Without significant dysfunction LVEF ≥ 50%</td>
<td>Moderate dysfunction LVEF ≥ 36-49%</td>
<td>Significant impairment LVEF ≥ 35%</td>
</tr>
<tr>
<td><strong>Complex ventricular arrhythmia</strong></td>
<td>Absent at rest or during exercise</td>
<td></td>
<td>Present at rest and during exercise</td>
</tr>
<tr>
<td><strong>Ischaemia on exercise stress test</strong></td>
<td>Absent</td>
<td>ST-segment depression ≥1mm a ≤ 2mm</td>
<td>ST segment depression &gt; 2mm</td>
</tr>
<tr>
<td><strong>Physical capability</strong></td>
<td>≥ 7 MET &gt;100W</td>
<td>5-6-9 MET 75-100W</td>
<td>&lt; 5 MET &lt; 75 W</td>
</tr>
<tr>
<td><strong>Haemodynamic reaction to exertion</strong></td>
<td>Normal</td>
<td></td>
<td>No increase or decrease of SBP or HR with the workload increase</td>
</tr>
<tr>
<td><strong>Clinical data</strong></td>
<td>Uncomplicated myocardial infarction, CABG, PCI</td>
<td></td>
<td>Myocardial infarction or PCI or CABG complicated with cardiogenic shock, heart failure, recurrent ischaemia</td>
</tr>
</tbody>
</table>
Absolute contraindications to exercise training

- Unstable angina
- Decompensated heart failure
- Resting sBP > 200mmHg; dBP > 100mmHg
- Severe valvular heart disease
- Ventricular and supraventricular arrhythmia on exertion
- Conduction disorders associated with exertion
- Third degree atrio-ventricular block in patient without stimulator
Absolute contraindications to exercise training

• Pericarditis
• Endocarditis
• Arterial embolism
• Thrombophlebitis
• Postoperative complication
• Other diseases which may exacerbate on exertion
Training should be interrupted in case of

- Chest pain
- Dyspnoe
- Excessive fatigue
- Dizziness
- Excessive heart rate increase (over 20/min in the first stage and more than expected in the II and III phase)
- Heart rate decrease
- No increase or decrease of blood pressure
Training should be interrupted in case of

- Increase of blood pressure: I stage- systolic >40 mmHg and/or diastolic >20 mmHg comparing to baseline; stage II and III – systolic >200 mmHg, diastolic > 110 mmHg
- Dangerous arrhythmia and conductance disturbance
- ST-segment depression or elevation > 1mm (in leads without Q wave)
Ways to define workload and training intensity

• Based on exercise stress test and pulse reserve:

\[ \text{Pulse reserve} = \text{max. exercise HR} - \text{rest HR} \]

\[ \text{Training pulse} = \text{rest HR} + 40\text{-}80\% \text{ pulse reserve} \]
Ways to define workload and training intensity

• Workload defined in Watts or METs based on exercise stress test

Training workload = 40-70% of the maximal workload tolerated during exercise stress test
Ways to define workload and training intensity

• Assessment by means of Borg scale

  *Training intensity* = 11-14 points in Borg scale

• Based on ventilatory anaerobic threshold (VAT) defined during ergospirometry

  *Training workload* = 10% below the workload at VAT
Ways to define workload and training intensity

• Based on peak oxygen consumption (peak VO$_2$) defined during ergospirometry

Training workload = 40-80% of workload at peak oxygen consumption (peak VO$_2$)
Stages of rehabilitation in patients after acute coronary syndromes

- **Stage I** – started in hospital and lasts up to the moment when progression to stage II is clinically reasonable, models depend on diagnosis
- **Stage II** – in hospital or in early outpatient phase, lasts from 4 to 12 weeks
- **Stage III** – late rehabilitation home- and outpatient-based, without time limit, may last till the end of life
Aims of stage I

• Optimization of pharmacologic treatment
• Prevention of immobilization complications
• Improvement of physical capacity
• Reduction of anxiety, psychologic support
• Education
• Precise information on the disease, treatment modalities, risk factors and methods of its modification
• Assessment of the clinical condition and qualification to the appropriate model of the stage II
Models of early in-hospital rehabilitation in patients with ACS

- **Model A1 (4-7 days)**
  - ACS without myocardial infarction
  - Non-ST- elevation myocardial infarction (NSTEMI)
  - ST- elevation myocardial infarction (STEMI) without significant impairment of left ventricular systolic function

- **Model A2 (7-10 days)**
  - ST- elevation myocardial infarction (STEMI) with left ventricular systolic dysfunction

- **Model B (>10 days)**
  - Complicated myocardial infarction
## Range of mobilization and kinesitherapy

<table>
<thead>
<tr>
<th></th>
<th>Stage I</th>
<th>Stage II</th>
<th>Stage III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A2 Days: 1-2</td>
<td>A2 Days: 3-5</td>
<td>A2 Days: 6-10</td>
</tr>
<tr>
<td></td>
<td>B Days: 1-7</td>
<td>B Days: 8-10</td>
<td>B Days: &gt;10</td>
</tr>
<tr>
<td>A1 Days: 1-2</td>
<td>Supine position, semi-sitting position, armchair</td>
<td>Active sitting in an armchair with legs down</td>
<td>Full self-service</td>
</tr>
<tr>
<td>A2 Days: 1-2</td>
<td>Eating in semi-sitting position</td>
<td>Self-service in feeding and toilet in bed (sitting)</td>
<td>Toilet in a bathroom</td>
</tr>
<tr>
<td>B Days: 1-7</td>
<td>Bed-pan in semi-sitting position, or in the bedside wheelchair</td>
<td>Toilet in the wheelchair</td>
<td>Longer walks</td>
</tr>
<tr>
<td></td>
<td>Washing and shaving in bed</td>
<td>Pionisation and walking around the ward</td>
<td>Stairs up to second floor</td>
</tr>
<tr>
<td></td>
<td><strong>Exercise in supine position(5-10min.):</strong></td>
<td><strong>Exercise in supine and sitting position (10-15min.):</strong></td>
<td><strong>Exercise in supine, sitting and upright and walk position(15-20min.):</strong></td>
</tr>
<tr>
<td></td>
<td>- respiratory training</td>
<td>- stage I exercise</td>
<td>- stage I and II exercise</td>
</tr>
<tr>
<td></td>
<td>- Isometric training of the selected group pf muscles (from day 2)</td>
<td>- Dynamic exercise of the upper and lower extremities</td>
<td>- Gradual increase of the walking distance up to 200 m</td>
</tr>
<tr>
<td></td>
<td>- Dynami exercises f the small groups of muscles (from day 2)</td>
<td>- Coordination exercise</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- relaxation</td>
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Aims of stage II

- Evaluation of the clinical condition and adjusting pharmacotherapy
- Treatment of mental disorders (anxiety, depression)
- Improvement of mental and physical condition
- Prevention of the disease-related disability
- Fighting the coronary artery disease risk factors
- Education of patients and their families
- Promotion of the healthy lifestyle
Exercise models in stage II

MODEL A

Risk: Low

Exercise tolerance: High (≥ 7 MET; ≥ 100 Wat)

Types of training: endurance, continuous on a treadmill or cycloergometer (3-5 days/week); resistance (2-3 days/week), general improvement exercise (5 days/week)

Total time: 60-90 min/day

Intensity: 60-80% of the pulse reserve or 50-70% of the maximal workload
Exercise models in stage II

MODEL B

Risk: Moderate

Exercise tolerance: High and moderate (≥ 5 MET, ≥ 7 Wat)

Types of training: endurance on a treadmill or cycloergometer continuous for patients with high tolerance and interval for those with moderate, resistance exercise, general training frequency same as in model A

Total time: 45-60 min/day

Intensity: 50-60% of the pulse reserve or 50% of the maximal workload
Exercise models in stage II

MODEL C – for moderate risk

Exercise tolerance: Low (3-5 MET, 50-75 Wat)

Types of training: endurance interval training on a treadmill and cycloergometer (3-5 days/week)

Total time: 45min/day

Intensity: 40-50% of the pulse reserve or 40-50% of the maximal workload
Exercise models in stage II

• MODEL C – for high risk
• Exercise tolerance: high (≥ 6 MET, > 75 Watt)
• Types of training: general training (5 day/week)
• Total time: 45min/day
• Intensivity: 40-50% of the pulse reserve or 40-50% of the maximal workload
Exercise models in stage II

- **MODEL D**
- **Risk:** moderate and high
- **Exercise tolerance:** very low (< 3 MET, < 50 Watt); low and moderate (< 6 MET, < 75 Watt)
- **Types of training:** Individual training 3-5 days/week, 2-3 times a day
- **Total time:** 30-45min. a day
- **Intensivity:** less than 20% of the pulse reserve or heart rate acceleration less than 10-15% of the baseline HR
Stage III

In the stage III various proportion of following types of training are prescribed, depending on individual clinical condition and exercise tolerance:

- Continuous or interval training on a treadmill or cycloergometer
- Dynamic exercises
- Resistance training
- Team games
- Individual exercises

Training should be supervised periodically
Aims of the stage III

• Optimalization of the pharmacotherapy
• Maintaining patients optimal physical and mental condition
• Fighting coronary artery disease risk factors
• Promotion of the healthy lifestyle
Models of the stage III rehabilitation

• Model A – low risk patients

• Model B – moderate risk patients with high exercise tolerance

• Model C – moderate risk patients with moderate or low exercise tolerance or high risk patients with high exercise tolerance
Patient after percutaneous coronary angioplasty (PTCA)

• Assessment of the clinical condition according to the general rules
• During the first day after PTCA patient is often immobilized due to compression on the femoral
• Stage I is shortened if there are no complications, the revascularisation is complete and patient has no left ventricular dysfunction
• In the case of planned revascularization, rehabilitation process is started before the procedure and stage one is cut down.
• Complications require individual regimen
Patient after coronary artery bypass graft (CABG)

Aims of preoperative preparation

✓ reducing thromboembolic complications
✓ reducing respiratory system-related complications
✓ maintaining proper functioning of the peripheral muscles in order to achieve patient mobilization as soon as possible
✓ minimalization of the peri-procedural stress
Patient after coronary artery bypass graft (CABG)

Methods of preoperative preparation

✓ Patient education regarding the matter of the procedure and the course of postoperative period
✓ Respiratory training
✓ Practicing effective cough
✓ Light exercises adjusted to patient condition
✓ Psychotherapeutic training
Patient after coronary artery bypass graft (CABG)

Stage I

✓ Rehabilitation according to model A2 in the case of no complications and according to model B if complications occur

✓ Place of rehabilitation:
  - Intensive care unit (2-3 days)
  - Cardiosurgery unit (from day 3 to day 7)
  - Cardiosurgery, cardiology and internal diseases units (from day 7)
Patient after coronary artery bypass graft (CABG)

Stage II

- Should last 6 weeks, in the case of complications 8-12 weeks.
- In complicated course, should start on day
  - Wound care
  - Mild respiratory training (without breastbone stretching)
  - Positional exercises to improve venous return with special regard to the leg from which a venous graft was taken.
  - Mild physiotherapy reducing postoperative pain (warmth, mild massage)
  - General exercises
Patient after coronary artery bypass graft (CABG)

- In the third week - exercise stress test up to 70% of the maximal heart rate or up to 13 point in the Borg scale.
- Patients are qualified to the appropriate rehabilitation models according to the exercise tolerance and the risk of cardiovascular events.
- At the end of stage II – submaximal exercise stress test (85% max. HR 15 points in the Borg scale).
- In patients after sternotomy, breastbone stretching exercises should start no sooner than 3 months after surgery.
- Stage III – according to the general rules of cardiac rehabilitation.
Practical advices for patients after CABG

Patients should avoid static efforts with apnea.

It is not allowed

✓ To carry heavy objects
✓ To push (np.: car, wheelbarrow)
✓ To change a car wheel
✓ To clear of snow (street)
✓ To pen windows in a train (or other activities requiring strong pulling)
✓ To hang curtains
✓ To dig soil
Practical advices for patients after CABG

Patient is allowed:

☑ To ride a bicycle
☑ To play recreational games (badminton, volleyball)
☑ To swim (water temp. 27-30°C)

The most advised effort is walking
Physical activity in the primary prevention of ischeamic heart disease

• Systematic physical activity reduces mortality of cardiovascular diseases as well as all-cause mortality
• Beneficial effect of exercise on circulatory and musculoskeletal system, metabolism and immunology is observed
• Endurance, dynamic exercise are believed to be the most beneficial
• It is advised to practice various sport disciplines and team games
Guidelines for physical activity in primary prevention of cardiovascular diseases.

<table>
<thead>
<tr>
<th>Training frequency</th>
<th>Minimum – 3 times a week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise intensity</td>
<td>Moderate – up to 60% of the maximal heart rate</td>
</tr>
<tr>
<td>Time of exercise unit</td>
<td>Minimum – 30-60min (average 40 min.)</td>
</tr>
<tr>
<td>Type of training</td>
<td>Endurance exercise</td>
</tr>
<tr>
<td>Resistance training</td>
<td>As an amendment - 10-15% of the whole training</td>
</tr>
<tr>
<td>Energetic cost</td>
<td>Minimum – 200-300 kcal/training and over 1000 kcal/week</td>
</tr>
<tr>
<td></td>
<td>Optimal over 2000 kcal/week</td>
</tr>
</tbody>
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