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Clinical Study

Psychometric properties of the 30-m walking test in patients with degenerative cervical myelopathy: results from two prospective multicenter cohort studies

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Abstract

BACKGROUND CONTEXT: The timed 30-m walking test (30MWT) is used in clinical practice and in research to objectively quantify gait impairment. The psychometric properties of 30MWT have not yet been rigorously evaluated.

PURPOSE: This study aimed to determine test-retest reliability, divergent and convergent validity, and responsiveness to change of the 30MWT in patients with degenerative cervical myelopathy (DCM).

STUDY DESIGN/SETTING: A retrospective observational study was carried out.

PATIENT SAMPLE: The sample consisted of patients with symptomatic DCM enrolled in the AOSpine North America or AOSpine International cervical spondylotic myelopathy studies at 26 sites.

OUTCOME MEASURES: Modified Japanese Orthopaedic Association scale (mJOA), Nurick scale, 30MWT, Neck Disability Index (NDI), and Short-Form-36 (SF-36v2) physical component score (PCS) and mental component score (MCS) were the outcome measures.

METHODS: Data from two prospective multicenter cohort myelopathy studies were merged. Each patient was evaluated at baseline and 6 months postoperatively.

RESULTS: Of 757 total patients, 682 (90.09%) attempted to perform the 30MWT at baseline. Of these 682 patients, 602 (88.12%) performed the 30MWT at baseline. One patient was excluded, leaving

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601 in the analysis. At baseline, 81 of 682 (11.88%) patients were unable to perform the test, and their mJOA, NDI, and SF-36v2 PCS scores were lower compared with those who performed the test at baseline. In patients who performed the 30MWT at baseline, there was very high correlation among the three baseline 30MWT measurements (r=0.9569–0.9919). The 30MWT demonstrated good convergent and divergent validity. It was moderately correlated with the Nurick (r=0.4932), mJOA (r=–0.4424), and SF-36v2 PCS (r=–0.3537) (convergent validity) and poorly correlated with the NDI (r=0.2107) and SF-36v2 MCS (r=–0.1984) (divergent validity). Overall, the 30MWT was not responsive to change (standardized response mean [SRM]=0.30). However, for patients who had a baseline time above the median value of 29 seconds, the SRM was 0.45.

CONCLUSIONS: The 30MWT shows high test-retest reliability and good divergent and convergent validity. It is responsive to change only in patients with more severe myelopathy. The 30MWT is a simple, quick, and affordable test, and should be used as an ancillary test to evaluate gait parameters in patients with DCM.

Keywords: Gait impairment; Myelopathy, compressive; Psychometrics; Recovery of function; Reproducibility of results; Spondylosis, cervical; Stenosis, cervical; Task performance and analysis; Time factors; Treatment outcome

Introduction

Degenerative cervical myelopathy (DCM) is a progressive, degenerative spine condition and the most common cause of spinal cord dysfunction in adults worldwide [1]. In a 2015 review by Nouri et al., the incidence of myelopathy caused by degenerative changes is conservatively estimated as 41 per million in North America [2]. DCM causes chronic compression of the cervical spinal cord and may result in symptoms of varying severity, including tingling, numbness and weakness of the upper and lower extremities, spasticity, gait abnormalities, neck pain, and bladder and bowel dysfunction [3–5]. Surgery is the recommended treatment for patients with myelopathy, as it can halt disease progression, relieve symptoms, and potentially improve functional status and quality of life [6–8].

Several measurement tools have been developed for patients with DCM to quantify disease severity, evaluate outcomes following intervention, and provide decision-making support to clinicians. Two of these, the Nurick Scale and the modified Japanese Orthopaedic Association (mJOA) scale, are used to evaluate functional impairment and are the two most frequently cited outcome measures [9,10]. Other common tools include the visual analogue scale (VAS) for pain, the Short-Form 36 version 2.0 (SF-36v2), the Neck Disability Index (NDI), and the Myelopathy Disability Index (MDI) for quality of life [11]. These assessment tools, however, do not objectively or quantitatively address gait dysfunction, a common symptom reported in these patients [9,10,12,13].

The 30-m walking test (30MWT) was developed in 1999 and is a quantitative and objective test to measure gait impairment in patients with DCM [13]. Patients are asked to stand up from a chair, walk 15 m, turn around, and walk back. The time taken to perform the test and the number of steps taken are recorded. Greater disability is reflected by the inability or a longer time required to perform the test. The 30MWT has been recommended for use in clinical practice as well as in the research setting to objectively quantify gait impairment in patients with DCM as well as patients with chronic obstructive pulmonary disease [14].

To date, knowledge is limited regarding the psychometric properties of the 30MWT [13,15]. The aim of this study was to evaluate the test-retest reliability, convergent and divergent validity, and responsiveness to change of the 30MWT using data from two recent prospective multicenter cohort studies.

Materials and methods

Subjects

It was preplanned to merge data collected from the prospective multicenter AOSpine North America and AOSpine International cervical spondylotic myelopathy studies [7,16]. The North American study was conducted between December 2005 and September 2007 and enrolled 278 patients at 12 sites in North America. The AOSpine International study was conducted between October 2007 and January 2011 and enrolled 479 patients at 16 sites on four continents. The inclusion criteria for these two studies were identical: (1) age 18 years or older; (2) symptomatic DCM with at least one clinical sign of myelopathy (secondary to either disc herniation, ossification of the posterior longitudinal ligament, hypertrophy of the ligamentum flavum, spondylosis, subluxation, or a combination of these degenerative changes); (3) objective evidence of cervical cord compression as determined by magnetic resonance imaging; (4) no prior surgical treatment for myelopathy; and (5) the absence of symptomatic lumbar stenosis. A total of 757 patients were enrolled in these two studies at 26 international sites. All participating patients provided informed consent. Investigators received approval to conduct the study from their respective Institutional Review Boards.

Measures

For the 30MWT, each patient was asked to walk a distance of 30 m as quickly as possible using any assistive device