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Dopamine Transporter Scan (DaTscan) for Diagnosis of Parkinson's Disease

Samantha Clark
clarks1@misericordia.edu

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Dopamine Transporter Scan (DaTscan) for Diagnosis of Parkinson's Disease

Student Researcher: Samantha Clark
Faculty Advisor: Loraine D. Zelna, M.S., R.T. (R)(MR)
Internship Mentor: Kenneth Barhight (NMTCB)
Internship Site: Nuclear Medicine, Regional Hospital of Scranton, Scranton, PA

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Introduction

The purpose of this project is to help provide clinical information for Parkinson's disease (PD) diagnosis. The project will further explore the advantages of Dopamine Transporter Scan (DaTscan) in Nuclear Medicine as a diagnostic tool for the evaluation of Parkinson's disease. Nuclear Medicine is a specialized area of radiology that uses radioactive pharmaceuticals to examine organ function and to diagnose and/or treat conditions or diseases. Parkinson's disease is a progressive disorder that affects the nervous system and the parts of the body controlled by the nerves that causes uncontrollable movements that worsen overtime. Parkinsonian Syndromes such as Parkinson's disease are difficult to accurately diagnose and distinguish from other neurological processes diseases. The DaTscan images demonstrate changes in brain chemistry to differentiate various Parkinsonism syndromes. With the use of DaTscan, physicians' ability to confirm a Parkinson's diagnosis is greatly improved. Accurately diagnosing Parkinson's disease is important because treatments can help manage symptoms and early intervention can prevent unnecessary procedures and medication. Medications can improve day-to-day function. In cases where medication does not provide a sustained benefit or has significant side effects, treatments like deep brain stimulation result in improved quality of life.

Parkinson's Disease (PD)

- Scientists do not know the exact cause(s) of PD but believe that it is a combination of genetics and environmental factors (Cleveland clinic, n.d).
    - Genetics cause about 10% to 15% (Mayo clinic, 2022).
- Is the most common form of Parkinsonian syndrome, but there are other forms, including multiple system atrophy and progressive supranuclear palsy (Gilbert D.R., 2022).
- Is a progressive disorder that affects the nervous system and the parts of the body controlled by the nerves (Cleveland clinic, n.d).
- Is rare in young adults (Cleveland clinic, n.d).
- It ordinarily begins in middle or late life (Mayo clinic, 2022).
- The risk increases with age (around age 60 or older) (Mayo clinic, 2022).

Statistics

- Nearly one million people in the U.S. are living with PD (Parkinson's Foundation, n.d.).
    - This number is expected to rise to 1.2 million by 2030. Approximately 60,000 Americans are diagnosed with PD each year (Parkinson's Foundation, n.d.).
- More than 10 million people worldwide are living with PD (Parkinson's Foundation, n.d.).

Nuclear Medicine

- Is a specialized area of radiology that uses radioactive pharmaceuticals to examine organ function and diagnose/treat diseases.

DaTscan

- DaTscan is performed in the Nuclear Medicine department.
- The use of DaTscan for imaging was approved by the FDA in 2011 to aid in diagnosis of PD and to help differentiate PD from essential tremor (Gilbert, D. R., 2022).
- DaTscan will appear abnormal in any disease in which there is a loss of dopamine nerve endings in the striatum (Cedars Sinai, 2022).
- Images detailed areas of the brain, focusing on the cells that produce the chemical dopamine (The Michael J. Fox Foundation, n.d.).
    - Dopamine deals with movement in the brain (The Michael J. Fox Foundation, n.d.).
    - The loss of dopamine cells underlies the movement symptoms of PD (Mayo clinic, 2022).
- Clinical assessment in combination with DaTscan can assist in the diagnosis of Parkinson's disease (Cedars Sinai, 2022).

DaTscan Method

- The patient is injected with a single vial dose of 185MBq of a radioactive pharmaceutical 3-6 hours in advance of the DaTscan (Cedars Sinai, 2022).
- It is injected through venous access into the bloodstream to assess dopamine- containing neurons, which are involved in controlling movement (Cedars Sinai, 2022).
- The DaTscan, once started, takes approximately 30-45 minutes (Cedars Sinai, 2022).
- When the radioactive pharmaceutical reaches the brain, it tags the dopamine cells (Cedars Sinai, 2022).
- Next, the patient is placed under a gamma camera where images of the brain demonstrate the location and density of dopamine cells.

Radioactive Pharmaceutical

- I-123 (DaTscan) is a radioactive agent that is produced in a cyclotron within a specialized lab (Cedars Sinai, 2022).
- Has a half-life of 13.2 hours (Gilbert D. R, 2022).

Equipment

Gamma Camera
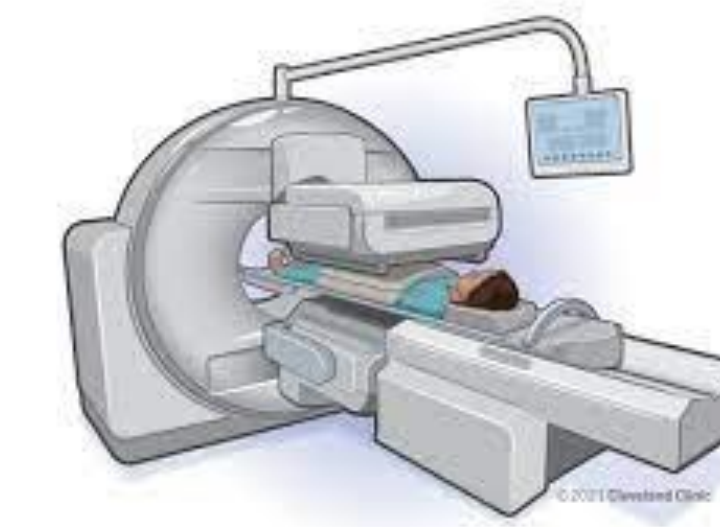
The gamma camera is a device use to capture images of the radioactive pharmaceutical. The pharmaceutical emits certain substances that the camera can view on the screen.

Dose Calibrator

The dose calibrator is a device used to measure the amount of radioactivity in a vials or needle This can measure in many different units and ensures the right amount of radioactivity for a substance.

DaTscan pharmaceutical

The radioactive pharmaceutical is a type of medicine that are used to diagnose certain conditions. This medicine can be given by injection, mouth. This glows under the gamma camera

Yakar, M. (n.d.).
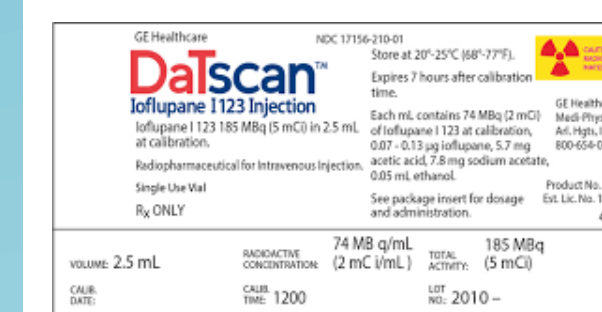
DaTscan Procedure

1. Patient arrives 3-6 hours in advance of scheduled scan to be injected with radioactive pharmaceutical.
2. Patient returns 3-6 hours after injection.
3. Patient is placed in the supine position on the gamma camera table.
4. Patient is advanced into the gamma camera.
5. Technologist begins imaging process.
6. Data is converted to a visual image of the brain.
7. Images are interpreted by physician.
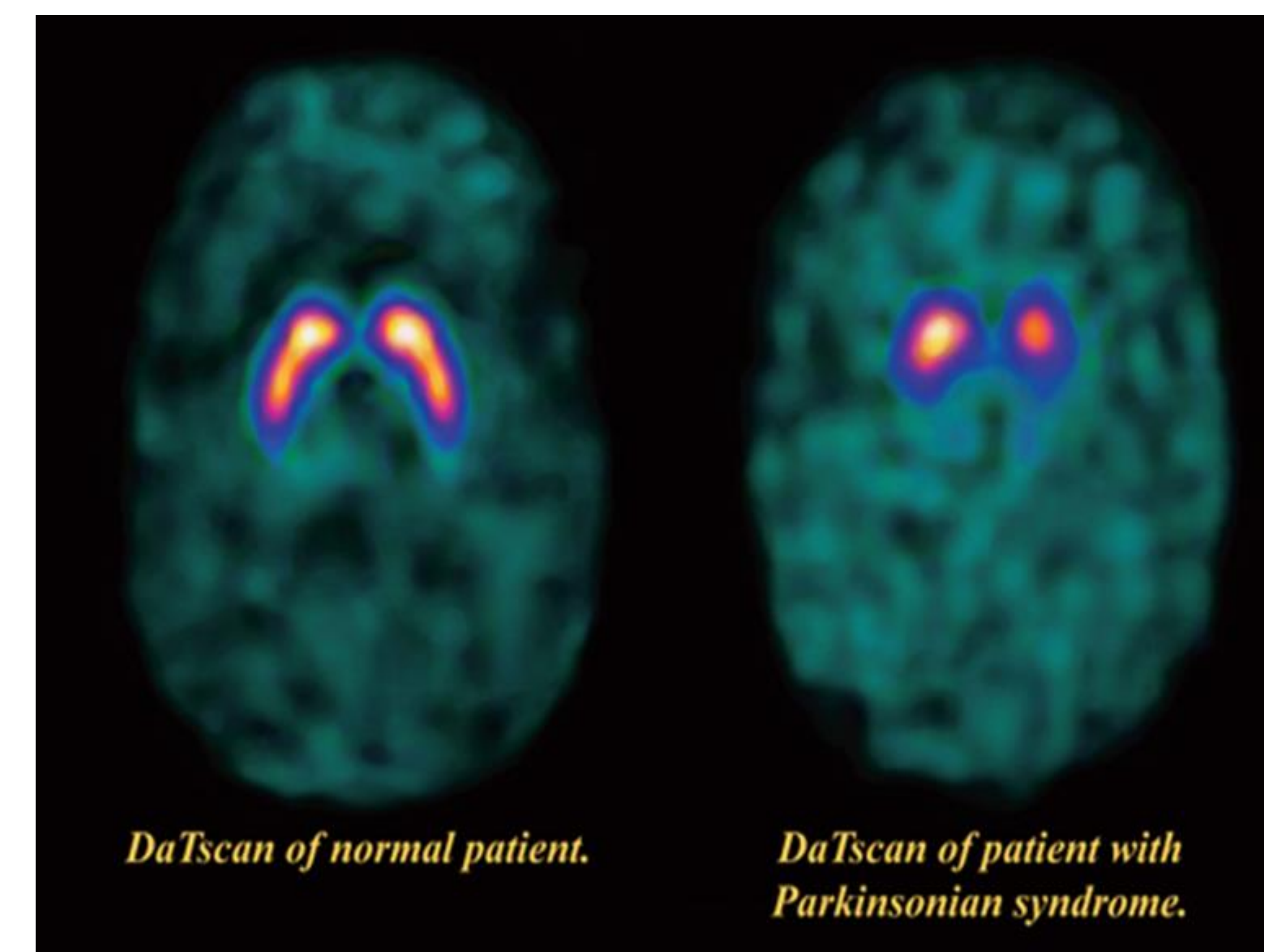
DaTscan of normal patient.   *DaTscan of patient with Parkinsonian syndrome.*

Left: demonstrates healthy dopamine system
Right: demonstrates unhealthy dopamine system (PD)

(Gilbert, D. R. 2022)

Risk Factors of PD

- Age
    - ordinarily begins in middle or late life
- Heredity
    - Likelihood increases when a close relative has PD
- Sex
    - Occurs more often in men
- Exposure to toxins
    - herbicides and pesticides

Signs and Symptoms of PD

Symptoms can start slowly and take years or even decades to appear.

- Tremor in hands
- Slowed movement
- Loss of smell
- Gastrointestinal problems
- Stiffness
- Sleep problems
- Mask-like facial expression
- Less blinking
- Drooling
- Unstable posture
- Trouble swallowing (Mayo clinic, 2022).

Side Effects of DaTscan

Less than one percent of patients have reported side effects.

- Headache
- Nausea
- Upset stomach
- Sensation of motion
- Dry mouth
- Dizziness (Cleveland clinic, 2022).

Treatment

- The disease is not curable.
- There are different treatment options
    - Medications are the primary mechanism to manage the symptoms of the disease.
    - Surgery to implant a device that delivers a mild electrical current to part of the brain (this is known as deep brain stimulation) (Haynes M.T., 2019).

Conclusion

Based on research conducted the project revealed that DaTscan is a useful and safe procedure to help diagnosis Parkinsonian syndromes such as Parkinson's disease. The diagnosis helps physicians manage the patients' symptoms. Symptom management provides a greater quality of life for the patient regardless of their age. While Parkinson's disease is not fatal, unmanaged symptoms may result in complications that lead to a shorter life. DaTscan procedures are relatively noninvasive procedures with minimal reported side effects. Therefore, DaTscan procedures are becoming increasingly useful in the diagnosis of Parkinson's disease.