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ORIGINAL ARTICLE

Level of Mobility Limitations and Falls Status in Persons With Multiple Sclerosis

Susan Coote, PhD,[a] Marcia Finlayson, PhD,[b] Jacob J. Sosnoff, PhD[c]

From the [a]Department of Clinical Therapies, University of Limerick, Limerick, Ireland; [b]School of Rehabilitation Therapy, Queen's University, Kingston, Ontario, Canada; and [c]Department of Kinesiology and Community Health, University of Illinois at Urbana-Champaign, Urbana, IL.

Abstract

Objective: To investigate whether fall rates are constant across levels of mobility limitations.

Design: Secondary analysis of baseline assessments from a stratified randomized controlled trial.

Setting: Community.

Participants: Persons with multiple sclerosis (N=365) were divided into 5 groups based on the mobility section of the Guy's Neurological Disability Scale (GNDS): no walking impairment (n=82); impaired walking, no aid (n=87); unilateral support (n=76); bilateral support to walk (n=78); or occasional wheelchair user (n=42).

Interventions: Not applicable.

Main Outcome Measures: Self-reported fall history (ie, retrospective) in the preceding 3 months.

Results: One hundred twenty-four persons in the overall sample reported falling in the last 3 months (fall prevalence, 33.97%). Of the total sample, 17.8% reported 2 or more falls in the last 3 months. Chi-square analysis revealed a significant difference in the proportion of fallers across GNDS categories ($\chi^2=42.64$, $P<.001$). Post hoc analysis revealed that the group who walked with bilateral support had the greatest proportion of fallers (52.6%), while the group without walking impairment had the lowest proportion (15.9%). An examination of recurrent fallers as a function of group found that there were more recurrent fallers (70%) in the group that had a walking impairment but used no aid, relative to the other groups.

Conclusions: The current findings highlight that fall rates including recurrent fall prevalence are not uniform across mobility aid categories in persons with MS. Those using bilateral assistance for gait have the highest prevalence of fallers, and those with walking limitations and not yet using an aid had the greatest prevalence of multiple falls.

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Multiple sclerosis (MS) is a chronic, potentially disabling neurologic disease common among adults worldwide.[1] MS is associated with inflammation, demyelination, and axonal damage throughout the central nervous system.[2] The widespread damage results in a heterogeneous accumulation of physical disability and cognitive dysfunction.[3]

Given the likelihood of physical and cognitive dysfunction, it is not surprising that falls are a major health concern for persons with MS.[4] Upwards of half of persons with MS fall within a 1-year period, and a significant proportion of these falls are injurious.[5-7] In addition to the physical injuries sustained from a fall, falls are believed to be related to activity curtailment, physiological deconditioning, and institutionalization in persons with MS.[4,8,9]

A recent systematic review and meta-analysis[10] of fall risk factors in persons with MS found that those who used a mobility aid had the highest risk of falls, with a pooled odds ratio (OR) of 2.5. Other significant fall risk factors that have been identified in the literature include balance impairment,[7,11,12] increased tone,[13] decreased sensation,[14] impaired cognition[15] and having progressive MS.[10] A limitation in our understanding of mobility aid use and falls in the MS community is that mobility device use is often viewed in binary terms (yes/no).[16,17] However, there is evidence that this binary view is limited. For instance, recently it has been shown that individuals with MS who use multiple mobility aids have a greater fall prevalence than those who do not use mobility aids.[17] However, how fall prevalence is influenced by the type of mobility aid is not

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clear. The type of device used for gait is quickly and easily obtainable clinical information. If this information can assist clinicians in identifying those at greatest risk of falls, then it could assist in targeting assessments and interventions more efficiently.

The Guy's Neurological Disability Scale (GNDS) mobility section[18] characterizes individuals by their need for, and use of, mobility aids on a scale from 0 to 5, with 0 indicating no walking limitations, 1 indicating the presence of walking difficulties but no use of aid, 3 indicating the use of bilateral support for gait, and 5 indicating the use of a wheelchair. Given the association between walking aid use and falls,[6,12,19] these mobility aid subcategories could be particularly relevant for furthering our understanding of the relationship between increasing walking limitations, mobility aid use, and falls among people with MS.

The purpose of this investigation was to determine whether there are differences in the fall prevalence across the categories of the GNDS mobility sections. The categories capture the need for increasing support for gait from mobility aids. We predicted, based on extant data, that the prevalence of falls and recurrent falls would increase as the GNDS category increased.

Methods

Overall design

This study was a secondary analysis of data from the baseline assessments of participants in 2 arms of a stratified randomized controlled trial of community-based physiotherapy and exercise interventions.[20] Ethical approval was obtained from each local ethical review committee in the 10 regions where the study took place.

Sampling and recruitment

Participants were recruited to the study through the MS Society of Ireland, their consultant or general practitioner, nurse specialist, or physiotherapist, or they self-referred. Criteria included being older than 18 years, having a diagnosis of MS confirmed by a consultant neurologist or physician, and not having had a relapse or started steroid treatment within 12 weeks of assessment. A total of 460 participants were recruited to the trial, of whom 365 were included in this secondary analysis. Inclusion in the current analysis was based on having complete GNDS and retrospective fall data. Those omitted from the analysis because of incomplete data were not significantly different from those included in terms of age (mean difference, 0.3; 95% confidence interval [CI], −2.6 to 3.2) and years since diagnosis (mean difference, .14; 95% CI, −2.3 to 2.6).

Data collection

Participants were first screened for eligibility by phone. Participants then attended community venues (such as gyms, hotels, and sports grounds) for a baseline assessment by a physiotherapist who had received training to administer the assessment procedures. The assessment began with a subjective history that included information on self-reported falls in the last 3 months, demographic characteristics such as age, time since diagnosis, type of MS, and number of medications; and self-reported dizziness and unsteadiness. Consistent with other studies in the area,[11,14] a fall was defined as "an unexpected contact of any part of the body with the ground." Participants were given the definition and then asked, "Have you fallen in the last 3 months?" The GNDS mobility category[18] was ascertained as part of the assessment procedure. The GNDS is a questionnaire covering 12 disability domains that has good test-retest reliability and validity.[21,22] The lower limb disability section is scored as follows: 0, walking is not affected; 1, walking is affected but patient is able to walk independently; 2 ±, usually uses unilateral support (single stick or crutch, 1 arm) to walk outdoors but walks independently indoors; 3 ±, usually uses bilateral support (2 sticks or crutches, frame, or 2 arms) to walk outdoors, or unilateral support (single stick or crutch, or 1 arm) to walk indoors; 4 ±, usually uses wheelchair to travel outdoors, or bilateral support (2 sticks or crutches, frame, or 2 arms) to walk indoors; or 5 ±, usually uses a wheelchair indoors.

The assessment process also involved objective measures of the body functions of tone, sensation, proprioception, and coordination. These measures were taken in order to evaluate the relative contribution of these impairment measures and the GNDS to falls prevalence. Tone was measured using the Modified Ashworth Scale.[23] The Modified Ashworth Scale was selected for the study because it is widely used in clinical practice and has been shown to have good-to-excellent interrater and intrarater reliability in people with spasticity poststroke.[24] Sensation was measured with a verbal analog scale anchored at 0 (no sensation) and 10 (normal sensation) at 3 locations on each lower limb. For this measure, a score of <60 was considered abnormal. Proprioception was assessed by placing participants' big toe randomly in an "up" or "down" position and asking participants to identify where their toe was. It was scored as either normal or abnormal.[25] Coordination was scored as either normal or abnormal using the heel-shin test. An error in either speed or accuracy, or the presence of tremor was considered abnormal.[25]

Walking endurance was measured using the 6-minute walk test (6MWT), which determines walking distance over a 6-minute period. The 6MWT is a good predictor of habitual walking.[26] Studies have suggested that it is valid[27] and reliable[28] for people with MS. Subjects were instructed to walk "as fast and as safely as possible."[29]

At the participation level, the Multiple Sclerosis Impact Scale (MSIS)-29 version 2[30] physical and psychological components were used. The impact of fatigue was measured using the Modified Fatigue Impact Scale[31] (MFIS).

Data analysis

The difference in the number of people reporting a fall (regardless of the number of falls experienced) across the GNDS mobility categories was investigated using chi-square analysis. In contrast, the number of falls reported as a function of GNDS categories was examined with a Kruskal-Wallis test. A Mann-Whitney *U* test was used to compare the number of falls between the individual GNDS categories.

To further examine the association between falls status and GNDS category, a logistic regression analysis was completed, with falls status as the dependent variable (faller/nonfaller).

List of abbreviations:

CI	**confidence interval**
GNDS	**Guy's Neurological Disability Scale**
MFIS	**Modified Fatigue Impact Scale**
MS	**multiple sclerosis**
MSIS	**Multiple Sclerosis Impact Scale**
OR	**odds ratio**
6MWT	**6-minute walk test**