



# AMERICAN PARKINSON DISEASE ASSOCIATION

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## EDUCATIONAL SUPPLEMENT 27

# Cognitive Changes in Parkinson's Disease

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Cognitive symptoms in Parkinson's disease (PD) are common, though not every person experiences them. Cognitive changes range from mild problems to more severe deficits which may impact daily functioning. Similar to slowness of movement (or bradykinesia), people with PD often report slower thinking processes (termed "bradyphrenia").

Cognition refers to the mental abilities used to process information and apply knowledge. These processes allow us to perform daily functions such as paying attention, solving problems, and remembering where items are and how to do certain tasks. When people talk about cognition, they often focus on "memory," but "memory" is only one of several different cognitive domains. Attention, working memory, executive function, and visuospatial function are the most frequently

affected cognitive areas in PD.

**1. Attention and working memory:** Attention is the ability to selectively focus on a particular part of one's environment, often while ignoring competing stimuli. In PD, people may find it difficult to concentrate on a conversation, read a book, or talk to someone while walking. Working memory refers to the process of temporarily storing information in one's mind and manipulating it over a short period; mental arithmetic is one example. These cognitive processes are often linked to alertness and worsen with sleepiness or sedating medications. These cognitive processes involve the frontal and parietal lobes in the brain. Working memory also involves the basal ganglia and dorsolateral prefrontal cortex, regions affected in PD.

**2. Executive function:** Executive function includes the ability to plan, organize, initiate, and regulate goal-directed behavior. These activities may include multi-tasking, solving problems, starting new tasks, and switching tasks. Executive function involves the prefrontal cortex and dopamine system, which are affected in PD. Executive dysfunction is one of the most common cognitive changes reported in PD.

**3. Memory:** In general, the concept of memory invokes learning and remembering information. Memory, however, can be classified into different processes and types. There is immediate (seconds-minutes), short-term (minutes-days), and long-term memory (days-years). There also is memory for facts, concepts, or events (declarative memory) and for how to do certain tasks like tie our shoes or ride a bicycle (procedural memory) as well as working memory (described above). Declarative memory involves the hippocampus or temporal lobe of the brain, whereas procedural memory involves frontal areas and basal ganglia. People with PD may have trouble recalling information, but in general, have less memory impairment compared to Alzheimer's disease. In PD, people frequently recall information more readily when given cues or choices, which help the person to retrieve information from the brain's memory "storage."

**4. Language:** Language abilities include naming objects, generating words, comprehension and verbal concepts. The most common language problem in PD is finding the "right" words. People with PD also tend to speak less and use simpler speech. Language difficulties can be frustrating for patients and caregivers because verbal communication is such an important part of human behavior.

**5. Visuospatial function:** These abilities give us a spatial map of our environment and involve our sense of direction. Visuospatial functions allow

us to estimate distance and depth perception, use mental imagery, copy drawings, or construct objects. Examples include being able to give someone directions by tracing the route in your mind and putting together a puzzle. These abilities rely on the parietal lobe of the brain.

## **Cognitive evaluation**

There are several ways to assess cognition in the clinic or research setting. Reports from the patient and the patient's caregiver, spouse or friend are important. The physician may ask questions about cognitive function, whether cognitive problems represent a change from prior functioning, and how they impact activities of daily living or work. The physician may perform short tests of thinking and memory, but generally the "gold standard" is more comprehensive, formal neuropsychological testing. Neuropsychological evaluations include multiple tests with oral or written answers and assess different cognitive domains; evaluations range from about 45 minutes to several hours.

## **Cognitive changes in PD**

Cognitive deficits that are mild and do not impair one's ability to carry out activities of daily living have been termed "mild cognitive impairment." Mild cognitive impairment may occur in about 25% of PD patients. We now recognize that mild cognitive changes can occur early in the course of PD and even at diagnosis. These changes may or may not affect the person's activities or work, depending on specific demands.

Dementia refers to a syndrome in which patients have problems in more than one cognitive domain and these cognitive problems significantly impair everyday life functioning. About 40% of PD patients develop dementia. In long-term studies, higher rates of dementia are seen, particularly after many years of PD. When

motor symptoms, patients are often diagnosed with dementia with Lewy bodies. PD dementia and dementia with Lewy bodies are often considered as related “Lewy body disorders.”

### **Causes of cognitive impairment in PD**

The exact causes of PD cognitive impairment or dementia are not fully understood. There are changes in neurochemical signals including dopamine, but also acetylcholine, serotonin, and norepinephrine, which are important in cognition, memory, attention, and mood. In autopsy studies, Lewy bodies (abnormal protein accumulations) have been found in neurons in brain regions responsible for cognitive processes; there also may be cerebrovascular disease and/or Alzheimer’s disease pathology in some.

Besides PD, other important causes of cognitive dysfunction include medical illnesses such as thyroid disease, vitamin B12 deficiency, urinary tract infections or pneumonia. In these settings, cognitive symptoms, confusion, or hallucinations generally improve after medical condition is treated. Some medications for pain or bladder problems may cause sleepiness or confusion and thereby, impair cognitive function. Hearing loss or vision impairment also can be a cause of cognitive problems. Cognitive function can be affected by poor sleep and excessive daytime sleepiness. Depression may mimic cognitive symptoms. Anxiety and apathy also may play a role in cognitive functions. Lastly, head trauma, seizures, strokes or “mini-strokes” may be other reasons for cognitive deficits.

Dopaminergic medications (levodopa, dopamine agonists, MAO-B inhibitors) used to treat PD variably affect cognition. Some studies report improved alertness, working memory, and planning abilities with these medications. Others find no effect of dopaminergic medications on PD cognition or in some, increased cognitive

symptoms or sleepiness, especially with dopamine agonists. Elderly patients do not tolerate dopamine agonists and anticholinergics as well as younger people and are more susceptible to confusion or hallucinations.

### **Management strategies**

If cognitive problems develop abruptly, the physician may first search for an infection, new neurological problem (e.g., stroke), or newly prescribed medication. If the cognitive problems gradually develop, the evaluation may differ, and examination by a neurologist, neuropsychologist, or specialist in cognition may be helpful.

Medications used to treat dementia in PD are based on FDA-approved treatments for Alzheimer’s disease, even though these are different diseases. The medications work on the cholinergic system (a neurochemical involved in attention and memory) and include: donepezil (Aricept), rivastigmine (Exelon), and galantamine (Razadyne). To date, only rivastigmine (Exelon) is FDA-approved for PD dementia. Cognitive benefits of these medications in clinical research studies have been modest, and any use should be discussed with one’s physician. Side effects include nausea, diarrhea, and in some, worsened tremor. Memantine (Namenda) is another medication that is FDA-approved for Alzheimer’s disease but requires further study in PD dementia. At present, these medications are not FDA-approved for mild cognitive impairment in PD.

Non-medication strategies may help patients with cognitive tasks, communication, and daily activities, and improve quality of life. Pill reminders, clock alarms and timers are useful. Simplifying activities into smaller steps, using daily planners to keep track of events and time, and making “to do” checklists are good strategies. Maintaining a regular routine for daily

activities and exercise is important. Household items (e.g., utensils, glasses, keys) should be kept in the same place, and drawers can be labeled. Patients often respond better when given choices or cues, particularly if word-finding difficulties or slowed thinking is present. Just like physical exercise, mental “exercise” is important. Although the exact mechanism is unknown, studies reveal that rats housed in “enriched environments” with toys and interesting objects show increased brain growth and better capacity for learning than those kept in “boring” environments. Mental activities can include doing puzzles, playing cards, reading books, going to lectures or concerts, or learning a new activity. These can be coupled with physical exercise such as learning new dance steps. Just like with physical exercise, there is no single “right” mental exercise. Social interactions are an important piece of mental stimulation, and many activities can be done with friends or

family members.

Driving is an important safety issue to address as it involves many cognitive and motor processes. Some occupational therapists perform simulated or on-the-road driving tests that can help physicians and families make decisions about driving abilities. For patients with more advanced dementia, adult day care programs and group activities in the nursing home can enhance social interaction. Social workers can be valuable assets to help patients and caregivers deal with stressors and frustrations.

In conclusion, cognitive dysfunction frequently accompanies PD. Awareness of cognitive impairment in PD has grown markedly over the years. Greater understanding of the causes of PD cognitive impairment and improved interventions, however, are still needed and are the focus of current research endeavors.

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