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ORIGINAL ARTICLE

Effect of Respiratory Muscles Training on Cardiopulmonary Parameters and Quality of Life in Patients with Dilated Cardiomyopathy

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ABSTRACT

Objective: To determine effects of respiratory muscles training on cardiopulmonary parameters and quality of life in patients with dilated cardiomyopathy.

Methodology: This Randomized Control Trial was conducted in Shifa International Hospital Islamabad from September 30, 2019 to December 31, 2019 and 22 patients with Dilated Cardiomyopathy were screened. Subjects were divided into 2 groups by sealed envelope sampling method. Bruce protocol according to ACSM guidelines (3 days per week, starting at shorter duration 5-20 min and progress to 30-40 min) was applied in Group 1. Bruce protocol same as in group 1 combined with Incentive spirometry (10-15 repetitions) and slow breathing technique was applied in Group 2. Tools and Outcome measures of study were EF, LV End systolic dimension, LV End diastolic dimension, QOL, PFT (FEV1, FVC, PEF and FEV1/FVC) and Vitals. Data was analyzed on SPSS version 21.

Results: All patients in both groups were male with mean age of 51.65±6.5. Group 2 had improvement in LV End systolic dimension (pre training- 53.73+10.57, Post Training- 52.00+11.84), LV End diastolic dimension (pre training- 56.45+13.21, Post Training-55.45+14.08) as compared to Group 1 with LV End Systolic dimension (pre training- 52.00+6.89, Post Training-51.56+6.71), LV End Diastolic dimension (pre training- 60.00+6, Post Training-60.00+6.000).

Conclusion: Respiratory muscles training by using bruce protocol combined with slow breathing and Incentive spirometry has significant effects on cardiopulmonary parameters and QOL in patients with dilated cardiomyopathy.

Keywords: Congestive heart failure, dilated cardiomyopathy, Bruce protocol, Incentive spirometry, slow breathing exercise.

INTRODUCTION

Cardiomyopathy is the disease of unknown cause in which heart ability to pump blood is decreased because the heart main pumping chamber, the left ventricle become enlarged and weak. (1) Cardiomyopathies are classified into primary and secondary. Primary is mixed (genetic and non-genetic) and secondary is due to systemic disease like amyloidosis, hemochromatosis or sarcoidosis infiltrative diseases and Hunter disease. (2) International Society Federation of Cardiology categories Cardiomyopathy into dilated cardiomyopathy, restrictive cardiomyopathy, hypertrophic cardiomyopathy, and arrhythmogenic right ventricular cardiomyopathy and unclassified cardiomyopathy.

Dilated Cardiomyopathy is disease of heart muscles characterized by left ventricular dilation and systolic dysfunction and is the most common reason of heart failure and primary source of heart replacement globally.(3) Although it is found most often in middle aged people and more in men than women.(4) Dilated cardiomyopathy most common sign and symptoms are ankle swelling, dyspnea, fatigue, jugular venous pressure elevated , pulmonary rales and these symptoms due to reduced cardiac function with low output and elevated intra cardiac pressure other sign symptoms cheat pain due to reduced coronary blood flow, palpitation, syncope and sudden cardiac death (SCD).(5) The first presentation of these patients is specially with DCM is often characterized by reduced exercise tolerance with fatigue and dyspnea, contributing to poor prognosis and quality of life (QOL). Previous studies have advised that respiratory muscle weakness is a part of the underlying cause for exercise intolerance in patients with heart failure with reduced ejection fraction.(6) Chronic heart failure patients have limited capacity to exercise and greater impairment in breathing function than those in mild to moderate disease.(7) Diagnosis of the cardiomyopathy starts with history, physical examination, Family history, Electrocardiogram (ECG), Exercise stress test, Cardiac Catheterization, Chest X-ray, CT or MRI scan, Biopsy, Echocardiography, Spirometry. Different management are used for Dilate Cardiomyopathy pharmacological and non-pharmacological management but specific treatment is not available for dilated cardiomyopathy, therefore the management focus to reduce clinically sign and symptoms and control of disease progression and complication like sudden cardiac arrest. (8) DCM prognosis is poor and risk stratification and mortality rate is very high.

Survival records in person in 12 months mortality of 25 to 30% and 50% survival at five years.[9]

Some research have defined that the coronaries dilate during exercise. This dilatation encompasses the discharge of vasoactive substances from the endothelium because of increased coronary heart oxygen consumption. During exercising oxygen demand increase and coronary vasodilation permits for improved oxygen delivery that is vital to coronary heart perfusion so stopping ischemia. (10) Exercise enhancements increase skeletal muscle blood flow and lower peripheral resistance to an increase in systolic blood pressure (SBP). Diastolic blood pressure (DBP) can remain unchanged, slightly increase or barely lower. [11]

Slow breathing treatment is safe and induces favorable effect in cardiopulmonary parameters. Deeper and slow breathing involved the use of diaphragm that is useful during slow breathing and does not increased respiratory workload.[12] Slow breathing have good effect on the function of the cardiovascular system ,increase blood saturation ,improve respiratory exchange in the lungs, increase exercise tolerance by decreasing the sensation of breathlessness and decrease excessive sympathetic modulation ,suppresses steady state sympathetic nerve activity and activating baroreceptor sensitivity reflecting parasympathetic modulation.[9] Incentive spirometry increase respiratory muscles strength and keeping lungs healthy and improve lungs function .This device help to retrain your lungs and increase lungs capacity and improves respiratory muscles strength .[14]

		FITT Recommendation for Individuals with Heart failure	
Frequency	3-5days-Wk-1	1-2 nonconsecutive days-wk-1	.>2-3days-Wk-1with daily being most effective
Intensity	If heart rate data available from a recent GXT,set intensity between 60% and 80% of HRR.In the absent of data from a GXT or if atrial fibrillation is present use RPE of 11-14 on a 6-20 scale	Being at 40% 1-RM for upper body and 50% 1-RM for lower body exercise. Gradually increase to 70% 1-RM over several weeks to months	Stretch to the point of Feeling tightness or slight discomfort
Time	Progressively increasing to 30min d-1and then up to 60min.d-1	2 sets of 10-15 repetitions focusing on major muscle groups	10-30s hold for static stretching; 2-4 repetitions of each exercise
Type	Treadmill, Free walking and stationary cycling	Machines may be best due to loss of strength and balance	Static, dynamic or PNF stretching

(13)

There was limited research available to compare effectiveness of Bruce exercise protocol combined with incentive spirometery and slow breathing techniques on a patient of dilated cardiomyopathy. The rationale of this study was therefore to find effects of spirometery and slow breathing techniques for respiratory muscle training and to improve quality of life of patients with dilated cardiomyopathy.

METHODOLOGY

This Randomized Control Trial was conducted in Shifa International Hospital Islamabad from September 30, 2019 to December 31, 2019 and screened 22 patients with Dilated Cardiomyopathy. Subjects were divided into 2 groups by sealed envelope method. 11 subjects in Control Group (Group1) and 11 in Experimental Group (Group 2). Diagnosed cases of DCM, New York Heart Association class (II), clinically stable patients for at least 3 months , EF (25 - 40%) and, both males and females aged 30- 60 years were included in this study. Whereas patients with myocardial infarction, exercise induced angina and Syncope, atrioventricular valve disease, selected for heart transplant, uncontrolled hypertension, uncontrolled diabetes, significant pulmonary disease were excluded from this study. Tools and Outcomes of study were EF, LV End systolic dimension, LV End dystolic dimension, QoL PFT (FEV1, FVC, PEF and FEV1/FVC) and Vitals. Data was analyzed on SPSS version 21.

RESULTS

All patients in both groups were male and overall mean and standard deviation of age in both groups were 51.65±6.5 and in Group1 was 50.56±7.020 and Group2 was 51.65±6.556.

Table 1: Demographic Data

VARIABLE	Group1 Mean+ SD	Group2 Mean+ SD
Age (years)	50.56+7.02	52.55+6.34

Table 2: Pre and Post Training values of cardiopulmonary parameters

Variable	Group 1 Mean + SD	Group 2 Mean + SD	P-value
Pre Training LV End Systolic	52 + 6.89	53.73+10.57	.679
Post Training LV End Systolic	51.56+6.71+	52.00+11.84	.921
Pre LV End Diastolic	60.00+6	56.45+13.21	.468
Post LV End Diastolic	60.00+6.000	55.45+14.08	.371

At the end of the training protocol experimental group showed significant improvement in cardiopulmonary parameters PEF, FEV1/ Global Distress Index QOL, Physical symptoms Index QOL and EF in patients with DCM. In Group 1, pre training Mean and SD of LV End Systolic was 52.00+6.89 and LV End Diastolic was 60.00+6 whereas post training Mean and SD of LV End Systolic was 51.56+6.71 and LV End Diastolic was 60.00+6.000. On the other hand in Group 2 pre training Mean and SD of LV End Systolic was 53.73+10.57 and LV End Diastolic was

56.45+13.21 whereas post training Mean and SD of LV End Systolic was 52.00+11.84 and LV End Diastolic was 55.45+14.08.

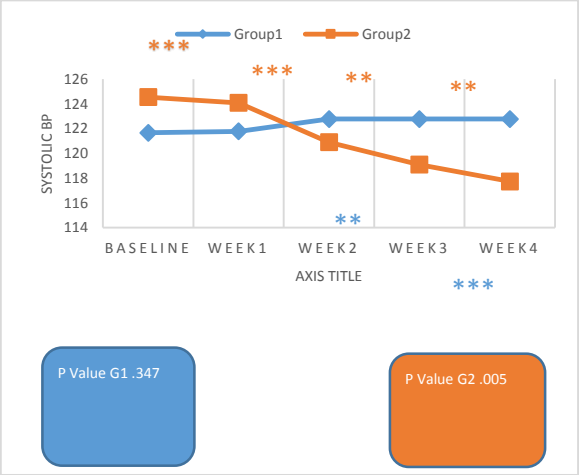

Figure1: Systolic BP from baseline to week 4 (G1 CONTROL and G2 EXPERIMANTAL,<0.05 *,<0.01**and <0.001 ***):

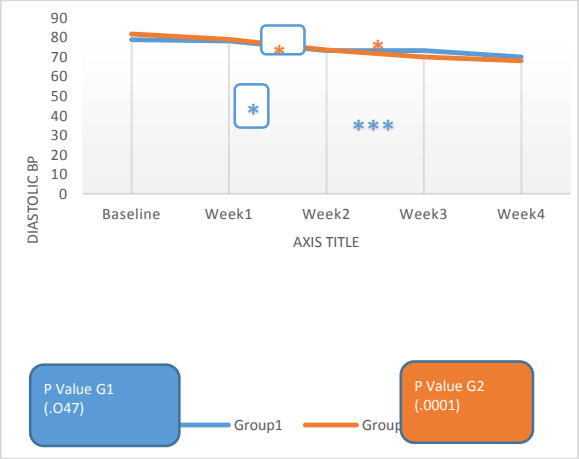

Figure 2: Diastolic BP from baseline to 4th week (G1 CONTROL and G2 EXPERIMANTAL,<0.05 *,<0.01**and <0.001 ***):

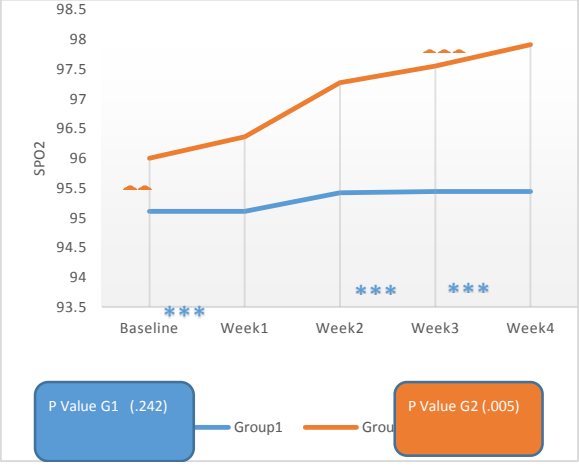

Figure 3: Spo2 from Baseline to 4th week(G1 CONTROL and G2 EXPERIMANTAL,<0.05 *,<0.01**and <0.001 ***)

There was significant difference in the effects of respiratory training on cardiopulmonary parameters between two groups.

DISCUSSION

Previous study showed that Bruce protocol did not specifically address any issue in patients with CHF. (15) Literature suggest that the effectiveness of slow breathing exercise training in patients with heart failure improving oxygen saturation, cardiorespiratory capacity, functional performance, and breathlessness highlight the important role of breathing frequency in HF patients.

While this study shows significant improvement in respiratory parameters by using combine effect of slow breathing exercise and modified bruse in patients with DCM. Moreover, in this study slow breathing exercise significantly reduced BP in patients with severe HFrEF that is beyond improvements in oxygen saturation, functional performance levels and cardiorespiratory capacity. (16)

Noghuchi M et al (2019) conducted a study to show that effect of Incentive spirometer was also used to improve inspiratory muscle strength. The benefits of using this device is that it can be widely used clinically, it can numerically indicate inspiratory volume, which enables us to assess the patient's condition objectively, Moreover, as it provides patients with visual feedback, they can maintain their motivation. (17)

This study also shows significant improvement in respiratory parameters and quality of life of patients with DCM by using combine effect of slow breathing exercise and spirometer.

CONCLUSION

Respiratory muscles training is effective in improving cardiopulmonary parameters PEFR, FEV1/FVC ratio and EF of the patients with dilated cardiomyopathy. It is also effective for decreasing distress and improves physical symptoms thereby improving quality of life of patients with dilated cardiomyopathy.

Limitation of study: This study has several limitations

- Small sample size
- Lack of follow-up
- Only male patients enrolled
- Total enrolled patients with NYHA CLASS II only

Recommendations: Additional researches with larger group sizes and the follow-up assessment to determine the positive effects of exercise training on cardiopulmonary parameters. Considering the lack of methodological rigor and duration, better quality evidence and long term trials are required, in order to make exercise training as part of the evidence based recommendations for the management of these patients.

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