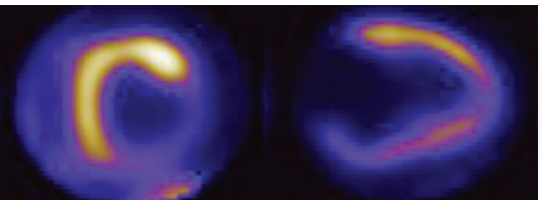
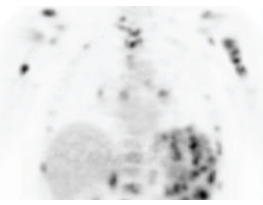
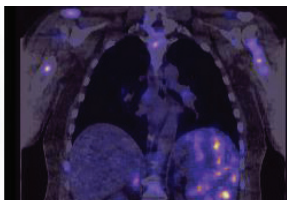
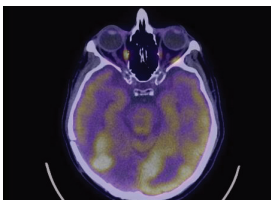
PET PROS

PET Professional Resources and Outreach Source



Elements of PET/CT Reporting

1. Clinical History
   - **a. Indication**
     - i. tumor type
     - ii. abnormality to be evaluated
     - iii. specific clinical question
   - **b. Relevent history**
     - i. biopsy results
     - ii. chemotherapy
     - iii. radiotherapy
     - iv. other treatments
     - v. significant medical/surgical history that may have relevence for PET/CT interpretation

2. Procedure
   - **a. PET**
     - i. radiopharmaceutical type
     - ii. radiopharmaceutical dose
     - iii. route of administration and injection site
     - iv. scan coverage (skull base - thigh, vertex - feet, etc.)
       1. Note should be made of any additional dedicated acquisitions (i.e. delayed chest for SPN, or delayed head and neck)
     - v. uptake time (approximate)
     - vi. serum blood glucose (if measured)
     - vii. medications administered as part of procedure (i.e. anxiolytics, muscle relaxants, beta blockers, premedication for contrast reaction)
   - **b. CT**
     - i. noncontrast
     - ii. iodinated intravenous contrast – type and amount
     - iii. oral contrast – type and amount
   - **c. Notes**
     - i. explanation of any deviation from standard protocol
     - ii. special measures patient may have required while at facility, i.e. supplemental oxygen, treatment of contrast reaction

3. Comparison
   - **a. Prior PET or PET/CT studies**
   - **b. Other studies, i.e. CT, MRI, US, mammography, nuclear medicine**

4. Findings
   - **a. Order of importance format**
   - **b. Anatomic site format**
   - **c. Hybrid format**

5. Impression

6. Sample Normal Reports

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SNM
PET
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1. Clinical History

The decision on how much detail to include in this portion of a report is a personal one, but there should be three basic pieces of information:

a. Indication for the examination

In cases of routine follow up scanning, this may be a simple statement such as "Restaging of non-Hodgkin lymphoma." If the PET/CT is being performed for a specific reason, however, this information should be included, such as "History of colorectal cancer, now with rising CEA." The indication should be a statement of the clinical issue(s) which are to be answered at the end of the report. To conform with present CMS guidelines, the indications for PET should be categorized as: Diagnosis, Initial Staging, Restaging, or Response to Therapy.

b. Relevant history

This portion of the Clinical History section should contain information regarding the patient which could have an impact on the interpretation of the examination. The most common information will pertain to histopathologic results, and previous treatments (such as "Prior chemoradiation, completed 3 months prior to this scan"). Other pertinent information would include concurrent and ongoing therapy, relevant surgeries, infection, and systemic processes that might interfere with interpretation such as sarcoidosis, vasculities, etc.

c. Information needed for billing

If not provided in the above sections, there should be a clear statement regarding the purpose of PET scanning using appropriate terminology to facilitate billing, such as: "Indeterminate nodule found on chest CT. PET/CT is obtained for evaluation of solitary pulmonary nodule."

2. Procedure and Protocol

a. PET Procedure

i. Radiopharmaceutical

As with any nuclear medicine procedure, it is important to list the radiopharmaceutical (including type and dose), the route of administration, and the site of injection.

ii. Scan field

Regardless of whether a PET/CT study is coded as a regional study, a skull base to mid thigh, or whole body, the actual axial coverage of the scan should be described in order to convey what areas of the body are being evaluated, and what areas lie outside the scan field. This description should be made using appropriate anatomic nomenclature. For example, many protocols for imaging of patients with cancers of the head and neck begin at the vertex of the skull and extend through the pelvis. Scans in patients with known malignant involvement of the femur may begin at the orbit and extend to the knees. True whole-body scans for patients with melanoma extend from the vertex to the feet.

iii. Localization time

The approximate time between injection and scanning should be given. In most cases, a range is appropriate, such as 60-90 minutes, but special note should be made of cases in which the localization time is either shorter or longer than normal.

iv. Serum blood glucose

Serum blood glucose should be measured on patients undergoing FDG-PET or PET/CT in order to comply with ACR guidelines. The result of this serum glucose measurement should be included in the report. In addition to its relevance to the interpretation of the current study, the blood glucose may have bearing when follow up scans are being performed at different serum glucose level.

v. Medication and Intervention

If medications were administered to the patient as part of protocol (i.e. anxiolytics, furosemide, etc.) the type, dose, and route of administration should be noted. Any interventions performed as part of the procedure should also be described, such as placement of a urinary catheter. If an oral premedication regimen was used prior to intravenous contrast administration, this should be noted.

vi. Other details

Some PET/CT protocols make use of additional acquisitions, such as delayed scanning of the chest for patients with indeterminate pulmonary nodules, or dedicated brain imaging in patients with a suspicion of cerebral disease. Some patients are scanned in specific postions, such as for radiation treatment planning, using an immobilization devices. Such additions to the standard PET/CT acquisition should be described.

b. CT Procedure

Some description of the CT procedure should be given in the report, with particular attention given to whether the study was performed without contrast material, or whether intravenous contrast, oral contrast, or both were administered. If intravenous contrast was administered, the type and amount of contrast should be stated. Details such as tube current, pitch, etc. may be included, but are optional. Regardless of the CT parameters used, it should be recognized that the CT portion of the study contains information which should be used in the interpretation of the PET portion of the examination, whether through anatomic localization, tissue characterization by density, or patterns of enhancement. As such, the use of such terms as "non-diagnostic CT" or "CT used only for attenuation correction" are discouraged.

i. If the CT technique used is of significantly lower quality than routine diagnostic CT at a particular institution, it may be appropriate to supply the details fo the technique used, i.e. 40 mAs, 120 kVp.
ii. If a diagnostic CT interpretation is performed on the CT component of a PET/CT study, then the details of the CT technique should be provided in the separate CT reports.

c. Additional notes

Any details regarding adverse reactions to contrast (including signs, symptoms, and treatment), special measures required by the patient (e.g. supplemental oxygen, IV fluids), and any significant devation from standard protocol should be included in the official report. Details of such interventions are also typically kept in a separate nurse's note or incident report.

3. Comparison

a. **Dates of any PET or PET/CT studies used for comparison should be given. If no previous PET studies are available, this should be stated.**
b. **In addition to comparing to other PET/CT studies, it is necessary to correlate the findings on PET/CT with other imaging studies including CT, MRI, plain films, etc.**

4. Findings

It is vital to have an organizational scheme when approaching PET/CT, given the extent of information available on the scan. There are two primary styles of PET/CT reporting, termed here as "Priority" and "Anatomic Site." Ideally, PET/CT reports incorporate features of both.

a. Priority

In this scheme, the findings are described in the order of relevance to the clinical care of the patient. In its simplest form, such a report follows the TNM staging classification for the type of tumor being evaluated. In other cases, it may begin with the largest or most clinically significant site of recurernt disease, followed by additional findings of less immediate importance. Once the pertinent PET findings (along with corresponding anatomic descriptors from the CT portion of the study) are described, there should be a description of significant CT findings which are not FDG-avid, followed by incidental findings, either on PET or CT, which are unlikely to have an impact on patient care. The overall organization can be outlined as below:

Dominant findings: [findings and pertinent negatives directly relevant to the clinical question; may be a description of the primary lesion using T nomenclature or of the dominant site(s) of recurrent disease]
Metastases: [additional sites of abnormal radiotracer localization suspected to represent nodal and/or extranodal sites of metastatic disease]
Other abnormal PET findings: [second primary tumors, diffuse thyroid activity, etc.]
Incidental CT findings [lung nodules w/o FDG uptake, AAA, renal masses, etc.]
Normal physiologic FDG uptake: [brown fat, prominent muscle or intestinal uptake]

b. Anatomic site

A second scheme which is more consistent and versatile is organization by anatomic region. In this style of dictation, the findings on both PET and CT are grouped region of the body, with a separate section for description of musculoskeletal findings. This style is conducive to a "top-to-bottom" review of the PET/CT, while maintaining a structured approach. Within each section, it is still appropriate to

begin with significant PET and CT findings, followed by relevant CT-only findings and incidental observations. This style of organization can be outlined as below:

For each level, describe the positive findings (both PET and CT), pertinent negatives, and any prominent or asymmetric physiologic uptake that might be misinterpreted by the naïve viewer.
Head and neck:
Chest:
Abdomen and Pelvis:
Musculoskeletal:

c. Synthesis of Priority and Anatomic Site

Ideally, a concise and informative PET/CT report will represent a combination of the two primary dictation styles. This can best be accomplished by organizing the overall report by anatomic region (Head and Neck, Chest, Abdomen and Pelvis, Musculoskeletal), and applying Order of Importance to each individual section. This assures that the report has an overall structure and consistency, and that the information is compartmentalized and presented in a clear fashion with ready access to relevant information. This hybrid style is illustrated in the normal reports at the end of this guideline.

d. General reporting notes

In both organizational schemes, disease location should be described using standard anatomic descriptors, ideally in conformance with the RADLEX convention. It is appropriate to provide size measurements for nodules and masses, either as a single axial diameter (per RECIST) or in 2 or 3 orthogonal directions. If a single linear measurement is reported there should be a statement that it is the short or long axis, realizing it is common practice in diagnostic imaging to use the short axis diameter, while in oncology (RECIST) the largest dimension of a lesion is used for follow up comparison. PET/CT is often used as a follow up to anatomic imaging, and in such cases it is advisable to compare anatomic information (i.e. increasing, stable, or decreasing lesion size) in addition to noting the metabolic findings on PET. One word of caution, however. When CT and PET/CT are performed separately but in close temporal proximity, the size measurements supplied by CT should take precedence. If lesion sizes are reported on PET/CT, care should be taken that there is concordance between the CT and PET/CT reports, since disparate measurements in studies performed around the same time lead to confusion and frustration on the part of the clincians. It is therefore important that there is communication between readers in situations where the PET and CT are read independently, to assure that a consistent message is given.

Once a description of sites of the patient's known or suspected tumor is completed, incidental sites of FDG uptake should be addressed. These might include second primary tumors, inflammatory or infectious processes, or benign but FDG-avid disease. Typical benign sites of FDG uptake can also be noted, such as brown fat and functional changes of the ovulatory cycle. There should be a full description of each site along with appropriate CT findings.

Finally, incidental CT findings without FDG uptake should be noted. This includes such findings as enlarged nodes that do not take up FDG, pulmonary findings (emphysema, pneumothorax, non-avid lung nodules), aortic dilation, adrenal nodules, renal masses or stones, and gallstones. Any finding which would belong in a full CT report should be included in the report of a PET/CT.

5. Impression

The impression is the most important section of any imaging report. Many referring physicians start with the impression, and read the Findings section only as time allows. It is essential that all the important information discovered in the study is presented here in a clear and succinct way. The goals of the impression section should be:

a. Brief and concise
b. Answer the clinical question
c. Give a precise diagnosis
d. When a precise diagnosis is not possible, a clear and organized differential diagnosis should be given
e. It may be appropriate to discuss the use of additional imaging studies or follow up, if this would aid in the arrival at the correct diagnosis

The impression should start off with a clear statement if it is abnormal. Examples include: "Definite evidence of malignancy in left upper lobe with ipsilateral hilar and mediastinal metastases" or "Probable malignancy in right piriform sinus, without evidence of metastases." For follow up scans after therapy, both the metabolic response and anatomic response should be commented on in the impression.

In the same sense, if everything appears benign, it is important to make such a statement at the beginning of the impression such as "Negative study for malignancy". Note that the similar expression "No evidence for active malignancy" is not as definitive and can be misinterpreted by the referring physician.

Considerably care must be exercised in selection of the descriptions of certainty used in the impression. Some terms such as "Absent", "excludes", "unlikely", "probable", "certain" and "definite" are interpreted in much the same way by the referring physician and the radiologist. Other commonly used terms such as "unlikely", "highly suggestive", "compatible with", "worrisome", and "suspicious" are often understood quite differently by the referring physician from what is intended.

Although there is over a century of tradition of using vague descriptive phrases to communicate the certainty of interpretation, it would be ideal to move to definite, numeric probability estimates in the impression. However, this is likely to be unacceptable to many radiologists. The following phrases can be used to communicate level of certainty and should be recognized appropriately by most referring physicians: "definitely benign", "probably benign", "equivocal", "probably malignant", "almost certainly malignant", "definitely malignant".

The goal is to optimize communication with the referring physician. It the findings are definite, it is important to communicate using the right, very specific words. If there is real uncertainty about the interpretation, then it is essential that the uncertainty be clearly communicated. Vague language only confuses the referring physician and can result in sub-optimal patient care.

Finally, it should be recognized that radiology reports are now made available to patients at many institutions. While it is important to be definitive in the Impression section of PET/CT reports, it is also important to recognize the limitations of the imaging studies, and that the results must be taken in the context of each clinical situation. Reports must convey the necessary informaiton to the referring physician without causing unnecessary anxiety to the patient.

6. Sample Normal Reports

Both of the following reports are examples of how a PET/CT report should be organized using the above recommendations. Both are a synthesis of Priority and Anatomic Site styles. Note that even though neither patient has PET findings suggesting disease recurrence, there is still a number of relevant positive and negative findings conveyed in each report. The organization of each subsection is different for the two reports, reflecting the application of Order of Importance. In the first case, the pertinent negatives have to do with the status of lymph nodes and spleen, and these are addressed early in each subsection. In the second case, a patient with an indeterminate pulmonary nodule, the nodule itself is addressed first and foremost. Note that even though the nodule is negative on PET, there is still a TNM format to the Chest subsection framed in the context of pertinent negative findings.

Sample Normal Report #1 – Negative Lymphoma

PATIENT NAME: Smith, John V.
EXAM DATE: __/__/____
MRN/DOB: 123456-7

EXAMINATION: 18F-FDG PET/CT Scan, Skull Base to Mid-Thigh

CLINICAL HISTORY: Restaging of follicular lymphoma, status post chemotherapy completed in 2004.

PROCEDURE: 12.5 mci (18F)-fluorodeoxyglucose was administered intravenously via the right antecubital vein. To allow for distribution and uptake of radiotracer, the patient was allowed to rest quietly for 60-90 minutes in a shielded room. Imaging was performed on an integrated 16-slice PET/CT scanner, with scanning from the skull base to the mid thigh. Serum blood glucose at the time of the injection was measured at 104 mg/dL. CT scanning was performed without oral or intravenous contrast material.

COMPARISON: Previous PET/CT performed 7/10/07 and CT performed 5/4/07.

FINDINGS:
Head and Neck: There is no nodal hypermetabolism in the neck. The visualized portions of the brain are normal in appearance on CT.

Chest: There is no nodal hypermetabolism in the chest. There are slight changes of centrilobular emphysema at the lung apices. There are no pulmonary nodules.

Abdomen and Pelvis: There is no nodal hypermetabolism in retroperitoneal or pelvic chains. The spleen is normal in size and FDG avidity. Incidental note is made of tiny stones in the lumen of the gallbladder, with no CT evidence of cholecystitis.

Musculoskeletal: Marrow uptake is within normal range.

IMPRESSION: No evidence of recurrent lymphoma.

Sample Normal Report #2 – Negative SPN

PATIENT NAME: Smith, John V.
RECORD NUMBER: 123456-7
EXAMINATION: PET/CT Base of skull to mid thigh
EXAM DATE: __/__/____

CLINICAL HISTORY: Mr. Smith is a 64 year old man who was incidentally found to have a right upper lobe pulmonary nodule on chest x-ray. CT on 07/01/2008 showed a 10 mm, smooth, non calcified nodule in the right upper lobe. There was no hilar or mediastinal adenopathy. There are no prior studies for comparison. The patient has a 40-pack year smoking history, and no history of cancer. The patient is referred for PET/CT for metabolic characterization of the nodule to determine the likelihood of malignancy.

RADIOPHARMACEUTICAL: F-18 fluorodeoxyglucose (FDG) 15.0 mCi IV.

COMPARISON STUDY: CT Thorax 07/01/2008

PROCEDURE: The patient's fasting blood glucose level was 100 mg/dL. The patient was positioned in the PET/CT scanner approximately 60 minutes after injection of the radiopharmaceutical. A non-contrast CT scan was acquired from the base of the skull through the inguinal region. A 3D emission scan of the same area was acquired in 6 bed positions over 12 minutes. Images were reviewed in the transaxial, coronal, and sagittal planes.

FINDINGS:
Head and neck:
There is no cervical adenopathy. Physiologic FDG uptake is seen in the oropharynx, salivary glands, and larynx.

Thorax:
There is a 10 x 12 mm smooth, non calcified nodule in the upper lobe of the right lung (image 197) that is unchanged compared to CT on 07/01/2008, and shows no FDG uptake. There are no other pulmonary nodules or other significant parenchymal abnormalities. There is no supraclavicular or axillary adenopathy. There is no hilar or mediastinal adenopathy. Normal FDG uptake is seen throughout both lungs. There are no pleural or pericardial abnormalities. Physiologic FDG uptake is noted in the heart. The caliber of the thoracic aorta is normal. The thyroid gland is normal.

Abdomen and pelvis:
There is no adenopathy or nodal hypermetabolism in the abdomen or pelvis. The liver, gallbladder, pancreas, and spleen are normal. There are no adrenal nodules. Physiologic FDG excretion is seen in the kidneys and bladder. The caliber of the abdominal aorta is normal.

Musculoskeletal:
Normal FDG activity is seen in the axial skeleton. No blastic or lytic lesions are noted on CT.

IMPRESSION:
The 10 x 12 mm right upper lobe pulmonary nodule seen on CT shows no FDG uptake above regional background, suggesting a benign etiology. As low-grade pulmonary malignancies such as bronchoalveolar carcinoma may not be hypermetabolic on PET, CT follow up is recommended to assure nodule stability.