

Highlights of the 2007 Scientific Sessions of the American Society of Nuclear Cardiology

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The 12th annual Scientific Sessions of the American Society of Nuclear Cardiology (ASNC) (chaired by Dr. Brian Abbott) were held in San Diego, California, from September 6 through 9, 2007. The meeting, entitled “Cardiac Imaging: Imagine the Future,” attracted over 1,700 attendees. The scientific sessions were structured along specifically designed tracks, including the technical, core, and advanced tracks focusing on nuclear cardiac imaging and a dedicated computed tomography (CT) track, addressing the growing role of CT in noninvasive cardiac imaging and its integration with nuclear techniques in hybrid cardiac imaging. These tracks were complemented by the plenary sessions, which included keynote speakers addressing the role of

nuclear cardiology in the healthcare system. Original research was presented in abstract presentations and a Young Investigator Award competition.

Plenary Sessions

Dr. Robert Bonow gave the sixth annual Mario Verani Memorial Lecture, which is presented each year at the ASNC annual meeting by a prominent nuclear cardiologist, in memory of Dr. Mario Verani (1943 to 2001), a pioneer in nuclear cardiology and founder and past president of the ASNC. Dr. Bonow pointed out the gains that have been made in the fight against cardiovascular disease in the U.S., with deaths due to coronary artery disease (CAD) declining since the 1970s. With this backdrop, he posed the question: What role does imaging play in improved outcomes? There has been a tremendous increase, on the basis of data from the Centers for Medicare and Medicaid Services and other sources, in the number of stress tests performed over the past 10 years, owing in large part to increases in myocardial perfusion imaging (MPI). With this increase comes an increase in cost, and Dr. Bonow asked whether this added cost provides added value. Cardiac imaging, mostly nuclear imaging and echocardiography at this point in time, has been shown to be useful for the diagnosis of CAD. In addition, there is a wealth of data, particularly regarding nuclear imaging, supporting the prognostic value of such tests. A normal study portends an excellent prognosis, whereas the prognosis becomes progressively worse with increasing degrees of abnormality of these tests. He noted, however, that all of the prognostic studies were retrospective, nonrandomized trials. Only one prospective study, the END (Economics of Noninvasive Diagnosis) study, dem-

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onstrated an economic benefit to a strategy of performing MPI to determine who needed cardiac catheterization versus a strategy of going directly to angiography. This economic benefit was noted despite similar outcomes in the groups. Dr. Bonow also discussed the recent data regarding the ability of cardiac CT to diagnose CAD and provide prognostic information. Several studies have shown the relationship between the coronary artery calcium (CAC) score and mortality or cardiac events. On the basis of the available data, cardiac CT might be a useful tool to help risk-stratify patients, particularly those at intermediate risk for events on the basis of traditional risk factors. However, there are still many unresolved issues regarding the practice of cardiovascular imaging, including which patients should be studied, who should interpret the studies, who will pay for the studies, and how quality of the testing and the resultant images will be determined and maintained. Dr. Bonow concluded that cardiovascular imaging has become a cornerstone in the diagnosis and management of patients with heart disease and has transformed and will continue to transform cardiovascular care. The exciting new imaging modalities create a unique opportunity to improve diagnostic and clinical management strategies. However, they also bring challenges in patient selection, clinical training, integration with established imaging methods, resource use, and cost effectiveness.

The keynote address in the second plenary session was given by Dr. Raymond Gibbons, past president of the American Heart Association. In his talk, Dr. Gibbons cautioned the audience that we are in the midst of a health care crisis. Health costs have increased to a greater degree than inflation over the past decade. The increase in cardiac imaging procedures has caused insurers to focus on controlling imaging through methods such as requiring pre-approval of MPI as a way to reduce costs. Furthermore, part of the Deficit Reduction Act of 2005 included a reduction in payments for imaging. It is important to respond to these challenges in a meaningful and responsible manner. Dr. Gibbons noted that there are tremendous regional variations in how often imaging stress testing is used. Furthermore, he discussed the American College of Cardiology/ASNC appropriateness criteria for MPI and how following these guidelines can reduce the number of inappropriate tests. Dr. Gibbons concluded that it is essential to continue to generate rigorous scientific evidence that emphasizes quality, efficiency, and outcomes and that physicians must begin to regulate testing and eliminate inappropriate testing.

The role of cardiac imaging in high-risk and specialized populations. The role of MPI and CT in patients with diabetes mellitus was discussed by Dr. Frans Wackers. He pointed out the well-known fact that diabetes is considered a "CAD equivalent" because of the high risk for cardiac events in diabetic patients, with an increased mortality and worse outcomes after myocardial infarction. These factors have led Dr. Wackers and others to wonder whether asymptomatic diabetic patients should be screened for

CAD. He noted that the prevalence of abnormal stress single-photon emission computed tomography (SPECT) studies in diabetic patients depends on the population being studied, with prevalence as high as 58% or as low as 7%. The DIAD (Detection of Ischemia in Asymptomatic Diabetics) study demonstrated that 22% had abnormal MPI, with 6% having markedly abnormal studies. Pre-screening with cardiac CT (using CAC) might enrich the population that could benefit from MPI, because patients with high CAC scores have a high likelihood of abnormal MPI.

Dr. Kim Williams reviewed the role of cardiac imaging in patients with renal failure, a group that is at increased risk for cardiac events, with 54% of the deaths due to cardiovascular causes. There are many possible mechanisms for this increased risk, including accelerated atherosclerosis, increased vascular calcification, left ventricular (LV) hypertrophy and dysfunction, anemia, hypertension, elevated homocysteine concentrations, and increased vasoconstriction. Cardiac CT studies have shown increased coronary calcification in end-stage renal disease, and higher CAC scores are associated with worse outcomes. Also, SPECT MPI could effectively risk-stratify patients undergoing renal transplantation, but even those with normal SPECT results had a relatively high event rate of 3%, suggesting that other mechanisms besides ischemia determine the increased mortality in this patient group.

Dr. Leslee Shaw discussed the often-debated topic of the role of noninvasive imaging in asymptomatic high-risk patients. She described the high-risk groups, including high-risk elderly patients (in whom 20% might have an ankle-brachial index of <0.9), those who are functionally impaired, patients who smoke, those with metabolic syndrome, high-risk women, and obese patients (who would seem to need other risk factors to be considered candidates for testing).

Core Curriculum: Update in Nuclear Cardiology

The primary focus of the core curriculum was to present practical information relevant to the everyday practice of nuclear cardiology. In addition to presenting many fundamental concepts important to nuclear cardiology, the sessions emphasized new developments in nuclear and CT imaging.

Emerging applications of SPECT perfusion imaging and cardiac CT. Many of the Core Curriculum sessions focused on emerging applications and recent developments in SPECT MPI. Dr. James Udelson highlighted the important role of MPI in several important patient populations. In patients with heart failure and systolic LV dysfunction, MPI might be used to identify patients who have significant CAD who might benefit from additional evaluation or treatment. In patients with known CAD, emerging evidence supports the role of MPI to determine which patients will likely benefit from aggressive interventions, such as coronary revascularization and/or medical therapy. In par-

ticular, the quantitative aspect of MPI might be important in this regard, because there is a threshold of ischemia on MPI, which might indicate patients who will have therapeutic benefit. Dr. Christopher Hansen discussed the important role of MPI in secondary prevention, highlighting the strong relationship between perfusion abnormalities and cardiac event rate, and recent evidence from the INSPIRE (Adenosine Sestamibi Post Infarction Evaluation) trial, which supports a role for adenosine MPI in the assessment of risk soon after myocardial infarction. In this prospective, multicenter trial, MPI results significantly improved prediction of subsequent death or myocardial infarction beyond the information provided by clinical (i.e., Thrombolysis In Myocardial Infarction risk score) and LV ejection fraction variables.

The complementary roles of cardiac CT and MPI were comprehensively reviewed by Dr. Leslee Shaw. Whereas there are data on the prognostic role for both coronary calcium measurement and MPI in patients at risk for coronary disease, Dr. Shaw highlighted the importance of distinguishing between a measurement of atherosclerotic burden and a measurement of ischemic burden. In low- to intermediate-risk patients, emerging evidence supports initial assessment of atherosclerotic burden by CAC scoring followed by stress MPI to assess ischemic burden in patients with abnormal CAC scores. Furthermore, evidence continues to support the important role of MPI as the initial test for risk stratification of patients at high risk for CAD. Trials are currently underway to assess the potential utility of hybrid SPECT/CT or positron emission tomography (PET)/CT systems to assess both atherosclerotic and ischemic burden in patients at risk for coronary disease.

New developments in nuclear imaging. The ASNC Core Curriculum also highlighted a number of new developments in cardiac SPECT and PET, which will expand the potential applications of nuclear imaging. Dr. Vasken Dilsizian reviewed the current status of metabolic imaging with iodine-123 β -methyl-iodophenyl-pentadecanoic acid (BMIPP) and F-18 fluorodeoxyglucose and discussed the use of these tracers as markers of recent ischemic events (ischemic memory). Results from a recent phase-2 trial of BMIPP show that this agent might detect ischemia up to 30 h after an ischemic episode, long after the perfusion defect has normalized. A phase-2 trial is currently underway, investigating the potential role for BMIPP in the evaluation of patients presenting with chest pain. The current status of rest/stress PET MPI was reviewed by Dr. Terrence Ruddy. Recent evidence indicates that PET MPI has a very high sensitivity to detect single- and multivessel CAD and that the overall accuracy remains equally high in obese patients and women.

Quantification of LV function remains a focus of nuclear cardiology techniques, and Dr. Guido Germano described a number of important new methods that might derive even more detailed information from SPECT MPI studies. For the assessment of LV function, diastolic filling might be assessed by analysis of ventricular volume curves on gated

SPECT. Phase analysis of regional ventricular function might be an important method to assess ventricular synchrony and could play an important role in identifying patients who would benefit from cardiac resynchronization therapy. In addition to assessment of LV function, it is now possible to assess right ventricular ejection fraction with gated SPECT. For assessment of myocardial perfusion, new developments in acquisition and processing might lead to increased resolution by "motion freezing" the heart in diastole and also allow accurate quantification of changes in perfusion on the basis of serial imaging.

Ensuring quality of imaging. The theme of ensuring quality in imaging was emphasized in the entire ASNC curriculum. Dr. Thomas Holly reviewed the rationale for using automated perfusion scores as an aid in the evaluation of MPI studies, emphasizing the potential role these programs can have in ensuring accurate interpretation of studies. Dr. Edward Ficaro discussed the importance of quality control in SPECT/CT systems, which is particularly important with the growing use of CT-based attenuation correction algorithms. Proper registration of CT and SPECT images is the single most important issue to ensure quality studies. The importance of reviewing all imaging data, including the attenuation maps and fused images, was emphasized.

Advanced Track: Recent Progress in Tracers and Imaging Technology

The advanced track is traditionally dedicated to novel, recently introduced topics related to tracers and imaging methodology. Both basic science concepts of cardiac imaging as well as clinical aspects are covered. A first session was dedicated to the role of imaging in heart failure, which is a topic of growing interest given the increasing prevalence and incidence of heart failure. Dr. Robert Bonow highlighted progress in the treatment of congestive heart failure. The increasing diversity of therapeutic options results in an increasing demand for imaging techniques to guide therapeutic decision-making. Dr. Kevin Allman elaborated on the prognostic value of nuclear imaging in heart failure. For example, viability imaging can be used to guide the clinician toward revascularization or medical therapy of ischemic LV dysfunction, on the basis of presence and extent of viable but jeopardized myocardium. The role of innervation imaging was subsequently emphasized by Dr. Mark Travin. Neuronal dysfunction can be identified in the failing heart and has implications for disease progression, arrhythmogenesis, and outcome. Iodine-123 metaiodobenzylguanidine is a tracer that is currently being evaluated in multicenter clinical trials and might soon become available for stratification of heart failure patients on the basis of the degree of cardiac denervation. Dr. Leo Hofstra introduced novel techniques to predict LV remodeling with molecular imaging radiotracers. A promising approach currently being tested exper-

imentally is the use of integrin ligands to identify the severity of post-ischemic myocardial damage.

A second session was dedicated to novel instrumentation. Dr. Ernest Garcia summarized trends in SPECT and PET instrumentation toward more sensitive higher resolution systems. Dr. Daniel Berman then provided an overview of the new generation of dedicated, fast cardiac SPECT systems, which will allow for a dramatic reduction in acquisition time and hold the promise of providing dynamic, quantitative SPECT imaging in the future. Motion correction and CT-based attenuation correction are other technical advances for SPECT, which will contribute to improved accuracy, as highlighted by Dr. James Case. Recent developments in software methodology have now provided tools for robust and reproducible fusion of nuclear and CT angiographic images, as shown by Dr. Philipp Kaufmann.

New trends in molecular imaging, which is an area of active investigation on the basic science and preclinical levels, were the topic of another advanced track session. Dr. Hyung Chun discussed the nuclear imaging techniques that can be used for tracking of stem cells and explained how these techniques can facilitate and improve understanding of stem cell therapy as a novel approach to restore damaged myocardium. Dr. Frank Bengel demonstrated how multiple tracers of the sympathetic nervous system can be combined to obtain deeper insights into the role of autonomic innervation for cardiac disease. Dr. Mehran Sadeghi provided an overview of novel tracers that allow for biologic characterization of atherosclerotic lesions. The session was concluded by Dr. Leo Hofstra, who discussed the potential of annexin-V as a marker of cell death in cardiomyopathy, ischemia, and plaque characterization.

Another session was fully dedicated to the role of nuclear imaging for characterizing the process of atherosclerosis. Dr. Leo Hofstra provided an overview on the pathophysiology of the vulnerable plaque and how lesions without significant luminal narrowing can contribute to life-threatening vascular occlusion. Dr. Heinrich Schelbert subsequently outlined how PET flow imaging can be used to identify coronary endothelial dysfunction as a diffuse process, which is considered an early marker of atherosclerosis and a facilitator of plaque progression. Dr. Mehran Sadeghi then summarized tracers that have been introduced to identify biologic features of plaque vulnerability, and Dr. Joanne Schuijff concluded the session by pointing out the potential of cardiac CT to identify morphologic components of plaque composition.

In addition to new tracers and technical advances, pharmacologic stressors and the definition of their clinical role have evolved in recent years. A session was devoted to the latest developments in pharmacologic testing, and Dr. David Glover started the session by explaining the physiology and pharmacology of the adenosine receptor system as a primary target of vasodilator stress testing. Dr. Robert Hendel presented initial clinical results of adenosine A2a

receptor agonists as novel, promising stress agents that are easy to administer and have fewer side-effects than adenosine.

The final session in the advanced track focused on the role of nuclear imaging for monitoring cardiac therapy, a topic that has generated increasing interest, owing to the continuously growing number of therapeutic options in treating cardiovascular disease. Dr. Tracy Faber explained how quantitative analysis of nuclear cardiac studies is helpful in improving the reproducibility and comparability of serial imaging before and after therapy. Dr. George Beller provided an update on the high value of MPI to evaluate interventions. Dr. Paolo Raggi illustrated how CT can be used for monitoring atherosclerotic plaque progression, and Dr. Juhani Knuuti showed how PET, owing to its potential for absolute quantification, is a very powerful tool in identifying the efficacy of therapeutic interventions.

The variety of topics covered in the advanced track clearly highlighted that the field of nuclear cardiology is moving forward. Novel tracers and the implementation of molecular imaging techniques help in broadening the application of imaging in cardiovascular disease. Novel camera and stress-testing methodologies will facilitate clinical throughput and patient comfort. In addition, the entire field has focused on moving toward an individual characterization of disease-related risk, to guide effective therapeutic decision-making.

Technical Track: Innovations in Clinical Nuclear Cardiology

Devices for faster acquisition. Several presentations emphasized the need to implement acquisition protocols that shorten the total imaging time to increase patient throughput and comfort as well as to improve image quality. These protocols might also be used to reduce radiation dose. Several manufacturers now have software solutions in the form of iterative reconstruction methods that have been implemented to account more properly for the geometry of the system for resolution recovery and to perform noise reduction to yield images of comparable conventional quality in one-half the conventional acquisition time. These methods are often called wide beam reconstruction (WBR), although each manufacturer uses their own proprietary name for the approach. Clinical trials using this approach are beginning to show that electrocardiography (ECG)-gated MPI studies acquired in one-half the conventional time and reconstructed with WBR yield perfusion and function information comparable to that acquired and reconstructed with filtered back projection in the same patient. Because of the higher contrast of WBR images compared with filtered back projection images, the WBR images are often rated as higher quality. This improved contrast results in larger LV volumes when compared with conventional protocols.

Hardware solutions to the faster acquisition challenge were also widely reported. These hardware solutions take the form of totally new camera/detector designs to perform

much faster SPECT imaging, in the range of 3 to 10 times the conventional sensitivity with no loss in resolution. The designs vary from as simple as adding a third SPECT detector to as unconventional as having 10 solid-state cadmium zinc telluride detectors constantly scanning the heart region. Other designs used a stationary curved detector system where only the collimator slat system moves to scan the heart; and another design used 2 conventional SPECT detectors mounted with multi-pinhole collimators pointed at the heart region. One advantage of this multi-pinhole approach is that there are no moving parts.

The collective presentations on SPECT technology clearly indicate that we are seeing both a rebirth of this technology as well as a commitment from manufacturers and researchers alike to move this technology forward. Several presentations emphasized the need to continue to optimize quality in patient care by performing quality control of acquisition and processing protocols of conventional SPECT imaging and to begin to develop and implement the quality control procedures for the new devices.

CT Track: Complementary Imaging Modality

The ASNC 2007 Scientific Sessions included a track specifically for cardiovascular CT. This track included presentations on cardiac CT research but also state-of-the-art lectures on computed tomographic angiography (CTA). The CT track was introduced by a session on the technical aspects of cardiac CT and included an overview by Dr. James Case that provided an important background on the physics and instrumentation required for state-of-the-art cardiac CT. Building upon this basis, the importance of technical and patient factors affecting study quality—including issues concerning gating and dose modulation, heart rate, and contrast delivery and timing of image acquisition—were emphasized in the following presentations.

Dr. John Mahmarian provided evidence demonstrating the incremental value CT can provide to SPECT imaging. Specifically, CT CAC scoring can provide important information concerning the burden of coronary calcifications and help direct aspirin and statin therapy in patients with no evidence of perfusion defects on SPECT studies. Furthermore, CAC scoring can aid in management decisions in patients with equivocal SPECT findings. With the introduction of hybrid SPECT/CT imaging systems, the identification of significant coronary artery stenoses increases dramatically. The use of hybrid systems also extends to PET imaging, in which a growing number of PET cameras are equipped with multidetector CT for attenuation correction. However, these PET/CT systems can also provide hybrid imaging modalities that can provide anatomic and physiologic information. Dr. Juhani Knuuti presented evidence demonstrating that the ability to detect and localize functionally significant coronary artery lesions is improved when multidetector CT is combined with PET.

Improvements in cardiac CT, driven in large part by technical advances in multidetector CT, including improvements in both spatial and temporal resolution, have improved the diagnostic performance of CTA. These improvements have led to the application of multidetector CT to the evaluation of more challenging patient populations, including patients with in-stent restenosis, bypass grafts, and calcified vessels. Dr. Albert Lardo reviewed the rapid developments in the area of cardiac CT for assessment of viability. Proof-of-concept studies have been performed in animals and humans for the assessment of myocardial viability through the determination of late hyperenhancement. The mechanism responsible for hyperenhancement 5 min after the injection of X-ray contrast in patients with myocardial infarction is thought to be related to disruption of cell membranes in nonviable myocytes allowing iodine to penetrate the cell.

Physicians interpreting cardiac CT angiographic studies have also noticed for some time that the LV myocardium subtended by a high-grade coronary occlusion is sometimes hypo-enhanced on the CT images obtained immediately after the initial (i.e., first pass) injection of contrast. Conceivably, myocardial perfusion by CTA can be measured at rest and then after coronary vasodilator stress with an agent such as adenosine and then measured again during the hyperemic state in order to assess the functional significance of the coronary lesions. Studies presented by Dr. Richard George suggest that quantification of myocardial washout kinetics for iodinated contrast on multidetector CT studies might be able to detect ischemia. These studies so far show the feasibility of this diagnostic approach. If this line of investigation proves successful, a single CT angiographic examination could provide a combination of CAC scoring, coronary angiographic anatomy, LV function, regional myocardial perfusion, and myocardial viability in a test lasting 15 min and a radiation dosage of only 12 mSv.

Original Research: Abstract Contributions

A total of 83 abstracts were selected from a group of competitive submissions after peer review. All selected abstracts were presented in 1 of 5 moderated poster sessions and published in the July/August issue of the *Journal of Nuclear Cardiology*. The following is a brief synopsis of these abstracts.

New developments in instrumentation. Advances in instrumentation and image acquisition were highlighted in a variety of abstracts. A comparison of dynamic-SPECT, a novel technology for high-speed MPI, with standard image acquisition showed increased count sensitivity and resolution with acquisition times of only 2 to 4 min (1). Scan time was also reduced in a WBR study, demonstrating no differences in quantitative indexes of LV function, thickening, and volumes (2), and a phantom study of iterative reconstruction combined with CT-based attenuation correction and scatter correction showed good correlation with

image reconstruction with filtered back projection (3). Studies of attenuation correction demonstrated that the attenuation maps obtained from gadolinium-153 transmission scans are not adversely affected by "half-time" acquisition protocols (4,5). A study of hybrid imaging with a PET/CT system in patients with chest pain recruited from emergency department patients found that the absence of CAC was predictive of a normal adenosine stress rubidium-82 scan, suggesting that stepwise imaging with CT for CAC performed first might reduce overall radiation exposure (6). Kajander et al. (7) described a novel approach to reduce radiation exposure by 60% with prospective ECG-gating of cardiac CT on a hybrid PET/CT system. Two reports demonstrated the importance of attenuation correction. In the first study, a hybrid SPECT/CT system with attenuation correction improved diagnostic accuracy for detecting CAD as compared with noncorrected SPECT (8). In the second study, analysis of SPECT/CT studies found that respiratory motion and misregistration of the perfusion and CT data sets were significant contributors to false positive findings (9).

Special populations. Several abstracts examined the application of nuclear cardiac imaging to patients with unique characteristics. Patients with advanced chronic kidney disease (glomerular filtration rate <60 ml/min/1.73 m²) were noted to have worse stress SPECT perfusion abnormalities than normal individuals or patients with mild to moderate renal dysfunction (10). In patients referred for evaluation of syncope, those with abnormal MPI findings were more likely to have known CAD or multiple risk factors (11). Of 177 patients referred for stress MPI with ECG evidence of LV hypertrophy, 60 (34%) died over a 5.5-year follow-up period; an abnormal stress technetium-99m tetrofosmin SPECT study was an independent predictor of mortality (12). Two studies focused on SPECT imaging in transplant recipients. Parodi et al. (13) found that SPECT imaging results were predictive of long-term prognosis after heart transplantation, whereas a presentation by Khan et al. (14) demonstrated that a normal pharmacologic stress MPI was associated with a very low incidence of adverse cardiac events in patients undergoing visceral organ transplants. Finally, one study reported on patients with diabetes type 2 who underwent MPI with vasodilator stress and exhibited a blunted heart rate response, suggesting the possibility of sympathetic denervation (15).

CT. The issue of the diagnostic accuracy of coronary CTA continues to be the subject of numerous studies. Chow et al. (16) presented a normalcy rate of 94.5% for CTA in a population with a pre-test probability of CAD $<5\%$, emphasizing the value of CT to rule out CAD. In addition, an increasing number of abstracts focused on risk stratification with cardiac CT. Two abstracts compared CTA with the Framingham risk score and reported that total plaque burden on CTA correlated weakly with the Framingham risk score (17) and that the risk score was unable to predict the severity of CAD on CTA (18), suggesting that CT

might have incremental value over the Framingham risk score. Computed tomographic angiography also identified more patients who require aggressive medical therapy than would be predicted by Adult Treatment Panel-III guidelines or identified by MPI (19). Patients with a higher total cholesterol/high-density lipoprotein cholesterol ratio had a higher prevalence of proximal and significant CAD on CTA (20). Another CT study in more than 700 patients demonstrated that low-density plaques were independently predictive of the occurrence of an acute ischemic episode over a 3-year follow-up period (21).

Another topic of interest is the radiation dosage associated with cardiac diagnostic testing, in particular cardiac CT. One study of the clinical experience with radiation sparing algorithms in coronary CTA revealed that by concerted effort the radiation dosage was dramatically reduced, whereas diagnostic quality remained good (22). For example, by a combination of using a very stringent ECG dose modulation program, reducing the tube voltage from 120 to 100 kV and reducing the tube current from 600 to 800 mAs to 350 to 450 mAs, the average effective dose was reduced from an estimated 28.4 to 5.1 mSv. This work highlights the importance of physicians paying careful attention to radiation dosimetry in CT and other X-ray studies and the dramatic dose reduction that can be achieved with current equipment and conscientious effort.

Pharmacologic stress. Rao et al. (23) performed a retrospective analysis of 252 patients undergoing vasodilator MPI, with ECG criteria that were positive for ischemia. Of these, 161 (65%) also showed ischemia on MPI. In a subset of 106 patients, invasive angiography was performed; the results showed that the distribution of ischemic ECG changes during adenosine did not localize the ischemic defect on SPECT MPI or territories of significant stenosis on angiography. Because vasodilators have substantial side-effects, there is growing interest in selective adenosine A_{2a} receptor antagonists, which might have less substantial side-effects. The safety of regadenoson in combination with submaximal exercise was shown in a randomized trial involving 60 patients (24), whereas Busse et al. (25) demonstrated the safety of binodenoson in 84 asthmatic patients.

LV dyssynchrony. Although cardiac resynchronization therapy is becoming more widely used in heart failure patients, 30% of patients do not respond to treatment. It has been suggested that cardiac dyssynchrony is important in the response to cardiac resynchronization therapy. Various abstracts focused on the application of Fourier phase analysis to quantify LV dyssynchrony, with the phase SD and histogram bandwidth. Trimble et al. (26) evaluated 125 heart failure patients and reported more extensive mechanical dyssynchrony in ischemic cardiomyopathy as compared with nonischemic cardiomyopathy. As expected, heart failure patients with a wider QRS complex (≥ 120 ms) also exhibited more extensive dyssynchrony (27).

Young Investigator Award. The Young Investigator Award symposium included 6 oral presentations that were selected on the basis of their scientific merit and reviewer scores. The symposium highlighted the quality and diversity of current research in cardiovascular radionuclide and CT imaging. Saeed et al. (28) won the Young Investigator Award, reporting on a multi-tracer PET study focusing on myocardial blood flow and cardiac metabolism in obese and diabetic patients. The authors demonstrated the impact of gender on changes in myocardial substrate use in the transition from obesity and insulin resistance to overt diabetes, by showing greater fatty acid use in obese and diabetic women compared with men, and suggested that this might partially be responsible for the higher mortality in diabetic women versus men. Suzuki et al. (29) focused on the utility of motion-frozen MPI SPECT in obese individuals. These images are obtained by nonlinear warping of gated SPECT data to a static dataset, which improved the accuracy for detecting CAD in a group of 90 patients with a body mass index above 30 kg/m². Lertsburapa et al. (30) reported on the prognostic value of LV ejection fraction obtained from gated rubidium-82 PET perfusion imaging. In 1,740 patients, LV ejection fraction provided incremental prognostic value to perfusion data, emphasizing the clinical importance of this additional information. Al-Mallah et al. (31) analyzed a group of 7,718 patients undergoing MPI SPECT and stratified the patients according to the degree of renal dysfunction; within each stage of renal function, patients with an abnormal MPI had higher incidence of death and myocardial infarction. Patel et al. (32) compared gated SPECT and magnetic resonance imaging for the assessment of LV function and volumes in 40 patients with abnormal MPI. Good correlations between gated SPECT and magnetic resonance imaging for assessment of function and volumes were shown. The agreement for assessment of regional wall thickening was somewhat less, but co-registration of the 2 technologies significantly improved the agreement. Hsu et al. (33) described experiments with imaging phantoms to define atherosclerotic plaques with simultaneous dual-source/dual-energy X-ray CT. The authors observed that calcium content within phantom lesions can be accurately identified with this technique and speculated that the method might be useful for more detailed evaluation of plaque constitution or vulnerability.

Conclusions

In keeping with the theme of the ASNC 2007 Scientific Sessions, “Imagine the Future,” the presentations and abstracts presented at the meeting offer a vision of the future of noninvasive cardiac imaging, including the use of multi-modality hybrid imaging in the evaluation of patients with heart disease. In addition, the meeting presented important new technologies and tracers that underscore the continued importance of nuclear imaging in the assessment of cardio-

vascular disease. Next year’s meeting will be held in Boston from September 11 to 14.

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