PET/CT In Neurology
Other neurological conditions

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BRAIN TUMORS

- Incidence of primary brain tumors

**Adults**
- Glioma 50%
- Meningioma
- Pituitary tumor
- Lymphoma

**Children**
- Medulloblastoma 20-25%
- LG supratentorial astrocytoma
- HG supratentorial astrocytoma
- Cerebellar astrocytoma
RF for brain tumor imaging

- Glucose metabolism - 18F FDG
- Amino acid transport - 11C MET
  - 18F FET
  - 18F DOPA
PET imaging in brain tumors

FDG PET
- Grading and prognosis
- DD recurrent tumor vs. posttherapeutic changes
- Assistance in biopsy
- Malignant transformation of low grade glioma into more aggressive tumors

L-Amino Acids PET
- Evaluation of treatment response
- Delineation of tumor borders
Uptake is related to histological tumor grade and may be influenced by corticosteroid therapy.

FDG uptake in low grade gliomas (WHO I, II) is usually close to that of normal white matter.

Uptake in WHO III gliomas is similar to or even exceeding that of normal grey matter.

Glioblastomas (WHO IV) express high uptake which can be inhomogeneous due to necrosis.
FDG PET useful in directing biopsy in lesions where mixed low and high grade tumor can coexist
FDG-PET Predicts Survival of Patients With Primary Brain Tumors

Research presented at the 49th Annual Meeting of the Society of Nuclear Medicine showed that F-18-fluorodeoxyglucose (FDG) PET images of the brain can predict histological grade and survival in patients with gliomas. In this glioma patient, the FDG-PET scan shows high FDG uptake (level 3 on a scale of 0 to 3) (see arrow). The lesion is also seen on MRI and methionine-PET (MET). For more information, see the article on page 2. Images courtesy of Vasantha Padma, MD, of the Wallace-Kettering Neurosciences Institute.
Amino Acid Tracers

- Low uptake in normal brain structures
- For primary dg, amino acids have a sensitivity of 75% and a specificity of 85%
- Tumors generally as hot spots (almost all high grade gliomas, brain metastases and oligodendrogliomas show intense uptake)
- Less influenced by inflammation than FDG
18F FET

jnm.snmjournals.org
Comparison study FDOPA and FDG
Recurrence vs post-therapeutic changes

- Increased glucose metabolism in recurent cerebral glioma can help differentiate it from post RT changes that may be indistinguishable with CT or MRI

- In one recent study 11C methionin PET had a sensitivity of 78% and specificity of 100% for differentiating recurrence from post RT changes
recurrent medulloblastoma hypermetabolic on PET
Differential diagnosis between recurrence and radionecrosis

FDG PET (60 min)

FDG PET (6 hours)

Courtesy of Dr. J Arbizu. Pamplona. SPAIN
PET IN EPILEPSY

- Presurgical evaluation of epileptogenic focus in MRI negative cases
- Correct lobar localisation in 60-90 % of patients with TLE
- Detection rate of hypometabolism in extratemporal lobe epilepsy 30-50 %
Hypoperfusion / hypometabolism (interictal) in dysfunctional area caused by:

- neuronal loss
- reduction of synaptic density
- inhibitory processes
FDG PET and surgical outcome

- Temporal hypometabolism predicts successful temporal lobectomy
- Worse outcome in case of multilobar hypometabolism, extratemporal hypometabolism especially in contralateral cortex
GABAa receptors: C11 flumazenil

- Most neurons express GABAa receptors
- Average reduction 30% in epileptogenic focus
- Reduced 11C FMZ binding restricted to sclerotic hippocampus
PET IN MOVEMENT DISORDERS

Clinical applications

- Confirmation of a neurodegenerative PS
- Differentiation of parkinsonian syndromes
Presynaptic Parkinsonism
- Parkinson’s disease (60-80%)
- atypical Parkinson syndrome

Non-presynaptic parkinsonism
- drug-induced PS
- essential tremor
- basal ganglia lesion/vascular

Movement Disorders Classification

- multiple system atrophy
- progressive supranuclear palsy
- corticobasal degeneration
- dementia Lewy bodies
18F-FDOPA PET

Courtesy of Dr. J Arbizu. Pamplona. SPAIN
DD of parkinsonian syndromes is of clinical importance:

- treatment strategy / response
- prognosis
Atypical PS

Presynaptic - pathological
Postsynaptic - pathological

PD

Presynaptic - pathological
Postsynaptic - Normal
La Fougère et al., JNM 2010;51:581-7  DA D$_2$ PET

Coutesy of J.Booij  AMC-UvA
DD between PD and atypical PD at postsynaptic level

Control

PD

MSA-P

PSP

DAT-SPECT

DAT-SPECT

DAT-SPECT

DAT-SPECT

DAT-SPECT

DAT-SPECT

D2-PET

D2-PET

D2-PET

D2-PET

D2-SPECT

Coutesy of J. Booij  AMC-UvA
Potential application

- Serial imaging of patients with PD to assess the progression of disease or therapy response
- In research trial
Thanks for your attention!