Effect of Aerobic Training on Selected Cardiopulmonary Parameters in Myocardial Infarction Patients with Stroke

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Abstract

Background: Patients in cardiac rehabilitation are typically advised to complete a period of maintenance phase. **The purpose** of this study was to determine if there was any difference in effect of aerobic training on selected cardiopulmonary parameters in myocardial infarction patients with stroke. **Methodology:** Forty patients of both sexes with age 40-50 years with chronic myocardial infarction patients with stroke after 6 months participated in the study. Patient's were assigned for 4 weeks into two groups: group (A) received aerobic training and traditional physical therapy program and group (B) which received traditional physical therapy program. Patients were assessed pre and post treatment using through Stress exercise test unit (Modified Bruce protocol) and modified ashwarth scale. **Results:** This study revealed that there is significantly improved in resting heart rate (10.10%), maximum heart rate (4.67%), METs (64.95%), maximum systolic blood pressure (4.45%), maximum diastolic blood pressure (9.45%) and VO2 max (35.36%) variables in group (A) treated by aerobic training than those of traditional physical therapy program only. **Conclusion:** Aerobic training was a valuable method for management myocardial infarction patients with stroke.

Key Words: *Myocardial Infarction, Stroke, Aerobic Training, Cardiopulmonary Parameter)*

Introduction

Myocardial Infarction is defined by **Borja Ibanez et al,[1]** as myocardial cell necrosis due to significant and sustained ischaemia. It is an acute manifestation of atherosclerosis-related coronary heart disease. Myocardial Infarction results from either coronary heart disease, which implies obstruction to blood flow due to plaques in the coronary arteries or, much less frequently, to other obstructing mechanisms.

Individuals after stroke generally have low endurance for exercise as a secondary consequence of immobility. The VO2max values are 25–45% lower than in age-matched, healthy patients. This early and persistent decline in aerobic capacity can delay or inhibit participation in a therapeutic exercise program, complicate the rehabilitation process and long-term post-stroke course of care, and limit the ability of the individual to perform functional activities independently.

[2].

A cardiopulmonary exercise test compares the coronary circulation during physical exertion, showing any abnormal blood flow to the myocardium (heart muscle tissue). The results can be interpreted as a reflection on the general physical condition of the tested patient. This test is used to diagnose coronary artery disease and used as prediction after a myocardial infarction [3].

Aerobic exercise (also known as cardio) is physical exercise of low to high intensity that depends primarily on the aerobic energy-generating process. Aerobic literally means "relating to, involving, or requiring free oxygen", and refers to the use of oxygen to adequately meet energy demands during exercise via aerobic metabolism. Generally, light-to-moderate intensity activities that are sufficiently supported by aerobic metabolism can be performed for extended periods of

time [4].

Material and Method

Patient Selection

Forty patients of both sexes (31 men and 9 women) with age 40-50 years was participated in the study, the study was delimited to chronic myocardial infarction patients with stroke after 6 months. They were selected from Physical Therapy Center, Modern University for Technology and Information.

Inclusion Criteria

Patients who demonstrate a mild spasticity according to Modified Ashwarth scale and Patients able to walk independently.

Exclusion Criteria

Patients having contraindication for stress test, Musculoskeletal or neurological disease that may affect walking, patients who didn't follow instructions (Aphasia, blindness and deafness) and Patients who had marked sensory loss.

Group (A): consist of twenty stroke patients (16 men and 4 women) received aerobic exercise (treadmill training) and traditional physical therapy program.

Group (B): consist of twenty stroke patients (15 men and 5 women) received traditional physical therapy program.

Instrumentation:

Instrumentation:

Assessment equipment

Stress exercise test unit.

QUARK_CPET, COSMED with 12 channels ECG to measure resting heart rate, maximum heart rate, METs, maximum systolic and diastolic blood pressure and VO2 max.

Methodology

Steps of evaluation carried at baseline of the study for both groups and re-assumed after 4 weeks of training.

I) Evaluation procedure

Stress test

Patient instructed not to eat at least 2 to 3 hours before the test. Patient was asked about the drug being taken, and potential electrolyte level abnormalities. A 12-lead ECG was applied in standing position. Careful explanations of the test; the testing procedure. The optimal exercise protocol (Modified Bruce protocol) last 10 minutes and will be adjusted to the patients. Begin exercise test, monitoring the 12 lead ECG, vital signs, oxygen saturation, and symptoms throughout the test. At regular intervals, asking patients how about Chest or arm discomfort, Short of breath, Dizzy, Lightheaded or Any other unusual symptoms. When the test starts there is half minute before the treadmill start then the phase of warming up for 2 minutes with speed 1.4 mph and 0 in inclination then exercise phase for 8 minutes with speed 2 mph and 0 inclination and final cooling down for 2 minutes with speed 1.4 mph and 0 inclination. After the test end wait until symptoms and/or ECG and vital signs returns to baseline.

Modified Ashwarth scale (MAS):

The MAS was done in supine position. Because spasticity is "velocity dependent", the MAS were done moving the limb at the "speed of gravity." The test was done for the maximum of three times for each joint. If it is done more than three times the short-term effect of a stretch impacts the score;

II) Treatment Procedure:

A) Group A:

Patients received 4 weeks of aerobic training and traditional physical therapy, three times per week for 45 minutes per session.

Patients obtained aerobic training (treadmill training) through speed range from 0.6 to 1.3KM/H, 0°incline and no resistance.

Traditional exercise program for both groups:

Relaxation technique for spastic muscles, Facilitatory technique for antispastic muscles, stretching exercise to prevent shortening, Proprioceptive Neuromuscular Facilitation (PNF) and Trunk control training.

B) Group B:

Patients received the same traditional physical therapy training for 4 weeks as in group A.

Results

Data collection

Normality test of data using Shapiro-Wilk test was used, that reflect the data was normally distributed after removal outliers that detected by box and whiskers plots. Additionally, testing for the homogeneity of variance revealed that there was no significant difference (P>0.05). All these findings allowed the researchers to conducted parametric and non-parametric analysis. Therefore, in the current study the data is parametric and normally distributed.

1. Demographic data

The mean values of age in group A and group B were 45.11 ±3.03 and 45.10 ±3.77year, respectively. The mean values of weight in group A and group B were 82.20 ±6.90 and 81.33 ±7.005kg, respectively. The mean values of height in group A and group B were 169.64 ±3.58 and 169.43 ±4.48cm, respectively. The mean values of BMI in group A and group B were 28.56 ±2.97 and 28.33 ±1.94kg/m^2, respectively. The statistical analysis by independent t-test revealed that no significant differences (P>0.05) in values of general demographic data (age, weight, height, and BMI) between both groups.

2. Rest HR (BPM) Table (1)

Within each group, the statistical analysis by paired t-test revealed there were significantly decreased of rest HR (BPM) at post treatment compared to pre-treatment within group A (P=0.0001; P<0.05) and group B (P=0.0001; P<0.05). Between both groups, the statistical analysis by independent t-test revealed that there were no significant difference in pre-rest HR (P=0.479; P>0.05) while, a significant difference in post-rest HR (P=0.0001; P<0.05) between both groups.

Table (1): Comparison between mean values of pre- and post-rest HR (BPM) within each group and between both groups.

Items	Rest HR (BPM)	
	Group A	**Group B**
Pre-treatment (Mean ±SD)	76.92 ±7.21	78.22 ±3.65
Post-treatment (Mean ±SD)	69.15 ±4.61	74.21 ±0.64
Mean difference	7.77	4.01
Improvement %	10.10%	5.13%
t-value	6.036	4.666
P-value (P<0.05)	0.0001	0.0001
Significance	S	S
	Pre-treatment (Mean ±SD)	Post-treatment (Mean ±SD)
Mean difference	1.30	5.06
t-value	0.715	6.524
P-value (P<0.05)	0.479	0.0001
Significance	NS	S

SD: standard deviation   P-value: probability value   NS: non-significant.

SD: standard deviation   %: percentage   P-value: probability   S: significant

3. Max HR (BPM) Table (2)

Within each group, the statistical analysis by paired t-test revealed there were significantly decreased of Max HR (BPM) at post treatment compared to pre-treatment within group A (P=0.0001; P<0.05) and group B (P=0.011; P<0.05). Between both groups, the statistical analysis by independent t-test revealed that there were no significant difference in pre-Max HR (P=0.458; P>0.05) while, a significant difference in post-Max HR (P=0.041; P<0.05) between both groups.

Table (2): Comparison between mean values of pre- and post-Max HR (BPM) within each group and between both groups.

Items	Max HR (BPM)	
	Group A	**Group B**
Pre-treatment (Mean ±SD)	134.42 ±6.21	135.47 ±1.08
Post-treatment (Mean ±SD)	128.13 ±10.13	132.78 ±2.11
Mean difference	6.29	2.69
Improvement %	4.67%	1.99%
t-value	6.829	3.947
P-value (P<0.05)	0.0001	0.011
Significance	S	S
	Pre-treatment (Mean ±SD)	Post-treatment (Mean ±SD)
Mean difference	1.05	4.65
t-value	0.749	2.457
P-value (P<0.05)	0.458	0.041
Significance	NS	S

4. METs (ml O$_2$/kg/min) Table (3)

Within each group, the statistical analysis by paired t-test revealed there were significantly increased of METs at post treatment compared to pre-treatment within group A (P=0.002; P<0.05) and group B (P=0.0001; P<0.05). Between both groups, the statistical analysis by independent t-test revealed that there were no significant difference in pre-METs (P=0.127; P>0.05) while, a significant difference in post-METs (P=0.001; P<0.05) between both groups.

Table (3): Comparison between mean values of pre- and post-METs (ml O$_2$/kg/min) within each group and between both groups.

Items	METs (ml O2/kg/min)	
	Group A	Group B
Pre-treatment (Mean ±SD)	1.87 ±0.2	1.94 ±0.8
Post-treatment (Mean ±SD)	2.74 ±0.7	3.20 ±0.5
Mean difference	0.87	1.26
Improvement %	64.95%	46.52%
t-value	4.568	7.257
P-value (P<0.05)	0.002	0.0001
Significance	S	S
	Pre-treatment (Mean ±SD)	Post-treatment (Mean ±SD)
Mean difference	0.07	0.46
t-value	1.568	14.740
P-value (P<0.05)	0.127	0.001
Significance	NS	S

5. Max SBP (mm Hg) Table (4)

Within each group, the statistical analysis by paired t-test revealed there were significantly decreased of Max SBP at post treatment compared to pre-treatment within group A (P=0.0001; P<0.05) and group B (P=0.039; P<0.05). Between both groups, the statistical analysis by independent t-test revealed that there were no significant difference in pre-Max SBP (P=0.878; P>0.05) while, a significant difference in post-Max SBP (P=0.006; P<0.05) between both groups.

Table (4): Comparison between mean values of pre- and post-Max SBP (mm Hg)within each group and between both groups.

Items	Max SBP (mm Hg)	
	Group A	**Group B**
Pre-treatment (Mean ±SD)	136.00 ±0.51	135.00 ±10.95
Post-treatment (Mean ±SD)	129.95 ±0.64	131.96 ±5.88
Mean difference	6.05	3.04
Improvement %	4.45%	2.25%
t-value	5.047	2.177
P-value (P<0.05)	0.0001	0.039

Cont... **Table (4): Comparison between mean values of pre- and post-Max SBP (mm Hg)within each group and between both groups.**

Significance	S	S
	Pre-treatment (Mean ±SD)	Post-treatment (Mean ±SD)
Mean difference	1.00	2.01
t-value	0.878	3.764
P-value (P<0.05)	0.359	0.006
Significance	NS	S

6. Max DBP (mm Hg) Table (5)

Within each group, the statistical analysis by paired t-test revealed there were significantly decreased of Max DBP at post treatment compared to pre-treatment within group A (P=0.0001; P<0.05) and group B (P=0.006; P<0.05). Between both groups, the statistical analysis by independent t-test revealed that there were no significant difference in pre-Max DBP (P=0.764; P>0.05) while, a significant difference in post-Max DBP (P=0.012; P<0.05) between both groups.

Table (5): Comparison between mean values of pre- and post-Max DBP (mm Hg) within each group and between both groups.

Items	Max DBP (mm Hg)	
	Group A	Group B
Pre-treatment (Mean ±SD)	85.01 ±13.20	85.99 ±5.83
Post-treatment (Mean ±SD)	76.98 ±10.99	80.00 ±9.40
Mean difference	8.03	5.99
Improvement %	9.45%	6.97%
t-value	10.816	3.078
P-value (P<0.05)	0.0001	0.006
Significance	S	S
	Pre-treatment (Mean ±SD)	Post-treatment (Mean ±SD)
Mean difference	0.98	3.02
t-value	0.302	2.478
P-value (P<0.05)	0.764	0.012
Significance	NS	S

7. VO$_2$ Max (ml/kg/min) Table (6)

Within each group, the statistical analysis by paired t-test revealed there were significantly increased of VO$_2$ at post treatment compared to pre-treatment within group A (P=0.0001; P<0.05) and group B (P=0.008; P<0.05). Between both groups, the statistical analysis by independent t-test revealed that there were no significant difference in pre-VO$_2$ (P=0.478; P>0.05) while, a significant difference in post-VO$_2$ (P=0.018; P<0.05) between both groups.

Table (6): Comparison between mean values of pre- and post-VO$_2$ Max (ml/kg/min) within each group and between both groups.

Items	VO2 Max (ml/kg/min)	
	Group A	**Group B**
Pre-treatment (Mean ±SD)	31.02 ±2.78	31.99 ±5.46
Post-treatment (Mean ±SD)	41.99 ±6.58	37.00 ±11.42
Mean difference	10.97	5.01
Improvement %	35.36%	15.66%
t-value	7.887	2.977
P-value (P<0.05)	0.0001	0.008
Significance	S	S
	Pre-treatment (Mean ±SD)	Post-treatment (Mean ±SD)
Mean difference	0.97	4.99
t-value	0.717	2.355
P-value (P<0.05)	0.478	0.018
Significance	NS	S

Ethical Clearance: Approval of the ethical committee of the faculty of physical therapy of Cairo University (No:P.T.REC/012/002148), written consent prior participation and confidentiality was assured.

Source of Funding: Self

Conflict of Interest: Nil

Discussion

The main aim of this study was to determine if there was any difference in effect of aerobic training on selected cardiopulmonary parameters in myocardial infarction patients with stroke.

Patients in cardiac rehabilitation are typically advised to complete a period of supervised aerobic training, in the current study there was significant difference in systolic and diastolic blood pressure in addition to heart rate with privilege to group A whom received aerobic exercise training.

This was explained by **Kjeldsen et al** [5], who proved that SBP and DBP rise during exercise provides information about the hemodynamic response to increasing physical stress. Dynamic exercise produces

a large increase in SBP and DBP. The highest cardiovascular disease mortality rate was observed in men with both elevated resting and exercise blood pressure. They reported that SBP and DBP at moderate and peak workloads was directly associated with the risk of cardiovascular events in hypertensive men with an increased risk of any stroke.

Both SBP and DBP changed to levels that were statistically significant when comparing both groups after the program, although changes in both groups separately were not significant. Percent of change in SBP was (4.2 % ↓ and 2.1% ↑) and DBP was (2.6% ↓ and 2.3% ↑) for study and control groups respectively. Improvement of study group and deterioration of control group showed the positive effect of Cardiac Rehabilitation program [6].

In the current study there was significant improvement in METs with aerobic training which was approved by **Swain and Franklin** [7], they demonstrated on their study improvements were 1.41 METs (39% improvement), 1.01 METs (15% improvement), and 0.80 MET (8.6% improvement) for the low, moderate, and high cardiorespiratory fitness patients (at baseline), respectively. The greatest improvements occurred in those patients who were most likely to benefit most from an aerobic training intervention, that is, those in the lowest cardiorespiratory fitness, high-risk cohort.

The present study showed significant improvement VO_2 max outcome after aerobic training, the result goes with a study in individuals starting exercise within 6 days to 6 months after stroke onset, revealed a large effect size. This finding supports the evidence that individuals in the sub-acute stage after stroke have high potential to increase VO_2peak following a cardiovascular training intervention. This is in addition to a spontaneous recovery of peak aerobic capacity of 16.9% that occurs during the first 6 months after stroke. But given the fact that VO_2peak is reduced within 0–30 days after stroke, and 10 ml/kg/min is required for light activities of daily living (ADL), this small improvement of peak aerobic capacity could lead to a large functional carryover [8].

Conclusion

The results of this study revealed better improvement of aerobic exercise more than those of traditional physical therapy program alone. Aerobic exercise could be considered a valuable method for improvement of cardiopulmonary parameters on myocardial infarction patients with stroke.

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