Balance and Falls: Assessment and Treatment among Older Adults

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Objectives

- Discuss multiple factors that play a role in balance and falls among older adults
- Discuss balance and fall risk assessment tools
- Discuss interpretation of test results to identify balance deficits and possible underlying impairments
- Use information from patient’s history and test results to develop a treatment plan
What is “Balance”? 

AND WHY IS IT SO IMPORTANT FOR OLDER ADULTS?
What is Balance?
- Process by which we maintain our center of gravity over our base of support while stationary or in locomotion

Types of Balance
- Static
- Dynamic
- Stability Limits
• What is postural control?
  ○ Act of maintaining, achieving or restoring a state of balance during any posture or activity

• Types of postural control
  ○ Anticipatory
  ○ Reactive
    ▪ Ankle, hip, step
Maintaining Balance and Postural Control

Sensory Input

CNS processing

Motor Response
Age-Related Changes that Impact Balance

- Sarcopenia
  - 10-15% loss per decade, primarily Type IIa, Type IIb
- Visual changes
  - Visual acuity is associated with postural sway, <20/40
- Vestibular hypofunction
  - Decrease in number vestibular neuronal cells
- Psychomotor slowing
  - Reaction time, CNS processing slower
- Decreased joint mobility/flexibility
- Sensation
  - Loss of sensory cells
Pathology’s Impact on Balance

- **Neurologic: Parkinson's, CVA, MS**
  - Postural control, motor control, coordination, vestibular
- **Vestibular: peripheral or central**
  - Gaze instability, vertigo, disequilibrium
- **Vision: macular degeneration, cataracts, blindness**
  - Decreased visual acuity, blurred vision, bifocals
- **Peripheral neuropathy: oncology, diabetic, idiopathic**
  - Impaired somatosensation, discomfort
- **Mental health**
  - Cognition, judgment, anxiety/depression
Pathologies continued

- **Spinal Stenosis**
  - LE weakness – symmetrical, LE neural claudication, impaired LE sensation and proprioception

- **Arterial insufficiency and PAD**
  - Arterial claudication, LE weakness, pain and decreased sensation/proprioception

- **CHF, cardiac health**
  - LE edema may impact ROM, strength and sensation, orthostatic hypotension, arrhythmias

- **COPD, pulmonary**
  - Decreased endurance, SOB, lightheadedness, side-effects of long-term use of corticosteroids
Discussion

Where does balance and postural control fit in this model?
Balance and Falls Risk Assessment
Reasons to Assess Balance

- Assess fall risk
- Gain information about each patient’s balance
- Identify possible impairments to test
- Guide decision making for treatment plan
Fall Risk Factors

1) History of falls
2) Muscle weakness
3) Balance/gait deficit
4) Visual deficit
5) Over 4 medications or psychoactive, sedative, anticholinergic medications
6) Sedentary lifestyle
7) Foot problems, footwear
8) Chronic conditions/pathology
9) Postural hypotension
10) Cognitive impairment
11) Incontinence
12) Age > 80 years
Subjective/Chart Review

- Fall history, fear of falling
  - Past 6 month to year, injurious or non-injurious
- Medications
  - Number and type
- Medical history
  - Sensory, CNS, motor, cardiopulmonary, orthopedic
- Activity level, behaviors
  - Daily routine, amount of exercise/activity, ADL/iADLS status
- Vision
  - Check-ups, history
- Footwear, sensation
<table>
<thead>
<tr>
<th>Balance Test Selection Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Types/components of balance included</td>
</tr>
<tr>
<td>• Functional level (history, observation)</td>
</tr>
<tr>
<td>• Ceiling or floor effect</td>
</tr>
<tr>
<td>• Time efficient</td>
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<tr>
<td>• Equipment available</td>
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</tbody>
</table>
Lower Level Test Batteries

- **Berg Balance Scale – 14 item**
  - Lower functioning population, possible ceiling effect
  - Static balance, stability limits, sensory

- **Tinetti – 9 item**
  - Low to moderate functioning, possible ceiling effect
  - Dynamic, static, sensory, stability limits, postural control, gait

- **Dynamic Gait Index- 8 item**
  - Low to moderate functioning, possible ceiling effect
  - Dynamic balance/gait, sensory
Higher Level Test Batteries

- **Functional Gait Assessment** – 10 items
  - Possible floor effect
  - DGI + walking backwards and EC
  - Dynamic balance, sensory
- **Balance Evaluation Systems Test - mini** (14 items)
  - Possible floor effect
  - Static, dynamic, sensory, postural control, gait
- **Fullerton Advanced Balance Scale**- full 10, short 4 items
  - Possible floor effect
  - Static, dynamic, stability limits, sensory, postural control
Single Tests

- **Timed up and go**
  - Good first test to screen overall mobility
  - Possible ceiling effect

- **Gait Speed**
  - Dynamic balance, gait analysis
  - Good screening measurement, easy to do in hallway

- **30 sec and 5 times sit<>stand**
  - LE Strength and power
  - Response to postural changes and movement pattern

- **mCTSIB- 4 items**
  - Sensory organization, static balance
Single Tests

- **4 Square Step Test**
  - Dynamic balance
  - Ability of patient follow directions/cognition
- **Single Leg Stance**
  - Static balance
  - Possible floor effect
- **Functional Reach**
  - Quick, easy assessment
  - Stability limits
Using the Information to Assess Fall Risk

- **Fall risk**
  - Always use a combination of subjective and medical history and functional testing to determine

- **Is this patient at risk?**
  - 86 y/o female
  - 4 falls in past 2 months – minor injuries only
  - On 5 medications for: depression, HTN, UTI, cholesterol
  - Spinal stenosis with associated mild sensory and muscular impairments in right LE, she uses a SPC in left UE
  - TUG 13 sec
  - 8 reps 30 sec chair rise
  - 50/56 Berg Balance Scale Score
Identify Possible Impairments

- Strength – LE, specifically hips, core and ankles!!
- ROM- ankles, hips, spine/torso
- Sensation- LE light touch and proprioception
- DTRs- hyper or hypo reflexive
- Coordination- UE or LE
- Vertigo/dizziness- with position changes
- Vision, oculomotor
- Pain- guarding, limiting movement
MOST BALANCE, GAIT AND FALL PROBLEMS ARE ASSOCIATED WITH MULTIPLE FACTORS

USE MULTIFACTORIAL TREATMENT APPROACH!!
### Therapeutic Exercise and Neuro Re-ed

#### Strengthening
- Prone hip strength
- Quadruped, kneeling hip and core strength
- Sideling and standing hip strength
- Ankle strength
- Weight bearing gross LE

#### Balance Training
- Center of gravity control training
- Multi-sensory training
- Gait pattern variation
- Reactive postural control
- Task-specific
- Variable practice
**Purpose:** establish effect of particular features of populations & exercise programs on fall prevention.

Sherrington et al. 2008.
Table 2. Trial-Level Determinants of Effects of Exercise: Univariate and Multivariate Associations

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Comparisons with This Feature, n</th>
<th>Ratio of Rate Ratios (95% Confidence Interval)*</th>
<th>P-Value</th>
<th>Variance Explained, %</th>
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<tbody>
<tr>
<td>Study population</td>
<td></td>
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<tr>
<td>Mainly care facility residents</td>
<td>13</td>
<td>1.17 (0.92–1.49)</td>
<td>.19</td>
<td>4</td>
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<td>Mainly high-support care facility residents</td>
<td>6</td>
<td>1.16 (0.81–1.65)</td>
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<td>Study population at high risk</td>
<td>29</td>
<td>1.21 (0.97–1.50)</td>
<td>.09</td>
<td>12</td>
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<td>Average age ≥75</td>
<td>32</td>
<td>1.05 (0.83–1.33)</td>
<td>.66</td>
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<td>Control group fall rate ≥2 per person per year during follow-up period (p1)</td>
<td>10</td>
<td>1.36 (1.05–1.77)</td>
<td>.02</td>
<td>17</td>
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<tr>
<td>Type and intensity of exercise</td>
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<tr>
<td>Moderate- or high-intensity strength training</td>
<td>19</td>
<td>1.09 (0.87–1.36)</td>
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<tr>
<td>High-intensity strength training</td>
<td>5</td>
<td>1.16 (0.81–1.67)</td>
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<tr>
<td>Moderate- or high-challenge balance training</td>
<td>34</td>
<td>0.75 (0.60–0.94)</td>
<td>.01</td>
<td>14</td>
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<tr>
<td>High-challenge balance training</td>
<td>25</td>
<td>0.76 (0.62–0.93)</td>
<td>.009</td>
<td>19</td>
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<tr>
<td>Moderate- or high-intensity endurance training</td>
<td>20</td>
<td>0.94 (0.75–1.18)</td>
<td>.58</td>
<td>0</td>
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<tr>
<td>Stretching program</td>
<td>12</td>
<td>0.89 (0.69–1.15)</td>
<td>.37</td>
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<tr>
<td>Walking program (any)</td>
<td>27</td>
<td>1.19 (0.96–1.46)</td>
<td>.11</td>
<td>9</td>
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<tr>
<td>Longer walking program (&gt;20 minutes)</td>
<td>8</td>
<td>1.07 (0.79–1.45)</td>
<td>.67</td>
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<tr>
<td>Exercise program features</td>
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<tr>
<td>Supervised exercise</td>
<td>41</td>
<td>0.89 (0.66–1.17)</td>
<td>.40</td>
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<tr>
<td>Moderately to highly supervised exercise (10 or fewer participants per instructor)</td>
<td>23</td>
<td>1.16 (0.93–1.44)</td>
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<tr>
<td>Progressive (monthly or more)</td>
<td>32</td>
<td>1.12 (0.89–1.40)</td>
<td>.34</td>
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<tr>
<td>More progressive (weekly or more)</td>
<td>14</td>
<td>1.01 (0.79–1.28)</td>
<td>.96</td>
<td>0</td>
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<tr>
<td>Intensity or type modified (most exercises)</td>
<td>28</td>
<td>1.21 (0.98–1.49)</td>
<td>.08</td>
<td>15</td>
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<tr>
<td>Good adherence</td>
<td>41</td>
<td>0.97 (0.73–1.27)</td>
<td>.80</td>
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<tr>
<td>Dose with instructor ≥30 hours</td>
<td>25</td>
<td>0.95 (0.77–1.19)</td>
<td>.67</td>
<td>0</td>
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<tr>
<td>Dose of prescribed home program ≥30 hours</td>
<td>12</td>
<td>0.84 (0.66–1.07)</td>
<td>.15</td>
<td>2</td>
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<tr>
<td>Total (instructor and home program) dose ≥50 hours over trial</td>
<td>25</td>
<td>0.80 (0.65–0.99)</td>
<td>.04</td>
<td>22</td>
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<tr>
<td>Total dose ≥8 hours per month (p2)</td>
<td>19</td>
<td>1.04 (0.83–1.30)</td>
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<td>Total length of exercise program ≥12 months (p2)</td>
<td>20</td>
<td>0.98 (0.78–1.22)</td>
<td>.83</td>
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<td>Study design features</td>
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<tr>
<td>Concealed allocation to groups</td>
<td>16</td>
<td>1.05 (0.83–1.32)</td>
<td>.69</td>
<td>0</td>
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<tr>
<td>Intention to treat analysis</td>
<td>22</td>
<td>0.91 (0.73–1.12)</td>
<td>.36</td>
<td>3</td>
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<tr>
<td>Multivariate (adjusted)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>High-challenge balance training</td>
<td>25</td>
<td>0.79 (0.66–0.95)</td>
<td>.01</td>
<td>0</td>
</tr>
<tr>
<td>Total dose ≥50 hours</td>
<td>25</td>
<td>0.80 (0.67–0.96)</td>
<td>.02</td>
<td>0</td>
</tr>
<tr>
<td>Walking program (any)</td>
<td>27</td>
<td>1.32 (1.11–1.58)</td>
<td>.003</td>
<td>0</td>
</tr>
</tbody>
</table>

Sherrington et al. 2008.
Significant Results

• 3 Factors = efficacy of exercise program
  – Balance training
    • Challenging but safe
  – Exercise dose
    • Intense, 2x/ wk. for 25 weeks
  – Absence of walking program
    • Training specificity
    • Still has overall health value
• 17% fall rate reduction
• Risk status as confounder
Other Interventions

1. Home safety check and modification
   - Lighting
   - Throw rugs
   - Bathroom hazard reduction
   - Clutter/Furniture
   - Railing installation

2. Medication check-ups

3. Visual check-ups and wearing glasses as Rx

4. Assistive device check-ups and modifications

5. Appropriate footwear

6. Education


References


Bohannon RW. Reference Values for the Timed Up and Go Test: A Descriptive Meta-Analysis. *Jour of Ger Phy Ther*. 2006. 29(2);64-68.


