Case Study

Alzheimer's Disease

Early Accurate Diagnosis of Cognitive Decline

71-year-old male, referred by neurologist.

Patient History

- This patient was referred because of concern for worsening memory.
- Initial physical examination, neurologic exam and blood tests were within normal limits.
- Initial comprehensive neuropsychological testing was found to be cognitively normal for his age.
- PET scan was ordered to help diagnose this patient.
- Further neuropsychological performance over next three years indicated significant cognitive deterioration.
- By the 3rd year the patient's performance met criteria for mild cognitive impairment, performing between one and two standard deviations below the mean established for his same age peers on at least 50% of the memory tasks.

Clinical Question

What is causing his loss of cognitive ability?

A PET scan was ordered to assist with this diagnosis.

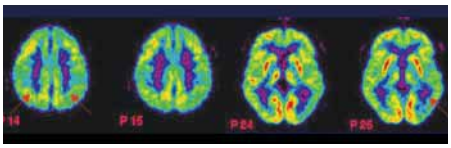

Figure 1A.

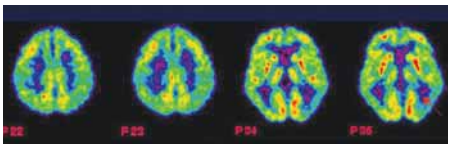

Figure 2A.

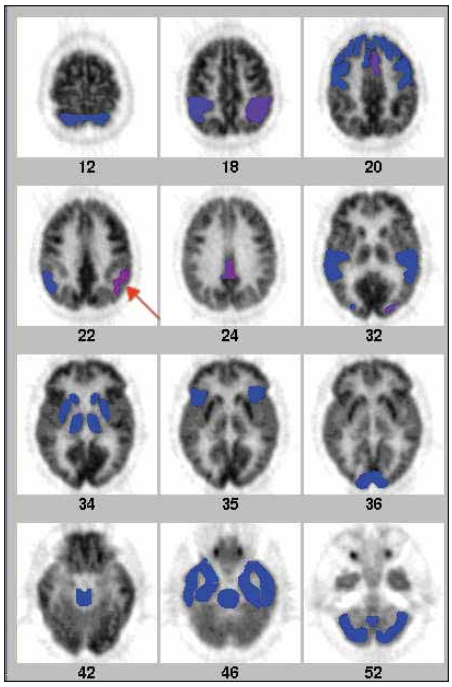

Figure 1B. Initial PET Scan

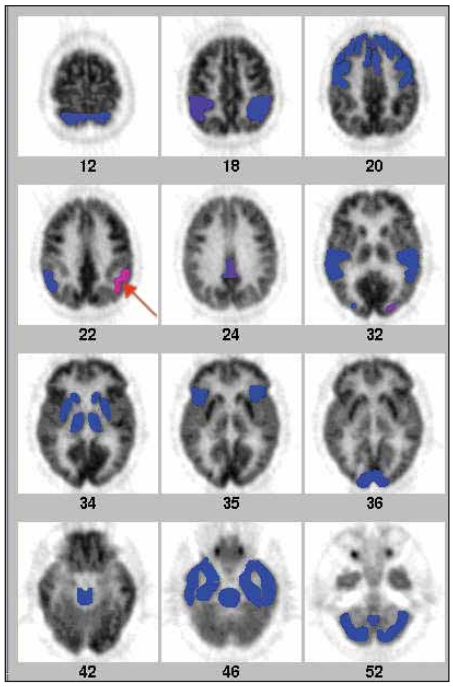

Figure 2B. Three years later

Initial PET Findings and Quantitative Analysis

- Initial brain scan revealed mild parietotemporal hypometabolism, more pronounced on the left (right side of image) *Fig.1A*

NeuroQ™ analysis identifies mild abnormalities (purple) in parietotemporal and posterior cingulate regions, with well preserved metabolism in other regions (blue). This pattern is suggestive of early stages of Alzheimer's disease.

Three Years Later - PET Findings and Quantitative Analysis

- There appears to be a slight worsening of parietotemporal hypometabolism in *Fig.2A*

NeuroQ™ analysis supports this showing the left parietotemporal cortex advancing to a near-red shade (12% and 4 standard deviations below normal) as referenced in plane 22 in *Fig.2B* vs. the purple shade (9% and 3 standard deviations below normal) seen earlier in *Fig.1B.*

PET FOUNDATIONS

Case study courtesy of Daniel Silverman, M.D., Ph.D., UCLA Medical Center, Los Angeles, California

Differential Diagnosis

Patient was diagnosed with incipient Alzheimer's Disease due to the clinical progression of declining neuropsychologic performance and the posterior-predominant pattern of hypometabolism affecting the posterior cingulate and parietotemporal cortex in the PET scans.

Treatment

Armed with the PET information, the patient's physician prescribed an anti-Alzheimer's combination regimen including both donepezil and memantine.

Positron Emission Tomography (PET)

Positron Emission Tomography (PET) is a non-invasive, advanced diagnostic imaging procedure that can provide unique information to aid in the differential diagnosis of Alzheimer's disease versus other dementias as well as assist with the management of stroke, brain tumors and epileptic seizures. Since glucose is the primary source of energy for cells in the brain, the radiopharmaceutical FDG, a glucose derivative, helps to create a normal versus abnormal map of brain function, as imaged in a PET scan. Distinctive patterns of glucose metabolism assist physicians in accurately diagnosing patients and treating them appropriately.

Differential Diagnosis of Alzheimer's Disease

Sensitivity 94%[1]

Specificity 87%[2]

1 Silverman, et al., JAMA 2001, 268: 2120 - 2127.
2 Silverman, Journal of Nuclear Medicine 2004; Vol 45, April 2004; pages 594-607

"The Association supports the use of FDG PET for patients with dementia or patients with mild or moderate cognitive impairment of at least 6 months duration."

Criteria for appropriate use:

- *Diagnosis remains uncertain after an experienced physician performs a standard comprehensive evaluation for dementia*
- *The information available through PET reasonably is expected to help clarify the diagnosis and/or help guide future treatment.*

– **Alzheimer's Association Statement on Positron Emission Tomography, January 2004**

"PET improves the overall accuracy of diagnosis compared to accuracy of an examination based on American Academy of Neurology (AAN) guidelines."

– **Agency for Healthcare Research and Quality U.S. Dept. of Health and Human Services, April 2004**

"The evidence is adequate to conclude that a FDG-PET scan is reasonable and necessary in patients with documented cognitive decline of at least six months and a recently established diagnosis of dementia who meet diagnostic criteria for both Alzheimer's disease (AD) and fronto-temporal dementia (FTD), who have been evaluated for specific alternate neurodegenerative diseases or causative factors, and for whom the cause of the clinical symptoms remains uncertain."

– **U.S. Centers for Medicaid and Medicare Services, 15 September 2004**

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