A Multi-Center Trial of High-Speed Versus Conventional SPECT Imaging: Quantitative Results of Myocardial Perfusion and Left Ventricular Function

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A novel high-speed SPECT camera employing cadmium zinc telluride crystal arrays has been shown in a single center study to detect a similar amount of myocardial perfusion abnormality compared to conventional Anger SPECT camera (conventional SPECT) in up to one seventh the acquisition time. This study compares quantitative results of myocardial perfusion and function by high-speed SPECT to conventional SPECT in a large prospective multi-center trial.

Methods: Two-hundred twenty four patients (127 males) underwent one-day Tc-99m sestamibi rest/ stress SPECT with D-SPECT and A-SPECT at four centers: Cedars-Sinai Medical Center (CSMC) (n=57), Vanderbilt University Medical Center (VUMC) (n=54), Brigham and Women's Hospital (BWH) (n=58) and Miami Baptist Hospital (MBH)(n=55). D-SPECT MPI was performed within 30 min of A-SPECT. Rest/ stress acquisition times were 20 and 15 minutes, respectively for A-SPECT, and 4 and 2 minutes, respectively for D-SPECT. Perfusion was analyzed using QPS software, deriving the total perfusion defect (TPD) of stress and rest, expressing overall extent and severity of perfusion defects. Due to the higher image resolution QPET (rather than QGS) was used for EDV, ESV and EF measurements. Perfusion and function measurments were automatically generated for the stress and rest images of D-SPECT and A-SPECT.

Results: D-SPECT stress and rest TPD in the entire cohort correlated linearly to A-SPECT TPD over a wide range of perfusion abnormality ($r=0.96$, $p<0.0001$). High linear correlation between D-SPECT and A-SPECT stress TPD was seen at each of the participating centers ($r=0.97$, 0.96, 0.97, 0.97 for CSMC, VUMC, BWH, and MBH, respectively, $p<0.0001$). Normalcy rates (normal defined as TPD<5%) in 61 patients with low prescan likelihood of coronary artery disease were 95.1% and 90.2% for D-SPECT and A-SPECT, respectively, p=ns. Post-stress EF, EDV and ESV by D-SPECT correlated linearly to A-SPECT over a wide range of EF and volumes ($r=0.88$, 0.96, 0.98, respectively, $p<0.0001$). Similarly, excellent linear correlation was observed between resting EF, EDV and ESV by D-SPECT and A-SPECT ($r=0.81$, 0.97, 0.97, $p<0.0001$).

Conclusions: The results of this prospective multicenter clinical trial demonstrate that the novel high-speed SPECT technology provides objective quantitative measures of myocardial perfusion and function, comparable to conventional SPECT imaging at up to one seventh the acquisition time.