NEUROSPINAL & MEDICAL INSTITUTE

Under the Patronage of M. Hashim Memorial Trust

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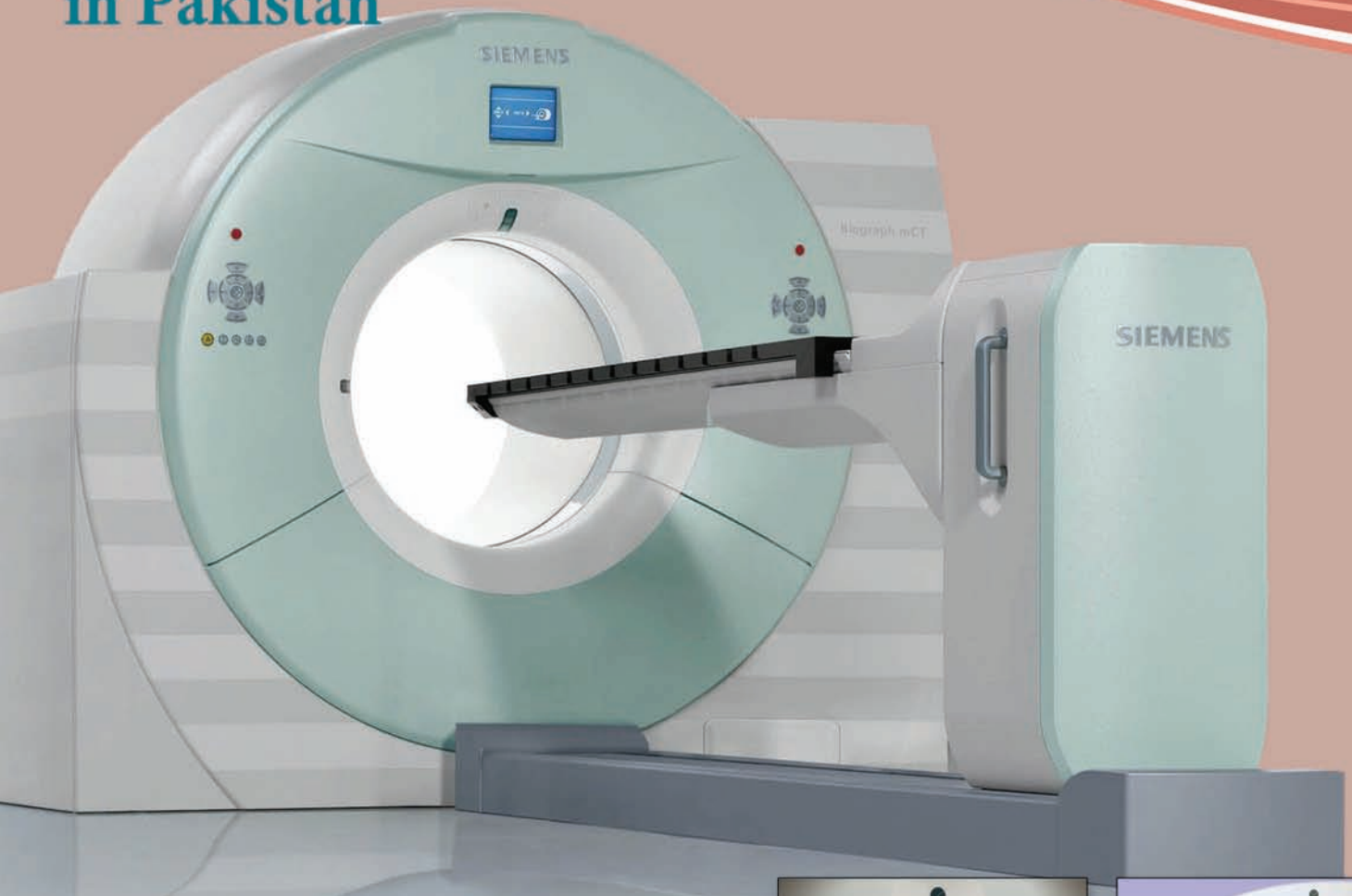
Gamma Knife & Stereotactic Radiosurgery Center

First 64 Slice
PET/CT Scan
in Pakistan



Center of Excellence
First PET/CT guided
Stereotactic Radio Surgery/Radiotherapy
Center of Pakistan

Imenant Faculty of Neuclear Medicine

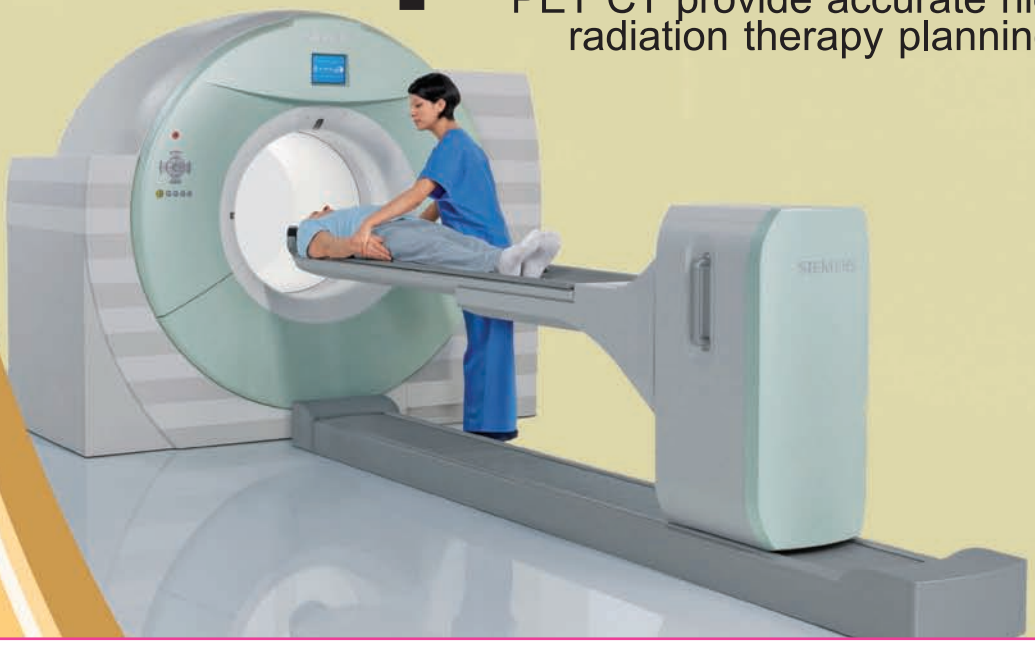
1. **Dr. Shahid Kamal**
   M.D. Ph.D (Specialist in Neuclear Medicine)
   Former Director KIRIN & JPMC (N,M).
   Director, Nuclear Medicine & Molecular Imaging
   Neurospinal & Medicine

2. **Dr. Asif Mateen**
   FRCR Oncological Radiologist 20 years experience in England. Chief Radiologist Neurospinal & Medical Institute.

3. **Dr. Sattar M. Hashim**
   M.D. Ph.d Chief Consultant Neurosurgeon &
   Managing Director Neurospinal & Medical Institute

We all welcome you to visit the facility
at any time, please feel free to ask any question
from any member of our team.

- State of art molecular Imaging.
- Characterise and monitor cancer lesians in sub m.m.s from head to toe, making cancer cure possible and effective at early stage.
- Best option for understanding of disease, its progression and response to treatment, Surgery, radiotherapy, chemotherapy.
- Complete screaning of cancer and other diseases.
- Smart auto cardiac registration, non-invasive quantitative assessment of cardiac blood flow and coronary flow reserve.
- Smart neuro account registration clear and quick assessment of hyper and hypo metabolic brain regions.
- Friendly for children, minimum dose and maximum speed.
- PET CT provide accurate high precision radiation therapy planning.

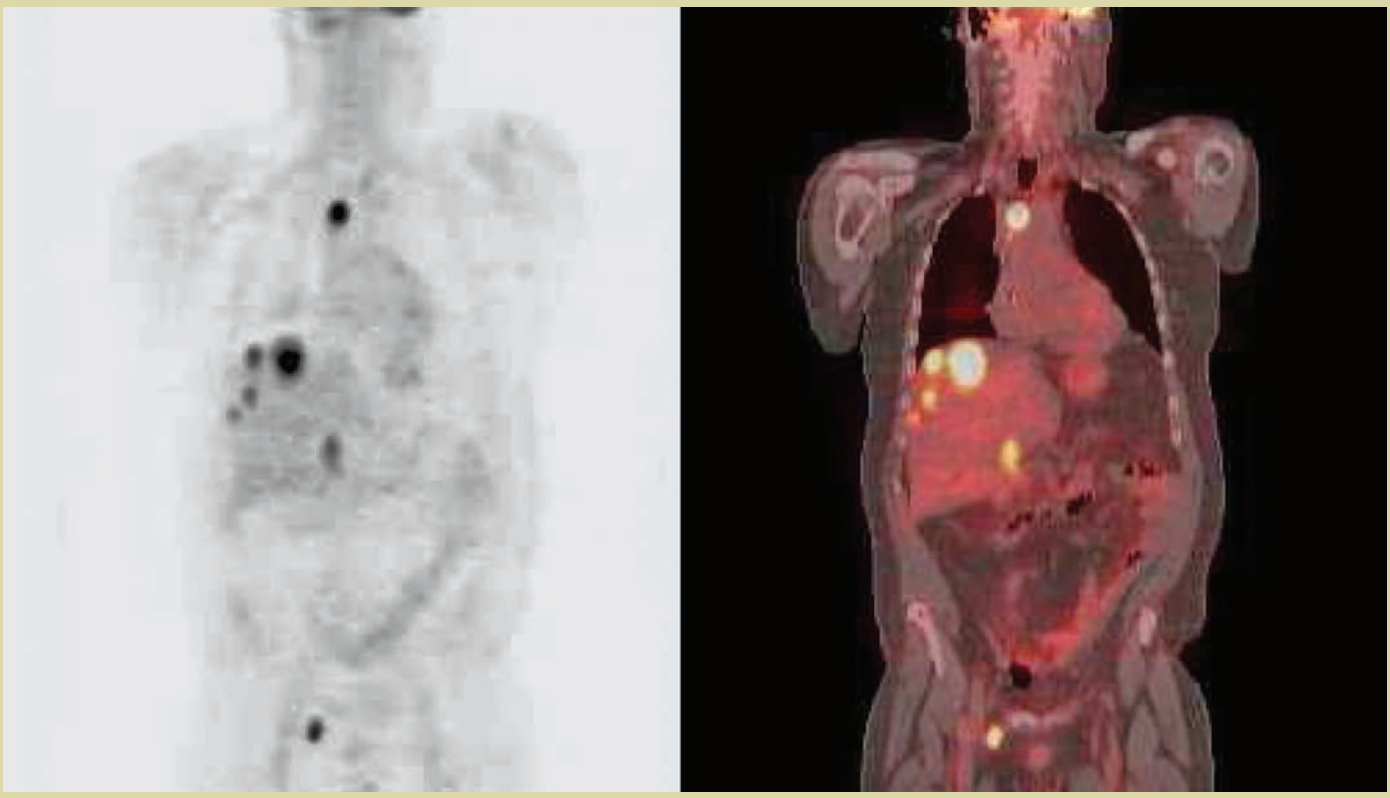


PET/CT Scan

INTRODUCTION

Neurospinal & Medical Institute (NMI), by the grace of God, has been serving the nation since its establishment in 1995. Our spirit of serving the nation with most advanced medical technology for diagnosis and therapeutics, has led us offering the best facilities for In and Out patient care, ICU, OT, X-ray, Ultrasound, EEG, EMG, laboratory, Multi-slice CT Scanner, Open MRI, 1.5 T high strength MRI and now a state of art PET-CT with Cyclotron for simultaneous radioisotope preparation under one roof to avid decay of radio isotope ,use of less isotope & less radiation to body.

General and specialized, neurosurgery like microsurgery, stereotactic surgery (biopsy & movement disorders), skull base neuroendoscopy, pediatric neurosurgery other disciplines of medicine, e.g., Neurology, orthopedics, general medicine and general surgery is practiced by eminent clinicians.



Abnormal PET-CT body Scan

PET/CT Scan

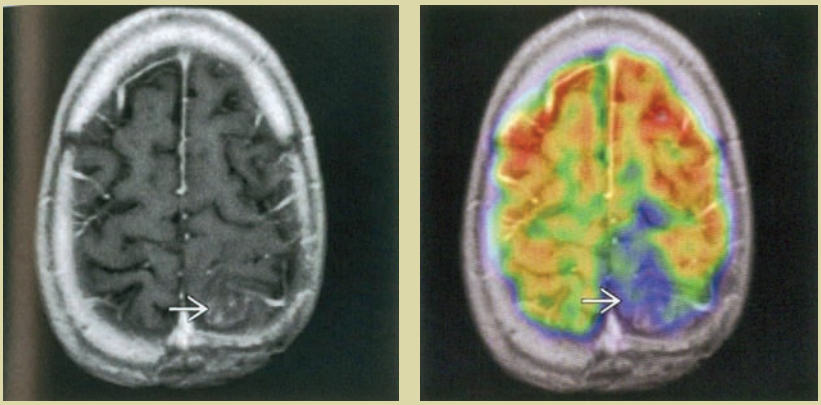
Positron Emission Tomography

PET/CT combines the strengths of two well-established imaging modalities, CT for anatomy and PET for function, into a single imaging device. By imaging with the two modalities in a single scan, disease can be both identified and localized, potentially resulting in an earlier diagnosis and more accurate staging.

scanners provide accurately aligned anatomical and functional images of a patient, allowing functional abnormalities to be localized and distinguished from normal uptake of the PET tracer, which increases physician confidence in arriving at a correct diagnosis.

Patient Management

- Fusing PET and CT images more accurately localizes metabolic activity to the appropriate anatomic structure or location, such as a lymph node, a bowel loop, or a vocal cord.
- For differentiation of tumor versus necrosis or scar tissue, knowing which part of a mass has viable tumor instead of necrosis or scar tissue assists in targeting the right areas to sample or remove.
    - o Example: Patient with suspected recurrent rectal carcinoma where there is typically scar tissue at the site of a previous AP resection. CT alone is often unable to determine if a tumor is present, and if present, CT may not distinguish the actual viable tumor focus from surrounding scar tissue. PET/CT can clearly show hypermetabolic tumor focus within an otherwise hypometabolic region of scar tissue, enabling a high-yield directed needle biopsy or open biopsy.



(Left) Axial T1 C+ MR shows minimal abnormal enhancement corresponding to a posterior left parietal lesion → in this patient with a newly diagnosed WHO grade II glioma. (Right) Axial fused PET/MR shows relative hypometabolism that corresponds to the posterior left parietal lesion → characteristic of a WHO grade II lesion

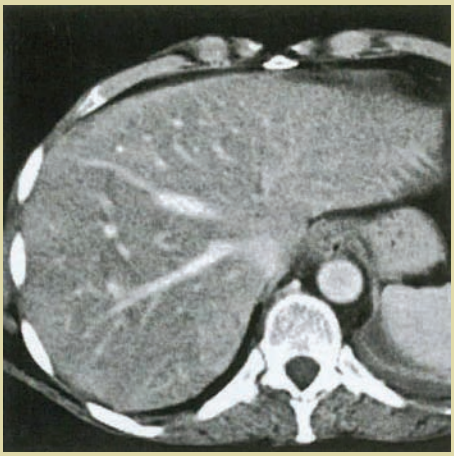
- Radiation oncologists need maximum information for radiation therapy planning, and PET/CT data files can be imported into many radiation therapy planning computers. For example, IMRT can deliver precise amounts of radiation to complex 3-D volumes, fully utilizing PET/CT datasets.
- IV contrast may or may not be used with PET/CT, depending on the studies being completed. PET/CT scanners have advanced imaging algorithms that allow for the use of IV contrast when needed.

Advantages of PET/CT

Cancer diagnosis - head to toe (whole body)

PET/CT provides physicians with superior information for determining tissue characterizations and classifications, staging of cancers, restaging of cancers, patient prognosis and monitoring the effectiveness of cancer therapies. Advantages include:

- Superior lesion localization from near-perfect anatomical/functional registration with fewer motion artifacts.
- Better distinction between physiological uptake and pathological uptake.
- Consolidation of patient's imaging studies.
- Shorter scan time (avg. 30 minutes to complete) by using CT for attenuation correction. This aids in patient comfort and minimizes claustrophobia problems.



Axial CECT (with well-timed portal venous phase) of a patient with a history of breast cancer and recent rise in CA 27-29 shows no evidence of hepatic lesions.

Axial fused PET/CT shows at least 6 FDG-avid bilodar hepatic metastatic lesions →. One of the major added benefits of PET/CT is detection of lesions not identifiable on CT, even with good contrst enhancement.

RT Planning

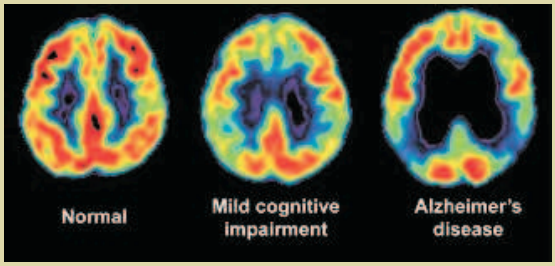
Radiation Therapy Treatment Planning is a promising area for PET/CT. The PET/CT, with a continuous 70cm patient bore, will accommodate many therapy treatment pallets. The image data set created by the PET/CT can be sent to nearly every treatment planning system on the market today. The Radiation Therapist can use the data set to define treatment contour maps without having to subject the patient to an additional CT scan.

Cardiology Applications

With the recent inclusion of PET studies for evaluating Myocardial Perfusion, and with the introduction of the 16 row, isotropic CT, we now have the potential to evaluate cardiac disease with increased information, and with exquisite detail.

Neurological Applications

In conjunction with PET imaging, CT shows great potential with its ability to quickly scan and demonstrate perfusion characteristics within specific areas of the brain. More research needs to be done in this area, but the potential usefulness of the fused PET scan and CT perfusion scan show great potential for early diagnosis and staging of these disease types.

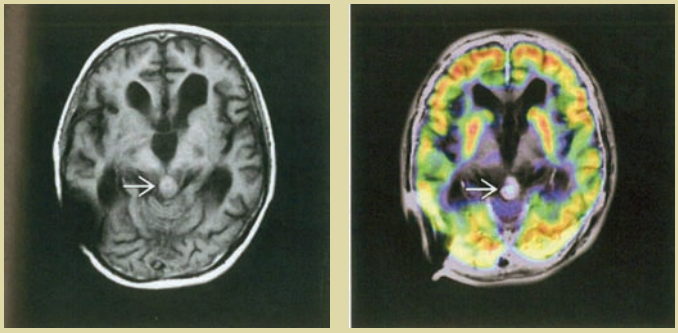


Oncology

In oncology, PET permits a physician to accurately image many organs of the body with a single scan in order to detect malignancy. PET has demonstrated usefulness in cost-effective whole-body metastatic surveys, avoiding biopsies. The benefits of PET include non-invasive differentiation of tumors from radiation necrosis, the possibility to change the course of ineffective chemotherapy and avoidance of unnecessary diagnostic and therapeutic procedures. Applications for PET in oncology include:

Brain Tumor

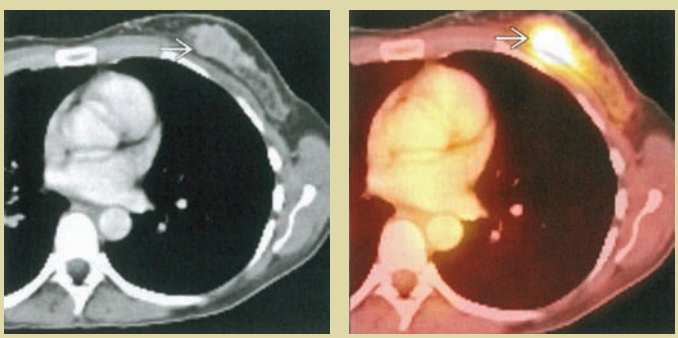
- Differentiate a recurrent tumor from radiation necrosis.
- Differentiate primary CNS lymphoma from toxoplasmosis.
- Exclude brain metastatic disease.



(Left) Axial T1WL MR shows a WHO grade I tectal lesion → that had been stable for several years and showed no increased metabolic activity on the original PET scan. A follow-up PET scan was ordered due to new worsening clinical symptoms. (Right) Axial fused PET/MR shows a new focus of moderately increased FDG activity correlating to the center of the tectal mass →, suggestive of high grade transformation of this previously low grade glioma.

Breast Cancer

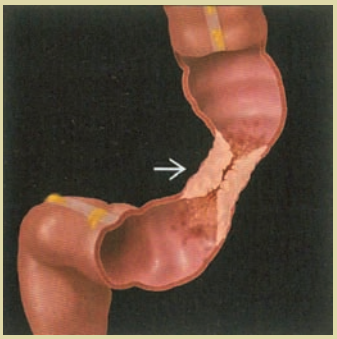
- Identify involved axillary nodes or distant metastatic disease.
- Exclude local recurrence of disease.
- Evaluate response to treatment.



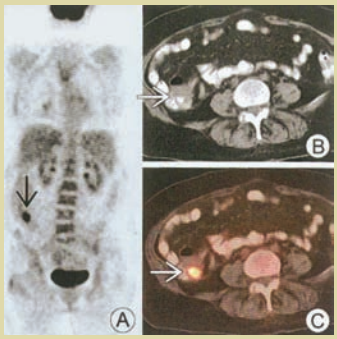
(Left) Axial CECT shows a heterogeneously enhancing mass in the left breast → that is compatible with breast cancer. (Right) Axial fused PET/CT shows focal intense FDG activity → that correlates with the enhancing mass in the left breast, compatible with primary breast carcinoma.

Colorectal Cancer

- Detect locally recurrent or distant metastatic disease in patients with elevated or rising CEA who may be candidates for surgical re-excision. PET/Scan also rule out distant metastases for preoperative evaluation.



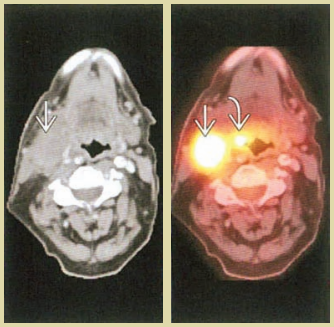
Graphic shows a circumferential mass in the sigmoid colon → that causes marked narrowing of the colonic lemen. This appearance is often termed “apple core” lesion on barium enema.



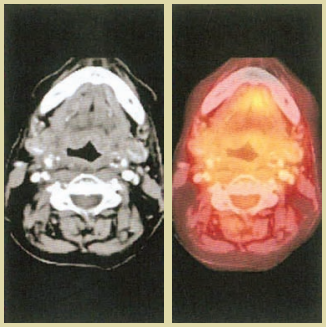
Coronal PET (A), axial CT (B) and fused PET/CT (C) show a focal area of intense FDG activity →, corresponding to primary colon carcinoma in the proximal ascending colon.

Head & Neck Cancer

- Determine extent of local, regional and distant disease.
- Detect recurrent/residual tumor following definitive therapy.



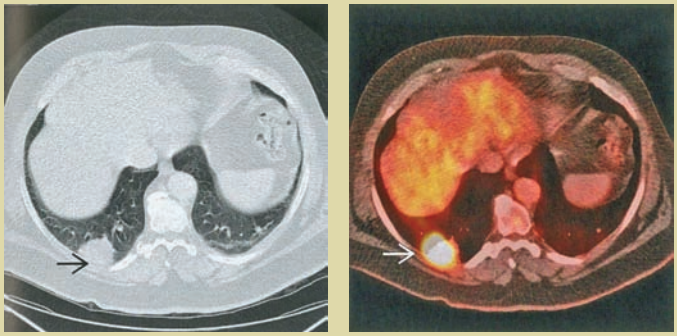
Axial CT (left) and fused PET/CT (right) show a right parapharyngeal space mass → and a mucosal lesion only identified on the fused PET/CT →.



Follow-up axial CT (left) and fused PET/CT (right) after surgery demonstrate no residual or recurrent tumor.

Lung Cancer

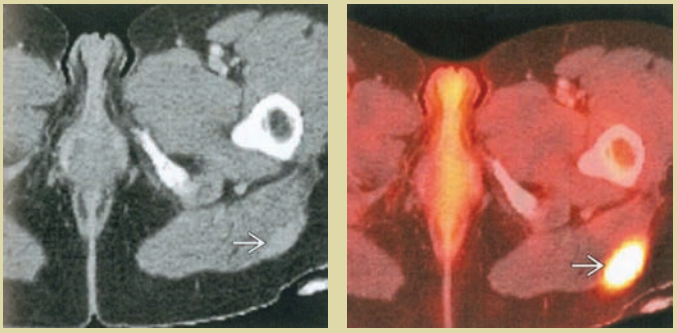
- Distinguish malignant pulmonary nodules from benign ones.
- Stage mediastinal or distant metastatic disease.
- Use as part of radiotherapy treatment planning.
- Detect recurrent/residual tumor following definitive therapy.



(Left) Axial CECT shows a peripherally based right lower lobe nodule →. (Right) Axial fused PET/CT shows the same lesion with intense FDG uptake →, compatible with a primary lung cancer.

Musculoskeletal Tumors

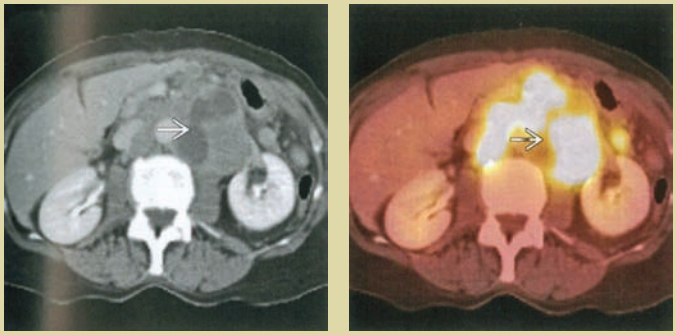
Evaluate local extent of disease and exclude distant metastases.
Measure treatment response and exclude recurrent/residual tumor following definitive therapy.



(Left) Axial CECT shows no obvious metastatic lesions, although there is questionable abnormal enhancement of the left gluteal muscle → that was not called prospectively on CT. (Right) Axial fused PET/CT shows focal intense FDG activity correlating with the lesion in the left gluteal muscle →, compatible with metastatic disese.

Lymphoma

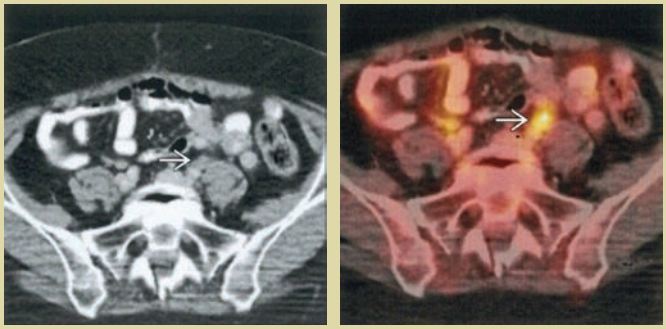
Determine extent of disease and measure treatment response.



(Left) Axial CECT shows confluent mesenteric and retroperitoneal soft tissue involvement → in this patient recently diagnosed with diffuse large B-cell lymphoma. (Right) Axial fused PET/CT shows intense increased FDG activity throughout the confluent adenopathy →. CT (not shown) revealed no definite evidence for disease above the diaphragm.

Ovarian Cancer

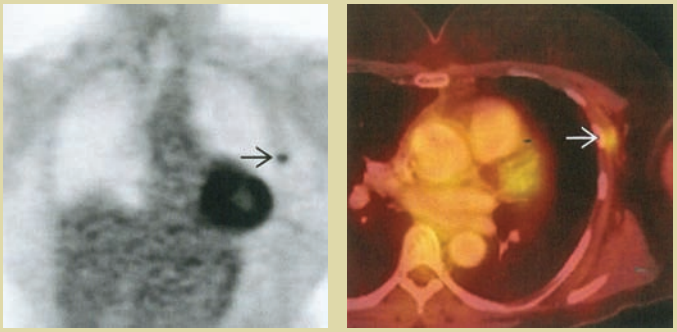
Detect recurrent/residual tumor prior to surgical exploration or additional chemotherapy.



(Left) Axial CECT shows a normal-sized left common iliac lymph node →, not identified prospectively on CT. (Right) Axial fused PET/CT shows focal intense FDG activity correlating with a small lymph node →, compatible with recurrent malignancy.

Melanoma

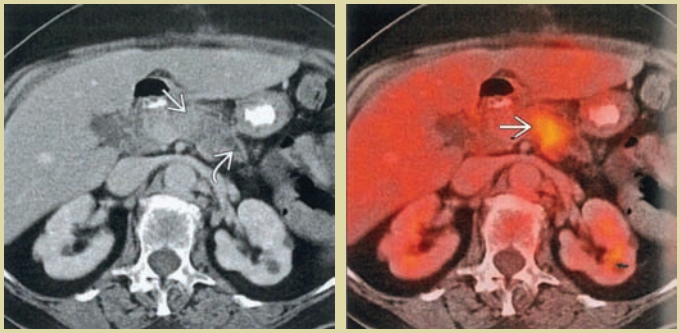
Identify extent of local and regional disease spread in patients with high risk melanoma (e.g., primary tumor less than 4mm) or in suspected recurrence.



(Left) Coronal PET shows focal uptake in the rib → , corresponding to a metastasis in this patient with known melanoma. (Right) Axial fused PET/CT shows that the same lesion demonstrates increased FDG uptake →.

Pancreatic Cancer

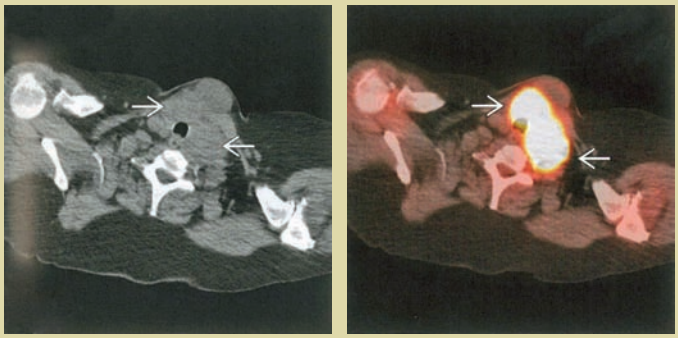
Differentiation of benign processes such as pancreatitis, mucinous cyst adenoma and pseudocyst from malignant disease.
Rule out distant metastases during preoperative evaluation.



(Left) Axial CECT shows a slightly hypodense lesion in the pancreatic body → with distal ductal dilation and atrophy →. (Right) Axial fused PET/CT of the same patient demonstrates increased metabolic activity →, consistent with pancreatic adenocarcinoma.

Thyroid Cancer

Detect metastatic or locally recurrent disease in patient with elevated thyroglobulin after definitive initial treatment and negative I-131 examination.



(Left) Axial NECT shows an enlarged thyroid anterior to the trachea →. (Right) Axial Fused PET/CT shows that the enlarged thyroid has intense, diffuse FDG uptake →. Subsequent bipsy revealed anaplastic thyroid carcinoma.

Neurology

In neurology, PET/Scan provides information for assessing various neurological diseases such as brain tumor, Alzheimer's disease and other dementias, Parkinson's disease, and Huntington's disease. Additionally, it localizes epileptic foci for qualifying and identifying the site requiring surgical intervention. It also allows the characterization, grading and assessment of possible brain tumor recurrence (see previous section).

Dementia

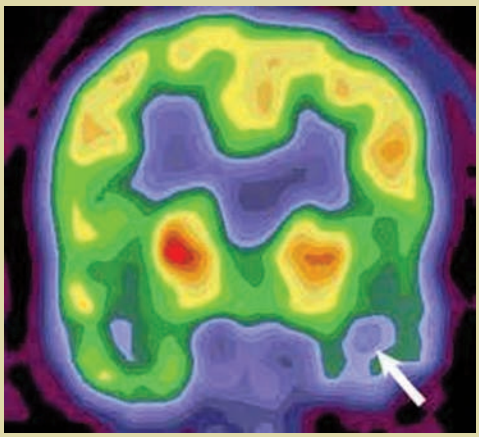
Differentiate Alzheimer's disease from multi-infarct dementia.

Epilepsy

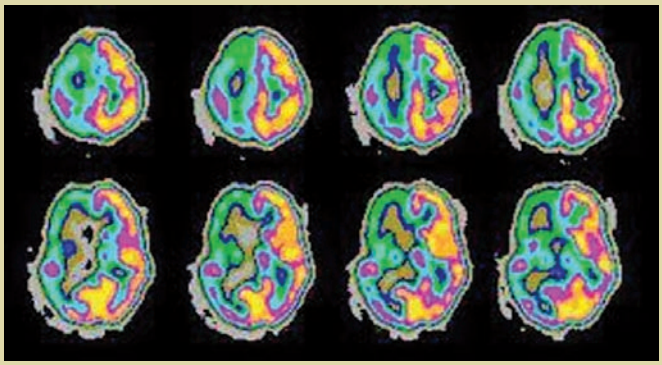
Localize the seizure focus in patients with intractable complex seizure disorders.

Stroke

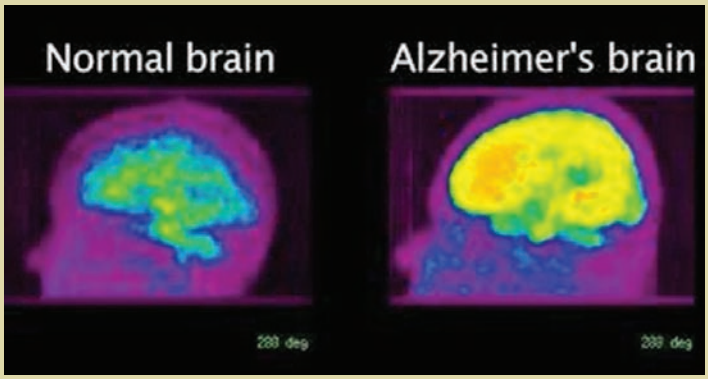
Evaluate extent of disease and recovery following therapy.



epileptic foci



Stroke



Cardiology

In cardiology, PET/Scan enables physicians to screen for coronary artery disease, to assess flow rates and flow reserve and to distinguish viable from nonviable myocardium for bypass and transplant candidates.

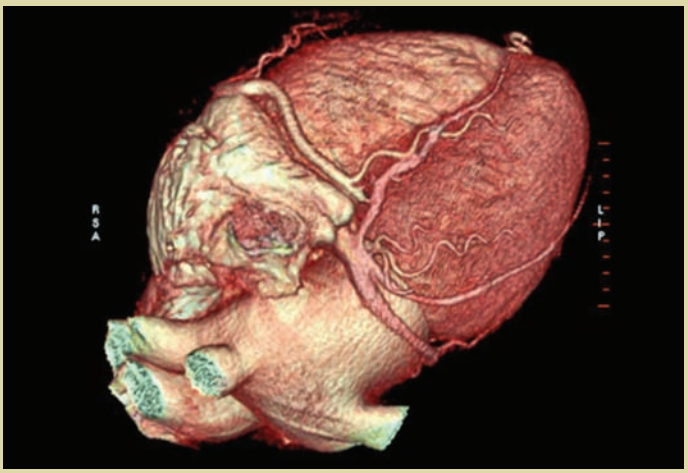
Myocardial Viability distinguish viable myocardium from infarcted tissue in patients with suspected hibernating or stunned myocardium.

Coronary Artery Disease

Identify ischemic disease.

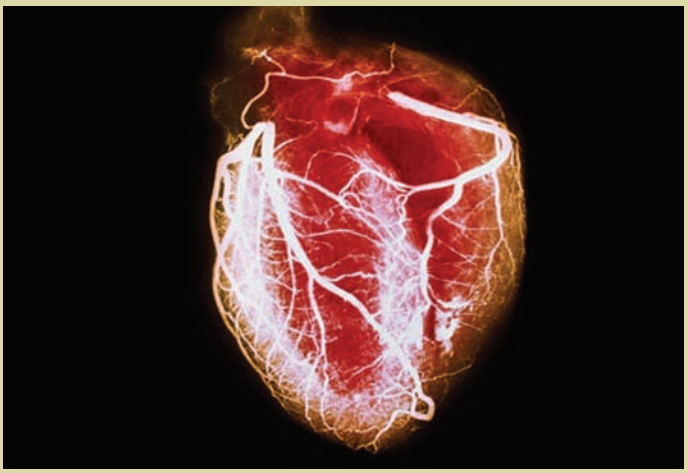
Preoperative Prognostic Assessment

Evaluate extent of disease in patients being considered for interventional revascularization or transplantation procedures.



Pyrexia of unknown origin (PUO)

Useful for identifying disease foci and excluding malignancy in highly selected patients where conventional imaging is negative or equivocal.

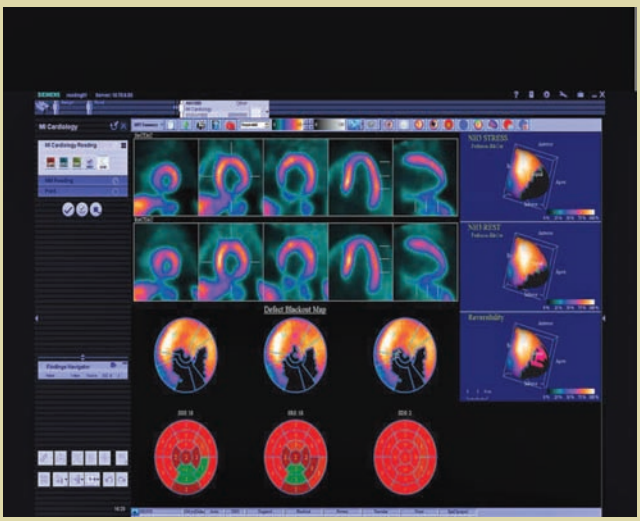


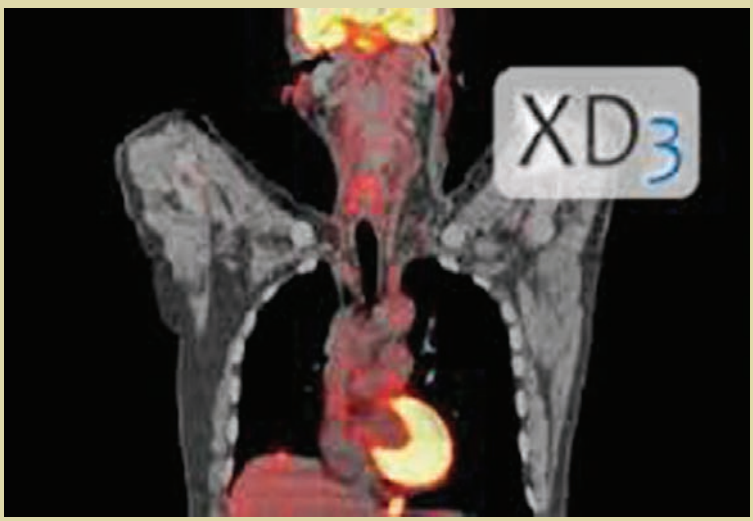
Paraneoplastic

Indicated in selected patients with non-metastatic manifestations of syndrome neoplastic disease e.g. neurological signs or raise antibodies to exclude or confirm an occult primary tumor when conventional imaging is negative or equivocal.

Vasculitis

Useful in the assessment of patterns of vasculitis and disease response. May have value in the assessment of aortic aneurysm follow up post stenting/surgical intervention, if graft infection is suspected.



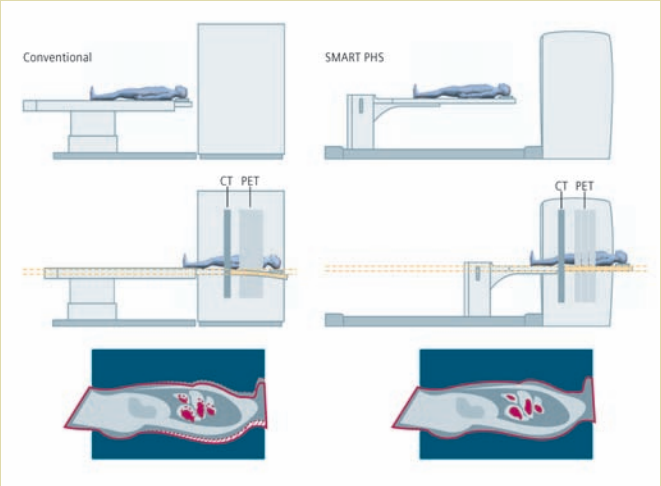


How does PETCT work?

During a PET scan, the patient is first injected with a radiopharmaceutical compound, usually FDG, a radioactive glucose compound. The compound distributes throughout the body and accumulates in various organs depending on the metabolic activity within the organ or tissue. Because cancer cells usually have a higher metabolic rate than surrounding cells, they absorb more of the tracer and will show up more prominently on the image. The PET CT scanner detects the FDG accumulated in glucose-avid organs or tissues and creates images that are displayed as colour-coded images.

PET CT and Cancer

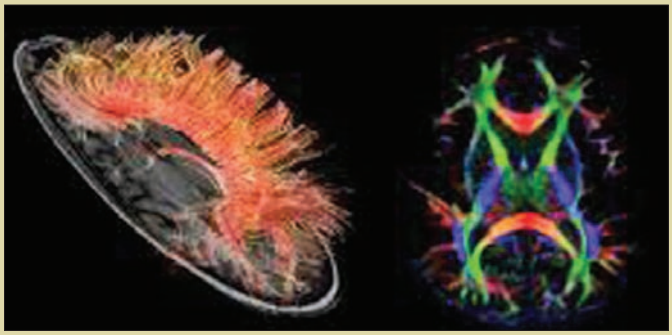
a. Diagnose cancer, from head to toe.
b. Staging of cancer: PET is extremely sensitive in detemining the full extent of disease, especially in cancers. Confirmation of metastatic disease allow the physician and patient to more accurately decide on how to proceed with the patients's management.
c. Cheking for recurrences: PET/CT is currently considered to be the most accurate diagnostic procedure to differentiate tumor recurrences from radiation necrosis or post-surgical changes. Such an approach allows for the development of a more rational treatment plan for the patient.
d. Assessing the Effectiveness of radiotherapy, Chemotherapy: The level of tumor metabolism is compared on PPET scans befor and after chemotherapy radiotherapy cycle. A successful response seen on PET scan frequently precedes alterations in anatomy and is considered to be an earlier indicator of tumor shrinkage than might be seen with other diagnostic modalities.



d. Provide key diagnostic information for Alzheimer's disease in select patients.
e. Differentiate among dementia disorder, including Alzheimer's disease, Parkinson't disese, and epileptic seizure disorders
f. Stroke

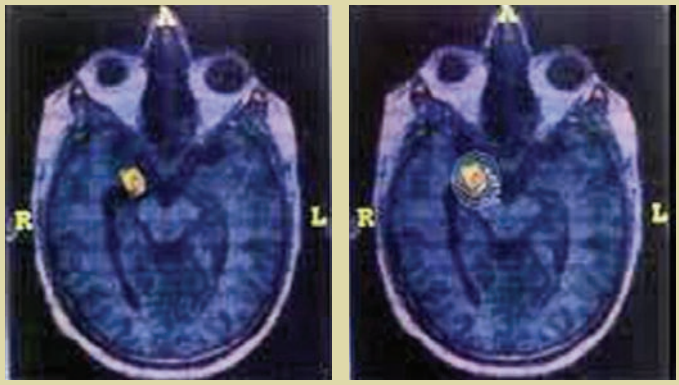
PET CT and Neurology

a. Diagnosis of Brain Tumors
b. PET/CT can reveal abnormal functional and structural patterns in the brain, helping to assess patients with various disorders, including epilepsy and dementia
c. Localize areas of the brain causing epileptic seizures – determine whether surgery is an option.



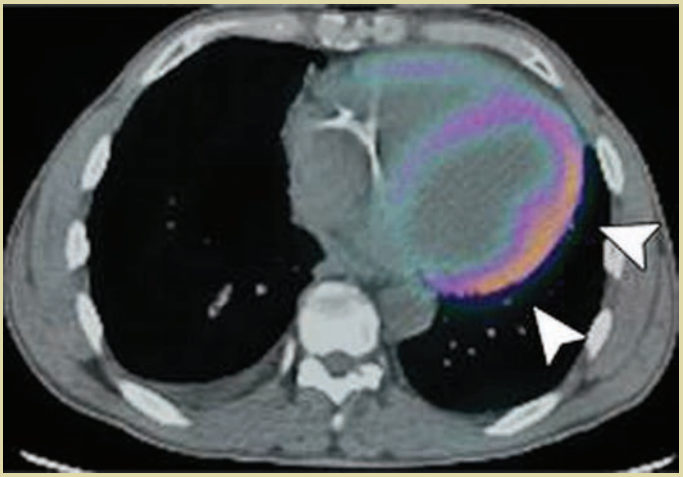
PET CT and Cardiology

PET CT provides unparalleled insight into myocardial viability. This often helps to determine the optimal treatment path – identifying whether a patient is a candidate for coronary angioplasty, coronary artery bypass graft (CABG) surgery, or heart transplantation. At our centre we have the unique capability of fusing PET/CT images with CT coronary angiography for the first time in south asia.



PET CT and infection

There is growing body of evidence that PET CT is very valuable in diagnosis of infection and for follow-up to determine eradiction of disease. It can be very useful in patients with fever of unknown origin (PUO). PET CT may provide objective evidence of when to stop treatment in selected patients with tubercular infections. It may also be useful in determining infection in joint implants.



Exam Preparation

There is very little preparation needed for a PET CT exam. Typically you will be asked not to eat 6-8 hours prior to the exam but you should drink a lot of water before the scan. If you are taking medication please consult with your physician before the exam. Most medications can be taken on the day of the exam. Please avoid alcohol and strenuous exercise 24 hours before your appointment. If you are diabetic it is important that your blood sugar be in control. If your blood sugar is high on the day of the scan the doctors at the PET CT centre may have to correct it by injecting a short-acting insulin. Alternatively your scan may be deferred till such time that your sugar comes under control. Please do not wear any jewellery. Please bring any related test reports including CT or MRI films. PET CT Scans are not done on pregnant patients. So please consult with your doctor if you think you are pregnant. Plan to spend about 3 hours at the PET CT centre.

The Exam

Prior to the exam you will receive a small injection of radioactive sugar (FDG). You will be asked to sit or lie down on a comfortable chair or bed for 30-60 minutes while the FDG travels throughout your body. It is important that you do not talk, read, walk around or chew gum during this period. In some cases you may be asked to drink medicine (oral contrast). This will be at regular intervals before the actual scan is performed. After this short time, the technologist will assist you to the scanner. An intravenous non-ionic iodinated contrast may be injected for the ct scan if required. It is important that you don't move for the duration of the scan. The length of the exam is determined by your height and area of interest. Most PET CT scans at our centre are typically completed within 20-30 minutes.

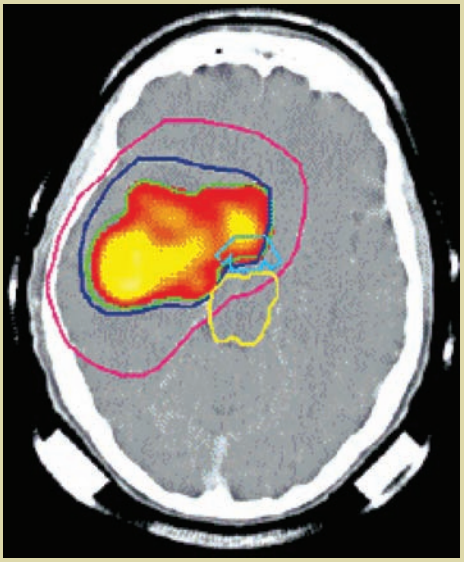
After the Exam

Once the scan has been performed you may resume normal daily activity. Even though the FDG and contrast will quickly leave your body, you can expedited the process by drinking plenty of water after your scan is complete. Your PET CT result will not be immediately available. You can collect your scan report the next day.

Important

Since the radioactive glucose prepared for you is expensive and has a very short life it is imperative that you keep your appointment on time. In case you need to cancel your appointment please inform us at least 24 hours ahead.

PET-CT Guided Radiation Planning

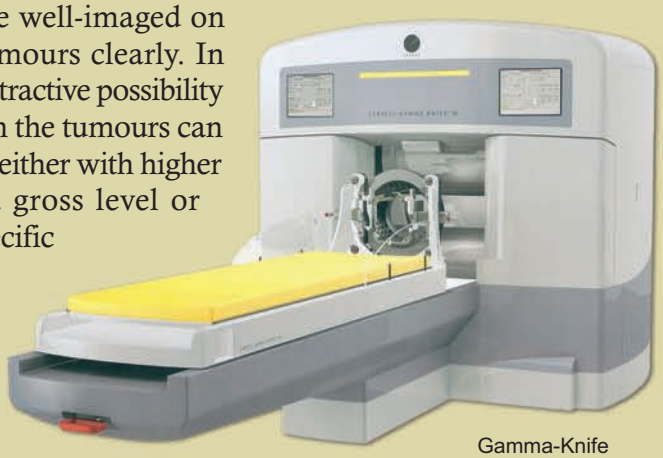


Accurate imaging is central to the treatment planning process for most malignancies managed with curative intent using radiation therapy. Positron emission tomography (PET) scanning has brought about a revolution in the imaging of many common cancers and, as it becomes widely available in developed countries, is increasingly being incorporated into routine radiation therapy planning. PET scanning, usually employing Fluorine-18-fluorodeoxyglucose (18F-FDG) as the radiopharmaceutical, in combination with structural imaging, such as X ray computed tomography (CT) scanning, currently provides the most accurate available information on tumours extent and distribution for many common cancers,including lymphomas and epithelial malignancies of the lung, esophagus, cervix and head and neck. As PET becomes more widely used for radiation therapy planning, it is important that it is introduced rationally and used appropriately for malignancies in which it provides significant incremental information aside from that obtained from structural imaging. Functional imaging with PET can provide information that can influence RT planning in a number of ways. Some of the most important include the following:

- PET can reveal targets that are not well visualized by CT/magnetic resonance (MR) structural imaging. These targets may be remote from the primary tumours, such as unsuspected lymph node or distant metastases, or they may be additional neoplastic regions adjacent to the tumours volume defined by CT/MR imaging.
- PET makes it less likely that treatment will be given to 'equivocal' regions on CT/MR which do not actually contain tumours. These regions may also be remote, such as benign reactive lymphadenopathy, or adjacent to the tumour volume defined by CT/MRI, such as atelectatic regions of lung.
- The imaging of biologic inhomogeneities within sub volumes of the tumour may offer the possibility to adapt doses to local differences in radiosensitivity (known as dose painting, not yet been shown to be of value in any tumour site).
- PET can be useful for the evaluation of residual masses after chemotherapy in conditions like lymphoma, helping to determine which regions, if any, require radiation therapy and helping to choose between a lower dose for presumed microscopic residual disease or a higher dose for gross residual disease.

Feasibility studies have found that the use of 18F-FDG-PET/CT for planning three dimensional conformal radiation therapy improves the standardization of volume delineation compared with CT alone for a number of cancers that are well-imaged on PET. It is simply easier for physicians to visualize the tumours clearly. In addition, there is the attractive possibility that sub-regions within the tumours can be targeted selectively, either with higher radiation doses on a gross level or more feasibly with specific pharmaceutical agents at a molecular level.

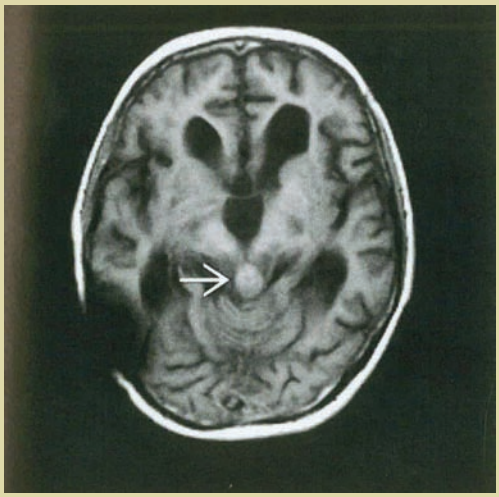
x-knife

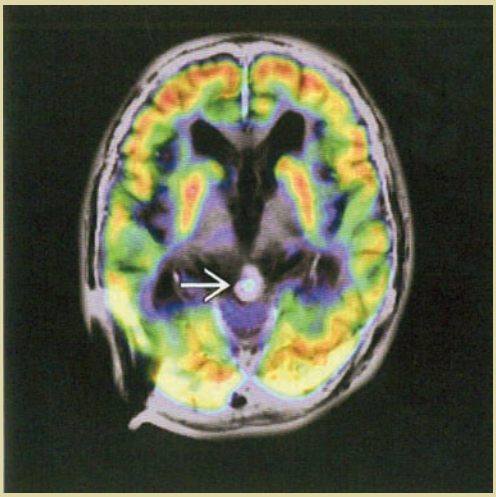


Gamma-Knife

Further Applications of PET

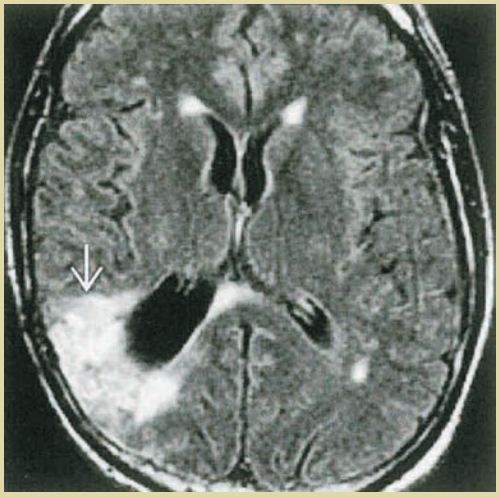
PRIMARY BRAIN NEOPLASMS

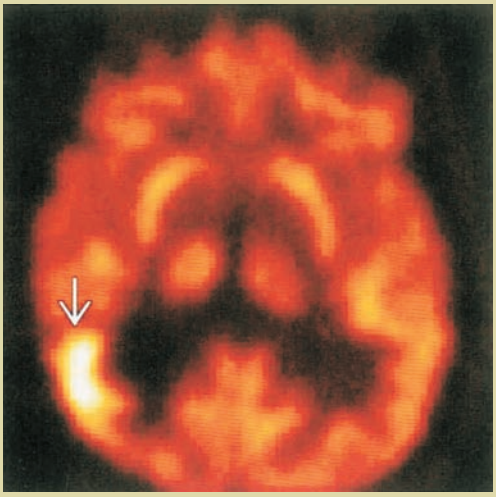




(Left) Axial T1WL MR shows a WHO grade I tectal lesion → that had been stable for several years and showed no increased metabolic activity on the original PET scan. A follow-up PET scan was ordered due to new worsening clinical symptoms. (Right) Axial fused PET/MR shows a new focus of moderately increased FDG activity correlating to the center of the tectal mass →, suggestive of high grade transformation of this previously low grade glioma.

PRIMARY BRAIN NEOPLASMS

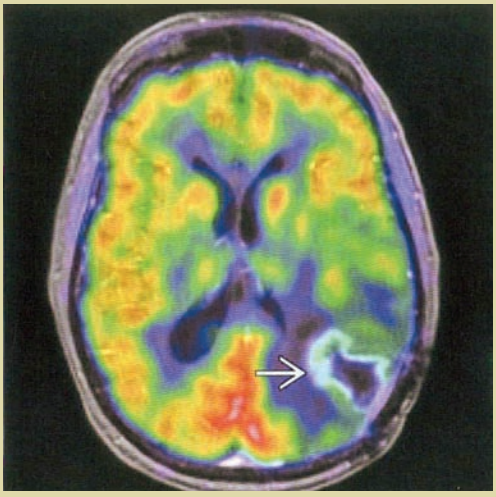




Axil FLAIR MR shows abnormal signal → in a patient with a glioblastoma multiforema treated with gamma knife. Differential is radiation necrosis vs. recurrent tumor.

Axil PET shows correlative intense FDG activity → compatible with residual/recurrent tumor rather than radiation necrosis.

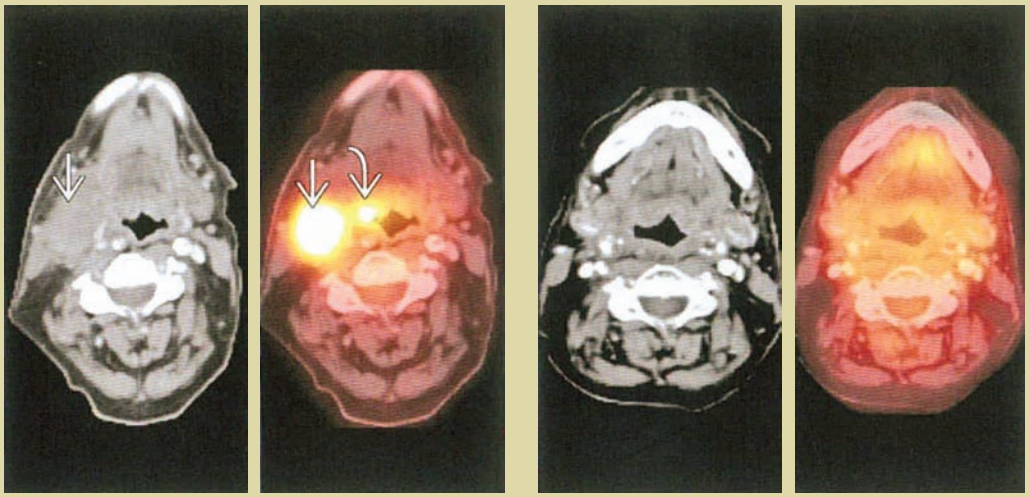
PRIMARY BRAIN NEOPLASMS



(Left) Axial T1 C+ MR in this patient with a history of prior glioblastoma status post resection and radiation shows extensive rim enhancement →, worrisome for possible recurrent tumor. (Right) Axial fused fused PET/MR shows no increased metabolic activity in the area of abnormal enhancement →, compatible with radiation with radiation necrosis. Both radiation necrosis and residual/recurrent tumor may have abnormal enhancement on MR, and PET can often to be used to distinguish between the two diagnoses.

Further Applications of PET

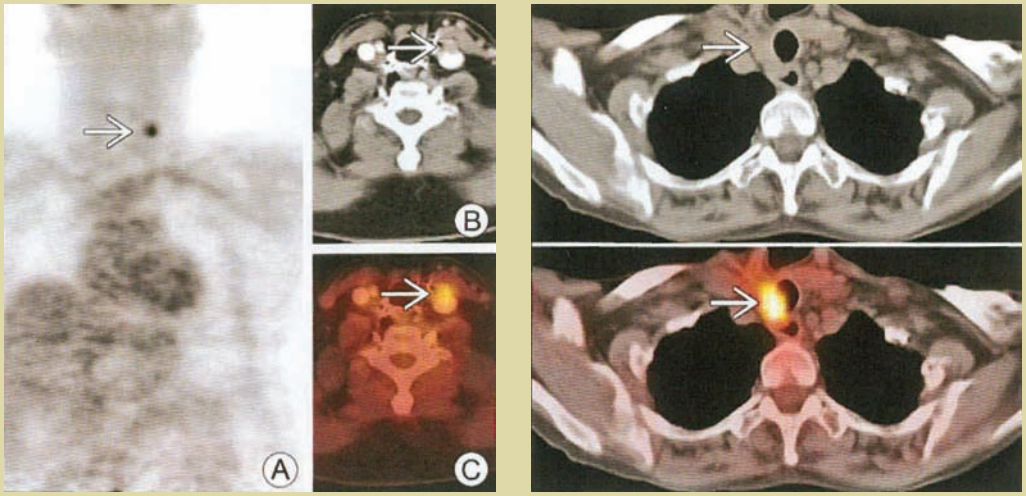
HEAD AND NECK CANCER, SQUAMOUS



Axial CT (left) and fused PET/CT (right) show a right parapharyngeal space mass → and a mucosal lesion only identified on the fused PET/CT →.

Follow-up axial CT (left) and fused PET/CT (right) after surgery demonstrate no residual or recurrent tumor.

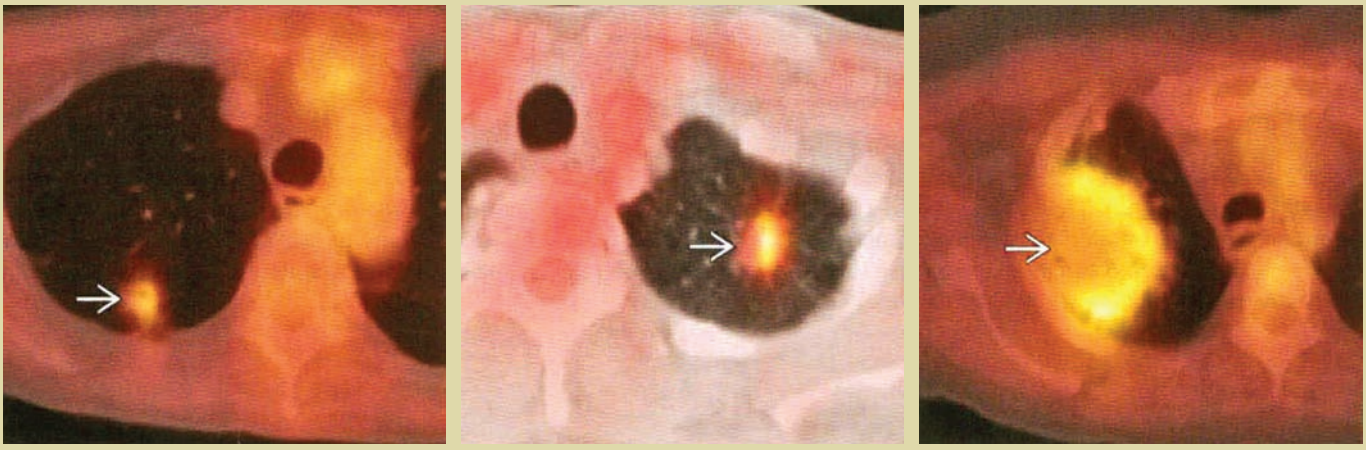
THYROID CANCER



Coronal PET (A), axial CT (B) and fused PET/CT (C) show a subtle recurrent thyroid carcinoma → in a patient with rising thyroglobulin levels and a negative iodine study.

Axial CT (top) and fused PET/CT (bottom) show focal thyroid cancer recurrence in the thyroidectomy bed →.

SOLITARY PULMONARY NODULES



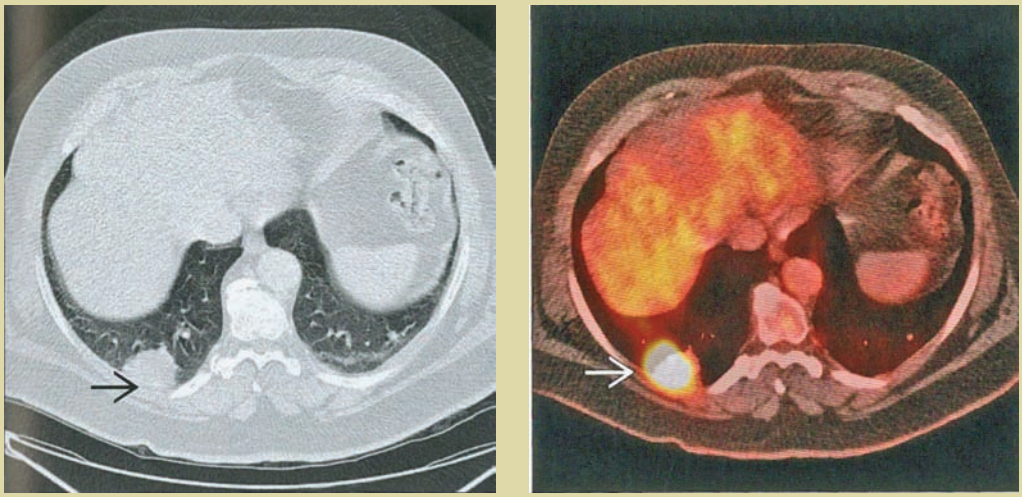
Infection: Tuberculosis

Malignancy: Metastasis

Inflammation: Pseudotumor

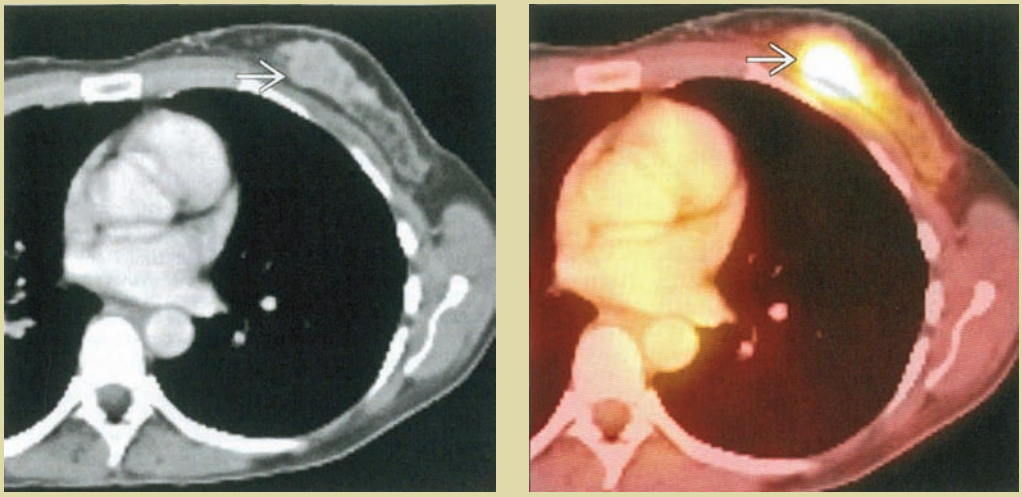
Further Applications of PET

LUNG CANCER



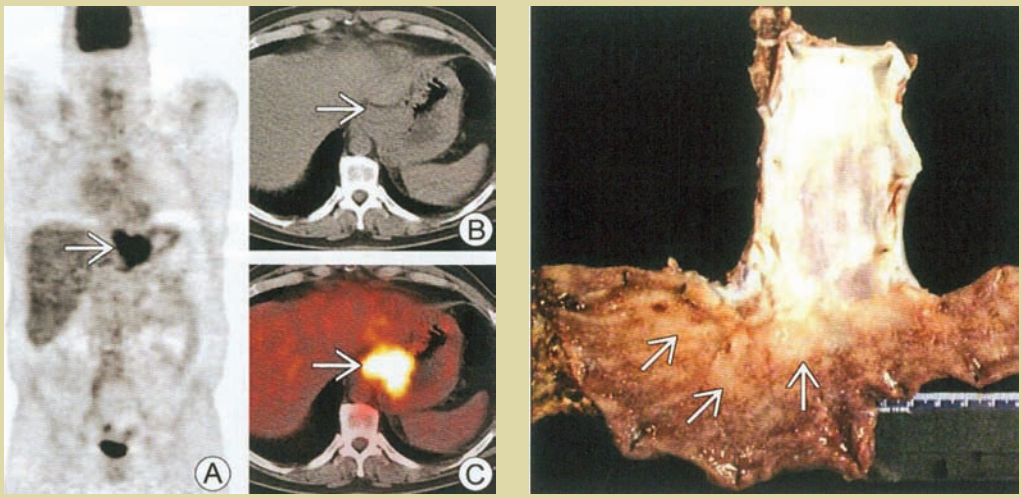
(Left) Axial CECT shows a peripherally based right lower lobe nodule →. (Right) Axial fused PET/CT shows the same lesion with intense FDG uptake →, compatible with a primary lung cancer.

BREAST CANCER



(Left) Axial CECT shows a heterogeneously enhancing mass in the left breast → that is compatible with breast cancer. (Right) Axial fused PET/CT shows focal intense FDG, activity → that correlates with the enhancing mass in the left breast, compatible with primary breast carcinoma.

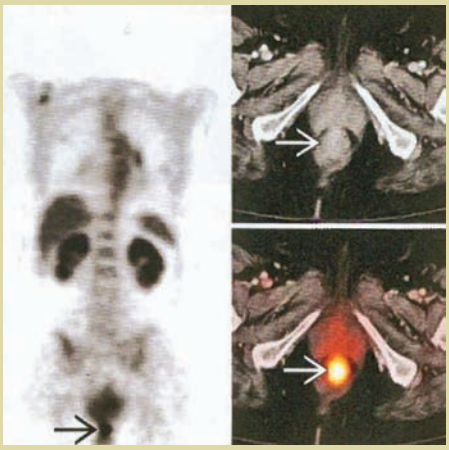
ESOPHAGEAL CANCER



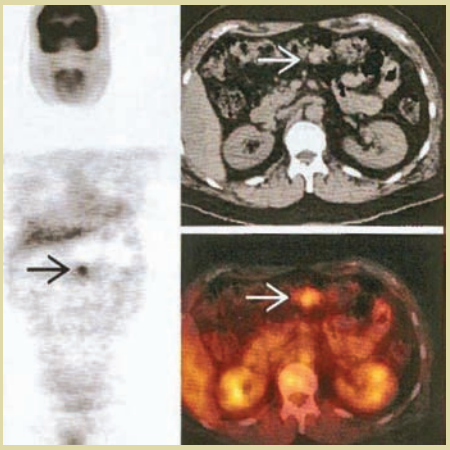
(Left) Coronal PET (A), axial CT (B) and fused PET/CT (C) images demonstrate intense FDG activity along the gastroesophageal junction → in this patient with newly diagnosed esophageal carcinoma. (Right) Specimen shows an infiltrative and nodular lesion at the gastroesophageal junction →, representing the patient's primary esophageal carcinoma.

Further Applications of PET

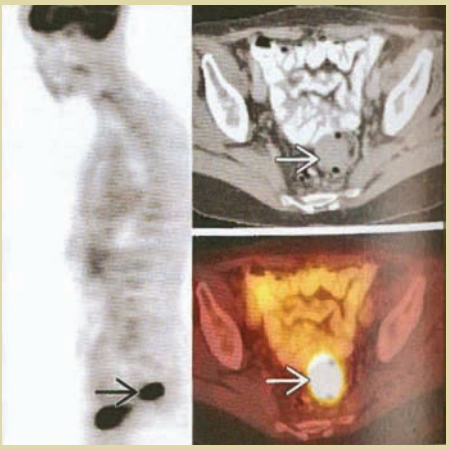
COLORECTAL CANCER



Physiologic Anorectal Junction



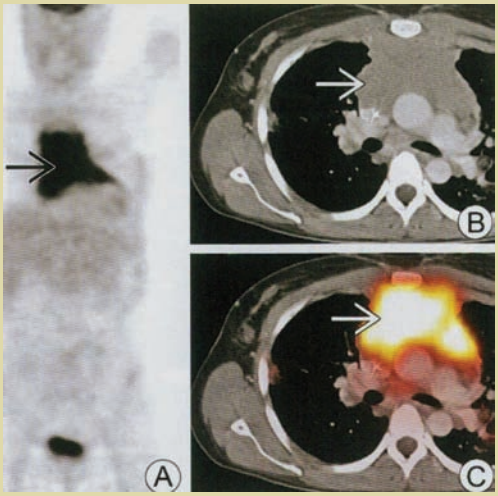
Polyp

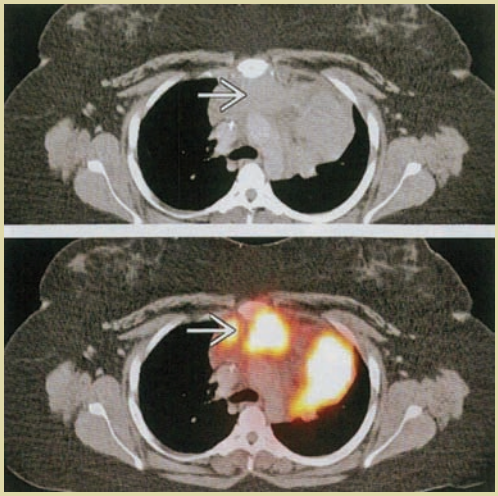


Villous Adenoma

HODGKIN LYMPHOMA

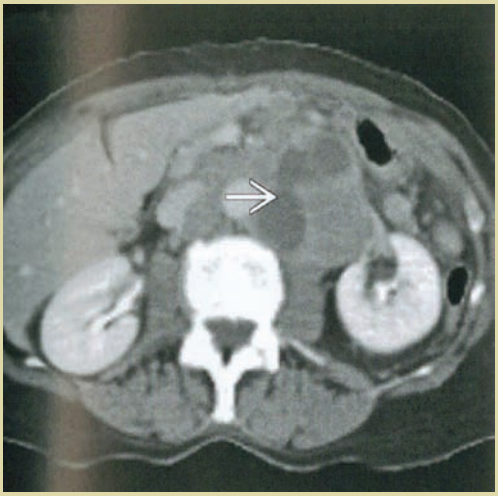
(Left) PET/CT study demonstrates intense FDG activity → on the coronal PET (A) corresponding to a large anterior mediastinal mass → on axial CT (B) and fused PET/CT (C). (Right) Axial CT (top) and fused PET/CT (bottom) demonstrate a large anterior mediastinal mass with intense FDG activity →, compatible with the patient's history of recently diagnosed Hodgkin lymphoma. The majority of odgkin lymphomas are FDG avid, and this is a typical representation.

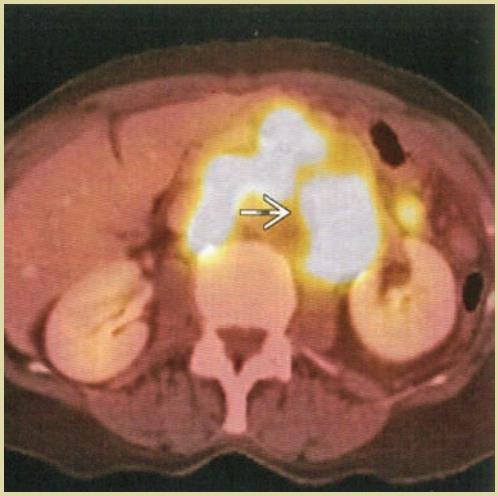




NON-HODGKIN LYMPHOMA

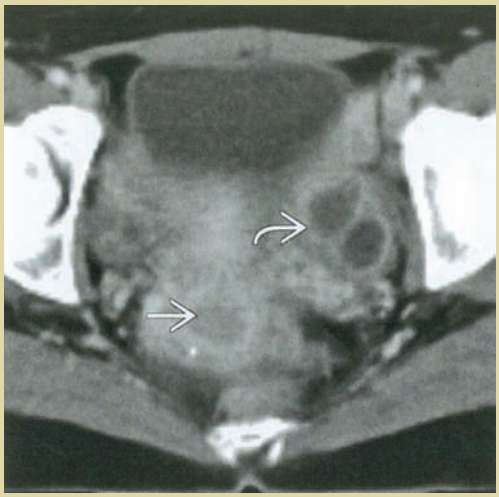
(Left) Axial CECT shows confluent mesenteric and retroperitoneal soft tissue involvement → in this patient recently diagnosed with diffuse large B-cell lymphoma. (Right) Axial fused PET/CT shows intense increased FDG activity throughout the confluent adenopathy →. CT (not shown) revealed no definite evidence for disease above the diaphragm.

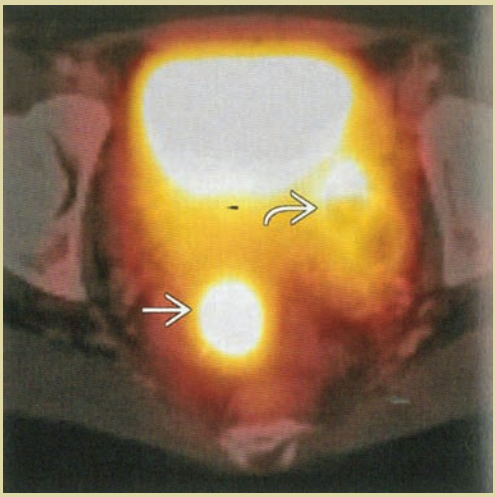




Further Applications of PET

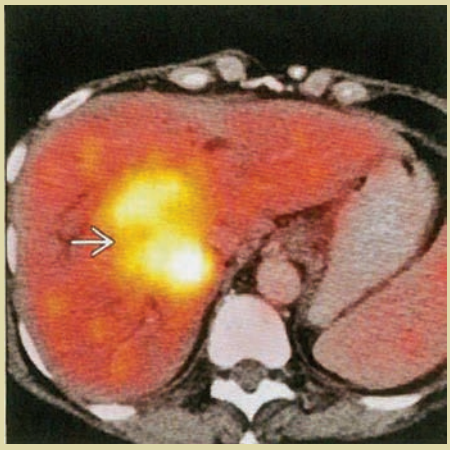
CERVICAL CARCINOMA



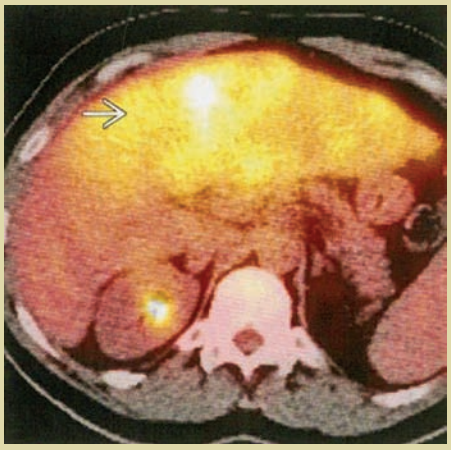


(Left) Axial CECT shows a heterogeneously enhancing cervical mass ---, compatible with the patient's primary cervica! carcinoma. In addition, there are cystic metastases involving the left adnexa ----. (Right) Axial fused PET/CT shows intense FDG activity within both the primary cervical mass --- and the left adnexa ----. In general, cervical carcinoma tends to be FDG avid, as are most squamous cell carcinomas throughout the body.

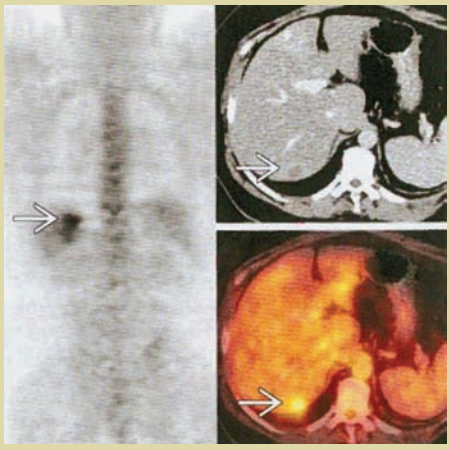
NEUROENDOCRINE TUMORS



Cholangiocarcinoma

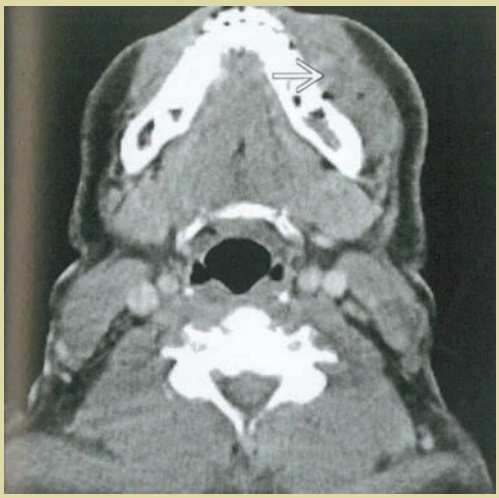


Hepatocellular Carcinoma



Metastasis

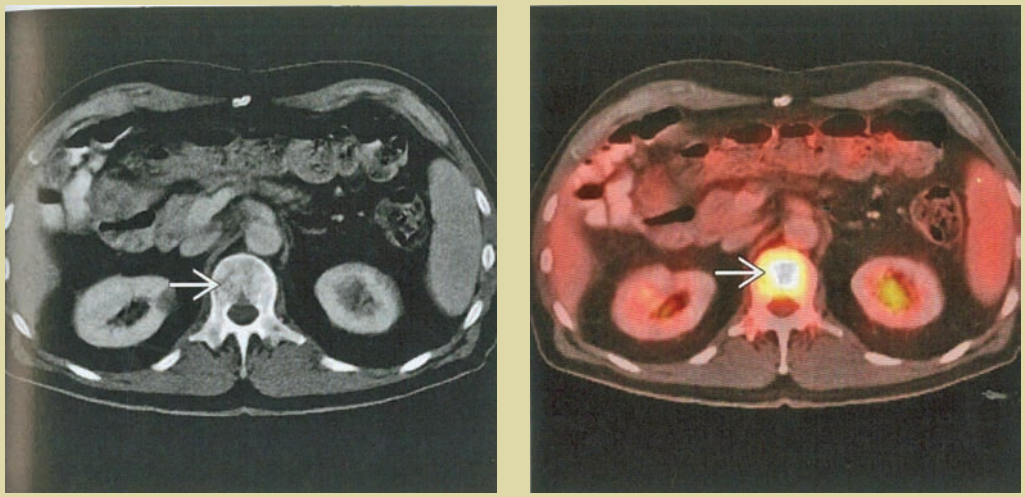
PRIMARY BONE NEOPLASMS



(Left) Axial CECT shows a small, almost imperceptible region of increased soft tissue → superficial to the body of the left mandible. (Right) Axial used PET/CT of the same patient as the previous image reveals intense FDG uptake in the same region → , compatible with malignancy.

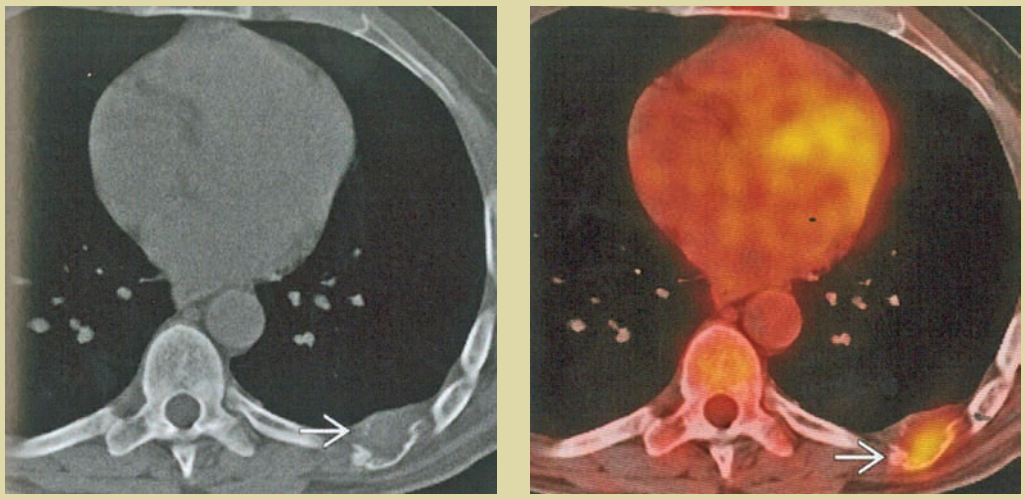
Further Applications of PET

METASTATIC LESIONS OF THE BONES



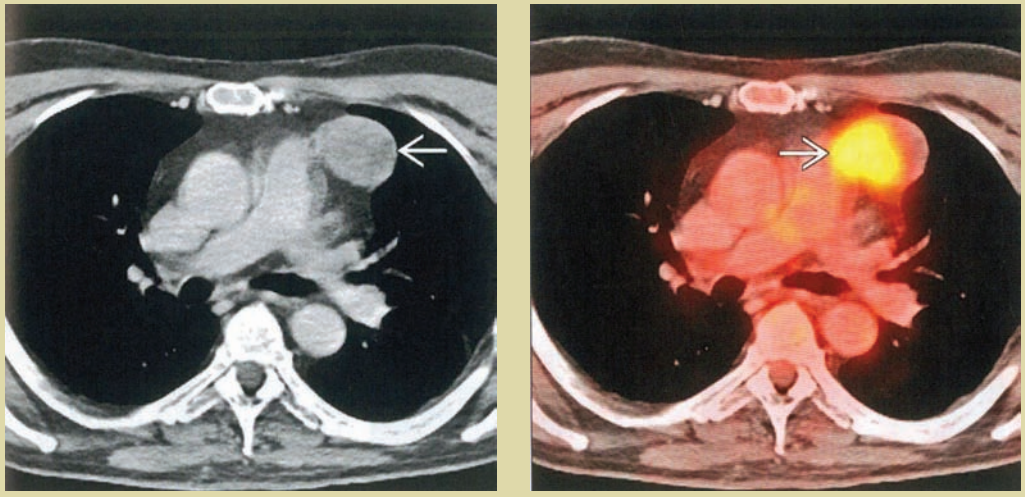
(Left) Axial CECT shows subtle mixed lytic metastases → throughout this vertebral body in a patient with breast cancer. (Right) Axial fused PET/CT of the same patient shows diffuse FDG activity → from the numerous small lytic metastases.

MULTIPLE MYELOMA



(Left) Axial CECT shows an expansile, lyctic lesion → in a rib with cortical disruption. (Right) Axial fused PET/CT of the same patient shows moderately increased FDG activity → within the lesion.

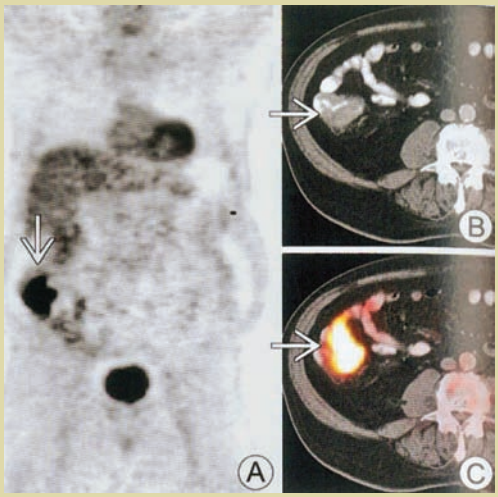
THYMIC PROCESSES



(Left) Axial CECT shows a heterogeneously enhancing soft tissue lesion that has convex margins → with the left mediastinal surface and may invade the pleura. This was pathologically proven to be invasive thymoma. (Right) axial fused PET/CT shows asymmetric increased FDG activity in the right aspect → of the invasive thymoma, which corresponds to the more solid-appearing component of the lesion.

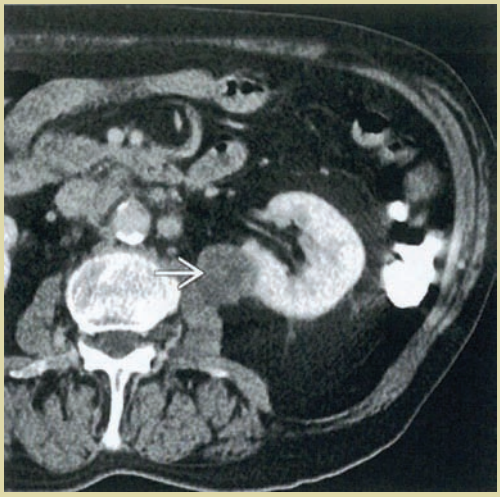
Further Applications of PET

HEPATOCELLULAR CARCINOMA



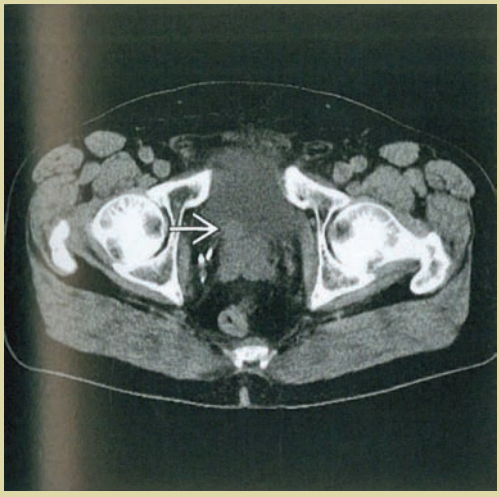
(Left) Axial CECT shows almost complete replacement of the left hepatic lobe → with tumor in this patient with hepatocellular carcinoma. Approximately 50% of hepatocellular carclnoma primary lesions may not be FDG avid. (Right) Coronal PET (A), Axial CT (B) and from the same patient, demonstrating a hepatic lesion.

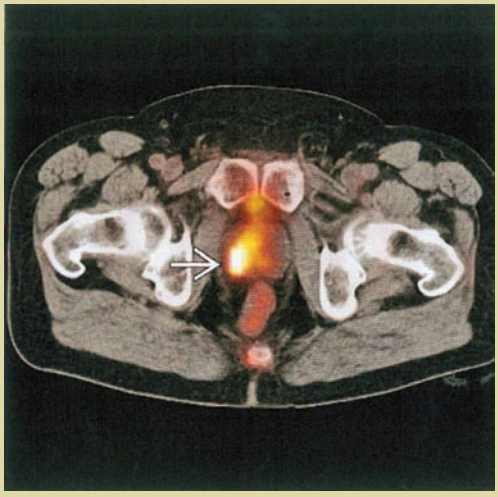
RENAL CELL CARCINOMA



(Left) Axial contrast enema shows a low attenuation mass → arising from the medial aspect of the left kidney. (Right) Axial fused PET/CT shows mild to moderate increased FDG activity within the left renal mass → with moderately hypermetabolic retroperitoneal adenopathy →. The overall appearance is compatible with renal cell carcinoma and regional metastases.

BLADDER CARCINOMA





(Left) Axial CECT shows a focal area of thickening along the right posterior lateral aspect of the bladder →, compatible with this patient's known history of primary transitional cell carcinoma. (Right) Axial fused PET/CT shows an asymmetrical focus of FDG activity correlating with the patient's primary transitional cell carcinoma →. Note slight misregistration of the images caused by filling of the urinary bladder during the PET portion of the exam.

NMI

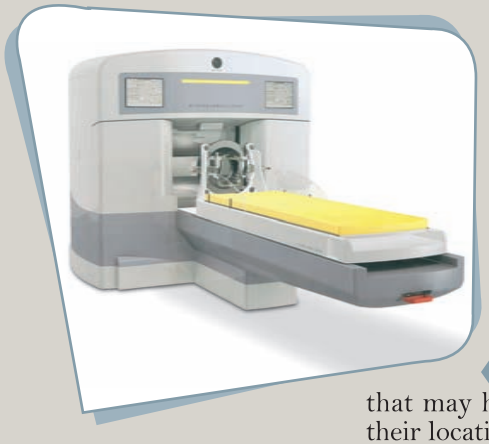
Treatment of Brain & Whole Body Tumors is Now Possible without Surgery in Pakistan!

PAKISTAN GAMMA KNIFE & STEREOTACTIC RADIOSURGERY CENTRE, NEUROSPINAL & MEDICAL INSTITUTE (Centre of Excellence)

○ Painless ○ Blood-less ○ Highly Targeted & Precise ○ Day Care Treatment ○ Experienced Team

Brain tumors and disorders for which Gamma Knife is considered most effective are:

- Brain tumors such as acoustic neuromas, pituitary adenomas, pinealomas, craniopharyngiomas, meningiomas, chordomas, chondrosarcomas, glomus jugulare and gilomas (low grade small volume).

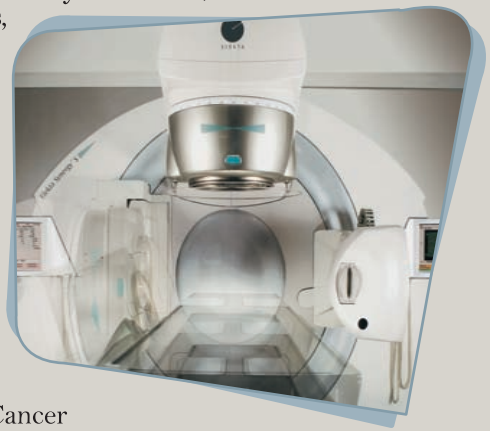


- Brain Mestastasis (Single or Multiple)
- Vascular Malformations including arteriovenous malformations and cavernomas.
- Orbital Tumors like melanomas and metastasis.
- Functioanl disorders such as trigeminal neuralgia, obsessive-compulsive disorder, movement disorders, intractable pain and epilepsy.
- Gamma Knife often can treat tumors that may have been termed inoperable beacause of their location in hard-to-access areas of the brain, or those treated unsuccessfully by conventional neurosurgery, radiation therapy and chemotherapy.
- Patients not suitbale for surgery due to illness or advanced age or children.

GAMMA KNIFE

X-Knife Radiosurgery (Synergy-S)
Stereotactic radiosurgery is best suitbale for:

- **Brain Tumors:** Primary & recurrent High & Low Grade Gliomas, Brain Metastasis (Single or Multiple) from other Primaries, Benign Brain tumors (Pituitary Adenoma, Meningiomas, Vestibular Schawanomas, AVM, etc.)
- **Spinal Tumors:** Primary & recurrent Ependymoma, Astroeytoma, Meningioma, Hemengiomas & other Tumors.
- **Liver Tumors:** Primary Hepatocellular, Colangiocarcinomas & Liver metastases.
- **Lung Cancer:** Bronchoganic Cracinoma & Metastases.



- Bladder Cancer
- Rectal Cancer
- Uterine Cancer
- Bonce Cancer
- Pancreatic Tumors.
- Soft Tissue Sarcomas.
- Prostate Cancer
- Breast Cancer
- Cervical Cancer
- Skin Cancer
- Lymphomas
- Anal Cancer.

Synergy-S

Patients return to their normal lifestyle immediately following treatment.

Neurospinal & Medical Institute (NMI)

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