Assessing falls in older adults
A comprehensive fall evaluation to reduce fall risk in older adults

Joseph O. Nnodim, MD, PhD • Neil B. Alexander, MD

Falls account for significant morbidity and mortality in the older adult population. A comprehensive fall evaluation (CFE) is proposed, particularly for use in recurrent fallers, those who seek medical attention for a fall, and those with a gait and/or balance disorder. The CFE focuses on key factors in the medical and fall history, review of systems, and physical examination. Interventions utilize a multifactorial model, although balance exercise may be the most critical component. While some components may be marginally successful when presented individually as an intervention (such as correction of vision impairment or environmental hazard reduction), when presented together, fall risk can be significantly reduced.


Key words: falls • exercise • fall prevention

Falls are events in which an individual inadvertently comes to rest on a lower-than-usual level in the absence of an overwhelming force, syncope, or stroke. Falls cause substantial morbidity and mortality in older adults, including 5.3% of all older-adult hospitalizations in the United States.1 Falls and fall-related injury may not be completely preventable, but with a directed evaluation and intervention, the risk of falls and injury can be reduced.

This paper will discuss a directed evaluation that can be used with recurrent fallers (such as two or more falls within 12 months), those who seek medical attention for a fall, and those with a gait and/or balance disorder. Clinical evaluation

Based on a recent consensus conference guideline, older adults should be asked about falls at least once a year.3 Recurrent fallers (such as two or more falls within 12 months), those who present for medical attention because of a fall, and those who demonstrate a gait and/or balance disorder should undergo a comprehensive fall evaluation (CFE).

The goal of CFE is to identify fall risk factors based on a review of key factors in the medical and fall history, review of systems, physical examination, and other screening (table). The circumstances of a fall help identify common fall risk situations. Premonitory signs (eg, chest pain) are important, although actual loss of consciousness prior to the fall leads to a more traditional syncope, rather than falls, work-up. Acute illness accounts for approximately 10% of falls in older adults, and syncope for an even lower percentage, and the fall assessment and intervention differs from the more common, subacute or chronic fall causation and intervention model.

Intrinsic risk factors from the medical and surgical history are important, such as Parkinson's disease or a previous hip fracture repair. A thorough review of the patient's medications for fall-causing potential, with a particular focus on psychotropic medications, is critical.

Evaluation of daily activities and habits is highly relevant: both functional (ADL) dependency and excess alcohol use (>2 drinks/day) increase fall risk. Assessment of the home environment for physical hazards may require a home visit. Questions about dizziness, paresthesia, focal weakness,
and memory problems help determine the extent of vestibular, cognitive, or other neurologic disease. Leg pain, manifested by arthralgia or myalgia, may destabilize gait and increase the likelihood of falls. Urinary urgency, causing a need to rush to the bathroom, may increase fall risk as well.

**Physical examination**

The physical examination begins with a general assessment of fluid and nutritional status. Blood pressure and pulse are measured with the patient supine, then immediately after standing and after at least two minutes of standing to check for orthostatic hypotension. Positional dizziness should also prompt administration of the Dix-Hallpike maneuver.

The precordium and neck are auscultated for rhythm, murmurs, and bruits. Carotid sinus massage, to identify a highly select group of those with carotid sinus hypersensitivity who might benefit from a pacemaker, should be performed only under EKG monitoring with IV access.

Examination of the lower extremities includes an inspection of leg joints and the feet for deformities and limitations in range of motion. Footwear should be checked for appropriateness; the sole wear pattern may provide insight into abnormal weight distribution while walking.

Neurologic examination should be thorough, including assessments of cerebellar coordination, muscle tone and power, deep tendon reflexes, and peripheral sensory perception.

Of the measures of gait and balance disorder, gait speed and, in particular, the Timed Up and Go (TUG: rise from a chair, walk 10 feet, turn, and return to the chair) are thought to be particularly strong predictors of clinical outcomes (TUG over 14 seconds suggests an increased risk of falls). In a standard gait evaluation, gait initiation, base width, stride length, speed, floor clearance, trajectory, truncal posture, arm swing, and quality of turn are observed. The use of an assistive device is monitored for appropriateness, fit, and efficacy. While classical gait patterns (such as festination in Parkinson’s disease) may be encountered, an abnormally appearing gait in an older adult usually has a multifactorial etiology, requiring exploration of the factors already reviewed elsewhere.

Assessment of bipedal (feet together) stance with eyes open and then with eyes closed, establishes whether the patient has low-level stance ability and functional proprioception and vestibular function. High-level testing includes tandem and unipedal (eyes open) stance (at least 10 seconds) and tandem walk (10 steps); patients who can perform these tests generally do not have a significant balance or gait disorder.

Screening for cognition (Mini-Mental State Examination), depression (Geriatric Depression Scale) and vision (visual acuity and, if possible, contrast sensitivity using, for example, a 10% contrast letter chart and the Pelli-Robson chart respectively) are advocated.

Laboratory testing is ordinarily not a key component of fall risk assessment. However, some findings (eg, mucosal pallor, low back pain with radiculopathy) may require either blood work or imaging for fuller characterization. Assessment batteries of varying degrees of technical complexity have been developed, with defined cut-points for patient stratification for fall risk. Some of these instruments are listed in Rubinstein et al.

**Intervention**

The goal of intervention is to eliminate or minimize remediable risk factors. The Panel on Falls Prevention has en-
Table Components of comprehensive fall evaluation

<table>
<thead>
<tr>
<th>History</th>
<th>Circumstances of fall</th>
<th>Medical and surgical history</th>
<th>Medications</th>
<th>Social History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review of systems</td>
<td>Neurologic (including ophthalmologic, otologic)</td>
<td>Cardiovascular</td>
<td>Musculoskeletal</td>
<td>Genitourinary</td>
</tr>
</tbody>
</table>

### Physical examination
- Vital signs
- Head and neck
- Cardiovascular
- Extremities
- Neurologic (including gait, balance)

### Screening tests
- Mini Mental State Examination
- Geriatric Depression Scale
- Visual acuity
- Laboratory and radiological testing

---

In older adults at high risk for falls, exercise should be customized, of long duration, and include balance routines. In some cases, a multifactorial intervention model. In the community setting, the following are recommended:

- Exercise: Exercise may be the most crucial component of successful community-based multifactorial programs, and an effective single intervention according to a recent meta-analysis. In older adults at high risk for falls, exercise likely needs to be individualized, of long duration (at least 10 weeks), and include balance routines. The optimal type, duration, and intensity remain to be determined. Recent studies suggest group exercise may also be effective, although fall reduction outcomes for an initially promising program, Tai Chi, were more modest in follow-up with a more physically impaired cohort. In a physical therapy-rehabilitation model, patients with specific disease-related impairments who are at high risk for falls, such as patients with vestibular impairment, may reduce their fall risk as indicated by improvement in intermediate fall risk measures.

**Medications:** Careful review of the patient’s medications (including over-the-counter agents) is essential. Medications should be limited to those absolutely essential, given that the risk of falls increases with multiple medications. Whenever possible, non-pharmacologic modalities should be tried first (e.g., sleep hygiene and evaluation for sleep-disordered breathing for insomnia).

If medications are deemed necessary, fall-inducing potential should be considered as well as dose adjustments. Both short-acting and long-acting benzodiazepines increase fall risk. While tricyclic antidepressants have been traditionally implicated in falls, falls have also been associated with selective serotonin-reuptake inhibitors, particularly at high doses.

Medications, especially psychotropics, should be initiated at a low dose and then slowly titrated upward. Complete removal of psychotropics can reduce fall risk by as much as 66% but many patients will eventually be placed back on a psychotropic medication.

Drug interactions and acute conditions, such as sepsis, may increase fall risk by altering drug pharmacokinetics. Medication use to treat disease symptoms may increase fall risk. Narcotics are associated with injurious falls and should be prescribed judiciously. For chronic pain, scheduled dosing is more effective than use “as needed.” Advanced osteoarthritis, with rest pain and functional compromise, may merit surgical evaluation.

While recurrent falls occur in those with extrapyramidal syndromes, such as Parkinson’s, as well as in patients with cognitive impairment, administration of appropriate medications (e.g., dopaminomimetic and cholinesterase inhibitor medications, respectively) has not been proven to reduce falls. Whether medication treatment may somehow facilitate participation in other interventions, such as exercise, in these two cohorts is also not clear.
Environmental modification: As a single intervention in controlled trials, environmental modification to increase safety does not reduce fall risk. However, as a component of multifactorial programs, environmental safety measures are thought to contribute only modestly to risk reduction. Use of an occupational therapist, presumably to provide home hazard assessment and safety instruction, however, results in significant fall risk reductions post-discharge from the hospital, with a 31% fall reduction in a group receiving two home safety visits. A facilitated home environmental assessment is thus recommended for at-risk older patients upon discharge from the hospital.

Behavior modification: Behavioral strategies, as a single intervention to reduce falls, are generally unsuccessful. However, as part of a multifactorial fall risk intervention, patients should be provided with their individual risk factors and counseled regarding coping with fall risk. Patients with vision loss or those with vestibular or proprioceptive loss, who are particularly dependent on vision, must maximize lighting in the home and develop safe navigation strategies and paths. Patients with cognitive loss may need supervision and maintenance of a distraction-free environment.

Assistive/protective devices: Assistive devices (e.g., cane or walker) increase stability by augmenting the base of support, providing proprioceptive input, and redistributing weight off an impaired (painful or weak) limb. Trained help is essential in choosing and fitting all assistive devices because the wrong equipment or incorrect fitting will exacerbate the fall risk. No fall reduction benefits are seen with the use of physical restraints. Instead, restraints increase the fall risk when applied to confused persons and have been associated with serious injuries, even deaths.

Hip pads (foam with a hard shell) deflect the force of impact during a hip landing to the soft tissues around the joint. Their use has been shown to result in a three-fold reduction in hip fracture risk but also high non-compliance and drop-out rates. The Amsterdam Hip Protector Study, in which data analysis was by intention-to-treat, failed to show a hip fracture preventive benefit with use of the device. In other studies, fall risk was not reduced but falls self-efficacy appeared to be enhanced. The optimal clinical use of hip pads to reduce hip fractures is still not clear.

Footwear: Walking in stocking feet is discouraged. Shoes should be well-fitting, sturdy, and well-contoured, with a non-skid sole and low broad heel. Footwear with laces or Velcro fasteners are favored over slip-ons. Athletic and canvas shoes are the footwear styles least associated with falls in community-dwelling elders.

Athletic and canvas shoes are the footwear styles least associated with falls in community-dwelling elders

Cardiac and circulatory interventions: In successful programs, the measures targeted at orthostatic hypotension include elimination or adjustment of any suspect medications (especially diuretics and antihypertensives), oral hydration, judicious salt loading, pre-standing ankle pumping, hand clenching, and waiting at the edge of a bed or upon immediate stance prior to walking. Compression stockings are used to counteract venous pooling and fluorocortisone or midodrine are also sometimes considered.

In patients with carotid sinus hypersensitivity, bradycyclic episodes can precipitate falls. Many such falls may well be syncopal, with the patients amnesic of their loss of consciousness. However, without a history of syncope, an evaluation for possible cardioinhibitory carotid sinus syndrome is usually not undertaken. Cardiac pacing of recurrent fallers with cardioinhibitory carotid sinus syndrome reduces events by two-thirds in the SAFE PACE study in a highly select sample.

Vision: Prescription lenses correct acuity errors. Single-lens glasses are preferred to multifocal glasses since the latter lead to impaired edge contrast and depth perception and increased fall risk.

Cataract extraction, even in unilateral disease, reduces fall risk. Whereas vision modification is generally not effective as a single intervention, vision may contribute to fall risk reduction as part of a multifactorial risk reduction program.

Vitamin D: In a recent meta-analysis, treatment with vitamin D resulted in 20% fall risk reduction, independent of calcium supplementation. The proposed physiologic basis of this benefit is increased muscle strength but the extent of musculoskeletal improvement associated with this reduction in fall risk is modest. There are no current recommendations for supplementation, although targeting women and using doses of 800 IU may be beneficial.

Conclusion

A comprehensive fall evaluation (CFE) is proposed, particularly for use in recurrent fallers, those who seek medical attention for a fall, and those with a gait and/or balance disorder. The CFE focuses on key factors in the medical and fall history, review of systems and physical examination. Interventions utilize a multifactorial model, although balance exercise may be the most critical component. While some components may be marginally successful when presented individually as an intervention (such as vision impairment or environmental hazard reduction), when presented together, fall risk can be significantly reduced.
Acknowledgments: The authors wish to acknowledge the support of National Institute on Aging (NIA) Claude Pepper Older Adults Independence Center grant AG08808, and the Department of Veterans Affairs Research and Development and the VA Ann Arbor Health Care System GRECC. Dr. Nnodim is the recipient of the VA Special Fellowship in Advanced Geriatrics. Dr. Alexander is also a recipient of a K24 Mid-Career Investigator Award in Patient-Oriented Research AG109675 from NIA. We also gratefully acknowledge the contributions of Debbie Strasburg and Diane Scarpace.

References
Copyright of Geriatrics is the property of Advanstar Communications Inc.. The copyright in an individual article may be maintained by the author in certain cases. Content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.