شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

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جامعة عين شمس

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قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

HANAA ALY

INTRODUCTION

Cardiac rehabilitation is a medically supervised program designed to improve cardiovascular outcomes after MI, heart failure, angioplasty, or heart surgery. It is a complex intervention that involves a variety of therapies, including supervised exercise training, health education and risk factor modification, behavior change, social and psychological support ***(Mishra et al., 2009).***

Cardiac rehabilitation is a class I recommendation in most of the current guidelines of cardiovascular societies worldwide ***(Jolly et al., 2011).***

Heart rate recovery (HRR) is defined as the difference between HR at peak exercise and exactly 1 minute and 2 minutes into the recovery period. A HRR value < 12 beats/minute at 1-minute recovery phase or < 22 beats/minute at 2 minutes into the recovery phase is considered abnormal and is an important predictor of all-cause mortality and death associated with coronary artery disease ***(Jolly et al., 2011).***

Changes in the heart rate (HR) during exercise and recovery from exercise are mediated by the balance between sympathetic and vagal activity. An attenuated HRR after exercise is thought to be a marker of reduced parasympathetic activity ***(Jolly et al., 2011).***

Speckle tracking 2D echocardiography (STE) is a non-invasive imaging technique that permits assessment of global and regional myocardial function independently from both cardiac translational movements and beam angle ***(Geyer et al., 2010).***

STE can capture myocardial deformation in 3 dimensions: radial, circumferential, and longitudinal. Before this technique, only Magnetic Resonance Imaging (MRI) provided a valid analysis of deformities in the myocardium ***(Mondillo et al., 2011).***

Echocardiographic strain imaging provides a semi-quantitative measure of subtle LV systolic dysfunction ***(Buckberg et al., 2008).*** GLS is a sensitive and specific index in post-myocardial infarction ***(Goffinet et al., 2007).***

The technique is semi-automated, leaving fewer margins for human error. Inter-observer and especially intra-observer reproducibility of global strain is superior to ejection fraction (EF) as a measure of global LV systolic function ***(Xu et al., 2011).***

Speckle tracking allows for the assessment of both long-axis and short-axis mechanics. Therefore, the endpoint of interest may be tailored to the underlying abnormality. For example, the sub-endocardial region is more sensitive to ischemia and therefore longitudinal mechanics are the first to be impaired after an ischemic event and more suitable as an endpoint, whereas in advanced dilated physiology the recovery of circumferential strain might be a more appropriate endpoint ***(Geyer et al., 2010).***

AIM OF THE WORK

To study the correlation between heart rate recovery & global longitudinal strain in heart failure patients subjected to cardiac rehabilitation.

CARDIAC REHABILITATION

Cardiac rehabilitation (CR) is a multi-component and well-established model of care designed to mitigate the great burden of cardiovascular diseases (CVD) globally ***(Thomas et al., 2017).***

CR is defined as "the sum of activities required to influence favorably the underlying cause of the disease, as well as the best possible physical, mental and social conditions, so that they may, by their efforts preserve or resume when lost, as normal a place as possible in the community" ***(Grace et al., 2013).***

For instance, CR referral is recommended in clinical practice guidelines for CVD patients, based on robust meta-analytic evidence of approximately 20% reductions in CVD mortality and re-hospitalization attributed to CR participation ***(Long et al., 2019).***

Moreover, CR guidelines recommend a "multidisciplinary team", to ensure competent delivery of all the evidence-based elements of secondary prevention (e.g., tobacco cessation interventions, dietary counseling, and stress management) ***(Gómez-Gonzáleza et al., 2015).***

Cardiac rehabilitation consists of 3 phases ***(British Association for Cardiovascular Prevention and Rehabilitation in 2012).***

Phase I: Clinical phase

This phase begins in the inpatient setting soon after a cardiovascular event or completion of the intervention. It begins by assessing the patient's physical ability and motivation to tolerate rehabilitation. Therapists and nurses may start by guiding patients through non-strenuous exercises in the bed or at the bedside, focusing on a range of motion and limiting hospital deconditioning. The rehabilitation team may also focus on activities of daily living (ADLs) and educate the patient on avoiding excessive stress. Patients are encouraged to remain relatively rested until completion of treatment of comorbid conditions, or post-operative complications. The rehabilitation team assesses patient needs such as assistive devices, patient and family education, as well as discharge planning.

Phase II: Outpatient cardiac rehab

Once a patient is stable and cleared by cardiology, outpatient cardiac rehabilitation may begin. Phase II typically lasts three to six weeks though some may last up to up to twelve weeks. Initially, patients have an assessment with a focus on identifying limitations in physical function, restrictions of participation secondary to comorbidities, and limitations to activities. A more rigorous patient-centered therapy plan is designed, comprising three modalities: information/advice, tailored training program, and a relaxation program. The treatment phase intends to promote independence and lifestyle changes to prepare patients to return to their lives at home.

Phase III: Post-cardiac rehab. Maintenance

This phase involves more independence and self-monitoring. Phase III centers on increasing flexibility, strengthening, and aerobic conditioning.

Goal: facilitate long-term maintenance of lifestyle changes, monitoring risk factor changes, and secondary prevention.

Longitudinal training studies have demonstrated that supervised exercise performed over many years maintains functional capacity in patients with coronary artery disease or chronic heart failure. Ten years of moderate exercise training was found to additionally improve the quality of life in individuals with heart failure ***(Belardinelli et al., 2010).***

The main scientific societies for cardiac rehabilitation, including the AHA, AACVPR, EACPR, and CACR, strongly recommend that patients undergo a symptom-limited, ECG-monitored exercise stress test to identify any abnormal signs or symptoms present during exercise and determine any contraindications to higher exercise intensities, in addition to establishing peak exercise capacity to enable individualized exercise prescription ***(Fletcher et al., 2013).***

However, guidelines for countries in Australasia and the UK recommend such formal testing of exercise capacity only for high-risk patients or those undertaking a high-intensity exercise program, while low- to moderate-risk patients are instead assessed using submaximal tests, such as timed walk tests ***(Probert et al., 2015).***

Timed walk tests, which include the 6-minute walk and incremental walk tests, are not considered to be equivalent substitutes for traditional exercise testing, as the intensity of effort may be variable due to the self-pacing nature of the test, and outcomes correlate only modestly with VO2max ***(Fletcher et al., 2013).***

Both the 6-minute walk test and incremental shuttle walk test may also exhibit a ceiling effect in patients with high levels of physical performance, where stride length or maximal walking speed may limit their performance ***(Harrison et al., 2013).***

Although ECG monitoring of exercise training sessions is not associated with the rate of adverse events, its use is beneficial in detecting significant exercise-induced changes, monitoring patient compliance concerning heart rate, and increasing patient self confidence. However, the use of ECG monitoring does not eliminate the need for educating patients on self-monitoring techniques. The AACVPR has provided recommendations for the level of ECG monitoring based on the risk level of the patient and their progress through the program, commencing with continuous monitoring and decreasing to intermittent monitoring as appropriate ***(American Association of Cardiovascular and Pulmonary Rehabilitation, 2013).*** In contrast, the majority of other guidelines for cardiac rehabilitation recommend ECG monitoring only for high-risk patients or those in the early stages of their participation ***(Belardinelli et al., 2010).***

The first step in cardiac rehabilitation is an initial assessment, with subsequent assessments typically performed monthly. These assessments are completed by a team of professionals who evaluate a patient's symptoms, lifestyle habits (e.g., diet, exercise, and tobacco use), comorbidities, and other parameters ***(Centers for Medicare and Medicaid Services, 2010).***

The exercise training program is typically a 24 to 36 session supervised program lasting 12 weeks. The sessions are led by a trained nurse, physical therapist, exercise physiologist, or physician, and are typically conducted with the patient under continuous cardiac monitoring. Exercise training sessions occur one to three times per week, depending on a patient's functional capabilities, with the goal being 30 minutes of moderate aerobic exercise occurring five days per week ***(Thomas et al., 2007).***

During cardiac rehabilitation sessions, patients meet for intensive education about nutrition ***(Servey and Stephens, 2016).***

There is a high prevalence of depression among patients with CVD, and research has shown that depression increases the mortality risk in these patients ***(Stenman et al., 2014).***

Assuring appropriate immunizations is another component of cardiac rehabilitation. Specifically, the Advisory Council on Immunization Practices recommends annual influenza vaccination for patients with CVD ***(Centers for Disease Control and Prevention, 2013).***

The benefits of cardiac rehabilitation have been repeatedly demonstrated over the past three decades, and include a reduction in cardiovascular risk, enhanced emotional well-being, and improvement in several other outcomes ***(Servey and Stephens, 2016).***

In a study of more than 600,000 Medicare beneficiaries hospitalized for acute coronary syndromes, stable ischemic heart disease, or revascularization procedures, there was a reduction in mortality rates among patients attending cardiac rehabilitation programs vs. those not attending. Patients were compared based on the number of sessions attended (one to 24 sessions vs. 25 sessions or more). At one year and five years, the mortality rates were lower for those who attended 25 or more cardiac rehabilitation sessions (2.2% vs. 5.3% at one year, and 16.3% vs. 24.6% at five years). Additionally, among patients attending 25 or more sessions, subgroup analyses showed that women, nonwhites, and older adults had the greater benefit ***(Suaya et al., 2009).***

Another study further defined the inverse relationship between the number of sessions attended and mortality. Compared with patients who attended 12 to 24 sessions, patients who attended all 36 exercise training sessions had decreased risks of death (14% vs. 22%) and MI (12% vs. 23%) over the four-year study ***(Hammill et al., 2010).***

Another study found reductions in cardiac-specific and all-cause mortality rates among patients participating in cardiac rehabilitation after percutaneous coronary interventions ***(Goel et al., 2011).***

Cardiac rehabilitation has been shown to increase functional capacity as measured by exercise tolerance and peak oxygen consumption ***(Lavie and Milani, 2011).*** Other parameters that demonstrate improvement include weight loss, lipid control, and management of comorbidities ***(Blum et al., 2013).***

A recent Cochrane review of 63 studies demonstrated a reduction in hospital admissions and increases in overall quality of life with cardiac rehabilitation. Although it showed a reduction in overall mortality, as in previous studies, there was no reduction in MI or revascularization rates ***(Anderson et al., 2016; Bellmann et al., 2020).***

Despite cardiac rehabilitation cost it is more cost-effective than thrombolytic therapy, rehospitalization, coronary angiography or bypass surgery, and cholesterol lowering drugs, though less cost-effective than smoking cessation programs. Cardiac rehabilitation should stand alongside these therapies as standard of care in the post-MI setting ***(Fidan et al., 2007).***

The safety of cardiac rehabilitation exercise programs is well established, and the occurrence of major cardiovascular events during supervised exercise is extremely low ***(Aashish, 2011).***

Cardiac Rehabilitation and Heart Rate Recovery

The heart rate is predominantly regulated and determined by the autonomic nervous system function. As the heart rate is a significant indicator of myocardial oxygen demand, it is has been demonstrated that individuals with a resting heart rate of more than 90 beats per minute (bpm) have a threefold increased mortality risk compared to those with a rate lower than 60 bpm ***(Thayer and Lane, 2007).***

During exercise, the heart rate is increased due to the suppression of the parasympathetic tone and the stimulation of the sympathetic system, while after the termination of exercise, the autonomic changes that happen during exercise are reversed and this helps decrease the heart rate ***(Borresen and Lambert, 2008).***

Alongside the resting heart rate, heart rate recovery (HRR) defined as the average drop in the heart rate 1 minute after the termination of exercise is an appropriate indicator of the autonomic nervous balance ***(Borresen and Lambert, 2008).*** Impaired HRR due to autonomic imbalance is associated with a significant increase in all-cause mortality ***(Morshedi-Meibodi et al., 2002).***

Accordingly, HRR is a simple indicator of autonomic regulation and balance. Previous studies have shown that HRR