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Positron Emission Tomography: A First-Hand Experience

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Executive Summary

- *In July 1999, the University of Kansas Hospital installed a positron emission tomography (PET) scanner and added PET to the imaging technologies it offers patients and physicians. The new service is managed by the nuclear medicine section in the department of radiology. Plans are being implemented now to install a cyclotron in March 2000.*
- *Prior to installation of the scanner, a radiation area survey was performed in the space being considered for the PET unit. We also needed to address other critical considerations, including the manufacturer's requirements for construction of the scanner room, special electrical needs, and how the system would connect to our existing information network.*
- *It is important to work closely with your chief financial officer and chief operations officer from the beginning of the purchasing process so that these administrators have up-to-date, supportive information about PET and the progress of the installation.*
- *We made use of a variety of promotional techniques to market the new service, including broadcast email, an open house for potential referring physicians, postings on the nuclear medicine Web site and communication through the local media.*
- *We also worked with the major insurance providers that utilize our hospital to educate them about PET and its benefits. In addition, we trained our own billing staff about procedures that optimize reimbursement for PET.*
- *In March 2000, University of Kansas Hospital will install the first cyclotron in the state, enabling us to generate the drugs used for PET scanning and potentially to add targets for research PET radiopharmaceuticals.*

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For more than a decade, University of Kansas Hospital considered the option of adding positron emission tomography (PET) to the imaging technologies we offer patients and physicians. Budgetary and other issues delayed its actual implementation until July 1999 when our facility installed a PET scanner.

The new service is managed by the nuclear medicine section in the department of radiology. In conjunction with the scanner, we also plan to install a cyclotron, which will be operated by a nuclear pharmacist under the department of pharmacy.

This article outlines the steps we took to plan, implement, install, market and support this new diagnostic service.

Installation Issues

Prior to installation, it is important to perform a radiation area survey in the space being considered for the PET unit. With the assistance of physicist consultants and our radiation safety officer, we placed a 10-millicurie dose of ^{18}F (hanging on an IV pole) in the isocenter of the room. Measurements were taken from all around the perimeter of the room, as well as above and below the room, the interstitial spaces and from adjacent floors. Since the room we had selected was previously used as a fluoroscopy room, there was already an existing 1/16th inch of lead in the walls. After making extensive measurements around the perimeter, it was determined that no area was above 2 mR per hour, which is the required radiation level.

We next considered how the PET isotopes would impact the gamma cameras, which at our facility would be both adjacent to and across the hall from the scanner (Figures 1 and 2). With the isotope placed at the isocenter of the room, background images were acquired on a ^{99m}Tc photopeak. The resulting data showed that additional lead shielding was required in the wall between one of the gamma cameras and the PET scanner.

Figure 1
Floor Plan: PET Scanner Room and Surrounding Area, University of Kansas Hospital

Figure 2
PET Scanner at University of Kansas Hospital

For the other camera, located one room away and diagonally across the hallway, we recommended that the PET isotopes be kept as far from it as possible to prevent radioactive interference.

For the room that required additional shielding, our physicist consultants recommended that 5/16" of lead be added for a total thickness of 3/8". The architect designed a 6' x 6' "shadow shield" that was installed directly next to the gamma camera gantry between the walls. The lead was fastened to two sheets of 3/4" plywood constructed on the ground and then lifted and placed next to the wall in the PET scanner room. It was then enclosed with sheetrock inside the scanner room. Following this construction, we repeated the same measurements and found that the background counts on the gamma camera were reduced by 50%.

The PET scanner manufacturer may have requirements for construction of the scanner room. For example, our manufacturer specified that the floor tile in the room be composed of antistatic material, that the tile be applied with nonconductive cement, and that the floor be grounded to the building. This requires that thin, foil copper strips be mounted in the adhesive while the tile is being placed; then all of the copper foils are connected around the room's perimeter. A main line is then grounded to the building. The manufacturer may also require that the room be in a negative air pressure environment. Work with your facility operations people to ensure that the HVAC will accommodate negative air pressure.

Important electrical considerations include the need to install a surge suppressor, location for the isolation transformer, and location of power out of the gantry. The electricians must also know the proper location for cable "pull" boxes, temperature-sensitive rheostats, and breaker shut-off panels.

Be sure to consider how the system will connect to your existing information network. In our facility, we tapped into the main gateway network and use IP addressing for the main and remote workstations, the laser printer and the color printer (these are all networkable devices). We also installed a mini-hub so that these four devices communicate with each other prior to communicating with the network. This helps eliminate unnecessary traffic for the workstation as well as the printers.

Preparing for Purchase

It's important to work closely with your chief financial officer (CFO) and chief operations officer (COO) from the beginning of the purchasing process. In our purchase, one of the first tasks for the radiology administrator and nuclear medicine supervisor was to coordinate meetings between the institution's CFO/COO and vendors.

Work closely with your CFO and COO from the beginning of the purchasing process.

Our first meeting, in February 1998, provided an overview of PET (at that time, only two indications, solitary pulmonary nodule and non-small cell lung CA, were approved by Medicare). At our next meeting in June 1998, we discussed business planning for the scanner and cyclotron, as well as a potential delivery schedule. By the time of the third meeting in September 1999, three new indications (colorectal cancer, melanoma and lymphoma) were reimbursable by Medicare.

These meetings were critical to the success of PET in our institution. It's important that administrators be persistent in providing up-to-date, supportive information to both hospital administration and referring physicians.

Since the University of Kansas is a member of Novation (formerly the University Health System Consortium), we were able to achieve a discount of 24% off the purchase of the scanner and cyclotron. Other services, such as MDB Information Network, can also be used to evaluate PET products and prices.

Marketing, Billing, Contracting and Reimbursement

Marketing is another critical component in the success of any new product or service. In the hospital setting, you will need to inform and educate personnel in your marketing, managed care and hospital/professional billing departments. We began this process in mid-December with a start-up meeting during which we, with the assistance of our vendor, provided clinical information on PET.

We also made use of our nuclear medicine Web site as a marketing tool, posting updates and photos of the construction process, installation, and information about the cyclotron. After the scanner was installed, we added descriptions about PET scans in general, as well as instructions on how to schedule an exam, and even a PET case study file which was created by our vendor. (The web site address is: www.rad.kumc.edu/users/jtraylor/nucmed/index.htm).

We announced the start-up of the PET service using broadcast email, sent out one week after our first patient was scanned. The email reached 8,800 physicians, nurses, technologists, administrators and students on three campuses in three different cities. A month later, we held an open house and invited 50 top physicians who we judged may potentially order PET services. Three one-hour sessions held at different times during the day accommodated these physicians' busy schedules. They toured the imaging suite and were able to look at some of the images we had obtained during the first month of operation.

Working with the hospital's public relations and media relations staff, we arranged for four TV news channels and two newspapers to cover the PET service. This type of marketing generates a great deal of public interest calls, so it's important to be prepared to mail and/or fax information about the service, hours of operation, general terminology on PET, and instructions on how to make an appointment. We created "PET Facts Packets," which are both printed and available on our Web site.

We announced the start-up by broadcast email.

We are currently extending our marketing reach by visiting hospitals and clinics in eastern Kansas to educate them about the service. This will provide smaller communities in the state with the opportunity to utilize PET by referral to an academic institution. We are also targeting oncologists, cardiologists and neurologists; we have sent over 700 letters to referring physicians announcing the service.

Managed Care Meetings

In May 1999, our director of managed care, nuclear medicine supervisor, physician director of nuclear medicine and our vendor representative met with the top four managed care insurance companies in our area. Our goal was to

educate these providers about PET and its benefits, and to convince them that the use of PET can significantly reduce healthcare costs.

Since our hospital serves a high population of Medicaid patients, we coordinated a meeting with the Kansas Social and Rehabilitation Services in August 1999. The same sort of presentation was made and a follow-up letter requesting a policy on PET reimbursement was also sent. Currently, Medicaid nationally does not have a policy for reimbursement of PET.

In addition to working with the major organizations that utilize your institution, it is important to educate your hospital billing staff about billing procedures that optimize reimbursement for PET. Again, vendors are willing to assist in this process. We also contracted with an outside billing service to provide a one-day workshop on billing requirements for both our hospital and physician billing staff. Currently, we bill PET procedures on paper, but in the near future hope to do this processing electronically.

Educate your billing staff to optimize reimbursement for PET.

HCFA has strict requirements on what must be presented and submitted on the claim forms in order to obtain reimbursement. This includes a medical necessity form (see Figure 3), the drug invoice for the FDG, the PET report, and the CT report (or the previous modality which led to a PET scan). Physicians must also provide an appropriate diagnosis code for all Medicare patients. To help physicians with this process, we developed a worksheet containing the temporary "G" billing codes and modifiers.

All this information must be sent to both your physician and hospital coders so that it can be stapled to the claim form before mailing. While some carriers require electronic billing, our consultant recommended that we do paper billing for all PET patients. It is important that an individual be designated to coordinate this information for PET.

Scheduling Exams

We have centralized scheduling in the department of radiology and decided to incorporate PET scheduling into this service. We educated the scheduling personnel about PET and the requirements for exam scheduling. For example, since a PET exam should be medically necessary, we created a list providing information on what examinations are used with PET. If the staff have any questions when scheduling an exam, they call either the nuclear medicine supervisor or physician.

We also inform the patient and/or ordering physician of requirements such as npo status, the need for the medical necessity form to be filled out and faxed to us, and the requirement to bring CT and/or MRI film if those procedures were not done at our facility. In addition, we pre-certify PET exams with all insurance companies except Medicare and Medicaid. It is also best to perform the scan on an outpatient basis, because inpatient DRGs may not include PET at this point. It is unclear how ambulatory payment classifications (APCs) will impact reimbursement once they are implemented in July 2000.

Unit Dose Versus Cyclotron Purchase

We presented proformas to our hospital's CFO demonstrating that purchase of a cyclotron would be more cost effective than purchasing unit doses. The cyclotron will allow us to generate our own FDG and ammonia; in the future it will potentially enable us to add targets for research PET radiopharmaceuticals. Because this will be the first cyclotron in the state of Kansas and Kansas City metropolitan region, any FDG can be sold to other users in the area.

Installation of a cyclotron can take up to one year and, once installed, it must have approval from the state radiation safety program (unless the Nuclear Regulatory Commission governs in your state). Installation can begin only after the facility obtains an amendment to its license and/or a specific license to operate the cyclotron.

At our facility, the installation of the scanner took place in July 1999 and the cyclotron will be installed in March 2000. During the interim period, an independent supplier in Omaha, Nebraska, ships three doses of FDG per day to us. We have them calibrate our injections at 10:00am, 12:30pm and 2:00pm. This service works very well; however, if a PET appointment is canceled or late, we are not able to inject the full 10 millicurie dose of ^{18}FDG and are billed for the cost of the drug.

Figure 3
Medical Necessity Form for PET Imaging, University of Kansas Hospital

Fax to _____ Physician approval _____

Patient Name		Patient's Insurance	Pre-certification number
Medical Record #			
Address		☐ Female	
Work phone #		(age 12–50) Pregnant ☐ No ☐ Yes	
Home phone #		☐ Male	
Birthdate	Age	☐ Inpatient Hospital Unit: ☐ Outpatient ☐ Diabetic	Extension
Referral date	Date call taken	Interviewed by	
Contact person/resident	Phone #	Date of scan	Time
Referring/attending Dr.	Fax report to	Mail Report to	E-mail report to
Diagnosis code		Rationale for PET scan	

Procedure type: ☐ FET brain metabolism ☐ FET brain perfusion ☐ PET heart metabolism ☐ PET heart perfusion ☐ PET tumor metabolism

During PET scan patient will need: ☐ Foley catheter ☐ IV sedation ☐ PO vallium ☐ Glucose level

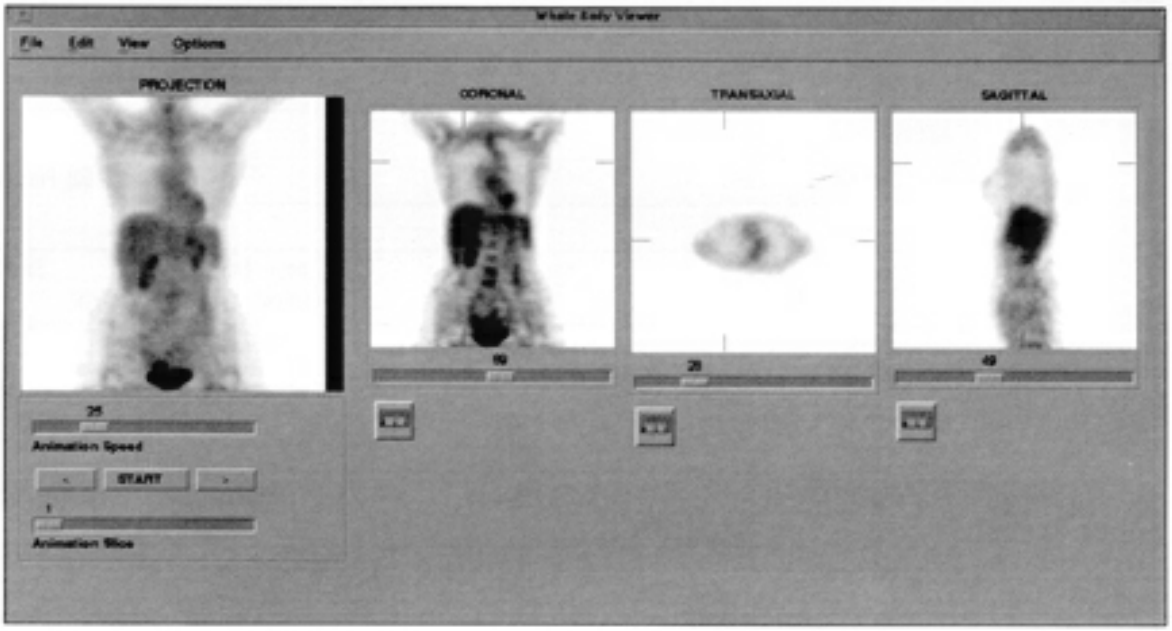
Films	Date	Body site	Film location/phone number

Primary diagnosis	Date of diagnosis	Tumor marker monitoring Tumor marker Date
Known METs	Date of diagnosis	

	Procedure/type	Date	Location	Amounts
Surgery/ biopsies				
Radiation therapy				
Chemo therapy				
Immuno therapy				

Figure 4
PET FDG Scan

Lungs are clear; no tumor. No need for surgery.



Conclusion

As of early December 1999, a total of 101 PET studies had been performed at the University of Kansas Hospital, including 93 whole-body scans and eight brain scans. The dramatic and unique benefits of PET imaging were demonstrated when one patient was saved from unnecessary surgery. This patient presented with a history of melanoma and had a mass on her chest x-ray, which was also present on a CT scan. She was scheduled for a thoracotomy, but had heard about PET and requested that a scan be done before the surgery. The scan was negative, which meant she did not have to undergo the thoracotomy. The lesion seen by CT and the chest x-ray was due to fibrotic scarring from a case of TB she had as a child (Figure 4).

A study on another patient compared a gallium tumor scan with PET for Hodgkin's Lymphoma; the gallium scan showed only one lesion in the pelvis, whereas the PET showed both lesions as seen by CT in the pelvis. This demonstrates PET's superior imaging capability over gallium scanning for lymphoma (Figures 5a and 5b).

While we are currently limited to three procedures per day, once our cyclotron is installed we should be able to perform up to six procedures in a 10-hour day along with offering several research-based procedures with the new radiopharmaceuticals from the cyclotron. Our patients and referring physicians have been very pleased with this new technology, and we are continuing to see improved support for PET reimbursement from third-party payers. ■

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Additional PET bibliography data is available on the University of Kansas Hospital Web site: www.rad.kumc.edu/users/jtraylor/nucmed/index.htm

Figure 5a
Gallium Scan

Only one tumor seen.

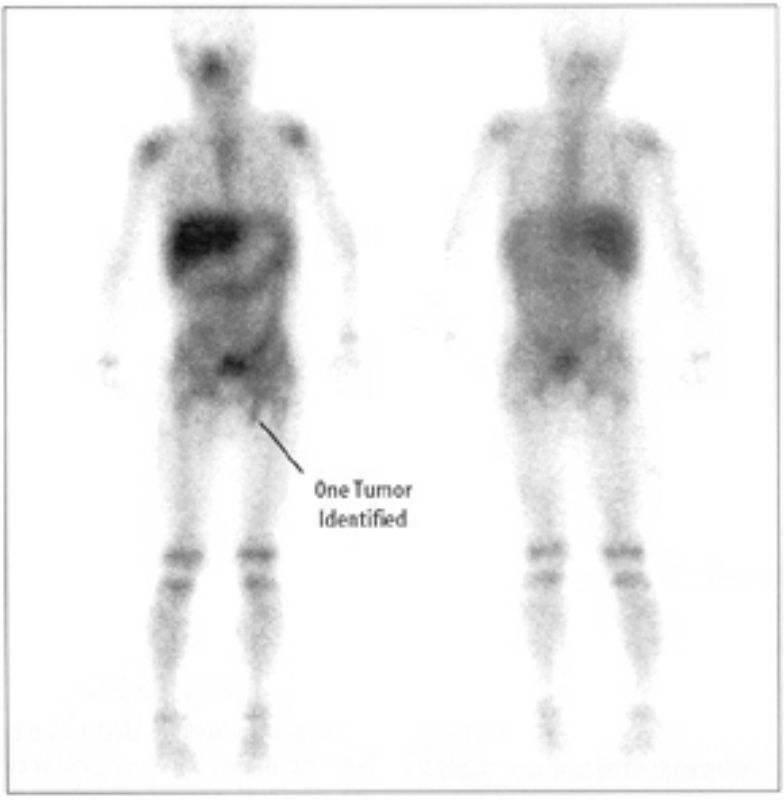

Figure 5b
PET FDG Scan

Shows additional tumor not seen on gallium tumor scan.