

In addition, coordination with technical operations is essential to ensure capacity and the ability to meet prospective demand. These principles are effective, regardless of the setting. Strategies for implementation, however, may differ depending on whether the market is rural or urban and on whether services will be delivered in hospital or outpatient venues.

Programs that successfully manage referring physician relationships share certain key characteristics. They are: focused and strategically driven, integrate measurable outcomes into their practice and relay these data to customers, have the full administrative and infrastructure support of their organizations, and are part of an environment that understands and values the physician's role in the referral process. Moreover, these programs have the clinical capability and expertise to meet patients' and referring physicians' needs; are ready to provide quality patient care, ease of access, and timely reporting of results; and are willing to embrace an approach based on the customers' needs. The best of these programs have liaisons or representatives who are solution oriented, focused on the referring physicians' practice and patient needs, and able to focus on specific needs; a single point of contact who is viewed as a trusted resource by the referring physician; a team of clinical specialists, radiologists, and administrators to provide depth of knowledge and coverage; and a perspective on issue resolution as an organizational process involving all participants. With these characteristics in place, the referring physician and his or her staff see a seamless operation ready to support the patient's best interest. The result can be long-term, loyal, and collaborative relationships with referring physicians.

An example from our work shows how impressive these results can be and points to specificity of message as another key element in success. In a review of annual referral patterns for 1 imaging center we found that the center was capturing

medical and surgical oncology referrals for lymphoma and colorectal and breast cancer. Lung cancer referrals accounted for only 18% of the total. Missing were referrals from pulmonologists, family practice and internal medicine physicians, and thoracic surgeons for solitary pulmonary nodes and initial staging of lung cancer. We realized that we could drive volumes by talking more specifically about PET/CT applications in a more targeted way. We developed targeted educational messages, flyers, and lunch-and-learn presentations to address the "gap" identified in referrals. Our customer service representatives were educated to deliver the content to key referring physicians. The results were immediate. In the first 5 mo, the center performed as many exams as they had in the entire previous year through capture of new referring physicians and increased awareness of the utility of PET in single pulmonary nodules and initial staging of non-small cell lung cancer.

A final important strategy is to work together to broaden the audience for our message. Efforts such as the molecular imaging education area and the SNM molecular imaging track at the annual meeting of the Radiological Society of North America are encouraging. We should expand efforts to place molecular imaging experts at meetings such as those of the American Society of Clinical Oncology and the American Society for Therapeutic Radiology and Oncology, as well as at other specialty meetings. We should also make our experts available to the National Comprehensive Cancer Network to provide input on appropriate utilization of molecular imaging during practice guideline development and review.

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Steps in Moving Molecular Imaging to the Clinic

I had the good fortune to be involved in initial PET imaging efforts in the San Diego, CA, area in 1999, when we brought a mobile van into my most recent site. Today 13 PET scanners are operative within 8 miles of my workplace. The technology has clearly taken off, but much remains to be done in raising our profile and in talking effectively and specifically with referring physicians.

Engaging the Primary Care Physician

A number of familiar strategies have been used for years to engage the interest and attention of referring

physicians. We are all familiar with tumor boards, conferences, cases of the month, and dinner meetings. I would like to outline a few strategies that are somewhat different but have worked quite well.

The first of these is to target outreach to primary care physicians. Oncologists, neurologists, and cardiologists are, of course, important partners in molecular imaging and continue to be excellent sources of referrals. But if we look at the percentage distribution of different disciplines, we see that primary care, family medicine, general practice, and internal medicine physicians make up 67.8% of all

physicians in the United States. The percentages of all other practitioners are quite small in comparison. Primary and general care physicians are often the decision makers, particularly in patients covered by managed care. They are also often the individuals who explain imaging results to patients. Even when patients already have oncologists or other specialists who may have ordered the imaging, many prefer to listen to their primary care physicians. These physicians need to understand the value of PET, both to justify its use and to better relay the results.

The bond between patients and their primary care physicians works both ways. These physicians want to know that they can maintain their role as coordinators of care, staying involved and informed about their patients over the years. In some cases, primary care physicians can be a fertile source for direct referrals for oncologic, neurologic, and cardiac imaging. This is admittedly a controversial area, because oncologists, cardiologists, and neurologists might perceive efforts to encourage these referrals as cutting into their own referral base. It is true that if primary physicians understand the value of specific imaging techniques, they are apt to order studies themselves and convey diagnoses to the patient. I personally do not think this will have the result of cutting down on specialist referrals. The challenge for imaging specialists is to talk to oncologists, neurologists, oncologists, and other specialists to let them know that partnering with primary care physicians allows us to refer the people to them who most need their services.

Strategies for Outreach

The focus in reaching out to any referring physician should be on education, direct communication, office staff interaction, and the provision of accurate, prompt, and easily understood consultations.

The value of positive and proactive interaction with referring physicians' office staff is often overlooked. These staff members often make decisions on where patients will go to be imaged, and their cooperation and good will are vital to rapid, accurate communication. It is helpful to identify a "go to" person in each office. This person could be the office manager or a managing nurse who is available for direct communication with questions or to address specific problems. The imaging specialist should visit each office at least once so that office staff can "put a face with the name." Channels of access (phone, e-mail, beeper) to the imaging specialist and his or her staff should also be clear. These staff members, like the referring physician, will benefit from being better informed about molecular imaging, its tools, and the information each type of imaging can convey.

Our best educational and marketing tool to date has been a 12-min DVD that we distribute to the office of referring physicians, where it is given directly to patients as they are referred for imaging. In the video, I describe the procedure to a "patient," with details on what will be required at each step

of the examination, what happens afterward, and when to expect results. We have found that by the time the patient comes to see us on the day of the test, he or she is much more relaxed and has appropriate expectations. In addition, the availability of the DVD means that the referring physician's office staff is not burdened with taking valuable time to explain a test with which they are not necessarily familiar. These staff members have told us how much they appreciate the fact that they have this information to give the patient and that this clearly sets us apart from most other imaging centers in the area. Even our own staff members have responded positively, because patients are now arriving for their imaging better prepared and less apprehensive. We also believe, although we have no numbers to prove it, that distribution of the DVD has decreased our no-show rate. This effort has been so successful that we plan to produce a second version in Spanish.

Another method of electronic outreach is the creation and delivery of special e-mails. At the University of California, San Diego, as at many other imaging centers, we now send reports by e-mail to referring physicians at secure sites. With each report, we add 1 or 2 sentences in the body of the e-mail that summarize the case or provide additional helpful information. This is a rapid and easy way to convey valuable information to our referring colleagues and demonstrates the consultative role we want to highlight for molecular imaging. We have received positive feedback from referring physicians on these messages.

A final strategy that seems almost axiomatic but may need to be reinforced is the importance of responding promptly to the additional requests that come our way from referring physicians. These include requests for comparison studies and retrieval of correlative studies. Direct contact by telephone when referring physicians have specific questions is also an effective way to reinforce collegial relationships.

Reaching Out Through PET/CT to Radiation Oncology

The use of PET/CT in the field of radiation oncology is fast becoming a necessity rather than a luxury. With newer and better ways to treat patients with radiation therapy, as well as the need for accurate simulation and the value of PET for longitudinal follow-up, radiation oncologists have embraced PET/CT with enthusiasm and creativity. With our current technology, we are now better able to provide data for tumor targeting and to accurately stage patients for our radiation therapy colleagues. This latter capability has been shown clearly to alter management (including radiation treatment) in a significant number of patients. One recent study indicated that >50% of patients referred for functional imaging have potential changes in target volume and/or dose distribution based on PET/CT.

With all of these successes, the potential for major growth in collaboration between nuclear medicine and radiation oncology is significant. The benefits that we have to offer include improving the selection of candidates for radiation

therapy, improving the success of radiation therapy and minimizing adverse effects, and providing “1-stop shopping” for simulation and diagnostics. Approaching radiation oncologists for enhanced use of imaging is not without its challenges. The field of molecular imaging, as a number of presenters at this summit have emphasized, is still short on validation (e.g., outcomes data). We have additional challenges in target motion, reproducible patient positioning, and more accurate quantification. We are still waiting, too, for new radiopharmaceuticals that can address many of the most pressing of radiation oncology imaging questions.

Effective collaboration and partnership with radiation oncologists may help to stave off the phenomenon of radiation oncologists purchasing their own scanners and farming out reads, keeping the technical component of reimbursement.

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Cardiovascular Molecular Imaging: Promoting Utilization and Outreach

Imaging of molecular markers and biological pathways can provide important insight into the pathogenesis and progress of cardiovascular diseases and assessment of therapeutic intervention. These include novel imaging strategies for heart failure, thrombosis, apoptosis, atherosclerosis, and angiogenesis. Molecular approaches directed at imaging of these processes will be discussed here, along with opportunities and challenges for advancing cardiovascular molecular imaging. The opportunities to be highlighted include: (1) current availability of metabolic imaging; (2) current availability of receptor imaging; and (3) availability of hybrid imaging systems. The challenges that will be outlined briefly here include: (1) equipment with inadequate sensitivity for imaging small vascular targets and inadequate correction capabilities for cardiac and respiratory motion; (2) lack of commercially available quantitative software for analysis of dynamic images or targeted “hot spot” images; (3) current investment in SPECT imaging on an outpatient basis by many cardiology practices; and (4) limited availability of ^{123}I and the need for more approved $^{99\text{m}}\text{Tc}$ -labeled agents.

To promote utilization and outreach in cardiovascular molecular imaging we need to first look at the current state of the art in molecular imaging in relation to current problems in management of cardiovascular disease. Molecular imaging techniques currently allow us to assess cardiac metabolism and neuronal function. We can perform receptor imaging and, in the future, targeted imaging of biological processes, including but not limited to atherosclerosis, vascular remodeling, thrombosis, inflammation, angiogenesis, apoptosis, necrosis, postinfarct remodeling, and heart failure. There is also a clear future role of cardiovascular molecular imaging for the monitoring of genetic or stem cell therapy.

However, for the purposes of this discussion, we will focus on imaging in patients following myocardial infarction (MI) with left ventricular (LV) dysfunction at risk for sudden cardiac death and LV remodeling as 2 practical applications. Receptor imaging offers a clinical approach available now, whereas other more specific targeted approaches may be available in the future.

Sudden Cardiac Death After MI

One area in which molecular imaging can have a major clinical impact right now is in assessing the potential for sudden cardiac death after MI and in providing direction for treatment. Patients are currently triaged on the basis of simple parameters such as LV ejection fraction (LVEF), and we know, for example, that an LVEF $<30\%$ carries with it a much higher risk for sudden cardiac death and that this risk is high in the earlier stages (Solomon et al., *N Engl J Med.* 2005;352:2581–2588). These at risk patients are managed with implantation of automatic internal cardiac defibrillators (AICDs). The current selection criteria for AICD placement are based on the results of a number of large clinical trials, the most prominent of which are the Multicenter Automatic Defibrillator Implantation Trials (MADIT) I and II. The results of MADIT-I suggested that patients who had positive electrophysiologic studies for induced ventricular tachycardia (VT) or even showed nonsustained VT on a Holter monitor might benefit from preventive insertion of an implantable defibrillator. MADIT-II offered amended criteria when participating researchers found a 30% reduction in mortality in patients who were randomized to receive an AICD (in fact, the trial was stopped early so that more participants could benefit from the procedure). Today the recommendation is