Reaching New Heights in CT Cardiac Imaging
The impact of spatial resolution at the University of Washington Medical Center

Over the last decade, clinicians have witnessed remarkable advancements in CT imaging. This includes the emergence of hybrid imaging, which brought CT together with functional imaging systems such as PET and SPECT, multi-slice CT, and techniques that significantly lower radiation dose.

GE Healthcare has been a leader introducing innovations that have redefined the clinical value of CT imaging. Now, the company is charging ahead with another evolution in CT technology that promises to help clinicians confidently view even hard-to-see lesions—high definition imaging that enhances spatial resolution.

CT has long been recognized as an imaging leader in spatial resolution, which is the ability to distinguish two separate structures that are a small distance from each other. Yet, many improvements in spatial resolution over the years were incremental—that is, until the introduction of the Discovery CT750 HD system.

“The Discovery CT750 HD provides better spatial resolution and image quality than other systems in our facility,” says William P. Shuman, MD, Director of Radiology at the University of Washington Medical Center (UWMC).

Dr. Shuman’s colleague, Kelley R. Branch, MD, Assistant Professor in Cardiology at UWMC, agrees that “the Discovery CT750 HD in high definition mode offers high detail spatial resolution needed for cardiac imaging.”

Value in cardiac imaging

Increased spatial resolution was always desired for cardiac imaging, Dr. Branch says, especially when imaging smaller patients and arteries.

This same detailed resolution also benefits characterization of plaque. “Better spatial resolution helps us improve the delineation of plaque characteristics,” adds Dr. Branch. “We can see the lumen and the outside wall of the coronary artery, and assess if the plaque is a concern that requires follow up.”

Dr. Shuman believes high spatial resolution in CT will play an important role in aiding them to detect disease within smaller vessels. Historically, he says, this has been a weakness of CT—the inability to successfully image the smaller branch vessels. This led to patients undergoing further evaluations, such as a diagnostic cardiac catheterization, after a diagnostic CT study.

“There is a good proportion of cardiac disease located more distally after the first and second branches that may still cause symptoms,” Dr. Shuman explains. “It is critical to be able to assess the peripheral branches for coronary artery disease, as well as capturing the extent of disease in the proximal coronary artery.”

CT perfusion studies are another potential area for greater clinical utility resulting from higher spatial resolution. “With CT perfusion, it comes back to precision,” Dr. Branch explains, “and the confidence that what you are seeing is really there.” When evaluating the myocardium with higher spatial resolution, for example, he is able to conduct more advanced calculations based on the imaging study—calculations that can help assess myocardial blood flow.

Impact on patient care

In describing the benefit of enhanced spatial resolution, Dr. Branch points to the high negative predictive value of CT. “As the spatial resolution increases, our confidence in the study improves significantly and we are more confident that we don’t have to conduct further tests to rule out the presence of disease.” This capability is very important not only for triaging chest pain patients in the ED, but also reducing the overall cost of a patient’s episode of care. Having the ability to provide patients a rapid answer is beneficial; not just for their care, but also to determine which chest pain patients can be discharged from the ED.

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While coronary artery disease may not be an immediate issue for these patients, it can develop in the future and Dr. Branch sees it as an opportunity to engage the patient to change their behavior. “It is our hope that patients will benefit by adopting a move toward a healthier lifestyle,” he says.
The double whammy

Both Drs. Branch and Shuman credit another GE innovation on the Discovery CT750 HD with helping improve spatial resolution—ASiR* (Adaptive Statistical Iterative Reconstruction).

"Using techniques such as ASiR, we have seen improvements in low contrast detectability (LCD),** but adding HD on top of that helps us use CT to examine the branch vessels and in some cases, provide us the images we need for a definitive evaluation of coronary artery disease after an inconclusive SPECT exam," Dr. Shuman says.

Dr. Branch describes the benefit of ASiR with HD as getting a noticeable improvement in spatial resolution without an increase in dose, almost like "getting more information for free." HD provides an increase in spatial resolution and ASiR may enable LCD improvement without the need to increase dose.** That, he says, continues to advance clinical precision. "Now CT is presumed a lower dose study, particularly important for younger patients." Dr. Shuman also appreciates the lower noise and virtually artifact free images when using ASiR.

"If we are struggling with spatial resolution in patients whose exams are likely to have a high level of noise, such as obese patients, we can use ASiR and HD to obtain a diagnostic study," says Dr. Branch.

He also finds that the fine spatial resolution obtained from the use of HD helps address the issue of artifact from blooming of calcium. Notes Dr. Shuman, "We used to exclude patients with calcium; now we don’t."

"These improvements—ASiR and HD—are impressive by themselves, but when used in combination we see a substantial difference across a very broad range of studies in spatial resolution and LCD," Dr. Shuman continues. When faced with new developments such as HD, he advises his peers to not become consumed with the lack of peer-reviewed literature or research. "Until users begin to integrate a technology into their standard-of-care, it will take time for new innovations such as HD. You just have to be willing to dive in and try it yourself." And he bets that the user will encounter a series of pleasant surprises and find it unlike any other technique.

Looking to the future, Dr. Branch believes higher spatial resolution will be a step toward redefining the role of CT imaging. "With these advancements, one can foresee a future where cardiac CT could be the first line of assessing (cardiovascular) symptoms and assessing high risk patients, and potentially changing therapy based on cardiac anatomy."

*in clinical practice, the use of ASiR may reduce CT patient dose depending on the clinical task, patient size, anatomical location and clinical practice. A consultation with a radiologist and a physicist should be made to determine the appropriate dose to obtain diagnostic image quality for the particular clinical task.

William P. Shuman, MD, is Director of Radiology at UWMC and Vice Chairman and Professor for the Department of Radiology. Dr. Shuman received his medical degree from State University of New York Syracuse, and completed a residency in radiology at the University of Vermont. Dr. Shuman is one of the leaders in creating cardiac CT at UW. Outside of UW, Dr. Shuman has served as Associate Editor for the two leading academic peer reviewed journals in Radiology, is currently on the Appropriateness Committee of the American College of Radiology, and is the President of the Society of Body CT/MR.

Kelley R. Branch, MD, is Assistant Professor in Cardiology at the University of Washington Medical Center. Dr. Branch received his medical degree from Jefferson Medical College, and completed a residency in internal medicine at the University of Michigan Medical Center. In 2003, Dr. Branch received the American College of Cardiology Merck Fellowship Award, and, in 2007-2008, the Cardiology Teaching Excellence Award and the School of Medicine CME Teaching Award from UWMC. He is also a founding member of the SCCT (Society of Cardiovascular Computed Tomography) and is actively engaged in several clinical studies.

A GE Healthcare CT publication • June 2011