INTRODUCTION:

Positron emission tomography (PET) is a rapidly developing technology that is able to detect biochemical reactions, e.g., metabolism, within body tissues. A radioactive tracer, e.g., fluorine 18 fluorodeoxyglucose (FDG), is used during the procedure. Unlike other nuclear medicine examinations, PET measures metabolic activity of the cells of body tissues, providing information about the functionality and structure of the particular organ or tissue examined. PET may detect biochemical changes that help to evaluate malignant tumors and other lesions.

The degree of uptake of FDG may indicate increased metabolism in the cells of body tissues. Cancer cells show increased metabolism of glucose and amino acids which can be monitored with FDG and 11C-L-methionine (MET) respectively. The most commonly used radionuclide is FDG for tumor cells. FDG uptake is higher in fast-growing tumors; PET is not useful or beneficial for slow growing tumors.

FDG uptake may occur in various types of active inflammation and is not specific for cancer. Thus it is not used for the initial diagnosis of cancer, but is useful in monitoring cancer cell viability and for the diagnosis and detection of recurrence of cancer. PET is also useful for monitoring the response to treatment of various cancers.

IMPORTANT NOTE:

- The following are noncovered for all other indications including (but not limited to):
  - **Breast Cancer** – Initial Treatment Strategy (formerly diagnosis and initial staging) of axillary lymph nodes.
  - **Melanoma** – Initial Treatment Strategy (formerly Evaluation) of regional lymph nodes.
  - **Prostate Cancer** – Initial Treatment Strategy (formerly Diagnosis and initial staging.)
  - **Infection and/or Inflammation** – PET for chronic osteomyelitis, infection of hip arthroplasty, and fever of unknown origin.
INDICATIONS FOR AN ONCOLOGICAL PET SCAN:

Initial Treatment Strategy

All solid tumors, including myeloma, with biopsy proven cancer or strongly suspected based on other diagnostic testing:

Including
- CLL – chronic lymphocytic leukemia
- SPN – solitary pulmonary nodule ≥ to 8mm in size (may have non-suspicious nodules in the lung)

Excluding
- ALL - acute lymphoblastic leukemia
- AML – acute myelogenous leukemia
- BCC – basal cell carcinoma (of the skin)
- Prostate cancer

- To determine the anatomic extent of tumor when the recommended anti-tumor treatment reasonably depends on the extent of the tumor, or
- To determine if patient is an appropriate candidate for an invasive diagnostic or therapeutic procedure, or
- To determine the optimal anatomic location for an invasive procedure.

Subsequent Treatment Strategy

Restaging or monitoring response to active treatment, and/or a single evaluation after completion/cessation of therapy not to be performed within 4 weeks of completion of therapy, and/or evaluation for suspicion of recurrence due to new or changing signs/symptoms. (Asymptomatic surveillance is not approvable.)

- Breast cancer (female and males)
- Cervical cancer
- Colorectal cancer (including colon, rectal, appendiceal or anal cancer)
- Esophageal cancer
- Head and neck cancer (not including Brain cancer/tumor; thyroid noted below)
- Lung cancer - Non-small cell
- Lymphoma
- Melanoma
- Myeloma
- Ovarian cancer

Subsequent PET Scans may be performed only if other imaging (US, CT, MRI) is inconclusive in determining a treatment plan or unable to be performed:

- Brain cancer: (with metastasis to non-head areas)
- Refer to Brain PET Scan Guidelines to image the brain
- Lung cancer - Small cell
- Neuroendocrine cancer (e.g. carcinoid, pheochromocytoma, etc)
- Pancreatic cancer
- Soft tissue sarcoma
- Testicular cancer
- Tumors of unknown origin

**Prostate cancer:**
- PET scan is not indicated for subsequent treatment strategy.

**Thyroid cancer:**
- Subsequent treatment strategy for recurrence or distant metastasis for thyroid cancer of Papillary, Follicular, or Hurthle cell origin AND patient has the following:
  - a thyroidectomy and radioiodine ablation initially, *and*
  - current serum thyroglobulin > 10ng/mL, *and*
  - current whole body I-131 scan is negative.
  - Medullary Thyroid cancer when calcitonin levels are elevated post-operatively.

**Surveillance/Remission**

Surveillance/remission PET scan testing to assess for possible changes in status with no signs or symptoms of active cancer changes and not on any active treatment. Unless otherwise specified above, PET scan is not indicated for surveillance/remission.

**ADDITIONAL INFORMATION RELATED TO PET SCANS:**

**Initial Treatment Strategy** - “Initial Anti-tumor Treatment Strategy” or “Initial Treatment Strategy” is replacing “diagnosis and initial staging”.

**Subsequent Treatment Strategy** - “Subsequent Anti-tumor Treatment Strategy” or “Subsequent Treatment Strategy” is replacing “restaging and monitoring response to treatment”.

**PET with CT Attenuation** – In contrast to the simple PET scan which requires a complex process of evaluation of body habitus to adjust for tissue density, newer scanners have the capacity to obtain a preliminary, general assessment of a patient’s habitus through the use of CT technology. Automatic adjustments (attenuation) are made. This is one study, not a combination study.

**PET/CT** – PET/CT fusion examination provides the sharp anatomical detail of a high performance CT with PET’s ability to measure tissue metabolic activity. The ability to view both the morphology and metabolic activity simultaneously helps to evaluate tumors with speed and clarity.

**PET and Breast Cancer** - PET provides important qualitative and quantitative metabolic information that is important in the initial staging and re-staging of breast cancer. The combination of PET and computed tomography (PET/CT) has advantages over PET alone.
because areas of tracer uptake are better localized and the image acquisition time is reduced.

**PET and Cervical Cancer** – Studies have shown that PET may be useful for the pre-treatment detection of retroperitoneal nodal metastasis in cervical cancer.

**PET and Colorectal Cancer** – PET is useful in the detection of recurrent disease, the localization of recurrence in patients with a rise of carcinoembryonic antigen (CEA), the assessment of residual masses after treatment, and in staging patient before surgery.

**PET and Esophageal Cancer** – The most common use of PET in esophageal cancer is to detect distant metastases and distant lymph node disease. It may also be used to assess therapy response and evaluate for esophageal tumor recurrence after treatment. PET findings do not specify each separate type of lesion. It is very helpful in detecting distant spread from invasive thymic carcinomas.

**PET and Head and Neck Cancer** – PET is used to evaluate cancer/tumor in the head and neck region, e.g., face, orbit, temporal, neck and is useful to rule out head and/or neck cancer/tumor as the “primary” when there is evidence of tumor elsewhere in the body and clinical examination or conventional imaging has failed to localize the lesion. It is also used to distinguish a benign tumor from a malignant tumor.

**PET and Lung Cancer** – The most common cause of death from cancer in western countries is lung cancer. PET is helpful in the evaluation of patients diagnosed with early-stage non-small lung cancer. It is valuable in picking up hidden metastasis. PET identifies areas of hypermetabolic sites such as neoplasia or inflammation and reveals occult metastases. The detection of hidden or unsuspected metastasis prevents unnecessary surgery or treatments.

**PET and Lymphoma** – FDG-PET is used in the early assessment of response to chemotherapy in Hodgkin lymphoma (HL) as well as in aggressive non-Hodgkin lymphoma (NHL). Soon after the initiation of therapy, changes in FDG uptake may occur and these changes precede changes in tumor volume. This information may be used to guide treatment for patients with HL and NHL.

**PET and Melanoma** – FDG-PET is not used in the diagnosis of melanoma. It may be used in the evaluation of stage III melanoma for detection of distant metastases and to identify candidates for further treatment or surgery.

**PET and Pancreatic Cancer** – In difficult cases, the presence of diffuse uptake of FDG by the pancreas or concomitant extrapancreatic uptake by the salivary glands on PET/CT can be used to aid in differentiation of autoimmune pancreatitis and pancreatic cancer.

**PET and Solitary Pulmonary Nodule** – FDG-PET may be used in the evaluation of patients with a single solitary nodule. It measures glucose metabolism which is different between benign and malignant nodules. FDG-PET is accurate in evaluation of the nodule. However, it may provide false positive results in patients who have inflammatory disease or active infections.
**PET and Thyroid Cancer** – The differentiated thyroid carcinoma (DTC) represents the most common type of thyroid cancer. It can be cured with surgical treatment and adjunctive therapy, but tumor recurrence is associated with significant morbidity and mortality. FDG PET is used to evaluate DTC patients with negative radiiodine scans and elevated thyroglobulin (Tg) levels to detect recurrent or metastatic DTC.
REFERENCES


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