FDG PET Brain Scan

Updated
9/8/2024

- **Indications**
  - Evaluation of cognitive impairment and dementia; movement disorders and parkinsonian syndromes; other neurodegenerative motor diseases (amyotrophic lateral sclerosis and Huntington's disease); epilepsy; encephalitis (including autoimmune and paraneoplastic encephalitis); neuro oncology (CNS lymphoma, glioma, radiation necrosis).
- **Radiopharmaceutical:**
  - 5-7 mCi F-18 FDG administered IV
  - The IV line should be in place for at least 10 mins prior to radionuclide administration.
- **Patient Preparation:**
  - The patient should avoid caffeine, alcohol and drugs affecting cerebral glucose metabolism for 24 hrs prior to the exam.
  - The patient should be NPO (other than plain water) for at least 4-6 hrs prior to the exam.
  - The patient should drink 16-20 oz of water 30-60 mins prior to the exam to ensure adequate hydration.
  - The patient should have a blood glucose of 70-180 mg/dL prior to the exam.
  - Diabetes medications:
    - Oral diabetes medications should be taken normally.
    - Rapid-acting insulin should be held for at least 4 hrs (Humalog/lispro, NovoRapid/aspart, Apidra/glulisine).
    - Short-acting insulin should be held for at least 6 hrs (regular, Humulin-R, Entuzity).
    - Intermediate-acting insulin should be held for 18 hrs (NPH, Humulin-N and Novolin NPH).
    - Long-acting insulin should be held for 24 hrs (Levemir/detemir, Lantus/glargine).
    - Ultra long-acting insulin should be held for 42 hrs (Tresiba/degludec, Toujeo/glargine).
  - All patients should remain seated or recumbent in a darkly lit and quiet room, keep eyes open (stay awake), not speak and be kept warm from before radionuclide administration until after the completion of imaging,
  - All patients should empty their bladder immediately prior to imaging and should void frequently for a day following the exam.
- **Conflicting Examinations:**
  - No Nuclear Medicine exams within the previous 24 hrs.
- **Pregnancy/Lactation:**
  - Pregnancy testing is only needed in potentially pregnant patients who state they could be pregnant. See Pregnant, Potentially Pregnant and Lactating Patients policy for specifics.
  - Breast milk does not need to be discarded following radionuclide administration, however the mother should limit direct contact with the infant for 12 hours to reduce the infant's radiation dose emanating from the mother's body.
- **Imaging Technique:**
  - PET Bed Time - 10 mins/bed position, table weight limit is 450 lbs
  - Matrix Size - 128 x 128
  - Patient Positioning - supine with arms by sides
- **Imaging Views**
  - Begin imaging 1 hr after radionuclide administration.
  - Obtain axial low-dose CT images from C1 vertebrae through top of head using a soft brain window and kernel.
  - Obtain axial non attenuation corrected and attenuation corrected PET images from C1 vertebrae through top of head.
  - Create axial, coronal and sagittal fused PET-CT images using a brain window and kernel for the CT portion.
- **Notes:**
  - Glucose metabolism provides approximately 95% of ATP required for brain function. Under physiological conditions glucose metabolism is tightly coupled to neuronal activity. FDG accumulates in neuronal tissue depending on facilitated transport of glucose via glucose transporters and hexokinase mediated phosphorylation, as well as the functional interactions between astrocytes and neurons. Neuronal activity induced by disease are reflected in an alteration of glucose metabolism. Inflammatory processes and malignant tumors also exhibit increased glucose metabolism. FDG PET is currently the most accurate in-vivo method for the investigation of regional human brain glucose metabolism in health and disease states.

- In neurodegenerative disorders such as Alzheimer´s disease, changes in synaptic activity occur early in the course of the disease (when macro-structural brain changes cannot yet be detected). Tau pathology was shown to mirror brain hypometabolism and clinical symptoms. This hypometabolism significantly exceeded atrophy in most altered brain regions (except the hippocampus).
- FDG PET is recommended to support the early diagnosis of Alzheimer's disease (AD) in mild cognitive impairment; early diagnosis of dementia with Lewy bodies (DLB) and frontotemporal lobar degeneration (FTLD); differentiation between AD, DLB and FTLD; differentiation between AD and vascular dementia; differential diagnosis within neurodegenerative parkinsonian syndromes associated with dementia.
- A normal FDG PET scan has relevant negative predictive value at the mild cognitive impairment stage with less than 10% of patients progressing to degenerative dementia over 3 years.
- FDG PET can be used for the differential diagnosis between Parkinson´s disease (PD) and atypical parkinsonian syndromes such as progressive supranuclear palsy (PSP), multiple system atrophy (MSA), corticobasal syndrome (CBS) and dementia with Lewy bodies (DLB).
- FDG PET as biomarker has been also proposed on other neurodegenerative diseases such as amyotrophic lateral sclerosis (ALS) and Huntington's disease (HD).
- FDG PET is used in the presurgical evaluation of focal pharmaco-resistant epilepsy in adults and children to identify the epileptogenic zone using inter-ictal injection.
- FDG PET is used in the evaluation of encephalitis including autoimmune encephalitis (AE), paraneoplastic limbic encephalitis (PLE), infectious and post-infectious encephalitis and inflammatory encephalopathies (neuro-lupus).
- FDG PET is used in the evaluation of CNS lymphoma, gliomas (less useful than amino acid PET) and in differentiation of post radiation necrosis from residual/recurrent neoplasm).
- Patients undergoing treatment with corticosteroids for autoimmune or paraneoplastic limbic encephalitis should undergo FDG PET imaging prior to initiation of corticosteroids or as soon as possible after their initiation.