PET/CT: Improving Cancer Care for Women

Positron Emission Tomography (PET) and Computed Tomography (CT) are advancing quickly. Today, these technologies are available in combination scanners like Siemens' biograph which offers almost instant, nearly perfect coregistration of functional and anatomical images.

By Joanna Downer, Ph.D.

To discover the benefits of combined PET/CT scanners, Siemens Medical Solutions magazine recently spoke at length with two experts in this field. Nuclear Medicine physician Elissa Kramer, M.D., of the New York University Medical Center, and Todd Blodgett, M.D., a University of Pittsburgh Medical Center radiologist with training in PET, shared their experiences and their expectations for combination scanners' contributions to cancer care for women.

MEDICAL SOLUTIONS: What are the advantages of combined PET/CT over separate scanners?

KRAMER: PET/CT provides immediate correlation between the anatomic information on the CT and metabolic information on the PET image. There's no need to identify landmarks to try to register images taken during different imaging sessions.

BLODGETT: PET/CT is critical for the abdomen because there is a lot of internal organ movement. If the patient with suspected cervical, endometrial, or ovarian cancer has to lie down and get up for two separate scans, potentially on different days, it's almost impossible in some instances to sufficiently coregister the images. Imaging the abdomen is not like imaging the brain, which is essentially fixed in the skull.

MEDICAL SOLUTIONS: What can the correlated images provide for patients with gynecologic cancers that they might not get from a PET scan alone, for example?

KRAMER: You need the accurate, co-registered anatomic image to distinguish cancerous and noncancerous uptake on PET, particularly in the abdomen. Fluorine-18-fluorodeoxyglucose (FDG), currently the only clinically available tracer for PET imaging of cancers, is a glucose analog, so it's taken up by all tissues to some extent. But this low-level background is usually dramatically overshadowed by regions of high uptake, cancerous tumors or certain non-cancerous tissues, such as bowel or inflamed or infected tissues. So you need accurate anatomic images to identify tissues and to define the

ELISSA KRAMER, M.D., is a nuclear medicine physician at NYU Medical Center. She is a strong supporter of PET/CT imaging. From her experience she can tell that trying to register images taken during different sessions isn't really worth while.

relationship of lymph nodes to blood vessels, since, for instance, atherosclerotic plaques hold onto FDG. And you need the PET because, unless it's hot, a lymph node smaller than 5 millimeters on a CT would never be called diseased.

BLODGETT: Depending on the type of cancer, PET/CT can also help refine areas to be included in a radiation therapy field or can affect chemotherapy decisions by establishing the stage of disease or detecting distant metastases. Also, because the metabolic changes seen with treated disease may change faster than the CT abnormality, for some cancers PET/CT can monitor response to treatment or can be used for follow-up to detect residual disease or disease recurrence after the treatment is completed.

MEDICAL SOLUTIONS: Let's talk about specifics. What can PET/CT offer patients with cervical cancer?

KRAMER: A physical exam has been the gold standard for detecting and diagnosing cervical cancer. But with combined PET/CT, we're moving into a new paradigm in tumor staging and detecting retroperitoneal disease. A PET/CT may reveal more disseminated disease than expected, and some centers are using combined PET/CT for treatment planning.

For cervical and ovarian cancer, combined PET/CT is particularly important for accurately detecting disease in para-aortic lymph nodes, and for distinguishing lymph node disease from uptake in blood vessels. The presence of retroperitoneal disease would certainly change the radiation field in cervical cancer treatment. PET and PET/CT are now covered by Medicare for staging as an adjunct to conventional imaging in patients with cervical cancer, and as part of clinical trials for patients with invasive cervical cancer whose conventional imaging exams show no extra-pelvic involvement.

BLODGETT: Patients can receive much less total radiation if you utilize PET/CT to help refine the radiation field. With PET/CT, the DICOM datasets can now be exported into

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Elissa Kramer, M.D.,
New York University Medical Center,
New York, NY

»The future of oncologic imaging is PET/CT...«

Todd Blodgett, M.D., University of Pittsburg Medical Center, Pittsburg, PA

most radiation oncologists' planning software, and by using computer-controlled radiation therapy, you can trace the exact outline of the tumor and irradiate that area specifically. PET/CT allows for more accurate assessment of tumor volume than does PET alone, and separate PET and CT images often can't be co-registered accurately enough in the abdomen. PET/CT can also monitor response to radiation therapy and restage after treatment.

MEDICAL SOLUTIONS: Can PET/CT add useful information for uterine or endometrial cancer patients?

KRAMER: Many say that the best approach for endometrial cancer is surgical staging of the lymph nodes, but this uses node sampling. It's not looking at all the lymph nodes, which is what PET/CT offers. PET/CT shouldn't be used for primary diagnosis, since fibroids can take up FDG, but it appears to offer at least a theoretical advantage for staging.

BLODGETT: These tumors do tend to be FDG-avid, and PET/CT could be particularly helpful for restaging after treatment or for follow-up. At this point, PET for uterine cancer is covered by Medicare only when it's being evaluated in a clinical trial.

MEDICAL SOLUTIONS: And what can combined PET/CT do for ovarian cancer patients?

KRAMER: For patients who might have primary ovarian cancer, PET may not be quite as helpful, because a corpus luteum cyst or an ovulating ovary can also be hot. But sometimes, combined PET/CT might be able to help distinguish these from malignant disease. The field is really just getting started; we're just starting to see published literature.

BLODGETT: We should be seeing more in the next year or two. The United States Centers for Medicare and Medicaid Services (CMS) has approved temporary Medicare coverage for FDG-avid ovarian cancer if the patient's information is entered into a central registry. The purpose is to get more data. Some ovarian tumors aren't FDG-avid, so the registry will help get sufficient data for analysis.

But I think that for FDG-avid ovarian tumors, PET/CT will shine as a modality for restaging, particularly to further investigate a patient with a rising CA-125 antigen level after treatment, when there's suspicion of recurrence, for instance, but it can't be found by other methods. It's clear that PET/CT could impact treatment decisions initially and on follow-up, but whether PET/CT-based decisions ultimately affect patient survival or outcome isn't known yet.

MEDICAL SOLUTIONS: PET has a long history in breast cancer. What has PET/CT brought to the table?

BLODGETT: Mammography is still the preferred method for detecting and diagnosing the primary disease, with or without ultrasound or biopsy. But PET and PET/CT are very good for determining the extent of disease at the time of staging – not to look at lymph nodes, but to identify any liver or osseous metastases. And distant disease alters treatment options and decisions.

KRAMER: We're certainly not where we'd like to be in terms of looking at axillary lymph nodes with PET or PET/CT. PET/CT can find macroscopic disease, not microscopic disease, and that's true for applications in breast cancer, too. But PET is very useful for identifying bone metastases, lytic metastases, and blastic metastases. PET/CT gives us the ability to look at a focus of uptake and the anatomy to define it. Also, PET or PET/CT may become a very important tool for measuring how experimental biologics are working – and if they aren't working, you could move on.

MEDICAL SOLUTIONS: The first application of PET approved for Medicare reimbursement was lung cancer. Is combined PET/CT applicable here?

BLODGETT: PET and PET/CT can distinguish between benign and malignant primary lung tumors. PET can identify pulmonary nodules, provide an initial diagnosis of lung cancer, and detect disease in mediastinal lymph nodes. PET is far superior to CT alone, and studies at Essen, Germany, show that having both modalities changes the staging of lung cancers. Everything PET/CT can do, it can do for lung cancer: detection and diagnosis, staging, restaging, radiation therapy planning, and detection of distant disease.

"PET AND PET/CT are very good for determining the extent of disease at the time of staging," says Todd Blogett from Pittsburg's University Medical Center. In his opinion, it's very helpful to identify any liver or osseous metastases – also in view of the fact that instant disease may change treatment options and decisions.

KRAMER: There's even evidence that a higher SUV (specific uptake value) for a primary lung tumor indicates a poorer prognosis. There are definitely a lot of studies out there for PET in lung cancer, but there are huge opportunities for more work, too.

MEDICAL SOLUTIONS: What kind of training is needed to make the most of combined PET/CT images?

BLODGETT: It requires expertise in two fields – nuclear medicine, specifically PET, and cross-sectional imaging, particularly CT – a combination many interpreting physicians don't have. At this point, there's a significant effort to retro-train people to do PET/CT by adding some amount of additional training for both radiologists and nuclear medicine physicians, depending on their background. In the future, perhaps a specific PET/CT certification could be developed.

KRAMER: At our center, one person reads both the PET and CT, but we have CT experts and we call on them shamelessly. We need to know exactly what we're seeing to get the most from PET/CT.

MEDICAL SOLUTIONS: What do physicians need to know before referring their patients for combined PET/CT?

KRAMER: Radiation treatment disturbs PET images, so that's a consideration for timing. For head and neck, PET/CT shouldn't be done until three months after radiation treatment. For lung cancer, it's two months. But this varies among patients and anatomic sites.

MEDICAL SOLUTIONS: What is the future of PET/CT in oncologic imaging for women?

BLODGETT: I always say this: The future of oncologic imaging is PET/CT. PET and PET/CT are in their infancies clinically because we have only FDG. As we move toward more specific tracers, there will be very little background activity. Combined PET/CT will be needed because there won't be any basic structural information from the PET alone once you have more specific tracers. That's the future.

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