Comparison between Standard Training Exercise and Interval Training Exercise as a Novel Protocol for Cardiac Rehabilitation Program in Ischemic Heart Disease Patients

Thesis

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By

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Aliaa Mohamed Abdelhalem

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Abb.	Full term
ACEI	*Angiotensin converting enzyme (ACE) inhibitors*
ACS	*Acute coronary syndrome*
AMI	*Acute myocardial infarction*
BMI	*Body mass index*
BMS	*Bare metal stent*
BP	*Blood pressure*
CABG	*Coronary artery bypass grafting*
CAD	*Coronary artery disease*
CCS	*Canadian Cardiovascular Society*
COPD	*Chronic obstructive pulmonary disease*
CPX	*Cardiopulmonary exercise*
CR	*Cardiac rehabilitation*
CRT	*Cardiac Resynchronization Therapy*
CVD	*Cardio-vascular disease*
DBP	*Diastolic blood pressure*
DES	*Drug –eluting stent*
DM	*Diabetes mellitus*
ECG	*Electrocardiography*
EMP	*Endothelial microparticles*
FC	*Functional capacity*
FMD	*Flow-mediated dilatation*
FPG	*Fasting plasma glucose*
HBA1C	*Glycated hemoglobin*
HF	*Heart failure*
HIIT	*High intensity interval training*
HMG Co-A	*3-hydroxy-3-methylglutaryl-coenzyme A*
HOCM	*Hypertrophic cardiomyopathy*
HHR	*Heart rate reserve*

List of Abbreviations (Cont...)

Abb.	Full term
HR	*Heart rate*
HRQOL	*Health-related quality of life*
ICD	*Implantable Cardioverter Defibrillator*
IHD	*Ischemic heart disease*
INT	*Intervention*
LAD	*Left anterior descending*
LCX	*Left circumflex*
LDL	*Low density lipoprotein*
LVEF	*Left ventricular ejection fraction*
METs	*Metabolic equivalent*
MICE	*Moderate intensity cardiac exercise*
MICT	*Moderate intensity continuous training*
MLWHF	*Minnesota Living with Heart Failure*
NO	*Nitric oxide*
NYHA	*New York Heart Association*
PA	*Physical activity*
PCI	*Percutaneous Coronary Intervention*
PVCs	*Pre mature ventricular tachycardia*
QOL	*Quality of life*
RCA	*Right coronary artery*
RPE	*Rating of perceived exertion*
SBP	*Systolic blood pressure*
SP	*Secondary prevention*
SPECT	*Single-photon emission computed tomography*
STEMI	*ST-segment elevations myocardial infarction*
TIMI	*'Thrombolysis in Myocardial Infarction'*
UC	*Usual care*
VT	*Ventricular tachycardia*
WHO	*World Health Organisation*

Abstract

Objective

To assess high intensity interval training program for cardiac rehabilitation after PCI and to compare its effect on the functional capacity and quality of life with standard exercise cardiac rehabilitation program

Study design

Prospective cohort study including 40 patients with ischemic heart disease who attended the outpatient CR cardiac rehabilitation program in Ain Shams University Hospital divided into two equal groups (20 patients each): Group (A) included the patients who did regular cardiac rehabilitation program, group (B) joined the high intensity interval training exercise program. Several clinical, analytical and echocardiographic parameters were evaluated at the beginning and at the end of the program after three months, including the results of a treadmill exercise test.

Results

Both groups showed dramatic improvement in all items of comparison; especially functional capacity and quality of life as assessed by exercise test and QOL questionnaire. There was no significant difference between the two groups in improvement except in group B who did High Intensity Interval Training in the QOL especially the emotional well-being. Also, the lipid profile showed marked improvement in the two groups in the form of increasing HDL and reducing LDL, cholesterol and triglycerides.

Conclusion

Cardiac rehabilitation programs had positive effects; decreasing morbidity and sense of disability especially after major events (myocardial infarction), improving functional capacity and psychological level by increasing self-confidence and emotional well-being, and improving clinical, analytical and echocardiographic parameters. Standard exercise cardiac rehabilitation (moderate intensity cardiac training) was non-inferior to the novel high intensity cardiac training

INTRODUCTION

Worldwide, ischemic heart disease (IHD) is the single most frequent cause of death. Over seven million people every year die from IHD, accounting for 12.8% of all deaths ***(Karamfiloff et al., 2015).***

Every sixth man and every seventh woman in Europe will die from myocardial infarction. The incidence of hospital admissions for acute myocardial infarction (AMI) with ST-segment elevations (STEMI) varies among countries Exercise therapy has long been used for rehabilitation purposes following STEMI and the benefit of regular physical exercise in stable IHD patients is also well established. It can reduce the anxiety associated with the life-threatening illness and improve patient self-confidence. Four mechanisms are considered to be important mediators of a reduced cardiac event rate: (i) improvement of endothelial function; (ii) reduced progression of coronary lesions; (iii) reduced thrombogenic risk and (iv) improved collateralization. In a large meta-analysis, exercise training as part of coronary rehabilitation programs was associated with a 26% reduction in cardiac mortality rate in patients with IHD ***(Taylor et al., 2004).***

It should be appreciated that, apart from its influence on mortality, exercise rehabilitation can have other beneficial effects. Exercise capacity, cardiorespiratory fitness, and perception of well-being have also been reported to improve, at

least during the actual training period, even in elderly patients. Thirty minutes of moderate intensity aerobic exercise at least five times per week is recommended ***(Perk et al., 2012).***

Each step of increase in peak exercise capacity is associated with a reduction in all-cause mortality risk in the range of 8–14% ***(Myers et al., 2002).***

Cardiac rehabilitation CR is a complex intervention offered to patients diagnosed with heart disease, which includes components of health education, advice on cardiovascular risk reduction, physical activity and stress management. Evidence that cardiac rehabilitation reduces mortality, morbidity, and unplanned hospital admissions in addition to improvements in exercise capacity, quality of life and psychological well-being is increasing, and it is now recommended in international guidelines ***(Perk et al., 2012).***

Cardiac rehabilitation and secondary prevention services are comprehensive, long term programs involving medical evaluation, prescribed exercise, cardiac risk factor modification, education, and counseling. These programs are designed to limit the physiological and psychological effects of cardiac illness, reduce the risk for sudden death or re-infarction, control cardiac symptoms, stabilize or reverse the atherosclerotic process, and enhance the psychosocial and vocational status of selected patients. Although exercise training is a core component, current practice guidelines

consistently recommend "comprehensive rehabilitation" programs that should include other components to optimize cardiovascular risk reduction, foster healthy behaviours and compliance to these behaviours, reduce disability, and promote an active lifestyle ***(Balady et al., 2007).***

Aim of the Work

To assess high intensity interval training program for cardiac rehabilitation after PCI and to compare its effect on the functional capacity and quality of life with standard exercise cardiac rehabilitation program.

Chapter 1

ISCHEMIA

Introduction:

Ischaemic Heart Disease is defined as 'myocardial impairment due to an imbalance between coronary blood flow and myocardial requirements caused by changes in the coronary circulation' ***(Antithrombotic Trialists' Collaboration, 2009).***

In most of the developed world, cardiovascular disease is the leading cause of death, with around 30% of annual worldwide deaths resulting from these conditions. Of these, approximately 44% are directly due to IHD. Whilst cardiovascular diseases have traditionally been considered as diseases of the 'developed' world, the prevalence of these conditions is decreasing in developed countries due to improvements in prevention, diagnosis and treatment, and changes in lifestyle such as the reduction in smoking rates. In contrast, due to increasing rates of urbanisation and adoption of 'western' culture, the prevalence of cardiovascular disease in developing countries is rapidly increasing ***(Fuster et al., 2011).***

It is expected that over 80% of the future increase in worldwide mortality rates for heart disease will be in third world and developing countries, with prevalence rates in developed countries falling or remaining static ***(Fuster et al., 2011).***

The clinical manifestations of IHD can be divided into four syndromes:

- Myocardial infarction (MI), the most important form of IHD, in which the duration and severity of ischemia is sufficient to cause death of heart muscle.
- Angina pectoris, in which the ischemia is less severe and does not cause death of cardiac muscle.

Of the three variants—stable angina, Prinzmetal angina, and unstable angina—the latter is the most threatening as a frequent harbinger of MI.

- Chronic IHD with heart failure.
- Sudden cardiac death ***(O'Toole, 2008).***

Pathogenesis:

The dominant influence in the causation of the IHD syndromes is diminished coronary perfusion relative to myocardial demand, owing largely to a complex and dynamic interaction among fixed atherosclerotic narrowing of the epicardial coronary arteries, intraluminal thrombosis overlying adisrupted atherosclerotic plaque, platelet aggregation, and vasospasm ***(Schoen and Mitchell, 2015).***

More than 90% of patients with IHD have atherosclerosis of one or more of the coronary arteries.