High-intensity interval training in patients with an implantable cardioverter defibrillator: a randomized controlled study

M. Nyman1, O.C. Mjolstad1, A.C. Dale1, B. Amundsen1, O. Rossvoll1, U. Wisloff2, J.P. Loennechen1

1St Olavs Hospital, Clinic of Cardiology, Trondheim, Norway
2Norwegian University of Science and Technology, Department of Circulation and Medical Imaging, Trondheim, Norway

Funding Acknowledgements: Type of funding sources: Public grant(s) – National budget only. Main funding source(s): 1) The Joint Research Committee between St. Olavs hospital and the Faculty of Medicine and Health Sciences, NTNU (FFU), 2) The Liaison Committee for education, research and innovation in Central Norway

Background: Exercise is an effective treatment in a broad spectrum of cardiovascular diseases. High-intensity interval training (HIIT) has shown superior effect on cardiorespiratory fitness and equal or superior effect on morbidity and quality of life (QoL) compared to moderate continuous exercise training. However, evidence of the efficacy and risks of HIIT in patients with increased risk of ventricular arrhythmia remains limited.

Purpose: To evaluate the effects of HIIT on exercise capacity, QoL and burden of ventricular arrhythmias in patients with an implantable cardioverter defibrillator (ICD) with or without cardiac resynchronization therapy.

Methods: Patients with ischemic or dilated cardiomyopathy and ICD were randomized to a supervised 12-week HIIT program or to a control group continuing their usual exercise routines. HIIT consisted of four 4-minute intervals aiming at 85-95% of maximum heart rate (HRmax), and 3-minute active recovery aiming at 60-70 % of HRmax in between intervals, 3 times a week for 12 weeks. Primary outcomes were exercise capacity measured as peak oxygen uptake (VO2 peak) and QoL assessed with the Short Form 36 (SF-36) questionnaire. Main secondary outcome was the burden of ventricular arrhythmias analysed from remote patient monitoring data.

Results: Fifty-six patients were included (table 1). Three patients in the HIIT group did not complete the intervention. Two withdrew due to a knee injury and due to fear of SARS-CoV-2 exposure, respectively. One experienced an appropriate shock during exercise and was excluded from further training after clinical consideration. Fifty-three patients completed all follow-up examinations. HIIT significantly increased VO2 peak with 7.0 %, with no changes in the control group (p = 0.001) (figure 1A). There was a significant increase in the SF-36 subscale scores on physical functioning (p < 0.05), general health (p < 0.05) and health change (p = 0.001) in the HIIT group compared to the control group (figure 1B). There were no significant differences between groups in number of non-sustained or sustained ventricular tachycardias, anti-tachycardia pacing therapy or ICD shocks.

Conclusions: In patients with ICD due to ischemic or dilated cardiomyopathy, a supervised 12-week HIIT-program significantly increased VO2 peak and QoL without increasing the burden of ventricular arrhythmias.
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<th>Table 1: Baseline patient characteristics</th>
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Figure 1: Peak oxygen uptake and QoL

A) Peak oxygen uptake (VO2 peak) in control group and high-intensity interval training (HIIT) group at baseline and follow-up.
B) Changes in Short Form 36 (SF-36) subscale scores from baseline to follow-up in control group and HIIT group.
Values are mean, 95% confidence interval.