^{18}F-FDG PET/CT Brain Imaging

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RATIONALE

^{18}F-FDG PET/CT imaging assists in evaluating metabolism and brain function. ^{18}F-FDG brain imaging can help with various clinical indications, including dementia, seizure disorders, and new or recurrent brain tumors. PET imaging performed with ^{18}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.

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- 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 ^{18}F-FDG injection.

REFERENCES

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