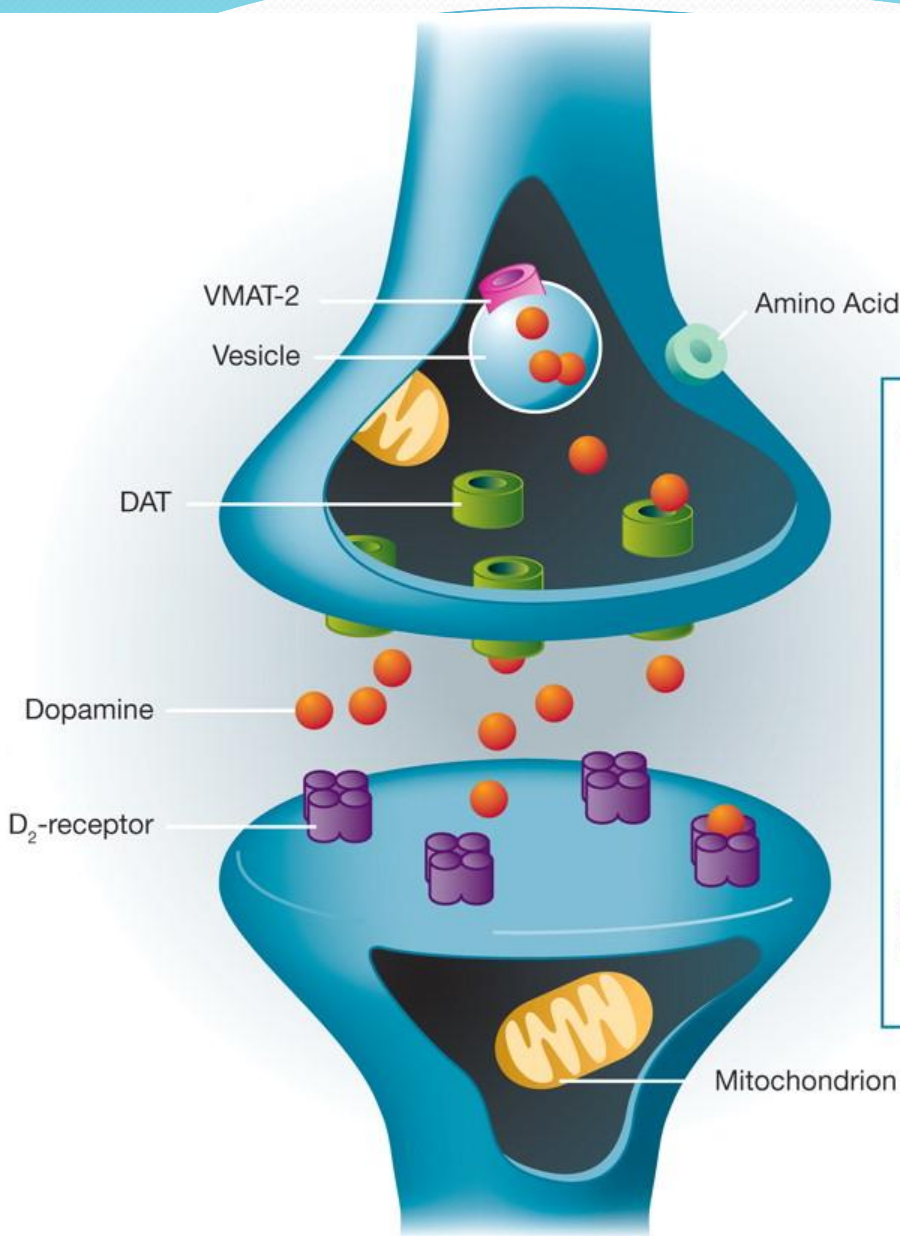






Imaging in movement disorders

Dr Vikram Lele MD(med) DRM,DNB
Director: Dept. of Nuclear Medicine
Jaslok Hospital & Research Centre

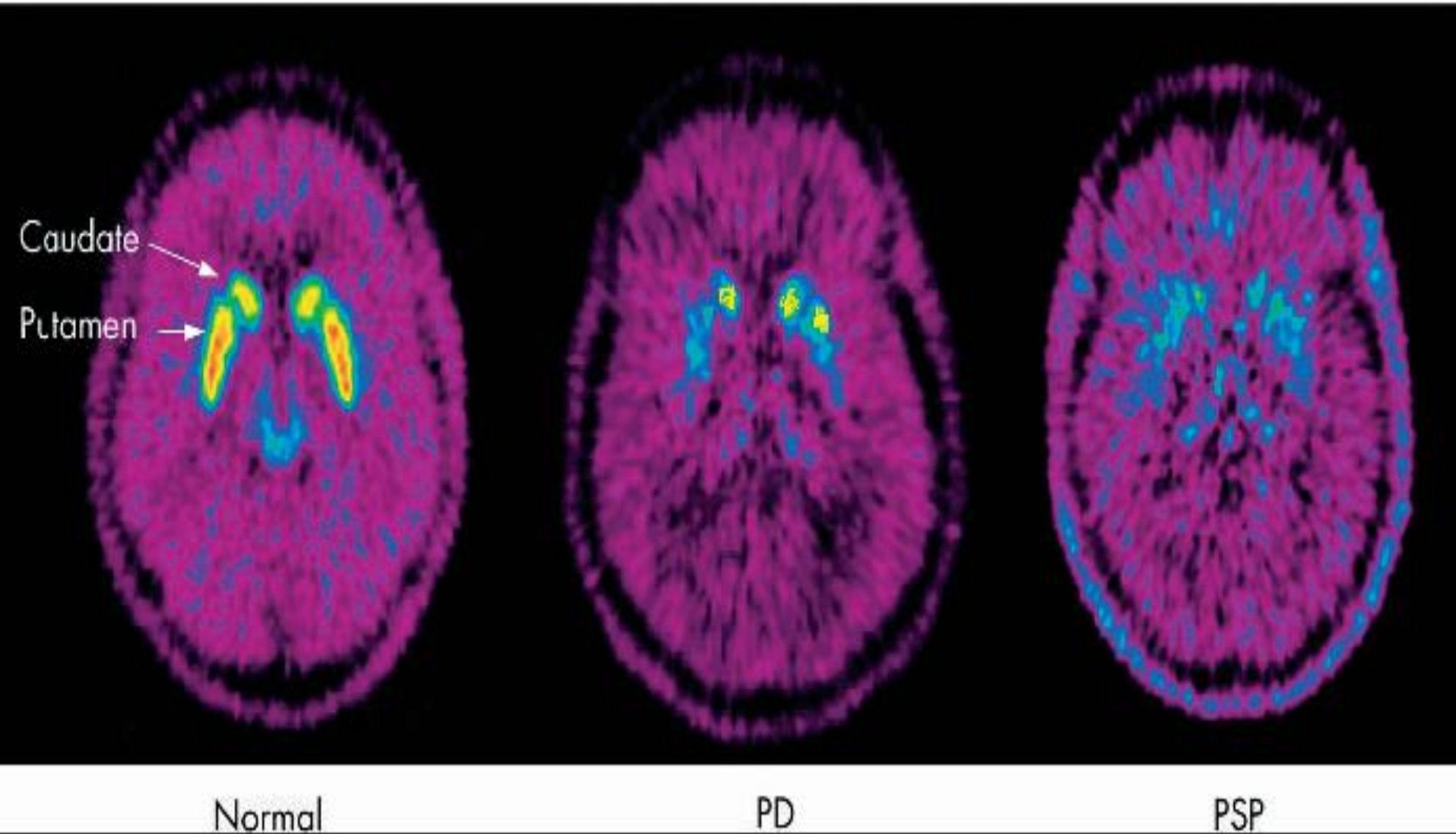
Movement disorders

- Parkinson's disease (PD)
- Parkinsons Plus disorders
 - PSP
 - MSA
 - CBGD
- Essential tremor
- Secondary parkinsonisms
 - Vascular, drug induced, structural/tumor, traumatic, infectious, toxin induced, metabolic
- Huntingtons disease, SCA



 Presynaptic radioligands DOPA decarboxylase (Measures dopamine synthesis)	SPECT	PET
		[¹⁸ F]dopa [¹¹ C]dopa
 DAT (Provides measure of functioning dopaminergic terminals)	[¹²³ I]FP-CIT [¹²³ I]β-CIT [^{99m} Tc]TRODAT-1 [¹²³ I]PE2I [¹²³ I]-altropane	[¹¹ C]cocaine [³ H]WIN [¹¹ C]altropane [¹¹ C]/[¹⁸ F]β-CFT [¹¹ C]FE-CIT [¹¹ C]dMP
		[¹¹ C]DTBZ
 VMAT-2 (Marker for dopaminergic terminals)		
 Postsynaptic radioligands D ₂ receptor	SPECT	PET
	[¹²³ I]IBZM	[¹¹ C]raclopride [¹⁸ F]DMFP [¹¹ C]NMSP

^{18}F -DOPA PET



Patient Name: DR.V.R.LELE
Study Date: 4/23/2009

Patient ID: TRODAT-2

DOB: 10/23/1960

Study Name: TRODAT SCAN
ATTENUATION CORRECTED IMAGES

Row A - TRODAT Brain Tomo [Reoriented]

Transverse

17-20

21-24

25-28

%

80

0

Right
Anterior
Posterior
Left

Bottom
to
Top

49-52

53-56

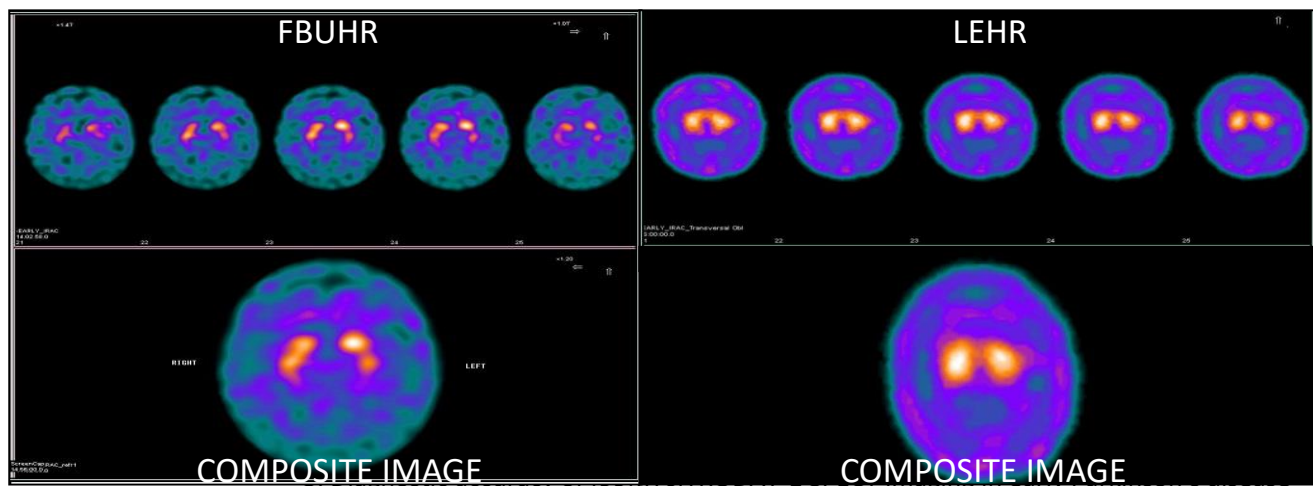
57-60

Coronal

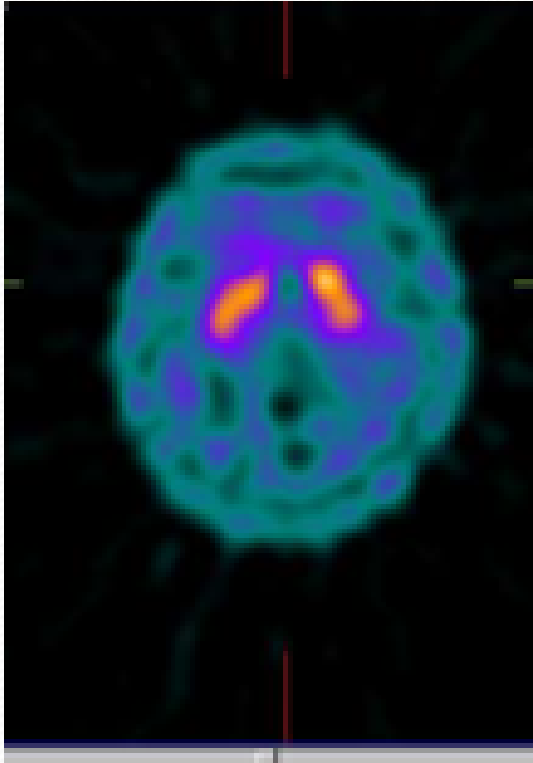
Right
Top
Bottom
Left

Anterior
to
Posterior

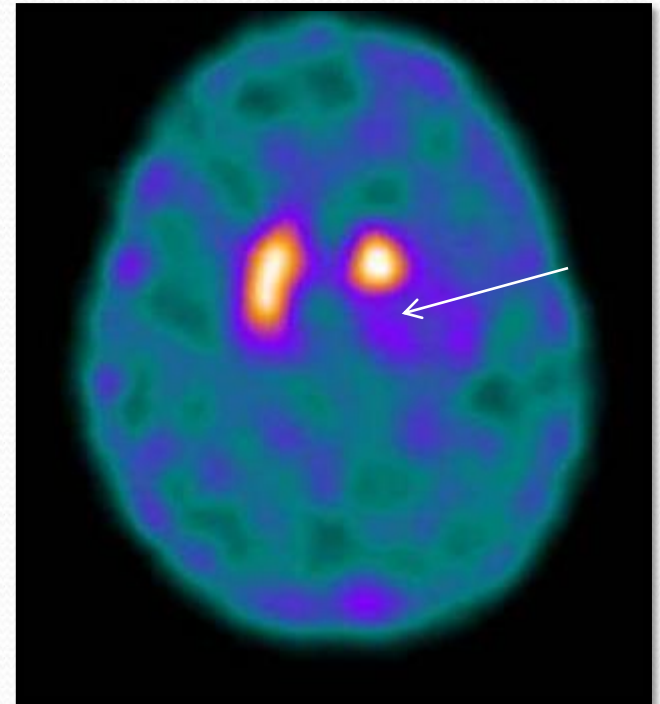
- Normal uptake in the striatum within the caudate nucleus and putamen with almost homogenous distribution
- The technetium-99m emits the gamma radiation from the area of uptake and hence are captured by SPECT camera



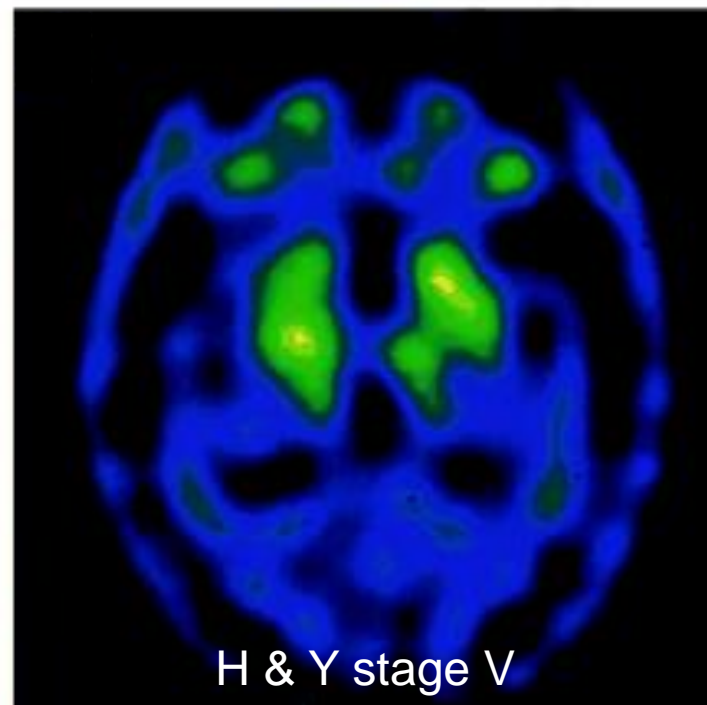
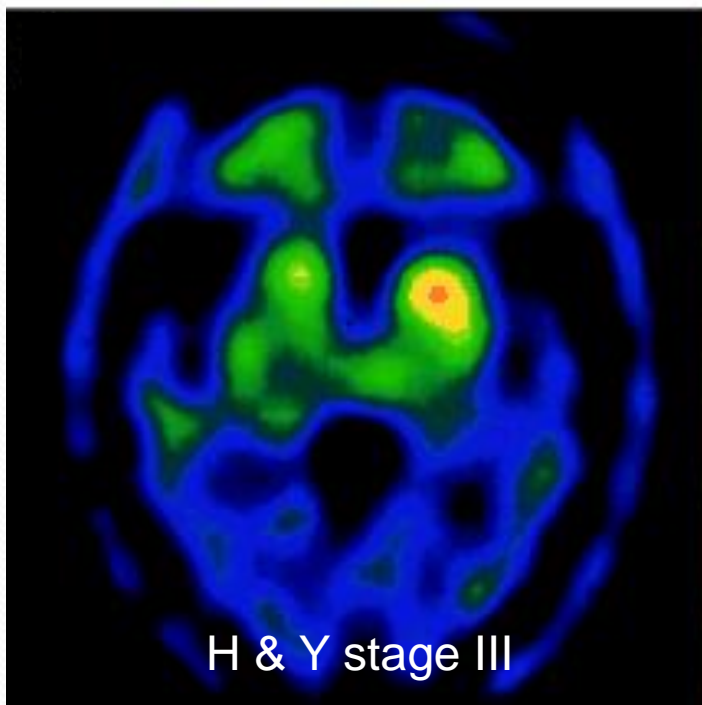
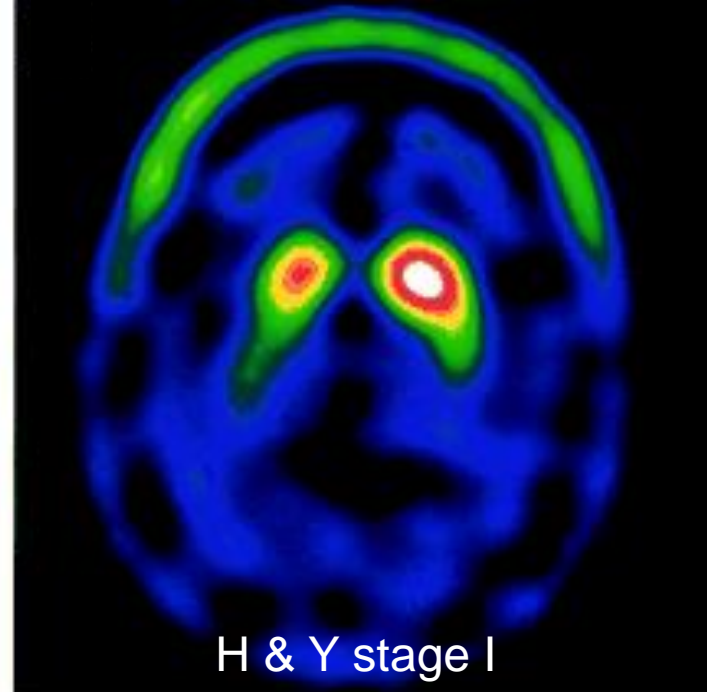
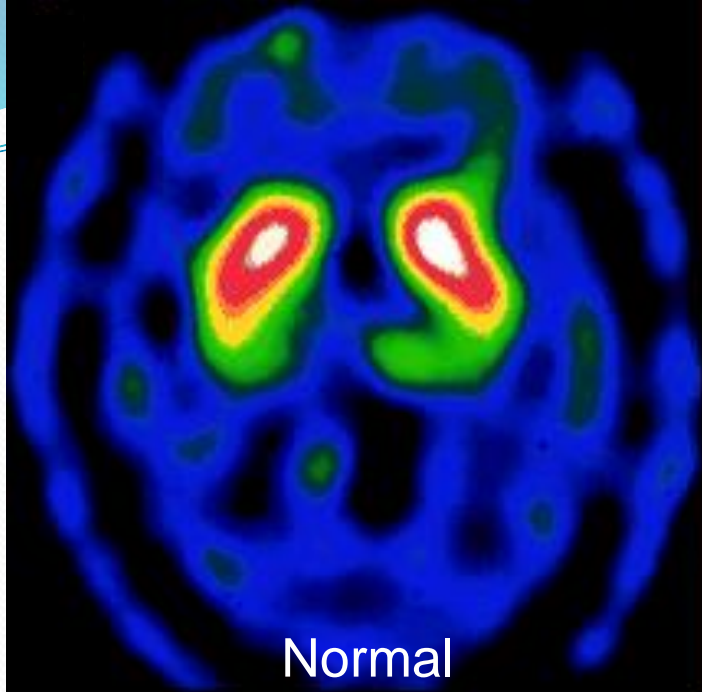
Dopamine Transporter SPECT



Normal dopamine transporter SPECT (TRODAT scan) showing symmetrical tracer uptake in bilateral caudates and putamen



Abnormal TRODAT scan in Parkinson's disease showing low uptake in left putamen



Dopamine transporter SPECT

- Early affection in parkinsons disease
- Can be used to distinguish early parkinsons disease from essential tremors, drug induced parkinsonism, vascular parkinsonism, psychogenic parkinsonism
- Distinguish Dopa responsive dystonia from Juvenile onset Parkinson's disease
- Useful in distinguishing alzheimers dementia from dementia due to diffuse lewy body disease
- Future use in follow up of stem cell transplants / DBS in Parkinson's disease

Radiopharmaceutical and Modality	¹²³ I-β-CIT SPECT	¹¹ C-VMAT2 PET	¹⁸ F-DOPA PET
Target	DA transporter	Vesicular transporter	DA turnover
Annual reduction in normal aging	0.8-1.4%	0.5%	No change
Bilateral reduction in hemiparkinson's disease	Yes	Yes	Yes
Correlates with UPDRS motor scores in cross-sectional studies	Yes	Yes	Yes
Annual loss of signal expressed as percent loss from baseline	6-13%	10%	7-12%

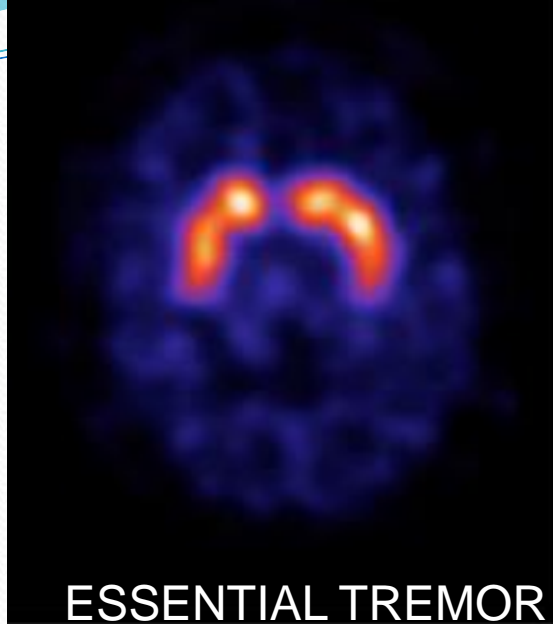
Impact of Dopamine Transporter Imaging

- European multicentre prospective longitudinal study comparing clinical diagnosis with ^{123}I -FP-CIT SPECT findings
- serial observations over 3 yrs
- standard of truth was video examinations at 36 months by 2 movement disorder experts
- 99 patients completed trial
- baseline clinical diagnosis had sensitivity of 93% but specificity of 46%
- baseline SPECT had mean sensitivity of 80% and specificity of 97%
- Marshall VL, Reiningner CB, Marquardt M, et al. Parkinson's disease is overdiagnosed clinically at baseline in diagnostically uncertain cases: a 3-year European multicenter study with repeat [^{123}I]FP-CIT SPECT. *Mov Disord.* 2009;24:500–508.

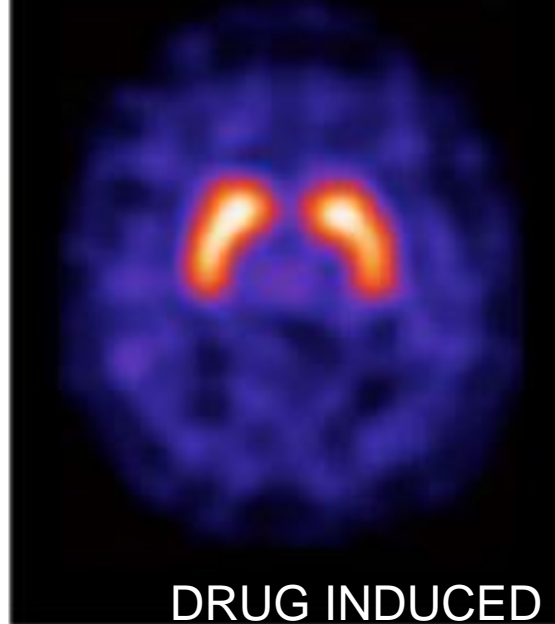
SWEDD syndrome

- 15% of early suspected PD patients have normal DAT scans
 - 150 patients with suspected PD and normal DAT scans were followed up for 2 yrs
 - only 4 (3%) showed clinical progression and were believed to have PD 2 years later
 - the rest were diagnosed as benign tremulous or nondegenerative parkinsonian disorders
-
- Marshall VL, Patterson J, Hadley DM, Grosset KA, Grosset DG. Two-year followup in 150 consecutive cases with normal dopamine transporter imaging. Nucl Med Commun, 2006; 933-937

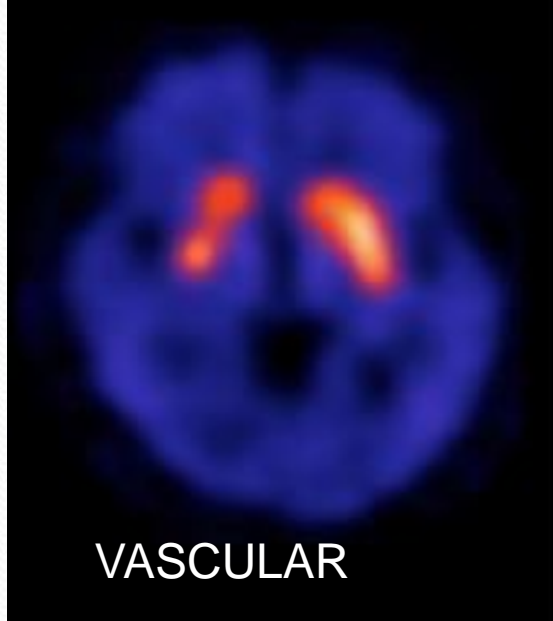
A



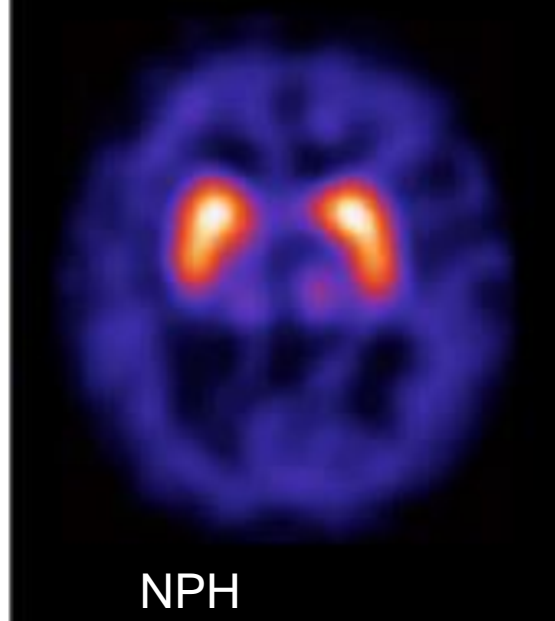
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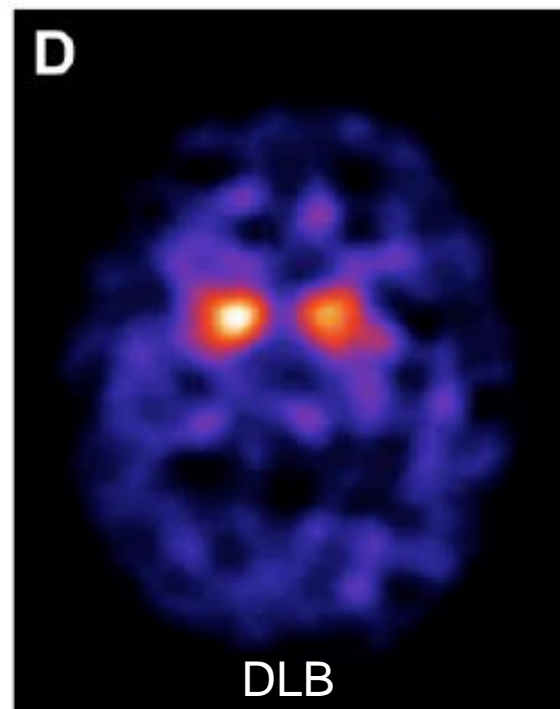
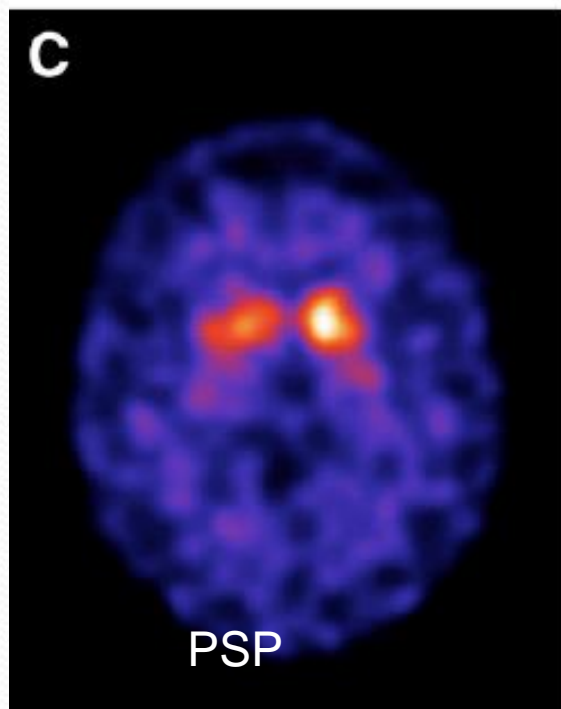
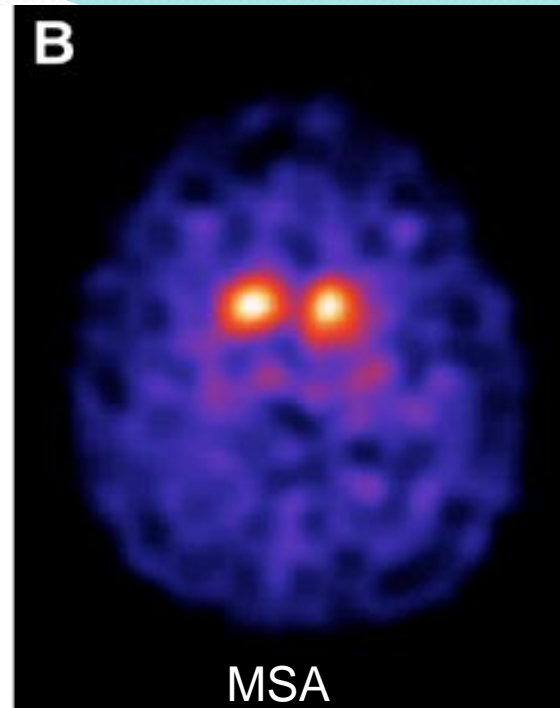
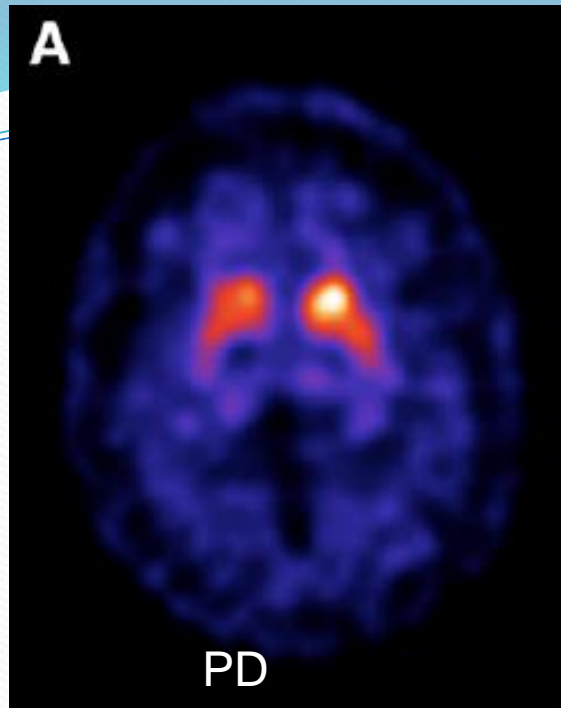


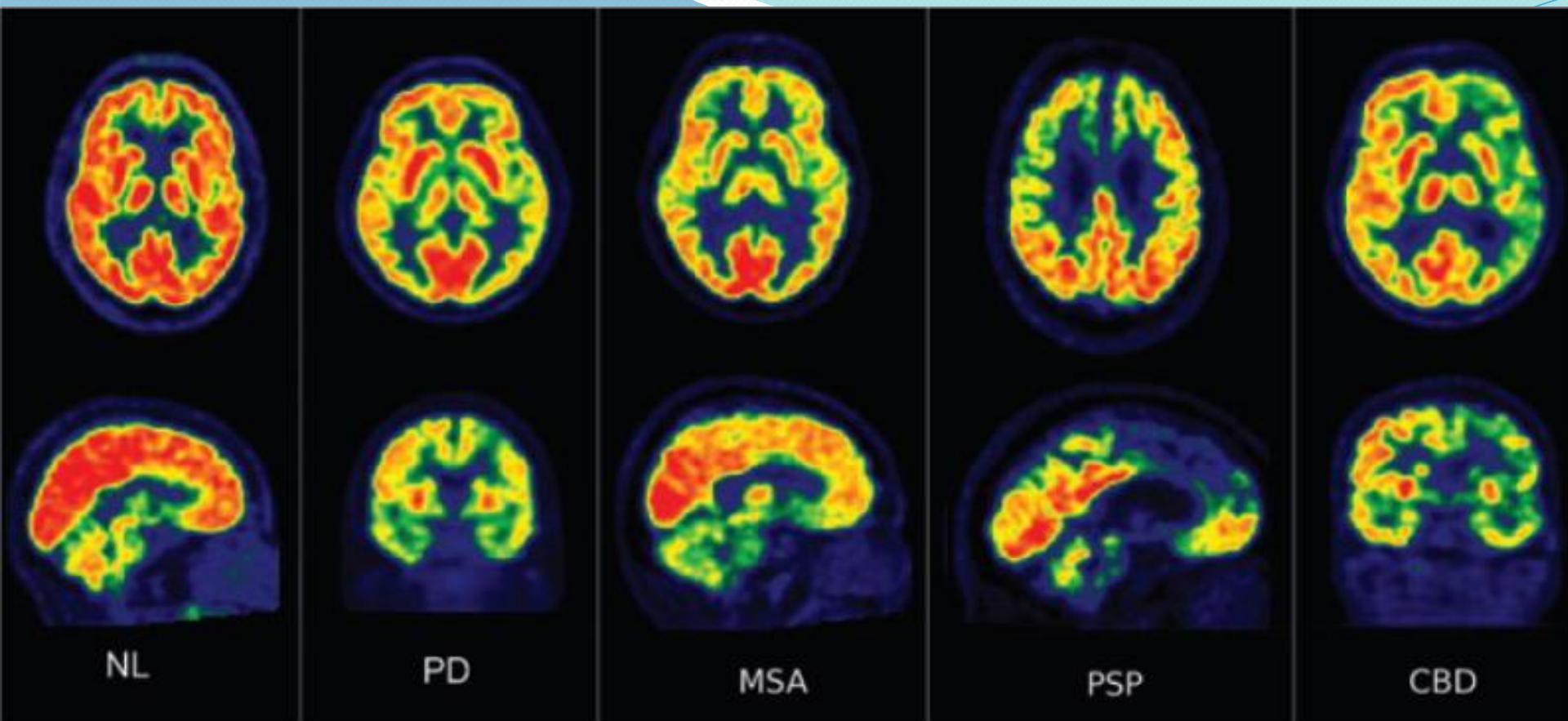
C



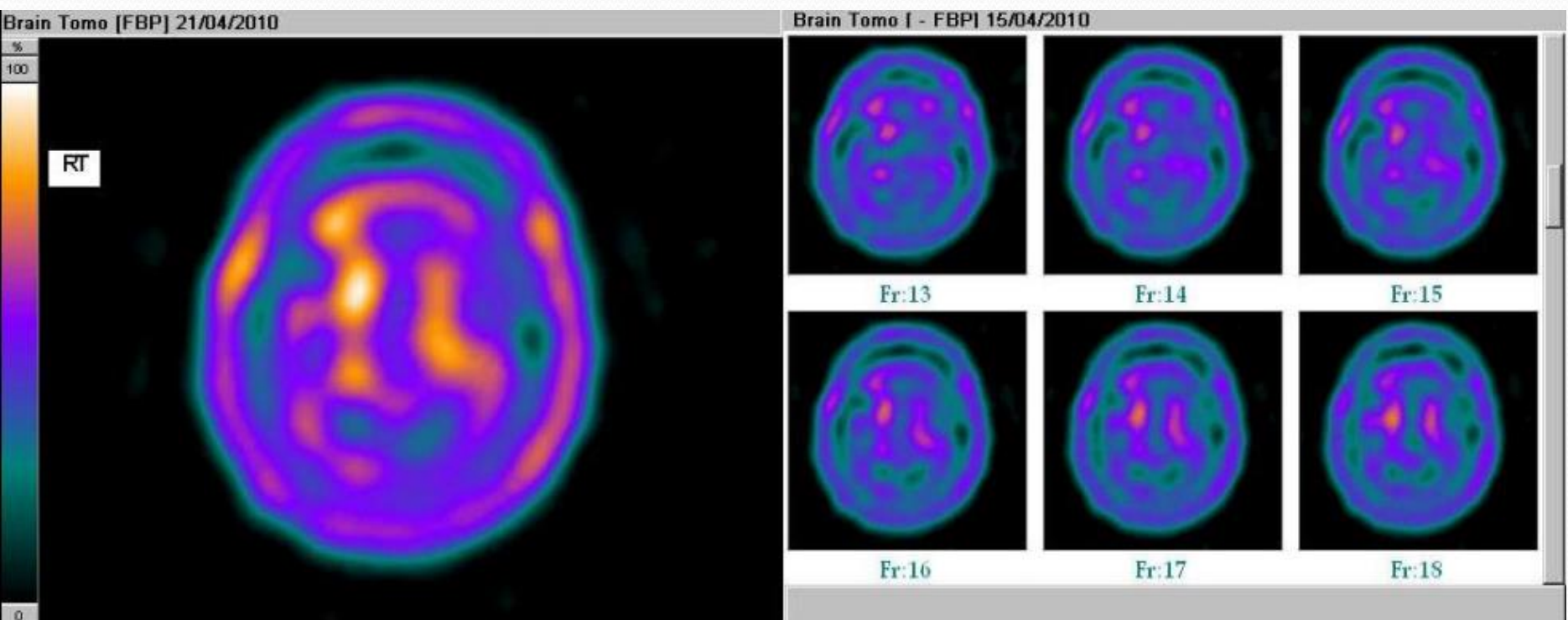
D



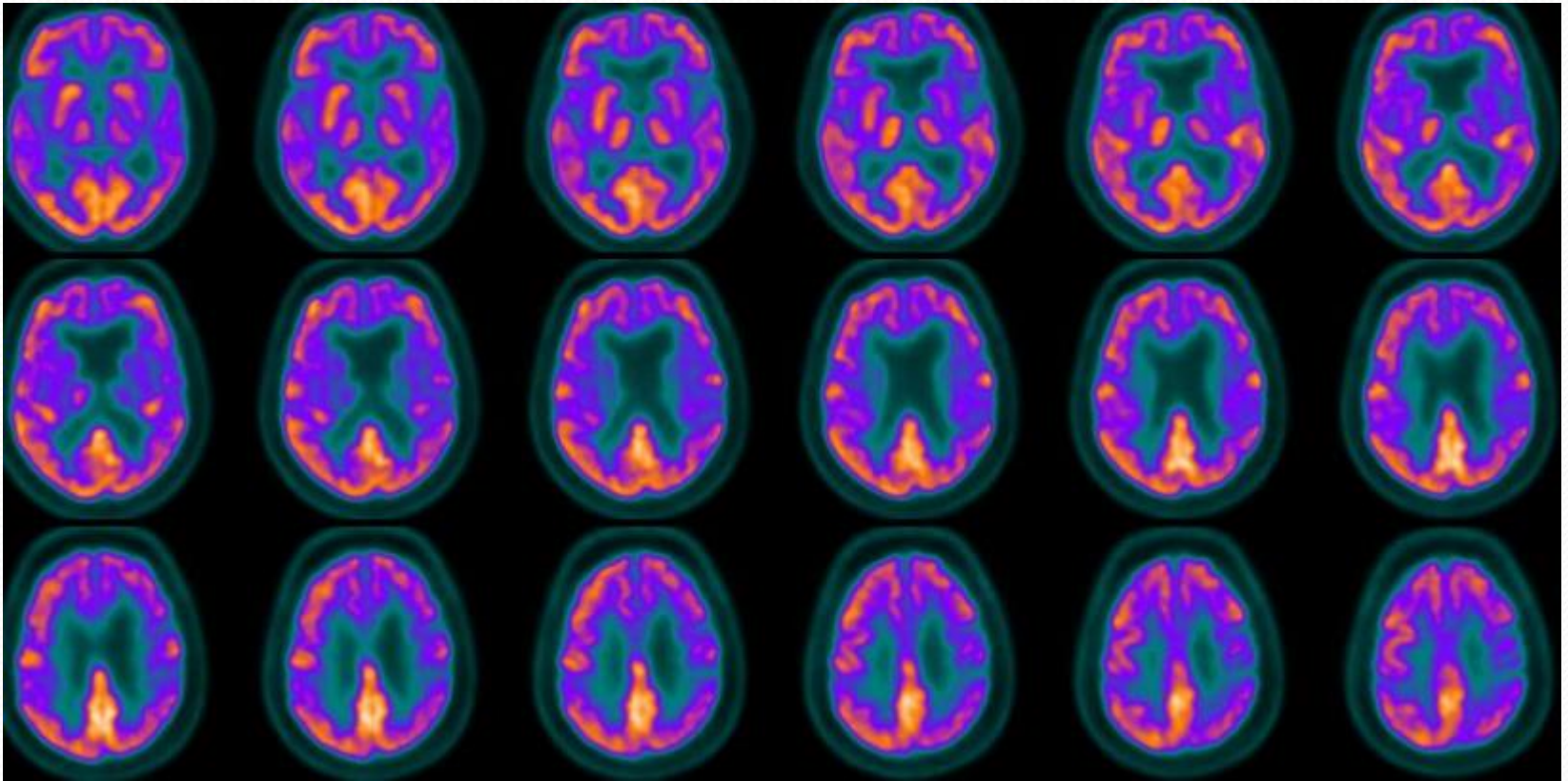




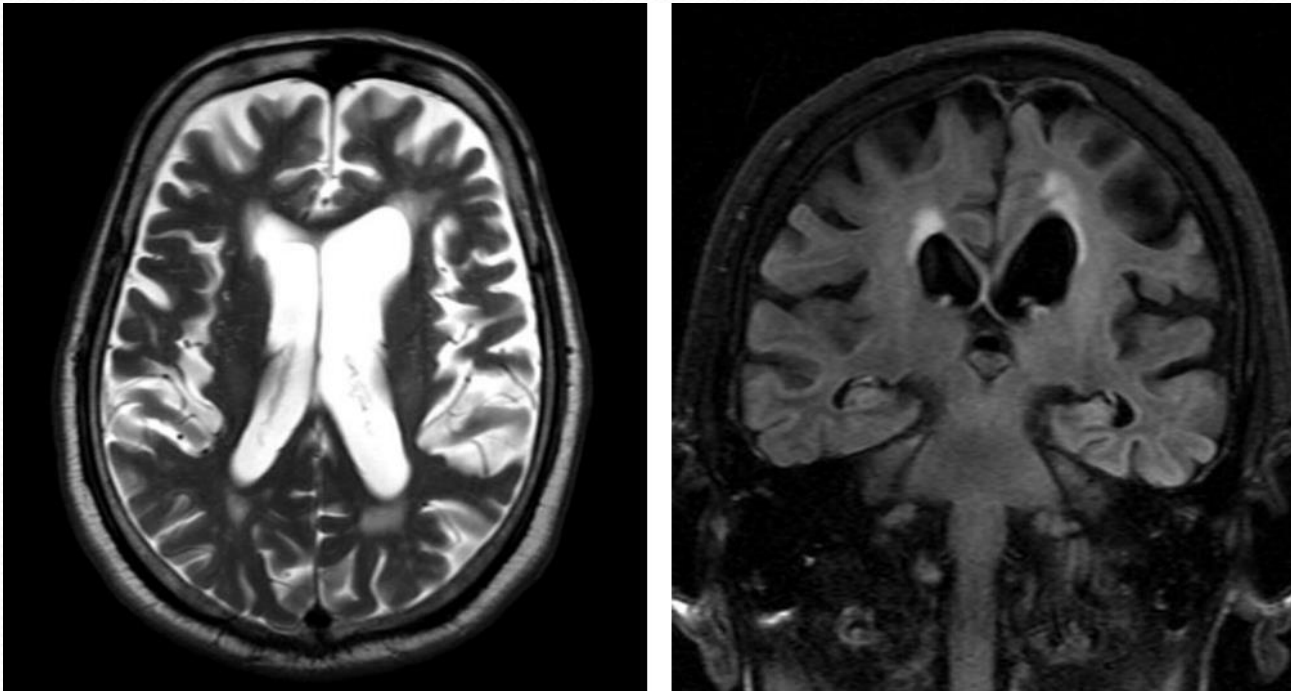
History: 68 years old male with complains of stiffness in right upper limb, followed by right lower limb since 2 years. He also complained of tremors in right hand but recently in left hand as well and ?myoclonus on examination.



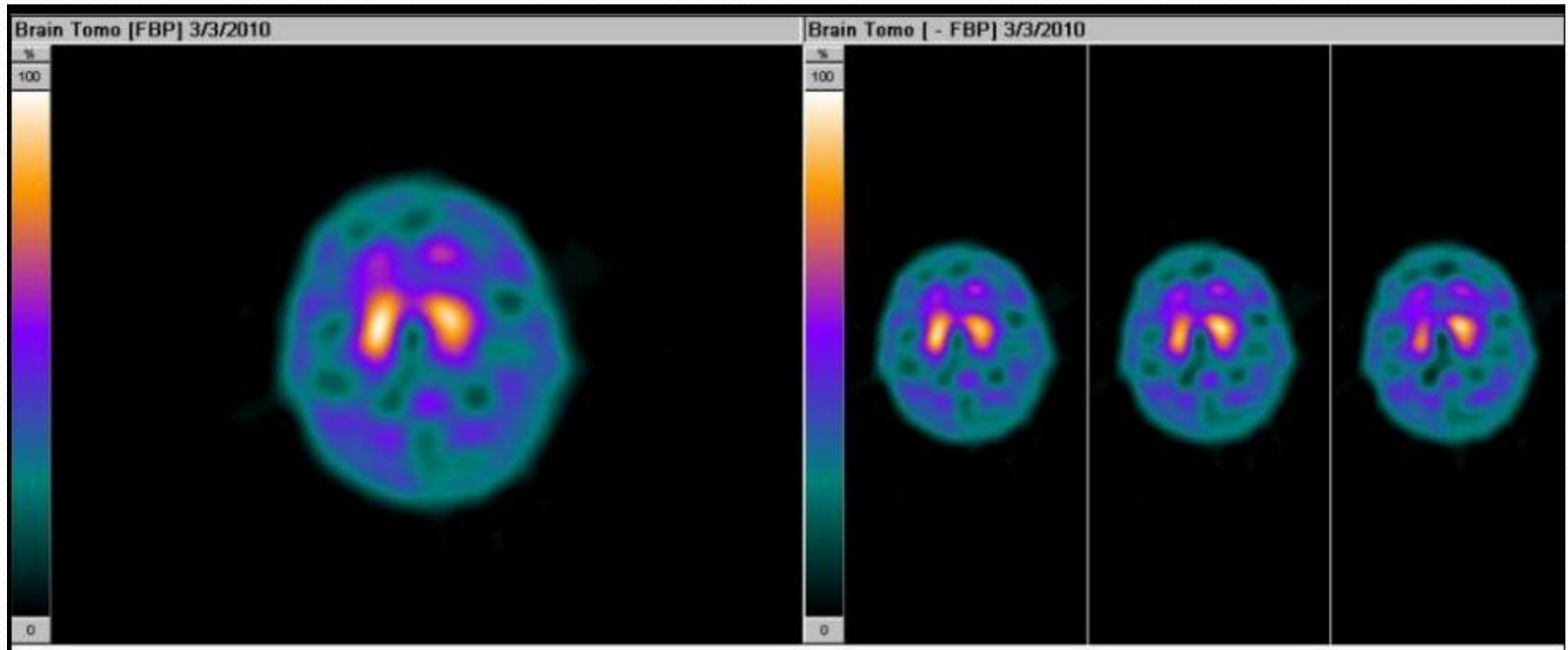
WARM COLOR SCALE

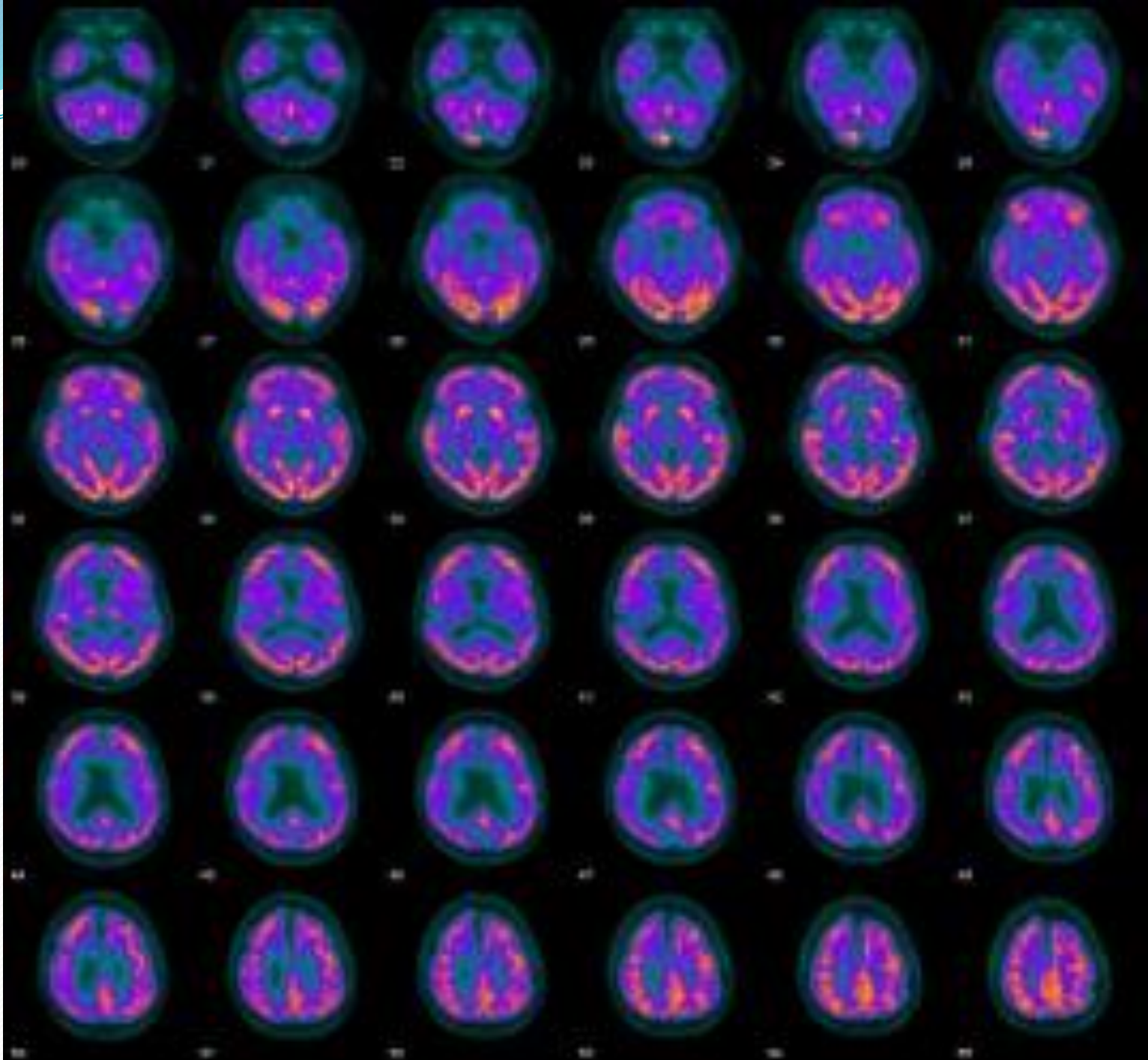


MRI OF THE SAME PATIENT

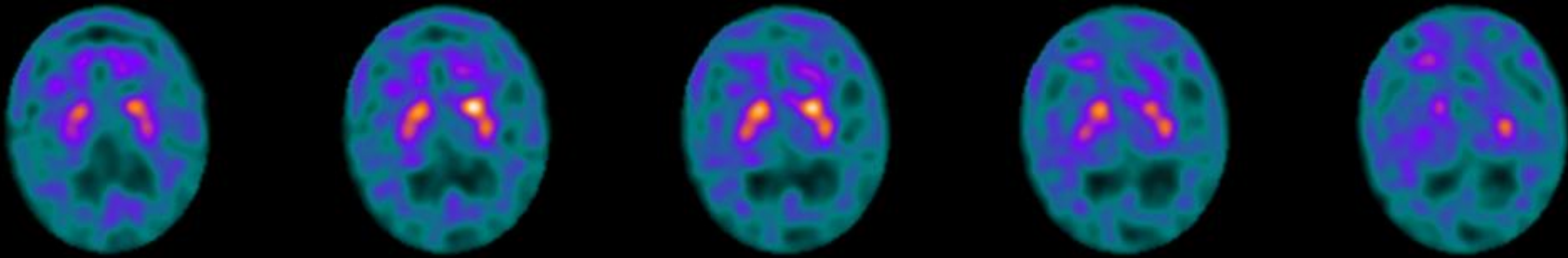


History: 72 years old male with dementia and imbalance with clinical suspicion of FTD/PSP/NPH. MRI scan showed cortical atrophy, more in temporal and marginally more in frontal lobe, suggestive of FTD.



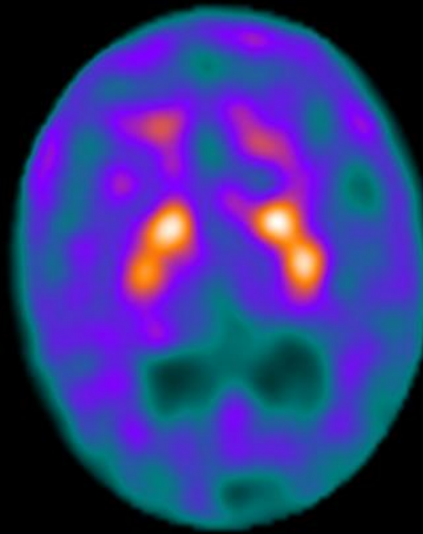


Slices



Composite image

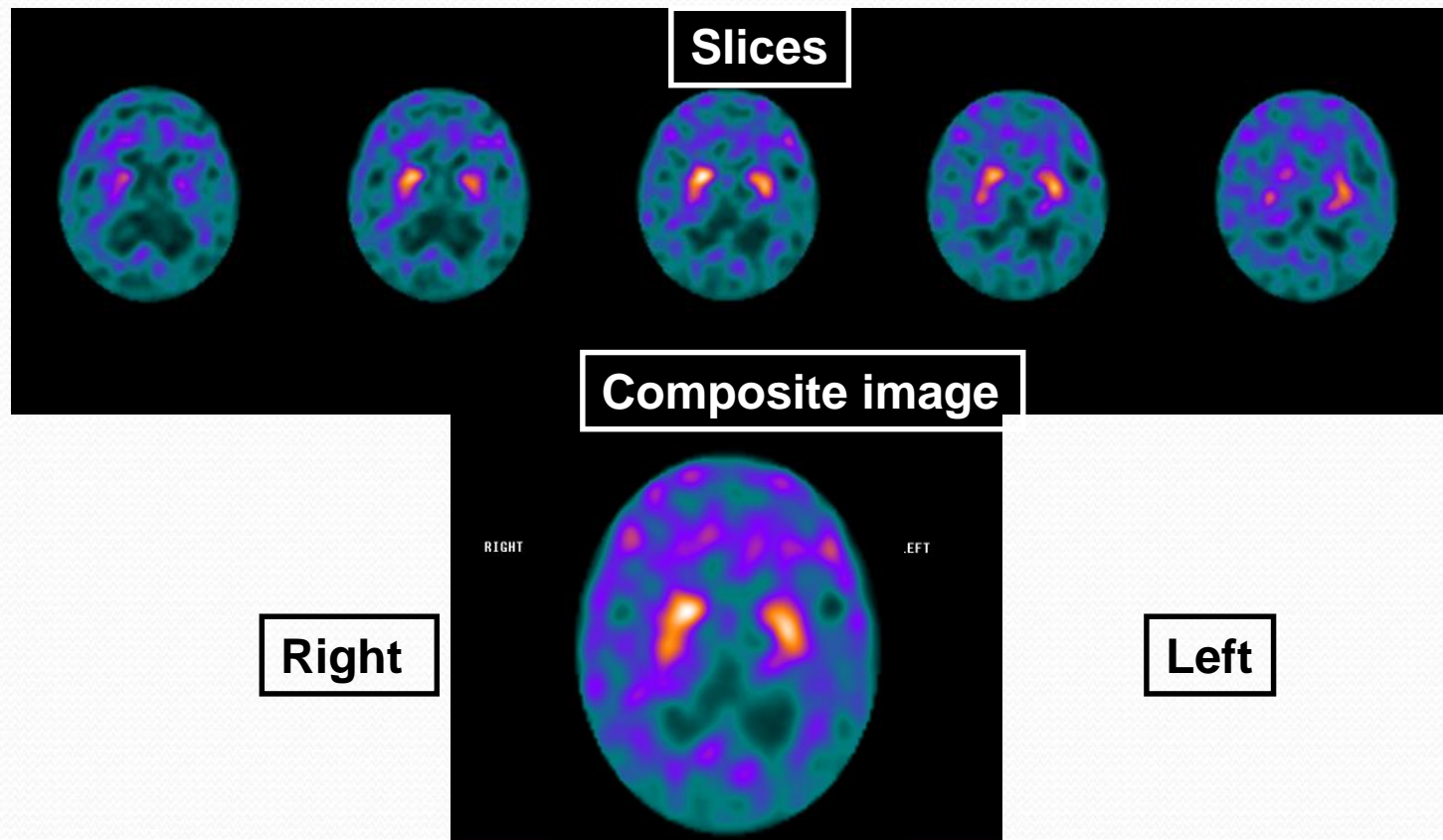
Right



Left

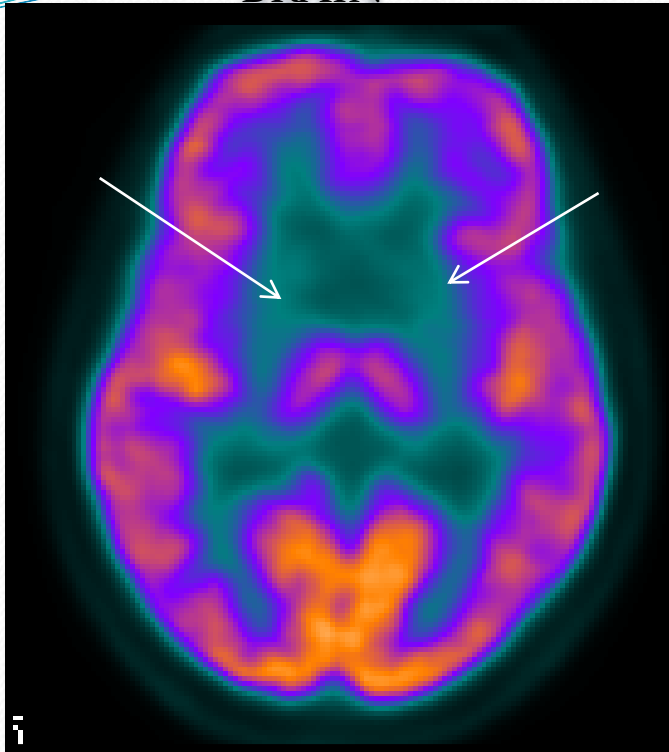
77 year old male, right handed, c/o slowness in movement, imbalance since 2 months

Not on any antiparkinsonism medications. Under evaluation.

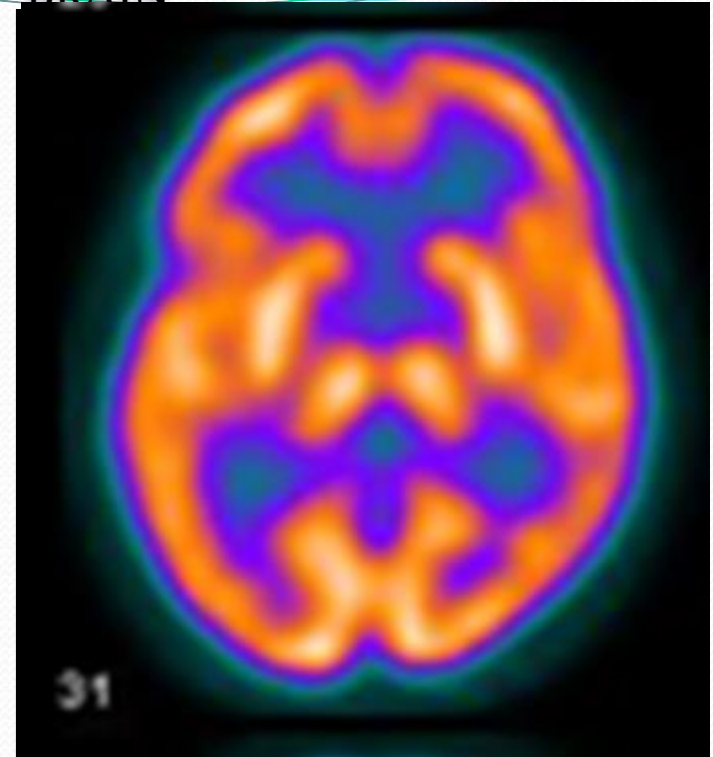


78 year old male, right handed, c/o coarse tremors in both hands, slowness in movements and imbalance since 1.5 years. Not on antiparkinsonism meds. Under evaluation.

FDG-PET
BRAIN



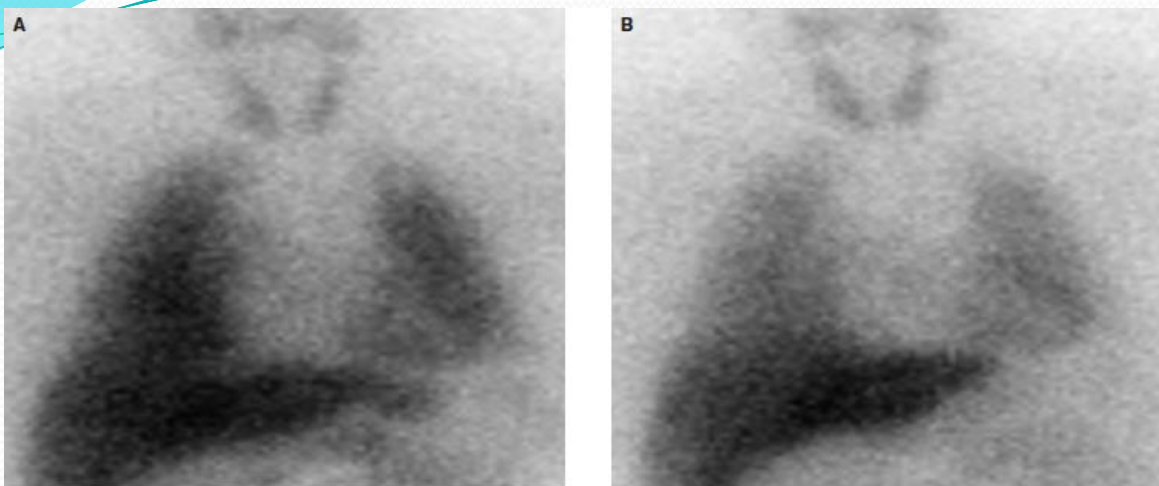
NORMAL REFERENCE FDG
BRAIN



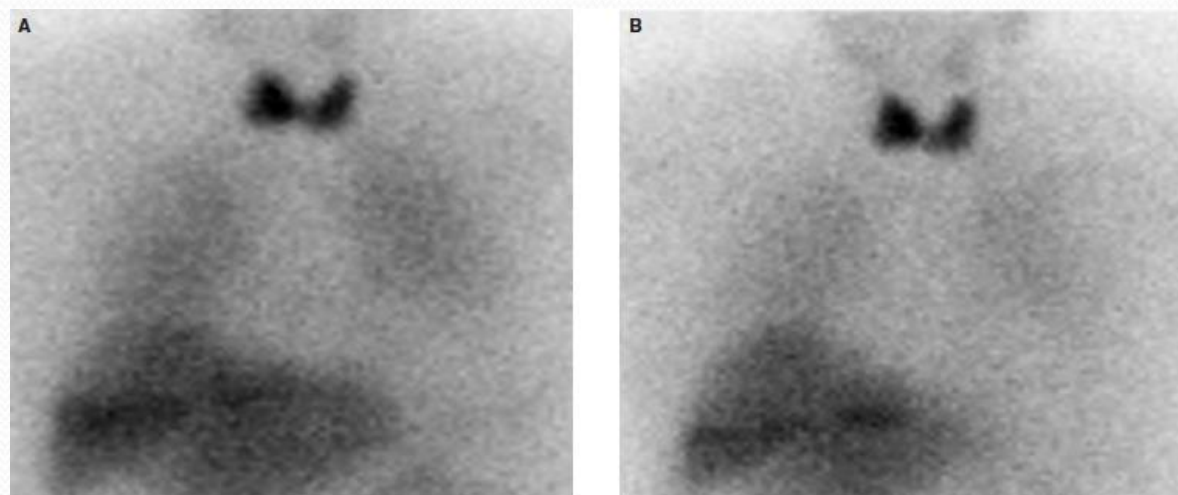
17 year old male, presents with slowness in movements. Family history of similar illness in grandfather.
Absent metabolism in putamen and caudate nuclei bilaterally, pathognomonic of Huntington's disease

impaired sympathetic innervation

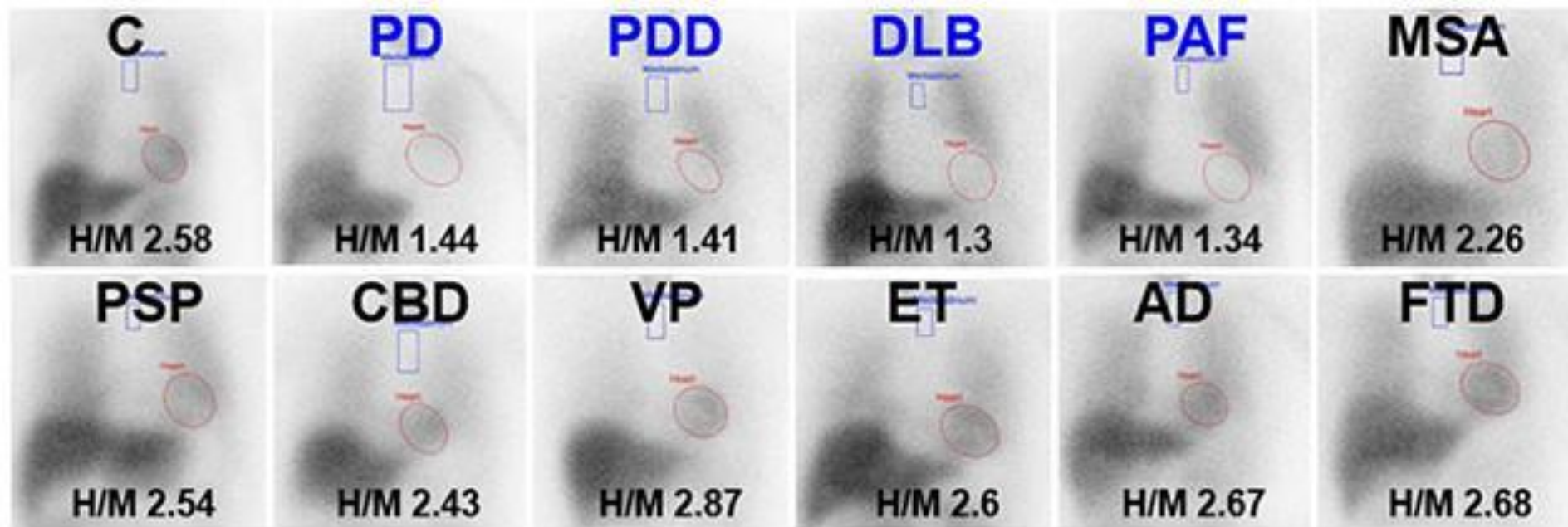
- PD patients show significant loss of sympathetic innervation of the heart in later stages. atypical variants like MSA do not show this finding



Early and Late ^{123}I -MIBG images . H/M ratio 2.1 and 2



Early and late H/M ratios 1.1 and 1.1 in patient with LBD



conclusion

- DaT scan is an important tool in the clinical management of patient with movement disorders by changing patient management in 1/3rd of referrals. It also leads to diagnostic change in 1/6th of referrals
- Combination of DaT scan and FDG brain PET-CT is very helpful in distinguishing parkinsonian syndromes

Thank you.

