Sensitivity of the Scintillation Camera

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Parameters having relation with system sensitivity of the scintillation camera involove efficiency of the detector, efficiency of the collimator, window width of the pulse height analyzer and energy resolution of the detector. As efficiency of the collimator also has relation to the spacial resolution, system sensitivity should be considered in connection with spacial resolution.

Photopeak efficiency of the detector is a function of its thickness. The efficiency of a NaI scintillator of 9 mm thick is 9.1% lower than the one of 12.7 mm thick by 150 keV gamma ray, and is 25% lower by 500 deV gamma ray.

Actual efficiency is lower than the photopeak efficiency when the window width of the pulse height analyzer doesn't cover enough the photopeak. The window width as equal as the full width half maximum (FWHM) of energy resolution of the detector causes 24% lowering of the photopeak efficiency, and the window width 1.5 times larger than FWHM also causes 8% lowering.

Therefore, onergy resolution of the detector can compete with thickness of the detector in the effect on system sensitivity.

Efficiency of the collimator has relation which was described by H. O. Anger to its spacial resolution. As system resolution is a function of intrinsic resolutions of both collimator and scintillation camers, two scintillation cameras having each value of intrinsic resolution can be realized the same value of system resolution by altering each value of intrinsic resolution of collimators. Therefore, above two scintillation cameras having same value of system resolution have different values of efficiency of collimator, accordingly have different values of efficiency of collimator, according y have different values of system sensitivity.

Assuming that window width covers full of the photopeak of the 150 keV gamma ray, system sensitivity of a scinti ation camera having a NaI scintillator of 9 mm thick and intrinsic resolution of 4 mm FWHM is 2.3 times larger than that having a 12.7 mm thick scintillator and intrinsic resolution of 6 mm FWHM provided the system is set at 7 mm FWHM. Former is 1.1 times larger than later provided the system resolution is set at 12 mm.

Basic and Clinical Evaluation of LFOV Gamma Camera

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A large field of view (LFOV) gamma camera (Searl Inc.) was used in combination with 3 types of collimators (P.H.R.; parallel high resolution, L.E.A.P.; low energy all purpose, and C.H.R.; converging high resolution), whole body scanning table and micro dot imager. The gamma camera is composed of 37 3 inch ϕ PMT and a 17×0.5 inch NaI (Tl) crystal. The field size is 15.25 inch in diameter.

Basic evaluation including uniformity, lineality, resolution and sensitivity were satisfactory both in static and whole body images. Deviation from the mean in count rates on 5×5 matrix areas was less than 8.3% and 10.9% in static and whole body images of flat phantom, respectively. Deformity of the images werelless than 4.3% within the field of 36 cm in diameter. C.H.R. showed best resolution without losing sensitivity as compared