Control/Tracking Number: 08-A-19-ASNC
Activity: Abstract
Current Date/Time: 4/3/2008 10:25:46 AM

Quarter-time Myocardial Perfusion SPECT Wide Beam Reconstruction

Author Block G. DePuey,[1] S. Bommireddipalli,[1] I. Beletsky,[2] J. Clark,[1] A. Leykekhman,[1] L. Thompson,[1] M. Friedman[1]; [1]St. Luke's-Roosevelt Hospital, New York, NY, [2]UltraSPECT, Ltd., Haifa, Israel

Abstract:
Background: Compared to filtered backprojection (FBP) and iterative reconstruction with OSEM, wide beam reconstruction (WBR), which incorporates resolution recovery and models noise during reconstruction without applying a post-processing filter, has been reported to allow half-time gated myocardial perfusion SPECT acquisition with preserved diagnostic quality. We postulated that with further noise modeling even shorter acquisition times would be possible.
Methods: The half-time WBR algorithm was modified for "quarter-time" acquisitions based upon anthropomorphic cardiac phantom data and a pilot group of 48 patients (pts). Pilot pts underwent 180-degree, 64-stop, full-time single-day rest (R) (25 second-per-stop (sps)) and stress (S) (20sps), and then "quarter-time" either R (6sps) (n=27 pts) or S (4 sps) (n=21pts) 9 mCi/32 mCi R/S ^{99m}Tc-sestamibi SPECT. A 90º-angled dual-headed camera with high resolution parallel-hole collimators was used. Subsequently, using the same protocol, 134 consecutive pts (61 men, 73 women, mean weight = 182 lbs., mean chest circumference = 41 in.) were imaged both at R and S with full-time FBP and OSEM, and also quarter-time WBR using the modified algorithm. Anticipating reconstruction artifacts in low count density R 6sps scans, a R 10sps acquisition was simulated by randomly dropping counts from each stop of the full time R acquisition while maintaining Poisson statistics, and the WBR algorithm was separately optimized for R 10sps SPECT. Blinded observers graded perfusion scans for quality (1=poor to 5=excellent) based on myocardial uniformity, endocardial/epicardial edge definition, and background noise. Perfusion defects were scored using a 17-segment model.
Results: For the 134 prospective pts mean image quality for R full-time OSEM and quarter-time WBR was equivalent (3.5) and superior to FBP (3.1) ($p<.0001$). For S, quarter-time WBR quality (4.2) was superior to both full-time OSEM (3.8) and FBP (3.4) (p's <.0001). Reconstruction artifacts (myocardial "streaks" or clustered hot pixels) were more frequent with quarter-time WBR than with full-time OSEM (14 R, 5 S vs. 1 R, 0 S), but did not confound interpretation. For R WBR, 10sps acquisitions were superior to 6sps (quality 3.7 vs. 3.5, $p = .003$) and artifacts were less frequent (8 vs.14). In pts with chest circumferences $\geq$ 44 in. (n=15), R image quality was better for 10sps than for 6sps (3.6 vs. 3.2, $p=0.03$). Of the19 patients with abnormal scans (SSSs >2 by OSEM), mean SSSs, SRSs, and SDSs were not significantly different with quarter-time

WBR vs. full-time OSEM (8.6 vs 9.3), (6.9 vs. 8.0), (1.9 vs. 1.3) (p's NS). Only 1 patient with normal full-time OSEM had abnormal quarter-time WBR (SSS = 3).
Conclusions: For perfusion SPECT quarter-time WBR affords image quality and defect characterization equivalent to full-time OSEM. Lengthening WBR R acquisitions to 10sps may be advantageous for larger patients.