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ORIGINAL ARTICLE

Comparison of Phase 1 Cardiac Rehabilitation with and without Lower Limb Paddling Effects in Post-CABG Patients

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ABSTRACT

Objective: To compare the effectiveness of Phase 1 cardiac rehabilitation with lower limb paddling, with phase 1 cardiac rehabilitation without lower limb paddling.

Study Design: Randomized clinical Trail

Place and Duration of Study: Department of Cardiology, Rawal General and Dental Hospital Islamabad from 1st January 2020 to 31st December 2020.

Methodology: Fifty four patients, 27 in each group were determined using general self-efficacy before intervention readings. Inclusion was made on post elective Sternotomy surgery, post extubation, both genders, age between 35 and 60 years, body mass index (BMI) between 20 and 30 kg/m2, hemodynamic stability, absence of arrhythmias.

Results: The mean SF-36 at day 1 was 37.74±1.45 and at Day 7 was 90.42±11.8 in experimental group and 37.22±1.45 at Day 1 and 76.81±2.58 at day 7 for control group respectively. The mean FIM at day 1 was 31.48±5.07 and on day 7 it was 109.03±5.97 in experimental group compared to 33.66±5.34 on day 1, and 82.44±13.35 on day 7 for controls. The mean for self-efficacy at day 1 was 19.11±2.5 and at day 7 it was 62.59±3.17 in experimental compared to 21.11±3.59 on day 1, and 61.74±6.32 on day 7 in the controls. The mean EF was same at day 1 and day 7, in experimental group it was 53.11±4.8 whereas for control group it was 53.85±3.76 one day 1 and day 7. The mean ABGs at day 1 were 7.41±0.05 and at Day 7 it was 7.42±0.04 in experimental group whereas in the controls it was 7.39±0.39 at Day 1 and 7.44±0.01 at day 7.

Conclusion: Phase 1 cardiac rehabilitation with and without paddling have similar effects according to ABGs and Ejection fraction. However, the quality of life was found significantly improved using paddling intervention during Phase 1 Cardiac rehabilitation compared to those without paddling. Hence it is implied that it is safe to incorporate paddling with phase 1 cardiac rehabilitation in post CABG patients.

Keywords: Coronary artery disease, Cardiac rehabilitation, CABG, Ergometer

INTRODUCTION

Cardiac rehabilitation (CR) is a multidisciplinary team work to deal with function limitations of patients with heart disease. According to WHO (World Health Organization) Cardiac rehabilitation is the multiple activities gathered together for patients suffering with cardiac disease, so that patients with cardiac issues can have an independent place in society and long way from bed rest for cardiac patients to the decreased hospital stay by CR. Many of the exercises are beneficial for cardiac patients but high intensity exercises can also have adverse effects, so there must be a set plan of care for exercises to overcome cardiac complications.[1] CABG (coronary artery bypass grafting) is the medical therapy to treat stable Coronary artery disease. PCI and CABG are the treatment options for CAD patients depending on the current status of the patient; out of these CABG is the Slandered surgical intervention for patients with CAD as compared to PCI. PCI is the advanced technology used to treat patients with complex lesions and with major heart disease.[2]

According to World Health Organization (WHO) 17.5 Mio of population die every year because of Coronary artery disease, 75% of which is from under developed countries.[3] In US 1/3 death is majorly caused by CAD and ¼ person is suffering with CAD.[4] Rate of death due to CAD in China is also increasing exponentially, as well in south Asian countries. 40% of prevalence rate is found in South Asian countries. Pakistan is at the 6th number between most populated countries and every ¼ adult is undergoing CAD risk factors.[5]

A study was conducted in Punjab, Pakistan which concluded that prevalence is high in both the genders Male and female in Punjab, which is 17.5% of the population taken under study. This study also concluded that the onset of CAD was more in female then in young adult male. Out of 17.5% of effected 16.6% were male, 18.3% female. Risk factors being observed in this study were the sedentary life style and the genetic cause or history of family related to disease.[6]

Longer intensive care unit (ICU) stay can cause difficulty in returning to preoperative conditions and even can lead to readmission to hospital.[7] Physiotherapy in ICU was recently incorporated and starting working on the concept of early mobilization, as well as its importance in the practice of early mobilization.[8] In ICU exercise prescription also prevent respiratory complications postoperatively to any surgical cardiac intervention, decreased in strength of muscles, reduces chance of death or disability, and helps to improve mental health. The objectives of Cardiac Rehabilitation are development, autonomy, acceptable mental execution, keeping away from pressure, keeping up a solid social similarity, and recapturing abilities.[9]

Internationally Physiotherapists are trained to treat patients with CAD or patients undergone CABG. These patients are recruited for cardiac rehabilitation in ICU and then also followed up as outpatient clients in order to maintain cardiopulmonary fitness and to avoid reoccurrence of symptoms.[10]

Gerlach et al[11] conducted a study, which concluded that those patients underwent cycling in cardiac rehabilitation have better improvement in vo2max for CAD patients. Khalid[12] conducted a study which concluded that cardiac rehabilitation post-CABG have significant effects on cardiorespiratory fitness.

The significance of this study is that it will help cardiopulmonary physiotherapist to enhance evidence based in phase 1 protocols of cardiac rehabilitation and more convenient for patients as it will reduce patient's hospital stay as well as reduce the systemic complications of Cardiac surgeries. Paddler is an affordable instrument and can be afforded by any of ICU, which can help in early recovery of patients than any other instrument.

MATERIALS AND METHODS

The study design of this study was a Randomized Clinical Trial, non-probability convenient sampling techniques was used to select the sample and then randomly allocated into groups through lottery method. Total sample size of this study was 54, randomly divided into 2 groups, 27 patients in each group.[13] Actual study duration was 6 months, but due to COVID-19 sample duration was extended. Started was started in from 1st January 2020 to 31st December 2020. This study was conducted in Rawal General and

Dental Hospital Islamabad. Sample selection criteria was well described, Inclusion criteria was post elective sternotomy surgery, post extubation, male and female both, age 35 to 60 years, body mass index (bmi) 20 - 30 kg/m^2,hemodynamic stable patients (with or without use of positive inotropic drugs), arrhythmias or angina not present and exclusion criteria was; no previous pulmonary disease and acute lung disease, mechanical ventilation >24 h, left ventricular ejection fraction (lvef) <35% or >54%, surgical reintervention, orthopedic impairments, unstable angina. Measuring tools used was SF-36, Functional independence measure (FIM), Self-efficacy formative questionnaire, echocardiography (Ejection fraction) and Arterial blood gasses (PH). Data collection procedure was well defined, after the approval of ethical, consent was taken from Patient as well as from department, allocation was through lottery method in two groups, one was experimental group and the other was control group. Baseline assessment was noted for each patient.

Treatment protocol for experimental group:

Days	Protocol
Day 1	• Breathing exercises (3 sets of 10 repetitions). • Active upper and lower extremity exercises (3 sets of 10 repetitions) with bed inclined at 45°. • Lower limb exercise on Paddler lasting 20 min (5-min warm-up, 10 min of low-intensity exercise, and 5-min recovery) at 30 rpm (Rotation per minute).
Day 2	• Active exercises as Day 1. • Up right standing and walking at the spot for 3 reps for 1 min each. • Lower limb exercise on paddler for 20 min.
Day 3	• Active exercises as Day 2. • Ambulation within the inpatient wards for 7 min. • Transfer to Chair, allocated at the side of bed (sitting for 30min). • Lower limb exercise on paddler for 20 min.
Day 4	• Same exercises as in day 3. • Ambulation within the inpatient wards for 10 min. • Transfer to Chair, allocated at the side of bed (sitting for 1hr). • Lower limb exercise on paddler for 20 min.
Day 5	• Same exercises as in Day 4. • Ambulation within the inpatient wards for 15 min. • Transfer to Chair, allocated at the side of bed (sitting for 2hrs). • Lower limb exercise on paddler for 20 min.
Day 6	• Active exercises as in previous day. • Ambulation within the inpatient wards 20 min. • Step training on stepper for continuously 3 times, step size 20cm (standard). • Lower limb exercise on paddler for 20 min.
Day 7	• Same active exercise as in previous day. • Step training on stepper for continuously 6 times, step size 20cm (standard). • Lower limb exercise on paddler for 20 min.

Treatment protocol for control group:

Days	Protocol (CONTROL GROUP)
Day 1	• Breathing exercises (3 sets of 10 repetitions). • Active upper and lower extremity exercises (3 sets of 10 repetitions) with bed inclined at 45°.
Day 2	• Active exercises as Day 1. • Up right standing and walking at the spot for 3 reps for 1 min each.
Day 3	• Active exercises as Day 2. • Ambulation within the inpatient wards for 7 min. • Transfer to Chair, allocated at the side of bed (sitting for 30min).
Day 4	• Same exercises as in day 3. • Ambulation within the inpatient wards for 10 min. • Transfer to Chair, allocated at the side of bed (sitting for 1hr).
Day 5	• Same exercises as in Day 4. • Ambulation within the inpatient wards for 15 min. • Transfer to Chair, allocated at the side of bed (sitting for 2hrs).
Day 6	• Active exercises as in previous day. • Ambulation within the inpatient wards 20 min. • Step training on stepper for continuously 3 times, step size 20cm (standard).
Day 7	• Same active exercise as in previous day. • Step training on stepper for continuously 6 times, step size 20cm. (standard).

Post-assessment after 7th day of training was noted. Data analysis was after checking the Normality Test non-parametric Mann Whitney test was applied by SPSS version 21. Parametric tests were applied between groups and within group analysis. Mann-Whitney test was used for between group analyses whereas Friedman test was applied for within group analysis. According to p value obtained through Shipro-Wilk test, the calculated p-value was <0.05, therefore the test of choice was the Mann Whitney nonparametric to compare the values of all variables between the groups. Shipro-wilk test was chosen because each group sample size was less than 30.

RESULTS

The median (IQ) SF-36 at day 1 was 37.82 (1.75) in experimental group compared to 36.89 (2.1) in the controls, this difference was statistically significant (p, 0.040). Similarly, the median (IQ) SF-36 at Day 7 was 92.56 (3.47) in experimental and 76.62 (3) in control group implying that QOL becomes better due to use of paddler with phase 1 training intervention (P Value 0.000). Functional independence according to FIM tool was compared between both groups. The median (IQ) FIM at Day 1 was 31.00 (8) in experimental group compared to 32.00 (6) in the controls, this difference was statistically not significant (P Value 0.097). Similarly, the median (IQ) FIM at Day 7 was 110.0 (4) in experimental and 76 (31) in control group implying that Function

independence was statistically significantly different (P Value 0.000). Self-efficacy according to Self-efficacy formative tool was compared between two groups. The median (IQ) Self-efficacy formative questionnaire at Day 1 was 19 (5) in experimental group compared to 20 (7) in the controls, this difference was statistically not significant (P Value0.75). Similarly, the median (IQ) Self-efficacy formative questionnaire at Day 7 was 64 (5) in experimental and 65 (4) in control group implying that Self-efficacy formative questionnaire was statistically not significantly different (P Value 0.927). Ejection fraction was compared between two groups. The median (IQ) Ejection fraction at Day 1 was 50 (10) in experimental group compared to 55 (5) in the controls, this difference was statistically not significant (P Value 0.343). Similarly, the median (IQ) Ejection fraction at Day 7 was 50 (10) in experimental and 55 (5) in control group implying that Ejection Fraction was statistically not significantly different (P Value0.343). Arterial blood gasses were also compared between both groups. The median (IQ) ABG's at Day 1 was 7.41 (0.1) in experimental group compared to 7.40 (0.03) in the controls, this difference was statistically not significant (P Value 0.162). Similarly, the median (IQ) ABG's at Day 7 was 7.44 (0.06) in experimental and 7.44 (0.01) in control group implying that ABG's was statistically significantly different (P Value 0.050). The mean SF-36 at day 1 was 37.74±1.45 and at Day 7 was 90.42±11.8 in experimental group and 37.22±1.45 at Day 1 and 76.81±2.58 at day 7 for control group. The Mean for FIM at day 1 was 31.48±5.07 and at day 7 109.03±5.97 for experimental group and at day 1 33.66±5.34, at day 7 82.44±13.35 for controls. The mean for self-efficacy at day 1 was 19.11±2.5 and at day 7 62.59±3.17 for experimental group and for controls at day 1 was 21.11±3.59, at day 7 was 61.74±6.32. The mean of EF at day 1 and day 7 was 53.11±4.8 for experimental group and for control group day 1 and day 7 mean was 53.85±3.76. The mean ABG's at day 1 was 7.41±0.054 and at Day 7 was 7.42±0.04 in experimental group and 7.39±0.39 at Day 1 and 7.44±0.01 at day 7 for control group.

Table 1: Comparison of experimental and control groups

Variable	Experimental Group	Control Group
Age (years)	51.85±7.23	52.26± 4.19
BMI (kg/m^2)	26.77±4.93	24.46±1.27
NYHA (Class)	3.00±0.00	2.92±0.27
Heart Rate (BPM)	70.48±2.60	71.89±4.34
Systolic BP (mmHg)	115.63±5.14	119.85±12.87
Diastolic BP (mmHg)	82.41±4.68	82.48±12.51
Temperature (°F)	98.33±0.48	96.62±1.54
SPO2 (%)	95.70±2.13	95.96±1.60
Intake (ml/Kg)	4336.74±542.20	3425.62±652.61
Output (ml/Kg)	4582.44±591.13	3637.22±680.98
Angina index (class)	3.00±0.00	2.96±0.19

Table 2: Man Whitney U Test was applied for between Groups analysis Day 1 and Day 7

Variable	Experimental Group Median (IQ)	Control Group Median (IQ)	P Value
SF-36 Day 1	37.82 (1.75)	36.89 (2.1)	0.040
SF-36 Day 7	92.56 (3.47)	76.62 (3)	0.000
FIM Day 1	31.00 (8)	32.00 (6)	0.097
FIM Day 7	110.0 (4)	76 (31)	0.000
Self-efficacy Day 1	19 (5)	20 (7)	0.75
Self-efficacy Day 7	64 (5)	65 (4)	0.927
Ejection fraction day 1	50 (10)	55 (5)	0.343
Ejection Fraction day 7	50 (10)	55 (5)	0.343
ABG's Day 1	7.41 (0.1)	7.40 (0.03)	0.162
ABG's Day 7	7.44 (0.06)	7.44 (0.01)	0.050

DISCUSSION

Cardiac rehabilitation is both an inpatient and outpatient exercise program for individuals underwent coronary artery bypass surgery. It is vital for cardiac patients because it helps them in improving cardiopulmonary endurance and prevents the recurrent cardiac events. Our study determined the effects of paddling in addition with Phase 1 cardiac rehabilitation in post CABG patients.

Evaluation of results from the current analysis shows important indications for use of paddler with Phase 1 CR to enhance QOL, Self-efficacy and Functional independence. This result favors the concept of early mobilization. The median (IQ) SF-36 at Day 1 was 37.82 (1.75) in experimental group compared to 36.89 (2.1) in the controls, this difference was statistically significant (P Value 0.040), also these results points out no impact of paddler/early mobilization on detoriation of ABG's and ejection fraction of patient, it is safe for patient to use paddler. Median of ABG's as per PH was (7.44) in each group, shows no effect of paddler on ABG's. As well as on EF median was (50) each groups on day 1 and (55) each group at day 7. These results were as presumed by previous study.[7] Also a previously conducted retrospective study concluded cardiac rehabilitation enhances the quality of life and functional capacity of patients underwent CABG.[14]

In ICU patients severe muscle weakness occurs due to prolonged immobility and deep seditions, which ultimately results in long recovery period and longer the stay on mechanical ventilator, which leads to decline in QOL. Early mobilization leads to more patients be able to stand and ventilator free days increased.[15] Another systematic review concludes that bed rest should be reduced and early mobilization must incorporate in regard to enhance functional capacity and less hospital stay.[16] In our study the same beneficial effects were achieved by patients. QOL and Functional independence increased in patients in experimental group i.e. The mean for FIM at day 1 was 31.48±5.07 and at day 7 109.03±5.97 for experimental group and at day 1 33.66±5.34, at day 7 82.44±13.35 for controls and the mean SF-36 at day 1 was 37.74±1.45 and at Day 7 was 90.42±11.8 in experimental group and 37.22±1.45 at Day 1 and 76.81±2.58 at day 7 for control group.

Application of phase 1 cardiac rehabilitation on patients improved patient's self-efficacy in aspect to independent daily activities and it also decreased the need for phase 2 CR. Score of self-efficacy in previous study was found to be ($p<0.001$) which shows the significant difference[13], but in our study no statistically significant difference was found but mean and standard deviation values shows an more improvement in experimental group i.e. The mean for self-efficacy at day 1 was 19.11±2.5 and at day 7 62.59±3.17 for experimental group and for controls at day 1 was 21.11±3.59, at day 7 was 61.74±6.32.

Early mobilizations after CABG with the use of cycle ergometer does not have any significant effect on independent physical activity when compared with conventional rehabilitation, moreover it is safe to use and it can be the choice for alternative treatment options and can be more useful for motivation of patients. Level of motivation in patients was found to be more i.e. (P Value 0.044).[17] Also a previously conducted RCT concludes that aerobic exercises for post CABG patients in early phase enables to promote Functional capacity, without disturbing pulmonary function and strength of muscles of respiration.[18] Such that in our study paddler did not have any significant effects on ABG's and Ejection fraction as well as no significant change was observed by researcher on vitals while apply the intervention. It just shows it is safe to imply paddler for early mobilization to patients post CABG. The mean of EF at day 1 and day 7 was 53.11±4.8 for experimental group and for control group day 1 and day 7 mean was 53.85±3.76. The mean ABG's at day 1 was 7.41±0.054 and at Day 7 was 7.42±0.04 in experimental group and 7.39±0.39 at Day 1 and 7.44±0.01 at day 7 for control group.

There were no dropouts from study; no post CABG death was recorded in this study. Use of paddler can also be beneficial for long term cardiopulmonary endurance and ultimately further cardiac events can be avoided in this regard.

The limitation of this study was on Day 7 Arterial lines were not present and ABG's were taken by using prick method, so due to human error there might be any VBG observed, and the other

limitation is no tool is used to measure cardiopulmonary endurance on patients.

It is recommended that some tool must be implied to observe improve in cardiopulmonary endurance after the use of paddler and also it is recommended to observe ABG's using Arterial lines, to get more error free précised results.

CONCLUSION

Physiologically both phase 1 cardiac rehabilitation with and without paddling have similar effects according to ABGs and ejection fraction. However, the quality of life was found significantly improved using paddling intervention during Phase 1 Cardiac rehabilitation compared to those without paddling. Hence it is implied that it is safe to incorporate paddling with phase 1 cardiac rehabilitation in post CABG patients.

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