PARKINSON’S SYNDROME

GOALS AND OBJECTIVES

Course Description
“Parkinson’s Syndrome” is a home study continuing education program for therapists and assistants. The course presents an updated comprehensive review of Parkinson’s Syndrome including etiology, epidemiology, diagnosis, treatment, pharmacology, therapeutic interventions, and caregiver strategies.

Course Rationale
Parkinson’s Syndrome continues to afflict a significant percentage of the population. This affects of this disease can profoundly alter the quality of life of an individual. By better understanding the pathology and the various care options available, it is possible for healthcare professionals to have a positive impact on both the patient and their family.

Course Goals and Objectives
Upon completion of this course, the therapist or assistant will be able to:
1. identify the possible etiological factors that cause Parkinson’s Syndrome.
2. recognize the demographics of Parkinson’s Syndrome
3. identify the clinical signs of Parkinson’s Syndrome
4. understand and differentiate the pharmacological treatment options available to treat Parkinson’s syndrome.
5. understand the rehabilitation needs of individuals with Parkinson’s Syndrome
6. identify and utilize biometric scales to quantify the health status of individuals with Parkinson’s Syndrome
7. recognize the many secondary conditions associated with Parkinson’s syndrome.
8. recognize and understand the challenges faced by the caregiver.

Course Instructor
Michael Niss PT

Target Audience
Physical therapists, physical therapist assistants, occupational therapists, and occupational therapist assistants

Course Educational Level
This course is applicable for introductory learners.

Course Prerequisites
None

Criteria for issuance of Continuing Education Credits
A documented score of 70% or greater on the written post-test.

Continuing Education Credits
Four (4) hours of continuing education credit (4 NBCOT PDUs/4 contact hours)
AOTA - .4 AOTA CEU, Category 1: Domain of OT – Client Factors, Context
Category 2: OT Process - Intervention

Determination of Continuing Education Contact Hours
Parkinson’s Syndrome: A Comprehensive Update will require at least 4 hours to complete. This estimate is based on the accepted standard for home based self-study courses of approximately 10-12 pages per hour (12 pt text). The complete text of this course is 51 pages (excluding Bibliography and Post Test)
OUTLINE

Goals & Objectives  1  start hour 1
Course Outline  2
Overview  3
Etiology  3-6
Genetic  4-5
Environmental  5
Viral  5
Oxidative Stress  5-6
Epidemiology  6
Symptomology  6-11
Bradykinesia  7
Tremor  7
Rigidity  7
Other  7-11
Diagnosis  11  end hour 1
Other Diseases  11-15  start hour 2
Stages of Parkinson's Syndrome  15-16
Prognosis  16
Treatment  16
Medications  17-23
Anticholenergic Drugs  17
Antiviral Agents  17-18
Antidepressants  18
Anti-Oxidants  18
Levodopa  19
Decarboxylase Inhibitors  19-20
Dopamine Agonists  20-22
COMT Inhibitors  22
Other Medications  22-23
Complications of Medication  23-24  end hour 2
Surgery  24-26  start hour 3
Thalamotomy  24-25
Pallidotomy  25
Deep Brain Stimulation  25-26
Neural Tissue Transplant  26
Physical & Occupational Therapy  26-31
Stretching  27
Strengthening  27-28
Fall Prevention  28-29
Walking  29
Relaxation  29-30
Activities of Daily Living  30-31
Diet  31-32
Hospital Tips  32
Comorbidities  32-34
Sleep Disorders and PS  34
Dementia and PS  34-36  end hour 3
Psychosis and PS  36-38  start hour 4
Caring for the Caregiver  39-40
Research  40-46
Parkinson's Health Biometrics  46-51
Schwab & England ADL  46
Unified Parkinson Disease Rating Scale  47-51
References  52-53
Post-Test  54-55  end hour 4
Overview

Parkinson's Syndrome (PS), also called paralysis agitans, is a chronic movement disorder with distinct symptoms. The term Parkinsonism refers to the group of symptoms that can occur with this movement disorder. In the past, Parkinson's Disease was the term used for this movement disorder when the cause of the biochemical disorder in the part of the brain leading to the symptoms was unknown (as opposed to the movement disorder being due to a brain injury or as a side effect of drugs or poisons, etc.). Because of the bad connotation of the word “disease,” and for other reasons, the phrase Parkinson's Syndrome (PS) is now being used by some groups instead of the phrase Parkinson's Disease. When Parkinsonism symptoms occur as a secondary symptom of some brain disorder other than Parkinson's Disease (such as Alzheimer's Disease), this is called a Parkinsonism-plus syndrome or Parkinson's Plus syndrome.

PS is characterized by three main symptoms — tremor (shaking), rigidity (muscle stiffness), and bradykinesia (difficulty in starting movement and slowing down of voluntary movement). Intelligence is not affected. It does not cause paralysis. PS results from a loss of a specific type of brain cells (nigrostriatal cells) deep within a midbrain region known as the “black substance” (Substantia Nigra). The cells in this area of the brain control the movement of our body parts by making chemical messengers (neurotransmitters) called dopamine that are sent to other brain cells to tell them how to control our movements. When 80% or more of the cells in the SN die, no matter what mechanism destroyed them, Parkinsonism is the result. When the cause of Parkinsonism cannot be determined, it is called idiopathic Parkinson's Disease (PD), and such people form the largest subgroup of people with Parkinson’s Syndrome (PS).

Parkinson's Plus Syndrome (PPS) is a mimic of PS, and can take various forms. There may be a disproportionate involvement of gait with few limb signs. This is sometimes called “lower half Parkinsonism,” and may be due to small strokes in the brain. While 10 to 20% of people with Parkinson’s Disease either lack a tremor or have more postural than rest tremor, this is even more common in other brain disorders mimicking Parkinson's Disease such as PPS. And there are other clues in such things as balance changes, eye movement changes, functioning of the autonomic nervous system, and the early onset and progression of a decline in cognitive functioning that may suggest that a person has a Parkinson's Plus Syndrome and not Parkinson’s Syndrome. The distinction is important because those with PPS respond only minimally and sometimes only briefly to the usual medications used to treat PS.

Etiology

Parkinson's disease occurs when neurons, in an area of the brain known as the substantia nigra die or become impaired. Normally, these neurons produce an
important brain chemical known as dopamine. Dopamine is a chemical messenger responsible for transmitting signals between the substantia nigra and the next "relay station" of the brain, the corpus striatum, to produce smooth, purposeful movement. Loss of dopamine results in abnormal nerve firing patterns within the brain that cause impaired movement. Studies have shown that most Parkinson's patients have lost 60 to 80 percent or more of the dopamine-producing cells in the substantia nigra by the time symptoms appear. Recent studies have shown that people with PS also have loss of the nerve endings that produce the neurotransmitter norepinephrine. Norepinephrine, which is closely related to dopamine, is the main chemical messenger of the sympathetic nervous system, the part of the nervous system that controls many automatic functions of the body, such as pulse and blood pressure. The loss of norepinephrine might help explain several of the non-motor features seen in PS, including fatigue and abnormalities of blood pressure regulation.

Many brain cells of people with PD contain Lewy bodies – unusual deposits or clumps of the protein alpha-synuclein, along with other proteins. Researchers do not yet know why Lewy bodies form or what role they play in development of the disease. The clumps may prevent the cell from functioning normally, or they may actually be helpful, perhaps by keeping harmful proteins "locked up" so that the cells can function.

Scientists have identified several genetic mutations associated with PD, and many more genes have been tentatively linked to the disorder. Studying the genes responsible for inherited cases of PD can help researchers understand both inherited and sporadic cases. The same genes and proteins that are altered in inherited cases may also be altered in sporadic cases by environmental toxins or other factors. Researchers also hope that discovering genes will help identify new ways of treating PD.

**Genetic Causes**

Several genes have now been definitively linked to PD. The first to be identified was alpha-synuclein. In the 1990s, researchers at NIH and other institutions studied the genetic profiles of a large Italian family and three Greek families with familial PD and found that their disease was related to a mutation in this gene. They found a second alpha-synuclein mutation in a German family with PD. These findings prompted studies of the role of alpha-synuclein in PD, which led to the discovery that Lewy bodies from people with the sporadic form of PD contained clumps of alpha-synuclein protein. This discovery revealed a potential link between hereditary and sporadic forms of the disease.

In 2003, researchers studying inherited PD discovered that the disease in one large family was caused by a triplication of the normal alpha-synuclein gene on one copy of chromosome 4. This triplication caused people in the affected family to produce too much of the normal alpha-synuclein. This study showed that an
excess of the normal form of the protein could result in PD, just as the abnormal form does.

Other genes linked to PD include parkin, DJ-1, PINK1, and LRRK2. Parkin, DJ-1, and PINK-1 cause rare, early-onset forms of PD. The parkin gene is translated into a protein that normally helps cells break down and recycle proteins. DJ-1 normally helps regulate gene activity and protect cells from oxidative stress. PINK1 codes for a protein active in mitochondria. Mutations in this gene appear to increase susceptibility to cellular stress.

LRRK2, which is translated into a protein called dardarin, was originally identified in several English and Basque families and causes a late-onset form of PD. Subsequent studies have identified this gene in other families with PD as well as in a small percentage of people with apparently sporadic PD.

Researchers are continuing to investigate the normal functions and interactions of these genes in order to find clues about how PD develops. They also have identified a number of other genes and chromosome regions that may play a role in PD, but the nature of these links is not yet clear.

**Environmental Toxins**

Although the importance of genetics in PD is increasingly recognized, most researchers believe environmental exposures increase a person’s risk of developing the disease. Even in familial cases, exposure to toxins or other environmental factors may influence when symptoms of the disease appear or how the disease progresses. There are a number of toxins, such as 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine, or MPTP (found in some kinds of synthetic heroin), that can cause parkinsonian symptoms in humans. Other, still-unidentified environmental factors also may cause PD in genetically susceptible individuals.

**Viral**

Viruses are another possible environmental trigger for PD. People who developed encephalopathy after the 1918 influenza epidemic were later stricken with severe, progressive Parkinson’s-like symptoms. A group of Taiwanese women developed similar symptoms after contracting herpes virus infections. In these women, the symptoms, which later disappeared, were linked to a temporary inflammation of the substantia nigra.

**Oxidative Stress**

Several lines of research suggest that mitochondria may play a role in the development of PD. Mitochondria are the energy-producing components of the cell and are major sources of free radicals — molecules that damage membranes, proteins, DNA, and other parts of the cell. This damage is often
referred to as oxidative stress. Oxidative stress-related changes, including free radical damage to DNA, proteins, and fats, have been detected in brains of PD patients.

Other research suggests that the cell’s protein disposal system may fail in people with PD, causing proteins to build up to harmful levels and trigger cell death. Additional studies have found evidence that clumps of protein that develop inside brain cells of people with PD may contribute to the death of neurons, and that inflammation or overstimulation of cells (because of toxins or other factors) may play a role in the disease. However, the precise role of the protein deposits remains unknown. Some researchers even speculate that the protein buildup is part of an unsuccessful attempt to protect the cell. While mitochondrial dysfunction, oxidative stress, inflammation, and many other cellular processes may contribute to PD, the actual cause of the dopamine cell death is still undetermined.

Epidemiology

The frequency of occurrence of Parkinson’s Syndrome rises from 1 per 1,000 in the general population to 1 per 100 in those between the ages of 55 and 65. More people have PS than other movement disorders combined (including multiple sclerosis).

PS can occur in any adult, and occurs slightly more often in men than women. It occurs in whites more often than blacks. About three-quarters of people develop the disease between the ages of 50 and 65, but it occasionally strikes people in their 30s or 40s. About 8% of those affected by PS have a close relative who had, or has, the symptoms. It is more likely to run in families if a family member developed it before age 46.

Statistical studies have often associated cigarette smoking with a decreased risk of developing PS, and some small studies have suggested that smoking improves the symptoms of PS. Researchers note that a statistical association is in no way proof of an effect, and they have been unable so far to determine why smoking might have a protective effect against PS. It is thought that perhaps the nicotine in cigarettes may have similar properties to dopamine, but no one knows for sure. Until this association is sorted out, it must be remembered that tobacco use is the number one preventable cause of death and disease in our society, and exposure to tobacco smoke should be avoided.

Symptomology

The cardinal clinical features of PS are bradykinesia, rigidity, and rest tremor. These three symptoms are often called the “triad” of Parkinson’s Syndrome.
Bradykinesia

It is characterized by a delay in starting all movements, slowness and poverty of all movements, and the arrest of ongoing movements. PS often produces acute difficulty or slowness in movements such as rising from the table or the bed or toilet, reaching for objects, turning, or getting out of bed. It is also seen as difficulty swallowing, constipation, decreased facial expression (“masked facial features”), and reduced blink frequency. Loss of spontaneous movement occurs as a diminished ability to carry out movements such as arm-swinging while walking, reduced emotional expressiveness, and may create a somewhat stony stare (with infrequent blinking). As PS progresses, difficulties with balance are frequent, as are falls.

Tremor

It is absent in as many as 25% of people with PS. Not necessarily the first, but often the clearest sign of PS, and one of its more annoying symptoms. At first a mere intermittent “tapping” of the hand (when hands are resting or supported on the lap, better known as a resting tremor), the shaking usually subsides when the hands are moved or during sleep, but increases with stress. It may also appear in the feet. Later, often years later, the tremor may spread to the head or neck or face or lips or jaw or legs. In some people, the tremor may increase when the hands are stretched out in front, and this is called a sustentation or postural tremor. If the tremor increases when the hands are moving, it is called an action tremor. Sustentation and action tremors usually do not respond to anti-parkinsonian drugs.

Rigidity

Rigidity is an increased tone or stiffness in the muscles and is present when the limbs are still. It increases when the limbs are moving. The stiffness of the muscles may be disabling, especially in advanced stages. Rigidity is often confused with bradykinesia.

Other Symptoms

Gait disturbance
The gait disturbance is often referred to as “festination” which means the inability to walk slowly and a tendency to walk with small quick shuffling steps. The person may develop a forward tilt or a tilt to one side, which further impairs balance. There is difficulty in turning, and there may be abrupt freezing spells.

Psychiatric disorders
Depression (occurs in as many as 50%), mood swings, and insomnia may occur with PS and may require treatment with medications. Depression may be associated with anxiety and agitation, a so-called “agitated depression.”
Sleep disturbances
Can include an inability to fall asleep or an inability to stay asleep, with frequent nighttime awakenings. Some people experience a reversal of their sleep patterns, sleeping during the day and being awake at night. People may have vivid dreams, and rarely, nightmares. Bed partners often report that people speak in their sleep and have jerking, involuntary movements of their limbs (myoclonus) during sleep. For some people, difficulty in sleeping is related to their depression. Some sleeping difficulties, especially vivid dreaming and myoclonus, are related to L-dopa. Readjustment of the dose of L-dopa, and eliminating the evening dose (if possible) may improve the person’s sleep. On the other hand, some people require L-dopa to sleep because a lack of medication makes them so rigid that they cannot turn in bed. Standard sleeping medications are occasionally helpful, but must be used with caution—particularly for depressed people.

Intellectual impairment or dementia
This occasionally occurs in some people, usually those who are elderly and in the late stages of PS. It can include memory failure, problems with recognition, reduced problem solving ability, problems with calculations, visuospatial abnormalities, and slow thought. Some develop dementia in later stages with confusion and disorientation. Anti-Parkinsonian drugs such as L-dopa, the anticholinergic drugs, amantadine, and the dopamine agonists may cause delusions, confusion, paranoia, or hallucinations on their own, but when the drug is stopped, the symptoms clear (it may take several days). The appearance of drug-induced mental changes in a person who is not senile does not mean that the person will become senile.

Forced eyelid closure (blepharospasm)
The inability to open the eyelids, or once opened, to keep them open. Rarely, blepharospasm results in the inability to open the eyes at all. Such people cannot read, watch television, or carry on many other daily activities. Antiparkinsonian drugs alleviate the blepharospasm for some people, though they may worsen this condition for others. To alleviate this, surgical treatment of the eyelid muscles may be necessary, or it may be possible to inject a small amount of a paralytic drug into the muscles that close the eyes.

Drooling (sialorrhea)
This usually results from the person’s inability to swallow saliva leading to its accumulation in the throat. This may be evident only at night when people are reclining and lose gravity’s assistance in swallowing. In a few people, drooling may result from an overproduction of saliva. Drooling usually improves with the use of medications, especially the anticholinergic drugs that decrease the production of saliva.
Speech problems
Usually, a mild impairment that consists of a change in voice volume, phonation, or articulation. Generally, the volume change is the first such symptom and the person speaks “more softly.” The person’s voice may be loud at the beginning of a sentence and then fade towards the end. The voice may also become monotonous, lacking variation and feeling. In others, the voice may sound breathy, tremulous, high-pitched, hoarse, or strident. Words may become slurred and indistinct, word endings may be omitted, final consonant sounds, such as the “k” in look may be unclear, syllables and words may be crowded and run together, and words may be accelerated towards the end of a sentence. Occasionally, speech difficulties arise early in the disease, and initially these problems may be evident only when the person uses the telephone (which filters out some of the normal frequencies). Specific measures such as speech therapy, amplification devices, and medications may be helpful.

Difficulty in swallowing (dysphagia)
Most often occurs late in PS, and is rarely one of the early symptoms. Sometimes people are unable to swallow pills, and if not reported by the person, this will only become apparent after other PS symptoms worsen. People may experience this difficulty with both solids and liquids, and it may be due to three problems:

1. In some people, the swallowing difficulty arises from an inability to force the food down the throat and an inability of the voluntary muscles of the throat and esophagus to contract. This results in pooling of food in the throat. These people complain of food getting stuck in their throat. To alleviate the problem, people should place small portions of food in their mouth and chew and swallow slowly and carefully. They should always completely swallow one morsel before putting other food into the mouth.

2. In some PS people, pooling of food in the throat may cause food to go into the lungs (aspiration). Frequent episodes of this may appear as a cough or pneumonia. This usually only occurs in people with advanced disease.

3. Other swallowing difficulties may result from the failure of the valve mechanism that allows food to pass from the gullet into the stomach to work properly. This will allow acid and chemicals from the stomach to come back up into the esophagus and burn it (and the lungs if there is aspiration also). The symptoms include indigestion, heartburn, burning in the throat or chest, and may occasionally resemble the pain of a heart attack. These symptoms should be evaluated by a doctor.
Sexual Problems
A decrease in the desire for sex may result from the non-specific effects of a chronic illness, fear of being unable to perform satisfactorily, depression, and medications. Men who note the inability to achieve or maintain an erection need to be evaluated for causes other than PS. People who seem to have increased sexual function after being started on L-dopa do so because of their general improvement, not because of a direct effect of L-dopa.

Breathing Problems (Dyspnea)
Shortness of breath after minimal physical activity should be evaluated to rule out heart or lung disease. If the results are negative, shortness of breath may be due to rigidity, or bradykinesia of the chest wall muscles which prevents the lungs from expanding, and increasing the anti-parkinsonian medications may help. Some people on L-dopa may experience shortness of breath and abnormal grunting respirations because L-dopa may cause uncoordinated involuntary movements of the diaphragm, chest wall muscles, and upper throat muscles. This usually improves if the L-dopa is decreased.

Weight Loss
Weight loss up to 30 pounds is not uncommon. It may be related to difficulty with swallowing, the increased energy used up by the tremors, or decreased appetite.

Urinary Dysfunction
This is a problem, which may consist of urgency (a strong desire to void even with little urine in the bladder), frequency (passing urine frequently, and if this happens at night it is called nocturia), hesitancy in starting to void, difficulty in completing voiding, and incomplete voiding with dribbling. Rarely a person may be unable to void. PS may cause difficult voiding because the muscles of the bladder become rigid and bradykinetic, thus decreasing the ability of the bladder to contract and expel urine. Some antiparkinsonian drugs, such as the anticholinergics and Symmetrel, may increase the voiding difficulty. PS people who experience difficulty in voiding must be checked for the other diseases and problems that can mimic these symptoms (prostate problems in men, vaginal laxness in women, diabetes, infection, etc.)

Peripheral Edema
Swelling in the extremities may occur toward the end of the day after a person has been standing and disappears when the person lies down. When this occurs, the person has to be evaluated for heart failure, but the swelling of the feet usually results from gravity holding fluid in the feet, and the inability of the rigid leg muscles to massage fluid from the feet back to the heart. Drugs such as Symmetrel and some of the dopamine agonists may result in swelling of the feet. If the swelling is mild, it may not require any treatment, but if it becomes more pronounced, a number of measures may be used, including elevating the feet, elastic support stockings, and less often, water pills.
Dizziness Upon Standing (Postural or Orthostatic Hypotension)
This is the result of a drop in blood pressure upon standing. Some antiparkinsonian drugs (L-dopa and the dopamine agonists) may cause dizziness on standing, but it usually disappears once the body has adjusted to the drugs. If it doesn’t, a decrease in the dose of the drugs may be needed, water pills must be stopped, and elastic stockings may be needed. The person may also have to take drugs (Florinef, Indocid) or table salt, which cause the body to retain fluid. Dizziness may also be caused by other drugs which some people take for different medical conditions (i.e., high blood pressure, heart failure, and depression), and can also occur due to dehydration, malnutrition, diabetes, or other illnesses.

Stooped Posture
The stooped posture arises, in part, from rigidity of the neck and back muscles. It is helpful for such people to participate in exercises that are designed to lessen this rigidity of the back muscles. Occasionally, the stooped posture may respond to treatment with L-dopa or one of the dopamine agonists.

Other
Diminutive handwriting (micrographia), extreme fatigue, increased body secretions (saliva, perspiration, and skin oil), constipation, muscle cramps, and a susceptibility to bladder and chest infections (partly due to immobility). Some people will have vague strange sensations and pain in the shoulders, trunk, low back, and lower limbs.

Diagnosis
An accurate diagnosis depends on a careful history (including a history of any drug or medication use), and a physical exam. There are no blood or X-ray tests that will confirm PS. A technique called iodobenzamide-single-photon-emission computed tomography (IBZMSPECT) allows doctors to tell if a person has a normal number and distribution of the channel type 2 (dopamine-D2-receptors) in the Striatum in the brain.

Based on history and examination, doctors can tell people that they suffer from PS with a chance of about 85% of being correct.

Other Diseases Resembling Parkinson’s
A number of disorders can cause symptoms similar to those of PD. People with symptoms that resemble PD but that result from other causes are sometimes said to have parkinsonism. Some of these disorders are listed below.
Postencephalitic Parkinsonism

Just after the first World War, a viral disease, encephalitis lethargica, attacked almost 5 million people throughout the world, and then suddenly disappeared in the 1920s. Known as sleeping sickness in the United States, this disease killed one third of its victims and led to post-encephalitic parkinsonism in many others. This resulted in a particularly severe form of movement disorder that appeared sometimes years after the initial illness. (In 1973, neurologist Oliver Sacks published *Awakenings*, an account of his work in the late 1960s with surviving post-encephalitic patients in a New York hospital. Using the then-experimental drug levodopa, Dr. Sacks was able to temporarily "awaken" these patients from their statue-like state). In rare cases, other viral infections, including western equine encephalomyelitis, eastern equine encephalomyelitis, and Japanese B encephalitis, have caused parkinsonian symptoms.

Drug-induced Parkinsonism

A reversible form of parkinsonism sometimes results from use of certain drugs, such as chlorpromazine and haloperidol, which are prescribed for patients with psychiatric disorders. Some drugs used for stomach disorders (metoclopramide), high blood pressure (reserpine), and epilepsy (valproate) may also produce parkinsonian symptoms. Stopping the medication or lowering the dosage of these medications usually causes the symptoms to go away.

Toxin-induced Parkinsonism

Some toxins — such as manganese dust, carbon disulfide, and carbon monoxide — can cause parkinsonism. The chemical MPTP also causes a permanent form of parkinsonism that closely resembles PD. Investigators discovered this reaction in the 1980s when heroin addicts in California who had taken an illicit street drug contaminated with MPTP began to develop severe parkinsonism. This discovery, which showed that a toxic substance could damage the brain and produce parkinsonian symptoms, caused a dramatic breakthrough in Parkinson’s research: for the first time, scientists were able to simulate PD in animals and conduct studies to increase understanding of the disease.

Arteriosclerotic Parkinsonism

Sometimes known as pseudoparkinsonism, vascular parkinsonism, or atherosclerotic parkinsonism, arteriosclerotic parkinsonism involves damage to the brain due to multiple small strokes. Tremor is rare in this type of parkinsonism, while dementia — the loss of mental skills and abilities — is common. Antiparkinsonian drugs are of little help to patients with this form of parkinsonism.
Post-traumatic Parkinsonism

Also known as post-traumatic encephalopathy or "punch-drunk syndrome," parkinsonian symptoms can sometimes develop after a severe head injury or frequent head trauma that results from boxing or other activities. This type of trauma also can cause a form of dementia called dementia pugilistica.

Essential tremor

Essential tremor, sometimes called benign essential tremor or familial tremor, is a common condition that tends to run in families and progresses slowly over time. The tremor is usually equal in both hands and increases when the hands are moving. The tremor may involve the head but usually spares the legs. Patients with essential tremor have no other parkinsonian features. Essential tremor is not the same as PD, and usually does not lead to it, although in some cases the two conditions may overlap in one person. Essential tremor does not respond to levodopa or most other PD drugs, but it can be treated with other medications.

Normal Pressure Hydrocephalus

Normal pressure hydrocephalus (NPH) is an abnormal increase of cerebrospinal fluid (CSF) in the brain's ventricles, or cavities. It occurs if the normal flow of CSF throughout the brain and spinal cord is blocked in some way. This causes the ventricles to enlarge, putting pressure on the brain. Symptoms include problems with walking, impaired bladder control leading to urinary frequency or incontinence, and progressive mental impairment and dementia. The person also may have a general slowing of movements or may complain that his or her feet feel "stuck." These symptoms may sometimes be mistaken for PD. Brain scans, intracranial pressure monitoring, and other tests can help to distinguish NPH from PD and other disorders. NPH can sometimes be treated by surgically implanting a CSF shunt that drains excess cerebrospinal fluid into the abdomen, where it is absorbed.

Progressive Supranuclear Palsy

Progressive supranuclear palsy (PSP), sometimes called Steele-Richardson-Olszewski syndrome, is a rare, progressive brain disorder that causes problems with control of gait and balance. People often tend to fall early in the course of PSP. One of the most obvious signs of the disease is an inability to move the eyes properly. Some patients describe this effect as a blurring. PSP patients often show alterations of mood and behavior, including depression and apathy as well as mild dementia. The symptoms of PSP are caused by a gradual deterioration of brain cells in the brainstem. It is often misdiagnosed because some of its symptoms are very much like those of PD, Alzheimer's disease, and other brain disorders. PSP symptoms usually do not respond to medication.
Corticobasal Degeneration

Corticobasal degeneration results from atrophy of multiple areas of the brain, including the cerebral cortex and the basal ganglia. Initial symptoms may first appear on one side of the body, but eventually affect both sides. Symptoms are similar to those found in PD, including rigidity, impaired balance and coordination, and dystonia. Other symptoms may include cognitive and visual-spatial impairments, apraxia (loss of the ability to make familiar, purposeful movements), hesitant and halting speech, myoclonus (muscular jerks), and dysphagia (difficulty swallowing). Unlike PD, corticobasal degeneration usually does not respond to medication.

Multiple System Atrophy

Multiple system atrophy (MSA) refers to a set of slowly progressive disorders that affect the central and autonomic nervous systems. MSA may have symptoms that resemble PD. It also may take a form that primarily produces poor coordination and slurred speech, or it may have a mixture of these symptoms. Other symptoms may include breathing and swallowing difficulties, male impotence, constipation, and urinary difficulties. The disorder previously called Shy-Drager syndrome refers to MSA with prominent orthostatic hypotension — a fall in blood pressure every time the person stands up. MSA with parkinsonian symptoms is sometimes referred to as striatonigral degeneration, while MSA with poor coordination and slurred speech is sometimes called olivopontocerebellar atrophy.

Dementia with Lewy Bodies

Dementia with Lewy bodies is a neurodegenerative disorder associated with abnormal protein deposits (Lewy bodies) found in certain areas of the brain. Symptoms can range from traditional parkinsonian symptoms, such as bradykinesia, rigidity, tremor, and shuffling gait, to symptoms similar to those of Alzheimer’s disease. These symptoms may fluctuate, or wax and wane dramatically. Visual hallucinations may be one of the first symptoms, and patients may suffer from other psychiatric disturbances such as delusions and depression. Cognitive problems also occur early in the course of the disease. Levodopa and other antiparkinsonian medications can help with the motor symptoms of dementia with Lewy bodies, but they may make hallucinations and delusions worse.

Parkinsonism Accompanying Other Conditions

Parkinsonian symptoms may also appear in patients with other, clearly distinct neurological disorders such as Wilson's disease, Huntington's disease, Alzheimer's disease, spinocerebellar ataxias, and Creutzfeldt-Jakob disease.
Each of these disorders has specific features that help to distinguish them from PD.

**Stages of Parkinson’s Syndrome**

One of the first questions many PS people and their families ask about is the severity of the disease. Since people are frequently at their “best” in their doctor’s office, decisions regarding treatment are not based solely on office observation. Scales rating the severity of PS are based on an evaluation of the symptoms. There are several different scales, and they differ in which symptoms are evaluated, and the value assigned to each symptom.

Following is the commonly used Hoehn and Yahr Scale:

**Stage zero** - no visible disease.

**Stage one** - mild unilateral tremor and some rigidity with minimal or subtle bradykinesia.

**Stage two** - moderate bilateral tremor and rigidity, moderate bradykinesia, and mild difficulties with daily activities.

**Stage three** - more severe bilateral tremor and rigidity, more severe bradykinesia, gait disturbances and instability, and impaired postural reflexes (dizziness when getting up from lying or sitting).

**Stage four** - severe disability with risk of falling spontaneously. The person may be mobile with a walking aid. The person may experience multiple freezing episodes, and may have periods of complete immobility, and a mild dementia.

**Stage five** - means complete immobility with an inability to walk, and there is often a moderate dementia and an inability to function independently.

Stages zero to two are mild disease, stage three is moderate disease, and stages four and five are marked or advanced disease. There are grey areas between the successive stages. Another way of staging the disease is to divide it into an early (or honeymoon) stage, a “predictable wearing off stage” about 3 to 5 yrs into the disease, and an “unpredictable motor fluctuations stage,” which may occur 5 to 10 yrs into the disease.

Complementing these rating scales are functional disability scales that rate the person’s ability to perform activities of daily living. These scales assign a weighted value to a particular activity, such as walking, eating, dressing, hygiene, and so on, and then grade the person’s degree of disability. For people who experience daily oscillation changes in performance, physicians assess the
daily number of hours people spend in their “on” (good) periods and the number of hours they spend in their “off” (bad) periods. Such a determination is made by instructing people with these oscillations (or their care-givers) to keep a daily diary of both the number of hours they are “on” and the number “off”. Through such a diary, the physician gains a better understanding of the person’s overall performance. Since reports on the degree of the person’s disability may differ between the person and the family, both may need to keep a diary for comparison purposes.

Prognosis

Parkinson’s Syndrome is not by itself a fatal disease, but it does get worse with time. The average life expectancy of a PS patient is generally the same as for people who do not have the disease. However, in the late stages of the disease, PS may cause complications such as choking, pneumonia, and falls that can lead to death. Fortunately, there are many treatment options available for people with PS.

The progression of symptoms in PS may take 20 years or more. In some people, however, the disease progresses more quickly. There is no way to predict what course the disease will take for an individual person.

Treatment

Treatment is tailored to the person’s needs and life situation, and must be tempered by the realization that long-term therapy may be associated with problems that eventually cause as much difficulty for the person as the basic disease itself does. The benefit of treatment for most people is improvement of symptoms with the ability to maintain adequate physical activity, and the ability to continue working. No specific treatment may be necessary when PS is first diagnosed except developing a regular exercise routine, and learning about PS.

A major dimension of therapy involves helping the person and family adapt to the reality of a chronic, progressive, disabling disease, and methods to help preserve the person’s independence assume top priority. Everyone should be encouraged to maintain social contacts and family and occupational responsibilities to counter the tendency toward immobility and apathy. Support groups can help with general information and answers to specific questions that arise in daily living, while providing a supportive social environment. People with early stage PS can be generally be divided into two groups: those in whom tremor is the major symptom, and those in whom slowness and stiffness predominate. People in whom tremor has become troublesome are candidates for the “anticholinergic drugs,” while people with stiffness and slowness are candidates for Amantadine. L-dopa is indicated when Parkinsonian symptoms become socially or occupationally disabling.
Medications

Various antiparkinsonian medications can partly compensate for lost dopamine and offset disability, but are disappointing because they cannot reverse or arrest the disease. All medications are started at low doses, and increased slowly while watching for side effects. When using drugs, there must be a careful analysis of the reactions to the drugs in order to find the lowest dose which gains a good degree of functional ability (which is not necessarily the maximal that could be achieved) with the least side effects. Current drugs tend to lose their effectiveness over time, and it is thought that the lowest the dose that can be used is best in the long run.

Medications which can alleviate PS symptoms include:

**Anticholinergic Drugs**

There are two classes of these drugs:

1. Piperidyl derivatives: Artane (Trihexyphenidyl) and Kemadrin (procyclidine)
2. Tropanol derivatives: e.g., Cogentin (Benztropine)

Artane and Cogentin are used at two to eight mg/day in two to three divided doses (the dose is usually increased by 1 mg per week). More potent drugs such as Kemadrin (procyclidine) at 7.5 to 20 mg per day can be tried. And sometimes antihistamine type drugs such as Benadryl (50 mg twice to four times per day), or the muscle relaxant Norflex (100 to 200 mg per day) can be used for their anticholinergic effects but they tend to be sedating. These drugs reduce some PS symptoms, particularly tremor, in the early stages. No one drug is superior to another, and it is trial and error to find which drug will work best.

Common side effects can include blurred vision, dry mouth, constipation, difficulty urinating, confusion, hallucinations, and “delirium.”

These drugs must be used with extreme caution in people with glaucoma or who have problems passing their urine, and when stopped, they should be withdrawn gradually. They tend to have more frequent and more severe side effects in the elderly, and must be used with great caution in this age group. Also intercurrent illness such as infections or starting other drugs may start or worsen the side effects of these drugs.

**Antiviral Agents**

Amantadine (Symmetrel) may improve most of the symptoms of PS. It is given as 100 mg twice a day. It cannot be used in people with severe heart or kidney failure, and must be used in caution in those with a dementia type illness. Some
people do not respond to it, and it often looses its effect after a few months. After a period of time off the drug, it may be effective again for a while.

Amantadine works by helping to increase dopamine release in the brain, not because it is an antiviral agent, but its exact mechanism of action remains uncertain. It comes as 100 mg capsules, but does come in a liquid form so that smaller doses can be used.

Potential adverse effects include insomnia, restlessness, confusion, depression, hallucinations, dry mouth, leg edema, urinary retention, and mottled skin discoloration of the legs. Seizures rarely occur. When stopped, it should be withdrawn slowly. The useful effect of this drug may wane over several months, but may return after the drug has been withdrawn and been reintroduced.

Antidepressants

These include medications such as Elavil (Amitriptyline), Aventyl (Nortriptyline), Norpramin (Desipramine), Desyrel (Trazodone), Luvox (Fluvoxamine), Zoloft (Sertraline), and Prozac (Fluoxetine), and are used to relieve depression. Some of these drugs also have anticholinergic effects, and may be tolerated better than the anticholinergic drugs noted above. Additionally, these drugs can be quite useful to help sleep patterns, and they are not addicting like “sleeping pills.” Recent trials have suggested that it is safe to use Prozac in Parkinson’s, even if the person is on Deprenyl (Eldepryl).

Anti-oxidants

Currently the only drug available in this class is Deprenyl (Selegiline, Eldepryl). It is available as 5 mg tablets, and the usual dose is one tablet once or twice a day (one dose should be given in the morning and one at noon: if the second dose is taken at bedtime, it will cause insomnia). The smaller dose may be just as effective as the larger dose.

This medication was initially thought to slow down the progression of PS by slowing down the loss of the SN cells that make dopamine. However, studies over the last five years have suggested that it does not slow the progression of PS, even when given to young PS people. It does, to a slight extent prevent the breakdown of dopamine in the striatum of the brain thus increasing dopamine levels. It is thus useful to prolong the effects of L-dopa, to lower the needed dose of L-dopa, and to smooth the response to L-dopa.

Deprenyl may cause nausea and dizziness (especially with changes in position), but the most common side effects (most people don’t have side effects) are sleep disorders and impaired cognition (confusion, hallucinations, poor memory, etc.). It should not be given in conjunction with Demerol. It may cause heart beat irregularities, and its use should be avoided in those with peptic ulcer disease.
Levodopa or L-dopa

This medication was introduced in 1967, and is still the mainstay of treatment. L-dopa dramatically improves all the cardinal symptoms of PS, especially rigidity and bradykinesia, although tremor may not respond well to it alone and may require the use of anticholinergics. The usual starting dose of L-dopa is 50 to 100 mg/day in two or three divided doses, and the dose is increased every few weeks until a satisfactory response is obtained.

Common side effects include nausea, vomiting, insomnia, weakness, sweating, emotional changes, dizziness with changes in position, nightmares, confusion, hallucinations, paranoia, heart palpitations and dyskinesias. Hypersexuality is a very rare side effect of L-dopa therapy, despite information that appears from time to time in the press. Lack of response to L-dopa suggests an incorrect diagnosis, inadequate dosage, or undesirable drug interactions.

If it bothers the stomach, it should be taken with food (although it is best absorbed when given 15 to 30 minutes before meals) and more carbidopa may be given (it is available on its own without L-dopa). It can also be given with a medication called domperidone (Motilium) 10 to 20 mg three times daily one hour before eating. Ginger tea may help with nausea.

After three to five years of treatment, the improvements obtained with L-dopa tend to diminish and it may then have to be given as frequent small doses. L-dopa treatment failures and complications represent the most challenging problems in the management of PS.

When dopamine is taken orally, it is not absorbed directly into the substantia nigra cells that need it. L-dopa however is absorbed into the brain and it is converted into dopamine in the black brain cells replenishing the supply of dopamine in the black cells, and giving temporary relief of symptoms.

About 80 to 90 per cent of Parkinsonians respond well to L-dopa therapy, but a small percentage cannot tolerate side effects. Also, since large doses must be given to get enough dopamine in the brain cells, after some years of treatment its beneficial effects may become short-lived. Thus many medical experts believe that L-dopa should be reserved for use only when symptoms are disabling enough to hamper daily living, while others maintain that, since it works well in so many people, L-dopa should be given as soon as PS develops.

Decarboxylase Inhibitors

These medications prevent L-dopa breakdown in tissues other than the brain and are usually added to L-dopa pills so that the L-dopa won’t disintegrate before reaching the brain.
These medications include carbidopa and benserazide. L-dopa with carbidopa is Sinemet, and L-dopa with benserazide is Prolopa.

Treatment is usually started with a low dosage of Carbidopa/Levodopa 100/25 (100 mg of levodopa, 25 mg of carbidopa), such as one-half tablet twice per day. The dose is then gradually increased by half-tablet increments over several months to a full tablet three times a day depending on the response and tolerance. Early in the treatment course this medication is usually taken after meals to avoid nausea, and as the stomach adjusts to the medication, it is then taken before meals as it is absorbed better.

A sustained release form of Carbidopa-Levodopa is called Sinemet CR (200/50). This allows people to take the same total mg per day dose with only half the number of doses. It is important to make sure that patients understand that this medication is given in divided doses during the day — all the tablets are not taken at once like many other so-called controlled release or sustained release medications. It is especially helpful for people with sleep disturbances, and regular carbidopa-levodopa can be used with it in the morning for a quick “kick-in.” Sinemet CR is started as one-half tablet twice a day (with breakfast and supper), and increased by one-half tablet per day every two weeks. The tablet should not be chewed.

Anticholinergics can be used to help reduce tremor if this medication does not do that on its own. Sinemet CR can be broken in half, but it is now available in a half-dose size (100/25) so breaking is not necessary.

Nausea caused by L-dopa (or any medication with this in it) can often be stopped by taking domperidone (Motilium) 10 to 20 mg 30 to 60 minutes before taking the L-dopa, or by using Vontrol (diphenidol, 25 to 50 mg up to every four hours). Some have suggested that ginger tea may help, and additional Carbidopa can be taken. Conventional antiemetic drugs such as Stemetil, Torcan, Tigan, and Compazine should be avoided.

Dopamine Agonists

Dopamine agonists are substances which act like dopamine on the dopamine 1 and/or dopamine 2 receptors in the Striatum without the need for conversion to any other form (unlike L-dopa which has to be converted to dopamine). They can thus be considered to be an artificial form of dopamine. The dopamine agonist acts directly on the dopamine 1 and 2 receptors, by passing the degenerating cells in the SN and the NigroStriatal fibers, and if they can be administered in an effective dosage without causing too many side-effects, the symptoms of PS are much better. Despite their chemical differences, the dopamine agonists (when used alone or with levodopa) improve symptoms in the same number of PS people. However, individual people react differently to these drugs; some
improve much more on one drug, and some develop side effects on a particular drug and not on another. Moreover, in most people when the response to one dopamine agonist decreases, symptoms improve when another agonist is substituted.

Bromocriptine (Parlodel) was the first dopamine agonist available and is available as a 2.5 mg scored tablet and a 5 mg capsule. It is usually started at a dose of 1.25 mg once daily, with gradual increases every week up to 2.5 mg to 7.5 mg three times per day. Occasionally higher doses are used.

Pergolide (Permax) is also available in 0.05 mg, 0.25 mg, and 1 mg tablets. The average dose used is 3 mg per day, starting at 0.05 mg per day for two days, and increasing by 0.1 mg per day every third day. The maximum dose is usually 6 mg per day. It is longer acting than bromocriptine, and may be more useful in people with advanced disease.

Ropinirole (Requip) is a dopamine agonist like Bromocriptine and Pergolide. It comes however from a different chemical class, and some people may tolerate it better than the older dopamine agonists. It comes in 0.25 mg, 1.0 mg, 2.0 mg, and 5.0 mg tabs. It is taken three times daily, starting at 0.25 mg a dose, and it can be increased by 0.25 mg per dose at weekly intervals till a dose of 1 mg three times a day is reached. It can then be increased more rapidly to a maximum dose of 24 mg per day. It has the potential side effects of nausea and dyskinesias, especially at higher doses.

Pramipexole (Mirapex) is another newer dopamine agonist. A significant reduction in “off” time has been noted with Pramipexole.

Dopamine agonists can potentiate or imitate L-dopa effects, and may be used alone or with L-dopa. When used with L-dopa, they usually allow a lower dose of L–dopa to be used.

Whereas Bromocriptine and Pergolide have been approved for use as adjuncts (add-on treatment) to L-dopa, both Ropinirole and Pramipexole have been found effective in treating the symptoms of early Parkinson’s when given alone. The benefit may be a little less than that derived from L-dopa, but some experts believe that it may be preferable to introduce treatment with a dopamine agonist rather than L-dopa in an effort to slow down the progression of Parkinson’s that might occur with L-dopa use, and because there may be a decreased risk of treatment related complications, including fluctuations in motor function and involuntary movements or dyskinesias.

These medications are costly and may have unpleasant side effects. Nausea and low blood pressure are most common, but vomiting, confusion, hallucinations, dizziness, impotence, sleepiness, heart palpitations and heart pain (angina) may occur with any of these drugs. There have been occasional reports of
PARKINSON’S SYNDROME

Pramipexole and Ropinirole causing sudden sleep attacks leading to motor vehicle accidents. Their effects are potentiated by the use of certain antibiotics such as Erythromycin, and with high blood pressure medication such as “ACE inhibitors” (e.g., Enalapril or Vasotec, Capoten or Captopril, etc.).

**Catechol-O-methyltransferase (COMT) Inhibitors**

COMT (Catechol-O-Methyl-Transferase) inhibition is a newer form of therapy. The Striatum can be thought of as a sink with one tap and two outlets. The dopamine deficit in the Striatum of PS people is substituted by intake of L-dopa. L-dopa is converted into dopamine, the substance that makes the Striatum work properly. In PS people, the sink is empty because of decreased dopamine from the Substantia Nigra, and because what little dopamine is present is destroyed by two enzymes, one called monoaminooxidase- B or MAO-B, and the other called Catechol-O-Methyl- Transferase or COMT. It has been found that blocking the MAO-B enzyme leads to a small increase of the dopamine in the striatum. This is one of the ways the drug Selegiline (Deprenyl, Eldepryl) works. But blocking the other outlet (COMT) leads to a larger increase of dopamine in the striatum.

Studies have suggested that COMT drugs may make L-dopa as much as two to three times more effective. It is thought that these drugs have to be taken with L-dopa as they are inactive on their own. They can reduce the “wearing off” problems that some people experience, and some people can reduce the dose of L-dopa they take by up to 50%.

**Other Medications**

**Apomorphine**

Apomorphine is a drug with anti-parkinsonian properties that are qualitatively similar to those seen with L-dopa. Although used in the 1950s, apomorphine was not widely prescribed because of the need for administration by injection and adverse reactions such as nausea, vomiting, low blood pressure, and sedation. In Europe it is being used as a continuous infusion with the aid of a mini-pump to deal with “off period” disabilities such as pain, bladder dysfunction, dystonia, and gastrointestinal symptoms.

**Chelation**

There is no evidence that iron chelation therapy helps PS, and it is not recommended for it. Additionally, there is little evidence to suggest that giving iron helps PS, and iron is not a recommended treatment.

**Dextromethorphan**

Dextromethorphan (DM) a common ingredient in over-the-counter cough syrups may help tremor and rigidity, but it has to be taken at 120 to 180 mg per day (the usual dose for coughs is up to 90 mg per day).
Immunoglobulin (IGIV)
There have been some reports of intravenous Immunoglobulin (IGIV) treatments helping those with PS, but it is unclear if such treatments are of any benefit.

NADH (nicotinamide adenine dinucleotide hydrogen)
NADH, also called Coenzyme 1 or Q1, is being promoted for treatment of PS. Note that this is not NAD, but rather “reduced NAD or NADH.” There are no clinical studies showing its usefulness for PS, but there are reports of it helping some symptoms and of PS people being able to reduce their dose of L-dopa while on it. It may have some potential to do harm if too much is taken, one of the common side effects being insomnia.

Complications of Long-term Medication Use

Unfortunately drug side effects from long-term use of medications may become worse than the symptoms they’re meant to suppress:

Dyskinesia

This means bizarre, involuntary, jerky movements of the head, tongue, and extremities, and is a particularly troublesome side effect of L-dopa. The abnormal movements can gradually become incapacitating unless the L-dopa dosage is reduced. Small doses of L-dopa, stopping anticholinergic therapy, and using bromocriptine with the L-dopa may help to control this.

“Frozen State”

A wearing off response to medication, with a return of symptoms can produce an awkward, “frozen” state that may persist until more medication is absorbed, although people sometimes spontaneously “unfreeze” without more medication. Freezing episodes, especially when starting to walk, run, or change direction, may become frequent as the effect of the drugs wear off. For some people taking more medication can bring on bad side effects, but not taking it may mean a worsening of the Parkinsonian symptoms.

End of Dose Deterioration

As each dose of medication wears off, symptoms may return with varying “good” and “bad” times through the day. More frequent L-dopa doses, sometimes with bromocriptine may help, and Sinemet CR may help.

Addiction to L-dopa
People who have had a problem with drug addiction (alcohol, street drugs) may become addicted to L-dopa, and experience withdrawal effects when it has to be stopped.

**The “On-Off” Phenomenon**

Sudden spells of immobility, apparently unrelated to drug doses, may occur several times a day and last from minutes to hours. Drugs do not help this type of parkinsonian immobility, but lowering the L-dopa dosage (and sometimes adding bromocriptine) may help these.

**Surgery**

Surgery, once a mainstay of treatment, was abandoned in the 1960s, when L-dopa therapy was introduced, and because of a high incidence of complications. However, improved techniques, as well as the limitations of drug treatment, have prompted a return to surgical treatments. Of the four procedures available, the two most established — thalamotomy and pallidotomy — require the destruction of certain brain cells that interfere with normal movement. These cells can be identified by using electricity to stimulate various areas of the brain (a procedure called brain mapping). The technique is also used to identify cells that control sight and other senses, so that they won’t be inadvertently destroyed during surgery.

Candidates must be relatively young (usually under age 65 or 70), in otherwise good health, and have the specific symptoms a particular technique is designed to address. When appropriate, surgery often relieves symptoms and decreases the need for medication (but may not eliminate the need for medications altogether), but it’s not a cure — nor does it stop progression.

Surgery can be a reasonable choice, but only if you have the specific symptoms for which a procedure was developed, and only when medication produces intolerable side effects or can no longer provide adequate control of symptoms. The four surgical options are:

**Thalamotomy**

The oldest type of surgery (thalamotomy) affects only tremor on the opposite side of the body to the surgery, and in the past was associated with significant postoperative deficits such as weakness, numbness, and disturbances of memory and language. New brain mapping techniques limit the risk of serious permanent complications (such as paralysis, loss of sensation, and stroke) to less than 1% now, with confusion and balance problems sometimes occurring. In this technique, the surgeon destroys a specific group of cells in the thalamus, the main relay center of the brain. Thalamotomy is appropriate for the 5 to 10%
of people who have a disabling tremor of the hand or arm, and few other symptoms. Improvement is immediate, with 80 to 90% of people experiencing a significant reduction or even elimination of tremor.

The procedure is performed with the person conscious, under local anesthesia and sometimes sedation. The hospital stay is usually two days, with full recuperation in six weeks. Risks include temporary balance disturbances and numbness around the mouth and in the hand.

**Pallidotomy**

Pallidotomy is also done by using “brain mapping” techniques. Microelectrodes are implanted by a surgeon in a specific group of cells within the globus pallidus, a portion of the brain’s movement center, and a current is passed through them. This causes lesions in the part of the brain that cause dyskinesias which usually improves them.

Although the criteria for pallidotomy have not been firmly established, the technique seems to be most effective for slow movement, with improvement in off-period motor scores, and is especially useful to ameliorate the side effects of medication such as severe dyskinesia and widely fluctuating symptoms. It may not help gait disturbances and falling, and sometimes does not help tremor much.

Like thalamotomy, pallidotomy is performed with the person conscious, and requires a similar recuperation period. Risks and benefits are also similar, with the additional possibility of damaging peripheral vision. Careful brain mapping limits the risk of visual impairment to between 2 and 5%. PS medication has to be continued after the surgery, and this treatment does not stop the progression of PS, but can give relief from dyskinesias for three to five years.

**Deep Brain Stimulation (DBS)**

An even newer type of surgery is called deep brain stimulation or DBS. In this technique, an implantable stimulator is placed in the globus pallidus or thalamus of the brain. The stimulator is hooked up to an external device (much like a heart pacemaker is hooked into the heart) which can emit an electric current when triggered. When the device is triggered, the brain is stimulated without being destroyed.

The long term effects of this technique have yet to be determined, but preliminary studies suggest it helps relieve or improve tremor in the majority of people who receive it. It also tends to reduce dyskinesia, but tends to have little or no effect on rigidity and bradykinesia. This is the basis for the “Parkinson’s pacemaker” that has recently been reported in the news.
Fetal or Neural Tissue Implantation or Transplantation

The goal of this experimental technique is to restore brain function by replacing damaged tissue in the dopamine-producing area of the brain with brain tissue that will produce dopamine. Because of the ethical concerns surrounding use of fetal tissue, it's likely that genetically engineered cells may one day be used. While neuroprotein systems are being developed that will provide protection from breaking down for the neurons that produce dopamine naturally, within the last years, scientists have discovered how to make “cultured” brain cells grow into the specialized nerve cells that are lost in PS. This discovery may make brain cell transplants less controversial and more widely available.

Additionally, the implantation of some types of animal cells such as pig brain cells is being studied and early results are encouraging. Specific criteria and optimal techniques have yet to be determined for transplanting cells into the brain, and most people undergo the procedure as part of a study. Short-term research indicates that implantation can cut the need for medication in half, but it may take up to six months for improvement to become apparent. The risk of stroke and other serious complications is estimated at no more than 5%. A history of cardiovascular disease, stroke, or dementia precludes surgery.

Physical and Occupational Therapy

Caregivers must get in the habit of letting individuals with Parkinson’s do things for themselves. The symptoms of PS can keep people from using their muscles adequately. Although prescribed medication will help relieve the symptoms, it is as important for people to keep as physically active as possible as it is for them to take medication. For most people, a simple at-home exercise program is strongly recommended, and must be done as regularly as taking medication. All physical activity is beneficial, from taking long walks to self-feeding, bathing, dressing and doing chores at home. No task should be undertaken to the point of fatigue. When fatigue sets in, the person should rest. Swimming and walking are particularly good for maintaining fitness and muscle tone.

People with balance problems should avoid walking alone. Individuals with a tendency to freeze in their movements should be supervised carefully and should only do exercises when sitting or lying. Individuals with fluctuations in the effectiveness of their medication should not be pressured to exercise during “off” periods when the medication is not working. Forcing people to walk or exercise during their “off” or “bad” periods will not “loosen them up.” Such exercises can be painful, as well as dangerous. When people emerge from an “off” period, most are so relieved that they will start moving about on their own, and encouragement and assistance at this time will motivate them even further.
Those who are unable to exercise for themselves should receive daily passive range-of-motion exercises to prevent permanent contractures of limbs. Tai Chi has been taken up by many with PS with great benefit.

Physical Therapists and Occupational Therapists can help initiate a program of home therapy and can provide advice about appropriate adaptations of household furnishings. Gait training, strength training, and balance training can help with balance and help to prevent falls. Railings, and specially designed toilet seats, eating utensils, dishes, dressing aids, garments, shoes, canes and walkers, and easy chairs can all be of help depending on the need for them. Speech therapy and even speech amplification devices can help if speech is affected. Using an electric razor may become necessary. Shoes without laces such as loafers may be best (and they may need non-slip soles). Close attention should be paid to keeping the mouth and teeth clean. And, physical exercise is very important for a caregiver, and must not be forgotten.

**Stretching**

Stretching is important because Parkinson’s can cause muscles to feel stiff and tight, especially when medications are wearing off. Sometimes muscles ache with PD. Muscles can become weak and joints may stiffen. Gradually people with Parkinson’s can become stooped and shuffle. Even being able to breathe deeply may be difficult.

There are many, many different stretches, but with PD the most useful stretches are those for the neck, front of shoulder, the trunk, the back of the legs and hands.

**Strengthening**

Parkinson’s does not directly cause weakness of muscles. But it can have a marked impact on muscle strength if it progresses to the point that everyday tasks are affected.

In mild to moderate Parkinson’s muscle strength can be maintained by keeping up an active life – walking, cycling, jogging, golf, bowls, swimming – any physical activity that the person enjoys. When Parkinson’s starts to limit these activities, then muscle strength must be maintained in other ways that are structured and safe. (i.e., weights, resistance tubing, balls and springs). Individuals may need extra prompts or cues to ‘kick-start’ exercises. Exercising to music or counting out loud are excellent ways of overcoming the slowness of Parkinson’s.

Muscles to focus on:
• The large muscles of the arms and legs.
• The muscles of the trunk – abdominals and back extensors.
• The muscles of the upper back and neck.
Fall Prevention

Falls are common in people aged 65 years and older and are the leading cause of injury in this age group. It has been estimated that up to 40% of people with Parkinson’s have problems with balance and falling.

Parkinson’s affects the automatic actions of the brain - like balance control. Loss of balance and falling can be a common feature of Parkinson’s caused by a variety of factors:

- slowness and weakness of the legs
- dizziness due to lower blood pressure
- painful joints
- cataracts

Research has shown that exercise can enhance balance and significantly reduce falls.

The following are some precautions and tips for patients to prevent accidents and falling.

- Avoid carrying objects in both hands while walking.
- Avoid standing for long periods with feet too close together, this can increase the risk of falls.
- Increase stride length when walking. Falls may result when individuals shuffle their feet, or as a result of foot drag, which is common among people with Parkinson’s disease.
- Swing arms when walking. This helps maintain balance and decreases fatigue.
- If feet feel ‘frozen to the floor’ when walking is initiated, attempt to step over an imaginary obstacle, or initiate the transfer of weight by rocking from side to side.
- Do not wear rubber-soled shoes because they grip the floor and may cause you to trip.
- If rising from a seated position is difficult, place feet directly under the knees, lean forward and stand up firmly in a smooth movement. Rather than using the hands and arms when attempting to stand up, use the thigh muscles. This exercise also helps strengthen the large muscles of the legs, maintaining strength and walking ability.
- If feeling lightheaded, move slowly when changing positions. When getting out of bed, sit up slowly, remain seated on the side of the bed for 15 to 30 seconds, and then stand in one place for 15 to 30 seconds before walking. This technique can prevent falls.
- Do not use throw rugs or wax the floors in the home home. Ensure that rooms are well lit, and use night-lights in hallways and bathrooms. Keep the home free of clutter to prevent tripping.
• Install grab bars to get into and out of the bath and shower. A raised toilet seat with arm rails may also be a helpful.

Walking

Walking becomes a task which cannot be performed without considerable attention. The automatic arm swing and weight transference become progressively diminished. Some people become stooped and their footsteps get smaller.

Some patient tips to improve gait:
• Visualize taking long steps.
• Think “back straight” and look ahead.
• Tell arms to swing.
• Tell heel to touch first.
• Plan the route.
• When turning around, walk in a semi circle, don’t swivel on one foot.
• If feeling unsteady, stop and take a step to recover.
• Don’t walk and talk at the same time.
• Walking to a regular beat like music works well.
• Try walking with a group.
• Always wear supportive shoes, but not with rubber soled soles as this increases friction making it more difficult to walk.

Relaxation

Living with Parkinson’s means that much mental energy is needed to do even simple things. Huge amounts of energy are expended, resulting in mental and physical fatigue. Anxiety is a feature of many people’s PD, especially in the ‘off’ times of medication.

Learning to relax is part of living well with Parkinson’s. There are many relaxation techniques that will help you. The following are just some techniques that people with Parkinson’s and families may wish to try.

Relaxation position
• Position self supine with a small pillow under the head.
• Put a small pillow under the knees.
• Take a deep breath in through the nose.
• Breathe out, opening the mouth and sigh a long, loud AAAAAHHH.
• Repeat 3 – 5 times.
• Be aware of any tension in the face, relax the jaw.
• On the in-breath feel the abdomen rise, then fall on the out-breath.

Concluding relaxation
• If feeling deeply relaxed, start to move fingers and toes.
• Breathe in, lifting arms up in the air.
PARKINSON’S SYNDROME

• Breathe out; lift arms above the head, stretching them back towards the floor.
• Hold and stretch for 2 breaths.
• Breathe in and lift arms back up.
• Breathe out, lower arms to sides. Turn over, slowly sit up.

Activities of Daily Living

Fine Motor Skills
A resting tremor may occasionally interfere with the functional activities that involve the hands. To better manage the tremor, have the person press the affected elbow against their body to stabilize the upper arm, and then perform the desired movement as quickly as they can.

Dressing
Dressing and undressing can be very tiring and time consuming. The following tips can help make dressing quicker and easier:

• Put on and take off clothes from the stiffer side first.
• If standing balance is affected, have the person sit over the edge of the bed or in a chair with armrests to dress.
• Use elastic waistbands or Velcro closures instead of buttons or zippers.
• Choose loose, lightweight clothes.
• Choose clothing that closes in the front.
• Use elastic shoelaces or slip-on shoes.
• Use a long-handle shoehorn to assist with shoes

Bathing
The bathroom is usually the most dangerous place for anyone with impaired balance, difficulty in walking, or tremors. When bathroom surfaces are wet, they are extremely slippery. Some preventive measures to avoid accidents are:

• Place a non-slip rubber mat or adhesive anti-slip surfaces at the bottom of the tub or stall shower.
• Remove glass doors from the tub.
• Use a tub bench or shower chair.
• Try a showerhead on a flexible hose.
• Attach soap to a rope which makes retrieving easier.
• Avoid using bathroom fixtures (i.e., towel racks) as grab railings since they are not very strong. Have grab bars installed if more support is required.
• A raised toilet seat makes rising easier and arm rails can be attached to the toilet seat or wall for leverage.
Driving
Many people in the early stages of PS are capable of driving. However, depending on the stage of the disease, and the medications being taken, it may be unwise for an individual to drive, even if they feel they can. PS can affect reaction time, and defensive driving skills may be diminished. People on medications and with the more advanced stages should not be allowed to drive.

Diet
In the early stages of PS, because the tremor and the muscular stiffness burn a lot of calories, an increase in food intake may be needed to maintain weight. The patient should be weighed at least once per week to monitor weight loss. In the middle and late stages of PS, a low protein diet may be necessary (this will aid in the absorption of L-dopa into the body). There is often a compromise between taking L-dopa on an empty stomach (to get full absorption) and taking it with food (to prevent nausea and vomiting). If there is weight loss, PS people should not skip meals. Supplements such as Carnation Instant Breakfast or Ensure or Sustocal or Enercal may be started either to ensure proper nutrition, or to prevent weight loss. Smooth solids and thick liquids are swallowed best. Tucking the chin to the chest when swallowing helps prevent aspiration. The patient should be upright (at 60 to 90 degrees) for meals and should remain sitting upright for 15 to 30 minutes after meals.

Since the conversion of L-dopa to dopamine is aided by an enzyme that requires vitamin B6, it was initially thought that more B6 would increase the conversion of L-dopa to dopamine. However, it is now known that B6 given with L-dopa counteracts the effect of L-dopa. Sinemet and Prolopa do not have this problem. People who are on L-dopa without Sinemet or Prolopa should avoid foods high in B6, such as avocados, lentils, and lima beans.

In India, the seeds of the Cowhage or Cow Itch plant (Mucuna pruriens) is made into a powder (which is mixed as a liquid and swallowed as a drink or encapsulated and swallowed) which is used as a drug called Atmagupta for the treatment of PS. L-dopa has been isolated from Macuna beans, and it is likely that which gives this medicine its therapeutic properties. Apparently there may also be some other substance in it as yet unidentified that may also help. The Fava bean (Vicia fava) or broad bean has been known to contain small amounts of L-dopa since 1913, and their consumption of course will help PS, although it apparently takes a lot of beans to make a difference.

Because Vitamin E and Vitamin C have anti-oxidant effects, it was hoped that Vitamin E or C might delay the progression of PS, but so far studies have been disappointing. Vitamin E, used at a dose of 2000 IU per day, does not seem to work.
The issue of whether or not Aspartame (NutraSweet, Equal) predisposes to or is safe for those with PS (especially if on medications like L-dopa and Eldepryl) remains controversial.

Some have wondered if the herb Ginkgo biloba might help PS people, but as yet there are no studies telling whether it is harmful or whether it can help. It has been speculated that in people with a genetic predisposition to this disease, certain types of foods can hasten the onset of the disease. The chemicals in these foods thought to be toxic to the brain are called Pyridines, and it is postulated that these substances are “methylated” in the body to get rid of them, but the methylated form is toxic to the brain. As yet there is no direct proof of this theory, but it may be that in the future a pyridine free diet will be prescribed for people with PS.

**Hospital Tips**

The hospitalized PS person, because of slowness and stiffness, is at increased risk for hospital acquired complications. Pneumonia, aspiration, urinary tract infection, clots (phlebitis) in leg and pelvic veins (that can break off and go to the lungs), and skin ulcers are particular concerns. Mobilization, careful feeding, preventative measures for phlebitis (especially after surgery) and attention to skin care may be life saving. It is also important to ensure that the PS person continues to get their medications according to their schedule (and not the hospital’s), and the PS person and their caregivers need to become part of the hospital staff team to ensure that this happens.

**Comorbidities**

People with PS often have other medical conditions. Sometimes these conditions, or the drugs that are prescribed for them, influence the treatment of PS. Some of these conditions are:

**Glaucoma**

Glaucoma may be exacerbated by anticholinergic drugs. These drugs do not necessarily have to be discontinued in people with glaucoma, but should be used with care. People with both conditions should be carefully monitored by an eye doctor.

**Heart Disease**

People who have had a recent heart attack, or whose heart rhythm is irregular (arrhythmia), may be sensitive to the side effects of some antiparkinson drugs. People who have had a recent heart attack may not be able to tolerate the slight
drop in blood pressure caused by some of the antiparkinson drugs. These drugs may not have to be stopped as long as the drugs' benefits exceed their risks.

**Hypertension**

In rare instances, drugs used to treat high blood pressure may worsen PS symptoms.

Clonidine is such a drug, but the effect is temporary and will disappear when Catapres is stopped. Clonodine should be avoided if another suitable drug is available.

Aldomet (methyldopa) may compete with the carbidopa in Sinemet and may decrease the beneficial effect of Sinemet. This does not always occur, and Aldomet does not have to be stopped in people with PS.

Diuretics are frequently used to treat people with high blood pressure or heart disease. Water pills produce a decrease in the amount of body fluid, which may result in dizziness on standing. This dizziness is more likely to affect PS people, particularly those who take Sinemet or a dopamine agonist.

**Stomach, Intestinal Diseases**

There have been some isolated reports relating bleeding ulcers to Sinemet and the dopamine agonists. However, no direct cause-and-effect relationship has been established. Sinemet and the dopamine agonists may open the valve like mechanism between the esophagus and the stomach, resulting in gastric reflux and causing an inflammation of the esophagus. This may be followed by nausea and vomiting, which will result in further inflammation. People who have a hiatus hernia are especially vulnerable to this complication. This inflammation may result in erosion of the wall of the esophagus, which can lead to bleeding. People who have a hiatus hernia, and take PS drugs, should follow an appropriate diet. In addition, such people may require antacids or other measures to decrease the inflammation. Antacids should not be taken within one hour of other medications since antacids may decrease the absorption of other drugs.

People with a history of liver disease, jaundice, or hepatitis should have “liver function tests” before taking antiparkinson drugs. These tests may have to be repeated periodically.

**Bladder Conditions**

Drugs such as the anticholinergics, Symmetrel, and some of the antidepressants may cause a temporary inability to void. This is especially likely to occur in men.
with an enlarged prostate gland. These drugs should be used carefully in such people.

Cancer

In general, the influence of a cancer on PS is not known. There have been a few reports in which the use of L-dopa has been associated with the growth of a melanoma. However, there have also been reports in which L-dopa has been given to people with melanoma who showed no accompanying increased growth in the skin tumor. Although this relationship is still unproven, caution is urged when using L-dopa with PS people who have a history of melanomas. If the person's neurological condition worsens to the point where the PS becomes the main problem, then L-dopa should be used with the knowledge and consent of the person.

Sleep Disorders and Parkinson’s Syndrome

Insomnia is now being recognized as a symptom that can have a significant impact on diseases and the quality of life. Fifty percent of PS people have sleep disorders. Insomnia is not a diagnosis. It is a symptom of many disorders and it has to be assessed like any other symptom. A management plan comprises documentation of the nature and duration of the sleep complaint (sleep diary), improvement in sleep hygiene, and possibly intervention with other techniques and medications.

Some sleeping difficulties, especially vivid dreaming and myoclonus, are related to L-dopa. Readjustment of the dose of L-dopa, and eliminating the evening dose (if possible) may improve the patient’s sleep. On the other hand, some patients require L-dopa to sleep because a lack of medication makes them so rigid that they cannot turn in bed.

Dementia and Parkinson’s Syndrome

Dementia means an irreversible permanent general mental deterioration including some or all of the following: disturbance of memory, disturbances in learning, reasoning, thinking, calculation, and aptitudes, and disturbances of personality and judgment. For many years, it was thought that intellectual deterioration was not an intrinsic feature of PS. It now appears that PS people are at high risk (10 times that of age-matched controls) of developing dementia. The incidence of brain cell changes of the Alzheimer type is higher in people with PS than in age-matched controls. Because so many symptoms of dementia in PS people seem to involve a slowing of both mentation and motor activity, it has been suggested that the part of the brain involved in PS (the black cells) may
play an important role in mental functioning (which had always been thought to
be the function of the grey matter of the brain).

The detection of cognitive impairment and dementia in PS people is best done
using the CAMCOG neuropsychological test as it is more sensitive than the
MMSE test.

Dementia often, but not always occurs late in the course of PS. It must always be
remembered that the drugs used in the treatment of PS can cause mental
confusion. When mental confusion occurs in a person with PS, a decision has to
be made as to which is worse: movement symptoms of PS left untreated, or the
mental confusion. If the mental confusion is severe enough to be a problem for
the person with PS, or their caregivers, then there has to be a withdrawal of
drugs to see if the person’s mental functioning improves. Anticholinergic drugs
are withdrawn first, followed by dopamine agonist medication and lastly levodopa
preparations. The progressive withdrawal of medication may need to be
done in the hospital because of the risk of complications such as severe rigidity
and immobility, heightened risk of falling, aspiration, and rarely a severely
elevated temperature. As the effects of the medications wear away, the person
with PS can then be assessed to see if changes in mental ability were secondary
to drug use, or were going to be present even in the absence of drugs. Currently
dementia in PS is treated the same as any other type of dementia (such as
Alzheimer’s Disease).

Newer drugs such as Donepezil (Aricept) may improve cognitive and behavioral
functioning in PS people, just as it does in some Alzheimer’s patients, although
there are no clinical studies proving this as yet. The initial dose of Donepezil of 5
mg at night must be continued for at least 3 months before the dose is increased
to 10 mg at night.

An early symptom of drug toxicity in someone with PS is often nocturnal upset
such as nightmares. Various daytime illusions then follow, with constant severe
confusion and agitation in the final stage. Almost any drug may adversely affect a
person with PS who is developing dementia. Pain killers (even aspirin), minor
tranquilizers (Serax or oxazepam, Ativan or lorazepam, Valium or diazepam,
Rivotril or clonazepam, Lectopam or bromazepam, Xanax or alprazolam, Loftran
or ketazolam, sleeping pills containing “benzodiazipams,” etc.), antidepressants,
and the anti-ulcer drug Cimetidine have all caused problems. The worst
offenders are drugs with “anticholinergic” properties such as some of the drugs
used to treat PS, many of the drugs used for urinary frequency, and even some
of the drugs that are usually used to control symptoms that accompany
dementia.

Drug holiday is no longer recommended for the general management of
levodopa complications, but occasionally a few days off all medication is
necessary to clear severe drug-induced confusion. Some late stage people with

Innovative Educational Services
To take the post-test for CE credit, go to: WWW.CHEAPCEUS.COM
35
PS and dementia may be managed with small, frequent doses of levodopa-carbidopa (50 to 100 mg, four to six times per day or half a tablet of 100/25 every two hours), or plain levodopa tablets (250 to 500 mg) may induce less confusion in these people.

**Psychosis in Parkinson’s Syndrome**

Probably because of news media and movie presentations, for most people, the word “psychotic” usually brings immediate fearful feelings to mind. Medically speaking however, a psychosis is a mental disorder in which a person’s mental capacity, emotional responses, and capacity to recognize reality, communicate, and relate to others are impaired enough to interfere with their capacity to deal with the ordinary demands of life. Psychosis occurs in approximately 30% of people with PS within 5 years of starting treatment with L-dopa. Psychosis in a PS person decreases their quality of life, increases caregiver stress, and poses a dilemma for treating physicians. PS people and their caregivers are often reluctant to report psychotic symptoms which delays the diagnosis of them, and doctor’s often hesitate to treat the symptoms for fear of worsening parkinsonian symptoms.

A hallucination is a false sensory perception without a concrete external source for the perception. Common hallucinations involve sights or sounds, although any of the senses can be involved. A delusion is a false fixed belief that is not in accord with a person’s intelligence and life situation. Common delusions include delusions of control which is a false belief that the person is being manipulated by others, delusions of grandeur which is an exaggerated belief of the person’s importance, delusions of infidelity which is a false belief that a person’s spouse is unfaithful, delusions of persecution which is a false belief that the person is being harassed by others, and paranoid delusions which is an over suspicious belief by the person about the actions of others.

Commonly reported symptoms in PS that are signs of a psychotic condition include: visual hallucinations (which are the most common), auditory hallucinations, sleeping alterations, vivid dreams, delusions, paranoia, altered sexual behavior and agitation. Psychotic symptoms can occur when a person seems otherwise clear mentally, but they can also occur with delirium (which medically speaking is actually a psychotic state in which confusion is a major symptom) or with a dementia. As an aside, delirium (a confusional state) is usually acute in onset, but may be chronic if it is mild and goes unrecognized for some time. It is characterized by a fluctuating level of consciousness that often becomes more pronounced as the day progresses (“sundowning” effect). Anticholinergic medications can cause or worsen delirium. There may be several causes for delirium in the same person going on at the same time. Hallucinations in PS often occur when the person seems otherwise clear, and are characterized by images from the person’s past. Realistic images of people,
familiar or strange, are common. They may involve formed images of people or animals familiar to the person, or may involve dead relatives, absent friends or relatives. The most common type of delusions tend to be those of paranoia, most often involving feelings of persecution, being followed, fears of being injured, poisoned, or controlled.

Determining a cause for a PS person’s psychotic symptoms can be helpful in decisions that have to be made regarding treatment of them. Some experts find that a useful classification of psychotic symptoms is based on their timing related to the stage of the PS, or their timing related to the initiation of drug therapy for PS.

“Early onset” of psychosis refers to symptoms that develop within days to weeks of starting antiparkinsonian therapy. A prior history of a psychotic disorder is a risk factor for early onset psychosis. Late onset of psychosis is usually observed after years of L-dopa therapy, and most PS patients who develop this do not have a previous history of psychiatric disease. PS people with advanced stages of PS and who have a dementia are more at risk for late onset psychosis. This type of psychosis is often but not always related to antiparkinsonian drug therapy. Because there is no definitive test for the cause of a psychosis, the causes must be deduced from the person’s current and past history, the history their caregivers give, the relationship of the symptoms to drug therapy, and the quality and type of hallucinations and delusions.

Other than being antiparkinson drug induced, psychosis may also be caused by medical conditions such salt imbalances in the blood, thyroid disease, adrenal gland disease, some types of infections, low oxygen levels in the blood, and also by mental disorders such as depression, dementias, and alcohol or other substance abuse disorders.

Treatment with an antiparkinsonian medication is the most common cause of psychosis in PS, and can result from any of the antiparkinsonian drugs from any class (MAO inhibitors such as Selegiline, dopaminergic agents such as L-dopa, amantadine, and the anticholinergic agents such as Benztropine). L-dopa can cause many neuropsychiatric problems in PS, including depression, crying spells, very low energy, mood swings, euphoria, manic or “hyper” states, increase in libido or loss of sexual inhibitions, anxiety, panic attacks, social avoidance, agitation, restlessness, nightmares, night terrors, vivid dreams, delusions, confusion, delirium, visual or sensory (or both) hallucinations, personality alterations, and paranoid feelings or thoughts.

Diagnosis of psychosis in PS is often delayed because PS persons and their caregivers may view these symptoms as embarrassing and are reluctant to report them to their doctors, or, the PS person may not be able to remember episodes of psychotic symptoms so that they go unreported. Once recognized,
some investigations may need to be done to help sort out the cause, and then the issue becomes treatment.

Psychotic symptom treatment for PS persons with drugs is difficult as the optimal treatment for the psychotic symptoms may mean worse motor symptoms, and increased risk for falls and bowel problems for example. Thus part of the treatment of psychotic symptoms involves “behavioral interventions.” The PS person and their family may have to learn to accept and cope with the presence of hallucinations. Families need to be educated regarding symptoms and encouraged to provide a calm stable environment. Paranoid patients are less likely to behave aggressively if family members avoid showing alarm. A variety of psychologic interventions may be helpful for the PS person and their caregivers - supportive or expressive psychotherapy may help the patient cope better with issues of loss, impaired functioning, depression or disrupted relationships, and marriage or family counseling may help.

Drugs called neuroleptic drugs that are often used to treat psychotic symptoms in people without PS often worsen PS. The newer neuroleptics such as Clozapine are expensive, and may injure the bone marrow. Thus initial steps in psychotic symptom treatment may involve adjusting the dose or withdrawing antiparkinsonian drugs other than L-dopa. If the symptoms persist, then the L-dopa dose may have to be adjusted. It should be noted that the effects of dosage reduction may take weeks to become apparent. In some, there may be a “threshold” dose of L-dopa, below which there are no psychotic symptoms, and above which the psychotic symptoms recur. In some, higher doses of L-dopa may be tolerated later on without recurrence of their symptoms. Unfortunately for many PD people, it may be impossible to find a dose that gives acceptable control of the motor symptoms without causing psychotic symptoms. If the psychotic symptoms are not relieved, then treatment with a “neuroleptic” drug can be tried. Many experts think that currently Clozapine is the drug of choice as it does not usually worsen motor symptoms and adjustment of L-dopa dosage is not necessary. However, it does have potential side effects, such as sedation, and bone marrow injury, and it can lower blood pressure significantly leading to falls or black outs. It occasionally paradoxically worsens the psychotic symptoms instead of improving them because of its anticholinergic activity. Another medication that can be used is called Risperidone, although it is more likely to worsen motor symptoms than Clozapine. Olanzapine at 2.5 mg to 10 mg per day is less likely to worsen motor symptoms than Risperidone, although more likely to lower blood pressure. Ondansetron is another medication that has been used in this situation. If the PD person has depression, ETC. treatment may help both the depressive and psychotic symptoms.
Caring For the Caregiver

“When one is sick, two need help.” Ms. Paula Goldberg, R.N., has explained the meaning of this quotation in talking about the roles a caregiver should fill in the life of the person with PS and in their own life. There are positives to caregiving, such as increased closeness and better communication between the person and the caregiver. There are also negatives, and it is important to eliminate or control as many negatives as possible. Caregivers face multiple problems related to day-to-day aspects of life such as financial problems, career planning, change of life situation, and loss of hobbies and activities. Caring for a Parkinsonian person means dealing with their psychological and physical problems in addition to the caregiver’s own problems. The responsibility for the partner’s life can be overwhelming. Feelings of guilt, insufficiency, anger, and aggression commonly occur. The spouse often behaves as if the disease has stricken the couple as a “team,” which in many respects is true.

Studies suggest that as many as 60% of PS people are depressed, but about 30% of their caregivers are also depressed. It is estimated that less than 10% of PS people and their caregivers are being treated for depression, as it often goes unrecognized.

People and their spouses should remember that PS need not be as incapacitating as it appears. People and their spouses should do as many things together as possible. A spouse can participate in doctor’s visits and help report on the person’s progress, difficulties, and needs. Spouses should encourage PS people to go out socially. If embarrassment from a disability arises, there are methods to minimize psychological distress. For example, when expected for a social engagement, people can arrive early and leave late, or in a restaurant, a waiter can be asked to specially prepare the food before the person is served. Warning signs of caregiver stress include denial of the disease and its effect on the person with Parkinson’s, anger toward the Parkinson’s person or others because currently available treatments may not be perfectly effective or because no cures currently exist, social withdrawal from friends and activities that once brought you pleasure, anxiety about facing another day and what the future holds, depression affecting your ability to cope, exhaustion making it nearly impossible to complete necessary daily tasks, sleeplessness caused by a never-ending list of concerns, irritability leading to moodiness and triggering negative responses and reactions from others, lack of concentration making it difficult to perform your usual tasks, health problems that begin to take a toll, both mentally and physically.

Here are some tips for the caregiver:

- Don’t compare yourself to others; others may look like saints to you, but they have shortcomings too, even if they don’t show. Instead take talents from your past life and apply them to caregiving.
• Decide what absolutely must be done, and assign priorities, avoiding busy work. Learn to say no. Subdivide tasks into 15 minute sections, and keep a victory list of what you've accomplished.

• Reward yourself. Do something you enjoy that is unrelated to your caregiving routine.

• Humor and exercise are two coping mechanisms that are helpful for both you and the person you give care to.

The assessment of someone with PS isn’t over until it has been determined how the caregiver is coping. Most people with PS are seen every three months by a doctor, and the caregiver should always be seen with them. It is important for the caregiver to have adequate means of coping when difficult situations arise. PS can be variable in its daily presentation, and even minor changes in medication levels can affect the person drastically. It is the caregiver who, in the first instance, has to learn to cope with these sudden unexpected changes.

To provide the best care for the person with PS, the caregiver will need outside support (note that that is not “may need,” but “will need”). That support can be met by family, friends, and professionals. The caregiver should make the situation clear to family and friends, get a community resources list, join a support group, and be sure to keep the doctor and his staff informed.

Research

In recent years, Parkinson's research has advanced to the point that halting the progression of PD, restoring lost function, and even preventing the disease are all considered realistic goals. While the ultimate goal of preventing PD may take years to achieve, researchers are making great progress in understanding and treating PD.

Etiology

Genetics
One of the most exciting areas of PD research is genetics. Studying the genes responsible for inherited cases can help researchers understand both inherited and sporadic cases of the disease. Identifying gene defects can also help researchers understand how PD occurs, develop animal models that accurately mimic the neuronal death in human PD, identify new drug targets, and improve diagnosis.

As discussed previously, several genes have been definitively linked to PD in some people. Researchers also have identified a number of other genes that
may play a role and are working to confirm these findings. In addition, several chromosomal regions have been linked to PD in some families. Researchers hope to identify the genes located in these chromosomal regions and to determine which of them may play roles in PD.

Researchers are gathering information and DNA samples from hundreds of families with PD and are conducting large-scale gene expression studies to identify genes that are abnormally active or inactive in PD. They also are comparing gene activity in PD with gene activity in similar diseases such as progressive supranuclear palsy.

Some scientists have found evidence that specific variations in the DNA of mitochondria can increase the risk of getting PD, while other variations are associated with a lowered risk of the disorder. They also have found that PD patients have more mitochondrial DNA (mtDNA) variations than patients with other movement disorders or Alzheimer's disease. Researchers are working to define how these mtDNA variations may lead to PD.

In addition to identifying new genes for PD, researchers are trying to learn how known PD genes function and how the gene mutations cause disease. For example, a 2005 study found that the normal alpha-synuclein protein may help other proteins that are important for nerve transmission to fold correctly. Other studies have suggested that the normal parkin protein protects neurons from a variety of threats, including alpha-synuclein toxicity and excitotoxicity.

**Environmental Toxins**

Scientists continue to study environmental toxins such as pesticides and herbicides that can cause PD symptoms in animals. They have found that exposing rodents to the pesticide rotenone and several other agricultural chemicals can cause cellular and behavioral changes that mimic those seen in PD. Other studies have suggested that prenatal exposure to certain toxins can increase susceptibility to PD in adulthood. A National Institute of Health sponsored program called the Collaborative Centers for Parkinson's Disease Environmental Research (CCPDER) focuses on how occupational exposure to toxins and use of caffeine and other substances may affect the risk of PD.

**Protein Disposal**

Another major area of PD research involves the cell's protein disposal system, called the ubiquitin-proteasome system. If this disposal system fails to work correctly, toxins and other substances may build up to harmful levels, leading to cell death. The ubiquitin-proteasome system requires interactions between several proteins, including parkin and UCH-L1. Therefore, disruption of the ubiquitin-proteasome system may partially explain how mutations in these genes cause PD.
Lewy Bodies
Other studies focus on how Lewy bodies form and what role they play in PD. Some studies suggest that Lewy bodies are a byproduct of degenerative processes within neurons, while others indicate that Lewy bodies are a protective mechanism by which neurons lock away abnormal molecules that might otherwise be harmful. Additional studies have found that alpha-synuclein clumps alter gene expression and bind to vesicles within the cell in ways that could be harmful.

Excitotoxicity
Another common topic of PD research is excitotoxicity – overstimulation of nerve cells that leads to cell damage or death. In excitotoxicity, the brain becomes oversensitized to the neurotransmitter glutamate, which increases activity in the brain. The dopamine deficiency in PD causes overactivity of neurons in the subthalamic nucleus, which may lead to excitotoxic damage there and in other parts of the brain. Researchers also have found that dysfunction of the cells' mitochondria can make dopamine-producing neurons vulnerable to glutamate.

Inflammation
Other researchers are focusing on how inflammation may affect PD. Inflammation is common to a variety of neurodegenerative diseases, including PD, Alzheimer's disease, HIV-1-associated dementia, and amyotrophic lateral sclerosis. Several studies have shown that inflammation-promoting molecules increase cell death after treatment with the toxin MPTP. Inhibiting the inflammation with drugs or by genetic engineering prevented some of the neuronal degeneration in these studies. Other research has shown that dopamine neurons in brains from patients with PD have higher levels of an inflammatory enzyme called COX-2 than those of people without PD. Inhibiting COX-2 doubled the number of neurons that survived in a mouse model for PD.

Since the discovery that MPTP causes parkinsonian symptoms in humans, scientists have found that by injecting MPTP and certain other toxins into laboratory animals, they can reproduce the brain lesions that cause these symptoms. This allows them to study the mechanisms of the disease and helps in the development of new treatments. They also have developed animal models with alterations of the alpha-synuclein and parkin genes. Other researchers have used genetic engineering to develop mice with disrupted mitochondrial function in dopamine neurons. These animals have many of the characteristics associated with PD.

Diagnostics
Biomarkers for PD – measurable characteristics that can reveal whether the disease is developing or progressing – are another focus of research. Such biomarkers could help doctors detect the disease before symptoms appear and improve diagnosis of the disease. They also would show if medications and
other types of therapy have a positive or negative effect on the course of the disease. Some of the most promising biomarkers for PD are brain imaging techniques. For example, some researchers are using positron emission tomography (PET) brain scans to try to identify metabolic changes in the brains of people with PD and to determine how these changes relate to disease symptoms. Other potential biomarkers for PD include alterations in gene expression.

**Therapeutics**

**Electrotherapy**
Researchers also are conducting many studies of new or improved therapies for PD. While deep brain stimulation (DBS) is now FDA-approved and has been used in thousands of people with PD, researchers continue to try to improve the technology and surgical techniques in this therapy. For example, some studies are comparing DBS to the best medical therapy and trying to determine which part of the brain is the best location for stimulation. Another clinical trial is studying how DBS affects depression and quality of life.

Other clinical studies are testing whether transcranial electrical polarization (TEP) or transcranial magnetic stimulation (TMS) can reduce the symptoms of PD. In TEP, electrodes placed on the scalp are used to generate an electrical current that modifies signals in the brain's cortex. In TMS, an insulated coil of wire on the scalp is used to generate a brief electrical current.

**Medications**
One of the enduring questions in PD research has been how treatment with levodopa and other dopaminergic drugs affects progression of the disease. Researchers are continuing to try to clarify these effects. One study has suggested that PD patients with a low-activity variant of the gene for COMT (which breaks down dopamine) perform worse than others on tests of cognition, and that dopaminergic drugs may worsen cognition in these people, perhaps because the reduced COMT activity causes dopamine to build up to harmful levels in some parts of the brain. In the future, it may become possible to test for such individual gene differences in order to improve treatment of PD.

A variety of new drug treatments are in clinical trials for PD. These include a drug called GM1 ganglioside that increases dopamine levels in the brain. Researchers are testing whether this drug can reduce symptoms, delay disease progression, or partially restore damaged brain cells in PD patients. Other studies are testing whether a drug called istradefylline can improve motor function in PD, and whether a drug called ACP-103 that blocks receptors for the neurotransmitter serotonin will lessen the severity of parkinsonian symptoms and levodopa-associated complications in PD patients. Other topics of research include controlled-release formulas of PD drugs and implantable pumps that give a continuous supply of levodopa.
Some researchers are testing potential neuroprotective drugs to see if they can slow the progression of PD. One study, called NET-PD (Neuroexploratory Trials in Parkinson's Disease), is evaluating minocycline, creatine, coenzyme Q10, and GPI-1485 to determine if any of these agents should be considered for further testing. The NET-PD study may evaluate other possible neuroprotective agents in the future. Drugs found to be successful in the pilot phases may move to large phase III trials involving hundreds of patients. A separate group of researchers is investigating the effects of either 1200 or 2400 milligrams of coenzyme Q10 in 600 patients. Several MAO-B inhibitors, including selegiline, lazabemide, and rasagiline, also are in clinical trials to determine if they have neuroprotective effects in people with PD.

**Nerve Growth Factors**

Nerve growth factors, or neurotrophic factors, which support survival, growth, and development of brain cells, are another type of potential therapy for PD. One such drug, glial cell line-derived neurotrophic factor (GDNF), has been shown to protect dopamine neurons and to promote their survival in animal models of PD. This drug has been tested in several clinical trials for people with PD, and the drug appeared to cause regrowth of dopamine nerve fibers in one person who received the drug. However, a phase II clinical study of GDNF was halted in 2004 because the treatment did not show any clinical benefit after 6 months, and some data suggested that it might even be harmful. Other neurotrophins that may be useful for treating PD include neurotrophin-4 (NT-4), brain-derived neurotrophic factor (BDNF), and fibroblast growth factor 2 (FGF-2).

**Diet**

While there is currently no proof that any dietary supplements can slow PD, several clinical studies are testing whether supplementation with vitamin B12 and other substances may be helpful. A 2005 study found that dietary restriction — reducing the number of calories normally consumed — helped to increase abnormally low levels of the neurotransmitter glutamate in a mouse model for early PD. The study also suggested that dietary restriction affected dopamine activity in the brain. Another study showed that dietary restriction before the onset of PD in a mouse model helped to protect dopamine-producing neurons.

**Cell Therapy**

Another approach to treating PD is to implant cells to replace those lost in the disease. Researchers are conducting clinical trials of a cell therapy in which human retinal epithelial cells attached to microscopic gelatin beads are implanted into the brains of people with advanced PD. The retinal epithelial cells produce levodopa. The investigators hope that this therapy will enhance brain levels of dopamine.

Starting in the 1990s, researchers conducted a controlled clinical trial of fetal tissue implants in people with PD. They attempted to replace lost dopamine-producing neurons with healthy ones from fetal tissue in order to improve
movement and the response to medications. While many of the implanted cells survived in the brain and produced dopamine, this therapy was associated with only modest functional improvements, mostly in patients under the age of 60. Unfortunately, some of the people who received the transplants developed disabling dyskinesias that could not be relieved by reducing antiparkinsonian medications.

Another type of cell therapy involves stem cells. Stem cells derived from embryos can develop into any kind of cell in the body, while others, called progenitor cells, are more restricted. One study transplanted neural progenitor cells derived from human embryonic stem cells into a rat model of PD. The cells appeared to trigger improvement on several behavioral tests, although relatively few of the transplanted cells became dopamine-producing neurons. Other researchers are developing methods to improve the number of dopamine-producing cells that can be grown from embryonic stem cells in culture.

Researchers also are exploring whether stem cells from adult brains might be useful in treating PD. They have shown that the brain’s white matter contains multipotent progenitor cells that can multiply and form all the major cell types of the brain, including neurons.

Gene therapy is yet another approach to treating PD. A study of gene therapy in non-human primate models of PD is testing different genes and gene-delivery techniques in an effort to refine this kind of treatment. An early-phase clinical study is also testing whether using the adeno-associated virus type 2 (AAV2) to deliver the gene for a nerve growth factor called neurturin is safe for use in people with PD. Another study is testing the safety of gene therapy using AAV to deliver a gene for human aromatic L-amino acid decarboxylase, an enzyme that helps convert levodopa to dopamine in the brain. Other investigators are testing whether gene therapy to increase the amount of glutamic acid decarboxylase, which helps produce an inhibitory neurotransmitter called GABA, might reduce the overactivity of neurons in the brain that results from lack of dopamine.

Vaccine
Another potential approach to treating PD is to use a vaccine to modify the immune system in a way that can protect dopamine-producing neurons. One vaccine study in mice used a drug called copolymer-1 that increases the number of immune T cells that secrete anti-inflammatory cytokines and growth factors. The researchers injected copolymer-1-treated immune cells into a mouse model for PD. The vaccine modified the behavior of supporting (glial) cells in the brain so that their responses were beneficial rather than harmful. It also reduced the amount of neurodegeneration in the mice, reduced inflammation, and increased production of nerve growth factors. Another study delivered a vaccine containing alpha-synuclein in a mouse model of PD and showed that the mice developed antibodies that reduced the accumulation of abnormal alpha-synuclein. While these studies are preliminary, investigators hope that similar approaches might one day be tested in humans.
Other Issues

Other studies are looking at treatments that might improve some of the secondary symptoms of PD, such as depression and swallowing disorders. One clinical trial is investigating whether a drug called quetiapine can reduce psychosis or agitation in PD patients with dementia and in dementia patients with parkinsonian symptoms. Some studies also are examining whether transcranial magnetic stimulation or a food supplement called s-adenosyl-methionine (SAM-e) can alleviate depression in people with PD, and whether levetiracetam, a drug approved to treat epilepsy, can reduce dyskinesias in Parkinson’s patients without interfering with other PD drugs.

Health Biometrics

Scales to measure the status of a person with PS have several purposes. Some are used to follow a person’s progress, such as the Schwab and England Activities of Daily Living Scale, and the Hoehn and Yahr Staging Scale, Others such as the Unified Parkinson Disease Rating Scale are often used for research studies to objectively determine the effectiveness of a new treatment.

Schwab and England Activities of Daily Living

Rating can be assigned by rater or by patient.

100% - Completely independent. Able to do all chores w/o slowness, difficulty, or impairment.
90% - Completely independent. Able to do all chores with some slowness, difficulty, or impairment. May take twice as long.
80% - Independent in most chores. Takes twice as long. Conscious of difficulty and slowing
70% - Not completely independent. More difficulty with chores. 3 to 4X along on chores for some. May take large part of day for chores.
60% - Some dependency. Can do most chores, but very slowly and with much effort. Errors, some impossible
50% - More dependant. Help with 1/2 of chores. Difficulty with everything
40% - Very dependent. Can assist with all chores but few alone
30% - With effort, now and then does a few chores alone of begins alone. Much help needed
20% - Nothing alone. Can do some slight help with some chores. Severe invalid
10% - Totally dependent, helpless
0% - Vegetative functions such as swallowing, bladder and bowel function are not functioning. Bedridden.
Unified Parkinson Disease Rating Scale (UPDRS)

The UPDRS is a rating tool to follow the longitudinal (over time) course of Parkinson’s Disease. It is made up of the following sections:

1) Mentation, Behavior, and Mood
2) ADL
3) Motor

These are evaluated by interview. Some sections require multiple grades assigned to each extremity. A total of 199 points are possible. 199 represents the worst (total) disability, 0 means no disability.

**Mentation, Behavior, Mood**

**Intellectual Impairment**

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>none</td>
</tr>
<tr>
<td>1</td>
<td>mild (consistent forgetfulness with partial recollection of events with no other difficulties)</td>
</tr>
<tr>
<td>2</td>
<td>moderate memory loss with disorientation and moderate difficulty handling complex problems</td>
</tr>
<tr>
<td>3</td>
<td>severe memory loss with disorientation to time and often place, severe impairment with problems</td>
</tr>
<tr>
<td>4</td>
<td>severe memory loss with orientation only to person, unable to make judgments or solve problems</td>
</tr>
</tbody>
</table>

**Thought Disorder**

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>none</td>
</tr>
<tr>
<td>1</td>
<td>vivid dreaming</td>
</tr>
<tr>
<td>2</td>
<td>&quot;benign&quot; hallucination with insight retained</td>
</tr>
<tr>
<td>3</td>
<td>occasional to frequent hallucination or delusions without insight, could interfere with daily activities</td>
</tr>
<tr>
<td>4</td>
<td>persistent hallucination, delusions, or florid psychosis.</td>
</tr>
</tbody>
</table>

**Depression**

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>not present</td>
</tr>
<tr>
<td>1</td>
<td>periods of sadness or guilt greater than normal, never sustained for more than a few days or a week</td>
</tr>
<tr>
<td>2</td>
<td>sustained depression for &gt;1 week</td>
</tr>
<tr>
<td>3</td>
<td>vegetative symptoms (insomnia, anorexia, abulia, weight loss)</td>
</tr>
<tr>
<td>4</td>
<td>vegetative symptoms with suicidality</td>
</tr>
</tbody>
</table>

**Motivation/Initiative**

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>normal</td>
</tr>
<tr>
<td>1</td>
<td>less of assertive, more passive</td>
</tr>
<tr>
<td>2</td>
<td>loss of initiative or disinterest in elective activities</td>
</tr>
<tr>
<td>3</td>
<td>loss of initiative or disinterest in day to day (routine) activities</td>
</tr>
<tr>
<td>4</td>
<td>withdrawn, complete loss of motivation</td>
</tr>
</tbody>
</table>

**Activities of Daily Living**

**Speech**

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>normal</td>
</tr>
<tr>
<td>1</td>
<td>mildly affected, no difficulty being understood</td>
</tr>
<tr>
<td>2</td>
<td>moderately affected, may be asked to repeat</td>
</tr>
<tr>
<td>3</td>
<td>severely affected, frequently asked to repeat</td>
</tr>
<tr>
<td>4</td>
<td>unintelligible most of time</td>
</tr>
</tbody>
</table>

**Salivation**

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>normal</td>
</tr>
<tr>
<td>1</td>
<td>slight but noticeable increase, may have nighttime drooling</td>
</tr>
<tr>
<td>2</td>
<td>moderately excessive saliva, may minimal drooling</td>
</tr>
<tr>
<td>3</td>
<td>marked drooling</td>
</tr>
</tbody>
</table>
### Swallowing

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>normal</td>
</tr>
<tr>
<td>1</td>
<td>rare choking</td>
</tr>
<tr>
<td>2</td>
<td>occasional choking</td>
</tr>
<tr>
<td>3</td>
<td>requires soft food</td>
</tr>
<tr>
<td>4</td>
<td>requires NG tube or G-tube</td>
</tr>
</tbody>
</table>

### Handwriting

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>normal</td>
</tr>
<tr>
<td>1</td>
<td>slightly small or slow</td>
</tr>
<tr>
<td>2</td>
<td>all words small but legible</td>
</tr>
<tr>
<td>3</td>
<td>severely affected, not all words legible</td>
</tr>
<tr>
<td>4</td>
<td>majority illegible</td>
</tr>
</tbody>
</table>

### Cutting Food/Handing Utensils

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>normal</td>
</tr>
<tr>
<td>1</td>
<td>somewhat slow and clumsy but no help needed</td>
</tr>
<tr>
<td>2</td>
<td>can cut most foods, some help needed</td>
</tr>
<tr>
<td>3</td>
<td>food must be cut, but can feed self</td>
</tr>
<tr>
<td>4</td>
<td>needs to be fed</td>
</tr>
</tbody>
</table>

### Dressing

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>normal</td>
</tr>
<tr>
<td>1</td>
<td>somewhat slow, no help needed</td>
</tr>
<tr>
<td>2</td>
<td>occasional help with buttons or arms in sleeves</td>
</tr>
<tr>
<td>3</td>
<td>considerable help required but can do something alone</td>
</tr>
<tr>
<td>4</td>
<td>helpless</td>
</tr>
</tbody>
</table>

### Hygiene

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>normal</td>
</tr>
<tr>
<td>1</td>
<td>somewhat slow but no help needed</td>
</tr>
<tr>
<td>2</td>
<td>needs help with shower or bath or very slow in hygienic care</td>
</tr>
<tr>
<td>3</td>
<td>requires assistance for washing, brushing teeth, going to bathroom</td>
</tr>
<tr>
<td>4</td>
<td>helpless</td>
</tr>
</tbody>
</table>

### Turning in Bed/Adjusting Bed Clothes

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>normal</td>
</tr>
<tr>
<td>1</td>
<td>somewhat slow no help needed</td>
</tr>
<tr>
<td>2</td>
<td>can turn alone or adjust sheets but with great difficulty</td>
</tr>
<tr>
<td>3</td>
<td>can initiate but not turn or adjust alone</td>
</tr>
<tr>
<td>4</td>
<td>helpless</td>
</tr>
</tbody>
</table>

### Falling-Unrelated to Freezing

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>none</td>
</tr>
<tr>
<td>1</td>
<td>rare falls</td>
</tr>
<tr>
<td>2</td>
<td>occasional, less than one per day</td>
</tr>
<tr>
<td>3</td>
<td>average of once per day</td>
</tr>
<tr>
<td>4</td>
<td>&gt;1 per day</td>
</tr>
</tbody>
</table>

### Freezing When Walking

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>normal</td>
</tr>
<tr>
<td>1</td>
<td>rare, may have start hesitation</td>
</tr>
<tr>
<td>2</td>
<td>occasional falls from freezing</td>
</tr>
<tr>
<td>3</td>
<td>frequent freezing, occasional falls</td>
</tr>
<tr>
<td>4</td>
<td>falls from freezing</td>
</tr>
</tbody>
</table>

### Walking

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>normal</td>
</tr>
<tr>
<td>1</td>
<td>mild difficulty, day drag legs or decrease arm swing</td>
</tr>
<tr>
<td>2</td>
<td>moderate difficulty requires no assist</td>
</tr>
<tr>
<td>3</td>
<td>severe disturbance requires assistance</td>
</tr>
<tr>
<td>4</td>
<td>cannot walk at all even with assist</td>
</tr>
</tbody>
</table>

### Tremor

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>absent</td>
</tr>
<tr>
<td>1</td>
<td>slight and infrequent, not bothersome to patient</td>
</tr>
<tr>
<td>2</td>
<td>moderate, bothersome to patient</td>
</tr>
<tr>
<td>3</td>
<td>severe, interferes with many activities</td>
</tr>
</tbody>
</table>
**Motor Exam**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal</td>
</tr>
<tr>
<td>1</td>
<td>Slight loss of expression, diction, volume</td>
</tr>
<tr>
<td>2</td>
<td>Monotone, slurred but understandable, mod. impaired</td>
</tr>
<tr>
<td>3</td>
<td>Marked impairment, difficult to understand</td>
</tr>
<tr>
<td>4</td>
<td>Unintelligible</td>
</tr>
</tbody>
</table>

**Sensory Complaints Related to Parkinsonism**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>1</td>
<td>Occasionally has numbness, tingling, and mild aching</td>
</tr>
<tr>
<td>2</td>
<td>Frequent, but not distressing</td>
</tr>
<tr>
<td>3</td>
<td>Frequent painful sensation</td>
</tr>
<tr>
<td>4</td>
<td>Excruciating pain</td>
</tr>
</tbody>
</table>

**Facial Expression**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal</td>
</tr>
<tr>
<td>1</td>
<td>Slight hypomymia, could be poker face</td>
</tr>
<tr>
<td>2</td>
<td>Slight but definite abnormal diminution in expression</td>
</tr>
<tr>
<td>3</td>
<td>Mod. hypomymia, lips parted some of time</td>
</tr>
<tr>
<td>4</td>
<td>Masked or fixed face, lips parted, complete loss of expression</td>
</tr>
</tbody>
</table>

**Tremor at Rest Face**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Absent</td>
</tr>
<tr>
<td>1</td>
<td>Slight and infrequent</td>
</tr>
<tr>
<td>2</td>
<td>Mild and present most of time</td>
</tr>
<tr>
<td>3</td>
<td>Moderate and present most of time</td>
</tr>
<tr>
<td>4</td>
<td>Marked and present most of time</td>
</tr>
</tbody>
</table>

**Right Upper Extremity (RUE)**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Absent</td>
</tr>
<tr>
<td>1</td>
<td>Slight and infrequent</td>
</tr>
<tr>
<td>2</td>
<td>Mild and present most of time</td>
</tr>
<tr>
<td>3</td>
<td>Moderate and present most of time</td>
</tr>
<tr>
<td>4</td>
<td>Marked and present most of time</td>
</tr>
</tbody>
</table>

**Left Upper Extremity (LUE)**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Absent</td>
</tr>
<tr>
<td>1</td>
<td>Slight and infrequent</td>
</tr>
<tr>
<td>2</td>
<td>Mild and present most of time</td>
</tr>
<tr>
<td>3</td>
<td>Moderate and present most of time</td>
</tr>
<tr>
<td>4</td>
<td>Marked and present most of time</td>
</tr>
</tbody>
</table>

**Right Lower Extremity (RLE)**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Absent</td>
</tr>
<tr>
<td>1</td>
<td>Slight and infrequent</td>
</tr>
<tr>
<td>2</td>
<td>Mild and present most of time</td>
</tr>
<tr>
<td>3</td>
<td>Moderate and present most of time</td>
</tr>
<tr>
<td>4</td>
<td>Marked and present most of time</td>
</tr>
</tbody>
</table>

**Left Lower Extremity (LLE)**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Absent</td>
</tr>
<tr>
<td>1</td>
<td>Slight and infrequent</td>
</tr>
<tr>
<td>2</td>
<td>Mild and present most of time</td>
</tr>
<tr>
<td>3</td>
<td>Moderate and present most of time</td>
</tr>
<tr>
<td>4</td>
<td>Marked and present most of time</td>
</tr>
</tbody>
</table>

**Action or Postural Tremor RUE**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Absent</td>
</tr>
<tr>
<td>1</td>
<td>Slight, present with action</td>
</tr>
<tr>
<td>2</td>
<td>Moderate, present with action</td>
</tr>
<tr>
<td>3</td>
<td>Moderate present with action and posture holding</td>
</tr>
<tr>
<td>4</td>
<td>Marked, interferes with feeding</td>
</tr>
</tbody>
</table>
PARKINSON’S SYNDROME

Action or Postural Tremor LUE
0 absent
1 slight, present with action
2 moderate, present with action
3 moderate present with action and posture holding
4 marked, interferes with feeding

Rigidity Neck
0 absent
1 slight or only with activation
2 mild/moderate
3 marked, full range of motion
4 severe

Rigidity RUE
0 absent
1 slight or only with activation
2 mild/moderate
3 marked, full range of motion
4 severe

Rigidity LUE
0 absent
1 slight or only with activation
2 mild/moderate
3 marked, full range of motion
4 severe

Rigidity RLE
0 absent
1 slight or only with activation
2 mild/moderate
3 marked, full range of motion
4 severe

Rigidity LLE
0 absent
1 slight or only with activation
2 mild/moderate
3 marked, full range of motion
4 severe

Finger taps Right
0 normal
1 mild slowing, and/or reduction in amp.
2 moderate impaired. Definite and early fatiguing, may have occasional arrests
3 severely impaired. Frequent hesitations and arrests.
4 can barely perform

Finger taps Left
0 normal
1 mild slowing, and/or reduction in amp.
2 moderate impaired. Definite and early fatiguing, may have occasional arrests
3 severely impaired. Frequent hesitations and arrests.
4 can barely perform

Right Hand Movements (open and close hands in rapid succession)
0 normal
1 mild slowing, and/or reduction in amp.
2 moderate impaired. Definite and early fatiguing, may have occasional arrests
3 severely impaired. Frequent hesitations and arrests.
4 can barely perform

Left Hand Movements (open and close hands in rapid succession)
0 normal
1 mild slowing, and/or reduction in amp.
2 moderate impaired. Definite and early fatiguing, may have occasional arrests
3 severely impaired. Frequent hesitations and arrests.
4 can barely perform
Right Rapid Alternating Movements (pronate and supinate hands)

0  normal
1  mild slowing, and/or reduction in amp.
2  moderate impaired. Definite and early fatiguing, may have occasional arrests
3  severely impaired. Frequent hesitations and arrests.
4  can barely perform

Left Rapid Alternating Movements (pronate and supinate hands)

0  normal
1  mild slowing, and/or reduction in amp.
2  moderate impaired. Definite and early fatiguing, may have occasional arrests
3  severely impaired. Frequent hesitations and arrests.
4  can barely perform

Right Leg Agility (tap heel on ground)

0  normal
1  mild slowing, and/or reduction in amp.
2  moderate impaired. Definite and early fatiguing, occasional arrests
3  severely impaired. Frequent hesitations and arrests.
4  can barely perform

Left Leg Agility (tap heel on ground)

0  normal
1  mild slowing, and/or reduction in amp.
2  moderate impaired. Definite and early fatiguing, occasional arrests
3  severely impaired. Frequent hesitations and arrests.
4  can barely perform

Arising From Chair (patient arises with arms folded across chest)

0  normal
1  slow, may need more than one attempt
2  pushes self up from arms or seat
3  tends to fall back, may need multiple tries but can arise without assistance
4  unable to arise without help

Posture

0  normal erect
1  slightly stooped, could be normal for older person
2  definitely abnormal, mod. stooped, may lean to one side
3  severely stooped with kyphosis
4  marked flexion with extreme abnormality of posture

Gait

0  normal
1  walks slowly, may shuffle with short steps, no festination or propulsion
2  walks with difficulty, little or no assistance, some festination, short steps
3  severe disturbance, frequent assistance
4  cannot walk

Postural Stability (retropulsion test)

0  normal
1  recovers unaided
2  would fall if not caught
3  falls spontaneously
4  unable to stand

Body Bradykinesia/ Hypokinesia

0  none
1  minimal slowness, could be normal, deliberate character
2  mild slowness and poverty of movement, definitely abnormal
3  moderate slowness, poverty, or small amplitude
4  marked slowness, poverty, or amplitude
REFERENCES


1. Which of the following statements is FALSE?
   A. Dopamine is produced in the Substantia Nigra and transmits signals to the corpus striatum.
   B. Parkinson’s symptoms typically appear after an individual has lost 30-40% of their dopamine producing cells.
   C. Mutations of the alpha-synuclein gene have been linked to Parkinson’s Disease.
   D. MPTP is a toxin that causes parkinsonian symptoms in humans.

2. Which of the following statements is TRUE?
   A. Parkinson’s Syndrome occurs in approximately 1% of the population.
   B. Parkinson’s Syndrome occurs slightly more often in men than in women.
   C. Parkinson’s Syndrome occurs equally among all races.
   D. Cigarette smoking is associated with an increased risk for developing Parkinson’s Syndrome.

3. Which of the following symptoms is NOT typically associated with the “triad” of Parkinson’s Syndrome?
   A. Masked facial features
   B. Intermittent hand tapping
   C. Increased muscle tone in limbs
   D. Bladder incontinence

4. Which of the following is best for diagnosing Parkinson’s Syndrome?
   A. Dopamine Agonist Assay
   B. EEG
   C. Triphasic CSF profile
   D. History and physical examination

5. An individual is experiencing bilateral finger tapping, moderate slowness of gait, and mild difficulty with grooming tasks. According to the Hoehn and Yahr Scale, they are in which stage of Parkinson’s?
   A. Stage 2
   B. Stage 3
   C. Stage 4
   D. Stage 5
6. Which of the following statements concerning Parkinson’s medications is FALSE?
   A. Common side effects of anticholinergic drugs can include blurred vision and hallucinations.
   B. Oral Dopamine is effective because it is absorbed directly into the Substantia Nigra cells.
   C. Decarboxylase Inhibitors prevent the breakdown of L-Dopa in tissues other than the brain.
   D. Requip is a Dopamine Agonist that functions as an artificial form of dopamine.

7. Which of the following would NOT typically be part of a Parkinson’s therapy program?
   A. Strengthening of the quadriceps and trapezius
   B. Gait training to increase stride length
   C. Activities to improve dexterity of hands
   D. Stretching of the thoracic paraspinals

8. An individual is taking a diuretic for hypertension and a dopamine agonist for Parkinson’s Disease. This drug combination may cause the patient to feel __________.
   A. calf pain secondary to DVT
   B. shallow breathing secondary to pulmonary acidosis
   C. dizziness secondary to orthostatic hypotension
   D. headache secondary to carotid rigidity

9. Approximately, what percentage of caregivers experience depression?
   A. 60%
   B. 30%
   C. 10%
   D. 5%

10. Which of the following is NOT accurately scored utilizing the Unified Parkinson Disease Rating Scale (UPDRS)?
    A. Severe memory loss with disorientation to time and often place, severe impairment with problems (3 points)
    B. Can cut most foods; some help needed (2 points)
    C. Monotone speech, slurred but understandable (3 points)
    D. Unable to arise from chair without help (4 points)