PET Imaging in Early Alzheimer's Disease

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Introduction:

- In America, 7.2 million Americans 65 and older are living with Alzheimer's.
- Alzheimer's disease is described as an accumulation of protein beta-amyloid plaques outside neurons and twisted strands of protein tau tangles inside neurons which cause nerve cells or the neurons to become damaged and destroyed.
- Alzheimer's is a progressive neurodegenerative disorder with no cure but can be detected in its early stages with PET.

PET Imaging:

- Non-invasive scan imaging tool that creates 3D images of bodily organs and tissues through an injection of a radioactive tracer that releases positrons for the scanner to identity any abnormalities at a cellular level.
- There are two type of scans, an Amyloid PET scan and a TAU PET scan.

References:

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https://www.cdc.gov/alzheimers-dementia/signs-symptoms/alzheimers.html.

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Amyloid PET Scans:

- Detects the accumulation of beta-amyloid plaques that can begin 10 to 20 years before cognitive impairment symptoms appear.
- Scans come back positive or negative based on what it is detected on the images.
- A negative scan will show binding restriction to white matter which will show the brain's normal appearance due to the radiotracers binding mainly to white matter which results in the gray appearing darker.
- On a positive scan there is an equal or greater binding to the gray matter compared to the white matter which is going to show abnormal accumulation of amyloid in gray matter that results in the gray matter showing up brighter.

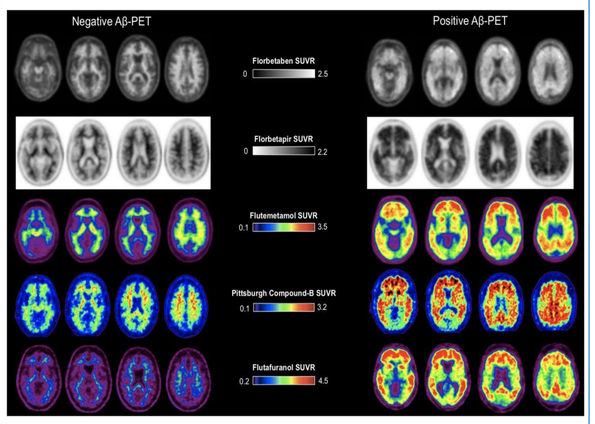


Figure 3. Examples of Positive and Negative amyloid PET findings using different tracers Source: The Journal of Nuclear Medicine, 2022

TAU PET Scans:

- Is recognized as a valid imaging biomarker to assess the tautrophy, "T Component" of Alzheimer's disease.
- Each lobe of the brain should be included, such as, the temporal, frontal and parietal. The temporal lobe must be divided into 4 quadrants due to the fact that only the posterolateral temporal quadrant can bestow a positive scan. The buildup of tau protein in the frontal lobe are more likely to have AD.
- This scan requires a Fluorodeoxyglucose (FDG) bio tracers that is a radioactive glucose used to help understand the pathology of neurodegenerative diseases such as AD and to monitor Alzheimer's progression.
- A positive scan will show an increase of red and orange overlay on the lobes.
- TAU scans provides patient's and their providers a course of action if scans show any concerning abnormalities.

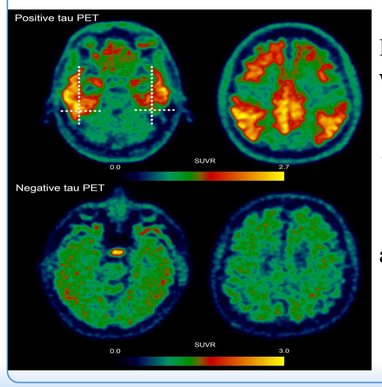


Figure 4: Tau PET with F-flortaucipir Source: Evaluation of Neurodegenerative Disorders with Amyloid-β, Tau, and Dopaminergic PET Imaging: Interpretation Pitfalls

Symptoms:

- Changes in mood and behavior can tend to happen before memory loss, with behavioral changes including personality changes, inappropriate behavior, withdrawalment, loss of interest and feelings such as anxious, sad, or angry about memory loss
- Memory loss can be linked to losing or misplacing things, getting lost in familiar areas, forgetting certain things or recent events, trouble solving problems or making decisions.
- Difficulty completing familiar tasks in a daily routine like dressing, daily hygiene, and forgetting to take medication.

Conclusion:

- Nearly 4 to 5 American adults 45 and older would want to know if they had Alzheimer's disease before experiencing symptoms or before symptoms interfere with daily activities.
- To be able to recognize and understand the course of symptoms of Alzheimer's denotes the importance of identifying its early stages. Medical advancement in amyloid and tau PET imaging notably enhances the ability to detect the early stages of Alzheimer's.
- Early identification grants the opportunity for proper intervention and treatment to slow the progression of Alzheimer's.

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