UNIVERSITY OF WASHINGTON SCHOOL OF MEDICINE

Department of Radiology

Division of Nuclear Medicine

Didactic

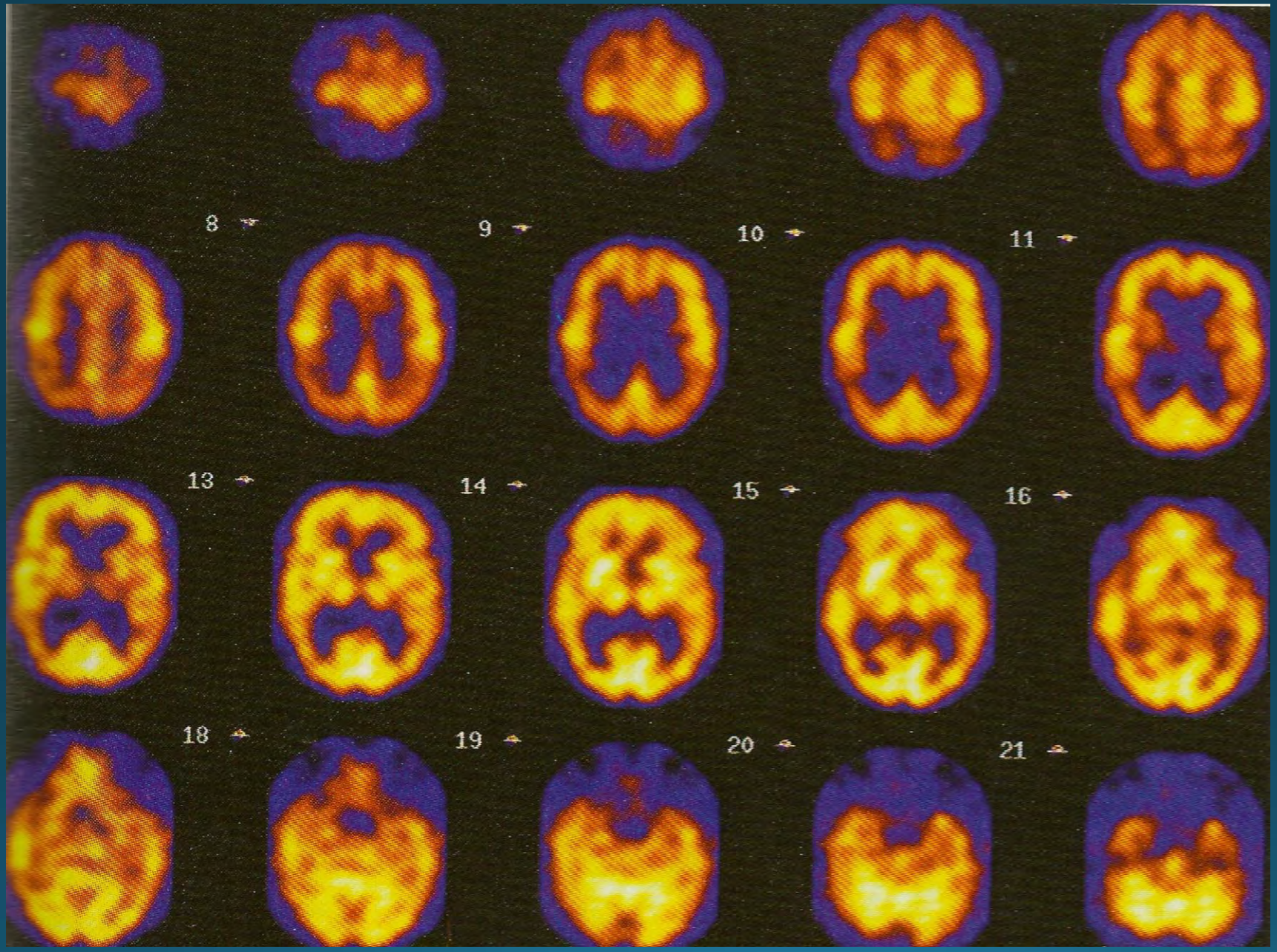
Dementia Review

Original presentation by: Shana Elman MD

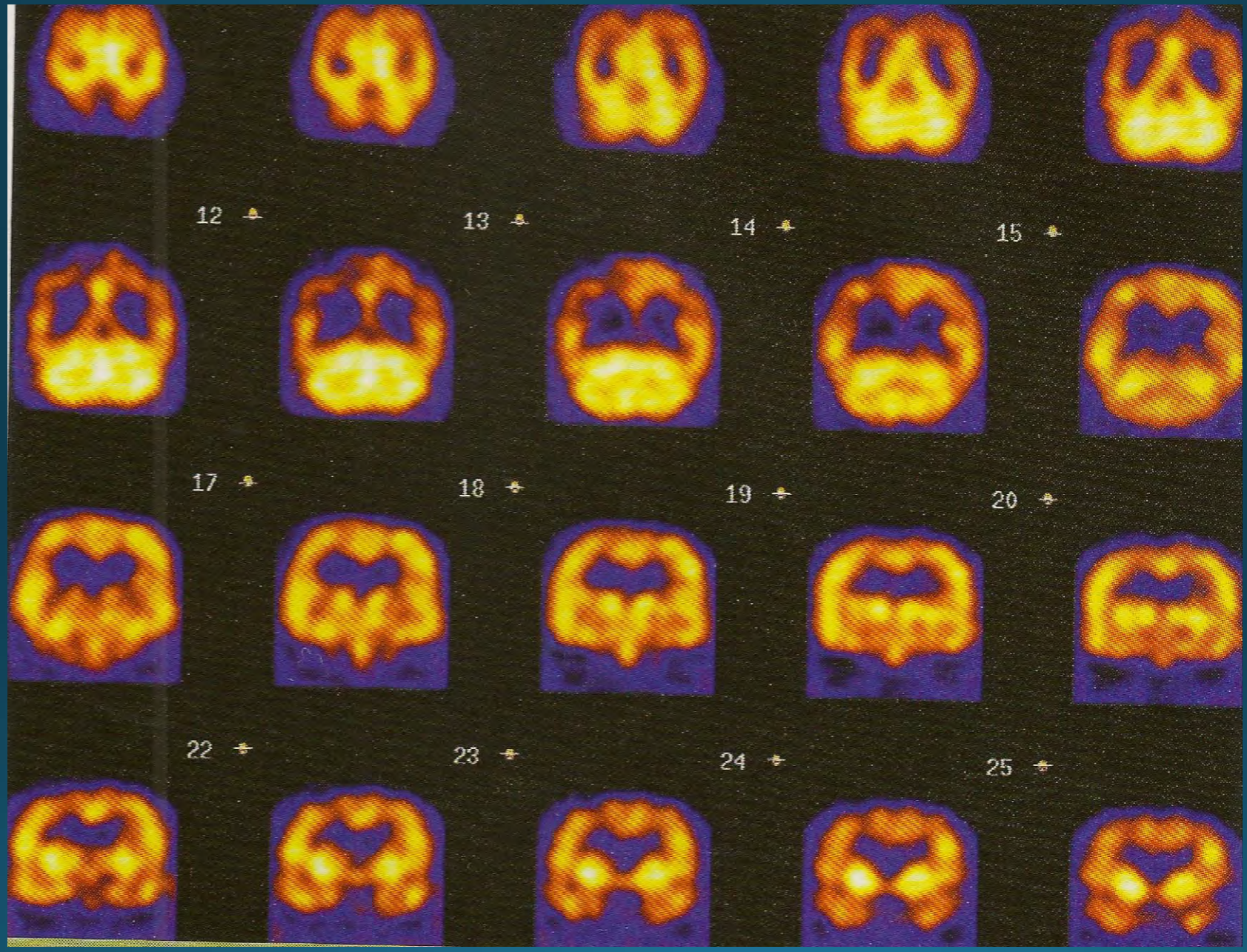
Reviewed by: Manuela Matesan MD

Last update: March 2016

- History: 72-year-old with progressive memory loss and difficulty managing finances.



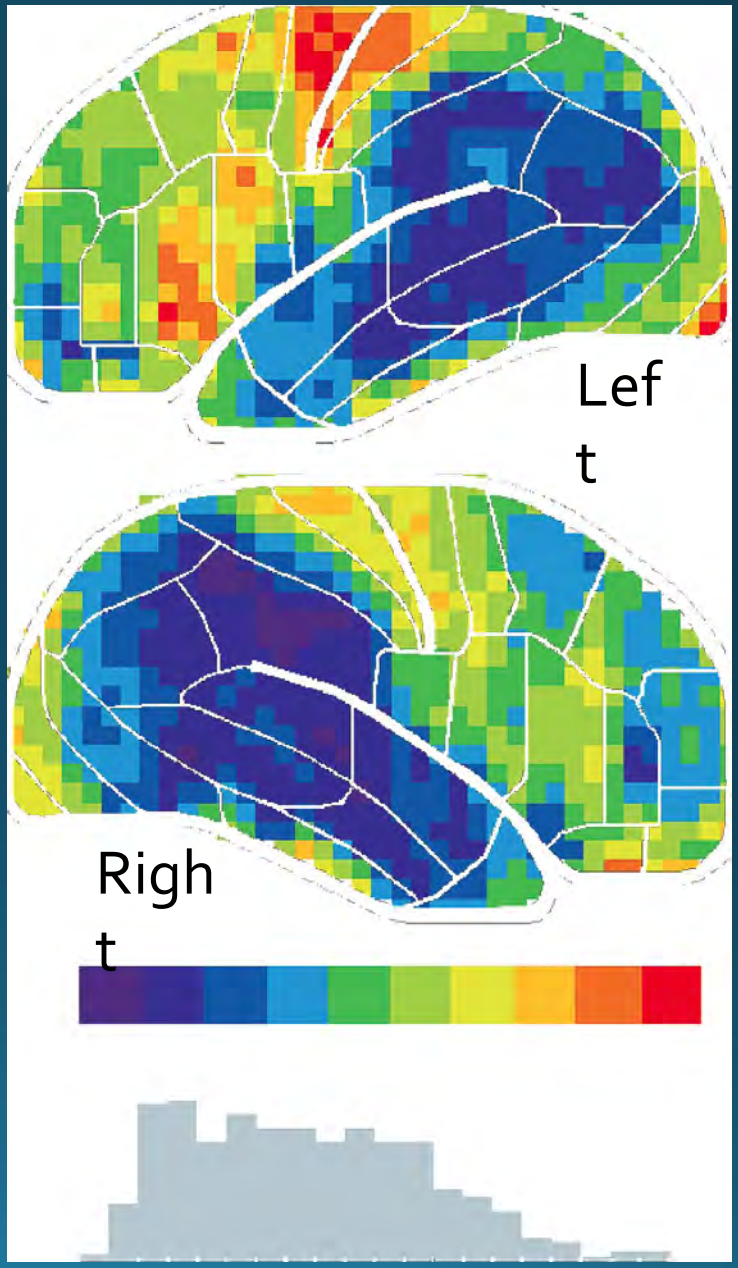
Rajendran & Manchenda. Nuclear Medicine Cases. McGraw-Hill (2011).



Rajendran & Manchenda. Nuclear Medicine Cases. McGraw-Hill (2011).

Lateral view of the cortical surface from SPECT analysis of 30 probable AD male patients with a broad range of severity.

Scale indicates range for Pearson correlations with single decimal precision with "time-indexed" estimation of dementia severity in 30 probable AD male patients. Bottom graph shows relative frequency of each decimal range

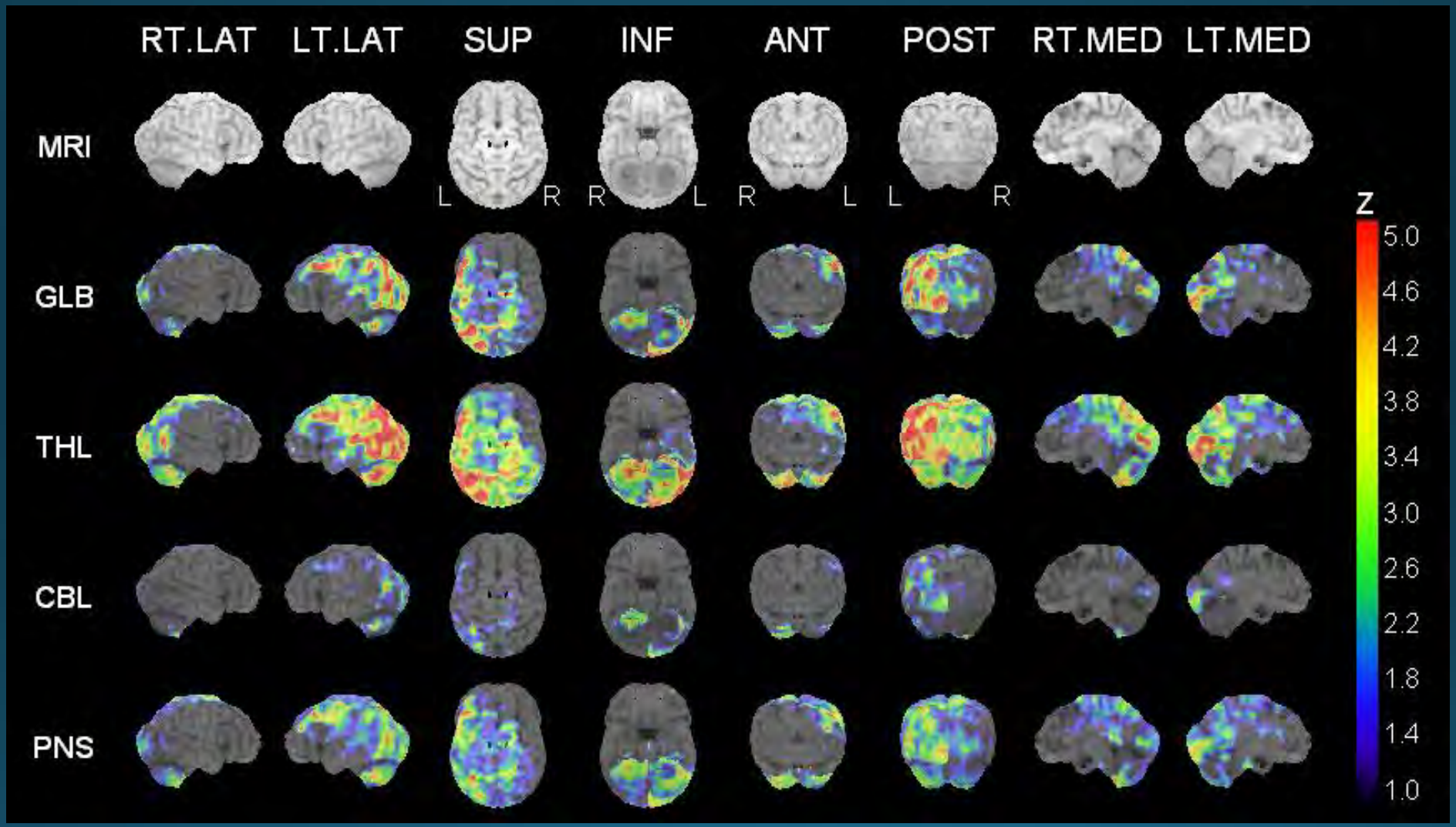


Ashford et al. (2000) Single SPECT measures of cerebral cortical perfusion reflect time-index estimation of dementia severity in Alzheimer's disease. J Nucl Med 41, 57-64.

Alzheimer's Disease

- Most common cause of dementia
- Prevalence strongly linked to age: 60-64 year old patients (1-10%), 85-90 years (>20-25%).
- Clinical features: starts with episodic memory loss, progressing to deficits in attention and execution processes and visuo-perceptual abilities.
- Treatment: acetyl-cholinesterase inhibitors, neuroleptics for agitation.

- History: 70-year-old with dementia who reports seeing ants crawling on ceiling.


RT.LAT
LT.LAT
SUP
INF
ANT
POST
RT.MED
LT.MED
MRI
GLB
THL
CBL
PNS
L
R
R
L
R
L
L
R
Z
5.0
4.6
4.2
3.8
3.4
3.0
2.6
2.2
1.8
1.4
1.0

Impression:

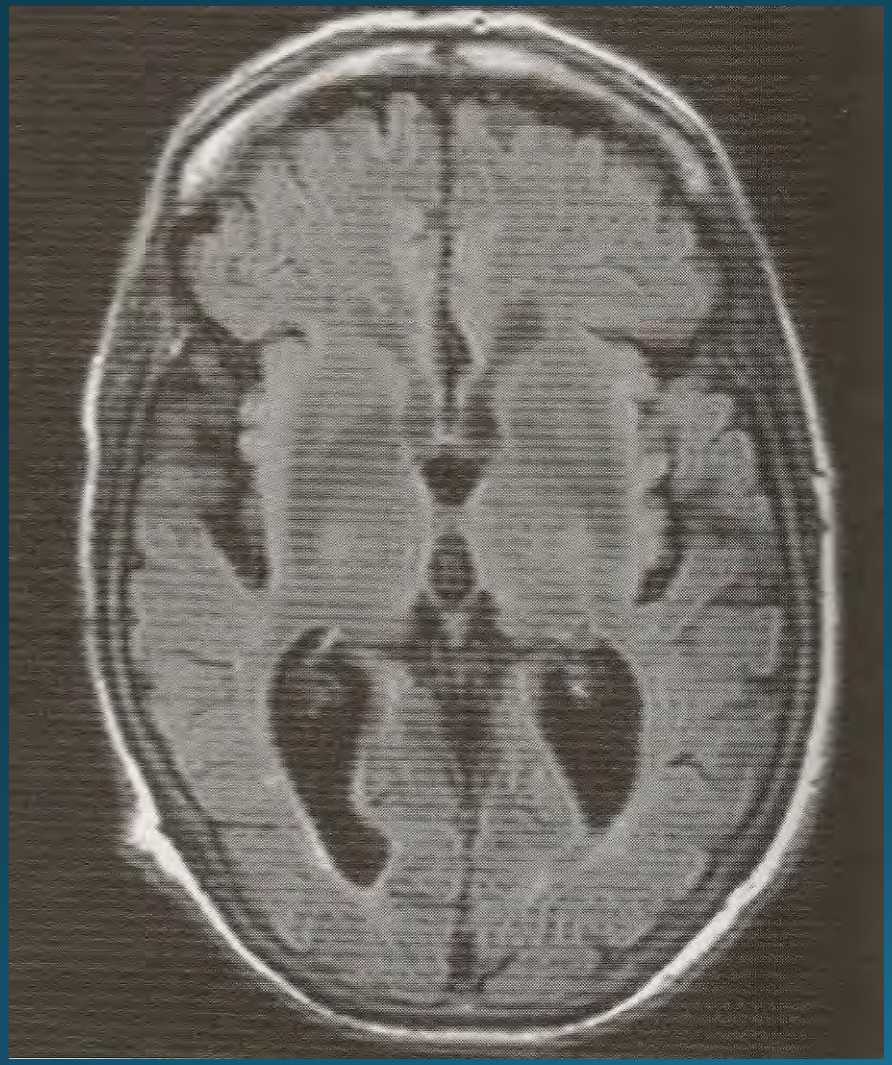
- Generalized hypoperfusion with most profound hypoperfusion in bilateral parieto-occipital regions with a pattern suggestive of Lewy Body Dementia.

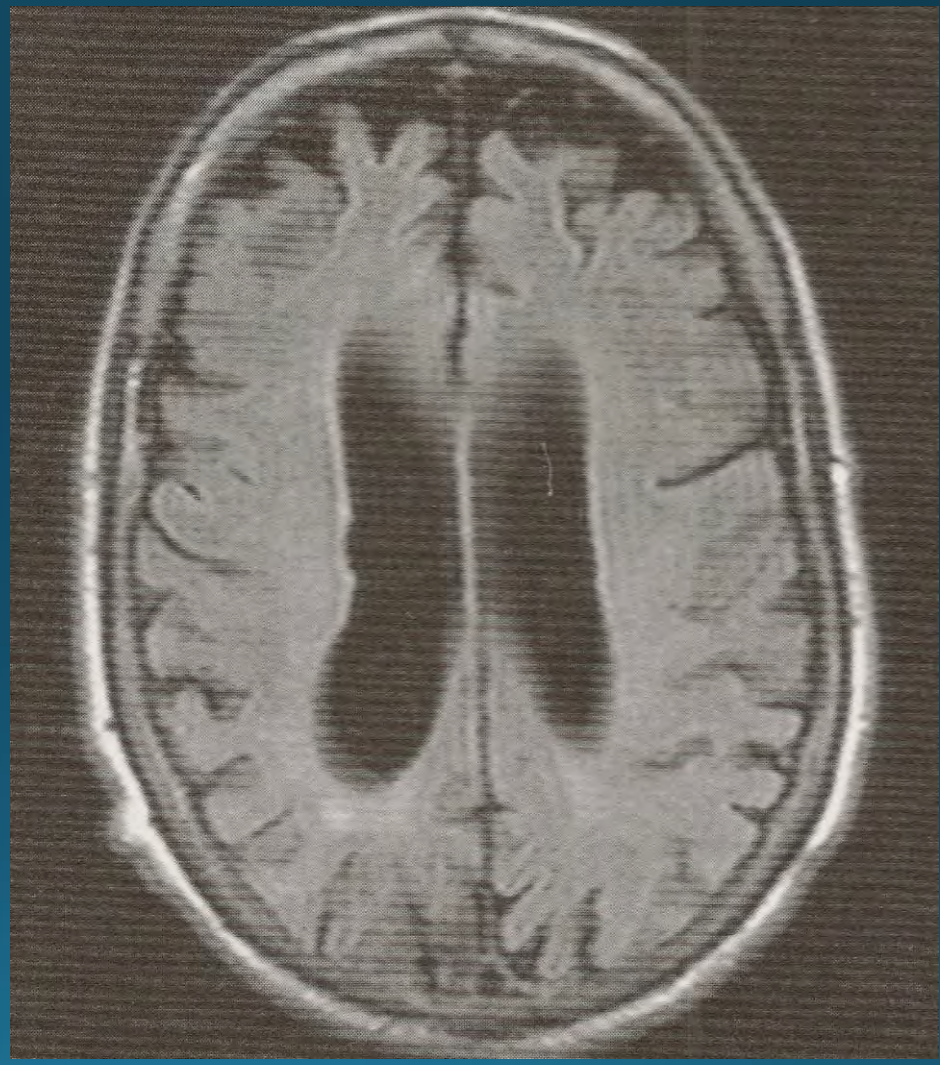
Lewy Body Disease

- Second most common type of dementia after Alzheimer's disease
- Typical age of onset 50-70, sporadic
- Mimic of Parkinson disease (both share nigrostriatal degeneration): main differentiation clinically is that dementia precedes or occurs within 12 month of diagnosis of Parkinson disease.
- Mimic of Alzheimer's disease—However, recurrent visual hallucinations are much more common with Lewy body disease (because of visual cortex involvement).

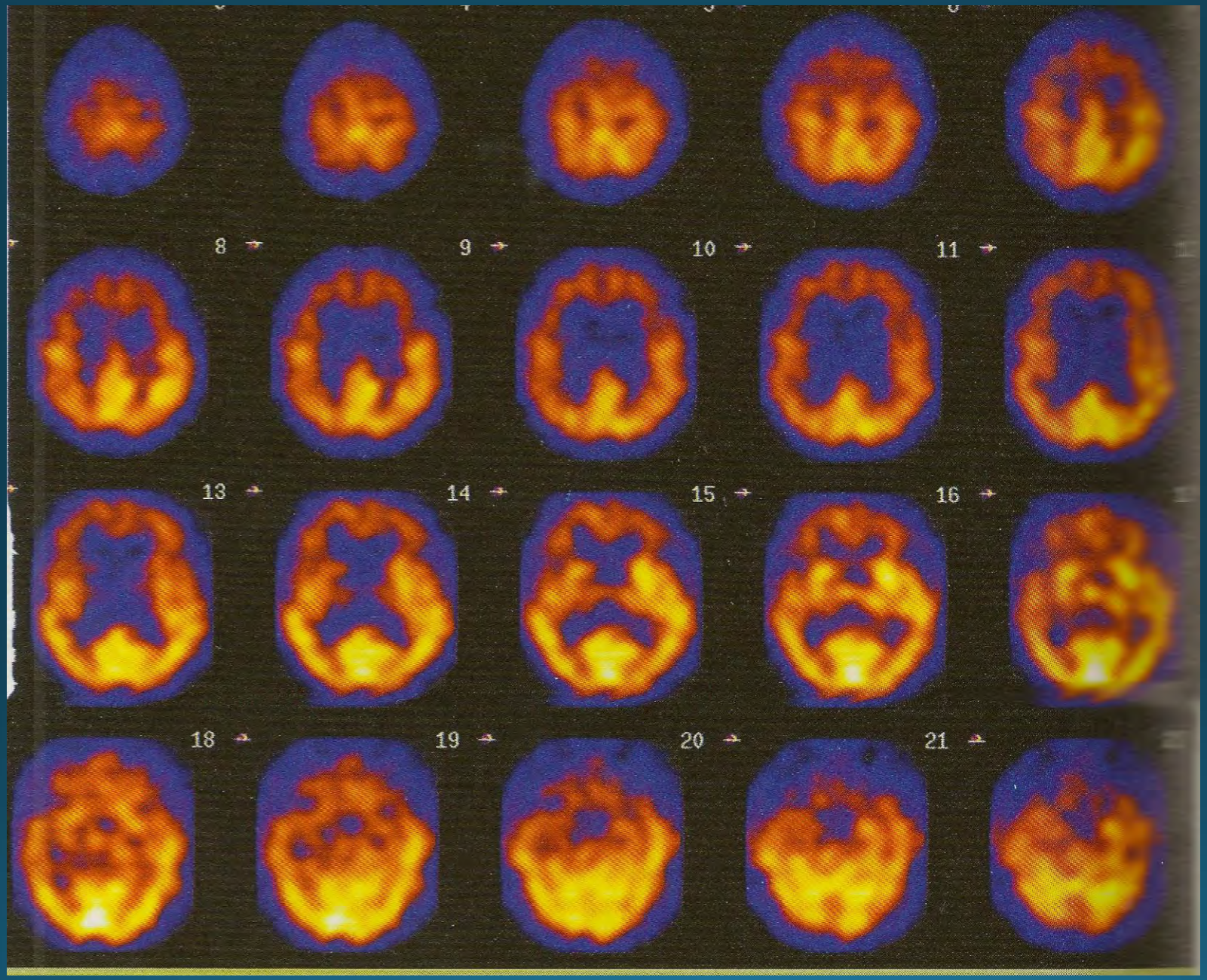
Lewy Body Disease Treatment

- May have severe sensitivity reactions to neuroleptic drugs, such as rigidity, reduced consciousness, pyrexia, falling, postural hypotension and collapse .
- Treatment similar to Alzheimer's with acetyl-cholinesterase inhibitors .
- Unlike Parkinson's disease, do not respond well to L-dopa.





Rajendran & Manchenda. Nuclear Medicine Cases. McGraw-Hill (2011).

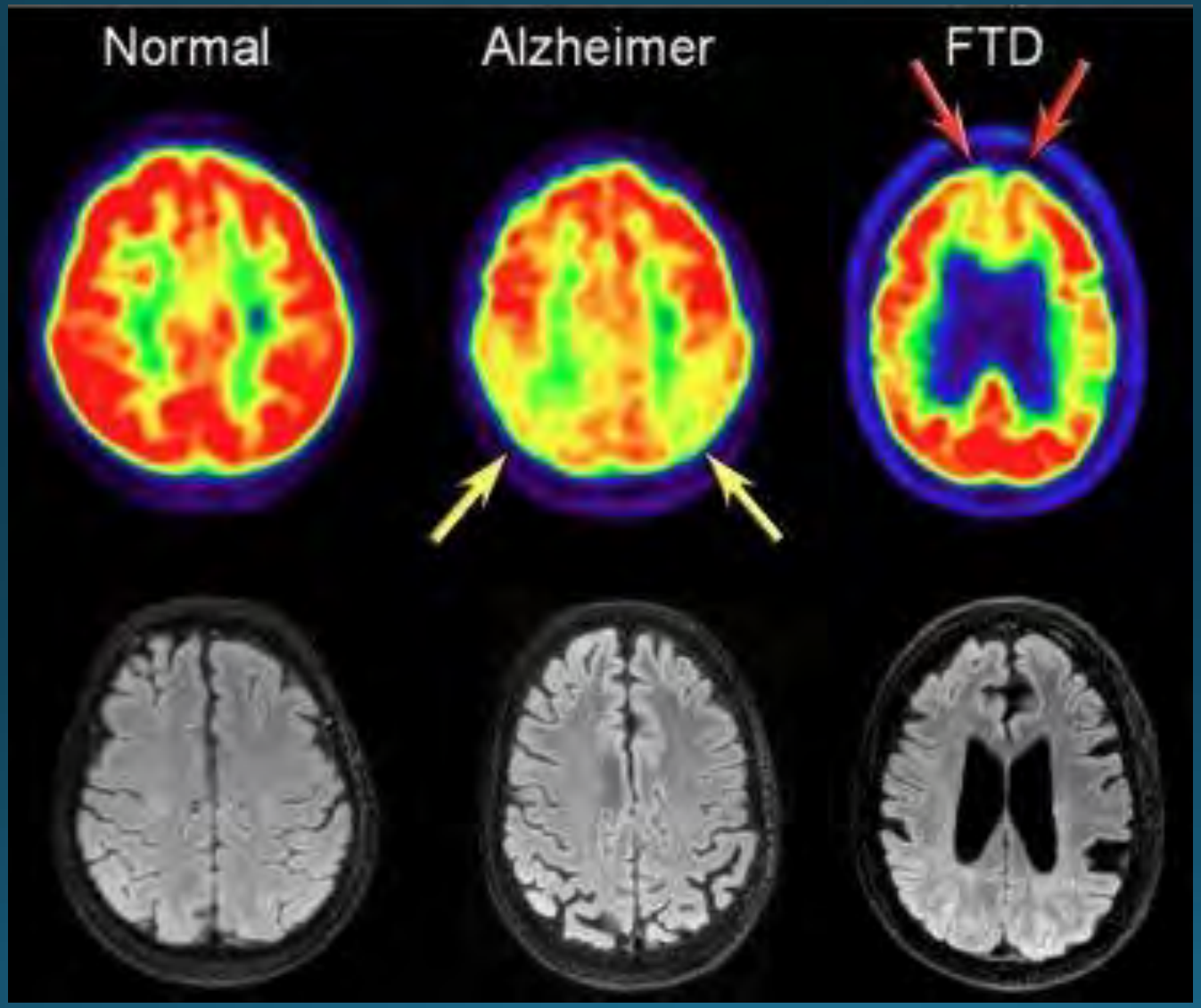


Rajendran & Manchenda. Nuclear Medicine Cases. McGraw-Hill (2011).

Frontotemporal Lobar Degeneration (FTLD)

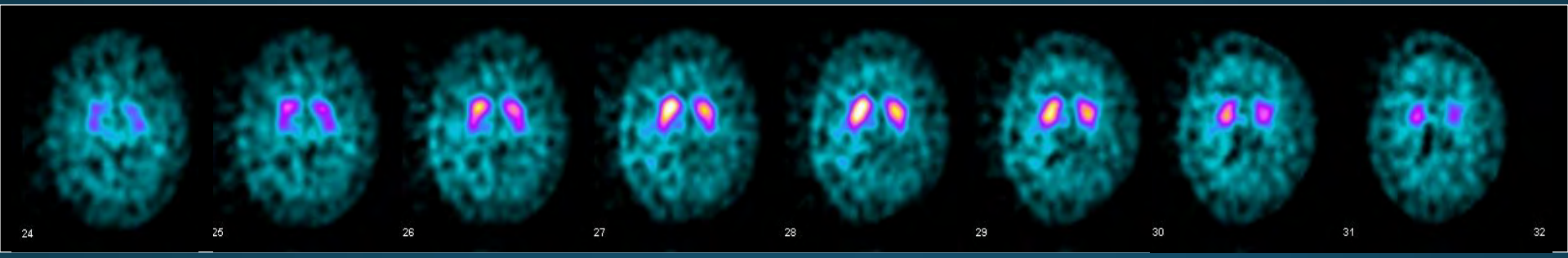
•Pre-senile Dementia (40-60 yo) with male predeliction
•4th most common cause of dementia
• FTLD is clinically characterized by behavioral and language disturbances that may precede or overshadow memory deficits. There is currently no treatment for this condition.
•Subtypes:

1. frontal variant (Pick's disease): predominantly behavioral and personality changes
2. temporal variant : predominantly language and communication changes
3. Semantic Dementia, a disease subtype with progressive aphasia and left-sided temporal lobe degeneration.


Normal
Alzheimer
FTD

- History: 55-year-old man with rigidity.

- History: 55-year-old man with rigidity.



Impression

- Mild reduction of radiotracer uptake in the bilateral putamen, left more severe than right, are consistent with mild nigrostriatal degeneration typically seen in idiopathic Parkinson's Disease or related disorders.

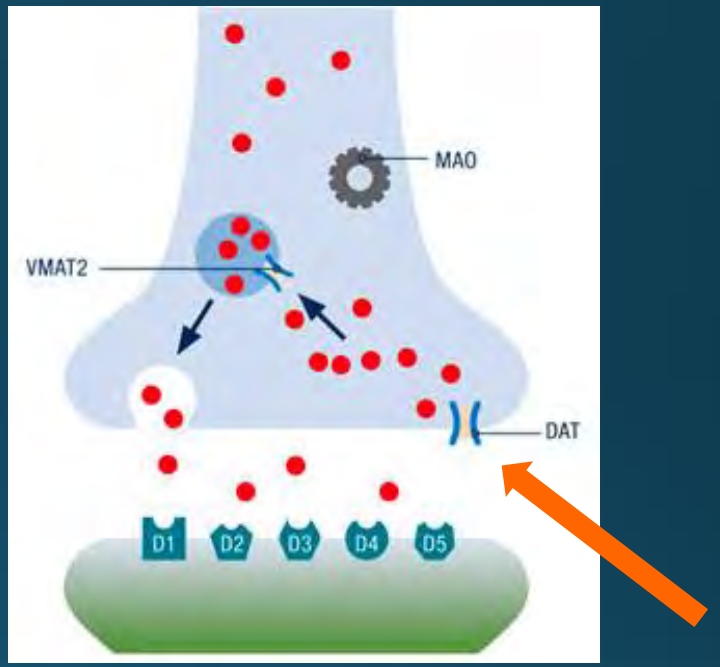
Parkinson's Disease (PD)

- PD is a neurodegenerative disorder
- Characteristic findings: resting tremor, rigidity, slowed movement, decreased dexterity, small handwriting, flexed posture, gait disorder, imbalance, dementia.
- Mean age of onset 57 years
- Affects 1-2% of population over age 60
- Highly varied collection of symptoms and pace of progression

DAT imaging in PD

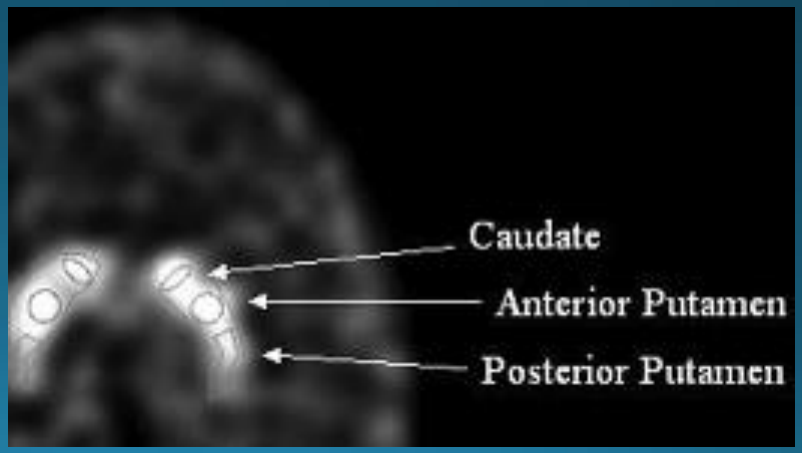
Radiotracers:

- 123I beta-CIT tropane (B-CIT)
- 123I FP-CIT ioflupane (DATSCAN)
  - Approved 1/20/11
- 99mTc-TRODAT-1 altropane (TRODAT)
- 18F FP-CIT



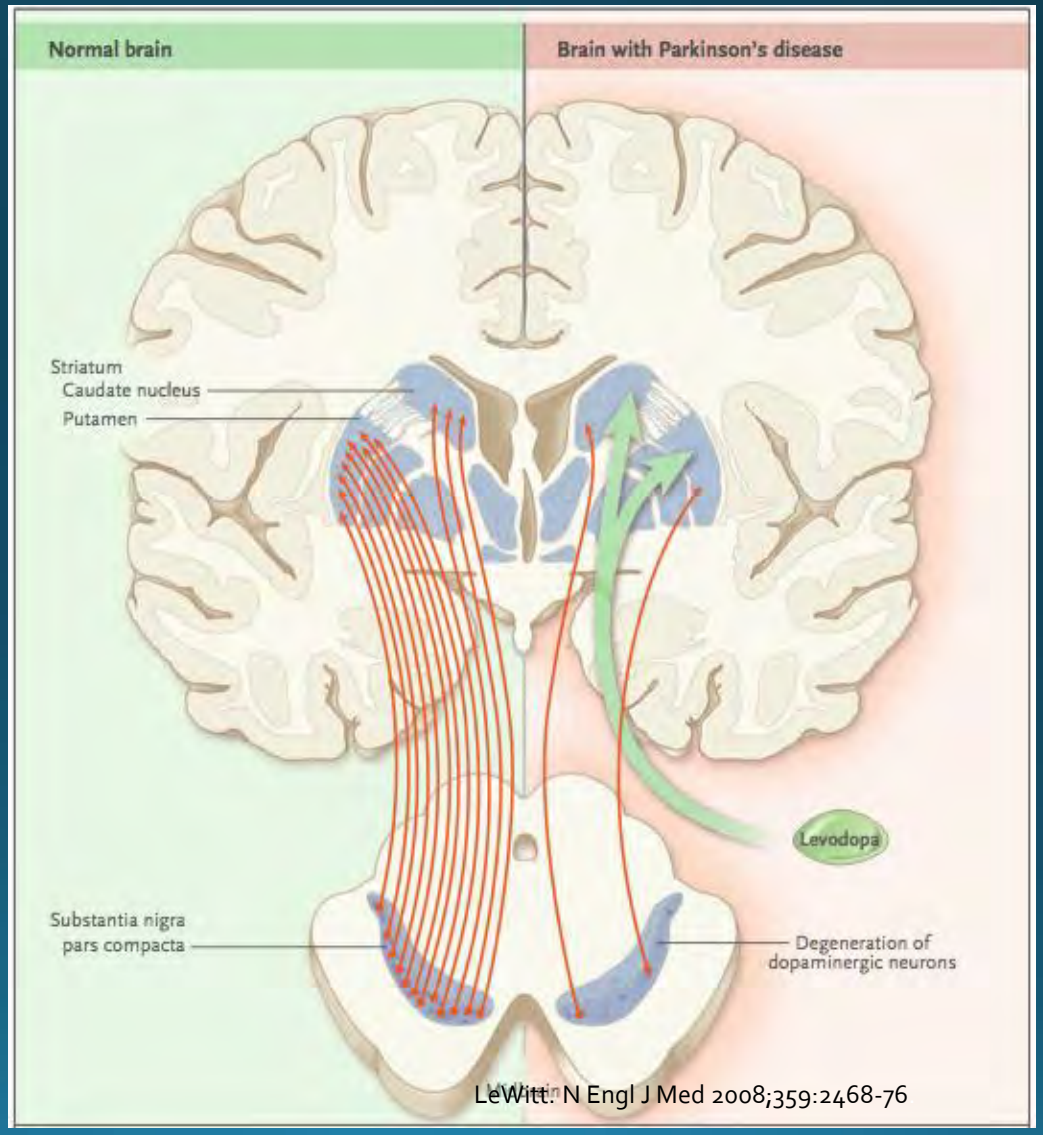
Findings:

1. Markedly reduced DAT density
2. Putamen > caudate
3. Asymmetric
4. Correlates with clinical severity



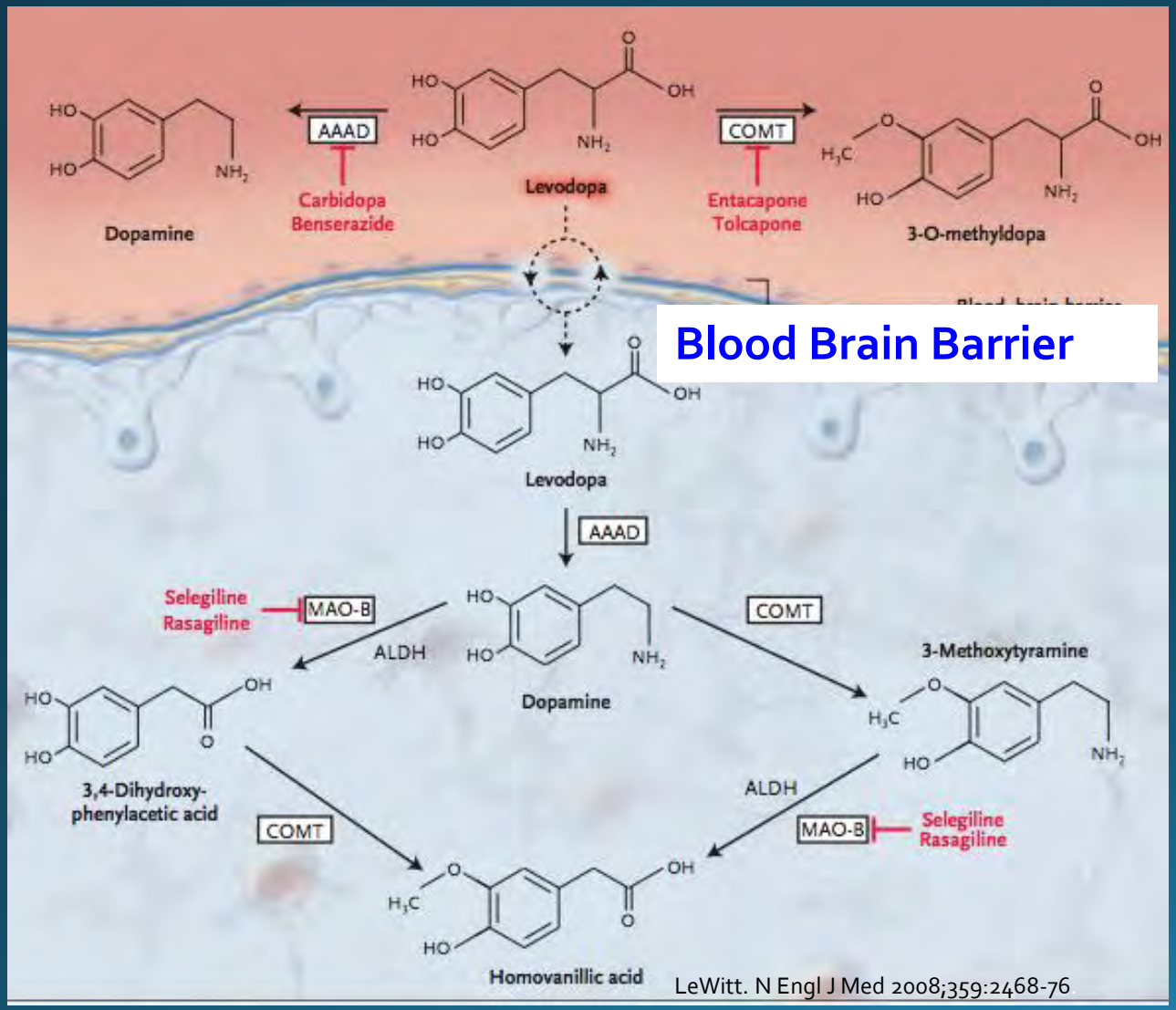
PD is neurodegenerative

- Motor impairments arise from loss of dopaminergic neurons arising from substantia nigra
- Nerve loss of ~50% required for symptoms



LeWitt. N Engl J Med 2008;359:2468-76

Treatments



LeWitt. N Engl J Med 2008;359:2468-76

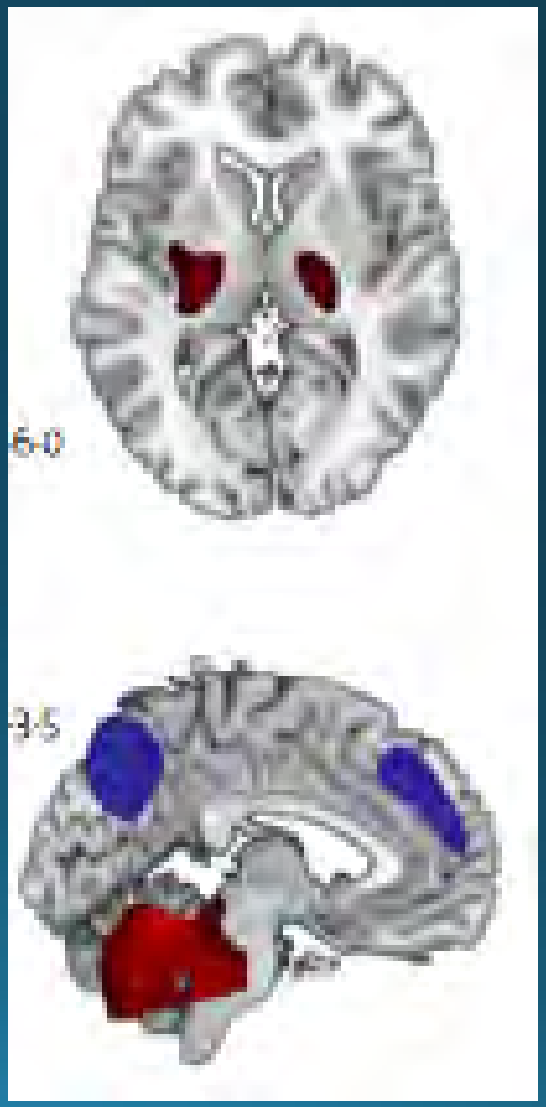
1. Levodopa
2. Dopaminergic agents (ropinirole, pramipexole)
3. Inhibitors of peripheral metabolism (carbidopa)
4. Inhibitors of CNS metabolism (selegiline)

[^{18}F]fluorodeoxyglucose (FDG) PET

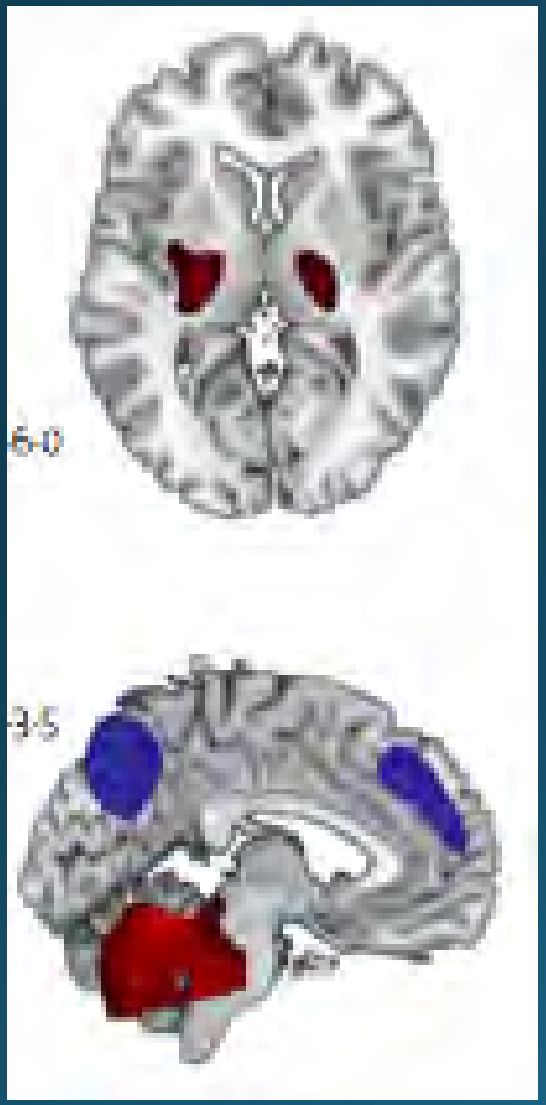
Disease-related pattern in PD:

hypermetabolism: pallidothalamic, pontocerebellar

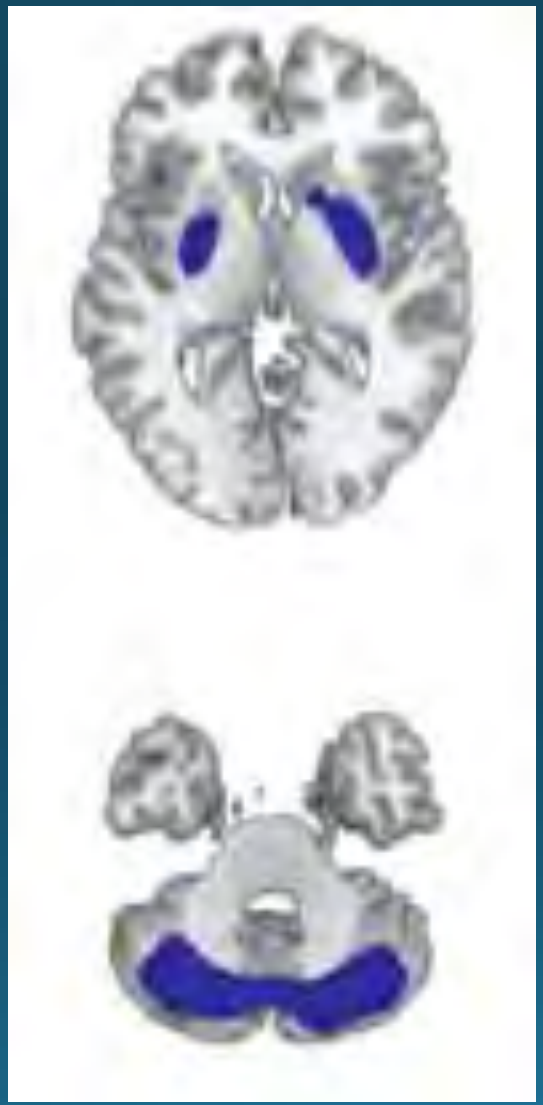
hypometabolism: lateral premotor cortex, supplementary motor area, parietooccipital association region



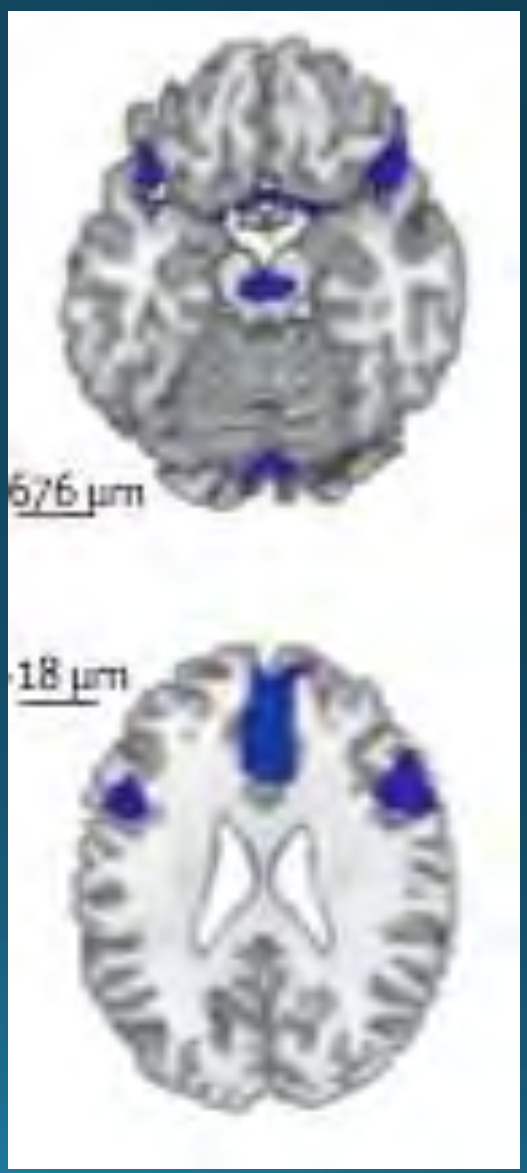
PD



MSA



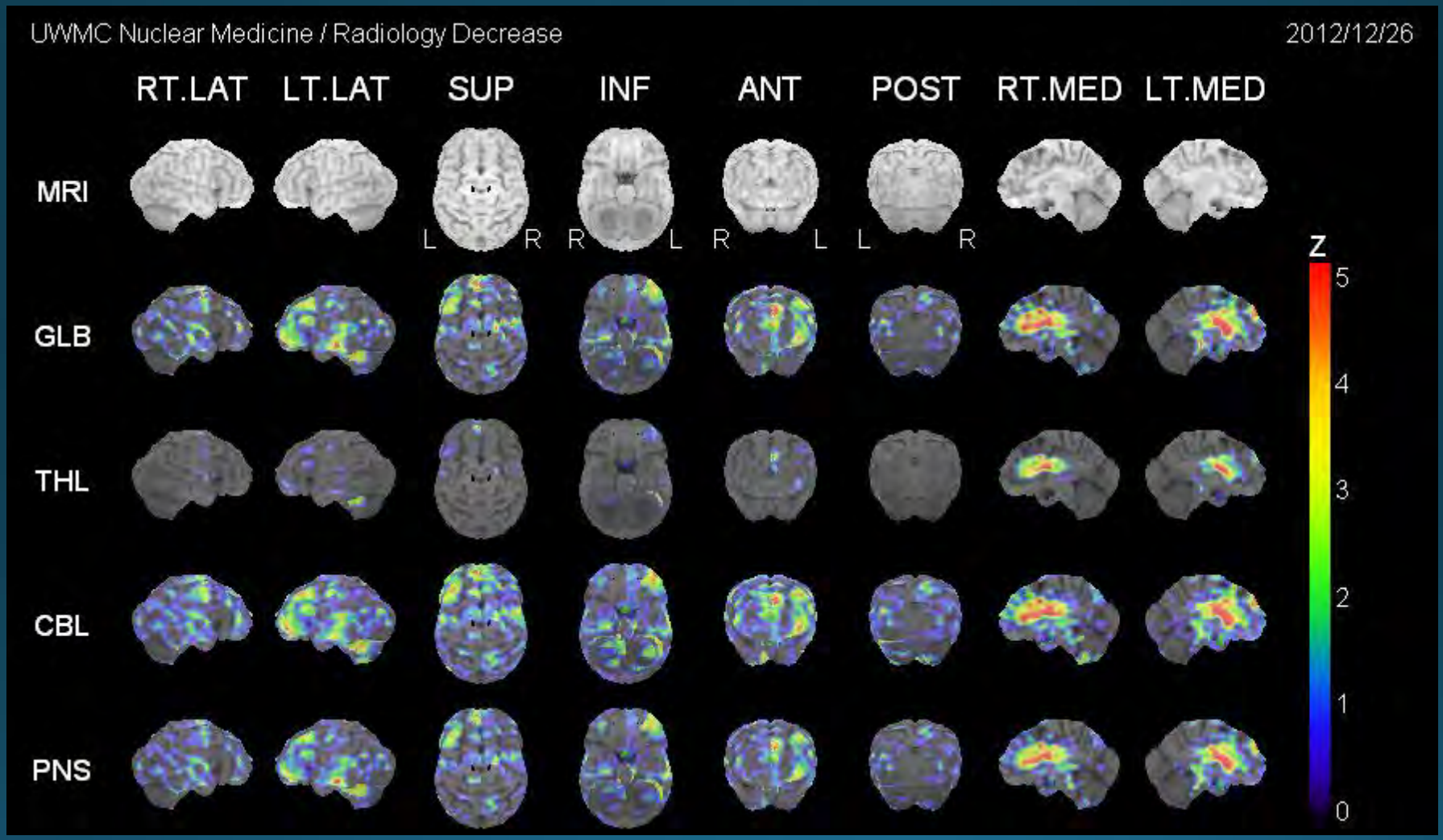
PSP



Red = increased metabolism

Blue = decreased metabolism

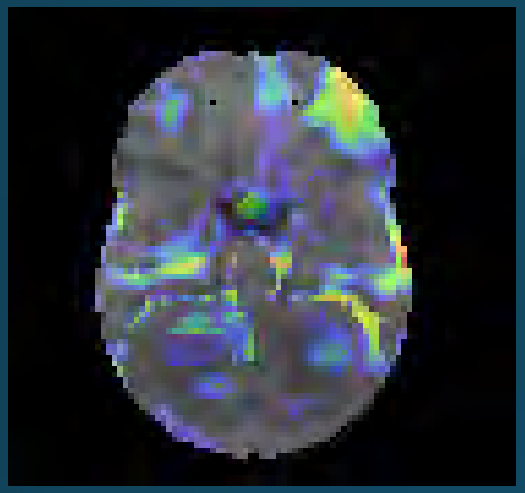
Brain SPECT Ordered 6 weeks later in same 55-year-old man.

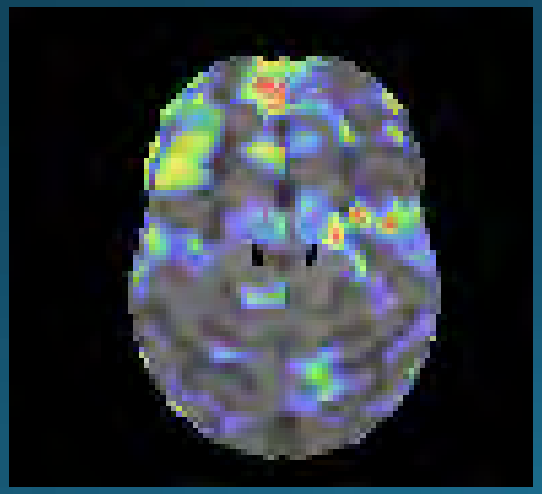


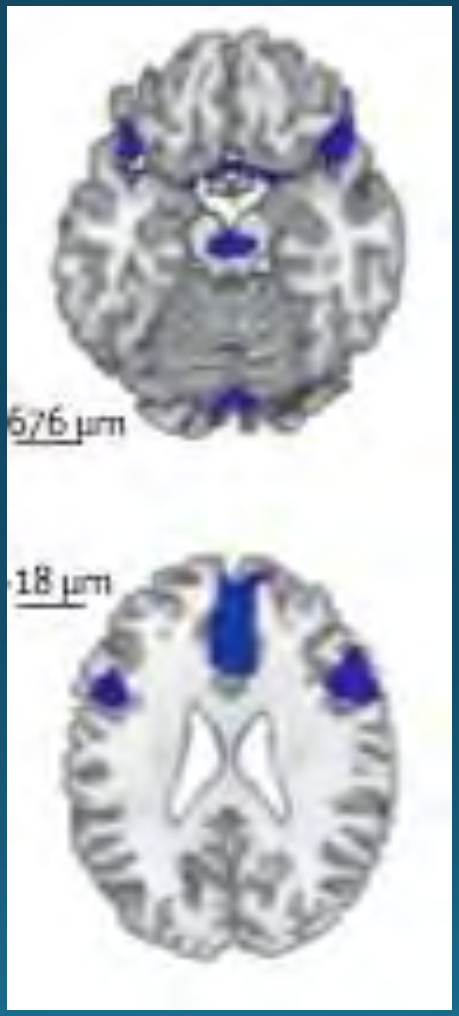
Impression

- Hypoperfusion seen in the frontal and anterior temporal lobe as well as in the upper brainstem and thalamus could be consistent with progressive supranuclear palsy.

Progressive Supranuclear Palsy





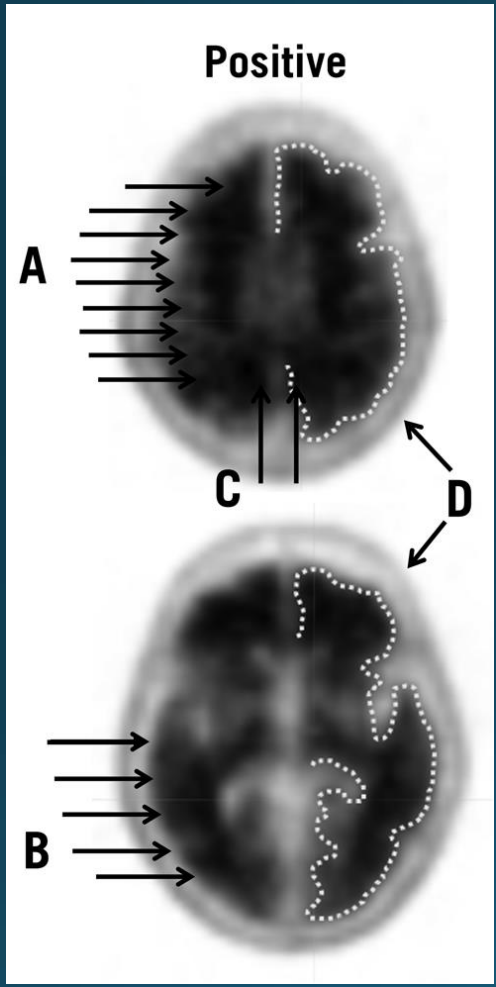


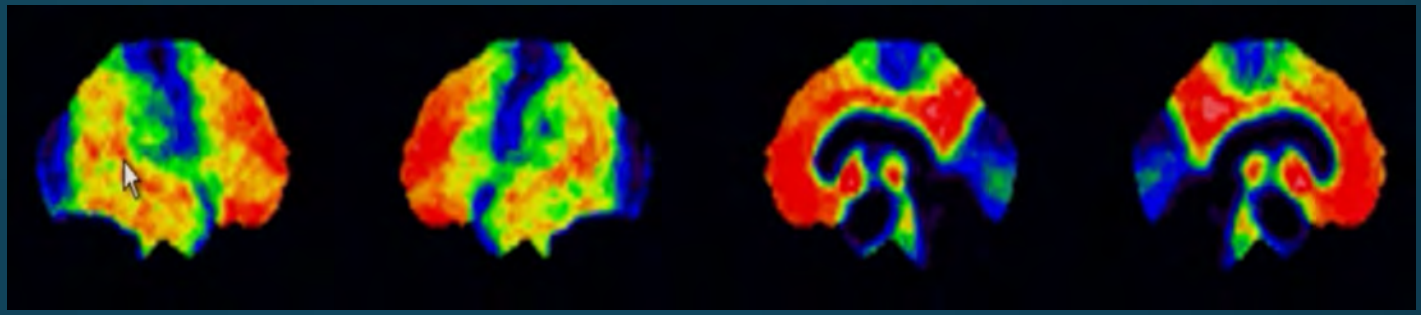
18F-LABELED RADIOPHARMACEUTICALS FOR AMYLOID IMAGING for

Clinicians can now choose between three approved PET Aβ imaging tracers:

- Florbetapir (Amyvid)
- Flutemetamol (Vizamyl)
- Florbetaben (Neuraceq)

Useful to estimate β-amyloid neuritic plaque density in adult patients with cognitive impairment who are being evaluated for Alzheimer's Disease (AD) and other causes of cognitive decline





Typical Positive Scan: pattern of uptake matters

A) White matter tracts are difficult to fully identify as they travel from frontal to parietal lobe.

B) Borders of white matter tracts in occipital/temporal area are lost in places.

C) Increase uptake:

- Intense: *gray matter in posterior cingulate and medial parietal cortex (precuneus)*
- *Frontal cortex including medial aspect*
- Less intense and less frequent: *parietal and temporal neocortex*
- *Relative sparring (very little) : pre and post central gyrus and primary visual cortex.*

Suggested Articles

1. Valotassiou V, Papatriantafyllou J, Sifakis N, et. al. Perfusion **SPECT** studies with mapping of Brodmann areas in differentiating Alzheimer's disease from **frontotemporal degeneration** syndromes.,Nucl Med Commun. 2012 Dec;33(12):1267-76. doi: 10.1097/MNM.0b013e3283599983.
2. Misch MR, Mitchell S, Francis PL et. al. Differentiating between visual hallucination-free dementia with Lewy bodies and corticobasal syndrome on the basis of neuropsychology and perfusion **single-photon emission computed tomography**.,Alzheimers Res Ther. 2014 Dec 5;6(9):71. doi: 10.1186/s13195-014-0071-4. eCollection 2014.
3. Rollin-Sillaire A, Bombois S, Deramecourt V, et. al. Contribution of **single photon emission computed tomography** to the differential diagnosis of dementia in a memory clinic., J Alzheimers Dis. 2012;30(4):833-45. doi: 10.3233/JAD-2012-111067
4. Richard Brown. **Brain PET in Suspected Dementia: Patterns of Altered FDG Metabolism**.Radiographics. 2014. 684-701.