Balance, Falls and Fall Prevention

СИНТИЯ РОБИНСОН, ДОКТОР НАУК,

СПЕЦИАЛИСТ ПО ФИЗИЧЕСКОЙ ТЕРАПИИ

ОТДЕЛЕНИЕ РЕАБИЛИТАЦИОННОЙ МЕДИЦИНЫ

УНИВЕРСИТЕТ ВАШИНГТОНА

Г. СИЭТЛ, ВАШИНГТОН

США

What is a fall?

- Fall (Lamb, 2005 in Gillespie et al, 2015)
  - An unexpected event in which the participant come to rest on the ground, floor, or lower level.
  - "In the past month, have you had any fall including a slip or trip in which you lost your balance and landed on the floor or ground or lower level?"

(Gillespie et al, 2015)

Incidence of Falls Among Older Adults

- >33% of people over 65 years of age living in the community fall each year
  - 10% result in fall related fractures
    - 50% of these are recurrent
  - 10% of falls result in serious injury
    - Hip fracture
    - Traumatic brain injury
    - Soft tissue injury
  - Fall-related fractures in older people are a significant source of morbidity and mortality.

(Tinetti et al, JAMA, 2003; Gillespie et al, 2015)

Risk Factors for Falls Among Older Adults

- Risk factors identified in 2 or more observational studies
  - Arthritis
  - Depressive symptoms
  - Orthostasis
  - ≥4 prescription medications
  - Impairments in
    - Cognition
    - Vision
    - Balance
    - Gait
    - Muscle strength
- Fall risk among elderly people living in the community
  - 8% (no risk factors)
  - 78% (4 or more risk factors)

(Tinetti et al, JAMA, 2003)

Causes of Falls Among Older Adults

- ~15% external event that would cause most to fall
- ~15% single identifiable cause such as syncope
- ~70% multiple interacting factors

- Cochrane Review of fall prevention interventions
  - 159 randomized controlled trials
  - 79,193 participants
    - ≥65 years old, Living in the community
  - Median sample 230 participants
  - Carried out in 21 countries

(Gillespie et al, 2015)

Many studies have examined falls among the elderly

…. but less is known about falls among populations with disabilities

Prevalence of Falls
Individuals Aging With a Disability

Disability	Prevalence	Peak age
Muscular Dystrophy	70%	55-64
Post Polio Syndrome	55%	55-64
Multiple Sclerosis	54%	55-64
Spinal Cord Injury	40%	45-54

- Survey, N=1862, 18-94yo
  - 584 Multiple Sclerosis
  - 492 Spinal Cord Injury
  - 446 Post Polio Syndrome
  - 340 Muscular Dystrophy

Matsuda et al, 2015

Risk Factors for Falls
Individuals Aging With a Disability

Disability	Risk Factors	OR	P-value
Muscular Dystrophy	Mild mobility disability **Mod mobility disability** Current imbalance severity rating	3.44 **4.19** 1.18	=.001 =.001 <.001
Multiple Sclerosis	**Mod mobility disability** Severe mobility disability Number of comorbid conditions Current imbalance severity rating	**4.08** 2.62 1.24 1.14	<.001 =.002 <.001 <.001
Spinal Cord Injury	Mild mobility disability **Mod mobility disability** Number of comorbid conditions	6.01 **6.11** 1.18	=.002 <.001 =.020
Post Polio Syndrome	Vision trouble	1.81	=.004

Matsuda et al, 2015

Risk Factors for Falls in Individuals with Multiple Sclerosis

Risk Factors	OR (CI)	P-value
Use of a cane or walker	2.62 (1.66-4.14)	<.001
Low income (<$25,000 per year)	1.85 (1.13-3.04)	.014
Balance problems	1.28 (1.11-1.49)	.001
Weakness in legs	1.26 (1.09-1.46)	.001

- Survey, 455 respondents, 265 reported falls
  Results based on fallers only

Matsuda et al, 2011

Causes of Falls in Individuals with Multiple Sclerosis

Precipitating Factor	% reporting
Transfers	85%
Ambulation	62%
Rising to Stand	37%
Stairs and Curbs	36%
Other	22%
Exercise/Physical Activity	10%

Matsuda et al, 2011

Perceived Reasons for Falls in Individuals with Multiple Sclerosis

Reason	% reporting
Trip or Slip	48%
Tired or Fatigued	47%
Inattention	30%
Rushing or Hurrying	26%
Not using walking aid	23%
Dizzy/lightheaded	22%
Carrying something	13%
Trouble seeing	7%

Matsuda et al, 2011

Prevalence of Falls Following Stroke

Time	Prevalence
Baseline	64%
3-month	35%
6-month	26%
12-month	33%
6-year	35%

Results based on 121 of original 349 participants (166 deceased)

N=121, 77 fallers & 44 non-fallers

Batchelor et al, 2012; Minet et al, 2015

Predictors of Falls Following Stroke

Variable	OR (CI)	P-value
Stroke Impact Scale ADL (↓ 15pts= MCID)	1.37 (1.04-1.80)	.025
Fall at 3 months	1.00 (1.01-3.94)	.046
Gait/balance disability at 3 months	0.35 (0.12-0.99)	.047
Gait/balance disability at 12 months	0.31 (0.12-0.81)	.017
NO gait/balance disability at 6 months	7.29 (1.99-26.73)	.003
NO gait/balance disability at 12 months	2.39 (1.05-5.45)	.038

Minet et al, 2015

- Association of severity of mobility limitations to fall risk
  - Higher in individuals with moderate disability than those with very poor or very good mobility.

Yates et al, 2002

Consequences of Falls In Older Adults

- Injury
  - Bruise
  - Fracture
  - Traumatic Brain Injury
- Psychological
  - Fear of falling
  - Loss of confidence
  - Self restricted activity
  - Reduction in physical function
  - Reduction in social interaction

(Gillespie et al, 2015)

"Clinical Guidance Statement" on Management of Falls

- Physical therapists *should* provide an individualized assessment within the scope of physical therapy practice that contributes to a multifactorial assessment of falls and fall risk.
  - Clinical Practice Guideline- recommendations intended to optimize patient care that are informed by a systematic review of evidence and an assessment of the benefits and harms of alternate care options
  - "Clinical Guidance Statement" is based on systematic review of "Clinical Practice Guidelines"

Academy of Geriatric Physical Therapy
American Physical Therapy Association
June 2015

Clinical Guidance Statement on Management of Falls

- Medication review
- Medical history
- Body structure and functions, activity and participation, environmental factors and personal factors

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Clinical Guidance Statement on Management of Falls

- Medication review- emphasis on
  - Polypharmacy
  - Psychoactive drugs
  - Cardiac medications- anti-arrythmics
- Medical history
- Body structure and functions, activity and participation, environmental factors and personal factors

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Clinical Guidance Statement on Management of Falls

- Medication review
- Medical history
  - Osteoporosis
  - Depression- Geriatric Depression Scale
  - Cardiac disease- heart rate and rhythm, blood pressure, postural response
- Body structure and functions, activity and participation, environmental factors and personal factors

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Clinical Guidance Statement on Management of Falls

- Medication review
- Medical history
- Body structure and functions, activity and participation, environmental factors and personal factors
  - Strength
  - Balance
  - Cognitive Function- mental status
  - Neurologic Function- peripheral neuromuscular function
  - Vision
  - Urinary function and incontinence

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Clinical Guidance Statement on Management of Falls

- Medication review
- Medical history
- Body structure and functions, activity and participation, environmental factors and personal factors
  - Gait- identify deficits and use of assistive device
  - Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL)
  - Physical Activity
    - Moderate- protective
    - High (not defined) and low (less than once per week) are risk factors

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Clinical Guidance Statement on Management of Falls

- Medication review
- Medical history
- Body structure and functions, activity and participation, environmental factors and personal factors
  - Home safety factors- loose rugs or mats and other trip hazards
  - Perceived functional ability and fear of falling
  - Social support
  - Alcohol use
  - Feet and footwear

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Clinical Guidance Statement on Management of Falls

- Physical therapists *must* provide individualized interventions that address all positive risk factors within the scope of physical therapist practice
  - Level 1 evidence
    - Strength training
    - Balance training
    - Gait training
    - Correction of environmental hazards
  - Level II evidence
    - Correction of footwear and structural impairments of the feet (low heal height and high surface contact area)
- Optimal outcomes achieved when interventions are integrated

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Systematic Review: Interventions to Reduce Falls

- Medication
- Education
- Environmental
  - Environment/assistive technology
  - Social environment
- Surgery
  - cataract
  - pacemaker
- Manage urinary incontinence
- Fluid or nutrition therapy
- Psychological interventions
- Exercise
  59 trials, 13,264 participants
  - Gait, balance & functional training
  - Strength/resistance training
  - 3-dimensional training (Tai Chi)
  - General physical activity (walking)
  - Flexibility (none in review)
  - Endurance (none in review)

(Gillespie et al, 2015)

Systematic Review: Summary of Results

Multiple-Component Group Exercise				
Rate of falls	RaR 0.71	95% CI 0.63-0.82	16 trials	3,622 participants
Risk of falls	RR 0.85	95% CI 0.76-0.96	22 trials	5,333 participants

Multiple-Component Home Based Exercise				
Rate of falls	RaR 0.68	95% CI 0.58-0.8	7 trials	951 participants
Risk of Falls	RR 0.78	95% CI 0.64-0.94	6 trials	714 participants

Systematic Review: Summary of Results

Tai Chi				
Rate of Falls	RaR 0.72	95% CI 0.52-1.00	5 trials	1,563 participants
Risk of Falls	RR 0.71	95% CI 0.57-0.87	6 trials	1,625 participants

Overall Exercise Interventions- Fall-related Fracture				
Risk of Falls	RR 0.34	95% CI 0.18-0.63	6 trials	810 participants

Systematic Review: Summary of Results

Multi-factorial with Individual Risk Assessment				
Rate of falls	RaR 0.76	95% CI 0.67-0.86	19 trials	9,503 participants
Risk of falls	RR 0.93	95% CI 0.86-1.02	34 trials	13,617 participants

Home Safety Assessment and Modification				
Rate of falls	RaR 0.81	95% CI 0.68-0.97	6 trials	4,208 participants
Risk of falls	RR 0.88	95% CI 0.80-0.96	7 trials	4,051 participants

Systematic Review: Summary of Results

Treatment Vision Problems				
Rate of falls	RaR 1.57	95% CI 1.19-2.06	1 trials	616 participants
Risk of falls	RR 1.54	95% CI 1.24-1.91	1 trials	616 participants

Pacemaker for Carotid Sinus Hypersensitivity				
Rate of falls	RaR 0.73	95% CI 0.57-0.93	3 trials	349 participants

First Cataract Surgery				
Rate of falls	RaR 0.66	95% CI 0.45-0.95	1 trials	306 participants

Systematic Review: Summary of Results

Gradual Withdrawal of Psychotropic Medication				
Rate of falls	RaR 0.34	95% CI 0.16-0.73	1 trials	93 participants

Prescribing Modification Program for Doctors				
Rate of falls	RR 0.61	95% CI 0.41-0.91	1 trials	659 participants

Anti-Slip Shoe Device in Icy Conditions				
Rate of falls	RaR 0.42	95% CI 0.22-0.78	1 trials	109 participants

Determining Fall Risk
Berg Balance Test

- 14 item test of static, dynamic, and proactive balance.

- Interpretation: Maximum score 56
  - 41-56 = low fall risk
  - 21-40 = medium fall risk
  - 0 –20 = high fall risk
- Psychometric properties
  - Sensitivity = 64%
  - Specificity = 90%

  - 56-54 each 1 point drop = 3-4% increase in fall risk
  - 54-46 each 1 point drop = 6-8% increase in fall risk
  - < 36 fall risk is close to 100%

Determining Fall Risk
Timed "Up and Go"

- Sit with back against chair, stand, walk 10 feet, return to sit with back against chair
  - Self-selected speed
  - Fast speed
  - Dual task
- Interpretation
  - Normative Values:
    <10 seconds: normal
    >15 seconds: increased risk for falls

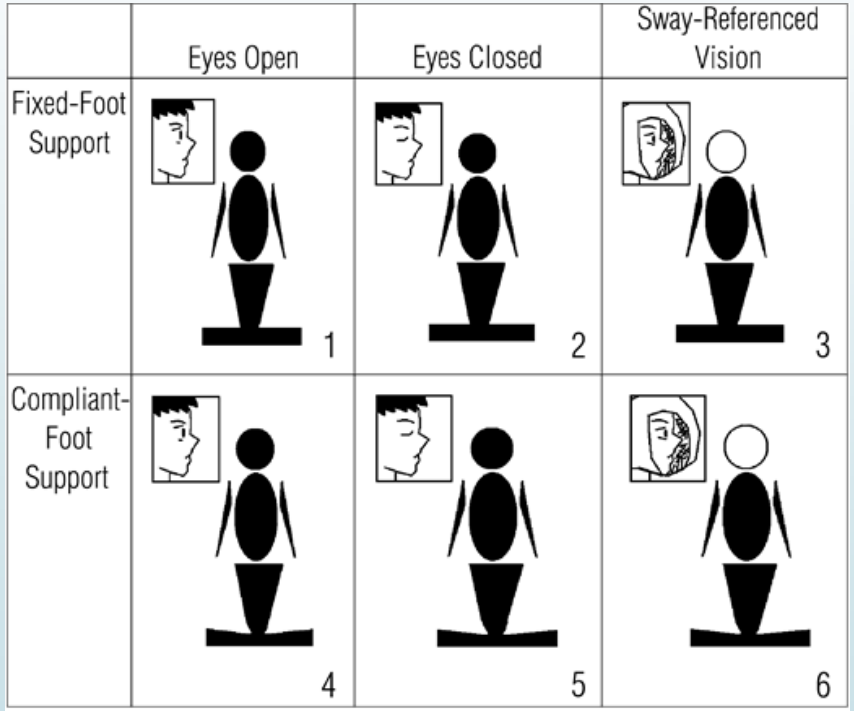
Age (years)	Time (s) to complete TUG (95% CI)
60-69	8.1 (7.1 – 9.0)
70-79	9.2 (8.2 – 10.2)
80-99	11.3 (10.0 – 12.7)

Determining Fall Risk
Performance Oriented Mobility Assessment

- Combined assessment of
  - Gait
  - Balance
- Interpretation
  - 28 points = maximum scores
    - gait = 12 points.
    - balance =16 points.
  - 19-24 = low fall risk
  - <19 =high fall risk

Determining Cause of Imbalance
Clinical Test of Sensory Integration and Balance

- Subject stands feet together, arms folded
  - Each condition held for 30 seconds
- Interpretation
  - Vision dependent- unstable in conditions 2, 3, 5 & 6 (eyes closed or conflict between vision and vestibular)
  - Somatosensory dependent- unstable in conditions 4,5 & 6 (compliant surface)
  - Vestibular loss- unstable in conditions 5 &6 (can not rely on vision or somatosensory function)
  - Sensory selection problems- unstable in conditions 3-6 (conflicting sensory input)



http://www.rehabmeasures.org

Determining Cause of Imbalance
Clinical Test of Sensory Integration and Balance

- Equipment requirements
  - Dense foam
    - 15cm high, 30cmx60cm
  - "Dome" or goggles
    - Allows eyes to be open
    - Test can be performed with eyes closed if unavailable

Thank You

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