

Walking Exercise in Phase II Cardiac Rehabilitation to Improve Aerobic Capacity in Patients with Congestive Heart Failure due to Three-Vessel Coronary Artery Disease

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ABSTRACT

Congestive heart failure (CHF) secondary to three-vessel coronary artery disease (CAD 3VD) is characterized by high morbidity and markedly reduced functional capacity, highlighting the importance of effective and individualized rehabilitation strategies. Exercise-based cardiac rehabilitation, particularly during Phase II, plays a critical role in restoring functional performance, improving cardiovascular efficiency, and enhancing quality of life in high-risk cardiac patients. This study aimed to evaluate the safety and clinical effectiveness of a Phase II cardiac rehabilitation program incorporating structured walking exercises in a patient with CHF and CAD 3VD. A single-case design was applied to a 54-year-old male diagnosed with CHF and CAD 3VD. The intervention consisted of ten supervised sessions of moderate-intensity aerobic exercise using track and treadmill walking. Clinical outcomes were assessed using the Six-Minute Walk Test (6MWT), metabolic equivalents (METs), heart rate-walking speed index (HRWSI), vital signs, and perceived exertion. Hemodynamic responses were monitored throughout all sessions to ensure safety and tolerance. Following completion of the program, the patient demonstrated clinically meaningful improvements in functional and aerobic capacity. The 6MWT distance increased from 428 to 535 meters, METs improved from 4.8 to 5.7, and HRWSI increased from 1.21 to 1.50. These gains were accompanied by stable hemodynamic parameters and reduced perceived exertion, indicating enhanced cardiovascular efficiency and improved exercise tolerance. In conclusion, supervised, progressive walking exercise within a Phase II cardiac rehabilitation program is safe, feasible, and effective for improving functional capacity in high-risk patients with CHF and CAD 3VD. The observed improvements support the integration of structured walking modalities as a core component of individualized cardiac rehabilitation.

Keywords: congestive heart failure; cardiac rehabilitation phase II; walking exercise; aerobic capacity; physiotherapy

INTRODUCTION

Congestive heart failure (CHF) is a multifactorial clinical syndrome with a substantial global burden, affecting more than 64 million individuals worldwide and continuing to rise in parallel with population aging and the increasing prevalence of cardiovascular risk factors [1]. In Indonesia, the 2023 Indonesian Health Survey (SKI) reported a heart disease prevalence of 0.85%, equivalent to approximately 877,531 individuals diagnosed by physicians. The prevalence of CHF in the adult population is estimated at 1–2%, with a marked increase among older adults, exceeding 10% in individuals aged 70 years and above [2]. CHF remains one of the leading causes of hospitalization, rehospitalization, and cardiovascular mortality, thereby imposing a significant challenge to national health systems and contributing to escalating healthcare expenditures [1]. Coronary artery disease (CAD) is the predominant etiology of CHF. CAD is characterized by progressive narrowing or obstruction of the coronary arteries, resulting in impaired myocardial perfusion and subsequent ischemic injury. Beyond its physiological consequences, CAD also exerts profound psychological and social impacts, contributing to reduced functional independence, diminished emotional well-being, and overall deterioration in quality of life [3].

Cardiac rehabilitation (CR) is a structured, medically supervised intervention designed to optimize cardiovascular recovery through individualized exercise prescription, risk factor modification, psychosocial support, and systematic clinical monitoring. In patients with heart failure, CR encompasses not only exercise training but also comprehensive education on pharmacological adherence, lifestyle modification, nutritional counseling, smoking cessation, and stress management. Over the past three decades, CR has evolved from a predominantly exercise-centered program into a multidisciplinary therapeutic strategy aimed at reducing morbidity and mortality while enhancing functional capacity and long-term prognosis [4]. CR is conventionally delivered in three sequential phases, with Phase II representing a structured outpatient program initiated after acute stabilization or hospital discharge [5,6]. This phase is particularly critical because it bridges the transition from inpatient care to long-term self-management, focusing on restoring aerobic capacity, improving hemodynamic stability, and preventing recurrent cardiovascular events.

This case report evaluates the safety and clinical effectiveness of a Phase II cardiac rehabilitation program in a patient with congestive heart failure secondary to three-vessel coronary artery disease (CAD 3VD), a condition characterized by extensive coronary involvement and elevated cardiovascular risk. Patients with CAD 3VD often exhibit markedly reduced exercise tolerance, impaired myocardial reserve, and heightened susceptibility to ischemic symptoms during physical exertion. Therefore, evidence supporting the feasibility and safety of structured aerobic training in this subgroup is essential. The observed improvement in aerobic capacity following a structured walking-based intervention in this case contributes to the growing body of literature advocating for the integration of supervised exercise modalities in high-risk cardiac populations, particularly in resource-limited settings where access to advanced rehabilitation equipment may be constrained.

Walking is a fundamental form of aerobic exercise that is both accessible and clinically applicable across diverse populations. Evidence indicates that walking exercise improves cardiovascular efficiency, reduces resting heart rate, enhances postural stability, alleviates perceived fatigue, and decreases anxiety, thereby contributing to overall cardiometabolic and psychological health [7,8]. Unlike equipment-dependent exercise modalities, walking requires no specialized infrastructure, making it a cost-effective and scalable intervention suitable for broad implementation. Its reliance on natural, functional movement patterns further supports its feasibility and sustainability in long-term rehabilitation programs. When performed regularly, particularly in outdoor environments, walking provides consistent light-to-moderate aerobic stimulation with additional psychosocial benefits, including improved mood, reduced stress, and enhanced motivation for continued physical activity [9].

Aerobic exercise is a cornerstone of Phase II cardiac rehabilitation and has consistently demonstrated benefits in improving functional capacity, reducing cardiovascular morbidity, and enhancing quality of life in patients with coronary artery disease and heart failure. However, most existing studies emphasize equipment-based modalities such as treadmill and cycle ergometer training performed under structured supervision, with outcomes primarily assessed through VO_2 max or six-minute walk test (6MWT) distance. Despite these findings, evidence remains limited regarding the efficacy of structured walking exercise prescribed at a defined moderate intensity in patients with CHF secondary to CAD 3VD, a subgroup characterized by

advanced coronary involvement and significantly reduced exercise tolerance. Furthermore, the evaluation of aerobic improvement through hemodynamic adaptations reflected in vital sign parameters in this high-risk population has not been comprehensively addressed.

Accordingly, this study investigates a 70%-intensity walking exercise protocol derived from 6MWT performance as a pragmatic, low-cost, and scalable intervention within Phase II cardiac rehabilitation. By targeting patients with CHF due to CAD 3VD, this study aims to strengthen the evidence base regarding the safety and clinical effectiveness of structured walking exercise while proposing a more accessible rehabilitation model that may enhance implementation in resource-limited healthcare environments. The findings of this case report underscore the potential of walking-based aerobic training to serve as a viable therapeutic modality for improving functional capacity and supporting cardiovascular recovery in high-risk cardiac populations.

METHODS

This study employed a single-case report design to examine the clinical effects of a structured walking exercise program delivered during Phase II cardiac rehabilitation in a patient with a complex cardiovascular profile. The single-case approach allowed for an in-depth exploration of the patient's baseline characteristics, individualized intervention parameters, physiological responses, and functional outcomes. Although this design does not permit causal inference or broad generalization, it provides clinically relevant insights into the feasibility, safety, and potential therapeutic value of walking-based aerobic training in high-risk cardiac populations. Such detailed characterization is particularly valuable in conditions involving extensive coronary involvement, where individualized rehabilitation strategies must be carefully tailored to ensure both safety and effectiveness.

The study was conducted at the Integrated Cardiac Care Unit of Prof. Dr. I.G.N.G. Ngoerah General Hospital in Denpasar, Bali, Indonesia, a tertiary referral center equipped with advanced cardiovascular diagnostic and therapeutic services. The institution provides comprehensive cardiac care, including interventional cardiology, cardiac surgery, and structured outpatient rehabilitation programs. Care is delivered by a multidisciplinary team comprising cardiologists, rehabilitation medicine specialists, physiotherapists, nurses, and clinical nutritionists, ensuring that each patient receives coordinated and evidence-based management. The rehabilitation program implemented in this study adhered to institutional protocols aligned with international cardiac rehabilitation standards, thereby ensuring consistency, safety, and clinical rigor throughout the intervention period.

The participant was a 54-year-old male with a confirmed diagnosis of heart failure secondary to extensive three-vessel coronary artery involvement. He had experienced progressive exertional fatigue over the preceding four months, prompting referral for structured rehabilitation following stabilization of his cardiac condition. His medical history included hypertension managed pharmacologically, with no reported family history of cardiovascular disease. At the time of enrollment, he was clinically stable and met the criteria for participation in moderate-intensity aerobic training. His medication regimen consisted of amlodipine 5 mg once daily, lisinopril 10 mg once daily, clopidogrel 75 mg once daily, and simvastatin 20 mg once daily, prescribed to optimize blood pressure control, reduce thrombotic risk, slow atherosclerotic progression, and support overall cardiovascular stability during the rehabilitation process.

Eligibility criteria for participation included a confirmed diagnosis of heart failure secondary to extensive coronary involvement, clinical and hemodynamic stability, suitability for Phase II rehabilitation, and the physical ability to perform supervised aerobic exercise. Written informed consent was obtained prior to participation. Exclusion criteria encompassed conditions associated with elevated exercise risk, including early post-acute coronary syndrome, unstable angina, decompensated heart failure, acute thromboembolic events, active inflammatory cardiac disease, aortic dissection, symptomatic severe aortic stenosis, uncontrolled hypertension, uncontrolled sinus tachycardia, life-threatening arrhythmias, third-degree atrioventricular block without pacemaker support, and severe comorbidities that could compromise exercise safety. Participants were withdrawn if adverse events or clinical deterioration occurred during the intervention period.

The intervention consisted of a structured Phase II cardiac rehabilitation program centered on walking exercise, incorporating both track-based and treadmill-based modalities. The program was delivered across ten supervised sessions conducted three to five times per week, with each session lasting approximately 30 to 60 minutes. Sessions followed a standardized structure comprising a preparatory warm-up, a core aerobic training phase, and a cool-down period to facilitate gradual cardiovascular adjustment. Exercise intensity was prescribed based on individualized parameters derived from baseline functional testing, ensuring that the training stimulus remained within a safe and clinically appropriate range. Continuous monitoring of physiological responses was performed throughout each session to ensure safety and to guide real-time adjustments to exercise intensity.

Outcome measures were selected to capture both functional and physiological adaptations to the intervention. Aerobic capacity served as the primary outcome and was assessed using the Six-Minute Walk Test, a validated and widely utilized measure of functional exercise performance in cardiac rehabilitation. The total distance walked was recorded, and metabolic equivalents were calculated to quantify functional aerobic capacity. Secondary outcomes included perceived exertion measured using the Borg scale, resting and post-exercise vital signs, and the heart rate-walking speed index, which served as an indicator of cardiovascular efficiency. Baseline assessments were conducted prior to the initiation of the rehabilitation program, and follow-up evaluations were performed upon completion of the ten-session intervention. All assessments were administered by a licensed physiotherapist trained in cardiac rehabilitation protocols to ensure procedural consistency, measurement accuracy, and clinical reliability.

RESULTS

Participant follow-up and intervention adherence

The patient completed the entire Phase II cardiac rehabilitation program, which consisted of ten supervised exercise sessions, without interruption. Attendance adherence was 100%, with no missed sessions. Throughout the intervention period, no new symptoms or exercise-related adverse events were observed. All training sessions were conducted under the direct supervision of a physiotherapist, with continuous monitoring of vital signs and subjective fatigue levels.

During the program, the patient demonstrated good tolerance to the gradual progression of exercise workload in both track-based and treadmill-based walking sessions. No evidence of clinical deterioration, exercise intolerance, or hemodynamic instability was identified that necessitated modification or discontinuation of the rehabilitation program.

Daily clinical assessment

Based on Table 1, systolic blood pressure ranged from 87–113 mmHg and diastolic blood pressure from 57–76 mmHg, values that fall within the low-normotensive range. Minor inter-session fluctuations represent normal physiological adaptations to submaximal aerobic exercise. No evidence of orthostatic hypotension was observed, indicating good hemodynamic tolerance to walking exercise [13]. In the context of heart failure, stable blood pressure responses suggest that the prescribed exercise intensity was safe and did not precipitate cardiovascular decompensation. This finding is consistent with established physiotherapy exercise prescription principles, which advocate initiating training at low intensity and progressively increasing it according to individual tolerance [10-12].

Table 1. Daily evaluation

Session 1			
Date	Track-based walking (Session 1)	Track-based walking (Session 2)	Borg scale
19 September 2025	BP: 96/65 mmHg HR: 63 bpm SpO ₂ : 100% Exercise dose: 700 meters	BP: 91/65 mmHg HR: 66 bpm SpO ₂ : 98% Exercise dose: 700 meters	6/20
Session 2			
Date	Track-based walking (Session 1)	Track-based walking (Session 2)	Borg scale
22 September 2025	BP: 99/61 mmHg HR: 72 bpm SpO ₂ : 97% Exercise dose: 800 meters	BP: 87/58 mmHg HR: 78 bpm SpO ₂ : 95% Exercise dose: 800 meters	6/20
Session 3			
Date	Track-based walking (Session 1)	Track-based walking (Session 2)	Borg scale
23 September 2025	BP: 93/66 mmHg HR: 76 bpm SpO ₂ : 100% Exercise dose: 900 meters	BP: 103/62 mmHg HR: 79 bpm SpO ₂ : 97% Exercise dose: 900 meters	6/20
Session 4			
Date	Track-based walking (Session 1)		Borg scale
25 September 2025	BP: 94/57 mmHg HR: 78 bpm SpO ₂ : 97% Exercise dose: 1.800 meters		7/20
Session 5			
Date	Treadmill walking (Session 1)	Treadmill walking (Session 2)	Borg scale
26 September 2025	BP: 108/66 mmHg HR: 95 bpm SpO ₂ : 97% Exercise dose: 4.1 km/h for 900 m (15 minutes)	BP: 97/76 mmHg HR: 93 bpm SpO ₂ : 99% Exercise dose: 4.1 km/h for 900 m (15 minutes)	6/20
Session 6			
Date	Treadmill walking (Session 1)	Treadmill Walking (Session 2)	Borg scale
29 September 2025	BP: 102/68 mmHg HR: 100 bpm SpO ₂ : 96% Exercise dose: 4.4 km/h for 1000 m (15 minutes)	BP: 101/66 mmHg HR: 104 bpm SpO ₂ : 99% Exercise dose: 4.4 km/h for 1000 m (15 minutes)	6/20
Session 7			
Date	Treadmill walking (Session 1)	Treadmill Walking (Session 2)	Borg scale
30 September 2025	BP: 84/66 mmHg HR: 83 bpm SpO ₂ : 98% Exercise dose: 4.7 km/h for 1100 m (15 minutes)	BP: 101/68 mmHg HR: 79 bpm SpO ₂ : 98% Exercise dose: 4.7 km/h for 1100 m (15 minutes)	7/20
Session 8			
Date	Treadmill walking (Session 1)	Treadmill walking (Session 2)	Borg scale
1 October 2025	BP: 117/67 mmHg HR: 83 bpm SpO ₂ : 98% Exercise dose: 5.0 km/h for 1200 m (15 minutes)	BP: 105/58 mmHg HR: 81 bpm SpO ₂ : 97% Exercise dose: 5.0 km/h for 1200 m (15 minutes)	6/20
Session 9			
Date	Treadmill walking (Session 1)	Treadmill walking (Session 2)	Borg scale
2 October 2025	BP: 106/70 mmHg HR: 99 bpm SpO ₂ : 98% Exercise dose: 5.3 km/h for 1300 m (15 minutes)	BP: 113/66 mmHg HR: 101 bpm SpO ₂ : 97% Exercise dose: 5.3 km/h for 1300 m (15 minutes)	6/20
Session 10			
Date	Treadmill walking (Session 1)	Treadmill walking (Session 2)	Borg scale
3 October 2025	BP: 99/68 mmHg HR: 116 bpm SpO ₂ : 98% Exercise dose: 5.6 km/h for 1400 m (15 minutes)	BP: 99/65 mmHg HR: 118 bpm SpO ₂ : 96% Exercise dose: 5.6 km/h for 1400 m (15 minutes)	6/20

Heart rate increased progressively from 66 bpm during the initial session to approximately 118 bpm by the tenth session, reflecting appropriate cardiovascular adaptation. The elevation in cardiac workload remained within physiological limits and suggests improvement in aerobic capacity. The absence of dyspnea or excessive fatigue, alongside achievement of the target intensity range (40–60% of maximal heart rate), indicates adherence to the American College of Sports Medicine (ACSM) recommendations for patients with heart failure [14].

Peripheral oxygen saturation (SpO₂) remained stable between 95–99% throughout the sessions, demonstrating adequate oxygenation. No clinically significant desaturation (<90%) occurred, confirming exercise safety from ventilatory and tissue perfusion perspectives. These results indicate preserved ventilation–perfusion efficiency and improved cardiopulmonary response following structured aerobic training.

Borg Scale ratings were consistently maintained at 6–7/20, corresponding to “very light” to “light” perceived exertion. During the initial conditioning phase of cardiac rehabilitation, this range is considered appropriate, as it provides sufficient cardiovascular stimulus while minimizing myocardial stress. Prior to the intervention, aerobic capacity was assessed using the Six-Minute Walk Test (6MWT) to establish baseline functional status and guide individualized exercise prescription.

Evaluation of aerobic capacity improvement

Based on Table 2, the aerobic capacity evaluation demonstrated significant improvement following ten sessions of the rehabilitation program. The patient’s Six-Minute Walk Test (6MWT) distance increased from 428 meters to 535 meters, representing a 107-meter gain. An improvement exceeding 50 meters on the 6MWT is considered clinically meaningful, indicating that the intervention effectively enhanced functional endurance [15].

Aerobic capacity increased from 4.8 to 5.7 METs, reflecting improved efficiency in oxygen uptake and utilization. These changes are consistent with physiological adaptations to aerobic training, including enhanced cardiac output, improved peripheral perfusion, and greater skeletal muscle metabolic efficiency. Exercise performed at 40–60% of maximal heart rate is recognized as a safe and effective training intensity for patients with heart failure [16]. The observed increase in METs suggests that a structured walking program, when prescribed at an appropriate intensity, can improve cardiovascular fitness without inducing excessive physiological strain.

The Heart Rate–Walking Speed Index (HRWSI) increased from 1.21 to 1.50, indicating enhanced cardiovascular efficiency in response to workload. A higher HRWSI reflects improved cardiac performance in maintaining adequate output during physical activity. This finding is consistent with established principles of aerobic adaptation, whereby regular exercise enhances myocardial efficiency, lowers resting heart rate, and improves endothelial function [17].

Heart rate increased from 67 bpm to 132 bpm, and respiratory rate rose from 19 to 22 breaths per minute, representing expected physiological responses to submaximal exertion. The increase in heart rate corresponds to elevated tissue oxygen demand, while the rise in respiratory rate reflects ventilatory adaptation to metabolic requirements. Systolic blood pressure increased modestly (101 to 111 mmHg) without a significant change in diastolic pressure, indicating safe hemodynamic adaptation. Peripheral oxygen saturation remained stable (100% to 98%), confirming adequate oxygenation throughout the rehabilitation process.

The Borg Scale score decreased from 9 to 8, suggesting that the patient perceived the activity as less demanding despite progression in exercise intensity. This reduction reflects improved exercise tolerance and autonomic adaptation to physical stress. Collectively, the findings demonstrate improvements in both objective measures, walking distance, aerobic capacity, HRWSI, and hemodynamic stability and subjective outcomes, particularly reduced perceived fatigue. The patient currently reports resolution of prior symptoms, indicating enhanced functional capacity and successful physiological adaptation to the structured exercise program.

Table 2. Before and after intervention comparison of physiological and functional outcomes

Variable	Before intervention	After intervention	Absolute change	Percentage change
Systolic blood pressure (mmHg)	101	111	+10	+9.90%
Diastolic blood pressure (mmHg)	65	63	-2	-3.08%
Heart rate (bpm)	67	132	+65	+97.01%
Oxygen saturation (%)	100	98	-2	-2.00%
Respiratory rate	19	22	+3	+15.79%
Borg scale	9/20	8/20	-1	-11.11%
6MWT distance (m)	428	535	+107	+25.00%
Heart Rate Walking Speed Index (HRWSI)	1.21	1.5	+0.29	+23.97%
METs	4.805	5.7	+0.895	+18.63%

DISCUSSION

The findings of this study demonstrate a clear and measurable improvement in aerobic capacity and physiological responses following participation in a structured Phase II cardiac rehabilitation program. Objectively, the patient exhibited a clinically meaningful increase in the distance covered during the six-minute walk test, accompanied by an improvement in metabolic equivalents and a notable enhancement in the heart rate–walking speed index. Hemodynamic parameters remained stable throughout the intervention period, with no episodes of hypotension, arrhythmia, desaturation, or other adverse cardiovascular events. Exercise intensity consistently remained within recommended safety thresholds, indicating that the walking-based aerobic program was both safe and well tolerated. Collectively, these outcomes provide strong factual evidence that the intervention was effective in improving functional performance in this clinical case.

From an interpretative standpoint, the observed improvements in functional capacity are likely attributable primarily to peripheral physiological adaptations rather than substantial central cardiac remodeling. In individuals with chronic heart failure, it is well established that the benefits of aerobic training arise predominantly from enhanced skeletal muscle oxidative capacity, improved endothelial function, increased capillary density, and more efficient peripheral oxygen extraction. These adaptations reduce the reliance on maximal cardiac output during exertion, thereby allowing patients to perform physical activity at a lower relative physiological cost. Although central parameters such as stroke volume and maximal cardiac output often show limited change in this population, improvements in myocardial efficiency and autonomic regulation can occur, contributing to better exercise tolerance. In this context, the increase in metabolic equivalents and the reduction in perceived exertion despite a higher workload suggest enhanced exercise economy, improved ventilatory efficiency, and more favorable autonomic balance.

These findings are consistent with previous studies demonstrating that supervised Phase II cardiac rehabilitation significantly improves functional capacity, exercise tolerance, and overall cardiovascular efficiency in patients with heart failure [18,19]. Similar research has reported increases in six-minute walk test performance, improved heart rate recovery, and favorable hemodynamic responses without evidence of instability

or adverse events. Furthermore, prior evidence indicates that structured aerobic exercise reduces rehospitalization rates, enhances quality of life, and contributes to long-term cardiovascular risk reduction [20]. The present results align with these established findings, reinforcing the clinical relevance and applicability of walking-based aerobic programs within supervised rehabilitation settings, particularly for patients with complex coronary pathology.

The results can also be interpreted through the lens of established exercise physiology principles. The principle of progressive overload posits that gradual and controlled increases in exercise intensity stimulate physiological adaptation without exceeding the individual's functional reserve. The FITT framework, encompassing frequency, intensity, time, and type provides a structured basis for individualized exercise prescription, ensuring that training stimuli are sufficient to induce adaptation while maintaining safety. Additionally, the theory of peripheral limitation in chronic heart failure explains that exercise intolerance is driven largely by skeletal muscle dysfunction, impaired peripheral perfusion, and reduced oxidative capacity rather than solely by diminished cardiac output. Consequently, aerobic training that targets peripheral conditioning plays a central role in improving functional outcomes in this population.

From a clinical perspective, the stable blood pressure responses, preserved oxygen saturation, and absence of arrhythmias throughout the program support the safety of moderate-intensity aerobic exercise, typically prescribed at 40–60% of maximal heart rate in accordance with established cardiac rehabilitation guidelines. The improvement in the heart rate–walking speed index and the reduction in Borg scores further indicate enhanced cardiovascular efficiency and improved subjective tolerance to physical exertion, both of which are important markers of successful rehabilitation adaptation. These findings suggest that even in patients with extensive coronary involvement, structured walking exercise can be safely implemented when appropriately monitored and individualized.

Despite these encouraging results, several considerations warrant caution in interpretation. As a single-case study, the findings cannot be generalized to all individuals with chronic heart failure, and substantial inter-individual variability in exercise response must be acknowledged. Additionally, improvements may have been influenced by concurrent pharmacological therapy, dietary changes, or other lifestyle factors that were not fully controlled within the study framework. The absence of long-term follow-up also limits conclusions regarding the sustainability of the observed improvements. Therefore, larger controlled studies are needed to validate these findings, clarify the mechanisms underlying functional improvement, and further delineate the role of walking-based aerobic training in the rehabilitation of patients with advanced coronary artery disease.

CONCLUSION

A Phase II cardiac rehabilitation program with supervised track and treadmill walking over ten sessions improved aerobic capacity, exercise tolerance, and cardiovascular efficiency in a patient with CHF and three-vessel CHD. 6MWT distance and METs increased while hemodynamic parameters remained stable, indicating safe physiological adaptation. High adherence and structured, progressive exercise contributed to these improvements. This case highlights the effectiveness and feasibility of walking-based aerobic training in Phase II cardiac rehabilitation to enhance functional performance and quality of life.

Ethical consideration, competing interest and source of funding

- This study received ethical approval from the Health Research Ethics Committee of the Faculty of Health Sciences, Universitas Muhammadiyah Surakarta (No. 1609/KEPK-FIK/X/2025).
- There is no conflict of interest related to this publication.
- Source of funding is authors.

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