# Greater Clarity From Nuclear Images Coming Soon

BY ROBERT FINN
*San Francisco Bureau*

SAN FRANCISCO — The near future of nuclear cardiology will be a bright one, with several important developments expected within the next 3 years, Manuel D. Cerqueira, M.D., said at a cardiovascular imaging conference sponsored by the American College of Cardiology.

New technology and improvements to current technology will lead to more information and greater efficiencies, reported Dr. Cerqueira of the Cleveland Clinic.

Dr. Cerqueira highlighted a number of advances:

► Attenuation from the breast and diaphragm and scatter from the liver and gut are big problems, especially in women and obese patients. Scanners with combined single-proton emission computed tomography (SPECT) and CT are beginning to address these issues.

**Several constituents of vulnerable plaques are inviting targets for radiotracers, including clotting components and LDL and HDL cholesterol.**

A combined, six-slice, SPECT/CT provides high-quality SPECT images with attenuation, scatter, and resolution correction. It also provides calcium scoring and CT coronary angiography.

But these scanners are expensive, they're quite large, and they require shielding, he said.

"We had to basically take two imaging rooms and combine them to put this system in place," Dr. Cerqueira said.

He added that new, smaller systems tailored to the practice setting will soon become available.

► PET scanners and combined PET/CT scanners will also make important contributions to cardiology. PET has much higher spatial resolution than SPECT, about 4-5 mm, vs. 16 mm. Attenuation correction can be quite accurate with these systems, and they can be used to make precise measurements of absolute myocardial blood flow and coronary flow reserve. This is especially important in the context of balanced disease, which is otherwise difficult to diagnose.

► Single acquisition rest/stress testing using two isotopes may soon become a reality.

Dr. Cerqueira envisions a protocol involving an initial infusion of 4.5 mCi of thallium-201, followed 30 minutes later by a stress test.

At the conclusion of the stress test would be an infusion of 9.0 mCi of technetium-99m, followed 30 minutes later by the acquisition of a rest image.

► Just a stress study, with no accompanying rest study, could be used to improve efficiency in certain patients.

The best candidates would be patients judged to be of low risk on the basis of risk factors, calcium scoring, or biomarkers. If the stress study proved to be normal, they would not need a rest study, according to Dr. Cerqueira.

On the other hand, if the stress study results proved to be abnormal, management decisions could be made on the basis of that study alone, or a rest study could be ordered.

► New systems to image vulnerable plaques may soon become a reality. Several constituents of vulnerable plaques provide inviting targets for radiotracers, he commented.

These include LDL cholesterol, oxidized LDL cholesterol, HDL cholesterol, membrane components of macrophages such as metalloproteinases, G-protein signaling or tyrosine kinase from smooth muscle cells, and clotting components, Dr. Cerqueira said. ■



# Noninvasive Angiography a Reality With CT

BY ROBERT FINN
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SAN FRANCISCO — With CT angiography, "patients literally go home with a Band-Aid and a bottle of water" after just 20 minutes, Matthew J. Budoff, M.D., said at a cardiovascular imaging conference sponsored by the American College of Cardiology.

With high sensitivity and specificity and images that rival the resolution obtainable with traditional coronary angiography from the catheterization lab, CT angiography will allow many more patients to avoid an invasive procedure, said Dr. Budoff of Harbor-UCLA Medical Center, Torrance, Calif.

After an injection of 80-100 mL of nonionic iodinated contrast solution, up to 4,000 two-dimensional images can be obtained within 20-30 seconds as the patient holds his or her breath. The entire procedure takes 20 minutes, and interpretation takes another 10 minutes, according to Dr. Budoff.

Sophisticated workstations assemble the stack of 2D images into a three-dimensional reconstruction. Interpretations are made on the basis of the 3D reconstruction with reference to the 2D images.

Dr. Budoff started working with CT angiography in the mid-1990s. In those days it took 3 weeks of full-time computation to assemble a single 3D reconstruction. This same function takes just 30 seconds today.

And these workstations allow the cardiologist to rotate the heart image in three dimensions, to zoom in to interesting features, and to easily reference the original 2D data from any point of interest, he said at the conference.

The initial studies of four-slice CT angiography revealed the limitations of this early technique. Only 30% of patients had all three major arteries available for analysis, and in detecting stenosis the sensitivity was just 58% with 76% specificity.

Nowadays, as 16-slice and even 64-slice CT angiography become available, the sensitivity and specificity have improved considerably. Studies have calculated sensitivities as high as 97% and specificities as high as 94%.

Most important, the negative predictive value is 98%-100%.

"The benefit of CT angio is that when the coronaries *look* normal, the coronaries *are* normal," Dr. Budoff said at the meeting.

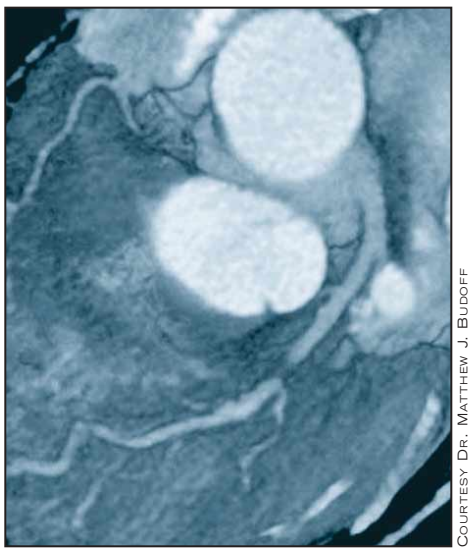
The temporal resolution of the CT images is about 175 milliseconds, so reducing the heart rate to below 60 beats per minute is important for accuracy and interpretability.

Most centers use 100 mg metoprolol 1 hour prior to the study and/or a 5-mg intravenous metoprolol push every 5 minutes until the patient achieves a slow heart rate.

A regular rhythm is also important. If there's a regular rhythm, with multiple detectors obtaining images at specific parts of the heart cycle, the modality reaches an effective frame speed of 15 images per second.

This is slower than the cath lab, but fast enough that the images are free of motion artifact.

CT angiography may be the best technique for imaging the results of bypass grafting as the anastomoses are clearly visible.



COURTESY DR. MATTHEW J. BUDOFF

**CT angiography reveals high-grade stenosis (dark area) in the mid-left anterior descending artery.**

Other clinical indications for CT angiography are: in cases of equivocal results following stress testing; to evaluate patency post angioplasty, post stent, and post bypass surgery; in cases of congenital abnormalities and anomalous coronaries; before and after atrial fibrillation ablation; and before placing a biventricular pacer.

CT angiography is not without its disadvantages, however. It's not very good for visualizing vessels with diameters less than 1.5 mm.

It is subject to artifacts from extensive calcification, stents, or extensive clips after bypass grafting.

And it subjects patients to a relatively high dose of radiation—about 9.3-11.3 mSv, compared with 2.1-2.3 mSv for the cath lab and 0.1 mSv for a chest x-ray, Dr. Budoff said. ■