A. Instrumentation, Computer Analysis and Data Processing

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PERFORMANCE AND COMPARATIVE EVALUATION OF WIDE FIELD SCINTILLATION GAMMA CAMERAS.

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Recently, wide-field gamma camera has become quite popular and vaious models have been supplied for the past several years. Therefore, there have been considerable interests about their performances especially in regard to comparative evaluations of one's to the others'.
In this study, we selected four different models, (A) OHIO NUCLEAR Σ410S, (B) HITACHI RC-IC 1635 LD, (C) SEARL LFOV, and (D) TOSHIBA GCA-401; and we investigated their performance characteristics in the following items; spacial resolution, uniformity, linearity, sensitivity, count-rate capability, and phantom images. The images were observed by 23 Nuclear Medicine specialists and performance scores were made on them.
As the results of this study, Camera B and Camera D were found to have distinct superiority in system resolution to the rests (A and C) which were found to be well equipped with unique modes such as DUFC (dynamic uniformity correction) for Camera A and HCM (high count rate mode) for Camera C, resulting in better uniformity (A) and better efficiency for high count rate (C).
As a conclusion, it is reasonable to say that each model has its own advantages to the others and the users should be aware of their characteristics in their daily practices.

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PERFORMANCE EVALUATION OF THREE TYPES OF GAMMA CAMERAS.

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Fundamental performances of three types of gamma cameras, LFOV, GVH(Gamma View-H), and GCA-10A are evaluated in terms of a)camera sensitivity, b)temporal resolution and counting losses, c)intrinsic and systemic spatial resolution, d)field uniformity and linearity, and e)degree of statistical fluctuations of the data.

In spatial resolution, GCA-10A shows the best quality, while LFOV the worst among these cameras, but LFOV has the best camera sensitivity and GCA-10A the worst.

Performing three experiments with various configulations, it is found that the counting losses depend largely on the experimental configulation. In case of attaching high-resolution-low-energy collimator and 2cm tissue equivalent material on it, counting losses begin to increase when source intensity exceeds 5mCi, which is about the same for LFOV and GVH. It is necessary to establish formula to correct counting losses for each camera system. As Eq. $n^*=n/(1-\tau n)$ is found to be insufficient to make correction accurately, we proposed the equation of the form $n^*=n/(1-an-bn^2)$.

It is found that the standard deviation from the mean is slightly greater than the square root of the mean, especially at the perimeter. This fact might indicate that the observed data obey somewhat distorted distribution from the Poisson type.

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COUNTING RATE CHARACTERISTICS AND ARTIFACTS OF SCINTI-CAMERAS.

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In most nuclear dynamic studies such as cardiac and plumonary flow studies, high dose activity is injected to a patient with a blous. In this circumstance, the photon input rate to the detector may be much higher than that observed, and we have also experienced delineation of an artifact image at a such high counting rate. The purpose of this study is to survey this cause either depend on the lower counting rate characteristics of the scinti-camera system, or is proper to it. The counting rate characteristics and the delineation of artifact images on five scinti-cameras were determined, using Tc-99m small size collimated sources similar to the bolus. The delineation of artifacts on the image was recognized only in delayline system scinti-cameras, in which the maximum counting rate was about 70 kcps to 110 kcps, and wasn't in resister matrix system ones in spite of a high counting rate. We found that the delayline system scinti-camera began to delineate the artifacts slightly from about 5 kcps, and was enhanced as taking a high counting rate. Although, the delayline system scinti-camera which was recently improved with an excellent counting rate characteristic (max. counting rate of about 160 kcps) was less appearauce of the artifact than that of former ones.

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ASSESSMENTS OF THE LESION DETECTABILITY OF THE MULTIWINDOW IMAGING.

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The purpose of this study is to compare the lesion-detectability of the single window imaging with the multiwindow imaging. Phantom studies were performed for the case of 201Tl. 201Tl-Phantom consists of hot right cylindrical lesions which the diameter is 0.5,0.7,1.0,1.4,2.0,2.8 cm and the activity is five levels, and the background activity of five levels,respectively. One hundred images contained hot lesions which the target-to-non-target-ratio is variable, were composed and observed by five readers. The percentage of detectable lesions for the total number of lesion was calculated as a function of a target-to-non-target-ratio of the object distribution before imaging the phantom. On the other hand, the modulation transfer function and the relative sensitivity in the case of the low(70Kev),and high (167Kev) photopeak with 20% or 80% window width were calculated from the line spread function. From these data, minimum detectable target-to-non-target-ratio for the case of the 201Tl-imaging carried out under the various conditions as well as phantom study was estimated, theoretically. Results compared the lesion-detectability of 201Tl multiwindow imaging with the single window imaging, we may conclude that 201Tl-multiwindow imaging is not effective if the high resolution collimator for 99mTc is used.