

## Effect of Short Term Cardiac Rehabilitation Program on Quality of Life in Patients with Coronary Artery Disease

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### Abstract

**Background:** Cardiac rehabilitation (CR) programs are known to be one of the effective managements which aim to improve the quality of life (QoL) in coronary artery disease (CAD). However, there is still controversy about the effect on QoL dimension. The purpose of this study is to determine the effect of short term cardiac rehabilitation program on quality of life in patients with coronary artery disease.

**Methods:** The study design used was a quasi experimental study with repeated measurements in consecutive sampling involving 11 subjects with CAD from September–November 2015 in Cardiorespiratory Clinic and Gymnasium of Physical Medicine and Rehabilitation and Cardiac Unit Services, Dr. Hasan Sadikin General Hospital Bandung. The cardiac rehabilitation program was performed for 4 weeks. The quality of life was scored using medical outcomes study short form 36 (SF-36) questionnaire before and after CR program. Statistics obtained in this study were analyzed using paired t-test and Wilcoxon test.

**Results:** This study involved 11 male patients with CAD with an average age of 58 (11) years old with the diagnosis of CAD post CABG (n=6), CAD post PCI (n=4), and CAD unrevascularized (n=1). The average total score of quality of life questionnaire SF-36 demonstrated a significant increase ( $p < 0.001$ ) after CR program 87.27(8.5) as compared to before CR program 49.09(8.4). This improvement occurred in all QoL dimensions.

**Conclusions:** Short term cardiac rehabilitation program can improve the quality of life in patients with coronary artery disease.

**Keywords:** Cardiac rehabilitation, coronary artery disease, quality of life

### Introduction

Based on the world health organization (WHO) in 2012, cardiovascular disease is the leading cause of death, representing 31% of total deaths worldwide. Of these deaths, the highest rate is due to coronary artery disease (CAD) that has high mortality and morbidity rate.<sup>1,2</sup> Management of CAD has been progressing rapidly either by medication or surgical intervention. Nevertheless, cardiac rehabilitation (CR) has an important role in the management of CAD as it has been proven to be effective in reducing mortality and morbidity rate, reducing health care cost, significantly increasing patient's functional capacity and quality of life, especially in women.<sup>3</sup> This

program can be performed both in health care facility and at home with the same effectivity rate.<sup>4</sup>

Quality of life (QoL) has been widely used as a criteria in assessing the outcomes of treatment and intervention given to the patients.<sup>5</sup> Quality of life can be defined as a complex, subjective, and multidimensional concept which represents a patient's perception or subjective evaluation of the impact of disease on their functional status and well being.<sup>6</sup> Various studies have been conducted to observe the effectiveness of cardiac rehabilitation program on QoL in various time periods. However, there is still controversy about the effect on QoL dimension. Nonetheless, studies about the effect of cardiac rehabilitation programs on the quality of life in shorter periods are

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still limited in Indonesia. The aim of this study was to observe the effect of short term cardiac rehabilitation program on quality of life in patients with coronary artery disease.

## Methods

This quasi experimental study without control group was conducted from September–November 2015. The population of this study included all CAD patients in Cardiorespiratory Clinic and Gymnasium of Physical Medicine and Rehabilitation and Cardiac Unit Services, Dr. Hasan Sadikin General Hospital Bandung. Minimum samples needed for this study were 11 subjects. The samples were taken with consecutive sampling method. The subjects were given an informed consent form as a proof of agreement to participate in this study. This study had received ethical approval from Health Research Ethics Committee Faculty of Medicine Universitas Padjadjaran.

The subject inclusion criteria were patients with CAD who agreed to participate as study subjects and were cooperative in answering questions throughout an interview session. Meanwhile, patients with unstable angina, uncontrolled risk factors, neuro-orthopedic pathological conditions that may affect exercise capacity, and who recently (<2 weeks) underwent surgical interventions such as percutaneous coronary intervention (PCI)/coronary artery bypass graft (CABG) were excluded from this study. Drop out criteria were patients who did not return for final evaluation, did not finish exercise phases for 4 weeks, only performed exercise <4 times out of total hospital visits, <8 times out of total home exercise, and did not perform any exercise 5 times in a row.

Before the rehabilitation program, vital signs were measured and submaximal exercise test was performed to determine subject's basic exercise capacity using a 6-minute walking test. All subjects who underwent the cardiac rehabilitation program were given an aerobic exercise modality by using a treadmill under doctor's supervision in the hospital as well as walking at home with a frequency of 3–5 times per week (2 times in the hospital and 3 times at home). Each exercise modality duration was  $\geq 30$  minutes which consisted of  $\geq 5$  minutes warm-up,  $\geq 20$  minutes aerobic exercise, and  $\geq 5$  minutes cool-down, and intensity exercise in the hospital was 60–70% of the  $VO_2$  max or 70–85% of maximum heart rate, while the home exercises were 60–75% of maximum heart rate.

This CR program was performed for 4 weeks. In every hospital visit, the subjects were given education and counselling about risk factor modifications and stress management. During home exercise, subjects were asked to walk on a flat surface around the patient's home at a pace that had been adapted to the patient's condition. The exercise distance was specified by the doctor.

Subject's quality of life was measured by medical outcomes study short form 36 (SF-36) questionnaire which has been widely used in Indonesia as well as other countries. The Indonesian version of the questionnaire had been validated and was used for outcome measurement in this study. The questionnaire was composed of 36 questions assessing physical and mental health components. Physical health component included 4 dimensions: physical function (PF), physical limitation (PL), body pain (BP), and vitality (V). The dimension that reflected mental health components were social function (SF), emotional limitation (EL), mental health (MH), and general health (GH). Each question was scored on a scale from 0 (maximal limitation) to 100 (no limitation). Every score from those questions that addressed each specific dimension were then averaged together, resulting in a final score within each of the 8 dimensions.<sup>7</sup>

The data were analyzed with statistical computer software. Bivariate analysis was performed to observe the correlation between the dependent and independent variables. Normality test using Shapiro-wilk was performed to assess data distribution. Data with normal distribution were assessed with paired t-test, while data with abnormal distribution were assessed with Wilcoxon test. The confidence interval (CI) used in this study was 95%.

## Results

The subjects were recruited using consecutive sampling. Subjects included 11 patients with coronary artery disease. All subjects were males with an average age of 58 years old. Most subjects had undergone revascularization in the form of CABG (Table 1).

Descriptive statistical analysis was performed on the data collected to obtain the average total score and the average score of each dimension of QoL. Then, the data collected were analyzed statistically. The data for normality test using Saphiro-Wilk were obtained to determine the total score of QoL,

**Table 1 Characteristics of Subject**

Variable (n=11)	Mean(SD)	n
Age (year)	58 (11)	
Weight (kg)	65.18 (6.9)	
Height (m)	1.63 (0.1)	
BMI (kg/m <sup>2</sup> )	24.5 (2.5)	
Diagnosis		
CAD unrevascularized		1
CAD post CABG		6
CAD post PCI		4
Gender		
Male		11
Female		0
Education		
Elementary school		3
Junior high school		1
Senior high school		3
College		4
Marital Status		
Married		10
Single		1
Occupation		
Working		8
Not working		3

Note : BMI= Body Mass Index; CAD= Coronary artery disease; CABG= Coronary artery bypass graft; PCI= Percutaneous Coronary Intervention; age, weight, height and BMI are presented as mean (standard deviation)

physical and mental component, dimension of physical functionality, vitality, mental health, and social functions which had normal data distribution. Thus, the data were interpreted using a parametric test, paired t-test. Meanwhile, the score of dimensions in physical limitations, emotional limitations, bodily pain, and general health had an abnormal data distribution, so the alternative nonparametric Wilcoxon test was used.

There were significant differences between the mean score of QoL before and after CR program (Table 2). Based on the SF-36 questionnaire, QoL can be divided into two large components consisting of physical and mental health components. The result shows significant differences between the average scores on the physical and mental health components of the patients before and after

CR program (Table 2).

Additionally, the questionnaire can also be divided into eight dimensions: physical function, physical limitation, emotional limitation, vitality, mental health, social function, body pain, and general health.

Based on the p-values in Table 3, there were significant differences between the QoL of patients before and after CR program in all QoL dimensions.

## Discussion

Coronary artery disease (CAD) is the leading cause of death in the world with high mortality and morbidity rate.<sup>1,2</sup> Cardiac rehabilitation program has largely demonstrated their long-term efficacy in reducing mortality and morbidity rate, increasing patient's functional

**Table 2 Quality of Life Score Differences based on Physical and Mental Components in Patients with Coronary Artery Disease before and after Cardiac Rehabilitation Program**

Scale	CR Program		p value
	Before (mean, SD)	After (mean, SD)	
Physical health component	34.04 (5.7)	87.16 (10.9)	<0.001
Mental health component	63.93 (15.4)	87.29 (8.8)	<0.001
Quality of life score	49.09 (8.4)	87.27 (8.5)	<0.001

Note : SD= Standard deviation

capacity and quality of life, and reducing risks that can arise from CAD and its complications.<sup>8</sup>

In this study, 11 people with CAD participated in cardiac rehabilitation program for 4 weeks. Based on the total study subjects, it can be said that the participation of the patient in cardiac rehabilitation is still quite low. This is supported by a study of Karam et al.<sup>9</sup> showing that the level of patient participation in cardiac rehabilitation is <50% in most countries, with the drop-out rate reaching 56% in high-income countries and 82% in middle-income countries.

All study subjects in this study were male. The low participation of females in this program is supported by a study from Samayoa et al.<sup>10</sup> showing that women's participation in CR program is significantly lower compared to men, women (36%) are less likely to enroll in CR programs.

Results of this study showed that there was an increase in average scores in all dimensions of quality of life significantly after cardiac

rehabilitation program for 4 weeks. This study showed that the effect of a shorter but optimal cardiac rehabilitation conducted for 4 weeks with consistent surveillance can increase the quality of life of the patient mentally and physically as good as a cardiac rehabilitation process conducted for a longer period of time. The results were consistent with the findings of several studies that have been done before. A study conducted by Saedi et al.<sup>3</sup> showed that QoL in 100 patients with CAD who followed cardiac rehabilitation for 8 weeks improve significantly. Freitas et al.<sup>11</sup> showed that patients' physical and mental health component of QoL improve significantly after 4-week cardiac rehabilitation program. The same findings were obtained from the study of Lee et al.<sup>12</sup> after undergoing cardiac rehabilitation within 12 weeks. A study conducted by Tavella et al.<sup>13</sup> on CAD patients who followed a CR program for 6 weeks showed that QoL is improved even for 6 months after the program. However, when compared with the control, there was no

**Table 3 Dimensional Scores Differences of Quality of Life in Patients with Coronary Artery Disease before and after Cardiac Rehabilitation Program**

Scale	CR Program		p value
	Before	After	
Physical function*	35.45 (9.1)	89.36 (8.5)	<0.001
Physical limitation**	0.00 (0-25)	100 (50-100)	0.003
Emotional limitation**	67 (0-100)	100 (67-100)	0.027
Vitality*	64.09 (14.6)	80.45 (12.1)	<0.001
Mental health*	82.55 (10.3)	88.00 (6.7)	<0.001
Social function*	48.55 (12.3)	83.73 (15)	<0.001
Body pain**	22 (0-55)	100 (68-100)	0.003
General health**	70 (45-75)	80 (75-100)	0.003

Note: \*: paired t-test (if normal distribution). Data were presented in mean and standard deviation, \*\*: Wilcoxon test (if abnormal distribution). Data were presented in median, minimum value and maximum value

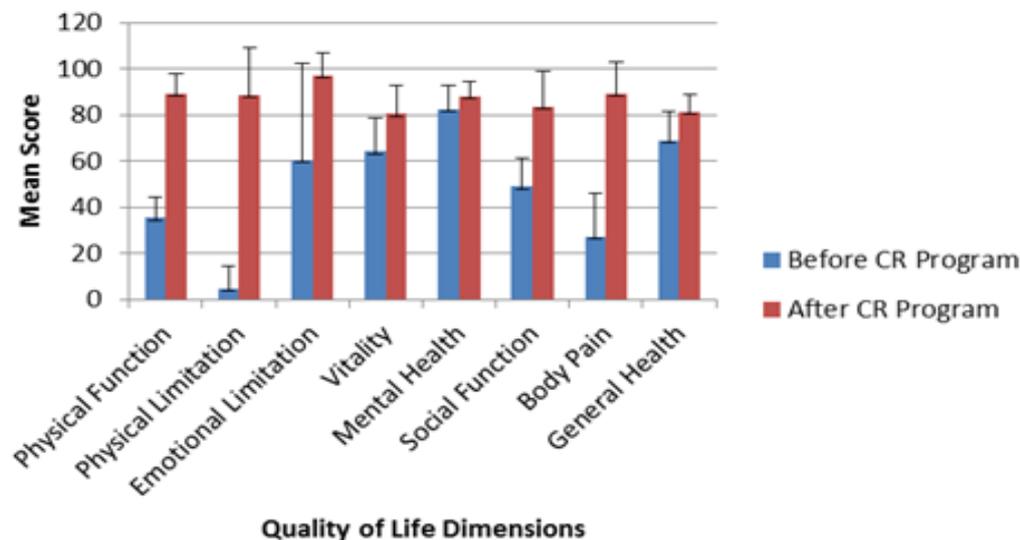


Figure Average Score of QoL Dimensions in 11 Patients with Coronary Artery Disease

significant difference.<sup>13</sup>

Quality of life can be divided into two major components, which are physical and mental health components. In the present study, physical health component score increased significantly after CR in total population. It can be explained as follows: the primary effect of aerobic exercise training is to increase maximal stroke volume (SV) and maximal arterial-venous O<sub>2</sub> difference (A-V O<sub>2</sub> Δ), resulting in an increase of maximal exercise capacity (VO<sub>2</sub>max). There are multiple factors that can influence improvement in VO<sub>2</sub>max, including age, baseline exercise capacity, characteristics of the training regimen, and genetic factors. Exercise-based rehabilitation increases the body's oxygen demand measured as the ventilatory oxygen uptake (ṠO<sub>2</sub>). Rearranging the Fick equation, ṠO<sub>2</sub> is determined by the product of (cardiac output) and A-V O<sub>2</sub>. Increasing either heart rate (HR) or stroke volume (SV) increases Q. Whereas Q is determined by the absolute ṠO<sub>2</sub>; HR and systolic blood pressure (SBP) response, an index of myocardial oxygen requirements (MO<sub>2</sub>), or internal work rate are determined by the ṠO<sub>2</sub> requirements of a physical task relative to maximal capacity or the percent ṠO<sub>2</sub>max. Exercise training raises the ventilatory threshold (VT) which indicates the maximal steady state or work rate that can be maintained during submaximal exercise and increased endurance capacity in cardiac patients. In conclusion, the increase in

ṠO<sub>2</sub>max means that any submaximal physical task represents a smaller percent VO<sub>2</sub>max, produces a slower HR and lower SBP, raises the VT, and therefore, requires a lower MO<sub>2</sub>.<sup>14</sup>

In this study, the average mental health component scores increased significantly after the CR program. These results are comparable to the study of Freitas et al.<sup>11</sup> that showed patient's psychological parameters such as anxiety and depression were improved after CR for 4 weeks. Poortaghi et al.<sup>15</sup> compared a group which received routine centre-based CR programs combined with home visits of a community health nurse throughout the follow-up period with centre-based CR programs alone. Improvements in patient's self efficacy showed statistically significant differences between two studied groups.<sup>15</sup> The findings of that study were the same as the results of the study by Lee et al.<sup>16</sup> in 2013. An investigation by Sharif et al.<sup>17</sup> on CAD patients undergoing CABG showed that cardiac rehabilitation is effective in reducing depression for almost 2 months after surgery. In addition, the decrease in anxiety is not statistically significant.<sup>17</sup> However, there are some investigations with different findings; the study conducted by Weberg et al.<sup>18</sup> on 89 cardiac patients showed that all MacNew heart disease health-related quality of life questionnaire (MacNew) and SF-36 domains show significant improvements except the SF-36 domain for emotional limitation. Moholdt et al.<sup>19</sup> compared 4 weeks of residential with home-based CR program.

They found that there is a significant increase in social and physical domains of the MacNew questionnaire in both groups, but not the emotional domain.<sup>19</sup>

Possible explanations of QoL improvement in the CR program are that the program may ameliorate subject's risk factors and lifestyle by education and also increase in exercise capacity by gradual exercise loading, resulting in improvement of their performance and a better QOL.<sup>12</sup> Improved physical status of patients also influences on their psychological condition and increases participation in social activities along with an improved well being throughout.<sup>3</sup> Recent studies showed that home- and supervised -based cardiac rehabilitation have the same effectiveness in improving the QoL in patients with CAD, myocardial infarction, and patients who underwent revascularization.<sup>4,20</sup> In this study, cardiac rehabilitation was performed in a short period of time, but the subjects were not only encouraged to undergo supervised cardiac rehabilitation at the hospital twice a week, but also underwent home-based cardiac rehabilitation three times a week. Thus, if the patient underwent CR program regularly, it may have a major impact in improving the patient's QoL. In addition, CR programs held at Dr. Hasan Sadikin General Hospital already has a good multidisciplinary team coordination whereby the outcome of rehabilitation programs is fairly outstanding.

Limitation of this study is that the absence of female study subjects which results in the findings of this study cannot be used to describe the effects of cardiac rehabilitation on quality of life in the whole population.

Based on the results of this study, it can be deduced that short term cardiac rehabilitation program can improve physical and mental health components in patients with coronary artery disease. This study is expected to be able to enhance the active participation of physicians and other health providers to motivate patients to undergo cardiac rehabilitation in accordance with the gold standards to increase the CAD patient's participation. We also hope this study will be a guide that optimal result can be obtained with cardiac rehabilitation program within a shorter period, however, patients must be observed that they did a proper and regular rehabilitation in hospital as well as at their home. To get better study results in future studies, using specific quality of life questionnaire for heart disease is recommended, such as the seattle angina questionnaire (SAQ), along with a generic

questionnaire. Routine follow ups with a longer period of time can also be performed to determine long-term effects of cardiac rehabilitation on quality of life. Moreover, further studies should be conducted not only to assess the subjective quality of life but also the objectivity by measuring the capacity of exercises.

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