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Experimental analysis of scattered photons in Tc-99m imaging with a gamma camera

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The amount of scattered photons in a clinical imaging window of Tc-99m was experimentally measured by means of a line source with scattering materials and a gamma camera. A symmetrical photopeak energy window centered at 140 keV with a width of 20% (126–154 keV) was partitioned into several small windows. Energy spectra were analyzed to determine the scatter fraction and the attenuation coefficient for each window. Line spread functions (LSF) were also obtained to characterize the spatial scatter distribution. The results of analysis of energy spectra show that scattered photons are included over the symmetric 20% window (SW) and scatter fractions increase linearly with the increasing thickness of the scattering material in all energy windows investigated. In addition, the results for the LSF show that the scatter distribution within the SW is represented as a mono-exponential function. Experimental measurements obtained with a phantom and a gamma camera simplify accurate quantification of scattered photons. Such quantitative analysis of scattered photons is important in developing and evaluating a scatter correction technique.

Key words: Compton scatter, attenuation coefficient, scatter fraction, line spread function