

ORIGINAL ARTICLE

Feasibility of the Two-Minute Walk Test in Elderly Patients After Acute Myocardial Infarction: A Cross-Sectional Study

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Abstract

Background: Pathologies involving the heart are still the main causes of death, and acute myocardial infarction (AMI) is consistently present in this index. The two-minute walk test (2MWT) is ideal for assessing the functional capacity of this patient.

Objective: To describe the feasibility of the 2MWT in older people after AMI.

Methods: This is a cross-sectional study. At hospital discharge, patients were invited to perform the 2MWT. Before starting the test, systolic blood pressure (SBP), diastolic blood pressure (DBP), peripheral oxygen saturation (SpO₂), heart rate (HR) and the Double Product (DP) were checked. After checking the vital signs, the patients were accompanied by an examiner, who was positioned laterally to ensure safety and verbally encouraged during the test; after the completion of the test, all vital signs were reassessed in two moments, at the immediate end and after 20 minutes of rest. ANOVA was used for the comparison of pre and post-test and pre and recovery. A $p < 0.05$ was considered significant.

Results: We evaluated 51 patients, 4 (80%) males with a mean age of 67 ± 8 years. The distance walked on the 2MWT had a mean of 157 ± 22 meters. The SBPmmHg Pre-Test 112 ± 21 vs 131 ± 15 Post-Test ($p = 0.24$) and 119 ± 22 at Recovery ($p = 0.34$) and HR (bpm) Pre-Test 75 ± 15 vs 89 ± 19 Post-Test ($p = 0.15$) and 79 ± 15 at Recovery ($p = 0.59$). After a rest, all variables analyzed followed the same pattern, returning to values close to the pre-test moment.

Conclusion: The performance of the 2MWT in the hospital environment presents good feasibility in the evaluation of submaximal capacity in elderly patients after AMI.

Keywords: Walk Test; Inferior Wall Myocardial Infarction; Aged.

Introduction

The pathologies that involve the heart are still the main causes of death in European countries, and acute myocardial infarction (AMI) is constantly present in this mortality rate. AMI occurs when there is an interruption of the blood supply to the heart, which is carried out by the coronary arteries.¹

Older people present some alterations, such as decreased functional capacity and physiological reserve,

that generate a negative impact on quality of life. Geriatric syndrome, frailty, loss of peripheral muscle strength, decreased vital capacity, decreased walking speed, and increased risk of falling are factors that interfere with the health of older people, making their functionality more limited. Therefore, these post-AMI patients need to be evaluated in an individualized way because they can present a loss of functional capacity and difficulty in performing their activities of daily living (ADL).²⁻⁷

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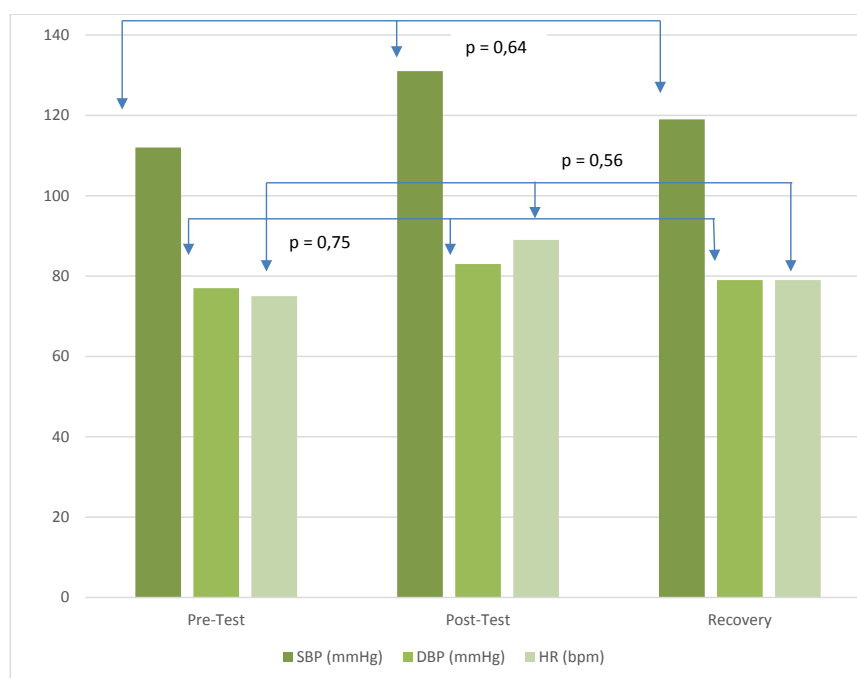
Editor responsible for the review: Glaucia Maria Moraes de Oliveira

DOI: <https://doi.org/10.36660/ijcs.20240023>

Manuscript received July 9, 2023; revised manuscript March 19, 2024; accepted April 4, 2024

Central Illustration: Feasibility of the Two-Minute Walk Test in Elderly Patients After Acute Myocardial Infarction: A Cross-Sectional Study

INTERNATIONAL JOURNAL OF
Cardiovascular
SCIENCES



Int J Cardiovasc Sci. 2024; 37:e20240023

Behavior of cardiovascular at the different times of the study. SBP: Systolic blood pressure; DBP: Diastolic blood pressure; HR: Heart rate.

In post-AMI patients, the six-minute walk test (6MWT) can be used to evaluate the individual during exercise in the respiratory, cardiac, and metabolic areas. The 6MWT is a submaximal test of the patient's cardiac capacity, the gold standard for the evaluation and prescription of cardiac rehabilitation.³ However, Pin,⁸ in his study, points out the inability of some individuals to walk for six minutes because of muscle weakness, frailty, poor gait, low resistance acquired during hospitalization, physical disability, or associated pathology.

An alternative to the 6MWT is the 2-minute walk test (TC2M). The walk test causes physiological changes in the patient's cardiorespiratory system, including changes in heart rate (HR), respiratory rate, systemic blood pressure (BP), perceived exertion, oxygen saturation, and other parameters.⁹⁻¹²

Evaluations made with different populations show that the distance walked during the 2MWT is proportional to the distance walked during the 6MWT. In this sense, it is possible to affirm the feasibility of using the 2MWT, which can be encouraged in specific populations, such as patients with heart diseases, chronic

obstructive pulmonary disease, neuromuscular diseases, amputees and elderly individuals unable to undergo the 6MWT. Thus, this is an alternative strategy for the assessment process in services where the time for patient care is more limited.¹³

This research, in turn, is important for the scientific society since there is a lack of evidence on the physiological changes during the two-minute walk test (2MWT). Therefore, this study aims to evaluate the feasibility of the 2MWT in elderly patients after AMI.

Methods

Study design

A cross-sectional study was conducted with patients admitted to a cardiology referral hospital in the city of Feira de Santana, Bahia in the period from September 2018 to May 2019. It was approved by the Research Ethics Committee of the Centro Universitário Nobre de Feira de Santana, with opinion number 3,072,435. All participating patients signed an Informed Consent Form.

Criteria and eligibility

Patients of both genders, aged 60 years or more, with a medical diagnosis of AMI, were included. Patients with hemodynamic instability, with variations of 20% more or less in HR and BP, the presence of musculoskeletal (lower limb amputations) or neuromuscular alterations that significantly limit walking or that require human assistance to walk, and the impossibility of verifying vital signs were excluded.

Study protocol

After the diagnosis of AMI, a triage was performed where personal data, clinical history, medications, and life habits were obtained. Clinical and surgical characteristics, such as diabetes mellitus, systemic arterial hypertension (SAH), dyslipidemia, and sedentary lifestyle, were collected. All these comorbidities were known through the patient's chart, except for the physical inactivity, where the International Physical Activity Questionnaire, or IPAQ, was applied in the long format, which evaluates 27 questions related to physical activities performed in a normal week. The patient who did not perform any physical activity for at least ten continuous minutes during the week was considered to be sedentary. The physical activity variable was related to the week preceding the surgical procedure.

On the day of hospital discharge, patients were invited to perform the 2MWT. Before the beginning of the test, systolic blood pressure (SBP), diastolic blood pressure (DBP), peripheral oxygen saturation (SpO₂), and HR were checked. In addition, the Double Product (DP) was calculated through SBP and HR.

Then, after measuring the vital signs, the patients were accompanied by an examiner, who was positioned laterally to ensure the safety of the volunteers and verbally encourage them.

After the evaluation, the 2MWT was performed as a way to learn and pass on information, and after a 24-hour interval, the 2MWT was used for evaluative purposes. Then, when the test was over, all vital signs were reevaluated in two moments, immediately after the test was over and after a 20-minute rest interval.

Research Instrument

The 2MWT is a simple tool that evaluates the submaximal exertion capacity and does not require high technology so that it can be applied in any clinical

or hospital setting. For its execution, a 30-meter-long corridor is required, with a flat surface, free of obstacles, in order to provide more safety to the patient. During the test, a physical therapist accompanied the patient, staying by his side throughout the test in order to stimulate him to continue the test, walking as fast as he could in a stretch marked on the ground with yellow tape.

At each period, the physiotherapist encouraged the patient not to stop the test and to walk as fast as possible, with some words of encouragement such as you are doing well, don't stop, walk as fast as you can, and he indicated how much time was left until the end. It was also explained to the patient that at any time, he could stop the test, rest, and come back when he was comfortable, which demonstrates an accessible test and is well accepted by patients.^{3,13-16}

Statistical Analysis

The Statistical Package for Social Sciences (SPSS) version 20.0 software was used for data analysis. Normality was assessed using the Shapiro-Wilk test. Data was expressed as mean and standard deviation (SD). Categorical variables were presented as absolute and relative frequencies. Paired Student's t-test was used for comparison of pre and post-test and pre and recovery. One-way ANOVA was used to check the variation between the three moments. A $p < 0.05$ was considered significant.

Results

The study included 51 patients, 41 of whom were male (80%) and a mean age of 67 ± 8 years. The most prevalent comorbidity was SAH. Table 1 shows the average distance traveled.

After the test was completed, cardiovascular behavior was altered within expectations, with no impairment of cardiovascular function. There was no statistical difference between the pre-test and the post-test and recovery. The values are shown in Table 2 and the central figure.

Table 3 shows that few adverse events occurred during the test. Palpitation was the most prevalent event, followed by dizziness.

Discussion

Based on our study, the 2MWT was well tolerated by elderly patients after AMI because there was no significant

Table 1 – Clinical characteristics of patients with AMI who underwent the 2MWT

Variable	Mean \pm SD	n (%)
Gender		
Male		41 (80%)
Female		10 (20%)
Age (years)	67 \pm 8	
BMI (kg/m ²)	26 \pm 3	
Comorbidities		
SAH		31 (61%)
DM		26 (51%)
DLP		22 (43%)
Alcoholism		6 (12%)
Sedentarism		17 (33%)
LVEF (%)	56 \pm 11	
Use of beta-blockers		31 (61%)
Length of hospital stay (days)	5 \pm 2	
NYHA		
I		6 (12%)
II		33 (65%)
III		9 (18%)
IV		3 (6%)
Type of AMI		
With ST-segment elevation		31 (61%)
No ST-segment elevation		20 (39%)
Walking distance in 2MWT (meters)	157 \pm 22	

BMI: Body Mass Index; SAH: Systemic Arterial Hypertension; DM: Diabetes Mellitus; DLP: Dyslipidemia; LVEF: Left Ventricular Ejection Fraction; NYHA: New York Heart Association; 2MWT: Two Minutes' Walk Test.

change in physiological variables and a low incidence of adverse events. Studies on cardiovascular behavior during the performance of the 2MWT are still scarce, so we made a parallel with studies that used the 6MWT.

Nogueira et al.¹⁷ and Sancho et al.¹⁸ noticed that all post-AMI patients were able to perform the 6MWT, and in turn, there were no adverse events. No patient needed to take breaks, showing that the test was safe and well tolerated by the patients, as well as Araújo et al.,¹⁹ who

did not detect adverse events. These data corroborate our results since all elderly post-AMI were able to complete the 2MWT. Furthermore, few adverse events were observed without any more serious impairment, indicating that it is safe to perform the test in post-AMI elderly patients.

Pedrosa and Holanda²⁰ describe the importance and relevance of the test since there is naturally a decline in motor and cardiovascular functions in older people during the test before and after AMI. The article points to a correlation between the 2MWT and 6MWT as far as aerobic endurance is concerned since reduced and/or decreased mobility directs patients to factors related to functional morbidities, where one can relate the higher energy expenditure due to immobility, consequently, to a cardiovascular decline, which are intrinsically related. It is also worth mentioning that Pedrosa and Holanda²⁰ suggest the 2MWT as an alternative for a quick test when compared to the 6MWT since there is an important correlation between the test results when used to assess the functional capacity of older people.

Diniz et al.²¹ state that the performance of walking tests is safe, even early on, when the behavior of HR, SBP, SpO₂ and the subjective perceived exertion are observed. The hemodynamic variations behaved physiologically, increasing during the test and returning to pre-test values after a period of rest.

Physiology explains the cardiovascular changes during the performance of the 2MWT. The HR is controlled by the autonomic nervous system, which in turn triggers electrical signals to the sinoatrial node, triggering its increase. During exercise, HR increases mainly as a result of the decrease in parasympathetic activity to the heart by the mechanoreflex.²²

It is common for post-AMI patients to use beta-blockers because their use is related to improved survival rates. Beta-blockers act by decreasing myocardial oxygen consumption, chronotropic and inotropic action of the heart, reducing HR and the force of contraction of the heart, directly influencing systemic BP. Furthermore, the action of the drugs will inhibit possible disturbances during the test, improving cardiac function and reducing the risk of arrhythmias.²³⁻²⁶

It is worth mentioning that the effects of the use of beta-blockers in the patients of this group allow the heart to remain stable, avoiding high variations in its behavior during the test, giving more security; this fact may explain our results in the variables HR, SBP and DBP in our study.

Table 2 – Behavior of cardiovascular and respiratory variables at the different times of the study.						
Variable	Pre-Test	Post-Test	Recovery	p ^a	p ^b	p ^c
SBP (mmHg)	112 ± 21	131 ± 15	119 ± 22	0.24	0.34	0.64
DBP (mmHg)	77 ± 12	83 ± 14	79 ± 15	0.43	0.68	0.75
HR (bpm)	75 ± 15	89 ± 19	79 ± 15	0.15	0.59	0.56
DP (mmHgxbpm)	8400 ± 315	11659 ± 285	9401 ± 330	0.07	0.31	0.62
Borg	4 ± 1	8 ± 3	4 ± 2	0.63	0.79	0.84
SpO ₂ (%)	97 ± 1	96 ± 1	97 ± 2	0.56	0.83	0.82
a. Comparison of pre-test to post-test; b. Comparison of pre-test to recovery; c. Comparison between the three moments; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; HR: Heart Rate; DP: Double Product; SpO ₂ : Peripheral Oxygen Saturation.						

The attenuation of the positive effects in the chronotropic phase, given the action of beta-blockers, happens with less evidence during the action of the drug. The data cited above propose a literature review of the pharmacokinetics of these drugs because the evidence does not prove the total interference of beta-blockers in the performance of 2MWT.

It is important to have a tool capable of accurately assessing the patient's functional capacity. The 2MWT proved to be effective in this hospital setting, being easy to apply and safe. Its interpretation serves as a basis for developing a therapeutic plan to minimize the functional impact caused by AMI.

More and more researchers are using the 2MWR and analyzing its results by correlating them with the 6MWT in several populations. Reid et al.²⁷ conducted a study with amputee patients who used prostheses to compare the results between the 6MWT and the 2MWT. With the same purpose, but in patients with neuromuscular diseases Andersen et al.²⁸ investigated whether the 2MWT can be an alternative to the 6MWT to evaluate patients with neuromuscular diseases. Both studies found that the 2MWT is able to predict the outcome and has a high correlation with the 6MWT.

Another relevant point is that there are already equations to predict the test result. Zhang et al.²⁹ evaluated 831 healthy and sedentary individuals with the 2MWT to determine an equation to predict the test result in the Chinese population. With the same objective, Mirza et al.³⁰ conducted their study with 87 Asian adult patients who performed the 2MWT, and Selman et al.¹³ evaluated 390 healthy individuals with the objective of establishing a reference equation

Table 3 – Adverse events during the 2MWT	
Adverse events	n (%)
Pain in lower limbs	3 (6%)
Palpitation	8 (17%)
Dyspnea	5 (10%)
Dizziness	7 (14%)
Nausea	3 (6%)

to predict the distance walked on the 2MWT. It is noteworthy that none of the studies mentioned the presence of adverse events during the performance of the tests.

Our study has some limitations, such as the lack of a sample size calculation, and the effects of medications used by the patients were not evaluated. Tools capable of measuring the chronotropic and/or inotropic responses with greater prediction, such as Holter, were not used during the tests, as well as the verification of test results, such as echocardiography, ambulatory BP monitoring, or myocardial scintigraphy, to detect possible changes in the patients before and after the test.

Conclusion

We conclude that the 2MWT's performance in the hospital environment presents good feasibility in evaluating submaximal capacity in elderly patients after AMI.

Author Contributions

Conception and design of the research, acquisition of data and writing of the manuscript: Cordeiro ALL, Santos LA, Oliveira L, Almeida AC, Alves D, Souza FF; analysis and interpretation of the data: Cordeiro ALL, Santos LA, Oliveira L, Almeida AC, Alves D; statistical analysis: Cordeiro ALL; critical revision of the manuscript for intellectual content: Silva HBMM, Guimarães ARF.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Sources of Funding

There were no external funding sources for this study.

Study Association

This study is not associated with any thesis or dissertation work.

Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of the Centro Universitário Nobre under the protocol number 3,072,435. All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

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