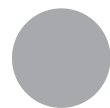
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ACUTE MYOCARDIAL INFARCTION;

ASSESSMENT OF LEFT VENTRICULAR EJECTION FRACTION IN PATIENTS UNDERGOING CARDIAC REHABILITATION FOLLOWING ACUTE MYOCARDIAL INFARCTION

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ABSTRACT... Background: Death and morbidity are commonly occurred worldwide due to heart diseases and are becoming an increasingly important problem in the developing countries including Pakistan. The left ventricular ejection fraction (LVEF) serves as a good assessment tool to document beneficial effects of cardiac rehabilitation (CR) program in cardiac patients. **Objectives:** To evaluate the effect of short-term CR program on LVEF in patients with myocardial infarction (MI). **Study Design:** Cross sectional and Case series study. **Setting:** Departments of Cardiology, Liaquat University Hospital, Hyderabad. **Period:** 1st January 2014 to 30th June 2014. **Methods:** 100 patients of less than 75 years of age with acute uncomplicated anterior wall or anterolateral wall MI, inferior and RV MI. Cases were randomized into two groups of age and sex matched 50 patients each. Group I (study group) patients were administered secondary prevention advice and were started on the CR exercise protocol, Group II (control group) patients were administered secondary prevention advice only. **Results:** At baseline, LVEF was 42.5% in the study group and 41.4% in the control group patients and was statistically comparable. After 10 weeks study group showed the LVEF of 47.78% and control group had LVEF of 42.26%. The differences are being statistically significant. **Conclusion:** Significant improvement in LVEF in patients who had been engaged in CR program besides the secondary prevention strategies when compared with the control group patients who followed secondary prevention strategies only. The present study is amplify the beneficial effects of simple CR program, which additionally improves the key cardiac parameters like LVEF in the recovery period.

Key words: Cardiac Rehabilitation, Left Ventricular Ejection Fraction, Secondary Prevention.

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INTRODUCTION

Coronary Artery Disease (CAD) is widely recognized outcome in significant inability and lost efficiency and contributes extensively to the expanding expenses of human health. In cardiology, there are many problems and challenges in prevention of continued cardiovascular attacks at the time of maintaining sufficient physical working and good life of patients who are already involved in cardiovascular diseases.[1,2]

For the patients who have various heart diseases and heart failure, cardiac rehabilitation program (CR) is well acknowledged as an important tool for the current management of these patients and this program should be continued for everlasting care of patients with heart diseases.[3,4]

There is persuading proof that the mix of standard exercise with mediations for way of life changes and adjustment of risk factors positively modify the clinical path of cardiovascular illnesses.[5,6,7,8,9]

Exercise preparing has accepted a part in CR of patients with CAD since it increments myocardial perfusion and decreases mortality. The regular physical activity play an important role to balance between nitric oxide (NO) production by NO synthase and NO inactivation.[10]

CR has planned to invert the boundaries of negative pathophysiologic and psychological

outcomes of cardiac attacks.[11,12]

As per the US Public Health Service; medical evaluation, prescribed exercise, education and counseling of patients with cardiac disease are included by rehabilitative program.[12]

Medical treatment is improved by the mechanism of CR prevention program by providing services such as initial patient evaluation, physical activity therapy and exercise training, risk factors management (lipids, HTN, weight, diabetes and smoking); physical management and vocational counseling.

The arrangement of these facilities by specific doctor's facility based groups in an out-patient department is suggested and a time of 8-12 weeks is considered as a sufficient to cover the core components of CR/secondary prevention programs suitably.[5]

MATERIALS AND METHODS

The study was conducted in the Departments of Cardiology, Liaquat University Hospital, Hyderabad from 1st January 2014 to 30th June 2014. 100 patients of acute myocardial infarction (MI) less than 75 years of age were included in this study.

Patients admitted to emergency room ER with the first event of documented uncomplicated CAD were encouraged to participate in this program. Diagnosis of CAD was made on the basis of Electrocardiogram, cardiac enzymes and the time of induction was 3-4 days prior to their anticipated day of discharge from the hospital. Patients with decompensated cardiac failure, chronic obstructive pulmonary disease, bronchial asthma, recent major surgical procedures and severe orthopedic conditions limiting their movements were excluded. Informed written consent was obtained from all patients. Patients included were randomized into two groups of 50 patients each:

Group I (study group) patients were administered secondary prevention advice. They were started on the CR exercise protocol as detailed below in Table-I.

- Group II (control group) patients were administered secondary prevention advice only.

METHODS

- A detailed history and general and systemic physical examination were carried out for each patient to assess their suitability for being enrolled in the study.
- Baseline assessment of life-style and risk factors was carried out for all patients inducted into the study and included activity assessment, occupational status, diet (based on 3-day recall), body mass index (BMI), waist circumference (cm), smoking status, blood pressure (BP), lipid profile, blood sugar and medication history.
- All patients were advised on Secondary Prevention Strategies as per their risk status.
- All patients were given dietary advice according to the BMI and the biochemical parameters or any underlying disease and hence that they attain their ideal weight.
- All patients underwent echocardiography to determine their left ventricular ejection fraction (LVEF), which was the single parameter to evaluate the efficacy of CR program in this study. Echocardiography was done on ARTIDA in the cardiology department.
- Non-compliant patients of either group and patients of Group I who were unable to complete the CR program for any reason were excluded from this study.

Risk assessment and secondary prevention strategies

BMI and Waist Circumference

Behavioral and nutritional counseling (by Dietician).

Goal - loss of 5-10% of body weight; maintain BMI < 25 kg/m^2; maintain waist circumference below 100 cm (in men) and below 90 cm (in women).

Smoking

Pick date for cessation of smoking; offers behavioral advice (group counseling if feasible); offer nicotine supplements and/or bupropion.

Goal - long-term abstinence.

BP

Regular BP monitoring if hypertensive; life-style modification, weight management, sodium restriction, moderation of alcohol intake; drug therapy and adherence to therapy. Goal - BP < 140/90 mm Hg (or < 130/85 mm Hg if patient has diabetes, chronic heart failure or renal failure).

Lipid Profile

Diet modification; physical activity; statins.
Goal: (i) Primary - low-density lipoprotein cholesterol level < 100 mg/dL. (ii) Secondary - high-density lipoprotein (HDL) cholesterol level > 45 mg/dL; triglyceride level < 200 mg/dL.

Blood Sugar

Dietary modification, weight control and exercise; oral hypoglycemics and/or insulin: Goal - Maintain fasting plasma glucose level (80-100 mg/dL); glycosylated hemoglobin level <7.0%.

Control Group

They followed the following schedule:

- At the end of the 4 th week: BMI, waist circumference, BP, smoking status and occupational status were reassessed for compliance to secondary prevention strategies and these strategies were emphasized again.
- At the end of the 10 th week: Risk assessment (including lipid profile and fasting blood glucose) and LVEF were re-assessed.

Study Group

The study group followed a comprehensive CR program as mentioned in Tale-I. Started from the step down phase in the ER (while in the hospital) and continued as an out-patient department (OPD)-based service in the Department of Cardiology, LUH Hyderabad and lasted for 10 weeks after discharge.

The above protocol table-I had been devised taking references from the various CR studies conducted.[11,12,13] All patients in the study group were contacted weekly telephonically to assess compliance to exercise program and secondary prevention strategies and to detect and to prevent the complications arising out of participation in the program. Patients contacted the investigator and the attending physician on facing difficulty/ complication during the study period.

RESULTS

The present study had patients of both sexes in the age range of 38-75 years who had experienced MI for the first time. The mean ± standard deviation of age of patients in the study and control group was (56.98 ± 7.038) and (58.60 ± 10.22) years, respectively. The sex ratio in the two groups was comparable with males (76%) and females (24%) in the study group and males (80%) and females (20%) in the control group. There was statistically insignificant variation in the presence of family history of CAD in the two groups (24% in the study group and 16% in the control group, P value – 0.37). Almost one-third of the patients in both groups were found to be diabetic (30% in the study group and 28% in the control group). None of the patients included in this study had a previous history of precordial pain or anginal pain. There was no statistically significant difference in the occurrence of these common symptoms in the two groups. The number of active smokers or those who were social alcohol consumers in the two groups were also comparable. The distribution of patients as per regional infarct showed a preponderance of the anterior wall MI over anterolateral MI, the difference between two groups being statistically insignificant as shown in Table-II.

At Baseline

LVEF was 42.5% in a study group and 41.4% in the control group patients and was statistically comparable.

Patients in both groups were advised secondary prevention strategies based on pre induction assessment of vital signs and ejection fraction.

Patients in group I were started on the CR exercise protocol. Patients in both groups were regularly assessed thereafter at 1, 2, 3, 4 and 10 weeks on the basis of vital signs and weight.

After 10 Weeks

Risk assessment was performed again to ensure compliance and LVEF assessment was done. Group I showed the LVEF of 47.78% and Group II had LVEF of 42.26% Table-III. There was a significant difference in terms of ejection fraction between patients who had been engaged in CR program besides the secondary prevention strategies when compared with group II patients who followed secondary prevention strategies only.

Phase	Location	Days/Weeks	Activity
I	ICCU	3 – 5 days	Assisted mobilization; Sitting On bedside chair, self-care activities (shaving, oral hygiene, sponge bathing)
	Step down	6-7days	sit up and stand (unassisted, supervised)
		8-10days	walking in their hospital rooms; start with 5 min daily; increase to 10 min daily
ii	OPD/Physiology Department/home	1st week	5 days; Home 10 min normal walk: 2days: Department of physiology; 10 min gradual warm up. 10 min walk in Normal pace.
		2nd week	5 days; Home 15 min normal walk: 2days: Department of physiology; 10 min gradual warm up. 15 min walk in Normal pace.
		3rd week	6 days; Home: 20 min normal walk 1day; department of physiology; 10 min warm up,
		4TH week	4 normal walk for 15 min at home and gradual climbing one flight of stairs on 2 days Supervised by family 2 days brisk walk for 5 min home at one day at department of physiology; 10 min warm up, Climbed one flight of stairs, 10 min of brisk walk, and 10 min of cool down.
iii	Home/ physiology Department	5thand 6th weeks	per week, ~ 500 m over 20 min walk 5 days+ climbed 1 flight of stairs 2 days at home, follow-up at end of 6 weeks for complains
		7thand 8th weeks	per week, ~ 700 m over 20 min walk 5 days+ climbed 1 flight of stairs 2 days at home, follow-up at end of 8 weeks for complains.
		9thand 10th weeks	per week, ~ 1 km over 30 min walk 5 days+ climbed 1 flight of stairs 4 days at home, follow-up at end of 10 weeks for final assessment.

Table-I

Parameters	Cases (n=50) %	Control (n=50) %	P Value
Age (mean ± SD)years	56.98±7.038 26(52.0%)	58.60±10.224	NS
Males	24(48. .0%)	30(60.0%)	NS
Females	12 (24.0%))	20(40.0%)	NS
Family h/o CAD	15 (30.0%))	8 (16.0%))	NS
Diabetes	15 (30.0%))	13 (26.0%)	NS
Hypertension	3(6.0%))	13 (26.0%)	NS
Angina	13 (26.0%))	3 (6.0%))	NS
Dyspnea	6(12.0%))	9(18.0%))	NS
Palpitations	12(24.0%))	8(16.0%))	NS
Fatigue	10(20.0%))	9(18.0%))	NS
Smoker	13(26.0%))	9(18.0%))	NS
Alcohol	11(22.0%))	11(22.0%))	NS
Anterolateral MI		7(14.0%))	NS

Table-II. Various parameters of study and control group (n = 100)

LVEF	Study Group	Control Group	P value
Baseline	42.5	41.14	0.133
After	47.78	42.26	<0.00001**
10 weeks			

Table-III. Assessment of left ventricular ejection fraction in study and control group at baseline and after 10 weeks (n = 100)

* <0.00001** is statistically significant, LVEF: Left ventricular ejection fraction

DISCUSSION

Our study showed a significant improvement in the ejection fraction of patients who had undergone a regular exercise regimen when compared with patients who did not exercise. Similar results have been observed in other studies.[13,14,15] Participation in rehabilitation was independently associated with decreased mortality and recurrent MI.

Prognostic value of assessment of left ventricular function in patients undergoing CR following acute MI can be seen. Cardiac attacks are strongly predicted by LVEF as revealed by various studies.[12,13] It is documented earlier that LVEF is proved as good predictor of survival as compared with the angiographyically revealed a number of diseased coronary vessels.[12-]

Various studies have been done to examine and evaluate improvements in post MI patients during and after a comprehensive 12 month exercise rehabilitations program, which show significant improvement in cardiorespiratory fitness, psychological profile and quality-of-life more were recorded in the treatment population when compared with their matched controls.[13,16]

In some cases with exercise training, reduction in the severity of coronary artherosclerosis is observed; However, in advance of CAD, physical training has shown that ischemic preconditioning of the heart muscle has been a temporary process, due to which myocardial ischemia during the exercise tolerance of myocardium have increased, longer ischemic stress.[17,18]

Moreover, exercise preparing and general physical movement might bring about moderate troubles for body weight. Persistence activities likewise could Push decline BP and serum triglycerides, build HDL cholesterol and change for insulin response affectability and glucose hemostasis, which alongside humble weight decrease need been demonstrated to decrease those hazard from claiming sort 2 diabetes mellitus done people with glucose bigotry.[19,20]

Sudden cardiac death caused by ventricular tachyarrhythmia are decreased due to exercise training and it increases parasympathetic movement, as proved by improved heart rate variability and baroreceptor sensitivity.[21,22]

CONCLUSION

In conclusion, addition of an exercise schedule to secondary prevention strategies in the post-infarction period can result in reduced morbidity and mortality and thus helps the patients to return back to their normal life sooner.

The present study reinforces the beneficial effects of simple CR program, which improves the key cardiac parameters such as LVEF in the recovery period. Improvement in LVEF is bound to show improved work efficiency, exercise tolerance, general sense of well-being and is also likely to reduce the incidence of reinfarction, as such patients do tend to adhere to such precautions as would be beneficial to their cardiovascular status in the future.

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