

# <sup>18</sup>F-FDG PET/CT Brain Imaging

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## RATIONALE

<sup>18</sup>F-FDG PET/CT imaging assists in evaluating metabolism and brain function. <sup>18</sup>F-FDG brain imaging can help with various clinical indications, including dementia, seizure disorders, and new or recurrent brain tumors. PET imaging performed with <sup>18</sup>F-FDG can exemplify pathologic conditions before morphologic presentation is seen with CT and MRI.

## CLINICAL INDICATIONS

- Diagnosis, staging, or detection of recurrent tumor.
- Tumor grading and directing biopsy.
- Evaluation of known dementia, including the diagnosis of Alzheimer disease and Parkinson disease.
- Seizure localization.
- Huntington disease.
- Differentiation of radiation necrosis versus tumor recurrence.

## CONTRAINDICATIONS

- Blood glucose levels that are above the range of 150–200 mg/dL.
- Pregnancy or breastfeeding: refer to local institutional policy for pregnancy assessment/exclusion.
- Patients unable to remain still for imaging (30–60 min).

## PATIENT PREPARATION/EDUCATION

- The patient should fast 4–6 h before the injection, except for hydration with water.
- Parenteral feeding or fluid given intravenously containing dextrose should be withheld for 4–6 h before the examination.
- The patient should avoid caffeine, alcohol, and other medications that can affect cerebral glucose metabolism for 24 h.
- A focused history should include current or past head trauma, mental status, psychiatric examinations, drug use, stroke, epilepsy, and transient ischemic attacks. Additional information should include: history of diabetes; prior brain surgeries; any current neurologic

medication and when last taken; and results of any previous brain imaging (CT, MRI, PET, or SPECT)

- Study should be scheduled 4–6 wk after radiation therapy where appropriate.

## PROTOCOL/ACQUISITION INSTRUCTIONS

- Verify blood glucose level before dose administration. Refer to the institution's policy; however, most commonly, the glucose level should not exceed 150–200 mg/dL.

### Preinjection

- Obtain intravenous access.
  - Place patient in a dimly lit, quiet room, seated for 20–30 min before injection of the radiopharmaceutical.
  - Instruct patients to keep eyes open (eyes should be closed only if the scan is being done for comparison and the eyes were closed previously); and to relax, not speak, and avoid any major movements.

### Postinjection

- The patient should continue to relax in a quiet room for 30–60 min (per institutional guidelines).
  - A restless uptake period should be noted for the interpreting physician.
  - Before imaging, the patient should void the bladder for greater comfort.

## IMAGING

- Remove any metal before positioning the patient supine on the imaging table.
- With the head in a head holder, use the canthomeatal line to position the head vertical with the imaging table.
  - As patient comfort is of greater importance, if the patient cannot tilt the head to achieve the required angle, proper orientation can be performed during image processing.
- Use straps across the forehead and chin to help minimize patient motion during imaging.
- Acquire images in either 2-dimensional (2D) or 3-dimensional (3D) mode.

- If acquiring in 2D mode, scan time will be 20 min per bed position.
- If acquiring in 3D mode, scan time will be 6 min per bed position.
- Refer to manufacturer's recommendations for 2D or 3D acquisition protocol.

### IMAGE PROCESSING

- Pixel size: 2–4 mm; images reconstructed into transaxial slices. Images displayed in transaxial, coronal, and sagittal projections.
- Hanning or Shepp-Logan filters are frequently used with filtered backprojection.
- Iterative reconstruction should follow manufacturer's recommendations for iterations, subsets, and smoothness.

### PRECAUTIONS

- Proper instructions for breastfeeding should be provided. Have patient withhold breastfeeding for 24 h.
- Supervision of patients should be constant; interaction should be kept to a minimum.

- If sedation is required, it should be done after the uptake period, as close to the imaging time as possible. Appropriate patient transportation should be arranged in the case of sedation.

### CONSIDERATIONS

- For PET/CT, follow the manufacturer's recommendations for CT acquisition parameters.
- When imaging for epilepsy, electroencephalography monitoring may be indicated, and monitoring should start 2 h before injection to confirm the patient is not in a postictal state. Monitoring should continue for 20 min after <sup>18</sup>F-FDG injection.

### REFERENCES

1. Farrell MB, Mantel ES, Basso DA, et al. PET: Brain imaging with <sup>18</sup>F-FDG. In: *Quick Reference Protocol Manual for Nuclear Medicine Technologists*. Society of Nuclear Medicine and Molecular Imaging; 2014:136–138.
2. Mettler F, Guiberteau M. *Essentials of Nuclear Medicine Imaging*. 6th ed. Elsevier; 2012.
3. Waxman A, Herholz K, Lewis D, et al. *Society of Nuclear Medicine Procedure Guideline for FDG PET Brain Imaging*. Society of Nuclear Medicine and Molecular Imaging; 2009.