PET COE Board Meets with Industry Advisory Group to Map Out Goals

By James W. Fletcher, MD
President, PET Center of Excellence

An inaugural meeting was held recently in Chicago between the PET Center of Excellence Board of Directors (BOD) and the Industry Advisory Group (IAG). The meeting was very well attended with representation from a large cross-section of industry.

The interaction and discussion at the joint morning meeting was lively and informative, with little disagreement on the issues that need to be addressed. Not surprisingly, these included reimbursement, standardization/clinical trials, demonstrating the value of PET to referring physicians, education, the need for collaboration, and government regulation—the later dealing mostly with PET radiopharmaceutical development.

In the afternoon the board met to create, based on the morning’s discussion, an agenda of specific goals that the PET COE plans to accomplish in the next 12 to 18 months.

Standardization/Clinical Trials

The BOD agreed to convene a workshop on standardization to be held in early 2007. The focus of the meeting will be to optimize PET/CT by identifying minimum standards of acceptable performance, with a goal of presenting a working draft of the standards at the 2007 SNM Mid-Winter Meeting, then presenting the final workshop proceedings at the Annual Meeting in June 2007. The workshop will cover multiple issues from quality assurance to standardized methods of performance.

Attendees at the workshop should include industry, instrument manufacturers, the National Electrical Manufacturers Association, and invited experts who have published on this topic.

(Continued on page 2. See BOD.)

Time-of-Flight PET

By Joel S. Karp, PhD

The idea to use time-of-flight (TOF) information in PET image reconstruction was originally proposed in the 1960s at a very early stage in the development of positron imaging. By the early 1980s, fully functional TOF PET systems had been built, not long after the first conventional PET systems were completed. Why then did it take so long to introduce a clinical TOF PET scanner, and how does it compare to the first TOF PET instruments built 25 years ago?

Time-of-Flight Theory

The concept of time-of-flight means simply that for each annihilation event, we note the precise time that each of the coincident photons is detected and calculate the difference. Since the closer photon will arrive at its detector first, the difference in arrival times helps pin down the location of the annihilation event along the line between the two detectors.

To understand why this information is useful, we need to recall that normally in PET we collect line pair data at many angles and create tomographic images through traditional filtered back-projection or through an iterative series of back- and forward-projection steps. While tomographic reconstruction leads to superior contrast compared to planar imaging, the drawback is that it leads to higher noise, although iterative reconstruction techniques help reduce this effect. Hypothetically, if we had perfect TOF information, we wouldn’t need to reconstruct the image at all—we could identify the location of each annihilation event based only on TOF information and crystal identification and create an image by adding events into an image matrix. Unfortunately, this is not the case.

However, even imperfect timing information helps to improve the image by approximately localizing the event. For example, a coincidence timing resolution of 600 picoseconds (ps) (FWHM) translates to a positional uncertainty of 9 cm (FWHM) along the line pair. At first glance it seems that this can’t possibly help, since this is much greater than the spatial resolution of a state-of-the-art PET scanner (4–6 mm). However, we can appreciate the significance of this information by considering that without TOF we would back-project the data for each line pair through a length D that is the distance across the patient, which for adults is considerably larger than 9 cm; with TOF PET the data are back-projected through a smaller distance, related to the positional uncertainty. For a typical patient, D is about 27 cm, which is 3 times larger than TOF positional uncertainty at 600 ps. We, therefore, expect the benefit of TOF to be proportional, though not necessarily equal, to this ratio.

The ratio between positional uncertainty and distance across the patient is also representative of the noise reduction or, conversely, the sensitivity gain, to be expected with TOF. This simple measure is useful since it provides an estimate of the relative importance of increasing timing resolution through improvements in the detector, calibration, and acquisition.

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Within the next six months a second workshop will also be convened, in collaboration with the SNM Clinical Trials Group, to probe the issues and concerns voiced at the meeting regarding 1) the difficulty of initiating and rapidly completing needed clinical trials in drug development, and 2) the introduction of FDG-PET and PET/CT as a surrogate marker in clinical trials.

**Reimbursement**

The BOD felt that we needed to look at Relative Value Unit (RVU) assessment of PET and PET/CT. The goal is to prospectively reevaluate the cost, time, complexity, and risk of PET and PET/CT. The center will drive this activity in collaboration with the Coding and Reimbursement Committee. The principle role for the center will be to ensure a line-up of individuals who, with the proper guidance, can develop and submit the necessary data. The timeline for completion is 12 months.

**Marketing**

The BOD agreed that we should create core messages about the real value of PET and PET/CT and disseminate them to oncologists, radiologists, etc. Our goal is to succinctly define the value of FDG, PET, and PET/CT in specific clinical circumstances, package the core message, and send it out. The initial effort will be focused on lung nodules and lung cancer, with a 12-month timeline for completion.

We also need to provide reliable and updated access to clinical practice guidelines that include the use of PET and PET/CT in patient management. For example, we can provide our own summary and hyperlinks on the guidelines page of the patient-friendly National Comprehensive Cancer Network Web site at www.nccn.org. An SNM PET COE Web-based listserv community, where referring physicians and patients can ask the experts questions about PET/PET/CT, is another way to spread our message about the value of PET. The timeline to complete these tasks is 6 months.

**Education**

We will continue various categorical and continuing educational programs at the Annual and Mid-Winter meetings—particularly in collaboration with councils, centers, and other organizational elements within SNM. We will develop and present future educational programs at the Annual Meeting that focus on best practices for PET and PET/CT. An initial session on best practices will be held as a PET COE-sponsored categorical seminar at the 2007 Annual Meeting. The PET COE will also explore the introduction of on-site PET and PET/CT maintenance of certification modules at SNM meetings.

**Collaboration**

Within SNM, the PET COE will have enterprise-wide responsibility for PET- and PET/CT-related project management and coordination. It will do this by ensuring that there is representation on key committees, councils, and task forces by members of the PET COE Board of Directors and by developing close working relationships with recently formed entities such as the Clinical Trials and PET/CT Phantom Working Groups. The center will endeavor to communicate and collaborate with other professional entities that share an interest in PET and PET/CT, e.g., promoting cardiac PET applications with the American Society of Nuclear Cardiology or working with the Academy of Molecular Imaging on reimbursement and other issues.

Although other issues and topics remain to be addressed, the BOD felt that the above items were goals that could be accomplished within the specified time frame of 12 to 18 months.

As current president of the PET Center of Excellence, it was very gratifying to me that industry representatives were able to attend this inaugural meeting to discuss these issues, which are important to all of us in ultimately demonstrating the value of PET and PET/CT in patient care. We plan to convene additional meetings in the future as we look forward to a closer and more collaborative relationship with industry.

**The PET Center of Excellence**

A center dedicated to all aspects of the development and utilization of PET and PET/CT for the benefit of patient care.

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**Call for Abstracts**

SNM’s 54th Annual Meeting

The online submissions Web page (www.snm.org/abstracts) is now accepting abstracts for the 54th Annual Meeting of the SNM, June 2–6 in Washington, DC. The page also provides links that can serve as a useful resource for corresponding authors preparing to submit abstracts for scientific presentations.

The deadline for physician/scientist/pharmacist/technologist abstract submissions is January 10. Technologist student submissions are due by February 7.
tions, and electronics. This metric argues that TOF gain increases not only as timing resolution improves but also as patient girth increases. This is fortuitous, since conventional PET image quality degrades noticeably for large patients due to increased attenuation, which leads to the loss of true counts and increase of scatter counts. In fact, the difference in the noise-equivalent count-rate for a heavy patient (e.g., 120 kg) compared to a slim patient (e.g., 50 kg) is about a factor of six. Thus, to achieve comparable image quality for the heavy patient, we would need to scan for six times longer, which is clinically impractical. The promise of TOF PET is that it has the potential to improve the image quality in heavy patients, precisely where it is needed most.

Advancements in TOF Technology

The potential benefits of TOF were understood in the early 1980s, and this motivated the development of the first TOF PET scanners. These early systems—developed at Washington University, CEA LETI, and University of Texas—used either cesium fluoride (CsF) or barium fluoride (BaF₂) scintillators, which were the best scintillators available at the time for TOF PET. These scanners were capable of meeting the high count-rate demands of research brain and heart studies using short-lived isotopes (such as ¹⁵O-water), but they could match neither the spatial resolution nor the sensitivity of conventional PET scanners that used bismuth germanate (BGO) scintillators. The system coincidence timing resolution of these TOF scanners was between 500 and 750 ps; however, it was reported to be very challenging to achieve this performance on a daily basis due to difficulties with reliability and stabilization of electronics and calibrations. By the early 1990s, these early TOF PET scanners had been retired—just before whole-body oncology studies with ¹⁸F-FDG became prevalent.

There are a number of reasons why TOF is making a resurgence in PET today. First, new scintillators are available that combine fast timing with high light output. The low light output of CsF and BaF₂ did not allow much choice for light-sharing and decoding crystals, as is commonly done today. This led to poor packing fraction in the detector (and low scanner sensitivity) and poor spatial resolution, since the crystals were necessarily large. Newer scintillators, such as lutetium orthosilicate (LSO), lutetium orthosilicate with a yttrium impurity (LYSO), and lanthanum bromide (LaBr₃), all combine fast timing and high light output, leading to very good timing resolution. Overall, the characteristics of these scintillators are superior to the original TOF scintillators and enable us to incorporate them in a TOF PET system with spatial resolution and sensitivity comparable to current state-of-the-art conventional (non-TOF) PET scanners. Where the original TOF PET scanners in the 1980s needed TOF to match the performance of conventional PET scanners, today, we can use TOF to leapfrog over the performance of conventional PET scanners.

In addition to new scintillators, continued improvements in the performance and reliability of photo-multiplier tubes and electronics are making TOF more practical today than in the past. Fast-timing electronics were available 25 years ago, but stability was difficult to achieve with early TOF PET scanners.

Finally, there has been a steady stream of progress in image reconstruction algorithms, although it is only recently that a 3D list-mode iterative algorithm for TOF PET data has been developed with all physical effects included in the system model. Including TOF information in the data leads naturally to list-mode acquisition, since the TOF information requires only a modest increase in data storage while still preserving the full spatial and temporal information of the data. However, a list-mode image reconstruction algorithm, particularly for 3D, is computationally intensive and requires computers that are orders of magnitude more powerful than those available two decades ago. Although list-mode reconstruction has been put into clinical practice for TOF, work continues to develop a faster TOF PET image reconstruction algorithm that, hopefully, won’t require such expensive hardware yet still achieves comparable image quality.

Commercial Introduction of TOF PET

Philips Medical Systems introduced a TOF PET/CT scanner (GEMINI TF) in June 2006, although pre-production testing began in November 2005 when the first system was installed at the University of Pennsylvania. The GEMINI TF is a fully 3D scanner using the LYSO scintillator. In contrast to early TOF scanners, this new scanner has very good intrinsic performance, including spatial resolution and sensitivity (as specified by NEMA NU-2 standards), and the TOF capability improves the quality of the reconstructed images. The system timing resolution is 600 ps, and our experience with this scanner demonstrates that the timing resolution is very stable over a period of many months without the need for recalibration. While a new timing calibration method was developed for this scanner, and an additional measure has been added to our daily quality control, these new procedures add only a little time compared to quality control for a conventional PET scanner. Although Siemens uses LSO in all of their clinical PET scanners, and GE uses LYSO in their research PET scanner, neither manufacturer has announced a TOF PET scanner as a product.

TOF Gains in the Clinic

The earlier discussion of the benefit of TOF information was characterized in terms of noise reduction and was based on a uniform activity distribution. This benefit should translate to either a reduction in scan time or improvement in image quality that is comparable to imaging with a more sensitive scanner. However, we should recognize that it is simplistic to characterize the TOF gain as a single value because TOF is inherently a local effect that depends on the method of data correction and image reconstruction as well as the activity distribution. We have, therefore, performed a series of phantom studies with hot and cold spheres in a warm background to simulate lesions in an oncology study because the task at hand for FDG whole-body imaging is often lesion uptake quantification (i.e., semi-quantitative SUV measurement) or lesion detectability. Using these phantom studies, we have found that the TOF PET reconstruction converges faster and with higher lesion contrast for similar image noise, compared to a non-TOF reconstruction. Alternatively, if we stop the TOF PET reconstruction

(Continued on page 4. See Flight.)
earlier (fewer iterations), we can achieve similar contrast with lower noise, compared to a non-TOF reconstruction. This conclusion is consistent with our prediction that TOF information would reduce image noise.

The improvement with TOF PET is dramatically seen in the example of a heavy patient diagnosed with colon cancer (Fig. 1). The patient weighs 119 kg with a BMI of 46.5. The data were reconstructed with and without TOF information and show an obvious improvement with TOF in lesion detectability (at arrow) and overall structural definition in the abdomen.

This patient was scanned for 3 minutes per bed position, about a 30-minute scan (10 bed positions), our default acquisition protocol at Penn. Rather than using TOF to reduce the scan time, we have emphasized the use of TOF to improve image quality or, more specifically, the signal-to-noise ratio. In the case shown here, the difference in lesion contrast is significant enough to make a visual impact on lesion detectability. We have evaluated images of lighter patients with scan times as short as 1 minute per bed position and achieved good image quality, but there is little doubt that additional counts lead to better image quality for both light and heavy patients.

Future Directions in TOF PET Technology Research

Our research efforts at Penn on TOF have included scintillators other than LYSO, in particular lanthanum bromide (LaBr₃), which was discovered in 2001 at Delft University and further developed at Radiation Monitoring Devices (RMD) and Saint-Gobain Crystals (SGC). Both the energy resolution and timing resolution of this scintillator are remarkable—a detector array built by SGC and suitable for PET (30-mm long crystals with 4x4 mm² cross-section) has 5% energy resolution and 300 ps timing resolution. These detectors have been incorporated into a prototype scanner, but further work is needed to improve the system electronics in order to match the scintillator performance that we have measured in the laboratory. When coupled with further refinement of the data correction and image reconstruction algorithms, we believe that the LaBr₃ scanner with its superior timing resolution will help us to better understand how to use TOF PET to improve image quality for patients of moderate, as well as large, size.

Developing methods to evaluate image quality, and in particular the influence of TOF on image quality, is an active area of research at a number of academic institutions. It is perhaps even more important to understand how to use TOF PET to improve the accuracy of quantification, which is key to the future of nuclear medicine imaging and targeted therapy.

There is experimental evidence that timing resolutions even better than 300 ps can be achieved, perhaps with new scintillators and photomultipliers under development and evaluation at a number of research centers. In the laboratory we have measured a coincidence timing resolution between two cerium bromide (CeBr₃) crystals from RMD of 110 ps, albeit in a configuration not designed to achieve the sensitivity and spatial resolution required for a PET detector. While challenging, these results convince us that it is possible to develop a practical detector for PET to surpass the TOF performance achieved to date in commercially available scanners. The GEMINI TF scanner is notable in that it gives us clinical evidence that TOF PET is an important technology and should help to motivate research for further improvements in TOF PET.

References


Joel Karp is a professor in the Department of Radiology at the University of Pennsylvania, Philadelphia, PA.
The international literature on PET and PET/CT continues to grow at a pace that challenges both researchers and clinicians. In each issue, the PCOE Newsletter presents a tomographic slice of the breadth of PET literature that appears in publications around the world. Weekly lists of all published PET research are available to logged-in members in the PET Center of Excellence Web area at www.snm.org/pet in the PET References Archive under RESOURCES. Articles selected for relevance to clinical oncologists are also featured weekly under PET News.

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A model to simulate tumour oxygenation and dynamic 18F-Fmiso PET data. (17068369)

Kelly CJ, Brady M.
PET/CT Case: Bladder Cancer

This 76-year-old woman presented with hematuria and was found to have a low-grade bladder tumor, which was resected. She developed a high-grade bladder recurrence three months later that was treated with resection and intravesical chemotherapy. After three more months she complained of low back pain. An MRI of the lumbar spine followed by a CT of the pelvis showed a destructive lesion of the sacrum with surrounding soft tissue infiltration. A biopsy revealed metastatic, moderately differentiated carcinoma consistent with the patient’s bladder tumor. Approximately 10 weeks later, a PET/CT was ordered.

The PET/CT showed extensive FDG uptake in and around the sacrum—with multiple additional sites of skeletal involvement, including the right scapula, thoracic and lumbar vertebrae, the right acetabulum, and the left ischium (arrowheads). Abnormal FDG uptake was also present in pelvic and mediastinal lymph nodes (white arrows) and in a single hepatic focus (gray arrow).

How Did PET/CT Imaging Help?

PET/CT demonstrated extensive metastatic disease, rather than a localized metastasis in the sacral region. Inappropriate sacral radiotherapy was avoided and the patient was started on palliative treatment.

There are not extensive data in the literature regarding PET and bladder cancer; however, available reports suggest that the sensitivity for metastases is quite good (77–100%) (1,2). Physiologic urine activity usually precludes assessment of the bladder itself.

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About Views You Can Use

This case was provided by David Seldin, MD, Franklin Square Hospital Center, Baltimore, MD. It was also featured on the Web site of Gabriel Soudry, MD, at www.petcases.com. In addition to the Web site, Dr. Soudry also mails printed versions of his example cases to referring physicians in Franklin Square and the surrounding community. Working with Dr. Soudry and other PET specialists, the PCOE Web site (www.snm.org/PET) features “Views You Can Use,” single-sheet PDFs that include specific cases, images, and references. As a PCOE member, you can add your own contact information to these sheets and distribute them electronically or by printed hard copy to referring physicians for educational purposes.
Journal of Nuclear Medicine Paper Chosen as Scientific Paper of the Year; SNM Member Sanjiv Sam Gambhir Named Most Influential Radiology Researcher in 2006

Released: November 9, 2006

Scientific Paper of the Year: 3-D Imaging That Flies “Through” and “Around” Cancer

“Flying Through” and ‘Flying Around’ a PET/CT Scan: Pilot Study and Development of 3-D Integrated 18F-FDG PET/CT for Virtual Bronchoscopy and Colonoscopy,” published in the July issue of The Journal of Nuclear Medicine, was named scientific paper of the year by AuntMinnie.com, a comprehensive Internet site for radiologists and related professionals in the medical imaging field. The Minnies are awarded annually to recognize excellence in radiology.

In the paper, Stanford University researchers demonstrated for the first time the ability to create 3-D positron emission tomography (PET)/computed tomography (CT) images for “fly-through” and “fly-around viewing” of cancer in the lungs and colon. The powerful ability to meld functional data with accurate anatomical information of possible cancerous tumors—from inside the body—provides a visual navigation of organs oftentimes portrayed on television crime shows like “CSI.” Such visualization “may be used to detect and characterize cancer, spare someone from more invasive medical procedures, lead to better disease detection rates of colon cancer, provide surgical guidance and detect which tumors may be easier to biopsy,” detailed SNM member Andrew Quon, clinical assistant professor of radiology/diagnostic radiology at California’s Stanford University. …

SNM Member Named Most Influential Radiology Researcher

SNM member Sanjiv Sam Gambhir, a professor of radiology and bioengineering, director of the Molecular Imaging Program and head of the nuclear medicine division at Stanford University, was named the most influential radiology researcher by AuntMinnie.com.

Gambhir, an associate editor for The Journal of Nuclear Medicine, has extensive experience with FDG PET and has developed many of the related management algorithms for cancer patients, including cost-effectiveness models. In addition, he has developed and validated both enzyme and receptor-based PET reporter gene-reporter probe assays and produced a novel way to use molecular imaging to examine “and” and “or” gate logic of protein-protein interactions in the living mouse. His studies have produced the first proof of principle that signals from protein-protein interactions that regulate cellular communication systems can be imaged in vivo. …

Nuclear Medicine Patients: No-Alarm Holiday Travel Tips

Released: November 9, 2006

SNM Asks Medical Community To Make Patients Aware of Potential Security Tie-ups After Treatment or Imaging Study

RESTON, VA—Traveling during the holidays—especially for the nearly 60,000 individuals who daily undergo a nuclear medicine treatment or test in this country—will go smoother if medical professionals advise their patients to follow some simple tips from SNM, the leading international molecular imaging and nuclear medicine society. …

“Due to heightened concerns about terrorism, sensitive radiation detectors are used in some major cities and in public transportation facilities,” explained SNM President Martin P. Sandler. “Occasionally, a patient who has had a nuclear medicine procedure may be stopped by security personnel because he or she may trigger the alarm on a radiation detector. On rare occasions, this could cause long delays, interrogation and body searches,” added Sandler, who represents the 16,000 physician, technologist and scientist members of the international scientific and professional society. …

Predicting PET Imaging’s Future: Diagnosing and Treating Diseases ASAP

Released: November 1, 2006

Breakthroughs in Sensitivity and Resolution Benefit Patients, Fundamentally Change How Doctors Will Diagnose and Treat Cancer and Heart, Brain Diseases, Notes Article in November Journal of Nuclear Medicine

RESTON, VA—Imagine a new world of detecting and diagnosing diseases sooner—even before any symptoms are present. Consider the possibility of receiving individualized, targeted molecular, cellular or genetic medical treatment as soon as possible and of undergoing scanning that can quickly tell your doctor whether your treatment is working. Continued advances in positron emission tomography (PET) imaging are key to this future, according to Simon R. Cherry, professor of biomedical engineering at the University of California, Davis.

“Earlier detection of diseases and of the effect of treatment on them is the main impetus in advancing PET technology,” says
Effect of the Deficit Reduction Act on PET and PET/CT Physician Office Reimbursement

By Emily Gardner and Denise A. Merlino, CPC, MBA, CNMT

Payment caps written into the 2005 Deficit Reduction Omnibus Reconciliation Act (DRA) will go into effect on January 1 for reimbursement on the technical (but not professional or pharmaceutical) component of PET and PET/CT procedures performed in freestanding and in-office outpatient imaging facilities. Reimbursement for physician/facility payments will be limited to the lesser of the Medicare Physician Fee Schedule (PFS) or the Hospital Outpatient Prospective Payment System (HOPPS). As best we understand, the caps will apply to all imaging, including molecular and nuclear imaging. Of the projected 5-year, $11 billion reduction Medicare and Medicaid expenditures mandated by this legislation, the cuts in imaging account for at least a quarter of that figure ($2.8B).

The implementation of the DRA, as currently written and interpreted in the in the 2007 physicians’ office rules, will have substantial impact on the molecular imaging community. With the publication of the final rules for HOPPS and the PFS on November 1, the Medicare reimbursement rates for nuclear medicine procedures for 2007 can be determined.

Most, but not all, older nuclear medicine procedures are unaffected because payment under PFS was already lower than under HOPPS. But the dramatic difference between reimbursements rates under PFS and HOPPS for PET and PET/CT scans will reduce payments for these procedures by as much as 70%. Some other nuclear medicine procedures will also be impacted, particularly cardiac and SPECT procedures. Table 1 lists the procedures that were negatively impacted by the DRA and compares the HOPPS reimbursement rate with the PFS. More information on the new reimbursement rates can be found online at www.snm.org/codingcorner.

In response to the looming impact of the DRA on imaging services, intense efforts are being made to reverse or halt its implementation in 2007. On June 28, Representative Joe Pitts (R-PA) introduced the Access to Medical Imaging Act (HR 5704), calling for a two-year moratorium on the DRA’s reduction in payments for in-office Medicare medical imaging services. Congressman Pitts was joined in this effort by 42 of his House colleagues as original cosponsors, including 16 members of the powerful House Energy & Commerce Committee. To date, over 130 members have signed on as cosponsors of the bill. On August 3 Senators Gordon Smith (R-OR) and Jay Rockefeller (D-WV) introduced the Access to Medical Imaging Act (S 3795) on the Senate side. This bill also calls for a two-year moratorium on certain Medicare physician payment reductions for imaging services and to date has the support of nearly 20 senators. Expect other proposals in the coming months. We encourage SNM members to respond to requests to support these initiatives.

Emily Gardner is associate director of Health Care Policy for SNM. Denise Merlino is president of Merlino HealthCare Consulting.

Diabetes Slows Nerve Recovery After Heart Transplant

Released: September 5, 2006

Understanding Nerve Abnormalities May Guide Treatment Aimed at Reducing Cardiac Risk With Diabetes Mellitus Patients

RESTON, VA—Diabetes has a detrimental effect on a person’s ability to recover from a heart transplant, notes a study in the September Journal of Nuclear Medicine.

...Cherry, who offered predictions about PET’s growing importance in the November issue of The Journal of Nuclear Medicine. In the far future, individuals may be able to take a simple—as yet undeveloped—annual blood and/or urine test to screen protein or metabolite levels that could indicate common diseases, said the author of “The 2006 Henry N. Wagner Lecture: Of Mice and Men (and Positrons)—Advances in PET Imaging Technology.” ...

“PET’s diagnostic ability in the future will tell us something about the precise molecular makeup of disease in a specific person,” added Cherry, who originally presented his technological predictions at this past June’s annual meeting of SNM, the largest organization dedicated to the practice, science and technology of molecular imaging and therapy and nuclear medicine. ...

“Using positron emission tomography (PET) and the transplanted heart as a very specific model to study the regenerative capacity of the heart’s sympathetic nervous system, we determined that reinnervation—or the heart’s ability to develop new nerves to replace damaged ones—is slower in diabetic patients,” said Frank M. Bengel, a visiting associate professor of radiology and the director of cardiovascular nuclear medicine at Johns Hopkins Medicine’s Russell H. Morgan Department of Radiology and Radiological Science in Baltimore, Md. “Our results confirm a detrimental effect of diabetes on the potential for recovery of sympathetic nerve fibers of the heart,” added the co-author of “Effect of Diabetes Mellitus on Sympathetic Neuronal Regeneration Studied in the Model of Transplant Reinnervation.” ...

Currently, nuclear medicine techniques (such as PET) are the only imaging techniques that can measure the presence and function of the sympathetic nervous system of the heart, said Bengel. “There are invasive methods that allow for the measurement of neurotransmitters released to the blood, offering indirect conclusions about the presence, storage and release of neurotransmitters from neurons. These methods require complicated and laborious sampling of blood from coronary arteries and veins,” he added. ...
Table 1: **Nuclear Medicine Procedures Negatively Affected by DRA in 2007**

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<th>Procedure Description</th>
<th>HOPPS Final Rate</th>
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<td>(e.g., chest, head/neck)</td>
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<tr>
<td>78608</td>
<td>Brain imaging, positron emission tomography (PET); metabolic evaluation</td>
<td>$855.43</td>
<td>$1,800.00 *</td>
<td>$855.43</td>
<td>-$944.57</td>
</tr>
<tr>
<td>78812</td>
<td>Tumor imaging, positron emission tomography (PET), skull base to mid-thigh</td>
<td>$855.43</td>
<td>$1,800.00 *</td>
<td>$855.43</td>
<td>-$944.57</td>
</tr>
<tr>
<td>78813</td>
<td>Tumor imaging, positron emission tomography (PET), whole body</td>
<td>$855.43</td>
<td>$1,800.00 *</td>
<td>$855.43</td>
<td>-$944.57</td>
</tr>
<tr>
<td>78811</td>
<td>Tumor imaging, positron emission tomography (PET); limited area</td>
<td>$855.43</td>
<td>$1,700.00 *</td>
<td>$855.43</td>
<td>-$844.57</td>
</tr>
<tr>
<td></td>
<td>(e.g., chest, head/neck)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>78492</td>
<td>Myocardial imaging, positron emission tomography (PET), perfusion; multiple studies</td>
<td>$731.24</td>
<td>$1,530.00 *</td>
<td>$731.24</td>
<td>-$798.76</td>
</tr>
<tr>
<td></td>
<td>at rest or stress</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>78491</td>
<td>Myocardial imaging, positron emission tomography (PET), perfusion; single study at</td>
<td>$731.24</td>
<td>$1,169.00 *</td>
<td>$731.24</td>
<td>-$437.76</td>
</tr>
<tr>
<td></td>
<td>rest or stress</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>78190</td>
<td>Kinetics, study of platelet survival, with or without differential organ/tissue</td>
<td>$123.29</td>
<td>$240.74</td>
<td>$123.29</td>
<td>-$117.45</td>
</tr>
<tr>
<td></td>
<td>localization</td>
<td></td>
<td></td>
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<tr>
<td>78191</td>
<td>Platelet survival study</td>
<td>$123.29</td>
<td>$238.94</td>
<td>$123.29</td>
<td>-$115.65</td>
</tr>
<tr>
<td>78496</td>
<td>Cardiac blood pool imaging, gated equilibrium, single study, at rest, with right</td>
<td>$92.53</td>
<td>$207.63</td>
<td>$92.53</td>
<td>-$115.10</td>
</tr>
<tr>
<td></td>
<td>ventricular ejection fraction by first pass technique</td>
<td></td>
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<tr>
<td>78073</td>
<td>Adrenal imaging, cortex and/or medulla</td>
<td>$166.86</td>
<td>$254.05</td>
<td>$166.86</td>
<td>-$87.19</td>
</tr>
<tr>
<td>78647</td>
<td>Cerebrospinal fluid flow, imaging (not including introduction of material); tomographic</td>
<td>$214.66</td>
<td>$290.76</td>
<td>$214.66</td>
<td>-$76.10</td>
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<tr>
<td></td>
<td>(SPECT)</td>
<td></td>
<td></td>
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<tr>
<td>78804</td>
<td>Radiopharmaceutical localization of tumor or distribution of radiopharmaceutical</td>
<td>$364.17</td>
<td>$432.90</td>
<td>$364.17</td>
<td>-$68.73</td>
</tr>
<tr>
<td></td>
<td>agent(s); whole body, requiring two or more days imaging</td>
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<tr>
<td>78803</td>
<td>Radiopharmaceutical localization of tumor or distribution of radiopharmaceutical</td>
<td>$245.47</td>
<td>$313.79</td>
<td>$245.47</td>
<td>-$68.32</td>
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<tr>
<td></td>
<td>agent(s); tomographic (SPECT)</td>
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<tr>
<td>78807</td>
<td>Radiopharmaceutical localization of inflammatory process; tomographic (SPECT)</td>
<td>$245.47</td>
<td>$307.31</td>
<td>$245.47</td>
<td>-$61.84</td>
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<tr>
<td>78456</td>
<td>Acute venous thrombus imaging, peptide</td>
<td>$148.78</td>
<td>$202.23</td>
<td>$148.78</td>
<td>-$53.45</td>
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<tr>
<td>78465</td>
<td>Myocardial perfusion imaging; tomographic (SPECT), multiple studies (including</td>
<td>$399.62</td>
<td>$436.50</td>
<td>$399.62</td>
<td>-$36.88</td>
</tr>
<tr>
<td></td>
<td>attenuation correction when performed), at rest and/or stress (exercise and/or</td>
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<td></td>
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<tr>
<td></td>
<td>pharmacologic), and redistribution and/or rest injection, with or without</td>
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<tr>
<td></td>
<td>quantification</td>
<td></td>
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<tr>
<td>78607</td>
<td>Brain imaging, complete study; tomographic (SPECT)</td>
<td>$285.32</td>
<td>$315.59</td>
<td>$285.32</td>
<td>-$30.27</td>
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<tr>
<td>78730</td>
<td>Urinary bladder residual study</td>
<td>$37.51</td>
<td>$59.37</td>
<td>$37.51</td>
<td>-$21.86</td>
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<td>78206</td>
<td>Liver image (SPECT); with vascular flow</td>
<td>$269.07</td>
<td>$284.64</td>
<td>$269.07</td>
<td>-$15.57</td>
</tr>
<tr>
<td>78806</td>
<td>Radiopharmaceutical localization of inflammatory process; whole body</td>
<td>$245.47</td>
<td>$254.77</td>
<td>$245.47</td>
<td>-$9.30</td>
</tr>
<tr>
<td>78710</td>
<td>Kidney imaging morphology tomographic (SPECT)</td>
<td>$210.28</td>
<td>$214.11</td>
<td>$210.28</td>
<td>-$3.83</td>
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<tr>
<td>78458</td>
<td>Venous thrombosis imaging, venogram; bilateral</td>
<td>$148.78</td>
<td>$152.58</td>
<td>$148.78</td>
<td>-$3.80</td>
</tr>
<tr>
<td>78630</td>
<td>Cerebrospinal fluid flow, imaging (not including introduction of material);</td>
<td>$214.66</td>
<td>$216.99</td>
<td>$214.66</td>
<td>-$2.33</td>
</tr>
<tr>
<td></td>
<td>cisternography</td>
<td></td>
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<tr>
<td>78282</td>
<td>Gastrointestinal protein loss</td>
<td>$224.52</td>
<td>carrier priced</td>
<td>$224.52</td>
<td></td>
</tr>
<tr>
<td>78414</td>
<td>Determination of central c-v hemodynamics (non-imaging) (e.g., ejection fraction</td>
<td>$253.65</td>
<td>carrier priced</td>
<td>$253.65</td>
<td></td>
</tr>
<tr>
<td></td>
<td>with probe technique) with or without pharmacologic intervention or exercise, single</td>
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<td></td>
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<tr>
<td></td>
<td>or multiple determinations</td>
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</tbody>
</table>

* Rate quoted is carrier-priced national average.
Table courtesy of Merlino Healthcare Consulting.
PET Center of Excellence Presents Update on Practice of Clinical PET/CT at Mid-Winter Educational Symposium

The 2007 SNM Educational Symposium and Mid-Winter Meeting is being held in conjunction with the 33rd Annual Meeting of the American College of Nuclear Physicians (ACNP) this year, February 15–18, in San Antonio, TX. The varied educational program will feature sessions organized by the Cardiovascular, Nuclear Oncology, Pediatric, Brain Imaging, Computer and Instrumentation, and Academic councils and the SNM Technologist Section. The Molecular Imaging Center of Excellence is collaborating on several sessions, and the PET Center of Excellence is presenting “Standardization of PET/CT Protocols, PET/CT in Radiotherapy Planning and PET/CT Case Reviews” on Sunday morning. (See program description below.) ACNP has organized seminars for Thursday and Friday. Over the four-day meeting, 23.5 hours of AMA PRA Category 1™ and VOICE CE credit will be available. For more information, go to www.snm.org/mwm.

Standardization of PET/CT Protocols, PET/CT in Radiotherapy Planning, and PET/CT Case Reviews
Organized by the SNM PET Center of Excellence With ACNP Collaboration

Sunday, February 18, 10:00 AM–1:00 PM

Designed for technologists and physicians involved in the clinical practice of PET/CT, this session will provide the attendee with an overview of important elements for standardization and optimization of PET/CT protocols, including noncontrast as well as contrast CT and PET components. There will also be an update on the emerging role of PET/CT in radiotherapy planning. The session will conclude with a review of a series of intriguing and interesting PET/CT cases by the faculty.

Upon completion of this session, attendees will be able to:
1. Describe minimum standards for performance and optimization of PET/CT protocols;
2. Relate the role of PET/CT in radiotherapy planning; and
3. Recognize and identify important PET/CT imaging features.

Organizer/Moderator: James Fletcher, MD
- Protocols for PET/CT
  Paul Shreve, MD
- Update on PET/CT in Radiotherapy Treatment Planning
  Jacqueline Brunetti, MD
- Interesting and Intriguing PET/CT Cases
  Jacqueline Brunetti, MD, James Fletcher, MD, Paul Shreve, MD

For more information contact the SNM Meetings Department at 703-708-9000 x1229 or meetinginfo@snm.org.