Effect of Valve Plane Constraint on LV Ejection Fractions from Gated Perfusion SPECT.

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Objective: Differences between quantitative algorithms for determining left ventricular (LV) ejection fraction (LVEF) can be problematic for serial studies if the software is changed. While correlation functions can adjust for differences in the mean but does not account for non-linear variations due to differences in the surface estimators. We propose that differences between the quantitative programs 4D-MSPECT (4DM) and Cedar's QGS could be better corrected by adjusting the accepted range of LV basal motion.

Methods: All short axis volumes were reconstructed from 16 frame Sestamibi SPECT perfusion studies. Fifty-five studies spanning the range of LVEFs from 10 through 85% determined the linear relationship between QGS and 4DM. Using this linear correlation, linearly scaled LVEF values (4DM-L) were estimated from standard 4DM estimates. In 4DM, the accepted range for LV basal motion is 5mm to 20mm. From a visual assessment of QGS surfaces, the range of LV basal motion is between 0 and 6mm. These basal constraint limits were used in a modified version of 4D-MSPECT (4DM-C) for determining LVEF. Accuracy was assessed for both QGS, 4DM and 4DM-C using 110 patients (group II) with a previous contrast ventriculography study for LVEF (mean=52±17%). Additional studies from 43 normal volunteers (group III) were used to assess differences in the normal limits. For each of these datasets, LVEF values were estimated from QGS, 4DM, 4DM-C (basal motion constrained between 0 and 6mm) and 4DM-L. Root mean square (RMS) differences and t-test p values were estimated for LVEF values from QGS and each of the 4DM estimates.

Results: The linear correlation from the group I patients was QGS = 0.95*4DM-2.9 (r=0.94). This was used to estimate the 4DM-L LVEF values. For groups II and III, the mean LVEFS, RMS and t-test p values are tabulated.

	QGS	4DM	4DM-C	4DM-L
Group II	(47±15)%	(51±16)%,RMS=5.0, p<0.01	(47±15)%, RMS=2.6, p=0.6	(46±15)%, RMS=3.3, p=0.04
Group III	(62±7)%	(67±6)%,RMS=5.5, p<0.01	(62±8)%, RMS=2.8, p=0.6	(61±6)%, RMS=4.1, p=0.2

Conclusion: While RMS values were significantly reduced for both 4DM-C and 4DM-L, 4DM-C demonstrated better agreement with QGS compared to 4DM-L making the two algorithms statistically equivalent for both test groups. While constraining the basal motion to 0 to 6mm minimizes differences between QGS and 4DM allowing more accurate serial LVEF assessments, accuracy is compromised as seen from a comparison to the CVG values (CVG=52%, 4DM=51%, QGS=47%).

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