

PET Scans Visualize the Abnormal Accumulation of Tau Proteins in the Brain; Possibly Leading to Improvements within Neurodegenerative Diseases

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Introduction

- What are tau proteins? A normal protein typically found within the central nervous system, that are responsible for the body's movements, thoughts, and actions. These proteins are vital for maintaining the cell's internal transport system, specifically known as the endoplasmic reticulum (ER).
- These proteins are found with PET scans.
- When tau protein aggregation and abnormal accumulation begins to occur, that is when the danger happens.
- What is tau protein aggregation? A buildup of abnormal tau leading to the proteins becoming tangled within the neurons. Once these tangles have formed, they are nearly impossible to fix. This is where neurodegenerative diseases begin to take effect.

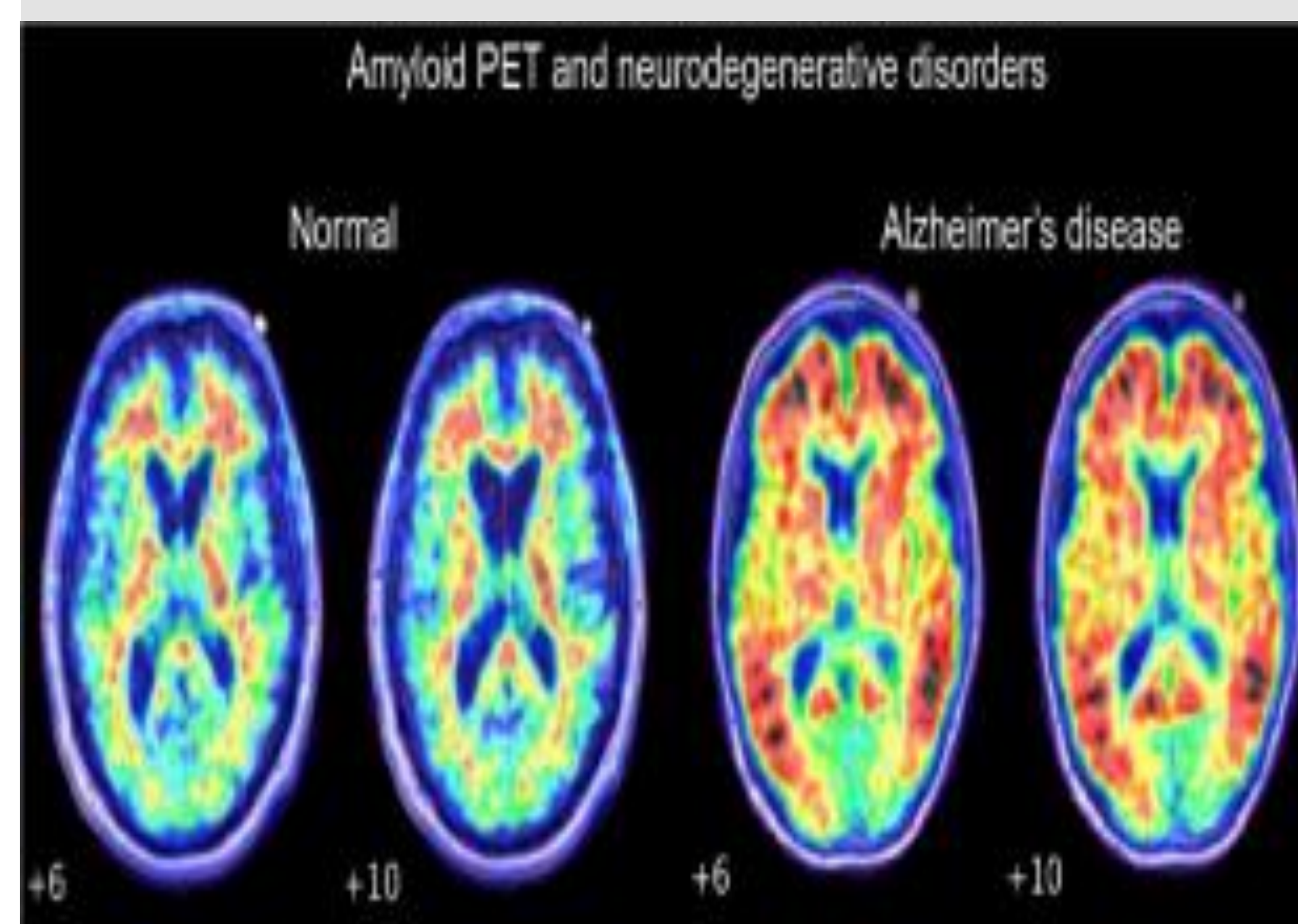
How are PET scans and radioactive tracers effectively used?

- For the most accurate results, the patient would need to undergo the PET scan within the earliest stages of their prognosis.
- What happens during this scan? A specific volume of radioactive tracers are given to the patient intravenously. There are specific tracers for specific proteins that need to be targeted. For this case, the radioactive trace being injected would be specific for the tau proteins.
- What happens once the tracer is injected? If the tracer is able to successfully locate the aggregating protein, that could allow for the disease to be found in the primary stage. Additionally, the severity of the disease can be determined allowing for the treatment to start sooner.

Improvements of Alzheimer's

- What is Alzheimer's? Alzheimer's is due to the buildup of tau proteins, more specifically, amyloid-beta.
- The radioactive tracer will not only highlight the tau protein, but also amyloid-beta (AB).
- Once a patient has the basic symptoms of Alzheimer's disease, they will be able to undergo the amyloid PET scan looking for the specific amyloid-beta and tau protein aggregations within the brain.
- When the amyloid are located, they will show a bright light establishing there is evidence of those proteins within that specific area.

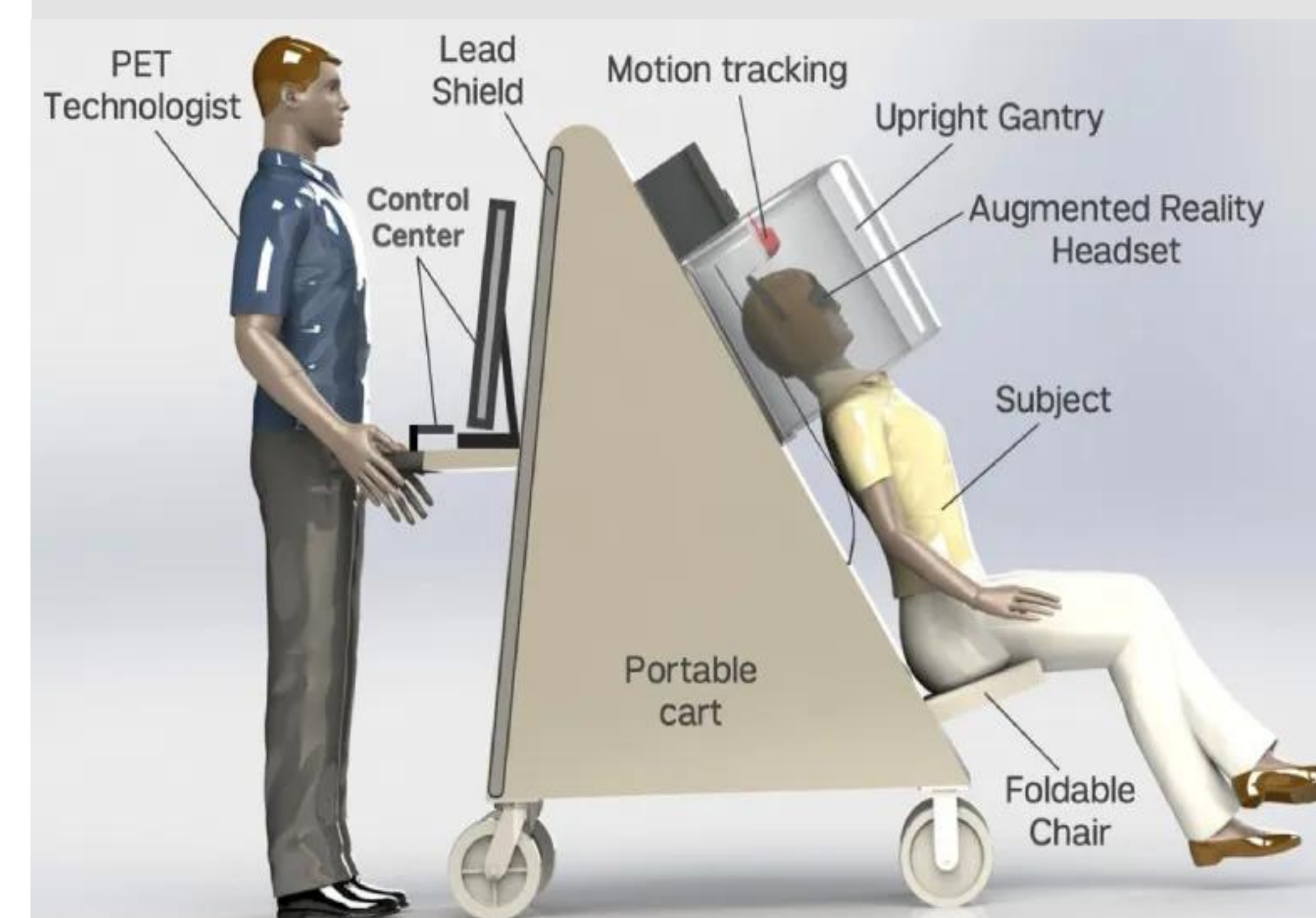
PET scan comparing a normal brain vs. Alzheimer's brain



This is a PET scan of a normal brain detecting the amyloid proteins on the left side and a brain with the neurodegenerative disease of Alzheimer's on the right side. The normal brain is shown with slight intensity and overall has blue, yellow, and lighter colors. The Alzheimer's brain has more intense activity by the red, orange, and darker colors.

New technology arising

- There has been a slow, but reassuring success for PET scans to allow for images to be seen where tau proteins deposit within the brain.
- While PET scans are able to see neurodegenerative diseases in the early stages, even if the brain moves a diminutive amount it could affect the results for the preventive stage.
- However, there have been advancements made that could allow for early detection of tau proteins through a high resolution upright scanner before signs are shown.
- The detector, (PRISM-PET/EMMT), allows for exact locations of radioactive tracers binding to tau, even less than 1 mm in diameter.



PRISM-PET/ EMMT prototype

- The scanner improves the patient's head motion during imaging which improves stabilization, improves comfort due to the patient sitting upright, and allows for the tech to go to the patient rather than the patient coming to the tech.
- Through the successful development of the PRISM-PET/ EMMT scanner there is hope to see successful development in the early detection or prevention in the delay of neurodegenerative diseases.
- This grant was made by Dr. Amir Goldan and Dr. Gloria Chiang and is predicted to be ready for clinical trials in late 2026.

Success Rates

- There have been several studies done on amyloid-beta PET scans to show positive effects on patients.
- The summary of multiple studies concluded:
 - 30% change within the initial diagnosis.
 - 60% increase in diagnostic assurance.
 - 60% overall change within the management of diagnosis.
- Patients who decline the AB PET scan have a:
 - 11% decrease risk of being institutionalized.
 - 7% decrease risk of mortality due to a neurodegenerative disease.
- These numbers speak volume about the importance of receiving a PET scan early on for early prevention of neurodegenerative diseases.

Conclusion

- PET scans have allowed for visualization of the accumulation of the tau proteins, also known as tauopathies.
- These tau proteins being visualized have allowed for early detection of neurodegenerative diseases, specifically Alzheimer's.
- Radiotracers will detect both tauopathies and amyloid-beta (AB) proteins.
- There have been several studies done to prove that PET scans need to continue to be done as early as possible to help with the early diagnosis of neurodegenerative diseases.

References

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