Audiologists’ Role in Assessing Risk of Falls

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Jessie Patterson, M.S.
Disclosure Statement

• Julie Honaker and Jessie Patterson have no financial or nonfinancial relationships relevant to the content of the presentation.

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Risk of Falling Assessment is Part of the Audiologists Scope of Practice?

a) Strongly agree  
b) Mildly agree  
c) Uncertain  
d) Mildly disagree  
e) Strongly disagree
Definition of a Fall

• “...unintentional event that results in a person’s coming to rest on the ground or on another lower level”
• The U.S. Census Bureau estimates that by 2050, the number of people 65 years and older will rise to 88.5 million (Vincent & Velkoff, 2010)

• One in three persons over 60 living in community will fall each year, a trend that increases to 50% by the age of 80. (Rubenstein & Josephson, 2002, Blake et al., 1988; O’Loughlin et al., 1993)

• The total direct cost of all fall injuries for older adults is projected to increase to $32.4 billion by 2020. (Englander et al., 1996)

• Effective fall prevention strategies and intervention programs are contingent upon accurate and early identification of falling risk factors. (Sherrington et al., 2008; Gillespie et al., 2009)
Mortality

- Among those age 65 and older, falls are the leading cause of injury death
- In 2007, over 18,000 older adults died from unintentional fall injuries in the U.S.

www.cdc.gov; Englander, Hodson, Terregrossa, 1996
Consequences of Falls

• Morbidity
  – Fractures
  – Soft tissue injuries
  – Head trauma
  – Joint dislocations
  – Activity Restriction
  – Loss of Confidence

Englander, Hodson, Terregrossa, 1996
## Common Intrinsic Risk Factors

1. History of Falls  
2. Age > 80 years  
3. Cognitive Impairment  
4. Depression  
5. Muscle Weakness  
6. Gait deficit  
7. Balance (Vestibular) deficit  
8. Visual deficit  
9. Assistive device use  
10. Arthritis  
11. Impaired Activities of Daily Living

The table shows the Relative Risk Ratio (RRR) for each risk factor:

- History of Falls: 3.0
- Age > 80 years: 1.7
- Cognitive Impairment: 1.8
- Depression: 2.2
- Muscle Weakness: 2.9
- Gait deficit: 4.4
- Balance (Vestibular) deficit: 2.9
- Visual deficit: 2.9
- Assistive device use: 2.5
- Arthritis: 2.6
- Impaired Activities of Daily Living: 2.4

*American Geriatrics Society (2001)*
Medical Conditions and Risk Factors Associated with Balance Disorders

Affective disorders/psychiatric conditions
- Depression
- Fear of Falling
- Sleep Disorders
- Substance Abuse
- Chronic Subj Dizziness/
- Health Anxiety

Cardiovascular diseases
- Arrhythmias
- Congestive heart failure
- Coronary artery disease
- Orthostatic hypotension
- Peripheral arterial disease

Infectious and metabolic diseases
- Diabetes mellitus
- Hyper-and hypothyroidism
- Obesity
- Tertiary syphilis
- Vitamin B\textsubscript{12} deficiency

Sensory Disorders
- Hearing Impairment
- Peripheral neuropathy
- Visual impairment

Salzmann, 2010
Medical Conditions and Risk Factors Associated with Balance Disorders

Neurological disorders

- Cerebellar dysfunction or degeneration
- Delirium
- Dementia
- Multiple sclerosis
- Myelopathy
- Normal-pressure hydrocephalus
- Parkinson disease
- Stroke
- Vertebrobasilar insufficiency
- Vestibular disorders

Vestibular Disorders:
- Vestibular Neuritis
- Labyrinthitis
- BPPV
- Meniere’s Disease
- Migraine

Salzeman, 2010
**Musculoskeletal disorders**

- Cervical spondylosis
- Lumbar spinal stenosis
- Muscle weakness or atrophy
- Osteoarthritis

**Other**

- Other acute medical illnesses
- Recent hospitalization
- Recent Surgery
- Use of certain medications

Salzman, 2010
Common **Extrinsic** Risk Factors

- Poor lighting
- Unsafe stairways
- Irregular floor surfaces
- Loose rugs
- Footwear

"Warning: Slipping on this banana peel may be hazardous to your health."
• Falls are a growing medical concern

• Both intrinsic and extrinsic factors may put an individual at risk of falling

How at risk are patients seen in the audiology clinic?
Robin Criter, Au.D.

FALL RISK IN AUDIOLOGY PATIENTS
The Inner Ear

Figure 2: The Vestibular System - semicircular canals and otolith organs

Iwasaki et al. (2009)
Purpose of the Balance System

- Perception of Orientation and Movement
- Control of Eye Movement for Clear Visual Imaging of the World
- Static and Dynamic Postural Control
Vestibular Reflexes

**Vestibulo-ocular**
Maintain steady vision during head movements

**Vestibulospinal**
Maintain posture

**Vestibulocolic**
Righting reflex; stabilizes head

From Halmagyi & Curthoys, In Herdman

Jacobson & Shepard, 2008
The ability to maintain balance is complex

- efficient interaction of sensory system input
- integrity of motor control output
- Both necessary to coordinate appropriate reflexive muscle response to prevent a fall.
Vestibular and Balance Degeneration

Vestibular Changes
• Hair cell reduction in Maculae and Cristae
• Primary vestibular neurons reduction
• Deterioration of the Velocity Storage Mechanism
• Reduced VOR gain

Proprioceptive Changes
• Decreased Vibratory Sensitivity
• Reduced numbers of cutaneous and joint mechanoreceptors

Visual Changes
• Diminished Visual Acuity, Depth Perception, & Contrast Sensitivity

Motor Function
• Muscle mass decline
• Decrease in muscle strength & reaction time (including eye muscles)

Barin & Dodson, 2008
Vestibular and Balance Degeneration

**Structural alignment changes**

**Kyphosis**: forward rounding of the vertebrae in your thoracic spine.

Slide courtesy of Diane Givens, PT
Vestibular and Balance Degeneration

Gait Initiation

Steady-State Gait

Elble, 1997

25-60 years optimal age range for quiet stance. (Pyykko et al. 1988)
Efficient integration of sensory inputs in the brain might be compromised due to age-related decline in gray & white matter. (Van Impe et al. 2012; Baezner et al. 2008.)
Vestibular and Balance Dysfunction

- Fall risk is highly associated with vestibular and balance dysfunction.
- Herdman et al (2000): community-dwelling adults 65 - 74 years old with bilateral vestibular hypofunction had a greater risk for falls compared to those with unilateral vestibular hypofunction and the general population.
- Individuals with peripheral vestibular dysfunction have been shown to have decreased balance confidence (Legters et al, 2005).
- A survey by Gananca et al in Brazil (2006) of adults age 65 years and older revealed that there is a high association between chronic vestibular problems and recurrent falls.
50% of adults complain of dizziness sometime in their life.

Dizziness 2nd most common complaint to medical doctors.

Prevalence of vestibular impairment affecting U.S. older adults is common - estimated at 32% - 35%.

The Inner Ear

Figure 2: The Vestibular System - semicircular canals and otolith organs

Iwasaki et al. (2009)
Hearing Loss and Falls

• **Fall Risk is correlated with hearing loss** (Grue et al, 2009; Viljanen et al, 2009; Hawkins et al, 2011; Lin and Ferrucci, 2012; Stevens et al, 2012)

• Approximately 45% of adults (9.5 million) ages 60 to 69 years experience bilateral hearing loss, with the percentage of hearing loss increasing with age (Lin et al, 2011)

• At least one of three older adults who fall report some degree of hearing difficulty (Stevens et al, 2012)

• Approximately two out of three older adults who fall and sustain hip fractures have a hearing impairment (Grue et al, 2009)
Aim: To examine the fall history and risk factors of older adults seen in an audiology hearing clinic

Participants: 88 older adults (60 to 96 yrs)
- 51 women (avg 77 yrs)
- 37 men (avg 74 yrs)

Methods:
- Activities-Specific Balance Confidence (ABC) Scale
- 10 case history questions

Criter & Honaker (in press)
Fall Risk in the Audiology Clinic

• Average ABC score: **77.7%**
  – Women: **74.5%**
  – Men: **82.0%**
• **36 (41%)** participants had ABC score ≤ **80%**
  – 3/4 women, 1/4 men
• **21 (24%)** participants had ABC score ≤ **67%**
  – 2/3 women, 1/3 men

Criter & Honaker (in press)
Fall Risk in the Audiology Clinic

- **Have you ever fallen?**
  - Women: 81.3%
  - Men: 55.6%

- **Number of falls in the past 12 months**
  - Women: 1.33
  - Men: 1.12

- **Did you have an injury from a fall?**
  - Women: 43.8%
  - Men: 25.7%

Criter & Honaker (in press)
Falls in the Audiology Clinic and the General Population

Q3: Did you have an injury from the fall?
Q2a: How many falls in the past 12 months?
Q2: Have you ever fallen?

Survey Question

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>General Population</th>
<th>Audiology Clinic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q3</td>
<td>33%</td>
<td>36%</td>
</tr>
<tr>
<td>Q2a</td>
<td>33%</td>
<td>50%</td>
</tr>
<tr>
<td>Q2</td>
<td>67%</td>
<td>72%</td>
</tr>
</tbody>
</table>
Fall Risk in the Audiology Clinic

- Do you need assistance to walk?
  - 23%

- Are you afraid of falling?
  - 56.5% (women: 68.8%; men: 40.5%)

- Do you think others are afraid you might fall?
  - ~50%

- Do you limit activities inside/outside of the home due to fear of falling or losing balance?
  - 31% / 40.2%

Criter & Honaker (in press)
• Over two-thirds fell at some point
• One-half sustained a recent fall
• The majority of our older patients will fall...
  ... many already have sustained their first fall...

So what are we, as audiologists, doing about this?
WHAT ARE AUDIOLOGISTS DOING ABOUT FALLS?

Jessie Patterson, M.S.
Survey on RoF Assessment in the Audiology Clinic

• Purpose of the survey was to gain an understanding of audiologists’ views on RoF assessment related to:
  – Training and education
  – Screening and assessment
  – Prevention and intervention
  – Impact/effectiveness of RoF assessment
  – Challenges associated with RoF assessment in the audiology clinic

Patterson & Honaker (in press)
Participants

• 2,000 audiologists across the United States were randomly selected to voluntarily participate in a survey
  – 275 audiologists participated in the survey
• Respondents who indicated they solely worked with the pediatric population were excluded from data analysis (n= 37)
Demographics

• Date of completion of highest degree:
  – 73.5% - between 2001-2011

• Highest Degree Earned:
  – 66.8% completed the Au.D.

• Geographic Location:
  – 69.8% practiced in a city
Demographics Continued

- Clinical Environment:
  - ENT Practice/Outpatient Facility - 29.4%
  - Hospital Setting - 26.1%
  - Private Practice - 18.1%
  - University Setting - 11.3%
  - School Setting - 2.9%
  - Hearing Aid Dispenser - 1.7%
  - Other - 13.0%
• Clinical Setting:
  – Work with adult diagnostic testing - 79.0%
  – Dispense hearing aids - 68.5%
  – Administer balance/ vestibular testing - 45.4%
  – Work with pediatric population - 45.4%
  – Teach - 22.7%
  – Conduct research - 11.8%
  – Work with cochlear implant patients - 10.1%
  – Other - 8.0%
• Primary Age of Patient Population:
  – 0-20 years of age - 52.5%
  – 21-40 years of age - 59.7%
  – 41-60 years of age - 71.4%
  – 61+ years of age - 83.0%
  – I do not see patients in a clinical setting - 6.7%
Two Themes Emerged from Survey:

1. Resources Used to Assess RoF
2. Audiologists Personal Views on RoF Assessment
Resources Used to Assess RoF
Majority of audiologists indicated routinely working with geriatric patients (age 61+)

Over half (62.1%) indicated no experience with RoF assessment

Only 13.9% (33) reported currently implementing RoF assessment and 13% (31) reported previously implementing RoF assessment
## Commonly Used Resources

<table>
<thead>
<tr>
<th>Resources</th>
<th>Percentage of Audiologists Surveyed Using Resource to assess RoF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall History Questionnaire</td>
<td>17.7%</td>
</tr>
<tr>
<td>Vestibular Function Testing</td>
<td>14.6%</td>
</tr>
<tr>
<td>Review of Medication History</td>
<td>10.8%</td>
</tr>
<tr>
<td>Computerized Dynamic Posturography</td>
<td>8.5%</td>
</tr>
</tbody>
</table>

*Note: Questions regarding resources used were formulated based on the work of Jacobson & McCaslin (2008).*
### Commonly Used Resources

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<th>Resources</th>
<th>Percentage of Audiologists Surveyed Using Resource to assess RoF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vision Screening</td>
<td>3.1%</td>
</tr>
<tr>
<td>Other</td>
<td>3.8%</td>
</tr>
<tr>
<td>Orthostatic Hypotension Evaluation</td>
<td>2.3%</td>
</tr>
<tr>
<td>Proprioception and Vibration Senses Screening</td>
<td>1.5%</td>
</tr>
<tr>
<td>Cognitive Function Scale</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

*Note:* Questions regarding resources used were formulated based on the work of Jacobson & McCaslin (2008).
## Commonly Used Resources

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<th>Resources:</th>
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</thead>
<tbody>
<tr>
<td>In addition to my RoF assessment, I typically refer on to another specialist for further evaluation</td>
<td>7.7%</td>
</tr>
<tr>
<td>None at this time, I refer on to another specialist for RoF assessment</td>
<td>33.1%</td>
</tr>
<tr>
<td>None at this time, I do not make recommendations for RoF assessment</td>
<td>48.5%</td>
</tr>
</tbody>
</table>

*Note: Questions regarding resources used were formulated based on the work of Jacobson & McCaslin (2008).*
# Commonly Used Resources for RoF Counseling

<table>
<thead>
<tr>
<th>Resources:</th>
<th>Percentage of Audiologists Surveyed Using Resource to assess RoF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal discussion on avoiding and/or modifying falling risk factors</td>
<td>37.8%</td>
</tr>
<tr>
<td>Fear of Falling/Balance Confidence Questionnaire</td>
<td>7.1%</td>
</tr>
<tr>
<td>Written instruction on avoiding and/or modifying falling risk factors</td>
<td>16.4%</td>
</tr>
</tbody>
</table>
## Commonly Used Resources for RoF Counseling

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<tr>
<th>Resources:</th>
<th>Percentage of Audiologists Surveyed Using Resource to assess RoF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Referral to a specific website addressing falling risk factors/fall prevention</td>
<td>5.9%</td>
</tr>
<tr>
<td>Other</td>
<td>15.5%</td>
</tr>
<tr>
<td>None at this time</td>
<td>53.4%</td>
</tr>
</tbody>
</table>
Audiologists’ Personal Views on RoF Assessment

- Many audiologists (87.3%) viewed RoF assessment as important in addressing the needs of the aging population
- 75% (175/233) of the surveyed audiologists consider RoF assessment a role in the audiologists’ scope
- Most (79%) audiologists indicated that RoF assessment services are more prevalent in the vestibular/balance disorder clinical setting
Audiologists’ Personal Views on RoF Assessment

- Only 16.3% (38/233) believe audiologists are knowledgeable
- 11.8% (27/228) believe audiologists are sufficiently trained to provide RoF assessment
- Only 37.2% (86/231) of those surveyed felt comfortable in identifying an individual at risk of falls
One common response from audiologists surveyed was a lack of resources available to them in the mainstream audiology clinic.

“...nor do I feel there is enough time or resources to add this to a dispensing practice.”
Lack of Resources & Training

- Respondents reported RoF training was most often seen in graduate course work (34.9%) and graduate clinic work (20%)
- No formal RoF training was reported by 38.2% of respondents
- Concerns regarding variability in graduate curriculum was expressed by many audiologists
“I don’t do it, but think that those who do should be adequately trained, and I think there is too much variation in the amount of vestibular training students get in their training programs...”
“I wish we had more coursework or training on this and I feel unprepared other than just referring to a PT for fall risk assessment/assistive device evaluation.”
53% of respondents felt that time and reimbursement may prevent involvement in RoF assessment.

"Due to reimbursement, it may drain our resources to implement this although it would be beneficial to so many people with our knowledge on the topic."
“It adds one more thing that we are not reimbursed for (time or CPT code) and if not written referral, Medicare will not cover. Even five more minutes is (in today’s health care field) five more minutes of unpaid time – hard to get admin on board to allow us to do it.”
Audiologists’ Views on the Role of PT

- 76.3% believe that RoF is a multidisciplinary approach
- 82.7% agreed or strongly agreed RoF assessment connects audiology and PT
- 64.9% indicated RoF assessment was necessary to determine candidacy for a rehabilitation program (e.g., physical therapy)
  - One audiologist commented that, “physical therapists do not consider audiological findings necessary for appropriate treatment for RoF patients.”
Comparison of RoF Views for Vestibular Audiologists & Non-vestibular Audiologists

• As previously stated, 79% indicated RoF assessment services are more prevalent in the vestibular/balance clinic
• A separate analysis was completed on the audiologists not performing vestibular and balance assessment (n=130)
Comparison of RoF Views for Vestibular Audiologists & Non-vestibular Audiologists

• Overall, the views were similar between the two groups of audiologists
• 67.7% still felt that RoF assessment was within the audiologists’ scope of practice
• Only 12.6% felt knowledgeable about RoF assessment
• Only 11% felt sufficiently trained
Comparison of RoF Views for Vestibular Audiologists & Non-vestibular Audiologists

- Fewer resources were used to assess RoF with audiologists not performing vestibular/balance assessment
- 48.5% of the non-vestibular audiologists indicated not using any resources to assess RoF and do not make any recommendation for RoF assessment
- 70.1% reported not using any resources to counsel patients on RoF
• The American Geriatrics Society’s Clinical guidelines recommend that every adult age 65 and older should be asked about fall history by a health care provider on a yearly basis.

• Any adult that reports a fall should be directed at determining the cause of the fall(s), as well as learning fall prevention strategies.
Shumway-Cook et al. (2009) conducted a survey to 12,669 Medicare Beneficiaries:

- Found that 48% of those who reported falls also reported speaking with a health care professional about the fall
  - 75% of individuals who spoke to a health care professional reported that their health care provider tried to determine the cause of the fall
  - 61% reported receiving fall prevention information
• Jones et al. (2011) examined primary care physician’s fall prevention strategies:
  – Wanted to understand both physician knowledge and attitudes towards fall prevention
  – Surveyed 100 physicians in Colorado
  – 67% responded to the survey
Primary Care Physicians & RoF Assessment

• Jones et al. (2011):
  – Majority of physicians reported only screening for fall risk if the patient expressed concerns
  • 56% reported screening on annual exam
  – Only 8% reported using clinical guidelines for screening for RoF
Primary Care Physicians & RoF Assessment

• Jones et al. (2011):
  – Barriers reported by physicians:
    • Patients have more pressing issues
    • Lack of time
    • Lack of educational materials
    • Patients do not feel they are at risk
    • Lack of training
    • Lack of referral resources
    • Too complex to address in one office visit
    • Patient’s insurance does not cover referrals
    • Reimbursement is too low
    • Patients do not want to discuss it
Summary of What Audiologists are Doing

• Many audiologists support RoF assessment and feel that it is within the scope of practice
• A majority of audiologists do not feel sufficiently trained to assess RoF
• Time and reimbursement is a barrier for many audiologists
• **Audiologists may be in a key position to identify RoF and make referrals for further RoF assessment**
WHAT CAN AUDIOLOGISTS DO TO PREVENT FALLS?

Julie Honaker, Ph.D.
Fall Risk Assessment and Prevention

• What we can do:
  – CDC Stopping Elderly Accidents, Deaths & Injuries (STEADI) Program Recommendations
    – Administer self-assessment tools
    – Identify falling risk factors
    – Test gait & balance
    – Undertake multifactoral assessment
    – Apply interventions
    – Follow-up

www.cdc.gov/injury/STEADI
Testing Considerations

Intrinsic Factors

Extrinsic Factors

Assessment of Falling Risk Factors

Fall

- Injury
- Loss of Independence
- Activity Restriction
- Loss of Confidence
1. Identify patients at greatest risk for falling – via risk of falling assessment tools

2. Keep older adults independent

Cost-Effective & Time Efficient Options to Incorporate into Audiology Practice

• Over 2/3 of audiologists do not ask questions regarding falls (Patterson and Honaker, in press)
• In-depth interview many not be practical
• Time efficient/cost-effective solution:
  – Initiate a dialogue about falls:
    • Have you fallen in the past year?
    • Any history of previous falls?
    • Any history of imbalance?
## Directed Case History

### Questions to ask the Patient
- History of previous falls
- Medications
- Gait Problems or Weakness
- Dizziness/Vertigo
- Loss of Consciousness
- Environmental problems
- Co-Morbid conditions (illnesses)
- Balance concerns and limitations in activities of daily living

### Questions to ask the Family
- History of previous falls
- Explanation of falling event/what lead to the fall?
- Fall related injuries
- Changes in balance/problems with gait, weakness
- Reports of dizziness/vertigo
- Balance Concerns and limitations in activities of daily living
<table>
<thead>
<tr>
<th>Patients ≤ 65 Years of Age</th>
<th>Patients &gt; 65 Years of Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel like I’m burdening everybody...normally I just do everything and I can’t.</td>
<td>I really can’t say that life has changed too much. I go on doing exactly what I did before only I’m a little bit more aware of my unsteadiness when I walk and during activities.</td>
</tr>
<tr>
<td>Well, I don’t do anything, not anything. I don’t know what happened.</td>
<td>I haven’t given up anything. I’m just more cautious about them.</td>
</tr>
<tr>
<td>I can’t believe I’ve gotten so helpless. I’m just weak...I want to get out but I can’t anymore.</td>
<td></td>
</tr>
</tbody>
</table>

Honaker and Kretschmer, in press
<table>
<thead>
<tr>
<th>Family Caregivers of Patients</th>
<th>Family Caregivers of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 65 Years of Age</td>
<td>&gt; 65 Years of Age</td>
</tr>
<tr>
<td>I don’t think I do too much about her falling. I try not to say too much about it because I know it bothers her when I say something about her falling. The idea of pushing her that can be aggravating. She’s got to help herself.</td>
<td>I always take his hand. I try not to make him dependent on me no I wouldn’t want that because that really, is not good for ya, but um we help each other. I go to the grocery store, get her medicine; I do some of the housecleaning, and the laundry...</td>
</tr>
</tbody>
</table>

Honaker and Kretschmer, in press
Fall Risk is correlated with hearing loss
Audiologists in general practice can recognize this as a potential falling risk factor
Audiologists can recommend hearing amplification, communication strategies, assistive listening devices etc.
  – Improve sound localization
  – Improve quality of life

(Grue et al, 2009; Viljanen et al, 2009; Hawkins et al, 2011; Lin and Ferrucci, 2012; Stevens et al, 2012)
Additional Testing Considerations

Self-Assessment Measures
Gait Assessment
Orthostatic Hypotension Screen
Vestibular and Balance Assessment: VNG/ENG, VEMP, Rotary Chair, DVA/GST, Posturography
Extrinsic Factors Assessment
Reduced Balance Confidence, Fear of Falling (FoF)

FoF has been noted in approximately 40-70% of individuals with a history of falls (Jung, 2008)

FoF common in older adults with dizziness and imbalance

- **Falls Efficacy Scale (FES;** Tinetti et al., 1990)
- **Activities Specific Balance Confidence (ABC;** Powell & Myers, 1995)
- **Survey of Activities and Fear of Falling in the Elderly (SAFE;** Lachman et al., 1998)
Additional Testing Considerations: Self-Assessment Measures

• **Mini-Mental State Examination (MMSE)**
  – Screens overall mental status
  – ≤23 points is considered abnormal – suggests additional testing is necessary does not indicate dementia.
  – 87% sensitivity/82% specificity

• **Geriatric Depression Scale (GDS)**
  • Standardized screening measure
  • 30 yes/no questions
  – ≥11 points – indication of depression
  – 84% sensitivity/95% Specificity

Yesavage et al., 1983; Folstein, Folstein, & McHugh, 1975
Additional Testing Considerations: Gait Assessment

- CDC (STEADI) Program Recommendations
  - Timed Up and Go (TUG)
    Specific instruction and time criteria used
    - **Interpretation:** $\geq 13.5$ sec correlates with fall risk in older adults (Shumway-Cook et al., 2000)
  - 30-sec Chair Stand
  - 4-Stage Balance Test
**Dynamic Gait Index (DGI)**

Assesses the ability to modify balance associated with walking under varying external demands.

**Instructions:**
- Strict use of instructions and scoring guidelines
- 8 gait tasks, score of 0-3, total score of 24 points

**Interpretation:** Score of 19/24 or less indicate falling risk

Shumway-Cook et al., (1997)
Functional Gait Assessment (FGA)
(Modification of DGI)

– Strict use of instructions and scoring guidelines
– 10 item gait assessment: walk at different speeds, with head turns, with eyes closed, in tandem, over obstacles, backwards, and stair climbing
– 0-30; 4-level ordinal scale; best score 30/30

Interpretation: Score of 22/30 or less indicate falling risk
Additional Testing Considerations:
Orthostatic Hypotension Screen

- 1.3-fold increase risk for falling with orthostatic hypotension
- Manifestation of abnormal blood pressure regulation

  - Measure blood pressure with the patient supine and after standing for 2 minutes*
  - 20 mmHg decrease in systolic blood pressure on standing
Conductive hearing loss not of middle ear origin

- Bilateral weakness
- Tubes
- Perforation
- Malformed canal

- CTSIB Abnormal
- Major c/o unsteadiness
- Known / suggested pathology involving postural control pathways

- VEMP

Slide courtesy of Kristen Janky, PhD
Additional Testing Considerations:
Vestibular and Balance Assessment

- Direct vestibular office exam
- Dizziness Handicap Inventory (DHI)
- ENG/VNG
- Rotational Chair
- VEMPs
- Unilateral centrifugation
- Dynamic Visual Acuity
- Gaze Stabilization Testing
Abnormal Vestibular results common in elderly patients referred for falling risk (Agrawal et al., 2012; Jacobson et al., 2008)

**Jacobson et al., 2008:** 73% of sample had evidence of vestibular system impairments + Moderate self-report dizziness handicap (DHI = 44.25)

<table>
<thead>
<tr>
<th>Table 1. Proportions of the Sample with Normal and Abnormal Results on Caloric and SHA Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Normal SHA Test</td>
</tr>
<tr>
<td>Abnormal SHA Test</td>
</tr>
</tbody>
</table>
Agrawal et al. 2012: characterized semicircular canal and otolith dysfunction that occurred with aging

Results:
- Increased logMAR scores with age (all canals)
- cVEMP peak-to-peak amplitude decline
- N1 oVEMP amplitude decline with age
Additional Testing Considerations:
Vestibular and Balance Assessment

Gaze Stabilization Test (GST)

Gaze Stabilization Test
Head Movement: Horizontal  
Static Acuity: -0.12 logMAR
Testing Distance: 8.0 feet
Stabilization Test Setting: 0.08 logMAR

<table>
<thead>
<tr>
<th>Movement Direction</th>
<th>Maximum GST Velocity</th>
<th>Max Velocity Symmetry (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left</td>
<td>165</td>
<td>17</td>
</tr>
<tr>
<td>Right</td>
<td>75</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Head Velocity (deg/sec)</td>
<td>129</td>
<td>102</td>
</tr>
<tr>
<td>Head Unable To Reach Higher Velocity</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Test Stopped At User Specified Limit</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Data Range Note: No Data Range.

Post Test Comment: {neurocom system version 8.3.0, copyright 1999-2007 neurocom international inc. all rights reserved.
Additional Testing Considerations: Vestibular and Balance Assessment

Comparison of DGI and GST ROC Curves

Source of the Curve
- DGI (AUC = 0.95)
- GST (AUC = 0.92)
- Reference Line

DGI + GST = AUC 1.0

Honaker et al. 2013
Increased sway with age observed on Sensory Organization Test (SOT) of Computerized Dynamic Posturography.

Adults > 60 yrs less stable; however, greater in those with vestibular symptoms (not necessarily vestibular disorders) (Pedalini et al. 2009)
Additional Testing Considerations: Extrinsic Factors Assessment

– Home Safety Checklist for Detection of Fall Hazards
  • 65 yes/no questions
  • “Do you have light switches near every doorway?”

U.S. National Safety Council, 1982
Reporting Falling Risk Results

• Report for referring physician should include the following:
  – General impression of overall falling risk
  – Description of subtests indicating risk of falling
  – Description of appropriate interventions to decrease falling risk
    • Reassessment of meds
    • Referral to ophthalmology, physical therapy, occupational therapy etc...
    • Manage hypotension
    • Optimize home safety

CDC, Jacobson and McCaslin, 2008
<table>
<thead>
<tr>
<th>Old Habit</th>
<th>New Habit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reaching up or using a stool</td>
<td>Use a long-handed “grabber”</td>
</tr>
<tr>
<td>Walking in the dark to find the light switch</td>
<td>Install night lights or use a “clapper”</td>
</tr>
<tr>
<td>Moving quickly from sitting to standing</td>
<td>Hold onto something and move slowly from sitting to standing</td>
</tr>
<tr>
<td>Bending over to pick up soap/shampoo in the shower</td>
<td>Mount liquid soap dispenser on the bathtub wall or use soap-on-a rope</td>
</tr>
<tr>
<td>Rushing to answer the door or phone</td>
<td>Walk slowly; wait to walk after first standing</td>
</tr>
</tbody>
</table>

Adapted from Alvord, L.S. (2008)
Audiologists’ Role

1. Identify patients who are at risk for falling
   - Initiate a conversation regarding falls

2. Make appropriate recommendations
   - Multidisciplinary care (team approach)

3. Provide educational information for patients and clinicians as needed
References


References

References


References

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