

PET and PET/CT ¹⁸F-FDG Oncology Protocol

Indications:

Differentiation of benign from malignant disease
Staging known malignant disease
Searching for an unknown primary tumor when metastatic disease is discovered
Differentiation of recurrent or residual malignant disease from therapy-induced changes
Monitoring the response to therapy
Grading of malignant brain lesions

Scheduling and Patient Preparation:

1. Pre-authorization for payment must be completed before patient is scheduled
2. Check to ensure patient is no pregnant or breast feeding
3. Determine if patient is diabetic
(If not insulin dependent patient should fast to obtain glucose level below 150mg/dL. If insulin dependent, eat high protein meal 4 hrs before scan and take insulin.)
4. When contrast CT is to be performed check for history of iodinated contrast material allergy, use of metformin for the treatment of diabetes mellitus and renal disease. Serum creatinine level is above 2.0mg/dL
5. Patients should fast for at least 6 hours prior to procedure
6. Patients may drink water
7. Patients may take medications
8. No exercise for 24 hours prior to scan
9. Wear comfortable warm clothing
10. Provide CT oral contrast and instructions if applicable.

Procedure and Radiopharmaceutical Administration:

1. Patient identification is confirmed by two methods, name, birth date or MRN.
2. Oral contrast for CT should be administered if desired at an appropriate time.
3. Have patient void and escort to uptake room. Place patient in reclining chair or on supine on gurney and cover with warm blanket.
4. Obtain focused history including type and site of malignancy, date of diagnosis, surgery, biopsy, radiation and chemotherapy, administration of bone marrow stimulants, fasting state, diabetes and recent infection. Assess patient's ability to lay still and put his/her arms overhead.
5. Angiocath IV is started.
6. Peripheral blood glucose is measured. If less than 180mg/dL technologist may inject as usual; if above 180mg/dL consult PET physician.
7. Instruct patient to remain quiet for 10 minutes prior to injection.
8. Administer IV ¹⁸F-FDG (10-15mCi adults, 0.21mCi/kg pediatric)
9. Patient should remain still during uptake period of 60-90 minutes.
10. Remove IV, unless IV needed for CT contrast

Positioning:

1. Just prior to imaging have patient void.
2. Remove any metal objects, prostheses, dentures, etc.
3. Place patient comfortably supine on the imaging table with support under knees, arms overhead or at sides depending on disease location (arms down for head or neck disease).
4. Cover patient with warm blanket and secure safety straps and instruct them not to move, the time required for the procedure and details of imaging sequence and breathing instruction as required.

CT and PET Imaging Protocols:

1. Select the PET/CT acquisition protocol that is appropriate for the diagnosis and clinical question [scan whole body region (skull base to proximal thigh)].
 - General Oncology – whole body [feet toward head]
 - Lung Cancer/SPN – whole body [head toward feet]
 - Melanoma – total body (top of head to feet)
2. Select 2D or 3D imaging mode according to the scanner capabilities and facility preferences
3. Set image time per bed position for 3 min or longer
4. Perform scout scan (topogram) over body area to be scanned.
5. Perform either low dose CT study for attenuation correction or diagnostic CT with or without contrast. Adjust CT parameters according patient size, age, disease, etc. Low dose CT should be acquired using a low milliamper-second setting to decrease the radiation dose to the patient.
6. Immediately following the CT study acquire the PET image data. (If scanner is PET only then substitute the CT study with a transmission scan using high energy radioactive sources available with the scanner for an appropriate data density to provide attenuation correction.)
7. Options –
 - a. Administer Lorazepam or diazepam before injection of ^{18}F -FDG may reduce brown adipose tissue uptake.
 - b. In head/neck cancer patients perform second scan over neck for longer time period to detect small lesions.
 - c. 2nd scan following an additional time delay to assess visual and quantitative uptake changes in disease with time.
8. Images should be reviewed prior to moving the patient from the imaging table.
9. Patient dismissed.

Image Reconstruction and Processing Protocol:

1. CT images should be reconstructed according to the image quality obtained; low dose attenuation correction or diagnostic. Diagnostic CT data should be reconstructed with an appropriate kernel, FOV and other parameters.
2. PET images are reconstructed from coincidence stored as line of response data or sinograms. All corrections should be applied during reconstruction for detector efficiency, normalization, dead time, randoms, scatter, attenuation, etc.
3. The reconstruction algorithm should be OSEM or similar with optimization of the iterations, subsets and filtering to produce high resolution images.
4. PET images should be reconstructed both with and without attenuation correction using an algorithm, matrix size and FOV that provides images free of artifact.

Image Display and Processing:

1. Send the image files to the viewing workstation.
2. Reformat the data sets into sagittal and coronal
3. If image fusion is desired or required perform fusion using commercial software packages and ensure that image registration and alignment are accurate.
4. Review all three data sets: CT (if performed), PET AC corrected, PET uncorrected. Also review MIP (maximum intensity projection) images.
5. Review all axial, coronal and sagittal images and correlate disease and anatomic locations.
6. Transfer images to PACS or archive images.
7. Create hard copies as necessary with appropriate patient information and anatomic orientation.