Balance Problems in the Geriatric Patient

Dennis E. Enix, DC, MBA; Joseph H. Flaherty, MD; Kasey Sudkamp, PT, DPT; Jessica Schulz, OT, MOTR/L

Address: 1Assistant Professor, Logan College of Chiropractic, Research Division, Chesterfield, MO, USA; 2Associate Professor of Medicine, Department of Internal Medicine & Division of Geriatrics, Saint Louis University School of Medicine, St. Louis, MO, USA; 3Logan College of Chiropractic, Chesterfield, MO, USA; 4SSM Rehabilitation Hospital, St. Louis, MO, USA

Email: Dennis E. Enix, DC, MBA* - dennis.enix@logan.edu

* Corresponding Author

Abstract

Balance problems and falls are common among the elderly and are a leading cause of institutionalization in this group. Low back pain (LBP) is the most frequently reported musculoskeletal condition in the elderly and is a leading comorbid factor directly linked to the incidence of falls. Balance disorders in the geriatric population are often a multifactorial condition. While there is not a single solution to postural control problems, there is evidence that the most effective treatment strategies for balance disorders consist of a multimodal approach including a re-evaluation of medications, manual therapy, exercise, and behavioral modification programs. This case report describes an interdisciplinary approach to the diagnosis and management of an 85 year old woman with balance problems.

Introduction

Balance problems and falls are common among the elderly and are a leading cause of institutionalization in this group that result in over five million patient outpatient visits per year. It is estimated that between 28% and 35% of individuals over age 65 fall each year, with a fifth of those requiring medical attention. The number of fallers increases to over 40% for those 75 and older. A history of falling is also a robust predictor of morbidity among the elderly.

Low back pain (LBP) is the most frequently reported musculoskeletal condition in the elderly, with a
prevalence ranging from 19.7% in people over the age of 65, to as high as 40% for individuals over 75.1,2,4 LBP is a leading comorbid factor directly linked to the incidence of falls in the elderly and is sharply on the rise; LBP prevalence has increased in the last fourteen years from 3.9% to 10.2%.4,5 LBP in the elderly can involve a wide range of possible diagnoses and co-morbidities, including a high incidence of malignant or visceral causes and therefore necessitate a close review of systems in addition to the usual musculoskeletal examination.5,6

Balance disorders in the geriatric population are often a multifactorial condition. Weakness in the core stabilizing muscles, altered muscle activation patterns, loss of proprioception, and an inability to control normal postural sway can all result in decreased balance in the elderly.7,8 A decrease in physiological reserves as we age, limits the ability to react quickly to perturbations. While there is not a single solution to postural control problems, there is evidence that the most effective treatment strategies for balance disorders consist of a multimodal approach including a re-evaluation of medications, manual therapy, exercise, and behavioral modification programs.7,9 This case report describes an interdisciplinary approach to the diagnosis and management of an 85 year old woman with balance problems.

History

An 85 year old Caucasian woman with a history of balance problems presented to an outpatient clinic for evaluation and treatment. This patient’s previous medical history included chronic obstructive pulmonary disease (COPD), asthma, hypertension, osteoarthritis, and osteoporosis. Her past surgical history included a total hip arthroplasty (THA) to repair a fractured right femur as the result of a fall in 2004. She also had an open reduction internal fixation of a fracture of her right humerus as a result of a fall in 2006. She wears an orthotic in her right shoe to accommodate a post-surgical leg length discrepancy and complains of right foot and leg pain when walking long distances. She has had periodic transient episodes of mild low back pain which she reports as worse in the morning. Her current medications include Spiriva (PRN), Trazodone (50 mg qd), Loratadine (10 mg qd), Benzonatate (100mg qd), Benicar/HCTZ (40/25 mg qd), and Aleve (220 mg PRN).

She lives in an independent living center and is ambulatory with a cane. She voiced concerns about her steadiness and reported a significant fear of falling again. She denies smoking or alcohol use and reports a sedentary lifestyle. She drives, but limits her trips to grocery shopping and medical appointments. She was treated by a physical therapist for 4 weeks following her THA in 2004.

Physical Examination and Diagnostic Test Results

This patient’s vital signs were the following: BP 134/64, pulse 72 bpm, weight 134 lbs, height 66”, Temperature 97.6°F. Her Achilles tendon reflexes were 1+ bilaterally; patellar reflexes were 1+ on the
right and 2+ on the left. Dermatomes and myotomes were intact. There was no evidence of neurological involvement, ataxia, or vestibular problems. There was a 2.0 cm actual leg length discrepancy on the right. There were bilateral hamstring and piriformis adaptive shortening. Manual muscle testing revealed 3+/5 in the gluteus medius, 4+/5 in the quadriceps; 4/5 in the iliopsoas, tibialis anterior, adductors and gluteus maximus muscles bilaterally. Previous MRI’s showed moderate diffuse degenerative disc disease in the lumbar spine.

Several balance tests were performed with the following results: Tinetti Performance Oriented Mobility Assessment 16/24 (high fall risk), Berg balance test 37/56 (medium fall risk), and the Timed up and Go Test required 17.23 seconds (below normal functional independence and high fall risk).

Two computerized balance tests were performed on the NeuroCom Balance Master device including the Limits of Stability Test (LOS) and the Clinical Test for Sensory Integration of Balance (CTSIB). On the Limits of Stability Test (LOS), the patient scored below the age adjusted norms for endpoint and max excursions in the forward, left, and right directions along with exhibiting decreased reaction times and directional control. In the CTSIB test, the patient scored below the age adjusted norms on the firm surface with her eyes closed and on the foam surface with both eyes open and eyes closed.

The patient also completed several standardized subjective reports including the following: Tampa Scale for Kinesiophobia 38/68, Visual analogue scale 2/10, Falls Efficacy Scale 60/100 (moderate fear of falling), and Oswestry Low Back Pain Questionnaire 28/50. The SF-36 health questionnaire scored a 31.1/100 and 52.8/100 on physical and mental health categories respectively. This demonstrated a below average functional health personal assessment while the mental portion was within the normal score set.

**Diagnosis**

1. Balance deficits
2. Gait abnormality
3. Diffuse degenerative disc disease in the lumbar spine.

**Treatment**

As discussed earlier, balance problems are often a multifactorial in nature, lacking a single underlying pathology. Many studies have shown the merit to a team approach when treating individuals with balance problems. An ideal plan of care for this patient should address as many of the contributing factors as possible. Therefore, treatment options for this patient are discussed from the standpoint of a chiropractor, a medical physician, a physical therapist and an occupational therapist.
Discussant 1

Dennis Enix, DC, MBA is an Assistant Professor at the Logan College of Chiropractic Division of Research, and the Principal Investigator on a multidisciplinary research collaboration with the VA Geriatric Research Education and Clinical Center and the Saint Louis University Center Division of Geriatrics. The three year HRSA funded study examines balance problems and low back pain in the geriatric population.

This patient’s risk for falls appears to be multifactorial. Her risk for falls is influenced by her overall posture, decreased flexibility, muscular strength, proprioception and certain medications and is further complicated by periodic bouts of low back pain. Her high kinesiophobia scores and reported fear of falling indicate not only a fear of movement and falling but also represent an increased psychological risk factor for future falls. Sarcopenia and a loss of flexibility and proprioception predispose an individual to an increased risk of falls and loss of independence. The general health status of this patient and loss of physiological reserves significantly limits her ability to react quickly in response to small perturbations. The ability to maintain normal balance is not only a function of the visual, vestibular, and somatosensory systems but also requires proper sensory-motor integration. Balance testing indicates that in addition to over or under estimating distances, this patient’s increased postural sway and decreased reaction time puts her at further risk of falling.

Table 1. Internal and external fall risk factors and recommendations

<table>
<thead>
<tr>
<th>Common problems</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthostatic hypotension</td>
<td>Rise slowly after sitting</td>
</tr>
<tr>
<td>Post prandial hypotension</td>
<td>Evaluate carbohydrate intake</td>
</tr>
<tr>
<td>Low back pain</td>
<td>Chiropractic care/Physical Therapy</td>
</tr>
<tr>
<td>Muscle weakness</td>
<td>Exercise, tai chi, yoga, walking</td>
</tr>
<tr>
<td>Balance problems</td>
<td>Falls specific exam, walker, 3 point cane</td>
</tr>
<tr>
<td>Transferring to bed, toilet, couch</td>
<td>Lower bed/raise toilet, add railings</td>
</tr>
<tr>
<td>Lighting, clutter, stairs, slippers</td>
<td>Home inspection/Occupational therapy</td>
</tr>
</tbody>
</table>
When working as part of a multispecialty group, it is important to coordinate a plan of care with the other members of the health care team. Recognizing the strengths within areas of specialization, a treatment plan tailored to a patient’s specific need increases outcomes (Table 1). From the perspective of a chiropractor, I would focus on the patient’s complaints of low back pain as it relates to her postural control problems. People with LBP have a 2-fold greater odds of falling than people without LBP. The pathology of LBP and the related disequilibrium is often multifactorial, including inhibition of core stabilizing muscles, altered muscle activation patterns, and loss of proprioception resulting in an inability to control normal postural sway. This patient’s previous diagnosis of lumbar disc disease and complaints of intermittent low back pain, loss of flexibility and proprioception make her a good candidate for manipulative therapy.

In addition to increasing this patient’s muscle mass, we want to help restore her flexibility, which includes not only stretching but also joint manipulation and mobilization. The goal of manual therapy will be to increase the range of motion and joint flexibility while decreasing the patients low back pain and nociception. Sixty percent of our balance comes from the somatosensory system. Manipulation has been shown to create both biomechanical and neurological changes. Along with decreases in pain and the production of substance P, manipulation has been shown to increase ranges of motion, change functional muscle activation patterns and increase postural control in patients with LBP.

Given her past surgical history of THA to repair a fractured right femur and humerus, and the resultant post-surgical leg length discrepancy, examination of the pelvis may reveal asymmetries that would respond well to manual therapy. Along with asymmetrical positioning of the pelvis, altered muscle firing patterns from LBP respond well to manipulation. Manipulation of the feet and ankles in elderly adults has also been shown to partially compensate for postural control changes by stabilizing postural sway. When appropriately screened for treatment with a clinical prediction rule, the benefit of manipulative therapy increases to a 92% chance of successful outcome. The minimum number of treatments per week needed to show a benefit at 4 weeks is 1.9. The cost effectiveness of chiropractic manipulation for LBP is equivalent to standard medical and other forms of therapy including hospital outpatient services. While an effective treatment and competitive from the standpoint of a cost model, chiropractic care remains an underutilized therapy among this age cohort. There is strong evidence that a multifactorial program of therapy is an effective treatment for LBP in older adults.
patient’s complex past medical history and current clinical presentation, coordination of her care within a multispecialty group ensures not only more accurate diagnosis but better outcomes.

References:

17. Meade TW, Dyer S, Browne W, Frank AO. Randomized comparison of chiropractic and hospital

---

**Discussant 2**

Joseph Flaherty, MD is a Professor of Medicine at Saint Louis University School of Medicine and the VA Geriatric Research Education and Clinical Center.

The outpatient clinic can be a busy place, so a targeted “check-list” type approach can help identify risk factors for falls, and then guide intervention and treatment options in an efficient manner. To do this, I use the mnemonic “A-G-A-I-N I’-V-E F-A-L-E-N” (Table 2).

**Table 2. Intervention and treatment options**

<table>
<thead>
<tr>
<th>A</th>
<th>Again</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>Gait &amp; Balance</td>
</tr>
<tr>
<td>A</td>
<td>ADL impairment</td>
</tr>
<tr>
<td>I</td>
<td>Impaired cognition</td>
</tr>
<tr>
<td>N</td>
<td>Number and Type of Medications</td>
</tr>
<tr>
<td>I’</td>
<td>Illness (Acute)</td>
</tr>
<tr>
<td>V</td>
<td>Vestibular function</td>
</tr>
<tr>
<td>E</td>
<td>Eyes, Ears</td>
</tr>
<tr>
<td>F</td>
<td>Feet</td>
</tr>
<tr>
<td>A</td>
<td>Alcohol</td>
</tr>
<tr>
<td>L</td>
<td>Lower extremity weakness</td>
</tr>
<tr>
<td>L</td>
<td>Low blood pressure (or OH)</td>
</tr>
<tr>
<td>E</td>
<td>Environment</td>
</tr>
<tr>
<td>N</td>
<td>Neurological</td>
</tr>
</tbody>
</table>

“Again” reminds me that the approach begins by realizing that a previous fall puts this patient at risk to fall again, so I will need to spend some extra time with this patient. "Gait and balance" evaluation has been done above. "ADL impairment" refers to loss of physical function to the degree that it has affected someone’s ability to do their basic activities of daily living. If this change is recent, it can signify very high risk for falls. One of the most common causes of ADL loss is a recent hospitalization. Impaired cognition includes dementia, delirium or depression. Any of these can put an older person at risk of falls. For further reading on these three geriatric syndromes, see these review articles by Tinetti 2003; Cigolle et
al. 2007 and Harlein et al. 2009. The number and type of drugs are some of the most important risk factors for falls. Taking >4 drugs is a risk factor by itself. Certain types of drugs will also increase risk. In a meta-analysis of 40 observational studies comparing fallers to non-fallers, the following psychotropic medications had increased odds ratio [(OR) (95% confidence interval): any psychotropic use [1.73 (1.52-1.97)], neuroleptics [1.66 (1.38-2.00)], sedative/hypnotics [1.54 (1.40-1.70)], any antidepressant [1.66 (1.4-1.95)], benzodiazepines [1.48(1.23-1.77)].

“Illness” indicates that acute as well as subtle illness can contribute to risk for falls. For example, someone with a mild anemia might continue to drop their blood count over time so slowly that the first symptom might be weakness and a fall. The fall might be what brings them to the emergency room. Vestibular function changes with age. There may be an age-related decline in balance due to accumulation of minute calciferous granules within the stratoconic membrane, which could lead to vestibular dysfunction. Impaired vision, more so than impaired hearing, contribute to risk of falls. In addition, bifocals increase risk for falls. Cerumen is not only a common cause of hearing impairment, but if impacted, it can affect balance.

Foot problems that can affect balance include calluses, bunions, poorly fitting shoes and thick or long toenails. Alcohol can affect balance. Lower extremity weakness is one of the strongest predictors of falls, increasing risk anywhere from 2 to 8 times compared to people without weakness. It is important to test for lower extremity weakness in a dynamic way by doing the “5 sit to stand” with arms crossed. Low blood pressure can occur if someone is dehydrated or just overtreated with antihypertensive medications. “OH” stands for orthostatic hypotension. This is a drop in systolic blood pressure of 20 mmHg or diastolic of 10 mmHg when going from a sitting to standing position. Environmental causes such as throw rugs in the home, or pets, should be queried about. Lastly, neurological problems as risk factors should be considered, such as peripheral neuropathy.

As these apply to our patient, we already know she has a gait and balance problem, so physical therapy evaluation is in order. She has no obvious ADL impairment, but if it takes her longer to do her ADLs than usual, an occupational therapist might be beneficial. We should screen our patient for dementia with a tool like the Saint Louis University Mental Status Exam, which is better than the traditional mini-mental status exam at picking up mild cognitive impairments. Depression can be screened for in just a few minutes using something like the Geriatric Depression Scale. Although treatment with antidepressants carries some risk for falls, depression is associated with several other negative outcomes in addition to falls, so it should be treated. Delirium typically occurs in hospitalized patients, and to a lesser extent, nursing homes, so this may not apply to our patient unless she gets hospitalized. On review of her meds, the goal would be to get her to 4 or fewer. We should investigate the need for trazodone and loratadine, and consider stopping them if possible. We’ll address the Benicar/HCTZ below.

It does not seem that she has an acute or subtle illness, but keeping a relatively high index of suspicion would be prudent. We should check her vision, and look in her ears. Most importantly, we could have her do 5 “sit to stands” with her arms crossed. If she cannot do this, referring her to PT for leg strengthening exercises would be indicated. Her blood pressure might be considered on the low side for
her age, and we should definitely check her blood pressure not just sitting, but standing. If OH is present, I would either stop or at least cut back her Benicar/HCTZ. Lastly, if she had fallen at home, I would consider ordering a home care evaluation (by an OT) to examine her environmental risks for falls.

References


Discusant 3

Kasey Sudkamp, PT, DPT is a Physical Therapist involved with the HRSA funded geriatric balance and low back pain study.

As a physical therapist, treatment of balance disorders, especially in the geriatric population, is an important aspect of my profession. The elderly represent more than one third of all hospital injury admissions, and more than 80% of these injuries are caused by unintentional falls.¹ These falls are the leading cause of nonfatal injuries requiring medical attention in the United States.²
As we age, changes in the body’s systems affect our mobility and balance. The dynamic equilibrium model shows that both sensory and motor components determine our ability to maintain balance. The sensory portion of the balance system is composed of 3 areas: vestibular, visual, and somatosensory/proprrioception. The motor portion of the equilibrium consists of our bodies’ ability to act on the sensory information provided using muscle contractile patterns and synergies. While balance disorders are often multifactorial in nature, the goal in management is to minimize physical disability and improve functional performance.

In order to develop a patient-specific treatment plan, a thorough evaluation of the neuromuscular and musculoskeletal systems is needed. Limitations imposed by range of motion deficits, muscle weakness, poor muscle endurance, and pain affect the ability to maintain dynamic equilibrium. Based on the subjective and objective measures listed in the patient history, I would focus on the muscle strength deficits, the adaptive shortening of one and specifically two joint muscles, the pain complaints, and her overall lack of postural control and motor coordination. The optimal initial treatment frequency is 2-3 times per week for 4-6 weeks.

Ankle, hip, and stepping strategies are our body’s way to manage the amount of sway during specific activities. If range of motion and strength is reduced in the leg and trunk joints, then the ability to correctly activate and use these strategies is decreased. I would choose light resistive exercises involving TheraBand and gravitational pull to strengthen the hip, knee, and ankle musculature with specific focus on the gluteus medius and the tibialis anterior. The exercises chosen should strengthen throughout the entire available range of motion as well as use concentric and eccentric contractions. Static as well as dynamic stretching of the rectus femoris, piriformis, and hamstrings will also be performed during the treatment regimen.

To improve the coordination and efficiency of translating the patient’s sensory signals into motor control actions, a controlled instability environment is extremely helpful. It requires putting the patient in a safe environment while at the same time challenging her base of support limits. This can be done in a variety of ways including stance activities on different supportive surfaces and varying the use of her upper extremities to assist her stability during standing exercises. Single leg stance work also fits into this category. Based on her NeuroCom CTSIB scores, the patient relies heavily on her vision and proprioception to maintain balance. Thus, having her perform standing activities with her eyes closed along with using unstable surface platforms (foam), will encourage activation of the vestibular system and reinforce her movement compensation strategies.

The patient’s low back pain complaints appear consistent with osteoarthritis and her diagnosis of degenerative disc disease. A lumbar stabilization exercise program can address both her pain and improve her postural control, which are important components in the balance algorithm. Any sudden increase in pain might require ultrasound, trigger point release, mobilization, and activity adjustment.

Finally, education is an important key when treating balance deficits in the elderly. Most falls happen in the home so instruction on the necessity to reduce tripping hazards such as clutter, poor lighting,
electric cords or throw rugs is important. The patient should also be made aware of other factors that put her at increased risk for falling such as performing activities that force her outside of a comfort level of stability i.e. carrying heavy objects, changing a light bulb, climbing a ladder. This patient’s current assistive device for gait is a single point cane, and while that may give her a small increase in base of support, a two or four wheeled walker can provide even more gait steadiness until she feels some improvement. A simple yet effective home exercise program is also imperative for rehabilitation success. In order for the patient to maintain any advances she made during her physical therapy sessions, she will need to have been instructed on a daily exercise program that is easily followed.

References


Discussant 4

Jessica Schulz, MOTR/L is an Occupational Therapist at the SSM Rehabilitation Hospital in St. Louis, MO.

The goal of an Occupational Therapist (OT) treating balance disorders is to address one’s physical, cognitive, psychosocial, and sensory aspects of their life in order to enhance independence, well being, and quality of life. Older adults and elderly make up a high percentage of people OTs evaluate and treat on a daily basis. Falls are the leading cause of injury and accidental death in adults over the age of 65. A fall can cause a dramatic change to an older adult’s life; reducing mobility, strength, and functional endurance.

Treatment of balance disorders is an important aspect of working with older adults. Evaluation of person and home are significant in order to best treat the older adult. An OT would evaluate one’s Activities of Daily Living, such as whether they stand up or sit while putting on pants, as well as their Instrumental Activities of Daily Living, such as cooking while standing up at the stove, to assess their strengths and weaknesses.
Assessment and modification of the home environment by an OT can significantly reduce the number of falls in older adults. Assessment and modification of one’s home is an important step in implementing a safe foundation.

There are many ways to adapt one’s environment to help protect people with balance disorders from falls. Bathrooms have a tendency to be wet and slippery, therefore increasing the risk of falls. Appropriate rugs that will safeguard the patient from slips and trips are the first and most efficient step; they should be advised to discard throw rugs and get flat, non-slip rugs. Grab bars, shower chairs, hand held shower heads, and raised toilet seats are durable medical equipment that will safeguard many people from unnecessary falls. In the kitchen, safety improvements include storing food in easy-to-reach places and setting up cooking tasks sitting down. In hallways, create clear pathways free from thick carpeting or rugs and install handrails if necessary. In the bedroom, create clear pathways as well as assess the bed’s height to ensure safety getting into and out of bed. Bedside commodes next to one’s bed at night are a way to decrease the risk of falls in case of urgency in the middle of the night.

OT treatments for balance disorders and fall prevention include increasing postural stability/strength, upper extremity strength/endurance, proprioceptive awareness, and safe functional mobility. Functional standing tasks during an Instrumental Activity of Daily Living, such as emptying the dishwasher, can promote dynamic standing strength and proprioceptive awareness as well as increase strength and endurance in postural muscles. This task also allows the OT to assess when the patient is fatiguing and educate him or her on energy conservation/safety techniques. Activities of Daily Living that require dynamic standing balance, such as lower body dressing and bathing tasks, are also functional ways to increase balance and safety as well as independence.

The use of adaptive equipment has been associated with promoting safety and independence in an older adult. A reacher is a piece of adaptive equipment that allows one to clasp onto pants and pull them up to the thighs, allowing for safer dressing. The reacher is also used as adaptive equipment while walking with a wheeled-walker. A reacher is hung conveniently on the wheeled walker in order to safely pick up dropped items from the floor.

Finally, it is very important to educate the patient and family/caregivers on fall prevention techniques and home modification suggestions. A study completed by Wyman, et al., revealed that home modification education and individual counseling led to significant safety changes in older women at risk for falling. Educating patients on proper medication schedules is also very important. If not taken correctly, dizziness and loss of balance may occur. An OT can educate older adults on their medications and help them use a weekly medication organizer, if needed. It is important that the patient understands the value of following home safety techniques and the simple home exercise plan in order to maximize the benefits of the OT sessions.
References:


Conclusion

Older adults represent the fastest growing population segment, but research into age-related conditions such as LBP has failed to keep pace with this growth\(^5\). Progress is dependent on a number of factors including treatment regimen, frequency of care, patient motivation, catastrophizing behavior, as well as the number of comorbidities present. Geriatric studies are under-represented in the back pain literature and there is a need to improve epidemiologic reporting of LBP in the elderly\(^6\).