Does Reduced Radiation Dose Adversely Affect the Ability to Detect Abnormal Myocardial Perfusion on Computed Tomography during Vasodilator Stress?

Amit R Patel, Sonal Chandra, Nadjia Kachenoura, Joseph A Lodato, Homaa Ahmad, Benjamin H Freed, Barbara Newby, Roberto M Lang and Victor Mor-Avi*

Chicago, IL, United States

The ability of multidetector computed tomography (MDCT) to detect stress-induced myocardial perfusion abnormalities is of great clinical interest as a potential tool for the combined evaluation of coronary stenosis and its physiological significance. However stress testing requires repeated scanning which is associated with additional radiation exposure and iodine contrast. Our goal was to determine the effects of reduced tube voltage and contrast dose on the ability to detect perfusion abnormalities. We studied 40 patients referred for CT coronary angiography (CTCA) who agreed to undergo additional imaging with A2A-agonist (regadenoson 0.4mg, Astellas). Images were acquired at rest and under regadenoson with prospective gating (256-channel scanner, Philips) using 120kV tube voltage with 80-90 ml contrast in 20 patients (Group 1) and 100kV with 55-70 ml contrast in the remaining 20 patients (Group 2). Custom 3D analysis software was used to define sixteen 3D myocardial segments and measure x-ray attenuation in each segment. In each group of patients, myocardial attenuation was averaged for segments supplied by coronary arteries with stenosis causing $>$50% luminal narrowing on CTCA, and separately for segments supplied by arteries without significant stenosis. CTCA detected stenosis $>$50% in 23/120 coronary arteries in 16/40 patients. In both groups of patients combined, myocardial attenuation increased from 86$\pm$9 at rest to 110$\pm$17 HU with stress, reflecting an increase in tissue blood flow, despite the decrease in left ventricular cavity attenuation (347$\pm$72 to 281$\pm$55 HU), reflecting an increase in cardiac output. Importantly, in both groups, myocardial attenuation was equally reduced in segments supplied by diseased arteries (Table), despite the 74% reduction in radiation and the 28% reduction in contrast dose ($p<0.05$). In conclusions, vasodilator stress MDCT imaging can detect hypoperfused myocardium even when imaging settings are optimized to provide a significant reduction in radiation and contrast doses.