Clinical validation of a novel wide beam reconstruction method for shortening scan time of cardiac SPECT perfusion studies

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Objectives
Newly developed reconstruction algorithms enable the acquisition of images at half scan times, while maintaining imaging quality. The purpose of this investigation was to evaluate a novel Wide Beam Reconstruction (WBR) method by UltraSPECT for decreasing scan times and to compare it with the routinely used filtered back-projection technique (FBP).

Methods
Phantom and clinical studies were performed. Hot and cold sphere phantom studies and cardiac phantom studies were performed using WBR, FBP and OSEM. We prospectively studied 50 patients using a standard and a short protocol. Rest Tl-201 studies were scanned for 40 seconds/frame and rest Tc-99m for 30 seconds/frame. Stress Tc-99m studies were scanned for 20 seconds/frame. For the short protocols, the time per frame was reduced by 50% on Tc-99m studies. Standard scans were processed with FBP and short Tc-99m scans and Tl-201 rest studies were processed using WBR. Images were interpreted using a 17 segment model and 5 degree severity score. Distributions including mean, median, and interquartile ranges were examined for all variables. The differences were computed for all variables and were examined using nonparametric signed rank tests. The absolute value of the difference was also examined. Spearman rank-order correlation, a nonparametric measure of association, was used for the two methods to determine significant correlations between variables.

Results
The phantom studies demonstrated that WBR improved contrast recovery and background uniformity than did the OSEM. Studies performed with attenuating medium and background activity showed that half scan time images processed with WBR had better contrast recovery and background uniformity than did the full scan time FBP reconstruction. In the clinical studies, highly significant correlations were observed between WBR and FBP for functional as well as for perfusion variables ($p<.0001$). The SSS difference was not statistically different for FBP and WBR, though SRS and SDS were significant. However, further examination of the mean and absolute differences suggests that these were not clinically meaningful differences (absolute differences of 1.58 and 1.70). Left ventricular volumes had a high correlation coefficient but were significantly larger with FBP compared to WBR.

Conclusion
Based on these data, cardiac SPECT perfusion studies may be performed with the WBR algorithm using half of the scan time without compromising qualitative or quantitative imaging results.