

Accuracy of CT Angiography Supported in Trial

BY PATRICE WENDLING
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CHICAGO — A second multicenter trial has shown that noninvasive CT angiography is highly accurate in assessing coronary artery disease when compared with conventional invasive angiography.

The per-vessel negative predictive value of 64-slice coronary CT angiography (CCTA) was 97% for identifying blockages greater than 50%, and 99% for blockages greater than 70%, when measured in 232 patients with typical or atypical chest pain in the Assessment by Coronary Computed Tomographic Angiography of Individuals Undergoing Invasive Coronary Angiography (ACCURACY) trial. Positive predictive values were 51% and 33%, respectively, Dr. James K. Min and his associates reported at the annual meeting of the Radiological Society of North America.

"The ACCURACY results [obtained] in a prospective, multicenter fashion definitively establish the high diagnostic accuracy and high negative predictive value of 64-detector-row CT angiography in chest pain patients with intermediate prevalence of coronary artery disease," said Dr. Min, director of the cardiac CT laboratory at New York-Presbyterian Hospital.

The findings echo those of the recent Coronary Artery Evaluation Using 64-Row

Multidetector Computed Tomography Angiography (CORE-64) trial, in which CT angiography had a 91% positive predictive value and an 83% negative predictive value for identifying significant coronary artery stenoses. CORE-64 was the first large, multicenter trial of the 64-slice technology for coronary angiography, but was criticized by some attendees at the annual scientific sessions of the American Heart Association where it was presented (CARDIOLOGY NEWS, Dec. 2007, p. 1). Concerns were raised that the radiation dose from repeated CT scans could pose a potential cancer risk. No such concerns were raised at the radiology meeting.

To reduce the amount of radiation given to patients in the ACCURACY trial, investigators used a radiation dose-reduction algorithm called EKG modulation that reduces CT angiography radiation by about 40%, Dr. Min said in an interview. The radiation dose per patient was about 10-15 millisieverts (mSv), which is about twice that of an invasive coronary angiogram and about half that of a noninvasive thallium stress test.

Since the trial began, a new algorithm called perspective axial gating has been commercially released and is reported to reduce exposure by 90%, to about 2-4 mSv. Both algorithms work by activating the CT scanner during select parts of the

cardiac cycle only, Dr. Min said. For comparison, New York City residents are exposed to about 3 mSv of radiation annually through background exposure.

Neither study used CT angiography for screening. "I believe very emphatically that the data to date don't support CT angiography as a screening tool at all," Dr. Min said. "In asymptomatic patients, we don't have any data of what to do with the results, and if treatment benefits them."

CT angiography is of greatest benefit for patients without known coronary disease who have low or intermediate pretest risk. "If you have a high pretest suspicion that someone has coronary artery disease, then direct progression to invasive coronary angiography or even myocardial perfusion imaging is probably a better alternative," he said.

The ACCURACY trial was unique in that it included all coronary artery segments in its analysis and all patients irrespective of their baseline coronary calcium score. In the CORE-64 trial, stented segments were excluded, as were patients with a calcium score higher than 600. As a result, the ACCURACY findings of high diagnostic accuracy are even more impressive and representative of actual clinical usage, Dr. Min said.

Between May 2006 and January 2007, ACCURACY investigators performed

CCTA prior to conventional quantitative coronary angiography (QCA) on 232 patients who had typical or atypical chest pain and had been referred for evaluation at 16 U.S. centers. The images were obtained on a GE Healthcare LightSpeed VCT CT scanner, and analyzed at 15 different locations throughout the coronary tree. The investigators used equipment made by GE Healthcare, which sponsored the study. Dr. Min is on the speakers' bureau for GE Healthcare.

Three independent radiologists interpreted the CCTA images, and one independent radiologist interpreted the QCA images, Dr. Min said.

The patients' mean age was 57 years (range 31-82 years); 138 were male, 203 were white, and 13 were black, and their average body mass index was 31 kg/m² (range 16.8-50.5). Risk factors included a family history of coronary disease (169 patients), hyperlipidemia (158), hypertension (155), diabetes mellitus (47), obesity (87), smoking (127), and sedentary lifestyle (80).

QCA detected 82 blockages greater than 50% in 55 patients and 31 blockages greater than 70% in 34 patients.

For noninvasive CCTA, per-patient sensitivity was 93% and specificity was 82% for blockages greater than 50%; sensitivity was 91% and specificity was 84% for blockages greater than 70%, Dr. Min said. ■

Dual-Source CT Offers High Resolution, Less Radiation

BY BRUCE K. DIXON
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CHICAGO — Dual-source computed tomography significantly reduces radiation exposure to patients undergoing heart scans, and eliminates the need for heart-slowing medications, according to a study presented at the annual meeting of the Radiological Society of North America.

Improved temporal resolution with dual-source CT improves diagnostic quality by significantly reducing cardiac motion artifacts, obviating the need for β -blockade, said Dr. U. Joseph Schoepf.

In addition, more effective ECG pulsing techniques and faster scan times available with dual-source CT (DSCT) significantly decrease radiation dose by an average of 10%, compared with conventional 64-slice CT, Dr. Schoepf said in an interview.

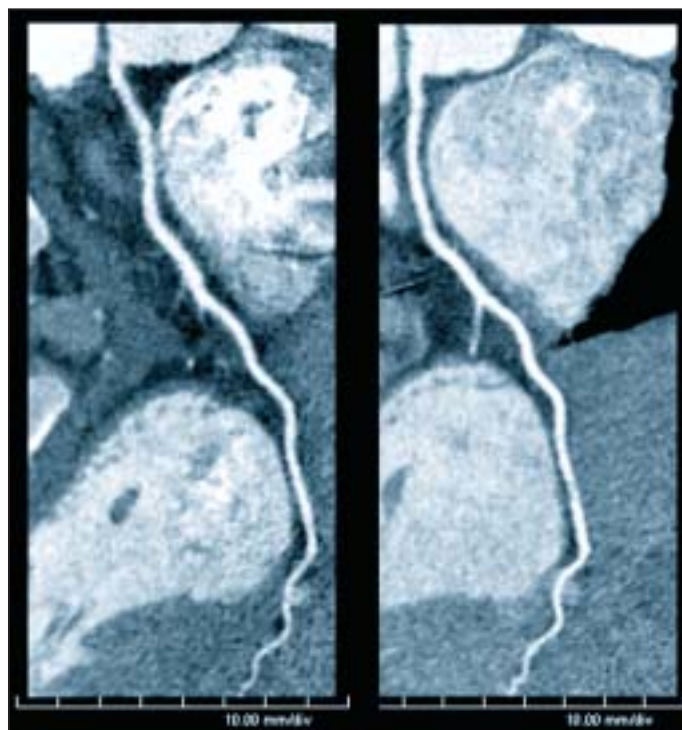
"Dual-source CT has built-in features that allow the operator to accurately tailor radiation dose to each patient," said Dr. Schoepf, associate professor of radiology and medicine at the Medical University of South Carolina (MUSC) in Charleston.

In this study, the first 30 patients who underwent CT angiography with a DSCT scanner (SOMATOM Definition, Siemens Medical Solutions) were compared with the most recent 30 patients to undergo 64-slice CT angiography at MUSC.

"With the DSCT group, we were at the beginning of our learning curve, so by now we're even more facile in using the dual scanner than we were with the study patients," Dr. Schoepf explained.

A fixed temporal resolution of 83 milliseconds, heart-rate adaptive pitch, and ECG pulsing were used with the DSCT in all cases. Temporal resolution at 64-slice CT was 165 milliseconds at a fixed pitch of 0.2.

With both scanners, the gantry rotation time was 330 milliseconds, collimation was 0.6 millimeters, and the injection protocol was triphasic.



DSCT (right) of the pulmonary vein shows clearer delineation of all segments, compared with single-source 64-slice CT (left).

A radiologist and a cardiologist who were blinded to the scanner type evaluated the coronary arteries for motion artifact using the American Heart Association segment model. Patient heart rate, radiation dose, and use of β -blockers were recorded.

"With the previous generation scanner, we still had to use β -blockers to slow heart rate to achieve good images," Dr. Schoepf said in an interview. "We quickly learned that medications were not necessary with the DS scanner because of the faster shutter speed and better temporal resolution."

The abandonment of β -blockade simplifies procedural

logistics, he said, explaining that the typical intravenous protocol requires having a nurse available and increases scan time because the drug is administered while the patient occupies the scanner table. "And it's always better to avoid giving drugs when you can," he added.

The average computed tomography dose index (fundamental radiation dose parameter used in CT) volumes were 61 milligray (mGy) for patients aged 35-72 years and 53 mGy for patients aged 21-89 years, respectively ($P < .001$).

The average heart rates were 64 beats per minute among the control group and 73 beats per minute among those imaged with the dual scanner. β -Blockers were used in 12 of the 30 patients scanned with 64-slice CT; none were used in the DSCT group.

Cardiac motion artifacts were observed in 24% of coronary segments in 64-slice CT patients, compared with 9% of segments in the DSCT arm. In each group, data sets were completely void of motion artifacts in 3 of 30 and 12 of 30 patients, respectively.

"Overall, the diagnostic quality was better in the DSCT group despite the faster heart rates," said Dr. Schoepf, who disclosed that he is a consultant to and has received research support from Siemens Medical Solutions and the imaging contrast divisions of Bayer, GE Healthcare, and Bracco Diagnostics. However, no outside funding was used for the current study or the scanners used in it, he said.

"With another step in the evolution of medical imaging, we're closing the gap from invasive to noninvasive diagnostic catheterization and getting to the point of being able to get the same diagnostic information, particularly for excluding coronary artery disease," Dr. Schoepf said. "But the investment of around \$2.6 million for a dual-source CT probably is only worth it if you want to exploit the particular capabilities of this device, which include the dedicated cardiac, vascular, and dual-energy applications."

The SOMATOM Definition has been available in the United States since early 2006. ■

PHOTOS COURTESY DR. U. JOSEPH SCHOEPF