A New Method for Obtaining Scintillation Camera Images with Serial Flow Camera

(The third Report: Basic Investigation on Efficiency)

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Last year in this meeting, we reported the system of taking the photograph of the large organs, such as the whole lung and the liver including the spleen, on one film without distortions by combining Serial Flow Camera, Linear Bed and Scintillation Camera. This time, we compared the efficiency of the photography by this system to that of the conventional photography.

Resolution: Line phantoms with the intervals of 6, 8, 10, 12 and 14 mm were prepared by sealing about 1mCi of $^{99m}TcO_4^-$ into a vinyl tube with the inside diameter of 0.6 mm, and the measurements were carried out on the slit of the recording system in three occasions: 1. when the slit was 4 mm wide, 2. when the slit was 8 mm wide, and 3. when there was no slit.

Distortion of Images: Grid phantom (30×30 cm) with the intervals of 3 cm was prepared by sealing $^{99m}TcO_4^-$ into the vinyl tube, and the measurement was carried out in the same way as above.

Detection of Shadow Defects: $^{99m}TcO_4^-$ was sealed into the liver slice phantom with 8 defects with the diameters of 4 cm to 0.8 cm, and the same measurement as above was performed.

Results: Concerning to the resolution and the detection of shadow defects, the conventional photography and the photography by this system had same efficiency, when the slit was 4 mm wide. Concerning to the distortion of images, better results were obtained by the photography by this system.

Whole-body Imaging with Large Field Gammacamera

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Whole-body imaging using large field gammacamera provided with field of view of 35 cmϕ is reported. Whole-body imaging has become very important ever since tumor seeking radiopharmaceuticals have become to be used.

Whole-body imaging has hithertofore been performed by means of scanner but recently Harper and Cooke and Kaplan have reported the method of performing whole-body imaging by using Gammacamera and scanning table. We have used a large-field Gammacamera GCA-202 having a field of view of 35 cmϕ in order to obtain good quality image in a short period of time by raising the detecting efficiency. This paper sets forth the principle of this system, studies the performance and indicates the clinical data.

A linear scanning table is installed under GCA-202 Gammacamera attached with parallel hole collimator, and the table is moved at constant speed along X-axis direction of the field of view. The image displayed on CRT is moved in X-direction synchronized with this movement, and this is recorded on Polaroid film or on X-ray film of life-size adaptor. The field of view of Gamma-camera is divided into rectangle by means of splitter and the CRT displays the brightening spots only inside the rectangle. The size can be set to any size.

We have checked how the position resolution, linearity, and uniformity of image change when the X-idirection width Δx of rectangle is changed from 5 cm to 20 cm. Position resolution becomes better as Δx becomes smaller but detecting efficiency becomes less in proportion to Δx. If the tabletop is scanned two times in X-direction, it is possible to measure the width of 50 cm of Y-axis direction. Whole-body scanning is performed using ^{99m}Tc pyrophosphate and good whole-body image is obtained in 10 minutes.

A New Appoach for Profile Scanning

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By this time, to investigate the RI distribution of human body, a bed for profile scanning and a slit collimator have been used.

But by using a whole-body scanner with focused collimators, We can get not only a scintigram of whole-body, but also a profile scanning data. Profile scanning with focused collimators is better than that of slit collimators at resolution and uniform sensitivity because of their good spatial resolution.

Method: In this case, two integrators are prepared. While one integrator accumulates the counts over one transverse scanning, the other one holds the output proportional to the accumulated counts over a previous scan line until the end of the transverse scanning. At this moment, The output terminal is switched to the output of the former integrator which holds the output at this time and the latter one releases its hold to begin accumulation over next scan line.

Result: Slit collimators used for profile scanning have poor spatial resolution for longitudinal direction and have non-uniform sensitivity to transverse direction because of different solid angle. On the other hand, focused collimators have very good spatial resolution to all direction and by moving these collimators to transverse direction, it is possible to make the sensitivity distribution uniform over the transverse direction.

Conclusion

(1) Profile scanning with focused collimators is better than that of slit collimators at resolution and uniform sensitivity.

(2) By applying this method to whole-body scanner, we can get a scintigram of wholebody and a profile scanning data simultaneously.