Case Report

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Aspects of Using High Technology in Physical Rehabilitation of Patients with Severe Heart Failure

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Abbreviations: CPET: Cardiopulmonary Exercising Test; EF: Left Ventricle Ejection Fraction; ET: Electrophysiological Therapy; HFrEF: Heart Failure with Reduced Ejection Fraction; ICD: Implantable Cardioverter Defibrillator; MRV: Maximum Required Values; NYHA: New York Heart Association; ODT: Optimal Drug Therapy; PR: Physical Rehabilitation; VO2 peak: Peak Oxygen Uptake

ABSTRACT

Rationale: Heart failure with reduced ejection fraction (HFrEF) is usually characterized by low levels of VO2 peak. Optimal drug therapy, cardiac devices and physical rehabilitation can improve both left ventricle ejection fraction (EF) and levels of VO2 peak. We describe an unusual case of significant discrepancy between VO2 peak and EF dynamics in severe heart failure patient on optimal drug therapy, after long term cardiac device therapy (Optimizer Smart IVs) and physical rehabilitation.

Patient Concern: In this report, a 58-year-old male with HFrEF after long term cardiac device therapy (Optimizer Smart IVs) and physical rehabilitation significantly improving VO2 peak.

Diagnosis: The patient was diagnosed with coronary artery disease, repeated myocardial infarctions and HFrEF.

Interventions: The patient underwent long term cardiac device therapy (Optimizer Smart IVs) and physical rehabilitation based on lactate threshold achievement during cardiopulmonary exercising test.

Outcomes: The patient had significant improvement in VO2 peak level, but EF did not change.

Conclusion: The difference between VO2peak and EF dynamics may be a result of skeletal muscles oxygen uptake improvement after aerobic physical rehabilitation.

Keywords: Heart Failure; Physical Rehabilitation; Optimizer Smart IVs; VO2peak; CPET

Introduction

Heart failure with reduced ejection fraction (HFrEF) is usually characterized by low levels of VO2 peak and a poor prognosis despite optimal drug therapy and cardiac device therapy [1,2]. Physical Rehabilitation (PR) is an important part of severe HFrEF treatment [1-6]. Long term PR based on lactate threshold achievement during Cardiopulmonary Exercising Test (CPET) in stable HFrEF patients can improve NYHA functional class and VO2 peak [3], while EF in some cases can show no significant dynamics. Response to PR is unique in each individual and based on gender, age, skeletal muscle condition [3].

Case Report

Informed consent for publication was obtained from the patient. A 58-year-old male with a long history of coronary artery disease, acute myocardial infarction, episode of ventricular fibrillation

requiring ICD was referred to our outpatient department. Despite optimal myocardial revascularization, drug therapy and cardiac device therapy (Optimizer Smart IVs implantation), decrease in left ventricle Ejection Fraction (EF) and heart failure II functional class (NYHA) persisted. Patient was included in PR program based on lactate threshold achievement during Cardiopulmonary Exercising Test (CPET). Training efficiency was assessed on the basis of VO2 peak and EF dynamics every 6 months. CPET was performed on a treadmill (Oxycon Pro (Jaeger, Germany), EchoCG apparatus Vivid S6 (GE, USA). Before PR program EF in was 31%, VO2peak was 18.4 ml / kg / min, 55% of the maximum required values (MRV), NYHA functional class II. After 6 months of training EF did not change - 31%, VO2peak increased to 21.2 ml / kg / min (87% of the MRV), NYHA functional class I. After a year of physical rehabilitation EF showed no significant increase (32%), while VO2peak increased up to 32.1 ml / kg / min (102% of the MRV), NYHA functional class I.

Discussion

Physical Rehabilitation (PR) is an important part of treating stable heart failure regardless of its cause or EF levels. Physical training helps to improve clinical state, quality of life, exercise tolerance, EF and VO2peak levels [2-5]. It is well known that EF and VO2peak both have significant prognostic value in heart failure patients [1,2]. Usually, we observe the positive impact of training in both EF and VO2peak levels [2-7]. In some cases, there is not such relationship. We did not find publications about this problem, it needs more study to understand it. We can explain VO2peak significant improvement by working skeletal muscles contribution to oxygen consumption during exercising and CPEC performing and aerobic phenotype of the patient.

Conclusion

a) Aerobic training, selected on lactate threshold achievement during CPET, was effective in VO2 peak levels improvement

b) An increase in VO2peak levels is prognostically favorable and may indicate an increase in myocardial function and skeletal muscle metabolism.

c) The difference between EF and VO2peak dynamics may be result of skeletal muscles contribution to VO2peak and the aerobic phenotype of the patient.

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Competing Interest

The authors declare that they have no competing interests.

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