18-F-FDG PET/CT Brain Imaging

Radiology Associates of Clearwater

INDICATIONS:

a. Differentiation of benign from malignant lesions (1, 2, 3, 4).
b. Staging of malignant disease (4, 5, 6).
c. Grading of malignant brain lesions (1, 2).
d. Differentiation of recurrent malignant diseases from therapy-induced changes (7, 8, 9).
e. Monitoring response to therapy (10).
f. Evaluation of dementia.

PATIENT PREPARATION & SCHEDULING:

a. Determine the primary indication and assure it is an approved indication.
b. The patient is to be called by a nurse or technologist, and the test explained prior to the scheduled date. Begin filling out the history sheet.
c. After the patient has been scheduled, order the FDG dose.
PATIENT INSTRUCTIONS

ASK THE FOLLOWING QUESTIONS:

Ask if the patient is claustrophobic and is able to lie absolutely still for approximately 30 min. or does patient need to be sedated (If offered by the facility).

Ask if the patient is diabetic or had borderline blood sugar problems. If the patient is diabetic. If so, the patient should take no insulin the morning of the exam and should be scheduled first in the am.

Ask if there has been recent surgery in the last 6 months, recent chemotherapy, radiation therapy or diagnostic procedures. Get the dates if possible.

If the patient is of childbearing age, ask if she may be pregnant. If the patient is unsure, she will need to have a BHCG done prior to the scan unless she has had a hysterectomy with documentation

TELL THE PATIENT THE FOLLOWING INFORMATION: Refer to patient prep sheet.

1. The patient needs to avoid vigorous exercise on the day before and on the day of the exam.

2. Patient needs to be NPO except for water for at least 6 hours prior to scan. Emphasize that No gum, candy, soda, coffee etc is to be used 6 hours prior to the exam. A low carbohydrate diet in the morning is OK (toast and a cup of orange juice or milk) if having an afternoon scan.

3. Patient also needs to be hydrated prior to the scan. Drink 2 glasses of water (8 oz), one each hour prior to scan.

4. Patient will arrive in the department and will have an I.V. inserted for hydration. Blood from the IV insertion will be used to check a glucose level. (High glucose level can severely effect myocardial uptake of 18F-FDG and severely degrade the quality of the 18F-FDG images). The patient may also be catheterized if examining the lower abdomen.

5. Usual time in the department is 2 hours.

6. Remind the patient not to wear any jewelry on the head or neck.
EXAMINATION TIME:

Total of 1 hour: 30min waiting period after 18F-FDG injection, 30min of imaging time.

RADIOPHARMACEUTICAL:

18F-FDG, 10mCi for Brain studies.

METHOD OF ADMINISTRATION:

- Intravenously.
- Patient should be relaxed and supine for injection. Patient should be supine and resting for uptake portion of 18F-FDG (minimum 30 minutes), preferably for the entire time, post injection to scanning. Eyes will be uncovered and ears will remain unplugged. The room will be dimly lit.
- Hydrate the patient with 2 glasses of water after arrival in the department.

EQUIPMENT:

PET/CT scanner

PROCEDURE:

1. On the morning of the study review the patients history and record on history sheet. The patient’s blood glucose level will be checked prior to injecting 18F-FDG. The patient’s blood glucose level reading will be obtained and recorded on the patient’s worksheet by the technologist. (Glucose levels less than 200 mg/dl are acceptable for brain and tumor imaging.) If this is not the case, notify the Nuclear Medicine physician of the blood glucose level result and DO NOT inject the 18F-FDG until further instruction from Nuclear Medicine physician.

2. Inject 18F-FDG intravenously after establishing an IV line.

3. After the injection of 18F-FDG, the patient must remain in the Nuclear Medicine Clinic.

4. After a 30min wait, have patient void prior to imaging.

5. Positioning is as follows:

   Be sure to have the proper items on the table prior to patient exam (i.e.: head rest or table extension) (see Positioning protocols below)
Have all metal items in the field of view removed from the patient (i.e.: glasses, false teeth)

Have patient lie on the table and make them comfortable (i.e.: blanket, wedge under knees, ect…)

Explain to patient what is expected of them and also let them know what will be happening as soon as the exam is started.

Use inner lasers to land mark patient for start of exam.

From acquisition screen:

1. Scout image is performed 1st at 120 kv, 10 mA

2. C.T. imaging brain at 140 kv, 80 mA.

3. P.E.T. imaging brain 3D at 10 minutes F.O.V.

* If the camera has auto dose adjustment this may be used.

Imaging Protocols based on tumor type:

Alzheimer's: head in, arms down, entire head, use head holder, 3D

**COMPUTER PROCESSING AND DISPLAY:**

**RECON**

Matrix – 128 x 128
Recon Method – Iterative
Subsets – 21
Iterations – 2
Z-axis filter – Heavy
Post filter – 3.00 (FWHM)

**ATTENUATION**
Type – Measured
Transmission Scan - Most recent

**CORRECTIONS**
Well Counter File – Default
Well Counter – Sensitivity and Activity
Singles
Decay – Yes
Deadtime – Yes

Normalization – Default
Randoms – Correction by Singles
Scatter – Yes
After acquisition completes normally, select the SCREENS icon located on top of left monitor and choose quit screens. Next, on the right monitor select the EXAM RX icon, located near the top of the monitor and choose the END EXAM icon on left monitor, located near the bottom of the screen. On the right monitor choose the IMAGE WORKS icon, located in the column located near the top of the monitor. Select a patient and highlight the CT SLICES group and WB 3D AC group. Now select the IMAGE QC icon located in the column on the right side of the right monitor. This will bring up views of the coronal, sagittal, and axial fused datasets. This will also bring up a 3D PET only image. Review the image for motion or poor positioning. Repeat study if needed. Send the SCOUT, CTAC 3D BRAIN, PET AC 3D BRAIN, MIP, and all paperwork to the PACS archiving system. Send the CTAC 3D BRAIN and PET AC 3D BRAIN to the physician’s review system.

**DOSIMETRY - 18F-FDG (14):**

a. Adult: The critical organ is bladder receiving 0.63 rads per 10 - 20 mCi dose.

b. Children (5 years old): The critical organ is bladder receiving 1.8 rads per 0.15 - 0.30 mCi/kg dose.

### Radiation Dosimetry in Adults

<table>
<thead>
<tr>
<th>Radiopharmaceutical</th>
<th>Administered Activity</th>
<th>Organ Receiving the Largest Radiation Dose*</th>
<th>Effective Dose*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MBq (mCi)</td>
<td>mGy (rad)</td>
<td>mSv (rem)</td>
</tr>
<tr>
<td>18-fluoro-2-deoxyglucose (FDG)</td>
<td>350 – 750 i.v.</td>
<td>bladder 0.17</td>
<td>0.027</td>
</tr>
<tr>
<td></td>
<td>(10 – 20)</td>
<td>(0.63)</td>
<td></td>
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</tbody>
</table>

*aPer MBq (per mCi)  
1ICRP 53, page 76

### Radiation Dosimetry in Children (5 year old)

<table>
<thead>
<tr>
<th>Radiopharmaceutical</th>
<th>Administered Activity</th>
<th>Organ Receiving the Largest Radiation Dose*</th>
<th>Effective Dose*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MBq/kg (mCi/kg)</td>
<td>mGy (rad)</td>
<td>mSv (rem)</td>
</tr>
<tr>
<td>18-fluoro-2-deoxyglucose (FDG)</td>
<td>5 – 10 i.v.</td>
<td>bladder 0.48</td>
<td>0.073</td>
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<tr>
<td></td>
<td>(0.15 – 0.30)</td>
<td>(1.8)</td>
<td></td>
</tr>
</tbody>
</table>

*aPer MBq (per mCi)  
1ICRP 53, page 76

REFERENCES


JSM

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