EFFECTS OF TAI CHI EXERCISES ON PHYSICAL ACTIVITY AND PULMONARY FUNCTION IN PATIENTS WITH CORONARY ARTERY BYPASS GRAFTING

Maria Razzaq¹, Sumaiyah Obaid¹, Iqbal Tariq¹, Muhammad Afshen Iqbal², Saina Khawar Kiani¹, Tahir Ramzan³

¹Riphah College of Rehabilitation & Allied Health Sciences, Riphah International University, Islamabad - Pakistan
²Armed Forces Institute of Cardiology / National Institute of Heart Diseases, Rawalpindi - Pakistan
³Shifa Tameer E Millat University Islamabad - Pakistan

ABSTRACT

Objective: To determine the effects of Tai Chi exercises on physical activity, pulmonary function, and rate of perceived exertion in post-coronary artery bypass grafting patients.

Material and Methods: A Randomized control trial was conducted in the Armed Forces Institute of Cardiology/National Institute of Heart Diseases Rawalpindi Pakistan from January 2018 - July 2018. 50 post-coronary artery bypass grafting patients were calculated by the open epi tool and randomly allocated into two groups in equal halves through non-probability purposive sampling with the toss the coin method. 40-60 years males and females with >40% ejection fraction were included while vitally unstable patients were excluded. The experimental group was given Tai Chi exercises while the control group was given a bicycle. Levels of physical activity and pulmonary functions were assessed at baseline, 4th and 6th week of training.

Results: Out of the total sample size only 39 were analyzed 11 were dropped off due to not following proper follow-up, and there was no statistical difference in heart rate P=0.095. Oxygen saturation shows a significant difference with P<0.001, Physical activity was low at baseline but after exercise training, the Tai Chi group showed great improvement P< 0.01. Pulmonary functions showed statistically insignificant results P=0.865. The rate of perceived exertion was high in 2nd week and gradually decreased with the mean of 3.20 and 3.37 while the time of exercise was improved with P<0.01.

Conclusion: Tai Chi exercises have better improvement in pulmonary function, rate of perceived exertion, time of exercise, and physical activity in post-coronary artery bypass grafting patients.

Keywords: Coronary artery bypass grafting, pulmonary functions, physical activity, rate of perceived exertion, Tai Chi

INTRODUCTION

Across Europe, more than 85 million people have cardiovascular diseases CVD every year. ¹ Advancement in medical technology and treatment strategies in health care improves the rate of recovery and survival day by day. ² ³ The most complicated and full of risks but long-lasting effective treatment is coronary artery bypass grafting CABG it is also known as open heart surgery. In this surgery flaps or grafts are placed on diseased vessels and make another pathway or bypass for circulation. ⁴ Flaps or grafts are replaced by the individual’s saphenous vein and internal left memory artery. ⁵

CABG is mandatory in multi vessels blockage mainly when 90% occlusion in the left anterior descending artery, and the left and right circumflex arteries. ⁶ In emergency conditions like with and without ST-segment elevation MI is also treated with CABG if poor ejection fraction but not in less than 35 %. ⁷ ⁸ After CABG, patients need urgent cardiac rehabilitation CR. It is designed according to the patient’s post-operative health condition. ⁹ However, in the literature it was observed the rate of patient participation in CR is very low and they drop exercise plans in various countries just because of difficult to follow up as most of the participants are living far away from the hospital. ¹⁰ Patients didn’t follow the exercise program regularly so the benefits of cardiac rehabilitation are not as high as it seems in the literature. ¹¹

CR is a complete model of care including a set of various core components, for instance, aerobic/ anaerobic exercise, patient training, psychosocial training, and
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Reduction in risk factors. To upgrade patients’ satisfaction and reduce the risk of future heart problems. 12 CR is a multidisciplinary teamwork, cardiologists, nurses, physical therapists, and cardiac rehab specialists work together to design and manage physical activities by avoiding risk factors, and unstable vital. 13 Physiotherapists or other exercise experts design a well-organized and specialized exercise plan separately for all individuals. 14 Tai Chi TC exercises are also known as aerobic exercises or conditioning exercises. 15 TC was used as a fighting form or defense, for this purpose it was used to emphasize strength, stability, elasticity, and fast movements. 16 Later on it progressed into health or physical fitness for this it convert into a smooth, steady, and gradual type of exercise which is practiced by all age groups. 17, 18 In 2016 a study was done by Cole AR et.al and they concluded that TC is used as aerobic exercise. Tai chi is slow, gentle, and rhythmical movements so it shows substantial descent in systolic and diastolic blood pressure but the heart rate is unchanged. 19

Different studies have focused on preventing and managing coronary arteries by TC exercises in phase III and IV but the effects of Tai Chi training during phase II cardiac rehabilitation is still needed to be determined. The purpose of the study was to determine the Effect of TC on physical activity, pulmonary function, and rate of perceived exertion after exercise in patients with CABG.

Material and Methods

A randomized control trial NCT03857282 was conducted at the Armed Forces Institute of Cardiology/ National Institute of Heart Diseases AFIC/NHID Rawalpindi Pakistan from January 2018 - July 2018. The sample of 50 post-CABG patients was calculated by the open epi tool and randomly allocated into two groups in equal halves through non-probability purposive sampling with the toss & coin method. 40-60-year males and females with >40% ejection fraction were included while vitally unstable patients were excluded. Before and after the exercise all vitals were checked, during each session, the treatment intervention was 5 to 10 min warm-up and cool-down exercises in both groups after that experimental group practiced 30 min Tai Chi exercises while the control group performed 30 min bicycling. The level of physical activity was analyzed by using an international physical activity questionnaire and the rate of perceived exertion Borge scale. Pulmonary function was assessed through a digital spirometer, all variables were analyzed at baseline, 4th, and 6th weeks of training. For the normality test, Shapiro Wilk values and the Non-parametric Man Whitney U test was applied to analyze all vitals except Heart Rate HR at the baseline to compare both groups, while the parametric independent t-test was applied to HR.

Results

74 post-CABG patients were assessed out of them 24 didn’t meet the inclusion-exclusion criteria, remaining 50 patients were randomly allocated into interventional and control groups in equal halves. 112% of patients were dropped off due to loss of follow up 3978% of patients were completed a 6-week exercise program, 2040% in the experimental group, and 1938% were in the control group. In the experimental group, 1743.6% were males and 37.7% were females while 1538.46% and 410.2% were males and females in the control group respectively. HR was significantly dropped as shown in Table 1 and Improvement in saturated Oxygen SPO2 is described in Table no.2

Pulmonary function was assessed by spirometer and results show the forced expiratory volume in 1 second FEV1 in the 2nd and 6th week of training in the experimental and control group was P-value >0.05 while in the 4th week was p-value <0.05. Forced vital capacity FVC and Peak expiratory flow PEF in the 2nd, 4th, and 6th week of training of the experimental and control group was p-value > 0.05.

Fig 1: Physical activity pre-exercise

Fig 2: Physical activity post-exercise

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**DISCUSSION**

In a recent study, Heart Rate was statistically significant between both groups in 2nd week of exercise while in the 4th and 6th weeks of training shows no effective results, which was due to adaptation of activities. A systemic review was conducted by Cole AR et al. and they concluded that at the beginning of training, TC exercises increase the vagal modulation, decrease the sympathetic modulation and shift the sympathovagal balance to the increased parasympathetic dominance, and ultimately HR increases. In the current study, Heart Rate Reserve showed positive effects on both groups in the 2nd week of exercise later on the 4th and 6th weeks of the exercise program had constant results. This extended the same results as a study conducted by Sato S, Makita S, et. al published in an international Heart J in 2010 and it proved that heart rate reserve was constant during all exercise protocols and showed conflicted outcomes. Saturated oxygen saturation was measured in this study at baseline, 2nd, 4th, and 6th week of training. Maximum oxygen saturation showed that TC Training had positive effects as compared to bicycling in post-CABG patients. Another study was done by Lu, Wan et al. in 2014 and they concluded that TC exercises had positive effects on autonomic nervous modulation so in TC groups increased vagal modulation and HR along with a decrease in breathing frequency and mean respiratory rate interval.

Pulmonary function was measured in a recent study by digital spirometer at baseline, 2nd, 4th, and 6th week of training results showed that there is no statistically significant difference in both groups because both exercise protocols were aerobic, which had the same effect
on pulmonary functions. A study was done on functional capacity in post-myocardial infarction MI patients by Nery RM et al., they concluded that after a recent MI functional capacity decreased as it was measured low level of VO2 max however after TC training increase in VO2 was observed. 22

The current study showed that the TC group improved functional capacity as the minimum walk time was 30 Min walk, increase time of exercise 30 min Tai chi and minimum level of exertion RPE=3, and no complaints of Short of Breath. While the control group’s maximum time of exercises was 10 min, RPE=8, and a maximum walk time of 20 min was recorded. A study was done on functional capacity by John Liu et al. and they concluded that TC training is more effective than traditional cardiac rehabilitation programs because it shows greater improvement in overall functional capacity in CAD patients. 23

A recent study found that there was a statistically significant difference in physical activities between both exercise programs. Before the exercise program, patients did not perform the physical activity but after the six weeks of training experimental group increased more in physical activity like traveling, walking, and sitting time without moderate and vigorous activity as compared to the control group. A systemic review was done on physical activity by Lan C et al. and they concluded TC training enhances cardiovascular health and can be used as an alternative method of training in CR. Previous studies concluded there is a great improvement in physical activity functional capacity on top of other effects of Tai Chi furthermore it is a safe technique for patients with CABG, CVD, CHF, and stroke. 24

The limitation of the study was that it was very difficult for the patients to follow up the session properly on time. As the study population was drawn from one hospital, the population is quite homogenous, and any generalization of the results has to be made cautiously.

CONCLUSION
It is concluded that Tai Chi exercises are a very effective technique to improve heart rate, Time of exercise, rate of perceived exertion, pulmonary functions, and physical activity in post-coronary artery bypass grafting patients.

It is recommended that studies should be conducted on the effect of TC in phase I cardiac rehabilitation in post-CABG patients. The research should focus on cellular changes due to TC in post-CABG patients.

DISCLAIMER
The online poster presentation of the abstract was presented at the World Conference of Physical Therapy on April 9-13 2021.

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