Title

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Journal

Neurology: Clinical Practice, 13(5)

ISSN

2163-0402

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Publication Date

2023-10-01

DOI

10.1212/CPJ.0000000000200184

Peer reviewed

REVIEW OPEN ACCESS

Fall Assessment and Monitoring in People With Multiple Sclerosis

A Practical Evidence-Based Review for Clinicians

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Neurology: Clinical Practice 2023;13:e200184. doi:10.1212/CPJ.0000000000200184

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Abstract

Purpose of Review

Falls occur in more than half of all people with multiple sclerosis (MS) but tend to be underdiagnosed and underreported in clinical encounters. This narrative review aims to summarize evidence-based approaches for evaluating fall risk and proven treatment strategies to reduce falling in people with MS to improve care for people with MS and to enhance interprofessional care coordination between treating neurologic and physical therapy (PT) teams.

Recent Findings

Screening not just for *falls* but for *near-falls* as well because *fear of falling* can improve fall assessment and identify patients who may benefit from fall prevention interventions. A number of barriers, including time constraints during visits and the fallacy that falling is inevitable in MS, can limit clinician awareness about patient falls and delay timely referral to PT. Consultation with physical therapists for individualized fall prevention treatment can reduce risk of falling. Interventional studies have also shown that PT-guided exercise programs improve balance confidence in people with MS. However, people with MS are often under-referred to PT by treating clinicians.

Summary

A clinical approach is provided to summarize practical, accessible, evidence-based, low-burden measurements and interventions likely to improve ascertainment of patients at risk of falling and optimize timely PT referral and treatment.

Background

Falling is a major concern for people with multiple sclerosis (PwMS).[1] Falling can have detrimental consequences to the patient, including injury from falling and mobility limitations from fear of falling, and implications for the health care system and use of health care resources. Therefore, there is strong onus on researchers and clinicians to develop protocols to promptly identify those at greatest risk of falling.[2-5] For the practicing neurologist, the expanding volume of literature on identification, prediction, and prevention of falls can make it hard to decide how to screen for falls and select actionable steps to recommend to try to prevent future falls.

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Funding information and disclosures are provided at the end of the article. Full disclosure form information provided by the authors is available with the full text of this article at Neurology.org/cp.

The Article Processing Charge was funded by the authors.

In this brief narrative review, we summarize key literature in this area, point to gaps in implementing fall prevention protocols, provide practical actionable approaches for clinicians to recognize and identify people at greatest risk of falling, and referring to rehabilitation specialists to try to reduce future falls.

What Is a Fall?

While it might seem straightforward to define a fall, clinicians have proposed and debated whether a "fall" is a slip or trip resulting in at least 1 body part touching the ground; landing on the ground or other surface (e.g., bed, chair); or unexpected loss of balance resulting in the whole body touching the ground.[6] This distinction is important because a positive *fall history* and whether a patient has fallen in a previous defined period are strong predictors of future fall risk.[7] Unfortunately, fall definitions and classification outcomes in the literature have tended to be heterogeneous, limiting the ability to pool or compare data or to draw conclusions on key topics such as fall risk or appropriate first-line intervention. Illustrating these discrepancies in terminology, there are 13 distinct definitions of what constitutes a "fall" in PwMS.[8,9] Similarly, the variable quantification of falls (e.g., total number of falls, number of injurious falls, length of reporting period) leads to challenges in identification. An individual may be considered a faller if at least 1 fall is reported during the recording period; however, this *period* can vary between 2 months[2] and 1 year.[10] When ascertaining whether a patient is a frequent or recurrent faller, definitions also vary—citing ranges between 2[10,11] and ≥3[12,13] falls within the reporting period. As a result, without specifying the period during which falls occurred, a clinician may not be able to appreciate the frequency or severity of falls.

Within this heterogeneity, a commonly used and clinically practical definition for falling, as reported by Lamb et al., is as follows: "an unexpected event in which participants come to rest on the ground, floor, or lower level."[8,9] Furthermore, according to a study examining predictors of future falls, a reasonable look back period for an initial fall screen in MS is 1 year.[2]

A further aspect central to the prevention and care of falls and the definition of falls is fear of falling. Defined as an ongoing concern of falling, fear of falling is present in more than 60% of PwMS.[14,15] PwMS who use a walking aid, who have experienced ≥3 falls, who have an Expanded Disability Status Scale (EDSS) score above 6.0, or who experience cognitive impairments are more likely to experience fear of falling.[3,16]

Impact of Falls and Fear of Falling

More than 50% of PwMS fall at least once in a 6-month period.[15,17] Causes of falls are numerous: in a large cohort, trips and slips accounted for 48% of falls, exacerbated by the use of a cane or walker, balance problems, and leg weakness. Other common potential causes of falls are summarized in the Table. Falls can result in serious injuries, including fractures and concussions.[16,23] Injuries from falls also carry high socioeconomic costs including the need for increased medical care, hospitalizations, and time off work in 42%–58% of cases.[13]

Although physical injury is a major concern, sustaining a fall can also cause fear of falling.[33] In turn, this often leads to reduced physical activity,[34,35] which can aggravate the primary causes of falls (i.e., weakness, balance impairments).[33] A vicious cycle can ensue, with fear of falling decreasing physical activity, social participation, and ability to perform activities of daily living, augmenting the incidence of social isolation, depression, weakness, and balance issues, which further increases fall risk.[15,36] Therefore, fear of falling represents an impactful and actionable concern in itself and should be addressed and identified promptly.

Ascertainment of Falls

A substantial volume of research has been devoted to identifying PwMS at greatest risk of falling and highlighting strategies to prevent future falls.[11-13,16,23,33,37-43] Evaluation and prediction of falls is multifaceted, and while much work has been conducted to identify patients at risk of falling, falls tend to be underascertained and reported in clinical care.[44] In a study with 94 PwMS, only half who experienced falls and reported them on a research survey also reported their falls to their health care team.[3,17] Potential explanations for such discrepancies include the reality that clinicians are not regularly or reliably asking whether their patients have fallen and the perception according to survey studies[45] that falling is inevitable and therefore not worth a person with MS informing their care team.[3,17] The underascertainment of falls is a phenomenon noted in multiple neurologic diagnoses (e.g., ataxia and Parkinson disease) and in healthy older adults.[7,46] In older adults, the causes of underreporting and underascertainment may include long reporting periods (>6 months), which affects recall, and feelings of embarrassment around discussing falls, with the implied increase in weakness and/or frailty.[44]

Overcoming the Underascertainment of Falls and Near-Falls

Among many validated options, a few brief instruments can be readily deployed in the clinic. Inclusion of these measures provides both patients and clinicians with the same language and definitions of a fall and near-fall, and its results can be a standardized outcome to monitor response to intervention and disease progression.

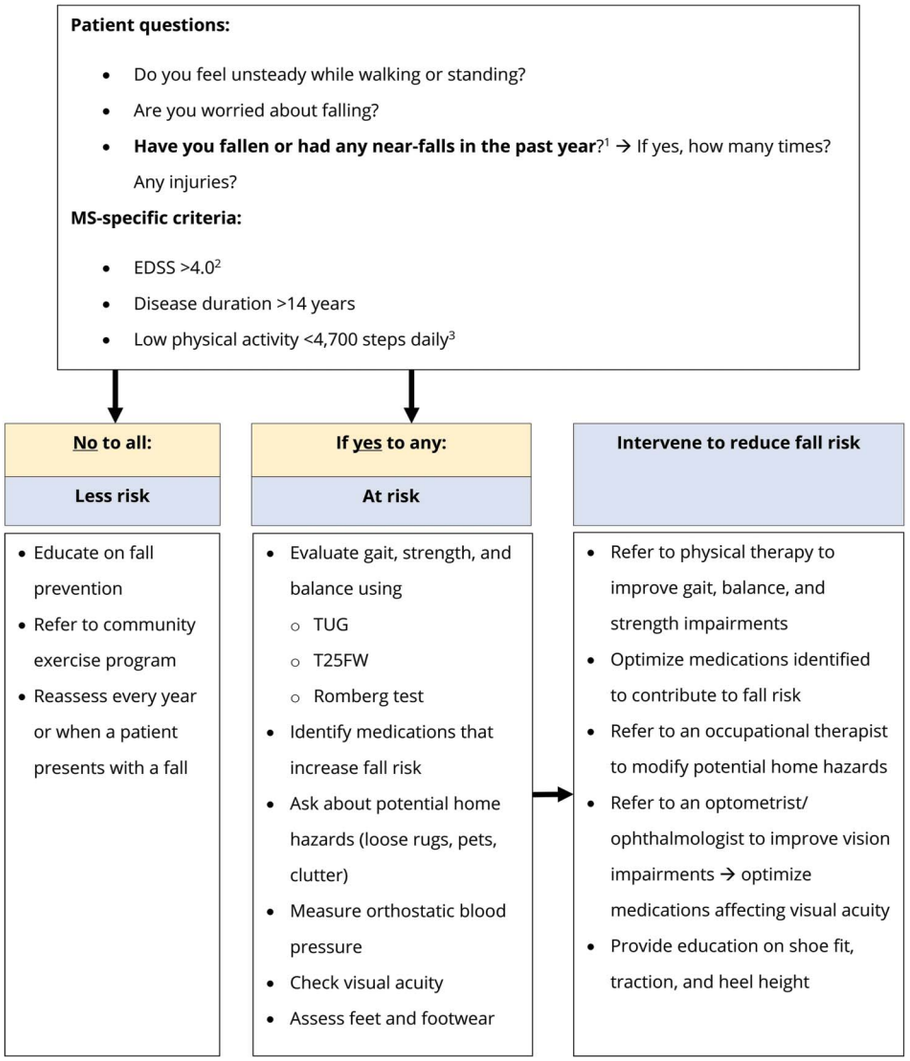
The Hopkins Falls Grading Scale[47] can be used to standardize fall reporting in many populations, including those with MS, given that the definition of a fall influences clinical

Table Evidence-Based Clinical Approach for the Neurologist to Evaluate for Increased Risk of Falling and Promote Fall Prevention in People With Multiple Sclerosis

History/clinical factors	Clinical pearls
History of falls, near-falls, and fear of falling	Ask your patient, "Have you fallen in the past year?"[2]; Have you had any near-falls or episodes where you almost fell?[2] and do you have a fear of falling?[15] A helpful practical definition of falling is "An unexpected event in which participants come to rest on the ground, floor, or lower level."[8,9]
Greater MS disease duration	People who have had MS for many years at a higher risk of falling and may benefit from more frequent screening.[3]
Medication effects	Particular attention to antihypertensive medication and medications with potential neurotoxic side effects (psychoactive and blood pressure medications)[18,19]
Orthostatic symptoms/ signs	Orthostatic hypotension is a potential fall risk and can be defined as follows: a fall in systolic blood pressure of at least 20 mm Hg and/or diastolic blood pressure of at least 10 mm Hg within 3 min of standing.[20]
Vision impairment	Note that visual field deficits, low-contrast vision,[21] and color vision[22] can contribute even when standard high-contrast central visual central acuity is relatively preserved.[23]
Home or community hazards	Ask about factors such as icy walkways, steps without railing, loose rugs, clutter, stairs in the home, low lighting—particularly problematic at night[24]
Bowel and bladder continence	Ask about fecal and urinary incontinence—particularly, urgency (neurogenic bladder)[25] can pose fall risk if rushing to the bathroom. Pelvic floor physical therapy referral should be placed.[26]
Cognitive impairment	Decreased attention is associated with higher MSWS-12 scores and self-reported walking ability.[27] Assess for verbal memory (such as with the California Verbal Learning Test or related instruments), a predictor for fall risk.[28]
12-item MS Walking Scale (MSWS-12)	The MSWS-12 is a patient-reported questionnaire assessing the impact of MS on the person's ability to walk.[29] People with higher scores (more symptomatic) on the MSWS-12 are at higher risk of falling.[2] Scores >25 gait and balance difficulty.[30]
Testing/evaluation	**Clinical pearls**
Comprehensive General and Neurological Physical Examination	Fall risk in MS is often multimodal (e.g., cognitive, visual, motor, sensory), and it is helpful to identify contributing pathways and domains affected (and how they interact)
EDSS ≥4.0	Even people who do not use an assistive device but have some degree of ambulatory disability can be at risk of falling.[3,4]
Timed-Up and Go (TUG)	People who take >11.5 s to complete the TUG are at higher risk of falling. To perform a TUG Test: Ask the patient to sit in a chair. Upon the therapist instruction, the patient stands up, walks 3 m, turns around, walks back to the chair and sits down. The time stops when the patient is seated with their back against the chair. Assistive device use is allowed and should be noted.[31]
Timed-25 Foot Walk (T25FW)	Patients are directed to walk 25 feet quickly and safely, the time taken to complete is calculated from the instruction to begin until the patient has reached the 25-foot mark. Scoring is done by the average of 2 trials.[32]
Low Physical Activity or Decrease in Activity Level	Remote activity monitoring may be helpful in assessing physical activity outside of the clinic setting. In one study, people who took <4,700 steps per day on average had greater fall risk.[3] [*Future studies will help refine ranges further]*
Orthotic footwear and assistive device evaluation	Falls may be due to incorrect or ill-fitting footwear, incorrect assistive device use, or broken or malfunctioning equipment.
Symptomatic interventions	**Clinical pearls**
Education and counselling for fall prevention	Provide patients with basic fall prevention education and resources. For example, NMSS "Free from Falls" [nationalmssociety.org/Resources-Support/Library-Education-Programs/Free-From-Falls]
Physical Therapy Referral	Refer for evaluation and individualized rehabilitation to improve gait, balance, strength, and function to reduce fall risk. Assessments may also include sensory organization testing to determine which system is affecting balance. [Options for referral: APTA find a Neurologic Specialist PT - aptaapps.apta.org//APTAPTDirectory/FindAPTDirectory.aspx]
Home hazards	Counselled about reducing home hazard risk and refer to an occupational therapist as indicated to evaluate and minimize potential home hazards.
Vision	Counsel patient and refer to an eye care and low-vision specialist referral as indicated to address potential vision impairments contributing to fall risk.
Footwear/ Proprioception	Educate as needed on shoe fit, traction, and heel height. i.e., well fitting, closed heel shoes with nonslip traction and not more than 1.5- to 2-inch heel.
Assistive devices	Patients who use canes, walkers, and wheelchairs may benefit from PT guidance for long-term usage. Refer to orthotics for decides such as ankle-foot orthoses.
Pelvic floor physical therapy	Pelvic floor physical therapy referral should be placed.[26]
Other	Physiatry consultation as indicated and available.

Abbreviations: APTA = American Physical Therapy Association; MSFC = Multiple sclerosis functional composite.

Figure Falls Screening Decision Tree to Aid Clinicians in Identifying and Reducing Fall Risk



EDSS = Expanded Disability Status Scale; T25FW = Timed 25-Foot Walk; TUG = Timed Up and Go.

decision-making.[47,48] The grades distinguish a near-fall, i.e., a slip, trip, or loss of balance but no fall to the ground (grade 1); a fall for which an individual did not receive medical attention (grade 2); a fall associated with medical attention but not hospital admission (grade 3); and a fall associated with hospital admission (grade 4).[47] Determining the grade of a recent fall can better capture its clinical and functional significance. Fritz et al.[48] reported that of 135 PwMS, 82.9% reported a near-fall (grade 1), and these reported near-falls were predictive of future falls. The individual grades are correlated with factors that contribute to fall risk (such as vision and balance control) and their ability to predict morbidity and mortality.[47]

The Falls Efficacy Scale-International (FES-I) can be used to identify fear of falling in PwMS; its 7-item short version can be easily integrated into standard clinical procedures.[15,49] The FES-I is used to assess the level of concern about falls during activities of daily living such as getting dressed or taking a shower.[49]

Several other brief validated options exist. The Activities-specific Balance Confidence Scale (ABC) is a patient-reported outcome measure examining perceived difficulty and confidence in daily activities and has been validated in PwMS.[50] The self-reported nature of this assessment allows clinicians to quantify fear of falling and activity. The 12-item MS Walking Scale (MSWS-12) is another validated questionnaire that assesses how people feel that MS has affected their walking function; it has validated benchmarks (e.g., score >25 indicate gait difficulty and challenges with activities of daily living) to inform MS-related ambulatory disability.[30] Studies have linked lower MSWS-12 scores with increased fall risk; therefore, this survey can be used as a complementary measure to identify people who may be at greater risk of falling outside of in-person visits.[51]

Combining Clinical Resources Into a Comprehensive Risk Assessment

Determining the fall risk profile for each individual with MS and which treatment or referral is most appropriate, given their specific causes of falling, can take time and require clinical investigation. The multifaceted tests and outcome measures that exist to screen for *fall risk* are elegantly outlined in publications from Coote et al. and Cameron et al.[2,6] The Table provides a practical approach that integrates these strategies into actionable effective ways to identify risk of falls for the clinician.

Patient clinical history can provide valuable insight into fall risk. In a 2013 systematic review of 8 studies, the highest risk of falling in PwMS was associated with balance and cognitive impairments, progressive MS subtypes, and use of a mobility aid.[52] Other factors are relevant as well. History of a previous fall is an excellent predictor of future falls, highlighting the benefit of asking patients about recent falls at every visit.[2] MS clinical characteristics, including an EDSS ≥4.0 and a disease duration ≥10 years, can also be useful indicators of increased fall risk.[3,4] Patients taking 1 or more medications such as antihypertensive and psychoactive medications are considered to be at increased risk of falling due to risks of dizziness, reduced alertness, and slower reaction times. Thus, review of prescriptions can help determine patients at higher risk. Additional fall risk factors to consider include vision impairments, bowel and bladder continence, and home hazards such as pets, loose rugs, or clutter[53] (see the Table, Clinical Factors).

Beyond the clinical history and patient-reported outcomes, instruments to identify fall risk include using data from wearable devices (combination of accelerometers and gyroscopes)[3,54,55] and machine learning algorithms[38,56-58]; benchmarks of clinical measures such as the Timed-Up and Go Test and Timed 25-Foot Walk; and severity of lower urinary tract symptoms.[59]

To streamline fall detection and prevention within the confines of time-constrained neurologic visits, we have assembled a list of key evidence-based outcome measures that are both cost-efficient and time-efficient (Table, Testing/Evaluation). In addition, a clinical approach is presented (Figure) to evaluate whether a patient is at greater risk of falling and requires additional care to prevent future falls.

Treatment to Prevent Falls

There has been an increase in evidence-based interventions for falls.[9,39,57] Given the multisymptom aspect of MS, various symptoms can cause falls individually or in combination. An example of a multifactorial scenario is a patient with mild visual and cognitive impairment who trips while rushing to the bathroom at night (nocturia) or who loses balance while stepping on an uneven walkway (balance impairment, proprioception loss, possibly also visual dysfunction) while trying to hold a conversation (dual-tasking impairment). Thus, there is no one-size-fits-all treatment for falls, and treatment is best tailored and targeted to each individual's constellation of impairments. Rehabilitation professionals such as physical therapists (PTs) can help guide individualized fall prevention strategies based on evidence-based interventions.

PT treatment modalities include functional strength training, balance training during static and dynamic positions, education on home safety, and functional electrical stimulation.[3,38,60] The specific frequency and duration of specific interventions needed to prevent falls is unclear,[12,61-63] emphasizing the need for individualized care. Such interventions are not only tools to prevent falls but also aim to mitigate the harmful effects of fear of falling.[12,14,38,64] Despite the evidence supporting PT rehabilitation to reduce fall risk, PwMS are under-referred to PT by their neurologists.[65] Education of patients and their neurologists about the effective treatments available by physical therapists is fundamental to enhancing the rate of referral.[66]

Conclusion

This brief review condenses the expanding literature of evidence-based assessments for fall detection and monitoring in PwMS into a simplified "prompt hub" for use by clinicians. This "hub" of reference information aims to improve the early identification of patients at risk of falling and provide themes for discussion regarding strategies for prevention and treatment, including the importance of PT referral.

Study Funding

The authors report no targeted funding.

Disclosure

A. Gopal reports no disclosures; J.M. Gelfand reports research support to UCSF from Roche/Genentech, Vigil Neurosciences, and personal fees from medical legal consulting; R. Bove receives research support from NIH, DOD, National Multiple Sclerosis Society (Harry Weaver Award), NSF, Biogen, Novartis and Roche Genentech. Scientific advisory board and consulting fees from Alexion, EMD Serono, Horizon, Janssen, Genzyme Sanofi, Novartis and TG Therapeutics; V.J. Block receives research support from National Multiple Sclerosis Society (Career Transition Award). Full disclosure form information provided by the authors is available with the full text of this article at Neurology.org/cp.

Publication History

Received by *Neurology: Clinical Practice* March 27, 2023. Accepted in final form July 7, 2023. Submitted and externally peer reviewed. The handling editor was Deputy Editor Kathryn Kvam, MD.

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How to cite this article: Gopal A, Gelfand JM, Bove R, Block VJ. Fall assessment and monitoring in people with multiple sclerosis: a practical evidence-based review for clinicians. *Neurol Clin Pract*. 2023;13(5):e200184. doi: 10.1212/CPJ.0000000000200184.