Adenosine Induced Stress Myocardial Perfusion Imaging Using Dual Source Computed Tomography: a novel technique allowing simultaneous visualization of coronary anatomy and physiology

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Clinical History
59 year old male with tobacco use and obesity but no prior cardiac history presented with chest pain and dyspnea on exertion. He was found to have an abnormal nuclear exercise perfusion which demonstrated moderate to severe exercise induced ischemia in the territory of the LAD. Subsequently, the patient agreed to participate in an IRB approved MGH research protocol designed to assess both stress and rest myocardial perfusion as well as coronary CT angiography (CTA) in a single comprehensive CT protocol. As part of his clinical care, following the abnormal nuclear stress imaging study, he underwent invasive angiography which showed 90% plaque in his proximal LAD involving the bifurcation of the diagonal branch. Subsequently, he was taken to the operating room for coronary artery bypass grafting surgery involving a LIMA to the LAD and a saphenous vein graft to the diagonal branch. Patient has done well since surgery and is now asymptomatic.

Discussion
While SPECT myocardial perfusion imaging is a well validated technique which offers accurate diagnostic and prognostic data, it is limited by attenuation artifacts and, less commonly, false negatives related to a balanced reduction of blood flow (“balanced ischemia”). Recent data from our group1 and others2 has showed that Cardiac CT may allow non-invasive simultaneous evaluation of coronary anatomy and physiology in a single study. Analogous to gadolinium based stress MRI protocols, the ability of CT to identify myocardial perfusion abnormalities is based on differences in myocardial uptake of iodinated contrast whereby there is rapid enhancement in healthy myocardium in comparison to ischemic or infarcted territories. Importantly, our comprehensive protocol combining stress and rest myocardial perfusion, CT angiography, and late enhancement imaging, was shown to expose patients to the exact same amount of radiation dose that is was observed during SPECT-MPI.1

While at this time, stress CT perfusion is an investigational technique and is not clinically available, it may in the future offer a highly effective and safe non-invasive method for the simultaneous evaluation of coronary anatomy and physiology.

REFERENCES