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Role of exercise and Cardiac Rehabilitation in CVD-A Review

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Abstract: *CHD is considered an important public health problem not only in the developed countries but also in developing countries like India. Prevalence of CHD in Indian adults has risen 4-fold over the last 40 years (to a present level of around 10%), that has doubled over the past 30 years (to a present level of around 4%). Within the spectrum of CHD, myocardial infarction (MI) is the leading cause of death. For those who survive an MI, the prevention of subsequent coronary events and the maintenance of physical functioning are the major challenges. Besides age, gender, genetics, family history which are the non-modifiable risk factors; smoking, hypertension, diabetes, hypercholesterolemia, obesity, sedentary lifestyle and faulty dietary habits are the modifiable risk factors which need to be controlled to prevent the occurrence and/or recurrence of CVD. Among all these, physical inactivity is considered an independent and a major risk factor for CVD making exercise an integral component of a comprehensive approach in the treatment of heart disease. Moreover, Cardiac rehabilitation (CR) / secondary prevention programs that include exercise along with dietary modification are recognized as integral to the comprehensive care of CVD patients and are recommended by the American Heart Association and the American College of Cardiology in the treatment of patients with CHD. Cardiac rehabilitation aims at returning the patient back to normal functioning in a safe and effective manner, and to enhance the psychosocial and vocational state of the patient. However, CR is still in its infant stage in India due to varied reasons including lack of awareness, financial reasons etc., and hence, needs to be popularized. In addition, it is also necessary to reinforce the health benefits of exercise for CVD patients, especially in the current scenario of highly prevalent co morbidities. Hence, this review on 'role of exercise and cardiac rehabilitation in CVD' emphasizes the health benefits of exercise in various metabolic diseases along while explaining the protocol of cardiac rehabilitation program in the prevention and management of CVD.*

Key words: *Cardiac rehabilitation, protocol, patients*

Introduction

World Health Organization has predicted that by A.D. 2020 up to three quarters of deaths in developing countries would result from non-communicable diseases and that coronary heart disease (CHD) will top the list of killers1. In India, NCDs account for 53 percent of deaths. Based on available evidence,

cardiovascular diseases (24%), chronic respiratory diseases (11%), cancer (6%) and diabetes (2%) are the leading causes of mortality in India (Sharma K.., 2013).

Globally, incidence of all types of circulatory diseases in 2011 was found to be about 11% (Asians-7.4%), of which 4.3% accounts for CAD (Asians- 6.3%), 18.7% for hypertension (Asians- 24.3%) followed by stroke with 2.7% (Asians-2.6%) (Vital and Health Statistics., 2011). The major risk factors for CVD include high levels of low-density lipoprotein (LDL) cholesterol, smoking, hypertension, diabetes, abdominal obesity, psychosocial factors, insufficient consumption of fruits and vegetables, excess consumption of alcohol, and lack of regular physical activity (Walden R, Tomlinson B., 2011). The risk factors of CVD are generally classified into non-modifiable, conditional and modifiable risk factors.

Non-modifiable risk factors include age, male gender, family history of premature coronary artery disease and low socioeconomic status that are not modifiable through intervention (Aryan Mooss and Neil f. Gordon, 2006). Where as conditional risk factors are those that are associated with an increased risk of coronary heart disease but whose causal link has not been proved with certainty. They include a group of novel or emerging risk factors including lipoprotein-a, homocysteine, coagulation factors like fibrinogen, C-reactive protein and plasminogen activator inhibitor-1. C-reactive protein levels, Cigarette smoking, hypertension, diabetes, elevated cholesterol or LDL, decreased levels of HDL and obesity are the modifiable risk factors (Wolf PA, Abbott RD, Kannel WB., 1991).

Physical inactivity is an independent and a major risk factor for CVD. A 51-countries survey showed that about 15% of men and 20% of women analyzed (most of which were developing countries) were at the risk for chronic diseases due to physical inactivity that was observed to be high in older age groups; and lower in rural as compared to urban areas (Regina Guthold et.al., 2008).

Also, in another study, it was found that physical inactivity was associated with the components of metabolic syndrome and CAD in the urban south-Indian population which concluded that the lifestyle changes focusing on increasing physical activity could help to prevent the exploding epidemic of metabolic syndrome and CAD in India (V. Mohan et.al., 2007). Thus, today, exercise remains an integral component of a comprehensive approach to treating heart disease- an approach that also includes psychosocial/vocational counseling, medical surveillance/ emergency support, and aggressive coronary risk factor modification (Kannel WB., 1961).

Sedentary Lifestyle And CVD.:

Sedentary lifestyle is a type of a lifestyle with no or irregular physical activity. In recent years, sedentary lifestyle has become increasingly common in many developed and developing countries, and with it, the incidence of metabolic syndrome, diabetes, and CVD has also risen. Increasing urbanization, higher level of mechanization at work, societal changes into more motorized transportation, use of physical activity-limiting devices (cars, escalators, and elevators), and the widespread availability of appliances that promote sedentary behaviour such as the

television and computers (Claes Held et.al., 2011).

Physical Activity Vs Exercise

Physical activity can be defined as "bodily movement produced by skeletal muscle that requires energy expenditure and promotes health benefits."

Exercise can be defined as "planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness." Over the years research has shown that an increase in leisure time physical activity, as well as structured exercise training, play an important role in reducing CHD mortality (Leon AS., 1997). To promote and maintain health, ACSM/AHA guidelines advise that all healthy adults aged 18 to 65 years need moderate-intensity aerobic physical activity for a minimum of 30mins on five days each week.

All post-surgery patients benefit from in-patient exercise intervention, risk factor assessment, lifestyle activity and dietary counseling, and patient and family education (Dr. Aashish S Contractor, 2011). The physical conditioning achieved by regular aerobic exercise decreases the heart rate and blood pressure at rest at any given level of exercise. Consequently, the workload on the heart is reduced and anginal symptoms may be alleviated. Regular exercise also improves muscle function and increases the cardiac patient's ability to take in and use oxygen. This is commonly referred to as the maximal oxygen consumption or aerobic capacity. As the body's ability to transport and deliver oxygen improves, the patient has added energy and less fatigue. This benefit is important for patients with heart disease whose aerobic fitness is typically less than that of healthy adults of similar age. Moreover, the greatest improvements often occur among the most unfit (Barry A. Franklin et.al., 2010).

Impact of exercise on cardiovascular system: Improvement of the balance between myocardial oxygen supply and demand at a given submaximal exercise intensity.

1. Decreased platelet aggregation and enhanced fibrinolysis.
2. Reduced susceptibility to malignant ventricular arrhythmias.
3. Beneficial effect on other coronary artery disease risk factors.

Regarding the beneficial effect on other coronary artery disease risk factors, regular physical activity has been shown to lower resting systolic and diastolic pressure, reduce serum triglyceride levels, increase serum HDL cholesterol levels, and enhance glucose tolerance and insulin sensitivity. However, despite this evidence, millions of people remain sedentary. Indeed, the number of individuals who are inactive is substantially greater than the number who smokes cigarettes, has hypercholesterolemia, or has hypertension.

Thus, the overall effect of stimulating individuals to lead a more physically active lifestyle could lower coronary artery disease rates more than reducing any other single risk factor (Wolf PA. et.al., 1991). Interventions of potential benefit include behavior modification, biofeedback, meditation, yoga and exercise, and when indicated, pharmacotherapy (Pasternak RC, 1996 & Ray WS, 2006).

A properly prescribed and monitored exercise program safely improves a cardiac patient's functional capacity. Clinical symptoms (e.g. ECG abnormalities) often improve or disappear (Dr. Aashish S Contractor, 2011).

Type and duration of exercise: Both endurance and strength training can elicit substantial increases in physical fitness. Endurance training induces greater improvements in aerobic capacity and associated cardiopulmonary and metabolic variables and more effectively modifies CHD risk factors. Resistance training enhances muscular strength, endurance, and muscle mass to a greater extent (David Jenkins, 2011).

While most of the studies have focused on endurance training, the benefits of resistance training for reducing blood pressure and improving cardiovascular health have been recognized in recent years. A recent position paper of the AHA endorsed by the ACSM recommends mild to moderate resistance for improving muscular strength and endurance, preventing and managing a variety of chronic medical conditions, modifying coronary risk factors, and enhancing physiological well-being (Williams MA.et.al., 2007).

Combining resistance training and aerobic training yields more pronounced physiologic adaptations (improved aerobic capacity, muscle strength and lean body mass) in patients with coronary artery disease than aerobic training alone.

The importance of understanding the physiological, genetic and clinical bases of diseases caused by physical inactivity has been undervalued largely by the research community. Exercise is viewed solely as a research or diagnostic tool and not as a true weapon against chronic disease. In reality, however, exercise attacks the roots of chronic disease, i.e. physical inactivity. In fact, the first step in a common "battle plan" is to convince the medical community that chronic disease is rooted in physical inactivity (Pollock ML et al., 2000).

The most consistent benefits appear to occur when exercise training is performed at least three times a week for 12 or more week's duration. Exercising more frequently may elicit even greater improvements; however, if the program is discontinued, the benefits are lost within weeks (Barry A. Franklin, 2010).

The exercise program should prescribe the appropriate mode, frequency, intensity, and duration of exercise, which should be tailored to the individual's cardiovascular and general medical status (David Jenkins, 2011).

However, certain contraindications need to be followed while prescribing resistance training to cardiac patients (William M., 2010).

Conditions during which resistance exercise should be avoided include the following:

1. Unstable angina
2. Uncontrolled arrhythmias
3. Left ventricular outflow obstruction (e.g. hypertrophic Cardiomyopathy with obstruction)
4. Recent history of CHF without follow-up and treatment
5. Severe valvular disease, hypertension
6. Poor left ventricular function and exercise capacity below 5 METS with angina symptoms or ischemic S-T segment depression

The therapeutic benefits of exercise in certain metabolic conditions such as

hypertension, hyperlipidaemias and diabetes further contribute to prevention of cardiac risk.

Exercise And Hypertension

Aerobic exercise training reduces systolic and diastolic blood pressure decreases by 6 to 10mm Hg in previously sedentary individuals regardless of age. Beneficial results occur with normotensive and hypertensive people during rest and exercise. Regular exercise as preventive therapy also controls the tendency for blood pressure to increase over time in individuals at risk for hypertension. Patients with mild hypertension respond favorably to exercise training. In fact, hypertension medication may be reduced by progressively increasing exercise intensity.

The precise mechanism(s) of how regular physical activity lowers the blood pressure remains unclear but two contributing factors include the following:

1. Reduced sympathetic nervous system activity with training and possible normalization of arteriole morphology decrease peripheral resistance to blood flow to lower blood pressure.
2. Altered renal function facilitates the kidneys' elimination of sodium, which subsequently reduces fluid volume and hence blood pressure.

Not all the research supports physical activity as a way to treat hypertension. Even when research shows that regular physical activity lowers blood pressure, the studies often have methodological shortcomings and inadequate design, particularly a lack of appropriate control subjects who have their blood pressure measured but do not exercise. Despite these limitations, it remains prudent to recommend regular aerobic exercise (and proper diet to induce weight loss when necessary) as a first line strategy to manage borderline hypertension (Piepoli MF., 2005).

A meta-analysis of 9 randomized controlled exercise trials of 245 subjects found decreases of approximately 7 ± 5 and 6 ± 2 mm Hg for resting SBP and DBP respectively, in the treatment groups (Kelly G et.al., 1994). Another review summarized 47 studies concerned with endurance training in individuals with hypertension. More than 70% of the groups in these studies decreased resting blood pressure with exercise training by an average of 10.5/8.6 mm Hg from an initial level of 154/98 mmHg. This review concluded that beneficial blood pressure responses associated with exercise are significantly more prevalent than negative or equivocal responses (Hagberg JM., 1995).

Exercise And Diabetes Mellitus

Exercise is an accepted adjunctive therapy in management of diabetes. One of the earliest indications of the effectiveness of exercise was the decreased sweetness of urine recorded in 600 B.C. by the Indian physician Shushruta. Exercise appears to be beneficial in controlling blood glucose in especially type-2 diabetes (non-insulin dependent diabetes mellitus) (Piepoli MF., 2005). Regular exercise improves daily blood glucose control and, therefore causes a decrease in glycosylated hemoglobin. It also improves insulin sensitivity and may be responsible for increased insulin receptor affinity (Barbara NC, 2006).

Decreases in systolic and diastolic blood pressure have been reported in mild to

moderate hypertension and may be associated with effects of lowered insulin levels on renal sodium retention (Denoria JT, Heishman M, et al., 1987). An important effect of regular exercise for type-2 diabetes is weight loss in conjunction with dietary intervention and preservation of lean tissue (Horton ES., 1991).
Recent studies show that regular physical activity, even non-vigorous activity, is associated with a lowered risk of insulin resistance and type-2 diabetes (Lampman RM et al. 1987, Hu FB et.al., 1999, Pan X et.al., 1997 & Torjensen PA, 1997). Recent research also indicates that resistance exercise may be beneficial for patients with diabetes (Mayer-Davis EJ, 1998 & Rice B et.al., 1999).

The effect of circuit training on long-term glycemic control in a group of moderately obese, sedentary elderly subjects with type-2 diabetes was evaluated. After 3 months of an individualized progressive resistance program of moderate intensity and high volume performed twice a week, there was a significant improvement in HbA1c (Eriksson J et.al., 1997).

Exercise And Dyslipidemics

The primary effects of exercise on lipoproteins are decreased triglycerides and increased HDL. 45mins of aerobic exercise on 4 or more days per week substantially lowers the triglycerides. Simultaneous weight loss may induce a greater increase in HDL (Eriksson J et.al., 1997, Wood PD et.al., 1991 & Wood PD et.al., 1998).

A recent study of 190 dyslipidemics randomized to control, isocaloric diet (about 23% fat), exercise (1500-2000 kcal/week), or combined groups showed a significant 14% decrease in LDL-C in the combined group compared to no change in the control and exercise groups, and a 7% decrease in the diet group Schaefer EJ et.al., 1995).

A meta-analysis of randomized controlled trials including only women participants (women aged ≥ 18yrs), using a random effects model, showed the significant reductions of approximately 2%, 3% and 5% for total cholesterol, LDL-C and triglycerides, and an increase of 3% in HDL-C; thus concluding that the aerobic exercise is efficacious for increasing HDL-C and decreasing total cholesterol, LDL-C and triglycerides (Stefanick ML et.al., 1998).

Exercise for Psycho-Social Rehabilitation: Psychological factors are strong risk factors for CHD and adversely affect recovery after major CHD events. After an MI, some of the common psychological reactions that patients may experience are: low moods, tearfulness, sleep disturbance, irritability, anxiety, acute awareness of minor somatic sensations or pains, poor concentration and memory. Cardiac patients who exercise often report increased self-confidence, especially in performing physical tasks; an improved sense of well-being; and, less depression, stress, anxiety and social isolation (Kelly GA et.al., 2004). It has been found that only small improvements in exercise capacity may produce profound improvements in depression and depression-related mortality (Milani R et.al., 2007, Lavie CJ et.al., 2009 & Lichtman JH et.al., 2008).

Cardiac rehabilitation program:

The term cardiac rehabilitation refers to coordinated, multifaceted interventions

designed to optimize a cardiac patient's physical, psychological, and social functioning, in addition to stabilizing, slowing, or even reversing the progression of the underlying atherosclerotic processes, thereby reducing morbidity and mortality (Ades PA, 2001 & Leon AS et.al., 2005). Prevention is presented as the most effective and efficient primary care intervention, whereas cardiac rehabilitation programs are considered the most effective of secondary prevention interventions; however, these are underused(Cano de la Cuerda R et al,2012).

Cardiac rehabilitation, aims at returning the patient back to normal functioning in a safe and effective manner and to enhance the psychosocial and vocational state of the patient. Cardiac rehabilitation / secondary prevention programs are recognized as integral to the comprehensive care of patients with coronary heart disease (CHD), and as such are recommended as useful and effective (Class I) by the American Heart Association and the American College of Cardiology in the treatment of patients with CHD (Balady G et.al., 2007).

The program involves education, exercise, risk factor modification and counseling. The cardiac rehabilitation program is recommended (apart from primary prevention) for individuals who have experienced any one or more of the following conditions: -

- Heart attack
- Bypass surgery
- Angioplasty (balloon/stent)
- Angiography showing blockage
- Angina pectoris
- Heart valve surgery
- Heart transplant surgery

A comprehensive cardiac rehabilitation program focuses on improving longevity and quality of life, in addition to risk factor modification. It aims at returning the patient back to normal functioning in a safe and effective manner and to enhance the psychosocial and vocational state of the patient (Ades PA, 2001 & Leon AS et.al., 2005).

Since, hospital stay for MI has dramatically decreased over time, reducing the opportunity for in-hospital risk factor interventions, outpatient cardiac rehabilitation programs have gradually broadened their scope to become an important avenue for secondary prevention (Donald M. Lloyd-Jones et.al., 2010).

American Heart Association has put up the guidelines for risk stratification to categorize the patients for subsequent rehabilitation. Patients differ greatly in symptoms, functional capacities and rehabilitation strategies. The rehabilitation program incorporates stringent guidelines to promote low-risk treatment.

Five important aspects of a successful cardiac rehabilitation program include-

1. Appropriate patient selection
2. Concurrent medical, surgical and pharmacological therapies
3. Comprehensive patient education
4. Appropriate exercise prescription
5. Careful patient monitoring during reha

- Congestive heart failure
- Myocardial infarction
- Pacemaker
- Congenital heart disease
- Arrhythmias
- Rheumatic heart disease

Safety

Use of evaluate rehabilit optimize minimiz

Risk stratification helps identify patients who are at increased risk for exercise-related cardiovascular events and who may require more intensive cardiac monitoring in addition to the medical supervision provided for all cardiac rehabilitation program participants (Leon AS et.al., 2005).

Supervised Versus Home Programs

Although medically supervised group exercise programs are associated with increased cost and extended travel time, such programs are recommended for patients with major cardiac impairment or adverse signs or symptoms (i.e., those at increased risk for future cardiovascular events). Furthermore, supervised programs facilitate patient education in regard to lifestyle changes for coronary risk reduction, provide variety and recreational opportunities, and offer staff reassurance and the potential for enhanced adherence, safety, and surveillance. Medically-directed home exercise rehabilitation represents a viable alternative, however, because of its lesser cost, increased accessibility, convenience, and potential to promote risk factor modification, independence and self-responsibility. For stable coronary patients, home-based exercise rehabilitation and supervised group programs have shown comparable safety and efficacy (Barry A. Franklin, 2010).

Exercise In Cardiac Rehabilitation Program Protocol For CVD Patients

A meta-analysis based on a review of 48 randomized trials that compared outcomes of exercise-based rehabilitation with usual medical care, showed a reduction of 20% in total mortality and 26% in cardiac mortality rates, with exercise-based rehabilitation compared with usual medical care (Balady G et.al., 2007). After diagnosis and intervention (coronary artery bypass surgery, angioplasty, etc.), the cardiac patient is evaluated by the exercise physiologist for functional capacity and ensuing classification and rehabilitation. Type of exercise plays an important role in the outcome of CR program. Both aerobic and strength training are recommended for a period of 30 minutes of moderate intensity activity for 5 times a week or 20 minutes of strenuous activity for 3 times a day maximum benefit to derive maximum benefit.

The cardiac rehabilitation program consists of the lifestyle modification which includes dietary modifications, medications and exercise under strict medical supervision. It is a teamwork consisting of a cardiologist, dietitian and an exercise trainer (William M et.al., 2010). Rehabilitation involves a multidisciplinary team that focuses on education, individually tailored exercise, risk-factor modification and the optimization of functional status and mental health (Dafoe W, 1997). Cardiac rehabilitation program consists of 4 phases as described below (Fardy et.al., 1996).

PHASE-I

It is an in-patient program and a strictly monitored phase (ECG monitored by telemetry machine). This begins when the patient is admitted to the hospital and ends on discharge, which is usually 7 to 10 days. The goals of inpatient rehabilitation are to assist the patient in becoming ambulatory; to prepare the patient and family to cope with the psychological and emotional stress that accompanies a coronary event; and to educate the patient about coronary risk factor modification. The program begins

as soon as the first day post-surgery or myocardial infarction. Small activities like self-care movements (arms and legs range of motion, intermittent sitting and standing to maintain the cardiovascular reflexes) are started. Gradually, walking should be started, for example, 2-5mins thrice a day which could be eventually increased till 5-10mins thrice a day (Enas EA et.al., 2008).

PHASE-II

It is an out-patient program and it needs to be strictly monitored (Fardy et.al., 1996). The outpatient program can be started once the patient has left hospital and has clearance from the physician. Depending on the patient's clinical condition, and the severity of the MI, the outpatient program, is typically started two to four weeks after the event[4]. After the discharge from the hospital, the patient is asked to continue the same walking activity at home. This phase continues at least till 2 months post-surgery. Cardiac rehabilitation centre should be joined after 2 weeks post-surgery (or as soon as the sutures are removed).

Table 2. Exercise program protocol using FITT principle (Fardy et.al., 1996).

Frequency	Thrice a week
Intensity	50-60% HRmax For beta-blocker users- RPE = 9 (light)
Type/Mode	Different modes- treadmill, cycle. Cross-trainer can be started after 7th session.
Time	15-20mins at the beginning (gradually increased to 30-45mins depending on an individual's rate of adaptation and comfort zone)

At this stage, the patient is not totally fit. All the vital parameters like blood pressure, heart-rate, blood-sugar for diabetics, ECG by telemetry) are checked periodically. Patients may also be introduced to Yoga meditation techniques.

PHASE-III

It is also an out-patient program and it need not be strictly monitored. This phase continues till at least 6 months post-surgery. It is a combination of progress and maintenance phase.

Aims

- To further increase exercise tolerance.
- To maintain or improve confidence.
- To provide support and encouragement.
- To help decrease risk factors and thereby decrease recurrence.

Brisk walking on treadmill and speed modulation for cycling can be started.

Very light weight-training can be started simultaneously using simple elastic bands (like biceps curls, shoulder flexion, calf raises, etc.). Avoid chest or abdominal exercises till 2 and half months (for sternum which was cut during surgery).

PHASE-IV

It is an out-patient program and it need not be monitored. It can be community-based or individual-based program. Patients are given guidelines and they can work-out independently if not in the

cardiac centre. Dietary guidelines are checked, and if necessary, modified regularly. But it is the Gym's responsibility to allow the cardiac patients to join the regular gym without any monitoring only after 4 months post-surgery.

Special Considerations

A. For CVD Patients With Hypertension

Few points have to be considered while planning an exercise regimen for CVD patients with hypertension.

Pre-Hypertension Stage-

Routine exercise program can be prescribed.

Track of blood pressure should be kept per 2 weeks.

Hypertension Stage-I-

If it is known case that is on medications, normal exercise program can be prescribed. If the case is just known/detected and is on no medications, then caution has to be taken. First step is to ask the client to visit a physician. Then, accordingly, the exercise program should be prepared:

1. Aerobic exercises: (To reduce systolic blood pressure)
   Any mode and frequency can be given, intensity can be low to moderate (60-70% HRmax or if on beta-blockers, RPE=11-13).
   Pre- and post-blood pressure is to be checked regularly.
2. Resistance exercises:
   Very light intensity with high number of repetitions can be given. When the condition improves with the aerobic training, resistance workload can be gradually increased.

Hypertension Stage-II-

Very light aerobic exercises can be done (50-60% HRmax or RPE=7-9).

Resistance work-outs are not to be allowed.

Very strict diet should be maintained .

For CVD Patients With Diabetes

Extra care has to be taken while planning an exercise program for diabetics with CVD history.

Impaired zone-

Aerobic exercises of moderate intensity can be given

Regular resistance exercises can be given where diabetes is controlled.

Diabetic patients-

Diabetics with medications and FBS<100mg/dl should never exercise in the fasting state as they can go into hypoglycemic stage.

Exercise should not be allowed when the random blood sugar of the patient is <100mg/dl or >300mg/dl.

Moderate intensity aerobic and resistance exercises can be performed.

Instructions and concerns-

- Always eat before exercising to increase the blood sugar levels.
- Always carry some food like biscuits, fruits, chocolates to gym.
- Avoid high-impact exercises.
- Always keep a foot-check.
- Use appropriate footwears.
- Avoid exercising late at night.
- Avoid taking the insulin injections in the working muscle(s) sites (as insulin activity increases with exercise and if insulin is introduced in the working muscle site, activity may further get elevated resulting in hypoglycaemia).
- Timings of insulin injections should not be changed and followed strictly as per the prescription. The exercise timings should be accordingly decided.

B. For CVD Patients With Dyslipidemia

Lifestyle modifications are to be made to normalise the cholesterol. These include dietary modification (to reduce exogenous cholesterol intake), exercise (to increase HDL-C levels) and appropriate medications (to reduce cholesterol levels and prevent blockages).With the known cases, lipid profile is advised to be done every 3 months.

Table 3. Exercise program for CVD patients with dyslipidemia (Fardy et.al., 1996).

Frequency	3-5 days a week
Intensity	60-75% HRmax
Mode	Any mode
Time	30-45mins per session

Need For Evaluation Of Program Effectiveness

Evaluating program effectiveness in improving patient outcomes is an important program function.

The primary goals and possible improvement in the patient from the rehabilitation program have to be decided after reviewing the patient's medical history.

Program effectiveness can be evaluated through an internal review of outcomes data by examining the changes observed between pre- and post-treatment and by comparing the outcomes with a predetermined goal (Dafoe et.al., 1997). Generally, the primary pre-determined goals which should be focussed are as follows (Sanderson et.al., 2004):

1. To improve the quality of life (QOL) of the participant as assessed by SF-36 questionnaire (or any other assessment of QOL questionnaires) - more than 10% improvement.
2. To improve the lipid profile, specifically to get the LDL-C < 100mg/dl (participant should comply to the program for at least 3 months).
3. To improve the blood pressure of the participants who are hypertensives i.e. to maintain it below 130/85 mmHg (participant should comply to the program for at least 3 months).
4. To have a high smoking cessation rate of more than 50% in current smokers over a period of 3 months.
5. To achieve a reduction of 2cms or more in the waist circumference within 3 months in those participants whose waist circumference is more than 100cms in males or more than 90cms in females while joining the program.
6. To improve the exercise capacity as assessed by the test performed pre-joining the program i.e. 6 min walk test or Bruce protocol (more than 10% improvement in the test distance or time respectively).
7. To achieve a rating of 3 or 4 point scale on the overall experience of the patients in the rehabilitation (through feedback forms).

It provides information that helps programs evaluate how effective the treatment activities were for a group of patients in reaching goals for secondary prevention and health.

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