MAINTENANCE OF BALANCE AND REHABILITATION IN THE ELDERLY

Yadati Sathyanarayana Raju, Hyderabad

INTRODUCTION

Complaints of dizziness and disequilibrium increase with age. Sixty-five percent of individuals older than 60 years of age experience dizziness or loss of balance, often on a daily basis.

Some degree of imbalance is present in all individuals older than 60. This is the result of a generalized functional degradation. Initially, the imbalance is situational and manifests when the righting reflexes cannot meet the demands of a challenging environment, such as a slippery surface. As the functional degradation progresses, the imbalance occurs during everyday activities, independent ambulation becomes difficult, and the likelihood of falls increases. When instability is constant, the individual resorts to the use of a cane, a walker, or a wheelchair.

In the elderly, falls often precipitate a series of events with catastrophic potential. The annual cost of the related injuries runs into crores of rupees.

The fear of falling is a major concern for the elderly. This fear is restrictive and constraining. It results in withdrawal, a progressive decrease in activity, and a steady decline in the quality of life and mental well-being.

Orientation and balance

The maintenance of posture and the ability to move about the environment depend on orientation and balance.

Orientation is the awareness of the relationship of the body and body parts to each other and to the environment in a dynamic and reciprocal interaction. It is a complex function that relies on multiple sensory input.

Balance is the process by which individuals maintain and move their bodies in a specific relationship to the environment. It is an automatic and unconscious process that allows individuals to resist the destabilizing effect of gravity. Balance is essential for purposeful movement and effective communication.

Mechanisms of balance

To achieve balance, the body’s center of gravity (COG) must be kept perpendicular over the center of the support base. This is accomplished through the integration of information received from sensory organs and through the execution of coordinated and synchronized movements. A loss of balance occurs when the sensory information about the position of the COG is inaccurate, when the execution of automatic righting movements is inadequate, or when both are present.

The postural control system receives information from receptors in the proprioceptive, visual, and vestibular systems, as well as from pressure sensors under the skin.

Somatosensory inputs

Somatosensory inputs provide information about the position of the body and body parts relative to each other and to the support surface. Somatosensory inputs are the dominant sensory information
for balance when the body is standing still on a fixed, firm surface. They are seconded by visual information. Humans seem to rely primarily on signals from the pressure sensors in the legs and torso to maintain good, balance.

Visual inputs
Vision informs about the physical environment and the relation of the body relative to that environment. Visual inputs are the primary back-ups when the somatosensory information becomes deficient. They play a major stabilizing role when the support surface is precarious or compliant. Clear vision depends on a stable gaze.

The vestibular system
Has both a sensory and a motor function:

Sensory function
The vestibular system measures the head’s angular velocity and linear acceleration and detects head position relative to the gravitational axis. Head angular velocity is measured by the cristae of the semicircular canals, while the maculae of the statolabyrinth (utricle and saccule) register linear acceleration and changes in the gravitational force. Because the vestibular system senses head motion, it is less sensitive to body sway than is the visual or the somatosensory system. When Somatosensory and visual information are adequate, the vestibular system plays a minor role in the control of the COG position. Its role is dominant when there is a conflict between visual and somatosensory information and during ambulation.

Motor function
The vestibular system controls muscular activity. During erect posture, it initiates transitory muscular contractions and controls muscle tone. In addition, it assists in stabilizing gaze during head and body movements by generating conjugate, smootheyemovementsoppositeindirectionandapproximately of equal velocity to head movements. The vestibule-ocular reflex stabilizes gaze during target fixation and unsuspected perturbation of head and body position. Gaze stabilization is essential for clear vision; it results from the combined effect of the vestibulo-ocular reflex on the nuclei of the extraocular muscles, neck proprioception, and the position of images on the retina.

The vestibulospinal reflex
Initiates the compensatory body movements necessary to maintain posture and to stabilize the head over the trunk. There are positional, acceleratory, and righting vestibulospinal reflexes. The positional reflexes are initiated by a change in the support surface. The acceleratory reflexes, attributed to the semicircular canals, assist in tilt detection and sway displacement. Righting reflexes tend to keep the head in an upright position and facilitate contraction of the neck receptors and the axial musculature.

The cerebellum
The cerebellum plays a prominent role in regulating the output of the vestibulospinal system through extensive reciprocal connections with the vestibular nuclei. Cerebellar lesions can result in severe postural disturbance.

Pressure sensors
Located beneath the skin, pressure sensors measure the intensity of contact made by the different parts of the body with the environment. These sensors play a dominant role in the maintenance of balance as they inform about the base of support.

Integration of input information
The inertial-gravitational reference provided by the vestibular system is critical to the resolution of sensory conflicts between visual and vestibular inputs and between spinal and vestibular inputs. The vestibular inputs are critical to the selection of appropriate postural movement strategies. The cerebellum and basal ganglia help to mediate visual, vestibular, and proprioceptive interactions and coordinate the proprioceptive reflexes sub-serving balance. Information from proprioceptive, visual, vestibular, auditory, tactile, and stretch receptors in various organs is integrated to create a picture of the position and movements of the body parts relative to each other and to the environment. This picture is stored and constantly upgraded. It is the essence for all body movements and the determinant for sudden and rapid corrective motor activity.

Normal balance
The postural control system is continuously involved in changing situations. The most remarkable property of the postural control system is its ability to maintain useful functioning responses to many novel motion environments and to adapt to abnormal function in one or more of its components.

Impaired balance
Impaired balance is the result of inaccurate information about the position of the COG, inadequately executed movements to bring the COG to a balanced position, or a combination of both.

More prevalent, chronic instability occurs when the compensating strategies can no longer offset the functional decline.

Falls
By definition, to fall is to drop or to come down freely under the influence of gravity. Falls are the expression of postural collapse and result from a failure to resist the destabilizing
The COG sway can be measured by computer analysis of information received from a forceplate on which stands the individual to be evaluated. The forceplate, or platform, is a rigid, flat surface supported by measuring devices that record the vertical forces exerted on the plate and calculate the position of the center of these vertical forces. This center represents the position of the COG or center of mass. The position of this center is recorded and followed as it moves across the surface plate. The sway index expresses the degree of scatter of data about the mean center of balance.

Evaluation of the individual with imbalance

The evaluation of patients with a vestibular disorder can be a most challenging task. The great overlap that exists between the different systems that subserve the balance function renders the interpretation of measurements of the vestibulo-ocular and the vestibulospinal reflexes difficult. Because of the effects of adaptation and habituation, these measurements do not reflect an organic loss but rather the functional loss that has remained uncompensated for at the time the measurements were made.

In the field of vestibular disorders, there is no gold standard. Rather, experienced clinicians—making use of the history, physical examination, and a medley of laboratory tests—render their best judgment regarding a particular patient.

In the elderly, the causes of unsteadiness and falls are multifactorial and overlapping. The approach to the management of an elderly individual with unsteadiness encompasses more than the diagnosis of the disease entity or entities that are causing the problem. Often, little can be done about the disease entities, and there usually is not a consistent relationship between anatomic abnormalities and physical signs or between physical signs and resulting function.

FUNCTIONAL ASSESSMENT

Test for clinical assessment of gait and Balance
**Functional reach (FR)**

Measure the distance in inches that a standing individual can reach or lean forward without stepping. Score of 6 inches or less in 70 years old is strongly correlated with high fall risk. Easy to perform, requires minimum equipment, time and space.

**Time up and go test (TUG)**

Time in seconds for an individual to stand up from a chair, walk 10 feet turn around, come back and sit down, score of 30 seconds or greater indication impaired and assistance is required.

**Berg Balance scale**

Functional activity test that rates performance from 0 (unable to perform) to 4 (normal performance) on 14 tables. Time required is 15 minutes. Table include ability to sit, stand, walk, turn in a complete circle, reach, lean over, turn and look over each shoulder and step. Maximum score of 56 indicate excellent balance, < 45 predict multiple falls.

Also Sensory organization test (SOT) in computerized dynamic posturography (DP)

Clinical test of sensory interaction and balance (CTSIB)

**Comprehensive management, therefore, includes:**

- Measurement of the functional competence of the vestibular, visual, proprioceptive, sensory, auditory, and musculoskeletal systems (imaging and/or laboratory tests may be necessary to arrive at a diagnosis)
- Evaluation of gait and movements
- Evaluation of cognitive function and psychological characteristics
- Determination of the impact of the functional loss (physiologic, functional, social, and societal) on the particular individual

**MANAGEMENT OF THE ELDERLY WITH IMBALANCE**

The goal of a management program is to prevent impairments by optimizing function. Balance reorganization strategies are the cornerstone of the management of balance disorders, especially in the elderly. They promote orientation, gaze stabilization, muscle strength, and joint mobility. The improvement to be expected from these exercises depends on accurate assessment of the causes of the imbalance, conceptualization of the exercises, severity of the impairments, the general physical and mental health of the patient, patient motivation, and family support.

1. Patients should be encouraged to incorporate these exercises into their daily routines and to use the new strategies in their everyday activities. The home environment should be made safe.

2. Single limb stance:
   - A great place to begin with fall prevention in the elderly is with the simplest standing balance exercise. Hold on to a chair and balance on one leg.
   - This is a great place to begin to feel your center of gravity over your ankles. This is your goal, maintaining your center over your ankles.
   - Try a few seconds balancing on each foot. Work up to a minute if you can. Then begin to hold on with one hand, then one finger and finally try to let go completely.

3. Eye tracking:
   - Move on to the other exercises for balance with static standing exercises as you gain confidence including this exercise which targets your vision and vestibular system.
   - This exercise can sometimes make you dizzy. If this happens, stop the exercise. Try it again with smaller head movements next time.
   - Gradually you will learn to do it correctly.

4. Clock reach:
   - Make sure to hold on to a chair when attempting this exercise to prevent falls in the elderly. Don’t reach back too far if you have pain in your shoulder.
   - *(Use your one pound wrist weight here to increase your workout.)*

5. Staggered stance:
   - Also hold on to a chair when trying this exercise for elderly balance problems. Let go of the chair for a few seconds at a time if you feel comfortable.

6. Single limb with arm:
   - Look up from your feet when balancing and pick a spot at eye level in front of you to improve falls in elderly. Lift your chest and bring your shoulders back.
   - Breathe in through your nose and out through your mouth.

7. Balancing wand:
   - This is a fun exercise and easy to do. Use a cane, broom or even an umbrella. Don’t have too much fun with these balance exercises for elderly!

8. Knee marching:
   - Try this one next to a counter so you can hold on
when performing knee marching. This is also a great cardio exercise and for leg muscle weakness.

9. Body circles:
   • This exercise for improving balance can be a little tricky. Keep a chair nearby if you are uncomfortable without one. Make sure your knees and hips are kept straight when you circle.

10. Heel to toe:
    • The moving exercises are the most difficult. Only try this balance exercise when you have become good at the preceding exercises.

11. Grapevine:
    • Seniors who dance will be more familiar with these balance exercises. Try it in your kitchen holding on to the counter.
    • Walk several steps in one direction, turn around and walk back. Continue for several minutes. Gradually hold on less and less until you can take a few steps without holding on.
    • It may take a while, but keep practicing...you’ll get it sooner or later.

12. Stepping:
    • This series of stepping exercises for falls and the elderly are very challenging. You may have a stable family member demonstrate these for you first.

13. Dynamic walking:
    • Try these exercises to improve balance only when you feel confident and have a helper in the home.
    • Give them a try when you are stronger and more sure of yourself. These exercises are great to do with someone else.
    • Holding hands with a stable family member will make these exercises easier and safer.

Despite all efforts, when the COG can no longer be maintained over the center of the base of support provided by the two feet, the base of support is extended with the use of a cane, walker, or a wheelchair.

CONCLUSION

Imbalance and disequilibrium are a part of the aging process and the cause of the frequent falls encountered with advancing age. Falls can and should be prevented.

An accurate determination of the functional loss and a proper understanding of the nature of the dysfunctions will engender the appropriate medical and surgical treatments and the balance reorganization strategies needed to rework orientation and balance. When imbalance persists despite adequate therapies, a cane, a walker, or a wheelchair should be recommended basis.

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REFERENCES