Dual-Source CT: Less Radiation, More Resolution

BY BRUCE K. DIXON
Chicago Bureau

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 (DSCT) improves diagnostic quality by significantly reducing cardiac motion artifacts, obviating the need for β-blockade, Dr. U. Joseph Schoepf said.

In addition, more effective ECG pulsing techniques and faster scan times available with 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, of 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.

A fixed temporal resolution of 83 msec, heart-rate adaptive pitch, and ECG pulsing were used with the DSCT in all cases. Temporal resolution at 64-slice CT was 165 msec at a fixed pitch of 0.2. With both scanners, the gantry rotation time was 330 msec, collimation was 0.6 mm, and the injection protocol was triphasic.

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."

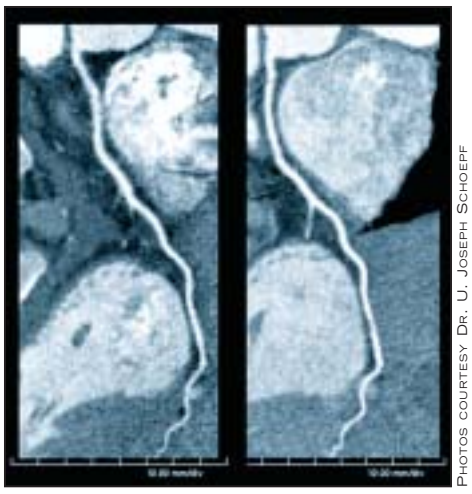
The abandonment of β-blockade simplifies procedural logistics, he said, explaining that the typical intravenous protocol requires having a nurse available and increases scan time because the drug is administered while the patient occupies the scanner table. "And it's always better to avoid giving drugs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

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

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.



PHOTOS COURTESY DR. U. JOSEPH SCHOEPF

Single-source 64-slice CT (left) has good diagnostic quality, but DSCT (right) results in even clearer delineation of all vessel segments.

"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," he added. ■

Coronary Artery Calcium Predicts CV Events

BY BRUCE JANCIN
Denver Bureau

SNOWMASS, COLO. —The most intriguing potential application for coronary artery calcium imaging is as a tool to track atherosclerosis progression over time in response to treatment, Dr. Matthew J. Budoff said at a conference sponsored by the Society for Cardiovascular Angiography and Interventions.

"I'm not suggesting that this is a current application, but the data now emerging are pretty interesting," said Dr. Budoff, director of cardiac CT at Harbor-UCLA Medical Center, Torrance, Calif.

He cited an observational study by Dr. Paolo Raggi of Tulane University, New Orleans, and coinvestigators, who measured the change in coronary artery calcium (CAC) on serial electron-beam tomography scans in 495 statin-treated asymptomatic patients.

During up to 7 years of follow-up, 41 subjects had an acute MI. The relative risk of an MI was increased 17-fold in those with at least a 15% per year rise in CAC score. CAC progression provided incremental prognostic value beyond that associated with LDL cholesterol level, which was a mean of 118 mg/dL in patients who had an MI and a similar 122 mg/dL in those with no MI (Arterioscler. Thromb. Vasc. Biol. 2004;24:1272-7).

"This might be a way, in the future, of monitoring therapy. You're on a statin, your LDL is pretty good, but your CAC is increasing—maybe we should do something more," Dr. Budoff commented at the conference cosponsored by the American College of Cardiology.

He also described several current uses for CAC imaging:

► **Screening asymptomatic patients with an intermediate Framingham risk score.** Of asymptomatic adults, 40% fall into the Framingham intermediate-risk category, meaning they have an estimated 10%-20% risk of a coronary event within the next 10 years. Most acute MIs occur in this mid-risk group. Dr. Budoff was coauthor of a 2007 ACC/American Heart Association Clinical Expert Consensus Statement that endorsed CAC measurement as a means of identifing a higher-risk subgroup in whom aggressive primary preventive measures are warranted (J. Am. Coll. Cardiol. 2007;49:378-402).

The Multi-Ethnic Study of Atherosclerosis (MESA), a National Institutes of Health–sponsored prospective study of 6,814 patients followed for 3.5 years, was merely the most recent of several large studies showing that a CAC score of 100 or more was associated with a 10-fold increased risk of incident coronary heart disease (CHD).

Prior to MESA, Dr. Budoff conducted an observational study of 25,253 consecutive asymptomatic patients referred by their primary care physicians for CAC scanning. After adjustment for traditional cardiovascular risk factors, a baseline CAC of 100 or greater was associated with a 10.4-fold increased rate of all-cause mortality over the next 10 years, compared with a CAC of 0 (J. Am. Coll. Cardiol. 2007;49:1860-70).

And an NIH-sponsored prospective study of more than 10,700 asymptomatic individuals free of known CHD showed that a baseline CAC of 97-409 was associated with an adjusted 9.7-fold greater risk of nonfatal MI or CHD death in the next 3.5 years, compared with subjects with a CAC of 0 (Am. J. Epidemiol. 2005;162:421-9).

"A CAC greater than 100 is more robust as a predictor of future events than Framingham risk factors, which are traditionally in the realm of two- to threefold increased risk, and more robust than C-reactive protein or carotid intimal-medial thickness, where relative risks are in the 1.5-3 range," said Dr. Budoff, who is on the speakers bureau for General Electric.

► **Identification of very-low-risk patients needing no further evaluation for coronary artery disease.** Four studies totalling nearly 6,000 patients indicate a CAC of 0 has a 95%-99% negative predictive value for obstructive coronary disease. A fifth study, by Dr. Budoff and coinvestigators, concluded that a CAC score of 0 has at least a 5-year warranty before a repeat scan is appropriate because the likelihood of CAC progression during that period is so low (Int. J. Cardiol. 2007;117:227-31). ■