PERSONALIZED HEALTH CARE: CUSTOMIZE YOUR PET/CT PROTOCOLS TO STAND APART!

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FINANCIAL DISCLOSURES

Lilly USA, LLC

- Speaker Bureau (Amyvid Reader Training Program)
LEARNING OBJECTIVES

1. Review the standard PET/CT imaging protocols with an emphasis on across the board variability

2. Describe glucose management in diabetic patients undergoing PET/CT imaging

3. Implement customized PET/CT protocols for case specific considerations
MOLECULAR IMAGING (MI)

- Molecular imaging is the visualization, characterization, and measurement of biological processes at the molecular and cellular levels in humans and other living systems.
- Techniques: NM, MRI, MR spectroscopy, optical imaging (bioluminescence and fluorescence), ultrasound, etc
- Probes used to visualize, characterize, and measure biological processes in living systems
- Quantification (determination of regional concentrations of probes and biological parameters in space and over time) is a key element

The term *molecular imaging* itself encompasses a new imaging paradigm that includes multiple image-capture techniques, cell/molecular biology, chemistry, pharmacology, medical physics, biomathematics, and bioinformatics
MI: CLINICAL RELEVANCE

➢ Reveals the clinical biology of the disease process

➢ Personalizes patient care by characterizing specific disease processes in different individuals

➢ Useful in drug discovery and development, for studying pharmacokinetics and pharmacodynamics.

➢ Is potentially the integral imaging component for health care in the 21st century: P4 medicine (Predictive, Preventive, Personalized and Participatory)

Although MI is a multidisciplinary entity, Nuclear Medicine, especially PET/CT Imaging remains the pre-dominant technique for MI in present clinical context
PET

- PET is a nuclear medicine imaging modality that provides quantitative tomographic images & allows non-invasive determination of the time course of a radioactive substance in vivo.
- Positron emitters are used for labeling biochemical substances.
- After injection of the radiotracer, radiation from the body is registered in external detectors & tomographic images of the tracer distribution in the body are reconstructed using mathematical algorithms.

PET provides a map of the biodistribution of the administered PET radiopharmaceutical/probe in the body.
VARIABILITY WITH IMAGING PHYSIOLOGY

Normal Biodistribution

Altered Biodistribution

Inappropriate Fasting

Rigorous Exercise

Physiologic Variation:
Brown Fat
HYBRID IMAGING: THE NEW NORM

PET/CT

- PET => Excellent functional imaging technique
  => Not very precise for anatomic localization
- CT => Excellent anatomic imaging
  => Not very good for functional information
- PET/CT: Dual modality/hybrid imaging
- PET & CT images are acquired ALMOST simultaneously
- Fusion of functional and anatomic information: best of both worlds!

Advances in PET component of scanners (attenuation corrected with transmission scan vs CT, TOF, Q clear, etc) as well as CT component of scanners (2 vs 4 vs 16 vs 64 slice CT) adds to the variation in practice
PET/CT SYSTEMS

CTI Reveal (Somatom Emotion 2-slice)

GE Discovery LS (Lightspeed Plus HiLite 4-16 slice)

Philips Gemini GXL (6 or 16-slice)

Philips Gemini TF (16 or 64-slice)

Siemens Biograph TruePoint PET•CT (64-slice)

GE Lightspeed VCT 64-slice
Primitive Pet Scan
PET RADIOTRACERS

FDA Approved:

➢ F-18 Fluoro Deoxyglucose (FDG): most cancers, brain metabolism (for seizure foci), cardiac metabolism (for myocardial viability with myocardial perfusion imaging)
➢ Bone Imaging: F-18 NaF
➢ NETs: Ga-68 DOTA-Tate (Netspot)
➢ Prostate Ca: C-11 choline, F-18 Fluciclovine (Axumin)
➢ Myocardial Perfusion: N-13 Ammonia, Rb-82 Chloride
➢ Brain β-Amyloid Imaging: Florbetapir (Amyvid), Flutemetamol (Vizamyl), Florbetaben (Neuraceq)

Other Tracers: F-DOPA, FLT, F-choline, C-11 acetate, CU-ATSM, FMISO & many more in research at present
CLINICAL PET APPLICATIONS

ONCOLOGY

FDG (most common)
For initial & subsequent treatment strategy of most malignancies
F-18 NaF bone PET/CT
C-11 Choline, F-18 Fluciclovine (Prostate Ca)
Ga-68 DOTA-Tate (NETs)

CARDIOLOGY

Cardiac Stress Perfusion PET: Rb-82 Chloride, N-13 Ammonia
Myocardial Viability: FDG Metabolism + SPECT or PET Rest Perfusion
Perfusion + CCTA (PET/CT with 64 slice CT)

NEUROLOGY

Dementia (FDG, β-Amyloid Imaging Agents)
FDG: Seizures Brain Tumors (esp. post XRT)
HIV pts: differentiate Toxoplasmosis from CNS Lymphoma
CONCEPT OF “SUV”

SUV = Standard Uptake Value

\[
SUV = \frac{\text{Tissue activity (mCi/mL)}}{\text{Injected FDG dose (mCi)/body weight (kg)}}
\]

- Previously used as “cutoff” value for benign vs malignant & to semi-quantitatively assess change in intensity over time

- Affected by numerous factors: dose infiltration, lean body mass, method of attenuation correction, etc

- For some, it is a “Simply Useless Value” & visual analysis of intensity with clinical acumen works just fine or even better!
SIGNIFICANCE OF SUV / INTENSITY

- In general, cancers tend to more intense & inflammation mild to moderate (not always true)
- In the past, a cut-off value of 2.5 was considered adequate for optimum sensitivity & specificity to differentiate malignant from benign lesions
- Some inflammations can be quite intense (e.g., Sarcoidosis)
- Intensely FDG-avid lesions tend to be more aggressive
- SUV may have prognostic significance (e.g., lymphoma)
- SUV may be useful for follow-up to assess response to therapy and in clinical research studies.
- How high can SUV be?  
  (max: 125.1, avg: 66.2 anaplastic thyroid cancer)
SUV VARIABILITY

Inter-center

➢ Different scanners (regular PET/CT vs TOF)
➢ Different uptake phase for FDG

Intra-center

➢ Different uptake for FDG
➢ Dose infiltration
➢ Patient factors

Try to adhere to your approved protocol as much as possible
Keep uptake time variance < ±10 min
SNMMI Procedure Standard for Tumor Imaging with $^{18}$F-FDG PET/CT 1.0

The optimum preparation for patients about to undergo PET/CT is evolving!
Date approved: Feb 11, 2006

- Fasting for 4-6 hrs before scan
- Encourage oral hydration with water
- Withhold i.v. dextrose or parenteral feedings for 4-6 hrs prior to scan
- BSL: <150-200 mg/dL (if higher: reschedule or consider decreasing it by administering insulin & delay FDG dose administration accordingly)
- Seated/recumbent for FDG administration & subsequent uptake phase
- FDG Dose: 10-20 mCi (adults), 0.14-0.20 mCi/kg (child < 5 yrs)
- If CT for attenuation correction/anatomic localization: may give oral contrast
- Uptake Phase: at least 45 min (many centers use 60-90 min)
- Image with arms up (if possible)
- For H&N imaging: hands down by the side (optimal)

Interventions:
- Hydration and loop diuretic with or without bladder catheterization
- Keeping patient in warm room 30-60 min prior to FDG administration or use of benzodiazepines or beta blockers
CT PROTOCOLS

Attenuation correction & anatomic localization versus diagnostic CT
Radiation dose concerns
Pediatric & adolescents: adjust milliampere-seconds settings appropriately for patient size, regardless of the CT protocol used, as radiation dose to the patient increases significantly as the diameter of the patient decreases.

“Low dose” CT: fixed current strength vs automated current modulation

Breath-holding: mid inspiratory hold versus shallow breathing

Diagnostic CT:
➢ Check for Iodine-allergy, history of metformin use for diabetes & renal function
➢ Timing of imaging in relation to i.v. contrast administration
➢ Sometimes, separate imaging may be necessary (in addition to CT for AC)
ACR Practice Parameters for performing FDG-PET/CT in Oncology
Revised: 2016

Prior to appointment:
- Avoid strenuous activity 24 hrs prior to FDG injection
- Recommend low-carbohydrate meals for 24 hours prior to FDG injection and no alcohol the evening prior to examination
- Fasting for a minimum of 4 hrs with no parenteral nutrition or oral/intravenous fluids containing sugar or dextrose for the same period.
- Encourage oral hydration with a goal of 1L (34 oz) in 2 hours prior to appointment

Prior to injection:
- Pregnancy test when appropriate
- Anxiolytics (BZDs), Beta blockers or i.v. narcotics to minimize muscle/brown fat uptake
- BSL < 200 mg/dL (if more: reschedule or repeat measurement in 20-30 min)

Following injection:
- Seated/recumbent during uptake phase
- Consider heated blankets & warm waiting room, consider alprazolam in H&N Ca
- Void immediately prior to imaging
- Consider sedation in children for imaging
ACR PRACTICE PARAMETERS

FDG Dose
Adults: 5 – 20 mCi (parameter-based calculated dose can also be used)
Children: 0.1 – 0.14 mCi/Kg

Uptake Phase:
Generally 60 min (no less than 45 min); keep it consistent (55 – 75 min range for 60 min)

CT:
- Diagnostic vs attenuation correction / anatomic localization
- Oral contrast can be considered (barium or water)
- Breathing: in end-expiratory phase or with shallow/quiet breathing
CUSTOMIZE YOUR FDG PET/CT ONCOLOGY IMAGING PROTOCOL

Patient Factors:
- Patient population mix (socio-economic status, education, compliance)
- Distance traveled
- Urgency for scan (asap vs routine)
- Co-morbidities (diabetes, immobility, in-patients, patients on ventilation/oxygen, TB/MRSA)

Management/Admin Factors:
- Capacity (backlog)
- Throughput vs quality tradeoff
- Accreditation considerations

Design your PET/CT protocol such that:
- It satisfies at the least the minimum recommendations per guidelines
- Is easy to follow by patients
- Is not tedious for staff to remain consistently consistent!

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SOPs:
- PET/CT Protocol
- Pregnancy & breast-feeding
- Diabetics & elevated BSL

Tech Sheet:
- Patient name, demographics, ht-wt, indication, ref physician, f/u appointment
- Brief but pertinent history/clinical info
- BSL, any premedication (dose, time, administration type & site)
- FDG (measured, residual & administered dose; time, site)
- Uptake time
- Imaging area (generally skull base to mid thighs), Any additional images
- CNMT sign and date
No exercise / rigorous work the previous day
Overnight fasting (allow meds with water)
Nothing with sugar that morning (mint, gum, soda, etc)
No smoking prior to arrival for scan
BSL should be <200 mg/dL, if >200 mg/dL consider insulin (if schedule allows)
Consider oral Valium* for select patients (H&N, Breast Ca, young/anxious/nervous): ~20 min prior to FDG
Hydration: Oral (~18 oz water) & IV** (250 cc normal saline)
Intravenous Lasix** ~ 15 min after FDG
Delay Period: 90 min
Consider oral Valium* claustrophobic patients: ~20 min prior to imaging
* Valium not given if patient is alone & driving on his own
** IV Hydration & Lasix is not given to patients with Renal failure & with fall hazard precautions
Recurrent Lymphoma in a 70 y/o Runner
INADEQUATE FASTING

45 min fast
Glucose = 64

8 hr fast
Glucose = 53
Brown Fat represents a rapidly mobilizable energy source important in thermoregulation.

- High concentrations of:
  - Adrenergic receptors (stimulatory)
  - Benzodiazepine receptors (inhibitory)
BROWN FAT CONTROL

Becomes metabolically active:
- Via adrenergic stimulation
  - Anxiety
  - Shivering
- Benzodiazepine receptor agonists can awaken hibernating animals

Can be blocked by:
- Oral Benzodiazepines (Diazepam, Alprazolam)
- Oral Beta blockers (propranolol)
- IV Narcotics (Fentanyl)

Baseline    Valium 5 mg po
20 min before FDG

Effect of BZDs on brown fat can likely be over-ridden by Nicotine
No smoking on the day of the scan!
DEALING WITH BROWN FAT / ANXIETY

➢ Consider “routine” Benzodiazepine use in certain patients
  – Head & Neck Ca, Breast Ca, Lymphoma
  – Others prn (anxious, nervous, cold/shivering, young)

➢ Make sure patients are accompanied
  – Shouldn’t drive or operate machinery after study

➢ No smoking on day of test

Minimize Muscle Uptake during Uptake Phase:

➢ Rest comfortably with as little movement as possible

➢ Kept warm & cozy (warm blankets prn, warm patient area, stress free environment)
Physiologic renal excretion of FDG
Intense uptake in renal collecting system
Intense Radioactive urine in bladder
Can limit evaluation of pelvis:
➢ Artifact
➢ Bladder primary
➢ Cervix cancer
THE SOLUTION: SOLUTION (HYDRATION)

Adequate hydration & diuresis:
- ↓es upper urinary tract activity
- Dilutes bladder activity
- Improves background

Can consider bladder catheterization if warranted (routine for cervix cancer in some centers)
MANAGING SUGAR: THE SWEET ISSUE FOR FDG PET

Fasting BSL > 200 mg/dL (most centers reschedule)

Competitive inhibition of FDG due to high indigenous glucose (same receptors for intracellular transport)
Risk of false negative scan

Insulin: decreases BSL by pushing blood glucose into muscles => also pushes FDG to muscle
Nice muscle scan but false negative for cancer!

Diabetic patients on oral hypoglycemic agents: not much issues
Diabetic patients on insulin: problematic
Diabetic patients on insulin pump: especially problematic!
SNMMI: Most institutions reschedule if BSL > 150–200 mg/dL.
Reducing BSL level by administering insulin can be considered, but the administration of FDG should be delayed after insulin administration (with the duration of the delay being dependent on the type and route of administration of insulin).

ACR: If BSL > 200 mg/dL, then the patient should usually be rescheduled.
If feasible, recheck BSL 20 to 30 min later. If decreases to 200 mg/dL => proceed with scan
If still >200 mg/dL, recheck again in about 20 to 30 min or FDG can be administered at the discretion of the interpreting physician.
If BSL >300 mg/dL, then the patient should be rescheduled (no need to recheck BSL in 20-30 min)

Diabetic patient guidelines:
Scheduled early in the morning (for some afternoon: depends when BSL is lowest for patient)
Take usual insulin dose or oral medications the day before ; NPO after midnight (except for water & nondiabetic medications)
Morning of the PET scan, hold all insulin & oral medications for early morning scan
For later scan (after 10 AM): eat a low-carb breakfast at least 4 hrs before ½ of usual regular (short-acting) insulin or regular dosage of oral meds at least 4 hours before the appointment.
Do not use long-acting or mixed (70/30) insulin after midnight.
Insulin pump: the setting should be maintained until the start of the PET scan. After the PET scan, settings can be adjusted as prescribed.
High BSL (> 200 mg/dL) in non-diabetics:
- Reduction of BSL with insulin can be considered & delay of FDG administration by more than 4 hrs.
- Use rapid-acting insulin s.c. Do not use regular/short-acting, intermediate-acting or long-acting insulin
- Intravenous insulin before FDG administration has not yet been validated

Type II Diabetics on oral meds:
- Schedule for late morning
- Comply with regular fasting rules
- Continue to take oral meds to control BSL

Type I Diabetics & Type II Diabetics on insulin:
- Attempt to reach fasting BSL < 200 mg/dL by discussing w/ pt’s endocrinologist
- For late morning or mid-day scan: eat normal breakfast by early morning, administer normal insulin dose & wait 4-6 hrs for FDG dose (rapid & short acting insulin respectively)
- For early morning scan: use intermediate-acting insulin the night before (try to avoid long-acting insulin)

Patients on Insulin Pump:
Schedule for early morning
Switch off pump 4 hrs prior to scan
USE OF I.V. INSULIN

- Rapid/Short-acting, Human Insulin intravenously
- Dose: depends on clinical situation (actual BSL, diabetic, whether on insulin/OHA, etc); maximum ~10 units
- On an average: 1 U decreases BSL by 10 mg/dL (less in cases of insulin resistance)
- Wait for ~90-120 min after insulin administration while monitoring sugar every 15-30 min to ensure drop in BSL
- BSL usually nadirs (below 200 mg/dL), then starts rising
- Inject FDG when BSL has nadired (keep on monitoring BSL if it is still dropping)
- If BSL > 300 mg/dL, usually reschedule
**THE MAGIC OF INSULIN**

Fasting BSL: 223 mg/dL

FDG injection without any intervention

Altered FDG biodistribution

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Small dose of short acting human insulin i.v. & waiting an appropriate amount of time before proceeding with FDG dose is an effective way to manage high BSL in diabetic patients allowing them to be scanned the same day without being rescheduled & without affecting FDG biodistribution/image quality.

Fasting BSL: 223 mg/dL

5 units short acting insulin i.v.

BSL nadir: 116 mg/dL,

BSL: 148 mg/dL at time of FDG injection

Normal FDG biodistribution
Cancer cells & inflammatory cells can show increased FDG activity. Important cause of false positives and decreased specificity.

Most centers image 60 min after FDG administration. Repeat Imaging (of just area of interest): ~90 min.

- Cancer cells continue to accumulate FDG with time (whereas inflammatory cells peak around 60 min and may show plateau to decreased FDG uptake at subsequent time points).
- Lesions that show higher SUV on dual time point imaging (compared to initial 60 min imaging) are more likely to be malignant (increases specificity).
- More lesions may be detected (increases sensitivity).
57 yr F w/ RUL mass on CT

Single intense RUL mass, SUVmax: 4.4
RUL mass more intense, SUVmax: 6.4
Tiny mildly FDG avid pleural based RUL lateral nodule
SNMMI: at least 45 min uptake phase but say 60-90 min is more common practice
ACR: generally 60 min (but at least 45 min)
EANM: recommends 60 min

Several centers have an uptake phase in their SOP but in reality, put the patient on the scanner as soon as the scanner is free since they are extremely busy!

Relevance:
Tumors may show continued FDG uptake over time: better signal to noise ratio
Assessment of response: change in intensity requires consistent protocols

PERCIST 1.0: 30% threshold for a change for FDG avidity index
EORTC PET Study group: 25% threshold

Uptake phase affects SUV calculations & needs to be consistent
ACR, EANM: recommend 55-75 min range for 60 min uptake phase
SNM: uptake time should be consistent
In practice: ±10 min or ±15 min
At our center: creating awareness of this issue (by education) and asking CNMTs to calculate and document the uptake period made a difference to more consistent uptake times.
PREGNANT PATIENTS

Cancer occurs in approximately 1 in 1,000 pregnancies. Breast Ca, Cervix Ca, Thyroid Ca, Ovarian Ca, Hodgkin D’se; Melanoma

Issues to consider:
Fetal radiation exposure: frightening & complicated issue.
Appropriate counseling as regards risks versus benefit to obtain consent

Most important thing: document consent
Ensure patient has been adequately counseled by treating team and Nuclear Medicine Physician/Nuclear Radiologist

Have a protocol for imaging pregnant patients in your protocol manual
Follow the protocol!!!
PREGNANT PATIENTS: TWEAKS TO PROTOCOL

Follow standard institutional protocol for P.E.T. Imaging with following modifications to decrease fetal radiation dose exposure:

• Lower FDG dose: ~ 5 mCi and increase imaging time (~6-7 mins/bed position)

• Optimal hydration and diuresis: Oral (~18 oz water prior to FDG administration) and intravenous (~250 cc NS after FDG administration) hydration, followed by diuresis (Lasix 10 mg i.v. or Bumetanide/Bumex 0.5 mg i.v. ~ 30 min after FDG): washes out the radiopharmaceutical and decreases radiation (especially from urinary bladder to fetus)

• PET-only scan if possible (with transmission scanning for AC)
34 yr-old woman, 28 wk pregnant
Recently diagnosed with squamous cell carcinoma of cervix

Estimated fetal radiation dose using our protocol: 1.1 – 2.43 mGy (0.11 – 0.243 rad).

CT can add 6 – 14 mGy based on CT protocol utilized

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PEDIATRIC PATIENTS

Not very common
Mostly children & young adults for Lymphoma, hepatoblastoma, sarcoma, brain tumors, seizure evaluation, cardiac studies
Infants: special studies like F-DOPA imaging for congenital hyperinsulinism

➢ Appropriate communication with parents & child is important
➢ Encourage parents to bring child’s favorite toy/blanket
➢ Encourage parent to stay with the child during the study (except for CT portion)
➢ Kid-friendly environment
➢ Preferably have intravenous access established by specialized peds iv team
➢ To keep patient still during imaging: Distraction => Sedation => GA
➢ To be decided on a case by case basis (Choral Hydrate, Propafol, etc)
➢ Involve anesthesia for sedation (and obviously for GA as well).
PEDIATRIC PATIENTS

Dose: 0.14 mCi/kg (min 2.5 mCi; may be 5 mCi for non-TOF)

PET-only if feasible (with transmission scanning for AC)
If PET/CT, drop CT current strength: 30 mA

Hydration & diuresis to improve image quality and washout

Brown fat can be an issue in kids

Crying can cause muscle uptake
THE DIFFICULT PATIENTS

The restless patient:
Education about importance of lying still
Reassurance
TLC

Patients who cannot lie flat/supine:
- Try 2 or more pillows
- Oxygen
- Valium
- Counseling

If everything fails: try imaging in **lateral decubitus position**

- Rt. vs Lf. Lateral decubitus as per patient preference
- Prior to CT scout, change patient position for CT by clicking on patient image until desired position is displayed & selected (Decubitus Left or Right)
- Acquire scout & ensure position is correct before performing CT
- Acquire subsequent PET/CT images as usual with standard processing
LATERAL DECUBITUS IMAGING
63 yr female w/ Endometrial Ca
Unable to lie supine due to significant dyspnea

PET/CT Imaging performed in Right Lateral Decubitus Position & reconstructed with proper orientation
PET FOR XRT PLANNING

Head & Neck Ca
Flat table Insert

C-spine: straight
Slightly extended neck

Head & neck Ca:
No Flat Table Insert

C-spine: curved
Flexed neck
Flat table Insert

Our setup for Head & Neck Ca patients

Head Holder
PRONE IMAGING

For rectal cancer XRT planning
To better match the planning CT
PET FOR XRT PLANNING: IMAGE REPROCESSING

AC 50
CT FOV: 50 cm
PET FOV: 55-60 cm (or even 70 cm on newer systems)

PET images need to be adjusted to CT FOV for appropriate fusion.
Done on the go by most PET workstations
Certain older XRT systems lack that ability

Reconstruct PET images shrinking it to 50 cm for 128 x 128 matrix (fairly automated process; filter parameters may change)

Transfer these images to XRT machine/console for Rx planning
PET FOR XRT PLANNING

Regular PET AC reconstruction

PET AC-50 reconstruction
THYROID CA RECURRENCE

THYROGEN STIMULATED PET

 Thyrogen injections on 2 days prior to FDG PET/CT
e.g., on Monday & Tuesday @ Endocrinologist’s office
FDG PET/CT on Wednesday at Imaging Center

H/O Thyroid Ca, s/p thyroidectomy and I-131 ablation
Rising Thyroglobulin
Negative Radio-iodine scan
Recurrence on thyrogen-stimulated FDG PET
Confirmed by surgical resection
WHOLE BODY PET:
HEAD TO TOES

When to do it:
Melanoma (selected)
Limb Sarcoma
Limb lesions
Brain mets (known)

http://www.petscaninfo.com/zportal/portals/phys/clinical/pet_case_studies/melanoma
LYMPHOMA PROTOCOL

Separate H&N images w/ arms down by the side allow better neck nodal evaluation
HEAD & NECK CANCER
DEDICATED NECK ± CECT

CECT of head & neck with optimized CT FOV
A cup of water just prior to start of imaging will distend the stomach & allow for better evaluation of gastric wall.
BRAIN P.E.T.

INDICATIONS:

• Primary & metastatic CNS Neoplasms (FDG; regular oncology protocol to include brain)
• Dementia (FDG, Amyvid)
• Localization of Seizure foci (FDG)
• HIV: differentiate between toxoplasmosis & CNS Lymphoma in HIV patients w/ ring enhancing brain lesions (FDG)
Medically intractable/refractory seizures: resection of the epileptogenic cortex may be necessary
Presurgical evaluation for localization of the epileptogenic zone & number of epileptogenic foci

**Evaluation:** complete seizure history, physical and neurological examination, neuropsychological examination, routine scalp EEG, video-EEG monitoring, interictal and ictal EEG

**Imaging:**
- High-resolution brain MRI (preferably 3T MRI)
- Interictal and Ictal SPECT (Tc99m-ECD or HMPAO)
- Interictal PET (F-18 FDG)
- Fuse PET with MRI (or PET/MRI Scan) when feasible
- SISCOM (Subtraction Ictal SPECT Coregistered to MRI)

We monitor our patients with EEG during uptake phase to ensure a true interictal PET study (without any subclinical seizures)
INTERICTAL PET

Left temporal lobe seizure focus on interictal FDG PET of the brain

The brain region with the most profound hypometabolism contains the epileptogenic zone (overall diagnostic sensitivity of 44%)

Rt. frontal lobe hypermetabolism (compared with the rest of the cortical areas) => seizure focus on an ictal FDG PET of the brain

EEG monitoring may be value when performing PET for seizure evaluation to ascertain that it is an interictal study & patient did not have a subclinical seizure at the time of the study!

INTERICTAL PET

The surgical outcome (seizure free) is significantly correlated with the lobar localization of the ictal focus by FDG-PET.

When multiple techniques are utilized to evaluate the seizure onset zone, it has been shown that the concordance between 2 or more presurgical assessments significantly correlates with a seizure-free outcome.

Surgical outcome can also be predicted by the extent of hypometabolism (unilateral temporal hypometabolism predicts a better surgical outcome vs. extended hypometabolism).

FDG PET BRAIN IMAGING IN DEMENTIA

Protocol:
- Patient lying quietly in a dimly-lit room, with low ambient noise
- Place i.v. catheter 10 min prior to FDG injection if feasible
- Radiopharmaceutical: ~10 mCi FDG I.V. injection
- Eyes preferably closed at and some time after FDG injection
- Imaging: 60 minutes post FDG administration
- Dictated PET or PET/CT images of the brain (FOV optimized for brain)
- Attenuation correction: Low-dose helical CT (for PET/CT)
- Image reconstruction: 5 mm slices orthogonal to the orbitomeatal line

Patient Prep:
Medications: hold or continue (depends on clinical question)
Prior Studies (esp. brain MRI)
SOFTWARE FOR OBJECTIVE ANALYSIS

➢ Neurostat (Free)
➢ SPM (Free)
➢ Cortex ID (GE)
➢ Scenium (Siemens)
➢ MIMneuro (MIMVista)
➢ PMOD: Neurology Package (Commercial)
➢ NeuroQ (Syntermed)
3-dimensional stereotactic surface projections (3D-SSP)

SPM ANALYSIS: EARLY MCI
SPM ANALYSIS: AD
AN IMAGE IS WORTH A THOUSAND WORDS

Lymphoma

Initial Staging Scan

After 2 courses of ABVD

After 2 courses of MOPP
THE POWER OF COMPARISON MIPS
SAGITTAL MIPs

Initial study:
6/16/16

6/30/17

Current study:
3/15/18

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Cardiac PET

Myocardial Perfusion Imaging

Rest & Post-stress (pharmacologic/exercise) Perfusion scan N-13 Nh3, Rb-83 Cl

Evaluation of CAD, chest pain (for ischemia)

Cardiac Metabolism Imaging

Rest Perfusion scan (N-13 Nh3, Rb-83 Cl) + FDG Metabolism Scan

Evaluation of myocardial viability, scar (for EP ablation), Cardiac Sarcoidosis

For more details, Come to my talk on Sunday April 15, 2018 At 11:15 am 😊
SUMMARY

➢ Consistently follow protocol
➢ Keep consistent uptake times for FDG
➢ Dual time point imaging, if applicable
➢ Separate head & neck with hands down for Lymphoma
➢ Dedicated Head & neck with FOC optimization ± CECT for H&N Ca
➢ True whole body in selected patients
➢ Gastric Luminal distention for Gastric Ca
➢ XRT Planning Scans: specialized positioning
➢ EEG monitoring for seizure studies
➢ Sedation for peds patients
➢ Save MIPs
➢ Offer new studies: Netspot, Axumin, Amyloid, NaF
Shreveport Welcomes You!

Thank You!