Case Report

Six-Minute Walking Test as Prognosis Indicator in Stable Chronic CHF Patients in Second Phase Cardiac Rehabilitation

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Abstract

Intorduction*: Congestive heart failure is a complex clinical syndrome that may result from disturbances in myocardial function (systolic and diastolic function) leading to decreased perfusion of cardiac blood flow. The main goals in treating patients with heart failure are to improve functional capacity and quality of life, as well as to reduce mortality and morbidity. Cardiac rehabilitation is one of many forms of treatment recommended by the American Heart Association and has been proven safe and effective in patients with heart failure.*
Case*: This case report consists of three patients undergoing phase two cardiac rehabilitation.*
Case Discussion*: Each patient underwent several examinations consisting of recollection of previous medical history and current complaints. Vital signs and Borg Scale were checked before and after the walking test. The 6-Minute Walk Test was carried out according to the standard protocol on a 30-meter flat track.*
Conclusion*: From a series of 6-minute walking trials conducted on three patients, there was a significant increase in mileage since cardiac rehabilitation phase I, early phase II, and four weeks of phase II exercise.*

Keywords: *6MWT, chronic CHF, prognosis indicator, cardiac rehabilitation*

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Uji Jalan Enam Menit Sebagai Indikator Prognosis Pada Pasien CHF Kronik Stabil Pada Rehabilitasi Jantung Fase II

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Abstrak

***Pendahuluan**: Gagal jantung kongestif merupakan sindrom klinik yang bersifat kompleks, dapat berakibat dari gangguan pada fungsi miokard (fungsi sistolik dan diastolik) yang mengakibatkan menurunnya perfusi aliran darah jantung. Tujuan utama pengobatan pasien dengan gagal jantung adalah untuk meningkatkan kapasitas fungsional dan kualitas hidup, serta untuk menurunkan angka mortalitas dan morbiditas. Rehabilitasi jantung merupakan salah satu bentuk tatalaksana yang direkomendasikan oleh American Heart Association dan terbukti aman dan efektif pada pasien dengan gagal jantung.*
***Laporan Kasus**: Laporan kasus ini melibatkan 3 pasien yang sedang menjalani rehabilitasi jantung fase kedua.*
***Diskusi**: Pada setiap pasien dilakukan pemeriksaan berupa anamnesis mengenai riwayat penyakit sebelumnya dan keluhan pasien saat ini. Dilakukan pemeriksaan tanda vital dan Borg Scale sebelum dan sesudah dilakukan uji jalan. Uji jalan 6 menit (UJ6M) dilakukan berdasarkan protokol standar pada lintasan datar 30 meter.*
***Kesimpulan**: Dari serial uji jalan 6 menit yang dilakukan terhadap ketiga pasien, terjadi peningkatan jarak tempuh yang bermakna sejak rehabilitasi jantung fase 1, fase 2 awal, dan 4 minggu latihan fase 2.*

***Kata Kunci:** UJ6M, CHF kronik, indicator prognosis, rehabilitasi jantung*

Introduction

Congestive heart failure is a complex clinical syndrome, that can result from disturbances in myocardial function (systolic and diastolic function), valvular or pericardial disease, or other aspects that can interfere with blood flow in the presence of fluid retention, usually appearing as pulmonary congestion, peripheral edema, dyspnea, and fatigue. In Indonesia, no statistical data explicitly shows the prevalence of CHF (Congestive Heart Failure), Riskesdas data in 2013 and 2018 show that around 1.5% of the population suffers from heart disease. Meanwhile, the prevalence of cardiovascular diseases such as hypertension increased from 25.8% in 2013 to 34.1% in 2018, and stroke from 12.1 per million in 2013 to 10.9 per million in 2018.

World Health Organization (WHO) describes that the increasing number of heart failures worldwide, including in Asia, is caused by the increasing number of smokers, obesity, dyslipidemia, and diabetes. The incidence of heart failure also increases with age.[2]

The main goals of treatment are to improve functional capacity and quality of life, as well as to reduce mortality and morbidity. Cardiac rehabilitation is one kind of treatment recommended by the American Heart Association and has been proven safe and effective in patients with heart failure.[3,4]

Currently, there are several methods to assess functional capacity and exercise tolerance in heart failure patients. The New York Heart Association (NYHA) functional status classification is widely used by clinicians worldwide and has been shown to demonstrate favorable effects of various drugs in reducing morbidity and mortality in heart failure patients. The gold standard for measuring exercise capacity is a direct assessment of cardiorespiratory peak oxygen consumption (peak VO_2). However, this method is expensive and requires specialized equipment and trained personnel, and its availability in health

facilities is still limited.[5]

The 6-Minute Walk Test (6MWT) is an assessment of the submaximal performance of daily activities. This assessment is simple and inexpensive and can be tolerated by patients with heart failure.[6] The 6MWT has been used extensively to assess the functional status of patients with heart failure, also provides prognostic information in several studies, and has been frequently compared with other cardiorespiratory exercise tests. The 6MWT is considered an alternative to the cardiorespiratory exercise test for risk stratification of patients with heart failure.[7] Initial improvement of aerobic capacity in heart failure patients occurs after stabilization, generally within two to three weeks, so it is advisable to start training during this period. The progress of exercise activity is adjusted to individual conditions such as initial functional capacity, clinical status, individual adaptability to the exercise program, as well as the possibility of secondary disease and biological age.[8]

Case Illustration

Three patients with stable chronic heart failure were about to start phase II of cardiac rehabilitation. Recovery of phase I cardiac rehabilitation was carried out during the inpatient period with the concept of early mobilization, meaning that as soon as the patient was stable, walking exercises were carried out around the treatment room and corridor. At the end of phase I, a 6MWT was performed before the patient left the hospital to determine daily activities at home. The patient then went to the Medical Rehabilitation outpatient clinic to continue with phase II cardiac rehabilitation. During the visit, a 6MWT was performed to determine the initial dose of exercise. Within four weeks of phase two exercise, the patient was re-evaluated with a 6MWT to determine their physical ability.

Each patient was examined in the form of history taking and current patient complaints. Vital signs and Borg Scale were checked before and after the walking test. The 6MWT was carried out according to standard protocols on a 30-meter flat track. The patient was instructed to walk as far as possible and turn 180º at the end of the 30-meter track for six minutes. After six minutes, the patient was instructed to stop, then the total distance traveled was measured. The reference value was obtained from the Cahalin formula for the 6MWT.

Case 1

A 59-year-old male patient with HF FC II (Heart Failure functional classification class II) on HFrEF (Heart Failure reduced Ejection Fraction) 13% on CRT-D (cardiac resynchronization therapy defibrillator) and paroxysmal AF (Atrial Fibrillation). The patient denied any chest pain and shortness of breath, but suffered low back pain that had occurred in the last two weeks, which did not interfere with daily activities. Patient underwent PCI (Percutaneous Coronary Intervention) in February 2015, but the shortness of breath did not improve, later patient underwent CRT-D in May 2021. Patient has had a history of hypertension since 2006. The result of 6MWT at the end of phase one was 412 meters, VO2 max of 16.34 ml/kgBW/minute and aerobic capacity equivalent to 4.66 METs. Before starting phase two of cardiac rehabilitation, 6MWT was performed with the results of 430 meters, VO2 max of 16.68 ml/kgBW/minute and aerobic capacity equivalent to 4.82 METs. After four weeks of phase II rehabilitation, a 6MWT was performed once more, resulting in improved distance at 461 meters, VO2 max of 17.81 ml/kgBW/minute, and aerobic capacity equivalent to 5.08 METs.

Case 2

A 40-year-old male patient with HF FC I at HFrEF 35.8%, denied any chest pain and shortness of breath, but complained of pain in the left leg every time he walked. Previously, the patient had a history of intermittent chest pain and routinely takes aspirin and ISDN (isosorbide dinitrate). Patient also had a history of hypertension for the last 1 year and regularly takes captopril 1x12.5 mg. The result of 6MWT at the end of phase one was 455 meters, VO2 max of 17.63 ml/kgBW/minute and aerobic capacity was equivalent to 5.03 METs. Before starting phase two rehabilitation, a 6MWT was performed, with the results of 478 meters, VO2 max of 18.32 ml/kgBW/minute and aerobic capacity was equivalent to 5.23 METs. After four weeks of phase II rehabilitation, a 6MWT was performed again, resulting in improved distance at 527 meters, VO2 max of 18.79 ml/kgBW/minute, and aerobic capacity equivalent to 5.65 METs.

Case 3

A 71-year-old male patient with HF FC I at 36.6% HFrEF. The patient complained of intermittent chest pain but denied any

shortness of breath. Patient had a history of hypertension and arrhythmias since 2015, and regularly takes bisoprolol and warfarin. History of diabetes was denied. The patient had a history of ischemic stroke in May 2021 with a sequel in the form of Broca's aphasia. The result of 6MWT at the end of phase one was 465 meters, VO2 max of 17.93 ml/kgBW/minute and aerobic capacity was equivalent to 5.12 METs. Before starting phase two rehabilitation, a 6MWT was performed, with the results was 489 meters, VO2 max of 18.65 ml/kgBW/minute and aerobic capacity was equivalent to 5.32 METs. After four weeks of phase II rehabilitation, 6MWT was performed once more, resulting in improved distance at 583 meters, VO2 max was 21.47 ml/kgBW/minute, and aerobic capacity equivalent to 6.13 METs.

Discussion

The patients in this case report were those who have completed phase I of cardiac rehabilitation, and results of 6MWT at the time of discharge were considered as baseline. The patient has undergone regular walking aerobic exercise for four weeks. Two patients had no chest pain or shortness of breath, but one had intermittent chest pain and history of coronary heart disease. By the time the 6MWT was conducted, all absolute contraindications have been eliminated.

Cardiac Rehabilitation	6MWT distance (meter)		
	Case 1	Case 2	Case 3
Phase I	412	455	465
Early Phase II	430	478	489
Phase II (4 week)	461	527	583

Graph 1. 6MWT Distance achieved in each Rehabilitation Phase indica

rehabilitation phase I, early phase II, and four weeks of phase II. This outcome is similar to a meta-analysis study conducted by Haykowsky et al in 2007, that walking as a type of aerobic exercise can restore or stop left ventricular remodeling in patients with heart failure who are clinically stable, with results of increased aerobic capacity, increased oxygen uptake (VO2) and modified risk factors for cardiovascular disease. Another noteworthy finding, in heart failure patients with decreased ejection fraction undergoing cardiac rehabilitation, functional capacity may also increase without an increase in left ventricular ejection fraction. In a meta-analysis study by Palau et al in 2016, others also mentioned that exercise during cardiac rehabilitation can improve the quality of life in heart failure patients with or without a decrease in ejection fraction.[3,5]

All three patients in this case series were heart failure patients with decreased ejection fraction. Increase in mileage was found in all three patients which reached above 400 meters, as stated by previous studies that a steady increase in mileage in patients with heart failure with a decreased ejection fraction, proved to increase survival rate.[7,10] There have been many studies examining whether mileage during a walking test is a prognostic indicator in patients with heart failure. The Studies of Left Ventricular Dysfunction (SOLVD) first conducted in 1993, was the first study to show a strong association between mileage and mortality in NYHA class II and class III heart failure patients. It explained that the total mortality rate was 10.23% in subjects with a distance of 6MWT less than 300 meters, and 2.99% in subjects with a distance of 6MWT ≥450 meters.[11] A study conducted by Sakir et al in 2007 proved that a low level of functional capacity (distance less than 300 meters) was a predictor of mortality and morbidity in

Table 1. Functional Capacity in The Three Cases

Indicator	Case 1			Case 2			Case 3		
	Phase I	Early phase II	Phase II (4w)	Phase I	Early phase II	Phase II (4w)	Phase I	Early phase II	Phase II (4w)
VO2Max (ml/kgBW/min)	16.34	16.68	17.81	17.63	18.32	18.79	17.93	18.65	21.47
Aerobic capacity (METs)	4.66	4.82	5.08	5.03	5.23	5.65	5,12	5.32	6.13

From a series of 6-minute walking trials conducted on three patients, there was a significant increase in mileage since cardiac patients with asymptomatic left ventricular systolic dysfunction as well as in patients with mild to moderate heart failure.[12] In a systemat-

ic review conducted by Jonathan et al in 2015 examining the correlation of NYHA classification with mileage, it was found that the average mileage was 400 meters for NYHA class I-II, 320 meters for NYHA class III. This is consistent with the three cases reporting that all three patients were heart failure patients with NYHA class I-II classification, able to perform a 6MWT with a distance of more than 400 meters.[10]

Conclusion

The 6MWT is a simple first-line of submaximal exercise testing for cardiorespiratory functional performance that can be relied upon as a prognostic indicator in patients with stable chronic heart failure, where the cut-off distance can change over time depending on the prognosis. In all three cases, it was found that there was an increase in functional capacity after following the cardiac rehabilitation program. Further studies involving multiple samples and longer follow-up time until completion of the third phase are needed to see how the 6MWT can be a prognostic indicator of cardiac rehabilitation in patients with stable chronic heart failure.

Conflict of interest

The authors have no relevant financial or non-financial interests to disclose.

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