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."

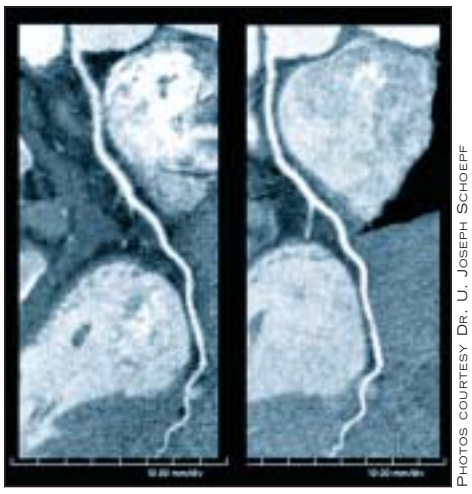
The abandonment of β-blockade simplifies procedural logistics, he said, explaining that the typical intravenous protocol requires having a nurse available and increases scan time because the drug is administered while the patient occupies the scanner table. "And it's always better to avoid giving drugs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

LEXAPRO® (escitalopram oxalate) TABLETS/ORAL SOLUTION

(3% and <1%); Anorgasmia[3] (2% and <1%).*Events reported by at least 2% of patients treated with Lexapro are reported, except for the following events which had an incidence on placebo ≥ Lexapro: headache, upper respiratory tract infection, back pain, pharyngitis, inflicted injury, anxiety. [1]Primarily ejaculatory delay. [2]Denominator used was for males only (N=225 Lexapro; N=188 placebo). [3]Denominator used was for females only (N=490 Lexapro; N=404 placebo). **Generalized Anxiety Disorder Table 3** enumerates the incidence, rounded to the nearest percent of treatment-emergent adverse events that occurred among 429 GAD patients who received Lexapro 10 to 20 mg/day in placebo-controlled trials. Events included are those occurring in 2% or more of patients treated with Lexapro and for which the incidence in patients treated with Lexapro was greater than the incidence in placebo-treated patients. The most commonly observed adverse events in Lexapro patients (incidence of approximately 5% or greater and approximately twice the incidence in placebo patients) were nausea, ejaculation disorder (primarily ejaculatory delay), insomnia, fatigue, decreased libido, and anorgasmia (see **TABLE 3**). **TABLE 3: Treatment-Emergent Adverse Events: Incidence in Placebo-Controlled Clinical Trials for Generalized Anxiety Disorder* (Lexapro (N=429) and Placebo (N=427)): Autonomic Nervous System Disorders:** Dry Mouth (9% and 5%); Sweating Increased (4% and 1%). **Central & Peripheral Nervous System Disorders:** Headache (24% and 17%); Paresthesia (2% and 1%). **Gastrointestinal Disorders:** Nausea (18% and 8%); Diarrhea (8% and 6%); Constipation (5% and 4%); Indigestion (3% and 2%); Vomiting (3% and 1%); Abdominal Pain (2% and 1%); Flatulence (2% and 1%); Toothache (2% and 0%). **General:** Fatigue (8% and 2%); Influenza-like symptoms (5% and 4%). **Musculoskeletal:** Neck/Shoulder Pain (3% and 1%). **Psychiatric Disorders:** Somnolence (13% and 7%); Insomnia (12% and 6%); Libido Decreased (7% and 2%); Dreaming Abnormal (3% and 2%); Appetite Decreased (3% and 1%); Lethargy (3% and 1%); Yawning (2% and 1%). **Urogenital:** Ejaculation Disorder[1,2] (14% and 2%); Anorgasmia[3] (6% and <1%); Menstrual Disorder (2% and 1%). *Events reported by at least 2% of patients treated with Lexapro are reported, except for the following events which had an incidence on placebo ≥ Lexapro: inflicted injury, dizziness, back pain, upper respiratory tract infection, rhinitis, pharyngitis. [1]Primarily ejaculatory delay. [2]Denominator used was for males only (N=182 Lexapro; N=195 placebo). [3]Denominator used was for females only (N=247 Lexapro; N=232 placebo). **Dose Dependency of Adverse Events** The potential dose dependency of common adverse events (defined as an incidence rate of ≥5% in either the 10 mg or 20 mg Lexapro groups) was examined on the basis of the combined incidence of adverse events in two fixed-dose trials. The overall incidence rates of adverse events in 10 mg Lexapro-treated patients (66%) was similar to that of the placebo-treated patients (61%), while the incidence rate in 20 mg/day Lexapro-treated patients was greater (86%). **Table 4** shows common adverse events that occurred in the 20 mg/day Lexapro group with an incidence that was approximately twice that of the 10 mg/day Lexapro group and approximately twice that of the placebo group. **TABLE 4: Incidence of Common Adverse Events* in Patients with Major Depressive Disorder Receiving Placebo (N=311), 10 mg/day Lexapro (N=310), 20 mg/day Lexapro (N=125)): Insomnia** (4%, 7%, 14%); **Diarrhea** (5%, 6%, 14%); **Dry Mouth** (3%, 4%, 9%); **Somnolence** (1%, 4%, 9%); **Dizziness** (2%, 4%, 7%); **Sweating Increased** (<1%, 3%, 8%); **Constipation** (1%, 3%, 6%); **Fatigue** (2%, 2%, 6%); **Indigestion** (1%, 2%, 6%).*Adverse events with an incidence rate of at least 5% in either of the Lexapro groups and with an incidence rate in the 20 mg/day Lexapro group that was approximately twice that of the 10 mg/day Lexapro group and the placebo group. **Male and Female Sexual Dysfunction with SSRIs** Although changes in sexual desire, sexual performance, and sexual satisfaction often occur as manifestations of a psychiatric disorder, they may also be a consequence of pharmacologic treatment. In particular, some evidence suggests that SSRIs can cause such untoward sexual experiences. Reliable estimates of the incidence and severity of untoward experiences involving sexual desire, performance, and satisfaction are difficult to obtain, however, in part because patients and physicians may be reluctant to discuss them. Accordingly, estimates of the incidence of untoward sexual experience and performance cited in product labeling are likely to underestimate their actual incidence. **Table 5** shows the incidence rates of sexual side effects in patients with major depressive disorder and GAD in placebo-controlled trials. **TABLE 5: Incidence of Sexual Side Effects in Placebo-Controlled Clinical Trials** [In Males Only: **Lexapro** (N=407) **and Placebo** (N=383)]: Ejaculation Disorder (primarily ejaculatory delay) (12% and 1%); Libido Decreased (6% and 2%); Impotence (2% and <1%). [In Females Only: **Lexapro** (N=737) **and Placebo** (N=636)]: Libido Decreased (3% and 1%); Anorgasmia (3% and <1%) There are no adequately designed studies examining sexual dysfunction with escitalopram treatment. Priapism has been reported with all SSRIs. While it is difficult to know the precise risk of sexual dysfunction associated with the use of SSRIs, physicians should routinely inquire about such possible side effects. **Vital Sign Changes** Lexapro and placebo groups were compared with respect to (1) mean change from baseline in vital signs (pulse, systolic blood pressure, and diastolic blood pressure) and (2) the incidence of patients meeting criteria for potentially clinically significant changes from baseline in these variables. These analyses did not reveal any clinically important changes in vital signs associated with Lexapro treatment. In addition, a comparison of supine and standing vital sign measures in subjects receiving Lexapro indicated that Lexapro treatment is not associated with orthostatic changes. **Weight Changes** Patients treated with Lexapro in controlled trials did not differ from placebo-treated patients with regard to clinically important change in body weight. **Laboratory Changes** Lexapro and placebo groups were compared with respect to (1) mean change from baseline in various serum chemistry, hematology, and urinalysis variables, and (2) the incidence of patients meeting criteria for potentially clinically significant changes from baseline in these variables. These analyses revealed no clinically important changes in laboratory test parameters associated with Lexapro treatment. **ECG Changes** Electrocardiograms from Lexapro (N=625), racemic citalopram (N=351), and placebo (N=527) groups were compared with respect to (1) mean change from baseline in various ECG parameters and (2) the incidence of patients meeting criteria for potentially clinically significant changes from baseline in these variables. These analyses revealed (1) a decrease in heart rate of 2.2 bpm for Lexapro and 2.7 bpm for racemic citalopram, compared to an increase of 0.3 bpm for placebo and (2) an increase in QTc interval of 3.9 msec for Lexapro and 3.7 msec for racemic citalopram, compared to 0.5 msec for placebo. Neither Lexapro nor racemic citalopram were associated with the development of clinically significant ECG abnormalities. **Other Events Observed During the Premarketing Evaluation of Lexapro** Following is a list of WHO terms that reflect treatment-emergent adverse events, as defined in the introduction to the **ADVERSE REACTIONS** section, reported by the 1428 patients treated with Lexapro for periods of up to one year in double-blind or open-label clinical trials during its premarketing evaluation. All reported events are included except those already listed in **Tables 2 & 3**, those occurring in only one patient, event terms that are so general as to be uninformative, and those that are unlikely to be drug related. It is important to emphasize that, although the events reported occurred during treatment with Lexapro, they were not necessarily caused by it. Events are further categorized by body system and listed in order of decreasing frequency according to the following definitions: frequent adverse events are those occurring on one or more occasions in at least 1/100 patients; infrequent adverse events are those occurring in less than 1/100 patients but at least 1/1000 patients. Cardiovascular - *Frequent:* palpitation, hypertension. *Infrequent:* bradycardia, tachycardia, ECG abnormal, flushing, varicose vein. Central and Peripheral Nervous System Disorders - *Frequent:* light-headed feeling, migraine. *Infrequent:* tremor, vertigo, restless legs, shaking, twitching, dysequilibrium, tics, carpal tunnel syndrome, muscle contractions involuntary, sluggishness, coordination abnormal, faintness, hyperreflexia, muscular tone increased. Gastrointestinal Disorders - *Frequent:* heartburn, abdominal cramp, gastroenteritis. *Infrequent:* gastroesophageal reflux, bloating, abdominal discomfort, dyspepsia, increased stool frequency, belching, gastritis, hemorrhoids, gagging, polyposis gastric, swallowing difficult. General - *Frequent:* allergy, pain in limb, fever, hot flushes, chest pain. *Infrequent:* edema of extremities, chills, tightness of chest, leg pain, asthenia, syncope, malaise, anaphylaxis, fall. Hemic and Lymphatic Disorders - *Infrequent:* bruise, anemia, nosebleed, hematoma, lymphadenopathy cervical. Metabolic and Nutritional Disorders - *Frequent:* increased weight. *Infrequent:* decreased weight, hyperglycemia, thirst, bilirubin increased, hepatic enzymes increased, gout, hypercholesterolemia. Musculoskeletal System Disorders - *Frequent:* arthralgia, myalgia. *Infrequent:* jaw stiffness, muscle cramp, muscle stiffness, arthritis, muscle weakness, back discomfort, arthropathy, jaw pain, joint stiffness. Psychiatric Disorders - *Frequent:* appetite increased, lethargy, irritability, concentration impaired. *Infrequent:* jitteriness, panic reaction, agitation, apathy, forgetfulness, depression aggravated, nervousness, restlessness aggravated, suicide attempt, amnesia, anxiety attack, bruxism, carbohydrate craving, confusion, depersonalization, disorientation, emotional lability, feeling unreal, tremulousness nervous, crying abnormal, depression, excitability, auditory hallucination, suicidal tendency. Reproductive Disorders/Female* - *Frequent:* menstrual cramps, menstrual disorder. *Infrequent:* menorrhagia, breast neoplasm, pelvic inflammation, premenstrual syndrome, spotting between menses. *% based on female subjects only: N= 905 Respiratory System Disorders - *Frequent:* bronchitis, sinus congestion, coughing, nasal congestion, sinus headache. *Infrequent:* asthma, breath shortness, laryngitis, pneumonia, tracheitis. Skin and Appendages Disorders - *Frequent:* rash. *Infrequent:* pruritus, acne, alopecia, eczema, dermatitis, dry skin, folliculitis, lipoma, furunculosis, dry lips, skin nodule. Special Senses - *Frequent:* vision blurred, tinnitus. *Infrequent:* taste alteration, earache, conjunctivitis, vision abnormal, dry eyes, eye irritation, visual disturbance, eye infection, pupils dilated, metallic taste. Urinary System Disorders - *Frequent:* urinary frequency, urinary tract infection. *Infrequent:* urinary urgency, kidney stone, dysuria, blood in urine. **Events Reported Subsequent to the Marketing of Escitalopram** - Although no causal relationship to escitalopram treatment has been found, the following adverse events have been reported to have occurred in patients and to be temporally associated with escitalopram treatment during post marketing experience and were not observed during the premarketing evaluation of escitalopram: abnormal gait, acute renal failure, aggression, akathisia, allergic reaction, anger, angioedema, atrial fibrillation, choreoathetosis, delirium, delusion, diplopia, dysarthria, dyskinesia, dystonia, ecchymosis, erythema multiforme, extrapyramidal disorders, fulminant hepatitis, hepatic failure, hypoaesthesia, hypoglycemia, hypokalemia, INR increased, gastrointestinal hemorrhage, glaucoma, grand mal seizures (or convulsions), hemolytic anemia, hepatic necrosis, hepatitis, hypotension, leucopenia, myocardial infarction, myoclonus, neuroleptic malignant syndrome, nightmare, nystagmus, orthostatic hypotension, pancreatitis, paranoia, photosensitivity reaction, priapism, prolactinemia, prothrombin decreased, pulmonary embolism, QT prolongation, rhabdomyolysis, seizures, serotonin syndrome, SIADH, spontaneous abortion, Stevens Johnson Syndrome, tardive dyskinesia, thrombocytopenia, thrombosis, torsade de pointes, toxic epidermal necrolysis, ventricular arrhythmia, ventricular tachycardia and visual hallucinations.

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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). ■