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The effect of high energy photons emitted from cobalt - 57 source on extrinsic uniformity test

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Aim:

During extrinsic uniformity test, to show FWHM limit excess can be observed due to using hot Co- 57 source and this excess doesn't affect clinical imaging.

Materials and Methods:

One of the most important parameters that determine the performance of the gamma camera system is the deterioration of the detector homogeneity. The test is used to evaluate the collimator homogeneity is extrinsic uniformity. Cobalt -57 flood source used to evaluate the extrinsic uniformity, uniformly dispersed in an epoxy matrix fully sealed in a high integrity ABS encapsulation. Radionuclide purity is greater than 99.9% (combined Co-56/Co-58 is less than 0.08% at source reference date). Co-56 isotope emits 0.416 MeV gamma rays. Co-58 isotope emits 810keV gamma ray with 99% probability. In our clinic, extrinsic uniformity test were done for GE Infinia Hawkeye 4 –SPECT/CT on 7 December 2015 with using Co-57 10 mCi(370MBq) (source reference date 1 December 2015) on H mode by collecting 8000 kcts. For D1 detector, Co-57 flood source placed on the top of the D2 detector and measurements were done for 3, 17, 25, 30, 35, 40 cm distances, respectively. The same procedure with same distances repeated for D2.

Results:

For detector D1 FWHM values were found as 12.5%, 11.1%, 10.8%, 10.7%, 10.6%, 10.6% for measurements done at 3, 17, 25, 30, 35, 40cm distances from the source, respectively. For detector D2 FWHM values were found as 12.5%, 11.2%, 11%, 10.9%, 10.8%, 10.8% for measurements done at 3, 17, 25, 30, 35, 40 cm distances from the source, respectively. FWHM value was read 12.5%, for the closest distance between detector and source, which should have been maximum 12% for extrinsic uniformity test. While increasing the distance between detector and source, this FWHM value decreased to 10.6% for D1 and 10.8% for D2.

Conclusion:

Exceeding the limit value of the FWHM means measurements were taken from energies outside the specified energy window range. The counting of high-energy rays emitted from the hot Co- 57 source with detectors causes FWHM to be measured beyond the value of 12% limit. Thus, waiting long enough after the date of reference calibration in direct proportion to the half-life, these differences are not observed. Besides, in clinic, these observed differences do not affect the image quality.

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