Beam-hardening correction in resting myocardial perfusion

CT clinical case study—GSI Cardiac CT

James P. Earls, MD
Director of Cardiovascular CT and Body and Cardiovascular MRI
Fairfax Radiological Consultants
Fairfax, VA USA
GSI Cardiac CTA and resting myocardial perfusion exam

**Introduction**

Dr. Earls is the Director of Cardiovascular CT and Body and Cardiovascular MRI at Fairfax Radiological Consultants. As one of the leaders in the use of CT in cardiac diagnostics, Dr. Earls and his colleagues were among the initial clinical users of the GE Discovery* CT750 HD.

The Discovery CT750 HD, combined with the AW or AW Server, offers Gemstone Spectral Imaging (GSI), which uses ultra-fast kVp switching to generate material decomposed images that provide additional information of the anatomy being scanned. As GSI retains the full spectral content in the review environment, it gives the clinician on-the-fly selection of the displayed energy, and even the ability to interrogate the density of the material, like IV contrast, displayed within the image.

The new GSI Cardiac application takes advantage of Discovery CT750 HD’s high-speed X-ray switching (0.25ms) to deliver accurate, registered dual-energy image reconstruction of moving anatomy—allowing clinicians the first ever spectral imaging capabilities from prospectively-gated, low-dose, cardiac exams.

**CT myocardial perfusion**

By combining anatomy and function in a single diagnostic exam, CT myocardial perfusion (CT MPI) may offer a more definitive cardiac exam without additional patient scanning. Assessing blood flow through density measurement is challenged by the large amounts of contrast in the heart, which hardens the beam; leaving an image artifact which resembles a hypo-perfused region on the muscle. GSI Cardiac provides images with reduced beam-hardening artifacts that can enable a more accurate perfusion assessment.

Dr. Earls recently used GSI Cardiac with CT MPI to help a patient with likely coronary artery disease.
Patient history
58-year-old male with chest pain after exercise and a family history of coronary artery disease. No prior cardiac exams.

Case description
GSI Cardiac Coronary CT angiography with resting assessment of blood perfusion in the myocardium.
Scanner: Discovery CT750 HD
Scan type: GSI Cardiac CTA
Pitch: Axial
Total scan time: 3.1 sec
Recon kernel: HD standard SFOV 25 cm
ASIR**: 40%
Type of contrast: Iohexol
Contrast injection rate: 6.5ml/s
Total contrast amount: 70 cc

Results
The study identified:
- Multiple significant stenoses in the LAD and first and second diagonal
- Stenoses in the first obtuse marginal branch, and posteriolarateral branch
- Perfusion defects corresponding to the stenoses in the anterior wall, apex, inferior wall. These defects are consistent with ischemia.

Dr. Earls' comments
Using GSI I was able to see under-perfused myocardium that correlated with the anatomical stenosis. Generating the quantitative iodine maps of the myocardium increased my confidence that the exam depicted hypo perfused myocardium allowing me to render a diagnosis of coronary stenosis with accompanying myocardial ischemia.

The conventional angiography confirmed the multiple coronary stenoses which were treated with surgical intervention.

**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.
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GE Healthcare
3000 N. Grandview Blvd.
Waukesha, WI  53188
U.S.A.

www.gehealthcare.com