DR. J.MALEKI'S CARDIOVASCULAR RESEARCH CENTER

SURJICAL & MEDICAL SPORT CLINIC

The Effects of Programmed Exercise Trainings on Patients Admitted To Our Center for Treatment with Dilated Cardiomyopathy during 2002 & 2008

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The Role of Programmed Training Exercises in the Management & Treatment of Dilated Cardiomyopathy

ABSTRACT:

Background:

Cardiomyopathy is a heart muscle disorder [2-3]. It is categorized into 3 types[4], based on Anatomical and Physiological in the forms of Dilated[6], Hypertrophic[11] and Restrictive. These diseases are considered to be primary disorders of the Myocardium and not secondary to acquired or congenital heart disease. The causes of Cardiomyopathy are varied and not fully understood[5]. The current procedures under investigation include genetic factors in Hypertrophic (CMP) 9 different Sarcomas Genes[5] (ß heavy chain of MYH 7 Myosin, Myosin Binding Protein C3 (MBPC3) Metabolic Disturbances (Homochromatosis, Amyloidosis), Hormones Imbalances, Anemia, Drug Abuse (Cocaine), and Alcohol, Calcium Overload, Altered Vascular Reactivity, Hypoxia, Free/Radicals, Infections and immune dysfunction. We had 6 Patients with Cardiomyopathy, 4 due to Coronary Artery Disease, One Diabetic (CMP) or Extrinsic (CMP) and one Post Partum (CMP) with Significant Dysfunction of left Ventricular End Systolic (LVESV) and left Ventricular End Diastolic Volume (LVEDV).

METHODS:

A study was conducted on Cardiac Performance and function by Impedance Cardio graphic (Cardio Screen), Echocardiography, VO_2 Max, Wireless Stress Tests and Angiography in 6 Patients, 3 Females aged 50±14 and 3 Males aged 70±15 Referred to Our Clinic from March 2002 to Feb. 2008. With (Ref) Resting Ejection Fraction 25±5, (STR) Systolic Time Ratio > %60 ±12, Cardiac Output (CO) 4±1 lit./min, Stroke Volume (SV) 45±10 ml/beat, Systemic Vascular Resistance (SVR) 1700± 500 dyn.s.cm^3, VO_2 max 25±8, 2 Normal Coronary Angiography and 4 showed 3 Vessel CAD.

CMP = CARDIOMYOPATHY

RESULTS:

Consistent exercise 3 days a week and the loss of 300-500kcal/day[14-17-18-20-21-26-27], totaling 1500-2000 kcal/week indicated a significant improvement in Cardiac Performance[8-14-26-27] induced at the end of the training period between 3 ~ 12 months duration. Not significant changes occurred in EF, CO, and SV within the female patients[17]. The parameters in men's were somehow interesting, indicating reduction in STR and SVR and elevated VO2 max up to %35±5, VO2 max increasing to 45±5, CO, SV, EF also increased, and STR declined in males where as SVR showed declined in both groups. Accelerated Cardiac Index (ACI) and Velocity Index (VI) increased in both groups[20-21-29-30-31].

CONCLUSION:

Our results had confirmed that consistent regular exercises could have a desirable improvement on Cardiac Performance in Dilated Cardiomyopathy by Collateralization due to CAD[21-26-31]. Improvement in Body Mass Index (BMI)[8], Diabetes, Hypertension, and Changes in diets, Psychotic problems could however be overcome in these cases. Improvement in all muscle**,** cardiac muscle due to telomere regulating protein, telomere reverse transcriptase gene expression profile, telomere repeat binding factor, insulin like growth factor I , increased in glucose transfrase 4 protein, myocyte inhancing factor II , increased in calcium binding protein, calcineurins(caveolin, calmodulin, caveola, muco protein complex shelterin) happened.

INTRODUCTION:

Cardiomyopathy is[1-2] a disorder that long been recognized to cause a significant disability in persons affected. Hippocrates described it as "Dropsy" for the way affected patients acted. Literally translated, Cardiomyopathy means a disorder of the Heart Muscle. It has been classified by the world health organization into 3 types based on anatomical and physiological features as[7] Dilated, Hypertrophic[11], and Restrictive. These disorders are considered to be those of primary sorts of myocardium and are not necessarily a secondary to acquired or congenital heart disorders. The possible causes of Cardiomyopathy are varied, therefore not fully understood. Current mechanisms under investigation include Genetic Factors, Metabolic Disturbances, Hormones Imbalances, Toxins, Calcium Overload, Altered Vascular Reactivity, Hypoxia, Infections, and Immune Dysfunction. The common mechanical pathology is impaired pump mechanics.

$$\text{(STR) SYSTOLIC TIME RATIO} = \frac{\text{(PEP) PRE EJECTION PERIOD}}{\text{(LVET) LEFT VENTRICULAR EJECTION TIME}}$$

PEP = OPENING OF THE AORTIC VALVE.
LVET = OPENING AND CLOSING OF AORTIC VALVE.
PEP, LVET MEANS PRELOAD.

DILATED CARDIOMYOPATHY[2-3-4-23]:

Dilated Cardiomyopathy is the most common category, estimated to affect 10 persons in 100,000 per year. It is characterized by impaired systolic function of both ventricles along with myocardial fiber hypertrophy in some cases. This impairment in contractility has been the most commonly associated with infections from Coxsackie B viruses. Although this has seen with other viruses such as Influenza, Mumps, Rubella, Cytomegalovirus, Epstein-burr virus, and Adenovirus. Infection with one of these viruses causes Myocarditis and is the precipitating factor in Cardiomyopathy development for many individuals. Other causes for Dilated Cardiomyopathy include Toxins such as Alcohol, Chemotherapeutic Agents, and Illicit Catecholamine drugs. It is also found in some genetic disorders, primarily of metabolism or neuromuscular diseases, such as progressive muscular dystrophy.
The dilated Cardio Myopathy associated with Alcoholism is rather unique in its dose-response relationship. It is generally accepted that Alcohol consumption of at least 5 Ounces per day for 5 years is indispensible for any individuals to develop the disorder.

However, alcoholics with Cirrhosis rarely exhibit Cardiomyopathy. It also appears that other precipitating factors are necessary, such as a Viral Infection[5]. This type of Cardiomyopathy also has been found to be reversible after a few months of abstention in over half of affected persons. For those who do not stop consuming alcohol, the expected lifespan is less than 3 years.

Dilated Cardiomyopathy has also been attributed to diabetes mellitus and Hyperthyroidism in some individuals Diabetics appears to increase the accumulation of collagen, cholesterol, and triglycerides in the myocardium, affecting contractile function, while chronic stimulation from thyroid hormone appears to over stimulate the muscle.

It has been estimated that 1000 US women will be affected with dilated Cardiomyopathy in the Peripartum[7] period. This has been diagnosed as left ventricular dysfunction that manifests in the last month of pregnancy or within 5 months of delivery. It is more common in older, multiparous women and those carrying twins. This type of Cardiomyopathy has not been associated with any viral infection, but appears to have an autoimmune component. Fortunately over half of the affected women have spontaneous resolution of symptoms within 6 months; however the remaining women had as much as 83% mortality within 5 years. There is also evidence that resolution of symptoms does not imply total recovery of cardiac function or exercise tolerance. These women should be counseled regarding the risks of future pregnancies as recurrence is common.

The major Pathophysiology of Dilated Cardiomyopathy due[5-11] to any cause is a loss of elastic recoil of the ventricles. This overstretched muscle is then placed at a mechanical disadvantage for contraction due to the altered length-tension relationship of the muscle fibers. The main consequence of the altered mechanics is a decline in Ejection Fraction. The heart attempts to compensate in early stages

through increasing Pulse Rate, but as the condition worsens, symptoms of low cardiac output become evident.

METHODS:

Persons with any of the Cardiomyopathies most often present to their physicians with symptoms of low Cardiac Output and Congestion. These symptoms include a gradual declining of tolerance towards activities and exercise. Although in dormant persons this may not be present until significant loss of Cardiac Function has occurred. Patients also complain of Orthopnea, nocturnal cough, Dyspnea on exertion, and possibly dependent edema. Diagnosis is made using chest x-ray to determine Cardiomegaly, echocardiography to determine ventricle size, and measurements of cardiac function, such as ejection fraction. Since Cardiomyopathy is a dysfunction that exists in the absence of other causes, it is important to rule out coronary artery disease and infection as a cause of symptoms. Although the mechanisms of Cardiomyopathy vary with the category, a specific etiology can be identified in less than 20% of patients. Therefore, the treatment has been directed to managing the common symptoms of chronic heart failure[18-20].

Prognosis of the patient depends on the severity of the symptoms and the degree of cardiac output impairment. Patients with very low ejection fractions have the poorest prognosis. Treatment alternative include medications and surgery, including transplantation for those with refractory dysfunction.

METHODS OF MEDICAL TREATMENT IN CARDIOMYOPATHY:

Diuretics[12-13-15] are commonly used to decrease the congestion in the lungs and periphery, particularly when combined with a salt restricted diet. Vasodilators have been used to decrease after load, particularly for those patients with severe systolic dysfunction. The most promising of these vasodilators are the Angiotensin Converting Enzyme (ACE) inhibitors. These drugs appear to aid in remodeling of dilated heart through their influence on growth factors in the myocardium and have been proven to improve survival.

Beta blockers β also are commonly used in conjunction with ACE inhibitors. These drugs used together, appear to dramatically improve the ability of the myocardium to remodel towards a more normal length-tension relationship and improve systolic function. Other [12-13]medications such as Antiarrhythmic agents and Inotropes have been used to improve symptoms. Digitalis is currently used with much caution in this population due to the risks of toxicity and multiple drug interactions. There have been conflicting studies regarding the ability of digitalis to improve exercise performance and it has been recommended only for those patients with more severe dysfunction. Inotropic agents, such as Dobutamine, are commonly used for symptomatic relief for patients with severe symptoms, although it is considered a short term effect. One interesting use of this medication has been to identify areas of hibernating myocardium that can predict functional capacity after exercise training. Since these patients had decreased cardiac pumping efficiency, they are prone to

Thromboembolism. Therefore, it is recommended that anticoagulation therapy be instituted. Some patients who demonstrate electrocardiographic abnormalities may also need pacemakers or implanted defibrillators. Recently Hilfiker – Kleiner, Marianc Limacher (MD) reported recovery from Cardiomyopathy in 2 patients (post partum) CMP by blocking Prolactine release with Bromocriptine[13-15].
(Dopamin Agonist Bromocriptine) 2008, Massachusetts Medical Society.

In the treatment of our patients, these drugs were administered more or less according to their conditions. However, more CA channels blockers – β blockers, Inotrops were used with much cautions and Angiotensin Converting Enzyme Inhibitors ACEI. All these drugs were used in our series of treatment of patients specifically in the emergency situations.

RESULTS OF EXERCISE IN CARDIOMYOPATHY:

Table1 shows the effects of exercise training in our patients[8-14-17-18-20-21-23].
For many patients the presence of CMP symptoms declined as their physical capacity increased thus had an immense impact on patients' returning to normal lifestyle. Therefore consistent physical exercises ought to be and is currently recommended as part of a comprehensive approach to CMP disorders. However, looking into the literatures on the subject in the past 5 years, it yielded only 5 study cases related to Cardiomyopathy and rehabilitation worldwide. Therefore research regarding the effects of exercise in patients with CMP is surely lacking and is long overdue. One the most important concept in our research into the effects of concurrent and well programmed exercises is presented here below; the trial was conducted over 3 months 3 times per week intervals, each session 60 to 80 minutes at a time.

1. The results indicated no significant changes in CO, EF, and SV in female group as compared with males. However considerable positive changes occurred in VO2 max, Wireless Stress Test, Pulmonary Function studies, Psychotic behavior, BMI, Diabetes and Hypertensions after 3 months. STR decreased in males, ACI and VI increased in both males and females. Where as SVR declined in both groups. Patients have been found to have abnormalities of other systems that affecting the exercise. Blood circulations in lower extremities (Legs) flow decrease while legs' vascular resistance increases during exercise countering the normal mechanisms. We did not have any abnormality in skeletal muscle in our series trial, but persons with CMP have also demonstrated abnormalities like atrophy of type 1 fibers, metabolic abnormalities, decreased aerobic enzyme levels and altered ultra structural make up. Respiratory muscle training is important, this training has been shown to decrease symptoms of dyspnea and improve exercise capacity.

2. Pulmonary function[22-25-26-27-29] study has demonstrated low pulmonary performance, specific low vital capacity, and low Force Expiratory Volume in one second (FEV1). This dysfunction seen during exercise has been demonstrated to last for more than 24 hours following the exercise cessation. However, some patients have been shown to improve filling pressures with exercise training in our study. All 6 patients' subjects with dilated CMP demonstrated a pattern of abnormal ventricular relaxation was seen to improve the most with an 8 weeks exercise program.

Table 1- Results of Regular Exercise on 6 Patients with Dilated Cardiomyopathy Between March 2002-2008 Admitted in Our Clinic.

Gender	Cause	Age	CO[1] (LIT)		SV[2] (ML)		%EF[3]		SVR[4] (DYN.S.CM.5)		% STR[5]		ACI[6] (1/100/S^2)		VI[7] (ML/SEC)		%VO_2 Max[8]	
			B[9]	A[10]	B	A	B	A	B	A	B	A	B	A	B	A	B	A
Female	Diabetes	38	3.5	3.9	35	41	15	30	1778	1220	59	53	0.77	0.91	32	60	%10	%40
Female	Post Partum	36	3.5	4.2	48	48	20	35	1711	1226	57	56	0.54	0.110	36	70	%15	%45
Female	CAD	52	4	4.2	50	60	20	40	1808	1451	52	48	0.40	0.75	38	50	%15	%45
Male	CAD	52	3.5	5	50	80	20	60	2235	1444	65	50	0.49	0.78	36	47	%10	%50
Male	CAD	70	3	5.5	60	75	25	60	1995	1334	75	40	0.50	0.80	34	46	%25	%50
Male	CAD	60	3.8	6.2	55	90	30	60	1886	1297	60	34	0.55	0.80	38	75	%20	%50

1. CO = Cardiac Output
2. SV = Stroke Volume
3. EF = Ejection Fraction
4. SVR = Systemic Vascular Resistance $= K \dfrac{MAP - CVP}{CO}$
5. STR = Systolic Time Ratio $= \dfrac{\text{Pre Ejection Period}}{\text{Left Ventricular Ejection Time}}$
6. ACI = Accelerated Cardiac Index
7. VI = Velocity Index.
8. VO_2 max = Volume of Maximum O_2 Uptake in 12 minutes.
9. B = Before
10. A = After

Conclusion

In our series of treatment without Surgical Intervention our patients achieved positive and desirable results. However Cardiomyopathy is a complex disorder which is not fully understood, affecting many people each year. It is categorised into 3 kinds, Dilated, Hypertrophic and Restrictive based on the Pathophysiology and Anatomical changes indications. Patients with Cardiomyopathy can benefit from well Programmed Exercise Intervention to improve their function ability and quality of life. However there is a need for more research to quantify optimal exercise mode, intensity, duration, and frequency. Innovative surgical procedures such as minimal intrusion for the management of Cardiomyopathy show promises for improving the quality of life for these disorders, but more study is needed in this area.

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