Summary

Scatter Correction in Myocardial Thallium SPECT: Needs for Optimization of Energy Window Settings in the Energy Window-Based Scatter Correction Techniques

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Accuracy and limitation of energy-window based scatter correction techniques have been evaluated for myocardial ^{201}Tl SPECT by means of Monte Carlo simulation. In particular, projection view-dependency of energy distribution of the scattered photons was evaluated. Two geometrical configulations were simulated; namely a homogeneous cylindrical radioactivity located asymmetrically in a homogeneous cylindrical phantom, and a homogeneous ring radioactivity positioned at the myocardial region of a human thorax phantom. Energy spectra were recorded for each projection, and accuracy of the triple-energy window (TEW) method was then evaluation for both phantoms. The energy distribution of the scattered photons was apparently dependent on the projection view. TEW also demonstrated systematic overcorrection for the scatter because of multipe photo peaks around 80 keV, and more importantly, the error was highly dependent on the projection view. The error reached to 35–38% for the view that is the closest to the ^{201}Tl radioactivity (anterior view in case of the myocardial ring phantom), and was approximately 20% in the opposite view. This view-dependency of the error remained for other energy window settings, and was found to cause significant artifact in the reconstructed myocardial images, typically causing a defect in the anterior myocardial wall. Thus, this study demonstrated the need for optimizing the window settings for each projection view in all energy window-based scatter correction methods.

Key words: Single photon emission computed tomography (SPECT), ^{201}Tl chloride, Scatter, Monte Carlo simulation.