Prevention of Falls in the Person with Parkinson’s

by Maria Walde-Douglas, PT
Struthers Parkinson’s Center, an NPF Center of Excellence

Course Description
70% of persons with Parkinson’s Disease (PD) fall annually. Postural Instability is one of the 4 primary symptoms of PD. Persons with PD have unique intrinsic risk factors that put them at risk for falls. Learn about evidence-based assessment tools and practical intervention strategies to reduce fall risk in this patient population.

Course Objectives
1. Identify appropriate assessment tools to assess balance and fall risk in the Parkinson’s population
2. Describe risk factors for falls unique to the person with Parkinson’s Disease (PD)
3. Design intervention and treatment strategies to reduce falls risk for the person with PD

Basic Pathology in Parkinson’s
- Loss of brain cells in the substantia nigra that produce the neurotransmitter dopamine
- Dopamine is a chemical messenger for control of movement and coordination
- Affects automatic movements so person experiences loss of “automatic pilot” and is unable to control movement normally

Parkinson’s Review: 4 Primary Symptoms
TRAP acronym
- Tremor-resting
- Rigidity: resistance to passive motion; can affect trunk/neck (axial) or limbs
- Akinesia or bradykinesia: poverty of movement or reduced speed
  - Hypokinesia: reduced amplitude (size) of movement
- Postural Instability—balance impairment; under-scaled balance responses
Medications in Parkinson’s

- Pharmacologic treatment is aimed at dopamine replacement:
- Most potent, “gold standard” medication is carbidopa/levodopa (trade name Sinemet)
- Dopamine agonists: stimulate parts of the brain influenced by dopamine—pramipexole (Mirapex) and ropinirole (Requip)
- Many others: anticholinergics, MAO-B Inhibitors, COMT Inhibitors, tremor-control drugs

Common Medication Side Effects That May Influence PT Plan of Care

- Orthostatic hypotension
- Hallucinations
- Confusion
- Nausea or vomiting
- Agonists linked with sedation/sleep attacks and compulsive behaviors
- Dyskinesia: writhing, twisting involuntary movements caused by PD medication side effect
  - only a problem if interferes with function

Modified Hoehn and Yahr Scale Staging of PD

- Stage 1: Unilateral Symptoms
- Stage 1.5: Unilateral plus axial involvement
- Stage 2: Bilateral symptoms, without balance impairment
- Stage 2.5: Mild bilateral symptoms with recovery on Pull Test
- Stage 3: Mild to mod bilateral symptoms; some postural instability; physically independent
- Stage 4: Severe disability; still able to walk or stand unassisted
- Stage 5: Wheelchair bound or bedridden unless aided

Motor Fluctuations

- The longer the duration on levodopa therapy, the greater the change of variability in motor function:
  - ON: optimal motor function on meds; may have dyskinesia
  - OFF: wearing off of meds or suboptimal functioning with increase in PD symptoms such as bradykinesia, rigidity, gait deficits

Definitions

- Fall: unexpected descent into a support surface (floor, chair, steps)
- Near fall: situation in which a fall almost occurs but a person catches themselves, regains stability with a support surface (wall, furniture) or is caught

Falls and PD

Research Synthesis

(Dr. Meg Morris, PT- World Parkinson Congress 2006)

- Fall incidence 60% in PD
- 20% resulting in a fracture
- Near falls 60-75%
- 60% in ON phase
- Dynamic activities (walking, turning)
Falls and Parkinson’s

- Age-related changes contribute to falls but persons with Parkinson’s have twice the fall risk of their peers
- Extra intrinsic risk-factors because of Parkinson’s-related symptoms
- More risk factors = more falls

PD Falls and Injuries
Struthers Parkinson’s Center
Movement Disorders Journal April 2005

- 1131 responses (79% response rate)
- Median disease duration of 7 years
- 55.9% had at least one fall in past 2 years
- 65% sustained an injury
- 33% sustained a fracture
- 75% required health care service

Gait and Balance Initiative (GABI)
Struthers Parkinson’s Center
supported by a grant from the National Parkinson Foundation

- Cross-sectional study of 453 people with Parkinson’s
- Applies a multidisciplinary strategy to address relationship between number of falls and demographic and clinical measures
- Involved assessments by Neurologists/RNs, PT, OT, Speech and patient self-assessment tools and falls diary

GABI Results
Publication pending

- Near-falls more frequent than falls
- Direction of falls: 45% forward, 26% backward, 29% sideways
- Associated symptoms: Wearing off (27%), fatigue (24%), freezing (21%), dizziness (15%)
- Associated activities: Walking (41%), Standing (27%), Reaching (22%), getting up/down (15%)

Physical Therapy Assessment Tools
for Balance, Gait and Falls Risk in the Person with Parkinson’s Disease

“Those who fail to study history are doomed to repeat it”
Winston Churchill

***View every fall as a learning experience***
The WHY of Falling: Keeping a Falls Diary

- Greater clarity about the frequency, cause and circumstances of falls and near falls
- Useful tool to determine what changes in activity, behavior, environment need to happen
- Useful info for PT to issue on Day One of assessment—have patient/carepartner complete for 1-2 week period

Fall/Near Fall Event Log

- Record time of day and where you were in medication cycle (ON, OFF)
- What you doing at the time; circumstances
- Direction of fall
- Witness’s perspective or unwitnessed
- Symptoms: dizziness, freezing, dyskinesia, confusion
- Injuries, Medical Attention

Ask Pertinent Questions

- Interview patient/carepartner carefully including questions listed in falls diary
- “Describe the most recent falls/near falls you have had”
- Gives insight into some of the causes/reasons and PD symptoms that are leading to falls
  *How could it have been prevented?*

Unified Parkinson’s Disease Rating Scale (UPDRS)

- Currently the most widely used and accepted scale
- Developed to assess effects of medications and/or surgery
- Can be long and cumbersome for purposes of PT examination

Unified Parkinson’s Disease Rating Scale (UPDRS)

- Numerical system provides common language/rating for Parkinson’s primary and secondary symptoms
- Not sensitive for assessing progress of PT treatment interventions
- Designed for neurologists not PT; not a functional measure

UPDRS Motor Examination

- Components may be useful during PT examination to quantify Parkinson’s symptoms at impairment level:
  - Tremor
  - Rigidity
  - Leg agility
  - Postural instability
UPDRS Pull Test—For postural stability

- Patient stands with feet slightly apart and eyes open and is prepared
- Examiner is behind the patient (and is also prepared to catch the patient!)
- A sudden, strong posterior displacement is produced by pull on patient’s shoulders

Postural Stability / Pull Test

Scoring from UPDRS

0 = Normal
1 = Retropulsion but recovers unaided
2 = Absence of postural response, would fall if not caught by examiner.
3 = Very unstable, tends to lose balance spontaneously
4 = Unable to stand without assistance

Reactive Postural Response (Push Release Test)

Fay Horak-BESTest
One component of BESTest (Balance Evaluation Systems Test):

In Place Response forward
Isometric push on anterior shoulders
In Place Response backward
Isometric push on scapulae
Patient stands with feet shoulder width apart, arms at sides

Instructions: Don’t let me push you. When I let go, keep your balance without taking a step

Postural Response Scoring

• (3) Recovers stability with ankles, no added arms or hips motion
• (2) Recovers stability with arm or hip motion
• (1) Takes a step to recover stability
• (0) Would fall if not caught OR requires assist OR will not attempt

Pushing or Pulling to Detect Falls in PD

Nature Clinical Practice-Neurology
Bloehm, Okun Oct 2008

- 2 groups of PD patients: prior fallers and non-fallers
- Pull Test and Push Release (PR) Test performed in dopaminergic On and OFF state
- Similar diagnostic accuracy but in ON state PR more accurate in classifying retrospective fallers

“Patients with abnormal PR Test should be candidates for an intensive, multifactorial intervention program, including optimization of Parkinson medication, physical therapy and education”

Berg Balance Test

Berg, K et al Physiotherapy Canada 1989

- 14 items, scored 0-4, (56 max score)
- Self-initiated tasks related to everyday function (sit to stand, forward reach, picking up item on floor, 360 degree turn)
- Designed for frail, community dwelling elderly
Percent Probability of Falling Based on Berg & Fall History

- Grid of falls probability calculated by Diane Wrisley MS, PT, NCS (from equation in Shumway-Cook et al, Phys Ther 1997 77:812 -819)
- Based on Berg score combined with reports of number of falls within the past 6 months

Limitations of Berg

- Documented ceiling effect; fails to identify more subtle balance deficits
- Less sensitivity to identify abnormalities in postural responses seen in persons with PD

Balance Assessment Tool: The Mini-BESTest (Dr. Fay Horak)

- 14 item, 32 point test-less cumbersome and time-consuming; more clinically relevant
- Includes Anticipatory, Sensory, Postural and Gait systems
- Contains elements of the Functional Gait Assessment and includes a Timed Up and Go (TUG) with divided attention

Mini-BESTest

- Identifies more subtle deficits and changes with therapy; less of a ceiling effect than Berg
- Found to be as reliable as the BEST and slightly greater discriminative properties for identifying fallers in individuals with PD (INPT, June 2011, Vol 35)

Balance Resource Website

- Developed by Fay Horak, PhD, PT
- Contains copies of BESTest MiniBEST and various other clinical balance scales

www.bestest.us

Research on Best Tool to ID Fallers in Persons with PD

- Functional Gait Assessment and BESTest have reliability and validity for balance assessment in PD
- BESTest is most sensitive for identifying fallers
- Cutoff scores for identifying fallers:
  - Berg 47/56; 15/30 FGA; 69% BESTest

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Timed Up and Go (TUG)
Posiadlo et al, JAGs

- Arm chair 18 inches high
- Instructions: “When I say go, I want you to stand up and walk to the line, then walk back to this chair and sit down again. Walk at your normal pace.”

TUG

- Subject walks a distance of 3 meters (approximately 10 feet).
- Performs a practice test first.
- Uses customary walking aid.
- Performance is timed.

Research on Timed Up and Go

- Older subjects who took 13.5 seconds or longer were classified as fallers.
- Scores >30 seconds identified patients to have significant difficulties with ADL’s.
- Normal ranges for young adults were around 10 seconds.
- Found to sensitive and specific indicator of whether falls occur in community dwelling adults.
- Reliable tool for PD (Meg Morris, et al)

TUG Research in PD
PT Journal Jan. 2011

- Minimal detectable change (MDC): smallest amount of difference in scores that represent true change

* MDC in TUG score in persons with PD was found to be 3.5 sec

Divided Attention TUG
Can add secondary task to TUG

Motor: carrying tray with water glass

Cognitive: subtract by 3s from 50 or male/female names through the alphabet

Combined cognitive and motor task *more relevance to real-life

Multi-Tasking/Divided Attention

- Performance in persons with PD deteriorates with divided attention (dual tasks).
- Cognitive vs. motor tasks proved equally demanding.
- Need to assess under dual task conditions
Blood Pressure Screening Orthostatic Hypotension
- Fainting when upright or just upon standing may be cause for falls in PD
- May occur as a result of ANS impairment especially in atypical Parkinsonism or as PD med side effect
- Screen blood pressures in both sitting and standing (wait one minute between position changes)
- Drop of more than 20 mm Hg systolic or 10 mm Hg diastolic considered orthostatic hypotension
- Patient may be asymptomatic

Assessing Mental/Emotional Factors Impacting Fall Risk
- Individuals who fall develop a risk for fear of falling, which adds spiraling risk for additional falling, greater fear and functional decline (Friedman et al, J Am Geri Soc 2002 Aug)
- 46% fear of falling (self-report tools) in persons with PD

Fear of Falling and PD
Mov Disorders Journal, May 2003
- Studied Fear of Falling (FOF) with qualitative and quantitative measures of postural control
- FOF an important, independent risk factor in persons with PD

Modified Falls Efficacy Scale
Arch Phys Med Rehab 1996; 77
14 daily activities self rated on 10 point scale to address confidence with various activities
- 9 are within home and 5 are in yard/community
- copies available on www.bestest.us/resources

Activities Specific Balance Confidence Scale
Powell et al J Gerontal Med Sci 50A(1) M28-M34
- 16 item self rated scale from 0% (no) to 100% (complete) confidence to complete each daily task
- Contains more community ambulation tasks with 7 activities within the home
Copies available at www.bestest.us/resources

Psychosocial Impact of Falling
- Reduction in community outings, social isolation, decreased activity, decreased strength, and endurance
- Issues of pride
  – Reluctance to use assistive device
  – Difficulty accepting assistance
- Embarrassment of PWP or carepartner
- Frequent injury; need to seek medical attention
Functional Gait Assessment
Wrisley, DM, Marchetti, GF, Kuharsky, DK and Whitney, SL

- 10 items; based on the Dynamic Gait Index
- Developed for use with vestibular disorders
- Useful for clients with balance dysfunction that have a ceiling effect score on the Berg
- Head turns, stop and pivot, obstacle, speed changes, eyes closed, tandem and retro-walking and stairs
- Components of it included in the Mini-BEST
- Copies available at www.bestest.us/resources

Gait Velocity

- Course of known distance.
- Record time (in seconds) to complete distance ÷ time = feet/second
- Gait velocity <2.5 ft/s determined to be higher fall risk (Susan Whitney, PhD, PT, University of Pitt.)
- Useful tool at determining effectiveness of an assistive device

Gait Cadence

- Count the number of steps per minute
- Useful to quantify a festinating pattern or document step hypokinesia

Parkinson’s- Related Risk Factors for Falls

PT Treatment Strategies

Slow, Shuffling Gait

- Amplitude problem caused by hypokinesia and bradykinesia
- Reduced foot clearance common cause of trips particularly on non-level surfaces
- Often worsens with wearing-off of medication or with fatigue
- Treatment strategies aimed at increasing step size to improve foot clearance

Training BIG for Hypokinesia
Exp Brain Res, 2005, Farley BG, Koshland, GF

- Motor Disorder: Inappropriate scaling of muscle force
- Sensory Disorder: Sensory proprioceptive processing problem
  – Mismatch between what person with perceives their movement to be and how it actually appears
Large Amplitude Movement Training

Dr. Becky Farley, PT

• High effort, intensive training on increasing SIZE of steps

• Have BIG STEPS be primary focus of gait training

• Intensity is key for best results (LSVT BIG protocol was 4 days/week)

Large Amplitude Gait Training Treatment Ideas

• Treadmill and overground walking

• Pole walking

• Can use taped markers on floor (horizontal lines) agility ladders, footprint cutouts

• Obstacle clearance (foam noodles)

• Surface transitions and uneven surface training

Turning Instability

• Multi-step turns common in PD (“wind-up doll”)

• Often base of support is too narrow

• Incomplete weight shift

• Inappropriate strategies used—crossing one foot over the other

Turning Instability Treatment Strategies

• Focus on wide base of support with rocking and weight shift

• Train in U Turn method for more open areas

• Rock and Turns with wide base and exaggerated weight shift for confined spaces

• Step and turn exercise

Turning Instability Treatment Strategies

• Incorporate individual turning strategies into function
  – Build a course that incorporates large and confined space turns, pivots, 45-90-180-360 turns

• Agility drills that involve quick direction changes without warning

• Navigation around cones, chairs

Freezing of Gait

• Akinesia: absence of movement; a temporary motor block

• May begin as a start-hesitation or be triggered
  • Base of support usually too narrow
  • Incomplete weight shift

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Freezing Triggers
• Sudden direction changes, turning, or pivoting.
• Doorways or thresholds.
• Approaching furniture / obstacles.
• Turning around to sit.
• Change in floor pattern.
• Confined spaces.
• Crowds.
• Stress, anxiety, hurrying.

Freezing Patient Cuing
4 S’s:
STOP (don’t force your way through a freeze)
STAND TALL (COG over BOS)
SWAY SIDE TO SIDE
STEP LONG (“sticky” foot first)—most involved side

Rhythmic/Auditory Cues
• Counting aloud (in synch with weight shift) or chanting
• Clapping or snapping fingers
• Metronome (portable-beeps)
• Rhythmic Auditory Stimulation (RAS): specialized technique employed by music therapists
  – Timing music bpm with movement

Tactile/Kinesthetic Cues
• Touch affected foot or knee (with cane or by carer)
• Manual weight shift; hands on pelvis
• “Dancing” with partner
• Complex movement: marching, kick forward

Visual Cues
• Focus on object BEYOND point of freeze (i.e. doorway)
• Taped horizontal lines on floor or X as target
• Laser device on U Step walker or Laser Cane
• Foot in front of patient’s obstacle to step over
• Patterns in tile

Carepartner Instruction
• Remain calm, avoid hurrying
• Avoid pulling on person with PD or their AD: let them take YOUR arm if necessary
• Give them space if safety permits; don’t hover
• Short, simple verbal cues given one at a time
**Freezing**

**Treatment Ideas**
- Exaggerated weight shifts in wide base of support in all directions-rocking
- Step estimation technique: have patient estimate how many steps to get from Point A to Point B and count them out as they walk
- Specificity of training in areas that likely to trigger freezing; lots of repetition
- Externally driven locomotion-treadmill, LiteGait

**Festination-forward propulsion**
- Hastening of gait combined with reduction in step size; “runaway train” syndrome
- Often triggered when center of gravity gets too far ahead of base of support
- Common triggers: reaching into a closet, approach to a chair (“horse sees the barn”)
- Can occur as a result of forcing way through a freeze

**Festination**

**Treatment Strategies**
- Focus attention on what leads up to an episode to trigger it
- Cues for upright posture and immediately STOP when shorter, quicker steps occur; widen base of support and start again with big step
- Weighted walkers or U Step walker with resistance control feature may be appropriate
- Rhythmic gait training with metronome to slow cadence; pacing activities

**Retropulsion**

**Compensatory strategies**
- Power Stance: martial arts split stance with wide base
- Sidestepping vs. backing away from objects like countertops
- Heavy duty walker such as U Step may be necessary to counterbalance

**Retropulsion**

**Treatment Techniques**
- Weight shift activities in Power Stance; add resistance as able (Theraband, bungees)
- Retro-walking on treadmill (if high level) or over-ground with emphasis on big steps-can add resistance as able
- Backward alternating lunges-using/near support if needed

**Retropulsion-backward balance loss**
- Common Triggers:
  - Backing up to sit down
  - Reaching overhead
  - Stepping away from sink, counter
  - Opening door
  - Carrying items close to body in both hands
  - Being approached closely/suddenly jostled
**Assistive Devices in PD**
- 5 inch swivel casters for front of standard walker
- 4 wheeled walker with hand brakes
- Laser cane- www. U Step.com
- U Step walker- www. U Step.com
- Dashaway Walker- www.dashaway.net
- Hiking poles

**Muscle Rigidity**
- Axial (core muscle) rigidity creates altered trunk mechanics and loss of segmental rotation
- Difficulty moving in multiple planes
- Difficulty initiating and completing protective responses during activities
- All contribute to increased risk of falls

*Concepts from Parkinsons Wellness Recovery Training, Dr. Becky Farley, PT*

**Rigidity Treatment Strategies**
- Multi-plane, reciprocal, rhythmical rotational movements in varying postures
- Active stretching of flexor musculature
- Yoga Poses: spinal twist, modified revolving triangle using a chair
- Transitions from varied positions exaggerating axial rotation and extension
  - 4 point to side-sitting to long-sitting with arms positioned in extension behind trunk

*Concepts from Parkinsons Wellness Recovery Training, Dr. Becky Farley, PT*

**Fatigue**
Can be major contributor to falls:
- Exhaustion from sleep disorder or poor sleep schedule
- Vicious cycle of feeling tired > becoming more sedentary > muscle atrophy > loss of endurance
- Imbalance between rest and activity
- Fatigue of PD different than ordinary deconditioning

**Fatigue: Patient Education**
- Balance rest and activity: take short rest periods, break projects into smaller tasks, one short daytime nap if needed
- Healthy sleep habits: avoid excessive daytime sleeping, consistent bedtimes and waking
- Frequent bouts of activity throughout the day: develop an activity schedule

**Orthostatic Hypotension Patient Education**
- Ankle pumps and leg kicks in seated position prior to standing to increase venous return
- Keep legs moving/weight shifting if standing still
- Encourage regular fluid intake-hydration to increase blood volume
- May need to wear support hose
- Report back to MD for further medical intervention

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Vision and Perceptual Changes
Rick Vandendolder, OT Struthers Parkinsons Center

• Reduced contrast sensitivity
• Impaired visual spatial perception
• Slower speed of eye scanning movements in walking path

Vision and Perceptual Changes: Patient Education Strategies
Rick Vandendolder, OT Struthers Parkinsons Center

• Mark edge of stairs, armrests, walker handles with brightly colored tape
• Bright lighting; especially path to bathroom at night or dark stairways
• Taped markers (X) on floor for proper positioning in front of toilet or chair

Impaired Cognitive Function
Marjorie Johnson, SLP, CCC Struthers Parkinsons Center

• Lack of attention; selective, dividing, alternating difficulty
• Impaired short-term memory
  – Remembering to use safety devices and strategies taught in OT or PT
• Reduced executive function:
  Plan>Act>Assess Outcome>Revise Plan
  – Problem-solving in novel situations, generalize learning, recognize risky situations, learn from past mistakes, “motor recklessness”

Impaired Cognitive Function: Patient Education Strategies
Marjorie Johnson, SLP, CCC Struthers Parkinsons Center

• Enlist help of carepartner for gentle reminders and supervision if needed
• Post visual cue cards to jog memory
• Simplify tasks; do one piece at a time
  – Do not bombard patient with multiple verbal cues

*consult Occupational and Speech Therapist for more specific recommendations and training

Divided Attention
Treatment Strategies

• Early Stage PD: Focus on training with motor and cognitive secondary tasks
  • Ideas: category naming, backward spelling
• Perform while walking through obstacle course, on “stepping stones”, or retrowalking to increase complexity
• Add to exercise: forward, sideways, backward lunges

Fall Recovery
Work on building blocks of floor transfers:

  – Prone to sidelying
  – Sidelying to sidesitting
  – Sidesitting to 4 point
  – 4 point to half kneel with/without support
  – Crawling
  – Supported ½ stand with wide base
  – Pivot to sit in chair safely

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Interdisciplinary Team

- Comprehensive team approach works best in area of fall prevention and PD
- PT, OT, SLP, SW, MD, RN collaboration
- Each member addresses their scope of practice

Community Programs

- Study of 10 wk comm ex class 2X/wk
  - Improved grip strength and 6 min walk
  - Long-term participants (14 mo) showed similar improvement and NO DECLINE
- Important for compliance and accountability upon discharge from PT
- Exercise groups: Silver Sneakers, Modified yoga, Tai Chi, NeuroFit
- Develop an integrated network of providers-education about PD and when to refer back to PT

**PERSERVERENCE:**

“Our greatest glory lies not in never falling but in rising every time we fall”