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The 2-min walk test is sufficient for evaluating walking abilities in sporadic inclusion body myositis

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Abstract

Sporadic inclusion body myositis causes progressive functional loss due to declining muscle strength. Although the underlying cause is unknown, clinical trials are underway to improve strength and function. Selection of appropriate outcome measures is critical for the success of these trials. The 6-min walk test has been the de facto standard for assessing function in neuromuscular disease; however, the optimal walking test has not been determined in this disease. In this study, 67 individuals with sporadic inclusion body myositis completed a battery of quantitative strength and functional tests including timed walking tests, patient-reported outcomes, and other tasks. The 2-min and 6-min walk tests are highly correlated to each other ($r = 0.97$, $p < 0.001$) and to all lower extremity strength, patient-reported, and functional measures in this population. All subjects completed the 2-min walk test, but 7% of subjects were unable to walk the full 6-min of the 6-min walk test due to fatigue. The 2-min walk test demonstrates similar correlation to all outcomes compared to the 6-min walk test, is less fatiguing and better tolerated. Results suggest that the 2-min walk test is a better alternative to tests of longer duration. Further research is needed to determine longitudinal changes on this outcome.

Keywords: Sporadic inclusion body myositis; Outcome measure; 2-min walk test; 6-min walk test; Function

1. Introduction

Sporadic inclusion body myositis (sIBM) is the most common inflammatory muscle disorder affecting persons over the age of 50 with males more commonly affected than females 3:1 [1]. The pathogenesis of this disease is currently unknown, although possible origins hypothesized have included autoimmunity, result of an infection, mitochondrial disorder, or an unidentified genetic mutation [2,3]. Individuals with sIBM typically present with muscle weakness principally affecting the quadriceps muscles, but this is frequently accompanied by finger flexors weakness and dysphagia [1]. Muscle weakness progresses gradually, commonly resulting in delays in diagnosis that have been reported as long as 16 years from the onset of symptoms with a mean time to diagnosis of 5 years [4,5]. Over time, muscle weakness progresses throughout the upper and lower extremities resulting in the loss of function and independence. Treatment options for sIBM are limited, although a few small studies have reported modest improvements in aerobic capacity and strength outcomes with no damage to muscle [6–8].

Although the underlying cause of sIBM remains unknown, clinical trials are underway to treat the symptoms of the condition and improve muscle strength [9–11]. Recent longitudinal natural history studies published in sIBM have primarily reported strength

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changes over time [12–14]. Although strength has been reported to correlate to function in some cases, in clinical trials a functional outcome measure rather than a measure of impairment is considered more meaningful in evaluating efficacy [4,15]. Timed walking tests, and predominantly the 6-min walk test (6MWT), have been a frequent choice for the primary functional outcome measure. Although the 6MWT has been studied in the elderly and other adult neuromuscular diagnoses, it has not been determined to be the optimal walking test in patients with sIBM [16–18].

The 2-min walk test (2MWT) has been introduced as another option to evaluate walking ability [4,19]. A shorter test such as the 2MWT may provide the same information while limiting the overall demand of physical testing. Data previously reported by our group indicates that distance walked in a timed test is correlated to strength and other functional outcomes in this disorder [4]. However, this previous study evaluated the first 2-min of the 6MWT versus the separate 2MWT. The aim of this study was to evaluate the 2MWT versus the 6MWT in patients with sIBM.

2. Methods

The study was approved by the Institutional Review Board in The Research Institute at Nationwide Children's Hospital. All study participants provided informed consent. Participants were recruited from our local Neuromuscular Disease clinics, as well as through advertisements through the Myositis Association and the Nationwide Children's Hospital website. A total of 67 subjects (54 male, 13 female; age range: 46–85 years; mean age: 66.3 ± 8.3 years) were evaluated during one testing session. All subjects had either definite or possible IBM according to the Griggs criteria or fulfilled the Medical Research Council's criteria for clinically-defined IBM [20,21].

2.1. Functional assessments

The 2MWT and 6MWT were administered separately in a randomly-assigned order. To complete these tests, subjects walked along a 25-m course for both 2 and 6 min. They were encouraged to walk as far as possible throughout the testing period according to American Thoracic Society guidelines [22]. Subjects were permitted to use an assistive device if needed for safety during both walking tests. A mandatory minimum rest period of at least 5 min was required between each walking test; however, subjects were strongly encouraged to rest as long as needed. The distance walked each min, the total distance walked, and number of falls was recorded. Administration details of the timed up and go (TUG), ascending 4 stairs, descending 4 stairs and stepping up on curbs (SoC) were previously reported [4]. If the activity was unsafe or impossible for the subject to complete, it was scored as 'unable'.

2.2. Quantitative muscle testing

Maximum voluntary isometric contraction testing (MVICT) of hip flexion and extension, knee flexion and extension, ankle dorsiflexion and plantarflexion were measured using the quantitative muscle analysis system as previously reported [4,23]. Subjects were encouraged to give their maximal effort and the best attempt of a minimum of three trials was recorded in kilograms. Trials were considered valid if there was no greater than 10% difference between the two best attempts.

2.3. Patient-reported outcomes

Subjects completed both the IBM functional rating scale (IBMFRS), the PROMIS health assessment questionnaire (PROMIS HAQ), and reported their fall frequency rate during their study visit. The IBMFRS is a 10-item scale (maximum score is 40-points) with questions related to swallowing, fine motor tasks, activities of daily living, and gross motor tasks [24]. A higher score on the IBMFRS indicates greater ability or function. The PROMIS HAQ is a 20-item scale (maximum score 100) with questions related to activities of daily living in the home and community [25]. A higher score on the PROMIS HAQ indicates greater disability. The frequency of fall rate was a question asked by the examiner. A fall was considered any unintended contact with the floor.

2.4. Statistical analysis

Spearman's correlation coefficient with post hoc Bonferroni adjustment was used to examine the relationship between the walking tests and between each walking tests and strength measures or functional outcomes. The means of walking velocity in the 2MWT and 6MWT were compared using paired t-test. Linear regression was used to predict the distance walked on the 2MWT using previous 6MWT data, and vice versa.

3. Results

All subjects completed strength testing and descriptive information can be found in Table 1. Muscle weakness was present in every muscle group tested with knee extension and ankle dorsiflexion having the lowest average strength across our cohort. MVICT of ankle plantarflexion was only performed by 54 of 67 participants, due to an inability to get into the prone testing position.

All subjects (100%) completed the 2MWT, and although all 67 attempted the 6MWT, only 62 (93%) were able to walk the full 6-min (Table 1). Those unable to walk the full 6-min reported leg weakness and fatigue as the