Clinical Oncological imaging :**PET-CT** and its role in RT

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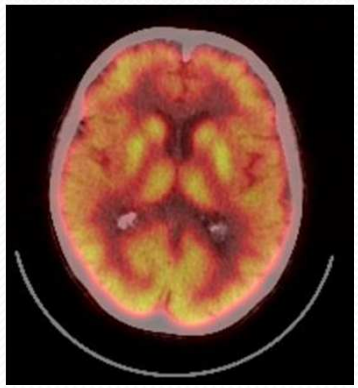
www.nucpetmrc.com

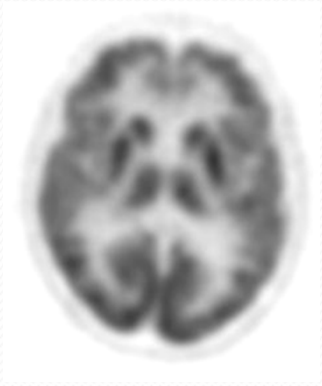
Evolution of Technology

CT



PET/CT

PET



1973

2000

2001

- *Structure without function is a corpse…function without structure is a ghost.*


THANK YOU
DANKE
27/04/2008

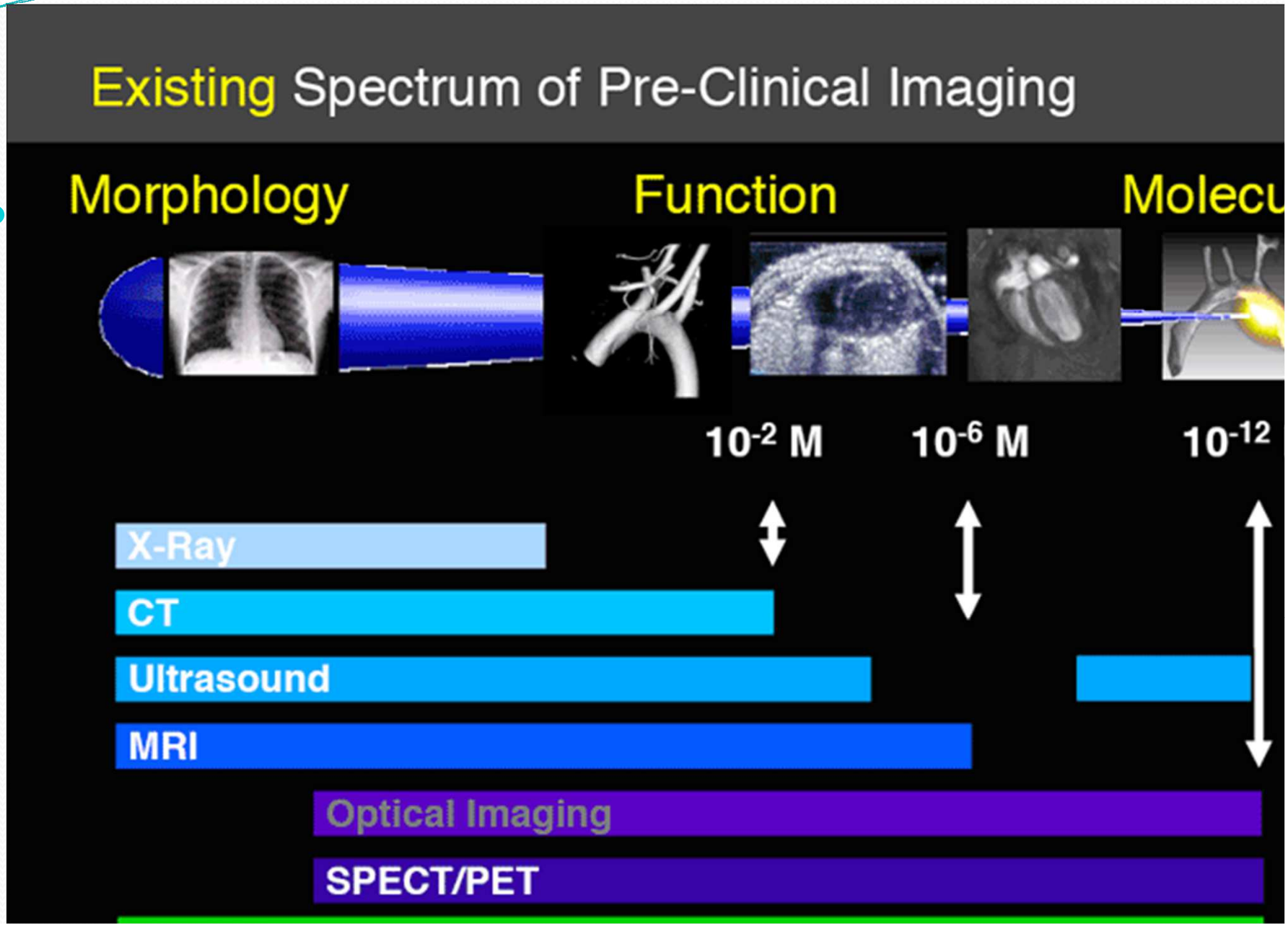
PET-CT the Mol Imaging.

Positron emission tomography (PET) enables *in vivo* imaging of the distribution of (FDG) (and other positron-emitting ligands) with high(< 1 cm) resolution and high (nanomolar) sensitivity.

The addition of transmission (CT) to PET instruments results in images that provide both functional/molecular information and structural images,

PET/CT has consequently become the most rapidly developing medical imaging modality.

Time Magazine honored PET/CT as the "Medical Science Invention of the Year" in 2000, noting that the PET/CT scanner has "provided medicine with a powerful new diagnostic tool."[1]


Existing Spectrum of Pre-Clinical Imaging
Morphology
Function
Molecu
10-2 M
10-6 M
10-12
X-Ray
CT
Ultrasound
MRI
Optical Imaging
SPECT/PET


Discovery

Imaging Protocol

Patient

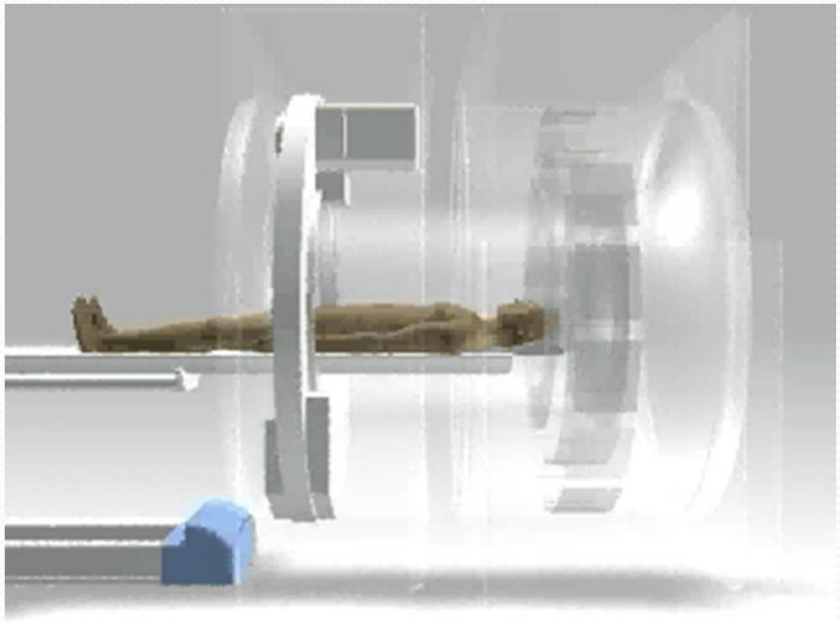
- Fast 4 hrs prior to exam
- Inject tracer
- Start scan 60 min later

CT

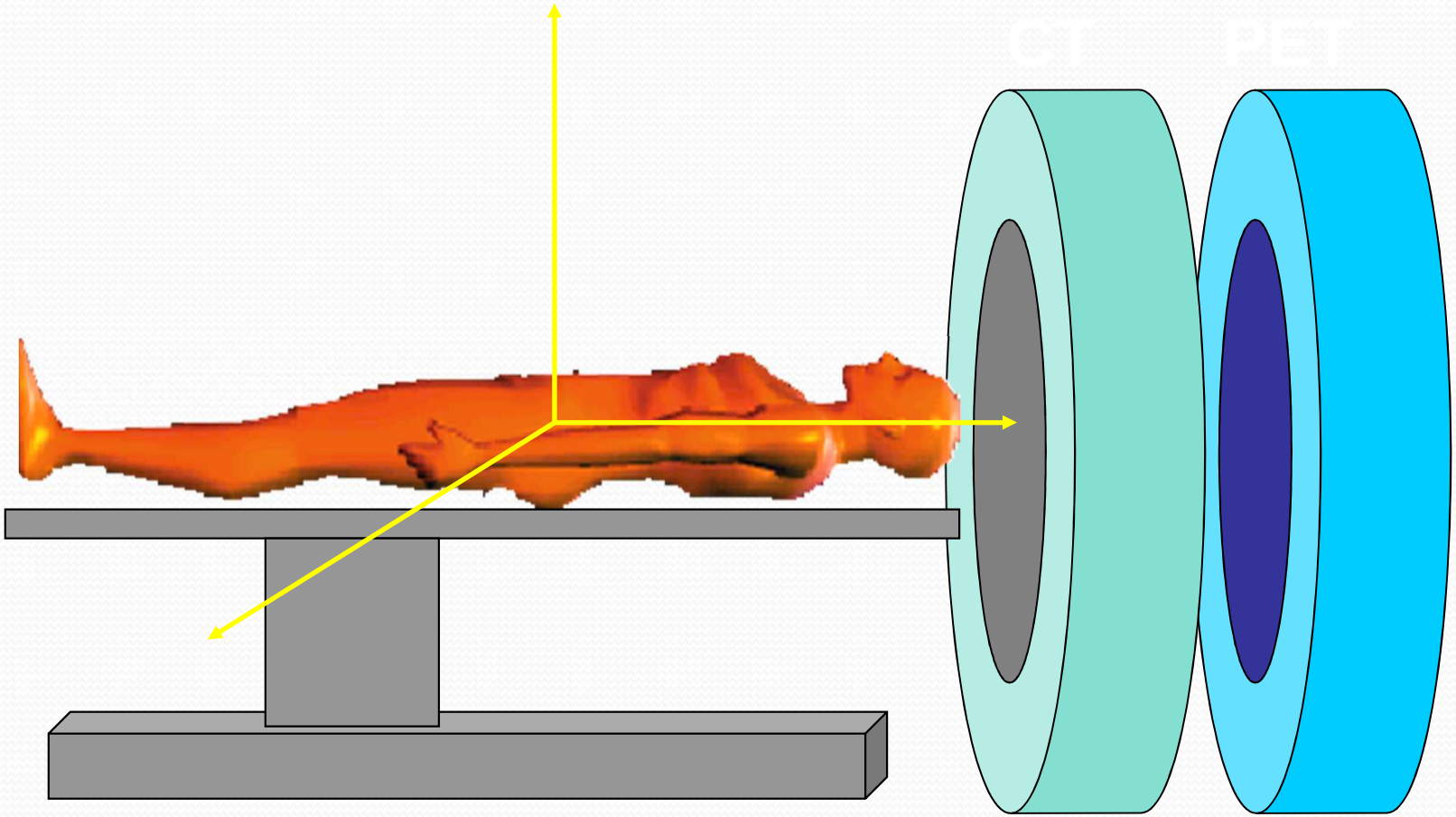
- Topogram (scout)
- CT scan (1 min)

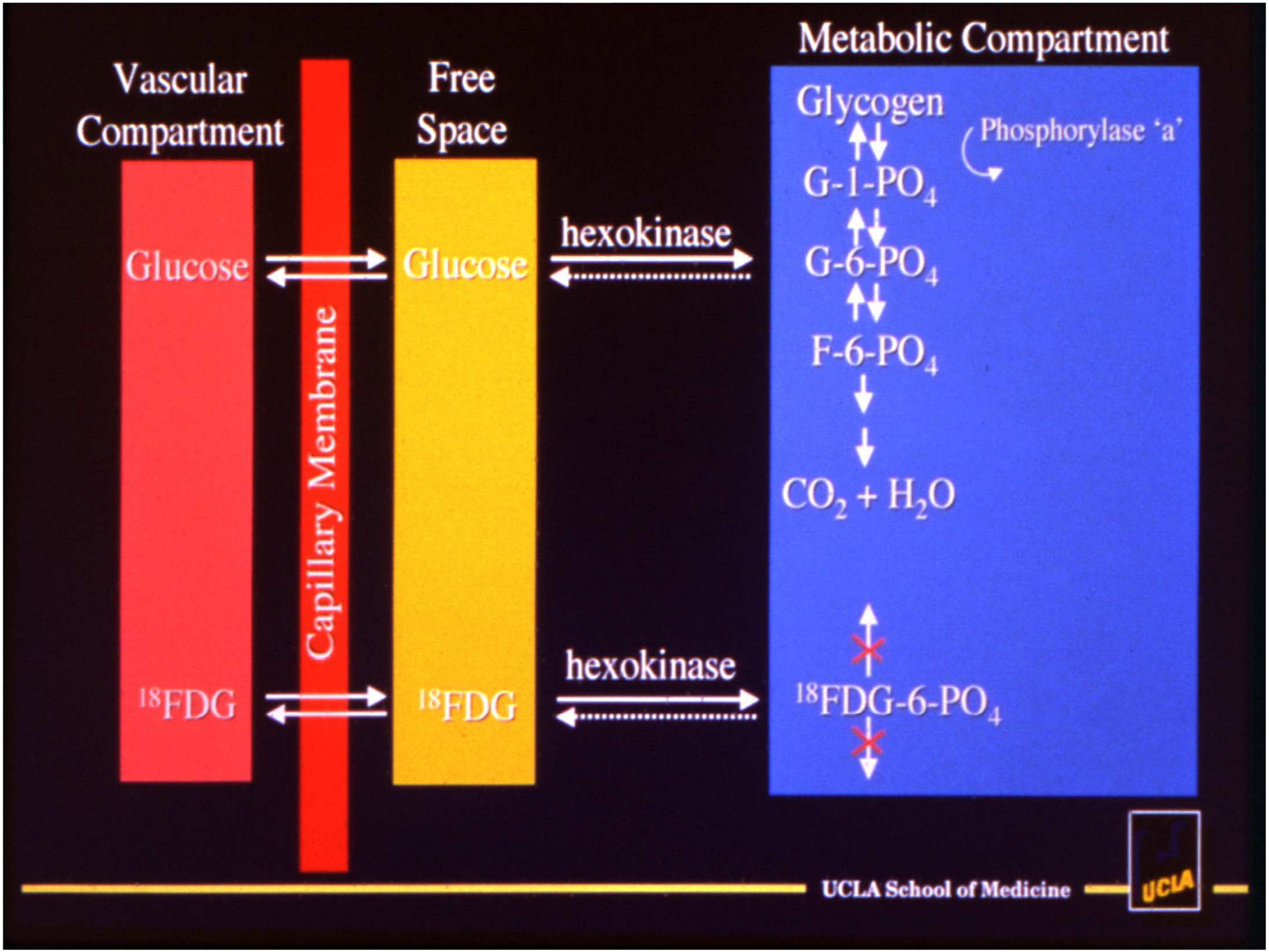
PET

- Brain (10 min)
- Heart (10 min)
- Body (20 min)

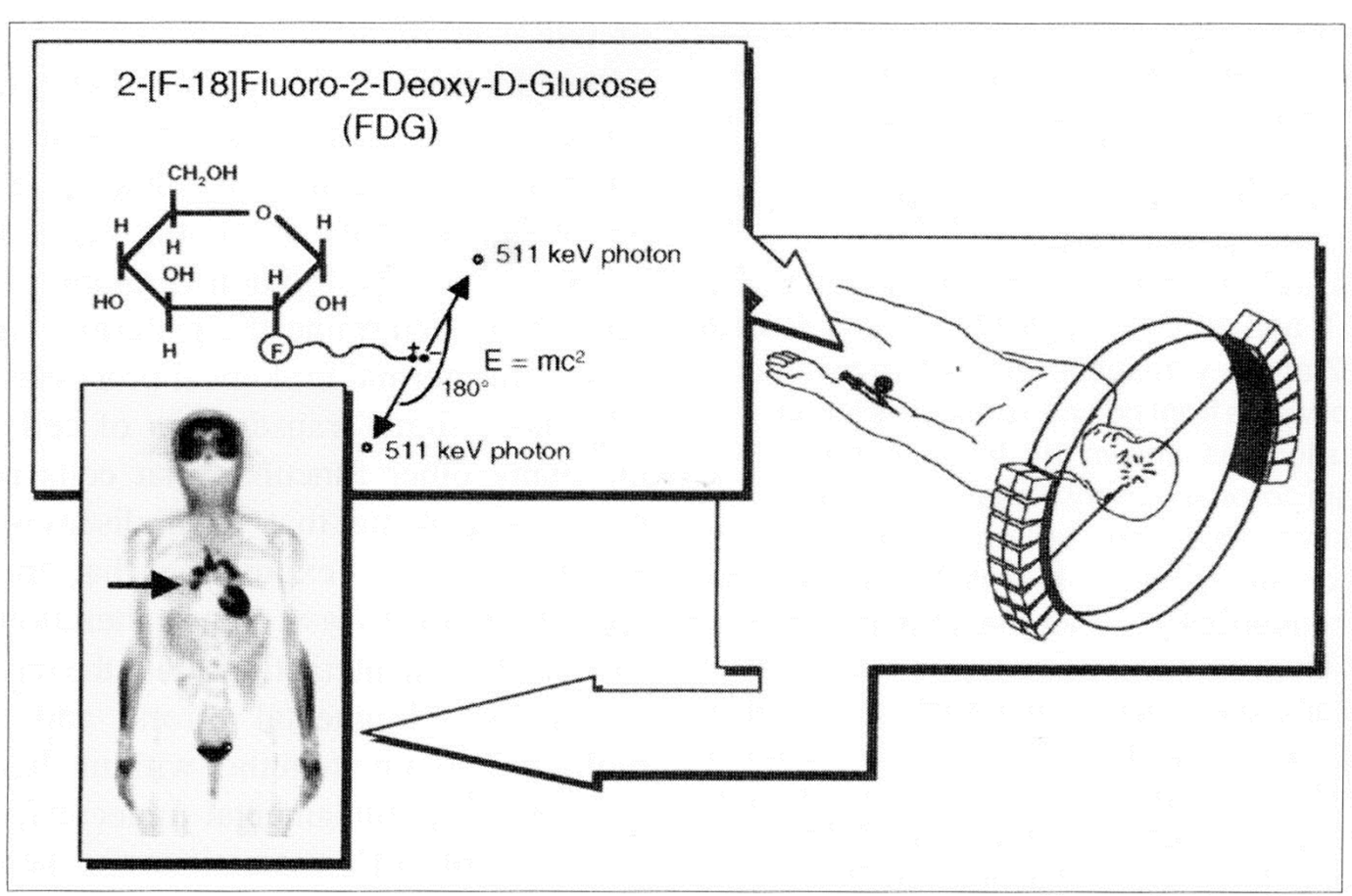


PET/CT



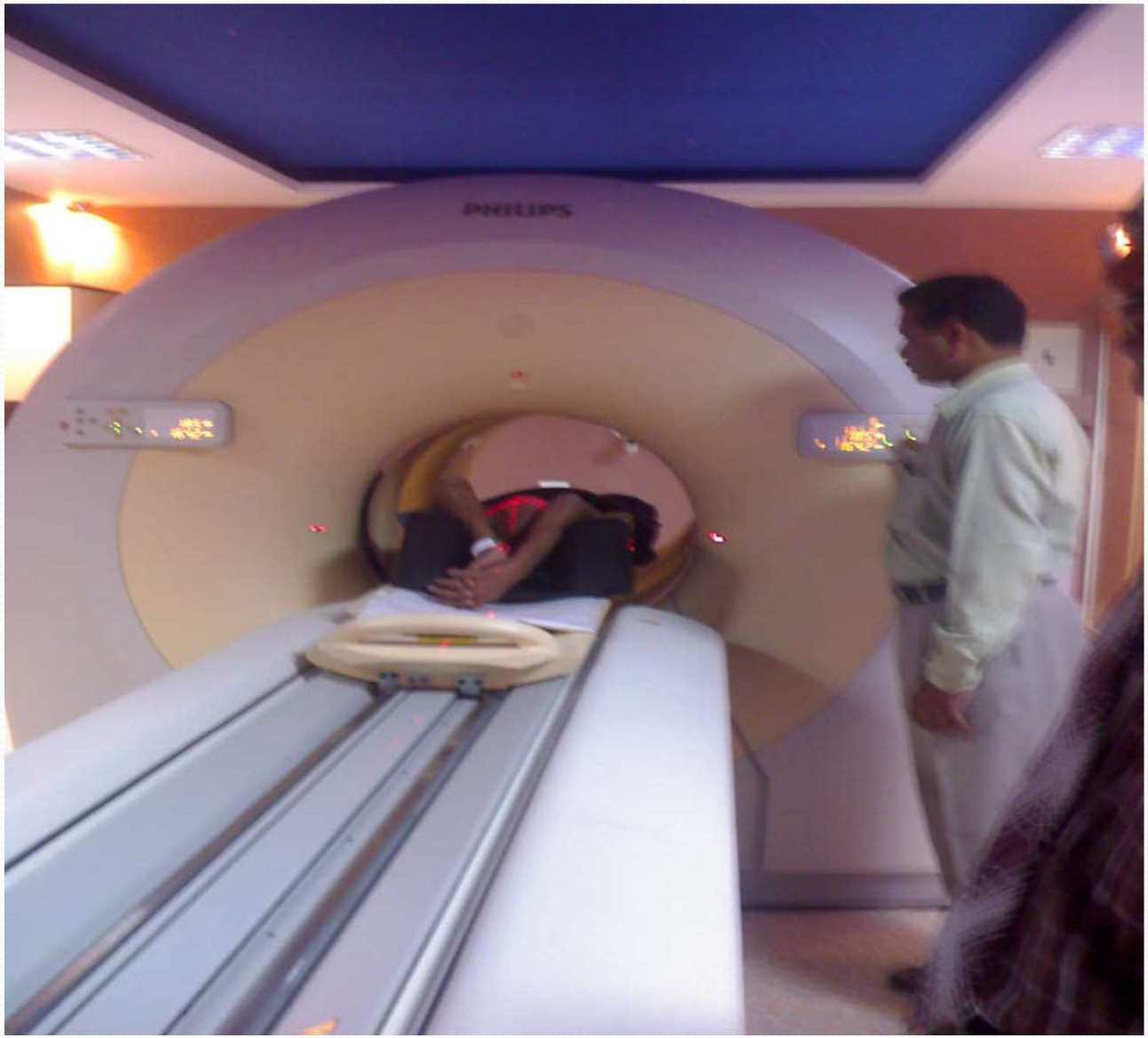

Vascular Compartment
Capillary Membrane
Free Space
Metabolic Compartment
Glucose
Glucose
hexokinase
Glycogen
Phosphorylase 'a'
G-1-PO4
G-6-PO4
F-6-PO4
CO2 + H2O
18FDG
18FDG
hexokinase
18FDG-6-PO4
UCLA School of Medicine
UCLA

Positron Emission Tomography



RADIOTRACERS PREPARED AT HSR

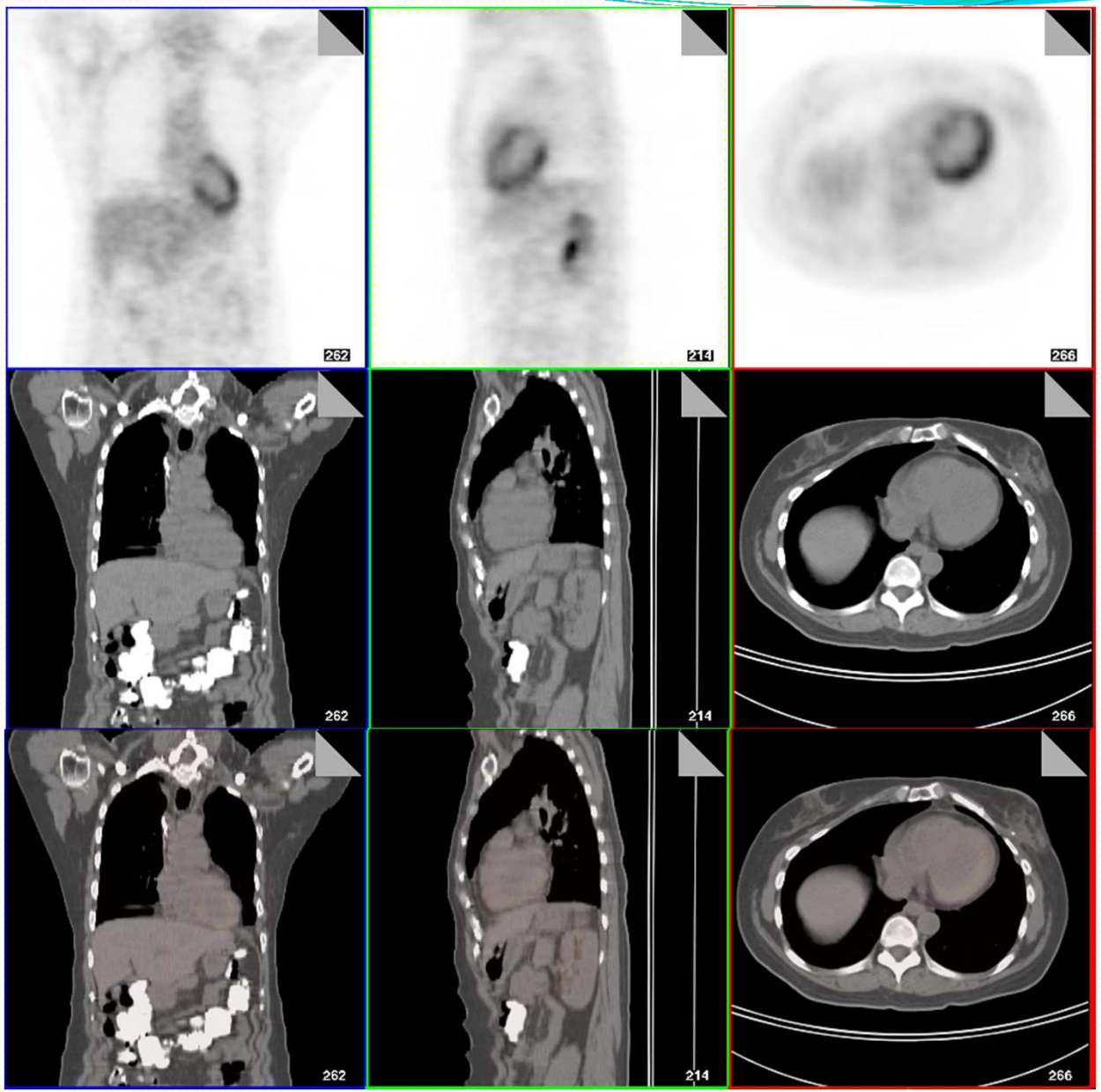
[18F]FDG	Glucose metabolism
[18F]FESP	D2 and 5-HT_2 receptor antagonist
[15O]H2O	Cerebral flow, Studi attivazione funzionale
[13N]AMMONIA	Myocardial flow
m-[11C]hydroxyefedrine	Adrenergic antagonist
[11C]FLUMAZENIL	Benzodiazepine receptor antagonist
[11C]RACLOPRIDE	Dopamine D2 receptor antagonist
[11C]FE-β-CIT	Dopamine reuptake inhibitor
[11C]SCH23390	Dopamine D1 receptor antagonist
[11C]CARAZOLOL	Adrenergic β1/β2 receptor antagonist
[11C]MCN5652	Serotonin reuptake inhibitor
[11C]MDL100907	Serotonin 5-HT2A receptor antagonist
[11C]methylcoline	Prostate Cancer
[11C]FLUVOXAMINE	Serotonin reuptake inhibitor
[11C]CGP62349	GABAB antagonist
[11C]isovaleroil-L-carnitine	Cerebral metabolism
[^{11}C]PNU167760	Serotonin 5-HT_{1A} receptor antagonist
[^{11}C] BISOPROLOL	Adrenergic β1 antagonist
[^{11}C] ICI118551	Adrenergic β_2 receptor antagonista
[^{11}C] OLANZAPINE	Atypical Antipsychotic
[^{11}C] SB235753	Dopamine D4 receptor antagonist
[^{11}C] E2020	Muscarinic M_2 receptor antagonist
[^{11}C] SCH442416	Adenosine A_{2A} receptor antagonist
[^{11}C] PALMITATE	Fatty acids metabolism
[^{11}C] A 84543	Nicotine $\alpha_2\beta_4$ antagonist
[^{11}C] VC195	Peripheral Benzodiazepine
[^{11}C] VC193M	Peripheral Benzodiazepine
[^{11}C] VC198M	Peripheral Benzodiazepine
[^{11}C] WAY100635	Serotonin 5-HT1A receptor antagonist
[^{11}C]RN5	Adrenergic α1 receptor antagonist
[^{11}C] VA100	Opioid K1 receptor antagonist
[^{11}C] CARFENTANIL	Opioid μ receptor agonist
[^{11}C] ZOFENOPRIL	ACE inhibitor
[^{18}F]FLUORO CAPTOPRIL	ACE inhibitor
[^{11}C] CNR1	α1 adrenergic antagonist
[^{11}C] PK1113195	Peripheral Benzodiazepine
[^{11}C] F167	σ_2 receptor antagonist
[^{11}C] PD60	dopamine D_3 antagonist
[^{11}C] PD78	dopamine D_3 antagonist


PHILIPS

PET

CT

PET/CT



FDG 15 mCi
Bed 1 min

KVs 130 kV
mAs 75 mA
Slice 5 mm

H.S., 077-64-28

What Are the Advantages of PET/CT?

Advantages of CT

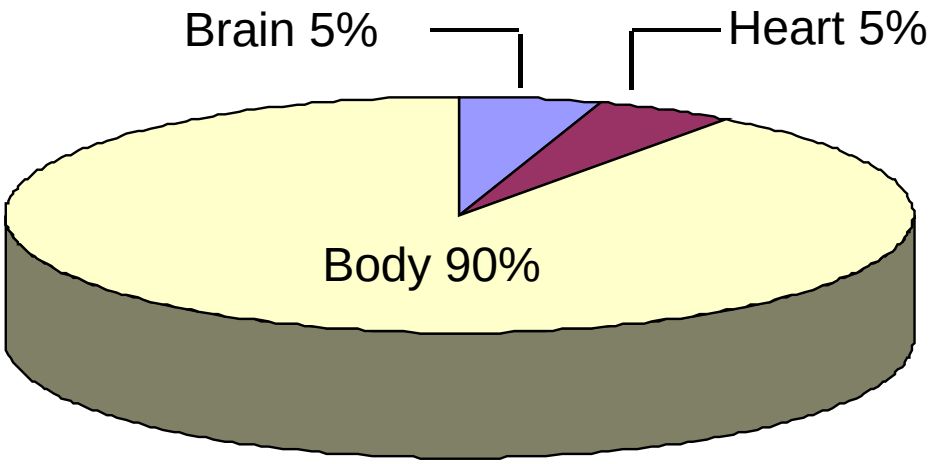
- high spatial resolution

Advantages of PET

- better lesion characterization
- enhanced lesion detection

Applications of PET-CT

- epilepsy
- tumor
- dementia

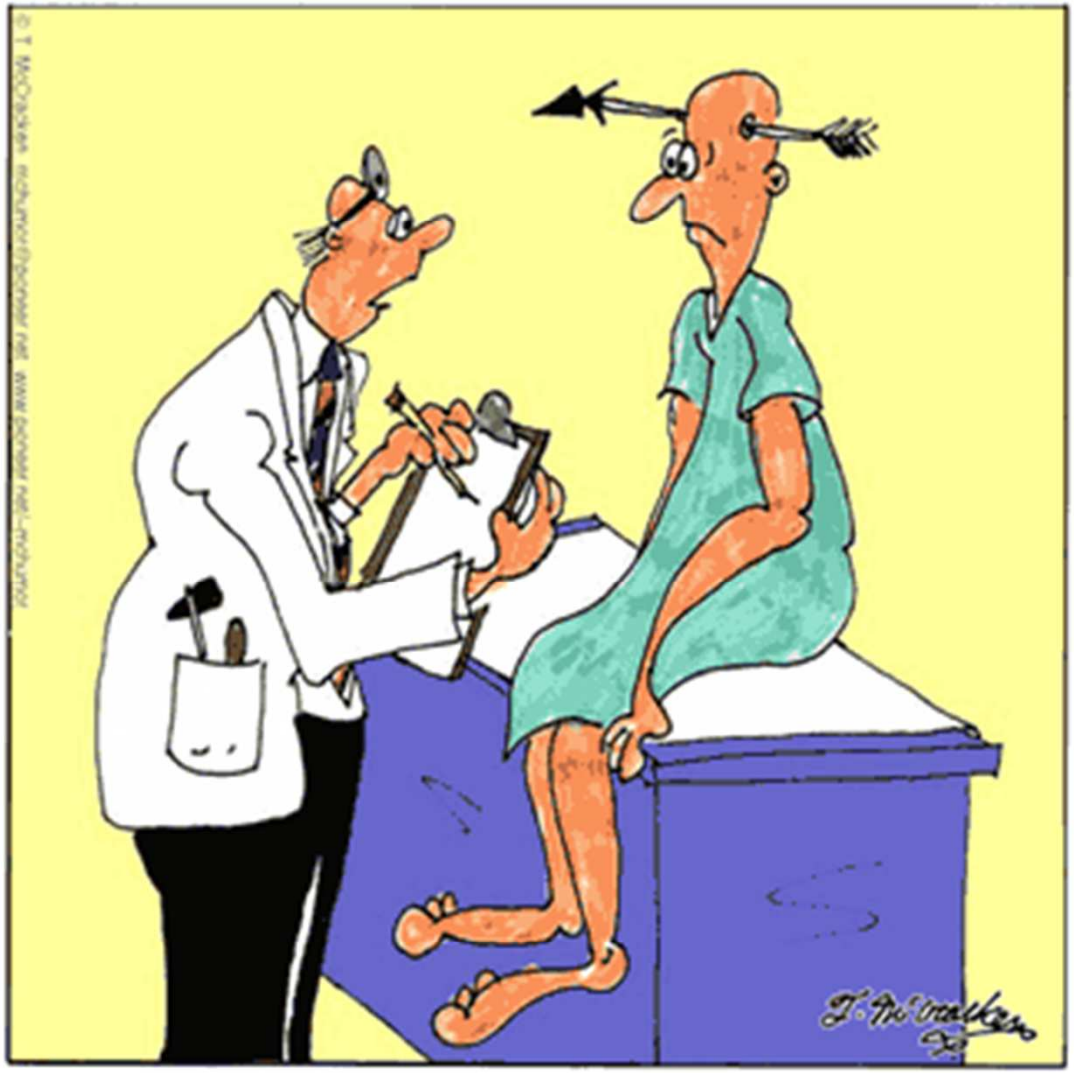


1.5 million exams performed annually

- perfusion
- viability

- tumor
- infection
- bone

McHUMOR by T. McCracken



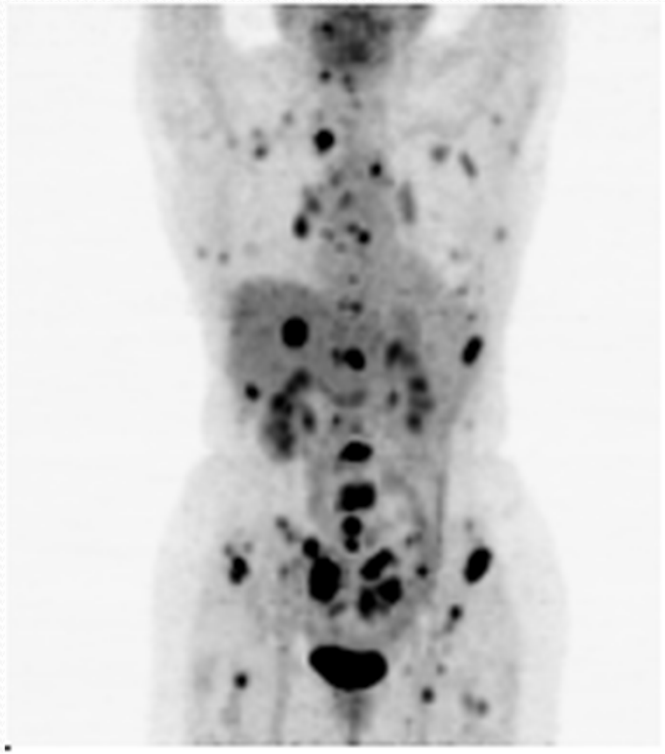
"Off hand, I'd say you're suffering from an arrow through your head, but just to play it safe, I'm ordering a bunch of tests."

PET - CT in Tumor Imaging

- Detect radiographically occult lesions
- Characterize radiographic abnormalities
- Evaluate extent of disease
- Evaluate response to therapy

^{18}F-FDG WHOLE BODY PET

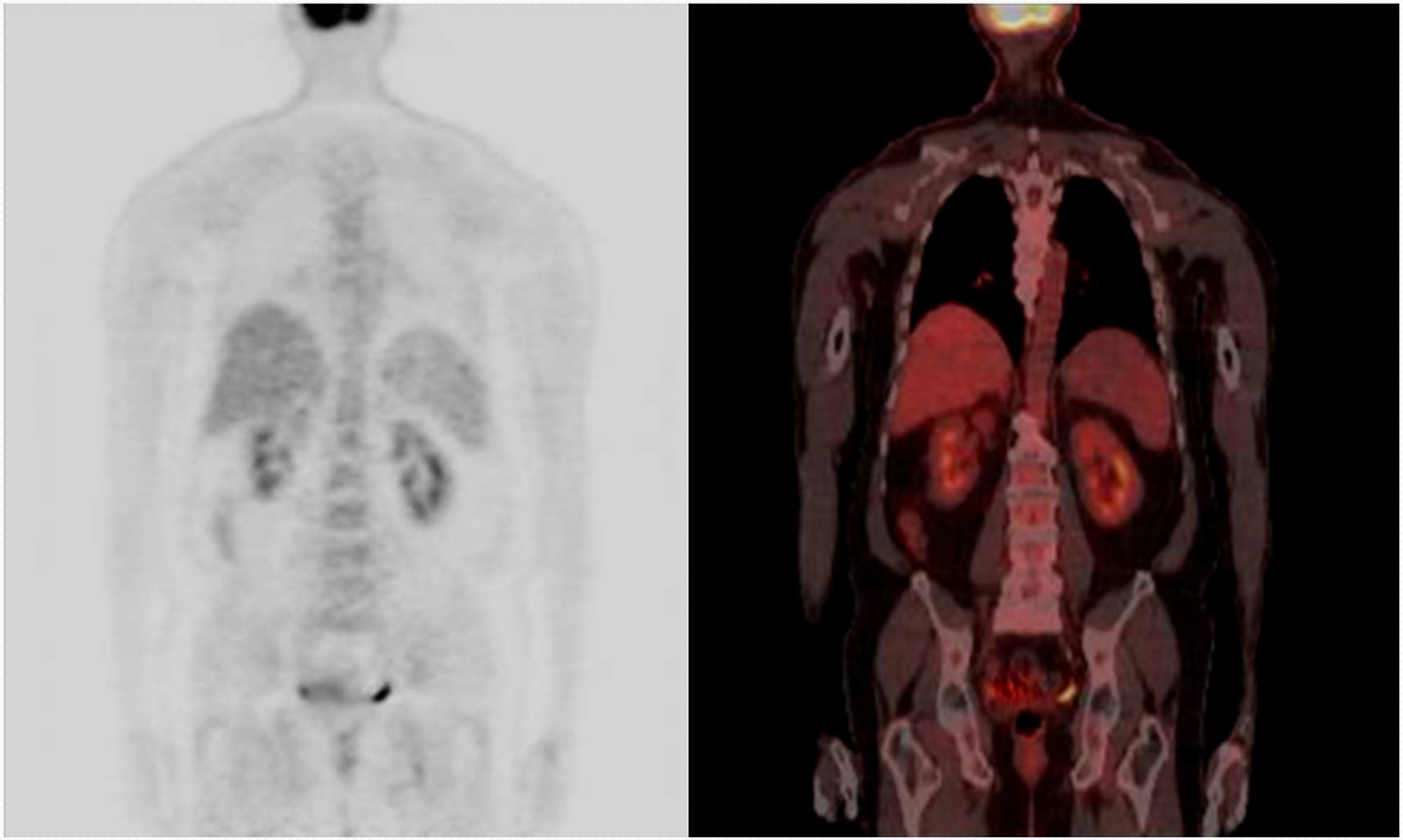
- DAGNOSIS
- STAGING
- RE-STAGING AND FOLLOW-UP
- RADIOTHERAPY



Role of PET imaging in Onco.

- Diagnosis of Malignancy. Eg SPN and Brain scan vs post tt recc.
- Grading Malignancy:-The so called metabolic Bx Prov info reg grading tumor indirectly provides info about Prog.
- Staging and Restaging Disease:-PET is found sup to other diag.
- Residual disease evaluation:-Lack of ch feature of anat imaging PET helps in this eg Lymphoma and Testicular abd masses.
- Detection of Recurrence:- eg treated cases of CRC with rising CEA.
- Measuring therapy response:-It is imp to plan future therapy strategy based on response to initial treatment and PET helps in this.Eg HL
- To Identify site of active disease:- to guide biopsy when disease is heterogenous eg STS.
- CUPS:-when an enlarged Mets node is seen to find the primary.
- For Guided biopsy and RT planning.

Normal PET - CT Body Scan



Normal PET/CT scan

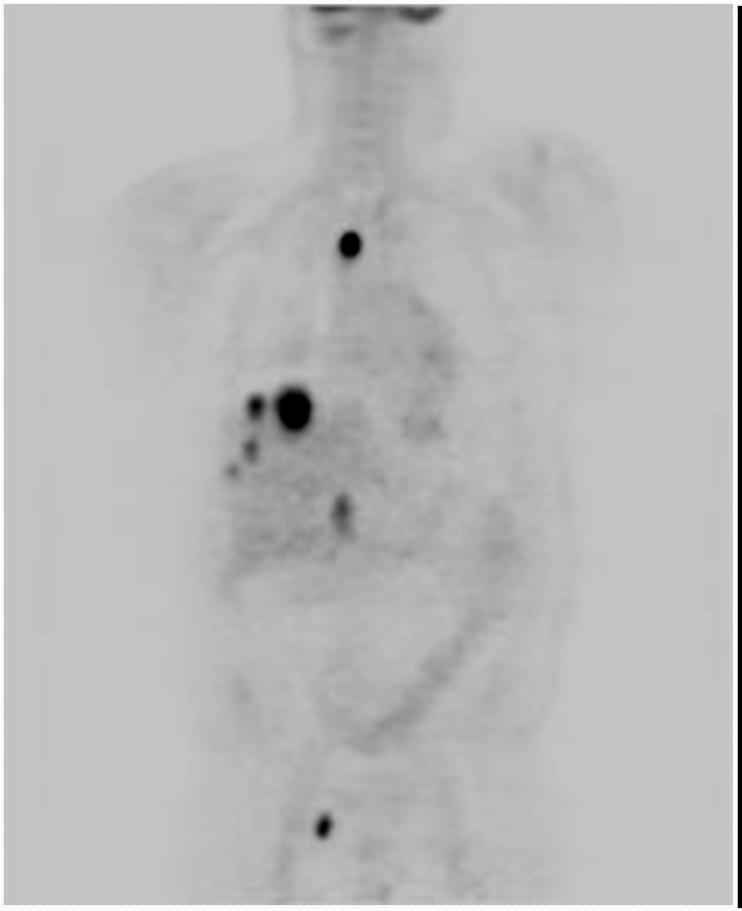
QuickTime™ and a
decompressor
are needed to see this picture.

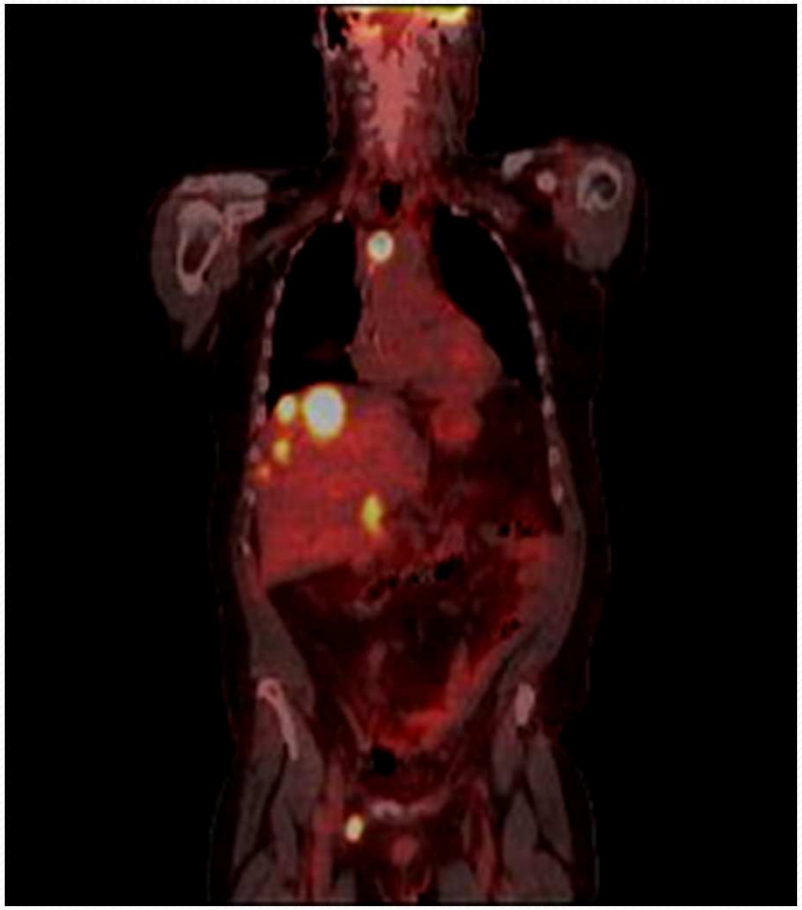
PET

CT

PET/CT

Abnormal PET - CT Body Scan





Approved Indications for PET-CT

Diagnosis, Staging, and Restaging
(unless otherwise indicated)

• Head & Neck	
• Thyroid	follicular: I -131 neg, Tg >10 ng/dL
• Breast	not breast masses or regional nodes
• Lung	only non-small cell
• Esophagus	
• Colon & Rectum	
• Cervix	CT/MRI neg for extra-pelvic mets
• Lymphoma	
• Melanoma	not regional nodes
• Other Cancers	when enrolled in NOPR

National Comprehensive Cancer Network

Practice Guidelines in Oncology

Acute Myeloid Leukemia
Bladder Cancer
Bone Cancer
Breast Cancer
Central Nervous System Tumors
Cervical Cancer
Chronic Myelogenous Leukemia
Colorectal Cancer
Esophageal Cancer
Gastric Cancer
Head and Neck Cancer
Hepatobiliary Cancer
Hodgkin's Disease
Kidney Cancer
Melanoma
Myelodysplastic Syndromes
Multiple Myeloma
Neuroendocrine Tumors
Non Hodgkin's Lymphoma
Non-Small Cell Lung Cancer
Occult Primary Cancer
Ovarian Cancer
Pancreatic Cancer
Prostate Cancer
Soft Tissue Sarcoma
Skin Cancer (except Melanoma)
Small Cell Lung Cancer
Testicular Cancer
Thyroid Cancer
Uterine Cancer

National Comprehensive Cancer Network

Practice Guidelines in Oncology

Bone Cancer
Breast Cancer

Cervical Cancer

Colorectal Cancer
Esophageal Cancer

Head and Neck Cancer

Hodgkin's Disease

Melanoma

Multiple Myeloma

Non Hodgkin's Lymphoma
Non-Small Cell Lung Cancer
Occult Primary Cancer
Ovarian Cancer

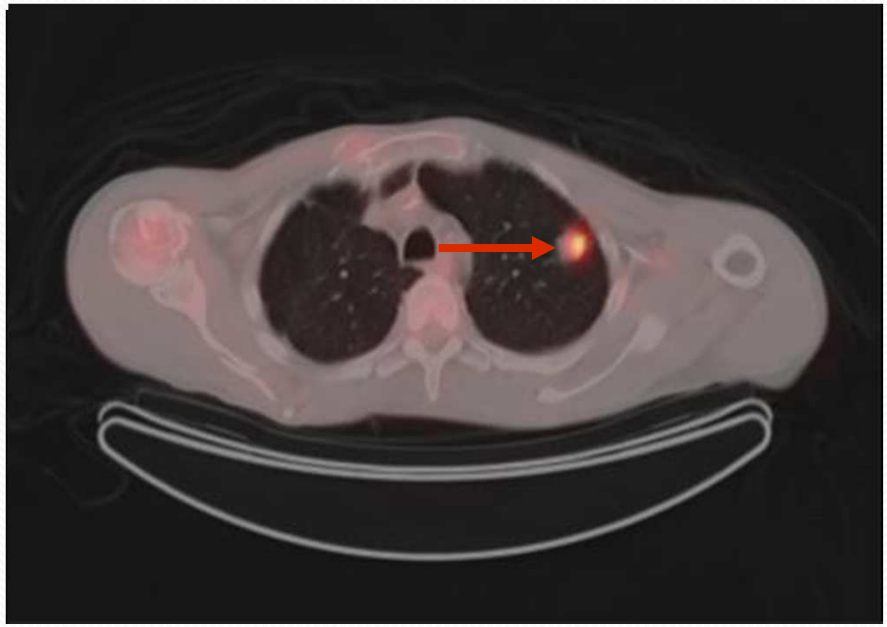
Soft Tissue Sarcoma

Small Cell Lung Cancer
Testicular Cancer
Thyroid Cancer

PET-CT and Lung Cancer

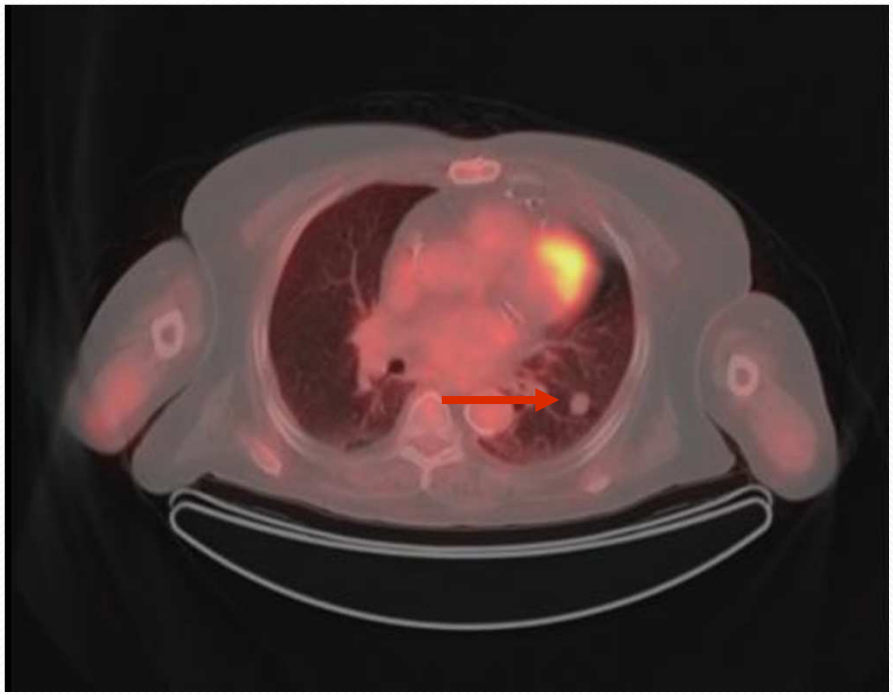
- The first FDA approaved application of PET was in characterization of SPN.
- The accuracy of detection of malignant pulmonary lesions using FDG PET is very high, typically> 90%
- The ability to image the whole body enables evaluation of nodal status and distant metastases.

Lesion Characterization



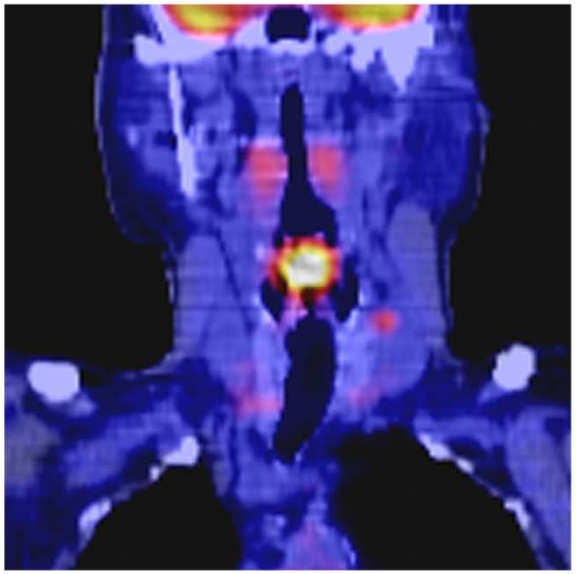
47 year old man with multiple trauma from a MVA who was incidentally discovered to have a pulmonary nodule

Lesion Characterization



84 year old man with chronic cough found to have a 13 mm nodule on CXR

Figure 1d. Images in a 62-year-old man with history of lung cancer who now has hemoptysis and was referred for evaluation for recurrent disease.

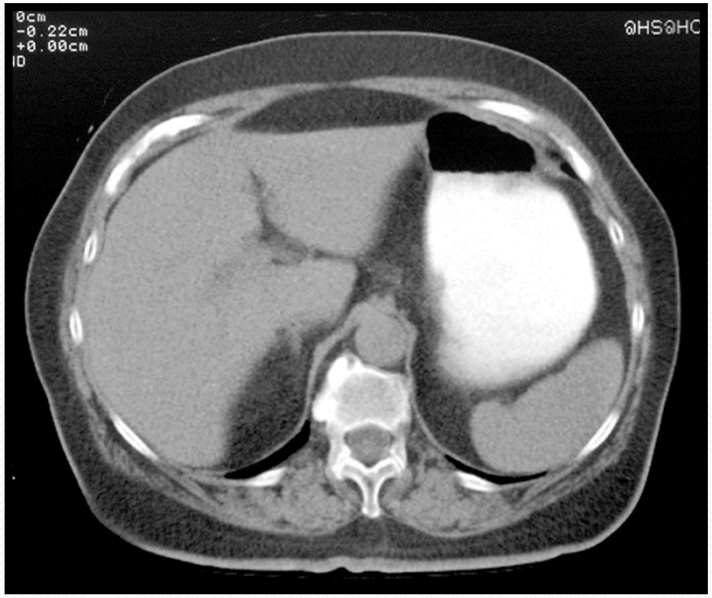


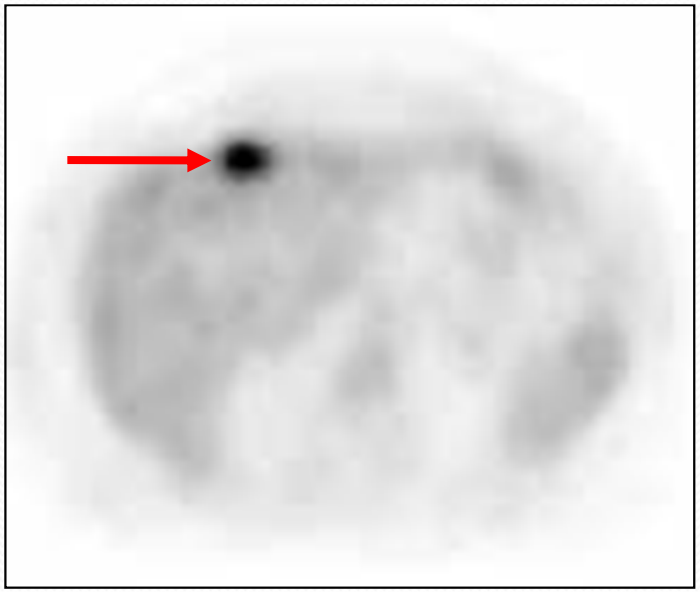
Correlation of 18F-fluorodeoxyglucose uptake on positron emission tomography with Ki-67 index and pathological invasive area in lung adenocarcinomas 30mm or less in size

European Journal of Radiology, 08/13/2010

Murakami S et al. – 18F–fluorodeoxyglucose positron emission tomography (FDG–PET) is commonly used to distinguish benign from malignant lesion. Recently, maximum standardized uptake value (SUVmax) on FDG–PET has found to have prognostic value. **SUVmax correlated significantly with Ki–67 index and diameter of the pathological invasive area. The present results suggest the potential role of FDG–PET in predicting adenocarcinomas with invasive characteristics.**

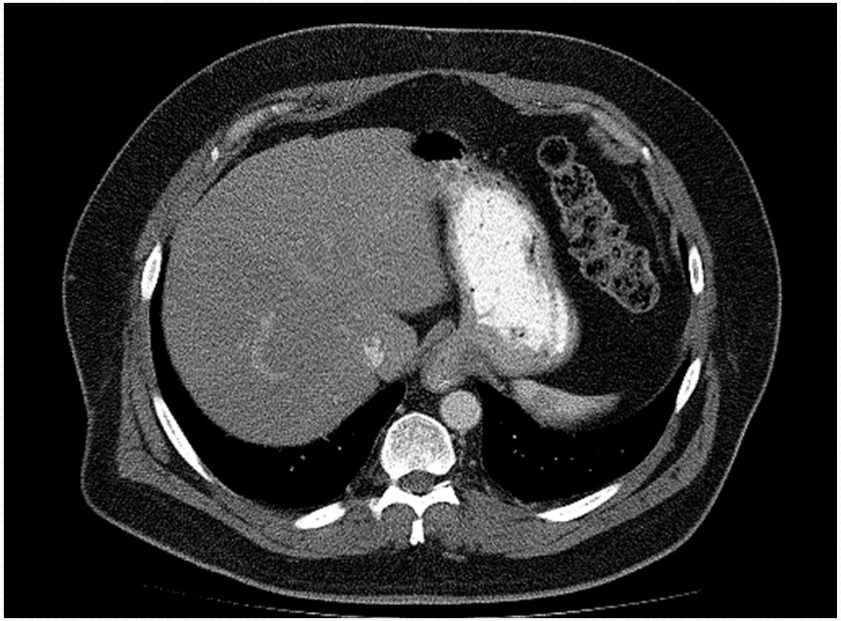
Enhanced Detection

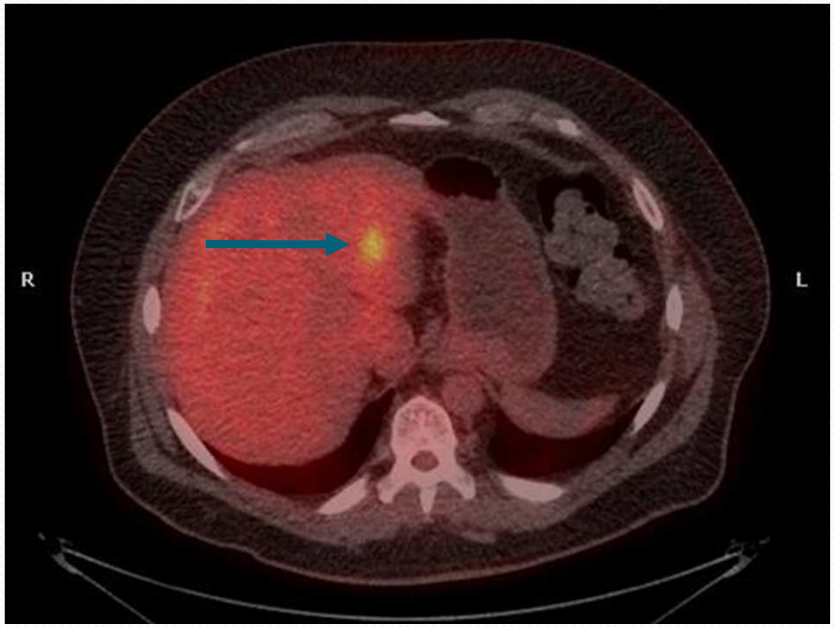




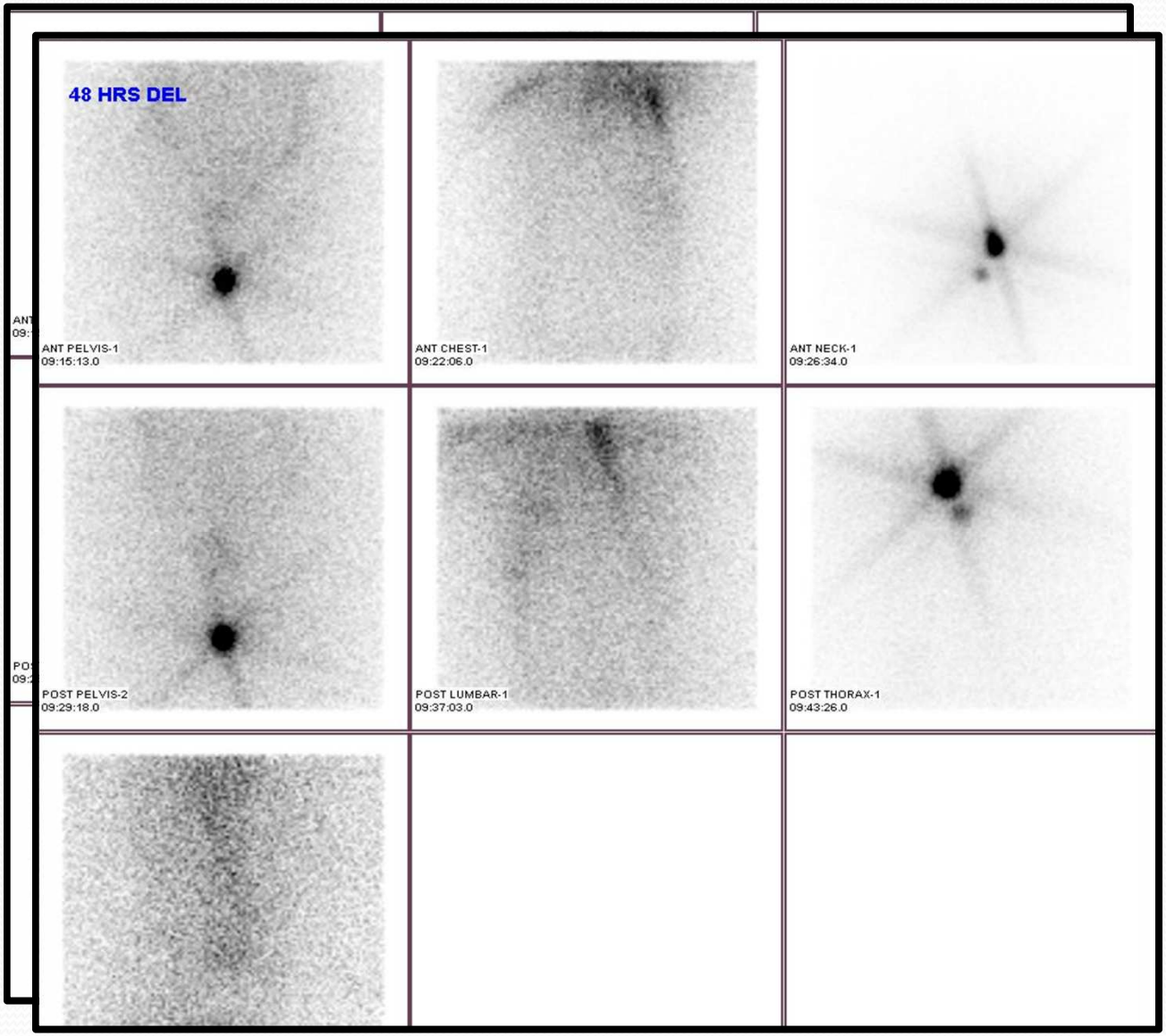
73 year old woman s/p resection for colon cancer, rising CEA level and negative CT

Enhanced Detection

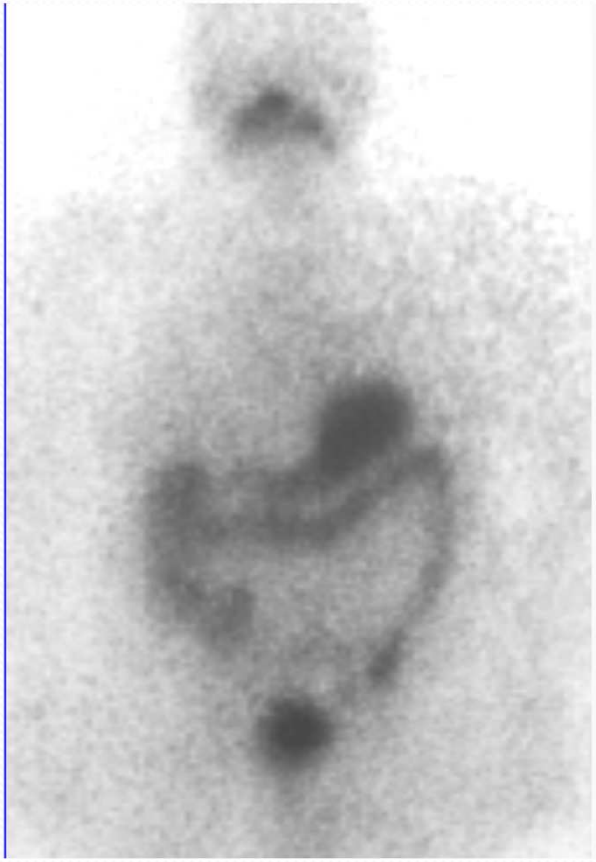


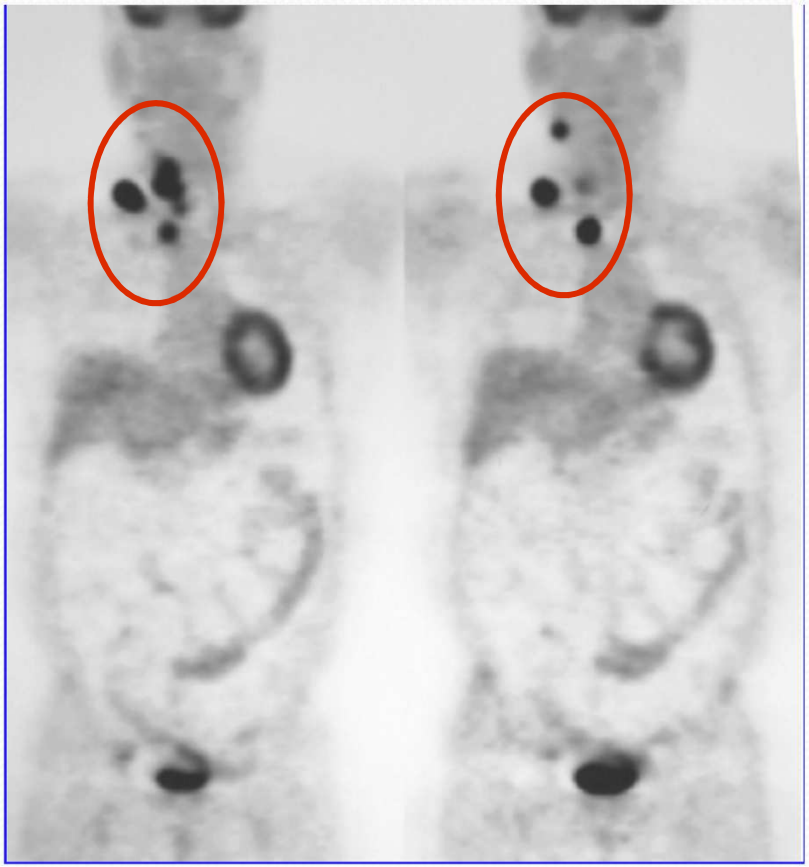


PRE THERAPY WB IODINE SCAN



Enhanced Detection





I-131

FDG PET

47 year old man with biopsy proven recurrent thyroid cancer 3 months after thyroidectomy

PET-CT and Rec Thy Ca

Positron emission tomography and positron emission tomography-CT evaluation for recurrent papillary thyroid carcinoma : Meta-analysis and literature review

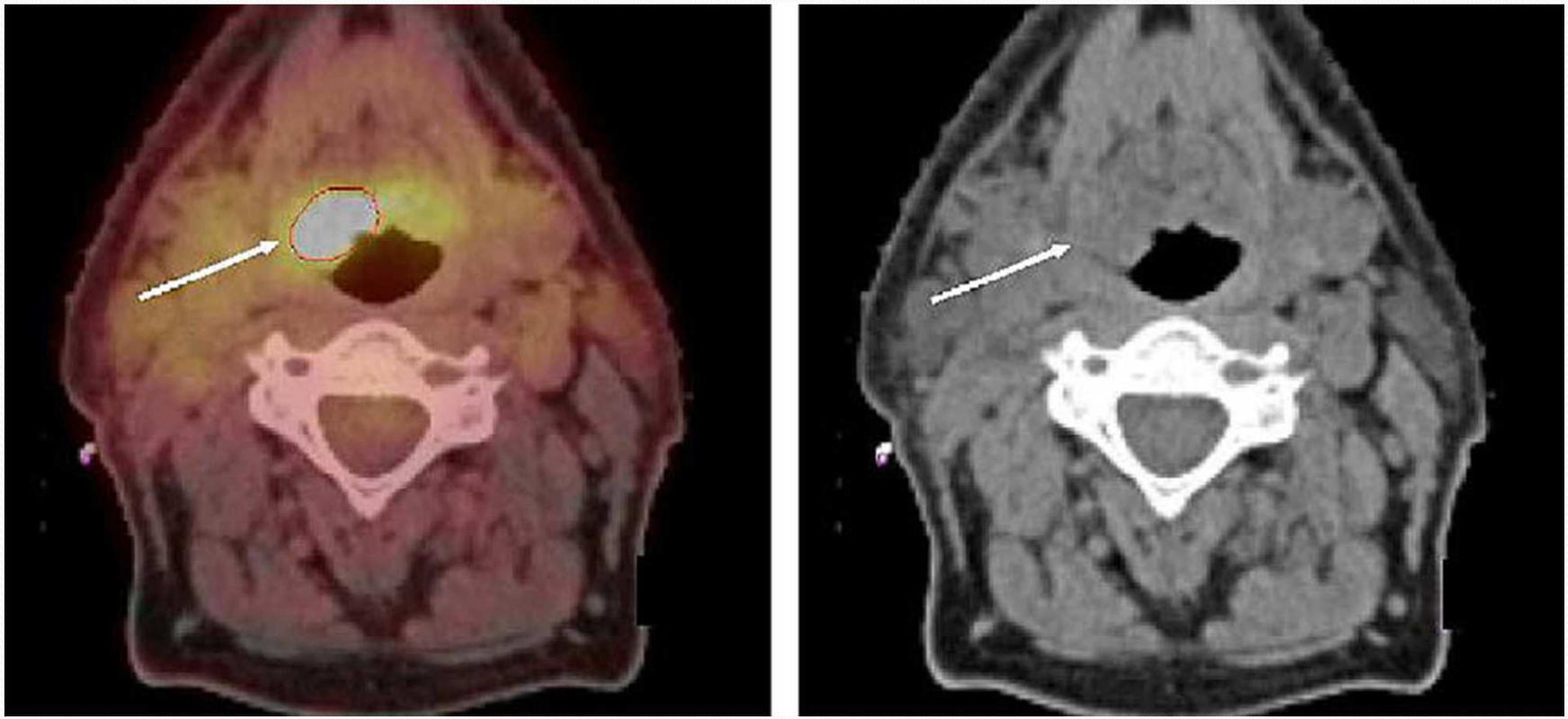
Head & Neck, 08/16/2010 Evidence Based Medicine

Miller ME et al. – Sensitivity and specificity data regarding positron emission tomography (PET) and PET/CT for surveillance of well–differentiated thyroid cancer does not evaluate subtypes separately. PET and PET/CT are useful modalities in surveillance of papillary thyroid carcinoma. This is the first study to examine papillary thyroid carcinoma independently of other subtypes of well–differentiated thyroid carcinoma.

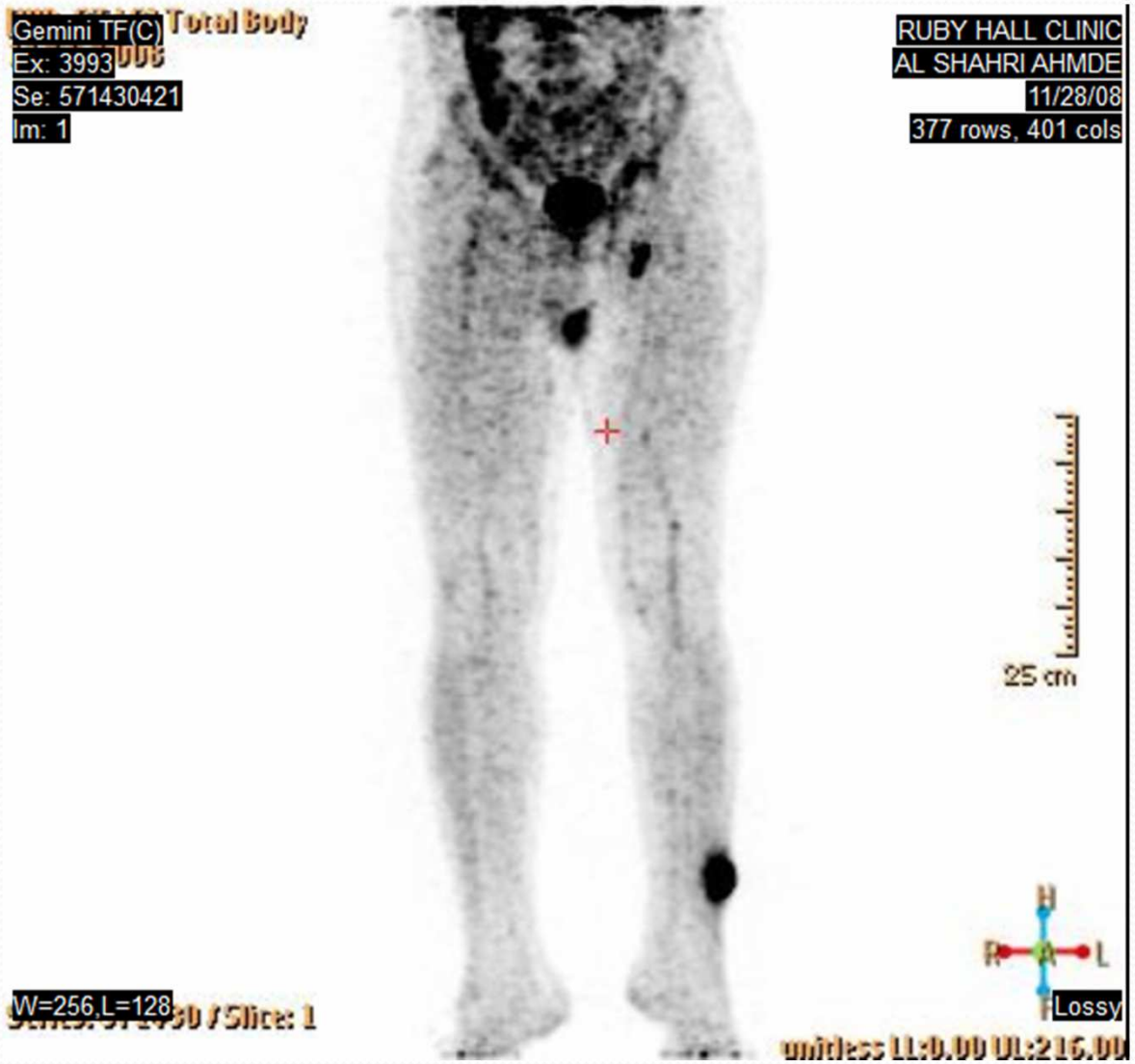
Unknown Primary

QuickTime™ and a
decompressor
are needed to see this picture.

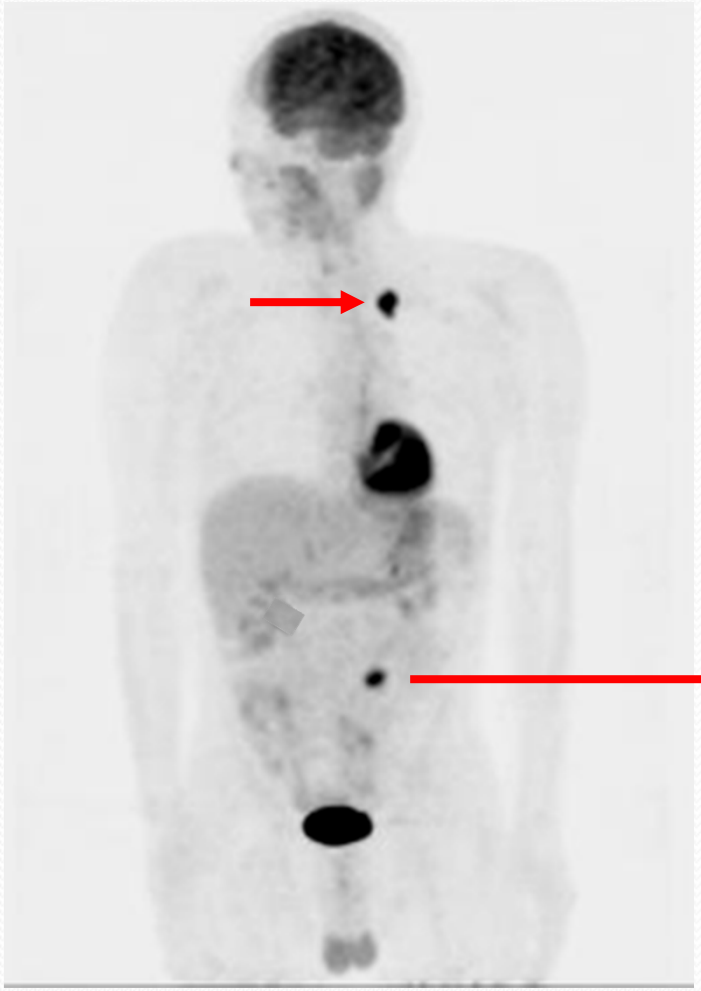
68 year old man who presented with right neck mass

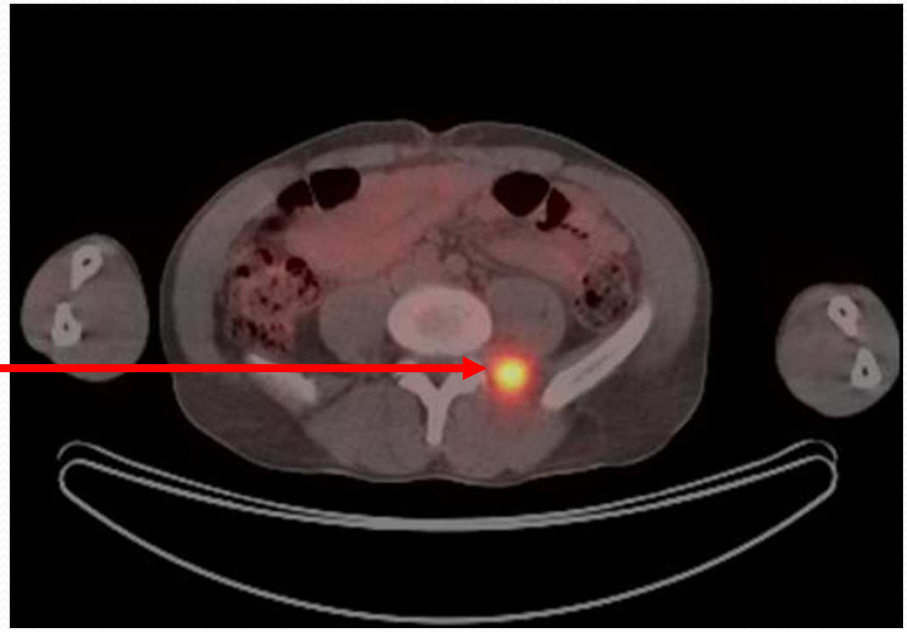


Metastatic Cx LN with unknown primary ,MR negative PET +ve detection


Gemini TF(C) Total Body
Ex: 3993
Se: 571430421
Im: 1
RUBY HALL CLINIC
AL SHAHRI AHMDE
11/28/08
377 rows, 401 cols
25 cm
H
R
A
L
F
Lossy
W=256,L=128
/ Slice: 1
unitless LL:0.00 UL:216.00

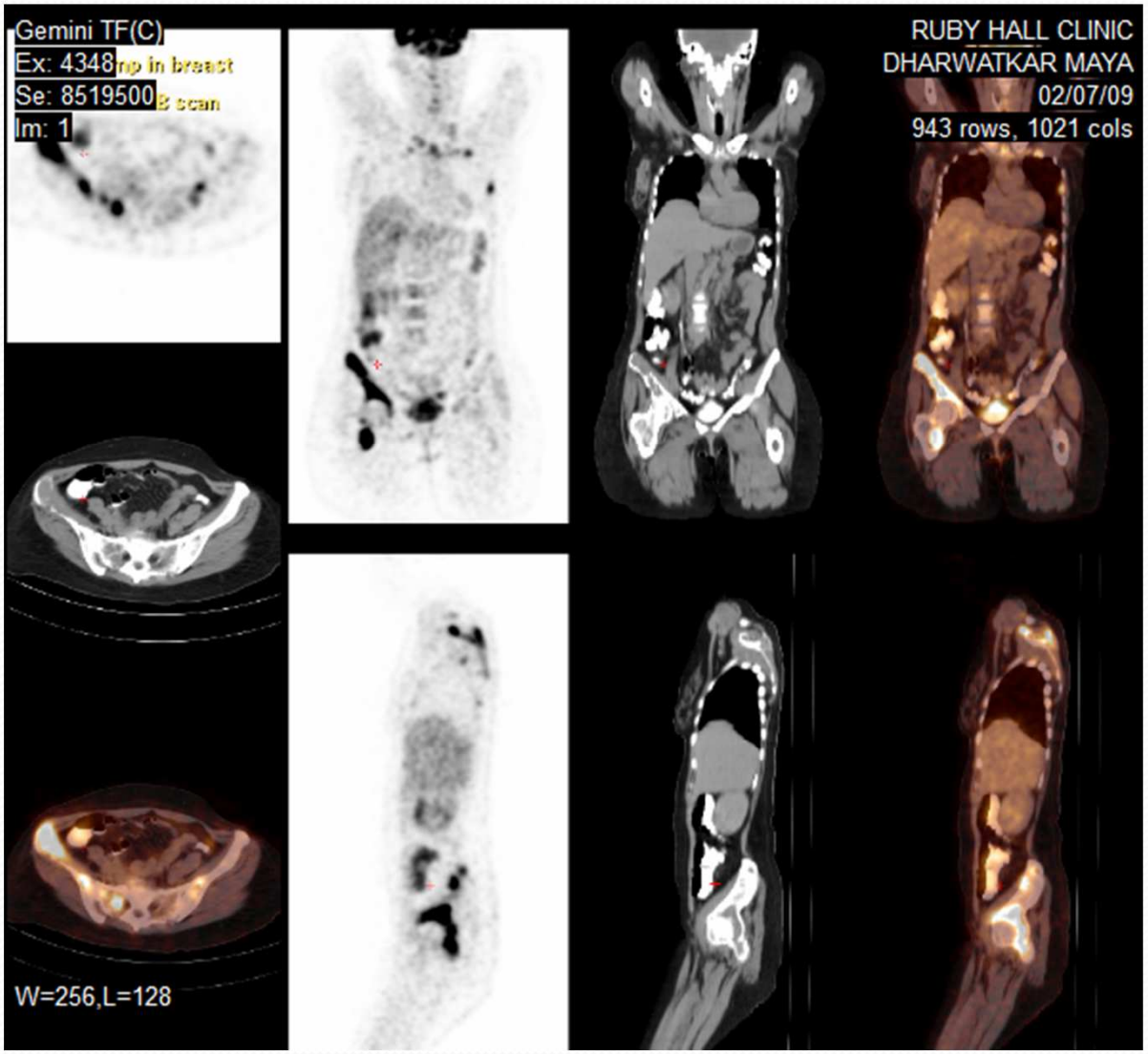
Staging





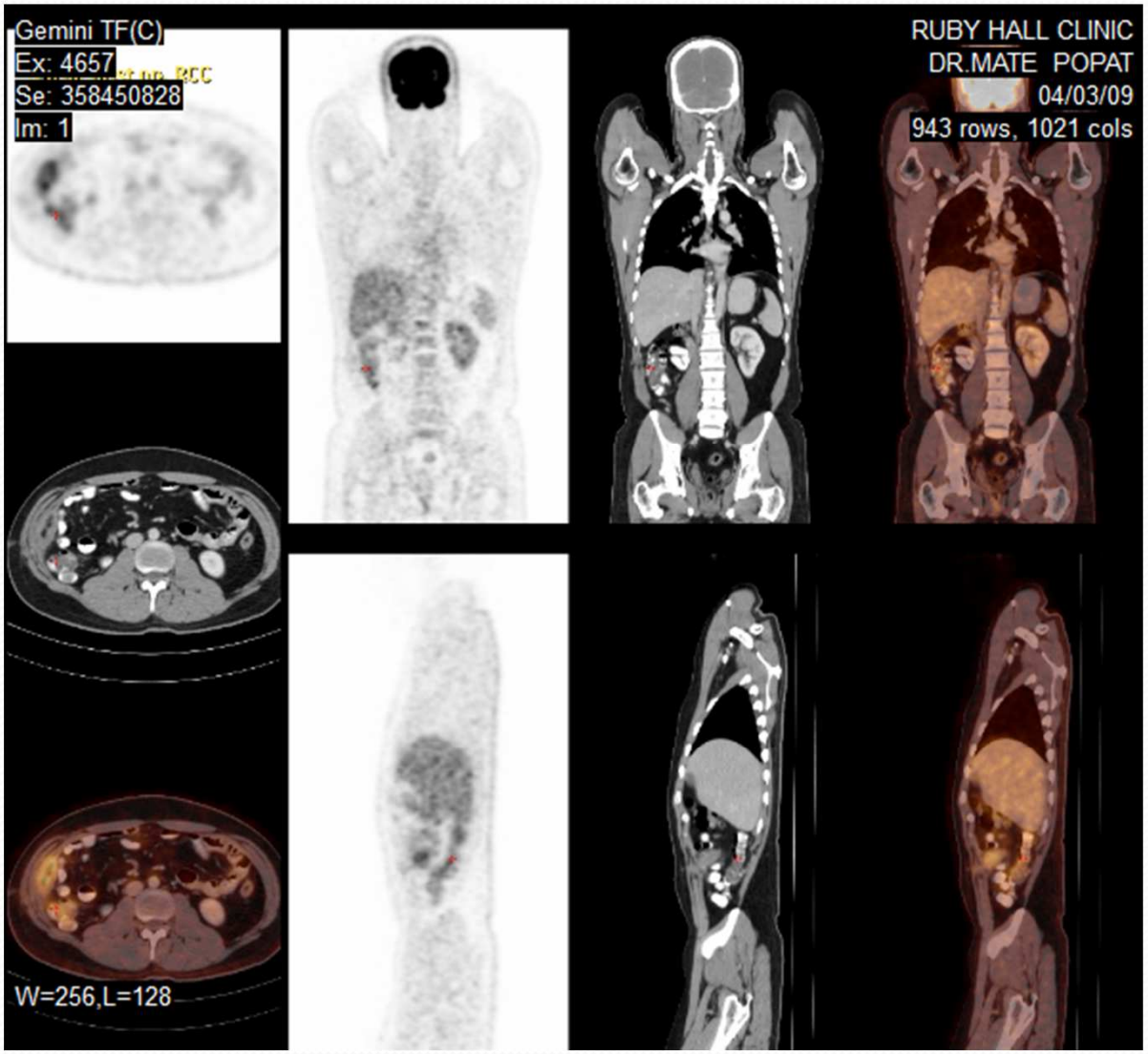
49 year old man with new lung cancer


Gemini TF(C)
Ex: 3725
Se: 97876031
Im: 1
<Full Institution Name>
BHADALE SAMBHAJI
09/27/08
446 rows, 251 cols
25 cm
PT Series: 978760 / Slice: 67
CT Series: 3 / Slice: 67
W=256,L=128
SUV LL:0.00 ULossy
Width:350 Level:35



52 Yr F c/o Ca Breast with mets.

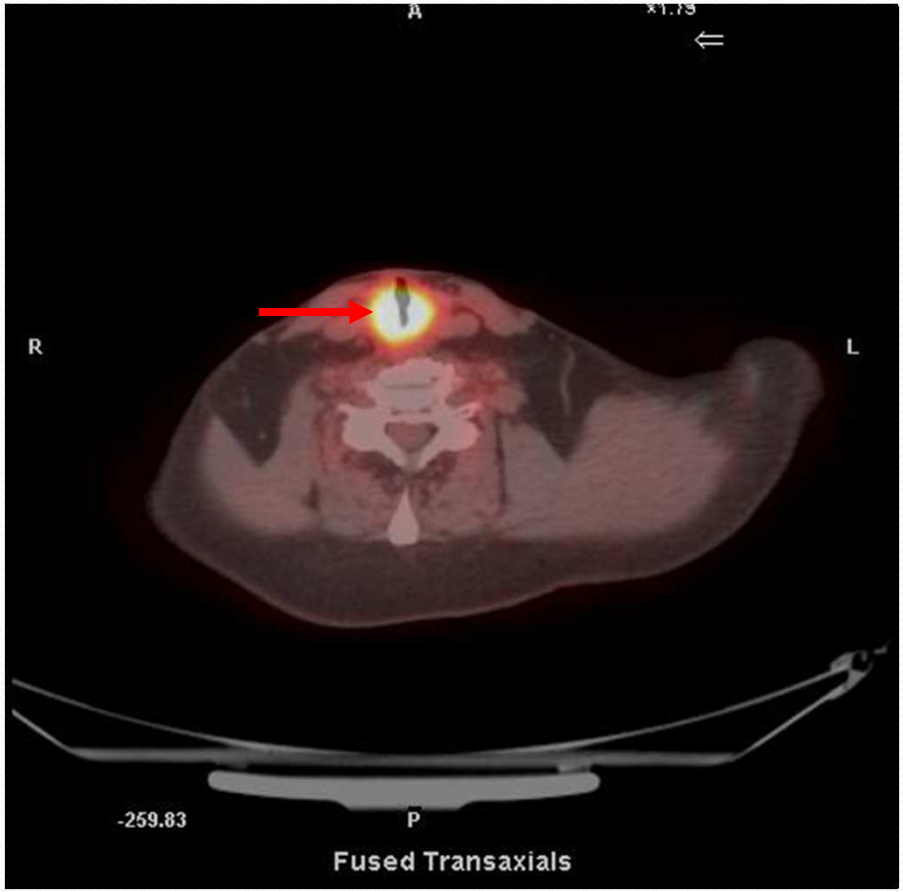
35/F with Ca Cx and post CT and RT for restaging.



43 Male with post op case of RCC for Restaging.

Recurrent Disease

QuickTime™ and a
decompressor
are needed to see this picture.



64 year old man s/p laryngectomy, now has dysphagia

Tongue Ca ? Recurrent post Ch and RT

Figure 2B. Transaxial images in a 64-year-old man with tongue cancer; status after chemotherapy and radiation therapy.

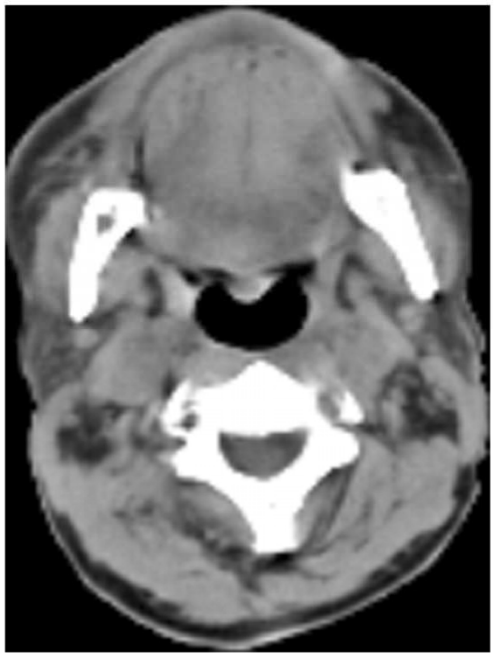
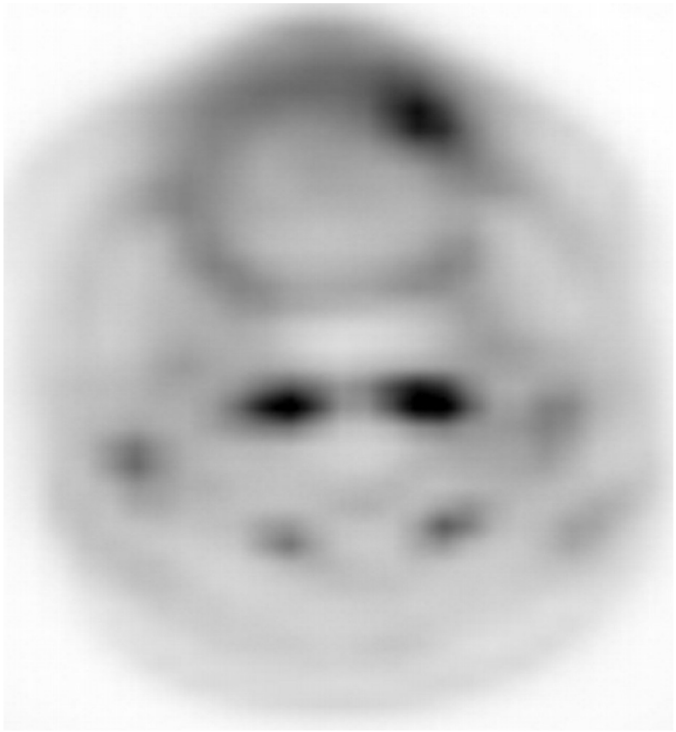


Figure Transaxial images in a 64-year-old man with tongue cancer; status after chemotherapy and radiation thrapy. Now Rec Tongue ca not seen by CT.



Role of PET in Head and Neck Ca

- Assessment of Distant Mets
- Ass. Synchronous 2nd primary.
- Detection of CUPS
- Ass. Residual and Recurrent disease.
- Precise delineation of tumor vol for RTP monitoring and providing prog information,

Clinical Application in H & N Ca

- Journal of Oncology
  Volume 2009 (2009), Article ID 208725, 13 pages
  doi:10.1155/2009/208725

- **Review Article**
- **Clinical Applications of FDG PET and PET/CT in Head and Neck Cancer**

- Akram Al-Ibraheem, Andreas Buck, Bernd Joachim Krause, Klemens Scheidhauer, and Markus Schwaiger

- Department of Nuclear Medicine, Technische Universität München, Ismaninger Strasse 22, 81675 Munich, Germany

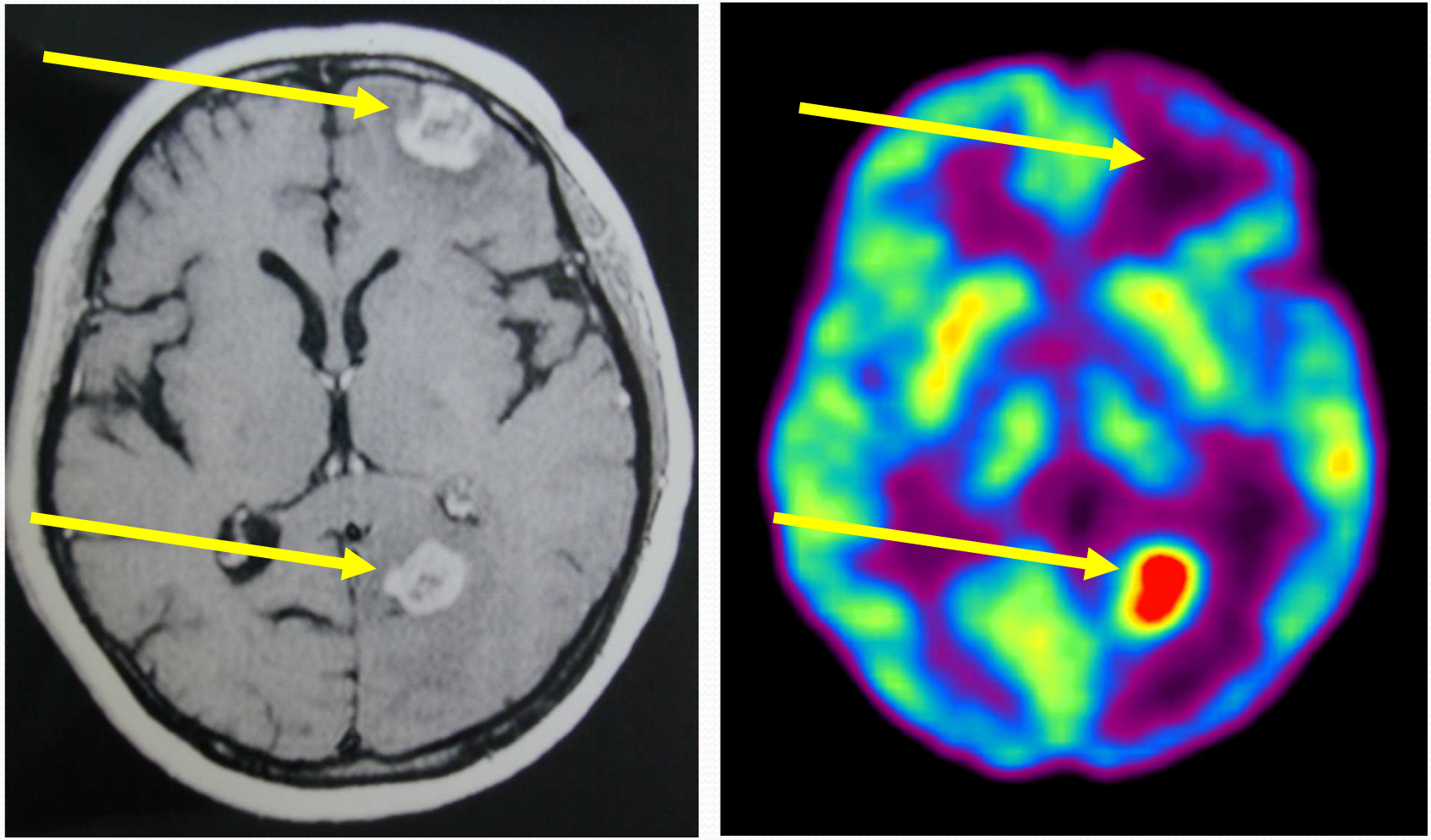
- Received 28 February 2009; Accepted 17 June 2009

- Academic Editor: Paul Harari

- **Abstract**
- 18F-FDG PET plays an increasing role in diagnosis and management planning of head and neck cancer. Hybrid PET/CT has promoted the field of molecular imaging in head and neck cancer. This modality is particular relevant in the head and neck region, given the complex anatomy and variable physiologic FDG uptake patterns. The vast majority of 18F-FDG PET and PET/CT applications in head and neck cancer related to head and neck squamous cell carcinoma. Clinical applications of 18F-FDG PET and PET/CT in head and neck cancer include diagnosis of distant metastases, identification of synchronous 2nd primaries, detection of carcinoma of unknown primary and detection of residual or recurrent disease. **Emerging applications are precise delineation of the tumor volume for radiation treatment planning, monitoring treatment, and providing prognostic information. The clinical role of 18F-FDG PET/CT in No disease is limited which is in line with findings of other imaging modalities. MRI is usually used for T staging with an intense discussion concerning the preferable imaging modality for regional lymph node staging as PET/CT, MRI, and multi-slice spiral CT are all improving rapidly. Is this review, we summarize recent literature on 18F-FDG PET and PET/CT imaging of head and neck cancer.**

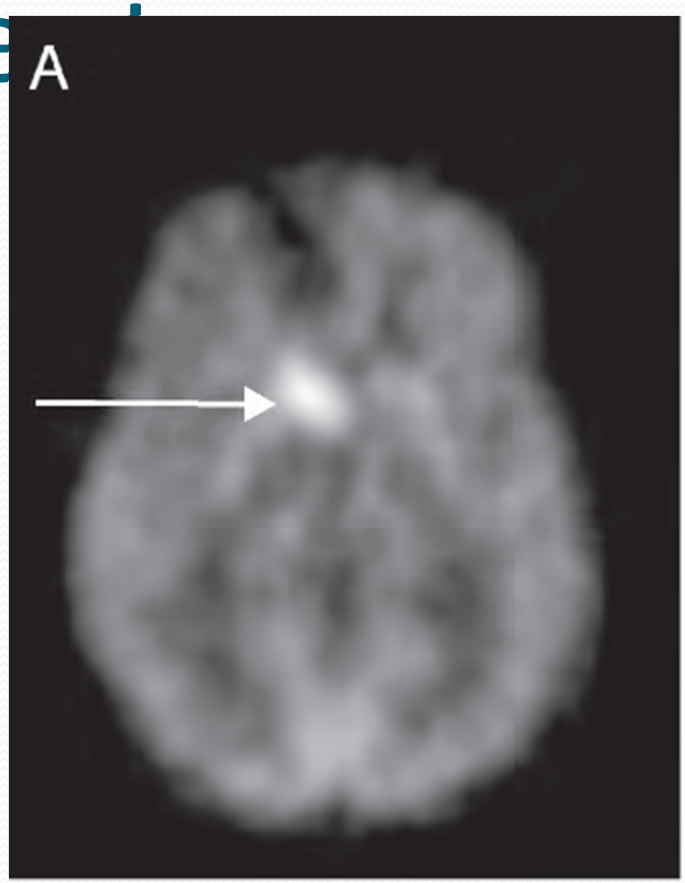
FDG PET – brain tumor post th

two foci on CT, only one viable tumor

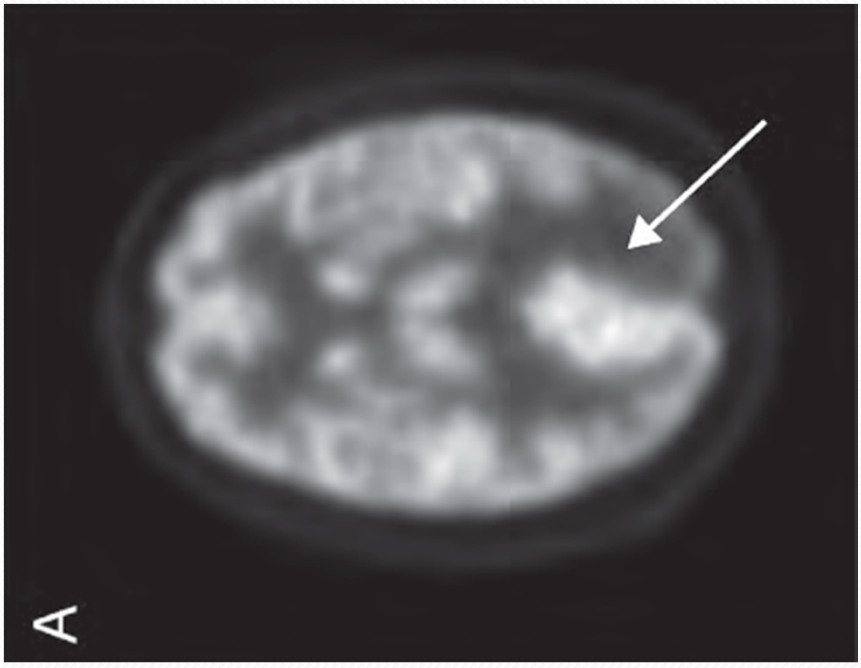


Anaplastic Oligodendroblastoma Post Sx

Post Sx Re



Grading Tumor: Astrocytoma


A

Clinical application of PET in BT

- 1.Initial Evaluation of Tum
- Determine grade/degree of malig
- Determine optimal site for sterettac Bx.
- Assessment of prognosis.
- 2.Post Therapy evaluation
- Detection of recurrent tumor
- Detection of residual/recurrent Tr post Sx
- Monitoring treatment response
- Diff rec/necrosis post RT
- Grading Malignancy
-

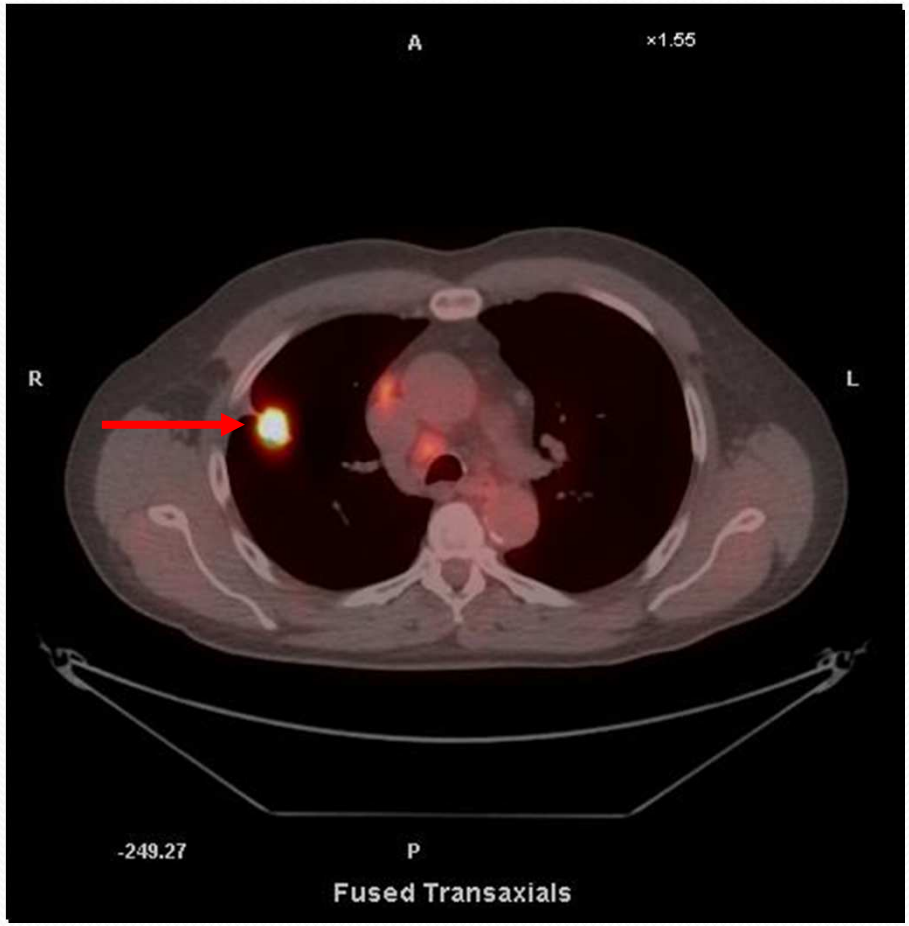
PET and MR in Glioma

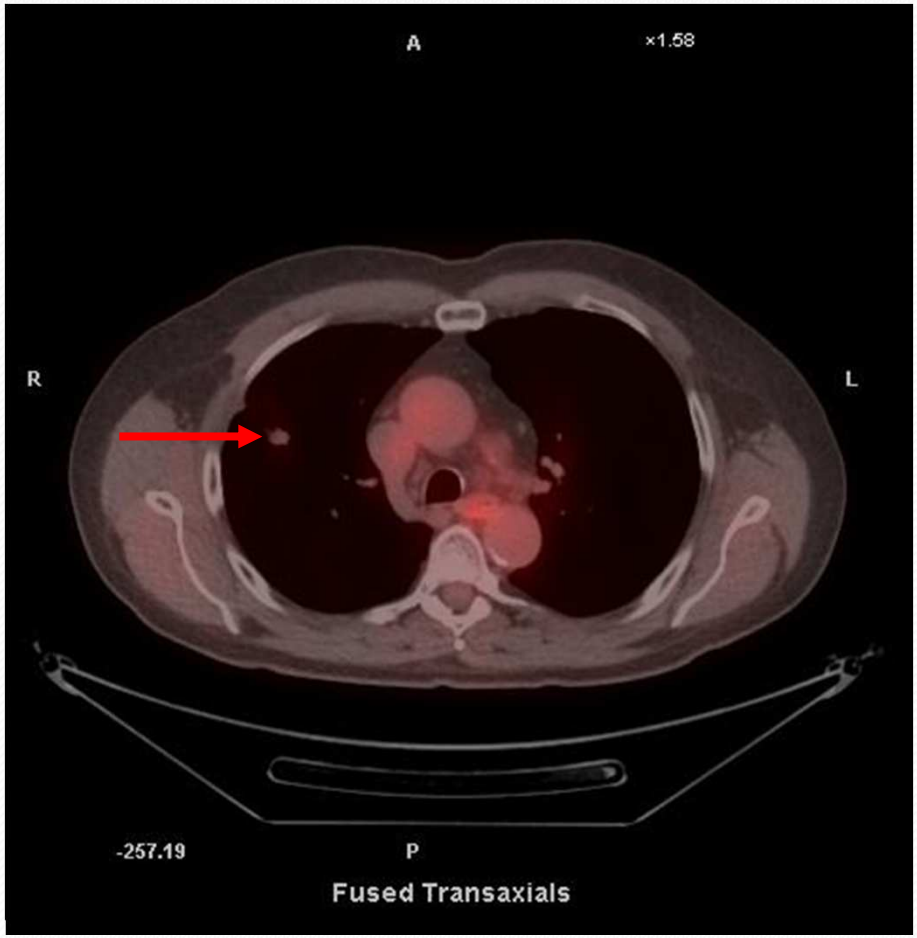
Advanced MRI and PET imaging for assessment of treatment response in patients with gliomas

The Lancet Neurology, 08/17/2010 Clinical Article

Dhermain FG et al. – T1–weighted MRI, with or without gadolinium, is the gold standard method. However, this technique only reflects biological activity of the tumour indirectly by detecting the breakdown of the blood—brain barrier. Therefore, especially for low–grade glioma or after treatment, T1–weighted MRI enhanced with gadolinium has substantial limitations. Development of more advanced imaging methods to improve outcomes for individual patients is needed. New imaging methods based on MRI and PET can be employed in various stages of disease to target the biological activity of the tumour cells (eg, increased uptake of aminoacids or nucleoside analogues), the changes in diffusivity through the interstitial space (diffusion–weighted MRI), the tumour–induced neovascularisation (perfusion–weighted MRI or contrast–enhanced MRI, or increased uptake of aminoacids in endothelial wall), and the changes in concentrations of metabolites (magnetic resonance spectroscopy). These techniques have advantages and disadvantages, and should be used in conjunction to best help individual patients.

Monitoring Response

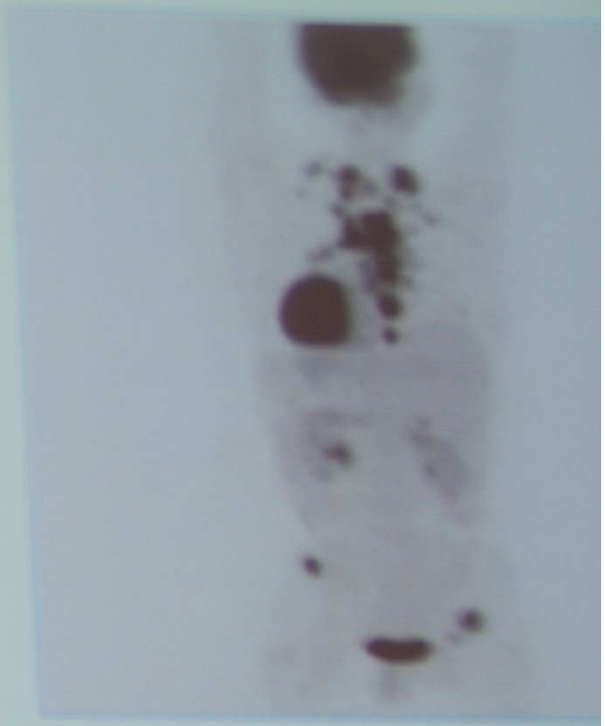




63 year old man stage 3A lung cancer, has received 4 cycles of chemotherapy

...east cancer: disease progression

Biograph



28 min (8/05)

10.6 mCi, 115 min pi
4 min/bed, 7 beds
3i / 8s; 6f

15 min (5/06)

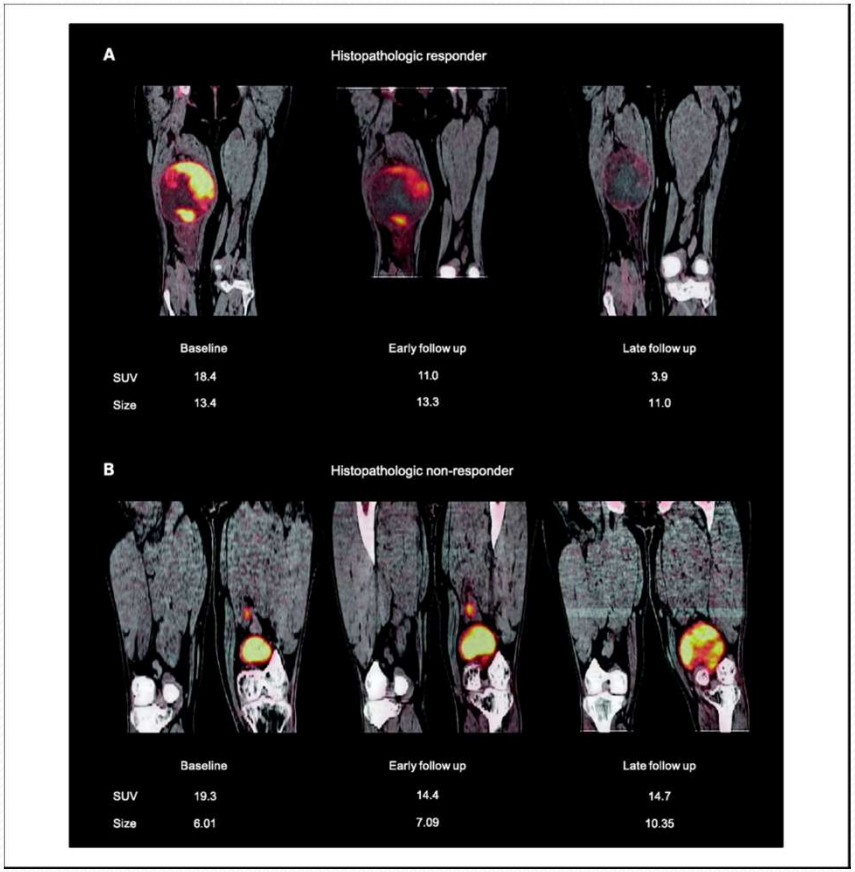
10.5 mCi, 104 min pi
3 min/bed, 5 beds
3i / 8s; 6f

Scan duration: 15

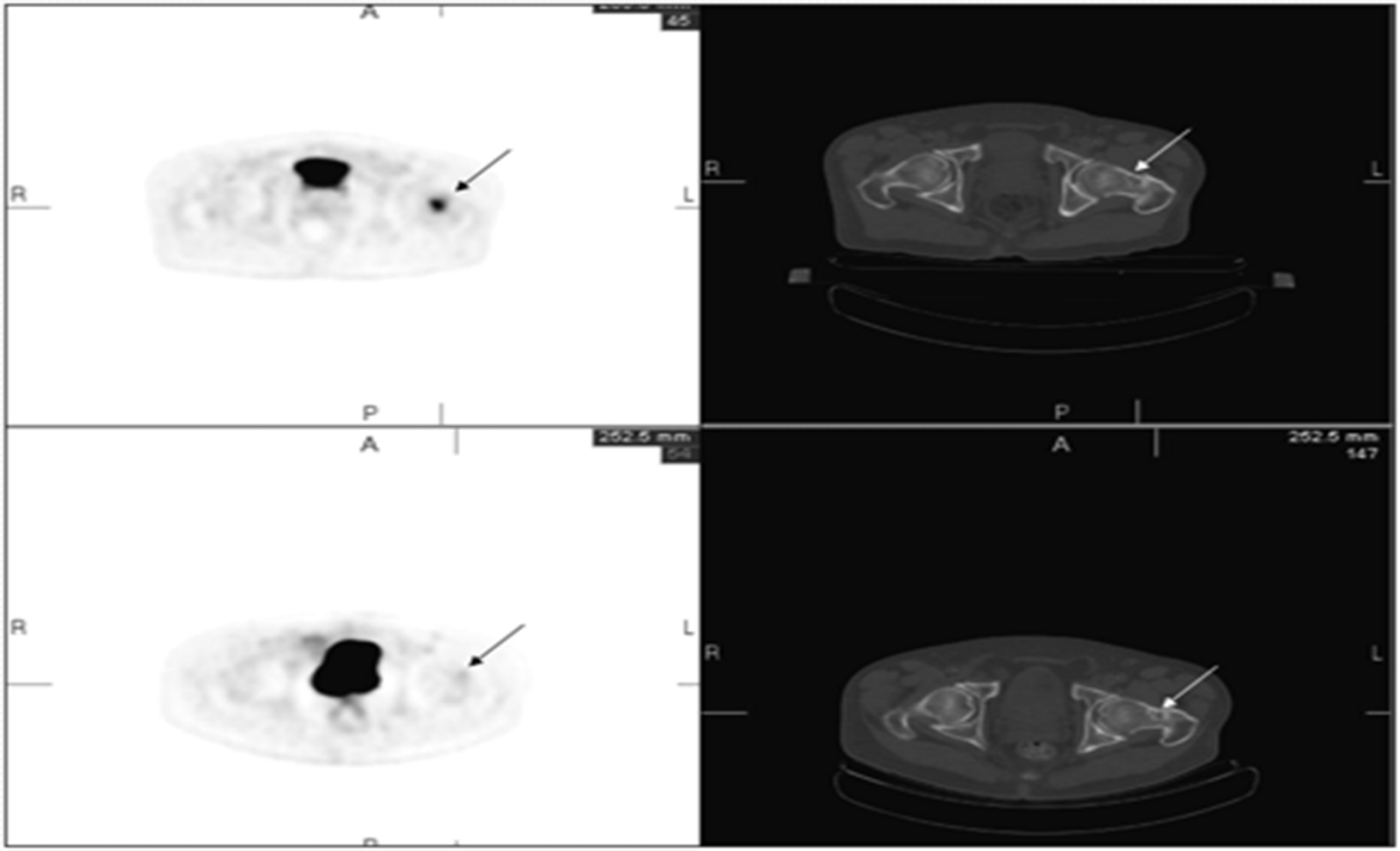
...year-old female (200 lbs) with history of breast cancer. PET/CT on 8/05 showed in...
...ake in bilateral supraclavicular, mediastinal and right parasternal nodes and the th...
...T/CT on 5/06 showed significant disease progression including sternum and pelvi...

12/11/2007

B/L early and late PET scan histopathological responder (A) and a non-responder (B). Changes in tumor SUVpeak and tumor sizes are indicated.



Response ass.With PET vs CT



Ca Colon with rising CEA

CT + PET/CT vs PET/ CT

MOST CASES

- Standard CT followed by PET/CT if needed

SOME CASES

- PET/CT

  CT component can be low resolution or optimized

Problems and Pitfalls

- False negative findings

  Tumor histology

  Lesions smaller than 5 mm

  Diabetes/Non-fasting patients

- False positive findings

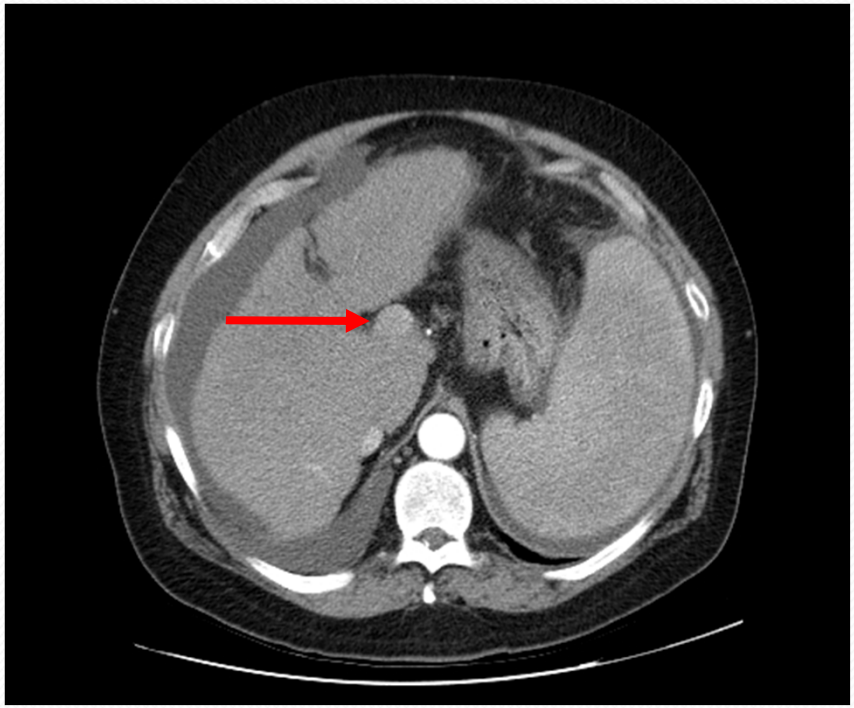
  Normal physiology

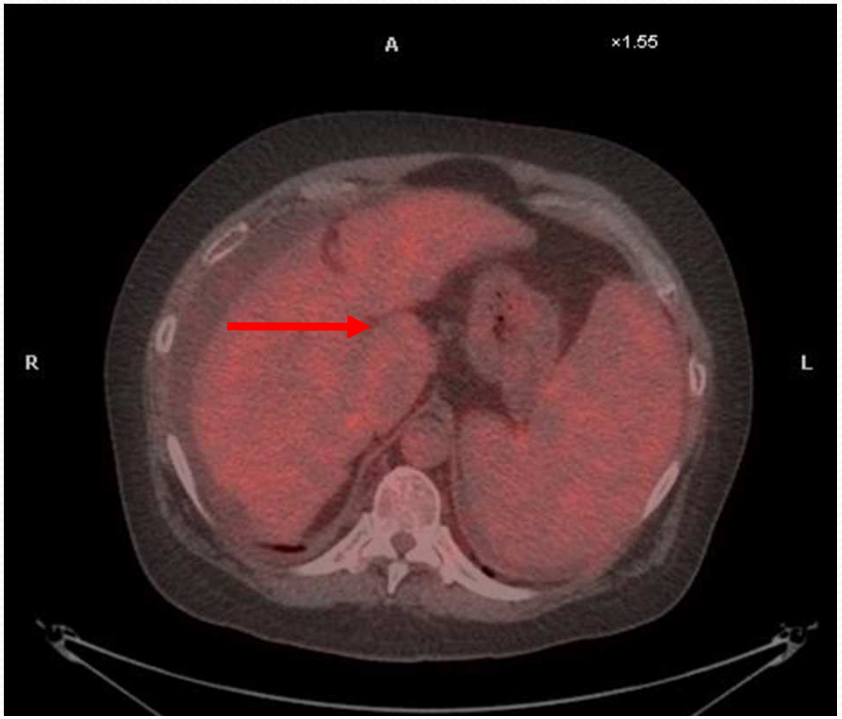
  Granulomas and other infections

  Adenomas

Standard CT

PET/CT





56 year man with HCV, end stage liver disease, and presumed hepatoma

Physiologic Uptake: Brown Fat

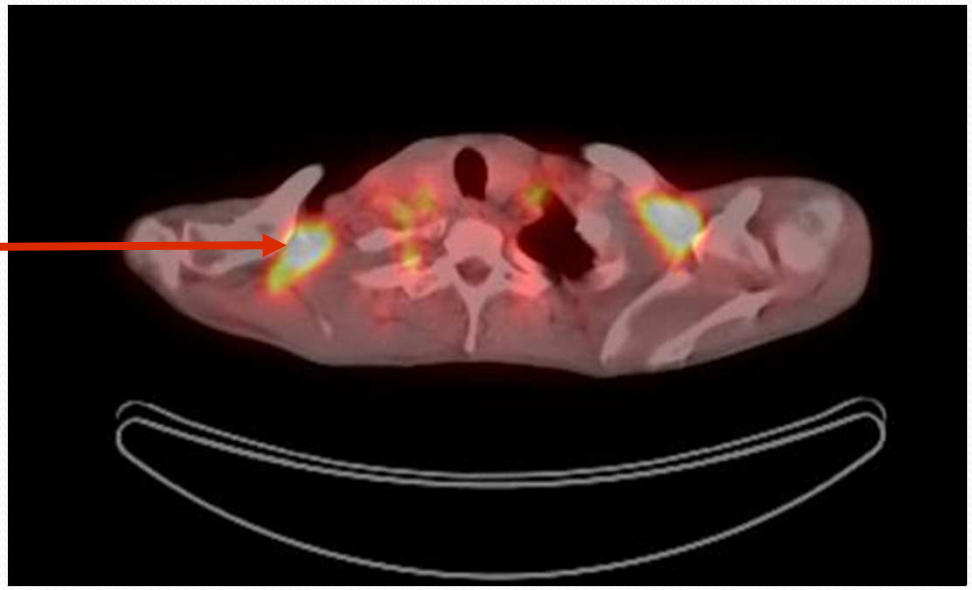
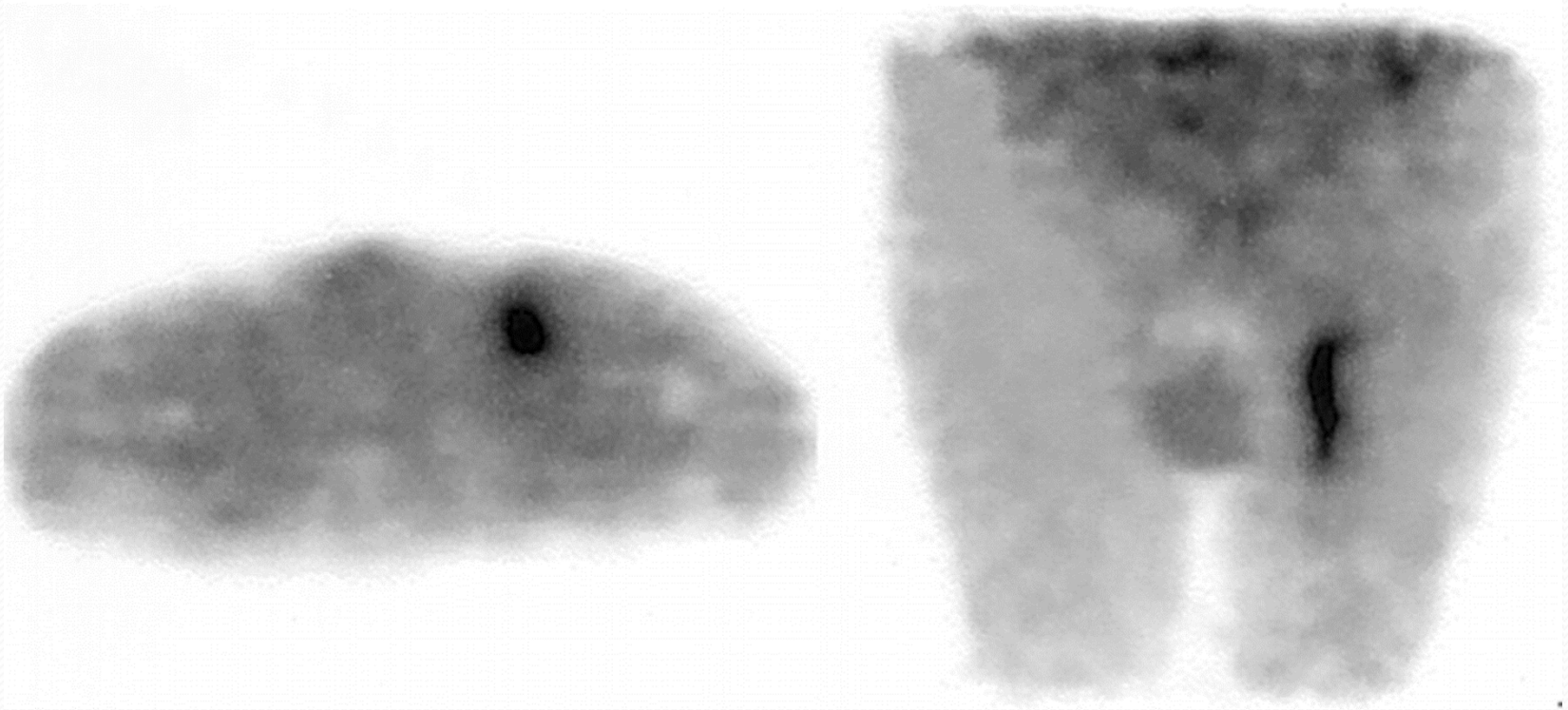


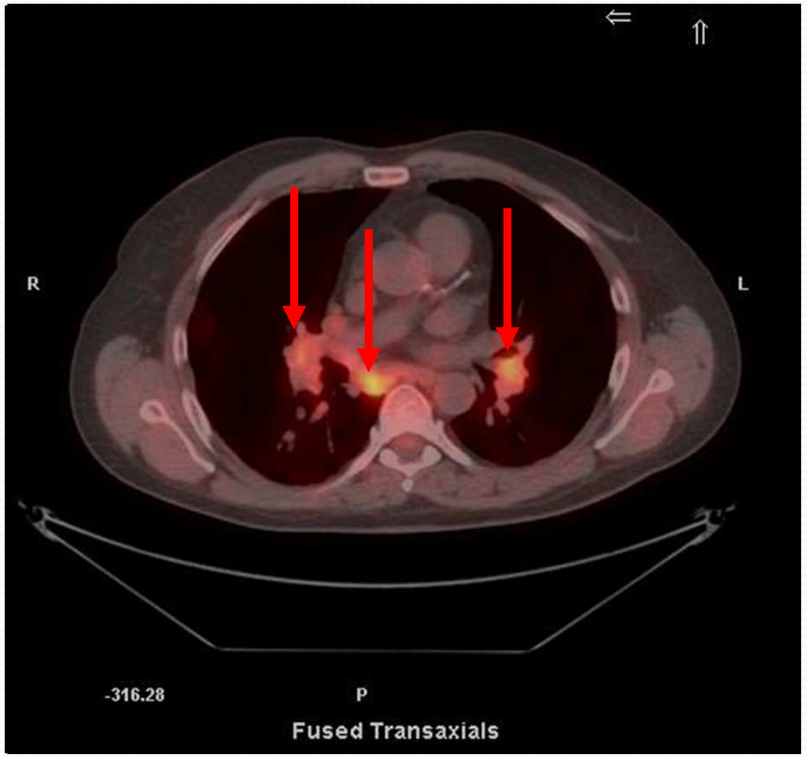
Figure 5. Infected bypass graft.



Infected vascular graft

Granulomatous Disease

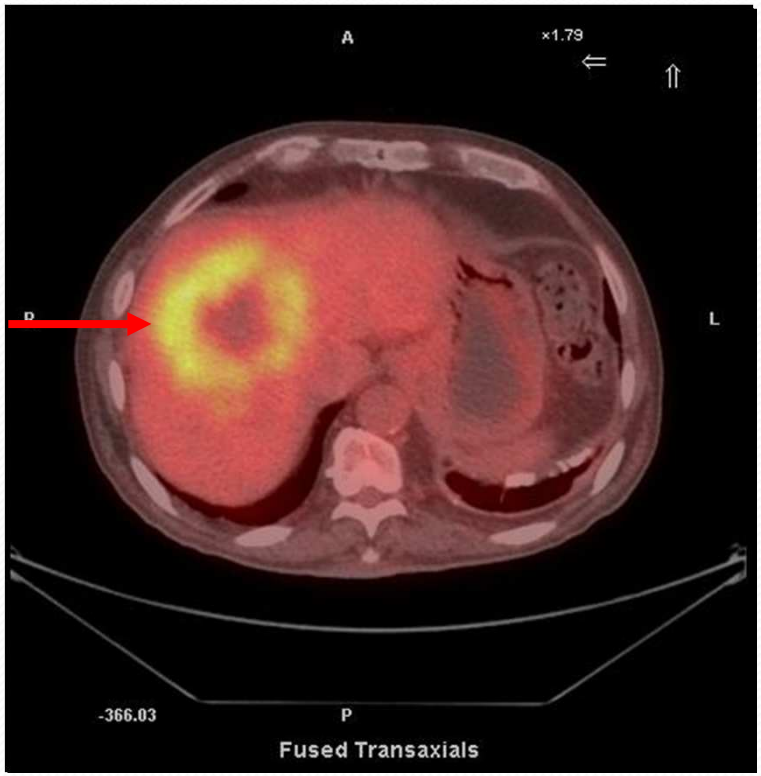
QuickTime™ and a
decompressor
are needed to see this picture.



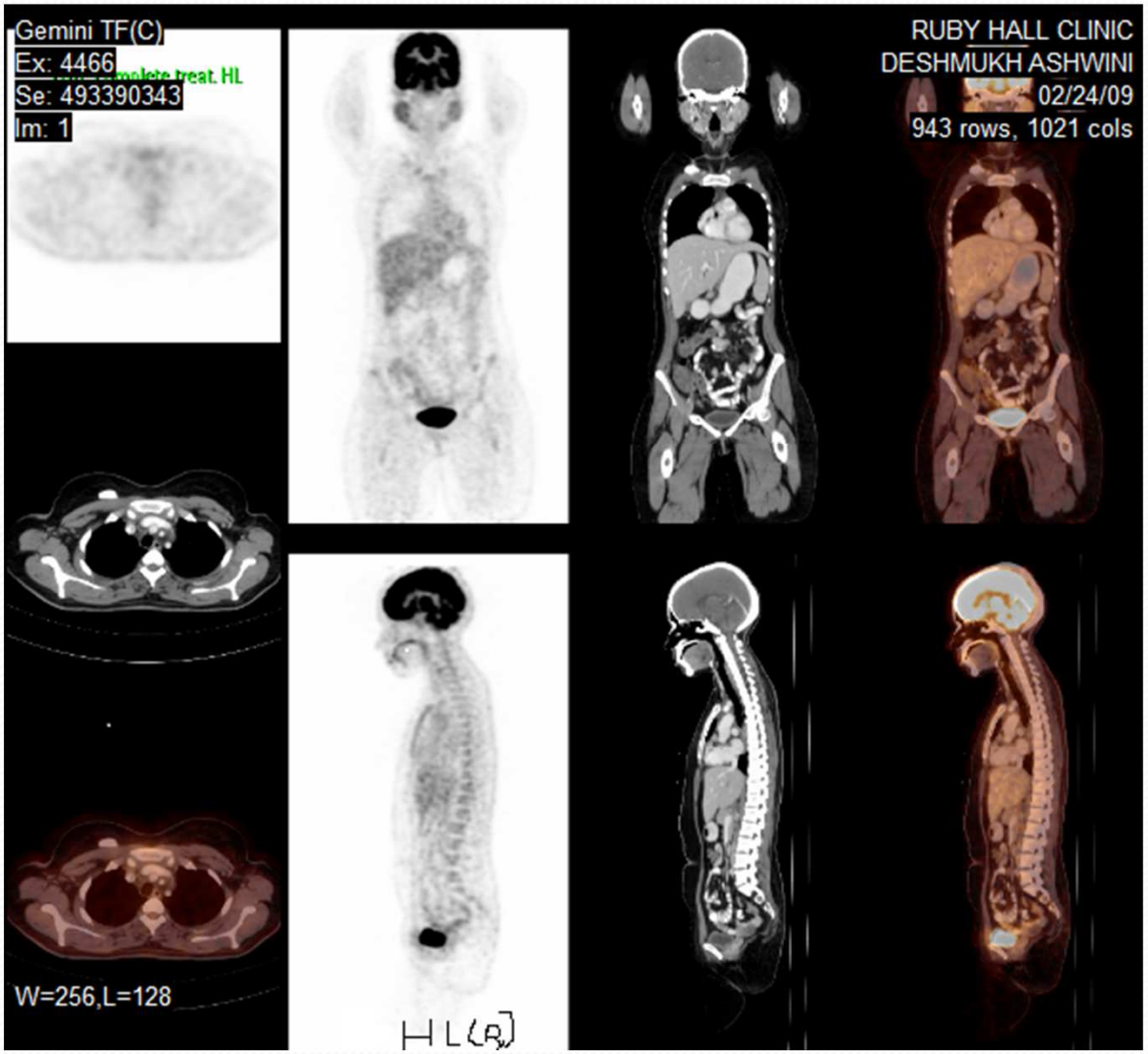
62 year old man with hilar and mediastinal adenopathy. Biopsy: sarcoidosis

HCC

QuickTime™ and a
decompressor
are needed to see this picture.



82 year old man with wt loss and liver masses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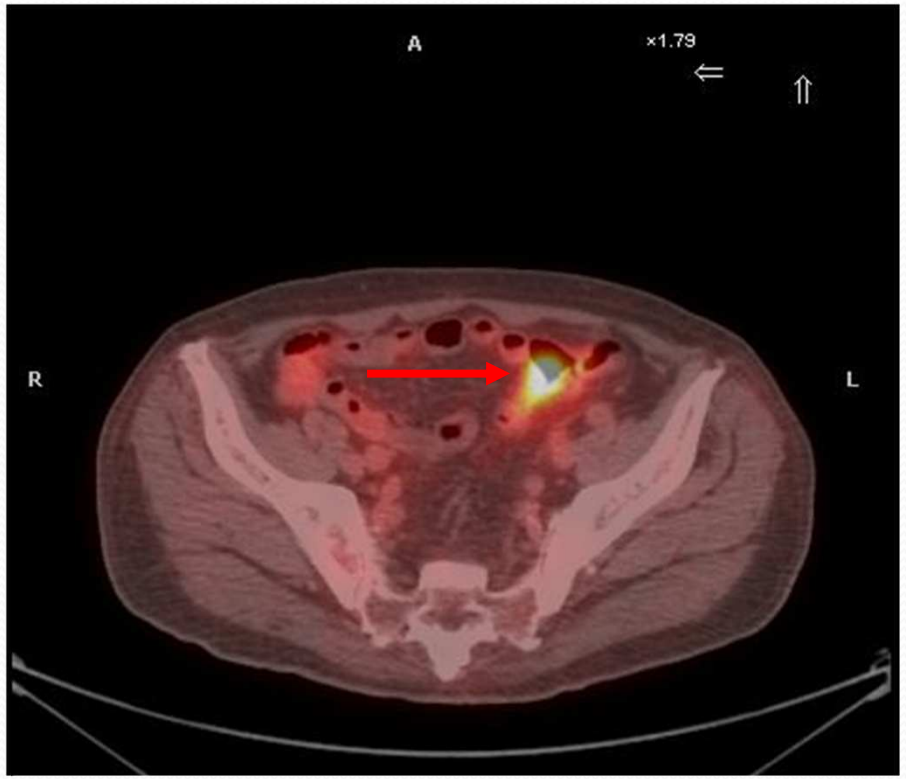
18F-FDG PET After 2 Cycles of ABVD Predicts Event-Free Survival in Early and Advanced Hodgkin Lymphoma

The Journal of Nuclear Medicine, 08/27/2010

Cerci JJ et al. – The objective was to assess the prognostic value of 18F–FDG PET after 2 cycles of chemotherapy using doxorubicin, bleomycin, vinblastine, and dacarbazine (ABVD) in Hodgkin lymphoma (HL) patients overall and in subgroups of patients with early and advanced stages and with low and high risks according to the International Prognostic Score (IPS). PET2 is an accurate and independent predictor of EFS in HL. A negative interim 18F–FDG PET result is highly predictive of treatment success in overall HL patients, as well as in subgroups with early or advanced–stage disease and with low or high IPS risk.

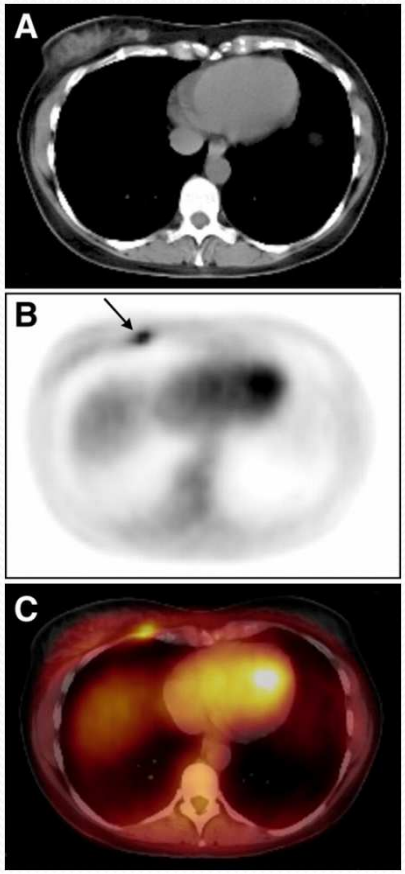
Colonic Mass?

QuickTime™ and a
decompressor
are needed to see this picture.

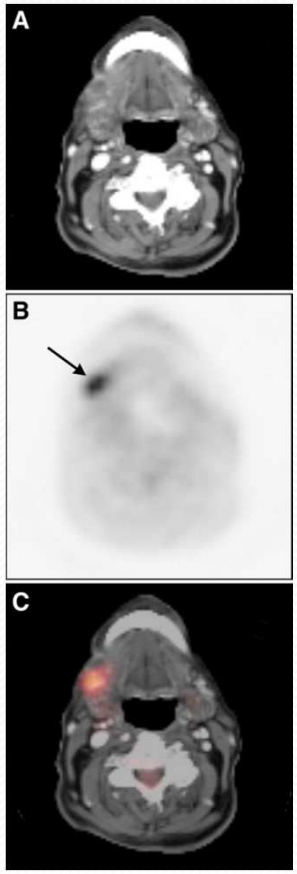


82 year old man with wt loss and liver masses

Metastatic LN with Unknown primary



Known case of Cervical LN Mets



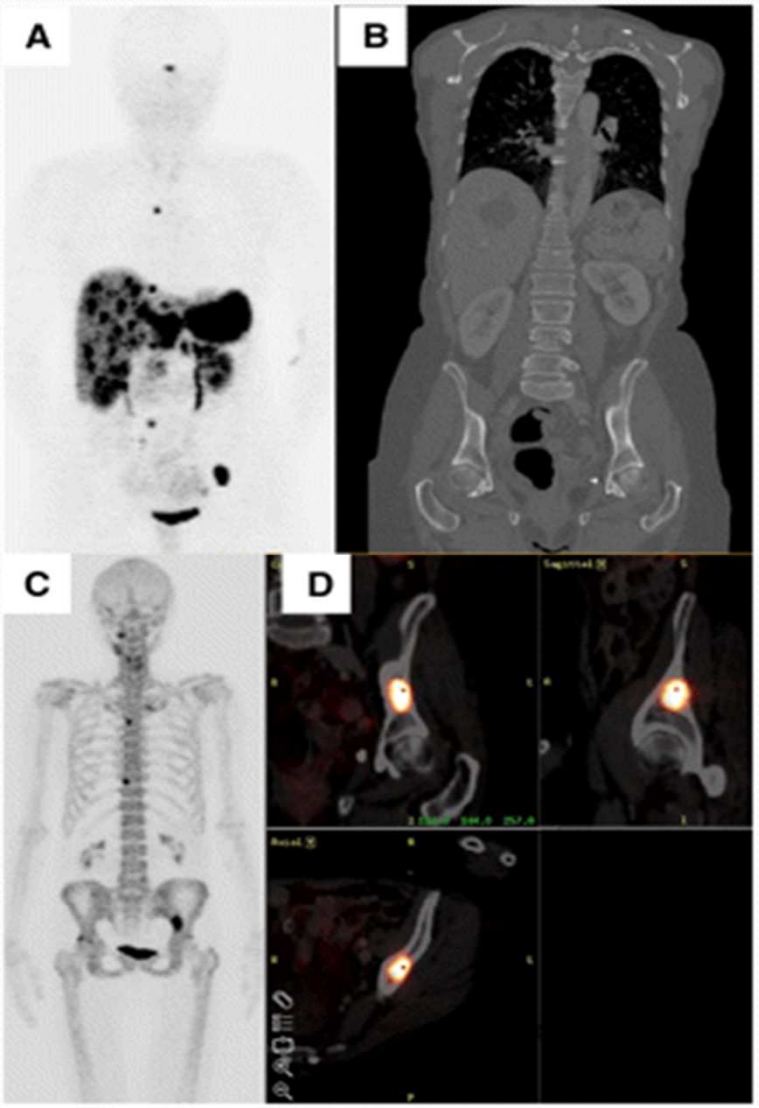
Clinical Impact of PET/CT

- More accurate diagnosis
- Avoidance of unnecessary tests, and (potentially) harmful procedures
- Better treatment or management

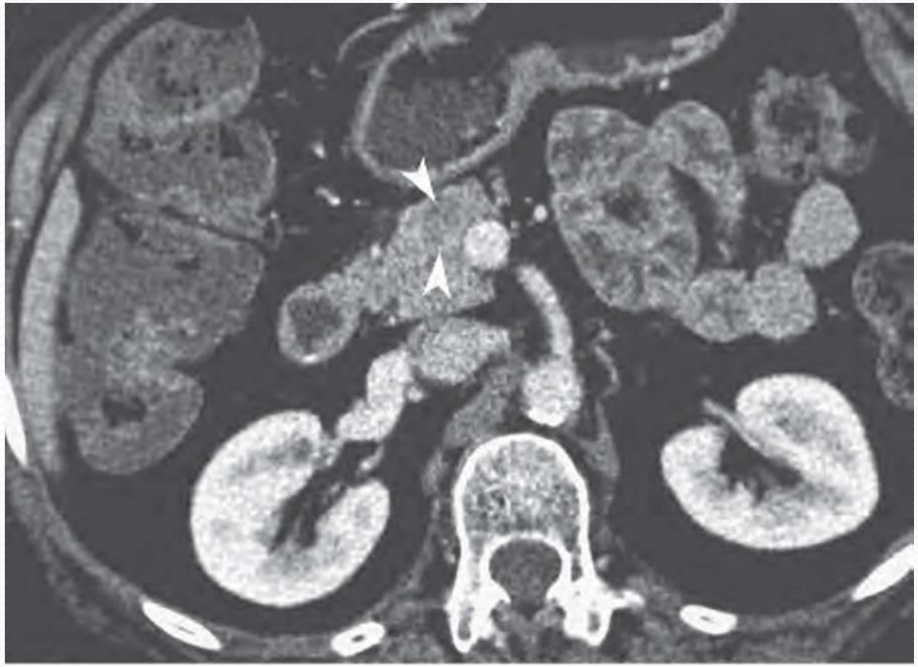
* PET also Serves as Prognostic Indicator and predicts EFS

Newer approaches

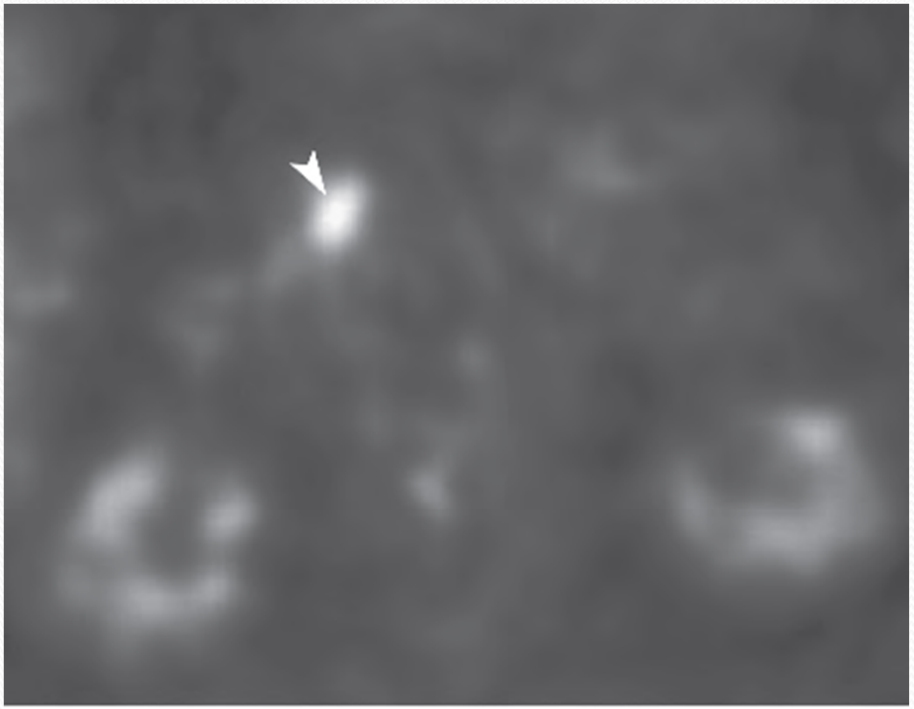
- FET or MISO PET scan
- F18 Bone scan done with high diag acc
- New tracers make it possible to study the tumor hypoxia/Angiogenesis/Gene therapy.
- PET will have excellent role in drug trials


A
B
C
D

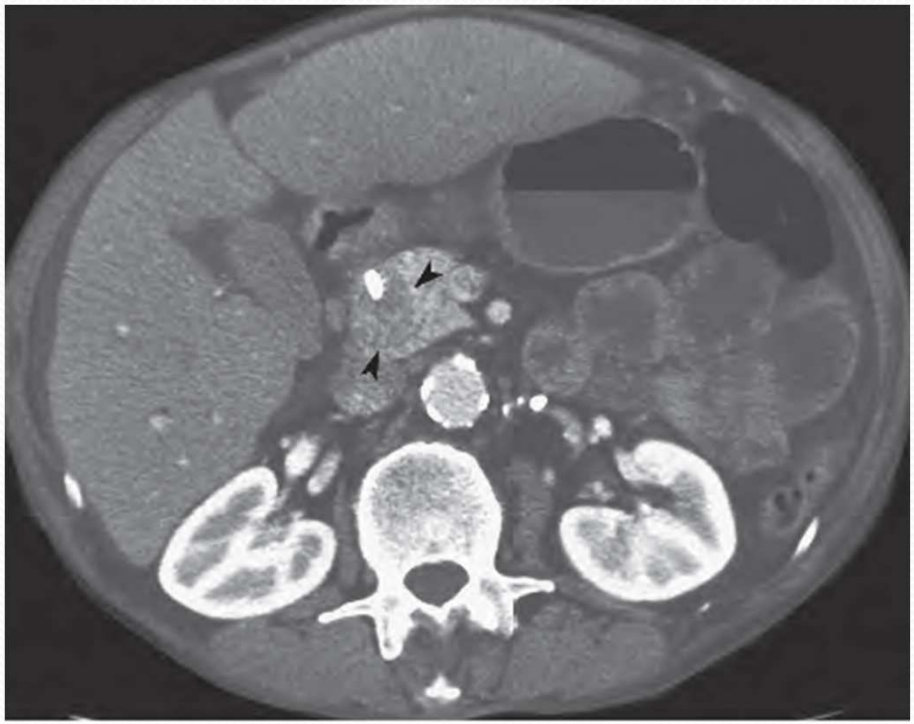
Pancreatic Mass



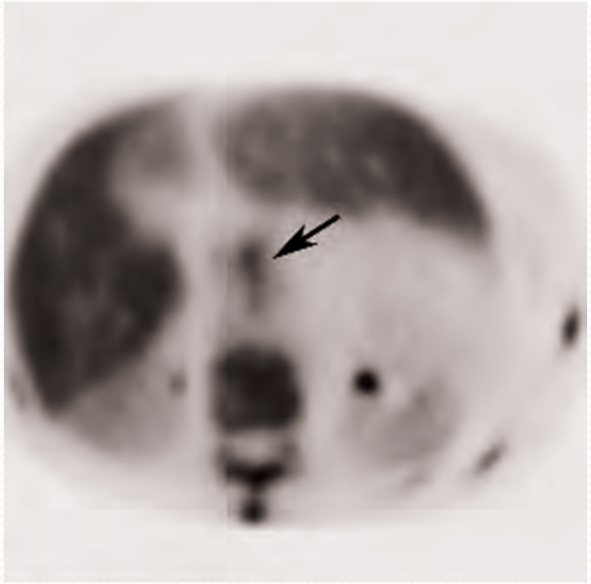
Mass in Pancreas with FDGPET

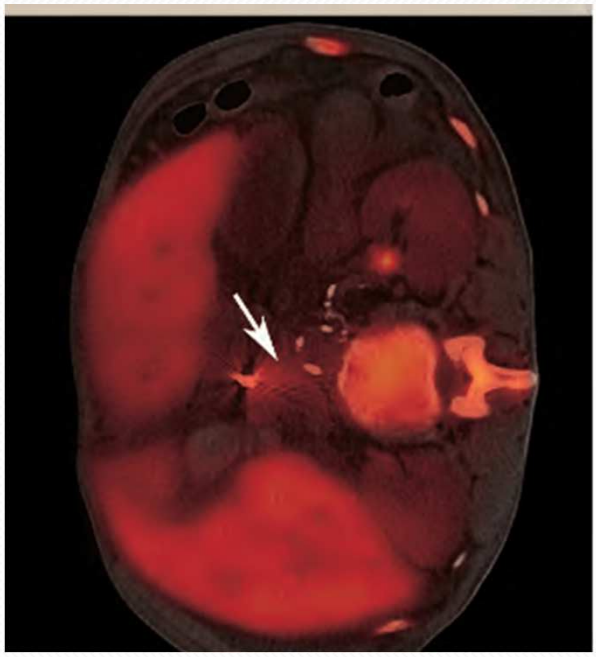


Pancreatic Mass

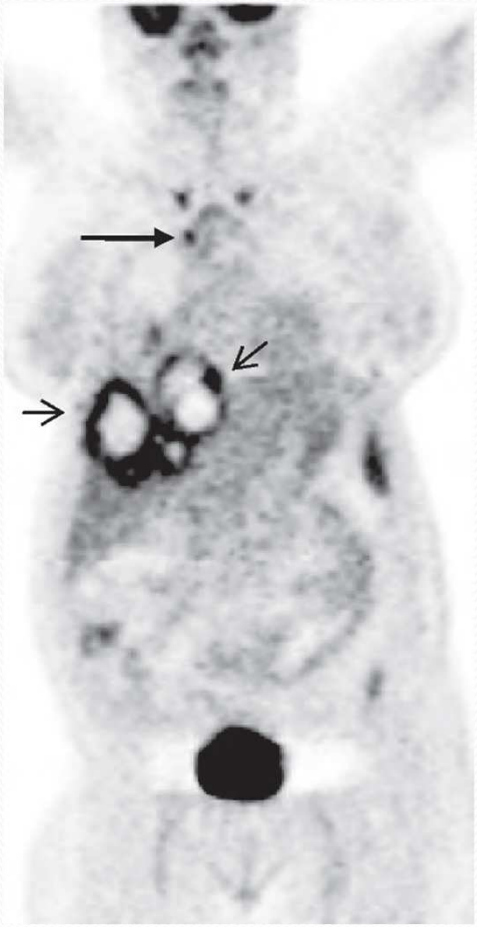


Ca Pancres FLT PET study

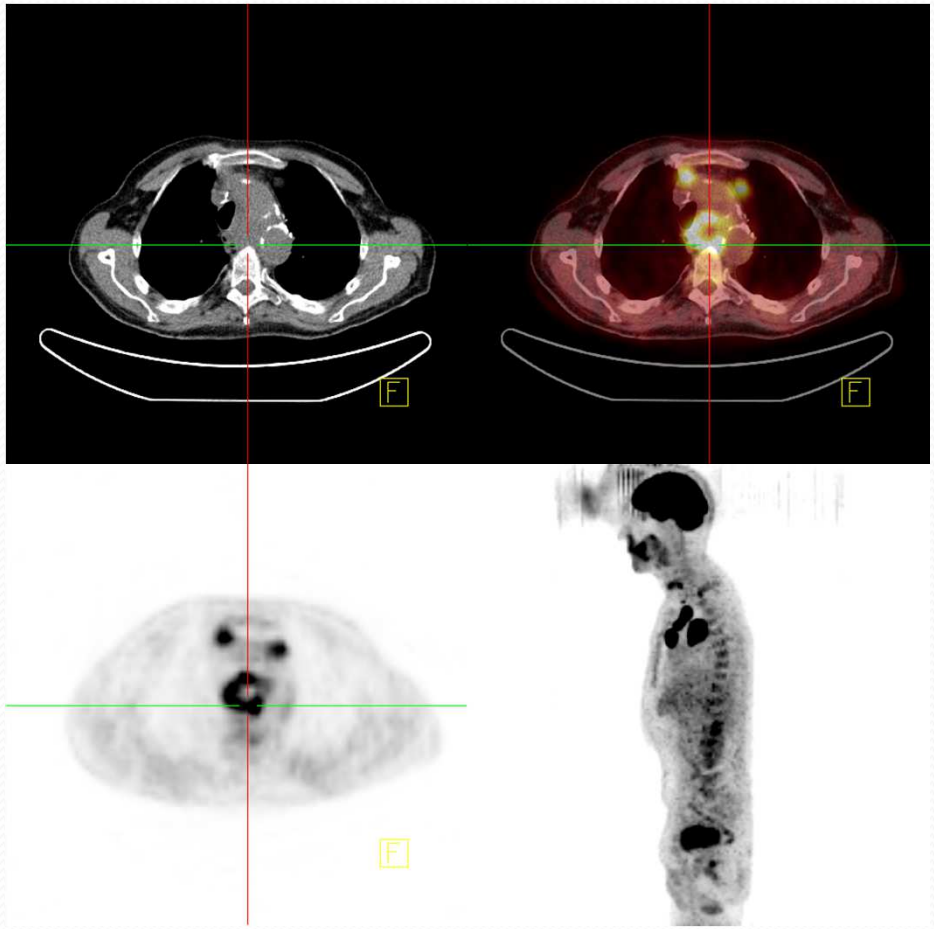




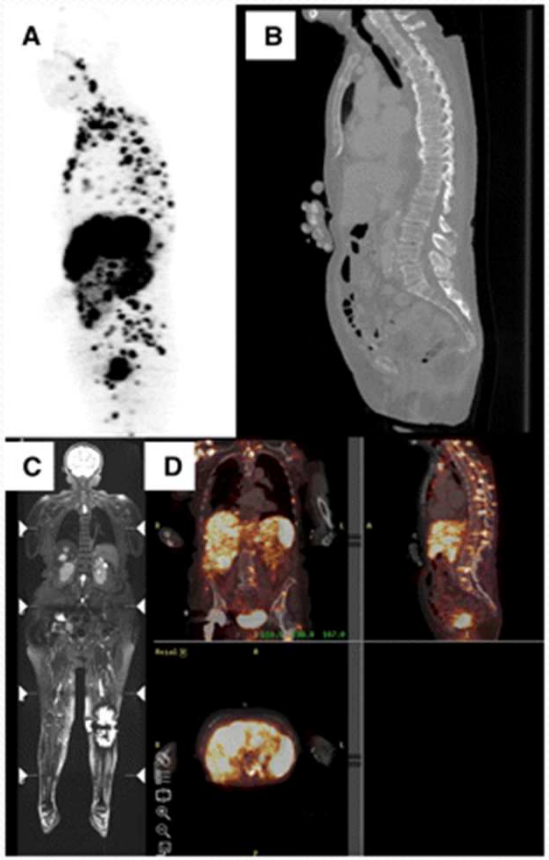
54/F Metastatic Endometrial Ca



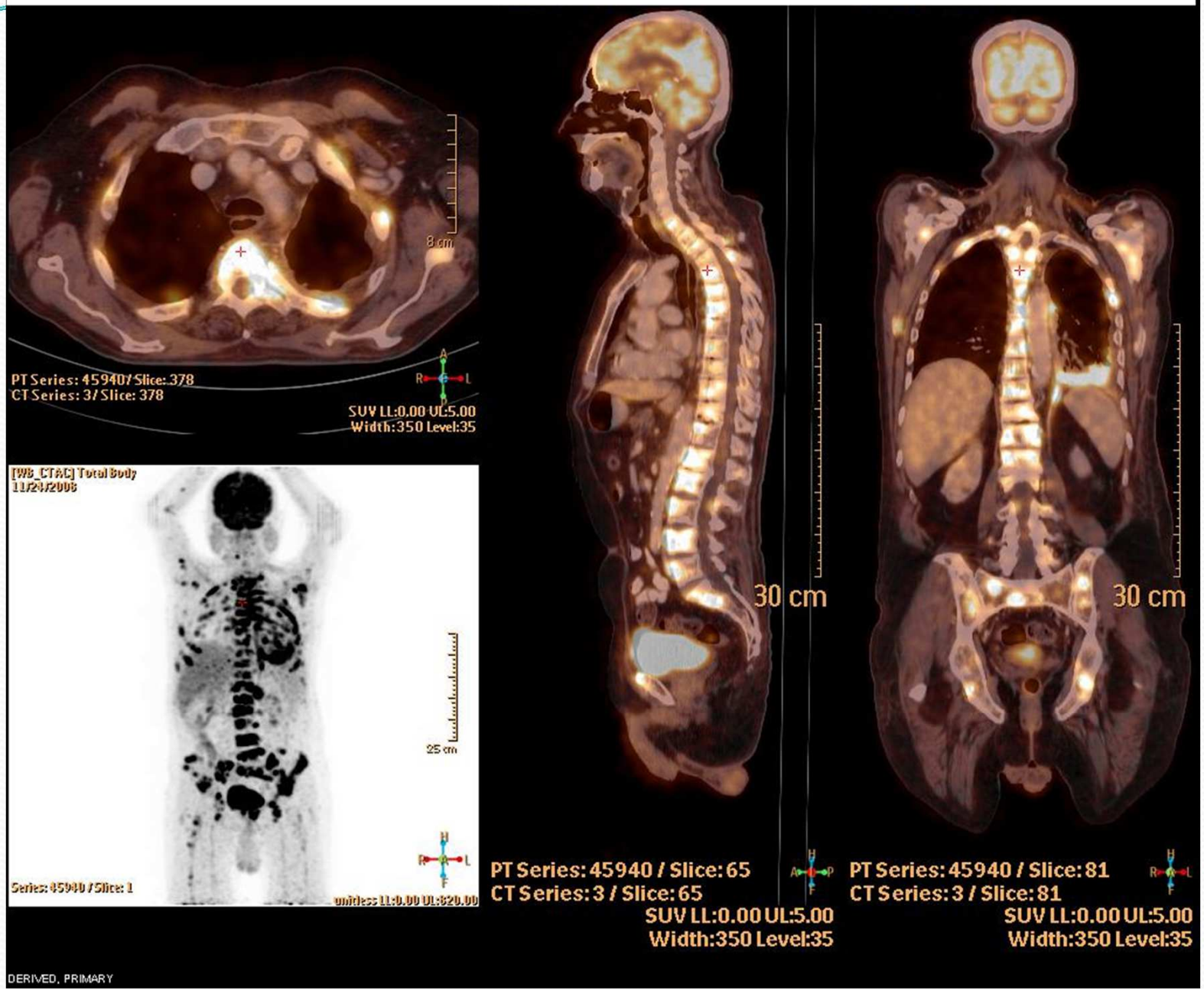
48Male with Metast Ca Bl.

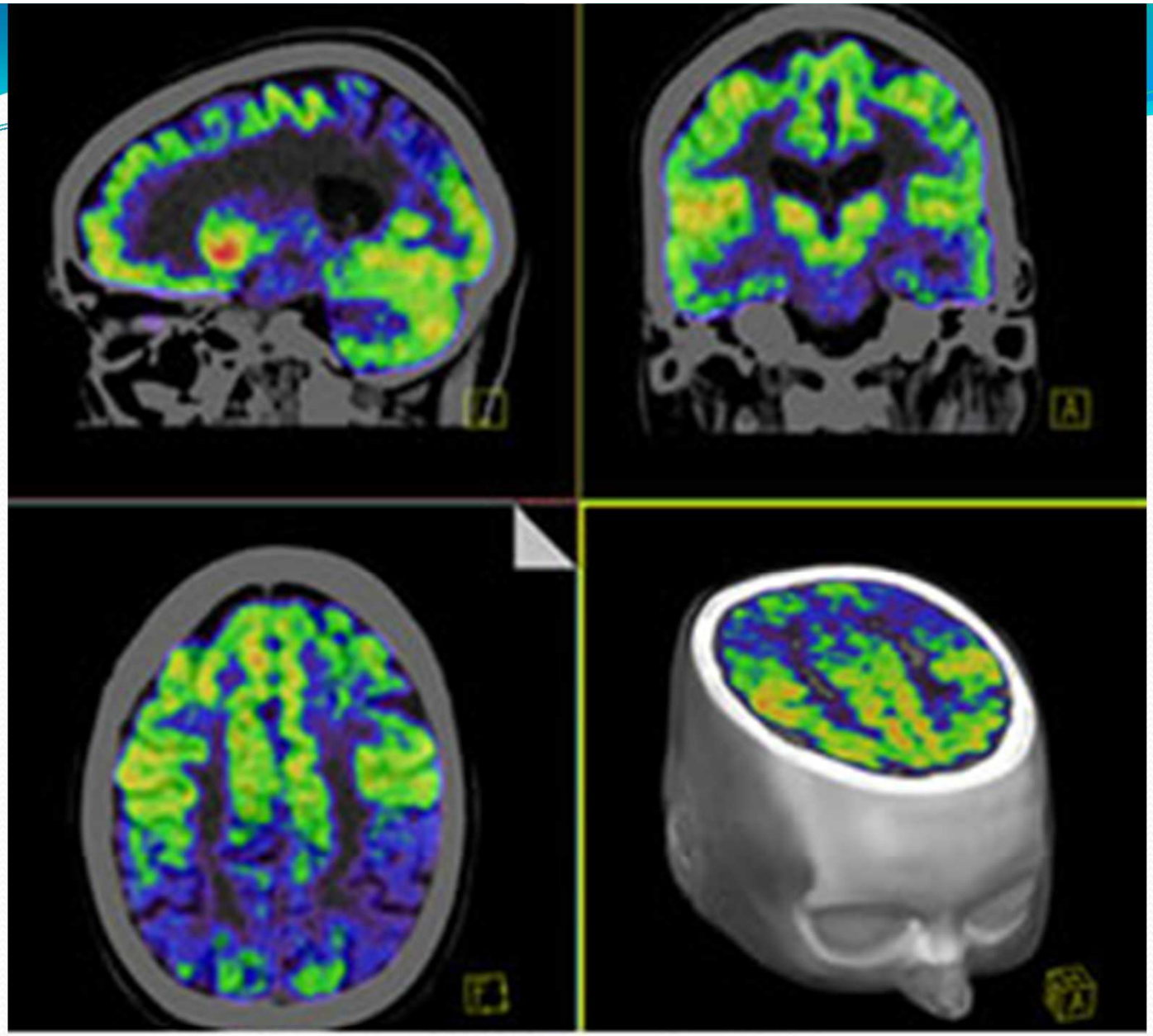


68 Yrs F with Mets NET



c/o Ca-Lung with bony mets





PET/CT Brain Scan

PET/CT or PET/MR : Clinical Benefits

Improved oncological diagnosis

- improved localization of disease
- assistance with biopsy guidance
- monitoring chemo- & radiation therapy
- radiation therapy planning
- faster PET scanning time

JNM 2000 (8):

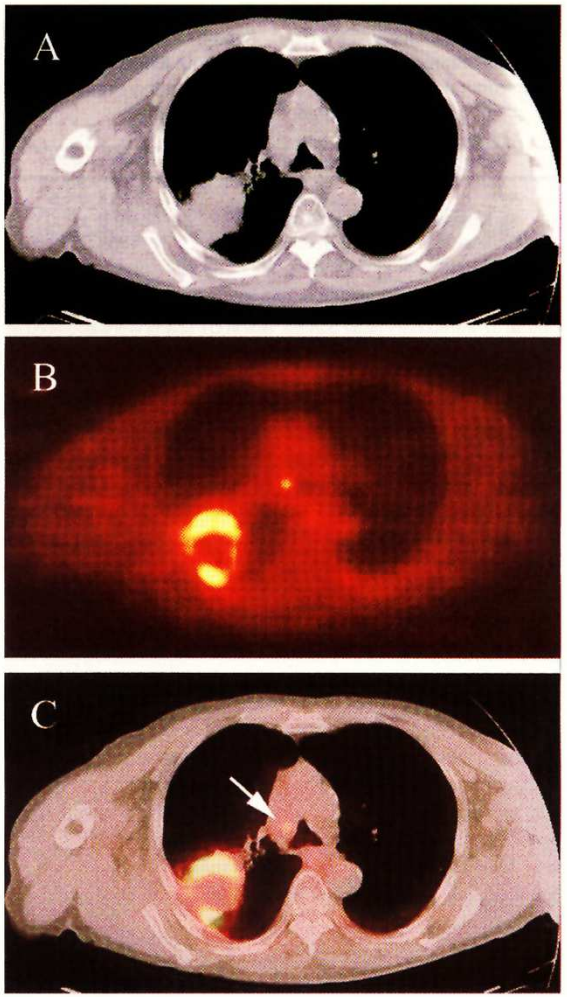


FIGURE A 78-y-old man with squamous cell carcinoma of the lung. (A) Large isodense mass seen on CT appears on (B) PET scan as a hypermetabolic rim of increased FDG uptake, with necrotic center. (C) Fused image shows good alignment of 2 modalities. Lymph node in mediastinum (arrow) also demonstrated increased FDG uptake.

Conclusions

1.CT is may be first imaging test of choice.

2. PET - CT is more accurate than CT or MR alone

- Characterizes lesions

*difficult to biopsy

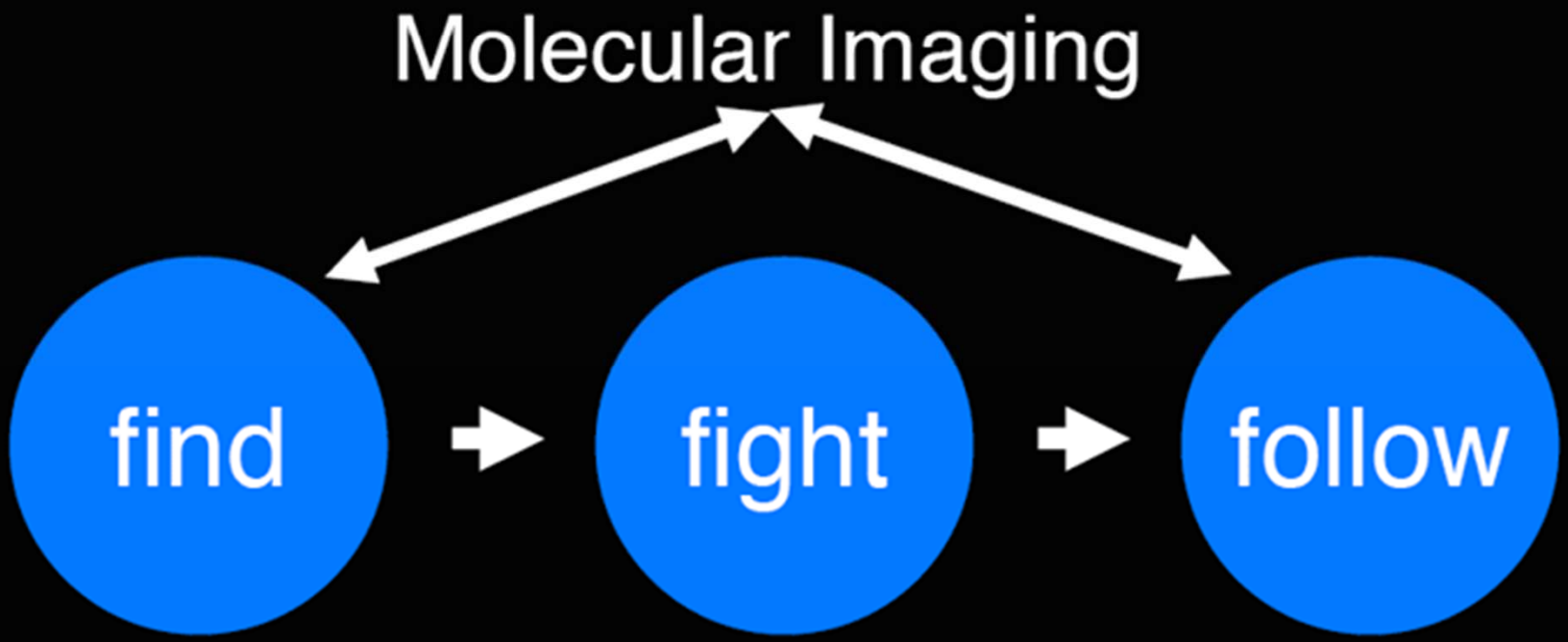
- Detecting occult cancer.
- Determining extent of cancer and response to therapy.

3. PET - CT changes management 36%

Why PET-CT ?

- Metabolic information (molecular imaging)
- Safe, non-invasive procedure
- Single test for the entire body
- Earlier detection, Precise staging
- Monitoring response to chemo/radiotherapy
- Avoidance of surgery or less extensive surgery
- Lowering the overall cost of care

Clinical Algorithms and Molecular Imaging



„Does it change the management of my patient?“

Why PET-CT?


CLOSE TO HOME
JOHN MCPHERSON
© 1994 JohnsonDist. by Universal Press Syndicate
McPHERSON
12-19
"Good news! The exploratory surgery turned up negative!"

PET-CT and RTP

CT has remained the cornerstone for assessing tumor volume (GTV) for RT.

However, positron emission tomography (PET) overlay on CT has shown to impact the gross target volume (GTV), decrease intraobserver variability, and change the treatment planning in a significant number of patients.

The utility of FDG PET to delineate metabolically viable tumor has found increasing application in the identification of appropriate tumor volumes for external beam radiotherapy.

Frequently, structural imaging is inadequate for this purpose as metabolic events precede changes to that of structural imaging.

*Molecular imaging is invaluable in such instances for accurate identification of tumor; it can also aid in the delineation of tumor volumes for therapy.

PET-CT and RT

- Several published data of PET/CT have shown alteration of The (primary tumor) GTV using PET data in RT plan.
- There has been decrease in 36% of patients by differentiating atelectasis and postobstructive pneumonia from tumor GTV in a significant in significant number of Lung cancer.
- There has been increse in GTV in 27% of cases in detecting additional tumor burden using PET data in RT.

Benefits of incorporting PET data

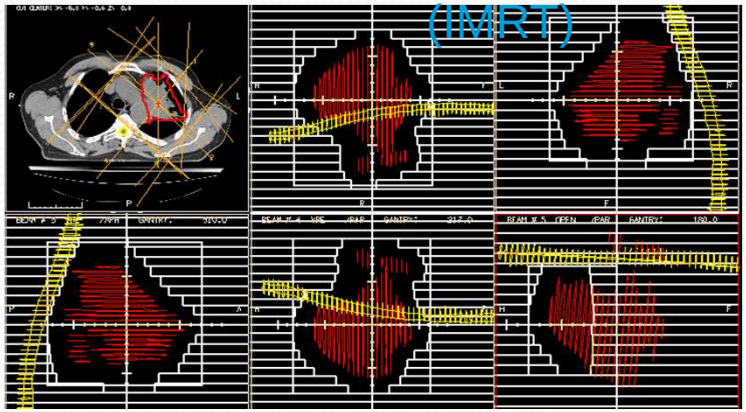
- PET for target volume delineation. 18F-FDG PET may reduce the interobserver variability in gross tumor volume (GTV) deliniation.
- Addition of PET data may reduce the size of the GTV, identify tumor areas or lymph nodes missed by CT or MRI, and identify parts of the GTV potentially requiring an additional radiation dose.
- As PET-CT upstages or downstages in many cancer by 24 t0 30% PET data may be useful for better targeting of biological active tumor site.

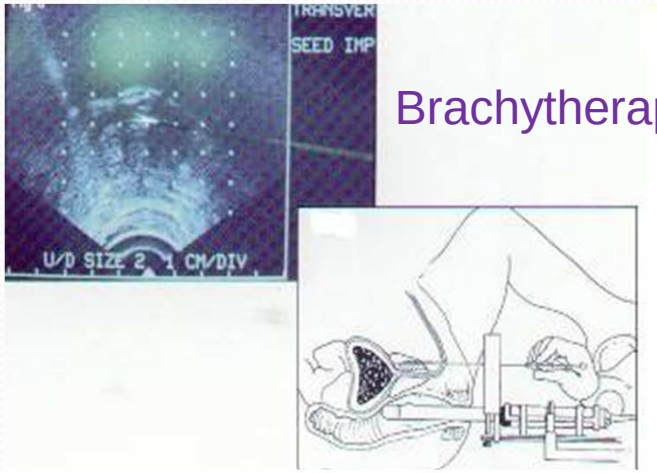
Advantages of Using PET in RTP

- PET can reveal target not det by CT/MR these may be remote mets or additional tumor region seen by PET alone.
- PET may enable to better delineate and charaterise sites that donot contain active tumor eg Reactive nodes or tumor volume nearby eg Lung atelect.
- Imaging of biological inhomogenity (sub volume of tumor) may offer possibility to adapt doses to local diff in Radio sensitivity (dose paint).
- PET may be helpful to evaluate residual mass post chemo eg Lymphoma segregating active vs fibrotic area besides identifying microscopic tumor vs macroscopic disease site.

The treatment of cancer with ionising radiation is called Radiotherapy (RT) or Radiation Oncology.

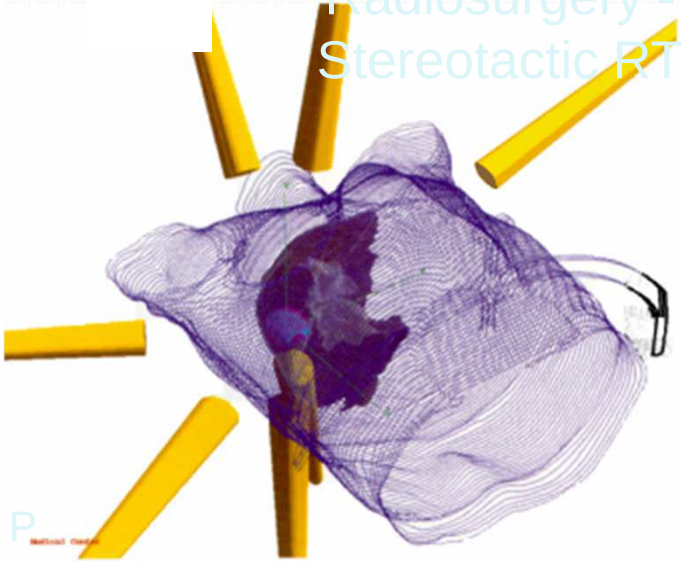
External RT + Intensity Modulated Radiotherapy (IMRT)

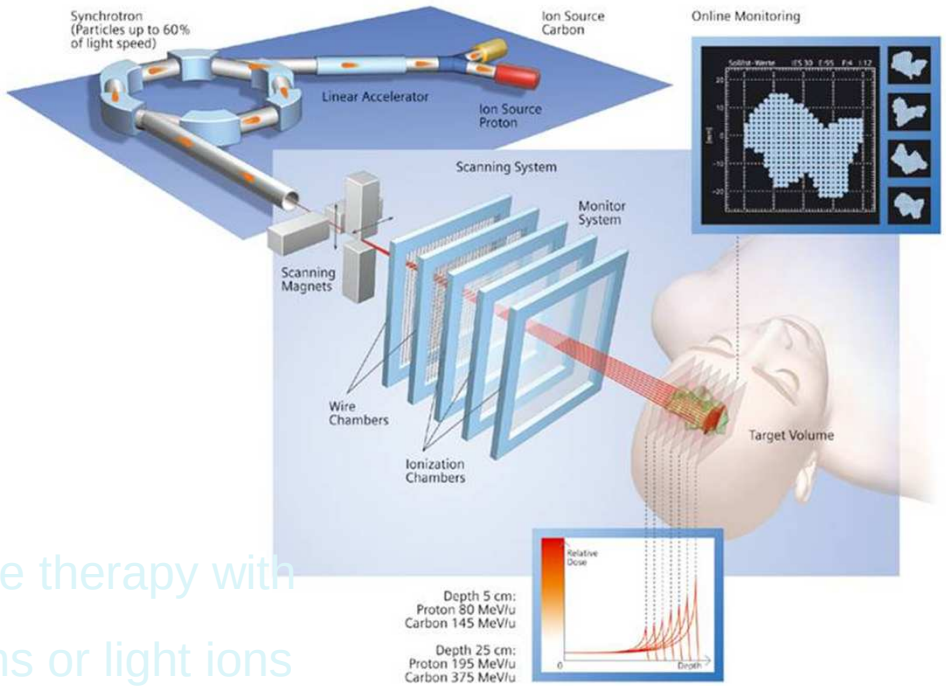




Brachytherapy

Radiosurgery - Stereotactic RT



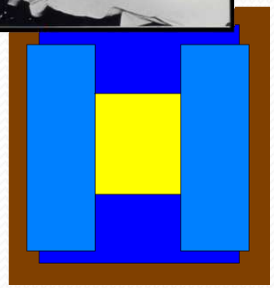


Particle therapy with Protons or light ions

The Evolution of Radiation Therapy

1960's

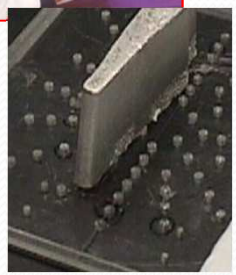
The First Clinac



Standard Collimator

The linac reduced complications compared to Co60

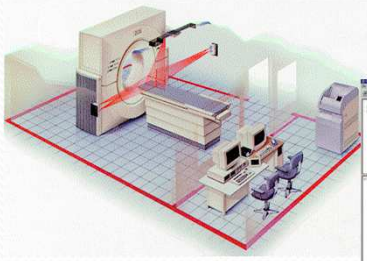
1970's



Cerrobend Blocking
Electron Blocking

Blocks were used to reduce the dose to normal tissues

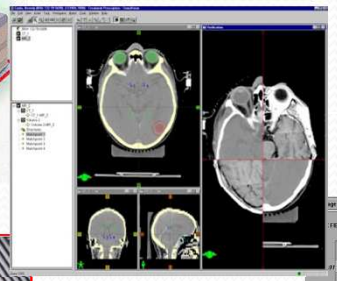
1980's

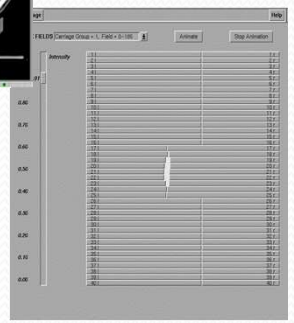


Multileaf Collimator

MLC leads to 3D conformal therapy which allows the first dose escalation trials.

Computerized 3D CT Treatment Planning



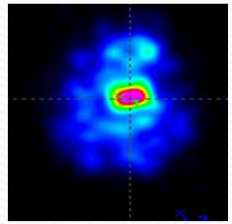


Dynamic MLC and IMRT

Computerized IMRT introduced which allowed escalation of dose and reduced compilations

1990's

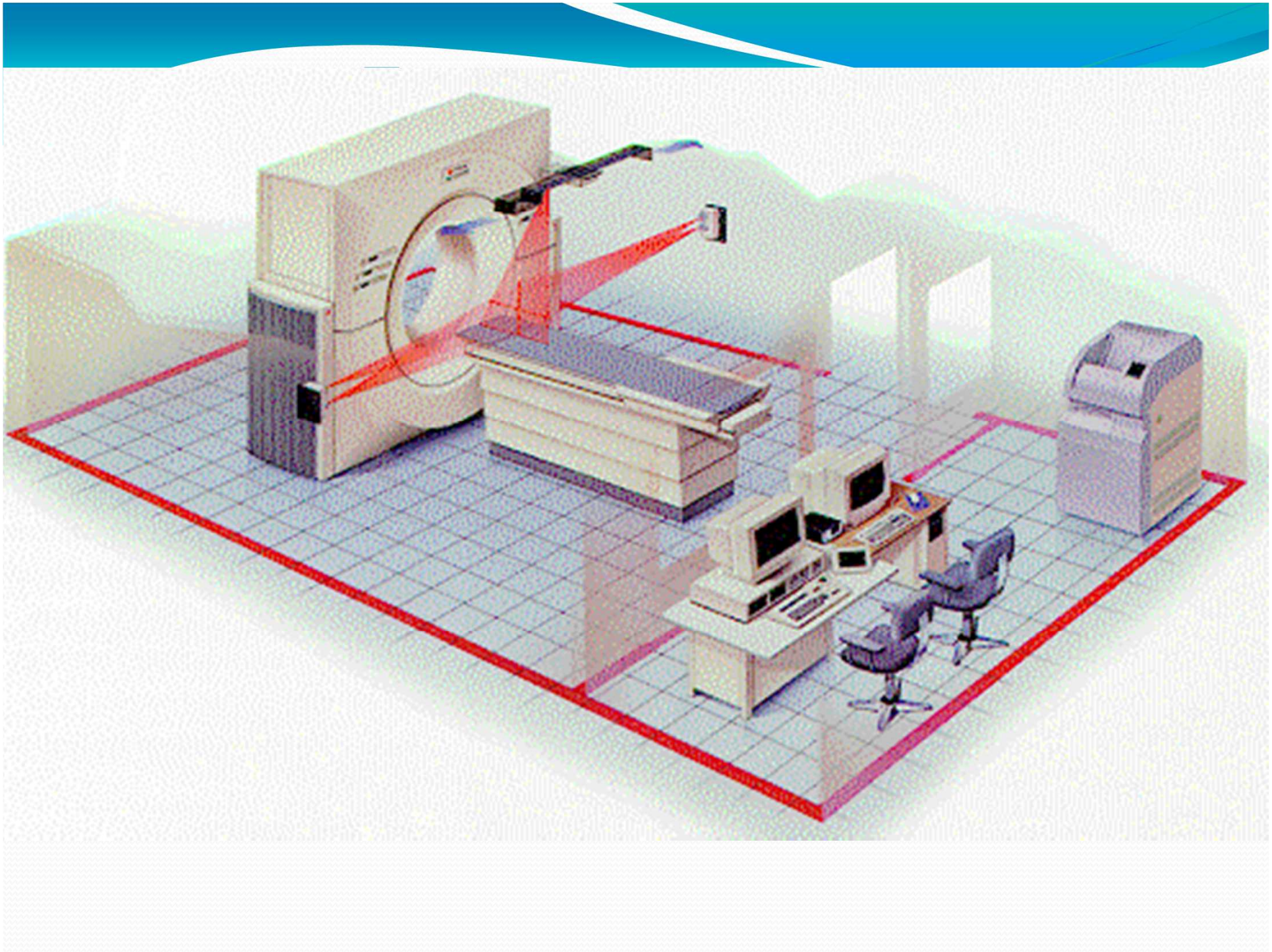
2000's



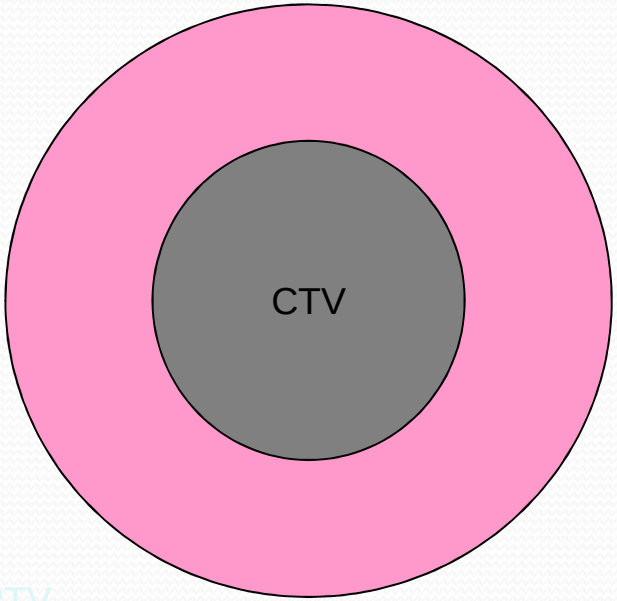
Functional Imaging

High resolution IMRT

IMRT Evolution evolves to smaller and smaller subfields and high resolution IMRT along with the introduction of new imaging technologies

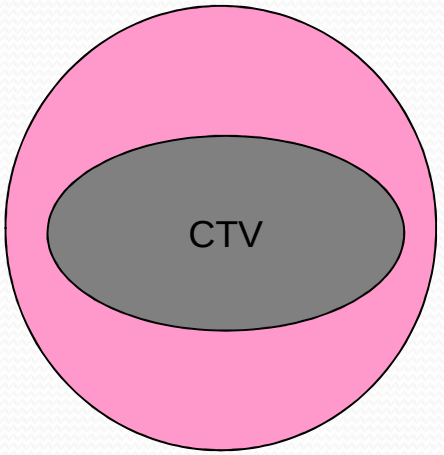


Objectives of IGRT & Dynamic Targeting



PTV

Without Imaging



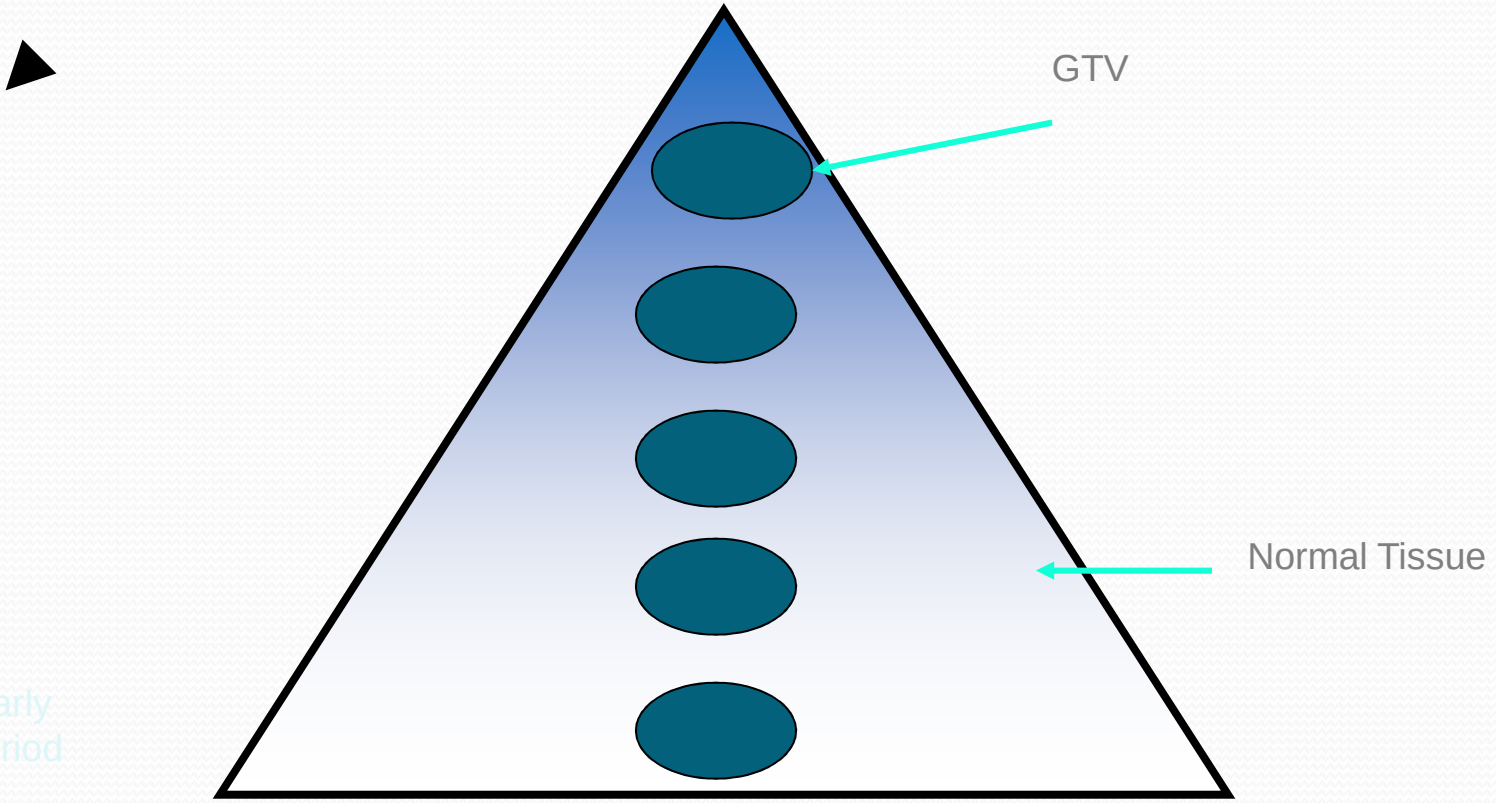
PTV

With Imaging

CTV – volume containing disease
PTV – volume that needs to be irradiated to ensure CTV is always treated

Advances in Radiation Therapy - The Pyramid

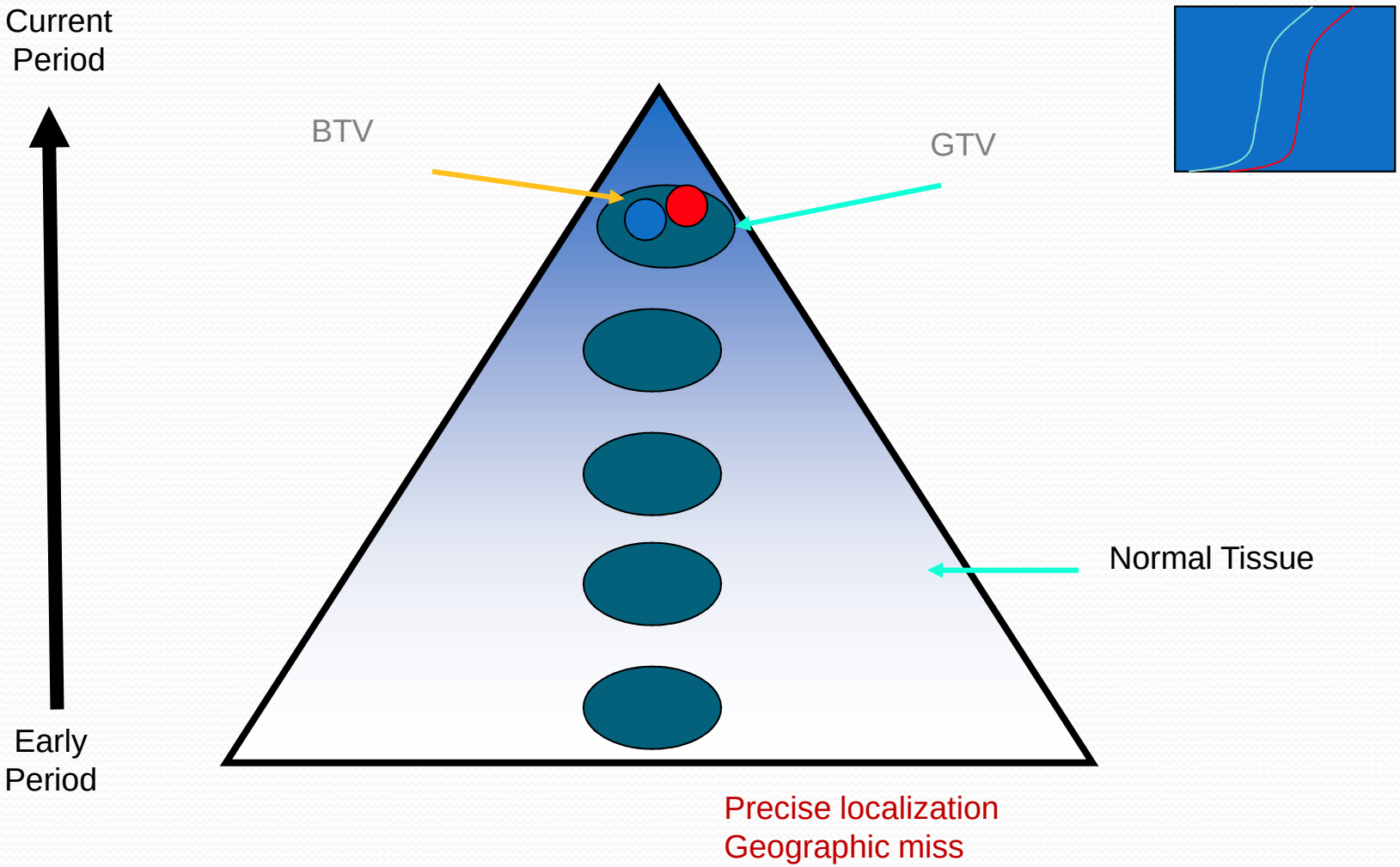
Current Period



Early Period

Precise localization
Geographic miss

Advances in Radiation Therapy – The New Pyramid



18 FLT PET for Oropharyngeal T3 M0N0 tumor

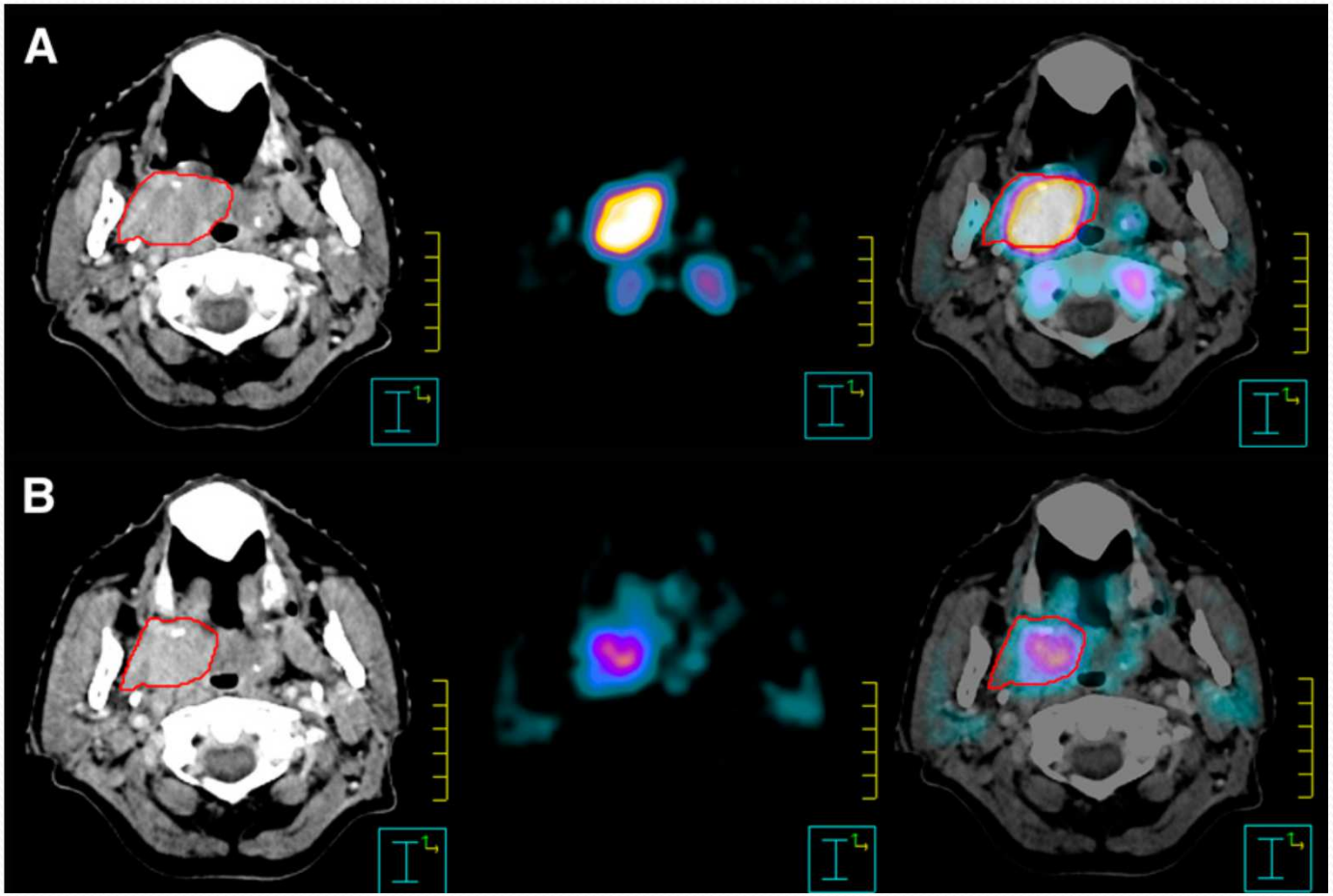


Figure 5a. Transaxial images in a 44-year-old man with history of nasopharyngeal carcinoma which was treated with radiation therapy.

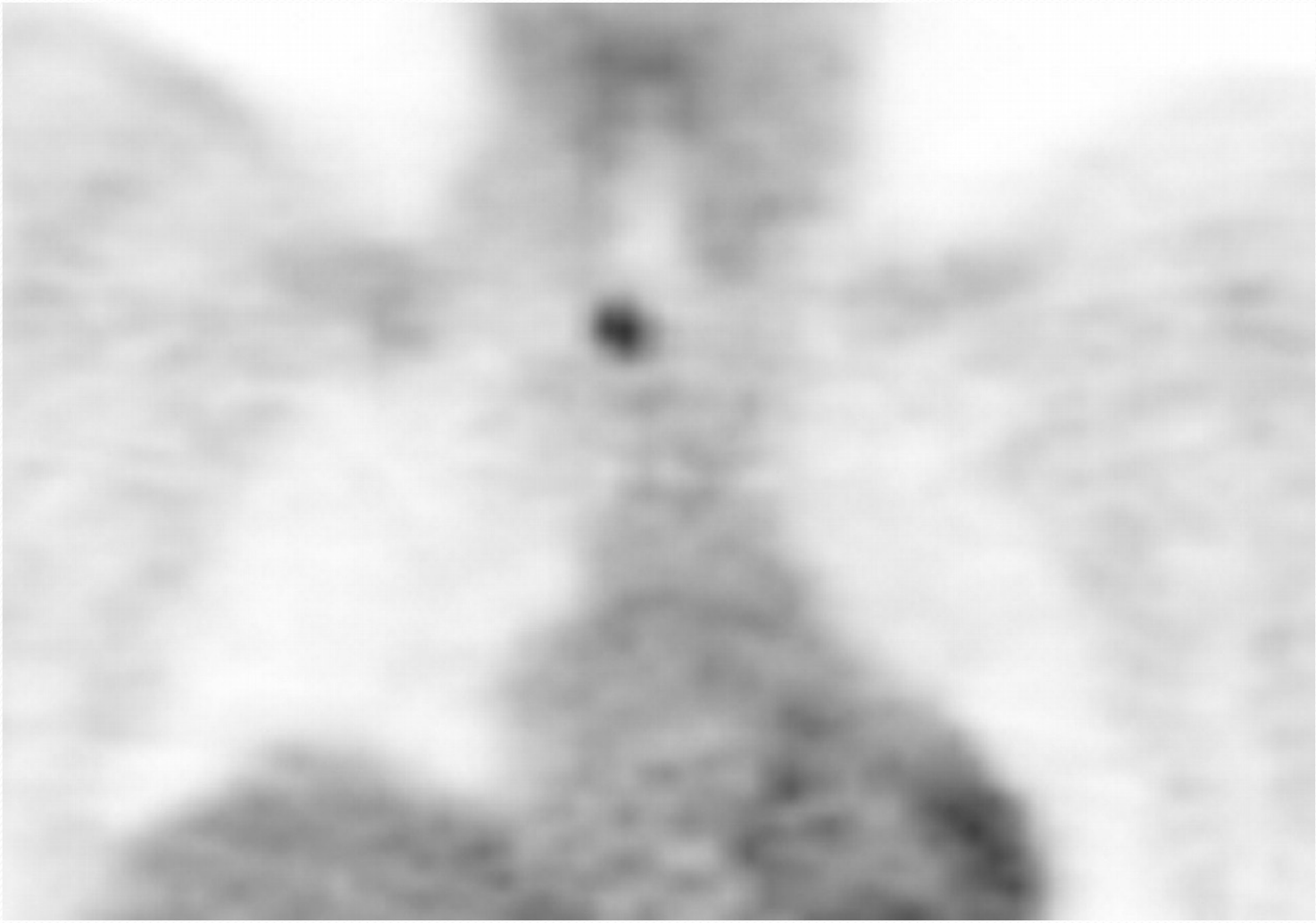
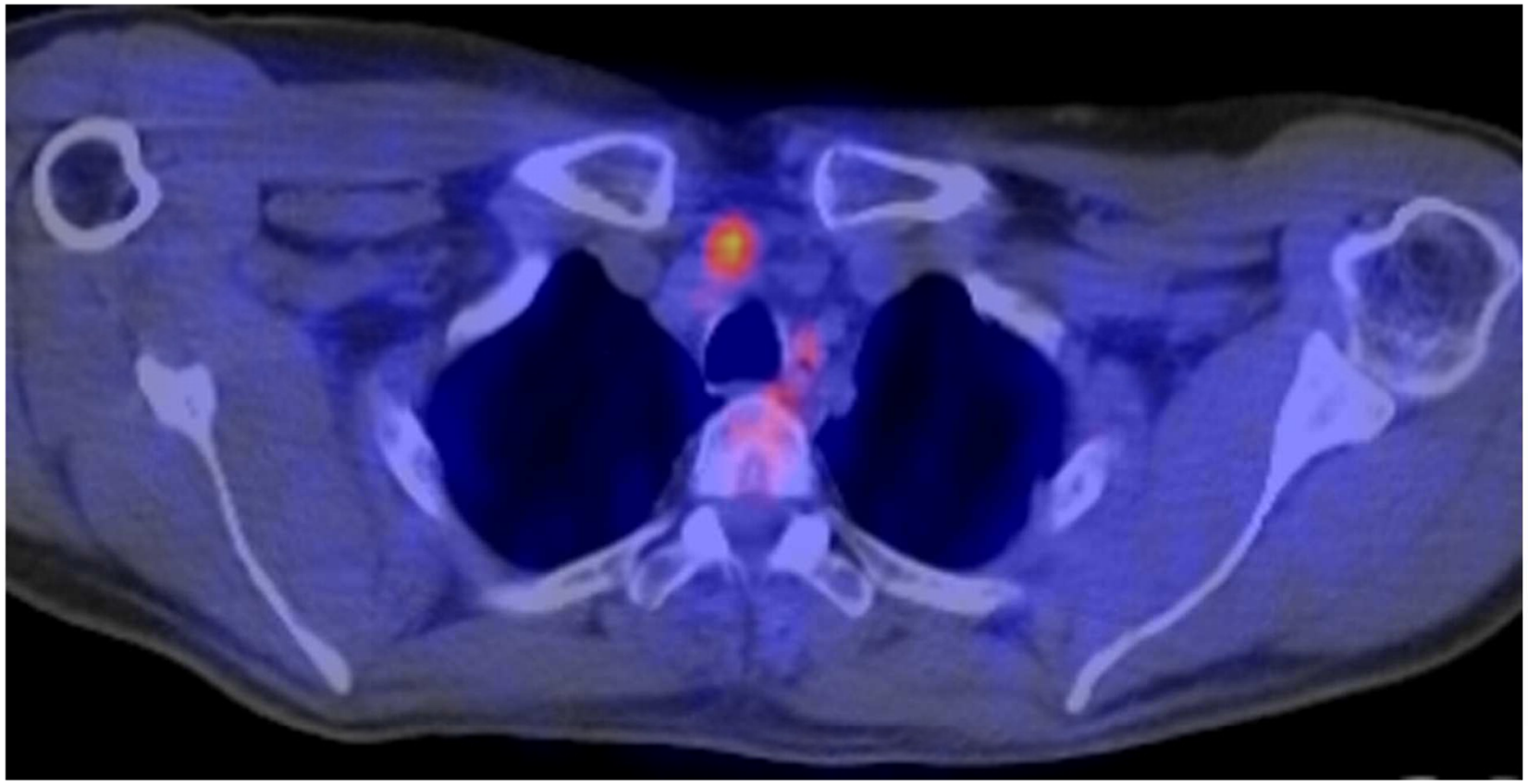
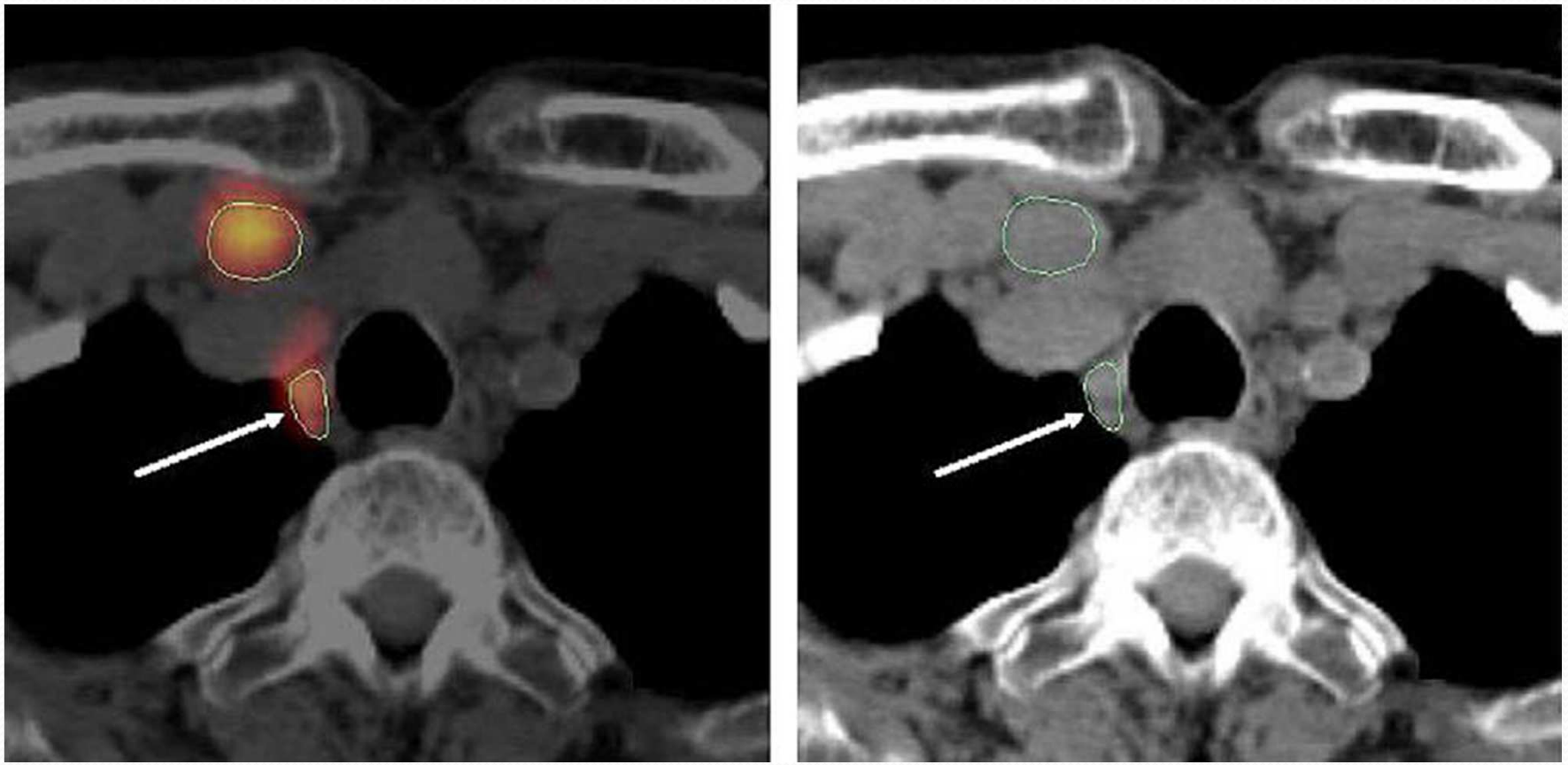


Figure 5c. Transaxial images in a 44-year-old man with history of nasopharyngeal carcinoma which was treated with radiation therapy.

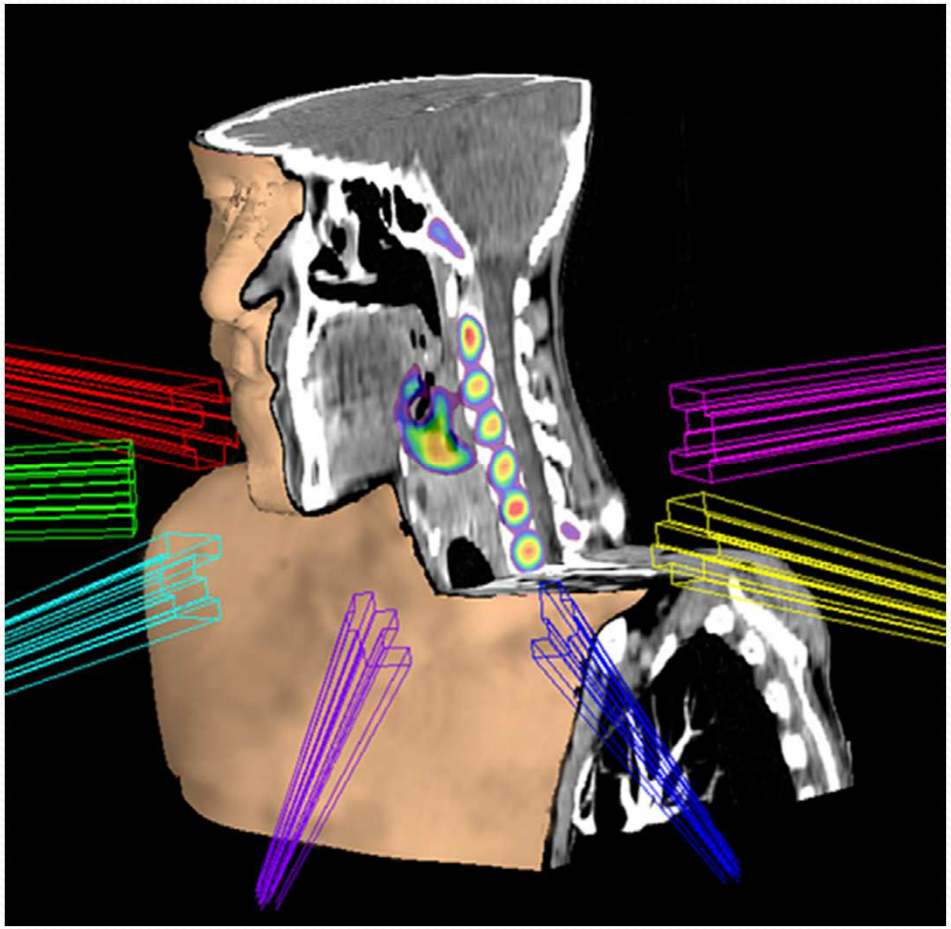
Figure 5d. Transaxial images in a 44-year-old man with history of nasopharyngeal carcinoma in 2000, which was treated with radiation therapy.



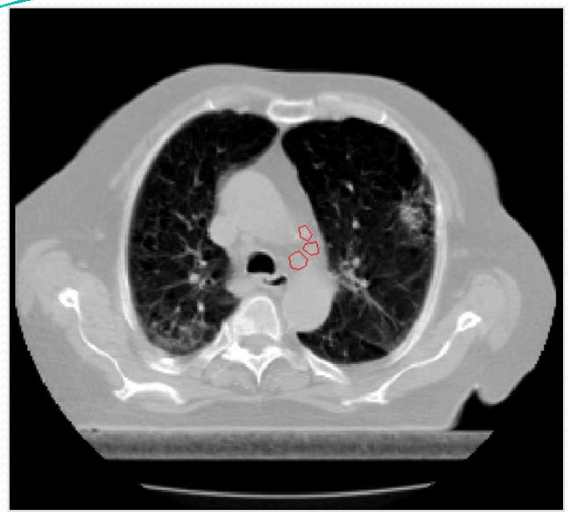


Pt with Gr Iia HL PET showing additional paratracheal LN & CT negative.

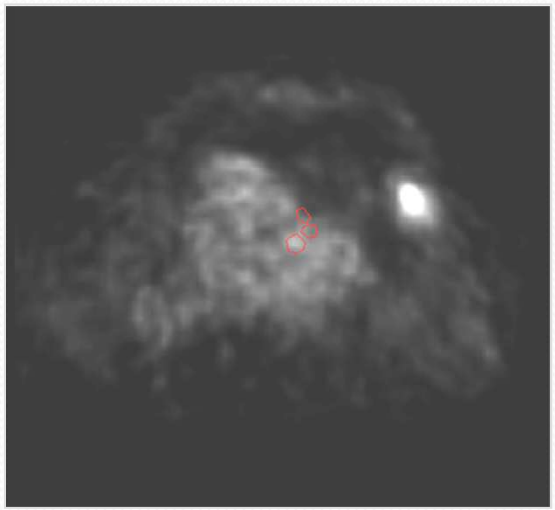
18FLT PET for image guided high precision RTP in Oropharyngeal Ca



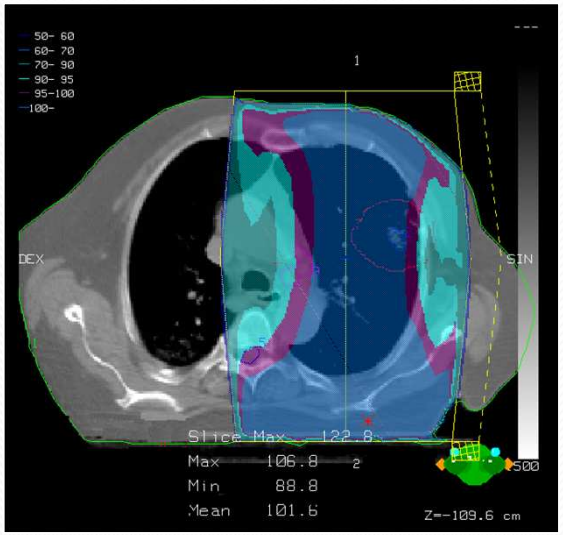
METABOLICALLY AIMED RADIOTHERAPY (MART)



CT



PET

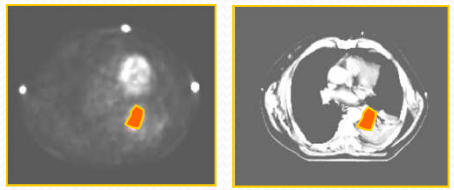


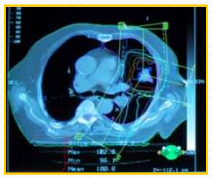
CT BASED

PET/CT BASED

TREATMENT PLAN

METABOLLICALLY AIMED RADIOTHERAPY MART





METABOLLICALLY AIMED RADIOTHERAPY MART

PET GUIDED
IMRT/TOMOTHERAPY

IMPROVED TUMOR/NON TUMOR
RADIATION DOSE

HYPO-FRACTIONATION
30-40 → 5-10 fractions

Metachronous vs. Synchronous Acquisition

Image-Based Radiation Therapy Planning for Brain Tumors with F-18-Fluorethyltyrosine (FET) PET and MRI:

Potential Impact on Target Volume Delineation

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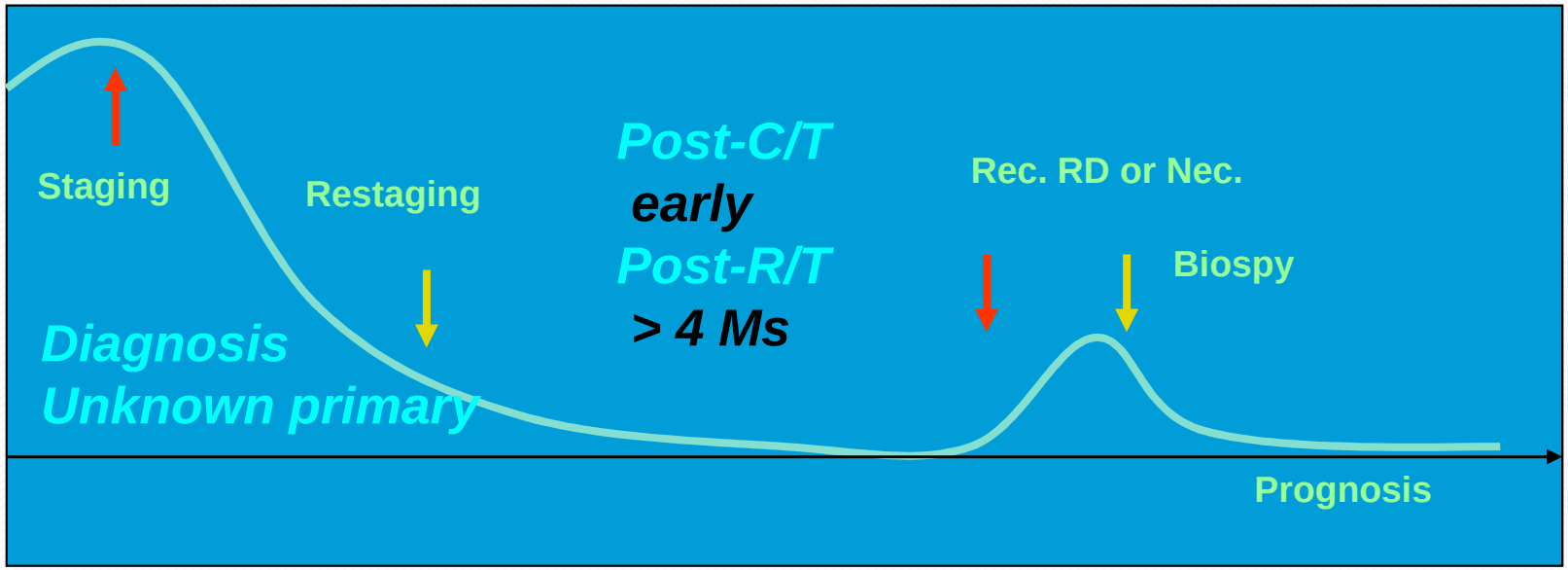
A. Bischof Delaloye,[1] J. O. Prior[1]

[1]Nuclear Medicine, [2]Radio-oncology, [3]Radiodiagnostic, [4]Oncology
Centre Hospitalier Universitaire Vaudois (CHUV), Lausanne, Switzerland.

Summary —

- ***FDG PET*** improved oncological management:
  - Improved detection of disease localization
  - Monitoring chemo- and radiation therapy
  - D.D. recurrence/residual tumor or necrosis
  - Assistance with biopsy guidance* and RTP.




Discovery
VCT

Facilities available @ AMRI NM

- 64 slice PET-CT 690 scanner
- 4slice SPECT-CT
- Dedicated Therapy ward for
- -High dose therapy for Ca Thyroid
- -High dose therapy for Neuroblastomas and NET.
- -Microsphere therapy for HCC
- -Treatment of Metastatic bone disease.
- -Therapy of Arthritis using RS.

Thanks for your kind attention

- My Personal thanks for all participants and organizers of this wonderful conference.

- Please call me (09874477385)or mail me pratapdoc@gmail.com for sugg/feed
- Please visit for additional information

www.nucpetmrc.com