



“You can do the ‘triple rule-out’ in real time, confirming three diagnoses with one scan.”

Udo Hoffmann, MD, MPH,
Director of Cardiac MR PET CT Program,
Massachusetts General Hospital, Boston, MA, USA

“With the new SOMATOM Definition Flash technology, you will be able to image the entire chest in less than one second.”

Harold I. Litt, MD, PhD, Assistant Professor of Radiology and Medicine,
Chief, Cardiovascular Imaging Section, Department of Radiology,
University of Pennsylvania Health System, Philadelphia, PA, USA



Chest Pain: Clarity with CT

It's not an insignificant problem, nor a cheap one. With more than six million patients a year presenting at emergency departments with chest pain, costing an estimated eight billion dollars, the importance of an accurate, efficient and quick way to determine which patients need interventional treatment and follow-up is hard to ignore. Dual Source CT scanners meet these criteria perfectly. They are enhancing diagnostic capacity for adult and pediatric patient populations that would have formerly been excluded from CT scans because of conditions such as obesity, high heart rates, atrial fibrillation or contra-indications to beta-blockers.

By Louisa Kasdon



“With the CT of the heart being less than one milliSievert, radiation will basically no longer be an issue.”

Gilbert Raff, MD, Director,
Ministrelli Center for Advanced Cardiovascular Imaging,
William Beaumont Hospital, Royal Oak, MI, USA

The “Holy Grail” in the emergency department, according to Gilbert Raff, MD, of William Beaumont Hospital in Royal Oak, Michigan, USA, is figuring out which patients to send home, and which to keep for further observation and treatment. Raff, a cardiologist with more than thirty years of clinical experience, says that misdiagnosing a patient and sending him or her home with a potentially fatal heart attack, is the nightmare scenario for every ER doctor. The tricky part is to identify the 10 to 20%, out of the patient cohort, who really do need immediate treatment.

A Roundtable at the University of Pennsylvania

A group of prominent American interventional radiologists and cardiologists, specialists at the forefront of their professions, suggest that immediate triaging to a CT scan for patients presenting with chest pain has the potential to radically streamline the diagnostic process and speed up the door-to-balloon interval. SOMATOM Sessions recently met with three of these experts for a roundtable discussion at the University of Pennsylvania – Harold I. Litt, MD, PhD, Assistant Professor of Radiology and Medicine, Chief, Cardiovascular Imaging Section,

Department of Radiology, University of Pennsylvania Health System in Philadelphia; Udo Hoffmann, MD, MPH, Director of Cardiac MR PET CT Program at the Massachusetts General Hospital (MGH) of Harvard University in Boston; and Gilbert Raff, MD, Director, Ministrelli Center for Advanced Cardiovascular Imaging, William Beaumont Hospital, Royal Oak, Michigan – and listened in as they revealed their vision for a new “gold standard” for the diagnosis of chest pain. These clinicians believe that scanning patients with a Dual Source CT (DSCT) SOMATOM® Definition can save billions of dollars in healthcare costs annually. “The work-up of those patients who do end up not having a heart attack costs us about eight billion dollars a year. A big chunk, with the potential for big healthcare savings,” says Hoffmann. Litt concurs, “we conducted a large trial, with more than 640 individuals, about the actual financial comparison of different strategies to evaluate patients with potential acute coronary syndrome.”* “Herein we compared the CTA group (A) with the two groups being treated the standard or current way,” describes Litt. These two groups are the clinical decision unit group with serials of biomarkers and stress test (B) and the usual care group

which was defined as admission with serial biomarkers and hospital-directed evaluation (C).

The main outcomes were actual cost of care (facility direct and indirect fixed, facility variable direct labor and supply costs), length of stay, the 30-day readmission rate as well as safety measured in 30-day death or myocardial infarction rate.

The study showed an overwhelming result. The standard of care group B and the usual care group C revealed median costs of \$2,913 – \$4,024 per patient and an average length of stay of 26.2 to 30.2 hours. The rate of myocardial infarction and death was 0.7 to 3.1%. The readmission rate was between 2.3 and 12.2% here, which means that additional cost has to be considered for the patients coming back for further test and treatment. Those results were compared with the new CTA strategy. The cost per patient in the CTA group A were found to be only \$1,240 which was a 57% to 69% saving. Similar results been revealed for length of stay with eight hours in CTA group, which was a time advantage of 69 – 73%. Interestingly the rate of myocardial infarction or death in the CTA group (A) was 0%, which can be explained with the high negative predic-



Dual Source scanners deliver high image quality, even at high heart rates.

tive value of almost 100% of the DSCT. Also the 30 day readmission rate was 0% which means no patients coming back for additional testing or treatment, which saves additional time and money. Litt and his group found that, using total facility cost in their analysis, immediate CTA was the least costly method of evaluation. It also resulted in reduced length of stay, decreased rate of admission, lower rate of return visits, and at least equivalent 30-day outcomes. Other strategies that required inpatient or observation unit admission were more costly, had more prolonged length of stay, and did not detect any more disease than the immediate CTA strategy.

The subset of patients who received 'usual care' accompanied by cardiac testing (stress echo, treadmill testing, or cardiac catheterization) had a mean cost of \$4,154 compared to \$1,239.

A Unique Tool for a Better Image

Beyond economic and efficiency issues, any new technology has to support better patient care. These three doctors feel strongly that the new generation of Dual Source CT scanners enables them to identify cardiac issues with more clarity, and yields diagnostic information to prevent future disease. There is a big impact on patient care. "We now have a unique tool

with the spatial and temporal resolution that can help us noninvasively visualize the disease," Hoffmann explains.

At MGH, Udo Hoffmann is conducting a randomized trial where both low-risk and high-risk patients are put into a CT scanner. For the high-risk patients with a suspicion of pulmonary embolism, aortic dissection, or acute coronary syndrome, he is finding the Dual Source scanners high-image-quality, even at high heart rates or with obese patients, extremely helpful. "You can do the 'triple rule-out' in real time, confirming three separate diagnoses with one scan," says Hoffmann. For the low-risk patient sub-clinical disease can be captured also and treatment can be started that could prevent a heart attack in the future."

The Heart is a Moving Target

Another advantage of the Dual Source CT scan seems to be speed. "Because the heart is moving, in order to get images of it that don't have motion artifacts, you need to be able to scan as quickly as possible," says Litt. He enthuses that a DSCT scanner like the SOMATOM Definition Flash scanner "can freeze the heart's motion twice as fast as other competing technologies. This is a particularly important benefit for patients who come to the emergency room and cannot take a beta-blocker to lower their heart rate so that the heart beats more slowly. "In our patient population," Litt explains, "we have patients with asthma or suspicion of other lung problems like pulmonary embolism, people who have taken cocaine recently – and you can't use these types of drugs on them. With the new Dual Source CT, it is possible to do a thorax scan in a split second without holding breath. We can scan patients with higher heart rates and have confidence that we're going to get good image quality."

Obese patients represent another clinical challenge. Litt says: "With the Dual Source CT technology, we're able to get better image quality at lower radiation doses in

obese patients, even those who weigh more than 350 pounds." At Raff's hospital in Michigan, using a new software package, that he terms the cardio obese model, in combination with the Dual Source CT allows him to scan 90% of obese patients and get a diagnostic image.

Next Steps for CT Scanners?

As the technology continues to improve, the doctors look ahead to a new era of even greater clinical utility as equipment like the Flash scanner comes into clinical use. When they see that one could now image at 83 milliseconds, they understand immediately that this is a tremendous improvement, really a quantum leap from the 64-slice CT. It opens up their

patient population to patients who were previously considered not suitable – for example, those with calcification – and lets a diagnosis become even more quantitative. Litt concurs, that with SOMATOM Definition Flash it is possible to image very quickly. "Typically a chest CT on an average high-end scanner might take five to ten, perhaps twenty seconds. With the new technology, you will be able to image the entire chest in less than one second. That will allow us to get very clear images of the heart, the pulmonary arteries, and the aorta without the patient needing to hold his breath. Similarly, in children and infants who can't understand the direction to take a deep breath and hold it, you will be able to get motion-free images of the entire chest or the

body in a time frame where the patient can remain still."

With sub-milliSievert heart scanning, the SOMATOM Definition Flash raises the bar even higher in terms of cardiac dose saving. Raff pronounces, "that with the CT of the heart being below 1 milliSievert, radiation will basically no longer be an issue." Hoffmann says that, due to its low dose, it is even conceivable that, in the future, this technology could be used for early detection and prevention of acute myocardial infarction.

Another priority for the future is collecting better clinical data. The physicians are working together to launch several, large, multi-center trials to get demonstrable data and validation of the new triage pattern for their colleagues, for the NIH, and for the large public and private insurers such as Medicare in the USA, all of whom will have to be convinced of the CT scanner's superiority as a diagnostic tool as well as its ability to increase workflow and efficiency in emergency departments all across the country. Other priorities for the doctors are education and training. Unless young physicians and radiological technicians are trained to use and interpret CT scans, the benefits of the technological advances will be limited to the most sophisticated medical centers.

Louisa Kasdon is a Cambridge, Massachusetts-based writer who specializes in health, medicine, nutrition, food and business. She writes about health issues for Fortune magazine, the Boston Globe and the Christian Science Monitor.

* Chang AM, Litt HI et al.: Actual Financial Comparison of Four Strategies to Evaluate Patients with Potential Acute Coronary Syndromes. *ACADEMIC EMERGENCY MEDICINE*. 2008; 15: 649-655.



With sub-milliSievert heart scanning, the SOMATOM Definition Flash raises the bar higher in terms of cardiac dose saving.

Further Information

www.siemens.com/somatom-definition