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RESEARCH ARTICLE

The Role of the Six-Minute Walk Test in the Overall Assessment of Exercise Tolerance in Patients with Chronic Heart Failure

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Abstract

The aim of the study was to evaluate the functional adaptive capacity of the cardiovascular system in patients with chronic heart failure based on the severity of dyspnea, assessed using the Borg scale, and the dynamics of hemodynamic parameters during a 6-minute walk test. The study included 40 patients (mean age 66.2 ± 4.9 years) of heart failure varying severity. A comparative analysis between the groups showed that patients with relatively low functional classes (FC II) had a moderate risk of complications and lower Borg scale scores, indicating a relatively favorable clinical course of the disease. Conversely, patients with high FC (III-IV), on the contrary, had a high risk of adverse outcomes and higher Borg scale scores. Our results show that the 6-minute walk distance correlates with the level of dyspnea, the degree of decline in exercise tolerance, and quality of life, making the test useful for monitoring dynamics and for clinical decision-making.

Keywords: 6-minute walk test, Exercise tolerance, Borg scale.

Introduction

Chronic heart failure (CHF) is a clinical syndrome that results from many cardiovascular diseases. Early diagnosis, appropriate therapy, and effective management are essential for improving the prognosis of patients with CHF. Decreased exercise tolerance is one of the leading symptoms of CHF [11, 12, 13], making the use of stress tests to assess the hemodynamic response justified [1, 2, 6]. Resting cardiac parameters do not adequately characterize the reserve and adaptive capacity of the cardiovascular system, as the assessment does not capture the heart's functional capacity during exercise [8, 18, 19]. The six-minute walk test (6-MWT) remains relevant, allowing both the adequate assessment of treatment outcomes and the prognosis of CHF progression. The 6-MWT is a type of physical activity that involves the upper body in physiological walking while maintaining natural gait biomechanics (pace, stride length, and postural dynamics) [9, 10, 5, 6, 7]. The method was proposed by V.A. Balke in 1963 and modified in the following decade for clinical application. Since 2002, the test has been standardized by the American Thoracic Society (ATS) and has been widely used in cardiology practice [21, 22, 23], serving as a simple and accessible tool for both the dynamic assessment of patients' condition and the effectiveness of therapy [5, 9]. Subjectively, in most patients with CHF, the most common complaint during physical activity is shortness of breath [14]. The second most common complaint is weakness in the lower extremities [15]. The following pattern is also observed: with a rapid increase in the intensity of exercise, patients first complain of increasing shortness of breath, and then, with a gradual increase in the degree of physical activity, weakness in the lower extremities begins to increase [16]. In the pathogenesis of shortness of breath during physical activity, in addition to central hemodynamic disorders, a decrease in vital capacity of the lungs and hyperventilation play an important role [17]. Absolute contraindications to the 6-MWT include unstable angina or myocardial infarction within the previous month, and musculoskeletal diseases that prevent performance of the test [20]. Relative contraindications include a baseline

heart rate (HR) of less than 50 beats per minute or more than 120 beats per minute, systolic blood pressure (SBP) greater than 180 mmHg, and diastolic blood pressure (DBP) greater than 120 mmHg [20]. Criteria for immediate termination of the test include the appearance of chest pain, intolerable shortness of breath, cramps in the lower extremities, imbalance, sudden pallor of the skin, or a decrease in blood oxygen saturation to 86% [20].

Purpose of the study

To study the functional capacity of the cardiovascular system in patients with CHF based on the severity of dyspnea assessed using the Borg scale, changes in hemodynamic parameters (heart rate, systolic blood pressure, and diastolic blood pressure), oxygen saturation (SP2), and the distance covered during a 6-minute walk.

Material and Methods

This study was conducted on 40 men with CHF of varying severity (NYHA functional classes (FC)) aged 47 to 78 years (mean age 66.2 ± 4.9 years). The subjects were divided into 3 groups: Group 1 included 11 patients with CHF FC II; Group 2 included 15 patients with CHF FC III; Group 3 included 14 patients with CHF FC IV. The data obtained were processed using variation statistics. Differences were considered significant at $p<0.05$. Patients were excluded from this study if they had comorbidities that could significantly impact the distance covered during the six-minute test (6 MW). During the 6 MW, hemodynamic parameters (heart rate, distance covered, SP2, as well as subjective feelings of shortness of breath and fatigue assessed using the Borg scale) were comprehensively assessed. The occurrence of shortness of breath during exercise was assessed using the Borg scale (0-10 points): 10 points is the worst possible result, 0 points is the most favorable (see Table 1). The occurrence of shortness of breath based on the degree of effort was assessed using 4 grades (see Table 2).

Table 1: Assessment of exercise tolerance using the Borg scale

	10	Maximum
Very, very heavy	9	
	8	
	7	Very heavy
	6	
Heavy	5	
	4	Moderately severe
Moderate	3	
	2	Light
Very light	1	
	0,5	Very, very light
No shortness of breath	0	

Table 2: Evaluation of dyspnea by degree of effort

I degree	Light
II degree	Moderate restriction
III degree	Significant limitation
IV degree	Inability to perform physical activity or presence of symptoms at rest

Study Results

6-MW Results and Their Prognostic Value in CHF Patients by NYHA Functional Class NYHA Functional Class Average Distance Traveled during 6-MW Risk Assessment of Adverse Outcome FC II 350-450 Moderate Risk FC III 200-350 Increased Risk FC IV <200 High Risk As can be seen from the data presented in Table 3, the average distance traveled during the 6-MW was highest in patients with CHF FC II and lowest in those with FC IV. The risk of developing an adverse outcome was lowest in patients with FC II, while it was highest in patients with FC IV. Table 4 Patient Group NYHA FC Number of Patients Risk Assessment of Adverse Outcome by 6 Mt Borg Scale Scores I II 11 Moderate 2-3 II III 15 Elevated 4 III IV 14 High 5 A comparative analysis between groups showed (Table 4) that CHF patients with a relatively low FC (II) had a moderate risk and lower Borg scale scores, indicating a relatively favorable clinical course of the disease. Meanwhile, patients with a high FC (IV) had a high risk of adverse outcomes and higher Borg scale scores. Our results demonstrate that the 6-minute distance traveled correlates with the level of dyspnea, the degree of decline in exercise tolerance, and quality of life, making the test useful for monitoring progression and for making clinical decisions. Discussion The obtained data confirm the diagnostic and prognostic value of the 6-minute walk test in patients with CHF. The average distance walked by patients correlated with the NYHA functional class of CHF, which is consistent with the results of previous studies [24]. Patients with lower exercise tolerance also demonstrated lower left ventricular ejection fraction and more pronounced clinical manifestations of the disease [25]. Thus, the 6-minute walk test is a functional test conceptually performed at a submaximal level to assess exercise tolerance, inform the selection of optimal therapy, and parameters for complex low-intensity physical training [26]. Conclusion. Overall, our results confirm that the 6-minute walk test remains a reliable and cost-effective method for assessing the functional status of patients with CHF for use in outpatient and inpatient settings, which can be used to monitor treatment effectiveness and disease prognosis.

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