High Speed Myocardial Perfusion SPECT: Validation of Quantitative Analysis and Use in Low-Dose Stress-only Protocol

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Objective:
To validate quantitative analysis of myocardial perfusion imaging (MPI) acquired with a solid state technology, and use it to facilitate stress only protocol.

Methods:
Sixty three patients with low CAD likelihood and 98 patients with intermediate-high likelihood underwent MPI using a solid state camera (Discovery 530c, GE healthcare). MPI acquisition comprised of stress (10mCi)/rest (25mCi) Tc-99m sestamibi , 5 min stress supine, 3:20 stress prone and 3:00 rest supine. Visual summed stress score (SSS) using 17 segments was converted to %SSS by dividing by 68. Quantitative analysis using commercial software (QPS, CSMC) utilized custom new normal limits (NNL) developed for the new technology from data of another 30 females and 30 males with low CAD likelihood. Total perfusion deficit (TPD) based on NNL was compared to TPD based on standard normal limits (SNL).

Results:
Among the 63 patients with low pretest likelihood mean stress NNL- TPD was close to zero and significantly lower compared to SNL-TPD ($1.17\% \pm 1.16$ vs $3.97\% 1 \pm 2.4$, $p < 0.00001$). Using NNL none of these patients had TPD>4% (normalcy rate 100%), while28 had TPD>4% using SNL (normalcy rate 55.6%). Forty three (68.3%) had a low-dose stress only protocol (10mCi Tc-99m sestamibi, patient exposure < 3 mSv) with NNL TPD $\leq$4% in all cases. Only 30 (47.6%) had SNL-TPD$\leq$4%.
Among the 98 patients with intermediate-high likelihood quantitative %SSS was similar to visual %SSS using either NNL or SNL (NNL: $20.2\% \pm 9.9$, SNL: $19.8\% \pm 9.9$, visual: $20\% \pm 8.9$, p=NS).
Quantitative %SSS (both NNL and SNL) highly correlated to visual %SSS (R= 0.84, $p < 0.0001$).

Conclusion:
Quantitative analysis of solid state SPECT using custom normal limits provided very high normalcy rate among patients with low likelihood, and correctly detected the amount of perfusion abnormality among patients with intermediate-high likelihood. This standardized analysis facilitated the use of low-dose, stress only protocol with very low patient radiation exposure (<3mSv).