

Tips and Tricks for Improving PET Imaging

Taibah Ali ALAhmad

Jaber ALAhmad Center for Nuclear Medicine and
Molecular Imaging (JACNMMI)



Lecture Outline

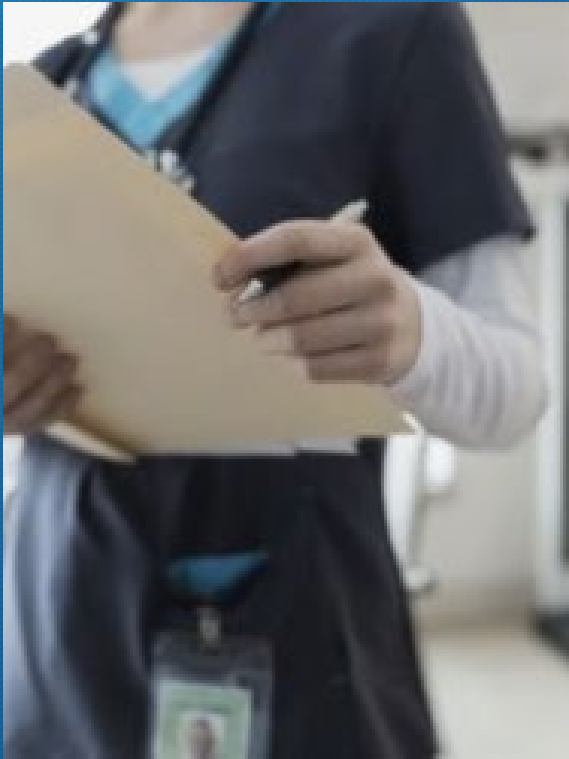
- Technologist Checklist
- Imaging Techniques + Reconstruction
- Obese Patients
- Pediatric Patients
- Technical Artifacts
- Radiotherapy (RT) planning
- New PET Technologies

✓ Technologist Checklist

- ✓ Read patient's history
- ✓ Prepare scanner room for imaging
- ✓ Radiation Exposure (ALARA)
- ✓ Patient compliance
- ✓ Special needs Patients
- ✓ Check patient's BMI
- ✓ Patient's positioning



Read patient's history



- - Type of cancer/ diagnosis.
- - Staging? Initial, restaging, or monitoring response to therapy.
- Type of imaging protocol needed (ROI) :
- Vertex to mid-thigh (VMT) - General PET/CT protocol.
- Full Whole Body (FWB) - melanoma, sarcoma, FUO, subcutaneous lymphoma etc.
- Arm position (Up/Down)

✓ Prepare scanner room for imaging

- Fix Head holder for Head & Neck and brain protocols.
- FWB imaging need bed extension.

✓ Radiation Exposure (ALARA)

- Be more efficient with time to lower radiation exposure.
- 511 keV vs 140 keV.



✓ Patient compliance

- Claustrophobic?

Develop a relationship with the patient.

- Techniques to avoid anesthesia.
- Did the patient void before scanning?



✓ Special needs patients

- Bedridden? Patient can tolerate imaging positioning?
- Conscious? Unconscious?
- Mental / psychological patients
- limited mobility?









<https://www.nursingtimes.net/news/workforce/new-guidance-on-ward-staffing-levels-retains-18-ratio/7014403.article>

<http://www.advantageurinal.com/wp-content/uploads/2016/04/advantage-home-slider-caregiver-woman-wheelchair.jpg>

✓ Check patient's BMI

- Check patient's :
weight + height + dose
(images will be effected)

$$\frac{\text{weight (kg)}}{\text{height(m)}^2} = \text{BMI}$$

Under weight	Normal weight	Over weight	Obese (Class I)	Obese (Class II)	Obese (Class III)
					
<18.5	18.5 – 24.9	25.0 – 29.9	30.0 – 34.9	35.0 – 39.9	>40.0

✓ Patient positioning

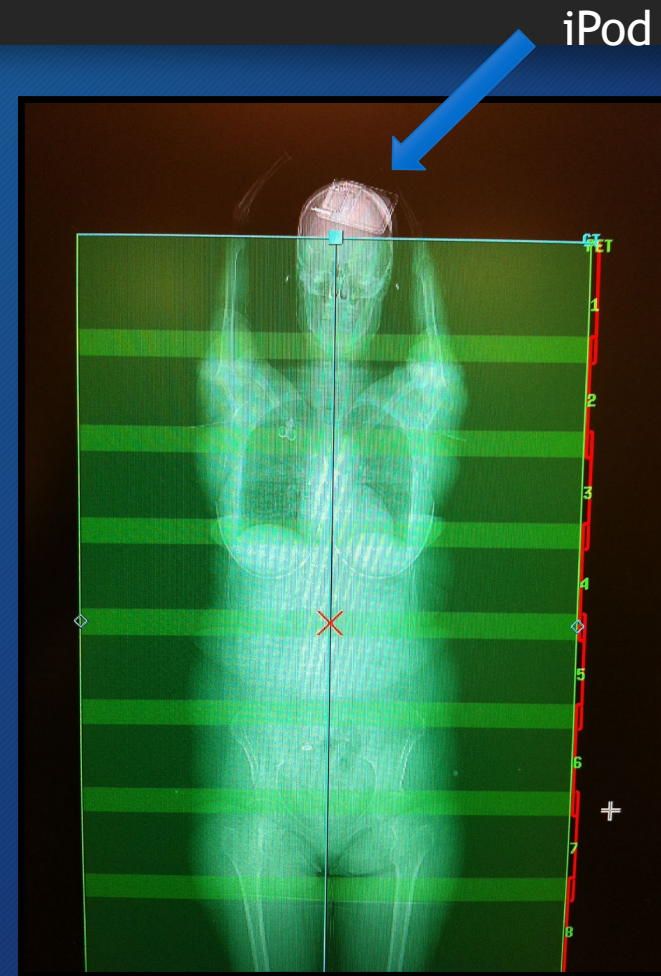
- Body is straight + knee support.
- check that all metal objects are removed.
- Foley catheter urine bag is out of the FOV.
- Clean colostomy bag + pampers.
- VMT = arms up relaxed on arm rest.
- FWB = arms down + feet away from each other.



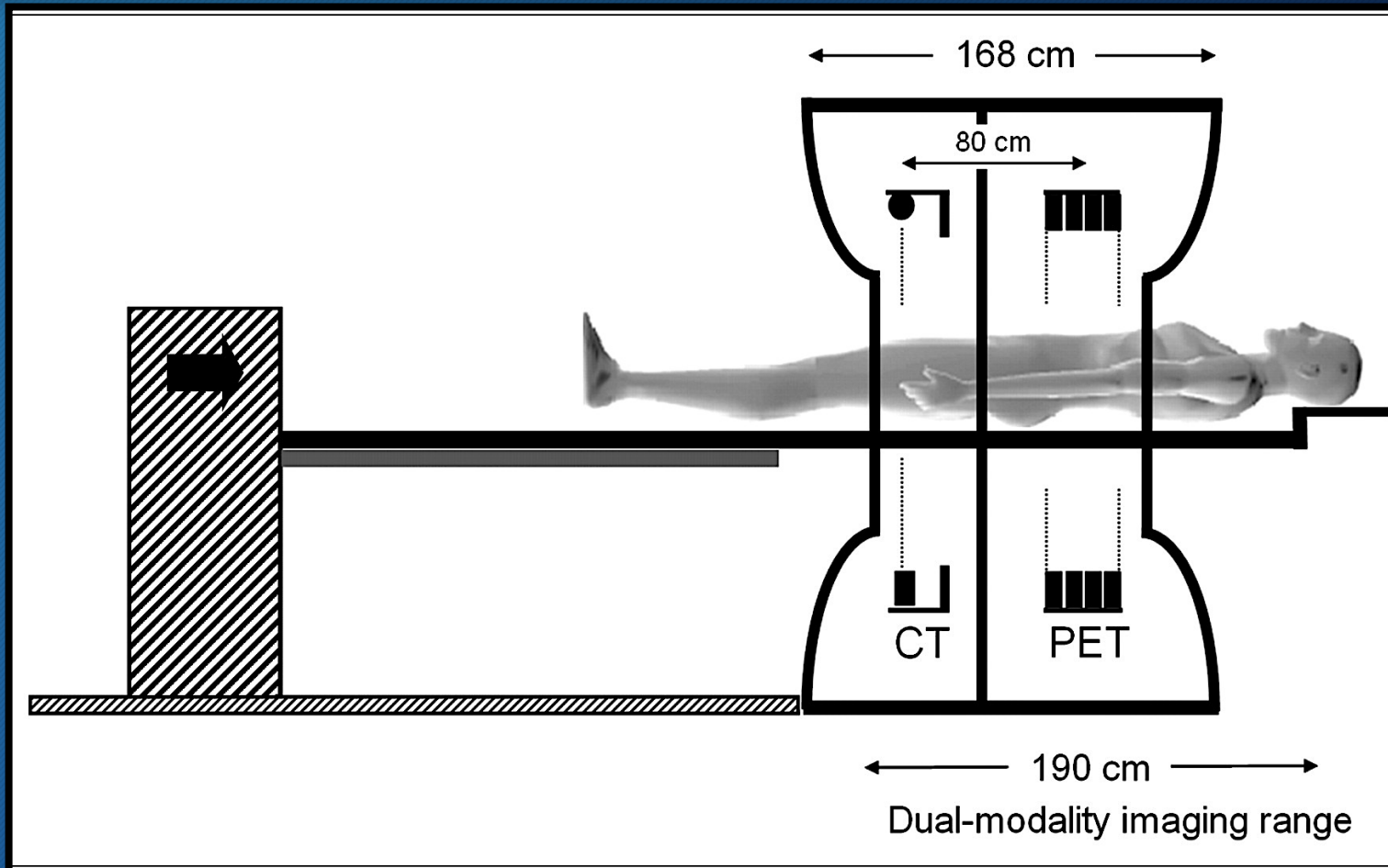
Imaging Techniques + Reconstructions

PET/CT Acquisition

- Scout view to outline the patient's body and ROI.
- CT Acquisition
- PET Acquisition



PET/CT Gantry



CT Acquisition (Local)

- Select the area desired to be imaged on the scout view.
- Check the slice thickness of images and reconstruction area.
- Auto mA and Smart mA is a new imaging option depends on the patient's body density.
- Imaging protocols depends on the patient's BMI :

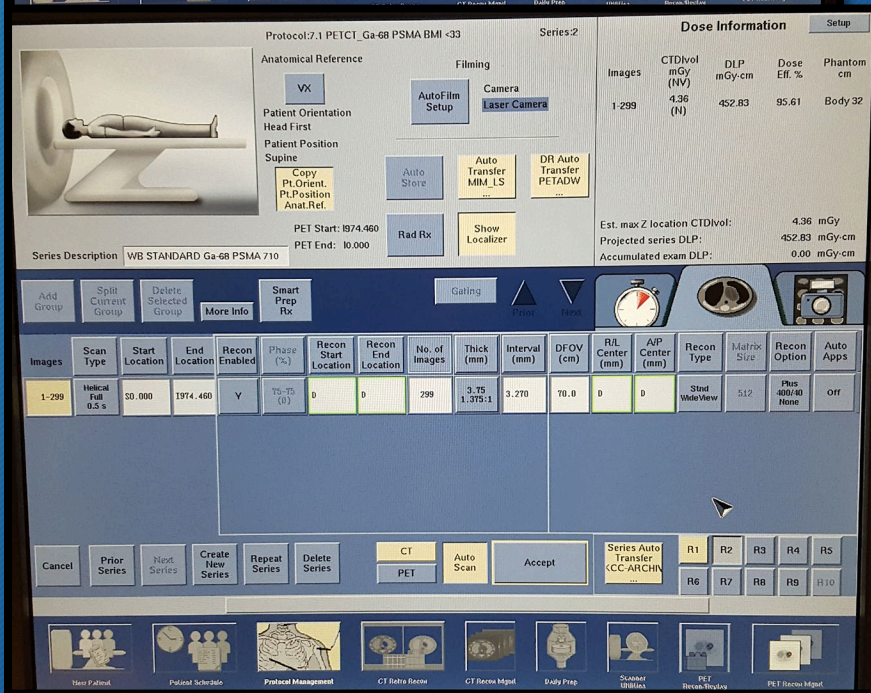
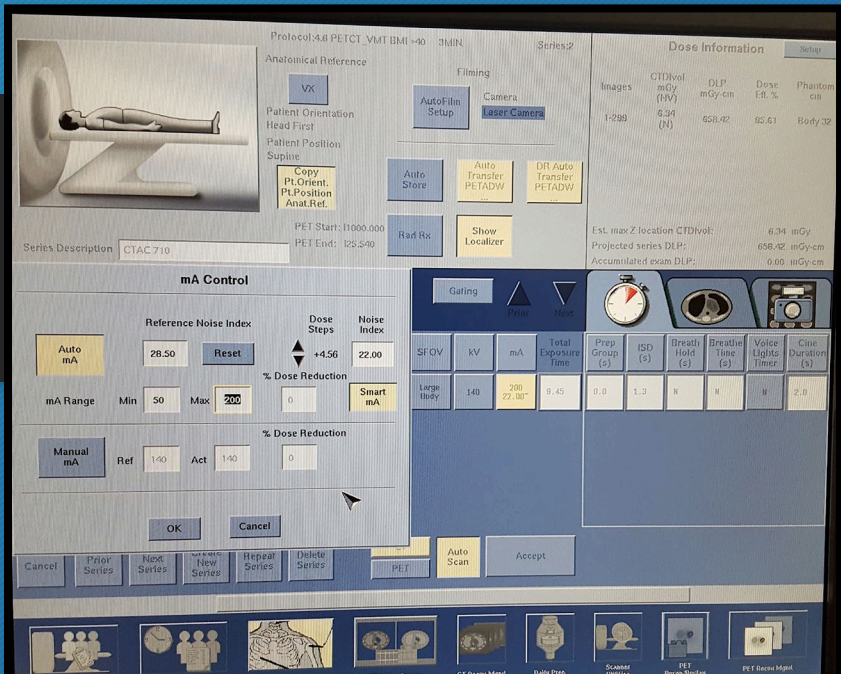
BMI	kV	Auto mA Range
<33	120	50 - 100
33 - 40	120	50 - 150
40<	140	50 - 200
50<	140	50 - 250

PET Acquisition (Local)

- The selected area on the CT view should be the same as the PET selection for accurate image registration.
- Check the patient's dose and time of administration.
- Check the selected imaging area for reconstructions.
- Imaging protocols depends on the patient's BMI :

BMI	MIN / BED
<33	2
33 - 40	2.5
40<	3
50<	4

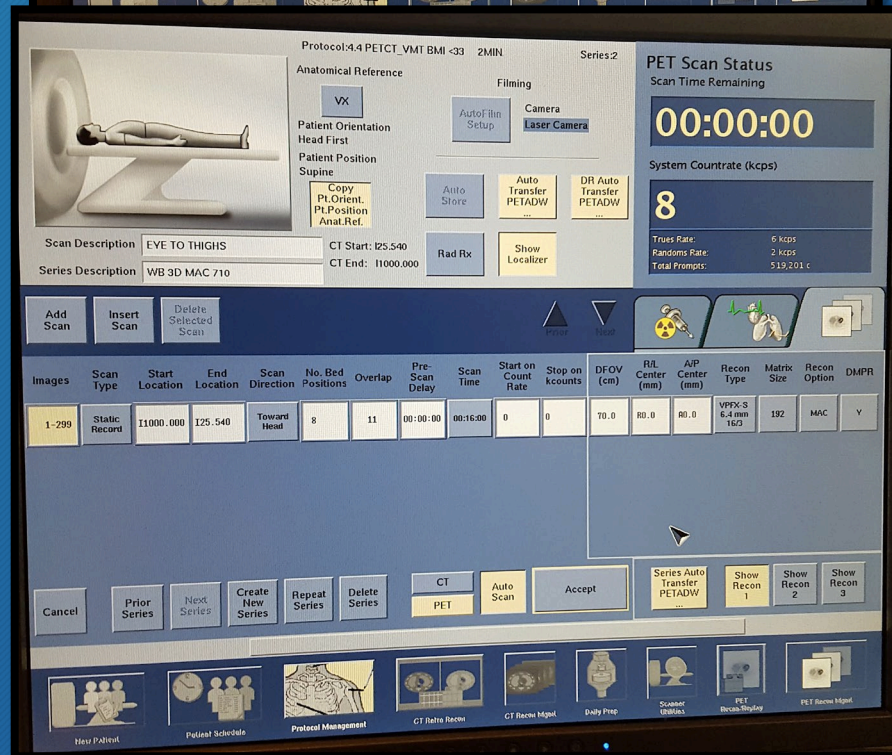
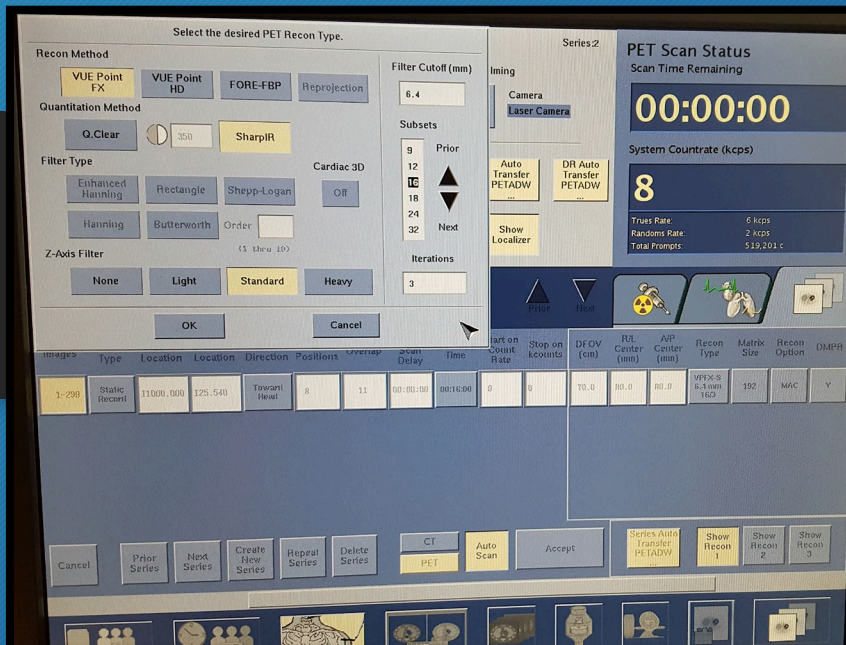
CT Parameters



CT Parameters can be adjusted to create new reconstructed images:

- mA
- kV
- Slice Thickness
- Recon type (standard, bone plus)
- Reconstruct a specific region with thinner slice thickness.

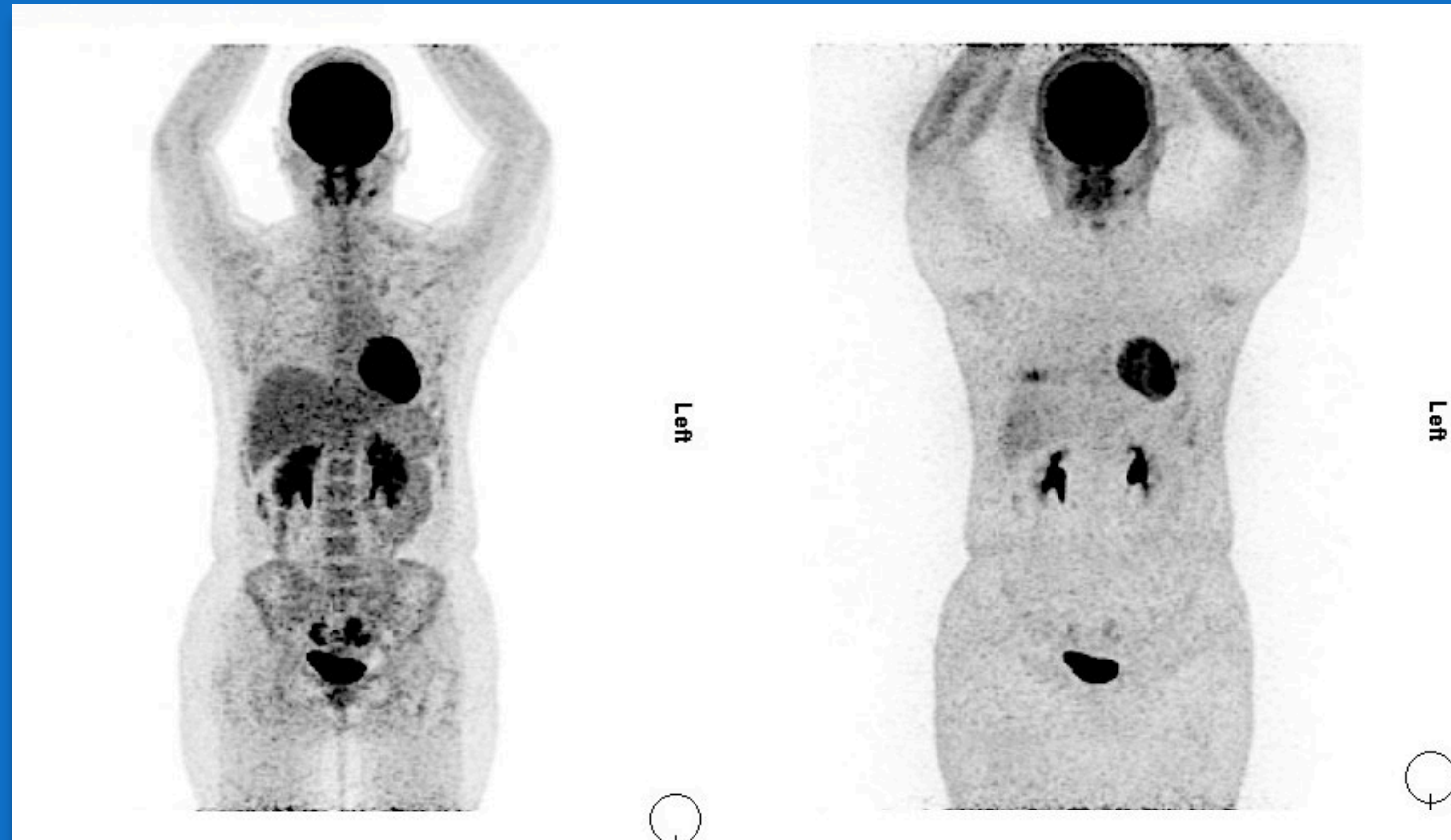
PET Parameters



PET Parameters can be adjusted to create new reconstructed images:

- Time/bed, less than acquired.
- Recon option (Non-AC)
- Recon type
 - subsets
 - Iterations
 - Filter cutoff
- Recon method (TOF)
- Quantitation method (Q Clear)

PET Images + Reconstruction



AC

Attenuated Corrected

NAC

Non-Attenuated
Corrected (Raw Data)

Time of Flight (TOF) Reconstruction method on Obese patients



New Reconstruction method

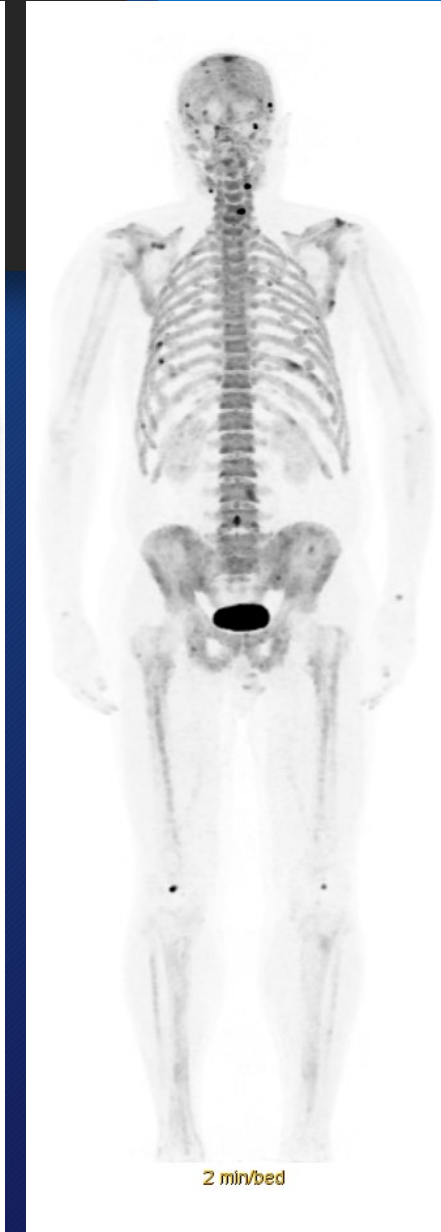
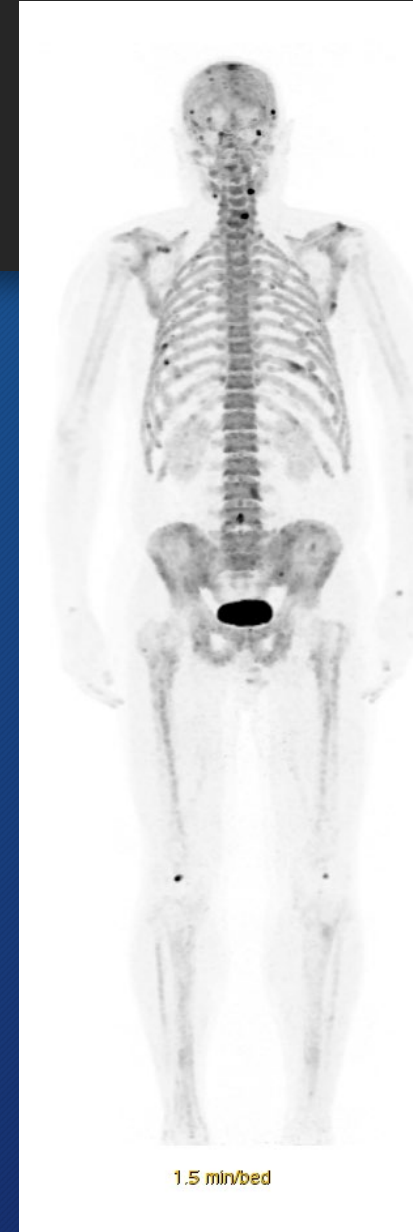
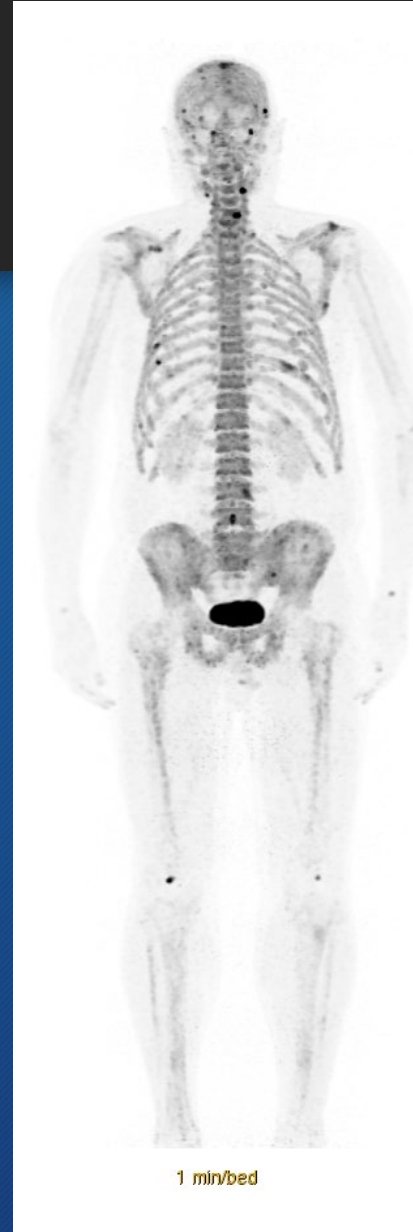
- A bone lesion in the rib was detected with the New Reconstruction method (e.g. Qclear)



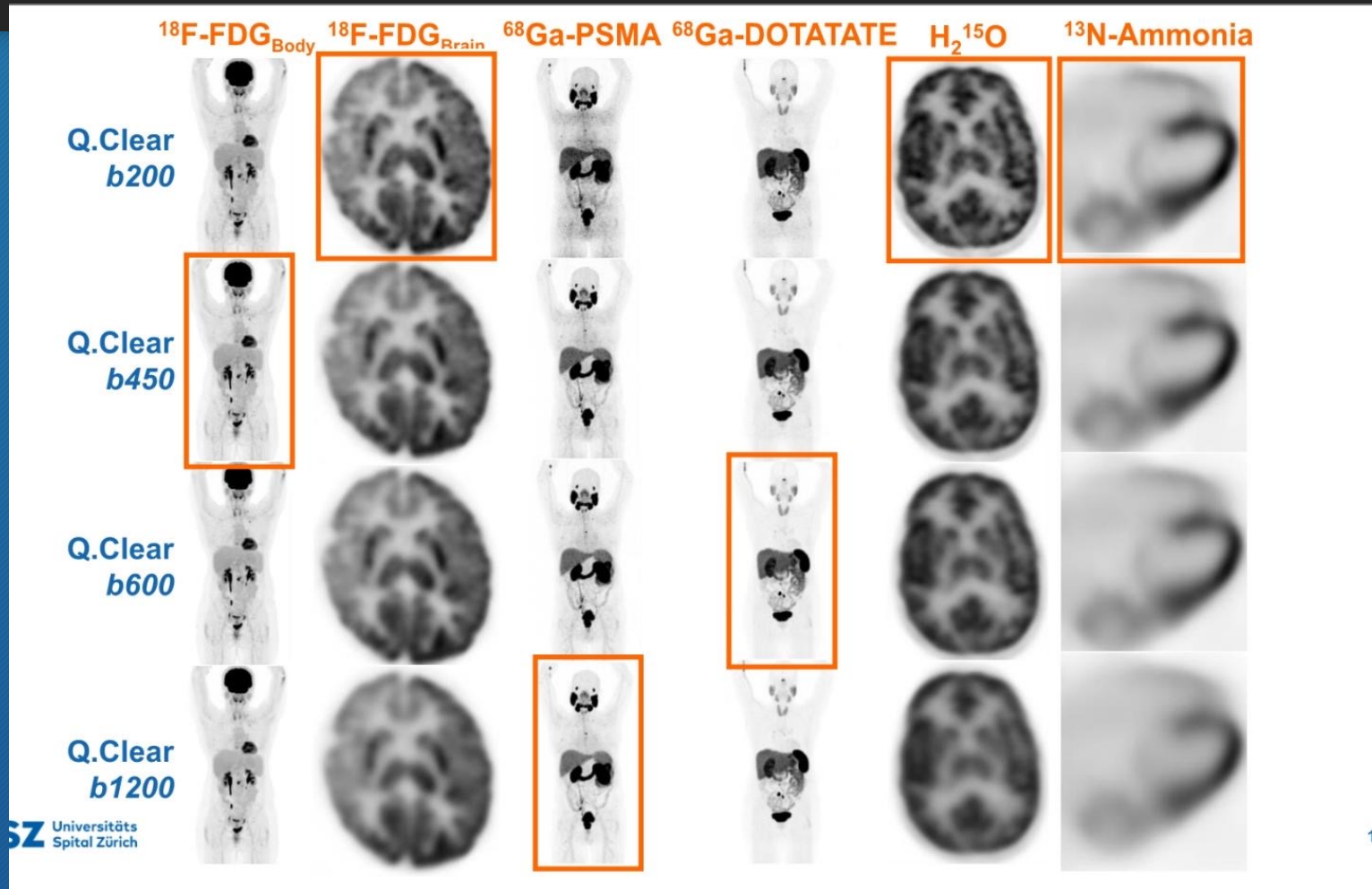
Reconstruct Raw data for research purposes

Reconstruct Images:

- Time/bed (can go lower but not higher)
- TOF on or off
- Change Q. clear values



Q. clear Reconstructions



Obese Patients

Obese Patients

- Consider scanner bed tolerance (227kg max)
- Will the patient fit in the scanner? (70cm diameter bore)
- Need restraints to minimize patient motion.

impact of obesity on imaging:

- Access to veins - extravasation?
- patient needs assistance to move?
- Positioning for acquisition.

Imaging protocol depends on the patient's BMI.



<https://www.emaze.com/@ACRRLOIQ/Presentation-Name>

Obese Patient Imaging

- Image resolution improved with a higher dose and longer time of acquisition.

BMI = 59

Weight = 190Kg



Left

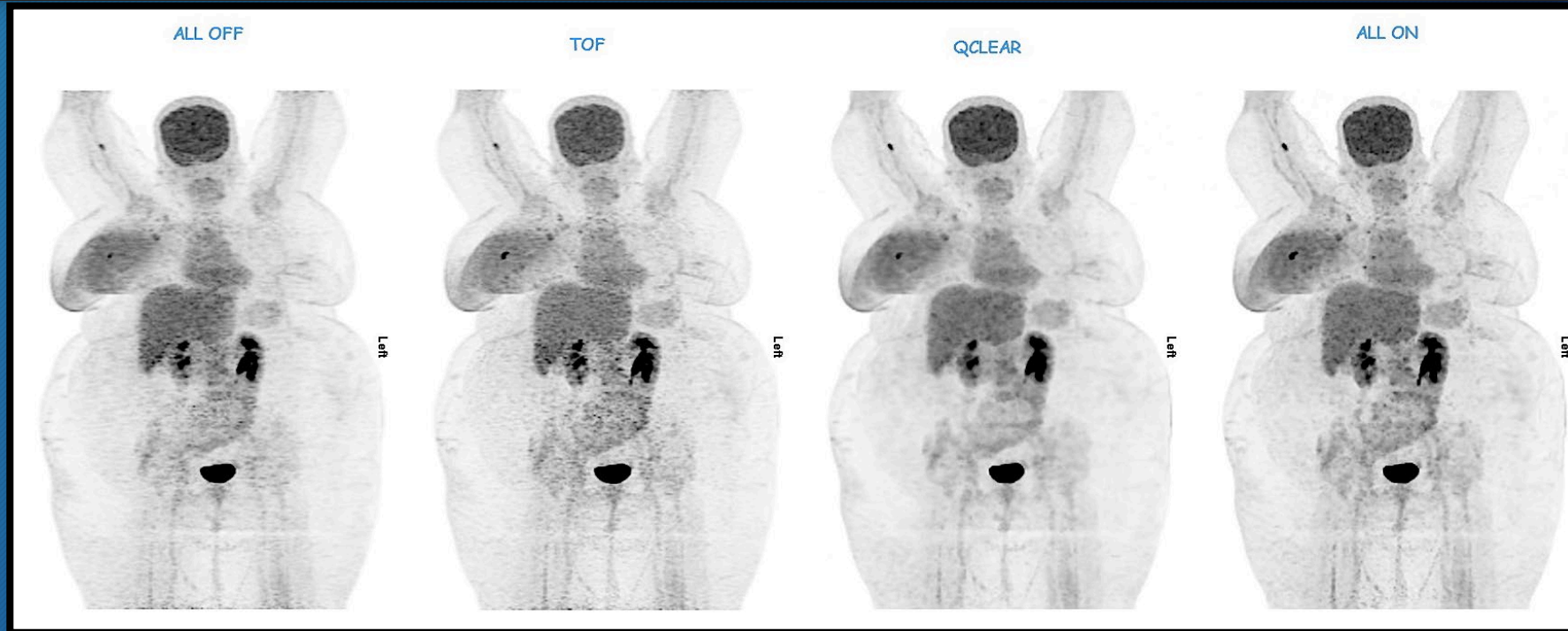
5 mCi + 3 min/bed



Left

12 mCi + 4 min/bed

TOF and New Reconstruction method in Obese patients



Right Peri-Cardial

- Lesions are detected when all reconstruction methods are on.

Pediatric Patients

Pediatric Patients

- 0 – 18 years (toddler most difficult)
- Need restrains to minimize patient motion.
- Some pediatric patients are cooperative.
- Develop a relationship with the patient.
- Usually need anesthesia (0-6 years old).
- Liquid chloral hydrate syrup is not allowed for sedation as it contains glucose.

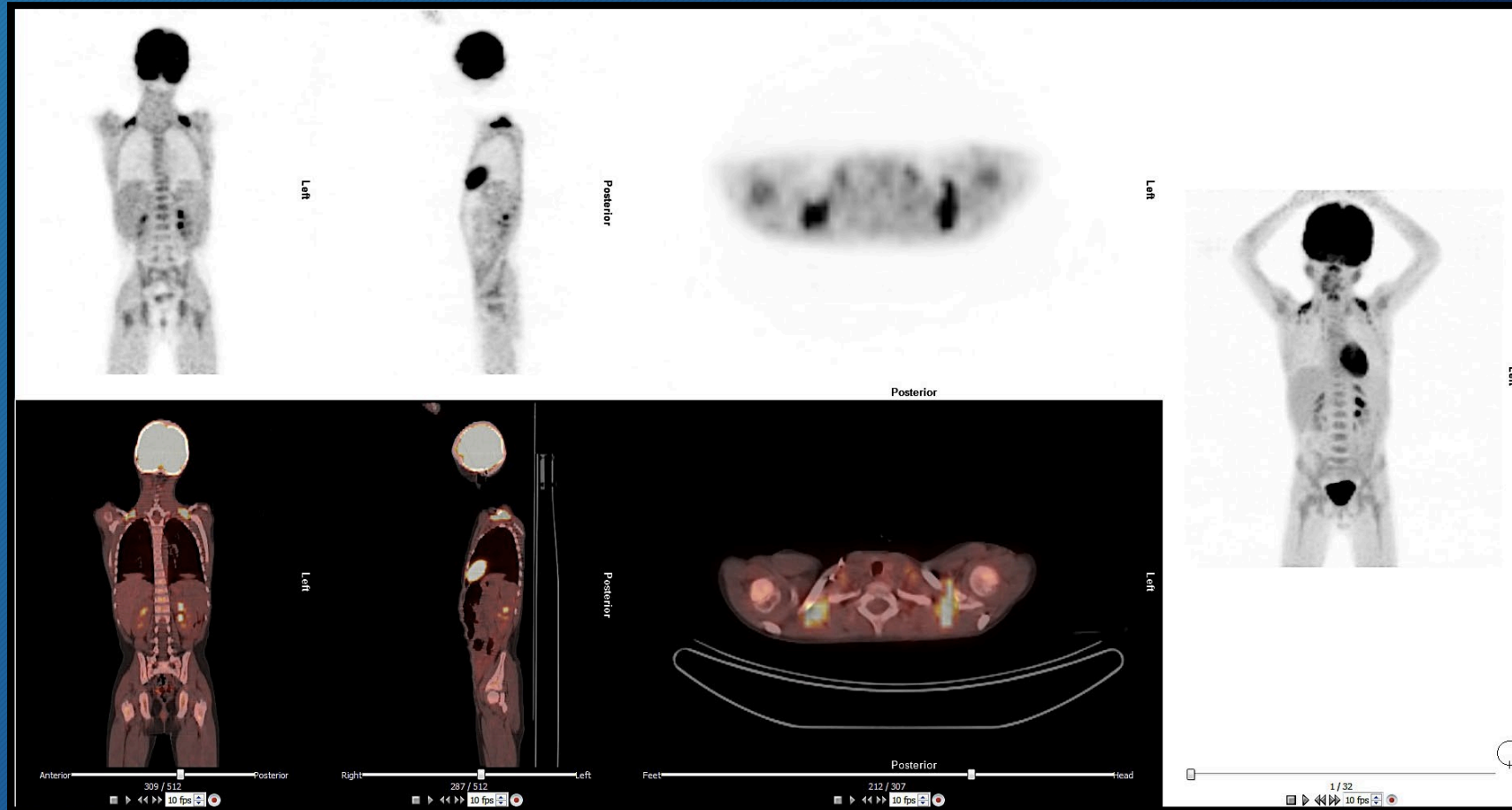


Pediatric Imaging Protocols (Local)

- Age and weight dependent (up to 55kg)
- If patient's weight is more than 55kg use adult protocol.
- Pediatric CT parameters depends on the patient's weight :

Weight (Kg)	kV	Auto mA Range
0 - 11.4	120	20 - 25
11.5 - 22.4	120	25 - 40
22.5 - 55	120	25 - 50

Pediatric Patient Imaging



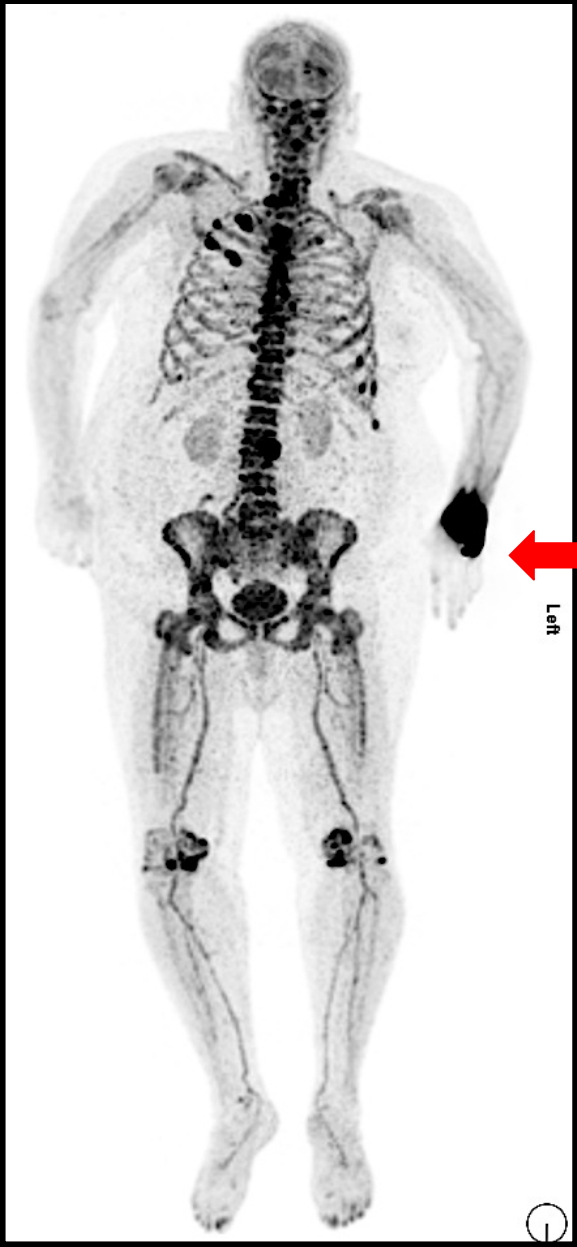
Technical Artifacts

Dose Extravasation

Arm Infiltration



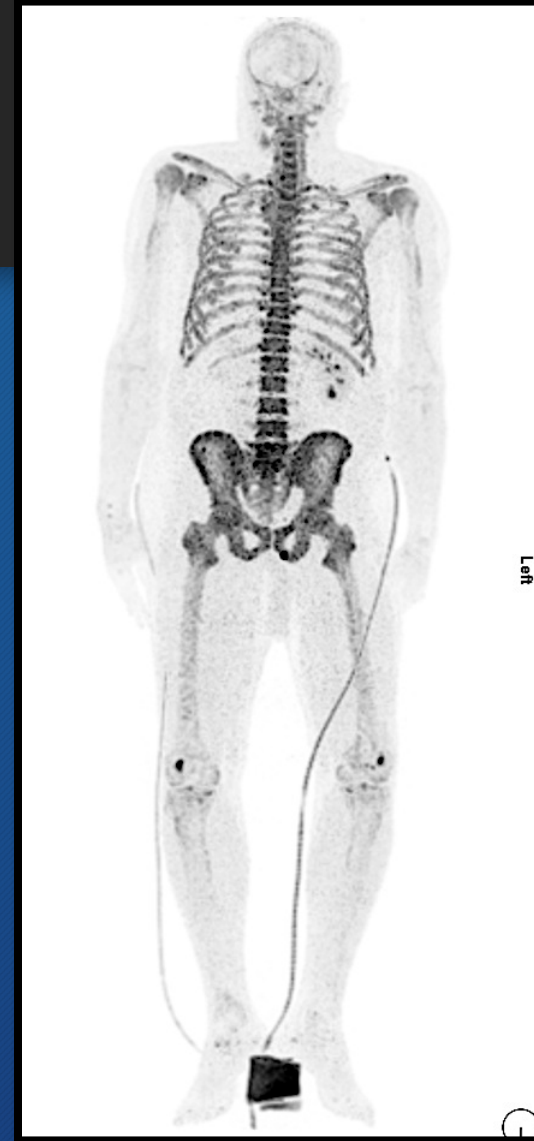
Hand Infiltration



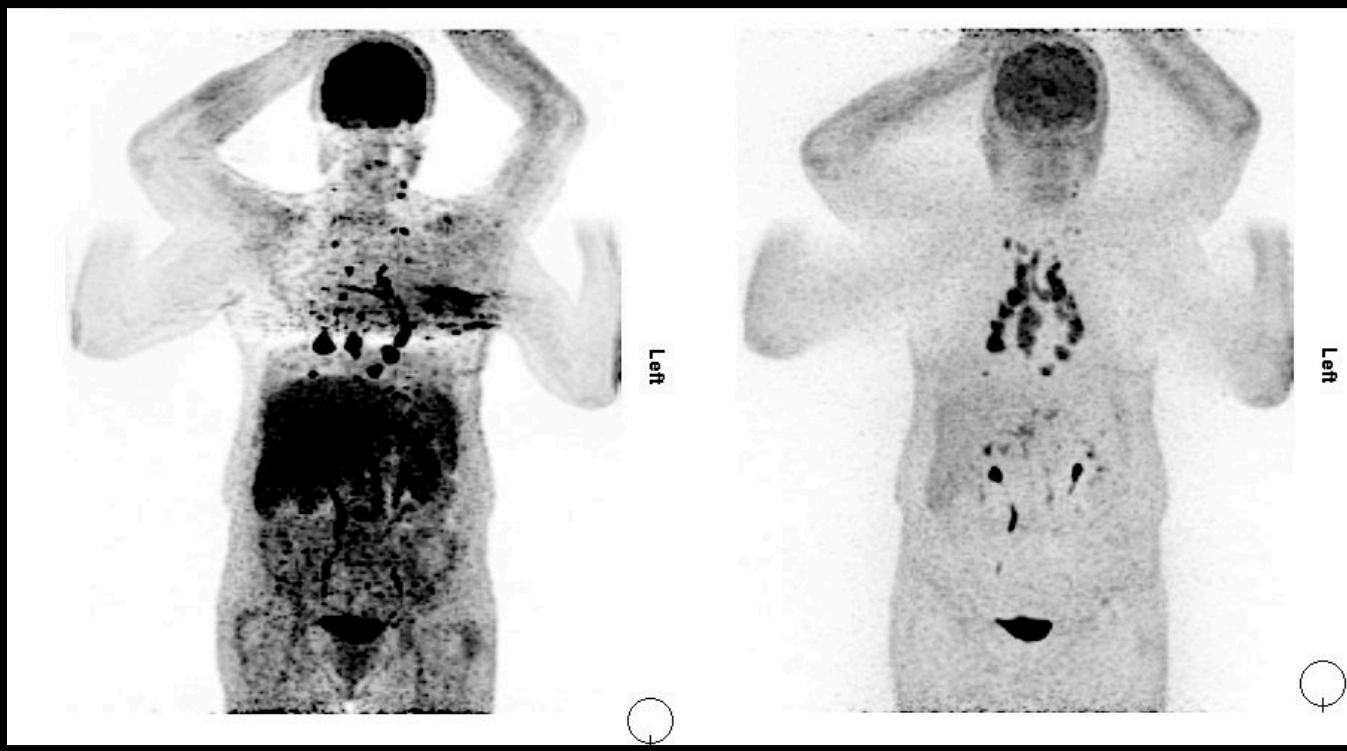


Full bladder

Patient has Cervical Cancer



Catheter urine bag
placed between feet.



Patient Moved arms during Acquisition



Head Movement

Radiotherapy (RT) Planning

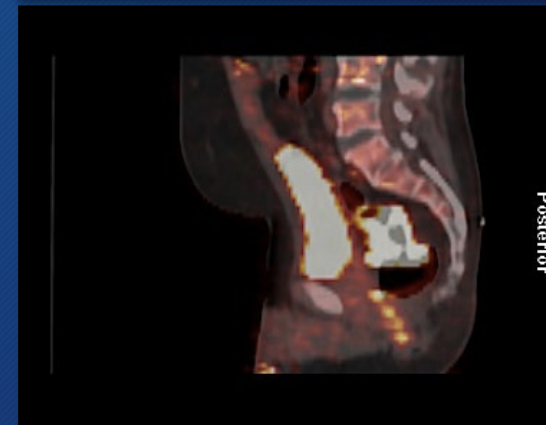
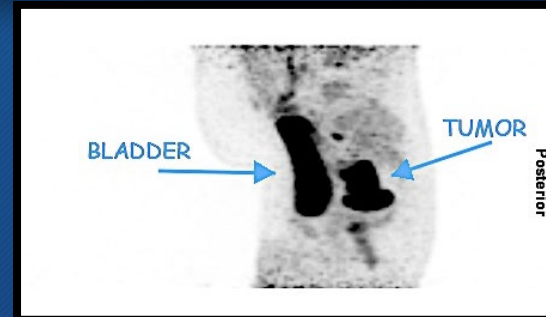
Radiotherapy (RT) Laser Simulation



Radiotherapy (RT) Laser Simulation



Head & Neck RT Planning



Fused PET/CT image
Colorectal RT Planning

New PET Technologies

- New Digital PET/CT Cameras.
- Motion free acquisition
 - Correct motion in chest and abdomen area
 - To increase detectability of lesions

Thank You



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