Study on the Whole-body Counting with MUHC

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Whole-body counting is one of the important applications of MUHC. Basic study on the medium-level whole-body counting were carried out for clinical purposes.

MUHC has four detectors which have 3×2 inch NaI (Tl) crystal. Two detectors are placed over the lying patient and the other two beneath the bed.

After the first counting for a certain fixed time the detectors are transferred to another place for the second counting. These two countings give us the geometrical arrangement equivalent to the whole-body counting with 8 detectors arrayed in line symmertically above and below body axis.

The distance between the detectors adjoining each other is 50cm and that between the detectors opposing is 100cm. The spatial distribution of measurement efficiency is fairly uniform (100±5%) in the limits of 10cm above and below from the mid-point between two opposing detectors and 150cm along the longitudinal axis. In the insertion of a subject, however, intensity of γ-rays decreases exponentially with depth provided that pure photo-peak from a nuclide in the subject is counted. The measurement efficiency should be uniform in the opposed combination of two isoresponce curves which decrease linearly with depth. For this reason the width of spectrum was studied by which the counting rate of γ-rays decreases linearly with depth. As a result, reduction in water was proved to be linear in the limited width of 240~400 KeV for ^{131}I, 525~725 KeV for ^{131}Cs and 1.05~1.45 MeV for ^{60}Co.

Generally for the lower energy γ-rays, uniform distribution (100±10%) of measurement efficiency was obtained in the water phantom of 20cm in thickness by a differential counting including Compton scattered region.

According to the above-mentioned results, in the practice of wholebody counting with MUHC, the optimal spatial arrangement of the detectors and the optimal channel width of spectrometer should be taken into account.

Collimators of MUHC

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In these condition the amount of radioisotope can be measured precisely not influenced by a state of internal distribution of radioisotope. 0.1 μCi of ^{131}I in vivo can be measured within relative errors of 5% by whole body counting for an hour.

In MUHC four different types of lead collimators were used, honey cone 37-hole (10, 15cm focused length) and multifocus type for an area scanning, slit type for a linear scanning, and 3 inch flat-field type for a whole body counting. They could be inserted into an opening of the tungsten and lead shielded probe with a 3×2 inch sodium iodide crystal (NaI).

Isoresponse curves were obtained as for properties of collimators in air and water with the point source of ^{131}I available as small as possible.

In general, the actual focal distance was less than the geometrical focal distance, and the shapes of isoresponse curves in water were shortened and narrowed in the axial direction of the hole of the collimator com-