Title of Research Paper: Parkinson’s Disease

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Introduction

Parkinson’s Disease is a progressive disease of the nervous system. It is commonly linked to the degeneration of the brain, specifically the basal ganglia, and a deficiency of the neurotransmitter dopamine. The disease affects mainly the middle-aged and elderly people, and is marked by tremors, muscular rigidity, slow, imprecise movement.

Parkinson’s disease can be divided into three different groups, categorised in terms of age sectors.

(i) Adult-Onset Parkinson’s Disease
The adult-onset disease is the most typical out of the other groups. The average age of Parkinson’s disease onset is around the age of 60 years old. As people begin to age and advance into their 70’s and 80’s, the percentage of those who have Parkinson’s disease begin to increase.

(ii) Young-Onset Parkinson’s Disease
People diagnosed with young-onset Parkinson’s disease range from the ages 21 to 40 years old. In the U.S., the incidence of Parkinson’s disease occurring at such a young age is very low, ranging from 5 to 10%. However in other parts of the World, such as in Japan, the incidence of the young-onset Parkinson’s diseases is very high, which is approximately 40% of the total diagnosed cases.

(iii) Juvenile Parkinson’s Disease
The age of onset is before the age of 21. The incidence of Juvenile Parkinson’s Disease is very rare.

Parkinson’s disease is also divided into 5 stages, in increasing severity.

Stage 1:
This is the very initial phase of the disease, and the patient would experience mild symptoms, like tremors or shaking in a limb. In this stage, there will be slight observable changes in the patients, such as the sitting posture he adopts, loss of balance and abnormal facial expressions.

Stage 2:
In this stage, the person’s symptoms are bilateral, and they affect both limbs, on both sides of the body. This stage is similar to stage 1, except its impacts are magnified and much more observable. The person most likely encounters walking problems and difficulties in maintain balance, and the inability to complete normal physical tasks.

Stage 3:
In stage 3, certain symptoms may be extremely severe, which may include the inability to walk straight or even stand. There is more noticeable effects of slowing of physical movements.
Stage 4:
In this stage, the disease's more severe symptoms start to show. Walking may occur rarely, and it is also very limited. Muscle rigidity or bradykinesia, is often visible. Patients, in this point of time are unable to complete day-to-day tasks, and usually are unable to live independently. However, in this stage, the tremors from the limbs may disappear from the patient.

Stage 5:
The final stage of Parkinson's disease is where the patient is mostly unable to care for himself, and is unable to walk or stand at all. A person at stage 5 would require 1-to-1 nursing facilities and more medical attention and care.

Causes

Certain nerve cells, also known as neurons, present in the brain will break down or die in Parkinson's disease. Many of the symptoms listed above are caused due to the loss of neurons, which role is to produce a dopamine. Dopamine is a chemical messenger, and most of the dopamine neurons are found in an area of the brain called the substantia nigra. When such levels of dopamine decrease, this triggers abnormal brain activity, since dopamine plays an important role in our ability to move without jerks or shakiness, which leads to the various signs of Parkinson's disease.

In addition to the main cause as above, there are also several other factors which affect the possibility of Parkinson's disease being present.

(i) Genetics
Certain specific gene mutations can cause Parkinson's disease. Misfolding of polypeptides, which are chains of amino acids, is a serious problem in cells. Many diseases, such as Alzheimer's, Parkinson's, and mad cow disease, are associated with an accumulation of misfolded protein, which leads to a different DNA sequence. However, this is a rare and uncommon case, unless one has multiple family members that have Parkinson’s disease. In this case, people with the gene of active alpha-synuclein has a 1.5 times more risk than usual people.

(ii) Environmental factors
Exposure to certain toxins or environmental factors, such as in rural areas where harmful chemicals, pesticides, fungicides are used, which are present in nature would increase the risk of Parkinson's disease, but with an extremely small percentage of this happening.

Signs and Symptoms

Scientists are exploring the idea that loss of cells in other areas of the brain and body contribute to Parkinson's. For example, researchers have discovered that the hallmark sign of Parkinson's disease — clumps of a protein alpha-synuclein, which are also
called Lewy Bodies — are found not only in the mid-brain but also in the brain stem and the olfactory bulb.

These areas of the brain correlate to non-motor functions such as sense of smell and sleep regulation. The presence of Lewy bodies in these areas could explain non-motor symptoms experienced by some people with PD before any motor sign of the disease appears. The intestines also have dopamine cells that degenerate in Parkinson’s, and this may be important in the gastrointestinal symptoms that are part of the disease.

As listed in Table 1, in addition to the internal cellular damages, these are the common primary motor conditions and symptoms as experienced by people with Parkinson’s disease.

Table 1: Common Primary Motor Conditions and Symptoms

<table>
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<th>Condition</th>
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| Tremor                                        | - A tremor is a form of shaking, that mostly begins in a limb, usually in the hands or fingers.  
  - A common characteristic of Parkinson’s disease is that there is tremors observed on the hand when it is fully relaxed (not clenched) |
| Muscle Rigidity                               | - Bradykinesia, also known as slowed movement, is caused by Parkinson’s disease. In this case, the disease possibly reduces the ability of movement, and hinders it, slowing one down.  
  - Simple tasks such as walking from one end of the room to the other, may take a much longer time than usual. In this case, steps become shorter when walking since it is harder to move.  
  - The rigidity of muscles may possible occur in any parts of the body.  
  - The stiffness of the muscles may limit motion, and may cause temporary pain and discomfort. |
| Posture and Imbalance                         | - Posture may be affected, and stooped.  
  - Issues of maintaining balance can also be observed. |
| Loss of automated movements                   | - Parkinson’s disease may decrease one’s ability to carry out unconscious motions, such as blinking, smiling, or the swinging motions of arms while walking. |
| Speech Changes                                | - Speech problems may arise. One may start to speak softer, quicker, or in a slur, and even hesitating before talking.  
  - The tone of speech may also become more monotonous, without any intonations. |
There are also several other non-motor related functions which have deteriorated from a patient with Parkinson's disease:

- Depression
- Cognitive impairment
- Dementia
- Vision disturbances
- Psychosis
- Sleep disturbances
- Constipation
- Fatigue
- Sexual dysfunction

Detection and Diagnosis

FMRI scans can reveal Parkinson’s disease, tumours and injuries to the brain. But it is important that the images are interpreted carefully. There may be activity in an area of the brain associated with a particular task but correlation does not imply cause. Many brain processes are complex and not confined to one area alone.

In the brain, the basal ganglia helps to control body movements, through the release of Dopamine via the substantia nigra. Parkinson's primarily affects neurons in an area of the brain called the substantia nigra. Some of these dying neurons produce dopamine, a chemical that sends messages to the part of the brain that controls movement and coordination. As Parkinson’s Disease progresses, the amount of dopaminergic received by the basal ganglia decreases, due to the degeneration of the substantia nigra, leaving a person unable to control their movement normally.

Treatment

There is presently no complete cure but there are treatment options such as medication and surgery to manage the symptoms.

**Medication to help relieve the symptoms of motor issues:**
- Amandatine; or other anticholinergic medication helps to reduce early, mild tremors or shaking
- Levodopa; Sinemet; Carbidopa can help to improve muscle movement and help in the early stages of Parkinson's disease.
- Selegiline; Rasagiline helps to reduce the breakdown of the chemical messenger dopamine, allowing more control of muscles and movements

**Medication to relieve stress or depression:**
- Antidepressants for mood disorders
• Gabapentin; Duloxetine to relieve pain

Lifestyle changes
• Healthy nutrition and diet
• Sufficient rest and reduced levels of stress
• Physical movement therapy, or speech therapy

Importance of understanding Parkinson’s Disease

(i) Widespread Occurrence

Parkinson’s disease is one that is prevalent throughout the entire society. It is commonly found in people aged 50 and above. According to the American Parkinson’s disease Association, approximately 1.5 billion people US are living with Parkinson’s disease, and the incidence of Parkinson’s disease ranges from 8.6 - 19 people per every 100 000 people. Annually, a staggering number of 50 000 new cases are diagnosed in the US.

Parkinson’s disease may potentially affect more people in the world, in the future. By understanding the various causes or the other different aspects of this disease, we would be able to understand the current limitations of technology to prevent the spread of this disease, and we may be able to innovate better solutions to completely eradicate this disease.

(ii) Impacts

The effects of Parkinson’s disease is an extreme liability to the one who has this disease. Since the motion of the limbs are limited, this causes difficulty in movement and motion, thereby making it inconvenient.

By understanding Parkinson’s disease and its impacts on people, we would be able to customise help towards these people such that their lives can be improved, or in the best case, be returned to its previous state (e.g. motor skills are well functioning).

(iii) Period of action

The impacts on motor-sensory skills from Parkinson’s disease does not usually happen within a short time span, and this slow, degenerative disease may have effects that appear unnoticeable to family members and doctors.

By understanding the symptoms of Parkinson disease, we would be able to safely identify signs of Parkinson’s disease, and we would be send patients in time for treatment.

Interesting information about Parkinson’s Disease
The main cause of the Parkinson’s disease is due to the loss of dopamine neurons, which cause a significant decrease in dopamine.

Signs and symptoms of Parkinson’s disease usually take place over a longer period of time, and it may sometimes go unnoticeable to doctors and family.

Men tend to have a higher chance of getting Parkinson’s disease compared to females. Women usually develop Parkinson’s disease 2 years later than men. The dominant symptom in women is mainly tremors or shaking, but in men, it is mostly rigid muscles.

**Percentage of persons age 65 or older with moderate or severe memory impairment, by age group and sex, 1998**

Note: Definition of moderate or severe memory impairment: four or fewer words recalled (out of 20) on combined immediate and delayed recall tests.

Reference population: These data refer to the civilian noninstitutional population.

Source: Health and Retirement Study.
Bibliography


