A flying start? – Early interval training in heart failure rehabilitation

Øyvind Ellingsen[a,b]

[a]K.G. Jebsen Center for Exercise in Medicine, Department of Circulation and Medical Imaging, Norwegian University of Science and Technology, Trondheim, Norway

[b]St. Olavs University Hospital, Department of Cardiology, Trondheim, Norway

Funding Sources

None

Corresponding author

Professor Øyvind Ellingsen MD PhD

Department of Circulation and Medical Imaging

P.O. Box 8905 MTFS

NO-7491 Trondheim, Norway

Email: oyvind.ellingsen@ntnu.no

Telephone: +47 9511 2111,

Fax: +47 7282 8372

Key words: heart failure; HFrEF; cardiac rehabilitation; exercise training, interval training; exercise intensity; early start; peak oxygen uptake; quality of life; motivation

Conflict of Interests Disclosures

None

Word count

1259

Low uptake to cardiac rehabilitation and poor adherence after hospital-based programs are major challenges in helping heart failure patients benefit from exercise training. Even though randomized controlled clinical trials demonstrate better quality of life and fewer hospitalizations, evidence-based strategies to overcome barriers to regular exercise are lacking[1]. According to consensus documents mobilization should start as early as possible after the clinical condition has stabilized[2]. In contrast, most studies wait several weeks before training programs start. Notably, a small observational study from the United States reported that only 17% (14/83) of heart failure patients eligible for cardiac rehabilitation enrolled as inpatients, whereas 97% (35/36) of those referred from cardiology or heart failure outpatient clinics accepted[3].

Two recent studies have taken potentially important steps forwards, documenting promising effects of exercise programs early after recovery from heart failure. Last year Acanfora and colleagues published results from a 4-week program starting within the first two weeks of hospital admission for acute cardiogenic pulmonary edema in middle-age and elderly patients[4]. Patients trained under supervision 6 days per week and the control group got written instructions to exercise at home. The training sessions comprised intensity-controlled continuous exercise on bicycle ergometer or treadmill for 20 minutes during the first 2 weeks, increasing to 30 and 40 minutes in week 3-4, respectively, plus 5-10 minutes warm-up and cool down. Training intensity was adjusted from 60% of peak oxygen uptake (VO_{2peak}) during week 1-2 to 70%/85% in week 3/4, respectively, using the heart rate response from the cardiopulmonary exercise test at baseline. VO_{2peak} increased significantly in both groups during the 4-week training period, from 12.5 $ml.kg^{-1}.min^{-1}$ to 15.8 in elderly patients and from 14.0 to 18.7 in middle-age, whereas there was no change in the control groups. These changes were accompanied by substantially improved quality of life in the training groups only, measured by the Minnesota living with heart failure questionnaire (MLHFQ).

Similar results from a randomized controlled clinical trial in Moscow are published elsewhere in the current issue of the European Journal of Preventive Cardiology (p. xx-yy). Doletsky and colleagues found an increase in VO_{2peak} from 13.6 $ml.kg^{-1}.min^{-1}$ to 15.9 after a 3-week exercise training program in mostly male heart failure patients (mean age 61, NYHA class II-III), and a further increase to 17.4 at 3-months follow-up, whereas there was no change in the control group. The improvements were paralleled by better MLHFQ quality of life, reduced left ventricular volumes, and higher ejection fraction. Participants started exercising 5 days per week on a bicycle ergometer within the first 2 weeks after hospitalization for heart failure. Sessions comprised 3 minutes warm-up and a period of interval training alternating between 20 seconds at approximately 70% of maximal heart rate (50% of maximal load) and 40 seconds pedaling at 10 W, followed by 2 minutes recovery. Duration of the interval training varied according to baseline fitness; 10 minutes for

patients with VO_{2peak} <10 ml.kg^{-1}.min^{-1}, and 15/20 minutes for patients with at 10-14/ >14 ml.kg^{-1}.min^{-1}, respectively. In addition, exercise time was increased by up to 5-10 minutes on the basis of individual tolerance. Patients in the control group received physical activity recommendations at discharge from hospital.

These studies suggest that an early start of exercise training is feasible and may give a flying start to patients' rehabilitation after worsening of heart failure. The large improvement in quality of life is encouraging and would probably boost the motivation for sustaining regular exercise and other life-style changes beyond the short-term supervised training period. A caveat is that the marked contrast to the control group could partly result from general factors, such as the extra attention, time and encouragement from professional helpers most days of the week.

Whether the large increments in cardiorespiratory fitness (VO_{2peak}) translate into fewer hospital admissions for decompensation and lower mortality remains to be seen. Even though the frequency of serious adverse events per week were similar as in the SMARTEX-HF study[5], the number of patients and the observation time were too small for statistical evaluation. To date, the only clinical trial with sufficient power to detect reduced number of clinical events was the HF-ACTION study with 2331patients[6].

As emphasized by the authors, the study participants were a selection of the healthiest patients without serious comorbidities and other handicaps, and – just like in most randomized clinical trials – those most willing and able to participate. Further studies are needed to determine whether an early start may be a useful tool to increase the uptake to exercise training programs, and whether it can improve adherence in everyday life when the structured program is over. A major challenge in cardiac rehabilitation is helping those who need it most to implement and maintain lifestyle changes over time. As detailed in *The ESC Handbook of preventive Cardiology*[7], working on the motivation to overcome potential barriers may enforce our efforts to reach these goals.

References

1. Karmali KN, Davies P, Taylor F, Beswick A, Martin N, Ebrahim S. Promoting patient uptake and adherence in cardiac rehabilitation. Cochrane Database of Systematic Reviews 2014, Issue 6. Art. No.: CD007131. doi: 10.1002/14651858.CD007131.pub3.

2. Piepoli MF, Conraads V, Corrà U, Dickstein K, Francis DP, Jaarsma T, McMurray J, Pieske B, Piotrowicz, E, Scmid JP, Anker SD, Solal AC, Filippatos GS, Hoes AW, Gielen S, Gianuzzi P, Ponikowski

PP. Exercise training in heart failure: from theory to practice. A consensus document of the Heart Failure Association and the European Association for Cardiovascular Prevention and Rehabilitation. *Eur J Heart Fail* 2011; **13**:347-357.

3. Rengo JL, Savage PD, Barrett T, Ades PA. Cardiac rehabilitation participation rates and outcomes for patients with heart failure. J Cardiopulm Rehabil Prev 2017 Jun 30. doi: 10.1097/HCR.0000000000000252 (Epub ahead of print).

4. Acanfora D, Scicchitano P, Casucci G, Lanzillo B, Capuano N, Furgi G, Acanfora C, Longobardi M, Incalzi RA, Piscosquito G, Cicerone MM. Exercise training effects on elderly and patients with chronic heart failure after acute decompensation: A randomized, controlled trial. *Int JCardiol* 2016; **225**:313-323.

5. Ellingsen Ø, Halle M, Conraads V, Støylen A, Dalen H, Delagardelle C, Larsen AI, Hole T, Mezzani A, Van Creaenebroeck EM, Videm V, Beckers P, Christle JW, Winzer E, Mangner N, Woitek F, Höllriegel R, Pressler A, Monk-Hanssen T, Snoer M, Feiereisen P, Valborgland T, Kjekshus J, Hambrecht R, Gielens S, Karlsen T, Prescott E, Linke A and Group SHFS. High-Intensity Interval Training in Patients With Heart Failure With Reduced Ejection Fraction. *Circulation*. 2017; **135**:839-849.

6. O'Connor CM, Whellan DJ, Lee KL, Keteyian SJ, Cooper LS, Ellis SJ, Leifer ES, Kraus WE, Kitzman DW, Blumenthal JA, Rendall DS, Miller NH, Fleg JL, Schulman KA, McKelvie RS, Zannad F and Pina IL. Efficacy and safety of exercise training in patients with chronic heart failure: HF-ACTION randomized controlled trial. *JAMA*. 2009; **301**:1439-1450.

7. "Behavioural strategies to support and sustain lifestyle change." Chapter 8 in*: The ESC Handbook of Preventive Cardiology. Putting Prevention into Practice*, page 35-42. Editors: Jennings C, Graham I, Gielen S. Oxford University Press, Oxford 2016.