

# **Diagnostic Positron Emission Tomography (PET)**

## **Oncological Applications of FDG PET Imaging**

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# What Is PET?

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- PET is a sensitive and accurate nuclear medicine technology rooted in molecular biochemistry.
- The alteration of biochemical processes in the body's tissues are visualized via PET- often before anatomical or structural changes have had time to occur.

# Glucose Metabolism

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- Glucose is the principle compound utilized for energy consumption by all cells.
- Tumor cells are known to have an increased rate of glucose metabolism and therefore are easily seen on an FDG PET scan.

# False Positive PET/FDG

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- **Inflammatory and Infectious Processes**
  - Granulomatous lymphadenitis
  - Tuberculosis
  - Sarcoidosis
  - Pneumonia
  - Rheumatoid Arthritis- Lung
  - Hematoma
  - Thrombus

# False Positive PET/FDG

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## ■ Healing Bone

- Surgical
- Fracture

## ■ Joints

- Degenerative or inflammatory joint disease

## ■ Drugs

- G-CSF

# Diagnostic Applications

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## ■ Oncology

- PET can assist the health care provider in:
  - Localizing tumors.
  - Determining if a tumor is benign or malignant.
  - Determining the effectiveness of cancer treatment modalities, such as chemotherapy.

# Diagnostic Applications

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## ■ Neurology

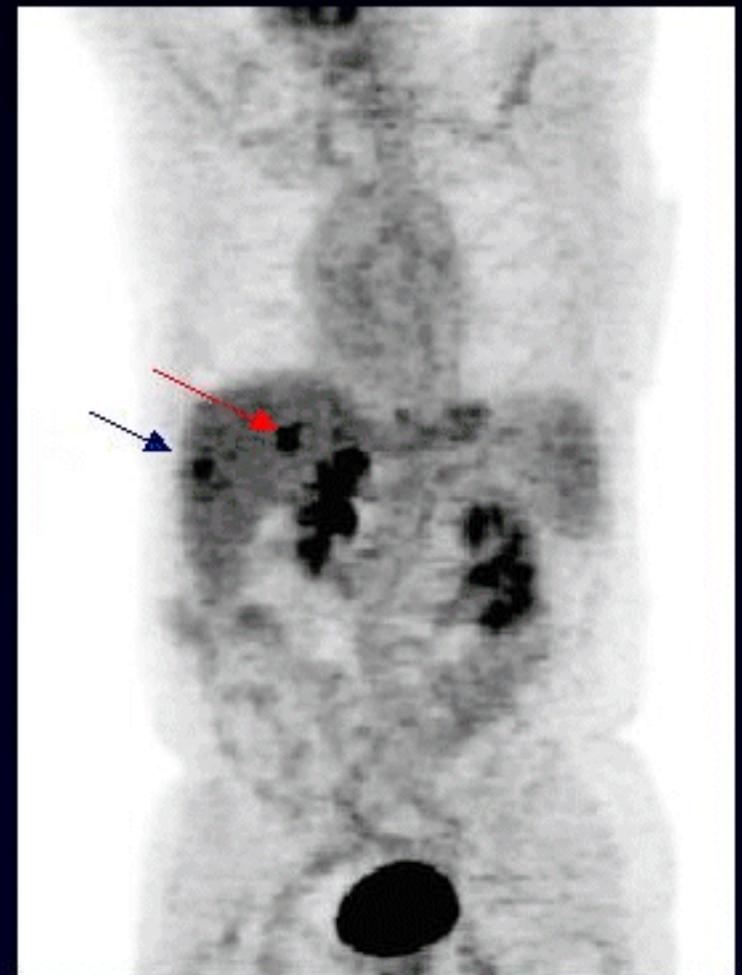
- PET can assist the health care provider in:
  - Determining tumor recurrence vs radiation necrosis/necrosis.
  - Identifying regions of reduced glucose metabolism; thereby, identifying epileptogenic tissue.

# Cases in PET

## ■ Recurrent Colorectal CA w/Rising CEA

Case: Colorectal CA w/Rising CEA and known liver metastasis. A whole body PET scan was performed to evaluate for wide spread metastasis and/or local recurrence. Sites of colorectal cancer recurrence undetected by anatomic CT or MRI are often evident on a PET scan.

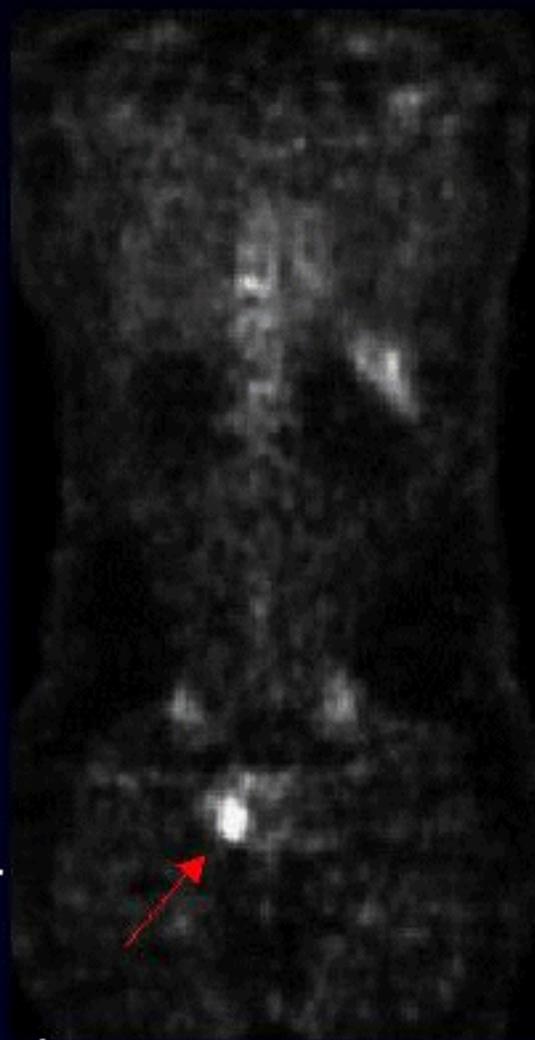
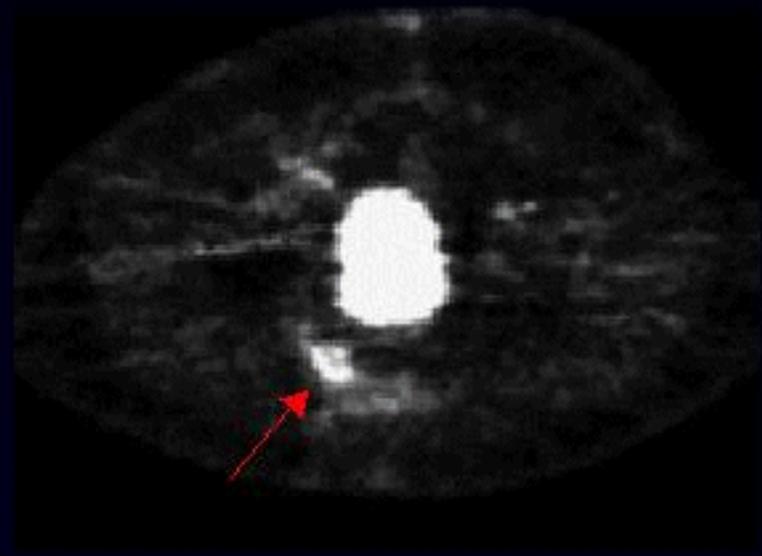
Case Outcome: No new sites of metastasis or local recurrence were identified. The two known liver metastasis (red and blue arrows) were clearly identified.



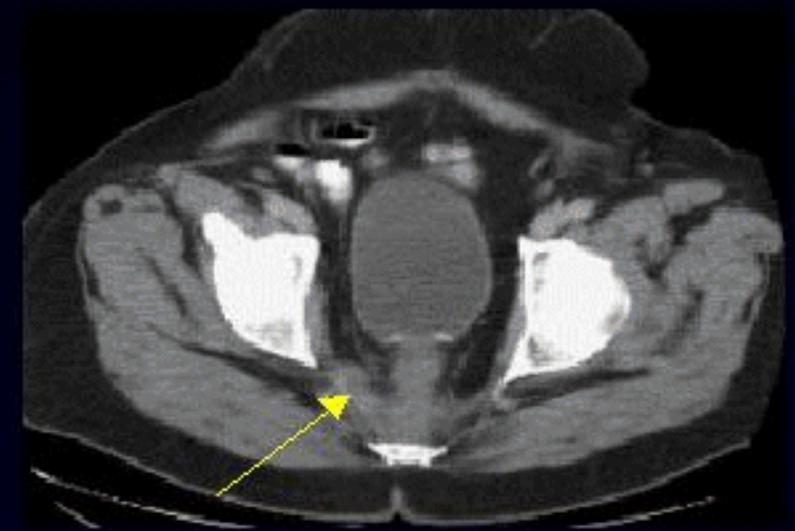
# Cases in PET

## Recurrent Colorectal CA w/Rising CEA

PET



CT



**Case:** 68 yo male with rectal primary adenocarcinoma. S/p resection 7/95 & chemotherapy & external beam pelvic radiation. NED per conventional CT/MRI. CEA rising. PET revealed metabolically active lesion (red arrows). Exploratory surgery was performed & no lesion detected.

**Case Outcome:** Patient was reevaluated At 3months with CEA continuing to rise. At that time CT revealed a mass in the same location as the previous PET study lesion (yellow arrow). A CT guided biopsy was performed & positive for adenocarcinoma. The patient was taken to surgery and the lesion was then resected

# Cases in PET

## Metastatic Melanoma

**Case:** 33yo male with metastatic melanoma.

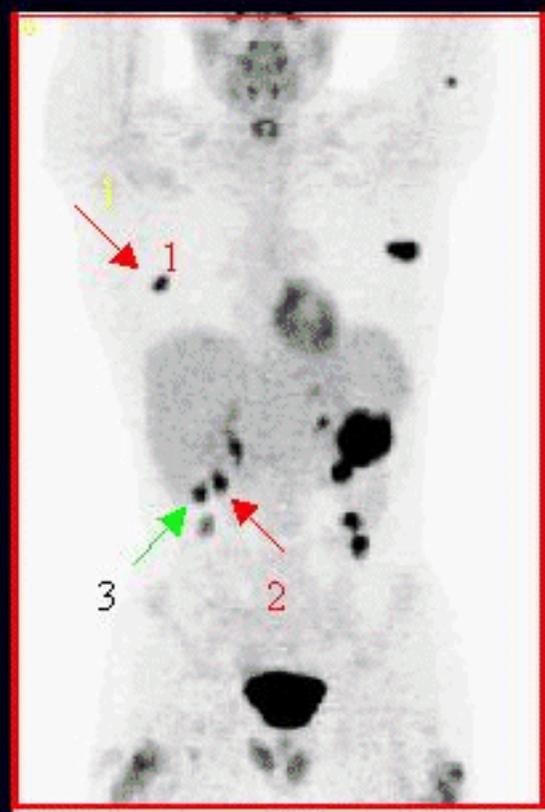
S/p complete response to IL2 therapy in the past. Presented with recurrent multiple lesions, 13 total. Conventional imaging revealed all lesion except two.

**Note:** the superficial lesions on both lateral thighs are secondary to injections sites during vaccine therapy.

Refer to the next slide.....

# Cases in PET

## Metastatic Melanoma



The two lesions not revealed on CT are noted here by the red arrows.

1. Rt. Mid posterior back (thought to be in soft tissue or possibly on a rib) at the time of the PET.

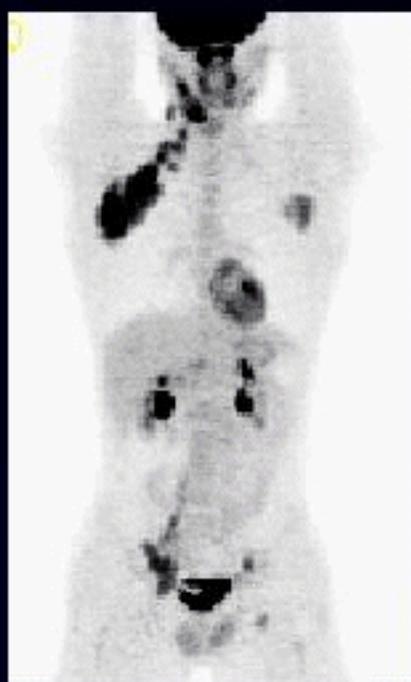
2. Anterior to the inferior tip of the liver.

**Case Outcome:** The patient underwent multiple resections of all 13 lesions. Surgery confirmed the two lesions identified on PET as positive melanoma lesions. (1) Was noted to be tucked under the rhomboid muscle. (2) Was in the ascending bowel with its posterior plane partner (3) (green arrow) in the gutter of the bowel.

# Cases in PET

## Non-Hodgkins Lymphoma

May, '99



**Case:** 19 yo male with non-hodgkins Lymphoma. Pre-therapy. Associated multiple sites of associated lymphadenopathy.

Sept. '99



**Case Outcome:** A PET was performed at the completion of his therapy and revealed a positive response.

**Note:** □ □ This patient demonstrates the effect of G-CSF on the bone marrow activity and Accumulation of FDG.

# PET Applied

## ■ Thyroid Cancer



**Case:** 43 yo male with metastatic papillary thyroid carcinoma with known multiple sites of pulmonary metastasis. Patient was admitted for a possible debulking of the multiple lung lesions, thought to be contributing to his Rt. shoulder pain. S/p complete thyroidectomy. Iodine 131 insensitive

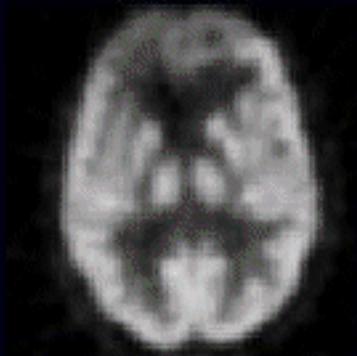
**Case Outcome:** A new Rt. glenohumoral lesion and Lt. Femur lesion were identified via PET. Patient underwent external beam radiation therapy.



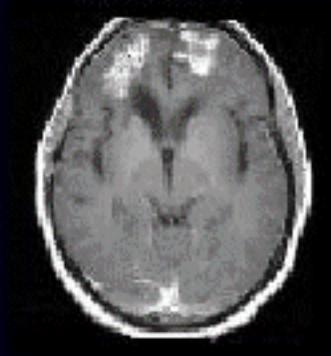
# PET Applied

## ■ Brain Tumor: Recurrence vs Radiation Necrosis

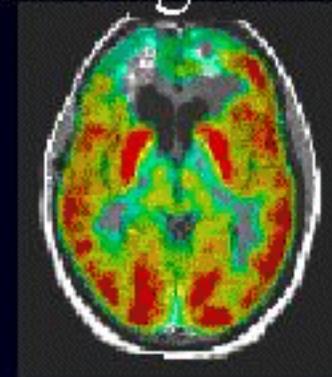
PET



MRI



Coregistered



**Case:** 27 yo female with initial diagnosis of anaplastic astrocytoma. S/p external beam radiation to frontal lobes 3 years ago. Recurrent seizures developed, after a seizure free period of 4 years.

**Case Outcome:** PET findings were consistent with radiation necrosis. Patient had anti-seizure medication increased and will be followed closely.