

PARKINSON'S DISEASE



EVERYTHING'S HARDER WHEN YOUR BODY TURNS AGAINST YOU.

 Parkinson Society Canada
Société Parkinson Canada

Learn more at parkinson.ca

Dr Sushil



Parkinson's disease

- ❑ Chronic, progressive disease characterized by **Rigidity, Bradykinesia, Tremor and Postural instability.**
- ❑ Onset is insidious, slow rate of progression
- ❑ Disruption in daily functions, roles and activities and depression is common with PD



Epidemiology:

Affects more than 2 % of the population older than 65. The incidence increases dramatically with increasing age.

By 2020 it is estimated that there will be more than 1.5 million people living with PD in the United States (Fuller et al., 2003).

The average age of onset is 62.4 years with the majority of cases occurring between 50 and 79 years; 10 percent of cases occur before the age of 40.



Etiology

Parkinsonism is used to refer to a group of disorders that produce abnormalities of basal ganglia (BG) function.

PD, or idiopathic parkinsonism, is the most common form, affecting 78 percent of patients.

Secondary parkinsonism results from a number of different identifiable causes, including virus, toxins, drugs and tumors.

Etiology

True PD or paralysis agitans was first described as “the shaking palsy” by James Parkinson in 1817. Etiology is idiopathic or unknown.

Postural instability gait disturbed [PIGD]

Tremor as the main feature (tremor predominant).



Etiology

Secondary Parkinsonism:

- ❑ Post viral infection – encephalitis lethargica
- ❑ Toxins – CO, Mg, MPTP
- ❑ Drugs – Phenothiazines, metoclopramide
- ❑ Vascular disease – multiple infarct, tumors, NPH
- ❑ Metabolic – Wilson's disease, Hypoparathyroidism

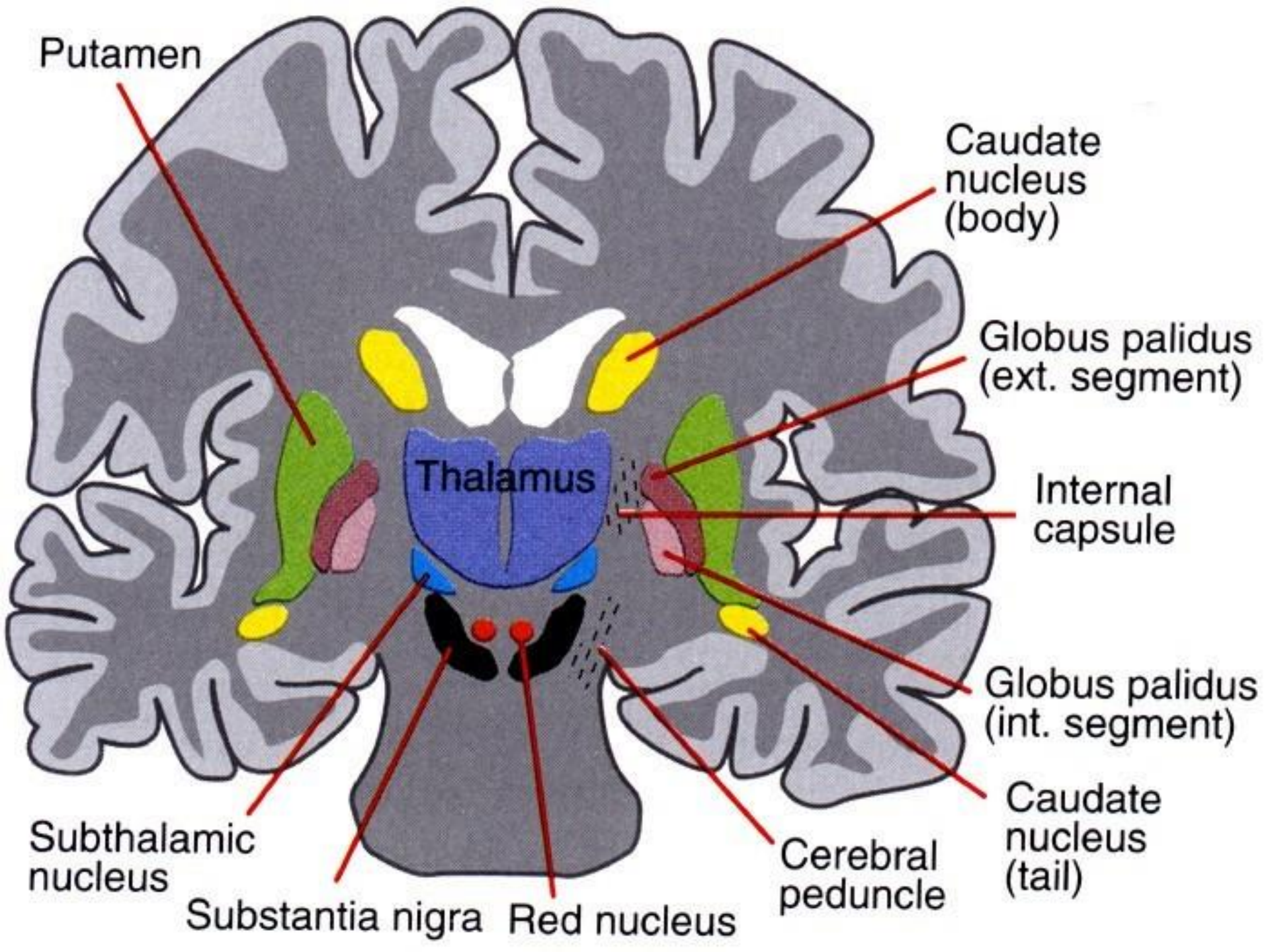
Etiology


Parkinsonism – plus syndromes:

- ❑ Progressive supranuclear palsy
- ❑ Corticobasal ganglionic degeneration
- ❑ Disorders with cerebellar/autonomic/pyramidal symptoms
- ❑ Disorders with prominent and often early dementia
- ❑ Parkinsonism-dementia-ALS complex

Pathophysiology

- ❑ Parkinson disease is a disorder of the dopamine (DA) producing neurons of the substantia nigra in the basal ganglia.
- ❑ The basal ganglia (BG) are a collection of interconnected gray matter nuclear masses deep within the brain.
- ❑ It is composed of the caudate and putamen (collectively termed the striatum) plus the globus pallidus, subthalamic nucleus, and the substantia nigra.



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- ❑ Dopamine is produced by cells in the pars compacta of the substantia nigra (SNpc).
 - ❑ A 70 to 80 percent loss of neurons occurs before symptoms become apparent.
 - ❑ Direct pathway facilitates BG output to the thalamus and motor areas
 - ❑ Indirect pathway disinhibits the STN and in turn inhibits thalamus and motor areas.
 - ❑ BG plays a important role in planning and programming of movement by selecting and inhibiting specific motor strategies.

Direct Pathway



Thalamus

Subthalamic nucleus

Substantia nigra (pars compacta)

To cerebral cortex

From cerebral cortex

Direct pathway

Globus pallidus internal segment

Globus pallidus external segment

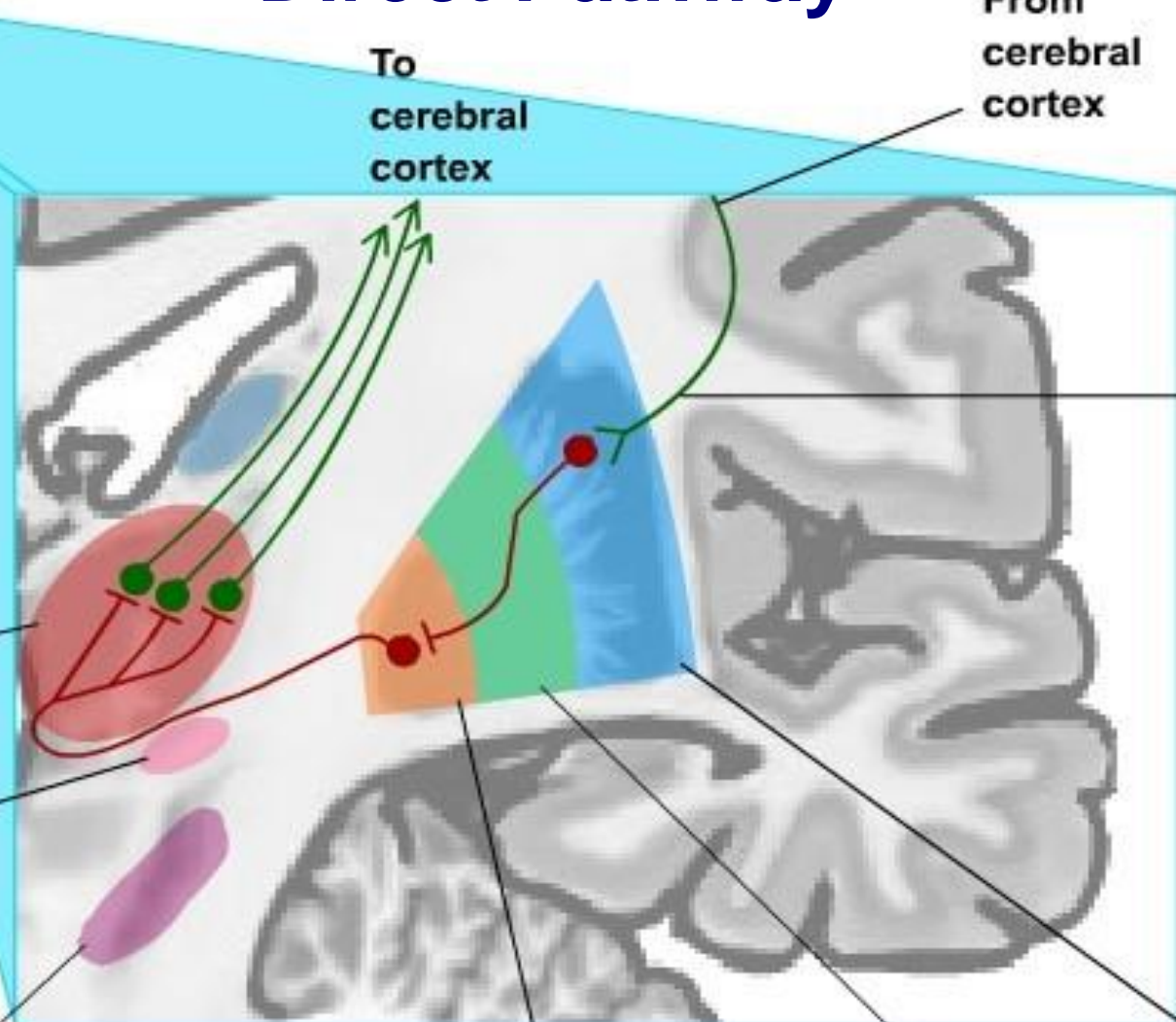
Striatum (Caudate + Putamen)

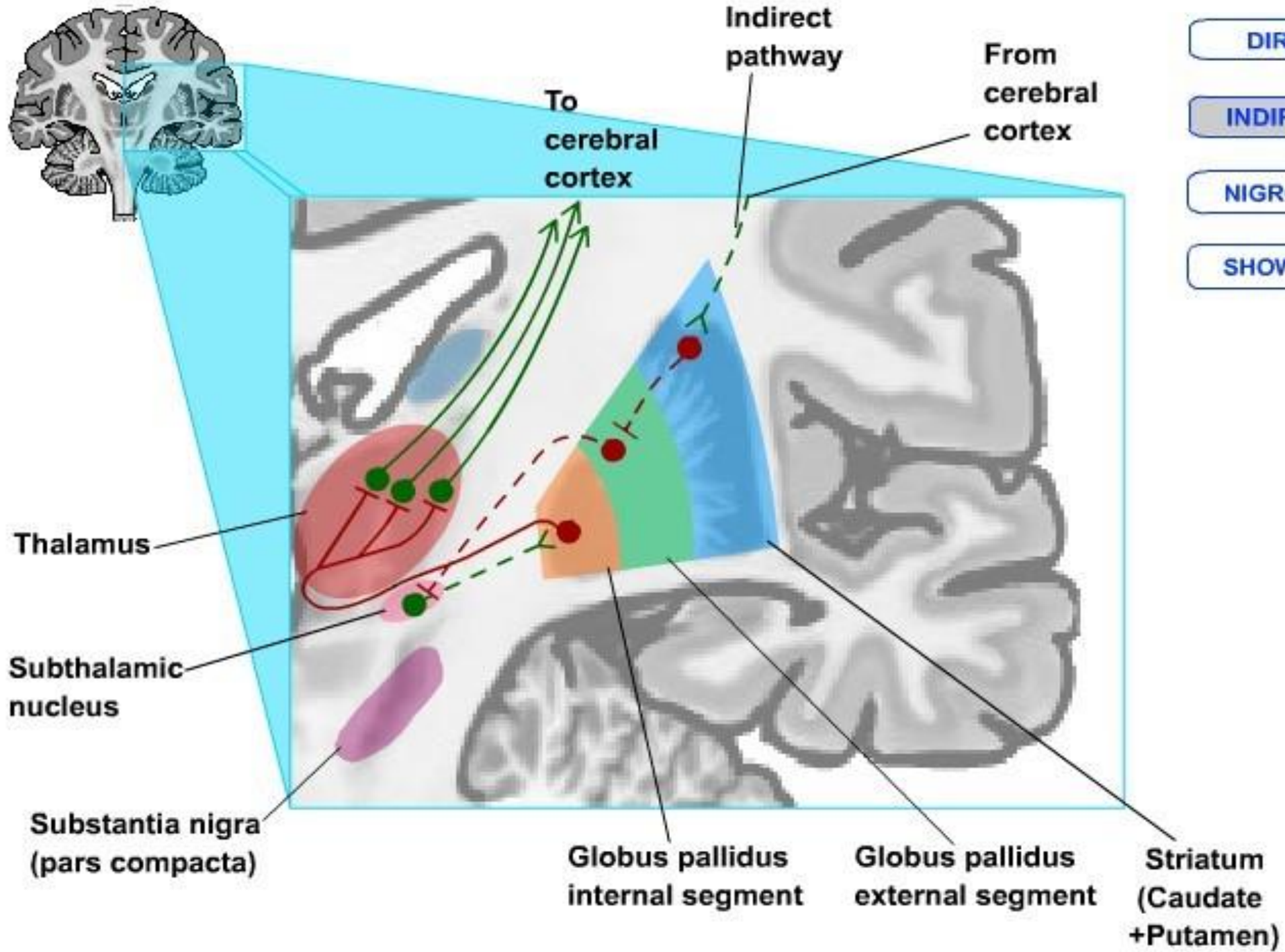
DIF

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Nigrostriatal Pathway



Nigrostriatal pathway

Thalamus

Subthalamic nucleus

Substantia nigra (pars compacta)

Globus pallidus internal segment

Globus pallidus external segment

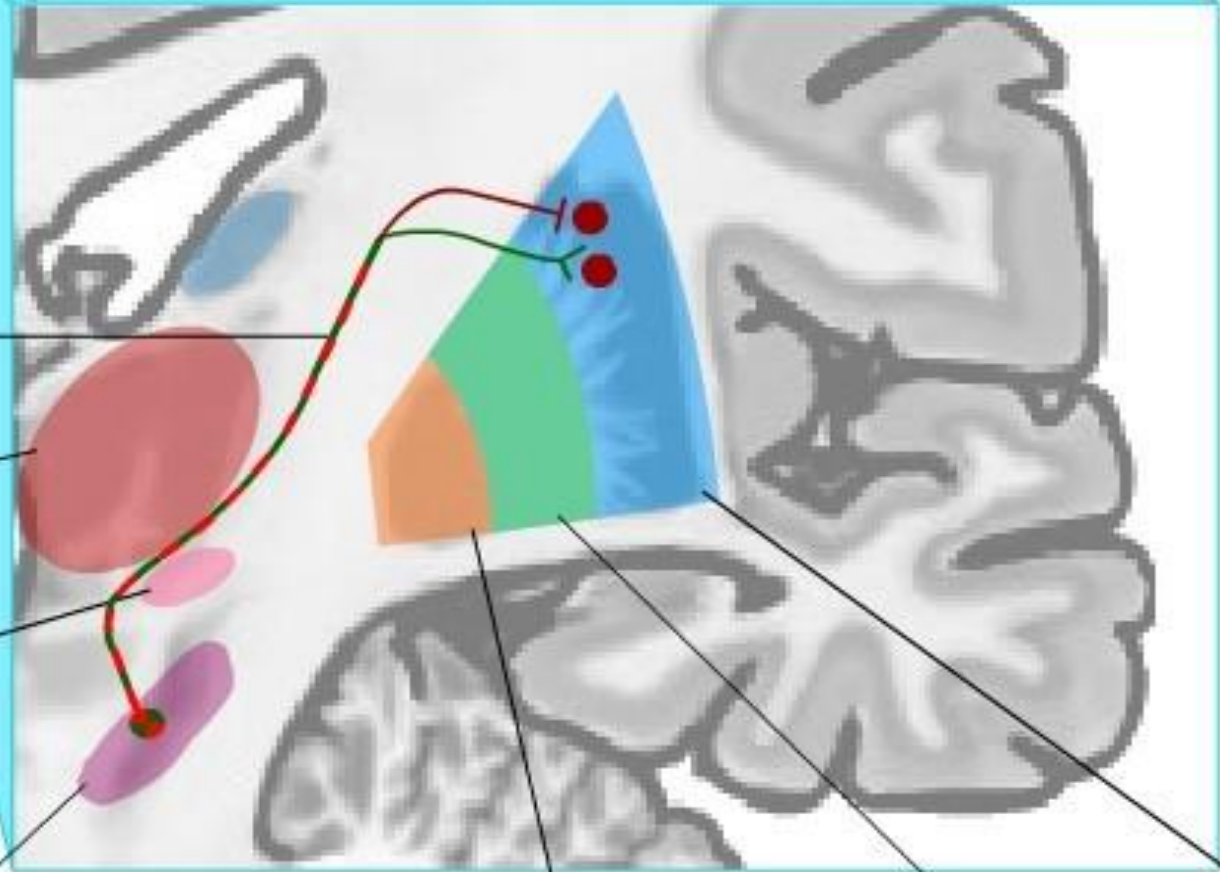
Striatum (Caudate + Putamen)


DIR

INDIR

NIGRO

SHOW





BG plays a role in some cognitive processes in awareness of body orientation in space, ability to adapt behaviour as task requirements change and motivation.

Loss of DA neurons and the production of Lewy bodies within the pigmented substantia nigra neurons are hallmarks of idiopathic PD.

Loss of dopamine results in an overactive indirect pathway that is thought to underlie Akinesia and Rigidity.

Underactive direct pathway is responsible for Bradykinesia.

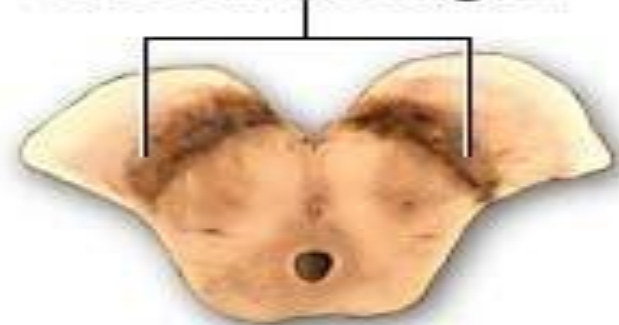
Pathophysiology



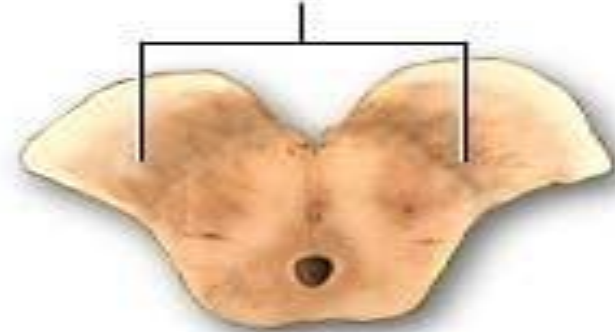
Cut section
of the midbrain
where a portion
of the substantia
nigra is visible



Substantia nigra



Diminished substantia
nigra as seen in
Parkinson's disease



Motor impairments



Bradikinesia



Hypersalivation



Postural imbalance



Tremor



Muscular rigidity



Walking difficulties



Freezing of movements

Non-motor impairments

Cognitive impairment



Sleeping disorders



Mood disturbances



Gastrointestinal issues



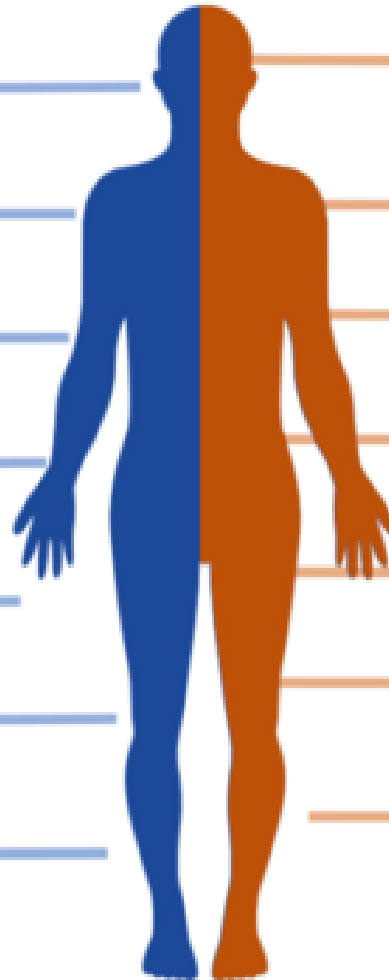
Sweat and olfactory disorders



Anxiety and depression



Pain



Clinical Features:


Cardinal Features:

- ❑ Rigidity
- ❑ Bradykinesia
- ❑ Tremor
- ❑ Postural instability

Motor performance:

- ❑ Start hesitation
- ❑ Freezing episodes
- ❑ Poverty of movement
- ❑ Masked face
- ❑ Micrographia

- ❑ Fatigue
- ❑ Contractures & deformities
- ❑ Impaired gait
- ❑ Kyphotic posture
- ❑ Increased fall
- ❑ Impaired sensations
- ❑ Akathisia
- ❑ Dysarthria
- ❑ Dysphagia
- ❑ Dementia

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- ❑ Visuospatial deficits
 - ❑ Depression
 - ❑ Bradyphrenia
 - ❑ Excessive sweating, Abnormal hot & cold sensations
 - ❑ Sialorrhea, Seborrhea
 - ❑ Mutism
 - ❑ Constipation
 - ❑ Low Blood Pressure
 - ❑ Compromised cardiovascular response to exercise
 - ❑ Impaired respiratory functions
 - ❑ Urinary bladder dysfunction

Cardinal Features

Rigidity

- ❑ It is felt uniformly in both agonist and antagonist muscles.
- ❑ Spinal stretch reflexes are normal.
- ❑ Rigidity is fairly constant regardless of the task, amplitude, or speed of movement.
- ❑ Both Cogwheel & Leadpipe rigidity are found
- ❑ affects shoulders & neck first and later involves muscles of face & extremities
- ❑ Prolonged rigidity results in contracture and postural deformity.



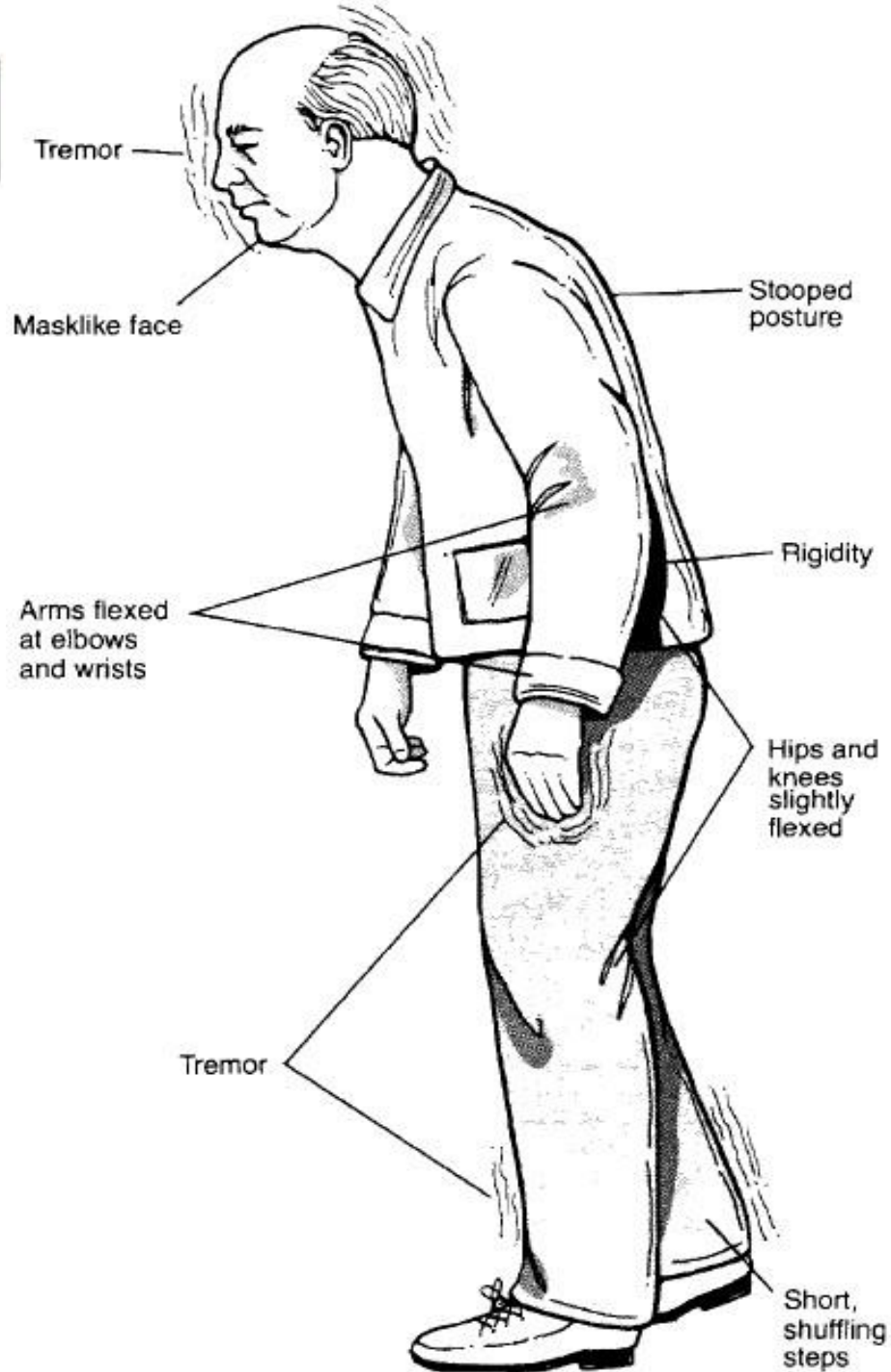
Forward tilt of trunk

Reduced arm swinging

Shuffling gait with short steps

Rigidity and trembling of head

Rigidity and trembling of extremities



Tremor

Masklike face

Stooped posture

Rigidity

Arms flexed at elbows and wrists

Hips and knees slightly flexed

Tremor

Short, shuffling steps

Bradykinesia:


- ❑ Slowness of movement, Movements are typically reduced in speed, range, and amplitude.
- ❑ Akinesia refers to absence of movement.
- ❑ Moments of freezing may occur and are characterized by a sudden break or block in movement.
- ❑ Disturbances in attention and depression can add to akinesia.

Tremor:

- ❑ Tremor is the initial symptom of PD in about 70 % of patients.
- ❑ Resting tremor - Involuntary oscillation of a body part occurring at a slow frequency of 4 to 6 Hz.
- ❑ Pill rolling of hand, seen in forearm, jaw or tongue
- ❑ Tremor of head and trunk – postural tremor

Postural Instability:

- ❑ Postural instability is rare in early years until 5 years of diagnosis.
- ❑ As the disease progresses, abnormal and inflexible postural responses along with increased body sway are seen.
- ❑ Narrowing BOS, divided attention situations & dynamic destabilizing activities increases postural instability.
- ❑ Contributing factors include rigidity, decreased muscle torque production, loss of available ROM particularly of trunk motions, and weakness.
- ❑ Extensor muscles of the trunk demonstrate greater weakness than flexor muscles causing stooped posture and significant change in the center-of-alignment

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- ❑ Frequent falls and fall injury results in progressive loss of balance.
 - ❑ Freezing, poor gait, dementia, depression, postural hypotension, involuntary movements increase the risk for falls.
 - ❑ Fear of falling increases levels of immobility and dependency and deteriorating QOL.
 - ❑ Contractures, deformities and osteoporosis are end results.

Motor Planning:

- ❑ Motor planning deficits are present.
- ❑ Movement preparation, start hesitation is evident as the disease progresses.
- ❑ Performing complex, sequencing or simultaneous movements are difficult.
- ❑ Micrographia, Freezing episodes, poverty of movement, hypomimia are observed
- ❑ Rotational movements are reduced
- ❑ All the cardinal features lead to mental fatigue and loss of motivation.

Gait:

- ❑ Reduced stride length, speed of walking
- ❑ Cadence normal but may be reduced in late stages
- ❑ Increased double limb support time
- ❑ Insufficient hip, knee and ankle flexion: shuffling steps
- ❑ Insufficient heel strike with forefoot loading
- ❑ Reduced trunk rotation and arm swing
- ❑ Festinating gait, Freezing of gait
- ❑ Difficulty turning, difficulty with dual tasking, difficulty with attentional demands

Prognosis:

- ❑ Slowly progressive
- ❑ Long sub clinical period of around 5 years
- ❑ 61% die within 10 years and 83% die within 15 years
- ❑ Mean survival with L-dopa as increased by 5 years
- ❑ Patients with predominantly tremor have a benign progression and those with PI & gait disturbances have rapid progression.
- ❑ Mortality is due to cardiovascular disease or pneumonia.

Hoehn & Yahr Classification of Disability

Stages Character of Disability

- I Minimal or absent; unilateral if present.
- II Minimal bilateral or midline involvement.
Balance not impaired
- III Impaired righting reflexes.
Unsteadiness when turning or rising from chair.
Some activities are restricted, but patient can live independently and continue some forms of employment.
- IV All symptoms present and severe.
Standing and walking possible only with assistance
- V Confined to bed or wheelchair

Pharmacological Management:

Neuroprotective therapy

- ❑ Monoamine Oxidase Inhibitors

Symptomatic Therapy

- ❑ Levodopa (L-dopa) is the mainstay of symptomatic treatment for PD.

Dopamine Agonists

Anticholinergic Agents

Nutritional Management

A high-protein diet can block the effectiveness of L-dopa. Thus the patients are advised high-calorie, low-protein diet.

Surgical Management:

- ❑ Ablative Surgery
 - ❑ Pallidotomy
 - ❑ Thalamotomy
- ❑ Deep Brain Stimulation
- ❑ Neural transplantation

Assessment:

- ❑ MMSE
- ❑ Depression Inventory
- ❑ Sensory evaluation – paraesthesias
- ❑ MMT
- ❑ ROM
- ❑ FRT
- ❑ Timed Up & Go test
- ❑ Dynamic Posturography
- ❑ 10 meter walk test, Walkie- Talkie test
- ❑ 6 minute walk test
- ❑ FIM



Problem List:

1. Reduced joint range
2. Impaired muscle strength
3. Abnormal posture
4. Impaired Balance
5. Impaired gait and locomotion
6. Fatigue
7. Pain
8. Impaired aerobic capacity



Goals for Physiotherapy:

1. Improve joint range and mobility
2. Strengthen weak muscles
3. Improve posture
4. Improve balance
5. Improve gait
6. Reduce fatigue
7. Reduce pain
8. Increase aerobic capacity

Effectiveness of PT:

- ❑ Physiotherapy is unlikely to impact on the three key motor signs of PD, i.e. bradykinesia, rigidity and resting tremor
- ❑ Gait, balance, posture and transfers are the key domains for physiotherapy within PD.
- ❑ Evidence is strongest for gait re-education & improving ADL scores.
- ❑ Some evidence suggest that physiotherapy may help increase flexibility, strength and cardiovascular fitness, e.g. secondary complications/ impairments.
- ❑ Design programs which will prevent or at least slow down the development of secondary impairments.
- ❑ A comprehensive multidisciplinary team (MDT) is required to meet the complex and progressive needs of people with PD

Physiotherapy Intervention:

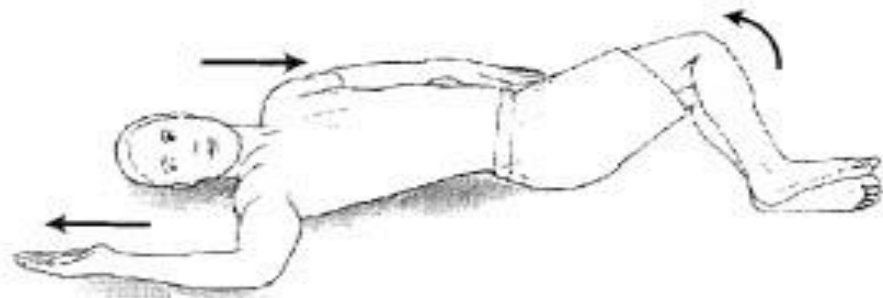
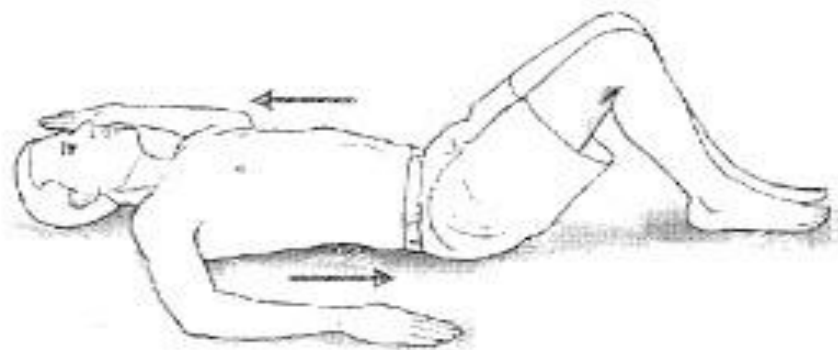
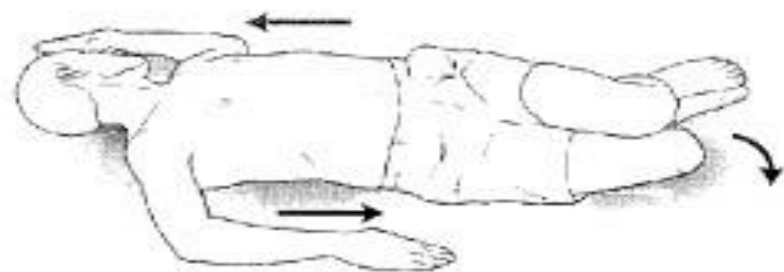
1. Relaxation Exercises:

- Gentle rocking can be used to produce generalized relaxation of excessive muscle tension due to rigidity.
- Slow rhythmic rotational movements of the extremities and trunk can precede intervention such as ROM, stretching and functional training. For eg., hooklying, lower trunk rotation or sideline rolling or upper and lower trunk segmental rotations can be used to promote relaxation.
- PNF technique of rhythmic initiation in which movement progresses from passive to active assistive to lightly resistive or active movement was specifically designed to help overcome the effects of rigidity.

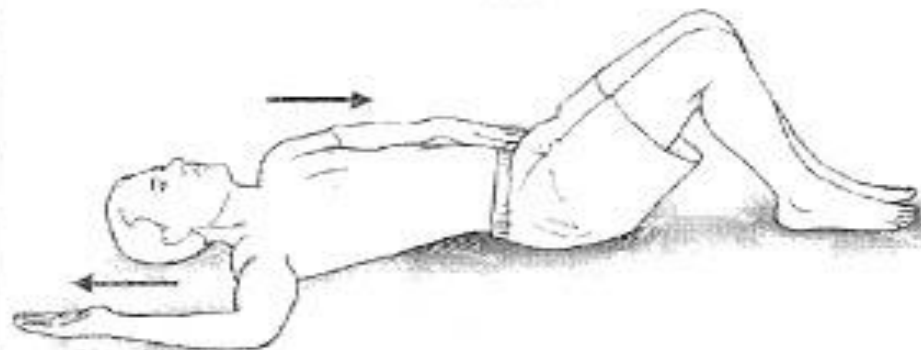
Rotational Activities in Supine



A

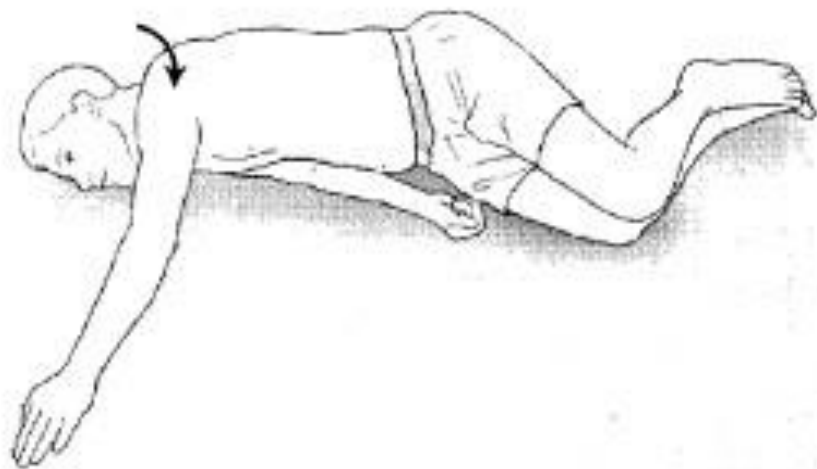


C



B

INTERVENTION 13-2 Rotational Activities in Side Lying



B

A

Side lying is also a good position to obtain a stretch of the trunk. In side lying, the thorax is slowly rotated forward and backward relative to the position of the pelvis while the upper extremity is protracted and retracted relative to the thorax.

A. Forward view of this movement.

B. Posterior view.

Advanced exercise: The patient rotates the pelvis backward as the thorax is rotated forward. The patient then rotates the pelvis forward as the thorax is rotated backward. These two combinations result in counter-rotation of the trunk.

2. Flexibility Exercises:

- ❑ ROM Exercises
- ❑ Passive stretching
- ❑ Hold & Contract Relax
- ❑ Passive Positioning

3. Strengthening Exercises:


- ❑ Training during “on” periods when the patient is at his best (i.e. 45 minutes to 1 hour after medication has been taken).
- ❑ Force production during isokinetic contractions rather than isometric contractions have been noted. (isometric training may be contraindicated.)
- ❑ Exercise machines are safer than free weights
- ❑ Functional training and pool exercises are also effective

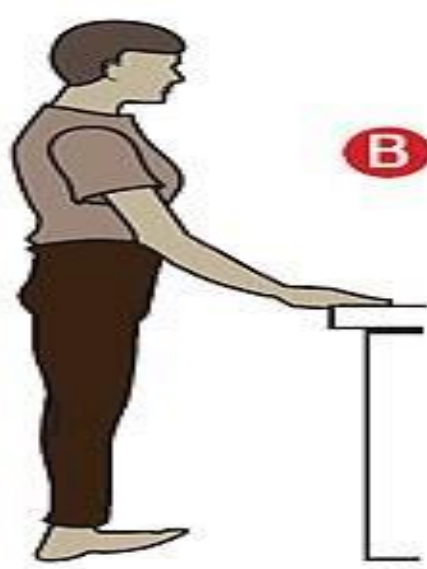
4. Functional Training:

- ❑ Moving in bed – rolling & supine - sit
- ❑ Side lying, rotation and weight bearing in side lying enhance transition to sitting
- ❑ Pelvic tilt – anterior – posterior, side to side and pelvic clock exercises in ball
- ❑ Sit- Stand activities
- ❑ Standing training with rotations
- ❑ Training to get up after fall
- ❑ Facial exercises.

5. Balance Training:

- ❑ Balance training should emphasize practice of dynamic stability tasks
- ❑ (e.g., weight shifts, reaching, axial rotation of the head and trunk, axial rotation combined with reaching and so forth).
- ❑ Seated activities can include sitting on a therapy ball.
- ❑ Challenges to balance can be introduced by varying arm position (i.e. arms out to side, arms folded across chair),
- ❑ Varying foot / leg position (i.e. feet apart, feet together)
- ❑ Adding voluntary movements (e.g., arm clapping, arms overhead, single leg raises, head and trunk rotations).

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- ❑ Stepping or marching in place and functional reach.
 - ❑ Posturography with feedback on COM, BOS are effective in improving balance.
 - ❑ **“Kitchen sink exercises”**
 - ❑ Movement transitions such as sit- to-stand or half-kneeling to standing can also be used to challenge the postural control system.
 - ❑ The patient can be instructed in standing exercises to enhance balance, including heel-rises and toe-offs, partial wall squats and chair rises.
 - ❑ Single-limb stance with side-kicks or back-kicks, and marching in place.



BALANCE EXERCISES

6. Locomotor Training:

- ❑ Lengthen stride
- ❑ Broaden base of support
- ❑ Improve heel-toe gait pattern
- ❑ Increased speed
- ❑ Increase trunk Rotation and arm swing
- ❑ Strategies for improving upright alignment include having the patient walk with verbal cues to “walk tall”.
- ❑ Gait training using an overhead harness also assists upright posture. The harness eliminates the need for UE
- ❑ Using visual and auditory cues to improve attention during a movement task.



Locomotor Training:

- ❑ Patients with PD combined use of harness and treadmill increased both walking speed and stride length.
- ❑ Walking toward a mirror allows use of visual feedback to maintain an upright trunk.
- ❑ Strategies to improve foot placement include use of floor grids or footprints on the floor.
- ❑ Strategies to improve step height include practice of marching in place progressing to walking using an exaggerated high stepping pattern.
- ❑ Mentally rehearsing the path to be taken prior to walking, and avoiding any additional mental or secondary motor tasks during walking.
- ❑ Breaking down the task into its component parts so the person can focus attention on each part separately is a very useful strategy.

Locomotor Training:

- ❑ Practicing alternative walking patterns such as sidestepping, walking backwards and marching to various rhythms can be helpful.
- ❑ PNF activity of braiding, (side stepping with alternate cross stepping is an ideal training activity for the patient with PD because it emphasizes lower trunk rotation with stepping and side stepping movements.)
- ❑ Two sticks (held by patient and therapist, one in each hand) can be used to facilitate reciprocal arm swing during gait.
- ❑ Verbal cues to normalize step length, velocity and arm swing excursion include walk fast, take large steps and walk while swinging both arms.

7. Postural Interventions:

- ❑ Exercises to strengthen postural extensors.
- ❑ Stretching exercises for tight pectorals
- ❑ TA stretching
- ❑ Rotational exercises of the trunk and limbs
- ❑ Rhythmic initiation
- ❑ Functional task training (mat)
- ❑ Postural corrections using feed back mechanisms

8. Cardiopulmonary Training:

- ❑ Diaphragmatic breathing exercises and exercises that recruit neck shoulder and trunk muscles.
- ❑ Deep breathing exercises to improve chest wall mobility and vital capacity.
- ❑ Aerobic training, UE, LE ergometry are recommended.
- ❑ Aerobic pool program are also useful.

9. Fatigue Management:

- ❑ Fatigue can be the cause or result of inactivity
- ❑ Begin aerobic conditioning as soon as a diagnosis of PD is made
- ❑ DBE, Activity pacing



Adaptive and Supportive Devices:

- ❑ Raised toilet seat and toilet rails
- ❑ Loose fitting clothing and sneakers with Velcro closures.
- ❑ If patient demonstrates a shuffling gait, shoes should have leather or hard composition soles because shoes with rubber soles will not slide easily and can result in falls.



ed by addition of modified



Adaptive and Supportive Devices:

- ❑ Reachers can be used to provide assistance in dressing.
- ❑ Eating can be facilitated by specially adapted utensils,



Strategies to Enhance Daily Tasks

Walking	<ul style="list-style-type: none">Instruct to walk with long steps.Swing arms.Place lines on the floor spaced at appropriate step lengths for person's age and height.
Turning around	<ul style="list-style-type: none">Instruct patient to use a large arc of movement.
Standing up and sitting down	<ul style="list-style-type: none">Use mental rehearsal before moving.Use gentle rocking back and forth before moving.Ensure sufficient forward lean to get weight over the feet.Increase height of seat or use armrests.
Turning over and getting out of bed	<ul style="list-style-type: none">Use a night light.Use a lightweight bedcover.Use mental rehearsal before moving.Use verbal cues to trigger each part of the sequence.Ensure sufficient bed height to enable ease in standing.
Reaching, grasping, manipulating objects, and writing	<ul style="list-style-type: none">Mentally rehearse prior to moving.Use the object as a visual cue.Break down the task into component parts.Use verbal cues for each part of the sequence.Avoid distractions or secondary tasks at the same time.

Exercise for Upper Extremity Function

Buttoning	Button clothing, practicing with buttons of different sizes and shapes.
Handwriting	Practice handwriting by doing crossword puzzles, writing on lined paper, signing name, and filling in forms with multiple boxes.
Reaching/grasping	Reach, grasp, and drink from cups of different sizes, shapes, and weights.
Pouring	Pour water from one cup to another.
Opening/closing	Open and close food jars of different sizes.
Lifting	Lift jars and boxes of different weights onto and off of different-height pantry shelves.
Fine-motor skills	Pick up grains of rice with the thumb and forefinger and place them in a teacup. Pick up a straw between the thumb and forefinger and place it in a soda can.
Dressing	Practice dressing, such as putting on a coat or sweater using verbal cues such as "left arm, right arm, pull."
Pressing/pushing	Practice pushing the correct sequence of telephone buttons to call family, friends, and local businesses while sitting or standing.
Folding	Fold napkins and place folded paper into envelopes.

Group and home exercises:

- ❑ Low impact aerobics are an important focus for a group class e.g., Marching in place in sitting and standing,
- ❑ Large high steps and use of music provides necessary stimulation to movement.
- ❑ Recreational activities follow the aerobic portion such as line dancing, ball activities and bean bag toss.



Thank you

