

Nuclear medicine diagnostics of diseases affecting central nervous system

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Basic diagnostic methods

- 1) Brain perfusion scintigraphy (SPECT)
- 2) Imaging of dopaminergic receptors' distribution in the brain (SPECT or PET)
- 3) Myeloscintigraphy (cerebrospinal fluid imaging)

Brain perfusion scintigraphy

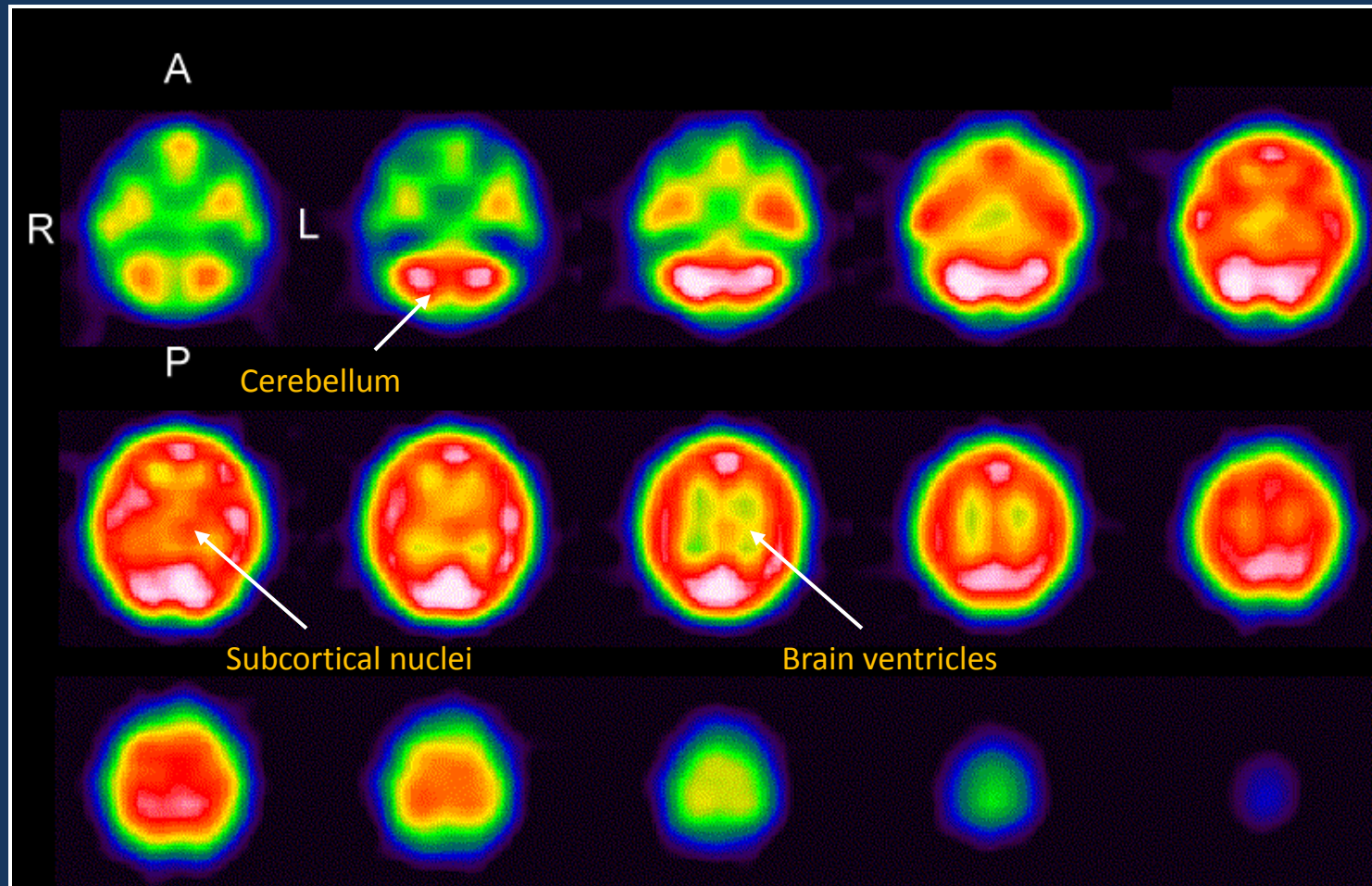
Radiopharmaceuticals (RPh):

- ^{99m}Tc -HMPAO
- ^{99m}Tc -ECD

Mechanism of RPh accumulation:

- After i.v. injection RPh passes through intact blood-brain barrier and its distribution in the brain is proportional to the regional blood flow

Brain perfusion scintigraphy – normal image



SPECT

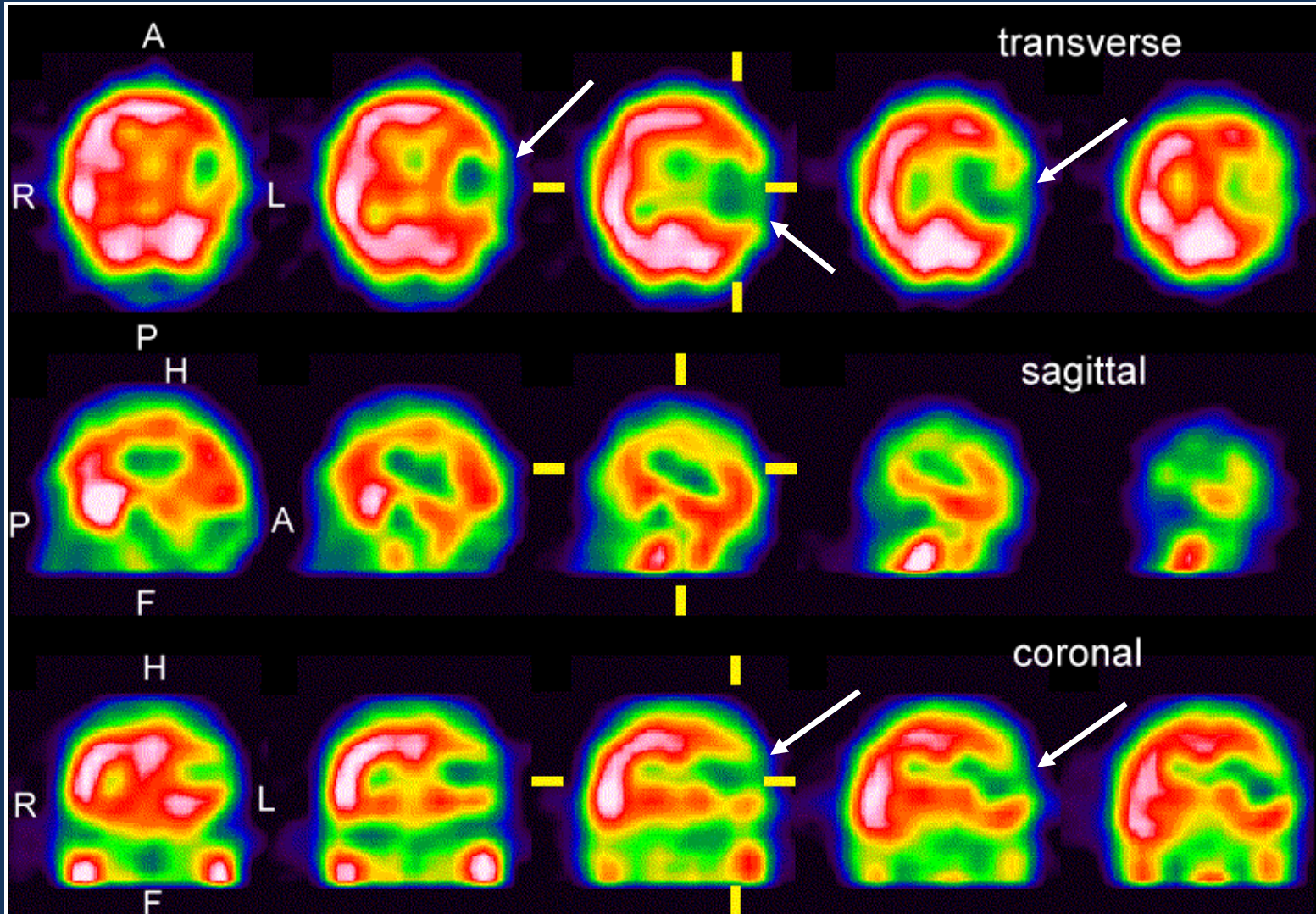
Brain perfusion scintigraphy

Clinical applications:

1. Diagnostics of vascular and vasculodependant brain diseases (especially TIA - transient ischemic attack)
2. Diagnostics and differentiation of dementias
3. Detection of epileptogenic foci

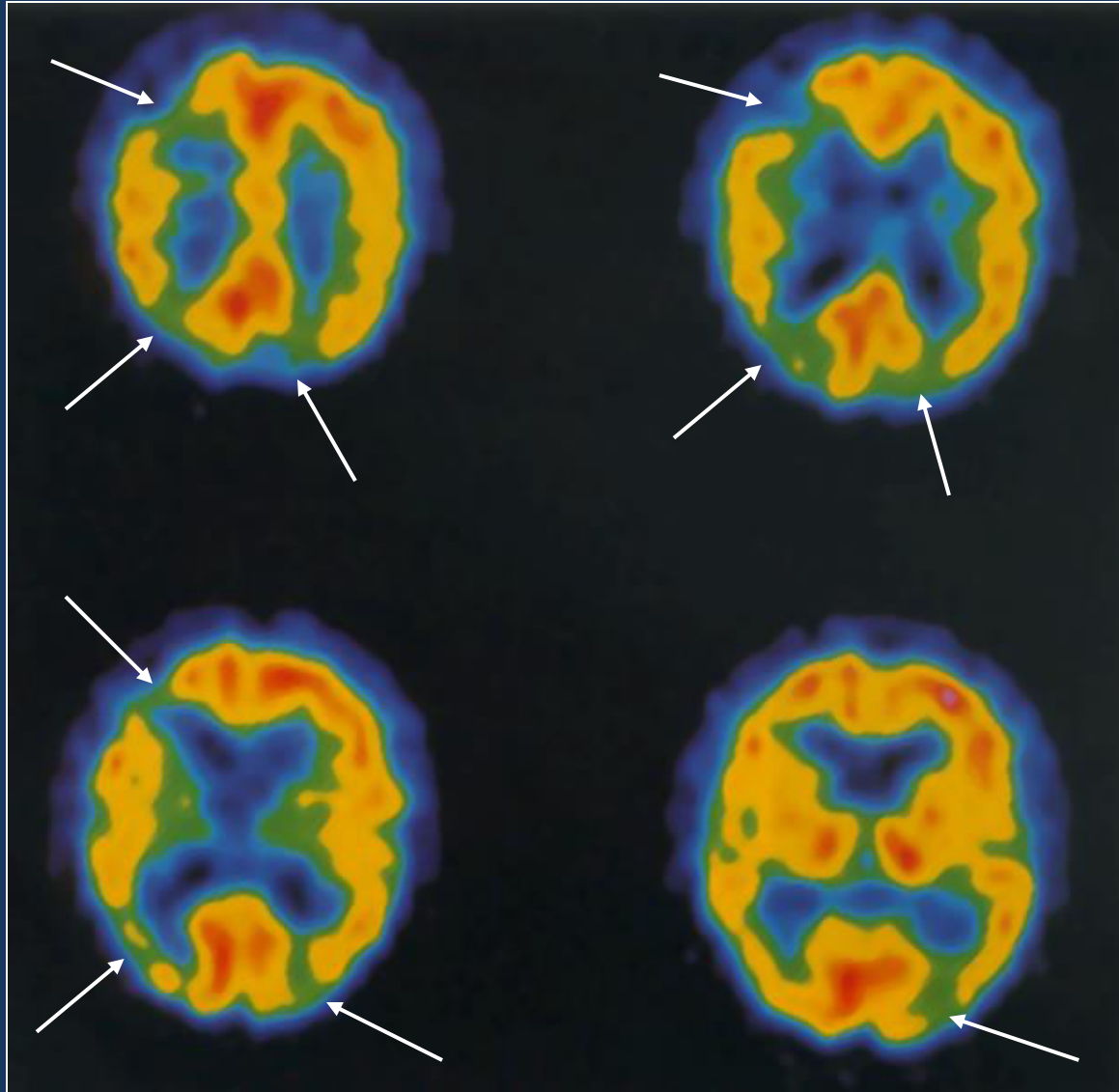
Brain perfusion study

Ischaemic stroke in the left temporoparietal region

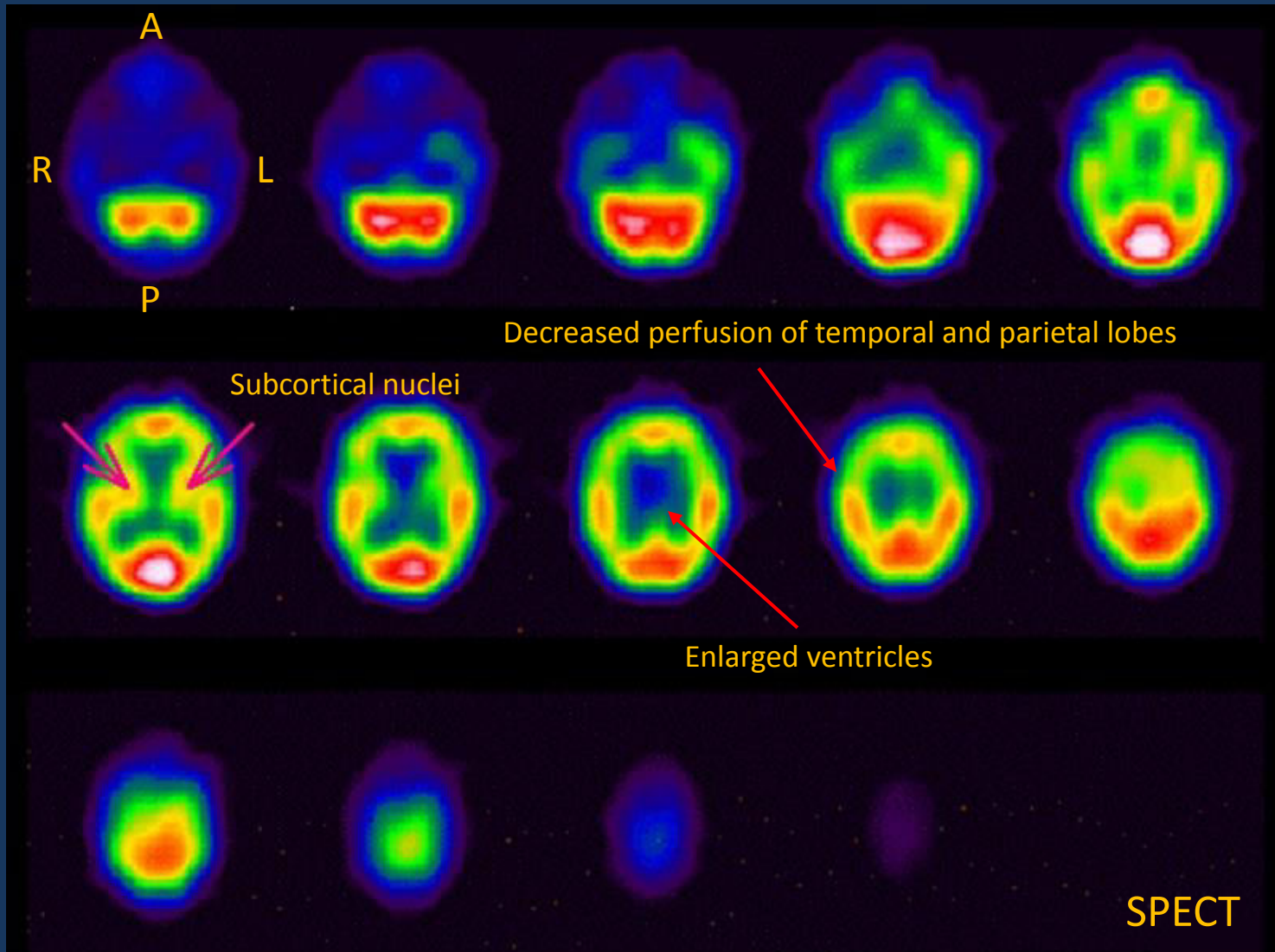


SPECT

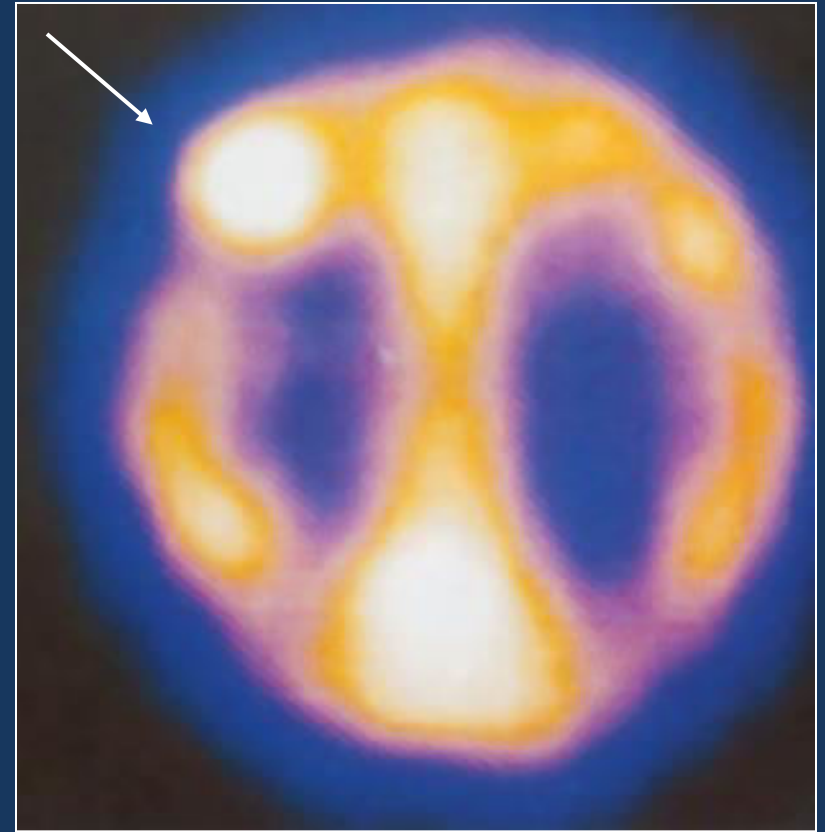
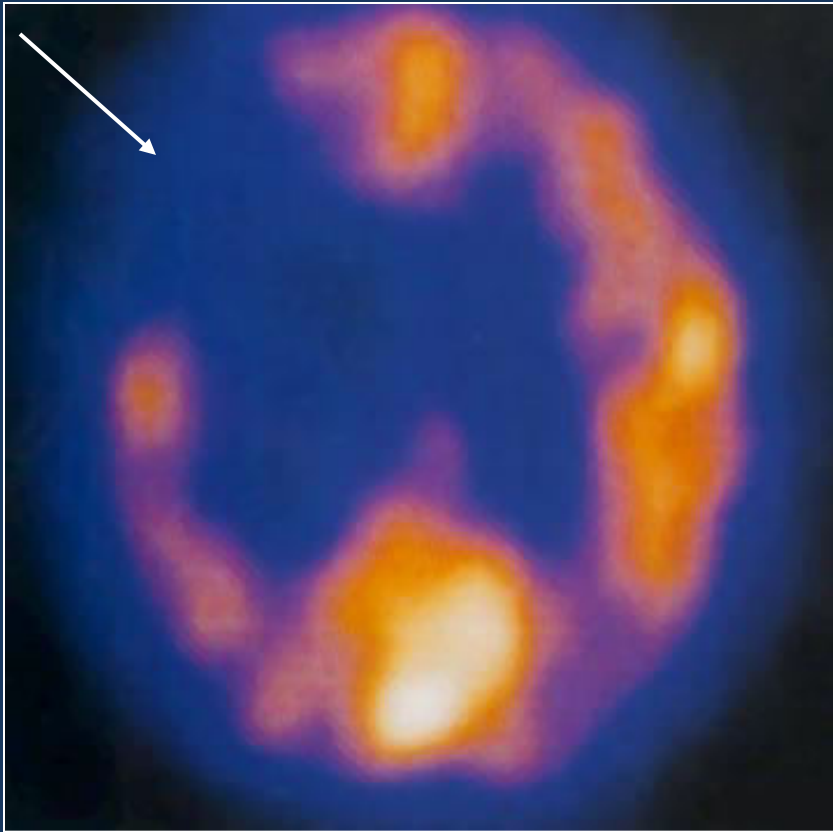
Multi-infarct dementia (MID)



Alzheimer's disease (AD)



Frontal epilepsy



„Cold” focus – between attacks of epilepsy

„Hot” focus – during attack of epilepsy

Imaging of dopaminergic receptors' distribution in the brain

Radiopharmaceuticals:

For visualization of pre-synaptic distribution of dopamine transporters

- ^{123}I -DaTSCAN (SPECT)
- $^{99\text{m}}\text{Tc}$ -TRODAT (SPECT)
- ^{18}F -DOPA (PET)

For visualization of post-synaptic distribution of D2 dopamine receptors

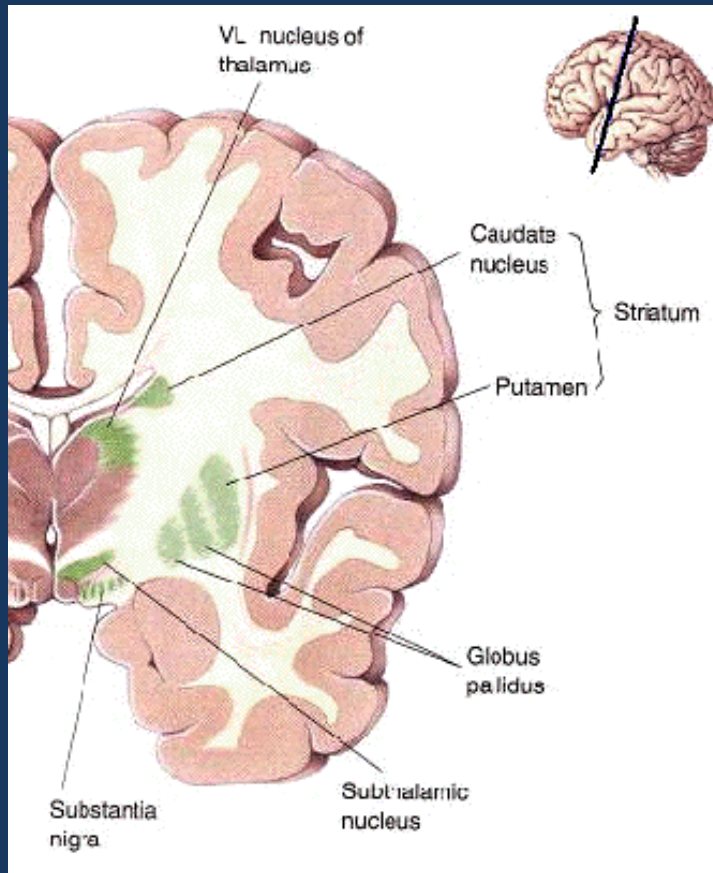
- ^{123}I -IBZM (SPECT)
- ^{11}C -racloprid (PET)

Imaging of dopaminergic receptors' distribution in the brain

Clinical applications:

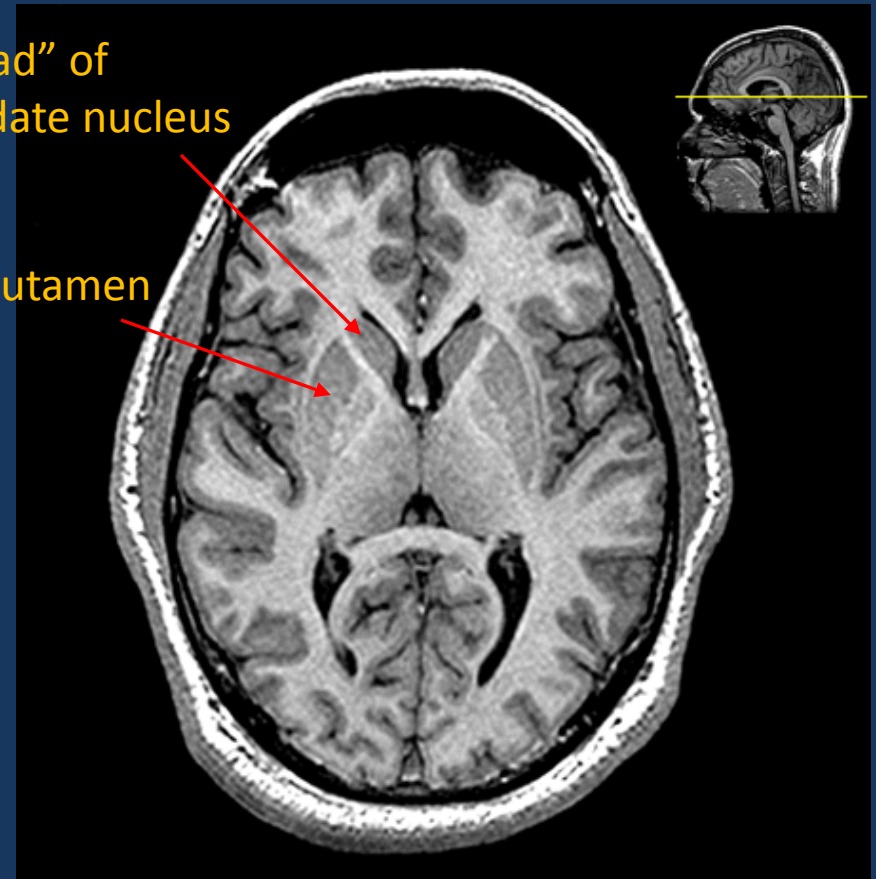
1. Diagnosis, staging and evaluation of treatment effectiveness in Parkinson's disease (PD)
2. Differential diagnosis between Parkinson's and other diseases (eg. essential tremor, Parkinsonian syndromes)

Striatum

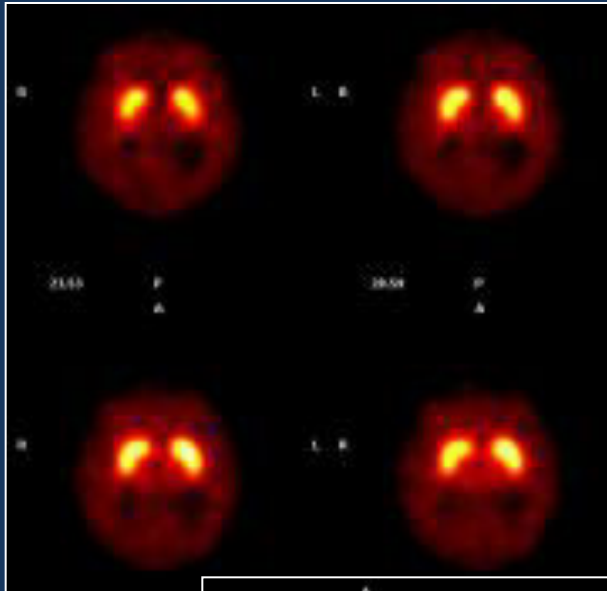


„Head” of caudate nucleus

putamen

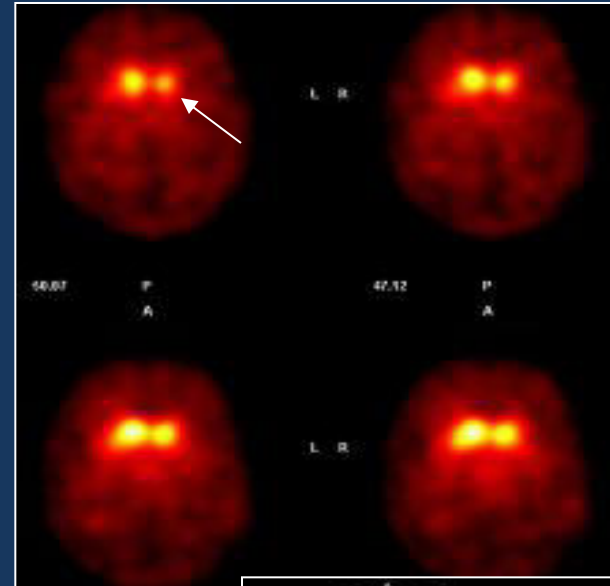


Normal image

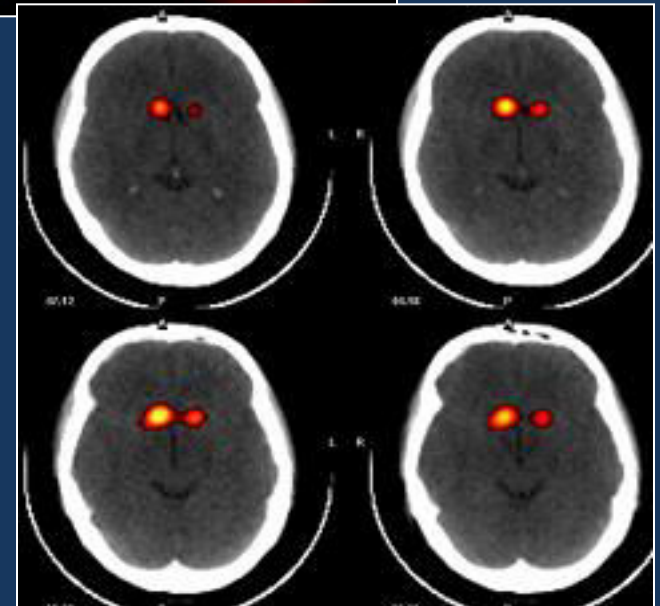
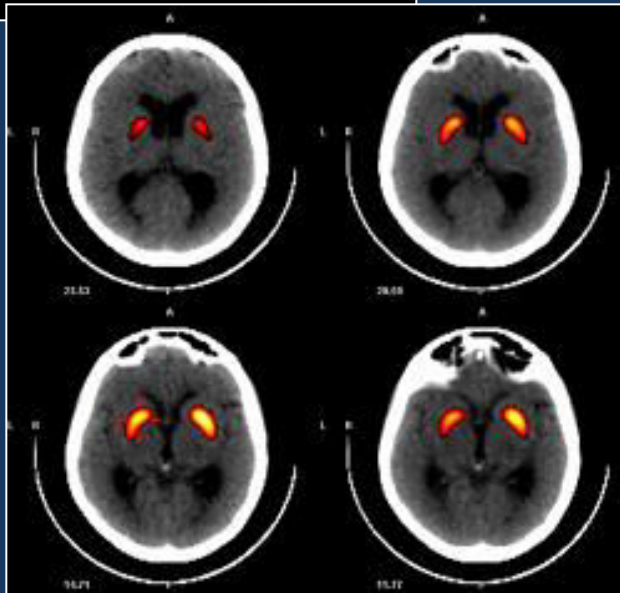


SPECT

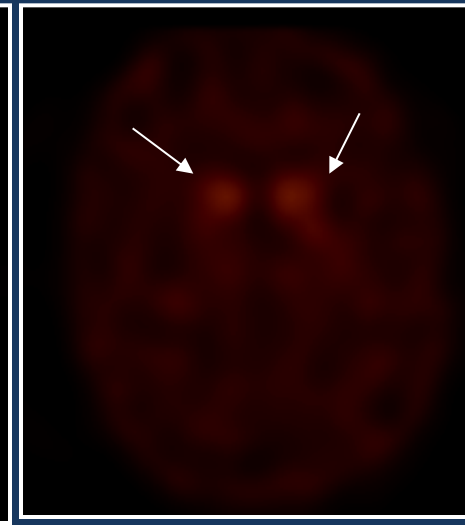
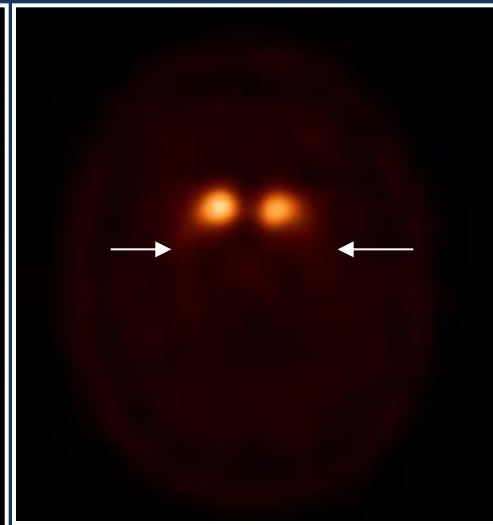
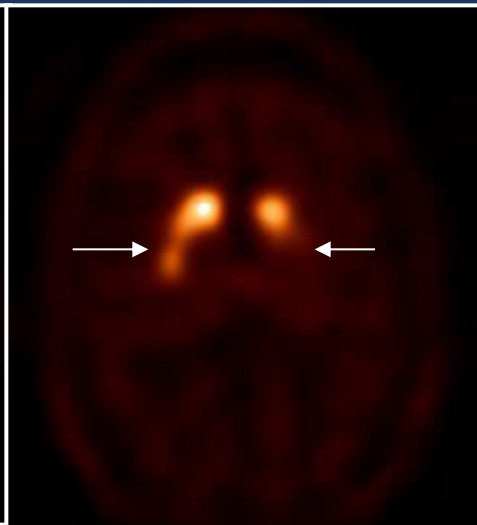
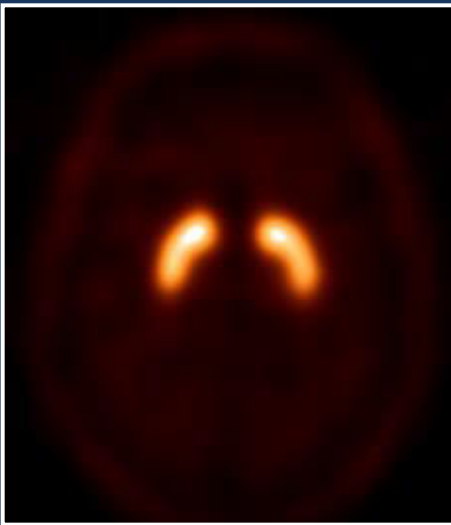
Parkinson's disease



SPECT/CT



Evaluation of Parkinson's disease advancement



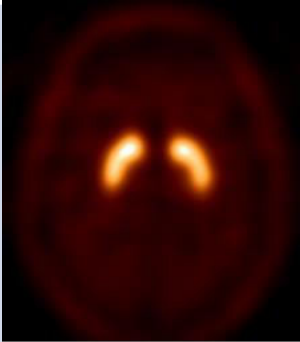
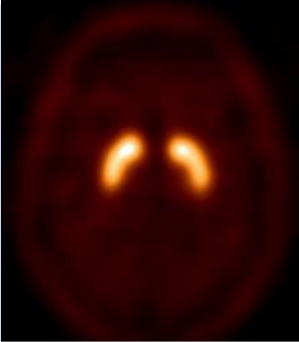
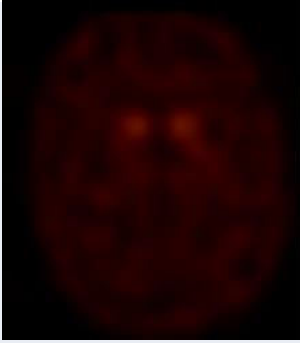
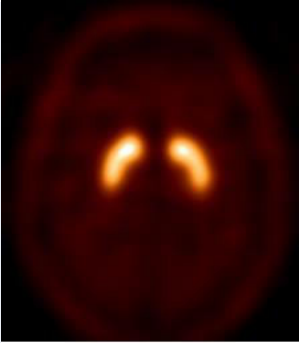
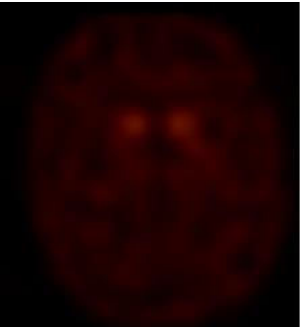
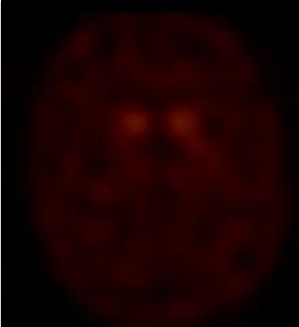
Normal image

Decreased,
assymmetric uptake
in putamens

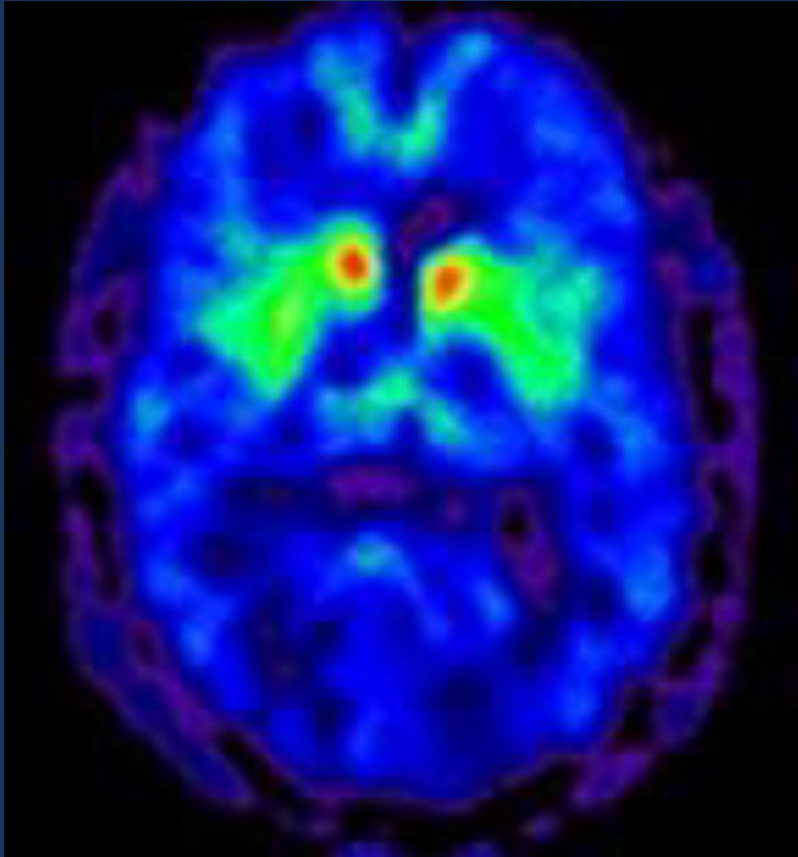
Lack of putamen
uptake - bilateral

Progressive
reduction of the
uptake in „heads”
of the caudate
nuclei

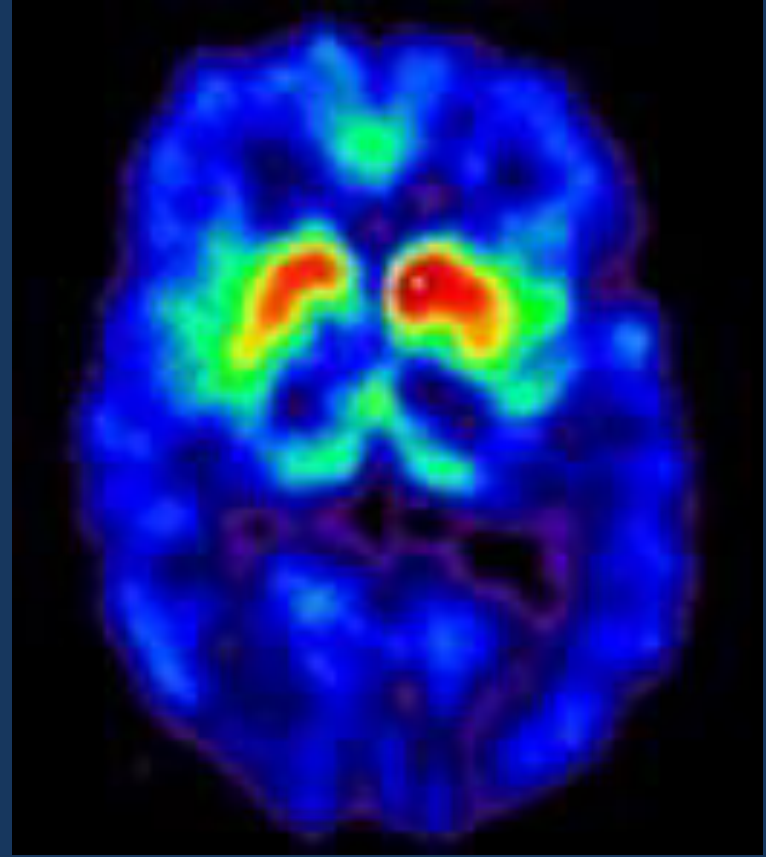
Differential diagnosis

	TRODAT (dopaminergic, pre-synaptic function)	IBZM (dopaminergic, post-synaptic function)
Healthy patient and also: Essential tremor Drug induced PS		
Parkinson's disease		
Parkinsonism-plus syndromes		

Evaluation of treatment in PD



Before treatment



After treatment

Myeloscintigraphy

Radiopharmaceuticals:

- ^{99m}Tc -DTPA

Mechanism of RPh accumulation :

- RPh is administered by a sterile lumbar puncture into the subarachnoid space. It reaches the level of basal cisterns in about one hour after administration.

Myeloscintigraphy

Clinical applications:

1. Localisation of the cerebrospinal fluid outflow
2. Detection of abnormal circulation of cerebrospinal fluid

Cerebrospinal fluid outflow from ethmoidal sinuses

