Austin Radiological Association

BRAIN METABOLISM STUDY
(F-18-Fluorodeoxyglucose)

Overview

- The Brain Metabolism Study with F-18-fluorodeoxyglucose depicts the distribution of glucose metabolism in the brain in a tomographic fashion. The sole energy source of the brain is glucose, and the gray matter uses three to four times as much glucose on a per volume basis as the white matter.

Indications

- Differential diagnosis of dementia, and particularly Alzheimer's disease.
- Preoperative lateralization of temporal lobe seizure foci.
- Detection of viable brain tumor post-surgery and/or radiation therapy.

Medicare PET Reimbursement Guidelines:

Indication	CPT	Coverage Guidelines
Refractory Seizures	78608	Presurgical evaluation to localize seizure focus of refractory seizure activity.
Alzheimer's	78608	Differential diagnosis of fronto-temporal dementia (FTD) and Alzheimer's disease (AD) under specific requirements (please refer to separate coverage criteria guide for AD)
Brain Tumor	78608	

NOTE:
Private payer coverage for PET often reflects that of Medicare but may vary. Providers should obtain coverage and pre-authorization guidelines for PET from their private payers.

Examination Time

- Allow approximately 1.5 hours for the entire PET/CT brain study.
- Prior to Scan: Allow 30minutes for interview, IV, BGL, followed by 30 - 45 minute uptake post injection.
- Image acquisition:

1. 78608 (Brain metabolism)
    a. 10 minutes on Siemens scanner / 8 - 25 minutes on GE scanner

Patient Preparation

- Prior to arriving for the study:
  > NPO for 6 hours.
  > No nicotine or caffeine for 12 hours.

- Patient to remain on any anti-seizure medications.

- Recent interventions, i.e. surgery, radiation therapy, biopsy, and chemotherapy:
  1. Record any interventions during the last 3 months (see clinical history sheet at the end of this section).
  2. Preferably, there should have been no interventions within the last 1-2 months.
  3. Record any head trauma.
  4. Record date of last seizure (if applicable).

- Place the patient in a dimly lit, quiet room. Provide the patient with an eye mask and ear plugs prior to injection.

- Check the blood glucose level.
  - Fasting blood sugar should be obtained on all patients. PET scan preferred blood sugar ≤ 200 mg/dl.
  - Normal range 70-110 mg/dl.
  - If blood sugar is low (i.e. < 50 mg/dl) consult the radiologist.
  - If the blood glucose is between 200 mg/dl and 225 mg/dl, try oral hydration and walking the patient to lower the blood sugar.
  - If the BGL is between 225 mg/dl and 250 mg/dl, consult the radiologist.
  - If the BGL is over 250 mg/dl, cancel the exam.

- Sedation may be needed for claustrophobia. Alprazolam (Xanax) at 1 mg is commonly used to treat panic disorders including claustrophobia. Sedation for brain studies must be given approximately 30 minutes post injection to prevent interference with distribution.

Equipment & Energy Windows

- Imaging system:
  - Siemens Biograph Horizon 16 PET-CT scanner.
  - United Imaging uMI 550
- Collimators:
  - 3D mode (septa out or absent) *(Siemens Biograph 16 only has 3D function)*

- 3D mode for United Imaging uMI 550

- Energy windows (may vary with manufacturer and machine design): 30% window centered at 511 keV.

Radiopharmaceutical, Dose, & Technique of Administration

- Radiopharmaceutical: F-18-fluorodeoxyglucose.

- Dosing:

	Siemens	**GE**
Average Adult	7 mCi (259 MBq)	10mCi (370MBq)

Pediatric Patients – use North American Consensus Guidelines for Administered Radiopharmaceuticals in Children or Adolescents.

ARA RAM licensure allows +/- 20% dose variance.

- Technique of administration: Standard intravenous injection or through an existing intravenous line.

Patient Positioning & Imaging Field

- Patient position: Supine.

- Restrain the head: Position the patient's head in the standard head holder.

- Imaging field of view: Cranium.

Acquisition Protocol

- Have the patient empty his/her bladder before image acquisition.

- Begin image acquisition approximately 45 minutes following injection of F-18-fluorodeoxyglucose.

- Imaging times:

Siemens Biograph Horizon 16

  - Emission data acquisition: 10 minutes.

GE Discovery ST

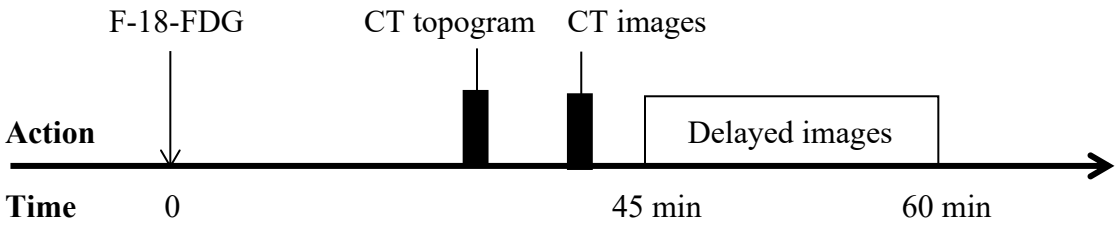
  - Emission data acquisition: 8 minutes with Dimension upgrade

- Have the patient empty his/her bladder after image acquisition.

CT parameter values vary with patient size and machine specific factors:

1. Milliampere-seconds (mAs) and Kilovolts peak (kVp) guidelines:
   a) pediatric patient ≤ 6 yrs old: 260 eff mAs, 120 kVp.
   b) pediatric patient > 6 yrs old: 300 eff mAs, 120 kVp.
   c) average adult: 450 eff mAs, 120 kVp.
2. The care dose is not utilized on Brain studies due to the bone density in the head.

Protocol Summary Diagram



Data Processing

- The PET images are reconstructed using iterative reconstruction. Siemens settings include: matrix 360, 8 iterations, 10 subsets, Gaussian filter, filter FWHM 2.0, zoom 2.0, T.O.F Settings for the United uMI 550 include: 3D reconstruction, HYPER Iterative, TOF, PSF, 256 matrix, measured attenuation..

- A rotating maximum intensity projection (MIP) display and surface-rendered 3D displays facilitate lesion evaluation.

Optional Maneuvers

- Attenuation correction: May be done with calculated attenuation coefficients rather than measured attenuation coefficients.

Principle Radiation Emission Data - F-18

- Physical half-life = 109.8 minutes.

Radiation	Mean % per disintegration	Mean energy (keV)
Positron	100	250
Gamma ±	200	511

Dosimetry - F-18-Fluorodeoxyglucose

Organ	rads/15 mCi	mGy/555 MBq
Bladder	2.21	22.1
Heart	0.80	8.0
Spleen	0.80	8.0
Kidneys	0.42	4.2
Brain	0.41	4.1
Lungs	0.39	3.9
Liver	0.38	3.8
Testes	0.35	3.5
Ovaries	0.26	2.6
Total body	0.20	2.0

Dosimetry - Computed Tomography

- Actual effective doses will depend on the user-specific exam protocols and the specific CT scanner used. It is important that each facility develop appropriate exam protocols and monitor the resultant patient doses for each machine in use.

Effective dose	rem	mSv
Diagnostic CT	0.15	1.5
Low dose CT	0.01	0.1