Imperial College Healthcare NHS Trust

A Case of F-18 Florbetapir PET CT in the Differentiation of Normal Pressure Hydrocephalus From Early Alzheimer's Disease

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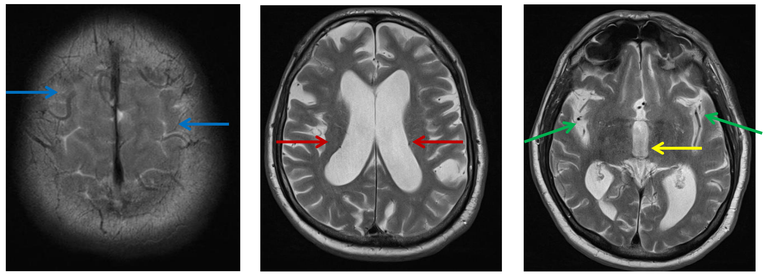
Case History

A 77-year-old man presented with a 1-year history of progressive memory decline whilst remaining otherwise cognitively intact. Blood sampling revealed normal thyroid function, B12 and folate levels. Cranial MRI (see below) demonstrated some imaging features suggestive of normal-pressure hydrocephalus (NPH).

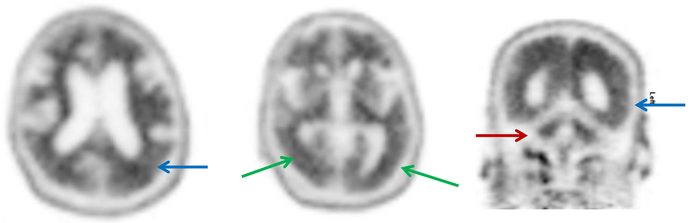
Although the MRI findings were suggestive of NPH, clinically the symptoms were felt to be more consistent with atrophy and possibly early Alzheimer's disease. A F-18 florbetapir (Amyvid) brain PET CT was requested for further evaluation and planning of future patient management.

MRI Findings



Cranial MRI demonstrated some imaging features suggestive of normal-pressure hydrocephalus (NPH). Namely prominence of the lateral (red arrows) and third (yellow arrow) ventricles as well as the sylvian fissures (green arrows) with some crowding of the gyri at the vertex (blue arrows). There was, however, preservation of the mesial temporal lobes and no evidence of significant associated small vessel disease.

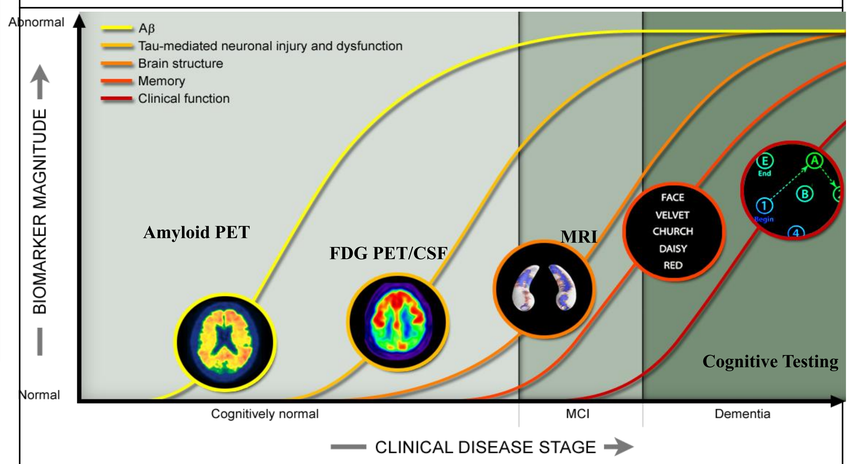
F-18 Florbetapir PET CT



F-18 florbetapir PET CT imaging of the brain demonstrated good cerebellar grey-white differentiation (red arrow) – this is used as the 'normal' template. However, there is generalised patchy increased grey matter uptake, in more than two lobes in the cerebrum. Most notably, there was loss of grey-white differentiation in both occipital lobes (green arrows), the left temporal lobe, the left posterior parietal cortex (blue arrows) and the precuneus consistent with a positive scan. A positive scan indicating moderate or severe levels of amyloid plaque deposition, which is compatible with a clinical diagnosis of Alzheimer's disease.

Change in Clinical Outcome

The positive Amyvid scan supported the clinical working diagnosis of early Alzheimer's and as a result the patient avoided CSF shunting as a treatment for NPH which would have proved futile and carries risk of complications both at insertion and thereafter.

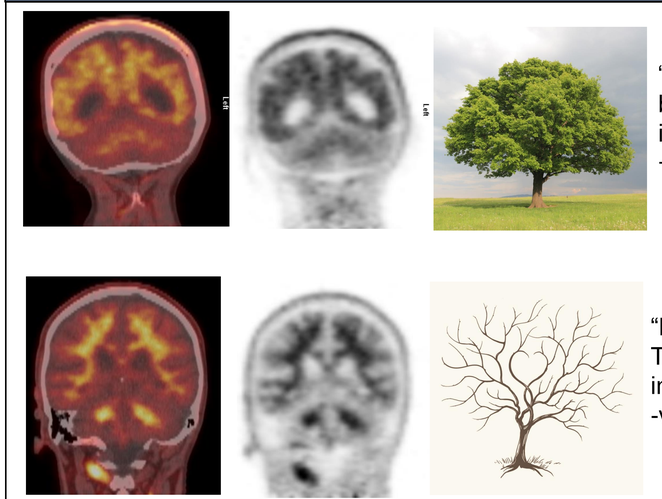


Adapted from Jack et al. Lancet Neurol. 2013;12(2):207–16.

Mechanism of Action

- Amyvid binds selectively to β-amyloid neuritic plaques
- In vitro binding studies in postmortem Alzheimer's disease brains demonstrated statistically significant (*P*<0.0001) correlations between Amyvid and β-amyloid aggregate deposition

Characteristic PET signs



"Tree-in-bloom" sign indicating a +ve scan

"Branching Tree" sign indicating a -ve scan

Conclusions

• Amyvid brain PET is a powerful, accurate, and consistently reproducible new tool in the investigation of suspected AD in vivo.

• A negative result is very powerful, and is not compatible with a clinical diagnosis of Alzheimer's disease.

• A positive scan:
- helps greatly to make a definitive clinical diagnosis of AD.
- result will be required to commence disease modifying drugs and to enter drug trials.
- will avoid unnecessary invasive procedures, such as lumbar puncture or ventriculo-peritoneal shunting.
- activate support services pathways/social security.

References:
1. Clark CM, Schneider JA, Bedell BJ et al. Use of florbetapir-PET for imaging β–amyloid pathology. JAMA 2011; 305: 275-283. 2. Clark CM, Pontecorvo MJ, Beach TG et al. Cerebral PET with florbetapir compared with neuropathology at autopsy for detection of neuritic amyloid-β plaques: a prospective cohort study. Lancet Neurology 2012; 11: 669-678. 3. Wong DF, Rosenberg PB, Zhou Y et al. In vivo imaging of amyloid depoisiton in Alzheimer disease using the radioligand 18F-AV-45 (florbetapir F-18). J Nucl Med 2010; 51: 913-920.
4. Johnson KA, Minoshima S, Bohnen NI et al. Appropriate use criteria for amyloid PET: A report of the AmyloidImaging Task Force, the Society of Nuclear Medicine and Molecular Imaging, and the Alzheimer's Association. J Nucl Med 2013; 54: 476-490.