Multislice CT nears revolution in coronary artery imaging

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About once every decade a new technology at the RSNA conference appears to change everything about clinical diagnostic imaging. The 2005 meeting will be remembered as such a landmark year for 64-slice cardiac CT.

Its impact was evident in a shift in emphasis among the scientific sessions. Usually relegated to secondary attention, cardiac imaging took center stage. More than 500 papers pertaining to cardiac imaging were presented. The 300 studies devoted to cardiac CT alone in 2005 equaled the entire output of cardiac imaging research presented at the meeting five years earlier.

New research shows that 40- and 64-slice coronary artery CT angiography overcomes many limitations of 16-slice CTA for detecting and characterizing stenoses in smaller coronary arteries and their branches, according to Dr. Martin Lipton, a professor of radiology at Beth Israel Deaconess Medical Center. Sensitivity rose about 15% to about 90% in the transition there from 16-slice to 64-slice platforms.

"This makes a huge difference in the confidence level for decisions about hospital admission or discharge of patients with chest pain," Lipton said.

Preliminary evidence presented in Chicago suggests that multislice CT may soon become a triage tool in the emergency room to determine if patients with chest pain should be hospitalized for suspected acute coronary syndrome.

"That means patients can either go home knowing that they don't have significant coronary disease, or they can be admitted promptly to the hospital for the normal pattern of evaluation," Lipton said. Researchers plotted the accuracy achieved in the shift from 16-slice to the current generation of high-performance scanners. At the Erasmus Medical Center in Rotterdam, Dr. Francesca Pugliese found that visualization problems that arise during four- and 16-slice scanning are less prominent during 64-slice imaging. She concluded after studying 153 patients that 64-slice CT is no better than 16-slice for identifying stenoses in coronary arteries 2 mm or larger, but it outperformed other CT technologies when vessels narrower than 2 mm were also examined.

In a study of 72 consecutive patients with suspected CAD, Dr. Kostantin Nikolaou, a radiology fellow at Ludwig-Maximilians University in Munich, established that 64-slice CT compares favorably with x-ray angiography for evaluating smaller vessels. He saw room for improvement in the 64-slice scanner's inability to visualize 13% of the segments but found its 95% accuracy and 99% negative predictive value rates encouraging.

Even better results appeared in Dr. Benjamin Cocheteux's study of 120 patients examined without the use of beta blockers on a 40-slice scanner. About 96% sensitivity and 93% specificity were achieved for all segments examined in his investigation at Pitie-Salpetriere Hospital in Paris. The positive and negative predictive values were 82% and 99%, respectively, and 97% of the segments were visualized. Even for patients with heart rates greater than 78 beats per minute, the overall sensitivity rate for stenosis was 90%.

Dr. Christopher Herzog of the Medical University of South Carolina at Charleston identified the residual limitations of 64-slice CT for tight stenoses and narrow segments. His study of 100 patients with stable angina found a 100% per patient detection rate when significant CAD was defined as 50% or greater stenosis, but per patient accuracy fell to 87% when the standard was 70% or greater stenosis.

TRIAGING CHEST PAIN PATIENTS

Two studies offered preliminary evidence showing that coronary artery CTA improves the initial triage of patients normally evaluated with ECG and enzyme markers. Inaccurate testing for chest pain wastes hundreds of millions of dollars from unnecessary hospitalization, according to Dr. Udo Hoffmann, director of cardiac CT research at Massachusetts General Hospital. Despite conservative practice, initial clinical and laboratory examinations miss 1% of ACS cases, and misdiagnosis constitutes 20% of emergency department malpractice costs.
Hoffmann's study of 40 nonconsecutive patients who awaited hospital admission despite negative ECG and enzyme tests suggests that 64-slice CT is well suited for the triage role. MSCT findings were positive in seven patients, and at least one significant stenosis was detected. The presence of stenosis was excluded in 26 patients, and results were inconclusive for seven patients. Five patients developed ACS during hospitalization, and 35 patients did not have ACS, Hoffmann said. The investigator shifted from 16-slice to 64-slice CT midway through the trial. The superior image quality possible with 64-slice CT was reflected in its 100% sensitivity to ACS, Hoffmann said. Specificity was 88%, and negative predictive value was 100%.

In 20% of the patients who underwent coronary angiography, MSCT correctly detected the presence of stenosis in four patients and ruled out stenosis in two patients. Overall, the admission of only seven of 30 patients to the hospital would still have identified every patient with ACS. Patients would have been discharged an average of 22 hours earlier because of the MSCT evaluation, and two angiograms would have been avoided, Hoffmann said.

Results from a similar trial by Dr. Tamar Gaspar at Carmel Medical Center in Haifa, Israel, produced equally favorable results. Sixty-four-slice CTA altered the initial evaluation of 54 patients who received ECG enzyme biomarker tests after they arrived in the ER complaining of chest pain. Planned hospitalization was canceled for eight of 24 patients, and nine recommended interventions were postponed. Coronary artery disease was found in four patients who had been cleared on the basis of their clinical findings, however. In three cases, the MSCT results were confirmed during intervention.

Another study by Gaspar showed that 64-slice cardiac CT provides more reliable initial CAD screening for patients with chest pain than does treadmill stress testing alone. MSCT revealed significant coronary artery narrowing in one-third of 49 patients with a positive treadmill stress test. Significant CAD was confirmed in five of those cases. It uncovered evidence of significant narrowing in 25 of 57 patients with equivocal treadmill stress tests, and a significant stenosis was confirmed in all but three of those 25. MSCT identified CAD in 19 of 76 patients with negative treadmill stress tests. The presence of a significant stenosis was confirmed with cardiac catheterization in all but one of those 19 cases.

**Disclosures:**

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