Assessment of Left Ventricular Ejection Fraction in Patients Undergoing Rehabilitation Following Acute Myocardial Infarction

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Abstract
Cardiovascular disorders are the leading cause of mortality and morbidity in the industrialized world 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. The aim of this study was to evaluate the effect of short-term CR program on LVEF in patients with myocardial infarction (MI). This study was conducted on 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. 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. 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 the beneficial effects of simple CR program, which additionally improves the key cardiac parameters like LVEF in the recovery period.

Keywords — Cardiac rehabilitation, left ventricular ejection fraction, secondary prevention

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and a period of 8-12 weeks is considered as an adequate to cover the core components of CR/secondary prevention programs appropriately.

II. 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 decompensate 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.

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

METHODS

1. 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.

2. Baseline assessment of life-style and risk factors was carried out for all patients included 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.

3. All patients were advised on secondary prevention strategies as per their risk status.

4. 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.

5. All patients underwent echocardiography to determine their left ventricular efficacy of CR program in this study. Echocardiography was done on ARTIDA in the cardiology department.

6. 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/m2; maintain waist circumference below 100 cm (in men) and below 90 (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; lifestyle 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 hypoglycemic 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 4th 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 10th week: Risk assessment (including lipid profile and fasting blood glucose) and LVEF were re-assessed.

Study group

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 1] had been advised 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.

III. 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 female (24%) in the study group and males (80%) and female (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 angina 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 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 showed in [Table 1].

Table 1: Various Parameters of Study and Control Group

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Cases (n=50) %</th>
<th>Controls (n=50) %</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age(mean±SD)years</td>
<td>56.98±7.038</td>
<td>58.60±10.224</td>
<td>NS</td>
</tr>
<tr>
<td>Males</td>
<td>76</td>
<td>80</td>
<td>NS</td>
</tr>
<tr>
<td>Females</td>
<td>24</td>
<td>20</td>
<td>NS</td>
</tr>
<tr>
<td>Family h/o CAD</td>
<td>12(24)</td>
<td>8(16)</td>
<td>NS</td>
</tr>
<tr>
<td>Diabetes</td>
<td>15(30)</td>
<td>13(26)</td>
<td>NS</td>
</tr>
<tr>
<td>Hypertension</td>
<td>15(30)</td>
<td>13(26)</td>
<td>NS</td>
</tr>
<tr>
<td>Angina</td>
<td>3(6)</td>
<td>3(6)</td>
<td>NS</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>13(26)</td>
<td>9(18)</td>
<td>NS</td>
</tr>
<tr>
<td>Palpitations</td>
<td>6(12)</td>
<td>8(16)</td>
<td>NS</td>
</tr>
<tr>
<td>Fatigue</td>
<td>12(24)</td>
<td>9(18)</td>
<td>NS</td>
</tr>
<tr>
<td>Smoker</td>
<td>10(20)</td>
<td>9(18)</td>
<td>NS</td>
</tr>
<tr>
<td>Alcohol</td>
<td>13(26)</td>
<td>11(22)</td>
<td>NS</td>
</tr>
<tr>
<td>Anterolateral MI</td>
<td>11(22)</td>
<td>7(14)</td>
<td>NS</td>
</tr>
<tr>
<td>Anterior MI</td>
<td>39(78)</td>
<td>43(86)</td>
<td>NS</td>
</tr>
</tbody>
</table>

NS-Non-significant; M I – Myocardial; CAD – Coronary artery disease; SD – Standard deviation

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, and 4 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 2]. 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.

Table 2: Assessment of Left Ventricular Ejection Fraction in Study and Control Group at Baseline and After 10 Weeks

<table>
<thead>
<tr>
<th>LVEF</th>
<th>Study group</th>
<th>Control group</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>42.5</td>
<td>41.14</td>
<td>0.133</td>
</tr>
<tr>
<td>After 10 weeks</td>
<td>47.8</td>
<td>42.26</td>
<td>0.0**</td>
</tr>
</tbody>
</table>

P Value < 0.05; **; LVEF - Left Ventricular Ejection Fraction

IV. 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 independent 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. Multiple studies have shown that LVEF is a powerful predictor of cardiac events. [12][13] Angiographic ally measured LVEF has been previously reported as a better predictor of survival, compared with the angiographic ally demonstrated a number of diseased coronary vessels. [12]

Various studies have been done to examine and evaluate improvements in cardiorespiratory fitness. Psychological well-being quality-of-life and vocational status in post MI patients during and after a comprehensive 12 months exercise rehabilitation 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 atherosclerosis is observed; however, in the presence of advance CAD, exercise training has been shown to induce ischemic preconditioning of the myocardium a process by which transient myocardial ischemia during exercise enhances tolerance of the myocardium to subsequent more prolonged ischemic stress. [17][18] In addition, exercise training and regular physical activity can result in moderate losses in body weight and adiposity. Endurance exercise also can promote decrease in BP and serum triglycerides, increase HDL cholesterol and improvement in insulin sensitivity and glucose hemostasis, which along with modest weight reduction have been shown to reduce the risk of type 2 diabetes in individuals with glucose intolerance. [19][20] Aerobic exercise training also may decrease the risk of sudden cardiac death due to ventricular tachyarrhythmia by reducing sympathetic and enhancing parasympathetic activity, as evidenced by increased baroreceptor sensitivity. [21][22]

V. 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.

References


