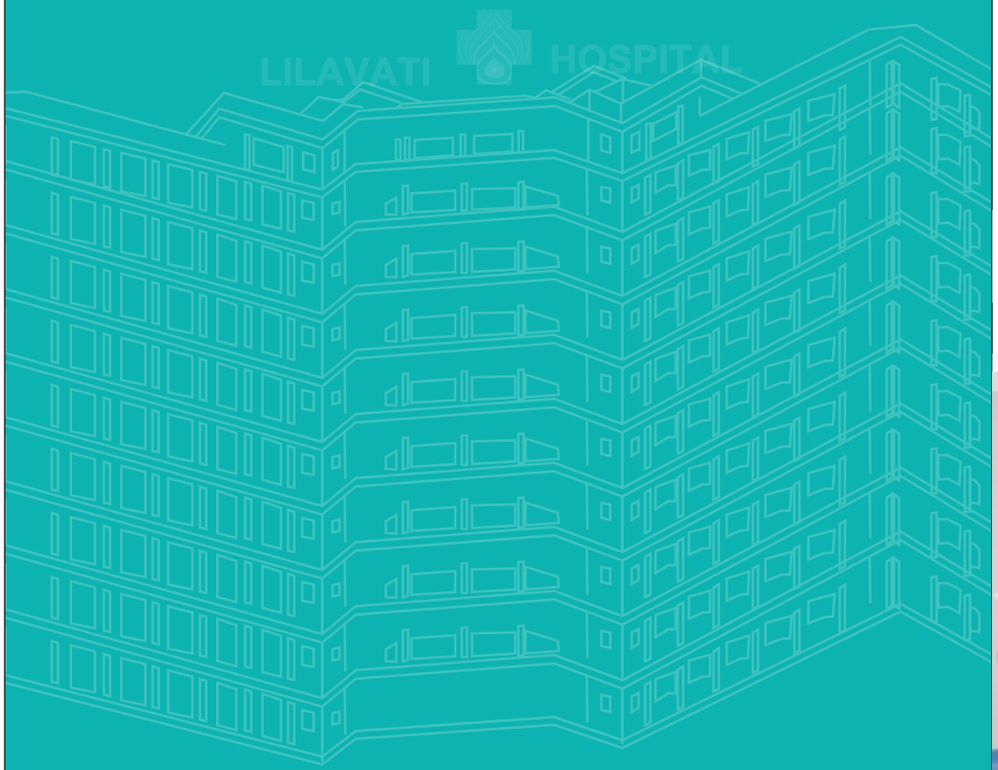

For appointments contact

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Department of Nuclear Medicine

Lilavati Hospital & Research Centre

Introduces the **NEW PET-CT SCANNER**

A State-of-the-art PET/CT scanner at LHRC

Unique Highlights

Scanner Special Features:

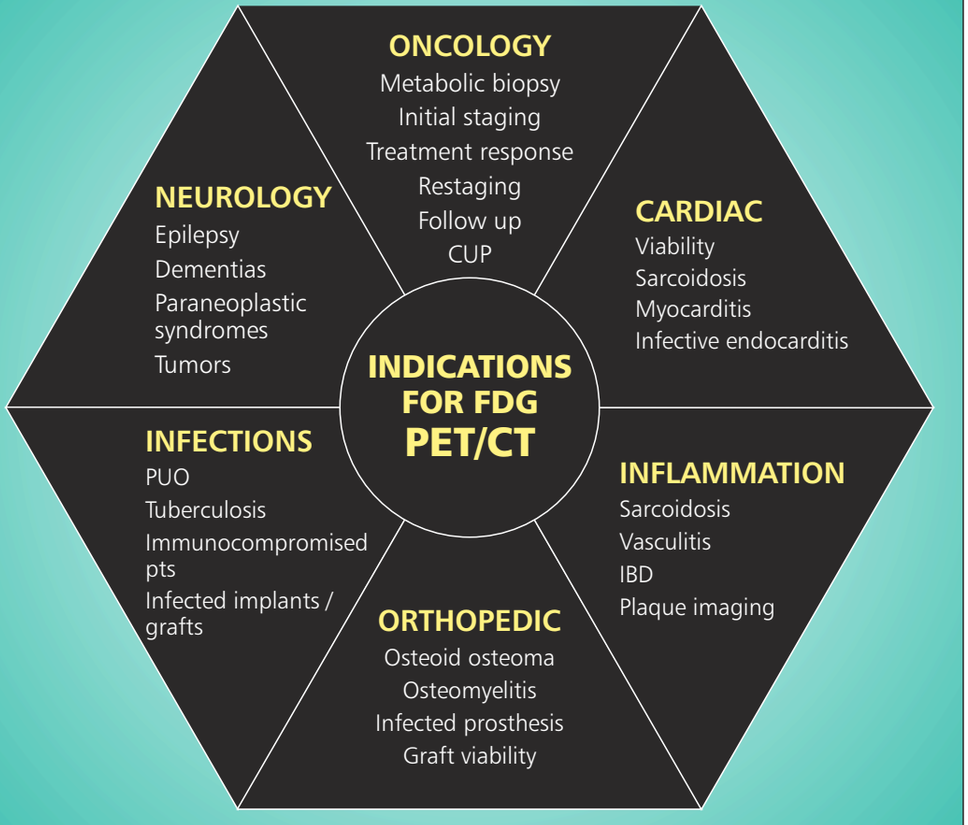
- **HIGH SENSITIVITY LSO CRYSTAL -** Smallest 4mmx4mm crystals offering best sensitivity.
- **BEST IN THE INDUSTRY RESOLUTION -** 2 mm spatial resolution across the field of view and Hi-Resolution PET imaging matrix - 35% better resolution than existing scanners.
- **TIME OF FLIGHT TECHNOLOGY -** High quality images at lower isotope doses.
- **SPECIAL RESPIRATORY GATING DEVICE -** Eliminates respiratory artifacts.
- **CARE Dose 4D -** Automatic CT settings to minimize radiation exposure.

Patient Friendly Features:

- **WIDEST GANTRY (78 cms) -** Accommodates larger patients.
- **SHORTEST GANTRY TUNNEL (136 cms) -** Lesser claustrophobia.
- **UNIQUE MAGNETIC LEVITATION TABLE -** Smooth motion of the patient throughout the procedure.
- **HIGHER WEIGHT BEARING CAPACITY** (upto 227 kgs).

ADVANTAGES OF PET/CT

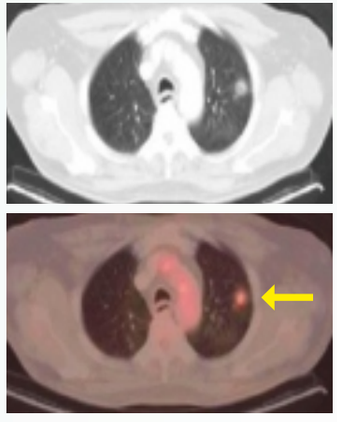
- **EARLY** detection of disease before appearance of anatomical changes.
- **ACCURATE** staging and restaging of cancers.
- **SIMULTANEOUS** contrast enhanced CT with metabolic information - Cost effective way of imaging the whole body in one sitting.
- **QUANTIFICATION** of tumor metabolism (SUV) before and after treatment.
- Metabolic **GRADING** of tumors possible - Impacts treatment decisions.
- **SAFE** for use in patients with chronic kidney disease, metallic implants, pacemakers, etc.



ONCOLOGY

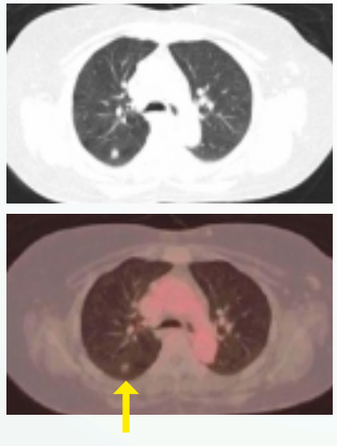
CHARACTERISATION OF LESIONS

Solitary Pulmonary Nodule: Benign vs. Malignant



FDG avid solitary pulmonary nodule. (arrow)

HPR: Adenocarcinoma



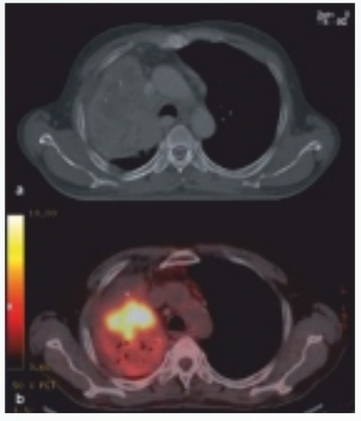
Non FDG avid solitary pulmonary nodule. (arrow)

HPR: Benign

FDG PET has a **High Negative Predictive Value**

INITIAL STAGING

Accurate 'T' Staging



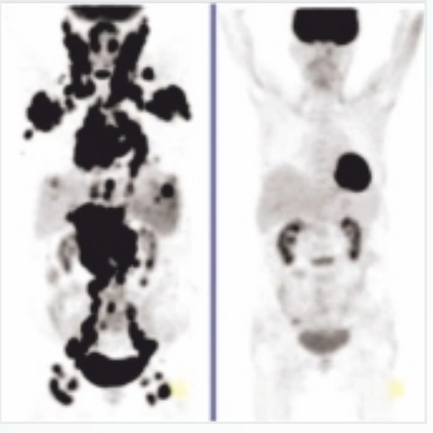
PET scan helps differentiate between cancer and collapsed lung

LABC : Lymph node and hepatic metastases

- Precise Nodal staging
- Whole Body imaging allows accurate detection of Distant Metastases

RESPONSE EVALUATION

Lymphoma



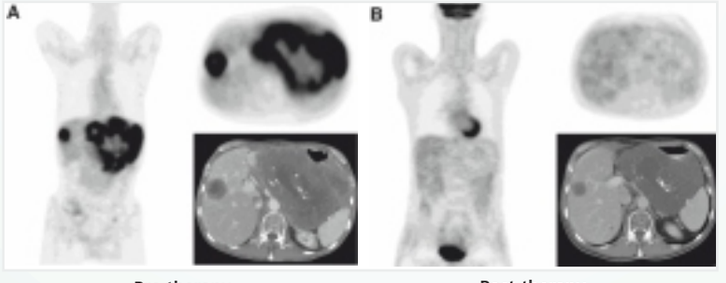
Pre-therapy **Post-therapy**

Complete Metabolic Response

Lugano Classification (2014):

- Combined FDG PET/CT: **More accurate** than CT alone for response assessment
- **FDG PET/ CT: 94% sensitive and 100% specific,**
- CECT: 88% sensitive and 86% specific.
- PET/CT demonstrates bone marrow lesions that are occult on CT images

GIST: Primary tumor with hepatic metastasis



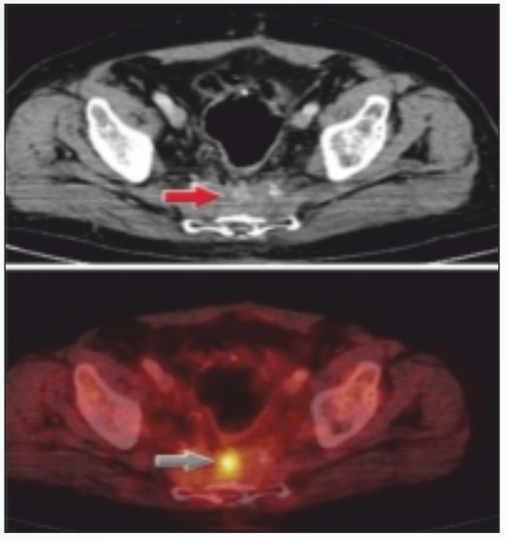
Pre-therapy **Post-therapy**

Post Therapy CT scan: no significant change on post therapy images - false positive

FDG-PET scan however clearly demonstrates complete Metabolic response

RESTAGING

Colorectal Carcinoma



Post treatment rising CEA levels.

CT : Equivocal presacral soft tissue

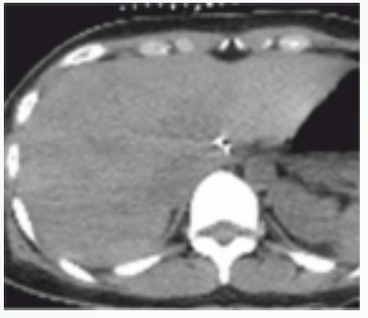
PET/CT : Focal FDG uptake in the presacral space suggestive of metastatic deposit

- PET/CT is currently mandatory prior to hepatic metastatic resection in colorectal cancer.
- PET/CT helps in avoiding unnecessary surgeries in 35% patients by demonstrating extra-hepatic lesions.

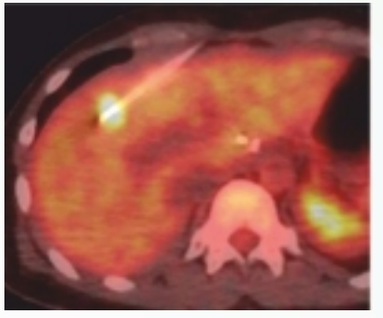
METABOLIC BIOPSY USING FDG PET/CT

FDG PET uptake site helps in targeting the biopsy site to reduce false negatives.

18FDG PET/CT-guided biopsy



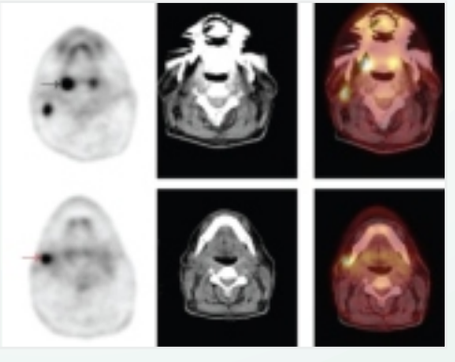
CT: The target lesion for biopsy cannot be visualized.



PET/CT : active area in the liver on 18FDG PET/CT with a needle targeting the lesion for biopsy.

METASTATIC CARCINOMA WITH UNKNOWN PRIMARY (CUP)

c/o right cervical lymphadenopathy Biopsy revealed metastatic SCC. FDG PET detected right Palatine Tonsillar primary malignant lesion



NON FDG PET SCANS

18F-FLUORIDE BONE PET

Benign bone disease

Primary & Metastatic bone tumors

Bone Graft viability

18F-MISO

Imaging of tumor hypoxia

Radiotherapy planning

18F-FLUOROTHYMIDINE

Imaging of tumor proliferation

Differentiates between benign & malignant pathologies

68 Ga-PSMA

Highly sensitive & specific tracer for prostate cancer imaging

68 Ga-DOTANOC

Somatostatin receptor imaging for NETs and pheochromocytoma

GA68 - DOTANOC SCAN- SOMATOSTATIN RECEPTOR IMAGING

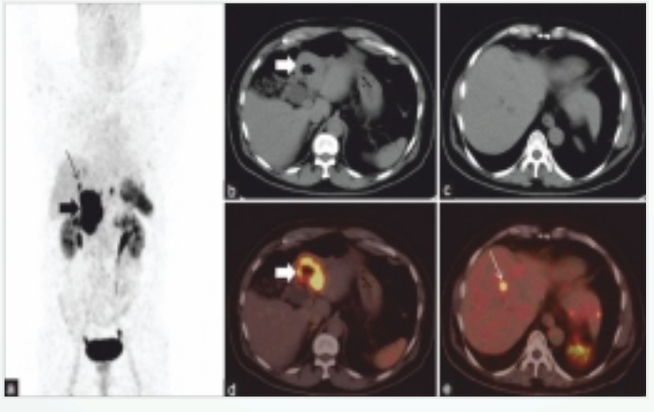
Imaging of Neuroendocrine tumors

Somatostatin receptor imaging :

- The expression of somatostatin receptors by NETs has led to the use of radiolabeled somatostatin analogs for imaging and Targeted Therapy
- More sensitive than conventional imaging modalities.

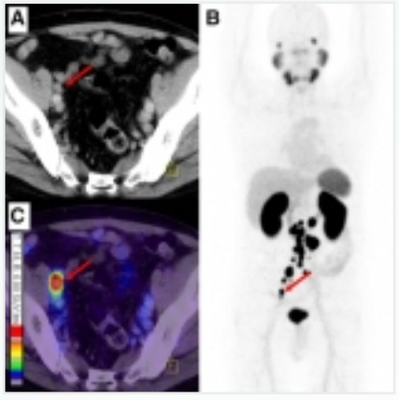
Ga-68 DOTANOC PET/CT

- Characterizes the disease as NET vs Adenocarcinoma
- Accurate staging of the disease.
- Determines feasibility of Targeted Therapy with PRRT (Peptide Receptor Radionuclide Therapy)



Duodenal Carcinoid with hepatic metastasis

GA68-PROSTATE SPECIFIC MEMBRANE ANTIGEN (PSMA) SCAN



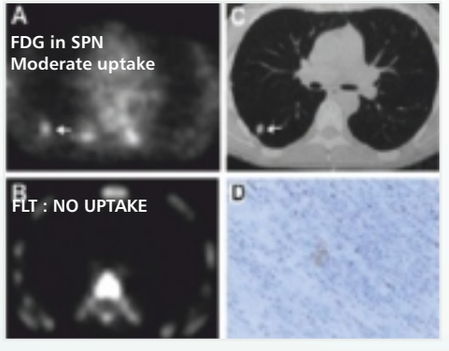
PROSTATE CANCER:
INITIAL STAGING

Lymph node metastases.

- PSMA over expression enables targeting of prostate cancer cells using gallium (68Ga) - labeled PSMA ligands for (PET/CT) imaging.
- Detects primary as well as metastatic lesions.
- Restaging of patients post prostatectomy: with rising PSA and normal MRI.
- Useful in patients with CRPC with painful bone metastases as a part of the pre-therapy evaluation for treatment with Lu177-PSMA.

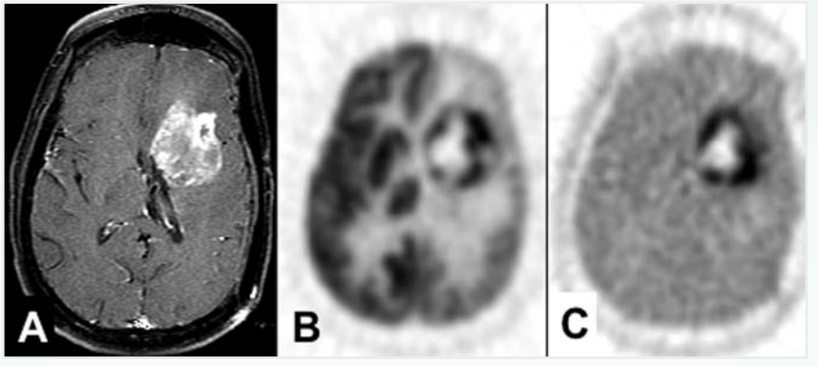
F18-FLUOROTHYMIDINE (FLT) SCAN

FLT & FDG in Koch's



- Dual Tracer PET Imaging with FDG and FLT differentiates neoplastic disease from infection / inflammation.
- Increases the specificity of imaging.
- FLT demonstrates proliferative activity of cancer cells.
- FLT does not localize in the sites of infection.

18F-MISONIDAZOLE (MISO): ASSESSMENT OF HYPOXIC TUMOUR VOLUME

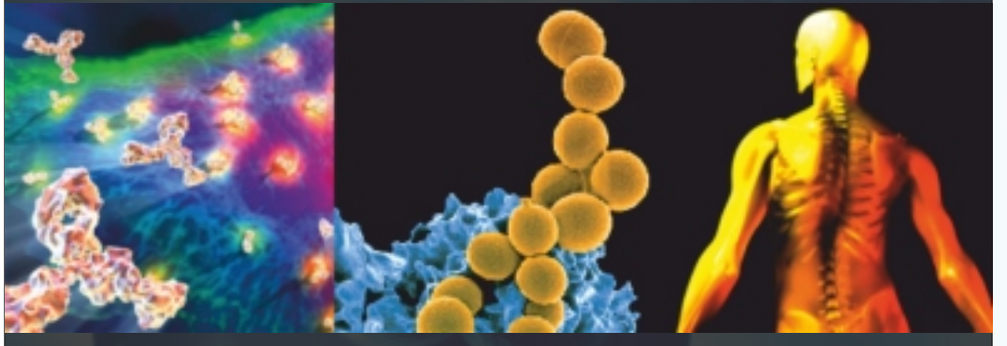


MRI **FDG PET** **F-MISO PET**

- F-MISO scan (C) demonstrates hypoxic areas which are different than the FDG uptake areas. (B)
- Hypoxic areas need additional booster dose of radiation which enhances survival especially in astrocytoma grade III and Glioblastoma Multiformae.

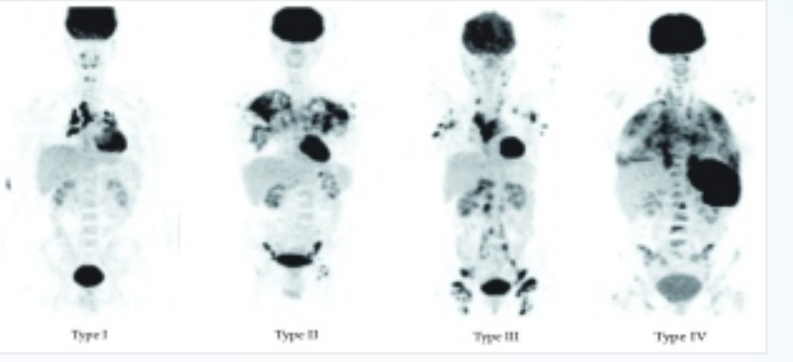
NON-ONCOLOGY

NON-ONCOLOGICAL indications



SARCOIDOSIS AND FDG PET SCAN

FDG PET scan helps in classifying sarcoidosis and assessing response to therapy.

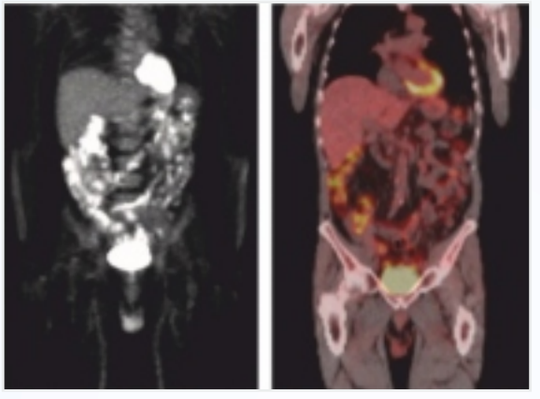


Classification using PET :

- **TYPE I :** Disease Restricted to thoracic lymph nodes.
- **TYPE II:** Disease involving lung parenchyma only.
- **TYPE III:** Disease involving supra and infra diaphragmatic nodes.
- **TYPE IV:** Involvement of spleen and skeletal system.

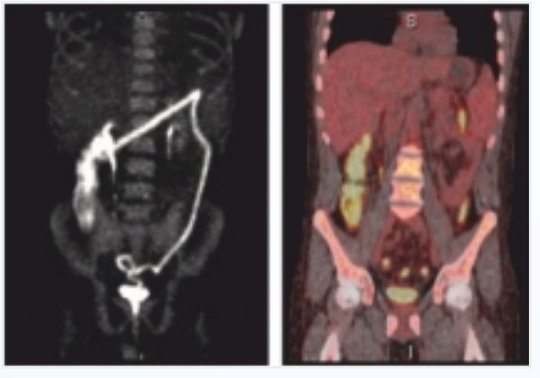
INFLAMMATORY BOWEL DISEASE

Crohn's Disease



Diffuse active disease in the small bowel and colon seen

Ulcerative Colitis



A colonoscopy performed thereafter demonstrated severe UC.

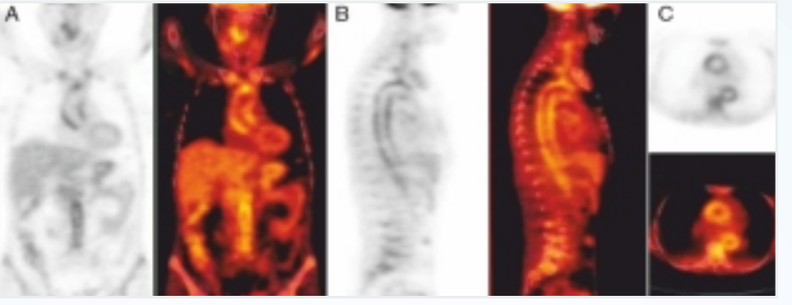
The scope was only passed to 30 cm owing to the severity of the colitis found.

PET/CT is useful in assessing:

- Extent of disease
- Small intestine involvement

VASCULITIS

Diagnosis



Large vessel vasculitis involving thoracic and abdominal Aorta

Response Assessment

Pre Therapy

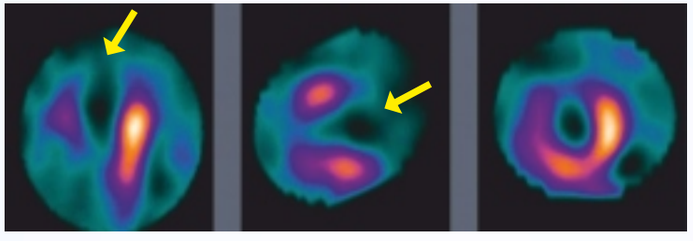
Post Steroid Therapy Scan

Takayasu's arteritis

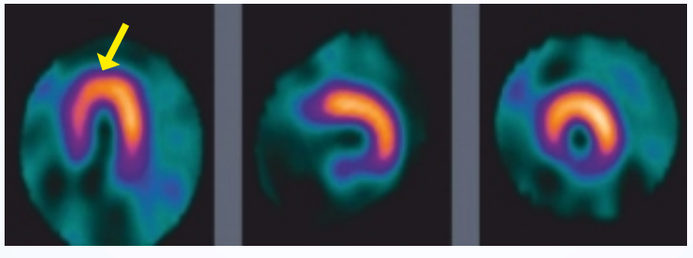
PET APPLICATIONS IN CARDIOLOGY

Myocardial Viability Assessment: FDG PET can identify presence of Hibernating / Stunned Myocardium and guide towards revascularization therapy which will improve cardiac function in **patients of cardiac failure.**

SPECT-Perfusion Imaging



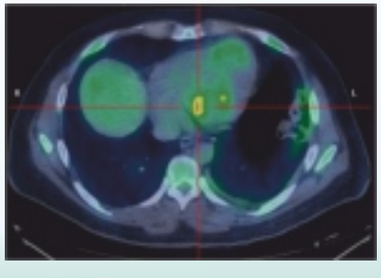
FDG PET (Metabolism) Imaging



The area (arrow) which appeared Non viable on Perfusion imaging shows Viability on FDG PET scan

Diagnosis of Cardiac Infection - FDG PET detects valvular infection even before the 2D - ECHO

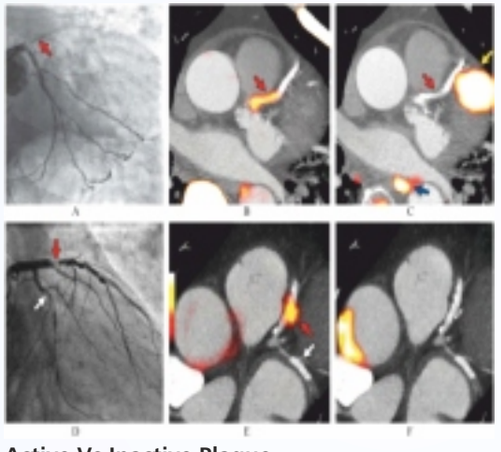
Subacute Bacterial Endocarditis



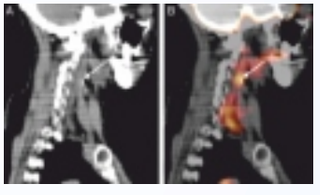
ACTIVE VS. INACTIVE PLAQUE

Microcalcification in the plaque is one of the feature of an active plaque.

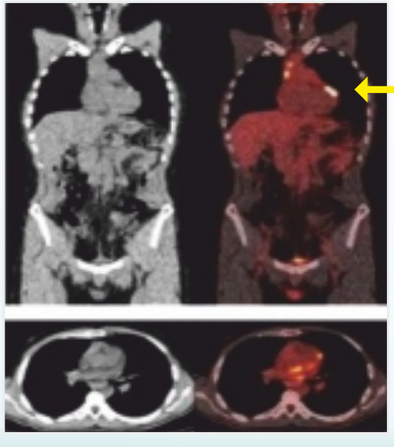
18-NAF PET-CT For Plaque Microcalcification



FDG uptake in active carotid plaque



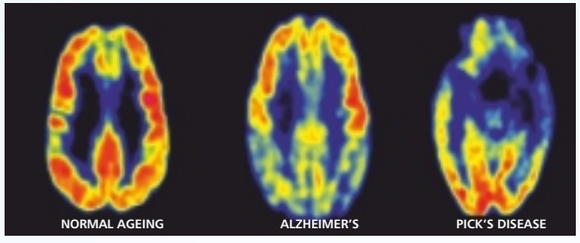
Active Vs Inactive Plaque



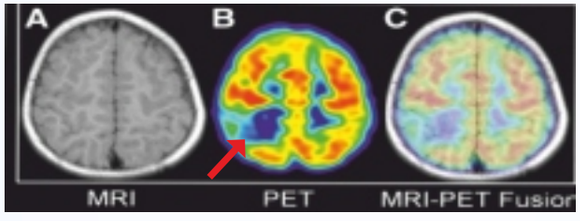
Focal Pericarditis on FDG PET

PET APPLICATIONS IN NEUROLOGY

Neurodegenerative Disease



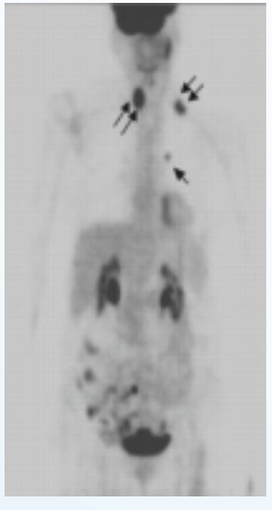
Epilepsy - Interictal PET



MRI - normal

FDG PET - large hypometabolic area in right posterior parietal lobe.

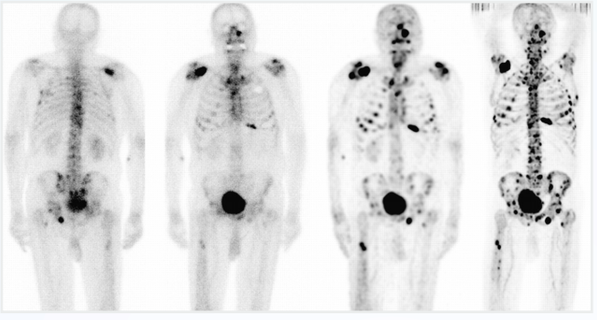
CNS Paraneoplastic Syndromes



Clinically - Sensory Neuronopathy PET/CT Imaging Showed Unsuspected Lung Cancer with Nodal Metastases

FLUORIDE PET BONE SCAN

Superior sensitivity and specificity compare to MDP bone scan

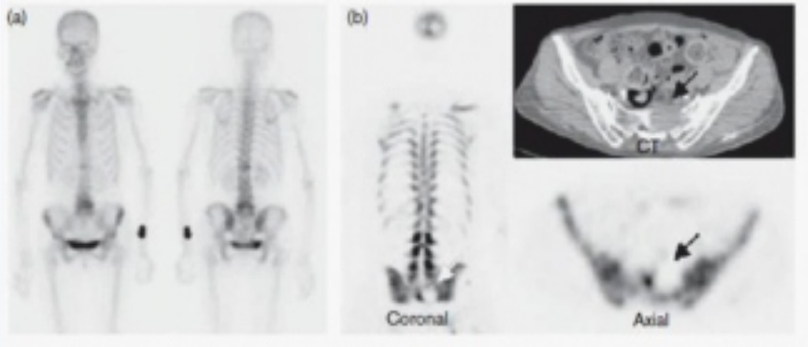


Metastatic Bone survey with Tc Bone Scan - shows multiple bone metastases

Significantly higher number of lesions detected in the same patient with a Fluoride PET scan

Fluoride PET bone scan is sensitive for the detection of lytic lesions

MDP bone scan **NaF bone PET**



47 yr old woman with low back ache :

MDP Bone scan - No sacral lesion

Fluoride PET Bone scan - large lytic lesion

INFECTION

PYREXIA OF UNKNOWN ORIGIN

More than 50% cases of FUO can't be diagnosed by conventional imaging modalities.

In such a situation, 18F-FDG PET/CT can be a one-stop-shop for detection of infection, inflammation or neoplasm, which could be the cause of fever.

Case of fever with leg pain.

Clinical suspicion of Polymyositis.

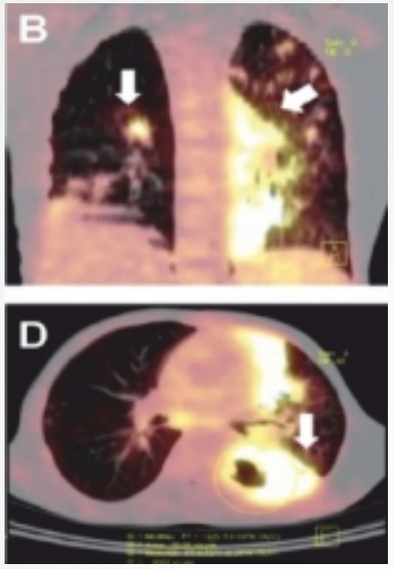
FDG PET - bilateral multiple focal abnormalities in lower limb muscles.

26-year-old man with fever of unknown origin.

FDG PET - active disease in multiple nodes and skeleton.

Biopsy - Tuberculosis.

PET/CT IN KOCH'S - RESPONSE ASSESSMENT

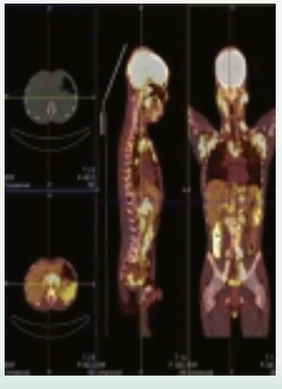


Pulmonary T.B-2 mo post antituberculous therapy.

Extensive FDG-avid lung lesions s/o active disease indicating poor response to therapy.

ROLE OF PET/CT IN IMMUNOCOMPROMISED PATIENT

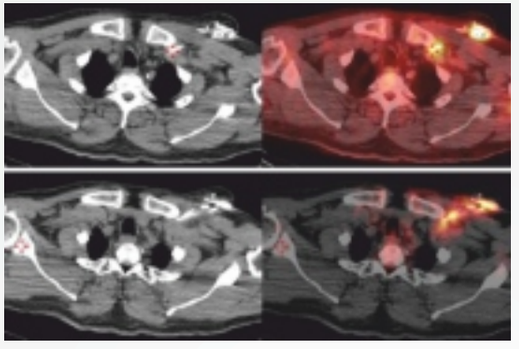
In immunocompromised patients, FDG PET helps in detecting extent of organ involvement.



HIV infection: extensive lymphadenopathy.

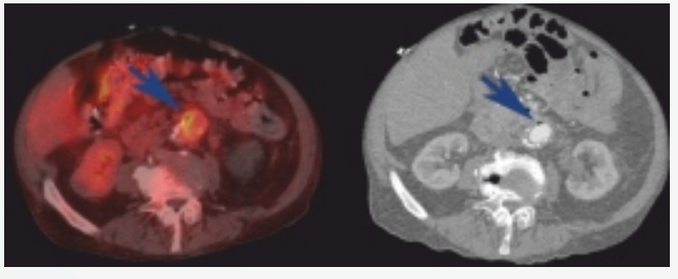
Progressive involvement of lymph nodes with progression of disease.

INFECTED GRAFTS / IMPLANTS



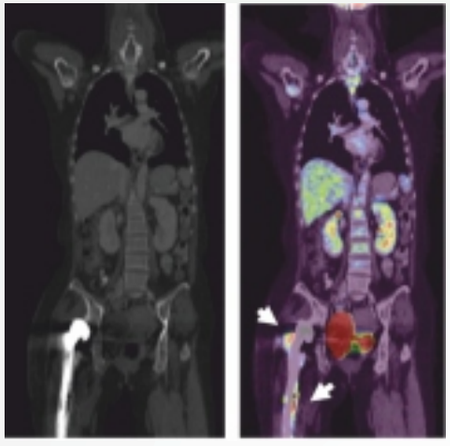
Suspected infection of a pacemaker.

Intense 18F-FDG uptake at the pocket site (upper panel) and all along the intravascular portion of the lead (lower panel).



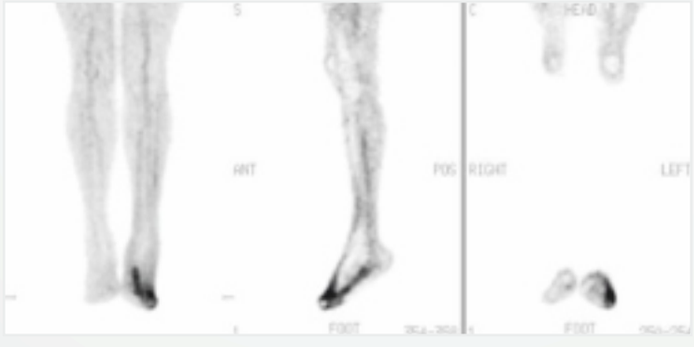
Infected aortic graft

FDG PET CT IN ORTHOPEDIC DISEASES



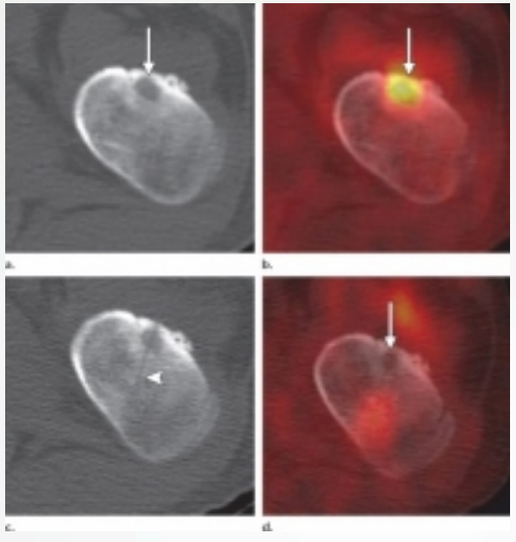
CT cannot delineate site of infection over a prosthesis.

Infected prosthesis shows FDG uptake which is seen in the macrophages at the site of infection



- FDG PET helps in accurate delineation of site of infection and involvement of adjoining soft tissue in diabetic foot.
- MRI underestimates the extent of infection.

OSTEOID OSTEOMA AND FDG PET SCAN - RESPONSE ASSESSMENT



PRE - ABLATION

POST ABLATION

PRE - ABLATION FDG PET scan shows high uptake in the left femoral osteoid osteoma

POST ABLATION - complete absence of uptake suggesting good response on PET scan. However the CT scan remains unchanged.