



# Nuclear Medicine Brain Imaging – Non-Dementia

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# TECHNIQUES:

- SPECT
- SPECT/CT
- PET
- Planar



# RADIOPHARMACEUTICALS:

- Tc99m Bicisate (Neurolite<sup>©</sup>)
- Tc99m HMPAO (Ceretec<sup>©</sup>)
- I-123 Ioflupane (DaTscan<sup>©</sup>)
- F-18 FDG
- In-111 DTPA
- Tc-99m pertechnetate
- Tc-99m glucoheptonate



# INDICATIONS:

- Dementia
- Interventional Studies
  - Pharmacologic –Diamox<sup>©</sup>
  - Occlusion
- Suspected Parkinsonian syndromes
  - DaTscan<sup>©</sup>
- Seizure Localization
- Brain Death
- CSF Studies
  - Flow analysis
  - Leak detection
  - Shunt evaluation



# SPECT in Transient Ischemic Attacks...Diamox<sup>©</sup> challenge

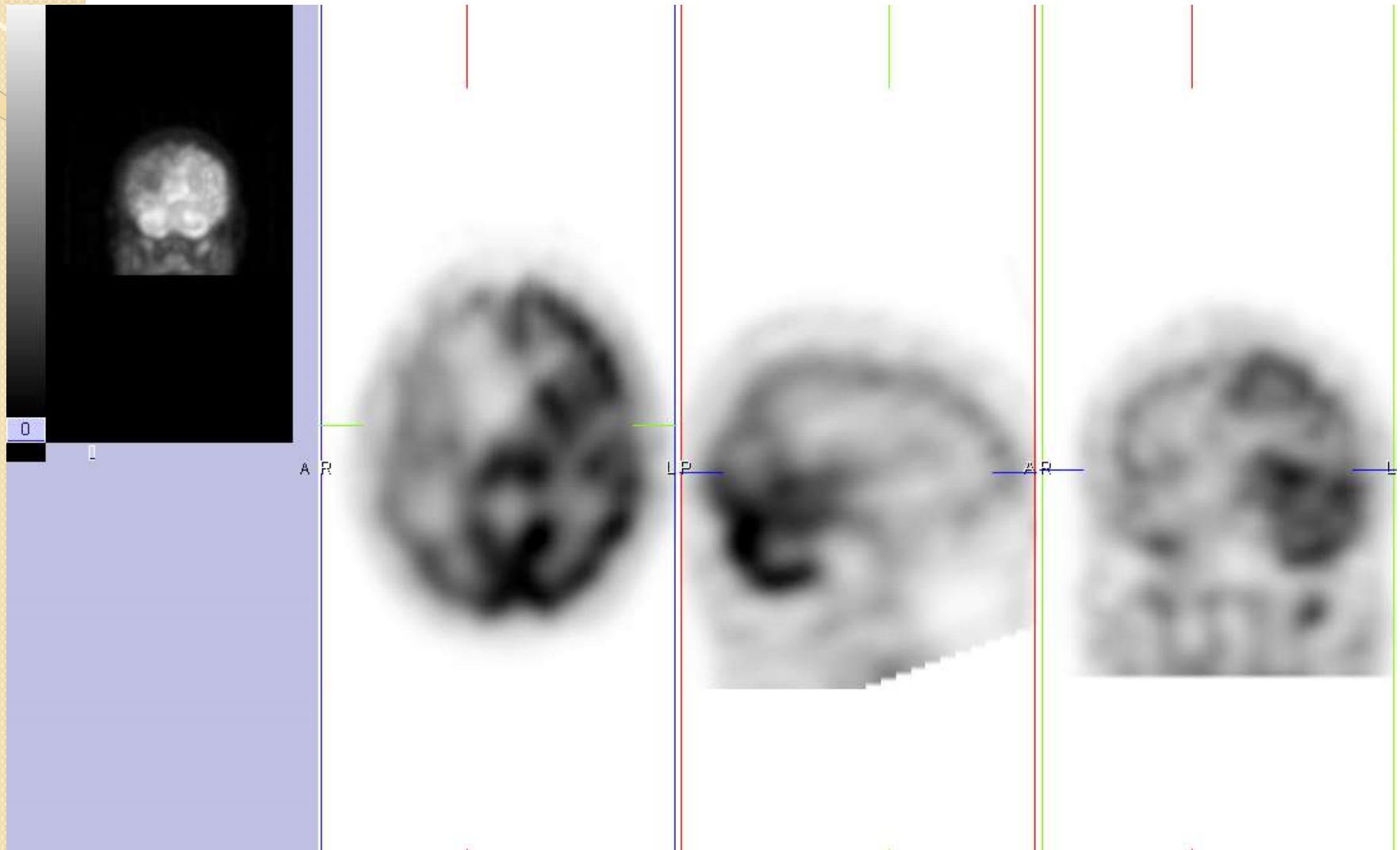
- Acetazolamide (1gm IV) Diamox<sup>©</sup> produces vasodilatation with 30-50% increase in rCBF in normal brain at 30 minutes
- Areas with vascular compromise show little or no increase
- Comparison of baseline and post Diamox images can identify territories at risk



# Cerebral Perfusion SPECT in Arterial Occlusion Assessment

- evaluation of patients with ICA aneurysms, tumors at base of brain
- study of perfusion, with injection during temporary balloon occlusion with imaging later
- baseline study (?)
- evaluate collateral blood flow
- location and severity of perfusion changes during occlusion
  - assess need for bypass prior to definitive surgery

# R ICA Balloon Occlusion







## I-123 Ioflupane (DaTscan<sup>®</sup>)

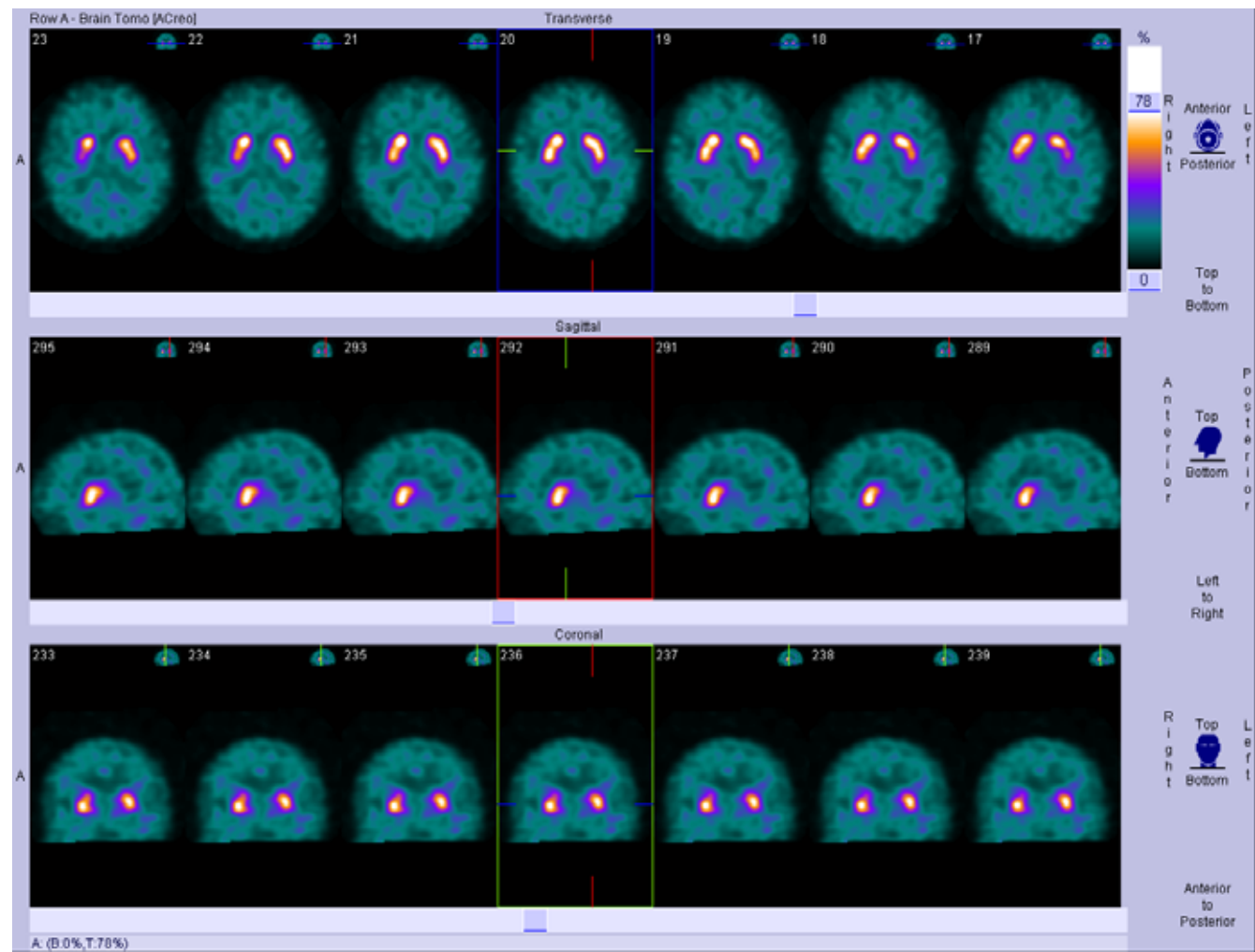
- evaluation of patients with suspected Parkinsonian syndromes (PS)
- striatal dopamine transport system visualization
- SPECT, SPECT /CT



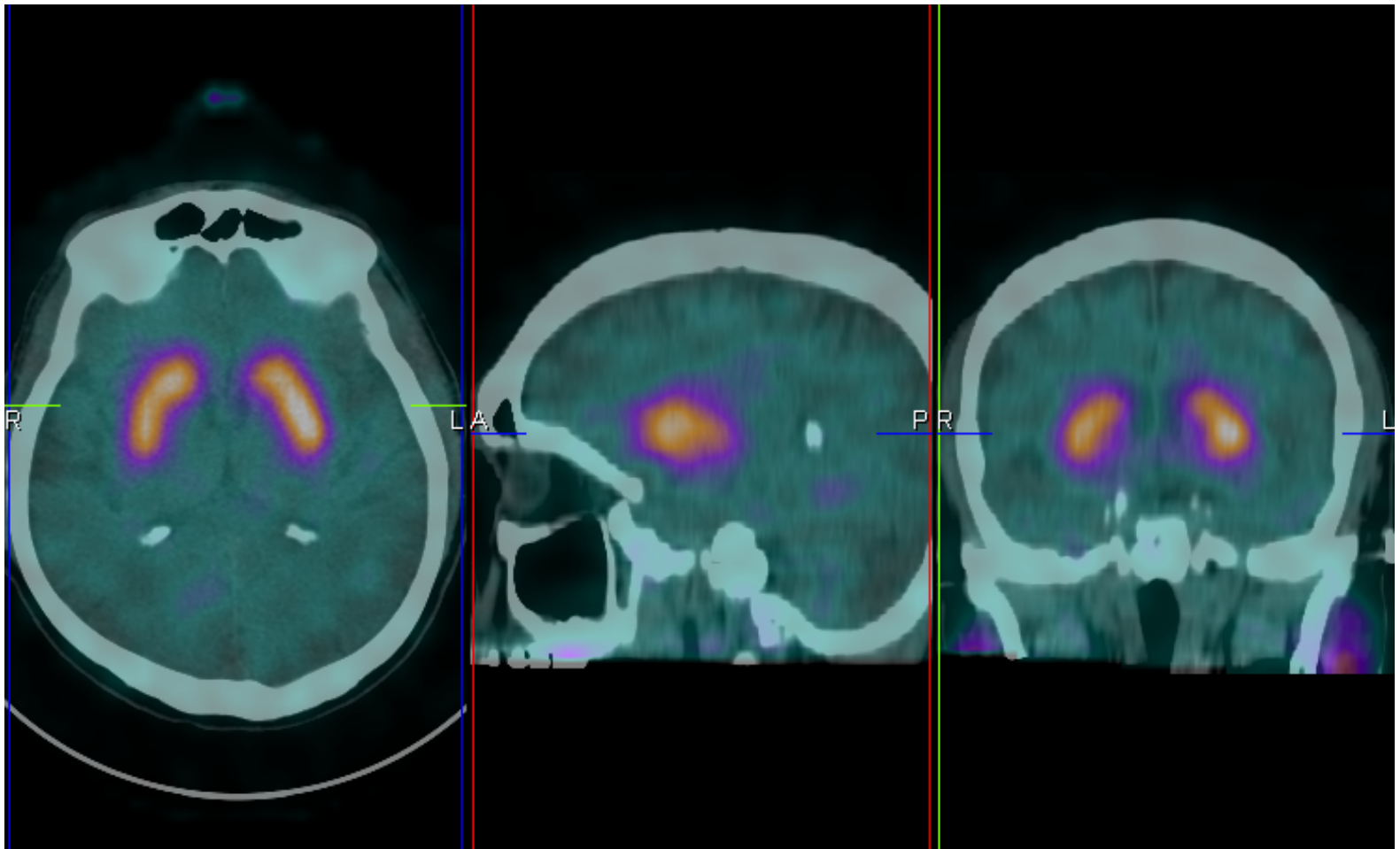
## Suspected Parkinsonian syndromes (PS)

- Essential Tremor (ES) vs PS
  - idiopathic Parkinson's disease
  - multiple system atrophy
  - progressive supranuclear palsy

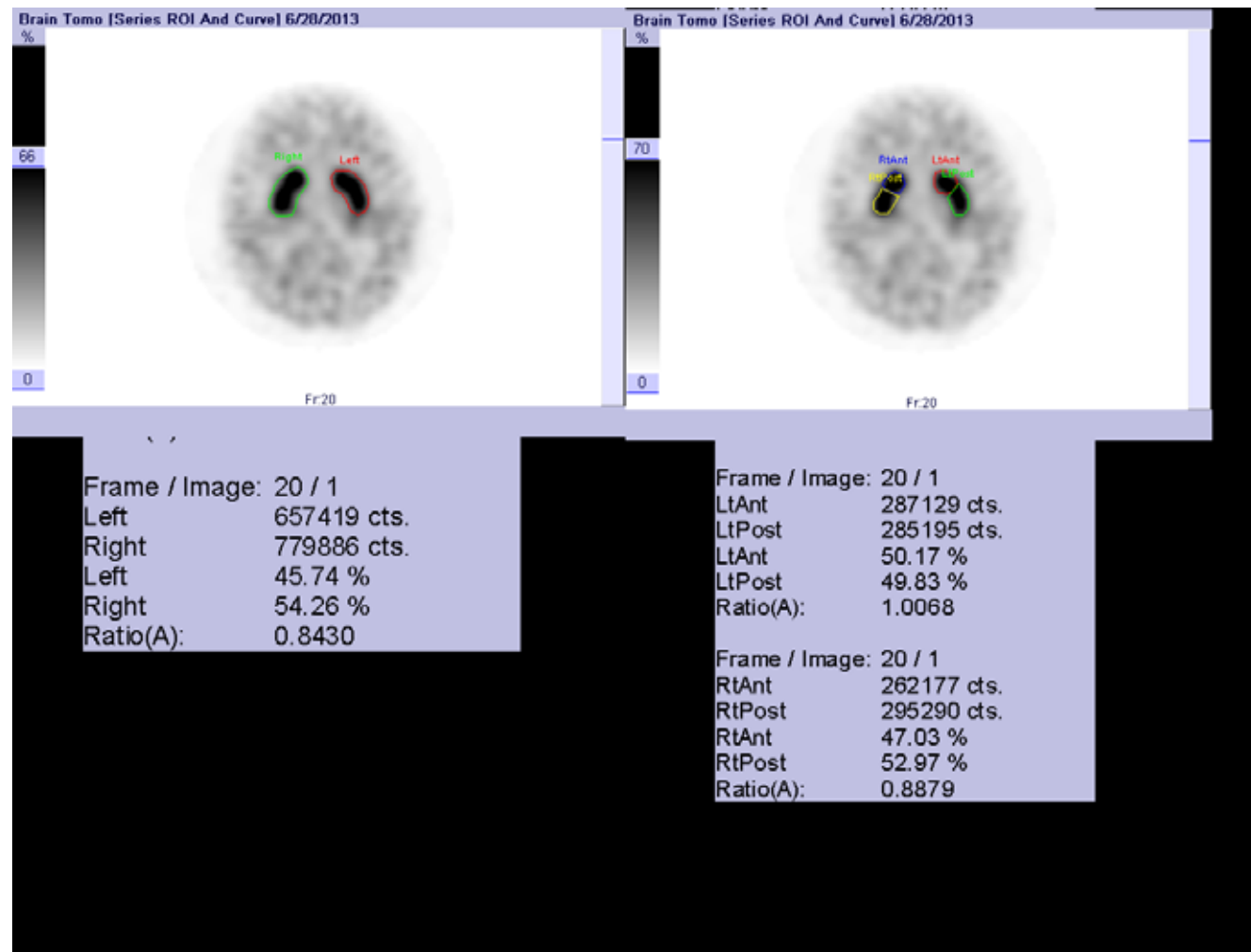
# Normal



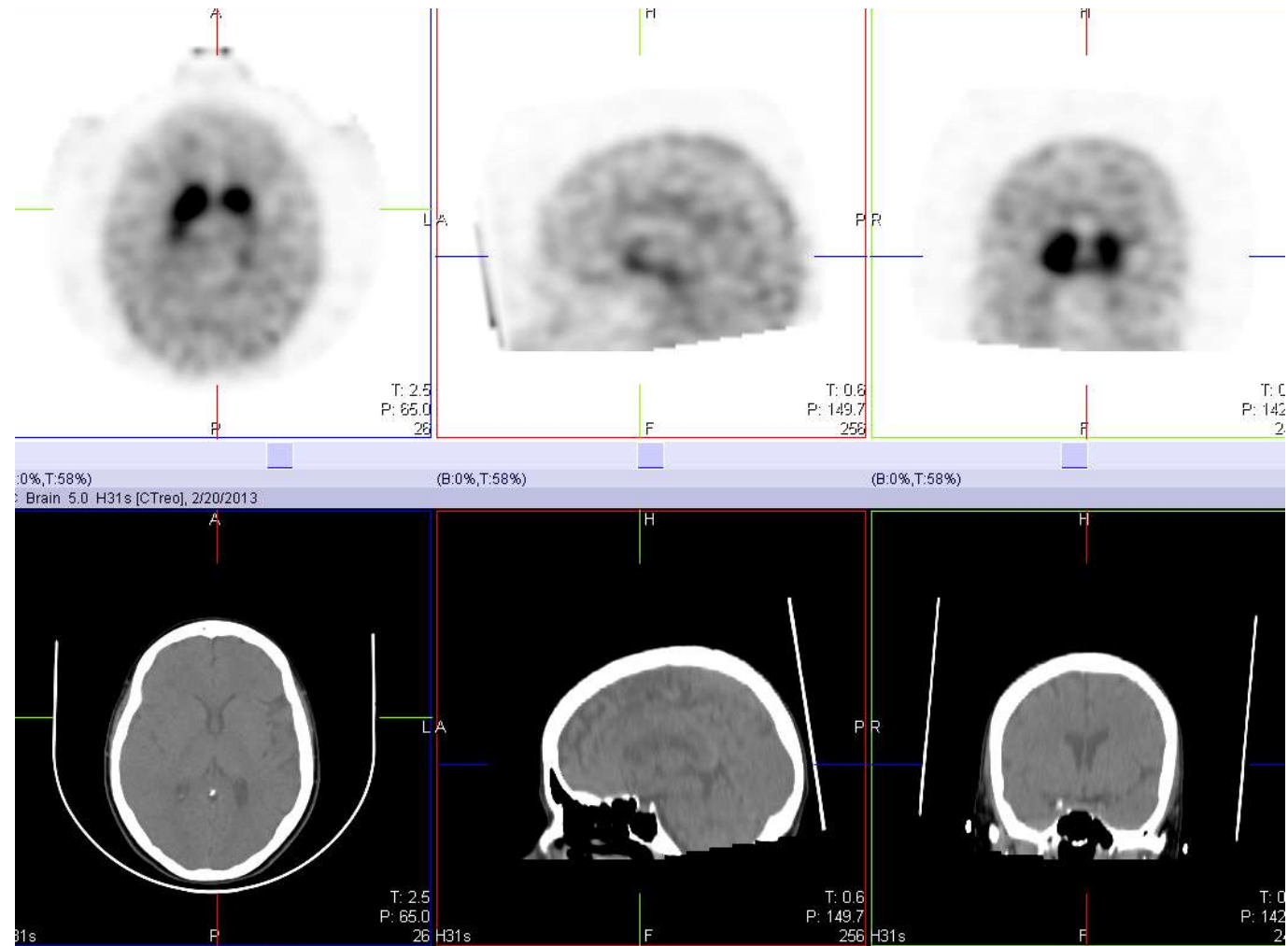
# Normal



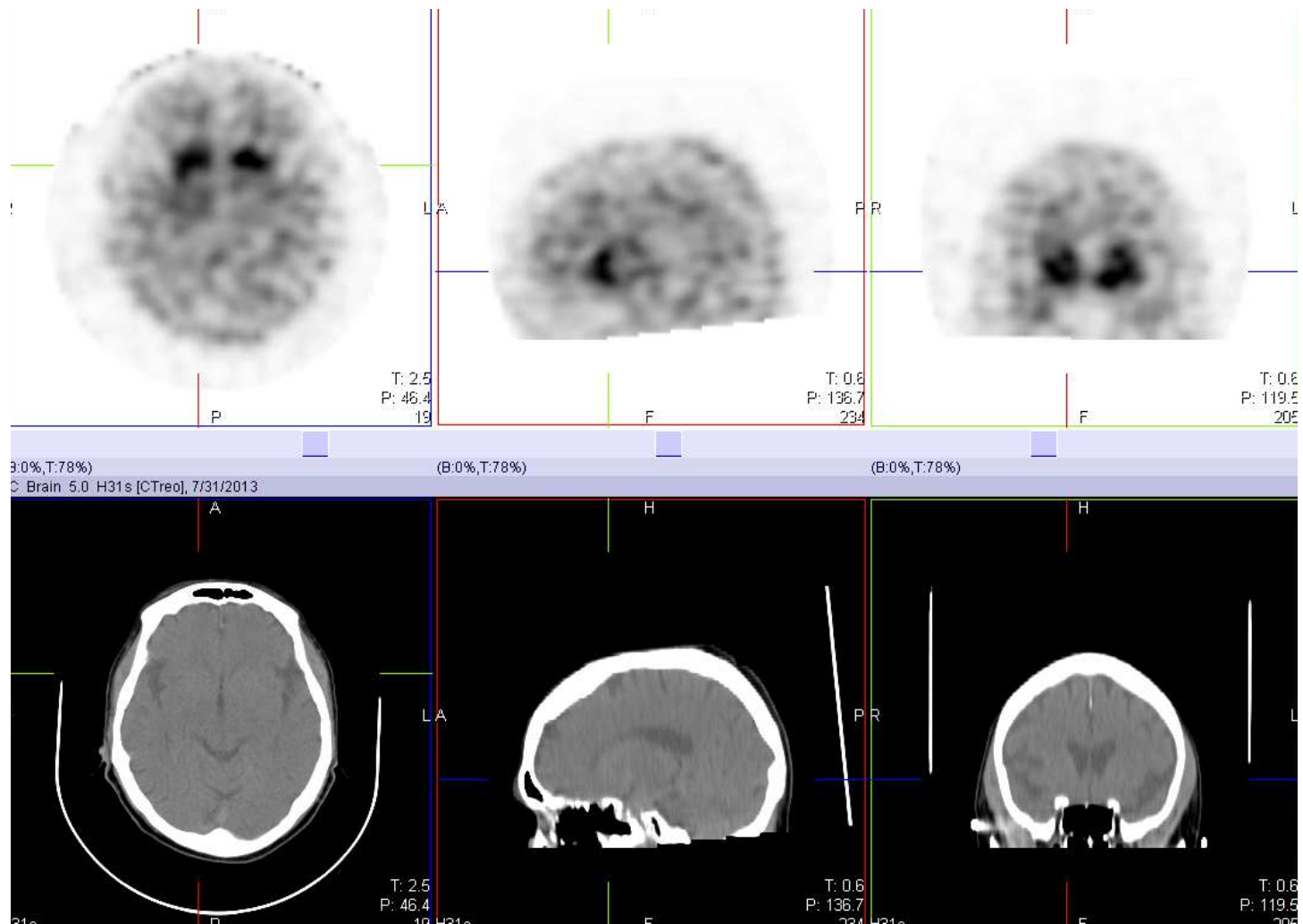
# Quantitative Analysis



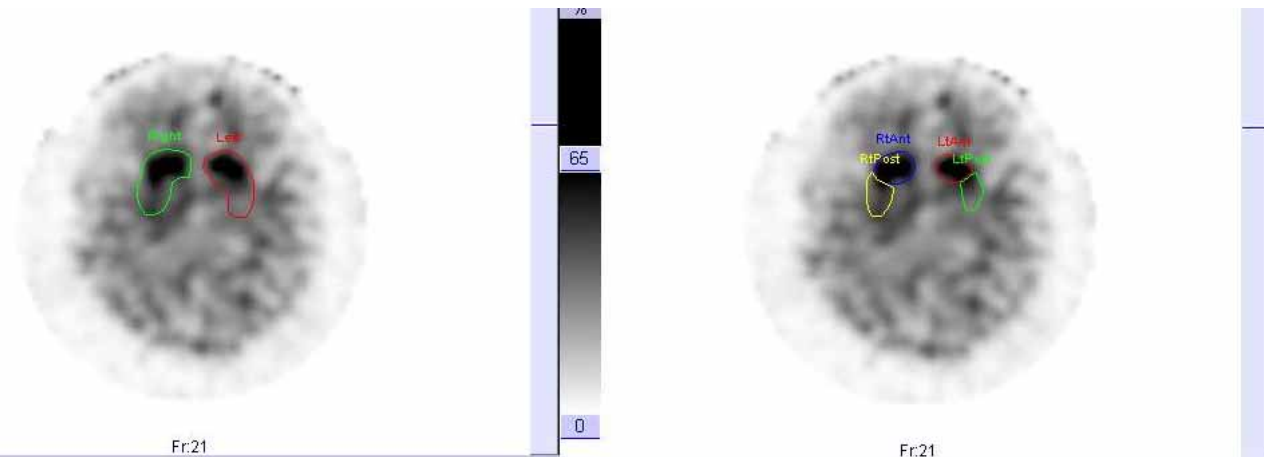
# Unilateral Decreased Dopamine Transporters



# Bilateral Decreased Dopamine Transporters



# Bilateral Decreased Dopamine Transporters



Frame / Image: 21 / 1  
 Left 300279 cts.  
 Right 349753 cts.  
 Left 46.19 %  
 Right 53.81 %  
 Ratio(A): 0.8585

Frame / Image: 21 / 1  
 LtAnt 134337 cts.  
 LtPost 85616 cts.  
 LtAnt 61.08 %  
 LtPost 38.92 %  
 Ratio(A): 1.5691

Frame / Image: 21 / 1  
 RtAnt 181009 cts.  
 RtPost 109840 cts.  
 RtAnt 62.23 %  
 RtPost 37.77 %  
 Ratio(A): 1.6479



# Seizure Focus Localization

- Surface EEG
  - poor spatial resolution
- Depth EEG
  - invasive
- SPECT/CT ( Bicisate, HMPAO)
  - increased rCBF (ictal)
  - decreased or normal rCBF (inter-ictal)
- PET



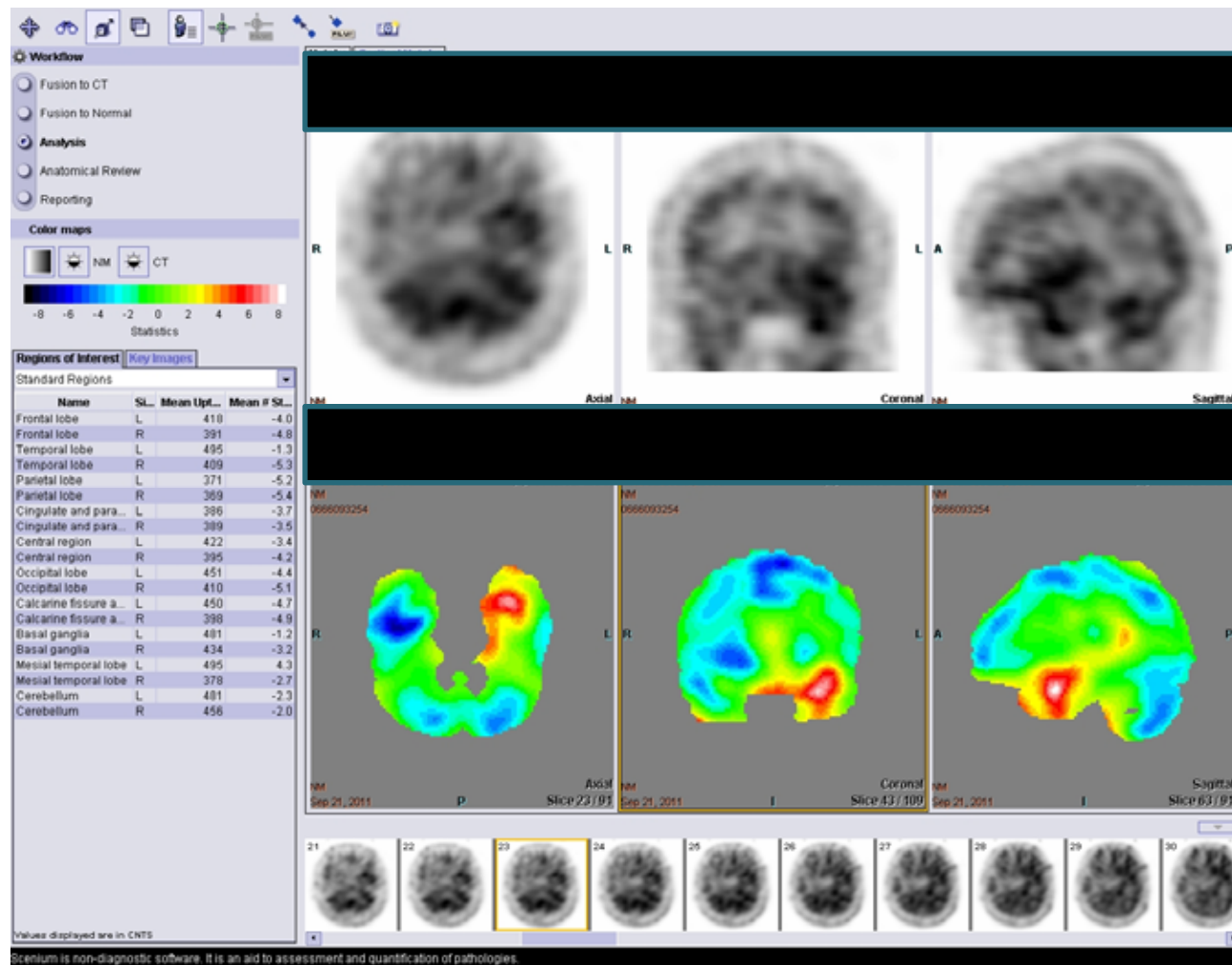
# SPECT in the Evaluation of Epilepsy

- primary goal of perfusion SPECT imaging is seizure focus localization
- inject activity to maximize diagnostic value:
  - ictal imaging
  - inter-ictal imaging
  - post-ictal imaging (?)

# Ictal Imaging

- inject tracer at onset of seizure
  - Within 10 seconds of seizure onset
  - Requires special monitoring/surveillance
- images show hyperperfusion (increased activity) in epileptogenic focus extending to ipsilateral basal ganglia/thalamus
- may also extend to ipsilateral motor cortex/contralateral cerebellum

# Ictal SPECT

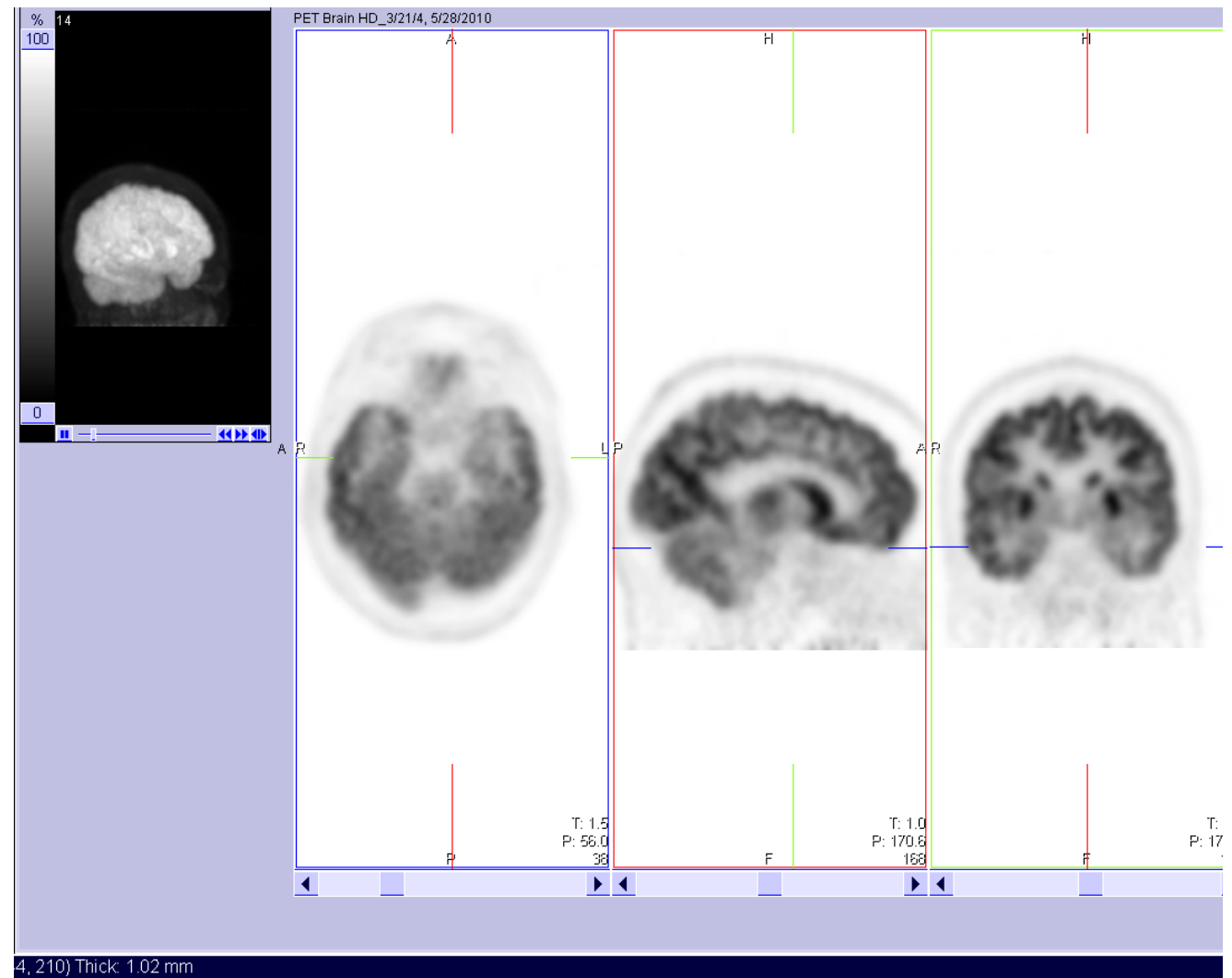




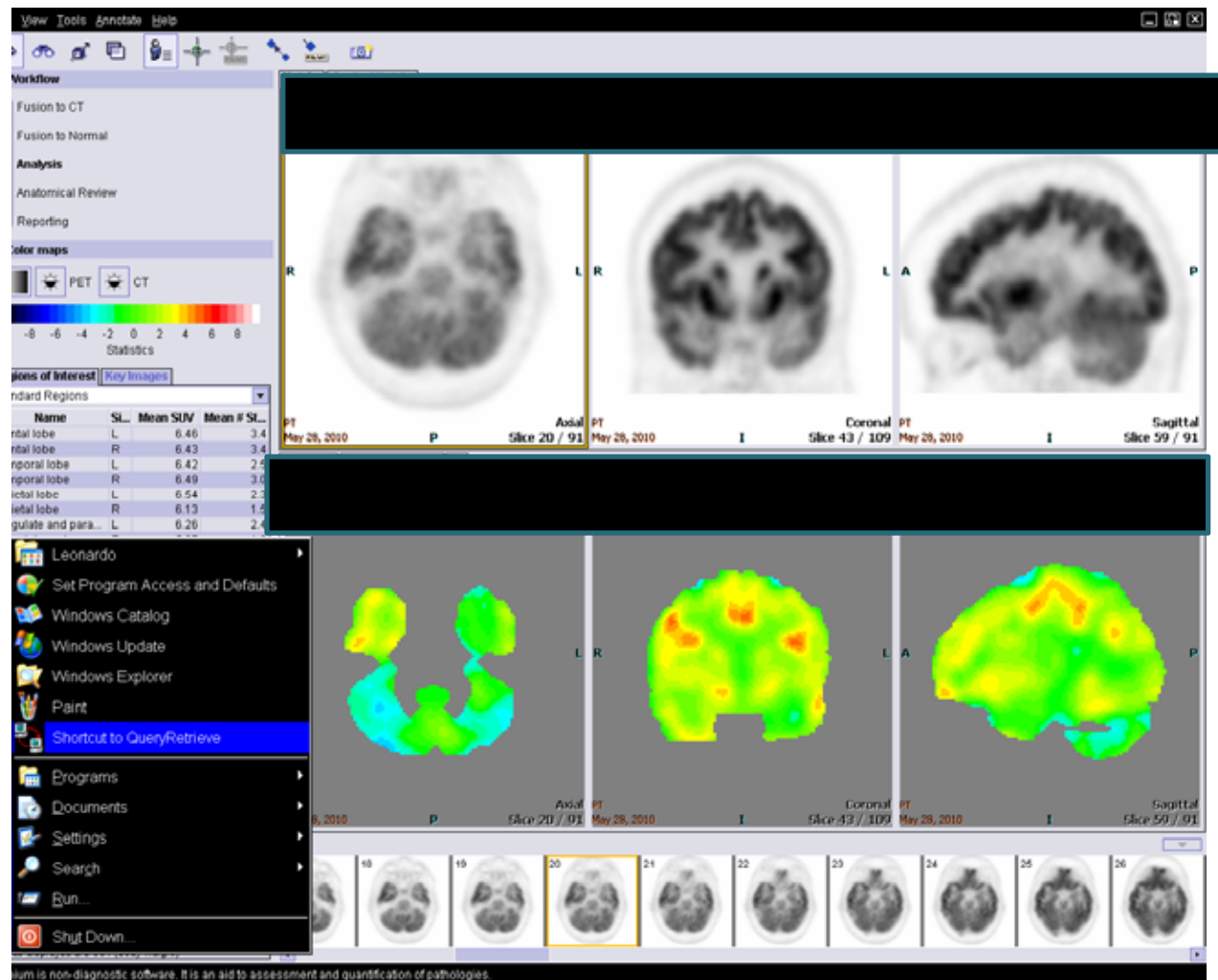
# Inter Ictal Imaging

- Least accurate of the three techniques
- Images may show hypoperfusion in the region of the seizure focus, but may be normal

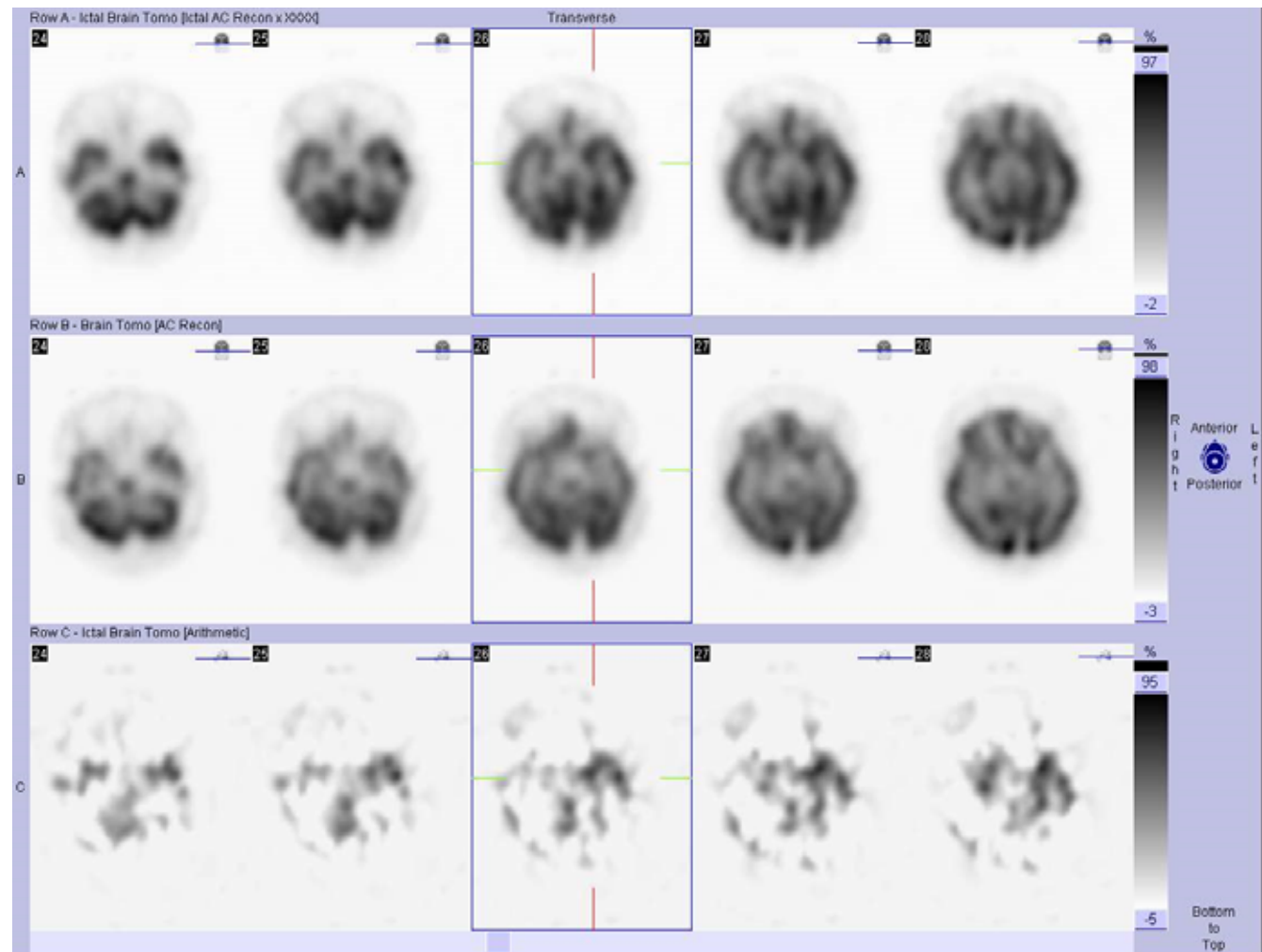
# Inter-Ictal



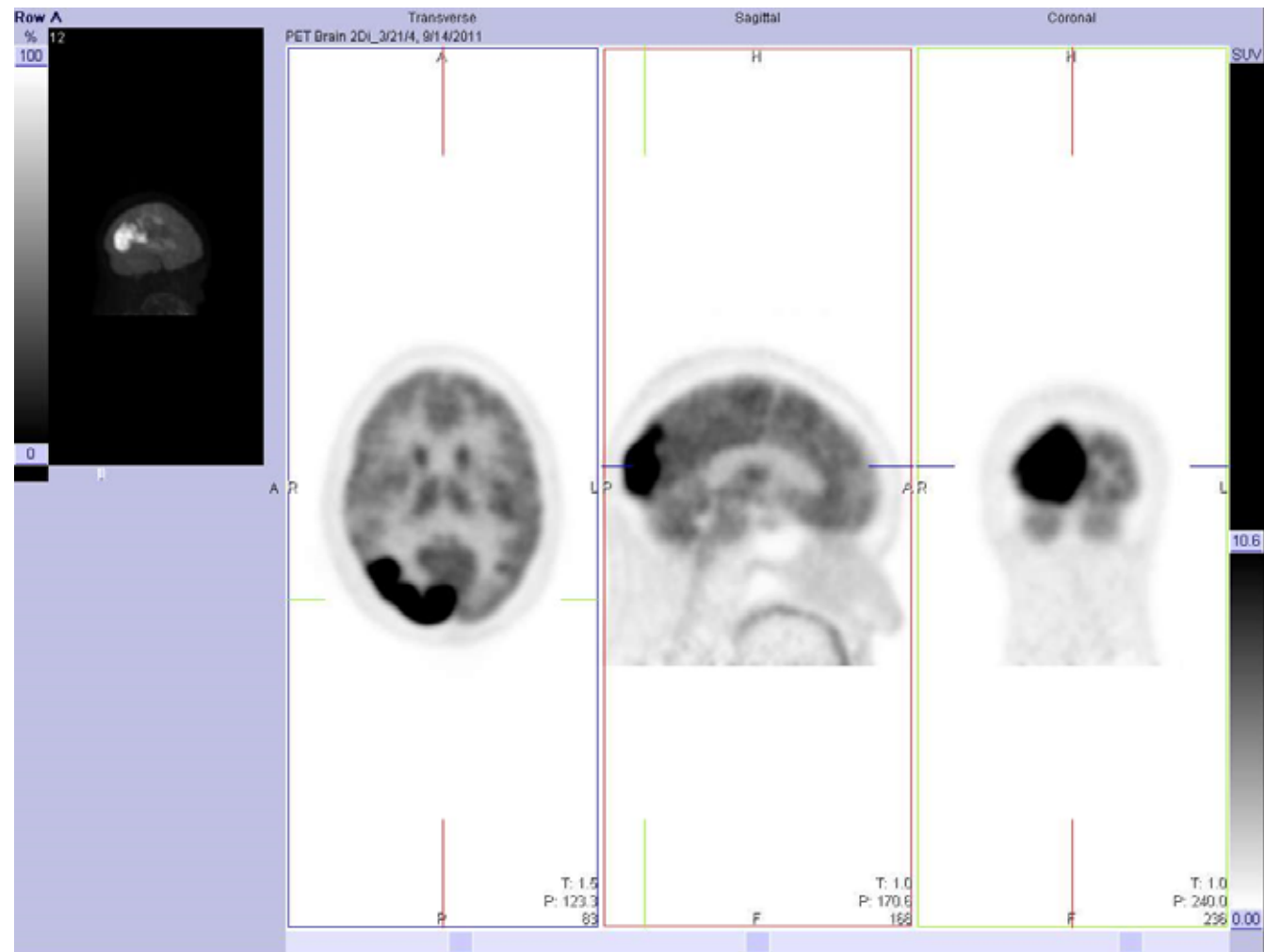
# Inter-Ictal



# Subtraction



# PET Seizure

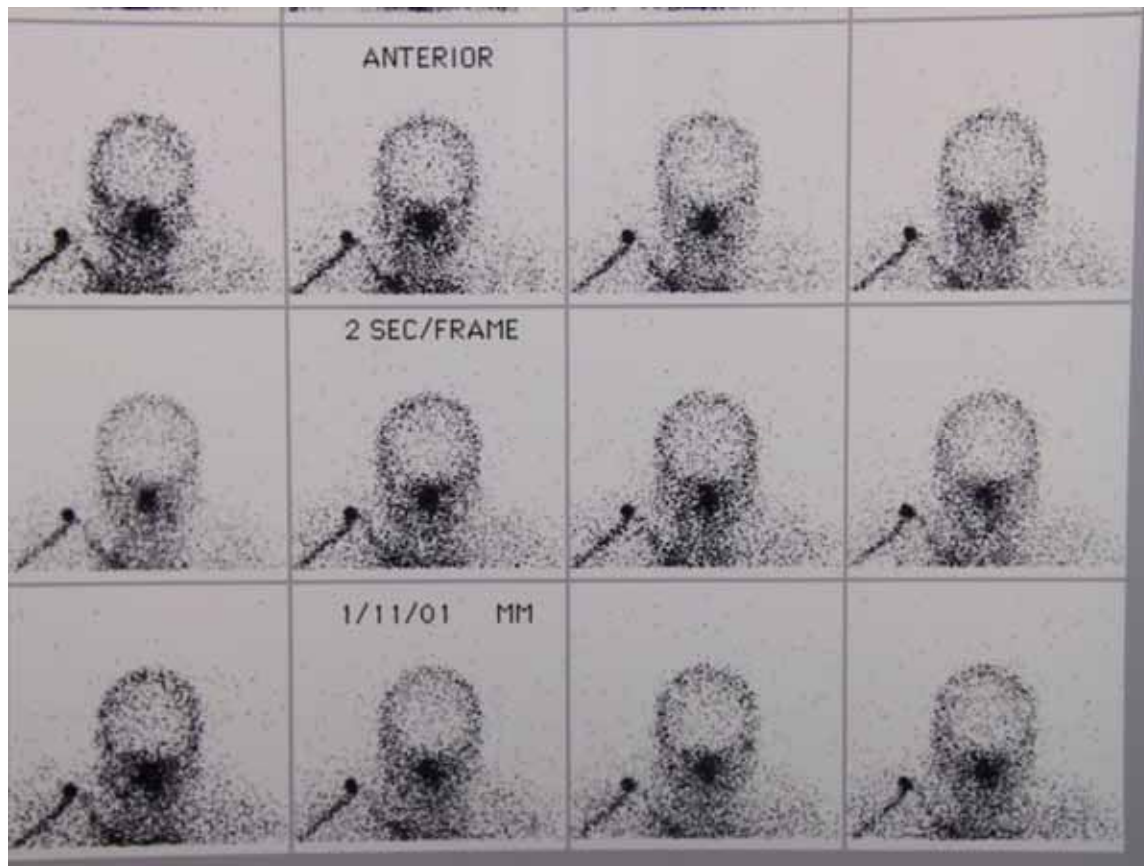




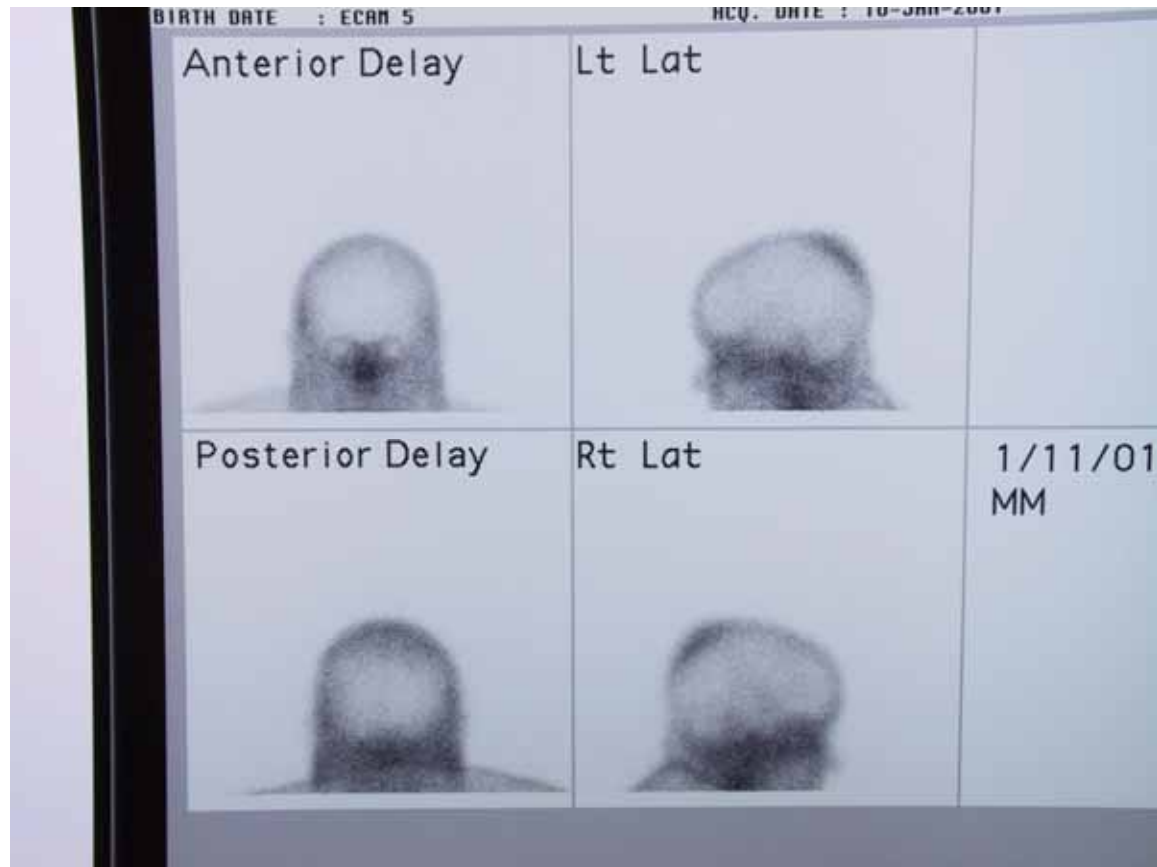
# Cerebral Death

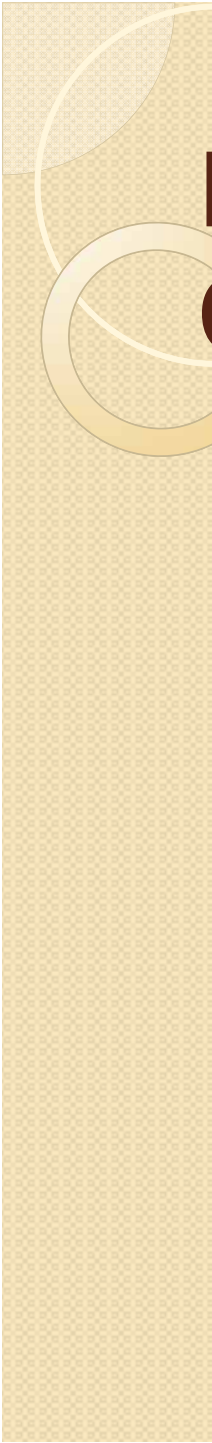
- Flow Study
- Static Images
- Tc99m Glucoheptonate
- HMPAO/ECD

# Cerebral Death Evaluation Blood Flow



# Cerebral Death Evaluation Planar Statics

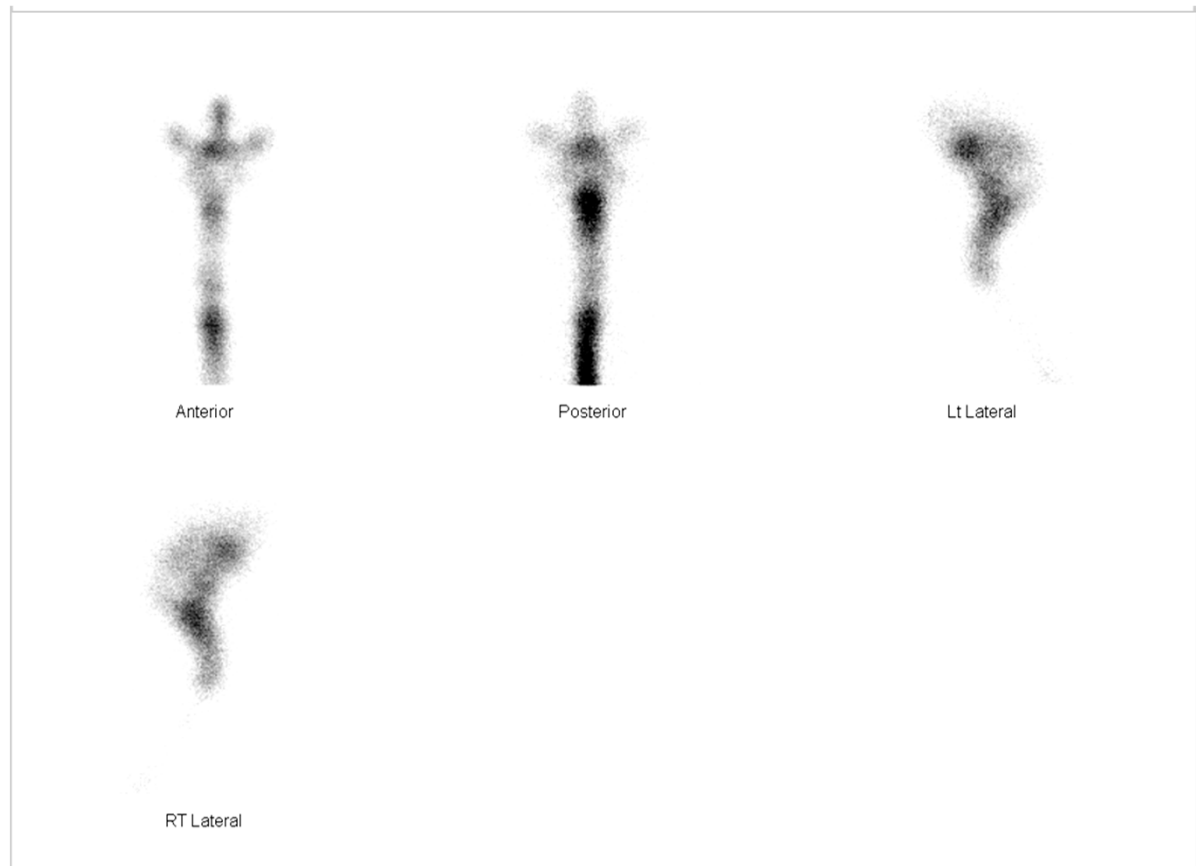




# RADIONUCLIDE CISTERNOGRAPHY

- Tc-99m or In-111 DTPA
- Normal Pressure Hydrocephalus (NPH)
- CSF Leaks
- Shunt Function/Patency

# Normal Cisternography 4 Hour



# Normal Cisternography 24 Hour



Anterior



Posterior

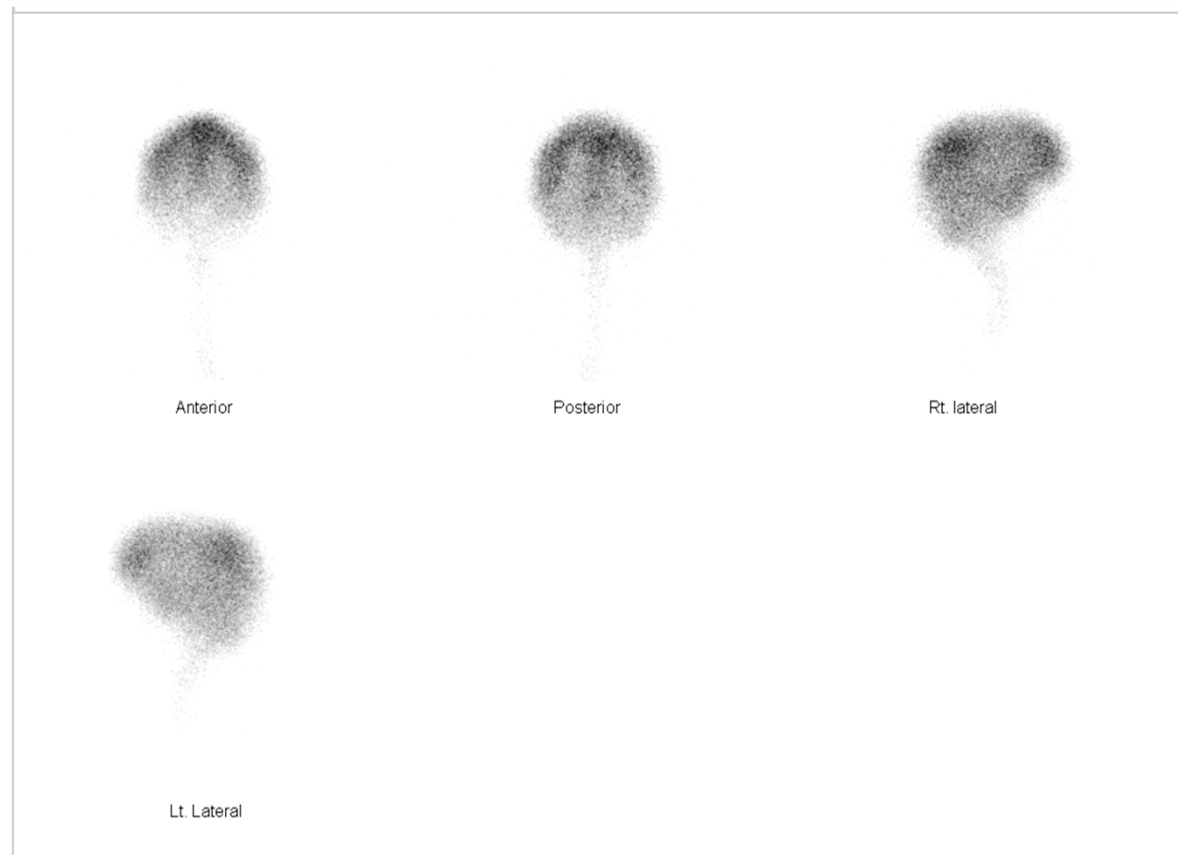


Rt Lateral

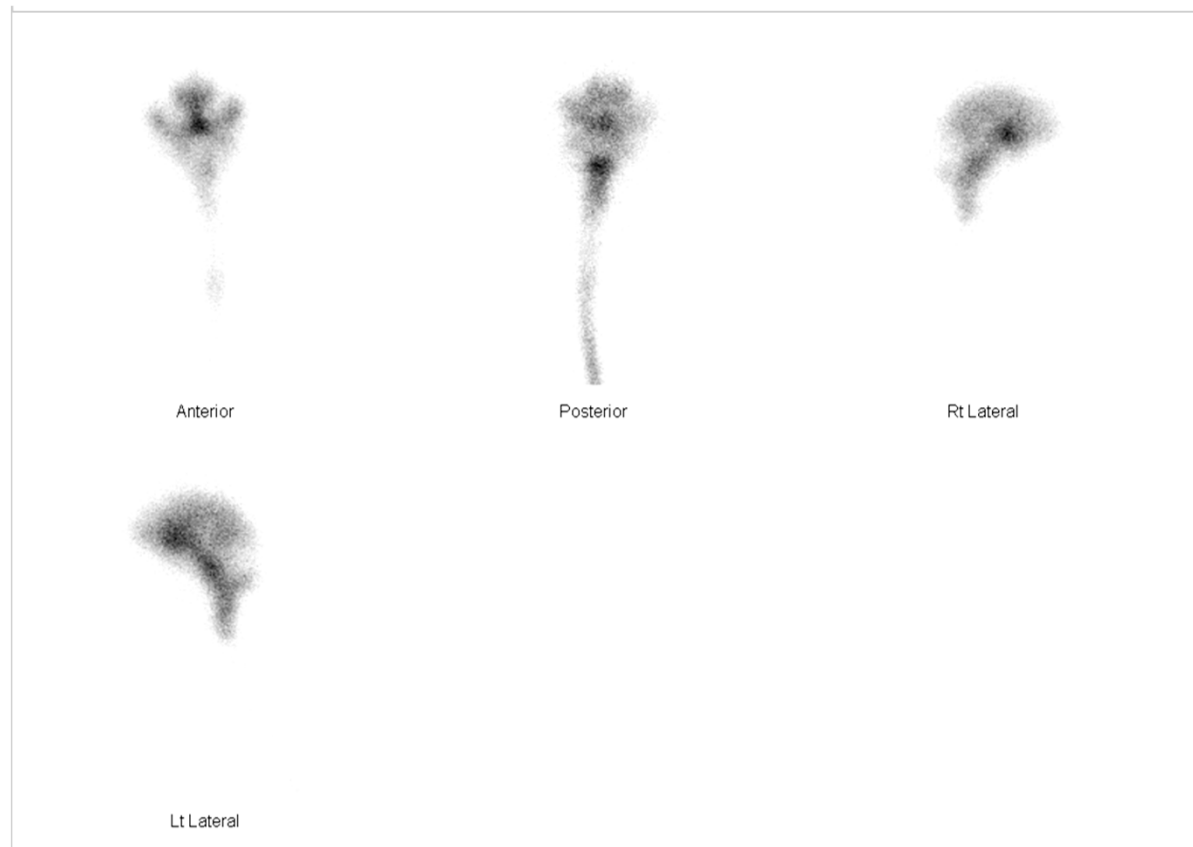


Lt Lateral

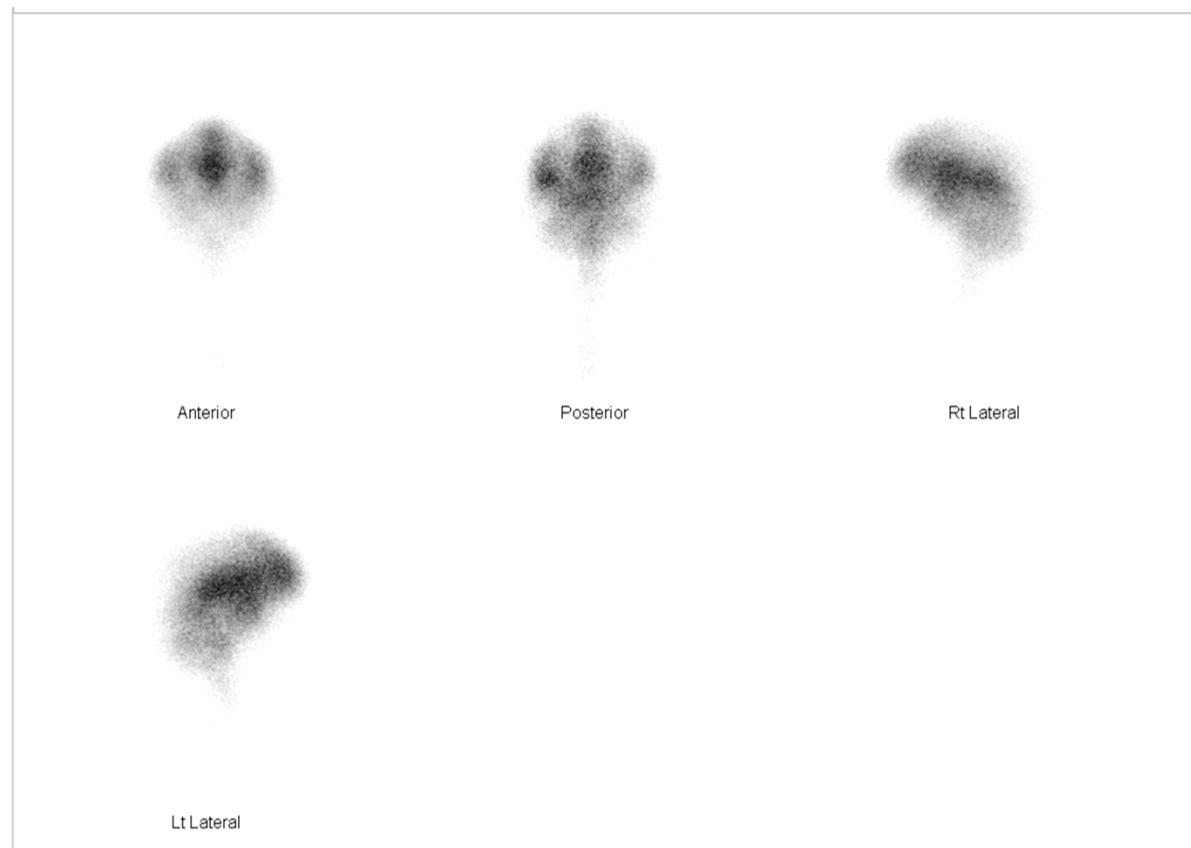
# Normal Cisternography 48 Hour



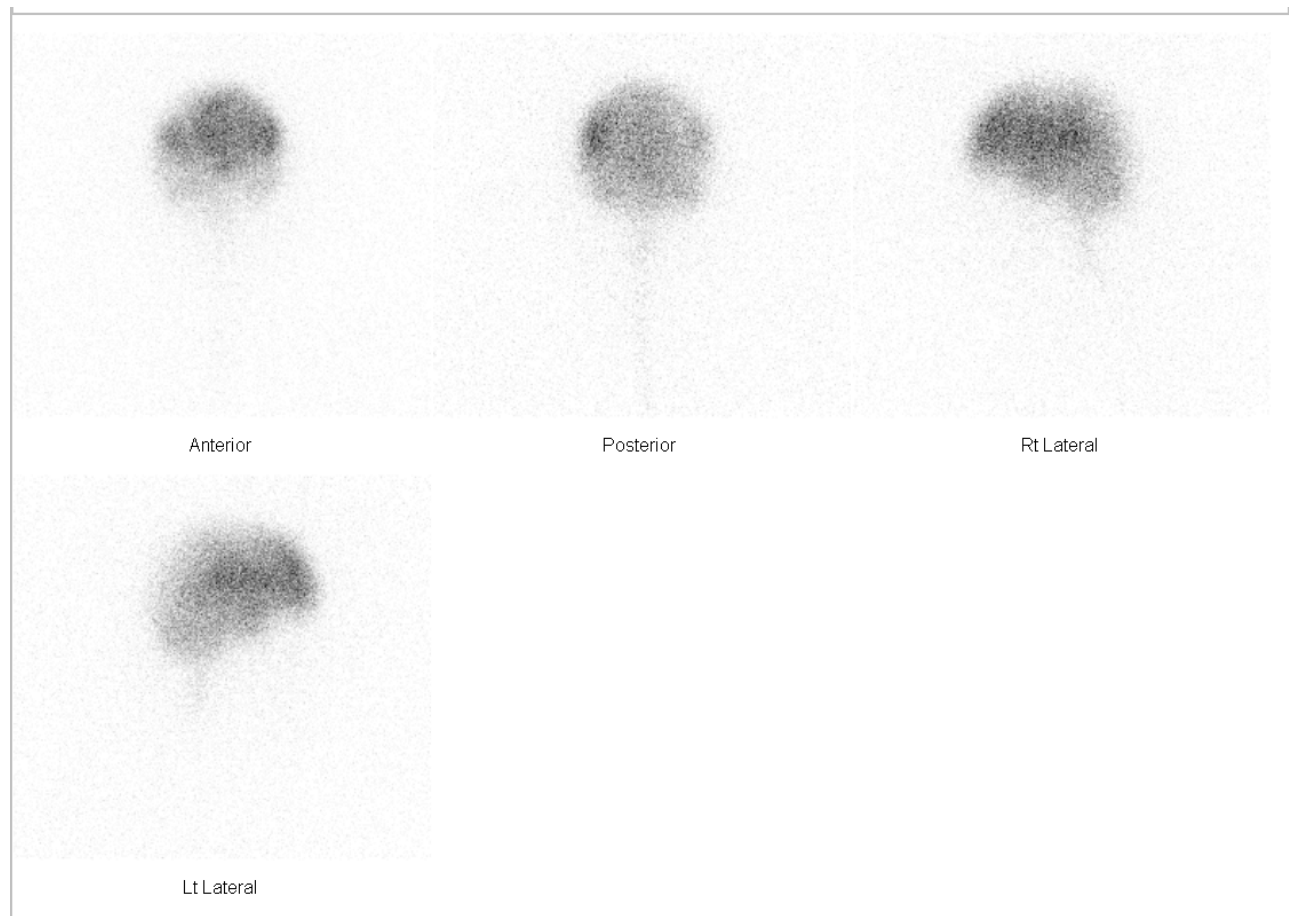
# NPH at 4 Hours

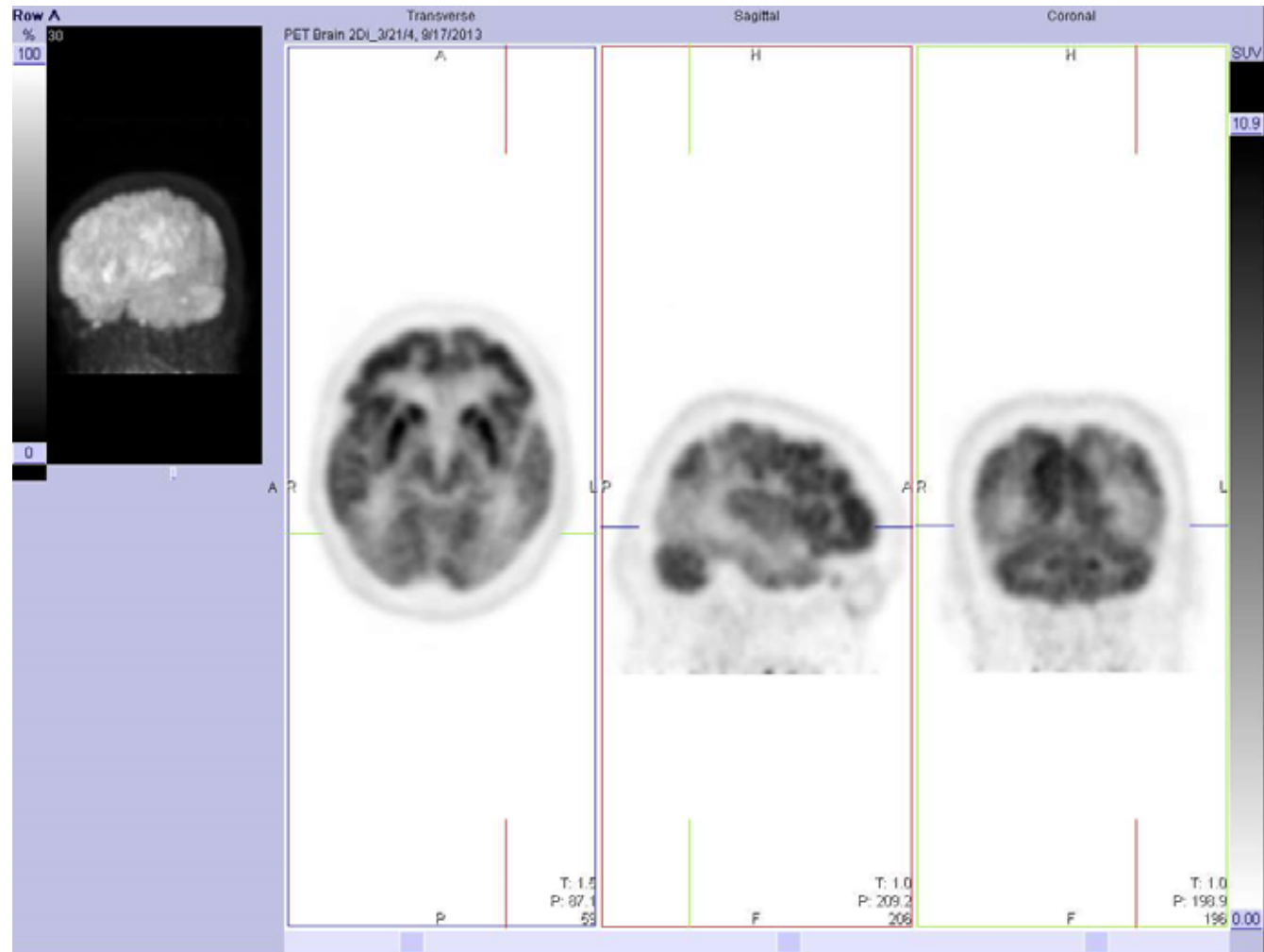


# NPH at 24 Hours

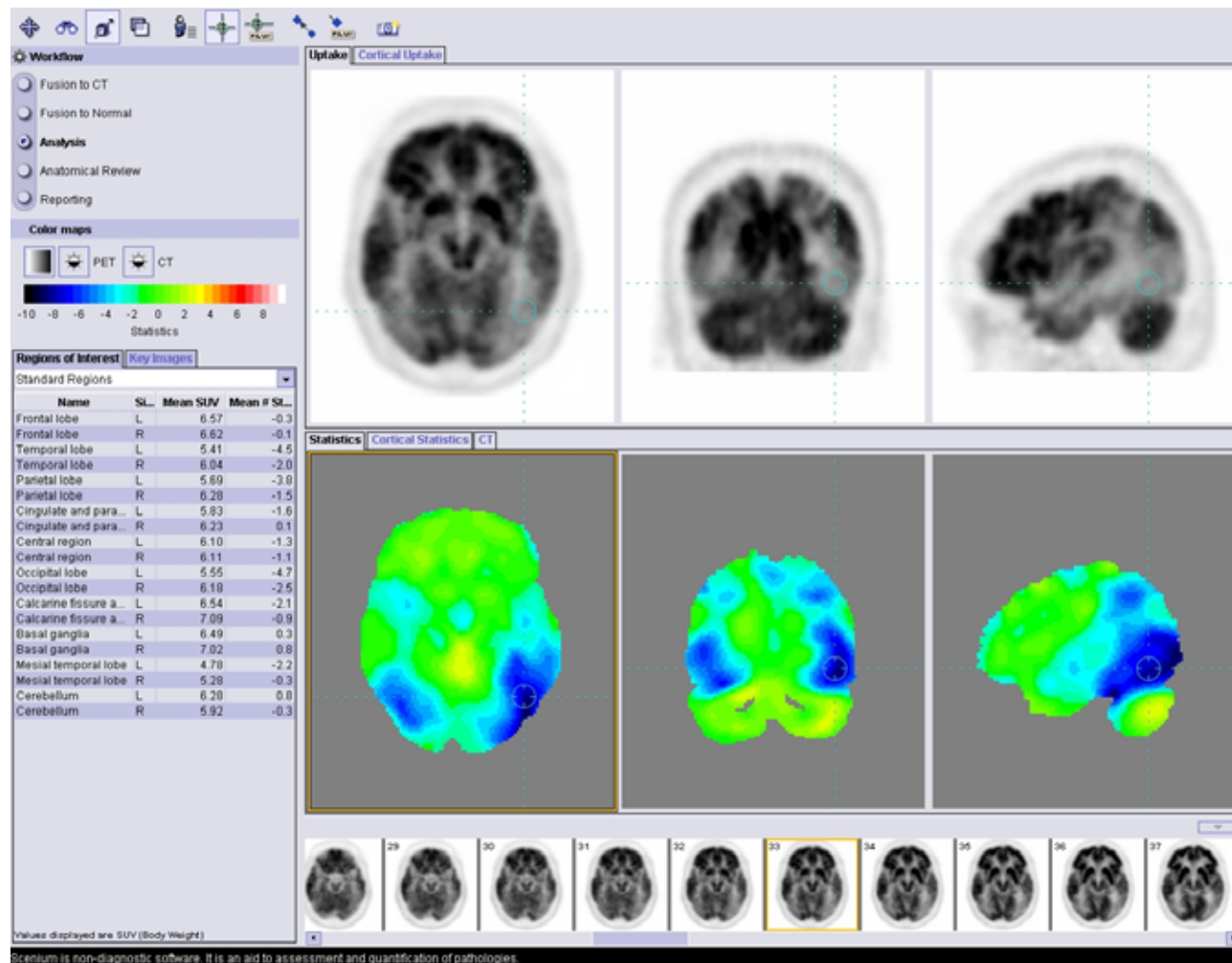


# NPH at 48 Hours





# Alzheimer's Disease PET





QUESTIONS ?